NAGIOS

SYSTEM AND NETWORK MONITORING

WOLFGANG BARTH

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Wolfgang Barth

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open source
PRESS
Munich

NO STARCH
PRESS
San Francisco

Printed on recycled paper in the United States of America.

1 2 3 4 5 6 7 8 9 10 – 09 08 07 06

Publisher: William Pollock
Cover Design: Octopod Studios
U.S. edition published by No Starch Press, Inc.
555 De Haro Street, Suite 250, San Francisco, CA 94107
phone: 415.863.9900; fax: 415.863.9950; info@nostarch.com; http://www.nostarch.com

Original edition © 2005 Open Source Press GmbH
Published by Open Source Press GmbH, Munich, Germany
Publisher: Dr. Markus Wirtz
Original ISBN 3-937514-09-0
For information on translations, please contact
Open Source Press GmbH, Amalienstr. 45 Rg, 80799 München, Germany
phone +49.89.28755562; fax +49.89.28755563; info@opensourcepress.de; http://www.opensourcepress.de

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Library of Congress Cataloging-in-Publication Data

```
Barth, Wolfgang
  Nagios :  system and network monitoring / Wolfgang Barth.-- 1st ed.
       p. cm.
  Includes index.
  ISBN 1-59327-070-4
1. Computer networks--Management--Automation.  I. Title.  TK5105.5.B374 2005
  004.6--dc22
                                                        2005026745
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Contents

Introduction

It's ten o'clock on Monday morning. The boss of the branch office is in a rage. He's been waiting for hours for an important e-mail, and it still hasn't arrived. It can only be the fault of the mail server; it's probably hung yet again. But a quick check of the computer shows that no mails have got stuck in the queue there, and there's no mention either in the log file that a mail from the sender in question has arrived. So where's the problem?

The central mail server of the company doesn't respond to a ping. That's probably the root of the problem. But the IT department at the company head office absolutely insists that it is not to blame. It also cannot ping the mail node of the branch office, but it maintains that the network at the head office is running smoothly, so the problem must lie with the network at the branch office. The search for the error continues...

The humiliating result: the VPN connection to head office was down, and although the ISDN backup connection was working, no route to the head office (and thus to the central mail server) was defined in the backup router. A globally operating IT service provider was responsible for the network connections (VPN and ISDN) between branch and head office, for whom something like this "just doesn't happen". The end result: many hours spent searching for the error, an irritated boss (the meeting for which the e-mail was urgently required has long since finished), and a sweating admin.

With a properly configured Nagios system, the adminstrator would already have noticed the problem at eight in the morning and been able to isolate its cause within a few minutes. Instead of losing valuable time, the IT service provider would have been informed directly. The time then required to eliminate the error (in this case, half an hour) would have been sufficient to deliver the e-mail in time.

A second example: somewhere in Germany, the hard drive on which the central Oracle database for a hospital stores its log files reaches full capacity. Although this does not cause the "lights to go out" in the operating room, the database stops working and there is considerable disruption to work procedures: patients cannot be admitted, examination results cannot be saved, and reports cannot be documented until the problem has been fixed.

If the critical hard drive had been monitored with Nagios, the IT department would have been warned at an early stage. The problem would not even have occurred.

With personnel resources becoming more and more scarce, no IT department can really afford to regularly check all systems manually. Networks that are growing more and more complex especially demand the need to be informed early on of disruptions that have occurred or of problems that are about to happen. Nagios, the Open Source tool for system and network monitoring, helps the administrator to detect problems before the phone rings off the hook.

The aim of the software is to inform administrators quickly about questionable (WARNING) or critical conditions (CRITICAL). What is regarded as "questionable" or "critical" is defined by the administrator in the configuration. A Web page summary then informs the administrator of normally working systems and services, which Nagios displays in green, of questionable conditions (yellow), and of critical situations (red). There is also the possibility of informing the administrators in charge—depending on specific services or systems—selectively by e-mail but also by paging services such as SMS.

By concentrating on traffic light states (green, yellow, red), Nagios is distinct from network tools that display elapsed time graphically (for example in the load of a WAN interface or a CPU throughout an entire day) or that record and measure network traffic (how high was the proportion of HTTP on a particular interface?). Nagios is involved plainly and simply with the issue of whether everything is on a green light. The software does an excellent job in looking after this, not just in terms of the current status but also over long periods of time.

The tests

When checking critical hosts and services, Nagios distinguishes between host and service checks. A ***host check*** tests a computer, called ***host*** in Nagios slang, for reachability—as a rule, a simple ping is used. A ***service check*** selectively tests individual network services such as HTTP, SMTP, DNS, etc., but also running processes, CPU load, or log files. Host checks are performed by Nagios irregularly and only where required, for example if none of the services to be monitored can be reached on the host being monitored. As long as one service can be addressed there, then this is basically valid for the entire computer, so that this test can be dropped.

The simplest test for network services consists of looking to see whether the relevant target port is open, and whether a service is listening there. But this does not necessarily mean that, for example, the SSH daemon really is running on TCP port 22. Nagios therefore uses tests for many services that go several steps further. For SMTP, for example, the software tests whether the mail server also announces itself with a "220" output, the so-called ***SMTP greeting***; and for a PostgreSQL database, it checks whether this will accept an SQL query.

Nagios becomes especially interesting through the fact that it takes into account dependencies in the network topology (if it is configured to do so). If the target system can only be reached through a particular router that has just gone down, then Nagios reports that the target system is "unreachable", and does not bother to bombard it with further host and service checks. The software puts administrators in a position where they can more quickly detect the actual cause and rectify the situation.

The suppliers of information

The great strength of Nagios—even in comparison with other network monitoring tools—lies in its modular structure: the Nagios core does not contain one single test. Instead it uses external programs for service and host checks, which are known as ***plugins***. The basic equipment already contains a number of standard plugins for the most important application cases. Special requests that go beyond these are answered—provided that you have basic programming knowledge—by plugins that you can write yourself. Before you invest time developing these, however, it is first worth taking a look in the Internet and browsing through the relevant mailing lists,[1] as there is lively activity in this area. Ready-to-use plugins are available, especially in the Nagios exchange platform, http://www.nagiosexchange.org/.

A plugin is a simple program—often just a shell script (Bash, Perl etc.)—that gives out one of the four possible conditions OK, WARNING, CRITICAL, or (with operating errors, for example) UNKNOWN.

This means that in principle Nagios can test everything that can be measured or counted electronically: the temperature and humidity in the server room, the amount of rainfall, the presence of persons in a certain room at a time when nobody should enter it. There are no limits to this, provided that you can find a way of providing measurement data or events as information that can be evaluated by computer (for example, with a temperature and humidity sensor, an infrared sensor, etc.). Apart from the standard plugins, this book accordingly introduces further freely available plugins, such as the use of a plugin to query a temperature and humidity sensor in Chapter 19 from page 377.

Keeping admins up-to-date

Nagios possesses a sophisticated notification system. On the sender side (that is, with the host or service check) you can configure when which group of persons—the so-called ***contact groups***—are informed about which conditions or events (fail-

[1] http://www.nagios.org/support/mailinglists.php

ure, recovery, warnings etc.). On the receiver side you can also define on multiple levels what is to be done with a corresponding message—for example whether the system should forward it, depending on the time of day, or discard the message.

If a specific service is to be monitored seven days a week round the clock, for example, this does not mean that the administrator in charge will never be able to take a break: instead, you can instruct Nagios to notify the person only from Mondays to Fridays between 8am and 5pm, every two hours at the most. If the administrator in charge is not able to solve the problem within a specified period of time, eight hours for example, then the head of department responsible should receive a message. This is also known as *escalation management*. The corresponding configuration is explained in Chapter 12.5 from page 231.

Nagios can also make use of freely configurable, external programs for notifications, so that you can integrate any system you like: from e-mail to SMS to a voice server that the administrator calls up and receives a voice message concerning the error.

With its Web interface (Chapter 16 from page 273, Nagios provides the administrator with a wide range of information, clearly arranged according to the issues involved. Whether the admin needs a summary of the overall situation, a display of problematic services and hosts and the causes of network outages, or the status of entire groups of hosts or services, Nagios provides an individually structured information page for nearly every purpose.

Through the Web front end, an administrator can inform colleagues upon accepting a particular problem so that they can concentrate on other things that have not yet been seen to. Information already obtained can be stored as comments on hosts and services, just like scheduled downtimes: Nagios prevents false alarms going off in these periods.

By reviewing past events, the Web interface can reveal what problems occurred in a selected time interval, who was informed, what the situation was concerning the availability of a host and/or services during a particular time period—all this also taking account of downtimes, of course.

Taking in information from outside

For tests, notifications, etc., Nagios makes use of external programs, but the reverse is also possible: through a separate interface (see 13.1 from page 240), independent programs can send status information and commands to Nagios. The Web interface makes widespread use of this possibility, which allows the administrator to send interactive commands to Nagios. But a backup program unknown to Nagios can also transmit a success or failure to Nagios, as well as a syslog daemon—there is no limit to the possibilities here.

Thanks to this interface, Nagios allows distributed monitoring. This involves several decentralized Nagios installations sending their test results to a central instance, which then helps to maintain an overview of the situation from a central location.

Other tools for network monitoring

Nagios is not the only tool for monitoring systems and networks. The most well-known "competitor," perhaps on an equal footing, is ***Big Brother*** (BB). Despite a number of differences, its Web interface also serves the same purpose as that of Nagios: displaying to the administrator what is in the "green area" and what is not.

The reason why the author uses Nagios instead of Big Brother lies in the license for Big Brother, on the BB homepage[2] called ***Better Than Free License***: the product continues to be commercially developed and distributed. If you use BB and earn money with it, you must buy the software. The fact that the software, including the source code, may not be passed on or modified except with the explicit permission of the vendor means that it cannot be reconciled with the criteria for Open Source licenses. This means that Linux distributors have their hands tied.

For the graphical display of certain measured values over a period of time, such as the load on a network interface, CPU load, or the number of mails per minute, there are other tools that perform this task better than Nagios. The original tool is certainly the ***Multi Router Traffic Grapher*** MRTG,[3] which, despite growing competition, still enjoys great popularity. The relatively young, but very powerful alternative is called Cacti[4]: this has a larger range of applications, can be configured via Web interface, and avoids the restrictions in MRTG, which can only display two measured values at the same time and cannot display any negative values.

Nagios itself can also display performance data graphically, using extensions (Chapter 17 from page 313). In many cases this is sufficient, but for very dedicated requirements, the use of Nagios in tandem with a graphic representation tool such as MRTG or Cacti is recommended.

About This Book

This book is directed at network administrators who want to find out about the condition of their systems and networks using an Open Source tool. It describes Nagios version 2.0, which is somewhat different from its predecessors in its configuration. The plugins, on the other hand, lead their own lives, are to a great extent independent of Nagios, and are therefore not restricted to a particular version.

[2] http://www.bb4.org/
[3] http://www.mrtg.org/
[4] http://www.cacti.net/

Even though this book is based on Linux as the operating system for the Nagios computer, this is not a requirement. Most descriptions also apply to other Unix systems,[5] only system-specific details such as start scripts need to be adjusted accordingly. Nagios currently does not work under Windows, however.

The first part of this book deals with getting Nagios up and running with a simple configuration, but one that is sufficient for many uses, as quickly as possible. This is why Chapters 1 through 3 do not have detailed descriptions and treatments of all options and features. These are examined in the second part of the book.

Chapter 4 looks at the details of service and host checks, and in particular introduces their dependency on network topologies.

The options available to Nagios for implementing service checks and obtaining their results is described in Chapter 5.

This is followed by the presentation of individual standard plugins and a number of additional, freely obtainable plugins: Chapter 6 takes a look at the plugins that inspect the services of a network protocol directly from the Nagios host, while Chapter 7 summarizes plugins that need to be installed on the machine that is being monitored, and for which Nagios needs additional utilities to get them running. Several auxiliary plugins, which do not perform any tests themselves, but manipulate already established results, are introduced in Chapter 8.

Two utilities that Nagios requires to run local plugins on remote hosts are introduced in the two subsequent chapters: in Chapter 9 the SSH is described, while Chapter 10 introduces a daemon developed specifically for Nagios.

Wherever networks are being monitored, SNMP also needs to be implemented. Chapter 11 not only describes SNMP-capable plugins but also examines the protocol and the SNMP world itself in detail, providing the background knowledge needed for this.

The Nagios notification system is introduced Chapter 12, which also deals with notification using SMS, escalation management, and taking account of dependencies.

The interface for external commands is discussed in Chapter 13; this forms the basis of other Nagios mechanisms, such as the Nagios Service Check Acceptor (NSCA), a client-server mechanism for transmitting passive test results, covered in Chapter 14. The use of this is shown in two concrete examples—integrating syslog-ng and processing SNMP traps. NSCA is also a requirement for distributed monitoring, discussed in Chapter 15.

Even though you may have already used the Web interface, you might still be wondering about all the detailed options that this offers. Chapter 16 tries to answer this question as completely as possible, supported by very helpful screenshots. It

[5] For example, *BSD, HP-UX, AIX, and Solaris; the author does not know of any Nagios versions running under MacOS X.

also describes a series of parameters which until now have not been documented anywhere, except in the source code.

Although in its operation, Nagios concentrates primarily on traffic light signals (red-yellow-green), there are ways of evaluating and representing the performance data provided by plugins, which are described in detail in Chapter 17.

Networks are rarely homogeneous, that is, equipped only with Linux and other Unix-based operating systems. For this reason Chapter 18 demonstrates what utilities can be used to integrate and monitor Windows systems.

Chapter 19 uses the example of a low-cost hardware sensor to show how room temperature and humidity can be monitored simply yet effectively.

Nagios can also monitor proprietary commercial software, as long as mechanisms are available which can query states of the system integrated into a plugin. In Chapter 20, this is described using an SAP-R/3 system.

The appendix *Nagios Configuration* introduces all the parameters of the two central configuration files nagios.cfg and cgi.cfg, while *Rapidly Changing States: Flapping* and *EventHandler* are devoted to some useful but somewhat exotic features.

Further notes on the book

At the time of going to press, Nagios 2.0 is close to completion. When this book is on the market, there could well be some modifications. Relevant notes, as well as corrections, in case some errors have slipped into the book, can be found at http://linux.swobspace.net/books/nagios/.

Note of Thanks

Many people have contributed to the success of this book. My thanks go first of all to Dr. Markus Wirtz, who initiated this book with his comment, "Why don't you write a Nagios book, then?!", when he refused to accept my Nagios activities as an excuse for delays in writing another book. I would also like to thank the two technical editors, Steffen Waitz and Jörg Linge, for their support. A very special thanks goes to Patricia Jung, who, as the technical editor for the German language version, overhauled the manuscript and pestered me with thousands of questions—which was a good thing for the completeness of the book, and which has ultimately made it easier for the reader to understand.

From Source Code to a Running Installation

Chapter 1

Installation

The simplest method of installation is for you to install the Nagios packages that are supplied with the distribution you are using. However, Nagios 2.0 is relatively new, so you may have to make do with an older Nagios version using this method. Configuring this is quite different from the version 2.0 described here, which is why it is recommended that you take things into your own hands and compile Nagios yourself if the distributor does not provide any Nagios 2.0 packages.

If you are compiling Nagios yourself, you also have an influence on directory structures and several other parameters. A Nagios system compiled in this way also provides an almost complete main configuration file, in which, initially, nothing has to be changed. But it should be mentioned here that compiling Nagios yourself might involve a laborious search for the necessary development packages, depending on what is already installed on the computer.

For compiling Nagios itself you require gcc, make, autoconf and automake. Required libraries are libgd[1] and openssl[2]. The development packages for these must also be installed (depending on the distribution, with either the ending -dev or -devel): libssl-dev, libgd-dev, libc6-dev.

For the plugins it is recommended that you also install the following packages at the same time: ntpdate,[3] snmp,[4] smbclient,[5] libldap2, and libldap2-dev,[6] as well as the client and developer packages for the database to be used (e.g., postgresql-client and postgresql-dev).

1.1 Compiling the Source Code

The Nagios source code itself is available for download on the project page, http://www.nagios.org/. The following installation description uses a beta version that has been released,[7] and that is provided by the developers as a tarball:

```
linux:~ # mkdir /usr/local/src
linux:~ # cd /usr/local/src
linux:local/src # tar xvzf Path/to/nagios-2.0b3.tar.gz
```

The three commands unpack the source code into the directory created for this purpose, /usr/local/src. When this is done, a subdirectory with the name nagios-2.0b3 is also created. Before the actual compilation and installation, the groups required for operation, namely nagios and nagcmd, are set up with groupadd, and the user nagios, who is assigned to these groups and with whose permissions the Nagios server runs is set up with useradd:

```
linux:~ # groupadd -g 9000 nagios
linux:~ # groupadd -g 9001 nagcmd
linux:~ # useradd -u 9000 -g nagios -G nagcmd -d /usr/local/nagios \
    -c "Nagios Admin" nagios
```

Instead of the user (9000) and group IDs (9000 or 9001) used here, any other (available) ID may be used. The primary group nagios of the user nagios should remain reserved exclusively for this user.

[1] http://www.boutell.com/gd/

[2] http://www.openssl.org/ Depending on the distribution, the required RPM and Debian packages are sometimes named differently. Here you need to refer to the search help in the corresponding distribution. For Debian, the homepage will be of help. If a configure instruction complains, for example, of a missing gd.h file, you can search specifically at http://www.debian.org/distrib/packages for the contents of packages. The search will then come up with all packages that contain the file gd.h.

[3] http://ntp.isc.org/bin/view/Main/SoftwareDownloads

[4] http://net-snmp.sourceforge.net/

[5] http://samba.org/samba/

[6] http://www.openldap.org/

[7] The final version of Nagios 2.0 was not yet available at the time of going to press.

The CGI scripts are run by Nagios under the user ID of the user with whose permissions the Apache Web server runs. In order that this user can access certain protected areas of Nagios, an additional group is required, the so-called *Nagios Command Group* nagcmd: only the Web user and the user nagios should belong to this group. The Web user can be determined from the Apache configuration file:

```
linux:~ # grep "^User" /etc/httpd/httpd.conf
User www-data

linux:~ # usermod -G nagcmd www-data
```

In the example, the Web user is called www-data. The command usermod (this changes the data for an existing user account) also includes the Web user in the nagcmd group thanks to the -G option, by manipulating the corresponding entry in the file /etc/group.

The Apache configuration file is not always located in the directory /etc/httpd/; depending on the distribution on the Apache version used, this could also be called /etc/apache or /etc/apache2; the configuration file itself is sometimes called apache.conf or apache2.conf.

In addition, the directory specified as the home directory of the user nagios, /usr/local/nagios, the configuration directory /etc/nagios and the directory /var/nagios, which records variable data while Nagios is running, are set up manually and are assigned to the user nagios and to the group of the same name:

```
linux:~ # mkdir /usr/local/nagios /etc/nagios /var/nagios
linux:~ # chown nagios.nagios /usr/local/nagios /etc/nagios /var/nagios
```

You now change to the directory with the Nagios sources to prepare these for compilation:

```
linux:~ # cd /usr/local/src/nagios-2.0b3
linux:src/nagios-2.0b3 # ./configure \
    --sysconfdir=/etc/nagios \
    --localstatedir=/var/nagios \
    --with-command-group=nagcmd
```

For the configure command, parameters are specified that differ from the standard; Table 1.1 lists the most important of these. The values chosen here ensure that the installation routine selects the directories used here in the book and that all parameters are correctly set when the main configuration file is generated. This considerably simplifies the fine-tuning of the configuration.

If --prefix is not specified, Nagios installs itself in the directory /usr/local/nagios. We recommend that you stick to this directory.[8]

[8] In accordance with the *Filesystem Hierarchy Standard* FHS, version 2.3, or local programs loaded by the administrator should be installed in /usr/local.

Table 1.1: Installation parameters for Nagios

Property	**Value**	configure **Option**
Root directory	/usr/local/nagios	--prefix
Configuration directory	/etc/nagios	--sysconfdir
Directory for variable data	/var/nagios	--localstatedir
Nagios user (UserID)	nagios (9000)	--with-nagios-user
Nagios group (GroupID)	nagios (9000)	--with-nagios-group
Nagios Command Group (GroupID)	nagcmd (9001)	--with-command-group

The system normally stores its configuration files in the directory **etc** beneath its root directory. In general it is better to store these in the **/etc** hierarchy, however. Here we use **/etc/nagios.**[9]

Variable data such as the log file and the status file are by default stored by Nagios in the directory **/usr/local/nagios/var**. This is in the **/usr** hierarchy, which should only contain programs and other read-only files, not writable ones. In order to ensure that this is the case, we use **/var/nagios.**[10]

Irrespective of these changes, in most cases **configure** does not run through faultlessly the very first time, since one package or another is missing. For required libraries such as **libgd**, Nagios almost always demands the relevant developer package with the header files (here, **libgd-dev** or **libgd-devel**). Depending on the distribution, their names end in **-devel** or **-dev**.

After all the tests have been run through, **configure** presents a summary of all the important configuration parameters:

```
*** Configuration summary for nagios 2.0b3 04-03-2005 ***:

 General Options:
 -------------------------
        Nagios executable:  nagios
        Nagios user/group:  nagios,nagios
       Command user/group:  nagios,nagcmd
            Embedded Perl:  no
             Event Broker:  yes
        Install $prefix:  /usr/local/nagios
                Lock file:  /var/nagios/nagios.lock
           Init directory:  /etc/init.d
                  Host OS:  linux-gnu
```

[9] This is not entirely compatible with FHS 2.3, which would prefer to have the configuration files in **/etc/local/nagios**.

[10] This also does not quite match the requirements of the FHS 2.3. But since Nagios makes no differentiation between spool, cache, and status information, an FHS-true reproduction is not possible to achieve in a simple manner.

```
 Web Interface Options:
 ------------------------
                HTML URL:  http://localhost/nagios/
                 CGI URL:  http://localhost/nagios/cgi-bin/
 Traceroute (used by WAP):  /usr/sbin/traceroute
```

If there was a **yes** after the item **Embedded Perl**, this would mean that Perl plugins are not continually reloaded, but are kept in the memory. This saves time when running Perl scripts.[11] The *Event Broker* in turn provides an interface for extensions that can be loaded as additional modules while the system is running.[12]

If you are satisfied with the result, **make** starts the actual compilation and then installs the software:

```
linux:src/nagios-2.0b3 # make all
linux:src/nagios-2.0b3 # make install
linux:src/nagios-2.0b3 # make install-init
linux:src/nagios-2.0b3 # make install-commandmode
linux:src/nagios-2.0b3 # make install-config
```

make all compiles all the relevant programs, which are then copied to the appropriate directories, together with CGI scripts and documentation, by **make install**. Apart from /etc/nagios and /var/nagios, further directories are created under /usr/local/nagios, which are summarized in table 1.2.

Table 1.2: Nagios directories under /usr/local/nagios

Directory	Contents
./bin	Executable Nagios main program
./libexec	Plugins
./sbin	CGI scripts
./share	Documentation, HTML files for the Web interface

make install-init installs a suitable init script for the system start. Here **make** automatically tries to detect the correct path, which for most Linux distributions is /etc/init.d. Depending on your system, this may also go wrong, which is why you should check it. In order for Nagios to start automatically when the system is booted, the following symbolic links are created in the /etc/rc?.d directories:

```
linux:~ # ln -s /etc/init.d/nagios /etc/init.d/rc2.d/S99nagios
linux:~ # ln -s /etc/init.d/nagios /etc/init.d/rc2.d/K99nagios
```

[11] At the time of going to press, however, the Embedded Perl interface had problems with memory usage: Nagios occupied more and more main memory until the machine came to a standstill.

[12] At the time of going to press there were not yet any external extensions, which is why the Event Broker is currently only of interest to developers.

Where necessary, this step is repeated for rc3.d and rc5.d. Finally make install-commandmode generates the directory that is required for later usage of the *command file mechanism* (see section 13.1 from page 240) onwards. This step is optional, depending on the intended use, but since it is easy to forget later on, it is better to take precautions now. The final make install-config creates the example configuration, which will be used in the next chapter.

1.2 Installing and Testing Plugins

What is now still missing are the plugins. They must be downloaded separately from http://www.nagios.org/ and installed. As independent programs, they are subject to a different versioning system than Nagios. The current version at the time of going to press was version 1.4, but you can, for example, also use plugins from version 1.3.1 if you don't mind doing without the most recent features. Although the plugins are distributed in a common source distribution, they are independent of one another, so that you can replace one version of an individual plugin with another one at any time, or with one you have written yourself.

1.2.1 Installation

The installation of the plugin sources takes place, like the Nagios ones, in the directory /usr/local:

```
linux:~ # cd /usr/local/src
linux:local/src # tar xvzf path /to/nagios-plugins-1.4.tar.gz
linux:src/nagios-plugins-1.4 # ./configure \
    --sysconfdir=/etc/nagios \
    --localstatedir=/var/nagios
```

When running the configure command you should specify the same deviating values as for the server, which here are the configuration directory (/etc/nagios) and the directory for the data saved by Nagios (/var/nagios). Since the Nagios plugins are not maintained by the same people as Nagios itself, you should always check in advance, with ./configure --help, whether the configure options for Nagios and the plugins really match or deviate from one another.

It is possible that a series of WARNINGs may appear in the output of the configure command, something like this:

```
...
configure: WARNING: Skipping radius plugin
configure: WARNING: install radius libs to compile this plugin (see
           REQUIREMENTS).
```

```
...
configure: WARNING: Tried /usr/bin/perl - install Net::SNMP perl
           module if you want to use the perl snmp plugins
...
```

If you are not using Radius, you need have no qualms in ignoring the corresponding error messages. Otherwise you should install the missing packages and repeat the configure procedure. The quite frequently required SNMP functionality is missing a Perl module in the example. This is installed either in the form of the distribution package or online via the CPAN archive:[13]

```
linux:~ # perl -MCPAN -e 'install Net::SNMP'
```

If you are running the CPAN procedure for the first time, it will guide you interactively through a self-explanatory setup, and you can answer nearly all of the questions with the default option.

Running make in the directory nagios-plugins-1.4 will compile all plugins. Afterwards you have the opportunity to perform tests, with make check. Because these have not been particularly carefully programmed, you will often see many error messages that have more to do with the test itself than with the plugin. if you still want to try it, then the Cache Perl module must also be installed. Irrespective of make check, the most important plugins should be tested manually anyway after the installation.

make install finally anchors the plugins in the subdirectory libexec (which in our case is /usr/local/nagios/libexec), but not all of them: the source directory contrib contains a number of plugins that make install does not install automatically.

Most plugins in this directory are shell or Perl scripts. Where needed, these are simply copied to the plugin directory /usr/local/nagios/libexec. The few C programs there are must first be compiled, which in some cases may be no laughing matter, since a corresponding makefile, and often even a description of the required libraries, is missing. If a simple make is not sufficient, as in the case of

```
linux:nagios-plugins-1.4/contrib # make check_cluster2[14]
cc     check_cluster2.c   -o check_cluster2
```

then it is best to look for help in the mailing list nagiosplug-help.[15] The compiled program must also be copied to the plugin directory.

[13] The *Comprehensive Perl Archive Network* at http://www.cpan.org/.

[14] With check_cluster, hosts and services of a cluster can be monitored. Here you usually want to be notified if all nodes or redundant services provided fail at the same time. If one specific service fails on the other hand, this is not critical, as long as other hosts in the cluster provide this service.

[15] http://lists.sourceforge.net/lists/listinfo/nagiosplug-help

1.2.2 Plugin test

Because plugins are independent programs, they can already be used manually for test purposes right now—before the installation of Nagios has been completed. In any case you should check the check_icmp plugin, which plays an essential role: it checks whether another computer can be reached via ping and is the only plugin to be used both as a service check and a host check. If it is not working correctly, Nagios will also not work correctly, since the system cannot perform any service checks as long as it categorizes a host as "down". Section 6.2 from 88 describes check_icmp in detail, which is why there is only short introduction here describing its manual use.

In order for the plugin to function correctly it must, like the /bin/ping program, be run as the user root. This is done by providing it with the *SUID bit*:

```
linux:~ # chown root.nagios /usr/local/nagios/libexec/check_icmp
linux:~ # chmod 4711 /usr/local/nagios/libexec/check_icmp
linux:~ # ls -l /usr/local/nagios/libexec/check_icmp
-rwsr-x--x  1 root nagios 61326 2005-02-08 19:49 check_icmp
```

Brief instructions for the plugin are given with the -h option:[16]

```
nagios@linux:~$ /usr/local/nagios/libexec/check_icmp -h
Usage: check_icmp [options] [-H] host1 host2 hostn

Where options are any combination of:
 * -H | --host        specify a target
 * -w | --warn        warning threshold (currently 200.000ms,40%)
 * -c | --crit        critical threshold (currently 500.000ms,80%)
 * -n | --packets     number of packets to send (currently 5)
 * -i | --interval    max packet interval (currently 80.000ms)
 * -I | --hostint     max target interval (currently 0.000ms)
 * -l | --ttl         TTL on outgoing packets (currently 0)
 * -t | --timeout     timeout value (seconds, currently  10)
 * -b | --bytes       icmp packet size (currenly ignored)
   -v | --verbose     verbosity++
   -h | --help        this cruft

The -H switch is optional. Naming a host (or several) to check is not.
```

For a simple test it is sufficient to specify an IP address (it is immaterial whether you prefix the -H flag or not):

```
user@linux:~$ cd /usr/local/nagios/libexec
user@linux:nagios/libexec$ ./check_icmp -H 192.168.1.13
OK - 192.168.1.13: rta 0.261ms, lost 0%|rta=0.261ms;200.000;500.000;0;
pl=0%;40;80;;
```

[16] The listed options are explained in detail in Section 6.2 from page 88.

The output appears in a single line, which has been line-wrapped here for the printed version: with zero percent package loss (**lost 0%**), the test has been passed. Nagios uses only the first 300 bytes of the output line. If the plugin provides more information, this is cut off.

If you would like to test other plugins, we refer you to Chapters 6 and 7, which describe the most important plugins in detail. All (reasonably well-programmed) plugins provide somewhat more detailed instructions with the **--help** option.

1.3 Configuration of the Web Interface

In order for the Web front end of Nagios to function, the Web server must know the CGI directory and the basis Web directory. The following description, with a slight deviation, applies to both Apache 1.3 and Apache 2.0.

1.3.1 Setting Up Apache

As long as you have not added a different address for the front end, through the **configure** script with **-with-cgiurl**, it can be addressed under **/nagios/cgi-bin**. Since the actual CGI scripts are located in the directory **/usr/local/nagios/sbin**, a corresponding script alias is set in the Apache configuration:

```
ScriptAlias /nagios/cgi-bin /usr/local/nagios/sbin
<Directory "/usr/local/nagios/sbin">
   AllowOverride AuthConfig
   Options ExecCGI
   # Remove the comment sign (#) from the following lines for Apache 2.0:
   # SetHandler cgi-script
   Order allow,deny
   Allow from 192.168.0.0/24
</Directory>
```

The directive **ScriptAlias** ensures that Apache accesses the Nagios CGI directory when calling an URL such as **http://*nagios-server*/nagios/cgi-bin**, irrespective of where the Apache CGI directories may be located. **Options ExcecCGI** ensures that the Web server accepts all the scripts located there as CGI. Apache 2.0 in addition demands the directive **SetHandler**. The directives **Order** and **Allow** ensure that only clients from the network **192.168.0.0/24** (**/24** stands for the subnet mask **255.255.255.0**) may obtain access to the specified directory.

To be able to address the Nagios document directory **/usr/local/nagios/share** under **http://*nagios-server*/nagios** (independently of where the Apache **DocumentRoot** is located), the following is added:

```
Alias /nagios /usr/local/nagios/share
<Directory "/usr/local/nagios/share">
    Options None
    AllowOverride AuthConfig
    Order allow,deny
    Allow from 192.168.0.0/24
</Directory>
```

Here the directives Order and Allow also allow access only from the specified network.

It is recommended that you write the above details in your own configuration file, called nagios.conf, so that this configuration is not lost during an Apache update, and place it in the Apache directory for individual configurations. This is usually to be found under /etc/apache/conf.d, but depending on the distribution and the Apache version, this could also be under /etc/httpd/conf.d or /etc/apache2/conf.d. In any case the Apache configuration file must integrate this directory with the directive Include. More recent SuSE distributions only accept files in the subdirectory conf.d that end in .conf. The command

```
linux:~ # /etc/init.d/apache reload
```

loads the new configuration. If everything has worked out correctly, the Nagios main page appears in the Web browser under http://*nagios-server*/nagios.

1.3.2 User Authentication

In the state in which it is delivered, Nagios allows only authenticated users access to the CGI directory. This means that users not "logged in" have no way to see anything other than the home page and the documentation. They are blocked off from access to other functions.

There is a good reason for this: apart from status queries and other display functions, Nagios has the ability to send commands via the Web interface. The interface for external commands is used for this purpose (Section 13.1, page 240). If this is active, checks can be switched on and off via the Web browser, for example, and Nagios can even be restarted. Only authorized users should be in a position to do this.

The easiest way to implement a corresponding authentication is via a .htaccess file in the CGI directory /usr/local/nagios/sbin.[17] The document directory, on the other hand, requires no special protection. In addition, the parameter use_authentication in the CGI configuration file cgi.cfg[18] of Nagios must be set to 1:

[17] The access rule described here, via .htaccess in the CGI directory, adheres to the official Nagios documentation. Those more familiar with Apache will have other configuration possibilities available, of course.

[18] More on this in Section 2.13 from page 57.

```
use_authentication=1
```

This is the default during installation. In the CGI directory **/usr/local/nagios/sbin** a **.htaccess** file is created with the following contents:

```
AuthName "Nagios-Monitoring"
AuthType Basic
AuthUserFile /etc/nagios/htpasswd
require valid-user
```

AuthName is just a comment that the browser displays if the Web server requests authentication. **AuthType Basic** stands for simple authentication, in which the password is transmitted without encryption, as long as no SSL connection is used. It is best to save the password file—here **htpasswd**—in the Nagios configuration directory **/etc/nagios**. The final parameter, **require valid-user**, means that all authenticated users have access (there are no restrictions for specific groups; only the user-password pair must be valid).

In combination with its own modules and those of third parties, Apache allows a series of other authentication methods. These include authentication via an LDAP directory, via Pluggable Authentication Modules (PAM),[19] or using SMB via a Windows server. Here we refer you to the relevant literature and the highly detailed documentation on the Apache home page at **http://httpd.apache.org/**.

The (basically freely selectable) name of the password file will be specified here so that it displays what type of password file is involved. It is generated with the **htpasswd2** program included in Apache (in Apache 1.3 the program is called **htpasswd**). Running

```
linux:/etc/nagios # htpasswd2 -c htpasswd nagios
```

generates a new password file with a password for the user **nagios**. Its format is relatively simple:

```
nagios:7NlyfpdI2UZEs
```

Each line contains a user-password pair, separated by a colon.[20] If you want to add other users, you should ensure that you omit the **-c** ("create") option. Otherwise **htpasswd(2)** will recreate the file and delete the old contents:

```
linux:/etc/nagios # htpasswd2 htpasswd another user
```

[19] The "Pluggable Authentication Modules" now control authentication in all Linux distributions, so that you can also use existing user accounts here.

[20] To be precise, the second position does not contain the password itself, but rather its hash value.

The user name cannot be chosen freely but must match the name of a contact person (see Section 2.7, page 50). Only the Web user (www-data in our example) needs to be able to read the generated htpasswd file, and it should be protected from access by anyone else:

```
linux:/etc/nagios # chown www-data htpasswd
linux:/etc/nagios # chmod 600 htpasswd
```

Even though configuration of the Web interface is now finished, at the moment only the documentation is properly displayed: Nagios itself must first be correspondingly adjusted—as described in detail in the following chapter– before it can make usable monitoring data available in this way.

Chapter 2

Nagios Configuration

Although the Nagios configuration can become quite large, you only need to handle a small part of this to get a system up and running. Luckily many parameters in Nagios are already set to sensible default settings. So this chapter will be primarily concerned with the most basic and frequently used parameters, which is quite sufficient for an initial configuration.

Further details on the configuration are provided by the chapters on individual Nagios features: in Chapter 6 about network plugins (page 85) there are many examples on the configuration of services. All parameters of the Nagios messaging system are explained in detail in Chapter 12, page 215, and the parameters for controlling the Web interface are described in Chapter 16 from page 273. In addition to this, Nagios includes its own extensive documentation, once it is installed, in the directory /usr/local/nagios/share/docs, which can also be reached from the Web interface. This can always be recommended as a useful source for further information, which is why each of the sections below refer to the corresponding location in the original documentation.

The installation routine in make install-config (see Section 1.1 on page 26) stores examples of individual configuration files in the directory /etc/nagios. They all end in -sample, so that a possible update will not overwrite the files needed for productive operation.

All subsequent work should be carried out as the user nagios. If you are editing files as the superuser, you must ensure yourself that the contents of directory /etc/nagios afterwards belong to the user nagios again. With the exception of the file resource.cfg—this may contain passwords, which is why only the owner nagios should have the read permission set—all other files may be readable for all.

2.1 The Main Configuration File nagios.cfg

The central configuration takes place in nagios.cfg. Instead of storing all configuration options there, it makes links to other configuration files (with the exception of the CGI configuration). The easiest method is first to copy the example file:

```
nagios@linux:/etc/nagios$ cp nagios.cfg-sample nagios.cfg
```

Those who compile and install Nagios themselves have the advantage that at first they do not even need to adjust nagios.cfg, since all paths are already correctly set.[1] And that's as much as you need to do. Nevertheless one small modification is recommended, which helps to maintain a clear picture and considerably simplifies configuration where larger networks are involved.

The parameter concerned is cfg_file, which integrates files with object definitions (see Sections 2.2 through 2.10). The file nagios.cfg-sample, included in the package, contains the following entries:

```
nagios@linux:/etc/nagios$ fgrep cfg_file nagios.cfg
...
cfg_file=/etc/nagios/checkcommands.cfg
cfg_file=/etc/nagios/misccommands.cfg
cfg_file=/etc/nagios/contactgroups.cfg
cfg_file=/etc/nagios/contacts.cfg
cfg_file=/etc/nagios/dependencies.cfg
cfg_file=/etc/nagios/escalations.cfg
cfg_file=/etc/nagios/hostgroups.cfg
cfg_file=/etc/nagios/hosts.cfg
cfg_file=/etc/nagios/services.cfg
cfg_file=/etc/nagios/timeperiods.cfg
#cfg_file=/etc/nagios/hostextinfo.cfg
#cfg_file=/etc/nagios/serviceextinfo.cfg
...
```

[1] If Nagios is from a distribution package, it is worth checking at least the path details. In a well-maintained distribution these will also be matched to the Nagios directories used there.

As an alternative to cfg_file, you can also use the parameter cfg_dir: this requests you to specify the name of a directory from which Nagios should integrate all configuration files ending in .cfg (files with other extensions are simply ignored). This also works recursively; Nagios thus evaluates all *.cfg files from all subdirectories. With the parameter cfg_dir you therefore only need to specify a signal directory, instead of calling all configuration files, with cfg_file, individually. The only restriction: these must be configuration files that describe objects. The configuration files cgi.cfg and resource.cfg are excluded from this, which is why, like the main configuration file nagios.cfg, they remain in the main directory /etc/nagios.

For the object-specific configuration, it is best to create a directory called /etc/nagios/mysite, then remove all cfg_file directives in nagios.cfg (or comment them out with a # at the beginning of the line) and replace them with the following:

```
...
cfg_dir=/etc/nagios/mysite
...
```

The contents of the directory /etc/nagios will then look like this:

```
nagios@linux:/etc/nagios$ tree[2]
.
|-- nagios.cfg
|-- cgi.cfg
|-- resource.cfg
|-- htpasswd
|-- mysite
|   |-- contactgroups.cfg
|   |-- misccommands.cfg
|   |-- contacts.cfg
|   |-- timeperiods.cfg
|   |-- checkcommands.cfg
|   |-- hosts.cfg
|   |-- services.cfg
|   `-- hostgroups.cfg
|-- sample
|   |-- ...
... ...
```

The main directory /etc/nagios contains only three configuration files and the password file for protected Web access. For the sake of clarity, the configuration examples *-sample should be moved to the directory sample.

In this book we will include all objects of a type in a file of its own, that is, all host definitions in the file hosts.cfg, all services in services.cfg, and so on. But you could just as well save each of the host definitions in a separate file for each host and use a directory structure to reflect this:

[2] http://mama.indstate.edu/users/ice/tree/

```
...
|-- mysite
|   |-- linux
|   |   |-- services
|   |   `-- hosts
|   |       |-- linux01.cfg
|   |       |-- linux02.cfg
|   |       `-- linux03.cfg
|   |-- windows
|   |   |-- services
|   |   `-- hosts
|   |       |-- win03.cfg
|   |       `-- win09.cfg
|   |-- router
|   |   |-- services
|   |   `-- hosts
|   |       |-- edge01.cfg
|   |       |-- edge02.cfg
|   |       `-- backbone.cfg
...
```

In doing this, only the top directory mysite needs to be integrated into nagios.cfg, using cfg_dir. For the initial configuration, however, we will leave all the files in the directory mysite.

The date specifications in Nagios appear by default in the American format *MM-DD-YYYY*:

```
date_format=us
```

If you prefer something else, e. g. the European date format, it is recommended that you change the parameter date_format in nagios.cfg right from the start. The value iso8601 ensures that Nagios date specifications are displayed in the ISO or DIN format *YYYY-MM-DD HH:MM:SS*. Table 2.1 lists the possible values for date_format.

Table 2.1: possible date format

Value	Representation
us	*MM-DD-YYYY HH:MM:SS*
euro	*DD-MM-YYYY HH:MM:SS*
iso8601	*YYYY-MM-DD HH:MM:SS*
strict-*iso8601*	*YYYY-MM-DD*T*HH:MM:SS*

The other parameters in nagios.cfg are described in Appendix D.1 on page 424; in the original documentation these can be found at http://localhost/nagios/docs/configmain.html or /usr/local/nagios/share/docs/configmain.html.

2.2 Objects—an Overview

A Nagios object describes a specific unit: a host, a service, a contact, but also the groups to which it belongs. Even commands are defined as objects. This definition has not come about by chance: Nagios is also able to inherit characteristics (Section 2.11 from page 54).

Object definitions follow the following pattern:

```
define object-type {
   parameter  value
   parameter  value
   ...
}
```

Nagios has the following values for the ***object-type***:

host
: The host object describes one of the network nodes that are to be monitored. Nagios expects the IP address as a parameter here (or the *Fully Qualified Domain Name*) and the command that should define whether the host is alive (see Section 2.3 from page 44). The host definition is re-referenced in the service definition.

hostgroup
: Several hosts can be combined into a group (see Section 2.4 on page 46). This simplifies configuration, since entire host groups instead of single hosts can be specified when defining services (the service will then exist for each member of the group). In addition, Nagios represents the hosts of a host group together in a table in the Web front end, which also helps to increase clarity.

service
: The individual services to be monitored are defined as service objects (Chapter 2.5 from page 47). A service never exists independently of a host. So it is quite possible to have several services with the same name, as long as they belong to different hosts. The following code,

```
define service {
    name PING
    host_name linux01
    ...
}
define service {
   name PING
   host_name linux03
}
```

describes two services that both have the same service name but belong to different hosts. So in the language of Nagios, a service is always a host-service pair.

servicegroup

As it does with host groups, Nagios also combines several services, to represent these in the Web front end as a unit with its own table (see Section 2.6 on page 50). Service groups are not absolutely essential, but help to improve clarity, and are also used in reporting.

contact

A person who is to be informed by Nagios of specific events (see Section 2.7 from page 50). Nagios also uses contact objects to show to a user via the Web front end only those things for which the user is listed as a contact person. In the basic setting users do not get to see hosts and services for which they are not responsible.

contactgroup

Notification of events in hosts and services takes place via the contact group (Section 2.8 from page 52). A direct link between the host/service and a contact person is not possible.

timeperiod

Describes a time period within which Nagios should inform contact groups (Section 2.10 from page 54). Outside such a time slot, the system will not send any messages. The messaging chain can be fine-tuned via various *time periods*, depending on the host/service and contact/contact groups. More on this will be presented in Section 12.3 from page 217.

command

Nagios always calls external programs via command objects (Section 2.9 from page 53). Apart from plugins, messaging programs also include sending e-mails or SMS messages.

servicedependency

This object type describes dependences between services. If, for example, an application does not function without a database, a corresponding dependency object will ensure that Nagios will represent the failed database as the primary problem instead of just announcing the nonfunctioning of the application (see Section 12.6 from page 234).

serviceescalation

Used to define proper escalation management: if a service is not available after a specific time period, Nagios informs a further, or different circle of people. This can also be configured on multiple levels, in any way you want (see Section 12.5).

hostdependency
: Like **servicedependency**, but for hosts.

hostescalation
: Like **serviceescalation**, but for hosts.

hostextinfo
: "*Extended Host Information*" objects are optional and define a specific graphic and/or URL, which Nagios additionally integrates into its graphic output. The URL can refer to a Web page that provides additional information on the host (see Section 16.4 from page 307).

serviceextinfo
: *Extended Service Information*, like *Extended Host Information*.

Not all object types are absolutely essential; especially at the beginning, you can easily do without the ***dependency**, ***escalation**, and ***extinfo** objects, as well as the **servicegroup**. Chapter 12 looks at escalation and dependencies in detail. The *extended information* objects are used to provide a "more colorful" graphical representation, but they are not at all necessary for running Nagios. We refer here to the original documentation.[3]

Notes on the object examples below

Although the following chapters describe individual object types in detail, only the mandatory parameters are described there and those that are absolutely essential for meaningful operation. Mandatory parameters here are always printed in **bold** type. The first (comment) line in each example lists the file in which the recorded object definition is to be stored.

When you first start using Nagios, it is recommended that you restrict yourself to a minimal configuration with only one or two objects per object type, in order to keep potential sources of error to a minimum and to obtain a running system as quickly as possible. Afterwards extensions can be implemented very simply and quickly, especially if you take on board the tips mentioned in Section 2.11 on templates (page 54).

Time details in general refer to time units. A time unit consists of 60 seconds by default. It can be set to a different value in the configuration file **nagios.cfg**, using the parameter **interval_length**. You should really change this parameter only if you know exactly what you are doing.

[3] http://localhost/nagios/docs/xodtemplate.html#hostextinfo and #serviceextinfo; the file can be found locally in /usr/local/nagios/share/docs/

2.3 Defining the Machines to Be Monitored, with host

The host object is the central command post on which all host and service checks are based. It defines the machine to be monitored. The parameters printed in bold must be specified in all cases:

```
# -- /etc/nagios/mysite/hosts.cfg
define host{
   host_name                    linux01
   hostgroups                   linux-servers
   alias                        Linux File Server
   address                      192.168.1.9
   check_command                check-host-alive
   max_check_attempts           3
   check_period                 24x7
   contact_groups               localadmins
   notification_interval        120
   notification_period          24x7
   notification_options         d,u,r,f
   parents                      router01
}
```

host_name

This parameter specifies the host name with which Nagios addresses the machine in services, host groups and other objects. Only the special characters - and _ are allowed.

hostgroups

This parameter, new in version 2.x, allocates the host to a host group object, which must already be defined (Section 2.4, page 46). A host group in the Web interface combines several hosts into a group (see Figure on page 280). The second possibility of assigning a host to a host group, compatible with version 1.x, uses the **members** parameter in defining the host group itself. The two methods can also be combined.

alias

This parameter contains a short description of the host, which Nagios displays at various locations as additional information. Ordinary text is allowed here.

address

This specifies the IP address or the *Fully Qualified Domain Name* (FQDN) of the computer. If it is possible (i.e., for static IP addresses), you should use an IP address, since the resolution of a name to an IP address is always dependent on DNS working, which is also not infallible.

check_command
This specifies the command with which Nagios checks, if necessary, to see whether the host is reachable. The parameter is optional. If it is omitted, Nagios will never carry out a host check! This can be useful for network components that are frequently switched off (for example, print servers).

The command normally used for check_command is called check-host-alive, which is already predefined in the supplied file, checkcommands.cfg (see Section 2.9 on page 53). This makes use either of the plugin check_ping or the more modern check_icmp. Both plugins check the reachability of the host via the ICMP packets "ICMP Echo Request" and "Echo Reply".

max_check_attempts
This parameter determines how often Nagios should try to reach the computer if the first test has gone wrong. The value 3 in the example means that the test is repeated up to three times if it returns anything other than "OK" in the first test. As long as there are still repeat tests to be made, Nagios refers to this as a *soft state*. If the final test has been made, the system categorizes the state as *hard*. Nagios notifies the system administrator exclusively of hard states and in the example sends messages only if the third test also ends with an error or warning.

check_period
This specifies the time period in which the host should be monitored. Really, only "round the clock" makes sense, that is, 24x7. A timeperiod object is involved here, the definition of which is described in more detail in Section 2.10 on page 54. It only makes sense to use a specification other than 24x7 if you want to explicitly suppress the host check at certain times.

contact_groups
This specifies the receiver of messages which Nagios sends with respect to the hosts defined here, that is localadmin. Section 2.8 explains this more fully on page 52.

notification_interval
This specifies at what intervals Nagios should repeat notification of the continued existence of the state. 120 time units normally mean one message every 120 minutes, provided the error state continues.

notification_period
This specifies at what time interval a message should be sent. A time period different from 24x7 could certainly be useful here. It is important to understand the difference here with check_period: if check_period excludes time periods, Nagios cannot even determine whether there is an error or not. But if the host is monitored round-the-clock and only the notification period is restricted by the parameter notification_period, Nagios will certainly log

errors and also display them in the Web front end and in log evaluations. Outside the **notification_period** the system does not send any messages. A more detailed description of the notification system is given in Section 12.3 from page 217.

notification_options

This parameter describes the states about which Nagios should provide notification when they occur. Nagios knows the following states for computers:

d	down
u	unreachable (host is not reachable because a network node between Nagios and a host has failed and the actual state of the host cannot be determined)
r	recovery (OK state after an error)
f	flapping (state changes very quickly; more on this in Appendix A from page 401).

By specifying **d,u**, the system will send messages if the host is not on the network or not reachable over the network, but not if it can be reached again after an error state (recovery). If **n** (none) is used as the value, Nagios will normally not give any notification.

The form in which Nagios sends out a message depends on how the contact is defined. Irrespective of when you want to be notified, the Web interface always shows the current state, even if Nagios does not send a message because the time period does not match or the system is still repeating the tests (the so-called soft state).

parents

This allows the physical topology of the network to be taken into account. Here the router or the network component is given by which the host is reachable if it is not in direct contact in the same network segment. This can also be a switch between the Nagios server and the host. If Nagios does not reach the host because all parents (separated by commas) are down, then Nagios categorizes it as "unreachable", but not as "down".

Further information is provided by the online help under **http://localhost/nagios/docs/xodtemplate.html#host**[4].

2.4 Grouping Computers Together with hostgroup

A host group contains one or more computers so that they can be represented in the Web interface together (see Figure on page 280)—in addition, certain objects

[4] can be found locally in **/usr/local/nagios/share/docs/xodtemplate.html**.

(e.g., services) can be applied to an entire group of computers instead of having to define them individually for each host.

The **hostgroup_name** parameter specifies a unique name for the group, **alias** accepts a short description. The **members** parameter lists all hosts names belonging to the group, separated by commas:

```
# -- /etc/nagios/mysite/hostgroups.cfg
define hostgroup{
   hostgroup_name  linux-servers
   alias           Linux Servers
   members         linux01,linux02
}
```

If you specify to which group they belong in the host definition for individual member computers, with the parameter **hostgroups** (page 44), the **members** entry may be omitted from version 2.0. This means that you no longer have two search through all group definitions if you just want to delete a single host. The combined use—of **members** in the **hostgroup** object and at the same time, of **hostgroups** in the **host** object—is equally possible.

2.5 Defining Services to Be Monitored with service

A service in Nagios always consists of the combination of a host and a service name. This combination must be unique. Service names, on the other hand, may occur many times, as long as they are combined with different hosts.

The simplest service consists of a simple ping, which tests whether the relevant host is reachable, and which registers the response time and any packet loss that may occur:

```
# -- /etc/nagios/mysite/services.cfg
define service{
   host_name                      linux01
   service_description            PING
   check_command                  check_ping!100.0,20%!500.0,60%
   max_check_attempts             3
   normal_check_interval          5
   retry_check_interval           1
   check_period                   24x7
   notification_interval          120
   notification_period            24x7
   notification_options           w,u,c,r,f
   contact_groups                 localadmins
}
```

In contrast to a host check, which Nagios carries out only if it cannot reach any other service of the host, a ping service is carried out at regular intervals. Problems in the network can be detected relatively simply through response times and packet loss rates. The host check is less suitable for this purpose.

host_name

This refers to the name defined in the host object. Nagios also obtains the IP address of the computer via this. Instead of a single host name, you can also enter a comma-separated list of multiple hosts. As an alternative to host_name, it is also possible to use the parameter hostgroup_name to specify an entire host group instead of individual hosts. The service is then considered to be defined for each of the individual computers groups together in this way. Whether you make use of this optimization, or allocate your own service definitions to each computer individually, makes no difference to Nagios.

service_description

This parameter defines the actual name of the service. Spaces, colons, and dashes may be included in the name. Nagios always addresses a service as a combination of host name (here: linux01) and service description (PING). This must be unique.

check_command

This defines the command with which Nagios tests the service for functionality. Arguments are passed on to the actual command, check_ping, separated by exclamation marks. The definition of the check_ping command, predefined in the example files, is explained in Section 2.9 on page 53.

In the example, the values for the warning limit (100 ms, 20%) and for the CRITICAL status (500 ms, 60%) are determined. You could compare this to a traffic light: the state OK (green) occurs if the response time remains under the warning limit of 100 milliseconds, and if none or less than 20 percent of packets have been lost. The WARNING state (yellow) occurs if the packet loss or response time lies above the defined warning limit, but still beneath the critical limit. Above the critical limit, Nagios issues a CRITICAL state (red). The return value of the plugin is described at the beginning of Chapter 6 (page 6), the underlying plugin check_icmp is introduced in detail in Section 6.2 from page 88.

max_check_attempts

This specifies how often Nagios should repeat a test in order to verify and definitively accept an error state which has been discovered (or also the recovered functionality), that is, to recognize it as a *hard state* In the transitional phase (for example from OK to CRITICAL) we speak of a *soft state*. Basic distinctions between soft and hard are only made by the Nagios notification system, which is why the two states are described in more detail in the context of this (Chapter 12 from page 215). The difference has no influence in the representation in the Web interface.

normal_check_interval

This specifies at what interval Nagios should test the service when the system is in a stable condition—this can equally be an OK or an error state. In the example this is five time units, which is normally five minutes.

retry_check_interval

This describes the time interval between two tests when the state is in the process of changing (for example, from OK to WARNING), that is, when there is a soft state

As soon as Nagios has performed the number of tests specified in **max_check _attempts**, it checks the service again at intervals of **normal_check_interval**.

check_period

This describes the time period in which the service is to be monitored. The entry represents a **timeperiod** object, the definition of which is described in more detail in Section 2.10 from page 54. Here you should enter **24x7** for "round the clock" unless you want to explicitly stop the test from running at specific times (perhaps because of a scheduled maintenance slot). If only the notification is to be prevented at specific time, it is better to use the option **notification_period** or other filters of the Nagios notification system (see Section 12 from page 215).

notification_interval

This determines at what regular intervals Nagios repeats reports on error states. In the example, the system does this every 120 time units (normally minutes), as long as the error state continues. A value of **0** causes Nagios to announce the current state only once.

notification_period

This describes the time period within which a notification should take place. This again involves a **timeperiod** object (see Section 2.10). Here in the example, **24x7** is used, so notification is sent round the clock. A more detailed discussion of the **notification_period** parameter can be found in Section 12.3 from page 217.

notification_options

This determines which error states Nagios should report. Possible values which can be used here are the five states already described for host objects, **c** (critical), **w** (warning), **u** (unknown), **r** (recovered) and **f** (flapping). specifying **c,r** only informs the system is a service is in a CRITICAL state and if it subsequently recovers (RECOVERY).

If you use n (none) as the value, Nagios will normally not send any notification. The Web interface nevertheless shows the current states.

contact_groups
: Finally, this parameter defines the recipient group whose members should receive the notifications. Several groups can be entered as a comma-separated list.

Further information can be found in the online help at http://localhost/nagios/docs/xodtemplate.html#service.[5]

2.6 Grouping Services Together with servicegroup

Service groups, like host groups, combine several services into a group, so that they can be represented together in the Web front end. This increases clarity and simplifies certain evaluations, but it is optional, and is not recommended at the beginning, because of the more simple configuration.

```
# -- /etc/nagios/mysite/servicegroups.cfg
define servicegroup{
   servicegroup_name  all-ping
   alias              All Pings
   members            linux01,PING,linux02,PING
}
```

servicegroup_name and alias have the same meanings as for the host group. It should be noted that the syntax is the same as for the members entry: since a service in Nagios always consists of the combination of host and service names, both must always be listed in pairs. The computer comes first, and then the service:

```
members host1,service1,host2,service2, ...
```

2.7 Defining Addressees for Error Messages: contact

A contact is basically a person to whom a message addressed via a contact group is sent:

[5] The corresponding file is located after installation in the directory /usr/local/nagios/share/docs/

```
# -- /etc/nagios/nagios/mysite/contacts.cfg
define contact{
   contact_name                   nagios
   alias                          Nagios Admin
   host_notification_period       24x7
   service_notification_period    24x7
   service_notification_options   w,u,c,r
   host_notification_options      d,u,r
   service_notification_commands  notify-by-email
   host_notification_commands     host-notify-by-email
   email                          nagios-admin@localhost
}
```

The contact also plays a role during authentication: a user who logs in at the Web front end only gets to see the hosts and services for which that user is entered as the contact. The user for logging in to the Web interface must therefore be identical with the value of contact_name specified here. The first time it is used, the user nagios is sufficient.

contact_name

This parameter defines the username. It must match the corresponding username in the password file htpasswd.

alias

This parameter describes the contact briefly. Spaces are allowed here.

host_notification_period

This defines the time period during which messages on the reachability of a computer can be sent. Section 12.3 (page 217) shows how the time period details can be sensibly combined in the different object types. At the beginning, the value 24x7 (that is: always) is certainly not a bad option.

service_notification_period

This defines the time period in which Nagios sends notifications to the relevant user service. The entry takes effect as a filter: the generated message is simply discarded here if it is sent outside the specified time period. If no further message follows, the contact remains uninformed. You must therefore think about combining individual time periods in various different definitions. Dependencies are described extensively in Section 12.3.

host_notification_options

This defines what types of host messages the user should receive. The same options are used here as for the host parameter notification_options (page 46).

service_notification_options
: This parameter describes what types of service messages are received by the contact. The same five values are involved as for the **notification_options** parameter for service and host objects.

service_notification_commands
: This parameter defines which commands (one or more) take charge of notification. They must be defined as the **command** object type (see Section 2.9); basically any external programs can be integrated.

host_notification_commands
: This parameter specifies, like the **service_notification_commands**, which commands are to be carried out to send the notification, although here it concerns the reachability of computers.

email
: This specifies one or more e-mail addresses (separated by commas) to which a message should be sent. The notification command can evaluate this value (one example of this is the command **notify-by-email**[6]).

Further information can be found in the online help at **http://localhost/nagios/docs/xodtemplate.html#contact**.

2.8 The Message Recipient: contactgroup

The **contactgroup** serves as the interface between the notification system and the individual contacts. Nagios never addresses individual contacts directly in various object definitions, but always goes through the contact group.

Here Nagios also expects a name (**contactgroup_name**) and a comment (**alias**), which reveals to visitors to the web site what the purpose of the group is. For members (**members**) of the group, you can enter an individual contact or a comma-separated list of several contacts:

```
# -- /etc/nagios/mysite/contactgroups.cfg
define contactgroup{
   contactgroup_name  localadmins
   alias              Local Site Administrators
   members            nagios
}
```

[6] see table 12.1 on page 226

2.9 When Nagios Needs to Do Something: the command Object

Everything that Nagios does is defined in command objects. In the example file supplied, checkcommands.cfg-sample defines a broad range of commands which only need to be included. To do this, you just copy file to the subdirectory mysite:

```
nagios@linux:/etc/nagios$  cp sample/checkcommands.cfg-sample \
   mysite/checkcommands.cfg
```

The already existing command check_ping illustrates the definition of this object type:

```
# -- /etc/nagios/mysite/checkcommands.cfg
...
define command{
   command_name check_ping
   command_line $USER1$/check_icmp -H $HOSTADDRESS$ -w $ARG1$ \
   -c $ARG2$ -p 5
}
...
```

check_ping is the name by which the command will later be called when defining a service. command_line describes the command to be executed. Not only the old plugin check_ping is used here, but also the more efficient check_icmp. The differences between the two are explained in more detail in Section 6.2 from page 88, but they use the same parameters to a large extent.

The identifiers used here, surrounded by dollar signs, are macros. Nagios recognizes three different types of macros: $USER*x*$ macros (*x* may take on values between 1 and 32) define the file resource.cfg. The macro $USER1$, which contains the path to the plugin directory, belongs to this.

The second group of macros are arguments which can be passed on when a command is called. These include $ARG1$ and $ARG2$.

The third group defined by Nagios includes the macro $HOSTADDRESS$, which references the IP address of the host in the host definition (that is, the parameter address). This type of macro is documented in the online help at http://localhost/nagios/docs/macros.html.

If you call the service defined on page 47, linux01,PING as a check_command

```
check_ping!100.0,20%!500.0,60%
```

then 100.0,20% will appear in $ARG1$, and 500.0,60% in $ARG2$. To separate the command and the arguments to be passed on, the exclamation mark is used.

In theory, any programs at all can be started via the **command_line**, but Nagios expects a certain type of behavior here, particularly where the return value is concerned. For this reason, only Nagios plugins should be used (see Chapter 6 up to 9).

2.10 Defining a Time Period with timeperiod

timeperiod objects describe time periods in which Nagios generates and/or sends notifications. The included example files **minimal.cfg-sample** and **bigger.cfg-sample** contain a number of definitions that can simply be copied to your own **timeperiods.cfg** file.

In this, the definition of **24x7** is stated as "Sundays to Saturdays, from 0 to 24 hours in each case":

```
# -- /etc/nagios/mysite/timeperiods.cfg
define timeperiod{
   timeperiod_name 24x7
   alias           24 Hours A Day, 7 Days A Week
   sunday          00:00-24:00
   monday          00:00-24:00
   tuesday         00:00-24:00
   wednesday       00:00-24:00
   thursday        00:00-24:00
   friday          00:00-24:00
   saturday        00:00-24:00
}
```

The times of day on individual weekdays can also be "cobbled together" from time periods, separated by a comma:

```
define timeperiod{
   ...
   monday          00:00-09:00,12:00-13:00,17:00-24:00
   ...
}
```

if a day specification is omitted completely, the defined time period will not include this day in its entirety.

2.11 Templates

Nagios categorizes definitions as objects for a very good reason: their features can namely be inherited by other objects—a feature that can save a lot of time otherwise spent typing. You can define a so-called *template* and pass this on to other objects as a basis from which you only need to describe those details that are different.

This is best illustrated by an example (the parameters that are required for the use of templates are printed in bold):

```
# -- /etc/nagios/mysite/hosts.cfg
define host{
   name                         Generic-Host
   register                     0

   check_command                check-host-alive
   max_check_attempts           3
   check_period                 24x7
   contact_groups               localadmins
   notification_interval        120
   notification_period          24x7
   notification_options         d,u,r,f
}
```

With **name**, the template is first given a name so that it can be referenced later on. The following entry, **register 0**, prevents Nagios from trying to treat this template as a real host. In the example, the entries for the genuine host object are not sufficient; consequently Nagios would break off when reading the configuration file, with the error message that parameters are missing that are obligatory for such a definition, for example:

```
Error: Host name is NULL
```

All the other parameters involve settings that are to apply to all definitions dependent on **Generic-Host**.

In the actual host definition—in the following example for **linux03** und **linux04**—the parameter **use** references the template and thus takes over the preset values:

```
# -- /etc/nagios/mysite/hosts.cfg
define host{
   host_name                    linux03
   use                          Generic-Host
   alias                        Linux File Server
   address                      192.168.0.1
}

define host{
   host_name                    linux04
   use                          Generic-Host
   alias                        Linux Print Server
   address                      192.168.0.2
}
```

In this way you only need to complete those entries that vary anyway between the two hosts.

But parameters may also appear in host definitions that have already been defined by the template. In this case the definition at the host has priority, it overwrites the value from the template.

Templates created in this way can generally be used for all object types. Further information on their use can be found in the online help at http://localhost/nagios/docs/templaterecursion.html.[7]

2.12 Configuration Aids for Those Too Lazy to Type

2.12.1 Defining services for several computers

You can simplify things a lot in the service definition by defining a service for several hosts, or even host groups, at the same time:

```
# -- /etc/nagios/mysite/services.cfg
define service{
   host_name                linux01,linux02,linux04,...
   service_description      PING
   ...
}
```

Specifying several hosts, separated by commas, ensures that Nagios defines multiple services in parallel. You can go one step further by specifying the '*' character instead of individual computer aliases. This will assign this service to all hosts.

A third possibility is an allocation in parallel via host groups:

```
# -- /etc/nagios/mysite/services.cfg
define service{
   hostgroup_name           linux-servers,windows-servers
   service_description      PING
   ...
}
```

In this case the parameter hostgroup_name is used instead of the host_name parameter.

[7] can be found locally in /usr/local/nagios/share/docs/templaterecursion.html.

2.12.2 One host group for all computers

The quickest way to describe a host group containing all defined computers is with the wild card '*':

```
# -- /etc/nagios/mysite/hostgroups.cfg
define hostgroup{
   hostgroup_name    all-hosts
   members           *
   ...
}
```

2.12.3 Other configuration aids

In practice, the definition of services covering multiple hosts, described on page 56, is by far the most important. But there are other configuration aids based on the escalation and dependency objects, introduced on page 224 (see Sections 12.5 and 12.6). There you can also use hostgroup_name instead of host_name (a list of host groups) or servicegroup_name instead of service_description. In addition you may set the value * for host_name and service_description, which covers all hosts or services.

2.13 CGI Configuration in cgi.cfg

In order for the Web front end to work correctly, Nagios needs the configuration file cgi.cfg. The example included, called cgi.cfg-sample, can initially be taken over one-to-one, since the paths contained in it were set correctly during installation:

```
nagios@linux:/etc/nagios$ cp sample/cgi.cfg-sample ./cgi.cfg
```

Important: the file cgi.cfg should be located in the same directory as nagios.cfg, because the CGI programs have been compiled in this path permanently. If cgi.cfg is located in a different directory, the Web server must also be given an environment variable with the correct path, called NAGIOS_CGI_CONFIG. How this is set in the case of Apache is described in the corresponding online documentation at http://httpd.apache.org/docs-2.0/env.html.

Out of the box, only a few parameters are enabled in the CGI configuration file. What these are is revealed by the following egrep command, which excludes comments and empty lines:

```
nagios@linux:/etc/nagios$ egrep -v '^$|^#' cgi.cfg-sample | less
main_config_file=/etc/nagios/nagios.cfg
```

```
physical_html_path=/usr/local/nagios/share
url_html_path=/nagios
show_context_help=0
use_authentication=1
default_statusmap_layout=5
default_statuswrl_layout=4
refresh_rate=90
```

main_config_file
: This parameter specifies the main configuration file.

physical_html_path
: This specifies the absolute path in the file tree to the directory in which the HTML documents—including online documentation, images and CSS stylesheets—are located.

url_html_path
: This also describes the path to the Nagios HTML documents, but from the perspective of the Web server, not of the operating system.

show_context_help
: This option provides—as long as it is switched on (value 1)—a context-dependent help if you move the mouse in the Web interface over individual links or buttons.

use_authentication
: This option should always be switched on (value 1). Nagios will then only allow access to authenticated users. The authentication itself is configured in a **.htaccess** file in the CGI directory (see Section 1.3 on page 33). If this file is missing, and if **use_authentication=1**, then the CGI programs will refuse to work.

default_statusmap_layout and default_statuswrl_layout
: These layout parameters describe forms of representation in the graphical illustration of network dependencies. Possible values are described in Appendix D.2 on page 444.

refresh_rate
: This specifies the timespan in seconds after which the browser is instructed to reload data from the Web server. In this way the display in the browser is always up-to-date.

authorized_for_all_services and authorized_for_all_hosts
: In order for a specific user to be able to see all computers and services in the Web interface right from the beginning, without taking account of the allocation of hosts and services to the correct contact group, you should also activate the following two parameters in the file **cgi.cfg**:

```
authorized_for_all_services=nagios
authorized_for_all_hosts=nagios
```

The Web user (and contact) **nagios** is now able to see all hosts and all services in the Web interface, even if he is not entered as the contact responsible for all hosts or services.

A complete list of all parameters can be found in Appendix D.2 on page 443.

2.14 The Resources File resource.cfg

Nagios expects to find the definition of macros, concerning how they are used to create command objects (Chapter 2.9 from page 53), in the resources file **resource.cfg**. This can also be copied from the example supplied:

```
nagios@linux:/etc/nagios$ cp sample/resource.cfg-sample./resource.cfg
```

The location where Nagios should search for this file is defined by the **resource.cfg** parameter in the main configuration file **nagios.cfg**. it makes sense here to use the same directory in which **nagios.cfg** is also located.

In its "factory settings", **resource.cfg** defines only the **$USER1$** macro, which contains the path to the plugins:

```
$USER1$=/usr/local/nagios/libexec
```

In total, Nagios has provisions for 32 freely definable **$USER*x*$** macros, where *x* can be from 1 to 32. These can be very useful in combination with passwords, for example: a password is defined via such a macro in the file **resource.cfg**, which may be read only by the user **nagios**. The defined macro is used in the actual service definitions, thus hiding the password from view of curious onlookers.

Chapter 3

Startup

Once Nagios and the plugins are installed, and Apache is set up for the Web interface, as well as the minimal configuration as described until now, operation of the system can get under way. If you have not already done so, it is recommended that you first spend a bit of time on the test for the **check_icmp** plugin, described in Section 1.2 (page 30), to check the initial configuration.

3.1 Checking the Configuration

The **nagios** program, which normally runs as a daemon and continually collects data, can also be used to test the configuration:

```
nagios@linux:~$ /usr/local/nagios/bin/nagios -v /etc/nagios/nagios.cfg
[...]
Checking services...
```

```
        Checked 1 services.
Checking hosts...
Warning: Host ’linux02’ has no services associated with it!
        Checked 2 hosts.
Checking host groups...
        Checked 1 host groups.
Checking service groups...
        Checked 0 service groups.
Checking contacts...
Warning: Contact ’wob’ is not a member of any contact groups!
        Checked 2 contacts.
Checking contact groups...
        Checked 1 contact groups.
Checking service escalations...
        Checked 0 service escalations.
Checking service dependencies...
        Checked 0 service dependencies.
Checking host escalations...
        Checked 0 host escalations.
Checking host dependencies...
        Checked 0 host dependencies.
Checking commands...
        Checked 22 commands.
Checking time periods...
        Checked 4 time periods.
Checking extended host info definitions...
        Checked 0 extended host info definitions.
Checking extended service info definitions...
        Checked 0 extended service info definitions.
Checking for circular paths between hosts...
Checking for circular host and service dependencies...
Checking global event handlers...
Checking obsessive compulsive processor commands...
Checking misc settings...

Total Warnings: 2
Total Errors:   0

Things look okay - No serious problems were detected during the
pre-flight check
```

Although warnings displayed here can in principle be ignored, this is not always what the inventor had in mind: perhaps you made a mistake in the configuration, and Nagios is ignoring a specific object, which you would actually like to use.

The first warning in the example refers to a host called linux02, which has not been allocated any services. Since Nagios works primarily with service checks, and uses host checks only if it needs them, a computer should basically always be allocated at least one service. Nagios issues a warning, as here, if no service at all has been defined for a particular host.

It is also recommended, however, to always define a "PING" service for every host, although this is not absolutely essential. Even if the same plugin, **check_icmp**, is used here as with the host check, this is not the same thing: the host check is satisfied with a single response packet, after all, it only wants to find out if the host "is alive". As a service check, **check_icmp** registers packet run times and loss rates, which can be used to draw conclusions, if necessary, concerning existing problems with a network card.

The second warning refers to a contact named **wob**, who, although defined, is not used, because he does not belong to any contact group.

In contrast to warnings, genuine **errors** must be eliminated, because Nagios will usually not start if the parser finds an error, as in the following example:

```
Error: Could not find any host matching 'linux03'
Error: Could not expand hostgroups and/or hosts specified in service
(config file '/etc/nagios/mysite/services.cfg', starting on line 0)

***> One or more problems was encountered while processing the config
files...
```

Here the configuration mistakenly contains a host called **linux03**, for which there is no definition. If you read through the error message carefully, you will quickly realize that the error can be found in the file **/etc/nagios/mysite/services.cfg**.

In the definition of independencies (*host* and *service dependencies*, see Section 12.6 page 234) there is a fundamental risk that circular dependencies could be specified by mistake. Because Nagios cannot automatically resolve such dependencies, this is also checked before the start, and if necessary, an error is displayed.

When using the **parents** parameter, it is also possible that two hosts may inadvertently serve mutually as "parents"; Nagios also test this.

3.2 Getting Monitoring Started

3.2.1 Manual start

During the Nagios installation, the command

```
linux:src/nagios # make install-init
```

saves a startup script in the **/etc/init.d** directory. If the configuration test ran without error, Nagios is first started manually with this script:

```
linux:~ # /etc/init.d/nagios start
```

3.2.2 Automatic start

If all runs smoothly here—which can be checked by running the Web interface (see Chapter 3.3)—you only need to ensure that the script is also started when the system boots. Symbolic links exist in the directories /etc/init.d/rc[235].d for this purpose:

```
linux:~ # ln -s /etc/init.d/nagios /etc/init.d/rc2.d/S99nagios
linux:~ # ln -s /etc/init.d/nagios /etc/init.d/rc2.d/K99nagios
```

Corresponding links are also set in the subdirectories responsible for runlevels 3 and 5 rc3.d and rc5.d.

3.2.3 Making configuration changes come into effect

If configuration changes are made, it is not required, and not even recommended, that you restart Nagios each time. Instead, you just perform a reload:

```
linux:~ # /etc/init.d/nagios reload
```

This causes Nagios to reread the configuration, end tests for hosts and services that no longer exist, and integrate new computers and services into the test. However, with each reload there is a renewed *scheduling* of checks, meaning that Nagios plans to carry out all tests afresh.

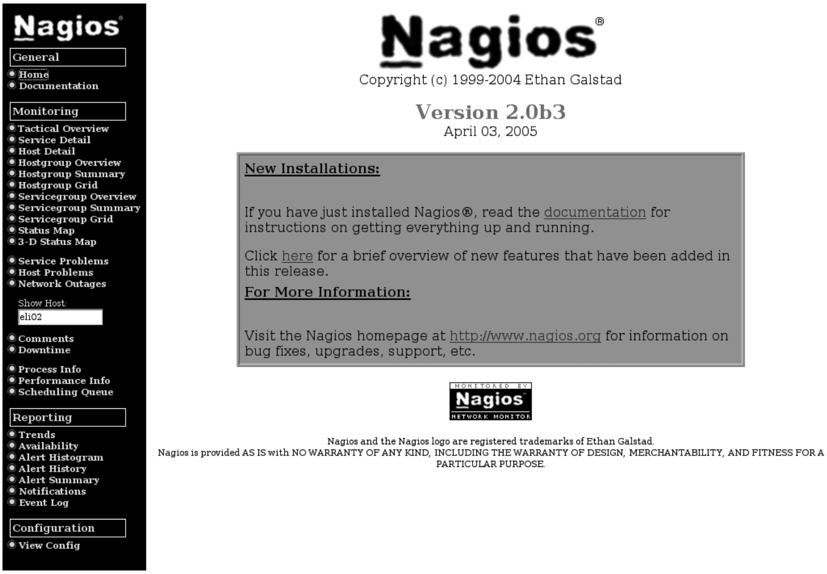
To prevent all tests from being started simultaneously at bootup, Nagios performs a so-called *spreading*. Here the server spreads the start times of the tests over a configurable period.[1] For a large number of services, it can therefore take a while before Nagios continues the test for a specific service. For this reason you should never run reloads at short intervals: in the worst case, Nagios will not manage to perform some checks in the intervening period and will perform them only some time after the most recent reload.

Before being reloaded, the configuration is tested to eliminate any existing errors, as shown in Section 3.1.

3.3 Overview of the Web Interface

If you call the URL http://*nagios-server*/nagios in the browser when the Nagios daemon is running, you will be taken to the welcome screen shown in Figure 3.1.

[1] The relevant configuration parameters are called max_host_check_spread and max_service_check_spread, see Appendix D.1, page 435.



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Version 2.0b3

April 03, 2005

New Installations:

If you have just installed Nagios®, read the documentation for instructions on getting everything up and running.

Click here for a brief overview of new features that have been added in this release.

For More Information:

Visit the Nagios homepage at http://www.nagios.org for information on bug fixes, upgrades, support, etc.

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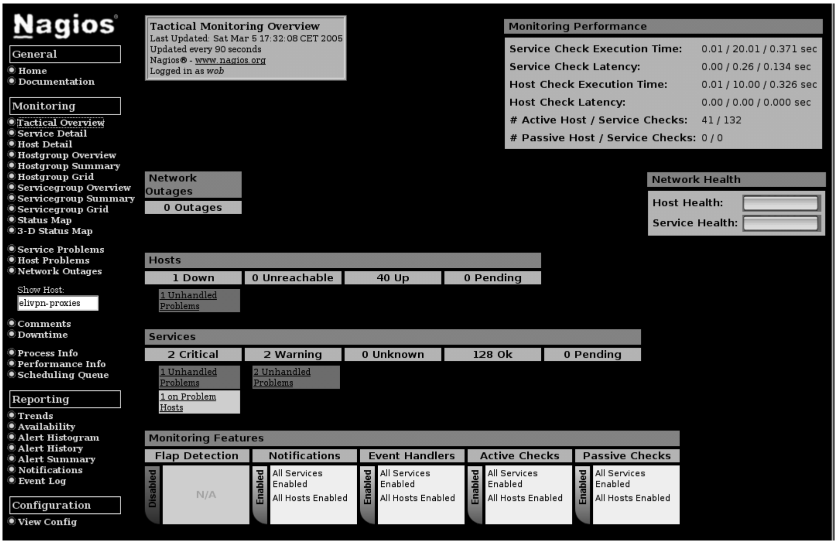
Figure 3.1: The start screen

The so-called "tactical overview" (**Tactical Overview**), which can be reached via the first **monitoring** link in the left menu bar, is shown in Figure 3.2. It summarizes the status of all tested systems.



Tactical Monitoring Overview
Last Updated: Sat Mar 5 17:32:08 CET 2005
Updated every 90 seconds
Nagios® - www.nagios.org
Logged in as *wob*

Monitoring Performance

Service Check Execution Time:	0.01 / 20.01 / 0.371 sec
Service Check Latency:	0.00 / 0.26 / 0.134 sec
Host Check Execution Time:	0.01 / 10.00 / 0.326 sec
Host Check Latency:	0.00 / 0.00 / 0.000 sec
# Active Host / Service Checks:	41 / 132
# Passive Host / Service Checks:	0 / 0

Network Outages
0 Outages

Network Health
Host Health:
Service Health:

Hosts

1 Down	0 Unreachable	40 Up	0 Pending
1 Unhandled Problems			

Services

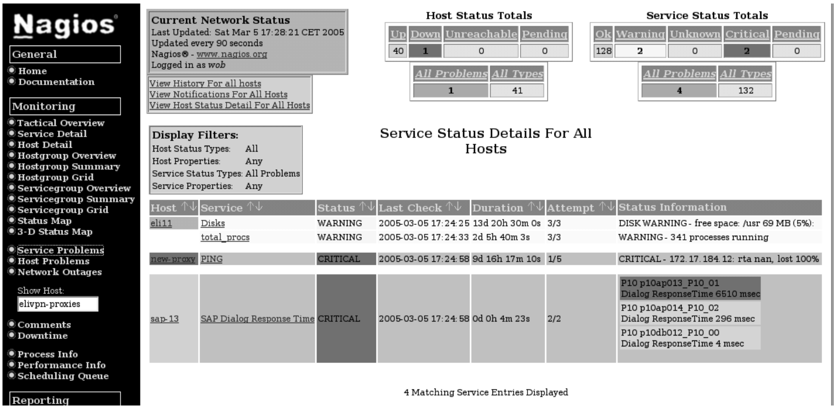
2 Critical	2 Warning	0 Unknown	128 Ok	0 Pending
1 Unhandled Problems 1 on Problem Hosts	2 Unhandled Problems			

Monitoring Features

Flap Detection	Notifications	Event Handlers	Active Checks	Passive Checks
Disabled N/A	Enabled All Services Enabled All Hosts Enabled	Enabled All Services Enabled All Hosts Enabled	Enabled All Services Enabled All Hosts Enabled	Enabled All Services Enabled All Hosts Enabled

Figure 3.2: "Tactical" overview of all systems and services to be monitored

Considerably more interesting in practice, however, is the display of the menu item **Service Problems** (Figure 3.3). It documents the services that are currently causing problems, those that are not in the OK status, in the very sense for which Nagios was conceived: to inform the administrator precisely of any problems.



Current Network Status
Last Updated: Sat Mar 5 17:28:21 CET 2005
Updated every 90 seconds
Nagios® - www.nagios.org
Logged in as *wob*

View History For all hosts
View Notifications For All Hosts
View Host Status Detail For All Hosts

Host Status Totals

Up	Down	Unreachable	Pending
40	1	0	0

All Problems	All Types
1	41

Service Status Totals

Ok	Warning	Unknown	Critical	Pending
128	2	0	2	0

All Problems	All Types
4	132

Display Filters:
Host Status Types: All
Host Properties: Any
Service Status Types: All Problems
Service Properties: Any

Service Status Details For All Hosts

Host ↑↓	Service ↑↓	Status ↑↓	Last Check ↑↓	Duration ↑↓	Attempt ↑↓	Status Information
eli11	Disks	WARNING	2005-03-05 17:24:25	13d 20h 30m 0s	3/3	DISK WARNING - free space: /usr 69 MB (5%):
	total_procs	WARNING	2005-03-05 17:24:33	2d 5h 40m 3s	3/3	WARNING - 341 processes running
new-proxy	PING	CRITICAL	2005-03-05 17:24:58	9d 16h 17m 10s	1/5	CRITICAL - 172.17.184.12: rta nan, lost 100%
sap-13	SAP Dialog Response Time	CRITICAL	2005-03-05 17:24:58	0d 0h 4m 23s	2/2	P10 p10ap013_P10_01 Dialog ResponseTime 6510 msec P10 p10ap014_P10_02 Dialog ResponseTime 296 msec P10 p10db012_P10_00 Dialog ResponseTime 4 msec

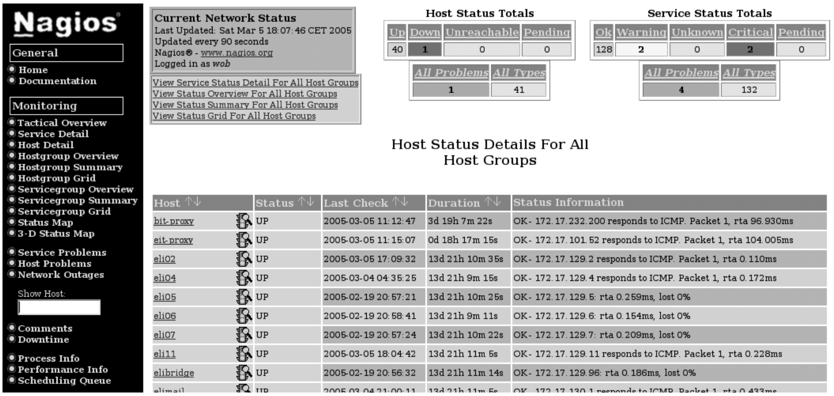
4 Matching Service Entries Displayed

Figure 3.3: Nagios: summary of all service problems

The first column names the host involved. If this has a gray background, Nagios can reach the computer in principle. If the host is "down" this can be seen by the red background. For services, red stands for CRITICAL and yellow for WARNING.

The second column provides the service name, the third column the staus again, in plain text. Column four specifies the time of the last check. Column five is interesting: it shows how long the current status has been going on.

The sixth column with the heading **Attempt** reveals how often Nagios has already performed the test (unsuccessfully): **3/3** means that the error status has been confirmed for the third time in succession, but that the test is only performed three times if there is an error (parameter **max_check_attempts**, see Section 2.3).



Current Network Status
Last Updated: Sat Mar 5 18:07:46 CET 2005
Updated every 90 seconds
Nagios® - www.nagios.org
Logged in as *wob*

View Service Status Detail For All Host Groups
View Status Overview For All Host Groups
View Status Summary For All Host Groups
View Status Grid For All Host Groups

Host Status Totals

Up	Down	Unreachable	Pending
40	1	0	0

All Problems	All Types
1	41

Service Status Totals

Ok	Warning	Unknown	Critical	Pending
128	2	0	2	0

All Problems	All Types
4	132

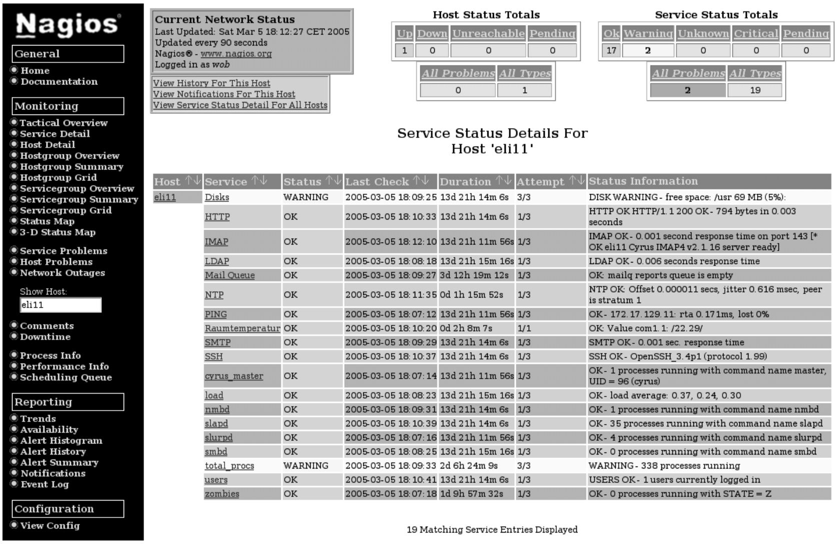
Host Status Details For All Host Groups

Host ↑↓	Status ↑↓	Last Check ↑↓	Duration ↑↓	Status Information
bit-proxy	UP	2005-03-05 11:12:47	3d 19h 7m 22s	OK - 172.17.232.200 responds to ICMP. Packet 1, rta 96.930ms
eit-proxy	UP	2005-03-05 11:15:07	0d 18h 17m 15s	OK - 172.17.101.52 responds to ICMP. Packet 1, rta 104.005ms
eli02	UP	2005-03-05 17:09:32	13d 21h 10m 35s	OK - 172.17.129.2 responds to ICMP. Packet 1, rta 0.110ms
eli04	UP	2005-03-04 04:35:25	13d 21h 9m 15s	OK - 172.17.129.4 responds to ICMP. Packet 1, rta 0.172ms
eli05	UP	2005-02-19 20:57:21	13d 21h 10m 25s	OK - 172.17.129.5: rta 0.259ms, lost 0%
eli06	UP	2005-02-19 20:58:41	13d 21h 9m 11s	OK - 172.17.129.6: rta 0.154ms, lost 0%
eli07	UP	2005-02-19 20:57:24	13d 21h 10m 22s	OK - 172.17.129.7: rta 0.209ms, lost 0%
eli11	UP	2005-03-05 18:04:42	13d 21h 11m 5s	OK - 172.17.129.11 responds to ICMP. Packet 1, rta 0.228ms
elibridge	UP	2005-02-19 20:56:32	13d 21h 11m 14s	OK - 172.17.129.96: rta 0.186ms, lost 0%
elimail	UP	2005-03-04 21:00:11	13d 21h 11m 5s	OK - 172.17.130.1 responds to ICMP. Packet 1, rta 0.433ms

Figure 3.4: A summary of all hosts (extract)

Finally, the last column passes on the information from the plugin to the administrator, to whom it describes the current status in more detail. The top line in Figure 3.3, for example, warns that only five percent of storage space is available in the /usr file system of the host **eli11**.

The **Host Detail** (Figure 3.4) and **Service Detail** overviews provide an overview of all hosts and services. In practice you will be looking more precisely for information, either via a single host or on a host group or service group The name in question is entered in the **Show Host** search field. Figure 3.5 shows this using the example of the **eli11** host.



Current Network Status
Last Updated: Sat Mar 5 18:12:27 CET 2005
Updated every 90 seconds
Nagios® - www.nagios.org
Logged in as *wob*

View History For This Host
View Notifications For This Host
View Service Status Detail For All Hosts

Host Status Totals

Up	Down	Unreachable	Pending
1	0	0	0

All Problems	*All Types*
0	1

Service Status Totals

Ok	Warning	Unknown	Critical	Pending
17	2	0	0	0

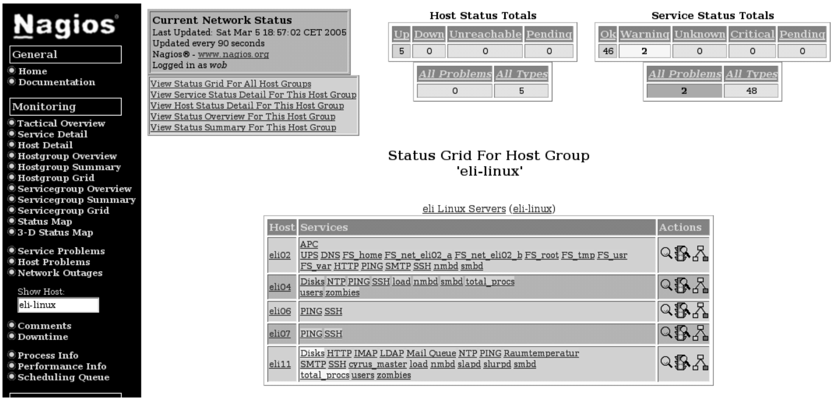
All Problems	*All Types*
2	19

Service Status Details For
Host 'eli11'

Host ↑↓	Service ↑↓	Status ↑↓	Last Check ↑↓	Duration ↑↓	Attempt ↑↓	Status Information
eli11	Disks	WARNING	2005-03-05 18:09:25	13d 21h 14m 6s	3/3	DISK WARNING - free space: /usr 69 MB (5%):
	HTTP	OK	2005-03-05 18:10:33	13d 21h 14m 6s	1/3	HTTP OK HTTP/1.1 200 OK - 794 bytes in 0.003 seconds
	IMAP	OK	2005-03-05 18:12:10	13d 21h 11m 56s	1/3	IMAP OK - 0.001 second response time on port 143 [* OK eli11 Cyrus IMAP4 v2.1.16 server ready]
	LDAP	OK	2005-03-05 18:08:18	13d 21h 15m 16s	1/3	LDAP OK - 0.006 seconds response time
	Mail Queue	OK	2005-03-05 18:09:27	3d 12h 19m 12s	1/3	OK: mailq reports queue is empty
	NTP	OK	2005-03-05 18:11:35	0d 1h 15m 52s	1/3	NTP OK: Offset 0.000011 secs, jitter 0.616 msec, peer is stratum 1
	PING	OK	2005-03-05 18:07:12	13d 21h 11m 56s	1/3	OK - 172.17.129.11: rta 0.171ms, lost 0%
	Raumtemperatur	OK	2005-03-05 18:10:20	0d 2h 8m 7s	1/1	OK: Value com1.1: /22.29/
	SMTP	OK	2005-03-05 18:09:29	13d 21h 14m 6s	1/3	SMTP OK - 0.001 sec. response time
	SSH	OK	2005-03-05 18:10:37	13d 21h 14m 6s	1/3	SSH OK - OpenSSH_3.4p1 (protocol 1.99)
	cyrus_master	OK	2005-03-05 18:07:14	13d 21h 11m 56s	1/3	OK - 1 processes running with command name master, UID = 96 (cyrus)
	load	OK	2005-03-05 18:08:23	13d 21h 15m 16s	1/3	OK - load average: 0.37, 0.24, 0.30
	nmbd	OK	2005-03-05 18:09:31	13d 21h 14m 6s	1/3	OK - 1 processes running with command name nmbd
	slapd	OK	2005-03-05 18:10:39	13d 21h 14m 6s	1/3	OK - 35 processes running with command name slapd
	slurpd	OK	2005-03-05 18:07:16	13d 21h 11m 56s	1/3	OK - 4 processes running with command name slurpd
	smbd	OK	2005-03-05 18:08:25	13d 21h 15m 16s	1/3	OK - 0 processes running with command name smbd
	total_procs	WARNING	2005-03-05 18:09:33	2d 6h 24m 9s	3/3	WARNING - 338 processes running
	users	OK	2005-03-05 18:10:41	13d 21h 14m 6s	1/3	USERS OK - 1 users currently logged in
	zombies	OK	2005-03-05 18:07:18	1d 9h 57m 32s	1/3	OK - 0 processes running with STATE = Z

19 Matching Service Entries Displayed

Figure 3.5: All services for the host eli11



Current Network Status
Last Updated: Sat Mar 5 18:57:02 CET 2005
Updated every 90 seconds
Nagios® - www.nagios.org
Logged in as *wob*

View Status Grid For All Host Groups
View Service Status Detail For This Host Group
View Host Status Detail For This Host Group
View Status Overview For This Host Group
View Status Summary For This Host Group

Host Status Totals

Up	Down	Unreachable	Pending
5	0	0	0

All Problems	*All Types*
0	5

Service Status Totals

Ok	Warning	Unknown	Critical	Pending
46	2	0	0	0

All Problems	*All Types*
2	48

Status Grid For Host Group
'eli-linux'

eli Linux Servers (eli-linux)

Host	Services	Actions
eli02	APC UPS DNS FS_home FS_net_eli02_a FS_net_eli02_b FS_root FS_tmp FS_usr FS_var HTTP PING SMTP SSH nmbd smbd	
eli04	Disks NTP PING SSH load nmbd smbd total_procs users zombies	
eli06	PING SSH	
eli07	PING SSH	
eli11	Disks HTTP IMAP LDAP Mail Queue NTP PING Raumtemperatur SMTP SSH cyrus_master load nmbd slapd slurpd smbd total_procs users zombies	

Figure 3.6: the host group eli-linux in the grid view

Alternatively you can search for the names of host and service groups. An interesting variation here is to have a ***status grid*** output shown via the link Hostgroup Grid, which displays an overview of all hosts and their corresponding services, together with the status of these (Figure 3.6). Through the color of the service (green/yellow/red) you can quickly see at a glance whether there are problems in the service group or host group that you are viewing.

In More Detail…

Chapter 4

Nagios Basics

The fact that a host can be reached, in itself, has little meaning if no service is running on it on which somebody or something relies. Accordingly, everything in Nagios revolves around service checks. After all, no service can run without a host. If the host computer fails, it also cannot provide the desired service.

Things get slightly more complicated if a router, for example, is brought into play, which lies between users and the system providing services. If this fails, the desired service may still be running on the target host, but it is nevertheless no longer reachable for the user.

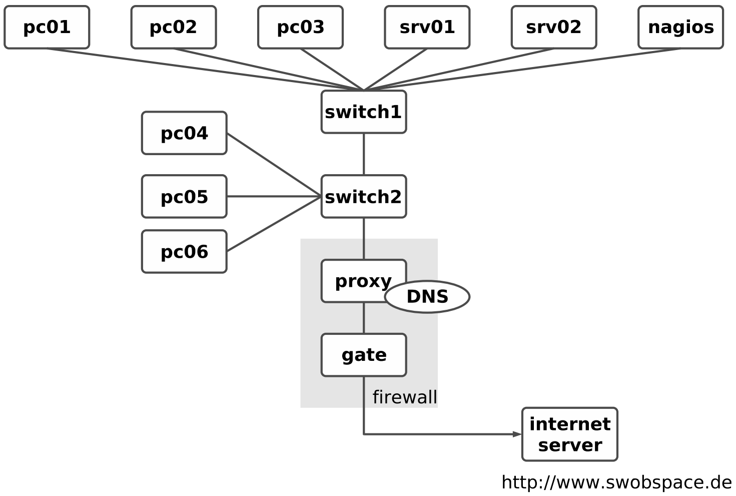
Nagios is in a position to reproduce such dependencies and to precisely inform the administrator of the failure of an important network component, instead of flooding the administrator with irrelevant error messages concerning services that cannot be reached. An understanding of such dependencies is essential for the smooth operation of Nagios, which is why Section 4.1 will look in more detail at these dependencies and the way Nagios works.

Another important item is the *state* of a host or service. On the one hand Nagios allows a much finer distinction than just "ok" or "not ok"; on the other hand the distinction between *soft state*) and (*hard state*) means that the administrator does not have to deal with short-term disruptions that have long since disappeared by the time the administrator has received the information. These states also influence the intensity of the service checks. How this functions in detail is described in Section 4.3.

4.1 Taking into Account the Network Topology

How Nagios handles dependencies of hosts and services can be best illustrated with an example. Figure 4.1 represents a small network in which the Domain Name Service on proxy is to be monitored.

Figure 4.1: Topology of an example network



The service check always serves as the starting point for monitoring that is regularly performed by the system. As long as the service can be reached, Nagios takes no further steps; that is, it does not perform any host checks. For switch1, switch2, and proxy, such a check would be pointless anyway, because if the DNS service responds to proxy, then the hosts mentioned are automatically accessible.

If the name service fails, however, Nagios tests the computer involved with a host check, to see whether the service or the host is causing the problem. If proxy cannot be reached, Nagios might test the *parent* hosts entered in the configuration (Figure 4.2). With the parents host parameter, the administrator has a means available to provide Nagios with information on the network topology.

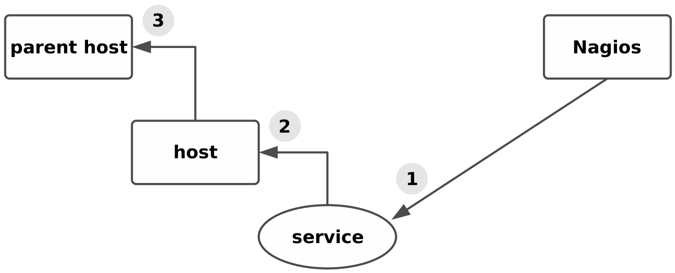


Figure 4.2: the order of tests performed after a service failure

When doing this, the administrator only enters the direct neighbor computer fo each host on the path to the Nagios server as the parent.[1] Hosts that are allocated in the same network segment as the Nagios server itself are defined without a parent. For the network topology from Figure 4.1, the corresponding configuration (reduced to the host name and parent) appears as follows:

```
define host{
   host_name        proxy
   ...
   parents          switch2
}

define host{
   host_name        switch2
   ...
   parents          switch1
}

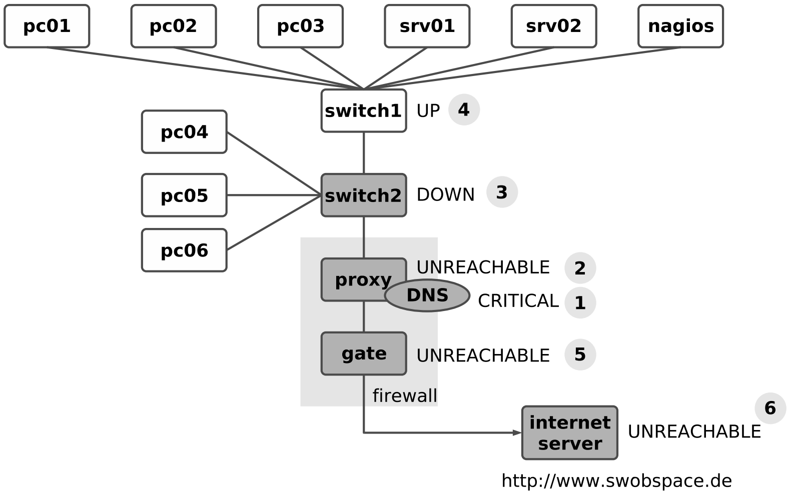
define host{
   host_name        switch1
   ...
}
```

switch1 is located in the same network segment as the Nagios server, so it is therefore not allocated a parent computer. What belongs to a network segment is a matter of opinion: if you interpret the switches as the segment limit, as is the case here, this has the advantage of being able to more closely isolate a disruption. But you can also take a different view and interpret an IP subnetwork as a segment. Then a router would form the segment limit; in our example, proxy would

[1] The parameter name parents can be explained by the fact that there are scenarios—such as in high availability environments—in which a host has two upstream routers that guarantee the Internet connection, for example.

then count in the same network as the Nagios server. However, it would no longer be possible to distinguish between a failure of proxy and a failure of switch1 or switch2.

Figure 4.3: Classification of individual network nodes by Nagios



http://www.swobspace.de

If switch1 in the example fails, Figure 4.3 shows the sequence in which Nagios proceeds: first the system, when checking the DNS service on proxy, determines that this service is no longer reachable (1). To differentiate, it now performs a host check to see what the state of the proxy computer is (2). Since proxy cannot be reached, but it has switch2 as a parent, Nagios also subjects switch2 to a host check (3). If this switch also cannot be reached, the system checks its parent, switch1 (4).

If Nagios can establish contact with switch1, the cause for the failure of the DNS service on proxy can be isolated to switch2. The system accordingly specifies the states of the host: switch1 is UP, switch2 DOWN; proxy, on the other hand, is UNREACHABLE. Through a suitable configuration of the Nagios messaging system (see Section 12.3 on page 217) you can use this distinction to determine, for example, that the administrator is informed only about the host that is in the DOWN state and represents the actual problem, but not about the hosts that are dependent on the down host.

In a further step, Nagios can determine other topology-specific failures in the network (so-called *network outages*). proxy is the parent of gate, so gate is also represented as UNREACHABLE (5). gate in turn also functions as a parent; the Internet server dependent on this is also classified as "UNREACHABLE".

This "intelligence", which distinguishes Nagios, helps the administrator all the more, the more hosts and services are dependent on a failed component. For a router in the backbone, on which hundreds of hosts and services are dependent, the system informs administrators of the specific disruption, instead of sending them hundreds of error messages that are not wrong in principle, but are not really of any help in trying to eliminate the disruption.

4.2 Forced Host Checks vs. Periodic Reachability Tests

Service checks are carried out regularly by Nagios, host checks only when needed. Although the **check_interval** parameter provides a way of forcing regular host checks, there is no *real* reason to do this. There is one reason *not* to do this, however: continual host checks have a considerable influence on the performance of Nagios.

If you nevertheless want to regularly check the reachability of a host, it is better to use a ping-based service check (see Section 6.2 from page 88). At the same time you will obtain further information such as the response times or possible packet losses, which provides indirect clues about the network load or possible network problems. A host check, on the other hand, also issues an OK even if many packets go missing and the network performance is catastrophic. What is involved here—as the name "host check" implies—is only reachability in principle and not the quality of the connection.

4.3 States of Hosts and Services

Nagios uses plugins for the host and service checks. They provide four different return values (cf. Table 6.1 on page 85): 0 (OK), 1 (WARNING), 2 (CRITICAL), and 3 (UNKNOWN).

The return value UNKNOWN means that the running of the plugin generally went wrong, perhaps because of wrong parameters. You can normally specify the situations in which the plugin issues a warning or a critical state when it is started.

Nagios determines the states of services and hosts from the return values of the plugin. The states for services are the same as the return values OK, WARNING, CRITICAL and UNKNOWN. For the hosts the picture is slightly different: the UP state describes a reachable host, DOWN means that the computer is down, and UNREACHABLE refers to the state of nonreachability, where Nagios cannot test whether the host is available or not, because a parent is down (see Section 4.1, page 72).

In addition to this, Nagios makes a distinction between two types of state: soft state and hard state. If a problem occurs for the first time (that is, if there was nothing wrong with the state of a service until now) then the program categorizes the new state initially as a soft state and repeats the test several times. It may be the case that the error state was just a one-off event that was eliminated a short while later. Only if the error continues to exist after multiple testing is it then categorized by Nagios as a hard state. Administrators are informed only of hard states, because messages involving short-term disruptions that disappear again immediately afterwards only add to an unnecessary flood of information.

In our example the chronological sequence of states of a service can be illustrated quite simply. A service with the following parameters is used for this purpose:

```
define service{
   host_name              proxy
   service_description    DNS
   ...
   normal_check_interval  5
   retry_check_interval   1
   max_check_attempts     5
   ...
}
```

normal_check_interval specifies at what interval Nagios should check the corresponding service as long as the state is OK or if a hard state exists—in this case, every five minutes. retry_check_interval defines the interval between two service checks during a soft state—one minute in the example. If a new error occurs, then Nagios will take a closer look at the service at shorter intervals.

max_check_attempts determines how often the service check is to be repeated after an error has first occurred. If max_check_attempts has been reached and if the error state continues, Nagios inspects the service again at the intervals specified in normal_check_interval.

Figure 4.4 represents the chronological progression in graphic form: the illustration begins with an OK state (which is always a hard state). Normally Nagios will repeat the service check at five-minute intervals. After ten minutes an error occurs; the state changes to CRITICAL, but this is initially a soft state. At this point in time, Nagios has not yet issued any message.

Now the system checks the service at intervals specified in retry_check_interval, here this is every minute. After a total of five checks (max_check_attempts) with the same result, the state changes from soft to hard. Only now does Nagios inform the relevant people. The tests are now repeated at the intervals specified in normal_check_interval.

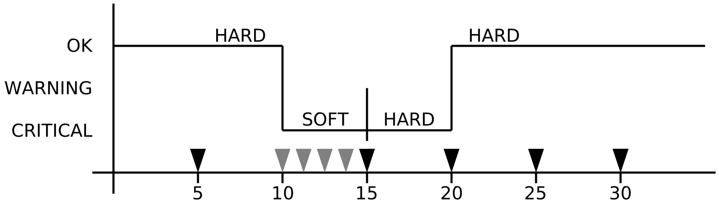


Figure 4.4: Example of the chronological progression of states in a monitored service

In the next test the service is again available; thus its state changes from CRITICAL to OK. Since an OK state is always a hard state, this change is not subject to any tests by Nagios at shorter intervals.

The transition of the service to the OK state after an error in the hard state is referred to as a ***hard recovery***. The system informs the administrators of this (if it is configured to do so) as well as of the change between various error-connected hard states (such as from WARNING to UNKNOWN). If the service recovers from an error soft state to the normal state (OK)—also called a ***soft recovery***—the administrators will, however, not be notified.

Even if the messaging system leaves out soft states and switches back to soft states, it will still record such states in the Web interface and in the log files. In the Web front end, soft states can be identified by the fact that the value 2/5 is listed in the column Attempts, for example. This means that max_check_attempts expects five attempts, but only two have been carried out until now. With a hard state, max_check_attempts is listed twice at the corresponding position, which in the example is therefore 5/5.

More important for the administrator in the Web interface than the distinction of whether the state is still "soft" or already "hard", is the duration of the error state in the column Duration. From this a better judgment can be made of how large the overall problem may be.

For services that are not available because the host is down, the entry 1/5 in the column Attempts would appear, since Nagios does not repeat service checks until the entire host is reachable again. The failure of a computer can be more easily recognized by its color in the Web interface: the service overview in Figure 4.3 (page 66) marks the failed host in red; if the computer is reachable, the background remains gray.

5 Chapter

Service Checks and How They Are Performed

To test services, Nagios makes use of external programs called *plugins*. In the simplest case this involves testing an Internet service, for example, SMTP. Here the service can be addressed directly over the network, so it is sufficient to call a program locally on the Nagios server that tests the mail server on the remote host.

Not everything you might want to test can be reached so easily over the network, however: there is no network protocol for checking free capacity on a hard drive, for example. Then you must either start a plugin on the remote host via a remote shell (but first this has to be installed on the remote computer), or you use other methods, such as the *Simple Network Management Protocol* SNMP, to test the hard drive capacity.

The fact that different methods are available here does not make it any easier in getting started with Nagios. For this reason, this chapter provides an overview of the common methods and attempts to bring an understanding of the underlying concepts involved. Later chapters then provide detailed configuration examples.

Figure 5.1: Nagios allows different testing methods

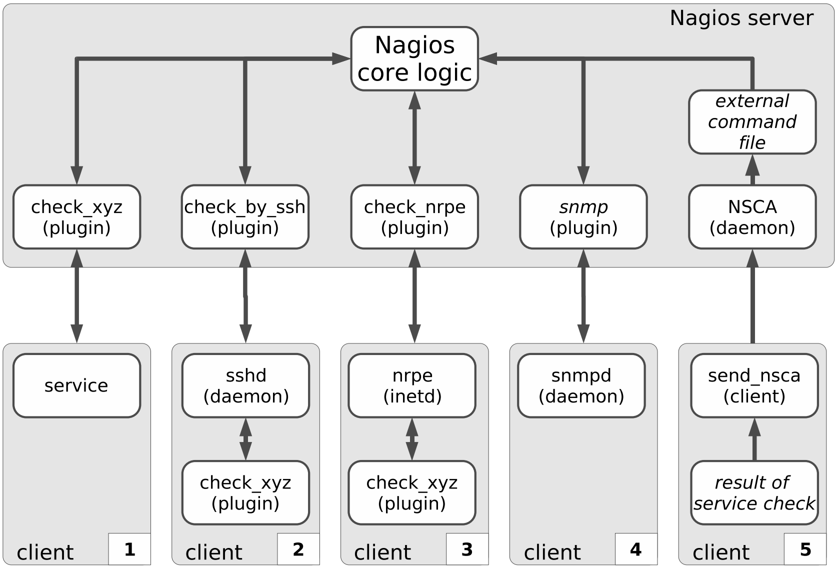


Figure 5.1 shows an overview of the various test methods supported by Nagios. The upper box with a gray background marks all the components that run directly on the Nagios server machine: this includes the server itself, as well as plugins and other auxiliary tools. This unit is in contact with five clients, which are tested in various different ways. The following sections will go into somewhat more detail regarding the individual methods.

In order to monitor the network service on the first client marked as **service** (starting from the left), the Nagios server runs its "own" plugin, **check_xyz** (Section 5.1, page 81). For the second client it starts the "middle plugin" **check_by_ssh**, in order to execute the plugin it really wants remotely on the client (Section 5.2, page 82).

In the third case the plugin is also executed directly on the client machine, but now Nagios uses the NRPE service, created specifically for this purpose. The query is made on the Nagios side with **check_nrpe** (Section 5.3, page 82).

The fourth method describes the query via SNMP. For this, the client must have an SNMP agent available (Section 11.1, page 178). Various plugins are available for querying data via SNMP (Section 5.4, page 83).

These four methods represent "active" checks, because Nagios takes the initiative and triggers the test itself. The fifth method, in contrast, is passive. Here Nagios does nothing actively, but waits for incoming information that the client sends to the Nagios server with the program **send_nsca**. On the Nagios server itself the *Nagios Service Check Acceptor*, NSCA, is running as a daemon that accepts the transmitted results and forwards them to the interface for external commands. (Section 5.5, page 84).

There are other ways of performing checks in addition to these. Usually a separate service is installed on the client, which is then queried by the Nagios server via a specialized plugin. A typical example here is NSClient/NC_Net, which can be used to monitor Windows servers (Section 18.1, page 354).

5.1 Testing Network Services Directly

Mail or Web servers can be tested very simply over the network, since the underlying protocols, SMTP and HTTP, are, by definition, network-capable (Figure 5.1, page 80, Client 1). Nagios can call here on a wide range of plugins, each specialized for a particular service.

Such a specific program has advantages over a generic one: a generic plugin tests only whether the corresponding TCP or UDP port is open and whether the service is waiting there, but it does not determine whether the correct service is on the port, or whether it is active.

Specific plugins adopt the network protocol and test whether the service on the port in question behaves as it is expected to. A Mail server, for example, normally responds with a so-called *Greeting* after a connection has been established:

```
220 swobspace.de ESMTP
```

The important thing here is the **220**. A number in the 200 range means OK, 220 stands for the greeting. The **check_smtp** plugin evaluates this reply. It can also simulate the initial dialog when sending mail (in addition to the greeting), as shown in Section 6.3 from page 92.

It behaves in a similar way with other specific plugins, such as **check_http**, which not only can handle a simple HTTP dialog, but also manipulates HTTP headers where required, checks SSL capabilities and certificates of the Web server, and even sends data to the server with the **POST** command (more on this in Section 6.4 from page 97).

The package with the Nagios plugins, which is installed separately (see Section 1.2 from page 30), includes specific plugins for the most important network services. If one is missing for a specific service, it is worth taking a look at the Nagios homepage[1] or the Exchange for Nagios Add-ons.[2]

[1] http://www.nagios.org/

[2] http://www.nagiosexchange.org/

If no suitable plugin can be found there either, you can use the generic plugins check_tcp or check_udp, which, apart from a pure port test, also send data to the target port and evaluate the response (but this only makes sense in most cases if an ASCII-based protocol is involved). More on generic plugins in Section 6.7.1 from page 110.

5.2 Running Plugins via Secure Shell on the Remote Computer

To test local resources such as hard drive capacity, the load on the swap area, the current CPU load, or whether a specific process is running, various *local plugins* are available. They are called local because they have to be installed on the computer that is to be checked.

The Nagios server has no way to directly access such information over the network, without taking further measures. But it can start local plugins on the remote host, via a remote shell (Figure 5.1, page 80, Client 2). Only the *Secure Shell*, SSH, can be considered for use here; the *Remote Shell*, RSH, simply has too many security holes.

To do this, the Nagios server runs the program check_by_ssh, which is given the command, as an argument, to run the local plugin on the target host. For this, check_by_ssh needs a way of logging in to the target host without a password, which can be set up with *Public Key Authentication*.

From the viewpoint of the Nagios server, check_by_ssh is the plugin whose results are processed. It does not notice anything concerning the start of the secure shell connection and of the remote plugin—the main thing is that the reply corresponds to the Nagios standard and contains the status plus a line of comment text for the administrator, see the introduction to Chapter 6 on page 85.

Further information on the *Remote Execution* of plugins via Secure Shell is provided in Chapter 9 from page 157.

5.3 The Nagios Remote Plugin Executor

An alternative method of running plugins installed on the target computer via the secure shell is represented by the *Nagios Remote Plugin Executor* (NRPE). Figure 5.1 (page 80) illustrates this with the middle client.

The NRPE is installed on the target host and started via the inet daemon, which must be configured accordingly. If NRPE receives a query from the Nagios server via the (selectable) TCP port 5666, it will run the matching query for this. As with the method using the Secure Shell, the plugin that is to perform the test must be installed on the target host.

So all this is somewhat more work than using the Secure Shell, especially as SSH ought to be installed on almost every type of Unix machine and, when it is used, enables monitoring to be configured centrally on the Nagios server. The Secure Shell method requires an account with a local shell, however, thus enabling any command to be run on the target host[3]; the Remote Plugin Executor, on the other hand, is restricted to the commands configured.

If you don't want the user **nagios** to be able to do anything more than run plugins on the target host without a password, than you are better off sticking with NRPE. The installation configuration for this is described in Chapter 10 from page 165.

5.4 Monitoring via SNMP

With the ***Simple Network Management Protocol***, SNMP, local resources can also Be queried over the network (see also Client 4 in Figure 5.1, page 80). If an SNMP daemon is installed (NET-SNMPD is very extensively used, and is described in Section 11.2.2 from page 187), Nagios can use it to query local resources such as processes, hard drive and interface load.

The advantage of SNMP lies in the fact that it is widely used: there are corresponding services for both UNIX and Windows systems, and almost all modern network components such as routers and switches can be queried via SNMP. Even uninterruptable power supplies (USPs) and other equipment sometimes have a network connection and can provide current status information via SNMP.

Apart from the standard plugin **check_snmp**, a generic SNMP plugin, there are various specialized plugins that concentrate on specific SNMP queries but are sometimes more simple to use. So **check_ifstatus** and **check_ifoperstatus**, for example, focus precisely on the status of network interfaces.

If you are grappling with SNMP for the first time, you will soon come to realize that the term "readable for human beings" did not seem to be high up on the list of priorities when the protocol was defined. SNMP queries are optimized for machine processing, such as for a network monitoring tool.

If you use the tool available from the vendor for its network components, SNMP will basically remain hidden to the user. But to use it with Nagios, you have to get your hands dirty and get involved with the protocol and its underlying syntax. It takes some getting used to, but it's not really as difficult as it seems at first sight.

[3] The Secure Shell does allow a single command to be executed without opening a separate shell. Usually, however, you will want to test several resources, so you'll need to run more than one command.

The use of SNMP is the subject of Chapter 11 (page 177); you can also learn there how to configure and use an SNMP daemon for Linux and other UNIX systems.

5.5 The Nagios Service Check Acceptor

The fifth method of processing the results of service checks leads to the use of the *Nagios Service Check Acceptor*, NSCA. This runs as a daemon on the Nagios server and waits for incoming test results (see Figure 5.1 on the right on page 80). This method is also referred to as *passive*, because Nagios itself does not take the initiative.

NSCA uses the interface for external commands used by CGI scripts, among others, to send commands to Nagios. It consists of a *named pipe*[4] from which Nagios reads the external commands. With the command PROCESS_SERVICE_CHECK_RESULT Nagios processes test results that were determined elsewhere. The interface itself is described in more detail in Section 13.1 from page 240.

The main area of use for NSCA is *Distributed Monitoring*. By this we mean several different Nagios installations that send their results to a central Nagios server. The distributed Nagios servers, perhaps in different branches of a company, work as autonomous and independent Nagios instances, except that they also send the results to a head office. This does not check the decentralized networks actively, but processes the information sent from the branches in a purely passive manner.

NSCA is not just restricted to distributed monitoring, however. With the program send_nsca, test results can be sent which were not obtained from a Nagios instance, but rather from a cron-job, for example, which executes the desired service check.

Before you use NSCA, you should consider the security aspects. Because it can be used by external programs to send information and commands to Nagios, there is a danger that it could be misused. This should not stop you from using NSCA, but rather should motivate you into paying attention to security aspects during the NSCA configuration.

Further information on using NSCA, distributed monitoring and on security in general is provided in Chapter 14 from page 247.

[4] A named pipe is a buffer to which a process writes something and from which another process reads out the data. This buffer is given a name in the file system so that it can be specifically addressed, which is why it is called *named* pipe.

Chapter 6

Plugins for Network Services

Every plugin that is used for host and service checks is a separate and independent program that can also be used independently of Nagios. The other way round, it is not so easy: in order for Nagios to use an external program, it must stick to certain rules. The most important of these concerns the return status that is returned by the program. Using this, Nagios precisely evaluates the status. Table 6.1 displays the possible values.

Table 6.1: Return values for Nagios plugins

Status	Name	Description
0	OK	Everything in order
1	WARNING	Warning limit has been exceeded, but critical limit not yet reached
2	CRITICAL	Critical limit exceeded or the plugin has broken off the test after a timeout

continued

Status	Name	Description
3	UNKNOWN	Error has occurred inside the plugin (the wrong parameter has been used,for example)

A plugin therefore does not distinguish by using the pattern "OK—Not OK", but is more differentiated. In order for it to be able to categorize a status as WARNING, it requires details of up to what measured value a certain event is regarded as OK, when it is seen as a WARNING, and when it is CRITICAL.

An example: apart from the response time, a ping also returns the rate of packet loss. For a slow network connection (ISDN, DSL), a response time of 1000 milliseconds could be seen as a warning limit and 5000 milliseconds as critical, because that would mean that interactive working is no longer possible. If there is a high load on the network connection, occasional packet loss could also occur,[1] so that 20 percent packet loss can be specified as a warning limit, 60 percent as the critical limit.

The following applies in all cases: the administrator decides what values shall serve as warning signs or be regarded as critical. Since all services can be individually configured, the values for each host may vary, even in the same plugin.

Plugins always have a ***timeout***, which is usually ten seconds. This prevents the program from waiting endlessly, thus stopping a large number of plugin processes from accumulating at the Nagios host. In other ways too, a response time above 10 seconds makes little sense for many applications, since these interrupt connection attempts themselves after a certain time span, which has the same effect as the total failure of the corresponding service. Here the administrator can also step in and explicitly specify a different timeout.

A further characteristic of all plugins is a text output, which Nagios shows in its overview and which is principally intended for the administrator, so it needs to be "human-readable". Since Nagios shows only the first line, this text output should not be too long. In addition, Nagios currently processes only a maximum of 300 characters of the text output; the rest is simply cut off. We recommend the following form for the text output:

```
TYPE_OF_CHECK STATUS - informational text
```

In practice, the text output looks like this:

```
SMTP OK - 0.186 sec. response time
DISK WARNING - free space: /net/eli02/a 3905 MB (7%);
```

[1] ICMP packets are not re-sent, a lost packet remains lost.

The above example is from the plugin **check_smtp**, the second from **check_disk**. In both cases, the type of check (here SMTP or DISK) is followed by the status in text form and then the actual information. Not all plugins adhere to this recommendation in their output. Sometimes the detail of the test type is missing, and sometimes even the status is missing.

Various plugins also provide performance information, which can be evaluated and graphically represented with external programs (see Chapter 17, page 313):

```
OK - 172.17.129.2: rta 97.751ms, lost 0%| rta=97.751ms;200.000;500.000;0;
pl=0%;40;80;;
```

As can be seen here from the example of the **check_icmp** plugin, the performance data follows the text output, separated by the pipe character **|**. But this data does not appear in the Web interface.

check_icmp here provides two values: the medium reply time, **rta** (*Real Time Answer*), in milliseconds and the packet loss rate, **pl**.[2] For each variable, the plugin first displays the measured value (**97.751ms** and **0%**), followed by the warning limit (200 milliseconds or 40 percent) and the critical limit (500 milliseconds or 80 percent).

To keep the installation (Section 1.2 from page 30) as simple as possible, there are no manual pages for the plugins. Each of these programs must maintain an online help which is displayed with the option **-h** or **--help**. Some plugins distinguish here between a short help (**-h**) and a long one (**--help**); it is therefore recommended that you always try out **--help** as well.

This chapter introduces the most important plugins from the basic distribution of the **nagios-plugins** package (version 1.3.1 or 1.4.x), which test network services. With their help, the Nagios server queries services on other servers. The description is restricted to the functionality that is important for normal operation. If you are interested in all the options, we refer you to the integrated online help.

6.1 Standard Options

Table 6.2 lists the options that are common to all plugins. The options in bold type must be known to all plugins. The key words not in bold type can be omitted by the programs, but if they are supported at all, they must be used in the sense specified.

If an option demands an argument, it is usually separated by spaces in the short form, but by equals signs in the long form. But for Perl or shell scripts in particular, not all authors adhere to these, so you have no option here but to take a look at the corresponding description.

[2] Short for *packet loss*.

Table 6.2: Standard options of plugins

Short form	Long form	Description
-h	--help	Output of the online help
-V	--version	Output of the plugin version
-v	--verbose	Output of additional information. This option may be given multiple times.[3]
-H	--hostname	Host name or IP address of the target
-t	--timeout	Timeout in seconds after which the plugin will interrupt the operation and return the CRITICAL status.
-w	--warning	Specificies the warning limit value
-c	--critical	Specifies the critical limit value
-4	--use-ipv4	Force IPv4 to be used
-6	--use-ipv6	Force IPv6 to be used

Thus it is not allowed to use **-c**, for example, for anything other than specifying a critical limit. How exactly **-c** and **-w** are used may, on the other hand, vary from plugin to plugin, because sometimes an individual value may be required, at other times, multiple values (see also the explanations on the plugin **check_icmp**), described below.

Not all plugins can handle the options **-4** and **-6**, with which the user can choose the version of the IP protocol to use, and if they can handle these, then usually only from plugin version 1.4.

6.2 Reachability Test with Ping

The classic reachability test in UNIX systems has always been a ping, which sends an "*ICMP echo request*" packet and waits for an "*ICMP echo response*" packet. The Nagios plugin package includes two programs that carry out this ping check: **check_icmp** and **check_ping**. Even though **check_ping** is used in the standard configuration, you should replace it with the more efficient **check_icmp**, which has been included since plugin version 1.4.

Whereas **check_ping** calls the UNIX program **/bin/ping**, which is why there are always compatibility problems with the existing **ping** version, **check_icmp** sends ICMP without any external help programs. **check_icmp** basically works more efficiently, since it does not wait for one second between individual packets, as **ping**

[3] Whether this leads to more information depends on the individual plugin ...

does. In addition it evaluates ICMP error messages such as *ICMP host unreachable*, while check_ping discards these. check_icmp is backwards-compatible to check_ping; this makes it easy to do without check_ping entirely and to replace it with check_icmp.

check_icmp measures the reply time of the ICMP packets and determines the proportion of packets that have been lost. If an error message arrives instead of the expected "*ICMP echo reply*", this is evaluated immediately. Thus Nagios breaks off the test if an "*ICMP host unreachable*" message arrives.

check_icmp has the following options:[4]

-H *address*
: Without the host name or the IP address of the computer to be tested, check_icmp cannot work. With -H, multiple *host* entries can be separated, using spaces.

-w *response_time,packet_loss_percent%*
: This switch sets the warning limit for a warning. *response time* stands here for the desired response time in milliseconds, *packet loss percent* stands for the corresponding packet loss as a percentage. If you specify

```
-w 500.0,20%
```

the plugin will give a warning either if the response time is at least 500.0 milliseconds or if 20 percent or more of ICMP packets are lost.

-c *response_time,packet_loss_percent%*
: This switch specifies the critical limit in the same way as -w defines the warning value. The critical limit should always be larger than the warning limit.

-n *packets*
: With *packets* you can set the number of packets that check_icmp should use for each test. The default is 5 packets.

-t *timeout*
: After *timeout* seconds have passed, the plugin interrupts the test and returns the CRITICAL status. The default is 10 seconds.

Like the program /bin/ping, check_icmp must also run with root permissions, which is why the SUID bit is set:

[4] The online help check_icmp -h does state that it knows the options in the long form as well, but these are neither implemented in version 1.5, included in the Nagios plugins 1.4, nor in later versions up to 1.18.

```
linux:~ #  chown root.nagios /usr/local/nagios/libexec/check_icmp
linux:~ #  chmod 4711 /usr/local/nagios/libexec/check_icmp
linux:~ #  ls -l /usr/local/nagios/libexec/check_icmp
-rwsr-x--x  1 root nagios 61326 2005-02-08 19:49 check_icmp
```

For a test, you should execute the plugin on the command line as the user nagios, since Nagios will later execute it under this account:

```
nagios@linux:~$  cd /usr/local/nagios/libexec
nagios@linux:nagios/libexec$  ./check_icmp -H 192.168.1.13 \
   -w 100.0,20% -c 200.0,40%

OK - 192.168.1.13: rta 0.253ms, lost 0%| rta=0.253ms;100.000;200.000;0;
pl=0%;20;40;;
```

check_icmp then sets the standard number of five ICMP packets on their way, and instead of an OK, issues a WARNING as soon as the response time, averaged over all the packets, is at least 100.0 milliseconds, or if 20 percent or more are lost—that is, at least one packet in five. For a CRITICAL status, the average response time must be at least 200.0 milliseconds, or at least two packets (40 percent of five) must remain unanswered.

6.2.1 check_icmp as a service check

In order that check_icmp can be used as a service check, you need to have a suitable command object. The file checkcommands.cfg, with check_ping, already has one for the ping service. We will just replace the check_ping plugin in it with check_icmp:

```
define command{
   command_name  check_ping
   command_line  $USER1$/check_icmp -H $HOSTADDRESS$ -w $ARG1$ -c $ARG2$
}
```

The macro $HOSTADDRESS$ provides the IP address of the parameter address from the host definition, and with the two freely defined macros $ARG1$ and $ARG2$, parameters can be taken over from the service definition, so that warning and critical limits can be set with these.

In the service definition (an extract of it is shown here)[5] for the PING service, the check_command entry, in addition to the name of the command object to be executed, now needs two arguments, which are entered after the command, both separated by an exclamation mark:

[5] Like any other object, service definitions can also be defined in a file of your choice, from which Nagios loads object definitions. For the sake of clarity, it is best to choose a descriptive name for the file, such as services.cfg, as in our example on page 39.

```
define service{
   service_description   PING
   host_name             linux01
   check_command         check_ping!100.0,20%!500.0,60%
   ...
}
```

From the definition of the command object, you can see that the first parameter (100.0,20%) defines the warning limit, and the second one (500.0,60%) defines the critical value.

6.2.2 check_icmp as a host check

To be able to use the plugin under the name check_host for host checks, a corresponding symbolic link to check_icmp is set:

```
linux:~ #  cd /usr/local/nagios/libexec
linux:nagios/libexec #  ln -s check_icmp check_host
```

If it is called under its new name, check_host, the plugin modifies its behavior somewhat: it interrupts the test after receiving the first *ICMP echo reply*, because a single reply packet is enough to prove that the host "is alive". The same applies if the first response to be returned is an error message such as *ICMP network unreachable* or *host unreachable*—the host is then considered to be unreachable.

Host checks are defined like every other check. The only difference is that this test is specified during the definition of the host object (and not of a service object):

```
define host{
   host_name        linux01
   alias            Linux File Server
   address          192.168.1.21
   check_command    check-host-alive
...
}
```

The name used here, check-host-alive, can be freely defined and can be specified separately for each host. The definition of the command itself is made in checkcommands.cfg:

```
define command{
   command_name check-host-alive
   command_line $USER1$/check_host -H $HOSTADDRESS$
}
```

Host checks do not always need to be executed with **check_icmp**. You could just as well measure the refrigerator temperature or test, with the generic plugins for TCP or UDP (**check_tcp** and **check_udp**; see Section 6.7.1 from page 110), whether a specific port is open or not. The port scanner **nmap**, for example, uses TCP port 80 (HTTP).

The disadvantage of such a method lies in the fact that, apart from the host itself, another application also needs to run—that is, the Web server. In addition, the test of a specific application by no means proves that the computer is no longer reachable. A ping has the great advantage that the kernel replies to "*ICMP echo request*" messages itself, so that no application needs to be running for this. You should therefore change from ping to other host check methods only if there is a good reason to do so. One example might be a firewall that filters ICMP messages, and over which the administrator has no influence, but that does let through HTTP queries on TCP port 80.

6.3 Monitoring Mail Servers

A number of plugins are also available to monitor mail servers: the mail server itself (*Mail Transport Agent* (MTA)) is monitored by **check_smtp**, and in addition to this the mail queue on the mail server can be checked with **check_mailq**. Since this test takes place locally, the plugin is described in the next chapter in Section 7.8 (page 147).

To monitor the "*Mail User Agent* (MUA)" POP3 and IMAP protocols—including the SSL variants, POP3S and IMAPS—the plugin **check_tcp** is used: **check_pop** and so forth are symbolic links to **check_tcp**, which determines which protocol it should test by means of the name by which it is called, and makes the relevant presettings.

6.3.1 Monitoring SMTP with check_smtp

The SMTP monitoring plugin **check_smtp** has the following options:

-H *address* / --host=*address*

This details the computer on which the SMTP service should be checked.

-p *port* / --port=*port*

port determines the ports, in case the mail service is not listening on the standard port 25. In this way the mail virus scanner Amavis (usually port 10024) can be monitored, for example. But this can normally be reached only from **localhost**.

-e *string* | --expect=*string*

string defines the text which the mail server must provide in the very first reply line. The default setting for *string* is 220, with which the normal SMTP greeting begins, but there may be servers that have different settings. A wrong reply from the service monitored will generate a WARNING.

-f *address* | --from=*address*

With *address* you specify a mail address that check_smtp then sends to the server with the "MAIL FROM:" command. This option is required to test a Microsoft Exchange 2000 Server.

-C "*mail command*" | --command="*mail command*" (from version 1.4)

With -C you can send individual mail commands to the server, to extend the test slightly (see example below).

-R "*string*" | --response="*string*" (from version 1.4)

If you send an SMTP command to the server with -C, you can specify the expected reply here instead of *string* (for example, 250). A "wrong" reply triggers a WARNING.

-4 | --use-ipv4 (from version 1.4)

The test is performed explicitly over an IPv4 connection.

-6 | --use-ipv6 (from version 1.4)

The test is performed explicitly over an IPv6 connection.

-S | --starttls (from version 1.4)

The connection setup during the test uses STARTTLS.

-w *floating_point_decimal* | --warning=*floating_point_decimal*

If the server takes longer than *floating_point_decimal* seconds for the answer, check_smtp issues a WARNING.

-c *floating_point_decimal* | --critical=*floating_point_decimal*

Like -w, except that check_smtp issues a CRITICAL after *floating_point_decimal* seconds.

In the simplest case, you just enter the name or the IP address of the mail server:

```
nagios@linux:nagios/libexec$  ./check_smtp -H smtp01
SMTP OK - 0,008 sec. response time|time=0,008157s;;;0,000000
```

The plugin check_smtp sends back a HELO *hostname* after receiving the SMTP greeting, which should contain the reply 250.

The definition of the corresponding command object in this case appears as follows:

```
define command{
    command_name  check_smtp
    command_line  $USER1$/check_smtp -H $HOSTADDRESS$
}
```

To check the host object linux01 with this, it requires the following service definition:

```
define service{
   service_description   SMTP
   host_name             linux01
   check_command         check_smtp
   ...
}
```

Using the -C option, the SMTP dialog can be extended even further, roughly until RCPT TO:

```
nagios@linux:nagios/libexec$  ./check_smtp -H localhost \
   -C "MAIL FROM: <bla@gna.dot>" -R "250" \
   -C "RCPT TO: <bla@gna.dot>" -R "554"
SMTP OK - 0,019 sec. response time|time=0,018553s;;;0,000000
```

Such a test could be used, for example, to check the configuration of the restrictions built into the mail server (invalid domains, spam defenses, and more). The example checks whether the mail server refuses to accept a mail containing the invalid domain gna.dot (that is, in the RCPT TO:). The test runs successfully, therefore, if the server rejects the mail with 554. What check_smtp does here corresponds to the following mail dialog reproduced by telnet:

```
user@linux:~$  telnet localhost 25
Trying 127.0.0.1...
Connected to localhost.
Escape character is '^]'.
220 swobspace.de ESMTP
helo swobspace
250 swobspace.de
MAIL FROM: <bla@gna.dot>
250 Ok
RCPT TO: <bla@gna.dot>
554 <bla@gna.dot>: Recipient address rejected: test not \
   existing top level domain
...
```

If the mail server did not reject the recipient domain because of the configuration error, the reply would no longer contain 554 and the plugin would issue a WARNING.

In general you should remember, when checking restrictions, that the server rejects mails only after a RCPT TO:, depending on the configuration, even if the reason for this (a certain client IP address, the server name in HELO or the sender address in MAIL FROM:) has already occurred before this.

6.3.2 POP and IMAP

Four pseudo plugins are available for testing the POP and IMAP protocols: check_pop, check_spop, check_imap, and check_simap. They are called pseudo plugins because they are just symbolic links to the plugin check_tcp. By means of the name with which the plugin is called, this determines its intended use and correspondingly sets the required parameters, such as the standard port, whether something should be sent to the server, the expected response and how the connection should be terminated. The options are the same for all plugins, which is why we shall introduce them all together:

-H *address* / --host=*address*
: specifies the computer on which POP or IMAP is to be checked.

-p *port* / --port=*port*
: *port* specifies an alternative port if the plugin is intended to monitor a different port from the standard one: 110 for check_pop, 995 for check_spop, 143 for check_imap, and 993 for check_simap (see also /etc/services).

-w *floating_point_decimal* / --warning=*floating_point_decimal*
: The placeholder *floating_point_decimal* is replaced by the warning limit for the response time in seconds, specified as a floating point decimal.

-c *floating_point_decimal* / --critical=*floating_point_decimal*
: This sets the critical limit for the response time in seconds (see -w).

-s "*string*" / --send="*string*"
: This string is to be sent to the server. In the default setting, none of the four plugins uses this option.

-e "*string*" / --expect="*string*"
: *string* specifies the reply that the server should give. The default is +OK for (S)POP and * OK for (S)IMAP.

-q "*string*" / --quit="*string*"
: This is the string with which the service is requested to end the connection. For (S)POP this is QUIT\r\n, for (S)IMAP, a1 LOGOUT\r\n.

-S / --ssl (from version 1.4)

The connection set up during the test uses SSL/TLS for the connection. If you call the plugins **check_simap** and **check_spop**, this option is set automatically. In order for a connection to be established, the server must support SSL/TLS directly on the addressed port.

STARTTLS[6] on its own does not support the plugin. With

```
./check_imap -H computer -s "a1 CAPABILITY" -e "STARTTLS"
```

you can at least check whether the server provides this method: the plugin returns OK if the reply string contains STARTTLS, or WARNING if it doesn't. But this is not really a genuine test of whether STARTTLS really does work properly.

Of course, all the other options of the generic plugin **check_tcp** (described in Section 6.7.1 from page 110) can be used with **check_pop**, **check_spop**, **check_imap**, and **check_simap**.

In the simplest case you just need to give the name of the computer to be tested (here: **mailsrv**) or the IP address:

```
nagios@linux:nagios/libexec$  ./check_pop -H mailsrv
POP OK - 0.064 second response time on port 110 [+OK eli11 Cyrus POP3
v2.1.16 server ready <1481963980.1118597146@eli11>]
|time=0.064228s;0.000000;0.000000;0.000000;10.000000
```

In each case the plugin provides just one line of output, which has been line-wrapped here for layout reasons. The details after the pipe character | in turn involve performance data not shown by the Web interface. The structure of performance data and how they are processed are described in more detail in Section 17.1 from page 314.

Implemented as a command object, the above **check_pop** command looks like this:

```
define command{
    command_name   check_pop
    command_line   $USER1$/check_pop -H $HOSTADDRESS$
}
```

As a service for the machine **linux01**, it is integrated like this:

[6] STARTTLS refers to the capacity of a service to set up an SSL/TLS-secured connection after a normal connection has been established—for example, for POP3, via TCP port 110. Every service that implements STARTTLS must have a suitable command available to do this. With POP3 this is called **STLS** (see RFC 2595). STARTTLS is used with SMTP, LDAP, IMAP, and POP3, among others, but not every server supports this method automatically.

```
define service{
   service_description   POP
   host_name             linux01
   check_command         check_pop
   ...
}
```

6.4 Monitoring FTP and Web Servers

The Nagios plugin package provides two plugins to monitor the classic Internet services FTP and HTTP (including HTTPS): **check_ftp** and **check_http**. When many users from a network are using Web services, a proxy is usually used in addition. To monitor this, you could also use **check_http**, but with the **check_squid.pl** plugin, The Nagios Exchange has a better tool available.

6.4.1 FTP services

The plugin **check_ftp** is, like the plugins for POP and IMAP, a symbolic link to the generic plugin **check_tcp**, so that it also has the same options. They are described in detail in Section 6.7.1 on page 110.

The generic plugin sets the following parameters if it is called with the name **check_ftp**:

```
--port=21 --expect="220" --quit="QUIT\r\n"
```

It does not send a string to the server, but it expects a reply containing the text **220**, and it ends the connection to the standard port 21 cleanly with **QUIT\r\n**.

On the command line there is, as usual, a one-line reply (with line breaks for the printed version) with performance data after the **|** character that is not shown by the Web interface, (see Section 17.1 from page 314) for an explanation of this:

```
nagios@linux:nagios/libexec$  ./check_ftp -H ftp.gwdg.de
FTP OK - 0,130 second response time on port 21 [220-Gesellschaft fuer
wissenschaftliche Datenverarbeitung mbH Goettingen] |time=0,130300s;0,
000000;0,000000;0,000000;10,000000
```

As a command object, this call appears as follows:

```
define command{
    command_name  check_ftp
    command_line  $USER1$/check_ftp -H $HOSTADDRESS$
}
```

A corresponding service definition looks like this:

```
define service{
   service_description   FTP
   host_name             linux01
   check_command         check_ftp
   ...
}
```

6.4.2 Web server control via HTTP

The **check_http** plugin for HTTP and HTTPS checks contains a large number of very useful options, depending on the intended use:

-H *virtual_host* / --hostname=*virtual_host*
: This switch specifies the virtual host name that the plugin transmits in the HTTP header in the **host:** field:

```
nagios@linux:nagios/libexec$  ./check_http -H www.swobspace.de
HTTP OK HTTP/1.1 200 OK - 2553 bytes in 0.154 seconds
```

If you don't want **check_http** to send this, you can use **-I** instead.

-I *ip-address* / --IP-address=*ip-address*
: Instead of *ip*, the host name or IP address of the target computer is given. For systems with several virtual environments, you will land in the default environment, and for most Web hosting providers you will then receive an error message:

```
nagios@linux:nagios/libexec$  ./check_http -I www.swobspace.de
HTTP WARNING: HTTP/1.1 404 Not Found
```

-u *url_or_path* / --url=*url_or_path*
: The argument is the URL to be sent to the Web server. If the design document lies on the server to be tested, it is sufficient to enter the directory path, starting from the *document root* of the server:

```
nagios@linux:nagios/libexec$  ./check_http -H linux.swobspace.net\
    -u /mailinglisten/index.html
HTTP OK HTTP/1.1 200 OK - 5858 bytes in 3.461 seconds
```

If this option is not specified, the plugin asks for the *document root /*.

-p *port* / --port=*port*
: This is an alternative port specification for HTTP.

-w *floating_point_decimal* | --warning=*floating_point_decimal*

This is the warning limit for the response time of the Web server in seconds.

-c *floating_point_decimal* | --critical=*floating_point_decimal*

This is the critical limit for the response time of the Web server in seconds.

-t *timeout* | --timeout=*timeout*

After *timeout* seconds have expired, the plugin interrupts the test and returns the CRITICAL status. The default is 10 seconds.

-L | --link-url

This option ensures that the virtual host in the text output appears on the Web interface as a link.

```
nagios@linux:nagios/libexec$  ./check_http -H www.swobspace.de -L
<A HREF="http://www.swobspace.de:80/" target="_blank"> HTTP OK HTTP
/1.1 200 OK - 2553 bytes in 0.156 seconds </A>
```

-a *username*:*password* | --authorization=*username*:*password*

If the Web server requires authentication, this option can be used to specify a user-password pair. The plugin can only handle *basic authentication*, however; *digest authentication* is currently not yet possible.

-f *behavivor* | --onredirect=*behavior*

If the Web server sends a redirect as a reply to the requested Web page, the *behavior* parameter influences the behavior of the plugin. The values ok, warning, critical and follow are allowed. The default is ok, so the plugin will simply return an OK, without following the redirect. The plugin can be made to follow the redirect with follow. warning and critical with a redirect return the WARNING or CRITICAL status.

-e "*string*" | --expect="*string*"

This is the text that the server response should contain in its first status line. If this option is not specified, the plugin expects HTTP/1. as a *string*.

-s "*string*" | --string="*string*"

This is the search text that the plugin looks for in the contents of the page returned, not in the header.

-r "*regexp*" | --regex="*regexp*"

This is a regular expression[7] for which the plugin should search in the page returned.

-R "*regexp*" | --eregi="*regexp*"

This switch works like -r, except that the plugin now makes no distinction between upper and lower case.

[7] Posix regular expressions, see man 7 regex.

-l / --linespan

Normally the search for regular expressions is restricted to one line with -r and -R. If -l precedes these options, the search pattern can refer to text covering multiple lines.

-P *string* / --post=*string*

Use this switch for data that you would like to send via a POST command to the Web server. The characters in *string* must be encoded in accordance with RFC 1738:[8] only the letters A to Z (upper and lower case), the special characters $-_.+!*'(), and the numbers 0 to 9 are allowed.

To send the text Übung für Anfänger ("Exercise For Beginners" in German) as a *string*, umlauts and spaces must be encoded before they are sent: %DCbung%20f%FCr%20Anf%E4nger.

-m *min_bytes* / --pagesize=*min_bytes*

-m *min_bytes*:*max_bytes* / --pagesize=*min_bytes*:*max_bytes* (from version 1.4)

The page returned must be at least *min_bytes* in size, otherwise the plugin will issue a WARNING. You can optionally use an upper limit as well—separated by a colon—to specify the size of the Web page. Now check_http will also give a warning if the page returned is larger than *max_bytes*. In the following example, everything is in order if the page returned is at least 500 bytes and at most 2000 bytes in size:

```
nagios@linux:nagios/libexec$  ./check_http -H www.swobspace.de \
    -m 500:2000
HTTP WARNING: page size 2802 too large|size=2802B;500;0;0
```

-N / --no-body (from version 1.4)

With this option the plugin does not wait for the server to return the complete page contents, but just reads in the header data. To do this it uses the HTTP commands GET or POST, and not HEAD.

-M *seconds* / --max-age=*seconds* (from version 1.4)

If the returned document is older than the date specified in the header (HTTP header field Date:), the plugin will generate a WARNING. Instead of seconds (without additional details) you can also use explicit units such as 5m (five minutes), 12h (twelve hours), or 3d (three days); combinations are not allowed.

-A "*string*" / --useragent="*string*" (from version 1.4)

Explicitly specifies a user agent in the HTTP header, such as -A "Lynx/1.12" for Lynx version 1.12. Normally the plugin does not send this field.

[8] http://www.faqs.org/rfcs/rfc1738.html, paragraph 2.2

-k "*string*" / --header="*string*" (from version 1.4)

This specifies any HTTP header tags. If several tags are to be specified, they must be separated by a semicolon, as in the following example:

```
-k "Accept-Charset: iso-8859-1; Accept-Encoding: compress, gzip;"
```

-S / --ssl

This forces an SSL connection to be used:

```
nagios@linux:nagios/libexec$ ./check_http --ssl -H \
    www.verisign.com
HTTP OK HTTP/1.1 200 OK - 33836 bytes in 1.911 seconds
```

The host **www.verisign.com** allows an SSL connection. If this is not the case, the server returns an error and the plugin returns the value CRITICAL:[9]

```
nagios@linux:nagios/libexec$ ./check_http --ssl -H www.swobspace.de
Connection refused
Unable to open TCP socket
```

-C *days* / --certificate=*days*

Tests whether the certificate is at least valid for the given number of days. Otherwise a WARNING is issued.

-4 / --use-ipv4 (from version 1.4)

The test is made explicitly over an IPv4 connection.

-6 / --use-ipv6 (from version 1.4)

The test is made explicitly over an IPv6 connection.

The definition of a corresponding command object and its use as a service is no different from that based on other plugins; page 102 shows an example.

6.4.3 Monitoring Web proxies

Proxy test with check_http

A proxy such as Squid can also be tested with **check_http**, but this assumes that you have some knowledge of how a browser makes contact with the proxy. It does this in the form of an HTTP header:

```
GET http://www.swobspace.de/ HTTP/1.1
Host: www.swobspace.de
User-Agent: Mozilla/5.0 (X11; U; Linux i686; de-DE; rv:1.7.5)
Gecko/20041108 Firefox/1.0
```

[9] This can be checked in the shell with **echo $?**.

```
Accept: text/xml,application/xml,application/xhtml+xml,...
Accept-Language: de-de,de;q=0.8,en-us;q=0.5,en;q=0.3
Accept-Encoding: gzip,deflate
Accept-Charset: ISO-8859-15,utf-8;q=0.7,*;q=0.7
Keep-Alive: 300
Proxy-Connection: keep-alive
Pragma: no-cache
Cache-Control: no-cache
```

The decisive entries are printed in bold type. In contrast to normal Web server queries, the browser requests the document from the server via a GET command, not by specifying the directory path, but by using the complete URL, including the protocol type. In the Host: field it specifies the host name of the Web server that it actually wants to reach. With normal HTTP queries that go directly to a Web server (and not via a proxy), the host name of the Web server would be written there. This behavior can be reproduced with check_http:

```
nagios@linux:nagios/libexec$ ./check_http -H www.swobspace.de \
    -I 192.168.1.13 -p 3128 -u http://www.swobspace.de
HTTP OK HTTP/1.0 200 OK - 2553 bytes in 0.002 seconds
```

In order to set the Host: field in the header, you specify the name of a Web server with -H. The nonlocal URL is forced by a -u, and specifying -I at the same time ensures that the proxy is addressed, and not the Web server itself. Finally you need to select the proxy port, and the proxy test is then complete. Then check_http will send the following HTTP header to the proxy:

```
GET http://www.swobspace.de HTTP/1.0
User-Agent: check_http/1.79 (nagios-plugins 1.4-beta1)
Host: www.swobspace.de
```

This test does not use any implementation-specific information of the proxy, so it should work with every Web proxy.

The command object is defined as follows:

```
define command{
    command_name  check_proxy
    command_line  $USER1$/check_http -H www.google.de \
    -u http://www.google.de -I $HOSTADDRESS$ -p $ARG1$
}
```

The proxy computer linux01 is then tested with the following service:

```
define service{
   service_description   Webproxy
   host_name             linux01
   check_command          check_proxy!3128
   ...
}
```

The parameter **3128** ensures that the command object **check_proxy** can read out the port from **$ARG1$**.

Proxy test with check_squid

The proxy check with **check_http**, introduced in the last section, works only if the desired Web page is available or is already in the cache. If neither is the case, this test will produce an error, even if the proxy is working in principle.

The plugin **check_squid.pl** uses a different method, but it is not part of the standard installation, and is to be found in the category **Check Plugins → Networking**[10] which can be found at **http://www.nagiosexchange.com/**.

It makes use of the *cache manager* of the Squid proxy, which is queried by a pseudo protocol. A command is sent in the form

```
GET cache_object://ip address/command HTTP/1.1\n\n
```

to Squid and obtains the desired information. The plugin **check_squid.pl** uses the **info** command, which queries a range of statistical usage information:

```
user@linux:~$ echo "GET cache_object://192.168.1.13/info HTTP/1.1\n\n" \
    | netcat 192.168.1.13 3128
...
File descriptor usage for squid:
        Maximum number of file descriptors:   1024
        Largest file desc currently in use:     18
        Number of file desc currently in use:   15
        Files queued for open:                   0
        Available number of file descriptors: 1009
        Reserved number of file descriptors:   100
        Store Disk files open:                   0
...
```

It is targeted at the number of still-free file descriptors (the third line from the end); you can set a warning or critical limit for this value. The number of file descriptors plays a role when access is made to objects in the Squid cache at the same time. In environments with a high number of parallel accesses to the proxy, it is quite possible that 1024 file descriptors are insufficient. In smaller networks with just a few hundred users, not all of whom are surfing at the same time, the compiled-in value of 1024 will be sufficient.

[10] http://www.nagiosexchange.org/Networking.53.0.html

Squid configuration

Normally Squid allows access to the cache manager only from **localhost**. So that Nagios can query it over the network, the proxy must be reconfigured accordingly:

```
...
acl manager proto cache_object
acl nagiosserver 192.168.1.9
http_access allow manager nagiosserver
http_access deny manager
cachemgr_passwd none info menu
...
```

The necessary changes to the configuration file **squid.conf** are printed in bold type, and the other relevant lines are already contained in the default file. The first line to be printed defines an access control list (*Access Control List*, **acl**) called **manager** by means of the internal protocol **cache_object**, so it refers to everything that accesses the proxy using the **cache_object** protocol. This is followed by an access control list for the Nagios server, based on its IP address, here **192.168.1.9**. The list name **nagiosserver** may be freely chosen here (as can **manager** in the first line). With **http_access allow**, **nagiosserver** obtains access to the cache manager (**manager**), before the line

```
http_access deny manager
```

prohibits access to all others through the **cache_object** protocol. Finally, **cachemgr _passwd** provides a password for the cache manager access. If you omit this, with **none**, then only selected commands should be allowed that have no potential to change things, such as **info** and **menu**, which shows all the things that the cache manager can do. After the configuration file has been modified, Squid needs to read it in again:

```
linux:~ #  /etc/init.d/squid reload
```

Applying the plugin

The test plugin **check_squid.pl** itself has the following options:

-H *address* / --hostname=*address*

This is the server on which Squid is to be tested, specified by IP address or FQDN.

-P *port* / --port=*port*

This specifies the port on which Squid is listening. The default is the standard port 3128.

-p *password* | --password=*password*
: This is the password for access to the cache manager.

-w *free_descriptors* | --warning=*free_descriptors*
: This is the number of free file descriptors, where the plugin will issue a warning if the number drops below this. The default is 200.

-c *free_descriptors* | --critical=*free_descriptors*
: This is the critical limit for free file descriptors. If the number falls below this, check_squid returns CRITICAL. The default is 50.

When check_squid is run, it is usually very unspectacular:

```
nagios@linux:nagios/libexec$  ./check_squid.pl -H 192.168.1.13
Squid cache OK (1009 FreeFileDesc)
```

The matching command also presents no problems ...

```
define command{
    command_name  check_squid.pl
    command_line  $USER1$/check_squid.pl -H $HOSTADDRESS$
```

...and the same goes for service definitions:

```
define service{
   service_description   Squid
   host_name             linux01
   check_command         check_squid.pl
   ...
}
```

6.5 Domain Name Server under Control

Two plugins are also available for testing the *Domain Name Services* DNS: check_dns and check_dig. While check_dns tests whether a host name can be resolved, using the external nslookup program, check_dig allows any records at all to be queried. Both plugins are part of the standard distribution.

The situations in which they are used overlap somewhat. With check_dns, you can also explicitly query a specific DNS server, although this plugin is really for checking whether the name service is available generally.

6.5.1 DNS check with nslookup

The check_dns plugin checks whether a specified host name can be resolved to an IP address. Used locally, the plugin tests the DNS configuration of the computer on which it is run. For the name resolution, it uses the name server configured in /etc/resolv.conf.

The possible options are just as unspectacular.

-H *host* / --hostname=*host*

This is the host name to be resolved to an IP address.

-s *dns-server* / --server=*dns-server*

This switch explicitly specifies the name server to be used. If this option is missing, check_dns uses the name server from /etc/resolv.conf.

-a *ip address* / --expected-address=*ip address*

The *ip address* is the IP address that *host* should have. If the name service returns a different address, the plugin will raise the alarm with CRITICAL. This option makes sense only if it is necessary for the name server to provide a fixed IP address. Without this option, the plugin will accept every IP address as a reply.

-A / --expect-authority

The name server specified with -s should answer the given query authoritatively, so the corresponding domain must act as a primary or secondary name server. If this is not the case, the plugin returns CRITICAL.

-t *timeout* / --timeout=*timeout*

After *timeout* seconds have expired, the plugin interrupts the test and returns the CRITICAL state. The default is 10 seconds.

For the local test of the DNS configuration (not that for a name server) you just require a host name that is highly unlikely to disappear from the DNS, such as www.google.de:

```
nagios@linux:nagios/libexec$  /check_dns -H www.google.de
DNS OK: 0,009 seconds response time www.google.de returns 216.239.59.99
```

The corresponding command definition appears as follows in this case:

```
define command{
    command_name  check_dns
    command_line  $USER1$/check_dns -H www.google.de
}
```

The following service tests whether the name server configuration for the computer **linux01** is functioning:

```
define service{
   service_description   DNS/nslookup
   host_name             linux01
   check_command         check_dns
   ...
}
```

6.5.2 Monitoring the name server with dig

The plugin **check_dig** provides more options for monitoring a name server than **check_dns**. As the name implies, it is based on the external utility **dig**, intended for precisely this purpose.

-H *address* / --hostname=*address*
The *address* is the IP address for the DNS server to be tested. It is also possible to specify a host name (instead of an IP address), but in most cases this makes little sense, because this would first have to be resolved before it can reach the name server.

-l *hostname* / --lookup=*hostname*
The *hostname* is the host name to be tested. If no particular computer is looked up, but only the functionality of the DNS server is to be tested, you should specify an address here easily reachable from the Internet, such as **www.google.de**.

-T *record_type* / --record_type=*record_type* (from version 1.4)
This switch specifies the record type to be queried. The default is **A** (IPv4 address), but often **NS** (relevant name server), **MX** (relevant *Mail Exchange*), **PTR** (*Pointer*; IP address for reverse lookup) or **SOA** (*Source of Authority*, the administration details of the domain) are also used.

-w *floating_point_decimal* / --warning=*floating_point_decimal* (from version 1.4) This switch sets the warning limit for the response time of the name server in seconds (floating point decimal).

-c *floating_point_decimal* / --critical=*floating_point_decimal* (from version 1.4)
This switch sets the critical response time of the name server in seconds (floating point decimal).

-a *address* / --expected_address=*address* (from version 1.4)
This is the address that **dig** should return in the *ANSWER SECTION*. In contrast to **check_dns**, **check_dig** delivers a WARNING only if the IP address does not match, but the reply itself has arrived within the given time limit.

-t *timeout* | --timeout=*timeout*]

After *timeout* seconds have expired, the plugin breaks off the test and returns the CRITICAL state. The default is 10 seconds.

The following two examples check the name server 194.25.2.129, by requesting it for the IP address of the computer www.swobspace.de. The second example ends with a WARNING, since the reply of the name server for www.swobspace.de returns a different IP address from 1.2.3.4 in the ANSWER SECTION:

```
nagios@linux:nagios/libexec$ ./check_dig -H 194.25.2.129 -l \
    www.swobspace.de
DNS OK - 2,107 Sekunden Antwortzeit (www.swobspace.de. 1800  IN   A
212.227.119.101)
nagios@linux:nagios/libexec$ ./check_dig -H 194.25.2.129 -l \
    www.swobspace.de -a 1.2.3.4
DNS WARNING - 0,094 Sekunden Antwortzeit (Server nicht gefunden in
ANSWER SECTION)
```

Example 1 is implemented as a command object as follows:

```
define command{
    command_name  check_dig
    command_line  $USER1$/check_dig -H $HOSTADDRESS$ -l $ARG1$
}
```

In order to test the specific name server linux01 with Nagios, you look for an address that Nagios should always be able to resolve, such as www.google.de:

```
define service{
   service_description   DNS/dig
   host_name             linux01
   check_command         check_dig!www.google.de
   ...
}
```

6.6 Querying the Secure Shell Server

Monitoring of Secure Shell servers (irrespective of whether they use protocol version 1 or 2) is taken over by the plugin check_ssh (included in the standard distribution). It is quite a simple construction and just evaluates the SSH handshake. Username and password are not required for the test.

Not to be confused with check_ssh is the plugin check_by_ssh (see Chapter 9 from page 157), which starts plugins remotely on a different computer.

-H *address* / --hostname=*address*
: Host name or IP address of the computer to which the plugin should set up an SSH connection.

-p *port* / --port=*port*
: specifies an alternative port. The default is 22.

-r *version* / --remote-version=*version* (from version 1.4)
: The version details for the tested Secure Shell must match the specified text instead of *version*, otherwise a WARNING will be sent (see example below). If the version details contain spaces, the string must be enclosed by double quotes.

  -4 / --use-ipv4 (from version 1.4) The test takes place explicitly over an IPv4 connection.

  -6 / --use-ipv6 (from version 1.4) The test takes place explicitly over an IPv6 connection.

-t *timeout* / --timeout=*timeout*]
: After *timeout* (by default, 10) seconds the plugin breaks off the test and returns the CRITICAL state.

The following example in turn tests the Secure Shell daemons on the local computer and on wobgate, to see whether the current SSH version from Debian Sarge is being used:

```
nagios@linux:nagios/libexec$ ./check_ssh -H localhost \
    -r 'OpenSSH_3.8.1p1 Debian-8.sarge.4'
SSH OK - OpenSSH_3.8.1p1 Debian-8.sarge.4 (protocol 2.0)
nagios@linux:nagios/libexec$ ./check_ssh -H wobgate -r \
    'OpenSSH_3.8.1p1 Debian-8.sarge.4'
SSH WARNING - OpenSSH_3.8.1p1 Debian 1:3.8.1p1-8 (protocol 2.0) version
mismatch, expected 'OpenSSH_3.8.1p1 Debian-8.sarge.4'
```

The latest version of SSH is not in use on wobgate.

In heterogeneous environments with various Linux distributions, you will usually use version checking "manually" only for plugin calls, and only rarely integrate them into the Nagios configuration. Instead, it is normally sufficient to use command and service definitions using the following simple pattern:

```
define command{
    command_name  check_ssh
    command_line  $USER1$/check_ssh -H $HOSTADDRESS$
}
```

```
define service{
   service_description   SSH
   host_name             linux01
   check_command         check_ssh
   ...
}
```

Otherwise you run the risk of having to adjust the version number in the command object after every security update.

6.7 Generic Network Plugins

Sometimes no plugin can be found that is precisely geared to the service to be monitored. For such cases, two generic plugins are available: check_tcp and check_udp. Both of them test whether a service is active on the target port for the protocol in question. Although this does not yet guarantee that the service running on the port really is the one in question, in an environment that one adminstrator looks after and configures, this can be sufficiently guaranteed in other ways.

Both plugins send a string to the server and evaluate the reply. This is at its most simple for text-based protocols such as POP or IMAP: these two "specific" plugins, which are tailor-made for these two mail services (see Section 6.3.2 from page 95), use nothing more than symbolic links to check_tcp, which has already completed the corresponding question-and-answer game with relevant default settings.

If you know the protocol to be tested and you configure a "quiz" that will fit this (no easy task for binary protocols), a check becomes considerably more than just a port scan. In this way the generic plugins can also be substituted for specific missing plugins.

6.7.1 Testing TCP ports

check_tcp is concentrated on TCP-based services. In line with its generic nature, it has a large number of options:

-H *address* | --hostname=*address*
: This is the IP address or host name of the computer whose port should be tested.

-p *port* | --port=*port*
: This specifies the target port. In contrast to the plugins that are formed as a symbolic link to check_tcp, this detail is always required.

-w *floating_point_decimal* | --warning=*floating_point_decimal*
: This sets the warning limit for the response time in seconds.

-c *floating_point_decimal* | --critical=*floating_point_decimal*
: This sets a time limit like -w but specifies the critical limit value.

-s "*string*" | --send="*string*"
: This is the string that the plugin should send to the server.

-e" *string*"| --expect="*string*"
: This is the string that the reply of the server should contain. The plugin does not restrict its search here to the first line.

-q" *string* | --quit="*string*"
: This is the string that requests the service to end the connection.

-m *bytes* | --maxbytes=*bytes*
: The plugin closes the connection if it has received more than *bytes*.

-d *floating_point_decimal* | --delay=*floating_point_decimal*
: This is the time period in seconds between sending a string and checking the response.

-t *timeout* | --timeout=*timeout*
: After *timeout* (the default is 10) seconds the plugin stops the test and returns the CRITICAL status.

-j | --jail
: Setting this displays the TCP output. For text-based protocols such as POP or IMAP, this is usually "human-readable", but for binary protocols you generally cannot decipher the output, so that -j is appropriate.

-r *return_value* | --refuse=*return_value* (from version 1.4)
: This switch specifies what value the plugin returns if the server rejects the TCP connection. The default is crit (CRITICAL). With ok as the *return_value*, you can test whether a service is available that should not be accessible from outside. The third possible value, warn, ensures that a WARNING is given.

-M *return_value* | --mismatch=*return_value* (from version 1.4)
: How should the plugin react if a returned string does not match what is specified with -e? The default is warn, which means that a WARNING is given. With crit, a false return value could be categorized as CRITICAL, and with ok, as OK.

-D *days* | --certificate=*days* (from version 1.4)
: This is the time span in days for which a server certificate must at least be valid for the test to run successfully. It is relevant only for SSL connections. Note that there is a danger of confusion: in the check_http plugin this same option is -C (see page 101). If the time span drops below the time period specified for the server certificate, the plugin returns a WARNING.

-S / --ssl (from Version 1.4)
: SSL/TLS should be used for the connection. The plugin cannot handle STARTTLS[11].

-4 / --use-ipv4 (from version 1.4)
: The test takes place specifically over an IPv4 connection.

-6 / --use-ipv6 (from version 1.4)
: The test takes place specifically over an IPv6 connection.

The following example checks on the command line whether a service on the target host **192.168.1.89** is active on port 5631, the TCP port for the Windows remote-control software, PC Anywhere:

```
nagios@linux:nagios/libexec$  ./check_tcp -H 192.168.1.89 -p 5631
TCP OK - 0,061 second response time on port 5631 | time=0,060744s;0,
000000;0,000000;0,000000;10,000000
```

For all services for which the computer name and port detail are sufficient as parameters for the test, the command object is as follows:

```
define command{
    command_name   check_tcp
    command_line   $USER1$/check_tcp -H $HOSTADDRESS$ -p $ARG1$
}
```

To monitor the said PCAnywhere on the machine **Win01**, the following service definition would be used:

```
define service{
   service_description pcAnywhere
   host_name           Win01
   check_command       check_tcp!5631
   ...
}
```

6.7.2 Monitoring UDP ports

It is not so simple to monitor UDP ports, since there is no standard connection setup, such as the *three-way-handshake* for TCP, in the course of which a connection is opened, but data is not yet transferred. For a stateless protocol such as UDP there is no regulated sequence for sent and received packets. The server can

[11] See footnote on page 96.

reply to a UDP packet sent by the client with a UDP packet, but it is not obliged to do this.

If you find an unoccupied port, the requested host normally sends back an "*ICMP port unreachable*" message, which evaluates the plugin. If there is no reply, there are two possibilities: either the service on the target port is not reacting to the request, or a firewall is filtering out network traffic (either the UDP traffic itself or the ICMP message). This is why you can never be sure with UDP whether the server behind a particular port really is offering a service or not.

In order to force a positive response where possible, you normally have to send data to the server, with the option -s, containing some kind of meaningful message for the underlying protocol. Most services will not respond to empty or meaningless packets. This is why you cannot avoid getting to grips with the corresponding protocol, since you will otherwise not be in a position to send meaningful data to the server, to prompt it into giving a reply at all.

The plugin itself has the following options:

-H *address* / --hostname=*address*
: This is the IP address or host name of the computer whose port should be tested by the plugin.

-p *port* / --port=*port*
: This switch specifies the target port.

-w *floating_point_decimal* / --warning=*floating_point_decimal*
: This sets the warning limit for the response time in seconds.

-c *time* / --critical=*time*
: This sets the critical limit in seconds (see -w).

-s "*string*"/ --send="*string*"
: This is the string that the plugin sends to the server.

-e " *string* "/ --expect="*string*"
: This is the string that the first reply line of the server should contain.

-t *timeout* / --timeout=*timeout*
: After *timeout* (default: 10) seconds have expired, the plugin stops the test and returns the CRITICAL status.

The following example tests whether a service on the target host 192.168.1.13 is active on the time server (NTP) Port 123. The NTP daemon only replies to packets containing a meaningful request (e.g., to ones whose contents begin with w):

```
nagios@linux:nagios/libexec$ ./check_udp -H 192.168.1.13 -p 123 -s "w"
Connection accepted on port 123 - 0 second response time
```

It does not respond to packets with data not in the protocol form. Normally NTP expects a relatively complex packet[12] containing various information. The w used here, reached by trial and error, does not contain really meaningful data, but it does provoke the server into giving a response.

The command line command shown above is implemented as follows as a command object:

```
define command{
    command_name  check_udp
    command_line  $USER1$/check_udp -H $HOSTADDRESS$ -p $ARG1$ -s $ARG2$
}
```

In contrast to **check_tcp**, it is useful here to give services that are based on this possibility of sending test data with **-s**. You therefore need two arguments.

Checking an NTP time server is then taken over by the following service definition:

```
define service{
   service_description
   host_name           timesrv
   check_command       check_tcp!123!w
   ...
}
```

As in the command line example, Nagios sends the string w to the service to provoke a positive response.

6.8 Monitoring Databases

Nagios provides three plugins for monitoring databases: **check_pgsql** for PostgreSQL, **check_mysql** for MySQL, and **check_oracle** for Oracle. The last will not be covered in this book.[13] They all have in common the fact that they can be used both locally and over the network. The latter has the advantage that the plugin in question does not have to be installed on the database server. The disadvantage is that you have to get more deeply involved with the subject of authentication, because configuring a secure *local* access to the database is somewhat more simple.

For less critical systems, network access by the plugin can be done without a password. To do this, the user **nagios** is set up with its own database in the database management system to be tested, which does not contain any (important) data.

[12] The protocol version NTPv3 is described in RFC 1305: http://rfc.sunsite.dk/rfc/rfc1305.html.

[13] The plugin **check_oracle** assumes the installation of an Oracle Full Client on the Nagios server; it does not work together with the Instant Client and expects its users to have an extensive knowledge of Oracle. To explain all this here is far beyond the scope of this book.

Areas accessed by this user can be isolated from other data, stored in the DBMS, through the database's own permissions system.

Of course, there is nothing stopping you from setting up a password for the user nagios. But if you cannot make use of SSL-encrypted connections, this will be transmitted in plain text for most database connections. In addition, it is stored unencrypted in the Nagios configuration files. In this respect the password does offer some protection, but it is not really that secure.

As an additional measure, you should certainly restrict the IP address from which a user nagios user can access the database on the Nagios server.

The plugins introduced here have only read access to the database. check_mysql additionally allows a pure connection check, without read access. A write access to the database is not available in any of the plugins mentioned. For Oracle there is a plugin on The Nagios Exchange[14] called check_oracle_writeaccess.sh, which also tests the writeability of the database.

6.8.1 PostgreSQL

With the check_pgsql plugin you can establish both local and network connections to the database. Local connections are handled by PostgreSQL via a Unix socket, which is a purely local mechanism. An IP connection is set up by check_pgsql if a target host is explicitly passed to it. The plugin performs a pure connection test to a test database but does not read any data from it.

In order that PostgreSQL can be reached over the network, you must start the postmaster program, either with -i, or by setting the parameter tcpip_socket in the configuration file postgresql.conf to the value true.

Configuring a monitor-friendly DBMS

In order to separate the data that the user nagios (executing the plugin) gets to see more clearly from other data, you first set up a database user with the same name, and a database to which this user is given access:

```
postgres@linux:~$  createuser --no-adduser --no-createdb nagios
postgres@linux:~$  createdb --owner nagios nagdb
```

Of particular importance when creating a database user with the command createuser is the option --no-adduser. To PostgreSQL, the ability to be allowed to create users automatically means that you are the superuser, who can easily get round the

[14] http://www.nagiosexchange.org/Databases.57.0.html

various permissions set.[15] But **nagios** should not be given superuser permissions under any circumstances.

createdb finally creates a new, empty database called **nagdb**, which belongs to **nagios**.

Access to the database can be restricted in the file **pg_hba.conf**. Depending on the distribution, this can be found either in **/etc/postgresql** or in the subdirectory **./data** of the database itself (for example, **/var/lib/pgsql/data** for SUSE). The following extract restricts access by the database user **nagios** to a specific database and to the IP address of the Nagios server (instead of the IP address to be completed by *ip-nagios*):

```
#type db     user    ip-address  ip-mask          method options
local nagdb  nagios                               ident  sameuser
host  nagdb  nagios  ip-nagios   255.255.255.255  ident  sameuser
```

The first line is a comment describing the function of the columns. The second line allows the database user **nagios** access to the database **nagdb** over a local connection. Even though the authentication method here is called **ident**, you do not need a local ident daemon for Linux and BSD variants (NetBSD, FreeBSD, etc.).

The last line describes the same restriction, but this time it is for a TCP/IP connection to the Nagios server. But now PostgreSQL asks the ident daemon of the Nagios server which user has set off the connection request. This means that an ident daemon must be installed on *ip-nagios*. In this way the DBMS tests whether the user initiating the connection from the Nagios server really is called **nagios**. It will not permit another user (or a connection from different host).

Normally the ident protocol is only partially suited for user authentication. But in the case of the Nagios server you can assume that a host is involved that is under the control of the administrator who can ensure that an ident daemon really is running on port 113.

There is a huge range of different ident daemons. **pidentd**[16] is widely used and is included in most Linux distributions. Normally it is already preconfigured and just needs to be started. But how it is started depends on the distribution; usually **inetd** or **xinetd** takes over this task. A glance at the documentation (should) put you straight.

After modifying the configuration file **pg_hba.conf** you must stop the DBMS so that it can reload the configuration files. This is best done with the command

```
linux:~ #  /etc/init.d/postgresql reload
```

(a restart is not necessary). If the configuration of the **inetd/xinetd** was modified, this daemon is reinitialized in the same way.

[15] Permissions in PostgreSQL are given by the database command GRANT.
[16] http://www.lysator.liu.se/~pen/pidentd/.

The test plugin check_pgsql

check_pgsql has the following options:

-H *address* / --hostname=*address*
: If given this option, the plugin establishes a TCP/IP connection instead of making contact with a local DBMS through a Unix socket.

-P *port* / --port=*port*
: In contrast to the plugins discussed until now, check_pgsql uses a capital P to specify the port on which PostgreSQL is running. In its default value it is connected to port 5432. This option is only useful if PostgreSQL allows TCP/IP connections.

-d *database* / --database=*database*
: This is the name of the database to which the plugin should be connected. If this detail is missing, it uses the standard database template1.

-w *floating_point_decimal* / --warning=*floating_point_decimal*
: This is the warning time in seconds for the performance time for the test.

-c *floating_point_decimal* / --critical=*floating_point_decimal*
: This is the critical limit for the performance time of the test in seconds.

-l *user* / --logname=*user*
: This is the name of the user who should establish contact to the database.

-p *passwd* / --password=*passwd*
: This switch sets the password for access to the database. Since this must be stored in plain text in the service definition, a potential security problem is involved. It is preferable to explicitly define a restricted, password-free access to the database in the PostgreSQL configuration for the user nagios.

-t *timeout* / --timeout=*timeout*]
: After *10* seconds have expired, the plugin stops the test and returns the CRITICAL status. This option allows the default value to be changed.

-4 / --use-ipv4 (from version 1.4)
: The test takes place explicitly across an IPv4 connection.

-6 / --use-ipv6 (from version 1.4)
: The test takes place explicitly across an IPv6 connection.

To test the reachability across the network of the database nagdb set up specially for this purpose, this is passed on as a parameter together with the target host (here: linux01):

```
nagios@linux:nagios/libexec$  ./check_pgsql -H linux01 -d nagdb
CRITICAL - no connection to 'nagdb' (FATAL: IDENT authentication failed
for user "nagios")
```

The fact that the check went wrong in the example is clearly due to the ident authentication. This happens, for example, if you forget to reload the ident daemon after the configuration has been modified. Once the error has been rectified, the plugin—hopefully—will work better:

```
nagios@linux:nagios/libexec$  ./check_pgsql -H linux01 -d nagdb
OK - database nagdb (0 sec.)|time=0,000000s;2,000000;8,000000;0,000000
```

If the database parameter is omitted, check_pgsql will address the database template1:

```
nagios@linux:nagios/libexec$  ./check_pgsql -H linux01
CRITICAL - no connection to 'template1' (FATAL:  no pg_hba.conf entry for
host "172.17.129.2", user "nagios", database "template1", SSL off)
```

A similar result is obtained if you run the test with the correct database, but with the wrong user:

```
wob@linux:nagios/libexec$  ./check_pgsql -H linux01 -d nagdb
CRITICAL - no connection to 'nagdb' (FATAL:  no pg_hba.conf entry for
host "172.17.129.2", user "wob", database "nagdb", SSL off)
```

You should certainly run the last two tests, just to check that the PostgreSQL database really does reject corresponding requests. Otherwise you will have a security leak, and we recommend that you remove settings in the configuration that are too generous.

If you have created a separate database for the check, there is no reason why you shouldn't write this explicitly in the command definition, instead of using parameters, with $ARG1$:

```
define command{
    command_name  check_pgsql
    command_line  $USER1$/check_pgsql -H $HOSTADDRESS$ -d nagdb
}
```

Then the service definition for linux01 is as simple as this:

```
define service{
   service_description   PostgreSQL
   host_name             linux01
   check_command         check_pgsql
   ...
}
```

6.8.2 MySQL

With the check_mysql plugin, MySQL databases can be tested both locally and across the network. For local connections, it makes contact via a Unix socket, and not via a real network connection.

MySQL configuration

In order that the database can be reached across the network, the skip-networking option in the configuration file my.cnf must be commented out. The database should then be running on TCP port 3306, which can be tested with netstat -ant, for example:

```
user@linux:~$ netstat -ant | grep 3306
tcp    0    0 0.0.0.0:3306    0.0.0.0:*    LISTEN
```

To set up the password-free access to the database relatively securely, a separate nagdb database is also created here that does not contain any critical data, and for which the user nagios is given restricted access from the Nagios server. To do this, you connect yourself, as the database user root, to the database mysql, and there you create the database nagdb:

```
user@linux:~$  mysql --user=root mysql
mysql> CREATE DATABASE nagdb;
```

If the command mysql --user=root mysql functions without the need to enter a root password, then you have a serious security problem. In that case, anyone—at least from the database server—is able to obtain full access to the database. If this is the case, it is essential that you read the security notes in the MySQL documentation.[17]

Recreating a user and the access restrictions can be done in one and the same step:

```
mysql> GRANT select ON nagdb.* TO nagios@ip-nagios;
```

The command sets up the user nagios, if it does not exist. It may only accept connections from the Nagios server with the IP address *ip-nagios* and obtains access to all tables in the database nagdb, but may execute only the SELECT command there (no INSERT, no UPDATE or DELETE); that is, user nagios only has read access.

[17] To be found, for example, at http://dev.mysql.com/doc/mysql/de/Security.html.

The test plugin check_mysql

check_mysql has fewer options than its PostgreSQL equivalent—apart from -H, it does not implement any standard flags and has neither a warning not a critical limit for the performance time of the test. For the database-specific options, it uses the same syntax as check_pgsql, except for the user entry:

-H *address* / --hostname=*address*
: This sets the host name or IP address of the database server. If the option -H is omitted, or if it is used in connection with the argument localhost, check_mysql does not set up a network connection but uses a Unix socket. If you want to establish an IP connection to localhost, you must explicitly specify the IP address 127.0.0.1.

-P *port* / --port=*port*
: This is the TCP port on which MySQL is installed. In the default, port 3306 is used.

-d *database* / --database=*database*
: This is the name of the database to which the plugin should set up a connection. If this option is omitted, it only makes a connection to the database process, without addressing a specific database.

-u *user* / --username=*user*
: This is the user in whose name the plugin should log in to the DBMS.

-p *passwd* / --password=*passwd*
: This switch is used to provide the password for logging in to the database.

To set up a connection to the database nagdb as the user nagios, both parameters are passed on to the plugin:

```
nagios@linux:nagios/libexec$  ./check_mysql -H dbhost -u nagios -d nagdb
Uptime: 19031  Threads: 2  Questions: 80  Slow queries: 0  Opens: 12
Flush tables: 1  Open tables: 6  Queries per second avg: 0.004
```

In contrast to PostgreSQL, with MySQL you can also make contact without establishing a connection to a specific database:

```
nagios@linux:nagios/libexec$  ./check_mysql -H dbhost
Uptime: 19271  Threads: 1  Questions: 84  Slow queries: 0  Opens: 12
Flush tables: 1  Open tables: 6  Queries per second avg: 0.004
```

With a manual connection to the database, with mysql, you can then subsequently change to the desired database, using the MySQL command use:

```
user@linux:~$  mysql -u nagios
mysql> use nagdb;
Database changed
mysql>
```

With this plugin, a subsequent database change is not possible. Here you must decide from the beginning whether you want to contact a database or whether you just want to establish a connection to the MySQL database system.

To test a nagdb database set up explicitly for this purpose, you can do without parameters when creating the corresponding command object, and explicitly specify both user and database:

```
define command{
   command_name   check_mysql
   command_line   $USER1$/check_mysql -H $HOSTADDRESS$ -u nagios -d nagdb
}
```

This simplifies the service definition:

```
define service{
   service_description   MySQL
   host_name             linux01
   check_command         check_mysql
   ...
}
```

6.9 Monitoring LDAP Directory Services

For monitoring LDAP directory services, the check_ldap plugin is available. It runs a search query that can be specified anonymously or with authentication. It has the following parameters to do this:

-H *address* / --hostname=*address*
: This is the host name or IP address of the LDAP server.

-b *base_dn* / --base=*base_dn*
: This is the top element (*Base Domain Name*) of the LDAP directory, formed for example from the components of the domain name: dc=swobspace,dc=de.

-p *port* / --port=*port*
: This is the port on which the LDAP server is running. The default is the standard port 389.

-a "*ldap-attribute*" | --attr="*ldap-attribute*"

This switch enables a search according to specific attributes. Thus -a "(objectclass=inetOrgPerson)" searches for all nodes in the directory tree containing the object class inetOrgPerson (normally used for telephone and e-mail directories, for example).

Specifying attributes in the check is less useful than it may seem. If you search through an LDAP directory for nonexistent attributes, you will normally receive an answer with zero results, but no errors.

-D *ldap_bind_dn* | --bind=*ldap_bind_dn*

This specifies a bind DN[18] for an authenticated connection, such as:

```
uid=wob,dc=swobspace,dc=de
```

Without this entry, the plugin establishes an anonymous connection.

-P *ldap_passwd* | --pass=*ldap_passwd*

This is the password for an authenticated connection. It only makes sense in conjunction with the option -D.

-t *timeout* | --timeout=*timeout*

After *timeout* seconds have expired (10 seconds if this option is not given), the plugin stops the test and returns the CRITICAL status.

-2 | --ver2 (from version 1.4)

Use LDAP version v2 (the default). If the server does not support this protocol version, the connection will fail. In OpenLDAP from version 2.1, v3 is used by default; to activate protocol version v2, the following line is entered in the configuration file slapd.conf:

```
allow bind_v2
```

Many clients, such as Mozilla and the Thunderbird address book, are still using LDAP version v2.

-3 | --ver3 (from version 1.4)

Use LDAP version v3. For many modern LDAP servers such as OpenLDAP, this is now the standard, but they usually also have parallel support for the older version v2, since various clients cannot yet implement v3.

-w *floating_point_decimal* | --warning=*floating_point_decimal*

If the performance time of the plugin exceeds *floating_point_decimal* seconds, it issues a warning.

[18] A bind DN serves to identify the user and refers to the user's nodes in the directory tree, specifying all the overlying nodes. The bind DN in LDAP corresponds in its function more or less to the username when logging in under Unix.

-c *floating_point_decimal* | --critical=*floating_point_decimal*
If the performance time of the plugin exceeds *floating_point_decimal* seconds, it returns CRITICAL.

-4 / --use-ipv4 (from version 1.4)
The test is done explicitly across an IPv4 connection.

-6 / --use-ipv6 (from version 1.4)
The test is done explicitly across an IPv6 connection.

In the simplest case it is sufficient to query whether the LDAP server really does own the base DN specified with -b:

```
nagios@linux:nagios/libexec$  ./check_ldap -H ldap.swobspace.de \
    -b "dc=swobspace,c=de"
LDAP OK - 0,002 seconds response time|time=0,002186s;;;0,000000
```

This query corresponds to the following command object:

```
define command{
    command_name  check_ldap
    command_line  $USER1$/check_ldap -H $HOSTADDRESS$ -b $ARG1$
}
```

Since an LDAP server can handle many LDAP directories with different base DNs, it is recommended that you configure this with parameters:

```
define service{
   service_description   LDAP
   host_name             linux01
   check_command         check_ldap!dc=swobspace,dc=de
   ...
}
```

If authentication is involved, things get slightly more complicated. On the one hand the plugin is given the bind-DN of the nagios user, with -D. On the other hand, the following example protects the necessary password from curious onlookers by storing this as the macro $USER3$ in the file resource.cfg, which may be readable only for the user nagios (see Section 2.14, page 59):

```
define command{
   command_name check_ldap_auth
   command_line $USER1$/check_ldap -H $HOSTADDRESS$ -b $ARG1$ -D $ARG2$ \
   -P $USER3$
}
```

Accordingly, the matching service definition contains the base DN and bind DN as arguments, but not the password:

```
define service{
   service_description   LDAP
   host_name             linux01
   check_command check_ldap_auth!dc=swobspace,dc=de!uid=nagios,\
   dc=swobspace,dc=de
   ...
}
```

6.10 Checking a DHCP Server

To monitor DHCP services, the plugin check_dhcp is available. It sends a DHCPDISCOVER via UDP broadcast to the target port 67 and waits for an offer from a DHCP server in the form of a DHCPOFFER, which offers an IP address and further configuration information.

Because check_dhcp does not send a DHCPREQUEST after this, the server does not need to reserve the sources and to confirm this reservation with DHCPACK, nor does it need to reject the request with DHCPNACK.

Granting the plugin root permissions

There is a further restriction to the check_dhcp: it requires full access to the network interface and must therefore run with root privileges.

It should, however, be executed—like all other plugins—by the user nagios. The program is accordingly transferred to the user root, and the SUID bit is set with chmod. Such s-bits are always a potential danger, since buffer overflows could be used to obtain general root privileges if code has been written carelessly. For this reason, the chmod command is chosen so that, apart from root, only the group nagios is given the permission to execute the plugin:

```
linux:nagios/libexec #  chown root.nagios check_dhcp
linux:nagios/libexec #  chmod 4750 check_dhcp
linux:nagios/libexec #  ls -l check_dhcp
-rwsr-x---  1 root nagios 115095 Jan  8 12:15 check_dhcp
```

The chown command assigns the plugin to the user root and to the group nagios, to whom nobody else should belong apart from the user nagios itself. (The user in whose name the Web server is running should be a member of a different group, such as nagcmd, as is described in Chapter 1 from page 25.)

In addition the chmod ensures that nobody apart from root may even read the plugin file, let alone edit it.

Applying the plugin

check_dhcp only has five options:

-s *server_ip* | --serverip=*server_ip*

This is the IP address of a DHCP server that the plugin should explicitly query. Without this entry, it is sufficient to have a functioning DHCP server in the network to pass the test satisfactorily. So you have to decide whether you want to test the general availability of the DHCP service or the functionality of a specific DHCP server.

-r *requested_ip* | --requestedip=*requested_ip*

With this option the plugin attempts to obtain the IP address *requested_ip* from the server. If this is not successful because it is already reserved or lies outside the configured area, check_dhcp reacts with a warning.

-i *interface* | --interface=*interface*

This selects a specific network interface through which the DHCP request should pass. Without this parameter, the plugin always uses the first network card to be configured (in Linux, usually eth0).

-t *timeout* | --timeout=*timeout*

After 10 seconds have expired (the default), otherwise *timeout* seconds, the plugin stops the test and returns the CRITICAL state.

With a configurable warning or critical limit for the performance time, the plugin is of no use. Here you must, where necessary, explicitly set a timeout, which causes the CRITICAL return value to be issued.

The following example shows that the DHCP service in the network is working:

```
nagios@linux:nagios/libexec$  ./check_dhcp -i eth0
DHCP ok: Received 1 DHCPOFFER(s), max lease time = 600 sec.
```

The plugin includes only the *lease time* as additional information, that is, the time for which the client would be assigned an IP address. If you want to see all the information contained in DHCPOFFER, you should use the option -v ("verbose").

In the next example the plugin explicitly requests a specific IP address (192.168.1.40), but this is not available:

```
nagios@linux:nagios/libexec$  ./check_dhcp -i eth0 -r 192.168.1.40
DHCP problem: Received 1 DHCPOFFER(s), requested address (192.168.1.40)
was not offered, max lease time = 600 sec.
nagios@linux:nagios/libexec$  echo $?
1
```

The result is a WARNING, as is shown by the output of the status, with $?.

If you want to test both the availability of the DHCP service overall and the servers in question individually, you need two different commands:

```
define command{
    command_name  check_dhcp_service
    command_line  $USER1$/check_dhcp -i eth0
}
```

check_dhcp_service grills the DHCP service as a whole by sending a broadcast, to which any DHCP server at all may respond.

```
define command{
    command_name  check_dhcp_server
    command_line  $USER1$/check_dhcp -i eth0 -s $HOSTADDRESS$
}
```

check_dhcp_server on the other hand explicitly tests the DHCP service on a specific server.

To match this, you can then define one service that monitors DHCP as a whole and another one that tests DHCP for a specific host. Even if the first variation is in principle not host-specific, it still needs to be assigned explicitly to a computer for it to run in Nagios:

```
define service{
   service_description   DHCP Services
   host_name             linux01
   check_command         check_dhcp_service
   ...
}

define service{
   service_description   DHCP Server
   host_name             linux01
   check_command         check_dhcp_server
   ...
}
```

6.11 Monitoring UPS with the Network UPS Tools

There are two possibilities for monitoring uninterruptible power supplies (UPS): the *Network UPS Tools* support nearly all standard devices. The apcupsd daemon is specifically tailored to UPS's from the company APC, described in Section 7.10

from page 149. The plugin check_ups included in Nagios only supports the first implementation.

The following rule generally applies: no plugin directly accesses the UPS interface. Rather they rely on a corresponding daemon that monitors the UPS and provides status information. This daemon primarily serves the purpose of shutting down the connected servers in time in case of a power failure. But it also always provides status information, which plugins can query and which can be processed by Nagios.

Both the solution with the Network UPS Tools and that with apcupsd are fundamentally network-capable, that is, the daemon is always queried via TCP/IP (through a proprietary protocol, or alternatively SNMP). But you should be aware here that a power failure may affect the transmission path, so that the corresponding information might no longer even reach Nagios. Monitoring via the network therefore makes sense only if the entire network path is safeguarded properly against power failure. In the ideal scenario, the UPS is connected directly to the Nagios server. Calling the check_ups plugin is no different in this case from that for the network configuration, since even for local use it communicates via TCP/IP—but in this case, with the host localhost).

The Network UPS Tools

The Network UPS Tools is a manufacturer-independent package containing tools for monitoring uninterruptible power supplies. Different specific drivers take care of hardware access, so that new power supplies can be easily supported, provided their protocols are known.

The remaining functionality is also spread across various programs: while the daemon upsd provides information, the program upsmon shuts down the computers supplied by the UPS in a controlled manner. It takes care both of machines connected via serial interface to the UPS and, in client/server mode, of computers supplied via the network.

The homepage http://www.networkupstools.org/ lists the currently supported models and provides further information on the topic of UPS. Standard distributions already contain the software, but not always with package names that are very obvious: in SuSE and Debian they are known by the name of nut.

To query the information provided by the daemon upsd, there is the check_ups plugin from the Nagios Plugin package. It queries the status of the UPS through the network UPS Tools' own network protocol. A subproject also allows it to query the power supplies via SNMP.[19] However, further development on it is not taking place at the present time.

[19] http://eu1.networkupstools.org/server-projects/

For purely monitoring purposes via Nagios (without shutting down the computer automatically, depending on the test result), it is sufficient to configure and start the upsd on the host to which the UPS is connected via serial cable. The relevant configuration file in the directory /etc/nut is called ups.conf. If you perform the query via the network, you must normally add an entry for the Nagios server in the (IP-based) access permissions. Detailed information can be found directly in the files themselves or in the documentation included, which in Debian is in the directory /usr/share/doc/nut, and in SuSE, in /usr/share/doc/packages/nut.

Provided that the Network UPS Tools include a suitable driver for the uninterruptable power supply used, the driver and communication interface are entered in the file ups.conf:

```
# -- /etc/nut/ups.conf

[upsfw]
    driver = apcsmart
    port = /dev/ttyS0
    desc = "Firewalling/DMZ"
```

In the example, a UPS of the company APC is used. Communication takes place on the serial interface /dev/ttyS0. A name for the UPS is given in square brackets, with which it is addressed later on: desc can be used to describe the intended purpose of the UPS in more detail, but Nagios ignores this.

Next you must ensure that the user with whose permissions the Network UPS Tools are running (such as the user nut from the group nut) has full access to the interface /dev/ttyS0:

```
user@linux:~$ chown nut:nut /dev/ttyS0
user@linux:~$ chmod 660 /dev/ttyS0
```

In order for Nagios to access information from the UPS via the upsd daemon, corresponding data is entered in an Access Control List in the upsd configuration file upsd.conf:

```
# -- /etc/nut/upsd.conf

# ACL aclname ipblock
ACL all 0.0.0.0/0
ACL localhost 127.0.0.1/32
ACL nagios 172.17.129.2/32

# ACCESS action level aclname
ACCESS grant monitor localhost
ACCESS grant monitor nagios
ACCESS deny all all
```

With the keyword ACL you first define hosts and network ranges with their IP address. You must always specify a network block here: /32 means that all 32 bits of the netmask are set to 1 (this corresponds to 255.255.255.255), which is therefore a single host address. It is not sufficient just to specify the IP address here.

An ACCESS entry transfers the actual access permissions to the computers specified in the ACL *aclname*. The computers defined in the ACLs localhost and nagios are allowed to access the monitoring data thanks to the monitor permission (grant), but nothing more. The last ACCESS finally denies (deny) any access to all others.

To conclude the configuration, you should make sure that the UPS daemon is started with every system start. In SuSE this is done via YaST2; in Debian this is taken care of during the installation.

The check_ups plugin

The monitoring plugin itself has the following options:

-H *address* / --host=*address*
: This is the computer on which upsd is installed.

-u *identifier* / --ups=*identifier*
: This is the name for the UPS in ups.conf, specified in square brackets.

-p *port* / --port=*port*
: This is the number of the port on which the upsd is running. The default is TCP port 3493.

-w *whole_number* / --warning=*whole_number*
: This switch defines a warning limit as a whole number. If no variable is given (see -v), *whole_number* means a response time in seconds; otherwise the value range of the variable (e.g., 80 for 80% in BATTPCT). Specifying multiple warning limits is currently not possible: the plugin then only uses the last variable and the last warning limit.

-c *whole_number* / --critical=*whole_number*
: This option specifies a critical limit in connection with a variable (see -v).

-v *variable* / --variable=*variable*
: With this option, specific values of the UPS can be queried. The limit values then referred to this parameter. check_ups currently supports only the following variables:

LINE: input voltage of the UPS.

TEMP: Temperature of the USV.

BATTPCT: Remaining battery capacity in percent.

LOADPCT: Load on the UPS in percent.

If this option is missing, the plugin only checks the status of the UPS (online or offline).

Since -v thus has another value, check_ups does not know the obligatory option --verbose (see Table 6.2 on page 88), even in its long form.

-T / --temperature
: This command issues temperature values in degrees Celsius.

-t *timeout* / --timeout=*timeout*
: After *timeout* seconds have expired, the plugin stops the test and returns the CRITICAL state. The default is 10 seconds.

The following example tests the above defined local UPS with the name upsfw. The -T switch should ensure that the output of the temperature is given in degrees Celsius, which only partially works here: the text displayed by Nagios before the pipe sign | contains the correct details, but in the performance data after the |, the plugin version 1.4 still shows the information in degrees Fahrenheit.

```
user@linux:nagios/libexec$  ./check_ups -H localhost -u upsfw -T
UPS OK - Status=Online Utility=227.5V Batt=100.0% Load=27.0% Temp=30.6C|
voltage=227500mV;;;0 battery=100%;;;0;100 load=27%;;;0;100 temp=30degF;;
;0
```

If a variable is not used, the plugin returns a CRITICAL if the UPS is switched off (Status=Off) or has reached low battery capacity (Status=On Battery, Low Battery). check_ups issues a warning if at least one of the three states On Battery, Low Battery or Replace Battery applies, but this is not sufficient for a CRITICAL status (for example because of correspondingly set variables). With On Battery the power supply is provided by the battery, with Low Battery the UPS is online with a low battery state, and with Replace Battery, the battery must be replaced.

If none of these points apply, the plugin issues an OK for the following states:

- In the normal online state
- If the UPS is being calibrated (Calibrating)
- If it is currently being bypassed and the power supply is provided directly from the power supply grid (On Bypass)
- If the UPS is overloaded (Overload)
- If the voltage in the power grid is too high and the UPS restricts the voltage to the normal value (Trimming)

- If the voltage in the power grid is too low and is supplemented by the UPS (Boosting)
- If the UPS is currently being charged (Charging)
- If the UPS is currently being discharged (e.g., during a programmed maintenance procedure) (Discharging).

Transformed into a command object, the above test for any host looks like this:

```
define command{
    command_name  check_ups
    command_line  $USER1$/check_ups -H $HOSTADDRESS$ -u $ARG1$ -T
}
```

The corresponding service definition for the computer linux01, to which the UPS is connected, and for the above defined UPS upsfw, would then look like this:

```
define service{
   service_description   UPS
   host_name             linux01
   check_command         check_ups!upsfw
   ...
}
```

If check_ups is to determine the UPS status by means of the current load, the relevant information is taken from the variable LOADPCT:

```
user@linux:nagios/libexec$  ./check_ups -H linux01 -u upsfw -T -v \
    LOADPCT -w 60 -c 80
UPS WARNING - Status=Online Utility=227.5V Batt=100.0% Load=61.9%
Temp=30.6C|voltage=227500mV;;;0 battery=100%;;;0;100 load=61%;60000;
80000;0;100 temp=30degF;;;0
```

With 61 percent, the UPS has a heavier load than specified in the limit value -w, but it does not yet reach the critical area above 80 percent, so there is just a warning. If two error criteria occur, such as a warning limit for a queried variable being exceeded and a critical state simultaneously, because the UPS is losing power (On Battery and Low Battery simultaneously), the most critical state has priority for the return value of the plug in, so here, check_ups would return CRITICAL, and not the WARNING which results from the query of LOADPCT.

Chapter 7

Testing Local Resources

The plugins introduced in this chapter from the basis range of the **nagios-plugins** package test local resources that do not have their own network protocol and therefore cannot be easily queried over the network. They must therefore be locally installed on the computer to be tested. Such plugins on the Nagios server can test only the server itself—with command and service definitions as described in Chapter 6.

To perform such local tests from a central Nagios server on remote hosts, you require further utilities: the plugins are started via a secure shell, or you use the *Nagios Remote Plugin Executor* (NRPE). Using the secure shell is described in Chapter 9 from page 157, and Chapter 10 (page 165) is devoted to NRPE.

The definition of command and service depends on the choice of mechanism. If you want to test for free hard drive capacity with the **check_by_ssh** plugin installed on the Nagios server, which remotely calls **check_disk** on the target server (see Section 7, page 133), then a special command definition is required for this, which differs somewhat from the definitions given in Chapter 6 (page 85). What command and service definitions for remotely executed local plugins look like is described in the aforementioned chapters on NRPE and SSH.

For the remote query of some local resources you can also use SNMP (see Chapter 11 from page 177), but the checks are then restricted to the capabilities of the SNMP daemon used. Local plugins are usually more flexible here and provide more options for querying.

7.1 Free Hard Drive Capacity

The question of when the hard drive(s) of a computer may threaten to overflow is answered by the check_disk plugin, which in version 1.4 includes considerably more functions than its predecessor:

-w *limit* / --warning=*limit*

The plugin will give a warning if the free hard drive capacity drops below this limit, expressed as a percentage or as an integer. If you specify percentage, the percent sign % must also be included; floating-point decimals such as 12.5% are possible. Integer values in kBytes are demanded by version 1.3.x, but by version 1.4 in MBytes (in each case without a unit abbreviation). The unit can also be influenced with -k, -k, and -u.

-c *limit* / --critical=*limit*

If the free hard drive capacity level falls below this as a percentage or integer (see -w), check_disk displays the CRITICAL status. The critical limit must be smaller than the warning limit.

-p *path_or_partition* / --path=*path* or --partition=*partition*

This specifies the root directory in file systems or the physical device in partitions (e.g., /dev/sda5). From version 1.4 -p can be called multiple times. If the path is not specified, the plugin tests all file systems (see also -x and -X).

-e / --errors-only

With this switch, the plugin shows only the file systems or partitions that are in a WARNING or CRITICAL state.

-k / --kilobytes (from 1.4)

With this switch, limit values given as whole numbers with -c and -w are to be interpreted as kBytes.

-m / --megabytes (from 1.4)

With this switch, whole number limit values with -c and -w are interpreted by the plugin as MBytes (the default). Caution: in version 1.3.x, -m has a completely different meaning!!

-m / --mountpoint (1.3.x)
: Normally check_disk in version 1.3.x will return the physical device (e.g., /dev/sda5). -m ensures that the file system path (e.g., /usr) is named instead.

-M / --mountpoint (from 1.4)
: From version 1.4 on, check_disk by default displays the file system path (e.g., /usr). With -M you are told instead what physical device (e.g., /dev/sda5) is involved.

-t *timeout* / --timeout=*timeout*
: After *timeout* seconds have expired the plugin stops the test and returns the CRITICAL status. The default is 10 seconds.

-u *unit* / --units=*unit* (from 1.4)
: In what unit do you specify integer limit values? kB, MB, GB and TB are all possible.

-x *path* / --exclude_device=*path*
: This switch excludes the mount point specified as *path* from the test. This option may be used several times in a plugin command.

-X *fs_typ* / --exclude-type=*fs_typ* (from 1.4)
: This switch excludes a specific file system type from the test. It is given the same abbreviation as in the -t option of the mount command. In this way *fs_type* can take the values ext3, reiserfs, or proc, for example (see also man 8 mount). This option can be used several times in a plugin command.

-C / --clear (from 1.4)
: From version 1.4 on, -p can be used multiple times. If you want to test several file systems at the same time, but using different limit values, -C can be used to delete old limit values that have been set:

```
-w 10% -c 5% -p / -p /usr -C -w 500 -c 100 -p /var
```

The order is important here: the limit values are valid for the file system details until they are reset with -C. Then new limits must be set with -w and -c.

The plugin versions 1.3.1 (above example) and 1.4 differ not only in their options, but also in their output. Performance data are missing from the latter (see Chapter 17 from page 313):

```
user@linux:nagios/libexec$ ./check_disk -w 10% -c 5% -p /usr
DISK CRITICAL [87000 kB (5%) free on /usr]
user@linux:nagios/libexec$ ./check_disk -w 10% -c 5% -p /
DISK OK - free space: / 710 MB (74%);| /=247MB;861;909;0;957
```

These can be extracted from the Nagios log files and prepared in graphic form.

The following example functions only with version 1.4:

```
user@linux:nagios/libexec$ ./check_disk -w 10% -c 5% -p / -p /usr \
    -p /var -C -w 5% -c 3% -p /net/emil1/a -p /net/emil1/c -e
DISK WARNING - free space: /net/emil1/c 915 MB (5%);| /=146MB;458;483;0;
509 /usr=1280MB;3633;3835;0;4037 /var=2452MB;3633;3835;0;4037 /net/emil1
/a=1211MB;21593;22048;0;22730 /net/emil1/c=17584MB;17574;17944;0;18499
```

Everything is in order on the file system /, /usr, and /var, since more space is available on them—as can be seen from the performance data—than the limit value of 10 percent (for a warning), and certainly more than 5 percent (for the critical status). The file systems /net/emil1/a and /net/emil1/c encompass significantly larger ranges of data, which is why the limit values are set lower, after the previous ones have been deleted with -C.

-e ensures that Nagios shows only the file systems that really display an error status. In fact the output of the plugin *before* the | sign, with /net/emil1/c, only displays one single file system. The performance information after the pipe can only be seen on the command line—it contains all file systems tested, as before. This is slightly confusing, because a Nagios plugin restricts its output to a single line, which has been line wrapped here for this printed version.

7.2 Utilization of the Swap Space

The check_swap plugin tests the locally available swap space. Here there are again fundamental differences between versions 1.3.x and 1.4:

-w *limit* / --warning=*limit*

The warning limit can be specified as a percentage or as an integer, as with check_disk, but the integer value is specified in *bytes*, not in kBytes!

In version 1.3.x the percentage specification refers to used, and not free, swap space. If at least 10 percent should remain free, you must specify -c 10% in version 1.4, but -c 90% in version 1.3. The integer specification, however, refers to the remaining free space for both versions.

-c *limit* / --critical=*limit*

Critical limit, similar to the warning limit. If a percentage is specified, versions 1.3.x and 1.4 differ, as in the -w option.

-a / --allswaps

Tests the threshold values for each swap partition individually.

The following example tests to see whether at least half of the swap space is available. If there is less than 20 percent free swap space, the plugin should return a critical status. The output is from plugin version 1.4, and after the | sign the program again provides performance data, which is logged by Nagios but not displayed in the message on the Web interface:

```
user@linux:nagios/libexec$  ./check_swap -w 50% -c 20%
swap OK: 100% free (3906 MB out of 3906 MB) |swap=3906MB;1953;781;0;3906
```

7.3 Testing the System Load

The load on a system can be seen from the number of simultaneously running processes, which is tested by the **check_load** plugin. With the help of the **uptime** program, it determines the average value for the last minute, the last five minutes, and the last 15 minutes. **uptime** displays these values in this sequence after the keyword **load average**:

```
user@linux:~$  uptime
 16:33:35 up  7:05, 18 users,  load average: 1.87, 1.38, 0.74
```

check_load has only two options (the two limit values), but these can be specified in two different ways:

-w *limit* | --warning=*limit*

This option specifies the warning limit either as a simple floating-point decimal (**5.0**) or as a comma-separated triplet containing three-floating point decimals (**10.0,8.0,5.0**).

In the first case, the limit specified applies to all three average values. The plugin issues a warning if (at least) one of these is exceeded. In the second case the triplet allows the limit value to be specified separately for each average value. Here as well, **check_load** issues a warning as soon as one of the average values exceeds the limit defined for it.

-c *limit* | --critical=*limit*

This specifies the critical limit in the same way as **-w** specifies the warning limit. These critical limit values should be higher than the values for **-w**.

In the following example Nagios would raise the alarm if more than 15 processes were active on average in the last minute, if more than 10 were active on average in the last five minutes, or if eight were active on average in the last 15 minutes. There is a warning for average values of ten, eight, or five processes:

```
user@linux:local/libexec$ ./check_load -w 10.0,8.0,5.0 -c 15.0,10.0,8.0
OK - load average: 1.93, 0.95, 0.50| load1=1.930000;10.000000;15.000000;
0.000000 load5=0.950000;8.000000;10.000000;0.000000 load15=0.500000;
5.000000;8.000000;0.000000
```

7.4 Monitoring Processes

The check_procs plugin monitors processes according to various criteria. Usually it is used to monitor the running processes of just one single program. Here the upper and lower limits can also be specified.

nmbd, for example, the name service of Samba, always runs as a daemon with two processes. A larger number of nmbd entries in the process table is always a sure sign of a problem; it is commonly encountered, especially in older Samba versions.

Services such as Nagios itself should only have one main process. This can be seen by the fact that its parent process has the process ID 1, marking it is a child of the init process. It was often the case, in the development phase of Nagios 2.0, that several such processes were active in parallel after a failed restart or reload, which led to undesirable side effects. You can test to see whether there really is just one single Nagios main process active, as follows:

```
nagios@linux:nagios/libexec$ ./check_procs -c 1:1 -C nagios -p 1
PROCS OK: 1 process with command name 'nagios', PPID = 1
```

The program to be monitored is called nagios (option -C), and its parent process should have the ID 1 (option -p). Exactly one Nagios process must be running, no more and no less; otherwise the plugin will issue a CRITICAL status. This is specified as a range: -c 1:1.

Another example: between one and four simultaneous processes of the OpenLDAP replication service slurpd should be active:

```
nagios@linux:nagios/libexec$ ./check_procs -w 1:4 -c 1:7 -C slurpd
PROCS OK: 1 process with command name 'slurpd'
```

If the actual process number lies between 1 and 4, the plugin returns OK, as is the case here. If it finds between five and seven processes, however, a warning will be given. Outside this range, check_procs categorizes the status as CRITICAL. This is the case here if there are either no processes running at all, or more than seven running.

Instead of the number of processes of the same program, you can also monitor the CPU load caused by it, its use of memory, or even the CPU runtime used. check_procs has the following options:

-w *start*:*end* | --warning=*start*:*end*

The plugin issues a warning if the actual values lie ***outside*** the range specified by the start and end value. Without further details, it assumes that it should count processes: -w 2:10 means that check_procs gives a warning if it finds less than two or more than ten processes.

If you omit one of the two limit values, zero applies as the lower value, or infinite as the upper limit. This means that the range :10 is identical to 0:10; 10: describes any number larger than or equal to 10. If you just enter a single whole number instead of a range, this represents the maximum. The entry 5 therefore stands for 0:5.

If you swap the maximum and minimum, the plugin will give a warning if the actual value lies ***within*** the range, so for -w 10:5 this will be if the value is 5, 6, 7, 8, 9 or 10. You may always specify only one interval.

-c *start*:*end* | --critical=*start*:*end*

This specifies the critical range, in the same way as for the warning limit.

-m *type* | --metric=*type* (from version 1.4)

This switch selects one of the following metrics for the test:

PROCS: number of processes (the default if no specific type is given)

VSZ: the virtual size of a process in the memory (*virtual memory size*), consisting of the main memory space that the process uses exclusively, plus that of the shared libraries used. These only take up memory space once, even if they are used by several different processes. The specification is given in bytes.

RSS: the proportion of main memory in bytes that the process actually uses for itself (*Resident Set Size*), that is, VSZ minus the shared memory.

CPU: CPU usage in percent. The plugin here checks the CPU usage for each individual process for morning and critical limits. If one of the processes exceeds the warning limit, Nagios will issue a warning. In the text output the plugin also shows how many processes have exceeded the warning or critical limit.

ELAPSED: The overall time that has passed since the process was started.

-s *flags* | --state=*flags*

This restricts the test to processes with the specified status flag.[1] The plugin in the following example gives a warning if there is more than one zombie process (status flag: Z):

[1] The following states are possible in Linux: D (uninterruptible waiting, usually a *Disk Wait*), R (running process), S (wait status), T (process halted), W (paging, only up to kernel 2.4), X (a finished, killed process), and Z (zombie). Further information is provided by man ps.

```
nagios/libexec@linux: $ ./check_procs -w 1 -c 5 -s Z
PROCS OK: 0 processes with STATE = Z
```

Things become critical here if more than five zombies "block up" the process table. Several states can be queried at the same time by by adding individual flags together, as in -s DSZ. Now Nagios cancels the processes that are in at least one of the states mentioned.

-p *ppid* / --ppid=*ppid*

This switch restricts the test to processes whose parent processes have the *parent process ID* (*ppid*). The only PPIDs that are known from the beginning, and that do not change, are 0 (started by the kernel, and usually only concerns the init process) and 1 (the init process itself).

-P *pcpu* / --pcpu=*pcpu* (from version 1.4)

This option filters processes according to the percentage of CPU they use:

```
nagios/libexec@linux: $ ./check_procs -w 1 -c 5 -P 10
PROCS OK: 1 process with PCPU >= 10,00
```

The plugin in this example takes into account only processes which have at least a ten percent share of CPU usage. As long as there is just one such process (-w 1), it returns OK. If there are between two and five such processes, the return value is a WARNING. With at least six processes, each with a CPU usage of at least ten percent, things get critical.

-r *rss* / --rss=*rss* (from version 1.4)

This option filters out processes that occupy at least *rss* bytes of main memory. It is used like -P.

-z *vsz* / --vsz=*vsz* (from version 1.4)

This option filters out processes whose VSZ (see above) is at least *vsz* bytes. It is used like -P.

-u *user* / --user=*user*

This option filters out processes that belong to the specified user (see example below).

-a "*string*" / --argument-array="*string*"

This option filters out commands whose argument list contains *string*. -a .tex, for example, refers to all processes that work with *.tex files; -a -v to all processess that are called with the -v flag.

-C *command* / --command=*command*

This causes the process list to be searched for the specified command name. *Command* must exactly match the command specified, without a path (see example below).

-t *timeout* | --timeout=*timeout*

After *timeout* seconds have expired, the plugin stops the test and returns the CRITICAL status. The default is 10 seconds.

The following example checks to see whether exactly one process called master is running on a mail server on which the Cyrus Imapd is installed. No process is just as much an error as more than one process:

```
user@linux:nagios/libexec$ ./check_procs -w 1:1 -c 1:1 -C master
CRITICAL - 2 processes running with command name master
```

The first attempt returns two processes, although only a single Cyrus Master process is running. The reason can be found if you run ps:

```
user@linux:~$ ps -fC master
UID       PID PPID  C STIME TTY      TIME CMD
cyrus    431    1  0  2004 ?    00:00:28 /usr/lib/cyrus/bin/master
root    1042    1  0  2004 ?    00:00:57 /usr/lib/postfix/master
```

The Postfix mail service also has a process with the same name. To keep an eye just on the master process of the Imapd, the search is additionally restricted to processes running with the permissions of the user cyrus:

```
user@linux:nagios/libexec$ ./check_procs -w 1:1 -c 1:1 -C master -u \
    cyrus
OK - 1 processes running with command name master, UID = 96 (cyrus)
```

7.5 Checking Log Files

Monitoring log files is not really part of the concept of Nagios. On the one hand, the syslog daemon notices critical events there immediately, so that an error status can be correctly determined. But if the error status continues, this cannot be seen in the log file in most cases.

Correspondingly the plugins described here can determine only whether other, new entries on error events are added. In order to communicate information on a continuing error behavior to Nagios via a log file, the service monitored must log the error status regularly—at least at the same intervals as Nagios reads the log file—and repeatedly. Otherwise the plugin will alternate between returning an error status, and then an OK status, depending on whether the (continuing) error has in the meantime turned up in the log or not.

Under no circumstances may Nagios repeat its test. The parameter max_check_attempts (see page 45) must have the valu*e*1. Otherwise Nagios would first assign the error status as a soft state, would repeat the test, and would almost always arrive at an OK, since it only takes into account new entries during repeat tests. max_check_attempts = 1 ensures that Nagios diagnoses a hard state after the first test.

For events that log an error just once, Nagios has *volatile services*, described in Section 14.5.2 from page 257. For services defined in this way, the system treats every error status as if it was occurring for the first time (causing a message to be sent each time, for example). Such services must be reset manually to the OK status. How this is done is described in Section 14.5.3 from page 258.

7.5.1 The standard plugin check_log

With check_log, Nagios provides a simple plugin for monitoring log files. It creates a copy of the tested log file each time it is run. If the log file has changed since the previous call, check_log searches the newly added data for simple text patterns. The plugin does not have any longer options and just has the states OK and CRITICAL:

-F *logfile*

This is the name and path of the log file to be tested. It must be readable for the user nagios.

-O *oldlog*

This is the name and path of the log file copy. The plugin just examines the difference between *oldlog* and *logfile* when it is run. Afterwards it copies the current log file to *oldlog*. *oldlog* must contain the absolute path and be readable for the user nagios.

-q *query*

This is the pattern searched for in examining the log file. Not found means OK; a match returns the CRITICAL status.

It is recommended that you generally do not use messages of the type *recovery notification* (OK after an error state).

An OK in a repeated test just means that no new error in events have occurred since the last test. The notification_options parameter (see page 46) in the service definition should therefore not contain an r.

The following command examines the file /var/log/auth for failed logins:

```
nagios@linux:local/libexec$  ./check_log -F /var/log/auth \
    -O /tmp/check_log.badlogin -q "authentication failure"
(1) < Jan  1 18:47:56 swobspace su[22893]: (pam_unix) authentication
failure; logname=wob uid=200 euid=0 tty=pts/8 ruser=wob rhost= user=root
```

This produces one hit. The plugin does not show its return value in the text, but it can be displayed in the shell with **echo $?**. In the example, a **2** for CRITICAL is returned.

If you examine the log file for several different events, you must specify a separate ***oldlog*** for each log file:

```
./check_log -F /var/log/messages -O /tmp/check_log.pluto -q "pluto"
./check_log -F /var/log/messages -O /tmp/check_log.ntpd -q "ntpd"
```

Even if you are searching in the same original log file, you cannot avoid using two different **oldlogs**: otherwise **check_log** would not work correctly.

7.5.2 The modern variation: check_logs.pl

As an alternative, The Nagios Exchange[2] provides a completely new plugin for monitoring log files. **check_logs.pl** represents a further development of the Perl plugin **check_log2.pl**, which is included in the **contrib** directory for Nagios plugins but is not installed automatically.

check_logs.pl can examine several log files simultaneously for events, in contrast to **check_log** and **check_log2.pl**. It requires a configuration file to do this.

It does have a simple command line mode, but this functions only if you specify a single log file and a single regular expression simultaneously. But the really interesting feature of **check_logs.pl** is that you can perform several examinations in one go. This is why we will not spend any more time describing the command line mode.

Initially we create a configuration file with roughly the following contents, preferably in the directory **/etc/nagios**:

```
# /etc/nagios/check_logs.cfg
$seek_file_template='/var/nagios/$log_file.check_log.seek';

@log_files = (
   {'file_name' => '/var/log/messages',
    'reg_exp' =>'ntpd',
   },
   {'file_name' => '/var/log/warn',
    'reg_exp' =>'(named|dhcpd)',
   },
);
1;
```

The Perl variable **$seek_file_template** contains the path to the file in which the plugin saves the current position of the last search. **check_logs.pl** remembers here

[2] http://www.nagiosexchange.org/Misc.54.0.html.

at what point in the log file it should carry on searching the next time it is run. This means that the plugin does not require a copy of the processed log file. Instead of the variable $log_file, it uses the name of the log file to be examined in each case and creates a separate position file for each log file.

What exactly check_logs.pl is to do is defined by the Perl array @log_files. The entry file_name points to the log file to be tested (with the absolute path), and reg_exp contains the regular expression[3], for which check_logs.pl should search the log file. In the example above this is just a simple text called ntpd in the case of the /var/log/messages log file, but there is an alternative in the case of /var/log/warn: the regular expression (named|dhcpd) matches lines that contain either the text named or the text dhcpd.

The only specification that the plugin itself requires when it is run is the configuration file (option -c) :

```
nagios@linux:local/libexec$ ./check_logs.pl -c /etc/nagios/check_logs.cfg
messages => OK; warn => OK;

nagios@linux:local/libexec$ ./check_logs.pl -c /etc/nagios/check_logs.cfg
messages => OK; warn => (4): Jul  2 14:33:25 swobspace dhcpd:
Configuration file errors encountered -- exiting;
```

The first command shows the basic principle: in the text output the plugin for each log file announces separately whether it has found a matching event or not. In the above example it didn't find anything, so it returns OK. In the second command the plugin comes across four relevant entries in the warn log file, but it doesn't find any in /var/log/messages. Because of this, the plugin returns a WARNING; OK is given only if no relevant events were found in any of the log files checked. In its output line, after (4):, the plugin remembers the last of the four lines found.

7.6 Keeping Tabs on the Number of Logged-in Users

The plugin check_users is used to monitor the number of logged-in users:

```
user@linux:nagios/libexec$ ./check_users -w 5 -c 10
USERS CRITICAL - 20 users currently logged in |users=20;5;10;0
```

[3] In the form of Perl-compatible regular expressions (PCRE, see man perlre), since check_logs.pl is a Perl script.

It has just two options:

-w *number* / --warning=*number*
: This is the threshold for the number of logged-in users after which the plugin should give a warning.

-c *number* / --critical=*number*
: This is the threshold for a critical state, measured by the number of logged-in users.

The performance data after the | is as usual visible only on the command line; Nagios does not include it in the Web interface.

7.7 Checking the System Time

7.7.1 Checking the system time via NTP

The check_ntp plugin compares the clock time of the local computer with that of an available NTP server in the network. If the Nagios server keeps time via NTP accurately enough, so that it can serve as a reference itself, then it can also be used as a network plugin, provided that the host to be checked in the network has an NTP daemon installed.

The plugin requires the program ntpdate, which, if you compile Nagios yourself, must already be available before the check_ntp installation. You should also install the program ntpq, which determines the *jitter*. This is a measure of the runtime deviations of incoming NTP packages. If the fluctuations are too large, the time synchronization will be imprecise.

In the simplest case, check_ntp is called, specifying the computer (here: ntpserver) whose time should be compared with that of the local computer:

```
nagios@linux:nagios/libexec$ ./check_ntp -H ntpserver
NTP OK: Offset -8.875159 secs, jitter 0.819 msec, peer is stratum 0
```

The deviation found here is over eight seconds. Whether this is tolerated or not depends on the intended use. If you want to compare log file entries for many computers, then they should all be NTP-synchronized. Then there is no problem in using -w 1 -c 2, which would already categorize a deviation of two seconds as critical.

check_ntp has the following options:

-H *address* / --host=*address*
: This is the NTP server with which the plugin should compare the local system time.

-w *floating_point_decimal* | --warning=*floating_point_decimal*
: This is the warning limit in seconds. The warning is given if the fluctuation of the local system time is larger than the threshold specified. The default is 60 seconds.

-c *floating_point_decimal* | --critical=*floating_point_decimal*
: If the local system time deviates more than *floating_point_decimal* seconds (in the default setting 120 seconds) from that of the NTP server, the status becomes CRITICAL.

-j *milliseconds* | --jwarn=*milliseconds*
: This is the warning limit for the jitter in milliseconds. The default here is 5000.

-k *milliseconds* | --jcrit=*milliseconds*
: The critical threshold for the jitter. The default is 10000 milliseconds.

7.7.2 Checking system time with the time protocol

Apart from the *Network Time Protocol* NTP there is another protocol, older and more simple: the *Time Protocol* described in RFC 868, in which communication takes place via TCP port 37. On many Unix systems the corresponding server is integrated into the inet daemon, so you do not have to start a separate daemon. With check_time, Nagios provides an appropriate test plugin.

check_time can also be used as a network plugin, in a similar way to check_ntp, but this again assumes that the time service is available for every client. In most cases it will therefore be used as a local plugin that compares its own clock time with that of a central time server (here: timesrv):

```
nagios@linux:nagios/libexec$ ./check_time -H timesrv -w 10 -c 60
TIME CRITICAL - 1160 second time difference| time=0s;;;0 offset=1160s;10
;60;0
```

The performance data after the | sign, not shown in the Web interface, contains the response time in seconds, with time (here: zero seconds); offset describes by how much the clock time differs from that of the time server (here: 1160 seconds). The other values, each separated by a semicolon, provide the warning limit, the critical threshold, and the minimum (see also Section 17.1 from page 314). Since we have not set any threshold values with the options -W or -C, the corresponding entries for time are empty.

check_time has the following options:

-H *address* | --hostname=*address*
: This is the host name or IP address of the time server.

-p *port* / --port=*port*
This is the TCP port specification, if different from the default 37.

-u / --udp
Normally the time server is queried via TCP. With -u you can use UDP if the server supports this.

-w *integer* / --warning-variance=*integer*
If the local time deviates more than *integer* seconds from that of the time server, the plugin returns a WARNING. *integer* is always positive, and this covers clocks that are running both slow and fast.

-c *integer* / --critical-variance=*integer*
If there is more than *integer* seconds difference between the local and the time server time, the return value of the plugin is CRITICAL.

-W *integer* / --warning-connect=*integer*
If the time server needs more than *integer* seconds for the response, a WARNING is returned.

-C *integer* / --critical-connect=*integer*
If the time server does not respond within *integer* seconds, the plugin reacts with the return value CRITICAL.

7.8 Regularly Checking the Status of the Mail Queue

The check_mailq plugin can be used to monitor the mail queue of a mail server for e-mails that have not yet been delivered. check_mailq runs the program mailq of the mail service installed. Unfortunately each MTA interprets the mail queue differently, so the plugin can evaluate only mail queues from mail services that the programmer has taken into account. These are, specifically: sendmail, qmail, postfix, and exim. check_mailq has the following options:

-w *number* / --warning=*number*
If there are at least *number* mails in the mail queue, the plugin gives a warning.

-c *number* / --critical=*number*
As soon as there are at least *number* of mails in the queue waiting to be delivered, then the critical status has been reached.

-W *number_of_domains* | --Warning=*number_of_domains*
This is the warning limit with respect to the number of recipient domains of a message waiting in the mail queue. Thus -W 3 generates a warning if there are any mails in the queue that are addressed to three or more different recipient domains.

-C *number_of_domains* | --Critical=*number_of_domains*
This is the critical threshold with respect to the number of recipient domains (like -W).

-M *daemon* | --mailserver=*daemon* (from version 1.4)
This specifies the mail service used. Possible values for *daemon* are sendmail (the default), qmail, postfix, and exim.

-t *timeout* | --timeout=*timeout*
After *timeout* seconds, the plugin stops the test and returns the CRITICAL status. The default here—as an exception—is 15 seconds (usually it is 10 seconds).

In the following example, Nagios should give a warning if there are at least five mails in the queue; if the number reaches ten, the status of the MTAs Postfix used here becomes CRITICAL:

```
user@linux:nagios/libexec$ ./check_mailq -w 5 -c 10 -M postfix
OK: mailq reports queue is empty|unsent=0;5;10;0
```

Since the queue is empty, check_mailq returns OK here.

7.9 Keeping an Eye on the Modification Date of a File

With the check_file_age plugin you can monitor not only the last modification date of a file, but also its size. From version 1.4 it is included in the default installation. In version 1.3.x the sources can be found in the subdirectory contrib; the plugin created from this must be copied manually to the plugin directory.

In the simplest case it is just run with the name and path of the file to be monitored:

```
user@linux:nagios/libexec$ ./check_file_age /var/log/messages
WARNING - /var/log/syslog/messages is 376 seconds old and 7186250 bytes
```

Here the plugin gives a warning, since the warning limit set is 240 seconds and the critical limit, 600 seconds. The last modification of the file was 376 seconds ago—that is, inside the warning range.

The file size is taken into account by check_file_age only if a warning limit for the file size (option -W) is explicitly specified. The plugin could then give a warning if the file is smaller than the given limit (in bytes). The defaults for the warning and critical limits here are both zero bytes.

check_file_age has the following options:

-w *integer* / --warning-age=*integer*
: If the file is older than *integer*[4] (the default is 240) seconds, the plugin issues a warning.

-c *integer* / --critical-age=*integer*
: A critical status occurs if the file is older than *integer* (default: 600) seconds.

-W *size* / --warning-size=*size*
: If the file is smaller than *size* bytes, the plugin gives a warning. If the option is omitted, 0 bytes is the limit. In this case check_file_age does not take the file size into account.

-C *size* / --critical-size=*size*
: A file size smaller than *size* bytes sets off a critical status. The default is 0 bytes, which means that the file size is ignored.

-f *file* / --file=*file*
: The name of the file to be tested. The option may be omitted if you instead—as in the above example—just give the file name itself as an argument.

7.10 Monitoring UPSs with apcupsd

To monitor uninterruptible power supplies (UPS) from the company APC there is the possibility, apart from the Network UPS Tools described in Section 6.11 from page 126 of using the apcupsd daemon, optimized specifically for use with these UPSs. The software can be obtained from http://www.apcupsd.com/ and is licensed under the GPL, despite the fact that it is vendor-dependent.

The principal function here is the capacity to be able to shut down systems in the event of power failure, rather than a mere monitoring function with Nagios. For this latter purpose, it is easier to configure the Network UPS Tools.

Nearly all Linux distributions contain a working apcupsd package,[5] so you don't have to worry about installing it. Nagios does not include an apcupsd plugin, but

[4] Because check_file_age is a Perl script, it does not matter in this case whether an integer or a floating-point decimal is specified. Fractions of a second do not play a role in the file system.

[5] At least SuSE and Debian use this package name.

there is a very simple and effective script available for download at http://www.negative1.org/check_apc/: check_apc. It is also licensed under the GPL, but it has no network capabilities. The plugin cannot be given a host when it is run, and it also does not support any other types of options. Instead of this, internal commands control its functionality, which are given as the first argument.

Executing check_apc status tests whether the UPS is online. If this is the case, the plugin returns the OK status, in all other cases it returns CRITICAL:

```
user@linux:nagios/libexec$ ./check_apc status
UPS OK - ONLINE
```

check_apc load *warn crit* checks the load currently on the UPS and displays it as a percentage of the maximum capacity. A warning is given if the load is greater than the warning limits specified in *warn* (in the following example, 60 percent), CRITICAL if the load is greater than *crit* (here 80 percent):

```
user@linux:nagios/libexec$ ./check_apc load 60 80
UPS OK - LOAD: 39%
```

The load status of the UPS is checked by the command check_apc bcharge *warn crit*. Here the warning limit *warn* and the critical limit *crit* are also given in percent. The value 100 means "fully loaded." The plugin accordingly gives a warning if the load is smaller than the warning limit, and a CRITICAL if the load is smaller than the critical limit:

```
user@linux:nagios/libexec$ ./check_apc bcharge 50 30
UPS OK - Battery Charge: 100%
```

You can find out how long the saved energy will last with check_apc time *warn crit*. Here check_apc gives a warning if the remaining time is less than *warn* minutes, and a CRITICAL if the remaining time is less than *crit* minutes:

```
user@linux:nagios/libexec$ ./check_apc time 20 10
UPS OK - Time Left: 30 mins
```

7.11 Nagios Monitors Itself

If necessary, Nagios can even monitor itself: the included plugin, check_nagios, tests, on the one hand, whether Nagios processes are running and, on the other hand, the age of the log file nagios.log in the Nagios var directory, for example /var/nagios/nagios.log.

Despite this, the question needs to be asked: if Nagios itself is not running, then the system simply cannot perform the plugin, which in turn cannot deliver an error message. The solution to this problem consists in having two Nagios servers, each of which addresses the locally installed plugin on the opposite server, with the help of NRPE (see Chapter 10 from page 165).

If you have just one Nagios server you can also run check_nagios alone via cron and have the return value checked using a shell script. In this case, you take action yourself, as shown in Section 7.11.1, so that you are suitably informed of this.

The plugin has the following options:

-C */path/to/nagios* / --command=*/path/to/nagios*
: This is the complete nagios command, including the path (e.g., -C /usr/local/nagios/bin/nagios).

-F */path/to/logfile* / --filename=*/path/to/logfile*
: This is the path to where the Nagios log file nagios.log is saved. The file is located in the Nagios var directory.

-e *integer* / --expires=*integer*
: This is the maximum age of the log file. If there have been no changes to the file for longer than *integer* minutes, check_nagios issues a warning.

  You should make sure that this time specification is large enough: if no errors are currently occurring, Nagios will not log anything in the log file. The only reliable way to obtain a regular entry is with the parameter retention_update_interval in the configuration file nagios.cfg (see page 438). The default value is 60 minutes.

In the following example the log file should not be older than 60 minutes (this corresponds to the default *retention update interval* (see page 438):

```
user@linux:nagios/libexec$ ./check_nagios -e 60 \
    -F /var/nagios/nagios.log -C /usr/local/nagios/bin/nagios
Nagios ok: located 5 processes, status log updated 303 seconds ago
```

With currently five running Nagios processes and a log file last changed 303 seconds ago (a good five minutes), everything is in order here. If the -e parameter is omitted, the plugin always gives a warning.

7.11.1 Running the plugin manually with a script

The following example script demonstrates how the plugin is called outside the Nagios environment. It starts check_nagios initially as Nagios does and then evaluates the return value. If the status is not 0, it sends an e-mail to the administrator nagios-admin@example.com, using the external mailx program:

```
#!/bin/bash

NAGCHK="/usr/local/nagios/libexec/check_nagios"
PARAMS="-e 60 -F /var/nagios/nagios.log -C /usr/local/nagios/bin/nagios"

INFO=`$NAGCHK $PARAMS`
STATUS=$?

case $STATUS in
   0) echo "OK : " $INFO
      ;;
   *) echo "ERROR : " $INFO | \
         /usr/bin/mailx -s "Nagios Error" nagios-admin@example.com
      ;;
esac
```

The script can be run at regular intervals via a cronjob—such as every 15 minutes. But then it will also "irritate" the administrator every quarter of an hour with an e-mail. There is certainly room for improvement in this respect—but that would go beyond the scope of this book.

7.11.2 check_nagios as a tool for CGI programs

Using the nagios_check_command parameter (see page 445) you can also use the plugin in the file cgi.cfg. If the parameter is set there, the CGI programs use the specified command to see if Nagios is operational. The test integrated into the CGI programs functions so well, however, that you do not need to go to the trouble of defining nagios_check_command.

7.12 Hardware Checks with LM Sensors

Modern mainboards are equipped with sensors that allow you to check the "health" of the system. In the lm-sensors[6] project it is also possible in Linux to query this data via I2C or SMBus (*System Management Bus*, a I2C special case).

To enable this, the kernel must have a suitable driver. Kernel 2.4.x normally requires additional modules, which are included in the software.[7] With a little luck, your distribution may include precompiled modules (e.g. SuSE). Kernel 2.6, however, already includes many drivers; here you just compile the entire branch below I2C Hardware Sensors Chip support.

It would take too much space here to detail the installation of the necessary modules. We will therefore only go into detail for the check_sensors plugin, and assume

[6] http://www.lm-sensors.nu/
[7] http://secure.netroedge.com/~lm78/download.html

that the corresponding kernel driver is already loaded as a module. Help is provided during operation with the **sensors-detect** program from the **lm-sensors** package, which does a number of tests and then tells you which modules need to be loaded. If all requirements are fulfilled, running the **sensors** program will produce an output similar to the following one, and shows that the onboard sensors are providing data:

```
user@linux:~$  sensors
fscher-i2c-0-73
Adapter: SMBus I801 adapter at 2400
Temp1/CPU:      +41.00 C
Temp2/MB:       +45.00 C
Temp3/AUX:      failed
Fan1/PS:          1440 RPM
Fan2/CPU:            0 RPM
Fan3/AUX:            0 RPM
+12V:           +11.86 V
+5V:             +5.10 V
Battery:         +3.07 V
```

The output depends on the hardware, so it will be slightly different for each computer. Here you can see, for example, the CPU and motherboard temperatures (41 and 45 degrees Celsius), the rotation speed of the fans, and the voltages on the 12- and 5-volt circuits and on the battery. Depending on the board design and the manufacturer, some details may be missing; in this example, only the fan for the power supply **FAN1/PS**[8] provides information; **Fan3/AUX** refers to an additional fan inside the computer box that, although it is running, is not recorded by the chipset.

Apart from the standard options **-h** (help function), **-v** (*verbose*), which displays the response of the sensors, and **-V**, which shows the plugin version, the plugin itself has no special options. Warning and critical limits must be set via the **lm-sensors** configuration. **check_sensors** only returns the status given by the onboard sensors:

```
user@linux:nagios/libexec$ ./check_sensors
sensor ok
```

If this is called with the **-v** option, you can see more clearly whether the test works:

```
user@linux:nagios/libexec$ ./check_sensors -v
fscher-i2c-0-73 Adapter: SMBus I801 adapter at 2400 Temp1/CPU: +40.00 C
Temp2/MB: +45.00 C Temp3/AUX: failed Fan1/PS: 1440 RPM Fan2/CPU: 0 RPM
Fan3/AUX: 0 RPM +12V: +11.86 V +5V: +5.10 V Battery: +3.07 V
sensor ok
```

[8] PS stands for *power supply*; but the names displayed can be edited in **/etc/sensors.conf**.

The output line is only wrapped for printing purposes; the plugin displays verbose information on a single line.

Alternatively you can use SNMP to access the sensor data: the NET-SNMP package (see Chapter 11.2 from page 184) provides the data delivered by **lm-sensors**, and with the SNMP plugin **check_snmp**, warning limits can also be set from Nagios. This solution is described in Section 11.3.1 from page 196.

7.13 The Dummy Plugin for Tests

For tests expected to end with a defined response, the **check_dummy** plugin can be used. it is given a return value and the desired response text as parameters, and it provides exactly these two responses as a result:

```
nagios@linux:nagios/libexec$ ./check_dummy 1 "Debugging"
WARNING: Debugging
nagios@linux:nagios/libexec$ echo $?
1
```

The output line contains the defined response, preceded by the status in text form. the return value can again be checked with **echo $?**: **1** stands for WARNING.

Alternatively you can give **check_dummy** a **0** (OK), an **2** (CRITICAL) or a **3** (UNKNOWN) as the first argument. The second argument, the response text, is optional.

8 Chapter

Manipulating Plugin Output

8.1 Negating Plugin Results

In some situations you may want to test the opposite of what the standard plugin normally tests, such as an interface that should *not* be active, a Web page or a host that should normally *not* be reached. In these cases the program **negate**, included in the Nagios plugins, provides a way of negating the return value of the original check.

Like plugins, **negate** has an option to specify a timeout in seconds, with **-t**, after which it should abort the operation. The actual command line must always contain the complete path to the plugin:

```
negate plugin command
negate -t timeout plugin command
```

negate changes the return value of 2 (CRITICAL) to 0 (OK) and vice versa. The return codes 1 (WARNING) and 3 (UNKNOWN) remain unchanged.

The following example carries out check_icmp on the host 192.0.2.1, which in normal cases should not be reachable:

```
nagios@linux:nagios/libexec$ ./negate \
     /usr/local/nagios/libexec/check_icmp -H 192.0.2.1
CRITICAL - 192.0.2.1: rta nan, lost 100%| rta=0.000ms;200.000;500.000;0;
pl=100%;40;80;;
nagios@linux:nagios/libexec$ echo $?
0
```

The plugin itself returns a CRITICAL in this case with a corresponding text. negate "inverts" the return value; 2 (CRITICAL) turns into 0 (OK). Since the text originates from the plugin and is not changed, the information CRITICAL remains here. For Nagios itself, however, nothing but the return value is of any interest.

8.2 Inserting Hyperlinks with urlize

The program urlize represents the text output of a plugin as a hyperlink, if required, so that clicking in the Nagios Web interface on the test result takes you to another Web page. Like negate, urlize functions as a wrapper around the normal plugin command and is included with the other Nagios plugins.

As the first argument it expects a valid URL to which the hyperlink should point. This is followed by the plugin command, including its path:

```
urlize url plugin command
```

To avoid problems with spaces in plugin arguments, you can set the complete *plugin command* in double quotation marks.

The hyperlink around the normal plugin output can be easily recognized when running the command manually:

```
nagios@linux:nagios/libexec$ ./urlize http://www.swobspace.de \
    /usr/local/nagios/libexec/check_http -H www.swobspace.de
<A href="http://www.swobspace.de">HTTP OK HTTP/1.1 200 OK - 2802 bytes
    in 0.132 seconds |time=0.132491s;;;0.000000 size=2802B;;;0</A>
```

In version 1.4 urlize also embeds the performance output in the link text, but Nagios cut this off before the representation in the Web interface, together with the end tag. But most browsers do not have any problem with the missing </A>.

Chapter 9

Executing Plugins via SSH

Local plugins, that is, programs that only run tests locally because there are no network protocols available, must be installed on the target system and started there. They check processes, CPU load, or how much free hard disk capacity is still available, among other things.

But if you still want to execute these plugins from the Nagios server, it is recommended that you use the secure shell, especially if any kind of Unix system is installed on the machine to be tested—a Secure Shell daemon will almost always be running on such a target system, and you do not require any special permissions to run most plugins. The Nagios administrator needs nothing more than an account, which he can use from the Nagios server. On the server itself, the check_by_ssh plugin must be installed.

In heterogeneous environments the Secure Shell itself often create conditions that may cause problems: depending on the operating system, an SSH daemon may be in use that returns a false return code[1] or is so old that it cannot handle the SSH protocol version 2.0. In this case it is better to install the current OpenSSH version from http://www.openssh.org/. In pure Linux environments with up-to-date and maintained installations, such problems generally do not occur.

9.1 The check_by_ssh Plugin

check_by_ssh is run on the Nagios server and establishes a Secure Shell connection to a remote computer so that it can perform local tests on it. The programs run on the remote machine are to a large extent local plugins (see Chapter 7 from page 133); the use of check_by_ssh is not just restricted to these, however.

The plugin sends a complete command line to the remote computer and then waits for a plugin-compatible response: a response status between 0 (OK) and 3 (UNKNOWN), as well as a one-line text information for the administrator (page 85). If you run network plugins via check_by_ssh in order to perform tests on other computers, these are known as *indirect checks*, which will be explained in the context of the *Nagios Remote Plugin Executor* in Section 10.5 from page 174.

The following example shows how check_by_ssh can be used to check the swap partition on the target computer:

```
nagios@linux:nagios/libexec$ ./check_by_ssh -H target_computer \
    -i /etc/nagios/.ssh/id_dsa \
        -C "/usr/local/nagios/libexec/check_swap -w 50% -c 10%"
SWAP OK: 100% free (972 MB out of 972 MB) |swap=972MB;486;97;0;972
```

The command is similar to that for a secure shell, in the form of

```
ssh -i private_key target_computer "command"
```

The fact that a separate private key—not the default private key in the home directory—is used, is optional and is described in detail in section 9.2 from page 160. The command to be run is specified in check_by_ssh—in contrast to the secure shell ssh— with the option -C, the plugin is always specified with an absolute path.

check_by_ssh has the following options:

-H *address* / --hostname=*address*

The host name or IP address of the computer to which the plugin should set up an SSH connection.

[1] In the nagios-users mailing list it was reported that Sun_SSH_1.0 returns a return code of 255 instead of 0, which makes it unsuitable for the deployment described here.

-C *command* | --command=*command*

The command to be run on the remote computer, that is, the plugin with its complete path and all the necessary parameters:

```
-C "/usr/local/nagios/libexec/check_disk -w 10% -c 5% -e -m"
```

-1 | --proto1 (from nagios-plugins-1.4)

Force version 1 of the secure shell protocol.

-2 | --proto2 (from Version 1.4)

Force version 2 of the secure shell protocol.

-4 | --use-ipv4 (from version 1.4)

The SSH connection is set up explicitly over an IPv4 connection.

-6 | --use-ipv6 (from version 1.4)

The SSH connection is set up explicitly over an IPv6 connection.

-i *keyfile* | --identity=*keyfile*

Which file should be used instead of the standard key file containing the private key of the user nagios? For one option, which is recommended, see Section 9.2.3, page 162.

-p *port* | --port=*port*

This specifies the port if the Secure Shell daemon on the target server is not listening on the standard TCP port 22.

-l *user* | --logname=*user*

User name on the target host.

-w *floating_point_decimal* | --warning=*floating_point_decimal*

If the response to the command to be executed takes more than *floating_point_decimal* seconds, the plugin will issue a warning.

-c *floating_point_decimal* | --critical=*floating_point_decimal*

The critical value in seconds concerning the response time of the command to be executed.

-f[2]

Starts a background process without opening an interactive terminal (tty).

-t *timeout* | --timeout=*timeout*

After *timeout* seconds have expired, the plugin stops the test and returns the CRITICAL status. The default is 10 seconds.

[2] There is currently no long form for this option.

In addition to this, check_by_ssh has parameters available, -O, -s and -n, enabling it to write the result in *passive mode* to the *interface for external commands* (see section 13.1 from page 240). The mode is named this way because Nagios does not receive the information itself but reads it indirectly from the interface.

This procedure has the advantage of being able to run several separate commands simultaneously over a single SSH connection. This may cause the command definition to be rather complicated, however. Since the plugins themselves are called and executed as programs on the target server, it hardly matters whether the SSH connection is established once or three times. For this reason it is better to use a simple command definition rather than the passive mode.

But if you still want to find more information about this, you can look in the online help, which is called with check_by_ssh -h.

9.2 Configuring SSH

So that Nagios can run plugins over the secure shell remotely and automatically, it—or, strictly speaking, the user nagios on the Nagios server—must not be distracted by any password queries. This is avoided with a login via a Public Key mechanism.

9.2.1 Generating SSH key pairs on the Nagios server

The key pair required to do this is stored by the key generator ssh-keygen by default in the subdirectory .ssh of the respective user's home directory (for the user nagios, this therefore corresponds to the installation guide in Chapter 1.1 from page 26, that is, /usr/local/nagios). If it is also sent on its way with the -f *private_keyfile* option (without path specification), it will land in the current working directory, which in the following example is /etc/nagios/.ssh:

```
nagios@linux:~$ mkdir /etc/nagios/.ssh
nagios@linux:~$ cd /etc/nagios/.ssh
nagios@linux:/etc/nagios/.ssh$ ssh-keygen -b 2048 -f id_dsa -t dsa -N ''
Generating public/private dsa key pair.
Your identification has been saved in id_dsa.
Your public key has been saved in id_dsa.pub.
The key fingerprint is:
02:0b:5a:16:9c:b4:fe:54:24:9c:fd:c3:12:8f:69:5c nagios@nagserv
```

The length of the key here is 2048 bits, and DSA is used to encrypt the keys. -N '' ensures that the private key in id_dsa does not receive separate password protection: this option forces an empty password.

9.2.2 Setting up the user nagios on the target host

Similar to the configuration on the Nagios server, the group and the user nagios are also set up on the computer to be monitored:

```
target_computer:~ # groupadd -g 9000 nagios
target_computer:~ # useradd -u 9000 -g nagios -d /home/nagios -m \
    -c "Nagios Admin" nagios
target_computer:~ # mkdir /home/nagios/.ssh
```

The target computer is given the directory /home/nagios as the home directory, where a subdirectory .ssh is created. In this the administrator (or another user[3]) saves the public key generated on the Nagios server /etc/nagios/.ssh/id_dsa.pub, in a file called authorized_keys:

```
linux:~ # scp /etc/nagios/.ssh/id_dsa.pub \
    target_computer:/home/nagios/.ssh/authorized_keys
```

Now the user nagios does not require its own password on the target server. You just need to make sure that on the target server the .ssh directory, together with authorized_keys, belongs to the user nagios:

```
target_computer:~ # chown -R nagios.nagios /home/nagios/.ssh
target_computer:~ # chmod 700 /home/nagios/.ssh
```

9.2.3 Checking the SSH connection and check_by_ssh

With this configuration you should first check whether the secure shell connection is working properly. The test is performed as the user nagios, since Nagios makes use of this during the checks:

```
nagios@linux:~$  ssh -i /etc/nagios/.ssh/id_dsa target_computer w
18:02:09 up 128 days, 10:03,  8 users,  load average: 0.01, 0.02, 0.00
USER     TTY      FROM             LOGIN@   IDLE   JCPU   PCPU WHAT
wob      pts/1    linux01:S.1      08Sep04  1:27   4.27s  0.03s -bin/tcsh
...
```

The -i option explicitly specifies the path to the private key file. If the command w to be run on the target computer does not provide any output or if the opposite SSH daemon requests a password, then the login via public key is not working. In this case you must first find and eliminate the error before you can move on to testing check_by_ssh.

[3] ...but not the user nagios, because when an account is created, useradd first sets an invalid password here, which we do not change into a valid one. This means that you cannot currently log in to the target computer as nagios.

In this next step, you run the local plugin on the target computer, with check_by_ssh, which later on is run automatically, from the command line of the Nagios server. Make sure that the plugin paths are correct in each case. The path to the private key file of the user nagios on the server is specified with -i:

```
nagios@linux:~$  /usr/local/nagios/libexec/check_by_ssh \
    -H target_computer -i /etc/nagios/.ssh/id_dsa \
    -C "/usr/local/nagios/libexec/check_disk -w 10% -c 5% -e -m"
DISK CRITICAL [2588840 kB (5%) free on /net/linux04/b] [937152 kB (5%)
free on /net/linux04/c]
```

In the example, check_by_ssh should start the /usr/local/nagios/libexec/check_disk plugin on the target computer with the options -w 10% -c 5% -e -m. If this does not work, then this is first run locally on the target host with the same parameter. By doing this you can rule out that the problem lies in the plugin command itself and not in the secure shell connection.

9.3 Nagios Configuration

The matching command object is again defined in the file checkcommands.cfg; similar to check_local_disk, it should be named check_ssh_disk:

```
# check_ssh_disk command definition
define command{
    command_name   check_ssh_disk
    command_line   $USER1$/check_by_ssh -H $HOSTADDRESS$ \
                   -i /etc/nagios/.ssh/id_dsa \
                   -C "$USER1$/check_disk -w $ARG1$ -c $ARG2$ -p $ARG3$"
}
```

The command line stored in command_line first runs check_by_ssh; $USER1$ contains the local plugin path on the Nagios server. Next come the arguments—the IP address of the target host (parameter -H), the private key file (parameter -i) and finally, with the -C parameter, the complete command that the target host should carry out. If the plugin path on the target host and on the Nagios server are identical, then you can also use the $USER1$ macro in it; otherwise the plugin path on the target computer is given explicitly.

Setting up the command is no different here to the one in check_local_disk in Section 7.1 on page 134. This means that apart from the warning and critical limits, we explicitly specify a file system or a hard drive partition, with the -p parameter.

The command check_ssh_disk defined in this way is applied as follows, here on a computer called linux02:

```
define service{
    host_name       linux02
    service_description FS_root
    ...
    check_command   check_ssh_disk!10%!5%!/
    ...
}
```

The service object defined in this way ensures that Nagios checks its / file system. The warning limit lies at 10 percent, the critical limit at 5 percent.

If you use the check_by_ssh plugin with check_ssh_disk, as in the example here, you must make sure that the plugin path is identical on all target hosts. This is also worth doing for reasons of simplicity, though it is not always possible in practice. The following service definition, for this reason, gives the plugin path to the target computer as an additional argument:

```
define service{
    host_name       linux02
    service_description FS_root
    ...
    check_command   check_ssh_disk!/usr/lib/nagios/plugins!10%!5%!/
    ...
}
```

In order for this to work, you must change the command line in the command definition, passed on with -C, as follows:

```
    -C "$ARG1$/check_disk -w $ARG2$ -c $ARG3$ -p $ARG4$"
```

Caution: this causes the numbers of each of the $ARG*x* macros for -w, -c, and -p to be shifted by one.

10 Chapter

The Nagios Remote Plugin Executor (NRPE)

The *Nagios Remote Plugin Executor* (or in short, NRPE) as the name suggests, executes programs on a remote host. These are usually plugins that test the corresponding computer locally and therefore must be installed on it. The use of NRPE is not restricted to local plugins; any plugins at all can be executed, including those intended to test network services—for example, to indirectly test computers that are not reachable from the Nagios server (as shown in Section 10.5 from page 174).

While a genuine user account must be available on the remote computer when the secure shell is used (see Chapter 9), which can also be used to do other things than just start plugins, NRPE is restricted exclusively to explicitly configured tests. If you want to, or are forced to, do without a login shell on the target host, it is better to use NRPE, even if there is somewhat more configuration work involved than with the secure shell. In addition to the Nagios configuration and the installation of the required plugins on the target system:

- The program nrpe must be installed on the target system.
- The inet daemon there (inetd or xinetd) must be configured with administrator privileges.
- The check_nrpe plugin must be installed on the Nagios server.

10.1 Installation

NRPE and the plugins are installed from the sources, or you can fall back on the packages provided by the distributor. You should use at least version 2.0 of NRPE, since this is incompatible with its predecessors. As this was released back in September 2003, there should now be corresponding packages for it.

Version 1.3.1 of the plugin collection is also from 2003; version 1.4 was only released at the beginning of 2005 and had not been integrated into all the standard distributions at the time of going to press. Whether you need the most up-to-date version depends on your expectations of the respective plugins.

10.1.1 Distribution-specific packages

SuSE Linux 9.3 includes the packages nagios-nrpe-2.0-111.i586.rpm, nagios-plugins-1.4-3.i586.rpm, and nagios-plugins-extras-1.4-3.i586.rpm. nagios-nrpe contains both the daemon and the plugin check_nrpe. nagios-plugins-extras installs several additional plugins, such as database checks, FPing test or Radius test, which can be omitted, depending on your specific monitoring needs.

For the sake of simplicity, the design packages are installed via YAST2[1] or rpm -ihv *package*. the second method is also open to Fedora users.

For Fedora Core 3, the corresponding Nagios packages have been made available by Dag Wieers at http://dag.wieers.com/home-made/apt/packages.php: nagios-nrpe-2.0-3.1.fc3.rf.i386.rpm, nagios-plugins-nrpe-2.0-3.1.fc3.rf.i386.rpm, and nagios-plugins-1.4-2.1.fc3.rf.i386.rpm.

Debian/Sarge distributes the NRPE daemon and the NRPE plugin check_nrpe in two different packages called nagios-nrpe-server and nagios-nrpe-plugin, which can be installed separately via apt-get install *package*. If you want to do without local documentation, you can omit the package nagios-nrpe-doc and just add the plugin package nagios-plugins to the target hosts.

The paths for the program nrpe, the configuration file nrpe.cfg, and the plugin directory are listed in Table 10.1.

[1] On the command line, using yast -i *package*.

Distribution	NRPE program	NRPE configuration file	Plugins
Self-compiled[2]	/usr/local/sbin/nrpe	/etc/nagios/nrpe.cfg	/usr/local/nagios/libexec
SuSE	/usr/bin/nrpe	/etc/nagios/nrpe.cfg	/usr/lib/nagios/plugins
Debian	/usr/sbin/nrpe	/etc/nagios/nrpe.cfg	/usr/lib/nagios/plugins
Fedora[3]	/usr/sbin/nrpe	/etc/nagios/nrpe.cfg	/usr/lib/nagios/plugins

Table 10.1: Installation paths for NRPE and plugins

10.1.2 Installation from the source code

The plugins are installed on the computers to be monitored exactly as described in Section 1.2 from page 30 for the Nagios server.

The NRPE source code is obtained from The Nagios Exchange.[4] The directory /usr /local/src[5] is ideal for unloading the sources.

```
linux:~ #  mkdir /usr/local/src
linux:~ #  cd /usr/local/src
linux:local/src #  tar xvzf /path/to/nrpe-2.0.tar.gz
```

In the new directory that has been created, you run the configure command:

```
linux:local/src # cd nrpe-2.0
linux:src/rnpe-2.0 # ./configure --sysconfdir=/etc/nagios --enable-ssl
```

The recommended path specifications are listed in Table 10.1. The only difference from the default settings are for the directory in which the NRPE configuration file is stored (configure option --sysconfdir).

Accordingly, we can leave out the entry for --with-nrpe-user and --with-nrpe-group in the configure command. Both options are relevant only if the nrpe program is running as a daemon, and they can be overwritten in the configuration file. If the inet daemon is used, you should specify the user with whose permissions nrpe should start in the configuration file for the inet daemon.

--enable-ssl ensures that NRPE communicates over an SSL-encrypted channel. This will only work, of course, if both nrpe on the target host and check_nrpe on the Nagios server have both been compiled accordingly.

[2] Recommended.

[3] From the packages provided by Dag Wieers.

[4] http://www.nagiosexchange.org/NRPE.77.0.html.

[5] The subdirectory src may need to be created first.

The command **make all** compiles the programs **nrpe** and **check_nrpe**, but it does *not* copy them from the directory **/usr/local/src/nrpe-2.0/src** to the corresponding system directories. Since there is no **make install**, you must do this yourself, following the details in Table 10.1: you need to have **nrpe** on the computer to be monitored and the **check_nrpe** plugin on the Nagios server.

If the Nagios server and the target host used the same platform, you can compile both programs on one computer (e.g., the server) and then copy **nrpe** together with its configuration file to the computer to be monitored, instead of separately compiling **check_nrpe** on the Nagios server and **nrpe** on the target system.

10.2 Starting via the inet Daemon

It is best to start the program **nrpe** on the machine to be monitored via the inet daemon rather than as a separate daemon, since the Nagios server only performs the tests occasionally, and **nrpe** does not need to load any large resources.

If you have a choice, you should use the more modern **xinetd**. But to keep work to a minimum, the inet daemon will normally be used, as it is already running on the target system.

In order that NRPE can be started as a service via **inetd** or **xinetd**, the **nrpe** service is defined in the file **/etc/services**:

```
nrpe   5666/tcp   # Nagios Remote Plugin Executor NRPE
```

Even if this has been installed as a distribution package, you should still check to see whether this entry exists. By default, NRPE uses TCP port 5666.

10.2.1 xinetd configuration

If **xinetd** is used, a separate file is stored in the directory **/etc/xinetd.d** for each service to be started, so for **nrpe** it is best to create a file called **nrpe** or **nagios-nrpe**:

```
# /etc/xinetd.d/nrpe
# description: NRPE
# default: on
service nrpe
{
   flags           = REUSE
   socket_type     = stream
   wait            = no
   user            = nobody
   group           = nogroup
   server          = /usr/local/sbin/nrpe
   server_args     = -c /etc/nagios/nrpe.cfg --inetd
   log_on_failure  += USERID
   disable         = no
   only_from       = 127.0.0.1 ip_of_the_nagios_server
}
```

The values printed in italics are passed on to your own environment; instead of the placeholder *ip_of_the_nagios_server* you should enter, for example for only_from, the IP address of your own Nagios server. The NRPE access from outside is then restricted to this computer and to localhost (127.0.0.1). The latter address allows local tests; multiple IP addresses are separated by a space. However, this restrictive configuration functions only if xinetd has been compiled with support for the TCP wrapper (this is normally the case).

Under no circumstances should NRPE run with the permissions of a privileged user—nobody is therefore a sensible value. The server parameter specifies the complete path to the program nrpe; for server_args you should enter the matching path to the configuration file. After this modification, the configuration of xinetd is reloaded, with

```
linux:~ # /etc/init.d/xinetd reload
```

10.2.2 inetd configuration

In the standard inetd, the following line is added to the configuration file /etc/inetd.conf:

```
nrpe  stream  tcp  nowait  nobody /usr/sbin/tcpd
/usr/local/sbin/nrpe
    -c /etc/nagios/nrpe.cfg --inetd
```

The line has been split up for reasons of space, but in the configuration file this must all be in a single line. Here the TCP wrapper tcpd is used. If this is not intended, you simply leave out this entry.[6] Here you should also explicitly enter the user nobody, the complete path to the binary nrpe, and the configuration file, also with its complete path. These strings, printed above in italics, should be adjusted to your own system, where necessary. After the configuration change, inetd is reloaded:

```
linux:~ # /etc/init.d/inetd reload
```

[6] inetd does not have a built-in method to allow access to services only from specific IP addresses. This function is added in the TCP wrapper tcpd. The access configuration is then taken over by the files /etc/hosts.allow and /etc/hosts.deny. More information on this is given by man host_access.

10.3 NRPE Configuration on the Computer to Be Monitored

When compiling NRPE, the file nrpe.cfg is created in the source directory, which contains several parameters as well as the commands to run NRPE. These are copied manually to the configuration directory, which normally first has to be created on the target computer:

```
linux:src/rnpe-2.0 #  mkdir /etc/nagios
linux:src/rnpe-2.0 #  cp nrpe.cfg /etc/nagios/.
```

Distribution-specific packages are unpacked from the location specified in Table 10.1 on page 167.

nrpe is given the permissions of the user at runtime specified in the inet daemon configuration, which in our case is that of nobody. Therefore nrpe.cfg needs to be readable for this user. As long as the file does not contain any passwords (these really should not be used) or other critical information, then read permissions for all can be allowed.

The configuration file contains many comments; the following command displays the active parameters:[7]

```
user@linux:~$  egrep -v '^#|^$' nrpe.cfg | less
server_port=5666
allowed_hosts=127.0.0.1
nrpe_user=nobody
nrpe_group=nogroup
dont_blame_nrpe=0
debug=0
command_timeout=60
...
```

The parameters server_port, allowed_hosts, nrpe_user, and nrpe_group are only relevant if nrpe is working as a daemon. When the inet daemon is used, the program ignores these values since they have already been determined by the (x)indetd configuration.

The entry dont_blame_nrpe=0 prevents nrpe from accepting parameters, thus closing a potential security hole. debug=1 allows extensive logging, useful if you are looking for errors (debug=0 switches off the output for debugging information), and command_timeout specifies a timespan in seconds after which nrpe abruptly interrupts a plugin that has hung. Comments in the configuration file explain all these parameters as well.

[7] The regular expression ^#|^$ matches all lines that either begin with a comment sign # or that consist of an empty line. The option -v ensures that egrep shows all lines that are *not* matched by this.

After this, the commands are defined that are to be executed by NRPE. The configuration file **nrpe.cfg** already contains some, but first they all have to be commented out, and only those commands activated that really are intended for use.

The keyword **command** is followed in square brackets by the name with which **check_nrpe** should call the command. After the equals sign (=), the corresponding plugin command is specified, with its complete path:[8]

```
command[check_users]=/usr/local/nagios/libexec/check_users -w 5 -c 10
command[check_load]=/usr/lib/nagios/libexec/check_load -w 8,5,3
-c 15,10,7
command[check_zombies]=/usr/lib/nagios/libexec/check_procs -w :1 -c :2
-s Z
```

With the path, care must be taken that this really does point to the local plugin directory. In the directory specified here, **/usr/local/nagios/libexec**, the self-compiled plugins are located[9]; and for installations from distribution packages the path is usually **/usr/lib/nagios/plugins**.

From the Nagios server, the command just defined, **check_users** is now run on the *target computer* via **check_nrpe**:

```
nagios@linux:nagios/libexec$ ./check_nrpe -H target_host -c check_users
```

10.3.1 Passing parameters on to local plugins

The method described so far has one disadvantage: for each test on the target system, a separately defined command is required for this. Here is the example of a server on which the plugin **check_disk** (see Section 7.1 from page 134) is required to monitor nine file systems:

```
command[check_disk_a]=path/to/check_disk -w 5% -c 2% -p /net/linux01/a
command[check_disk_b]=path/to/check_disk -w 4% -c 2% -p /net/linux01/b
command[check_disk_c]=path/to/check_disk -w 5% -c 2% -p /net/linux01/c
command[check_disk_d]=path/to/check_disk -w 5% -c 2% -p /net/linux01/d
command[check_disk_root]=path/to/check_disk -w 10% -c 5% -p /
command[check_disk_usr]=path/to/check_disk -w 10% -c 5% -p /usr
command[check_disk_var]=path/to/check_disk -w 10% -c 5% -p /var
command[check_disk_home]=path/to/check_disk -w 10% -c 5% -p /home
command[check_disk_tmp]=path/to/check_disk -w 10% -c 5% -p /tmp
```

To avoid all this work, NRPE can also be configured so that parameters may be passed on to **check_nrpe**:

[8] The **check_users** command is explained in Section 7.6 from page 144, **check_load** is explained in Section 7.3 from page 137, and Section 7.4 from page 138 deals with **check_procs**.

[9] . . . provided you have followed the instructions in the book.

```
dont_blame_nrpe=1
...
command[check_disk]=path/to/check_disk -w $ARG1$ -c $ARG2$ -p $ARG3$
```

In order for this to work, the NRPE **configure** script must be run with the option **--enable-command-args**. The reason for this inconvenient procedure is that passing parameters on is a fundamental risk, since it cannot be ruled out that a certain choice of parameters could cause an (as yet unknown) buffer overflow, allowing the target system to be penetrated.

If you still decide on this, despite all the security risks, you should use a TCP wrapper (see Section 10.2.2, page 169), to ensure that only the Nagios server itself is allowed to send commands to NRPE.

If the plugin provides the corresponding options, there is sometimes a third method, however: the above-mentioned problem can also be solved by getting **check_disk**, if necessary, to test all file systems with one single command:

```
user@linux:nagios/libexec$  ./check_disk -w 10% -c 4% -e -m
DISK WARNING [2588840 kB (5%) free on /net/linux1/b] [937160 kB (5%) free
 on /net/linux1/c]
```

The **-e** parameter persuades the plugin to display only those file systems that produced a warning or an error. One restriction remains: the warning and critical limits are, by necessity, the same for all file systems.

10.4 Nagios Configuration

Commands that "trigger" local plugins on remote computers via **check_nrpe** are defined as before in the file **checkcommands.cfg** on the Nagios server.

10.4.1 NRPE without passing parameters on

If no parameters are passed on to the target plugin, things will look like this:

```
define command{
    command_name check_nrpe
    command_line $USER1$/check_nrpe -H $HOSTADDRESS$ -c $ARG1$
}
```

As the only argument, Nagios passes the command here that NRPE is to execute. If the **check_nrpe** plugin on the Nagios server is located in a different directory to the other plugins, you must enter the correct path instead of **$USER1$**.

A service to be tested via NRPE uses the command just defined, **check_nrpe**, as **check_command**. As an argument, the command is specified that was defined in **nrpe.cfg** on the target system (here: **linux04**):

```
define service{
    host_name           linux04
    service_description FS_var
    ...
    check_command   check_nrpe!check_disk_var
    ...
}
```

10.4.2 Passing parameters on in NRPE

In order to address the command defined in Section 10.3.1 on page 171

```
command[check_disk]=path/to/check_disk -w $ARG1$ -c $ARG2$ -p $ARG3$
```

from the Nagios server, the **check_nrpe** is given the corresponding arguments through the option **-a**:

```
define command{
    command_name check_nrpe
    command_line $USER1$/check_nrpe -H $HOSTADDRESS$ -c $ARG1$ -a $ARG2$
}
```

So that **$ARG2$** can correctly transport the parameters for the remote plugin, these are separated by spaces in the service definition. in addition, you should ensure that the order is correct:

```
define service{
    host_name           linux04
    service_description FS_var
    ...
    check_command   check_nrpe!check_disk!10% 5% /var
    ...
}
```

The locally installed **check_disk** on **linux04** distributes the three strings **10%**, **5%**, and **/var** to its own three macros **$ARG1$**, **$ARG2$**, and **$ARG3$** for the command defined in **nrpe.cfg**.

10.4.3 Optimizing the configuration

If the NRPE commands are given identical names on all target systems, then all NRPE commands with the same name can be included in a single service definition.

When doing this you can make use of the possibility of specifying several hosts, or even an entire group of hosts:

```
define service{
    host_name           linux04,linux02,linux11
    service_description FS_var
    ...
    check_command  check_nrpe!check_disk_var
    ...
}
```

With the command check_disk_var, defined at the beginning of Section 10.3.1 on page 171, Nagios now checks the /var file systems on the computers linux04, linux02, and linux11. If other file systems are to be included in the test, a separate service is created for each one, thus avoiding the security problem involved in passing parameters on. If you use the option of testing all file systems at the same time, with the check_disk plugin (see Section 7.1), then ultimately, one single service definition is sufficient to monitor all file systems on all Linux servers—provided you have a corresponding NRPE configuration on the target system:

```
define service{
    hostgroup_name      linux-servers
    service_description Disks
    ...
    check_command  check_nrpe!check_disk
    ...
}
```

10.5 Indirect Checks

NRPE executes not just local plugins, but any plugins that are available. If you use network plugins via NRPE, these are referred to as *indirect checks*, as illustrated graphically in Figure 1.

If every network service was tested directly across the firewall, it would have to open all the required ports. In the example, these would be the ports for SMTP, HTTP, LDAP, PostgreSQL, and SSH. If the checks are performed indirectly from a computer that is behind the firewall, on the other hand, then it is sufficient just to have the port for NRPE (TCP port 5666) open on the firewall. As long as it is configured via NRPE, the NRPE server behind the firewall can perform any tests it wants.

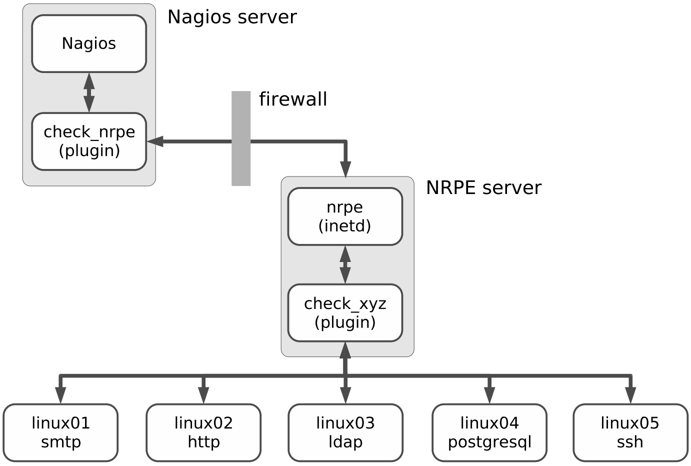


Figure 10.1: Indirect checks with NRPE

Whether the effort involved in indirect checks is greater than that for direct ones is dependent on the specific implementation: if this means that you would have to "drill holes into your firewall," then the additional work on the NRPE server may be worthwhile. But if the ports involved are open anyway, then the direct test can usually be recommended; this would make additional configuration work on an NRPE host unnecessary.

11

Chapter

Collecting Information Relevant for Monitoring with SNMP

SNMP stands for *Simple Network Management Protocol*, a protocol defined above all to monitor and manage network devices. This means being able to have not only read access, but also write access to network devices, so that you can turn a specific port on a switch on or off, or intervene in other ways.

Nearly all network-capable devices that can also be addressed via TCP/IP can handle SNMP, and not just switches and routers. For Unix systems there are SNMP daemons; even Windows servers contain an SNMP implementation in their standard distribution, although this must be explicitly installed. But even uninterruptible power supplies (UPSs) or network-capable sensors are SNMP-capable.

If you are using Nagios, then at some point you can't avoid coming into contact with SNMP, because although you usually have a great choice of querying techniques for Unix and Windows systems, when it comes to hardware-specific components such as switches, without their own sophisticated operating system, then SNMP is often the only way to obtain information from the network device. SNMP certainly does not have a reputation of being easy to understand, which among other things lies in the fact that it is intended for communication between programs, and machine processing is in the foreground. In addition, you generally do not make direct contact with the protocol and with the original information, since even modems or routers provide a simple-to-operate interface that disguises the complexity of the underlying SNMP.

If you want to use SNMP with Nagios, you cannot avoid getting involved with the information structure of the protocol. Section 11.1 therefore provides a short introduction to SNMP. Section 11.2 from page 184 introduces NET-SNMP, probably the most widely used implementation for SNMP on Unix systems. On the one hand it shows how to obtain an overview of the information structure of a network device with command-line tools, and on the other it describes the configuration of the SNMP daemon in Linux. Finally, Section 11.3 from page 196 is devoted to the concrete use of SNMP with Nagios.

11.1 Introduction to SNMP

Although SNMP contains the P for "protocol" in its name, this does not stand for a protocol alone, but is used as a synonym for the *Internet Standard Management Framework*. This consists of the following components:

- Manageable network nodes that can be controlled remotely via SNMP. A specific implementation of an SNMP engine, whether by software or hardware, is referred to as an *agent*.
- At least one SNMP unit consisting of applications with which the agents can be managed. This unit is referred to as a *manager*.
- A protocol with which agent and manager can exchange information: the *Simple Network Management Protocol* (SNMP).
- A well-defined information structure, so that any managers and agents can understand each other: the so-called *Management Information Base*, or in short, MIB.

The framework assigns the manager the active role. The agent itself just waits passively for incoming commands. In addition, so-called *traps* extend the application possibilities of SNMP: these are messages that the agent actively sends to a single manager or a whole group of managers, for example if predefined limit values are exceeded or if functions of the network device fail.

As agents, SNMP engines implemented by the manufacturer are used for hardware-specific devices (switches, routers). For Linux and general Unix systems, the NET-SNMP implementation is available (see Section 11.2), for Windows servers there is equivalent software already included with the operating system.

In combination with Nagios, there are two possibilities. With respect to Nagios in the active role, corresponding Nagios plugins, as the manager, ask the agents for the desired information. The other way round, Nagios can also passively receive incoming SNMP traps using utilities and process these. Section 14.6 from page 260 is devoted to this topic.

An understanding of the SNMP information structure, the so-called *Management Information Base* (MIB), is critical if you want to use SNMP with Nagios successfully. For this reason this section will focus on this. The protocol itself is only mentioned briefly to illustrate the differences between different protocol versions.

If you want to get involved more deeply with SNMP, we refer you to the numerous *Request for Comments* (RFCs) describing SNMP. The best place to start would be in RFC 3410, "Introduction and Applicability Statements for Internet Standard Management Framework", and RFC 3411: "An Architecture for Describing Simple Network Management Protocol (SNMP) Management Frameworks." Apart from an introduction and numerous cross-links, you will also find references there to the original documents of the older versions, today referred to as SNMPv1 and SNMPv2.

11.1.1 The Management Information Base

The SNMP information structure consists of a hierarchical namespace construction of numbers. Figure 11.1 shows an extract from this. The tree structure is similar to those of other hierarchical directory services, such as DNS or LDAP.

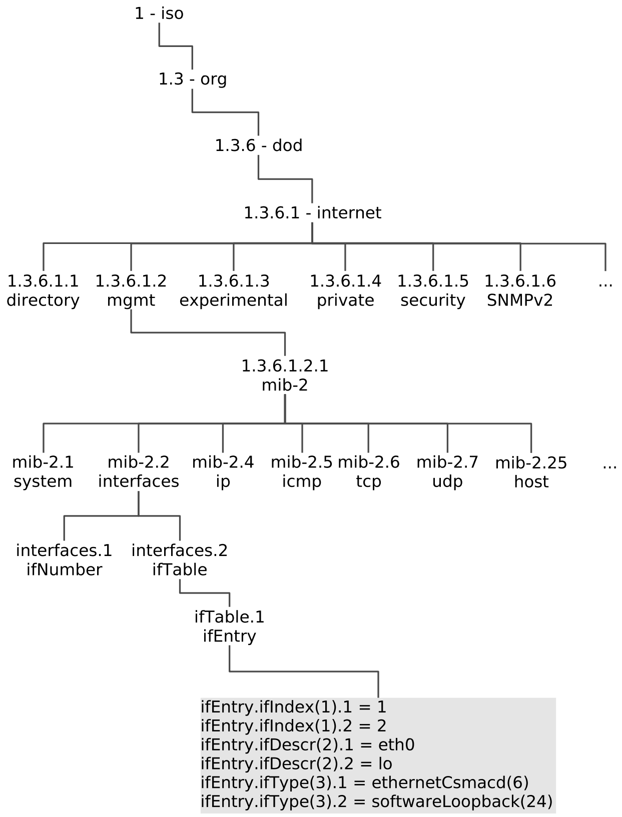
Its root is called 1 (iso) and stands for the *International Organization for Standardization*. The next level, 3 (org) shown in Figure 11.1 provides a space for general, national and international organizations. Beneath this is 6 (dod) for the U.S. *Department of Defense*. The general (IP-based) internet owes its assignment as a subitem 1 (internet) of dod to its origin as a military project.

If you bring together the corresponding numbers from left to right and separate them with the dot, then for the internet node in the tree, you arrive at the designation 1.3.6.1. Such nodes are referred to in general as *object identifiers* (OID). Their syntax is used not only in SNMP but also in the definition of LDAP objects and attributes, for example.

The OID 1.3.6.1 is not exactly easily readable for humans, which is why other notation methods have gained acceptance: both iso.org.dod.internet and the combination iso(1).org(3).dod(6).internet(1) is allowed. Because this would quickly make readable descriptions infinitely long if the tree were deep enough, another abbreviated notation method has become established: as long as the term remains unique, you may simply write **internet** instead of **1.3.6.1**.

The important thing here is that the communication between manager and agent is exclusively of a numerical nature. Whether the manager also allows text input or is capable of issuing information as text instead of as a numeric OID depends on the implementation in each case. The information on individual nodes is provided by the manufacturer of the SNMP agent as a Management Information Base (MIB) in file form.

Figure 11.1: SNMP namespace using the example of the MIB-II interfaces



The data stored in the MIB includes contact information (who designed the MIB; usually the manufacturer of the device will be given here), the definition of individual subnodes and attributes, and the data types used. If an MIB file also describes the individual subnodes and attributes, this puts the manager in a position to supply the user with additional information on the meaning and purpose of the entry in question.

Below **internet**, the next level is divided into various namespaces. The management node **1.3.6.1.2** is especially important for SNMP, that is, **iso(1).org(3).dod(6).internet(1).mgmt(2).** The namespace here is described by RFC 1155, "Structure and Identification of Management Information for TCP/IP-based Internets."

In order for manager and agent to be able to understand each other, the manager needs to know how the agent structures its data. This is where the *Management Information Base, Version II* comes into play. SNMP requests information from the agents on their implementation; with this, every manager can access the most important parameters of the agent, without a previous exchange of MIB definitions. The *Management Information Base II*, or MIB-II (or mib-2) for short, can be found in the namespace at **1.3.6.1.2.1** or **iso(1).org(3).dod(6).internet(1).mgmt(2).mib-2(1).** Since it is well-defined and unique, OIDs lying beneath that are usually described in short, starting with MIB-II or mib-2.

Manufacturer-specific information can also be defined in your own Management Information Base. Corresponding MIBs are located beneath **internet.private.enterprise.** Once an OID has been described in an MIB, the meaning of this entry may never be changed. The description format for an MIB is standardized by RFC 1212, which is the reason that special MIBs, included by a vendor for its agents, can be integrated into almost any manager.

MIB-II

MIB-II, the Management Information Base , which is obligatory for all SNMP agents, contains several information groups. The most important of these are summarized in Table 11.1. The notation **mib-2.*x*** stands for **1.3.6.1.2.1.*x***.

Table 11.1: MIB-II groups (a selection)

Group	OID	Description
system	mib-2.1	Information on the device, (e.g., the location, contact partner, or uptime)
interfaces	mib-2.2	Information on the network interfaces (Name, interface type, status, statistics etc.)
at	mib-2.3	Assignment of physical addresses (e.g., of MAC addresses) to the IP address (*Address Translation Table*)
ip	mib-2.4	Routing tables and IP packet statistics
icmp	mib-2.5	Statistics on individual ICMP packet types
tcp	mib-2.6	Open ports and existing TCP connections
udp	mib-2.7	ditto for UDP
host	mib-2.25	Information on storage media, devices, running processes and their use of resources

How you specifically handle information stored in the MIB-II can be explained using the example of the *interfaces* group: Figure 11.1 shows how they are split up into the two OIDs interfaces.ifNumber and interfaces.ifTable. This is because one network node initially reveals an unknown number of interfaces. This number is taken up by ifNumber. Before looking at these interfaces more closely, a manager can get the information from ifNumber about how many there really are.

ifTable then contains the actual information on the different interfaces. To obtain this information for a specific interface, the manager queries all the entries in which the last number is the same, like this:

```
ifEntry.ifIndex.1 = INTEGER: 1
ifEntry.ifDescr.1 = STRING: eth0
ifEntry.ifType.1 = INTEGER: ethernetCsmacd(6)
ifEntry.ifMtu.1 = INTEGER: 1500
ifEntry.ifSpeed.1 = Gauge32: 100000000
ifEntry.ifPhysAddress.1 = STRING: 0:30:5:6b:70:70
ifEntry.ifAdminStatus.1 = INTEGER: up(1)
ifEntry.ifOperStatus.1 = INTEGER: up(1)
...
```

ifIndex describes the device-internal index—SNMP always starts counting from 1, switches start counting here from 100. ifDescr contains the name of the interface, here eth0—this is obviously a Linux machine. It can be assumed from the next four entries that a normal 100-MBit Ethernet interface is involved. If ethernetCsmacd is given as the interface typeifType,[1] that is, Ethernet. ifMtu specifies the *Maximum Transfer Unit*, which in local networks is always 1500 bytes for Ethernet. The interface speed ifSpeed is 100,000,000 bits here, that is, 100 MBit. And ifPhysAddress contains the physical network address, also called the MAC address.

ifAdminStatus reveals whether the admin has switched the interface on (up) or off (down) via the configuration. ifOperStatus on the other hand specifies the actual status, since even interfaces activated by an administrator are not necessarily connected to a device, or even switched on.

There is a similar picture for the second interface:

```
ifEntry.ifIndex.2 = INTEGER: 2
ifEntry.ifDescr.2 = STRING: lo
ifEntry.ifType.2 = INTEGER: softwareLoopback(24)
ifEntry.ifMtu.2 = INTEGER: 16436
ifEntry.ifSpeed.2 = Gauge32: 10000000
ifEntry.ifPhysAddress.2 = STRING:
ifEntry.ifAdminStatus.2 = INTEGER: up(1)
```

[1] *Carrier Sense* (CS) means that each network interface checks to see whether the line is free, based on the network signal (in contrast to Token Ring, for example, where the network card may use the line only if it explicitly receives a token); *Multiple Access* (MA) means that several network cards may access a common network medium simultaneously.

```
ifEntry.ifOperStatus.2 = INTEGER: up(1)
...
```

This is not an ethernet card here, however, but a local loopback device.

11.1.2 SNMP protocol versions

The first SNMP version and *Internet Standard Management Framework* were described back in 1988 in RFCs 1065–1067; the current documentation on this version, named SNMPv1, can be found in RFC 1155–1157. It is still used today, since higher versions are fundamentally backward-compatible.

The big disadvantage of SNMPv1 is that this version allows only unsatisfactory authentication in precisely three stages: no access, read access, and full access for read and write operations. Two simple passwords, the so-called *communities*, provide a little protection here: they divide users into one community with read permissions, and the second one with read and write permissions. No further differentiation is possible. If this was not enough, the community is transmitted in plain text, making it an easy pray for sniffer tools.

Further development on the second version, SNMPv2, was intended to solve problems concerning the display of value ranges, error events, and the performance if there are mass requests (RFC 1905). This RFC was never fully implemented, however. The only relatively complete implementation that was used in practice is known as the *Community-based SNMPv2*, or SNMPv2c for short (RFC 1901–1908). The current version, SNMPv3 (RFC 3411–3418), has the status of an Internet standard. Agents with SNMPv3 implementations always understand requests from SNMPv1.

Apart from extended protocol operations, there are no fundamental differences between SNMPv1 and SNMPv2c. This is probably also the reason why SNMPv2 could not really gain a foothold. The hoped-for increase in security was certainly missing in this version. It is only the extensions of the framework in SNMPv3 which allow more precise access control, but this is much more complicated than the two community strings in SNMPv1. RFC 3414 describes the *user-based security model* (USM), RFC 3415 the *view-based access control model* (VACM).

When accessing an SNMP agent, you must tell all tools, including plugins, which protocol version is to be used. In Nagios you exclusively require read access. If this is restricted to the required information and you only allow the access from the Nagios server, you need have no qualms about doing without the extended authentication of SNMPv3. It is only important that you configure the agent—if possible—so that it completely prevents write accesses, or at least demands a password. You should never use this: since it is transmitted in plain text, there is always a danger that somebody may be listening, and misuse the password later on.

In NET-SNMP, write accesses can be completely prevented, access can be restricted to specific hosts, and information revealed can be limited. For other agents implemented in hardware such as switches and routers, you must weigh up whether you really need SNMPv3, assuming the manufacturer has made this available. SNMPv1, however, is available for all SNMP devices.

We will therefore only explain access via SNMPv1 below, and assume that this is generally read access only. If you still want to get involved with SNMPv3, we refer you to the NET-SNMP documentation.[2]

11.2 NET-SNMP

Probably the most widely used SNMP implementation for Linux and other UNIX systems is NET-SNMP[3] and was originally conceived at Carnegie-Mellon University. Wes Hardacker, a system administrator at the University of California in Davis, continued developing the code and first published it under the name UCD-SNMP (Version 3.0).

With version 5.0 the project finally got the name NET-SNMP. But various distributions still call the package UCD-SNMP, in part because it contains version 4.2, in part because the maintainer has simply not gotten around to renaming it.

NET-SNMP consists of a set of command line tools, a graphic browser (**tkmib**), an agent (**snmpd**, see Section 11.2.2 on page 187) and a library, which now forms the basis of nearly all SNMP implementations in the Open Source field.

All common distributions include corresponding packages. In SuSE this is called **net-snmp** and contains all the components; Debian packs the tools in the package **snmp**, and the daemon in the package **snmpd**. At the time of going to press, version 5.2.1 was the current version, but an older version (even 4.2) will do the job for our purposes. Their outputs differ to some extent, but the exact options can be looked up where necessary in the manpage.

11.2.1 Tools for SNMP requests

Command line tools snmpget, snmpgetnext and snmpwalk

For read access, the programs **snmpget**, **snmpgetnext** and **snmpwalk** are used. **snmpget** specifically requests a single OID and returns a single value from it. **snmpgetnext** displays the next variable existing in the Management Information Base, including its value:

[2] http://net-snmp.sourceforge.net/docs/FAQ.html#How_do_I_use_SNMPv__

[3] http://net-snmp.sourceforge.net/

```
user@linux:~$ snmpget -v1 -c public localhost ifDescr.1
IF-MIB::ifDescr.1 = STRING: eth0
user@linux:~$ snmpgetnext -v1 -c public localhost ifDescr.1
IF-MIB::ifDescr.2 = STRING: lo
user@linux:~$ snmpgetnext -v1 -c public localhost ifDescr.3
IF-MIB::ifType.1 = INTEGER: ethernetCsmacd(6)
```

The option -v1 instructs snmpget to use SNMPv1 as the protocol. With -c you specify the read community an; in this case then, the password is public. This is followed by the computer to be queried, here localhost, and finally there is the OID whose value we would like to find out.

The NET-SNMP tools are masters of OID abbreviation: without special instructions, they always assume that an OID is involved which lies inside the MIB-II. For unique entries such as ifDescr.1, this is sufficient. But whether the various SNMP plugins for Nagios can also handle this depends on the specific implementation; it is best to try out cases on an individual basis. To be on the safe side, it is better to use complete OIDs, either numerical in readable form. The latter is obtained if you instruct snmpget to display the full OID:

```
user@linux:~$ snmpget -v1 -On -c public localhost ifDescr.1
.1.3.6.1.2.1.2.2.1.2.1 = STRING: eth0
user@linux:~$ snmpget -v1 -Of -c public localhost ifDescr.1
.iso.org.dod.internet.mgmt.mib-2.interfaces.ifTable.ifEntry.ifDescr.1 =
STRING: eth0
```

The -On option provides the numerical OID, -Of the text version. In this way you can easily find out the complete OID, for plugins which cannot handle the abbreviation. It is important to remember here: each OID always starts with a period. If you omit this, there will always be a plugin which doesn't work properly.

In order to obtain the entire information stored in the MIB-II, it is better to use snmpwalk. As the name suggests, the program takes a walk through the Management Information Base, either in its entirety or in a specified part of the tree. If you would like to find out about all the entries beneath the node mib-2.interfaces (Figure 11.1 on page 180), you simply give snmpwalk the required OID:

```
user@linux:~$ snmpwalk -v1 -c public localhost mib-2.interfaces
IF-MIB::ifNumber.0 = INTEGER: 3
IF-MIB::ifIndex.1 = INTEGER: 1
IF-MIB::ifIndex.2 = INTEGER: 2
IF-MIB::ifIndex.3 = INTEGER: 3
IF-MIB::ifDescr.1 = STRING: eth0
IF-MIB::ifDescr.2 = STRING: lo
IF-MIB::ifDescr.3 = STRING: eth1
IF-MIB::ifType.1 = INTEGER: ethernetCsmacd(6)
...
```

snmpwalk hides the exact structure slightly (links to ifTable and ifEntry are missing, for example, see Figure 11.1), so that it is better to use -Of:

```
user@linux:~$  snmpwalk -v1 -Of -c public localhost mib-2.interfaces
...mib-2.interfaces.ifNumber.0 = INTEGER: 3
...mib-2.interfaces.ifTable.ifEntry.ifIndex.1 = INTEGER: 1
...mib-2.interfaces.ifTable.ifEntry.ifIndex.2 = INTEGER: 2
...mib-2.interfaces.ifTable.ifEntry.ifIndex.3 = INTEGER: 3
...mib-2.interfaces.ifTable.ifEntry.ifDescr.1 = STRING: eth0
...mib-2.interfaces.ifTable.ifEntry.ifDescr.2 = STRING: lo
...mib-2.interfaces.ifTable.ifEntry.ifDescr.3 = STRING: eth1
...mib-2.interfaces.ifTable.ifEntry.ifType.1 = INTEGER: ethernetCsmacd(6)
```

The three dots ... in the version here abbreviated for print stand for .iso.org.dod.internet.mgmt.

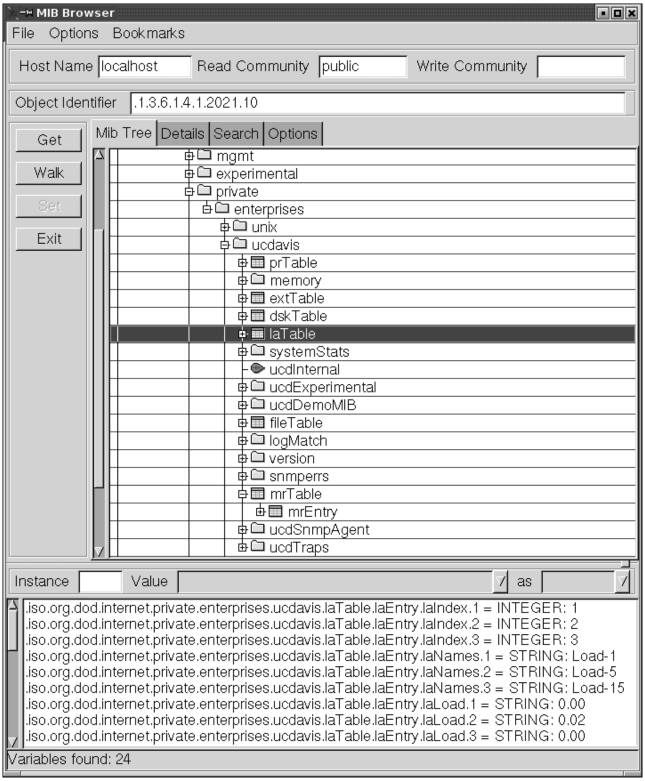
As the next step, you could take a look around your own network and query the Management Information Bases available there. Normally you will get quite far with the read community public, since this is often the default setting. So you should also try out the community string private, which is the default set by many vendors. An extremely dubious practice, by the way: anyone who knows a bit about SNMP and who has access to the network can use this to manipulate device settings, such as switching off certain ports or the entire switch. But even with all the other default passwords, you should take the trouble to change them. Entire password lists can be found on the Internet, sorted by vendors and devices—easily found through Google.

Whether you also change the preset read community (such as *public*) depends on the information available on it and on your own security requirements. But the read-write community should under no circumstances retain the default setting. In addition it is recommended that you switch off SNMP completely for devices that are neither queried nor administrated via SMNP, just to be on the safe side.

Taking a graphic walk with mbrowse

A graphic interface is often recommended for interactive research and for initial explorations of the Management Information Base, such as the SNMP browser mbrowse[4] (see Figure 11.2). This is not a component of NET-SNMP, but most Linux distributions provide an mbrowse package for installation.

[4] http://www.kill-9.org/mbrowse/



Host Name: localhost
Read Community: public
Write Community:
Object Identifier: .1.3.6.1.4.1.2021.10
Instance:
Value:
as:

```
.iso.org.dod.internet.private.enterprises.ucdavis.laTable.laEntry.laIndex.1 = INTEGER: 1
.iso.org.dod.internet.private.enterprises.ucdavis.laTable.laEntry.laIndex.2 = INTEGER: 2
.iso.org.dod.internet.private.enterprises.ucdavis.laTable.laEntry.laIndex.3 = INTEGER: 3
.iso.org.dod.internet.private.enterprises.ucdavis.laTable.laEntry.laNames.1 = STRING: Load-1
.iso.org.dod.internet.private.enterprises.ucdavis.laTable.laEntry.laNames.2 = STRING: Load-5
.iso.org.dod.internet.private.enterprises.ucdavis.laTable.laEntry.laNames.3 = STRING: Load-15
.iso.org.dod.internet.private.enterprises.ucdavis.laTable.laEntry.laLoad.1 = STRING: 0.00
.iso.org.dod.internet.private.enterprises.ucdavis.laTable.laEntry.laLoad.2 = STRING: 0.02
.iso.org.dod.internet.private.enterprises.ucdavis.laTable.laEntry.laLoad.3 = STRING: 0.00
```

Variables found: 24

Figure 11.2: SNMP browser mbrowse

If you highlight an entry and click on the **Walk** button, the lower window displays the same output as **snmpwalk**. The graphical display, however, allows better orientation—it is easier to see in which partial tree you are currently located. It is also interesting that **mbrowse** shows the numeric OID of each selected object, in **Object Identifier**.

11.2.2 The NET-SNMP daemon

The NET-SNMP daemon **snmpd** works as an SNMP agent for Linux and other Unix systems; that is, it answers requests from a manager and also provides a way of making settings to the Linux system via write accesses, such as manipulating the routing table.

Supported Mangement Information Bases

The agent initially provides information on the MIB-II described in RFC 1213 (Section 11.1.1 from page 179), but also the host extensions belonging to this from RFC 2790 (host MIB). Table 11.2 summarizes the groups of the host MIB, and the most important MIB-II groups are introduced in Table 11.1 (page 181).

If you are interested in a detailed description of the MIB-II, including the host MIB, we refer you to the MIB browser of TU Braunschweig.[5] In addition to the basic MIB-II, the NET-SNMP implementation has its own extension at **private.enterprises.ucdavis** (UCD-SNMP-MIB). The directives given in table 11.3 refer to instructions in the configuration file **snmpd.conf** (see page 190). Some of the information here is also given in the host resource MIB.

Table 11.2: Components of the Host Resources MIB *mib-2.host (RFC 2790)*

Group	OID	Description
hrSystem	host.1	System time and uptime of the host, logged-in users, and number of active processes
hrStorage	host.2	Details on all storage media such as swap, hard drives, removable media, and main memory
hrDevice	host.3	List of available devices and their properties: apart from details on the processor, network interfaces, printer and DVD-/CD-ROM drives, there is also information on hard drives, their partitioning, file systems, mount points and file system types
hrSWRun	host.4	All running processes including PID and command line parameters
hrSWRunPerf	host.5	CPU usage and memory usage for the processes from hrSWRun
hrSWInstalled	host.6	Installed software; the information originates from the RPM database (unfortunately this does not work in Debian).

Table 11.3: Extract from the UCD-SNMP-MIB

Group	OID	Directive	description
prTable	ucdavis.2	**proc**	details of running processes
memory	ucdavis.4	–	Memory and Swap space load, as in the program **free**

[5] http://www.ibr.cs.tu-bs.de/cgi-bin/sbrowser.cgi

continued

Group	OID	Directive	description
extTable	ucdavis.8	exec	Information on self-defined commands in the configuration file[6]
dskTable	ucdavis.9	disk	Information on file systems, see example in the text
laTable	ucdavis.10	load	System load
ucdExperimental	ucdavis.13	–	Experimental extension containing an entry with lm-sensor information, among other things
fileTable	ucdavis.15	file	Information on files to be explicitly monitored
version	ucdavis.100	–	Details on the NET-SNMP version and the parameters with which the daemon was compiled

While **mib-2.host** only specifies absolute values, such as for file systems, UCD-SNMP-MIB also allows threshold values to be set for agent pages, which then explicitly generate an error value (**dskErrorFlag**) with error text (**dskErrorMsg**):

```
user@linux:~$  snmpwalk -v1 -c public localhost ucdavis.dskTable |\
    grep '.2 ='
UCD-SNMP-MIB::dskIndex.2 = INTEGER: 2
UCD-SNMP-MIB::dskPath.2 = STRING: /net/swobspace/b
UCD-SNMP-MIB::dskDevice.2 = STRING: /dev/md6
UCD-SNMP-MIB::dskMinimum.2 = INTEGER: -1
UCD-SNMP-MIB::dskMinPercent.2 = INTEGER: 10
UCD-SNMP-MIB::dskTotal.2 = INTEGER: 39373624
UCD-SNMP-MIB::dskAvail.2 = INTEGER: 1694904
UCD-SNMP-MIB::dskUsed.2 = INTEGER: 35678636
UCD-SNMP-MIB::dskPercent.2 = INTEGER: 95
UCD-SNMP-MIB::dskPercentNode.2 = INTEGER: 1
UCD-SNMP-MIB::dskErrorFlag.2 = INTEGER: 1
UCD-SNMP-MIB::dskErrorMsg.2 = STRING: /net/swobspace/b: less than 10%
free (= 95%)
```

The **grep '.2 ='** filters all entries on the second device from the **snmpwalk** output, the Linux software-RAID **/dev/md6**. The entry **dskPercent** shows the current load of this data medium. An error exists if **dskErrorFlag** contains the value 1 instead of 0; **dskErrorMsg** adds a readable message to the error message. It can be assumed from this that the agent is being configured so that it will announce an error if free capacity falls below 10 percent.

[6] Any executable programs can be used here.

The configuration file snmpd.conf

Configuring the agent is done in the file **snmpd.conf**, which is either located in the directory **/etc** directly (the case for SUSE) or in **/etc/snmp** (Debian), depending on the distribution.

Authentication and security

As the first step towards a finely tuned access control, you first need to define who should have access to which community:

```
# (1) source addressesQuelladressen
com2sec  localnet  192.168.1.0/24 public
com2sec  localhost 127.0.0.1      public
com2sec  nagiossrv 192.168.1.9    public
```

com2sec links the source IP addresses to a community string (the SNMP password). This keyword is followed by an alias for the IP address range, the address range itself, and then a freely selectable community string, for which we will use **public** here, to keep things simple.[7] **192.168.1.0/24** refers to the local network; the Nagios server itself has the IP address **192.168.1.9**. If you set access permissions for the alias **localnet** later on, they will apply to the entire local network **192.168.1.0/24**, but if you reference **nagiossrv** when doing this, they will only apply to the Nagios server itself.

Then the defined computers and networks are assigned via their aliases to groups which have different security models:

```
# (2) assignment of group - security model - source-IP alias
group Local     v1        localhost
group Nagios    v1        nagiossrv
```

The keyword **group** is followed first by a freely selectable group name: here we define the group **Local** with the security model **v1**, which belongs to the address range defined as **localhost**, and the group **Nagios** with the same security model contained in the Nagios server.

You can choose from **v1** (SNMPv1), **v2c** (community-based SNMPv2), and **usm** (the *User Model* from SNMPv3) as the security model. If you assign a computer or a network several security models at the same time, then separate entries with the same group name are required:

```
group Nagios     v1       nagiossrv
group Nagios    usm       nagiossrv
```

[7] See also page 186.

With the definition of views (keyword **view**) the view from the outside can be restricted precisely to partial trees of the Management Information Base. Each view here is also given a name for referencing:

```
#(3) View definition for partial trees of the SNMP namespace
view all    included  .1
view system included  .iso.org.dod.internet.mgmt.mib-2.system
```

The reference **included** includes the following partial tree in the view. Thus the view **all** covers the entire tree (**.1**). If you want to exclude certain partial trees in this, then the keyword **excluded** is used:

```
view all    included  .1
view all    excluded  .iso.org.dod.internet.private
```

The partial tree beneath **private** in **all** is now blocked, such as the MIB **ucdavis** (**private.enterprises.ucdavis**).

One interesting feature is the mask; it specifies in hexadecimal notation which nodes correspond exactly to the subtree:

```
view all    included  .iso.org.dod.internet.mgmt       F8
```

All places of the queried OID, for which the mask contains a 1 in binary notation, must be identical in the queried partial tree to the OID specified here, **.iso.org.dod.internet.mgmt**, otherwise the daemon will refuse access and not provide any information. **.iso.org.dod.internet.mgmt** is written numerically as **.1.3.6. 1.2.**

Thanks to the mask **F8**,[8] binary 11111000, the first five places from the left in the OID must always be **.iso.org.dod.internet.mgmt**. If somebody queried an OID (such as the **private** tree **.1.3.6.1.4**), which deviates from this, the agent would remain silent and not provide any information. If you leave out the mask detail, **FF** will be used.

If you have defined the alias, community, security model, and view, you just need to bring them together for the purpose of access control. This is done with the **access** instruction:

```
# (4) Definition of the access control
access Local            any       noauth  exact  all    none   none
access NagiosGrp        any       noauth  exact  all    none   none
```

The access restrictions are bound to the group. The *context* column remains empty (**""**), since only SNMPv3 requires it.[9] As the security model, you then normally

[8] F= $1 \cdot 2^3 + 1 \cdot 2^2 + 1 \cdot 2^1 + 1 \cdot 2^0$ = 1111, 8=1000

[9] Corresponding descriptions on SNMPv3 would go beyond the bounds of this book.

choose **any**, but you may define a specific model with **v1**, **v2c** or **usm**, since several different security models may be assigned to a group, as shown in the discussion of "Authentication and Security" at the beginning of this Section. The fifth column specifies the security level, which is also of interest only for SNMPv3. In the other two security models (we are only using **v1**), **noauth** is given here. The fourth last column also has just one meaning in SNMPv3. But since you must enter a valid value forSNMPv1 and SNMPv2c as well, then **exact** is chosen here.

The last two columns specify which view should be used for which access (read or write). In the example, the groups **Local** and **NagiosGrp** obtain read access for the view **all**, but no write access. The final column defines whether the agent should send SNMP traps—that is, active messages, to the manager—for events that occur within the range of validity of the view. Section 14.6 from page 260 goes into more detail about SNMP traps.

With the configuration described here, you can now exclusively access the Nagios server and **localhost** via SNMPv1 for information. The server access can be restricted further by defining a view that makes only parts of the MIB visible. But you should only try this once the configuration described is working, to avoid logical errors and time-consuming debugging.

System and local information

The partial tree **mib-2.system** provides information on the system itself and on the available (that is, implemented) MIBs. With **syslocation** you can specify where a system is located in the company or on the campus, and after the keyword **syscontact** you enter the e-mail address of the administrator responsible:

```
# (5) mib-2.system
syslocation Server room Martinstr., 2nd rack from the left
syscontact root <wob@swobspace.de>
```

As long as you do not redefine the parameters **sysname** and **sysdescr** at this point, the corresponding MIBs in the default will reveal the host name and/or the system and kernel specification, corresponding to **uname -a**:

```
user@linux:~$ snmpwalk -v1 -c public localhost system
system.sysDescr.0 = STRING: Linux swobspace 2.6.10 #20 SMP Mon Dec 27
11:55:25 CET 2004 i686
system.sysObjectID.0 = OID: NET-SNMP-MIB::netSnmpAgentOIDs.10
system.sysUpTime.0 = Timeticks: (1393474) 3:52:14.74
system.sysContact.0 = STRING: root <wob@swobspace.de>
system.sysName.0 = STRING: swobspace
system.sysLocation.0 = STRING: Serverraum Martinstr., 2. Rack von links
...
```

Defining processes to be monitored

Processes that you want to monitor using SNMP are specified with the **proc** directive, and if required you can specify the minimum or maximum number of processes:

```
# (6) Processes: enterprises.ucdavis.procTable
# proc process maximum minimum
# proc process maximum
# proc process
proc sshd
proc nmbd 2 1
proc smbd
proc slapd
```

If the entry for maximum and minimum is missing, at least one process must be running. If only the minimum is omitted, NET-SNMP will define this with zero processes. The corresponding entries end up in the MIB **ucdavis.prTable**; in case of error you will receive an error flag (**prErrorFlag** and an error description (**prErrMessage**) (which unfortunately you cannot define yourself):

```
user@linux:~$ snmpwalk -v1 -c public localhost prTable
...
prTable.prIndex.4 = INTEGER: 4
prTable.prNames.4 = STRING: slapd
prTable.prMin.4 = INTEGER: 0
prTable.prMax.4 = INTEGER: 0
prTable.prCount.4 = INTEGER: 0
prTable.prErrorFlag.4 = INTEGER: 1
prTable.prErrMessage.4 = STRING: No slapd process running.
...
```

ucdavis.prTable only reveals the configured processes; on the other hand it allows **mib-2.host.hrSWRun** and **mib-2.host.hrSWRunPerf** in general to query all running processes. If you want to prevent this, the view must exclude the area you do not want.

Your own commands

With the **exec** directive you can specify commands in the extension **ucdavis.extTable**, which the agent will execute in the corresponding queries. The result then appears in the relevant entries. In the following example the agent calls **/bin/echo** if it is asked for **ucdavis.extTable**:

```
# (7) your own commands: enterprises.ucdavis.extTable
# exec name command arguments
exec echotest /bin/echo hello world
```

The program to be executed must appear with its absolute path in the configuration. Running snmpwalk provides only the following:

```
user@linux:~$ snmpwalk -v1 -c public localhost extTable
extTable.extEntry.extIndex.1 = INTEGER: 1
extTable.extEntry.extNames.1 = STRING: echotest
extTable.extEntry.extCommand.1 = STRING: /bin/echo hello world
extTable.extEntry.extResult.1 = INTEGER: 0
extTable.extEntry.extOutput.1 = STRING: hello world
...
```

extTable.extEntry.extResult contains the return value of the command executed, and extTable.extEntry.extOutput contains the text output.

With the exec directive you can thus query everything that a local script or program can find out. This could be a security problem, however: if the programs used are susceptible to buffer overflows, this feature could be misused as a starting point for a denial-of-service attack.

Monitoring hard drive capacity

The disk directive is suitable for monitoring file systems. The keyword disk is followed by the path for a mount point, and then the minimum hard drive space in kBytes or in percent that should be available. If you omit the capacity entry, at least 100 MBytes must be available; otherwise an error message will be given.

In the following example the free capacity in the / file system should not drop below 10%, and on /usr, at least 800 MBytes[10] should remain free:

```
#(8) File systems: enterprises.ucdavis.dskTable
#disk mount point
#disk mount point minimum_capacity_in_kbytes
#disk mountpoint minimum_capacity_in_percent%
disk / 10%
disk /usr 819200
disk /data 50%
```

As far as the data partition /data is concerned, the alarm should be raised if free capacity falls below 50%. dskErrorFlag in this case contains the value 1 instead of 0, and dskErrorMsg contains an error text:

```
...
UCD-SNMP-MIB::dskPercent.3 = INTEGER: 65
UCD-SNMP-MIB::dskErrorFlag.3 = INTEGER: 1
UCD-SNMP-MIB::dskErrorMsg.3 = STRING: /data: less than 50% free (= 65%)
...
```

[10] 1024kBytes ∗ 800

dskPercent reveals a current load of 65%. Instead of the partial tree configured here, ucdavis.dskTable, mib-2.host.hrStorage also provides an overview of all file systems, even those not explicitly defined. These are missing percentage details, however, and you do not receive an error status or error message, as supplied by ucdavis.dskTable.

You should think hard about whether you set the warning limit in the NET-SNMP or in the Nagios configuration. In the first case you must configure the values on each individual host. If you query the percentage load, however, with the check_snmp plugin (see section 11.3.1 from page 196), then you set warning and critical limits centrally on the Nagios server, saving yourself a lot of work if you make changes later on.

The includeAllDisks directive adds all existing file systems to the dskTable table:

```
includeAllDisks 10%
```

It requires a minimum limit to be specified in percent, and also returns error values. An absolute specification in kBytes is not possible here. If you set warning and error limits centrally for check_snmp; (see Section 11.3.1 from page 196) the error attributes dskErrorFlag and dskErrorMsg are not queried, so that the value set here as the minimum limit can be ignored.

System load

The load directive queries the CPU load. As the limit values, you specify the average values for one minute, and optionally for five and 15 minutes:

```
# (9) System Load: enterprises.ucdavis.laTable
# load max1
# load max1 max5
# load max1 max5 max15
load 5 3 2
```

If the values are overstepped, laErrorFlag will contain the status 1 (otherwise: 0) and laErrMessage will have the text of the error message.

In a system that exceeds one of the specified limits, snmpwalk returns the following:

```
user@linux:~$ snmpwalk -v1 -c public localhost laTable
...
UCD-SNMP-MIB::laNames.1 = STRING: Load-1
UCD-SNMP-MIB::laNames.2 = STRING: Load-5
UCD-SNMP-MIB::laNames.3 = STRING: Load-15
UCD-SNMP-MIB::laLoad.1 = STRING: 5.31
UCD-SNMP-MIB::laLoad.2 = STRING: 2.11
```

```
UCD-SNMP-MIB::laLoad.3 = STRING: 0.77
...
UCD-SNMP-MIB::laLoadInt.1 = INTEGER: 530
UCD-SNMP-MIB::laLoadInt.2 = INTEGER: 210
UCD-SNMP-MIB::laLoadInt.3 = INTEGER: 77
UCD-SNMP-MIB::laLoadFloat.1 = Opaque: Float: 5.310000
UCD-SNMP-MIB::laLoadFloat.2 = Opaque: Float: 2.110000
UCD-SNMP-MIB::laLoadFloat.3 = Opaque: Float: 0.770000
UCD-SNMP-MIB::laErrorFlag.1 = INTEGER: 1
UCD-SNMP-MIB::laErrorFlag.2 = INTEGER: 0
UCD-SNMP-MIB::laErrorFlag.3 = INTEGER: 0
UCD-SNMP-MIB::laErrMessage.1 = STRING: 1 min Load Average too high (=
5.31)
UCD-SNMP-MIB::laErrMessage.2 = STRING:
UCD-SNMP-MIB::laErrMessage.3 = STRING:
```

From laLoadInt.1 we are told the one-minute average value for the system load as an integer, from laLoad.1 as a string, and from laLoadFloat.1 as a floating-point decimal. laErrorFlag.1 contains the corresponding error status, laErrMessage.1 the corresponding error message. The same applies for the other two averages.

You can also use the check_snmp plugin here to query the floating-point decimal values just as accurately, and specify limit values centrally.

11.3 Nagios's Own SNMP Plugins

Among the standard Nagios plugins there are three programs with which data can be obtained via SNMP: a generic plugin that queries any OIDs you want, and two Perl scripts that are specialized in interface data of network cards and the ports of switches, routers and so forth. In addition to this, the directory contrib contains the source code of other SNMP plugins that are not automatically installed. Apparently these are no longer maintained and cannot run without major adjustments to the code.

http://www.nagiosexchange.org/ also provides some useful specialized plugins, some of which are introduced in Section 11.4 from page 205. The following descriptions are limited, for reasons of space, to SNMPv1/2 queries; for SNMPv3-specific options, we refer you to the online help for the corresponding plugin.

11.3.1 The generic SNMP plugin check_snmp

With check_snmp a generic plugin is available that queries all available information via SNMP, according to your requirements. However, its operation does require a degree of care, since as a generic plugin, it has no idea of specifically what data it is querying.

For this reason as well, its output looks quite meager; specialized plugins provide more convenience here. But since these don't exist for every purpose, **check_snmp** is then quite justified. It calls the program **snmpget** auf, which means that the NET-SNMP tools must be installed.

It provides the following options:

-H *address* / --host=*address*
: This is the host name or IP address of the SNMP agent to be queried.

-o *OID* / --oid=*OID*
: This is the object identifier to be queried, either as a complete numerical OID or as a string, which is interpreted by **snmpget** (e.g., **system.sysName.0**).

  Attention: in contrast to **snmpwalk**, you must always specify the end nodes containing the information.

-p *port* / --port=*port*
: This is the alternative port on which the SNMP agent is running. The default is UDP port 161.

-C *password* / --community=*password*
: This is the community string for read access. The default value is **public**.

-w *start*:*end* / --warning=*start*:*end*
: If the queried value lies within the range specified by *start* and *end*, **check_snmp** does not give out a warning. For **-w 0:90** it must therefore be larger than 0 and smaller than 90.

-c *start*:*end* / --critical=*start*:*end*
: If the query value lies outside the range, the plugin gives out CRITICAL. If the warning and critical limits overlap, the critical limit always has priority.

-s *string* / --string=*string*
: The contents of the queried OID must correspond exactly to the specified *string*, otherwise **check_snmp** will give out an error.

-r *regexp* / --ereg=*regexp*
: This option checks the contents of the queried OID to see whether the regular expression *regexp*[11] is matched. If this is the case, the plugin returns OK, otherwise CRITICAL.

-R *regexp* / --erexi=*regexp*
: As **-r**, except that there is no case distinction.

-l *prefix* / --label=*prefix*
: A string that is placed in front of the plugin response. The default is **SNMP**.

[11] POSIX regular expression, see **man 7 regex**.

-u *string* | --units=*string*
: SNMP only has simple values, not units. A string that is specified instead of *string* is extended by the plugin in the text output so that it serves the value as a unit. Because only text is involved here, you can also specify apples or pears, for example, as "units".

-d *delimiter* | --delimiter=*delimiter*
: This character separates the OID in the snmpget output from the value. The default is =.

-D *delimiter* | --output-delimiter=*delimiter*
: The plugin is able to query several OIDs simultaneously. The result values are separated with *delimiter*, which in the default is a space.

-m *mibs* | --miblist=*mibs*
: This specifies the MIBs that should be loaded for snmpget. The default is ALL. -m +UCD-DEMO-MIB[12] loads *in addition*, -m UCD-DEMO-MIB (without the + sign) *only* loads the specified MIB.[13]

-P *version* | --protocol=*version*
: Defines the SNMP protocol version. The values for *version* are 1 or 3. Without this option, SNMPv1 is used.

SNMP provides almost unlimited possibilities, so the following examples can merely convey a feeling for other plugins used.

Testing hard drive capacity via SNMP

The following command queries the load of a file system and to do this accesses the partial tree ucdavis.dskTable of a locally running NET-SNMP agent:

```
nagios@linux:local/libexec$ ./check_snmp -H swobspace -C public \
    -o dskTable.dskEntry.dskPercent.2 -w 0:90 -c 0:95 -u percent
SNMP WARNING - *95* percent
```

The query applies to the percentage load of the file system with the index number 2. As long as no more than 90 percent of the hard drive space is then occupied, the test should return OK; here a warning will be returned if it is between 91 and 95 percent, and critical status if it goes beyond this. Thanks to the -u option, check_snmp adds the description percent to the output of the figure determined.

Nevertheless, the plugin does not tell the whole truth: a test check with df shows a 96 percent load, which comes from the fact that this program correctly rounded

[12] UCD-DEMO-MIB is an MIB included for demonstration purposes.
[13] See also the online help, with man snmpcmd.

up the actual 95.8 percent load, while integer values in SNMP are seldom rounded up, but simply cut off. So you just have to live with slight inaccuracies as long as the MIB does not provide any floating-point decimals.

If you would like things to be more detailed, you can use the option -l: -l 'SNMP-DISK: /net/swobspace/b' causes other, self-defined information to be added to the output of the above command:

```
SNMP-DISK: /net/swobspace/b WARNING - *95* percent
```

The above query can be more generally run through a command object such as the following:

```
define command{
    command_name  check_snmp
    command_line  $USER1$/check_snmp -H $HOSTADDRESS$ -C $USER3$ \
                     -P 1 -o $ARG1$ -w $ARG2$ -c $ARG3$ -l $ARG4$
}
```

This definition assumes that the value being queried is numerical, and not Boolean (see page 201), otherwise specifying a warning and critical value simultaneously would make no sense. We store the community here in the macro $USER3$.[14] this is followed by the protocol version (-P 1 stands for SNMPv1), the OID, the warning and critical limits, and a prefix.

The call for this command in service definitions is then made in the form

```
check_snmp!oid!warn!critical!prefix
```

If you want to specifically monitor the load of the file system with the index number 2 on the computer swobspace through dskTable, then the following definition would be used:

```
define service{
   service_description   SNMP-DISK-a
   host_name             swobspace
   check_command check_snmp!dskTable.dskEntry.dskPercent.2!\
                          0:90!0:95!DISK: /net/swobspace/a
   ...
}
```

Even though the check_command line is wrapped here, in practice all parameters must be on a single line, separated by an exclamation point ! (without spaces before or after the delimiter).

[14] The $USER*x*$ macros are defined in the resource file resource.cfg.

Measuring temperature via lm-sensors

The next test checks the CPU temperature of the host. For the sensor, the package lm-sensors[15] is used here, which accesses corresponding chips on modern mainboards. As soon as lm-sensors is active, it allows the NET-SNMP agents to read out the corresponding information from the partial tree ucdavis.ucdExperimental.lmSensors:

```
nagios@linux:local/libexec$ ./check_snmp -H localhost -C public \
    -o lmTempSensorsValue.1 -w 25000:45000 -c 20000:48000  \
    -u ’degrees Celsius (* 1000)’ -l ’Temp1/CPU’
Temp1/CPU OK - 41000 degrees Celsius (* 1000)
```

The output depends on the chipset: here you must multiply the query values by the factor 1000. Accordingly, you have no other alternative but to adjust the warning and critical limits to the main board you are using. In the example, the CPU temperature, 41 degrees Celsius, is “on a green light”: if it were to drop below 25 degrees or rise above 45 degrees, it would cause a warning, while below 20 or above 48 degrees, this would be critical.

Regular expressions and comparing fixed strings

You can check whether the text swobspace occurs in the system name as follows:

```
nagios@linux:local/libexec$ ./check_snmp -H localhost -C public \
    -o system.sysName.0 -r swobspace
SNMP OK - "swobspace"
```

Instead of defining the string being searched for, with -r as the regular expression, you could also use the -s option. Then the text must match exactly, however, which may be quite tricky, since everything counts that snmpget outputs after the delimiter, =.

Monitoring network interfaces

The final example queries whether the first network interface of a Cisco router is in operation:

```
nagios@linux:local/libexec$ ./check_snmp -H cisco1 -C public \
    -o ifOperStatus.1 -w 1:1 -l ’SNNP: Port Status for Port 1 is: ’
SNNP: Port Status for Port 1 is:  OK - 1
```

[15] http://www.lm-sensors.nu/

The information sought can be found in ifOperStatus. Here we are querying port 1. While ifOperStatus gives out the operating status, ifAdminStatus reveals whether the interface is administratively switched on or off.

When specifying the warning limit here, we use the range 1:1, so that the plugin gives out a warning if the interface is physically switched off, and the return value is thus 0. We will do without the definition of a critical status here, since there are only two states, "on" or "off." If the plugin returns a CRITICAL when the interface is switched off, you should use -c 1:1 and omit -w entirely.

If you just want to query the status of network interfaces, you should certainly take a look at the plugins check_ifstatus and check_ifoperstatus, described below, which provide slightly more operating convenience.

If MIB-II or MIB ucdavis do not provide the desired information, you could also take a look at the MIB provided by the manufacturer. You can find out from mib-2.system in which partial tree the overall MIB is hidden:

```
user@linux:~$ snmpwalk -v1 -c public konica01 system
system.sysDescr.0 = Konica IP Controller
system.sysObjectID.0 = OID: enterprises.2364
...
```

The example involves a network-capable Konica photocopying machine called konica01. system.sysObjectID.0 reveals that enterprises.2364 serves as the entry point for device specific details. With snmpwalk you can then obtain further information:

```
user@linux:~$ snmpwalk -v1 -c public konica01 enterprises.2364
...
enterprises.2364.1.2.6.1.1.5.1.1 = "Ready to Print"
...
```

In the concrete case of this photocopier, you can query the current device status through enterprises.2364.1.2.6.1.1.5.1.1. Manufacturers usually store information on the implemented MIBs, so that you are not restricted to just guessing.

11.3.2 Checking several interfaces simultaneously

Active network components such as switches usually have quite a large number of ports, and it would be very time-consuming to check every single one of them. Here the check_ifstatus plugin is very useful, since it tests all ports simultaneously. It retrieves the information necessary for this via SNMP, and has the following options:

-H *address* / --host=*address*

This is the host name or IP address of the SNMP agent to be queried.

-C *password* / --community=*password*
: This sets the community string for read access.

-p *port* / --port=*port*
: This parameter is the alternative port on which the SNMP agent is running. The default is UDP port 161.

-v *version* / --snmp_version=*version*
: This parameter specifies the SNMP version (1, 2, or 3) for the query.

-x *list* / --exclude=*list*
: Use this to specify a comma-separated list of interface types that should not be queried (see example below).

-u *list* / --unused_ports=*list*
: Use this to specify a comma-separated list of all ports that should be excluded from the test. Like -x, the list consists of the indices of the interfaces which are determined from ifIndex: -u 13,14,15,16.

-M *bytes* / --maxmsgsize=*bytes*
: This is the maximum size of the SNMP data packets; the default is 1472 bytes.

With exclusion lists it is possible to exclude certain interface types or port numbers from the test, perhaps because these are not occupied, or are connected to PCs or other devices that are not always running.

With the following query we can find out, for example, which interface types are gathered together on the Cisco switch here named cisco01:

```
user@linux:~$ snmpwalk -v1 -c public cisco01 ifType
...
interfaces.ifTable.ifEntry.ifType.12 = ethernetCsmacd(6)
interfaces.ifTable.ifEntry.ifType.13 = other(1)
interfaces.ifTable.ifEntry.ifType.14 = propVirtual(53)
...
```

If the interface types other(1) and propVirtual(53) should now be excluded, the plugin is sent off with the two figures, separated by a comma, as the exclusion list -x 1,53:

```
nagios@linux:local/libexec$ ./check_ifstatus -C public -H cisco01 \
    -x 1,53
CRITICAL: host 'cisco01', interfaces up: 2, down: 10, dormant: 0,
excluded: 4, unused: 0<BR>GigabitEthernet0/2: down
<BR>GigabitEthernet0/3: down <BR>GigabitEthernet0/4: down
<BR>GigabitEthernet0/10: down <BR>GigabitEthernet0/5: down
<BR>GigabitEthernet0/11: down <BR>GigabitEthernet0/6: down
```

```
<BR>GigabitEthernet0/7: down <BR>GigabitEthernet0/8: down
<BR>GigabitEthernet0/9: down <BR> |up=2,down=10,dormant=0,excluded=4,
unused=0
```

In reality, this plugin also does *not* display its output over several lines, as the line wrap here may suggest. The fact that this information appears on the Nagios Web interface in a relatively clear form is because the HMTL formatting element <BR> is thrown in. This causes the output for each port to be displayed on a separate line. The | character defines the beginning of the performance data, which does not appear at all in the Web interface.

A query of this type is implemented as a command object as follows:

```
define command{
    command_name  check_ifstatus
    command_line  $USER1$/check_ifstatus -H $HOSTADDRESS$ \
                  -C $USER3$ -x $ARG1$
}
```

Here the macro $USER3$ is also used to define the community string in the file resource.cfg. Altogether, 32 $USER*x*$ macros are available, of which the first two usually contain path details, and the others can be used in any way you want.

If you would prefer to exclude ports rather than interface types, you can use the -u option instead of -x in the definition.

If Nagios is to monitor the switch cisco01, as shown above, excluding the two interface types 1 and 53, the corresponding service definition begins as follows:

```
define service{
   service_description   Interfaces
   host_name             cisco01
   check_command         check_ifstatus!1,53
   ...
}
```

11.3.3 Testing the operating status of individual interfaces

To test an individual interface, you can use either the generic plugin check_snmp or check_ifoperstatus, which specifically tests the operating status (ifOperStatus) of the network card. The advantage of this over the generic plugin consists above all in its ease of use: instead of an index for the port, you can also specify its description here—for example, eth0.

check_ifoperstatus has the following options:

-H *address* / --host=*address*
This is the host name or IP address of the SNP agent to be queried.

-C *password* / --community=*password*

This parameter gives the community string for read access.

-p *port* / --port=*port*

As long as the SNMP agent is not running on UDP port 161, the port is specified with this option.

-k *ifIndex* / --key=*ifIndex*

ifIndex is the number of the network interface to be queried (such as the network card of a computer or the port of a switch).

-d *ifDescr* / --descr=*ifDescr*

Instead of the index key, the plugin processes the name of the interface from *ifDescr* (see below).

-v *version* / --snmp_version=*version*

This specifies the SNMP version (1, 2, or 3) for the query.

-w *return_value* / --warn=*return_value*

This option selects the return value if the interface is dormant. The *return_value* can be i (ignore the dormant status and return OK!), w (WARNING) or c (CRITICAL, the default).

-D *return_value* / --admin-down=*return_value*

What value (i, w or c) should the plugin return if the interface has been shut down administratively? The default, w, issues a warning, c returns CRITICAL, and i returns OK.

-M *bytes* / --maxmsgsize=*bytes*

This is the maximum size of the SNMP data packets; the default is 1472 bytes.

On a system called igate, on which snmpwalk finds the following interfaces ...

```
...
interfaces.ifTable.ifEntry.ifDescr.3 = ipsec0
interfaces.ifTable.ifEntry.ifDescr.4 = ipsec1
...
interfaces.ifTable.ifEntry.ifDescr.7 = eth0
interfaces.ifTable.ifEntry.ifDescr.8 = eth1
interfaces.ifTable.ifEntry.ifDescr.9 = eth2
interfaces.ifTable.ifEntry.ifDescr.10 = ppp0
```

the first Ethernet card is tested either with -k 7 or with -d eth0. Since the plugin in the second case has to query all ifDescr entries to determine the index itself, this variation generates a somewhat higher network load. It can be especially useful if not all network interfaces are active on a host, causing its index to change.

The plugin itself reveals which index this port currently has:

```
nagios@linux:local/libexec$ ./check_ifoperstatus -H igate -c public \
    -d eth0
OK: Interface eth0 (index 7) is up.
```

As the command object in the Nagios configuration, the call looks like this:

```
define command{
    command_name  check_ifoperstatus
    command_line  $USER1$/check_ifoperstatus -H $HOSTADDRESS$ \
                     -C $USER3$ -d $ARG1$
}
```

The $USER3$ macro again contains the community string, defined in the file resource.cfg. The service definition for igate specifies the name of the interface to be tested as a plugin argument:

```
define service{
   service_description   Interface eth0
   host_name             igate
   check_command         check_ifoperstatus!eth0
   ...
}
```

11.4 Other SNMP-based Plugins

Apart form the SNMP plugins from the Nagios Plugin package, the Nagios community provides a large variety of other plugins for special purposes. Most of them can be found at http://www.nagiosexchange.org/ in the category Check Plugins → SNMP.[16]

11.4.1 Monitoring hard drive space and processes with nagios-snmp-plugins

One of these is the package nagios-snmp-plugins,[17] which exists not only as source code but also as an RPM package (for Red Hat and Fedora). It contains two very easy-to-use plugins: check_snmp_disk and check_snmp_proc.

Both absolutely require the NET-SNMP agent as the partner on the other side (see Section 11.2.2 from page 187) and use ucdavis.dskTable and ucdavis.prTable to

[16] http://www.nagiosexchange.org/SNMP.51.0.html
[17] ftp://ftp.hometree.net/pub/nagios-snmp-plugins/

test the processes and file systems specified in the configuration file snmpd.conf. Its options are restricted to specifying the host and the community string:

-H *address* / --host=*address*
: This is the host name or IP address of the NET-SNMP agent to be queried.

-C *password* / --community=*password*
: This is the community string for read access.

The next example tests the available capacity of the /data file system; public is again used as the community string:

```
nagios@linux:local/libexec$ ./check_snmp_disk -H swobspace -C public
/data: less than 50% free (= 95%) (/dev/md6)
```

The configuration of the NET-SNMP agent specifies, with the disk directive (page 194), 50% as the threshold for this file system. In this case the plugin accordingly returns a CRITICAL. It can only distinguish between an error and OK; it does not have a WARNING status.

Using check_snmp_proc is just as easy:

```
nagios@linux:local/libexec$ ./check_snmp_proc -H localhost -C public
No slapd process running.
```

The plugin again tests the processes defined in the configuration of the NET-SNMP agent with the proc directive (page 193). The process slapd is missing here, which is why a CRITICAL is returned. The return value is revealed by echo $?.

The corresponding command objects are defined in a similar unspectacular way:

```
define command{
    command_name  check_snmp_proc
    command_line  $USER1$/check_snmp_proc -H $HOSTADDRESS$ -C $USER3$
}

define command{
    command_name  check_snmp_disk
    command_line  $USER1$/check_snmp_disk -H $HOSTADDRESS$ -C $USER3$
}
```

This definition also assumes that the community string is stored in the $USER3$ macro in the file resource.cfg. In order to query the NET-SMTPD on the computer linux01 for its hard drive load, the following service object is defined:

```
define service{
   service_description   DISK
   host_name             linux01
   check_command         check_snmp_disk
   ...
}
```

11.4.2 Observing the load on network interfaces with check-iftraffic

The MIB-II contains only numbers that provide information on the load on network interfaces, but no average values for the used bandwidth, for example. If the vendor has not specifically made such an entry available in his MIB, then you will always have to make a note of the last counter status and the timestamp, so that you can work out the relative usage yourself.

http://www.nagiosexchange.org/ introduces two plugins that take over this task. The Perl-based plugin check_traffic[18] writes the query values into a *round-robin database* (RRD, see page 317), which makes it somewhat more complex to handle.

The same purpose is achieved, but with more simple means, by the check_iftraffic.pl plugin.[19] It has the following options:

-H *address* / --host=*address*
: *address* is the host name or IP address of the NET-SNMP agent that is to be queried.

-C *password* / --community=*password*
: *password* is the community string for read access. The default is public.

-i *ifDescr* / --interface=*ifDescr*
: From the interface name *ifDescr* the plugin determines the index so that it can access other values (e.g., the counter states).

-b *integer* / --bandwith=*integer*
: This is the maximum bandwidth of the interface in bits (see -u).

-u *unit* / --units=*unit*
: This is the unit for bandwidth specification with -b. Possible values are g (Gbit), m (Mbit), k (kbit) and the default b (bit): -b 100 -u m corresponds to 100 Megabits (Fast Ethernet).

[18] http://nagios.sourceforge.net/download/contrib/misc/check_traffic/

[19] http://www.nagiosexchange.org/SNMP.51.0.html?&tx_netnagext_pi1[p_view]=37

-w *integer* / --warning=*integer*
: If traffic exceeds this warning limit in percent (default: 85 percent), the plugin issues a WARNING.

-c *integer* / --critical=*integer*
: This is the critical threshold in percent (default: 92 percent).

The plugin saves the timestamp and counter status of the interface queried in files in /tmp, to which it adds the prefix traffic. So if you are using a different user ID than nagios for the manual test on the command line, you should delete the files /tmp/traffic_*interface_computer* before activating the appropriate Nagios service.

The following command line example queries the Fast Ethernet network interface eth0 on the computer linux01, which in theory has a bandwidth of 100 MBit:

```
nagios@linux:local/libexec$ ./check_iftraffic.pl -H linux01 -i eth0 \
    -b 100 -u m
Total RX Bytes: 60.32 MB, Total TX Bytes: 26.59 MB<br> Average Traffic:
1.14 kB/s (0.0%) in, 777.93 B/s (0.0%) out | inUsage=0.0,85,98 outUsage
=0.0,85,98
```

The amount of data transmitted here is reported separately by the plugin, depending on the direction, and here it announces 60.32 (RX, "received") and 26.59 MBytes (TX, "transmitted"). The text contains the HTML element <br> (line break), to display the output in the Nagios Web interface on two lines. This is followed by the average transmission rate, again separated for incoming and outgoing data traffic. The performance data (see Section 17.1, page 314 pp.) after the | sign contain only the average load as a percentage, each separated by incoming and outgoing values. The numbers 85 and 98 are the default values for the warning and critical limits.

The corresponding command object is implemented as follows:

```
define command{
    command_name  check_iftraffic
    command_line  $USER1$/check_iftraffic.pl -H $HOSTADDRESS$ \
                     -C $USER3$ -i $ARG1$ -b $ARG2$ -u m
}
```

If the definition is taken over literally, you must define the community string in the $USER3$ macro. If you only generally use public as the password, it is better to write -C public instead of -C $USER3$.

To simplify the call of the command within the following service definition, we set the unit to MBit/second (-u m).

```
define service{
   service_description   Traffic load eth0
   host_name             linux01
   check_command         check_iftraffic!eth0!100
   ...
   max_check_attempts      1
   normal_check_interval   5
   retry_check_interval    5
   ...
}
```

check_iftraffic calculates the bandwidth used by comparing two counter states at different times. Because Nagios does not test exactly down to the second, the check interval you choose should not be too small. The *Multi Router Traffic Grapher*, [20] which displays the bandwidth used in graphic form, normally works at five-minute intervals.

If you select max_check_attempts other than 1, you should make sure that the retry interval (retry_check_interval) is the same as the normal check interval. For max_check_attempts 1 this makes no difference, but you have to define a retry_check_interval at some time or other.

11.4.3 The manubulon.com plugins for special application purposes

The Nagios Exchange, with the SNMP plugins to be found under http://www.manubulon.com/nagios/ (see Table 11.4), also includes some that are customized to a specific application, such as querying hard drive space. They are relatively simple to use.

Two of the plugins—check_snmp_storage.pl and check_snmp_load.pl—are introduced here in detail.

Table 11.4: The manubulon.com-SNMP plugins

Plugin	Description
check_snmp_storage.pl	Query of storage devices (hard drives, swap space, main memory, etc.)
check_snmp_int.pl	Interface status and load
check_snmp_process.pl	processes: status, CPU and memory usage
check_snmp_load.pl	System load
check_snmp_mem.pl	main memory and swap usage
check_snmp_vrrp.pl	querying a Nokia-VRRP cluster[21]

[20] http://www.mrtg.org/

[21] The abbreviation VRRP stands for *Virtual Router Redundancy Protocol*.

continued

Plugin	Description
check_snmp_cpfw.pl	querying a Checkpoint firewall-1[22]

Keeping checks on storage media with check_snmp_storage

While the **check_snmp_disk** plugin, introduced in Section 11.4.1 from page 205, only checks the file systems entered in the NET-SNMP configuration, **check_snmp_storage.pl** is capable of querying any storage media—even swap space or main memory—without previous configuration on the target host. **check_snmp_storage.pl** tests the partial tree **mib-2.host** here, while **check_snmp_mem.pl** uses **ucdavis.memory**, so that it remains restricted to NET-SNMP.

The fact that you do not have to battle with OIDs, but instead can work with descriptions of the **swap space** type to specify the type of the storage medium, provides a certain level of convenience. These can be queried with **snmpwalk** as follows:

```
user@linux:~$ snmpwalk -v1 -c public swobspace hrStorageDescr
hrStorageDescr.2 = STRING: Real Memory
hrStorageDescr.3 = STRING: Swap Space
hrStorageDescr.4 = STRING: /
...
hrStorageDescr.11 = STRING: /net/swobspace/b
```

When the plugin is called, the text specified after the **STRING:** is sufficient or—if unique—a part of this:

```
nagios@linux:local/libexec$ ./check_snmp_storage.pl -H swobspace \
    -C public -m /net/swobspace/b -w 90 -c 95
/net/swobspace/b : 91 %used (34842MB/38451MB)  (<  90) : WARNING
nagios@linux:local/libexec$  ./check_snmp_storage.pl -H swobspace\
    -C public -m "Swap" -w 50 -c 75 -f
Swap Space : 0 %used (0MB/3906MB)  (<  50) : OK | 'Swap Space'=0MB;1953;
2930;0;3906
```

In the second example, it is sufficient to specify **Swap**, in order to query the data for **Swap Space**, since the pattern is unique. The **-f** option ensures that **check_snmp_storage.pl** will include performance data in its output.

-w and **-c** specify in normal fashion the warning or critical limits in percent of the available memory space. The following overview lists all the options:

[22] http://www.checkpoint.com/products/firewall-1/

-H *address* / --host=*address*
: This is the host name or IP address of the NET-SNMP agent that is to be queried.

-C *string* / --community=*string*
: This is the community string for read access.

-p *port* / --port=*port*
: *port* specifies an alternative port if the SNMP agent is not running on the default UDP port 161.

-m *string* / --name=*string*
: *string* contains a description of the device to be queried, corresponding to its description in hrStorageDescr (see above), such as -m "Swap Space" for swap devices, -m "Real Memory" for the main memory, or -m "/usr" for the partition mounted under /usr in the file tree.

-w *percent* / --warn=*percent*
: A warning is given in the default if the proportion of used memory is larger than the specified threshold. Other warning limits can be defined with the -T parameter.

-c *crit* / --critical=*crit*
: In the default, the status is categorized as critical if the proportion of used memory is larger than the specified critical limit. Other critical limits can also be specified with the -T parameter.

-T *option* / --type=*option*
: Selection options for specifying the critical and warning limits:

- pu (percent used): used capacity in percent
- pl (percent left): free capacity in percent
- bu (bytes used): used capacity in megabytes
- bl (bytes left): free capacity in megabytes

The default is -T pu.

-r / --noregexp
: Normally the description in the -m parameter is treated as a regular expression. For example, /var here stands for all file systems containing /var, for example /var and /var/spool/imap, provided that these are really two independent file systems. The -r option switches off the regular expression capability, so that specifying /var will then match this file system exactly, but not /var/spool/imap, for example.

-s / --sum

Instead of individual tests for several named memories, these are first added together (user space and overall capacity), and only then is the test performed on the limit values.

-i / --index

With -m, a text is normally specified, which turns up again in the description hrStorageDescr. With the -i option, the index table is used instead of the description. Here the Regexp capability also applies: -m 2 matches all the entries containing the number 2 in the index (that is, 2, 12, 20, etc.). It then makes sense to use the -r option at the same time.

-e / --exclude

Now all the memories that are matched by the -m specification are excluded from the test, the remaining ones are included in the test.

-f / --perfparse

This option provides an additional output of performance data that is not shown in the Web interface but can be evaluated by additonal tools (see Chapter 17).

Testing system load with check_snmp_load

The plugin checks either the average system loaded against the usual specification of three averages of 1 min, 5 min, and 15 min, or the CPU loaded in percent.

-H *address* / --host=*address*

This is the host name or IP address of the NET-SNMP agent to be queried.

-C *string* / --community=*string*

This is the community string for read access.

-p *port* / --port=*port*

port is the alternative UDP port on which the SNMP agent is running. The default is UDP port 161.

-w *warning_limit* / --warn=*warning_limit*

The warning limit is given either as a simple integer value in percent (e.g. 90) or as an integer triplet separated by commas, which defines the thresholds for the system load average for one, five, and 15 minutes (e.g. 8,5,5). The percentage load, on the other hand, always refers to the CPU load of the last minute.

If the plugin queries a NET-SNMP agent, you *must* additionally specify the -L option in the second variation, for the percentage, -N.

-c *critical_limit* / --crit=*critical_limit*
: This specifies a critical limit; the syntax is the same as that for **-w**.

-L / --linux
: This option specifies that the plugin queries the system mode of a Linux system via NET-SNMP.

-A / --as400
: This option specifies that the CPU loaded on an AS/400 machine is queried.

-I / --cisco
: This option specifies that the CPU load of a Cisco network component is involved.

-N / --netsnmp
: If the plugin queries the percentage CPU load of a Linux system via NET-SNMP, the **-N** option must be specified.

-f / --perfparse
: This option ensures the output of performance data that is not displayed in the Web interface, but can be evaluated by additional tools (see Chapter 17).

The following example queries the system load on the computer **swobspace** via NET-SNMP and specifies threshold values for the one-, five-, and fifteen-minute averages:

```
nagios@linux:local/libexec$ ./check_snmp_load.pl -H swobspace \
    -C public -w 1,2,3 -c 3,5,6 -L
Load : 0.05 0.07 0.06 : OK
nagios@linux:local/libexec$ ./check_snmp_load.pl -H swobspace \
    -C public -N -w 80 -c 90 -f
CPU used 3.0 : < 80 : OK | cpu_prct_used=3%;80;90
```

The second example involves the percentage CPU load on the same machine. Here we additionally request performance data, which as usual repeats not only the measured value but also the thresholds.

Chapter

12

The Nagios Notification System

What would be the point of system and network monitoring if it did not inform the right contact partner when things went wrong? Hardly any system or network administrator can afford to keep an eye on the Nagios Web interface continually and wait for changes in status to occur. A practical working system must inform the admin actively (push information), so that the admin has time to devote to other things and needs to intervene only when Nagios raises the alarm.

Whether a notification system does its job in practice or not is ultimately decided by how well it can be adjusted to the requirements of a specific situation. What may already be a critical error for one person may, for another, not be normal but still tolerable, and nothing is worse than being bombarded with supposed error messages that are not even seen as errors in a certain environment. An excess of wrong information can make the administrator careless, and at some point the real problems get lost in a flood of false messages.

Nagios provides a sophisticated notification system allowing your own environment to be fine-tuned to your own requirements. The wide range of settings at first seem confusing, but once you have understood the basic principle, everything becomes much clearer.

The efforts to keep Nagios small and modular also apply to the notification system: sending a message is again left by the system to external programs: from a simple e-mail through SMS, down to hardware solutions—such as a real traffic light on the server cabinet—anything is possible.

12.1 Who Should be Informed of What, When?

In order for Nagios to send meaningful messages, the administrator must answer four questions:

- When should the system generate a message?
- When should it be delivered?
- Whom should the system inform?
- How should the message be sent?

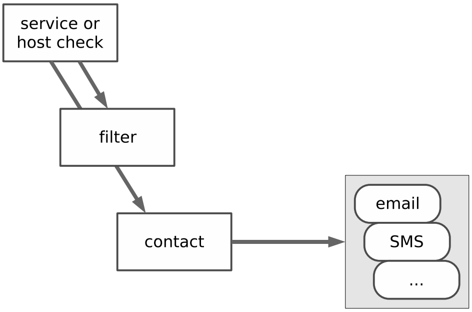


Figure 12.1: An overview of the notification system

Figure 12.1 gives a rough outline of the concept. The service and host check generate the message, which then runs through various filters,[1] which usually refer to the time. The ***contact*** refers to the person whom Nagios should inform. If the message has passed all tests, the system hands it to an external program, which informs the respective contact.

[1] Strictly speaking, filters defined in the host or service prevent a message from being created, instead of filtering already generated messages. To keep things simple, however, we pretend that Nagios has created a message that is then discarded by a corresponding filter.

12.2 When Does a Message Occur?

Each message is preceded by a host or service check, which determines the current status. In the following two cases it generates a message:

- One hard state changes to another hard state.
- One computer or service remains in a hard error state. (The test therefore confirms a problem that already exists.)

To remind you: the **max_check_attempts** parameter (see Sections 2.3 and 2.5) defines in host and service objects how often a test should be repeated before Nagios categorizes a new status as "hard." If it is set to **1**, this is immediately the case and is followed by the corresponding message. With a value greater than 1, the system repeats the test that number of times, and only if they all come to the same new result—such as determining the CRITICAL error status—does the status finally change to the new hard state, thus triggering a new notification.

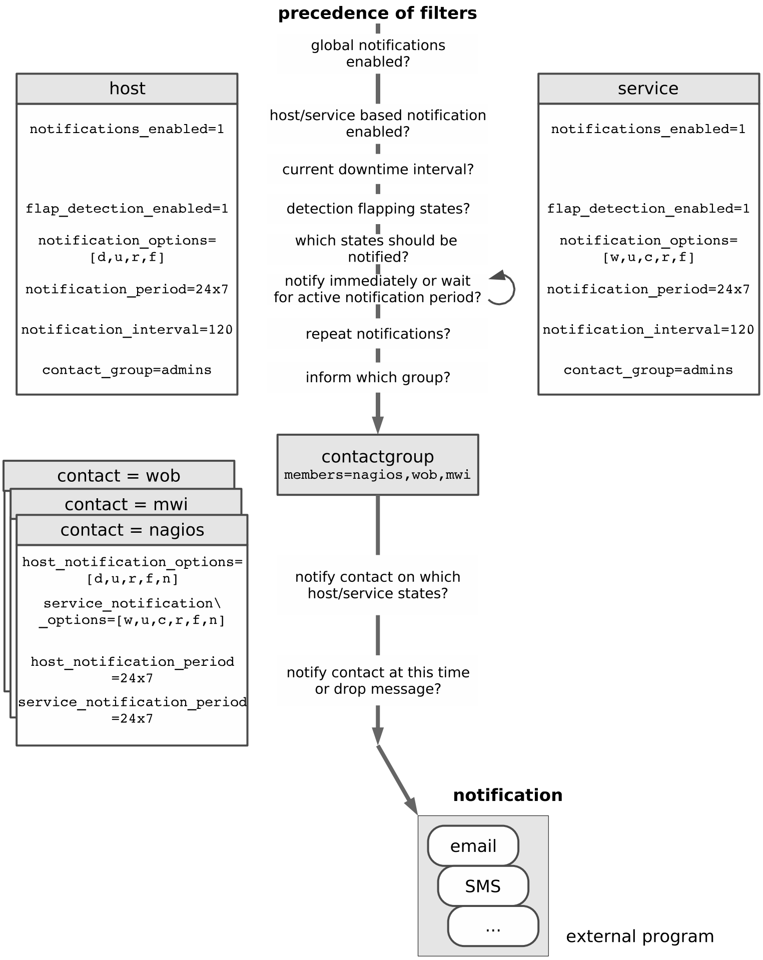
As long as Nagios has not exhausted the specified number of repeats, a soft state exists. If the old status reoccurs before these have finished, the administrator remains uninformed unless he looks at the Web interface or in the log file. Ultimately the administrator is only interested in genuine unsolved problems. On the other hand, to assess availability as such, it normally does matter if a service is not available for minutes on end, which is why the soft states are also taken into account in the evaluation.

12.3 The Message Filter

Even if you define on a systemwide basis that Nagios may bring attention to errors not just through the Web interface and log files but also via e-mail and/or SMS, filter parameters in the host and service definition may in individual cases cancel out these basic decisions. In all cases the final word is had by the filters defined for the relevant contact. Which parameters play a role on each of these three levels (systemwide, host/service, contact), is described in Figure 12.2.

If a filter stops a notification, the filter chain ends "in a vacuum," so to speak—filter options further down in the hierarchy remain unaccounted for—and Nagios does not generate any message.

Figure 12.2: Sequence of filters in the Nagios notification system


precedence of filters
global notifications enabled?
host/service based notification enabled?
current downtime interval?
detection flapping states?
which states should be notified?
notify immediately or wait for active notification period?
repeat notifications?
inform which group?
host
notifications_enabled=1
flap_detection_enabled=1
notification_options=[d,u,r,f]
notification_period=24x7
notification_interval=120
contact_group=admins
service
notifications_enabled=1
flap_detection_enabled=1
notification_options=[w,u,c,r,f]
notification_period=24x7
notification_interval=120
contact_group=admins
contactgroup
members=nagios,wob,mwi
contact = wob
contact = mwi
contact = nagios
host_notification_options=[d,u,r,f,n]
service_notification_options=[w,u,c,r,f,n]
host_notification_period=24x7
service_notification_period=24x7
notify contact on which host/service states?
notify contact at this time or drop message?
notification
email
SMS
...
external program

12.3.1 Switching messages on and off systemwide

With the **enable_notifications** parameter in the central configuration file **nagios.cfg**, you can in principal define whether Nagios should send messages at all. Only if it is set to **1** will the notification system work:

```
enable_notifications=1
```

12.3.2 Enabling and suppressing computer and service-related messages

When defining a host or service, various parameters can influence the messaging system. Here you can define, for example, at what time Nagios should send messages, whether the contact person is regularly informed of error states, and about which states or changes in state he should be informed (just CRITICAL, or WARNING as well, etc.).

The switch **notifications_enabled** determines whether this specific computer or service is important enough for the admin to be informed of errors not just through the Web interface, but also in other ways as well. If this is so, the parameter must be set to **1**:

```
notifications_enabled=1
```

This is also the case in the default, so that you have to set the value explicitly to **0** at this point to stop separate notifications.

Taking downtimes into account

At times when a specific service or host is intentionally not available, Nagios should certainly not send any error messages through the network. The configuration of corresponding maintenance periods (*downtime scheduling*) is only possible through the Web interface and is described in Section 16.3 from page 304.

What states and changes of state are worth a notification?

If a regular test shows that service or computer is changing its data continuously, this is called *flapping* in Nagios (see also Appendix A from page 401). If the **flap_detection_enabled** parameter is set to **1**, the system tries to detect this situation.

Whether Nagios sends a message in this case depends on the **notification_options** filter. This decides on which states or changes of state Nagios will inform the contact involved. In host definitions it can have the following combinations of values, separated by commas: **d** (switched off or crashed, *down*), **u** (*unreachable*), **r** (computer again reachable, *recovered*), and **f** (quickly alternating state, *flapping*).

For service objects, **notification_options** recognizes the following states: **c** (CRITICAL), **w** (WARNING), **u** (UNKNOWN, unknown problem), **r** (service again reachable, *recovered*), and **f** (*flapping*). Nagios correspondingly informs the admin of the state of the service whose definition is contained in the line

```
notification_options=c,r
```

only if this is critical or was recreated after an error state. Messages involving a WARNING or flapping are discarded by the system.

If notification_options is set to n (*none*), Nagios will generally not send a message concerning this computer or service.

When should Nagios send messages?

At what time should a message be sent? This can be defined with the notification_period parameter:

```
notification_period=24x7h
```

notification_period expects a time object (see Section 2.10 from page 54) as the value; 24x7h is such a value and stands for "round the clock."

Outside the specified time period, Nagios suppresses possible messages, but does not simply discard them, in contrast to the other filters. Instead of this, the system places the message in a kind of queue and sends it as soon as the notification period begins (*rescheduling*). This means that the relevant contact will certainly get to hear about the problem. Nagios also ensures that the admin receives the message only once, even if multiple messages on the same event were generated outside the time period.

notification_period is the only time-controlled filter in which a message is not lost, despite filtering. With all the other time filters, the message never reaches its destination outside the specified period of time.

With an *interval check*, Nagios can be instructed to report at regular intervals on problems that persist for a longer time:

```
notification_interval=120
```

If a state persists that Nagios should normally report, corresponding to the notification_option parameter—CRITICAL, for example—for a long time, the system would grant this wish, in the example, every 120 time units (normally, minutes). In other words it suppresses the notification that is generated anyway with every check, after a corresponding notification until the specified time has elapsed. If nothing has changed in the state until then, it then sends the corresponding notification.

If you set notification_interval to 0, Nagios will send a notification of this only once. You should be careful when doing this, however: filters defined for the contact can also reject messages. If you normally generate just one single message, which might arrive at the relevant admin outside the admin's chosen contact time period, then the admin will never be told anything about the problem, even if it persists into working hours.

Whose concern is the message?

The contact group defined in the host or service object does not itself belong to the message filters, but it still decides on who is informed and who is not:

```
contact_group=admins
```

What contacts belong to the specified group (here: **admins**) is defined by the corresponding **contact_group** object in its definition object (see also Section 2.8 from page 52):

```
# -- /etc/nagios/global/contactgroups.cfg
define contactgroup{
    contactgroup_name  admins
    alias              administrators
    members            nagios,wob,mwi
}
```

The specified contact group, though, merely makes a rough preselection: which of the contacts specified in it actually receive the message depends on the filter functions in the definition of the individual contact. In this way you can ensure that one employee is only notified during normal office hours, another one round-the-clock, and that one of them is kept up to date about all changes in status, and the other one is informed only of a selection (for example, only CRITICAL but not WARNING).

12.3.3 Person-related filter options

When defining the **contact** objects, the method is also specified in which Nagios delivers the notification in specific cases (see Section 12.4 from page 224). It can be described separately for host and service problems. Several parallel methods are also possible, such as via e-mail *and* SMS.

Since the contact-related filters are specifically for the corresponding contact object, it can certainly be useful to define several contacts for one and the same recipient that differ in individual parameters, such as a contact object that keeps the person informed via e-mail of all problems during normal working hours, and a second one for SMS messages concerning critical events outside working hours.

What should Nagios inform you about?

The events for which somebody should be informed can be specified not only by host or service, but also by contact. Host and service-related states are defined separately here:

```
host_notification_options=d,u,r
service_notification_options=c,r,u
```

The possible values are the same as those for the host-service parameter **notification_options** (page 219).

When do messages reach the recipient?

The final filter in the filter chain again refers to time periods. If a message is produced in the time period specified here, Nagios notifies the contact; otherwise it discards the message. The notification window can again be set separately for hosts and services, and as a value it expects a **timeperiod** object defined elsewhere:

```
host_notification_period=24x7
service_notification_period=workhours
```

12.3.4 Case examples

Letting you know once, but doing this reliably

What should you do if only a single message should be sent for each change in status of the service, but this message must always reach the relevant recipient during working hours? We can illustrate the solution to this problem through the example of the **admins** contact group to which the contact **wob** is assigned, ...

```
define contactgroup{
   contactgroup_name   admins
   alias               Local Site Administrators
   members             wob
}
```

...and to the **PING** service for the computer **linux01**:

```
define service{
   host_name                    linux01
   service_description          PING
   check_command                check_ping!100.0,20%!500.0,60%
   max_check_attempts           3
   normal_check_interval        2
   retry_check_interval         1
   check_period                 24x7
   notification_interval        0
   notification_period          workhours
   notification_options         w,u,c,r,f
   contact_groups               admins
}
```

notification_interval 0 normally forces Nagios not to produce any repeat messages. The **notification_period** ensures the desired time period through the **timeperiod** object **workhours**: if Nagios raises the alarm at other times, the inbuilt *rescheduling* is used, that is, the notification is sent on its way only if the specified time period again applies. It is definitely not discarded.

In order for Nagios to be active in all changes of state, the **notification_options** must always cover all possible events for services.

To guarantee that the contact **wob** always receives the messages, it is essential that the **service_notification_period** in the corresponding **contact** object is **24x7**:

```
define contact{
   contact_name                    wob
   alias                           Wolfgang
   host_notification_period        24x7
   host_notification_options       d,u,r
   service_notification_period     24x7
   service_notification_options    w,u,c,r,f
   ...
}
```

A restricted time filter at this position could, under certain circumstances, lead to the loss of each of the individual messages. The same applies for the values of **service_notification_options**: only if all are entered here as well will no message be lost.

Informing different admins at different times

If you want to inform different persons at different times about different events, you may not restrict either the **notification_period** or the **notification_options** of a host or service:

```
define service{
   ...
   notification_interval       120
   notification_period         24x7
   notification_options        w,u,c,r,f
   ...
}
```

Filtering takes place exclusively for individual contacts. For this to work on a time level you must ensure that Nagios generates a message regularly (here every 120 time units, normally minutes) if error states persist.

If admin A is to be informed only during his working hours, and then only of changes to critical or OK states, A's contact object will be sent with the following parameters:

```
define contact{
   ...
   service_notification_period     workhours
   service_notification_options    c,r
   ...
}
```

There is also a second and not quite so obvious difference to the first example: let us assume that the service reports the CRITICAL status at 7.30 in the morning, which will persist for several hours. The **workhours** object is defined so that it describes the time from Monday to Friday between 8.00 and 18.00. In the above example, Nagios holds back the message (rescheduling), until the time period defined in it has been reached. The administrator therefore receives a corresponding message at 8.00.

In the case described here, no rescheduling takes place, Nagios generates a corresponding message every two hours, which is filtered out if the contact is currently taking a "break." The system correspondingly discards the message at 7:30, but allows the next message two hours later to pass through. The administrator therefore does not receive the corresponding information until 9:30, provided that the problem still exists at this point in time.

Which of the two solutions is more suitable depends on specific requirements. For an e-mail notification, for example, it makes little difference if the administrator receives mails round-the-clock but reads them only when sitting in his office. A filter for Nagios messages in the mail client, sorting them in reverse chronological order (the most current mail first) makes sense in this case. Sitting in front of the screen, the administrator can also take a quick look at the Web interface when problems are announced, to check whether anything has changed.

If the methods of differentiation described so far are not sufficient, then escalation management, described in Section 12.5, may be of further help.

12.4 External Notification Programs

Which external programs deliver the messages is defined by thecontact definition.

Here there are again two parameters to define the commands to be used, one for services and one for hosts:

```
define contact{
  ...
  service_notification_commands  notify-by-email,notify-by-sms
  host_notification_commands     host-notify-by-email,host-notify-by-sms
  email                          nagios-admin@localhost
  pager                          +49-1234-56789
  address1                       root@example.com
  address2                       123-456789
  ...
}
```

Both *_notification_commands allow comma-separated lists, so it is permitted to specify more than one command at the same time. The message is then sent simultaneously to the recipient in all the ways defined. The names of the command objects describe these ways: via e-mail and via SMS.

To achieve a better overview, the corresponding commands are not defined together with the plugin commands in the file **checkcommands.cfg**, but in a separate object file, **misccommands.cfg**. Nagios loads these like any other file with object definitions, which is why any name can be chosen for them.

The other parameters, **email**, **pager**, **address1**, and **address2**, can be regarded as variables. The delivery commands access the values set in these through macros. Whether **pager** contains a telephone number for SMS delivery or an e-mail address pointing to an e-mail SMS gateway is immaterial for the contact definition. The decisive factor is that the value matches the corresponding command that references this variable.

12.4.1 Notification via e-mail

In defining the **notify-by-email** command, a name and the command line to be executed is specified, as with every other command object. Only its length is unusual, which is why it has had to be line-wrapped several times for this printed version:

```
define command{
  command_name    notify-by-email
  command_line    /usr/bin/printf "%b" "***** Nagios *****\n\n
Notification Type: $NOTIFICATIONTYPE$\n\nService: $SERVICEDESC$\nHost:
$HOSTALIAS$\nAddress: $HOSTADDRESS$\nState: $SERVICESTATE$\n\nDate/Time:
$LONGDATETIME$\n\nAdditional Info:\n\n$SERVICEOUTPUT$" | /usr/bin/mail
 -s "** $NOTIFICATIONTYPE$ alert - $HOSTALIAS$/$SERVICEDESC$ is
$SERVICESTATE$ **" $CONTACTEMAIL$
}
```

The printed-out command object comes from the included example file **misccommands.cfg-sample**. The command line defined in it can be reduced in principle to the following pattern:

```
printf text | mail -s "subject" e-mail_address
```

With the help of the macro, **printf** generates the message text, which is passed on to the mail program through a pipe. What is caused by the macros specifically used is revealed in Table 12.1.[2] Using this, the jumbo line shown above produces messages that look something like this:

```
To: wob@swobspace.de
Subject: ** PROBLEM alert - mail-WOB/SMTP is CRITICAL **
Date: Fri, 14 Jan 2005 16:22:47 +0100 (CET)
From: Nagios Admin <nagios@swobspace.de>

***** Nagios  *****

Notification Type: PROBLEM

Service: SMTP
Host: mail-WOB
Address: 172.17.168.2
State: CRITICAL

Date/Time: Fri Jan 14 16:22:47 CET 2005

Additional Info:

CRITICAL - Socket timeout after 10 seconds
```

Table 12.1: Macros used in notify-by-email and host-notify-by-email

Macro	Description
$CONTACTEMAIL$	Value of the **email** parameter from the contact definition
$LONGDATETIME$	Long form of data specification, e.g., **Fri Jan 14 16:22:47 CET 2005**
$HOSTALIAS$	Value of the **alias** parameter from the host definition
$HOSTADDRESS$	Value of the **address** parameter from the host definition
$HOSTNAME$	Value of the **host_name** parameter from the host definition
$HOSTOUTPUT$	Text output of the last host check
$HOSTSTATE$	State of the host: **UP**, **DOWN**, or **UNREACHABLE**
$NOTIFICATIONTYPE$	Type of notification: **PROBLEM** (CRITICAL, WARNING, or UNKNOWN), **RECOVERY** (OK after error state), **ACKNOWLEDGEMENT** (an admin has confirmed the error state; see Section 16.1.2, page 278), **FLAPPINGSTART** or **FLAPPINGSTOP**

[2] A complete list of all macros is contained in the original documentation at http://localhost/nagios/docs/macros.html (normally to be found in the file system under /usr/local/nagios/share/docs/macros.html).

continued

Macro	Description
$SERVICEDESC$	Value of the **description** parameter in the service definition
$SERVICEOUTPUT$	Text output of the last service check
$SERVICESTATE$	State of the service: OK, WARNING, CRITICAL, UNKNOWN

For the command **host-notify-by-email**, the command line looks similar, except that now host-related macros are used:

```
/usr/bin/printf "%b" "***** Nagios  *****\n\nNotification Type:
$NOTIFICATIONTYPE$\nHost: $HOSTNAME$\nState: $HOSTSTATE$\nAddress:
$HOSTADDRESS$\nInfo: $HOSTOUTPUT$\n\nDate/Time: $LONGDATETIME$\n" |
/usr/bin/mail -s "Host $HOSTSTATE$ alert for $HOSTNAME$!" $CONTACTEMAIL$
```

It generates e-mails with the following content:

```
To: wob@swobspace.de
Subject: Host UP alert for wob-proxy!
Date: Fri, 14 Jan 2005 17:50:21 +0100 (CET)
From: Nagios Admin <nagios@swobspace.de>

***** Nagios  *****

Notification Type: RECOVERY
Host: wob-proxy
State: UP
Address: 172.17.168.19
Info: PING OK - Packet loss = 0%, RTA = 69.10 ms

Date/Time: Fri Jan 14 17:50:21 CET 2005
```

12.4.2 Notification via SMS

While the infrastructure necessary for sending e-mails[3] is usually available anyway, programs for sending SMS messages such as **yaps**,[4] **smssend**,[5] or **smsclient**[6] usually have to be additionally installed. **yaps** and **smsclient** require a local modem or ISDN card and "telephone" directly with the cell phone provider (e.g., T-Mobile), **smssend** establishes a connection to the Internet servers of the cellphone provider and sends

[3] Apart from the **/usr/bin/mail** client, a local mail server is required.
[4] http://www.sta.to/ftp/yaps/
[5] http://zekiller.skytech.org/smssend_menu_en.html
[6] http://www.smsclient.org/

the SMS message on this route. With yaps und smsclient you can also use a mail gateway that generates and sends an SMS message from an e-mail.

Whichever method you choose, you should be aware of possible interference in sending messages: a connection between the Nagios server and the Internet passes through many hosts, routers, and firewalls. Especially if Nagios is itself monitoring one of the computers involved, things get interesting: if this machine is down, then a message sent via smssend will no longer work either. The same thing applies for e-mail-SMS gateways. Whether a self-made construction is involved, with yaps or smsclient, each of which represents its own SMS gateway, or a telecom installation with a sophisticated unified messaging solution, if the actual sender of the SMS is many nodes removed from the Nagios server (because you have a networked telephone installation with several locations, for example), the chances increase that the message will not reach its destination because of an interrupted connection.

For this reason the best solution is an smsclient or yaps installation on the Nagios server itself with a direct telephone access. In larger, networked telephone systems you can also consider giving the telephone access a dedicated, direct line from the telephone system. Whether this is ISDN or analog is just a question here of the technology used.

To represent the programs mentioned here, we will take a closer look at smsclient, which can be configured very simply, and has an active community. On its homepage you can also find a link to a mailing list whose members will be pleased to help in case you have questions.

Setting up smsclient

While Debian has its own precompiled smsclient package, for SuSE and other distributions you have to compile the software yourself. For historical reasons the program itself is called sms_client; a short subtext is provided with man sms_client.

The installation from the source code follows the usual procedure:

```
linux:~ # cd /usr/local/src
linux:local/src # tar xvzf /path/to/sms_client-2.x.y
linux:local/src # cd ./sms_client-2.x.y
linux:src/sms_client-2.x.y # ./configure
linux:src/sms_client-2.x.y # make && make install
```

The only point worth mentioning here is that the “homemade” configure procedure manages without autoconf and automake.

The configuration files listed in Table 12.2 are now located in the directory /etc/sms; the Debian package installs it to /etc/smsclient.

File	Description
sms_addressbook	Definition of aliases and groups
sms_config	Main configuration file
sms_daemons	Configuration file for the daemon mode of smsclient, in which this can be reached via a proprietary protocol. Is not required.
sms_modem	Modem configuration
sms_services	Supported provider

Table 12.2: smsclients configuration files

The file sms_services lists the supported providers and at the same time assigns them to the protocol used. The precise telephone number dialed is specified by the corresponding service file in the directory services (if you have compiled this yourself) or /usr/lib/smsclient/services (for Debian). In case of doubt, you should request the telephone number of your own mobile cell provider. The mailing list can also be of assistance here.

In the file sms_config you set a default provider, which the program uses for calls when the provider is not specifically given:

```
SMS_default_service  = "d1"
```

Only the configuration of the modem is now missing in the file sms_modem. In principle, however, any modem that functions under Linux can be used. In the following example we address an ISDN card with the Isdn4Linux-HiSax driver:

```
MDM_lock_dir       = "/var/lock"    # directory for the lock files
MDM_device         = "ttyI0"        # device name of the modem
...
MDM_command_prefix = "AT"
MDM_init_command   = "Z&E<MSN>"
MDM_dial_command   = "D"
MDM_number_prefix  = "0"            # outside line, if required
...
```

/dev/ttyI0 is used as the device here; for MDM_init_command, your own MSN is used. This applies particularly to private branch exchanges, which allow a connection only if your own MSN has been correctly specified. Since Isdn4Linux does not recognize tone or pulse dialing, we use only D instead of the usual DT as the MDM_dial_command. If the ISDN connection requires an outside line as part of a phone exchange, you should enter the corresponding prefix; otherwise this string remains empty.

smsclient requires write permissions both for the device used and for the log file /var/log/smsclient.log:

```
linux:~ # touch /var/log/smsclient.log
linux:~ # chgrp dialout /usr/bin/sms_client
linux:~ # chgrp dialout /dev/ttyI0 /var/log/smsclient.log
linux:~ # chmod 2755 /usr/bin/sms_client
linux:~ # chmod  664 /dev/ttyI0 /var/log/smsclient.log
```

To test this, you should now send—preferably as the user **nagios**, who will later use **smsclient**—an SMS message to your own cellphone (here to be reached at the number **01604711**):

```
nagios@linux:~$ sms_client 01604711 "Text"
Dialing SMSC 01712521002...
WARNING: read() Timeout
Connection Established.
Login...
SMSC Acknowledgment received
Login successful
Ready to receive message
Received Message Response: Message 3003123223 send successful - message
submitted for processing<CR>
Successful message submission
Disconnect...
Disconnected from SMSC
Hangup...
d1 Service Time: 17 Seconds
[000] d1:01604711 "Text"
Total Elapsed Time: 17 Seconds
```

Getting Nagios to work together with smsclient

If the second argument is missing in **smsclient**, which contains the message text, the program will read it from STDIN:

```
nagios@linux:~$ /bin/printf "%b" message | sms_client  number
```

Based on the command **notify-by-email**, described from page 225, we will use the second variation here for defining the **notify-by-sms** command:

```
# ’notify-by-sms’ command definition
define command{
   command_name    notify-by-sms
   command_line    /usr/bin/printf "%.150s"
      "$NOTIFICATIONTYPE$ $HOSTNAME$[$HOSTADDRESS$]/$SERVICEDESC$
      is $SERVICESTATE$ /$SHORTDATETIME$/ $SERVICEOUTPUT$" |
      /usr/bin/smsclient $CONTACTPAGER$
}
```

As usual, the entire command_line is written on a single line. Nagios obtains the telephone number (or alias) through the macro $CONTACTPAGER$, which reads out the value of the pager parameter from the contact definition. Since an SMS here may not be longer than 150 characters, we will considerably abbreviate the information, compared to the e-mail message. To be on the safe side (you never know how long the plugin output ($SERVICEOUTPUT$) really is), the printf format specification .150 (instead of %b) cuts off the text after 150 characters. Although we then do without the line breaks in the message, by means of \n, an SMS is never formatted cleanly, due to its limited display. Thus notify-by-sms generates a one-line message of the following type:

```
PROBLEM elimail[172.17.130.1]/UPS is CRITICAL /2005-03-30 17:00:53/
Connection refused
```

12.5 Escalation Management

Whenever the administrators responsible cannot find a solution in the specified time when important components fail, although Service Level Agreements or other contracts commit the IT department to do this,[7] Nagios's ability to escalate notifications makes allowances for conflicts, at least on an organizational level. It can be used to provide multilevel support. For example, Nagios first informs the *First Level Support* (usually the *Help Desk*). If the problem still persists after one day, then the *Second Level Support* is notified, and so on.

Nagios also makes a distinction here between host- and service-related escalation stages. In essence, both function identically.

In the escalation, Nagios does not count in time units, but in how many messages it has already sent out. In the following example the system should report on error states of the Database service on linux01 every 120 minutes,[8] and this, round-the-clock:

```
define service{
    host_name              linux01
    service_description    Database
    notification_period    24x7
    notification_interval  120
    ...
    contact_groups          admins
}
```

The corresponding messages always go to a contact group, so without escalation, that is to admins.

[7] These can also be internal specialist departments.
[8] To be precise, every 120 time units, whereby the default time unit is 60 seconds.

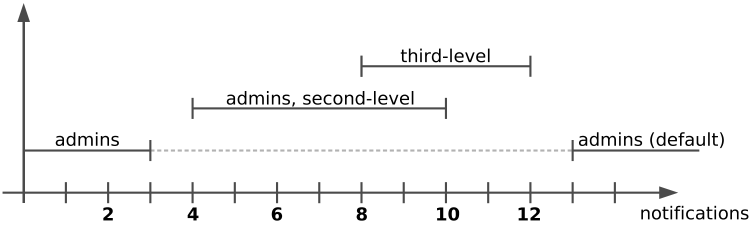


Figure 12.3: Nagios escalates, depending on the number of messages already sent

After the fourth notification, Nagios should switch on the first stage of escalation (as illustrated in Figure 12.3) and, in addition to **admins**, should notify the **second-level** contact group. The eighth message triggers the second level, at which Nagios informs the **contact_group third-level**.

As shown in Figure 12.3, escalations may certainly overlap. It can also be seen from the graphics that the contact group defined in the service object only applies as long as Nagios does not escalate. As soon as an escalation stage is switched on, the system puts the default contact group out of action.

If the original contact group—here **admins**—should also receive a message in the first escalation level, then this must be additionally specified in the escalation definition. If several levels overlap, Nagios informs all the groups involved. In Figure 12.3 the eighth to the tenth messages accordingly go both to **admins** and to **second-level** and **third-level**, while only the latter receives message numbers 11 and 12. From message number 13, Nagios keeps only the contact group **admins** informed, since escalation is no longer defined here.

The latter takes place via separate **serviceescalation** (for services) and **hostescalation** objects (for computers). For a service escalation object, Nagios requires the beginning and the end of exceptional circumstances to be defined, apart from service details (consisting of the **service_description** and **host_name**) parameters and the name of the contact groups responsible:

```
define serviceescalation{
    host_name              linux01
    service_description    Database
    first_notification     4
    last_notification      10
    notification_interval 60
    contact_groups         admins,second-level
}
```

The escalation level defined here starts, as desired, with message No 4 and ends with message No 10. If **last_notification** is given the value **0**, the escalation only ends if the service changes back to the OK state.

In addition you must specify the notification_interval parameter for service escalations: this changes the notification interval (previously 120 according to the service definition) to 60 time units. This parameter is also mandatory for a host escalation. The only difference in the definition of a hostescalation object is that instead of the host name, you can also specify one or more host groups (in addition the service_description parameter is dropped, of course).

The second escalation step is defined in the same way:

```
define serviceescalation{
    host_name             linux01
    service_description   Database
    first_notification    8
    last_notification     12
    notification_interval 90
    contact_groups        third-level
}
```

If there are overlapping escalations with different notification_intervals, Nagios chooses the smallest defined time unit in each case. Nagios therefore sends messages 8 to 10 at intervals of 60 minutes, numbers 11 and 12 at intervals of 90 minutes, and then the original interval of 120 minutes again applies.

With escalation_period and escalation_options there are two more setting parameters specially for escalations. Both have the same function as notification_period and notification_options in the host or service definition, but they refer only to the escalation case.

In contrast to notification_interval, escalation_period *does not replace* the notification_period, but acts in addition to this. From the intersection of notification_period and escalation_period, the actual time period is deduced. Suppose that notification_period refers to the time between 7:00 A:M and 5:00 P.M., and escalation_period to the period from 8:00 A.M. to 8:00 P.M.. Then Nagios will only send out messages in the escalation level between 8:00 A.M. and 5:00 P.M.. You must always remember here that it is only the number of messages that have already been sent that decides whether an escalation level exists. escalation_period and escalation_options only have an effect as additional filters.

Before these two parameters are used, you should carefully consider what it is you want to achieve with them. To restrict the escalation to a specific time period could under certain circumstances result in it being omitted entirely. If you restrict them to weekdays, for example, this would mean that if the Database service failed during the weekend, Nagios would inform the contact group admins only on Monday morning: over the weekend the system has already sent more than 12 messages, so it no longer even uses its escalation mechanism. If there is a time restriction via escalation_period, you should set last_notification to 0 to ensure that the escalation really does take place.

Every case of error is followed at some point in time by a recovery. An intelligent mechanism ensures that Nagios only notifies those contacts of the corresponding recovery who have previously been informed of an error state.

12.6 Dependences between Hosts and Services as a Filter Criterion

If you test services with local plugins (see Chapter 7) via NRPE (see Chapter 10), all these tests will come to nothing the moment the Plugin Executor fails. With ***service dependencies*** you can prevent Nagios from flooding the appropriate administrator with messages on the dependent services. Instead of this, the system informs him specifically of the NRPE failure.

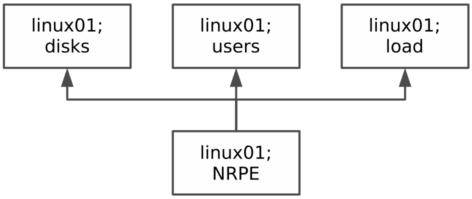
Aa with such service dependencies, Nagios also has ***host dependencies***, which suppress messages, depending on individual hosts. Both variations can also be used to specifically "switch off" tests.

12.6.1 The standard case: service dependencies

Let us take as an example the host linux01, illustrated in Figure 12.4, on which locally installed plugins, controlled via NRPE, monitor hard drive space (Disks service, see page 174), the number of logged-in users (Users service), and the system load (Load service). If NRPE were now to fail, Nagios would announce the CRITICAL state for all three services, although their actual state is unknown, and the real problem is the "NRPE daemon."

In order to solve this contradiction, NRPE is defined and monitored as a separate service and describes the dependencies in a servicedependency object.

Figure 12.4: The three above-mentioned services depend on NRPE



To define the additional service check for NRPE, we make use of the possibility of calling the check_nrpe plugin (see page 166) (almost) without any parameters at all. It then simply returns the version of the NRPE daemons being used:

```
nagios@linux:~$ /usr/local/nagios/libexec/check_nrpe -H linux01
NRPE v2.0
```

The command defined in Section 10.4 on page 172, **check_nrpe**, requires further arguments and therefore cannot be used for our purposes. For this reason we set up a new command object, **test_nrpe**, which exclusively tests NRPE:

```
define command{
    command_name    test_nrpe
    command_line    $USER1$/check_nrpe -H $HOSTADDRESS$
}
```

With this, an **NRPE** service can now be defined:

```
define service{
    host_name           linux01
    service_description NRPE
    check_command       test_nrpe
    ...
}
```

The dependencies of the three local services of NRPE are described by the following **servicedependency** object.

```
define servicedependency{
    host_name                      linux01
    service_description            NRPE
    dependent_host_name            linux01
    dependent_service_description  Disks,Users,Load
    notification_failure_criteria  c,u
    execution_failure_criteria     n
}
```

host_name and **service_description** define the master service, the failure of which leads to the failure of the services named in **dependent_service_description** on the computer specified in **dependent_host_name**. Multiple entries, separated by commas, are possible for all four parameters mentioned. You should bear in mind, however, that each dependent service is dependent on every possible master service.

The remaining parameters influence service checks and notifications: **notification_failure_criteria** specifies for which states of the master service notifications involving an error of the dependent services (e.g., **Disks**) should not appear. Possible values are **u** (UNKNOWN), **w** (WARNING), **c** (CRITICAL), **p** (PENDING, i.e., an initial check is planned but was so far not yet carried out), **o** (OK), and **n** (None).

u,c in the example above means that Nagios does not inform the administrators responsible of “errors” in the services **Disks**, **Users**, and **Load** on **linux01** if the master service is in the CRITICAL or UNKNOWN state. With an **o** for OK, the logic can be reversed: here there is no message if there is an error in the dependent service, as long as the master service is in an OK state. Accordingly, **n** means that Nagios provides a notification irrespective of the status of the master service.

The **execution_failure_criteria** parameter controls tests, depending on the state of the master service. The details **u** (UNKNOWN), **w** (WARNING), **c** (CRITICAL), **p** (PENDING), **o** (OK), and **n** (None), as with **notification_failure_criteria**, refer to states of the master service for which there should be no check. In the example, **n** is specified, so that Nagios tests **Disks**, **Users**, and **Load** even if NRPE fails.

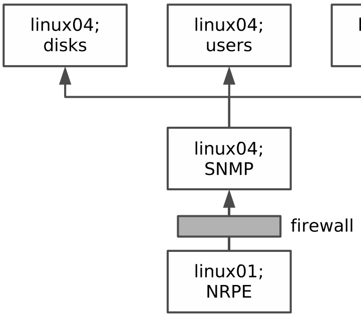
Nagios therefore suppresses messages, but since it still carries out the service checks on the dependent services, the Web interface always shows the current status of these.

The details for **notification_failure_criteria** interact with the *Freshness mechanism* of passive tests (see Section 13.4 from page 243). If **check_freshness** is used in the service definition, and if Nagios considers the most recently determined status to be out of date, it will carry out active tests even if it ought to suppress them, according to the service dependency.

Inheritance

Nagios does not automatically inherit dependencies. An example of this is shown in Figure 12.5: on the internal side of a firewall, the system should query various resources via SNMP. For security reasons, the test is performed indirectly via NRPE, that is, the Nagios server runs the SNMP plugins, which are installed on a host inside the file, indirectly via NRPE.

Figure 12.5: Multilevel dependencies for services



The following two **servicedependency** objects describe a dependency between the **SNMP** (Master) service and the **Disks** service (dependent service) on the host **linux04**, as well as between the **NRPE** service on **linux01** and the **SNMP** service on **linux04**:

```
define servicedependency{
    host_name                      linux04
    service_description            SNMP
    dependent_host_name            linux04
    dependent_service_description  Disks
    notification_failure_criteria  c,u
    execution_failure_criteria     c,u
}

define servicedependency{
    host_name                      linux01
    service_description            NRPE
    dependent_host_name            linux04
    dependent_service_description  SNMP
    notification_failure_criteria  c,u
    execution_failure_criteria     c,u
}
```

If the NRPE daemon on linux01 fails, Nagios would only recognize the defined dependencies between NRPE and SNMP, but not the implicit dependency between NRPE and Disks. To take these into account as well, the parameter inherits_parent is inserted in the definition of the service dependency between Disks and SNMP:

```
    inherits_parent                1
```

With this, Nagios tests whether the master service itself (here SNMP) is dependent on another service, thanks to a corresponding servicedependency. If the NRPE service on linux01 fails (CRITICAL state), Nagios leaves out the check of Disks on linux04, thanks to execution_failure_criteria c,u, and also does not send any notification of the most recently detected status of Disks.

Other application cases

Dependency definitions between services are particularly useful if a great deal depends on a single service, so that the actual problem is in danger of disappearing under a flood of error messages. Apart from the already described use in combination with NRPE, this applies for all services that the Nagios server cannot test directly and for which it must use tools instead (NRPE, SNMP, or even NSCLIENT for Windows, see Section 18.1). If a simple connection to the utility cannot be established and a constant value (version number, system name) cannot be queried, you can still use a generic plugin to address the corresponding port.

Another example of using service dependencies are the applications that depend on a database: a Web application with dynamic Web pages fails if the underlying database (which may be located somewhere in the network on another host) is not working. A precisely defined dependency between the database service and dynamic Web application also ensures here that the administrator is notified of the actual cause.

12.6.2 Only in exceptional cases: host dependencies

Host dependencies function in principle exactly like service dependencies; the **hostdependency** object is also capable of suppressing messages.

There are a number of subtle differences in the detail, however. Only explicitly configured regular host checks can be suppressed in which checked intervals are defined as for services. This type of host check should be used only in exceptional circumstances, however, since it can have a significant influence on the performance of Nagios. Normally Nagios decides for itself when it will perform a host check (see Section 4.1 from page 72).

In nearly all cases the **parents** parameter in the host definition is better at describing the dependencies between hosts. As long as Nagios can test individual hosts directly, the system can distinguish much better between DOWN and UNREACHABLE (see Section 4.1 from page 72). If you do not want any notification for particular hosts, dependent on the network topology, then you should be informed only for DOWN, but not for UNREACHABLE.

Host dependencies should be used only when Nagios can no longer distinguish between DOWN and UNREACHABLE. This is usually the case when the host check is is performed indirectly (e.g., in Figure 12.1 on page 175).

Chapter 13

Passive Tests with the External Command File

Apart from active service and host checks, Nagios also makes use of passive tests (and combinations of both types of test). While the system itself defines the time for active checks when they are performed, and then initiates them, Nagios in passive mode only processes incoming results.

For this to work, an interface is required that allows test results from the outside to be passed on to Nagios, as well as commands that perform checks and feed in the results through the interface. Normally remote hosts send their test results, determined by shell scripts, via the *Nagios Service Check Acceptor* (NSCA), which is introduced in the next chapter (page 247), to the Nagios server.

Passive checks are used in particular with distributed monitoring, in which noncentral Nagios servers send all their results to a central Nagios instance. This subject is discussed in Chapter 15. Another field in which they are used is in the processing of asynchronous events, the time of which Nagios cannot define itself. One example of this is a backup script that sends a result to Nagios (OK or CRITICAL) when it has completed a data backup, and another example is processing SNMP traps (see Section 14.6).

13.1 The Interface for External Commands

The interface for external commands, known in Nagios jargon as *External Command Files*, consists of a named pipe (FIFO)[1] in the subdirectory rw of the Nagios var directory:

```
user@linux:~$ ls -lF /var/nagios/rw
prw-rw----  1 nagios nagcmd 0 Dec 19 10:56 nagios.cmd|
```

The pipe, marked in the ls output with p, correctly sets up the make install-commandmode command during installation. For reasons of security it is essential that you ensure that only the group nagcmd can read from and write to the pipe. Anyone who has access here can control Nagios remotely via commands, and can, if they want, shut it down entirely.

Commands that Nagios accepts from the External Command File have the following form:

```
[timestamp] command;arguments
```

As the timestamp in square brackets, Nagios expects the current time in epoch seconds, that is the number of seconds which have elapsed in the UTC time zone since January 1, 1970. This is followed by a space, then a command followed by a matching number of arguments, separated by a semicolon.

The interface makes extensive use of this mechanism, allowing its users to make various settings via mouse click.[2] In this chapter we will limit ourselves to the two processing commands with which computers deliver the results of passive checks to the Nagios server, PROCESS_SERVICE_CHECK_RESULT and PROCESS_HOST_CHECK_RESULT.

For reasons of security, the processing of external commands must be explicitly switched on in the main configuration file nagios.cfg with the directive check_external_commands=1:

[1] A named pipe is a buffer to which a process can write something, which can then be read by another process. Whatever is written first is also read first: *First In, First Out* (FIFO). Since this involves space in the main memory, a named pipe does not need any space on the hard drive.

[2] A detailed description of all possible commands is provided by the online documentation at http://localhost/nagios/docs/extcommands.html or file:/usr/local/nagios/share/docs/extcommands.html.

```
# /etc/nagios/nagios.cfg
...
check_external_commands=1
command_check_interval=-1
command_file=/var/nagios/rw/nagios.cmd
...
```

The **command_check_interval** determines that Nagios checks the interface for existing commands every so many seconds. **-1** means "as often as possible." **command_file** specifies the path to the named pipe.

13.2 Passive Service Checks

In order for Nagios to be able to accept passive service checks via the interface, this must be explicitly allowed in the global configuration and in the corresponding service definition. The corresponding entry in **nagios.cfg** is

```
# /etc/nagios/nagios.cfg
...
accept_passive_service_checks=1
...
```

In the service definition you can select whether you want to perform active checks in parallel to the passive ones. Active checks are only possible, of course, if Nagios can query the information itself. The following example allows passive checks and stops all active ones:

```
define service{
    host_name              linux01
    service_description    Disks
    passive_checks_enabled 1
    active_checks_enabled  0
    check_command          check_dummy
        check_period           none
    ...
}
```

An exception is normally made for *freshness checks* (see Section 13.4 from page 243)—here Nagios makes use of the command defined in **check_command**. To ban active checks entirely, the **check_period** parameter is set to **none**. The check command does not play a role in this case, so you can just enter a dummy check here, for example (which like all other commands has to be defined, of course).

On the computer to be tested passively (in this example, **linux01**) you must ensure, via NSCA (see Chapter 14), that it contacts the Nagios server through the interface for external commands. There it writes the command for passive service checks in the following one-line form:

```
[timestamp] PROCESS_SERVICE_CHECK_RESULT;host-name;service;
return value;plugin output
```

The timestamp can be created in a shell script, for example with **date**:

```
user@linux:~$ date +%s
1112435763
```

A simple script that passes on the result of a passive service check on the Nagios server itself to the Nagios installed there, could look like this:

```
#!/bin/bash
EXTCMDFILE="/var/nagios/rw/nagios.cmd"
TIME=`date +%s`
HOST=$1
SRV=$2
RESULT=$3
OUTPUT=$4
CMD="[$TIME] PROCESS_SERVICE_CHECK_RESULT;$HOST;$SRV;$RESULT;$OUTPUT"

/bin/echo $CMD >> $EXTCMDFILE
```

When it is run it expects the parameters in the correct sequence:

```
name_of_script linux01 Disks 0 'Disks ok: everything in order :-)'
```

After the host and service names, the test status follows as a digit, and finally the output text. If the service name contains spaces, then it should also be set in quotation marks.

13.3 Passive Host Checks

Passive host checks follow the same principle as passive service checks, except that they involve computers and not services. To allow them globally, the **accept_passive_host_checks** parameter is set in **nagios.cfg** to 1:

```
# /etc/nagios/nagios.cfg
...
accept_passive_host_checks=1
...
```

In addition, the host definition for the computer to be monitored passively must allow this kind of host check:

```
define host{
    host_name              linux01
    passive_checks_enabled 1
    active_checks_enabled  0
    check_period           none
    check_command          check_dummy
    ...
}
```

In this example it simultaneously forbids active checks.

The command to be sent through the external interface with which the computer delivers its test results differs here only marginally from the syntax used in the service check command already introduced:

```
[timestamp] PROCESS_HOST_CHECK_RESULT;hostname;return  value;
plugin output
```

Active and passive host checks differ in one important respect: with passive checks, Nagios is no longer in a position to distinguish between DOWN and UNREACHABLE (see Section 4.1 from page 72). If you still want to take account of network topology dependencies when making notifications and to give specific information on the actual host that is down, you must make use of host dependencies in this case (see Section 12.6.2 from page 238).

13.4 Reacting to Out-of-Date Information of Passive Checks

It lies in the nature of passive checks that Nagios is content with the information delivered. Nagios has no influence over when and at what intervals the remote host delivers them. It may even be the case that the information does not arrive at all.

In order to classify the "knowledge state" of the server as out of date, Nagios has the ability to become active itself, with a *freshness check*. Like passive checks, freshness checking must be enabled both globally and in the relevant serviceable host object. To do this, you need to set the following global parameters in the file nagios.cfg:

```
# /etc/nagios/nagios.cfg
...
check_service_freshness=1
```

```
service_freshness_check_interval=60
check_host_freshness=0
host_freshness_check_interval=60
...
```

The value 0 in check_host_freshness and the value 1 in check_service_freshness ensure that Nagios carries out freshness checks only for services, and not for hosts. The check interval defines the intervals at which the server updates its information, in this case, every 60 seconds. When Nagios really becomes active in the case of a specific service or host depends on the threshold value, which you can set in the appropriate service or host definition with the freshness_threshold parameter:[3]

```
define service{
    host_name              linux01
    service_description    Disks
    passive_checks_enabled 1
    active_checks_enabled  0
    check_freshness        1
    freshness_threshold    3600
    check_command          service_is_stale
    ...
}
```

So in this example Nagios performs the freshness check for this service only if the last transmitted value is older than 3600 seconds (one hour). Then Nagios starts the command defined in check_command, even if active checks have been switched off in the corresponding host or service definition, or even globally.

If you define the command named here in the example, service_is_stale, so that Nagios really does check the service or host, then Nagios will perform active tests even if active checking is switched off, but always only if passive results are overdue for longer than the threshold value set.

If active checks are not possible or not wanted, you can ensure, using a pseudo-test, that Nagios will explicitly signal an error status, so that the administrator's attention is drawn to it. Otherwise Nagios will always display the last status to be received. If this was OK, then it will not necessarily be noticed that current results have not been arriving for some time. The following pseudo-test script delivers an appropriate error message with echo, and with exit 2 delivers the return value for CRITICAL, so that the administrator can react accordingly:

```
#!/bin/bash
/bin/echo "CRITICAL: no current results of the service"
exit 2
```

[3] If you do not explicitly specify freshness_threshold, the value set for normal_check_interval will be used in the hard state, and if there is a soft state, the value retry_check_interval will serve as the default.

If you start the script from the plugin directory as **service_is_stale.sh**, the Nagios command **service_is_stale** will be defined as follows:

```
define command{
   command_name    service_is_stale
   command_line    $USER1$/service_is_stale.sh
}
```

If the results for the service **Disks** on **linux01** fail to appear for longer than one hour, Nagios will run the script **service_is_stale.sh**, which always returns CRITICAL, irrespective of what data **linux01** last sent. This CRITICAL status is only ended when the host passes on new and more positive results to the server through a passive check.

14 Chapter

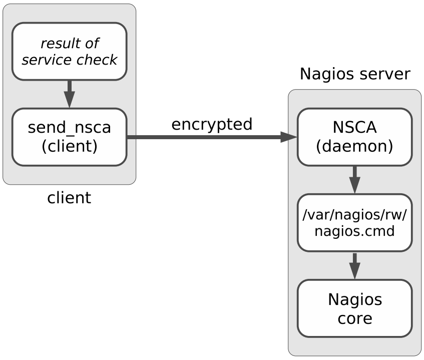
The Nagios Service Check Acceptor (NSCA)

In order to send service and host checks across the network to the central Nagios server, a transmission mechanism is required. This is provided by the *Nagios Service Check Acceptor* (NSCA). It consists of two components: a client program send_nsca, which accepts the results of a service or host check on the remote host and sends them to the Nagios server, and the NSCA daemon nsca, which runs on the server, receives data from the client, processes this for the External Command File interface (see Section 13.1), and passes this data on to it (Figure 14.1).

The Nagios Service Check Acceptor was originally developed to enable distributed monitoring in which decentralized Nagios servers can send their results to a central Nagios server (see Chapter 15 from page 265). In principle, the data that send_nsca sends to the Nagios server can come from any applications you like.

Sending commands across the network to the central Nagios instance is not insignificant, from a security point of view, since Nagios could be completely switched off using the External Command File. This is why NSCA sends the data in encrypted form, and clients must have the correct key to obtain access to the interface. This prevents an arbitrary network participant from being able to run any commands at all on the Nagios server.

Figure 14.1: How the NSCA functions



14.1 Installation

NSCA version 2.4, current at the time of going to press, was published in the summer of 2003; the chances are therefore quite high that the distribution you are using contains a current package. The source code[1] is quite easy to compile yourself, however. As a prerequisite, you need to have the library libmcrypt installed, together with the relevant header files,[2] or else the integrated encryption cannot be used.

In the unpacked source directory, you should run the included configure script, specifying the Nagios configuration and var directories:

```
linux:local/src # tar xvzf /path/to/nsca-2.4.tar.gz
...
linux:local/src # cd nsca-2.4
linux:src/nsca-2.4 # ./configure --sysconfdir=/etc/nagios \
   --localstatedir=/var/nagios
...
*** Configuration summary for nsca 2.4 07-23-2003 ***:
```

[1] http://www.nagiosexchange.org/Communication.41.0.html

[2] The corresponding binary package usually contains -dev or -devel in its name.

```
 General Options:
 -------------------------
 NSCA port:  5667
 NSCA user:  nagios
 NSCA group: nagios
...
```

At the end it displays output, showing the permissions with which the NSCA user starts by default, if not otherwise specified in the configuration. Normally the NSCA daemon waits on TCP port 5667.

A final **make all** compiles the two programs **nsca** and **send_nsca**. They are now located in the subdirectory **src** and need to be copied manually to a suitable directory:

```
linux:src/nsca-2.4 # cp src/nsca /usr/local/sbin/.
linux:src/nsca-2.4 # scp src/send_nsca remote    host:/usr/local/bin/.
```

nsca is copied to the Nagios server, preferably to the directory **/usr/local/sbin**. **send_nsca** belongs on the remote host that is to send its test results to the Nagios server. If this computer has a different operating system version or platform, it is possible that the client to run there will need to be recompiled.

Both programs each require their own configuration file, which is best stored in the directory **/etc/nagios**:

```
linux:src/nsca-2.4 # cp nsca.cfg /etc/nagios/.
linux:src/nsca-2.4 # scp send_nsca.cfg remote_host:/etc/nagios/.
```

14.2 Configuring the Nagios Server

14.2.1 The configuration file nsca.cfg

For NSCA to work, the External Command File interface on the Nagios server must be activated in the configuration file **/etc/nagios/nagios.cfg** (Section 13.1, page 240) and the corresponding data entered in the NSCA configuration file **nsca.cfg**:

```
# /etc/nagios/nsca.cfg
server_port=5667
server_address=192.168.1.1
allowed_hosts=127.0.0.1
nsca_user=nagios
nsca_group=nagios
debug=0
command_file=/var/nagios/rw/nagios.cmd
```

```
alternate_dump_file=/var/nagios/rw/nsca.dump
aggregate_writes=0
append_to_file=0
max_packet_age=30
password=verysecret
decryption_method=10
```

The parameters server_port, server_address, allowed_hosts, nsca_user, and nsca_group take effect only if nsca is started as a daemon. If it is started as an inet daemon, the values set in its configuration apply to the NSCA server address and the port on which the NSCA is listening, the IP addresses of the hosts that are allowed to access the interface,[3] and the users and group with whose permissions the Service Check Acceptor runs.

The debug parameter makes it easier to search for errors, but it should normally be switched off (value 0). If it is set to 1, NSCA writes debugging information in the syslog.

The named pipe is defined by the entry command_file. If you specify an alternative output file, with alternate_dump_file, this serves as a fallback in case the named pipe given does not exist. Before version 2.0, Nagios removed the pipe each time it was shut down, but this should not happen anymore.

If it is set to 1, aggregate_writes ensures that NSCA collects all the incoming commands just once and then passes these on to the interface as a block. If the value at this position is 0, then NSCA sends on each incoming command immediately to the External Command File.

append_to_file can have the values 0 (opens the External Command File in write mode) or 1 (opens it in the append mode), and it should always be set to 0.[4]

Client messages older than max_packet_age seconds are discarded by NSCA, to avoid replay attacks. This value may not be larger than 900 seconds (15 minutes) and should be as small as possible.

The last two parameters refer to the encryption of the communication. password contains the actual key, which is identical for clients, and which must be entered in the configuration for the clients (cf. Section 14.3 on page 252). Because the key is written in the file in plain text, nsca.cfg should be readable only for the user with whose permissions the NSCA is running, which in our case is nagios:

```
linux:/etc/nagios # chown nagios.nagios nsca.cfg
linux:/etc/nagios # chmod 400 nsca.cfg
```

[3] If you want to define more than one IP address for allowed_hosts, they are separated by a comma.

[4] The append mode only makes sense if the External Command File is replaced for debugging purposes with a simple file.

Finally, decryption_method defines the encryption algorithm. The default is 1 (XOR), which is almost as insecure as 0 (no encryption). 10 stands for LOKI97, which is regarded as secure.[5] The list of all possible algorithms is contained in the supplied configuration file, which contains many old algorithms and some newer ones, such as DES (2), Triple-DES (3), Blowfish (8), and Rijndael (AES).[6]

14.2.2 Configurung the inet daemon

If you want to start nsca with the inet daemon, the following entry is added in the file /etc/services:

```
nsca    5667/tcp    # Nagios Service Check Acceptor (NSCA)
```

xinetd configuration

If the newer xinetd is used, the file nagios-nsca is created in the directory /etc/xinetd.d with the following contents:

```
# /etc/xinetd.d/nrpe
# description: NRPE
# default: on
service nrpe
{
   flags            = REUSE
   socket_type      = stream
   wait             = no
   user             = nagios
   group            = nagios
   server           = /usr/local/sbin/nsca
   server_args      = -c /etc/nagios/nsca.cfg --inetd
   log_on_failure  += USERID
   disable          = no
   only_from        = 127.0.0.1 ip1 ip2 ... ipn
}
```

The values printed in bold type for the user and group with whose permissions the NSCA should run, and the path to the NSCA daemon nsca (parameter server) and the corresponding configuration file, are adjusted if necessary to your own environment. The line only_from, as an equivalent to the nsca.cfg parameter allowed_hosts, takes in all the IP addresses, separated by spaces, from which the NSCA may be addressed. Distributions that include NSCA as a finished package and install xinetd by default, include a ready-to-use xinetd configuration file, where you only need to adjust this last parameter.

[5] http://en.wikipedia.org/wiki/LOKI97

[6] Rijndael-128: 14; Rijndael-192: 15; Rijndael-256: 16

In order for the new configuration to become effective, the xinetd init script is run with the reload argument:

```
linux:~ # /etc/init.d/xinetd reload
```

inetd configuration

If the standard inetd command is run, the following line is added (line-wrapped for the printed version) in the configuration file /etc/inetd.conf:

```
nsca   stream   tcp   nowait   nagios /usr/sbin/tcpd
      /usr/local/sbin/nsca -c /etc/nagios/nsca.cfg --inetd
```

If you want to leave out the TCP wrapper tcpd, you just omit the string /usr/sbin/tcpd. In this case you must also explicitly specify the user (nagios) with whose permissions the NSCA starts, the complete path to the binary nsca, and the configuration file with its absolute path. So that the Internet daemon can take account of the modification, its configuration must be reloaded:

```
linux:~ # /etc/init.d/inetd reload
```

14.3 Client-side Configuration

The configuration file send_nsca.cfg on the client side must contain the same encryption parameters as the file on the Nagios server:

```
password=verysecret
decryption_method=10
```

Since the key is also written here in plain text, it should not be readable for just any user. For this reason it is best to create a user nagios and a group nagios on the client side:

```
linux:~ # groupadd -g 9000 nagios
linux:~ # useradd -u 9000 -g nagios -d /usr/local/nagios \
    -c "Nagios Admin" nagios
```

You should now protect the file send_nsca.cfg so that only the user nagios can read it, and ensure, using the SUID mechanism, that the program send_nsca always runs under the user ID of this user. If you now grant execute permission to the group nagios, only its members may execute the NSCA client program:

```
linux:~ # chown nagios.nagios /etc/nagios/send_nsca.cfg
linux:~ # chown nagios.nagios /usr/bin/send_nsca
linux:~ # chmod 400 /etc/nagios/send_nsca.cfg
linux:~ # chmod 4710 /usr/bin/send_nsca
linux:~ # ls -l /usr/bin/send_nsca
-rws--x--- 1 nagios nagios  83187 Apr  2 17:56 /usr/local/bin/send_nsca
```

14.4 Sending Test Results to the Server

The client program send_nsca reads the details of a host or service check from the standard input, which the administrator must format as follows:[7]

```
host-name\tservice\treturn value\toutput
host-name\treturn value\toutput
```

send_nsca sends this to the Nagios server. The first line describes the format for service checks and the second line, that for host checks. The placeholder ***return value*** is replaced by the status determined, that is, 0 for OK, 1 for WARNING, 2 for CRITICAL, and 3 for UNKNOWN. By ***output***, a one-line text is meant, of the type that plugins provide as a support for the administrator. As the separator, a tabu sign is used (\t).

In order to make a complete command from this that can be understood by the external command, the NSCA daemon first prefixes the timestamp and the matching command (PROCESS_SERVICE_CHECK_RESULT or PROCESS_HOST_CHECK_RESULT). This is why only these two commands can be sent using NSCA.

send_nsca itself has the following options:

-H *address*
: This is the host name or IP address of the Nagios server to be addressed by NSCA.

-d *delimiter*
: This is the delimiter for the input; the default is a tab sign. The following example page uses the semicolon as a *delimiter*.

-c *path/to_the/configuration_file*
: This parameter specifies the path to the configuration file send_nsca.cfg. Since no path has been compiled into the client, send_nsca expects by default to find the file in the current directory. For this reason it makes sense to specify the absolute path with this option.

[7] Normally you have to ensure that test scripts you have written yourself produce the correct output; if you use Nagios plugins, you must reformat their output accordingly. Since the latter can be run much better directly with NRPE, this should be the exception to the rule.

-p *port*
: This defines an alternative port if the default, the TCP port 5667, is not used.

-to *timeout*
: After *timeout* seconds (by default, 10) send_nsca aborts the connection attempt to the NSCA daemon, if no connection is established.

With simple test scripts such as the following one, the functionality of the NSCA can be tested. A service is chosen as the test object, which is in a state other than UNKNOWN (e.g., OK), in this case, nmbd on the host linux01:

```
#!/bin/bash
CFG="/etc/nagios/send_nsca.cfg"
CMD="linux01;nmbd;3;UNKNOWN - just one NSCA test"

/bin/echo $CMD | /usr/local/bin/send_nsca -H nagios  -d ';' -c $CFG
```

The script puts it, from Nagios's point of view, into the UNKNOWN status. After it is run, you should discover if the transfer was successful:

```
nagios@linux:~$ bash ./test_nsca
1 data packet(s) sent to host successfully.
```

As soon as Nagios processes the command and you have reloaded the page in your browser, the Web interface displays the UNKNOWN status for the selected service. With the next active check, the previous status will be recovered.

Because it is so simple to send Nagios check results with send_nsca, it is essential that you protect the NSCA from misuse, as already demonstrated. On the client, you should restrict access to the client program send_nsca and to its configuration file and you should make sure that you have secure encryption, and on the server explicitly define the sender and IP addresses that are to be allowed.

14.5 Application Example I: Integrating syslog and Nagios

Linux and Unix systems as a rule log system-relevant events through syslog. Sooner or later you will probably want Nagios to also inform the administrator of important syslog events. To do this, you require passive service checks, NSCA for transmitting the results to the Nagios server, and a method of filtering individual block entries.

If you are using syslog-ng[8] instead of the standard BSD syslog, you can make use of its ability to set filters and to format the output using templates. The use of

[8] The "ng" stands here for *next generation*.

NSCA compensates for the fact that the program cannot itself transmit data in encrypted form.

This connection to Nagios is supplemented by programs to evaluate log files, such as **logcheck**,[9] which is contained in almost every Linux distribution, but it does not replace them. This is because Nagios can send individual e-mails for each event, but not for a summary of events, as **logcheck** does (usually once per hour). In addition to this, the Web interface always displays the last event in each case.

14.5.1 Preparing syslog-ng for use with Nagios

Apart from the source code, the **syslog-ng** homepage[10] also provides a detailed manual, which is why we shall only discuss the basic principle at this point. The software differentiates between the **source**, **filter**, and **destination**. All three objects can be combined in any form; they are defined in the configuration file **/etc/syslog-ng/syslog-ng.conf**:

```
# /etc/syslog-ng/syslog-ng.conf
source local {
   unix-stream("/dev/log");
   internal();
   file("/proc/kmsg" log_prefix("kernel: "));
};

destination console_10 {
   file("/dev/tty10");
};

filter f_messages {
   not facility(auth, authpriv) and
   level(info .. alert);
};

log {
   source(local);
   filter(f_messages);
   destination(console_10);
};
```

This example defines three sources at the same time: **unix-stream** reads from the socket **/dev/log**, through which most programs send their messages to the syslog. **internal** is the name of the source **syslog-ng** feeds with internal messages, and from the file **/proc/kmsg** syslog receives kernel messages. These are given the **kernel:** prefix, so that they can be be distinguished from normal log entries.

[9] http://sourceforge.net/projects/logcheck/

[10] http://www.balabit.com/products/syslog_ng/

The **destination** definition ensures that all syslog output appears on the console **tty10** (this can be displayed with Alt-F10).

filter defines what messages should reach this destination, if any. In the case of the **f_messages** filter, this is all messages matching the category (the **level**) **info** and that syslog does not provide with the stamp (the **facility**; see **man syslog.conf** and **man 3 syslog**) **auth** or **authpriv**. Alternatively **syslog-ng** filters according to a search pattern, with the instruction **match("*pattern*")**, according to the program doing the logging (**program("*program name*")**) and according to the source host (**host("*hostname*")**).

Finally the keyword **log** links the source, filter, and destination. Multiple specifications are possible here, so several sources and destinations can be specified in a single statement:

```
log {
   source1); source2; ...
   filter1; filter2; ...
   destination1; destination2; ...
}
```

If you specify several filters in a **log** statement, **syslog-ng** only allows data through that matches all filter criteria (AND link).

To integrate this into Nagios, use is made of the option of defining a program as a target, which is called for every event:

```
destination d_nagios_warn {
   program("/usr/local/nagios/misc/send_syslog.sh"
   template("$HOST;syslog-ng;1;WARNING: $MSG\n") template_escape(no));
};

destination d_nagios_crit {
   program("/usr/local/nagios/misc/send_syslog.sh"
   template("$HOST;syslog-ng;2;CRITICAL: $MSG\n") template_escape(no));
};
```

The **template** directive formats the output so that it is suitable for **send_nsca**, using a semicolon as the delimiter: host and service names (**syslog-ng**) are followed by the state (**1** = WARNING; **2** = CRITICAL), and then the actual output text is given. Apart from **$HOST** and **$MSG**, **syslog-ng** has a series of further macros, which are described individually in the documentation on the homepage. The parameter **template_escape** protects quotation marks in the text and is intended principally for SQL commands, so in this case it can be set to **no**.

The following script **send_syslog.sh** uses the bash function **read** to read from the standard input line by line, and for each line read it calls up **send_nsca**, which sends on the data—as described in this chapter—as a passive test result to Nagios:

```
#!/bin/bash
while read -r line; do
    echo $line | /usr/bin/send_nsca -H nagsrv -d ';' \
              -c /etc/nagios/send_nsca.cfg \
               1>/usr/local/nagios/var/send_syslog.log 2>&1
done
```

Because a semicolon is used as a delimiter, we specify this explicitly with the option **-d**. The status report that each **send_nsca** command displays on the standard output is diverted by the script into a separate log file (**/usr/local/nagios/var/send_syslog.log**).

Thanks to the **program** instruction in the syslog configuration, **syslog-ng** starts the script automatically. This is also the reason that the **send_nsca** command is in an endless loop: this means that **syslog-ng** does not run an external program every time there is a relevant event.

14.5.2 Nagios configuration: volatile services

In Nagios slang, "volatile" refers to services that show an error state only once. This refers to devices, for example, that automatically reset the state when an error is queried—which means that the error cannot be reproduced. The same applies for syslog entries: if a check following an error state returns an error, this will always be a second event. So we don't have a continuing error state here, but a problem that has again occurred.

For continuing error states, Nagios normally does not send any further messages for the time being. With the **is_volatile** parameter, however, it treats every error as if it had just occurred. Nagios logs the state, sends a notification, and implements the event handler—provided it is defined—(see Appendix B from page 409).

For **syslog-ng**, this means that each entry is seen as an independent event. In order that Nagios sees things in this way as well, the corresponding service definition contains the **is_volatile** parameter:

```
define service{
    host_name                linux01
    service_description      syslog-ng
    active_checks_enabled    0
    passive_checks_enabled   1
    check_freshness          0
    is_volatile              1
    max_check_attempts       1
    normal_check_interval    1
    retry_check_interval     1
    check_command            check_dummy!3!active check
    check_period             none
    contact_groups           localadmins
    notification_options    w,c,u
    notification_interval   480
    notification_period     24x7
}
```

Since the Nagios server should not test anything on its own, **active_checks_enabled 0** switches off active service checks. However, *freshness checking* (see Section 13.4 from page 243) can always cause Nagios to perform active tests. To prevent this, we set the **check_freshness** parameter in this case explicitly to **0**.

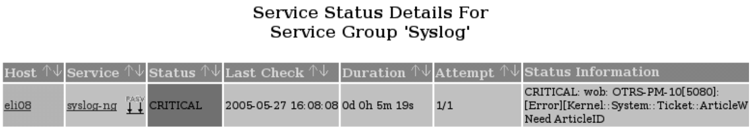
This service definition does not really require the parameters **check_command** and **check_period**, but since these are mandatory parameters, they must still be specified: as **check_command**, the plugin **check_dummy** (see Section 7.13 on page 154) is used.

It is also important that **max_check_attempts** is set to **1**, so that a transmitted error state immediately triggers a hard state. With a value larger than **1**, Nagios would wait for further error results here before categorizing the problem state as a hard state.

The **notification_options** parameter ensures that the system informs the specified contact group of all error states (WARNING, CRITICAL, and UNKNOWN). The **notification_interval**, which defines the interval between two notifications for a continuing error state, is actually superfluous, since Nagios, thanks to **is_volatile 1**, provides notification of every event immediately, irrespective of what the previous state looked like. But since it is a mandatory parameter, **notification_interval** still has to be specified.

14.5.3 Resetting error states manually

Events that are taken into account by the syslog filter always inform you of only one current state, which is why the syslog service in Nagios never displays an OK state on its own (Figure 14.2). This problem can be solved with the Web interface, which allows a passive check result to be generated manually.

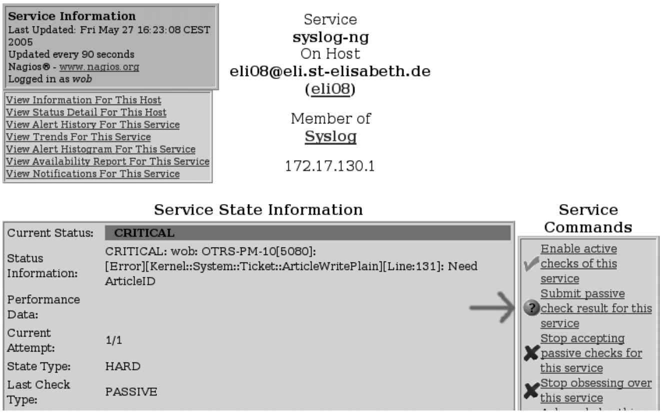


Service Status Details For
Service Group 'Syslog'

Host ↑↓	Service ↑↓	Status ↑↓	Last Check ↑↓	Duration ↑↓	Attempt ↑↓	Status Information
eli08	syslog-ng PASV	CRITICAL	2005-05-27 16:08:08	0d 0h 5m 19s	1/1	CRITICAL: wob: OTRS-PM-10[5080]: [Error][Kernel::System::Ticket::ArticleW Need ArticleID

Figure 14.2: The syslog-ng service in an error state

If you click on the service name in Figure 14.2, the extended status information will be shown (Figure 14.3). There you will find the entry **Submit passive check result for this service**, with which a test result can be sent manually (Figure 14.4). In this way the **syslog-ng** service can be reset to its normal state. Since the Web interface always shows only the most recent error state, but not individual error messages, you must look through the e-mail messages to see whether other errors have occurred apart from those errors displayed by Nagios in the Web interface.



Service Information
Last Updated: Fri May 27 16:23:08 CEST 2005
Updated every 90 seconds
Nagios® - www.nagios.org
Logged in as *wob*

View Information For This Host
View Status Detail For This Host
View Alert History For This Service
View Trends For This Service
View Alert Histogram For This Service
View Availability Report For This Service
View Notifications For This Service

Service
syslog-ng
On Host
eli08@eli.st-elisabeth.de
(eli08)

Member of
Syslog

172.17.130.1

Service State Information

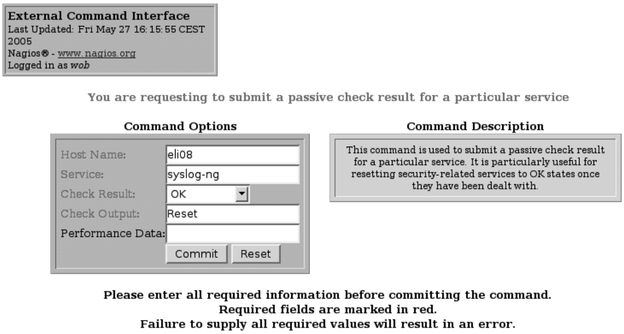
Current Status:	CRITICAL
Status Information:	CRITICAL: wob: OTRS-PM-10[5080]: [Error][Kernel::System::Ticket::ArticleWritePlain][Line:131]: Need ArticleID
Performance Data:	
Current Attempt:	1/1
State Type:	HARD
Last Check Type:	PASSIVE

Service Commands

Enable active checks of this service
Submit passive check result for this service
Stop accepting passive checks for this service
Stop obsessing over this service

Figure 14.3:
The arrow points to the possibility of "generating" a passive test result for the syslog-ng service

You can also define your own service for each syslog event, of course. This may sometimes be quite time-consuming, but it does allow you to separate various messages and their processing states in the Web interface. If the filter in syslog-ng is restricted so that a syslog service object always refers to just one resource to be monitored, you can also leave out the is_volatile parameter.



External Command Interface
Last Updated: Fri May 27 16:15:55 CEST 2005
Nagios® - www.nagios.org
Logged in as *wob*

You are requesting to submit a passive check result for a particular service

Command Options

Host Name:	eli08
Service:	syslog-ng
Check Result:	OK
Check Output:	Reset
Performance Data:	

Command Description

This command is used to submit a passive check result for a particular service. It is particularly useful for resetting security-related services to OK states once they have been dealt with.

Please enter all required information before committing the command.
Required fields are marked in red.
Failure to supply all required values will result in an error.

Figure 14.4:
Creating a passive check result syslog-ng

14.6 Application Example II: Processing SNMP Traps

Asynchronous messages that are sent by an SNMP agent (see Section 11.1 from page 178) to a central management unit, called *traps* in SNMP jargon, can be processed by Nagios in a way similar to the Nagios Service Check Acceptor (NSCA). In addition, it allows SNMP traps to be accepted on a host other than the Nagios server itself.

Processing SNMP traps with Nagios is particularly worthwhile if the system monitors the network almost completely, and only a few devices or services restrict their communication just to SNMP and SNMP traps. Nagios, or the Open Source tool OpenNMS,[11] are no substitutes for real commercial SNMP management systems.

In many cases, SNMP traps are vendor-specific, so that you cannot avoid getting to grips with the appropriate documentation and the vendor-specific MIB (*Management Information Base*; see Section 11.1.1 from page 179).

14.6.1 Receiving traps with snmptrapd

In order to receive SNMP traps, you require a special Unix/Linux daemon that generates messages for Nagios from them. The software package NET-SNMP, described in Section 11.2.2 from page 187, includes the daemon snmptrapd.

In the following scenario, snmptrapd is installed on a third host (neither the computer generating the trap, nor the Nagios server). It evaluates the information received by means of a script and forwards it with NSCA to the Nagios server.[12]

In the snmptrapd configuration file /etc/snmp/snmptrapd.conf, each trap type is given a separate entry, the syntax of which corresponds to one of the following lines:

```
traphandle oid program
traphandle oid program arguments
traphandle default program
traphandle default program arguments
```

The keyword traphandle is followed either by the object identifier of the desired trap, or by the keyword default. In the second case the entry applies to all traps that do not have their own configuration entry. Finally the program that should run if a relevant trap arrives is specified.

[11] http://www.opennms.org/

[12] If you install the snmptrapd on the Nagios server itself, you do not need NSCA and you can send a correspondingly formatted command, as described in Section 13.2 from page 241 directly to the interface for external commands.

In addition you can also include arguments used with this program. But you must be a bit careful when doing this. Quotation marks are passed on by **snmptrapd** as characters and spaces are always used as delimiters. This means that you cannot pass on any arguments containing spaces, which you should bear in mind when assigning name services in Nagios.

snmpdtrapd gives this program information via the standard output in the following format:

```
hostname
ip-address
oid value
...
```

The first line contains the ***fully qualified domain name*** of the host that sends the message and the second, its IP address. Then one or more OID-value pairs are given, each on a separate line. A particular event is very often linked to a unique OID-value pair, so that the program can often omit the evaluation of the OID-value pair entirely.

In the following **snmptrapd.conf** example, the lines are wrapped for readability. Each **traphandle** instruction ***must*** be entered on a single line:

```
# snmptrapd.conf
traphandle SNMPv2-MIB::coldStart /usr/local/nagios/libexec/eventhandler/
handle-trap SNMP cold-start
traphandle NET-SNMP-AGENT-MIB::nsNotifyRestart /usr/local/nagios/libexec
/eventhandler/handle-trap SNMP restart
traphandle NET-SNMP-AGENT-MIB::nsNotifyShutdown /usr/local/nagios/libexe
c/eventhandler/handle-trap SNMP shutdown
traphandle default /usr/local/nagios/libexec/eventhandler/handle-trap SN
MP unknown
```

The traps used here are sent by the SNMP agent **snmpd** from the NET-SNMP package by default, as long as a destination was specified in **snmpd.conf**:

```
# snmpd.conf
trapsink name_or_ip_of_the_nagios-server
```

If a trap arrives with the OID **SNMPv2-MIB::coldStart**, for example, **snmptrapd** starts the script **handle-trap** with the argument **cold-start**. In this way it does not have to search first for the necessary information from the OID-value pairs. However, this shortcut only works with trap OID names that describe their function.

14.6.2 Passing on traps to NSCA

The script **handle-trap**, which is run by **snmptrapd**, breaks down the information passed on and hands it over, correctly formatted, to **send_nsca**:

```
#!/bin/bash

NAGIOS="nagsrv"
LOGFILE="/usr/local/nagios/var/handle-trap.log"

read HOST && echo "host: $HOST" >> $LOGFILE
read IPADDR && echo "ip: $IPADDR" >> $LOGFILE

case $IPADDR in
   192.168.201.4)
      HOSTNAME="irouter"
   ;;
   *)
      # silent discard from unknown hosts
      exit 0
   ;;
esac

if [ -z "$1" ]; then
   echo "usage: $0 <service> <key>"
   echo "usage: $0 <service> <key>" >> $LOGFILE
   exit 1
else
   SERVICE="$1"
fi

if [ ! -z "$2" ]; then
   SWITCH="$2"
fi


case $SWITCH in
   "cold-start")
      OUTPUT="snmpd: Cold Start"
      STATE=0
      ;;
   restart)
      OUTPUT="snmpd: Restart"
      STATE=1
      ;;
   shutdown)
      OUTPUT="snmpd: Shutdown"
      STATE=2
      ;;
   *)
      OUTPUT="Unknown Trap"
      STATE=1
      ;;
esac

CMD="$HOSTNAME;$SERVICE;$STATE;$OUTPUT"
```

```
echo "$CMD" >> $LOGFILE

echo "$CMD" |  /usr/bin/send_nsca -H $NAGIOS -d ';' \
               -c /etc/nagios/send_nsca.cfg >> $LOGFILE 2>&1
```

First it saves the log file and the name of the Nagios server nagsrv, each in a separate variable. The first case statement specifies the host name used by Nagios for the IP address passed on (and temporarily stored in IPADDR). HOST normally contains the fully qualified domain name, which also cannot be used directly, and sometimes also just contains one IP address, so that it is better to use the latter here. The explicit test also allows it to discard traps from undesired hosts. Finally, matching traps land without further authentication on the Nagios server.[13]

The following if statement determines whether a service name was also given to the script. If this is the case, then it is saved in the SERVICE variable. If there was a second argument, the procedure is similar. Depending on the value, the next "case $SWITCH" instruction defines the output text and the desired status for Nagios.

The command for NSCA is finally assembled and the CMD variable is passed on by the script to send_nsca. As in previous examples, a semicolon is used as the delimiter, which must be specified in send_nsca with the option -d.

14.6.3 The matching service definition

As in the syslog-ng example (page 257), we again define the service on the Nagios server as a purely passive one:

```
define service{
    host_name                irouter
    service_description      SNMP
    active_checks_enabled    0
    passive_checks_enabled   1
    check_freshness          0
    max_check_attempts       1
    is_volatile              1
    ...
}
```

Since soft states do not make any sense in a single trap message, we should set max_check_attempts back to 1. Whether the parameter is_volatile is used or not depends on the purpose to which the service is put. As long as you define a separate service for each error category, there is no problem in omitting is_volatile. But if you form different error categories using a single service, you should set is_volatile 1, because in this case the previous error will seldom have anything to do with the new one. Section 14.5.2 on page 257 is devoted to the subject of volatile services.

[13] Although SNMPv3 does provide authentication for SNMP traps, this would go beyond the scope of this book.

Chapter 15

Distributed Monitoring

Passive service and host checks can be used to create a scenario in which several noncentral Nagios instances send their results to a central server. In general they transfer their results using the Nagios Service Check Acceptor (see Chapter 14); the central Nagios instance receives them through the External Command File interface and continues processing them as passive checks (see Chapter 13).

What is now missing is the mechanism that prepares each test result of a noncentral Nagios instance to be sent with NSCA. For such cases, Nagios provides the "obsessive" commands, OCSP ("Obsessive Compulsive Service Processor") and OCHP ("Obsessive Compulsive Host Processor"), two commands designed specifically for distributed monitoring. In contrast to ***event handler*** (see Appendix B from page 409), which shows changes in status and only passes on check results if the status has changed, these two commands obsessively pass on every test result (Figure15.1).

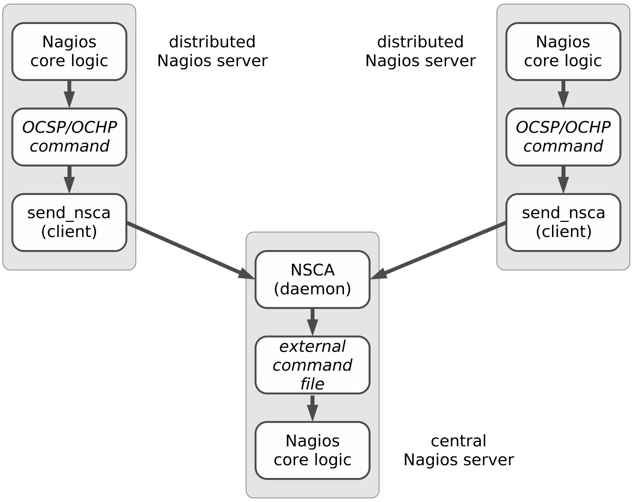


Figure 15.1: Distributed monitoring with Nagios

15.1 Switching On the OCSP/OCHP Mechanism

In order to use OCSP/OCHP, several steps are necessary. The mechanism is initially switched on (only) on the noncentral Nagios servers in the global configuration file /etc/nagios/nagios.cfg, where a global command for hosts (OCHP) and services (OCSP) is defined. This causes the noncentral Nagios instance to send every result to the central server.

In the service and host definitions you can additionally set whether the corresponding service or host should use the mechanism or not. For the central Nagios server to be able to use the results transferred, each service or host on it must finally be defined once again.

You should only switch on the two parameters obsess_over_services and obsess_over_hosts in nagios.cfg if you really do want distributed monitoring:

```
# /etc/nagios/nagios.cfg
...
obsess_over_services=1
ocsp_command=submit_service_check
ocsp_timeout=5
obsess_over_hosts=1
ochp_command=submit_host_check
ochp_timeout=5
```

Every time a new test result arrives on the Nagios server, it calls the command object defined with **ocsp_command** or **ochp_command**. This causes an additional load on resources.

The two timeouts prevent Nagios from spending too much time on one command. If processing does not terminate (because the command itself does not receive a timeout and the central Nagios server does not react), then the process table of the noncentral Nagios instance would fill very quickly, and might overflow.

If you want to selectively exclude test results for specific services and hosts from transmission to the central Nagios server, the following parameters are used:

```
define host{
   ...
   obsess_over_host=0
   ...
}

define service{
   ...
   obsess_over_service=0
   ...
}
```

With a value of **1** the local Nagios instance sends the results of the host or service check to the central server, but with a value of **0**, this does not happen. The **1** is the default for both **obsess_over_host** and **obsess_over_service**; if results are *not* to be transferred, then you have to specify the two parameters. This is always recommended if the central location is only responsible for particular things, and the remaining administration is carried out on site.

15.2 Defining OCSP/OCHP Commands

Defining the two commands with which the noncentral instances send their results to the Nagios main server in most cases involves scripts that are based on **send_nsca** (see also the example on page 254). For services, such a script would look like the following one, in this case called **submit_service_check**:

```
#!/bin/bash
# Script submit_service_check

PRINTF="/usr/bin/printf"
CMD="/usr/local/bin/send_nsca"
CFG="/etc/nagios/send_nsca.cfg"
HOST=$1
SRV=$2
```

```
RESULT=$3
OUTPUT=$4

$PRINTF "%b" "$HOST\t$SRV\t$RESULT\t$OUTPUT" | $CMD -H nagios -c $CFG
```

When run, the command expects four parameters on the command line in the correct order: the host monitored, the service name, the return value for the plugin opened (0 for OK, 1 for WARNING, etc.), and the one-line info text that is issued by the plugin. To format the data we use the **printf** function (**man printf**). The newly formatted string is finally passed on to **send_nsca**.

The equivalent script for OCHP (stored here in the file **submit_host_check**) looks something like this:

```
#!/bin/bash
# Script submit_host_check

PRINTF="/usr/bin/printf"
CMD="/usr/local/bin/send_nsca"
CFG="/etc/nagios/send_nsca.cfg"
HOST=$1
RESULT=$2
OUTPUT=$3

$PRINTF "%b" "$HOST\t$RESULT\t$OUTPUT" | $CMD -H nagios -c $CFG
```

The only thing missing is the specification of the service description.

It is best to store the two scripts, in conformity with the Nagios documentation, in a subdirectory **eventhandlers** (which normally needs to be created) in the plugin directory (usually **/usr/local/nagios/libexec**, but for some distributions this will be **/usr/lib/nagios/plugins**). You can retrieve this from the definition of the matching command object using the macro **$USER1$**. This is best defined in the **misccommands.cfg** file:

```
define command{
    command_name submit_service_check
    command_line $USER1$/eventhandlers/submit_check_result \
        $HOSTNAME$ '$SERVICEDESC$' $SERVICESTATEID$ '$SERVICEOUTPUT$'

define command{
    command_name submit_host_check
    command_line $USER1$/eventhandlers/submit_host_result \
        $HOSTNAME$ $HOSTSTATEID$ '$HOSTOUTPUT$'
```

If you use a separate file for this, you must make sure that Nagios will load this file by adding an entry to **/etc/nagios/nagios.cfg**. The single quotes surrounding the **$SERVICEDESC$** macro and the two output macros in the **command_line** line are important. Their values sometimes contain empty spaces, which the command line would interpret as delimiters without the quotes.

15.3 Practical Scenarios

One application for distributed monitoring is the monitoring of branches or external offices in which a noncentral Nagios installation is limited to running service and host checks and sending the results to the central instance. The noncentral instances do not need further Nagios functions, such as the notification system or the Web interface.

On the other hand, if administrators look after the networks at the distributed locations, while the central IT department only looks after special services, then the noncentral Nagios server is set up as a normal, full-fledged installation and selectively forwards only those check results over the OCSP/OCHP mechanism to the central office for which the specialists there are responsible.

Whatever the case, you must ensure that the host and service definition is available both noncentrally and centrally. This can be done quite simply using templates (Section 2.11 on page 54) and the **cfg_dir** directive (Section 2.1, page 38): you set up the definition so that the configuration files can be copied 1:1.

15.3.1 Avoiding redundancy in configuration files

In the following example we assume that the noncentral servers only perform host and service checks and send the results to the central server, and do not provide any other Nagios functions. The following directories are set up on the central host:

```
/etc/nagios/global
/etc/nagios/local
/etc/nagios/sites
/etc/nagios/sites/bonn
/etc/nagios/sites/frankfurt
/etc/nagios/sites/berlin
...
```

Each of the configurations used for a location lands in the directory **/etc/nagios/sites/*location***. After **global**, all the definitions follow that can be used identically at all locations (e.g., the command definitions in **checkcommands.cfg**). The directory **local** takes in specific definitions for the central server definitions. These include the templates for services and hosts, where distinction must be made between central and noncentral.

This directory is also created separately on the noncentral servers: only the folders **global** and **sites/*location*** are copied from the central instance to the branch offices.

The three directories are read in with the cfg_dir directive in /etc/nagios/nagios.cfg:

```
# -- /etc/nagios/nagios.cfg
...
cfg_dir=/etc/nagios/global
cfg_dir=/etc/nagios/local
cfg_dir=/etc/nagios/sites
...
```

Only settings that are identical for the noncentral and central page are used in the service definition:

```
# -- /etc/nagios/sites/bonn/services.cfg
define service{
    host_name           bonn01
    service_description HTTP
    use                 bonn-svc-template
    ...
    check_command       check_http
    ...
}
```

The location-dependent parameters are dealt with by the templates.

15.3.2 Defining templates

In order that service definitions are identical on both the central and noncentral servers, the local templates must have the same names as the central ones. In addition you should ensure that the obligatory parameters (see Chapter 2 from page 37) are also all entered, even if they are not even required at one of the locations, because together, the template and service definitions must cover all obligatory parameters.

The following example shows a service template for one of the noncentral locations:

```
# -- On-Site configuration for the Bonn location
define service{
    name            bonn-svc-template
    register        0

    max_check_attempts      3
    normal_check_interval   5
    retry_check_interval    1
    active_checks_enabled   1
    passive_checks_enabled  1
    check_period            24x7
    obsess_over_service     1
    notification_interval   0
    notification_period     none
    notification_options    n
    notifications_enabled   0
    contact_groups          dummy
}
```

The parameters that are important for the noncentral page are printed in bold type. Besides the parameters that refer to the test itself, the parameter **obsess_over_service** must also not be left out. This ensures that the check results are sent to the central server.

notifications_enabled switches off notification in this case, since the local admins do not need to worry about error messages from services that are centrally monitored. Alternatively this can be done globally in the noncentral **/etc/nagios/nagios.cfg**.

register 0 ensures that the template is used exclusively as a template, so that Nagios does not interpret it as a separate service definition.

The counterpart with the same name on the central server looks something like this:

```
# -- Service template for the central Nagios server
define service{
    name            bonn-svc-template
    register        0

    max_check_attempts      3
    normal_check_interval   5
    retry_check_interval    1
    active_checks_enabled   0
    passive_checks_enabled  1
    check_period            none
    check_freshness         0
    obsess_over_service     0
    notification_interval   480
    notification_period     24x7
    notification_options    u,c,r
    notifications_enabled   1
    contact_groups          admins
}
```

The parameter **passive_checks_enabled** is of importance here, as well as the configuration of the notification system. On the central side, the parameters involving the test itself come into play only if freshness checking is used (see Section 13.4 from page 243). This works only if the central Nagios server is itself in a position to actively test all services if there is any doubt. Since the **check_command** in this simple template solution is given in the location-dependent service definition, which is identical on the noncentral and central servers, this will work only if the same command object can be used both centrally and noncentrally—if the object definitions in **global/checkcommands.cfg** match on both sides.

In the example, however, we completely switch off active tests of services at the Bonn location, with **check_period none** and **check_freshness** set to 0. The system described so far can also be applied to host checks, of course.

Chapter 16

The Web Interface

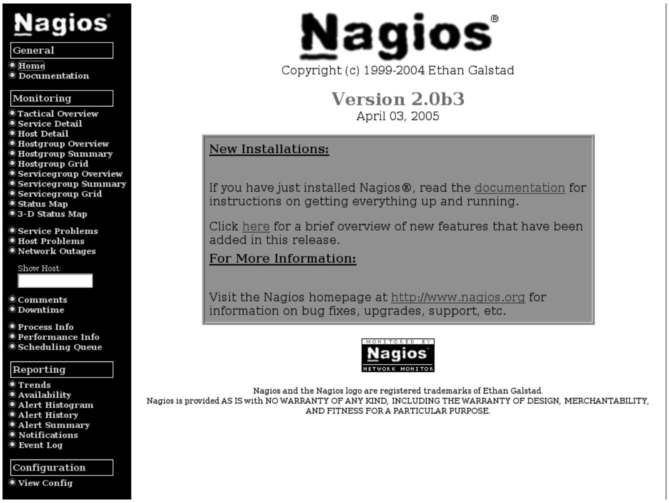
On the right is the navigation area with the unmistakable black background, and the remaining area is for displaying the CGI scripts called (Figure 16.1)—the Nagios Web interface is that simple. The start screen provides access to the program documentation—extremely useful if you just want to look up something quickly.

Provided you have the correct access rights, the Web interface allows much more than just looking up information. You can run a series of commands and control Nagios actively: from setting a single command, to switching messages on and off, to restarting the server.

A separate book would be needed to describe all the features completely. This is why we will just describe the concept here on which the CGI programs are based,[1] in this way giving you a picture of the extensive range of options available.

[1] There is a good reason that we refer here to CGI programs and not to CGI scripts: all CGI programs for Nagios 2.0 are C programs.

Many functions use the very same CGI program. If you move the mouse up and down in the navigation area shown in Figure 16.1 and observe the status display of the browser when doing this, which reveals the URLs to be called, you will see that in the Monitoring section up to the Show Hosts: entry field, the CGI program status.cgi is always called, with just four exceptions. Only the parameters are different. Things are similar for the CGI program cmd.cgi, with which general commands can be run. The parameters passed specify whether a comment is to be read, or a message enabled or disabled, or if Nagios is to be restarted.



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Version 2.0b3
April 03, 2005

New Installations:

If you have just installed Nagios®, read the documentation for instructions on getting everything up and running.

Click here for a brief overview of new features that have been added in this release.

For More Information:

Visit the Nagios homepage at http://www.nagios.org for information on bug fixes, upgrades, support, etc.

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Figure 16.1: Start page of the Nagios Web interface

Table 16.1: overview of CGI programs

CGI program	Description
status.cgi	Status display in various forms; by far the most important CGI program (Figures 16.10 to 16.14, page 280.)
statusmap.cgi	Topological representation of the monitored host (see Figure 16.26, page 292)
statuswrl.cgi	Topological representation in 3D format; requires a VRML-capable browser and allows interactive navigation in a virtual space (Figure 28, page 294)
statuswml.cgi	Simple status page for WAP devices (cellphone)
extinfo.cgi	Additional information on a host or service, with the possibility of running commands (Figure 16.4, page 277)
cmd.cgi	Running commands (Figure 16.22, page 288)
tac.cgi	Overview of all services and hosts to be monitored, the Tactical Overview (see Figure 16.25 on page 291)

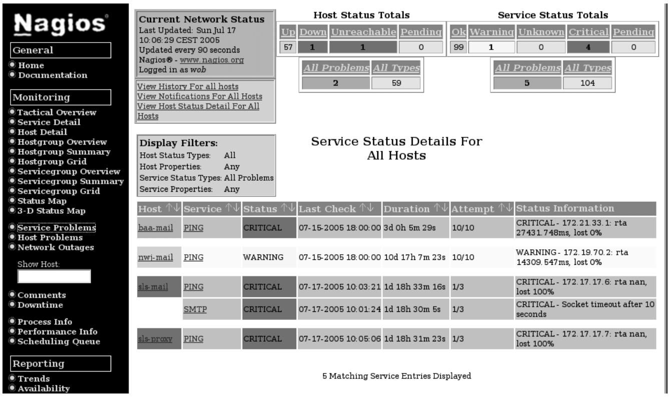
continued

CGI program	Description
outages.cgi	Network nodes that cause the failure of partial networks (Figure 16.29, page 295)
config.cgi	Display of Nagios object definitions (Figure 16.30, page 296)
avail.cgi	Availability report (e.g., "98 percent of all systems OK, 2 percent WARNING", see Figure 16.31, page 296)
histogram.cgi	Histogram of the number of events occurring (Figure 16.33, page 298)
history.cgi	Display of all events that have ever occurred (Figure 16.34, page 300)
notifications.cgi	Overview of all sent notifications (Figure 16.35, page 300)
showlog.cgi	Display of all logfile entries (Figure 16.36, page 301)
summary.cgi	Report of events, which can be compiled by host, service, error category and time period (Figure 16.38, page 303)
trends.cgi	Time axis recording the states that have occurred (Figure 16.39, page 304)

Table 16.1 shows an overview of all the CGI programs included in the package. They all check to see whether the person running the requested action is allowed to do so. Normally a user can only access the hosts and services for which he is entered as the contact. In addition there is the possibility of assigning specific users more comprehensive rights, so that they are basically allowed to display all hosts and services, for example, or to request system information. Settings for other users are made in the **cgi.cfg** configuration file, and the authentication parameters are described in Appendix D.2, page 443.

16.1 Recognizing and Acting On Problems

A suitable starting point for the administrator is the **Service Problems** page, which can be reached through the menu item, shown in Figure 16.2. You can see all problems at a glance. If there is just a service-related problem, but not a host-related one, the host name in the **Host** column has a gray background, but a red background means the host itself is the source of the trouble.



Current Network Status
Last Updated: Sun Jul 17 10:06:29 CEST 2005
Updated every 90 seconds
Nagios® - www.nagios.org
Logged in as *wob*

Host Status Totals

Up	Down	Unreachable	Pending
57	1	1	0

All Problems	All Types
2	59

Service Status Totals

Ok	Warning	Unknown	Critical	Pending
99	1	0	4	0

All Problems	All Types
5	104

Display Filters:
Host Status Types: All
Host Properties: Any
Service Status Types: All Problems
Service Properties: Any

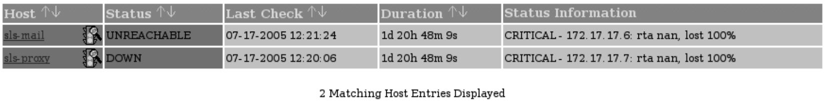
Service Status Details For All Hosts

Host ↑↓	Service ↑↓	Status ↑↓	Last Check ↑↓	Duration ↑↓	Attempt ↑↓	Status Information
baa-mail	PING	CRITICAL	07-15-2005 18:00:00	3d 0h 5m 29s	10/10	CRITICAL - 172.21.33.1: rta 27431.748ms, lost 0%
nwj-mail	PING	WARNING	07-15-2005 18:00:00	10d 17h 7m 23s	10/10	WARNING - 172.19.70.2: rta 14309.547ms, lost 0%
sls-mail	PING	CRITICAL	07-17-2005 10:03:21	1d 18h 33m 16s	1/3	CRITICAL - 172.17.17.6: rta nan, lost 100%
	SMTP	CRITICAL	07-17-2005 10:01:24	1d 18h 30m 5s	1/3	CRITICAL - Socket timeout after 10 seconds
sls-proxy	PING	CRITICAL	07-17-2005 10:05:06	1d 18h 31m 23s	1/3	CRITICAL - 172.17.17.7: rta nan, lost 100%

5 Matching Service Entries Displayed

Figure 16.2: The menu item Service Problems brings current problems to attention

The hosts **sls-mail** and **sls-proxy**, which have failed in Figure 16.2, can be seen again in the **Host Problems** menu item (Figure 16.3): **sls-mail** cannot be reached (UNREACHABLE), so the real problem therefore exists in the failure of the host **sls-proxy**. This dependency is illustrated in the **Outages** menu item (Figure 16.29, page 295) or the **Status Map** (Figure 16.26, page 292). In Figure 16.26 the two failed hosts are shown with a red background, and you can also clearly see which host is dependent on the other (always from the point of view of the central Nagios host).



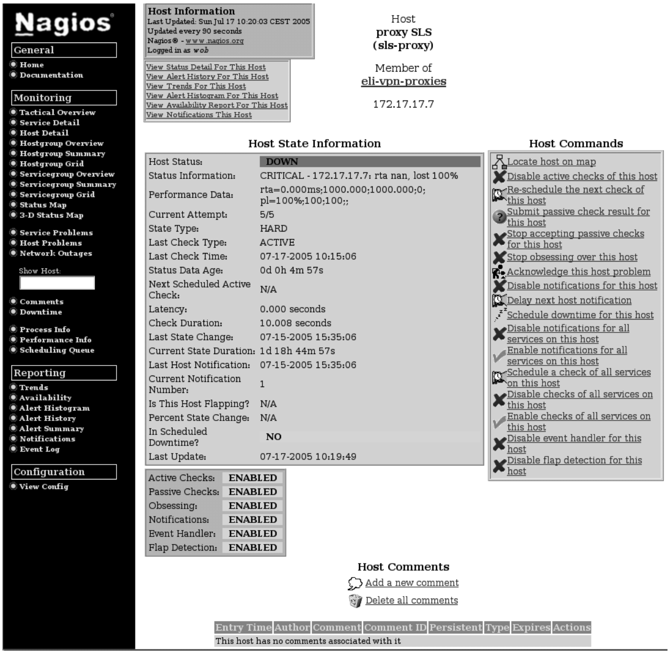
Host ↑↓	Status ↑↓	Last Check ↑↓	Duration ↑↓	Status Information
sls-mail	UNREACHABLE	07-17-2005 12:21:24	1d 20h 48m 9s	CRITICAL - 172.17.17.6: rta nan, lost 100%
sls-proxy	DOWN	07-17-2005 12:20:06	1d 20h 48m 9s	CRITICAL - 172.17.17.7: rta nan, lost 100%

2 Matching Host Entries Displayed

Figure 16.3: The Host Problems menu item reveals this display

16.1.1 Comments on problematic hosts

The administrator clarifies the problem with the external office by telephone: the DSL connection has failed. He announces this failure to the provider responsible. To stop his colleagues from going to the same trouble again, the admin enters a corresponding comment on the failed host. To do this he clicks in the status display on the host name, which takes him to an information page for this specific host (Figure 16.4), the options of which are described in more detail in Section 16.2.2, page 284.


Nagios
General
Home
Documentation
Monitoring
Tactical Overview
Service Detail
Host Detail
Hostgroup Overview
Hostgroup Summary
Hostgroup Grid
Servicegroup Overview
Servicegroup Summary
Servicegroup Grid
Status Map
3-D Status Map
Service Problems
Host Problems
Network Outages
Show Host:
Comments
Downtime
Process Info
Performance Info
Scheduling Queue
Reporting
Trends
Availability
Alert Histogram
Alert History
Alert Summary
Notifications
Event Log
Configuration
View Config
View Status Detail For This Host
View Alert History For This Host
View Trends For This Host
View Alert Histogram For This Host
View Availability Report For This Host
View Notifications This Host
Locate host on map
Disable active checks of this host
Re-schedule the next check of this host
Submit passive check result for this host
Stop accepting passive checks for this host
Stop obsessing over this host
Acknowledge this host problem
Disable notifications for this host
Delay next host notification
Schedule downtime for this host
Disable notifications for all services on this host
Enable notifications for all services on this host
Schedule a check of all services on this host
Disable checks of all services on this host
Enable checks of all services on this host
Disable event handler for this host
Disable flap detection for this host
Add a new comment
Delete all comments

Host Information
Last Updated: Sun Jul 17 10:20:03 CEST 2005
Updated every 90 seconds
Nagios® - www.nagios.org
Logged in as *wob*

Host
proxy SLS
(sls-proxy)

Member of
eli-vpn-proxies

172.17.17.7

Host State Information

Host Status:	DOWN
Status Information:	CRITICAL - 172.17.17.7: rta nan, lost 100%
Performance Data:	rta=0.000ms;1000.000;1000.000;0; pl=100%;100;100;;
Current Attempt:	5/5
State Type:	HARD
Last Check Type:	ACTIVE
Last Check Time:	07-17-2005 10:15:06
Status Data Age:	0d 0h 4m 57s
Next Scheduled Active Check:	N/A
Latency:	0.000 seconds
Check Duration:	10.008 seconds
Last State Change:	07-15-2005 15:35:06
Current State Duration:	1d 18h 44m 57s
Last Host Notification:	07-15-2005 15:35:06
Current Notification Number:	1
Is This Host Flapping?	N/A
Percent State Change:	N/A
In Scheduled Downtime?	NO
Last Update:	07-17-2005 10:19:49

Active Checks:	ENABLED
Passive Checks:	ENABLED
Obsessing:	ENABLED
Notifications:	ENABLED
Event Handler:	ENABLED
Flap Detection:	ENABLED

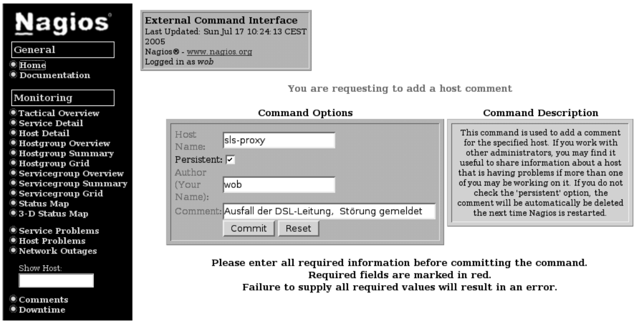
Host Commands

Host Comments

Entry Time	Author	Comment	Comment ID	Persistent	Type	Expires	Actions
This host has no comments associated with it							

Figure 16.4: extinfo.cgi provides additional information on the selected host

Using the **Add a new comment** link at the bottom of the page, the CGI program **cmd.cgi** (Section 16.2.3, page 288.), which by passing on a corresponding parameter is already prepared for this task,[2] allows a comment to be recorded (Figure 16.5). The host name is already shown, the checkmark in the **Persistent** box ensures that the comments will also "survive" a Nagios restart. The username filled out in the **Author (Your Name):** field can be edited, as can the actual comment in the **Comment** field.



External Command Interface
Last Updated: Sun Jul 17 10:24:13 CEST 2005
Nagios® - www.nagios.org
Logged in as *wob*

You are requesting to add a host comment

Command Options

Host Name: sls-proxy
Persistent: ☑
Author (Your Name): wob
Comment: Ausfall der DSL-Leitung, Störung gemeldet

Command Description

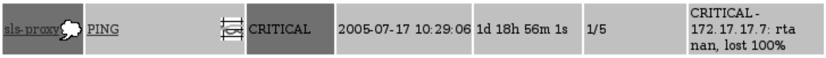
This command is used to add a comment for the specified host. If you work with other administrators, you may find it useful to share information about a host that is having problems if more than one of you may be working on it. If you do not check the 'persistent' option, the comment will be automatically be deleted the next time Nagios is restarted.

Please enter all required information before committing the command.
Required fields are marked in red.
Failure to supply all required values will result in an error.

Figure 16.5: Entering a comment for a host

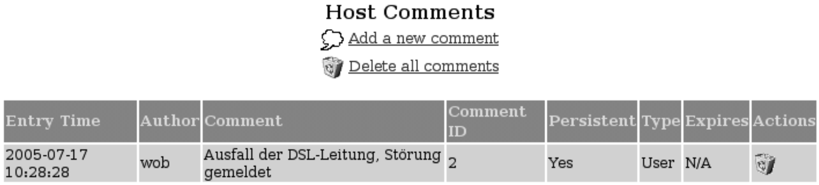
[2] cmd_type=1&host=sls-proxy. More on the parameters in Section 16.2.3 following, page 288.

The administrator confirms the entry with the **Commit** button. Returning to the status overview, for example with the **Service Problems** menu item, the administrator will see a speech bubble next to the host name, indicating that a comment exists for this host (Figure 16.6). Clicking on the icon opens the corresponding information page and takes the admin directly to the comment entries (Figure 16.7). Clicking on the icon of the trash can in the **Actions** column deletes these individually, if required.



sls-proxy	PING	CRITICAL	2005-07-17 10:29:06	1d 18h 56m 1s	1/5	CRITICAL - 172.17.17.7: rta nan, lost 100%

Figure 16.6: A speech bubble displays the existence of comments



Host Comments

Add a new comment

Delete all comments

Entry Time	Author	Comment	Comment ID	Persistent	Type	Expires	Actions
2005-07-17 10:28:28	wob	Ausfall der DSL-Leitung, Störung gemeldet	2	Yes	User	N/A	

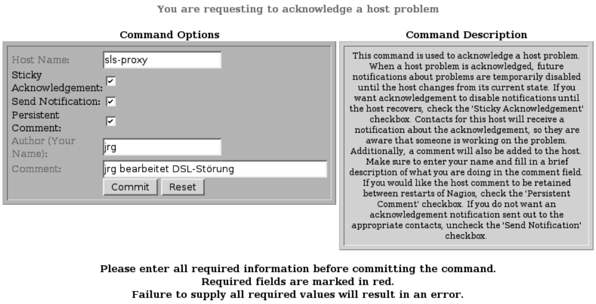
Figure 16.7: A click on Delete all comments deletes all comments at once

16.1.2 Taking responsibility for problems: acknowledgements

Acknowledgements (so spelled on the Web interface) are oriented more closely to the workflow than simple comments. An acknowledgement signals to other administrators that somebody is already working on a problem, so nobody else needs to get involved with it for the time being. In the status overview, a small laborer icon symbolizes this form of taking responsibility (Figure 16.9), and Nagios additionally notifies the relevant contacts.[3]

To issue such a statement, the link **Acknowledge this Host Problem** is used on the extended info page for the host in question. As well as the fields used for entering a normal comment, there are two checkboxes in this case, **Sticky Acknowledgement** (Figure 16.8)—if checked, this option prevents period notification if the error status persists—and **Send Notification**. If the latter is also checked, Nagios notifies the other administrators.

[3] Sending a notification to the contact addresses in charge did not work up to and including version 2.0b3, however.



You are requesting to acknowledge a host problem

Command Options

Host Name:	sls-proxy
Sticky Acknowledgement:	☑
Send Notification:	☑
Persistent Comment:	☑
Author (Your Name):	jrg
Comment:	jrg bearbeitet DSL-Störung

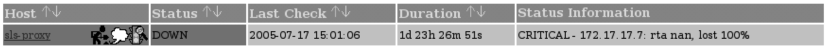
Command Description

This command is used to acknowledge a host problem. When a host problem is acknowledged, future notifications about problems are temporarily disabled until the host changes from its current state. If you want acknowledgement to disable notifications until the host recovers, check the 'Sticky Acknowledgement' checkbox. Contacts for this host will receive a notification about the acknowledgement, so they are aware that someone is working on the problem. Additionally, a comment will also be added to the host. Make sure to enter your name and fill in a brief description of what you are doing in the comment field. If you would like the host comment to be retained between restarts of Nagios, check the 'Persistent Comment' checkbox. If you do not want an acknowledgement notification sent out to the appropriate contacts, uncheck the 'Send Notification' checkbox.

Please enter all required information before committing the command.
Required fields are marked in red.
Failure to supply all required values will result in an error.

Figure 16.8: Entry dialog for a host acknowlegement

What we are demonstrating here, using a faulty host state, can also be applied to faulty services. The CGI programs are the same, and through the passing of parameters they receive information on whether a host or service is involved, and react accordingly; only the host field receives company in the form of a **service** entry.



Host ↑↓	Status ↑↓	Last Check ↑↓	Duration ↑↓	Status Information
sls-proxy	DOWN	2005-07-17 15:01:06	1d 23h 26m 51s	CRITICAL - 172.17.17.7: rta nan, lost 100%

Figure 16.9: A laborer icon shows that an admin has already taken on responsibility for the problem (acknowledgement)

16.2 An Overview of the Individual CGI Programs

At the time of going to press, this chapter was the most extensive documentation on the Nagios Web interface, especially for the individual CGI scripts. But for reasons of space, we shall not go into every detail. If you want to know more, you must take a look at the source code of the scripts or look at the **nagios-users**[4] mailing list. Some of these are also read by the Nagios developers, and many a question is answered there for which there is currently no documentation.

16.2.1 Variations in status display: status.cgi

By far the most important CGI program, **status.cgi** is responsible for the status display. What it shows is determined by three parameter groups. The first one defines whether the Web page generated displays all hosts, a specific host, or a service group:

[4] http://lists.sourceforge.net/mailman/listinfo/nagios-users

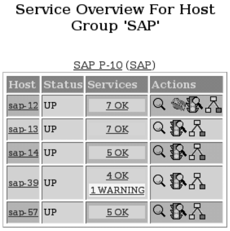
```
http://nagiosserver/nagios/cgi-bin/status.cgi?host=all
http://nagiosserver/nagios/cgi-bin/status.cgi?hostgroup=all
http://nagiosserver/nagios/cgi-bin/status.cgi?servicegroup=all
```

With host you can select individual hosts, and all in this case stands for *all hosts*. hostgroup enables a specific host group to be displayed, and again you can use all to stand for *all host groups*. Finally, servicegroup tells the CGI program to display either the individual service group given as a value, or all service groups, given with all.

The outputs of host=all and hostgroup=all are only different in their style, which is defined by the second parameter group. For host=all, style=detail is the default setting, and for hostgroup=all, it is style=overview. status.cgi?host=all&style=overview therefore delivers the same result as status.cgi?hostgroup=all.

Hosts that do not belong to a host group only appear in the detail view host=all&style=detail or hostgroup=all&style=hostdetail. All other display styles always show entire host groups from which individual hosts may be missing.

Figure 16.10: The overview output style



Service Overview For Host Group 'SAP'

SAP P-10 (SAP)

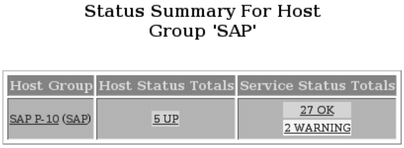
Host	Status	Services	Actions
sap-12	UP	7 OK	
sap-13	UP	7 OK	
sap-14	UP	5 OK	
sap-39	UP	4 OK 1 WARNING	
sap-57	UP	5 OK	

status.cgi provides five possible output styles: overview represents the hosts in a table, but summarizes the services according to states (Figure 16.10). For the host group SAP, you would call the corresponding display with the URL

```
http://nagiosserver/nagios/cgi-bin/status.cgi?hostgroup=SAP&style=overview
```

The style value summary compresses the output of overview: status.cgi only displays one host group for each line (Figure 16.11).

Figure 16.11: The summaryoutput style

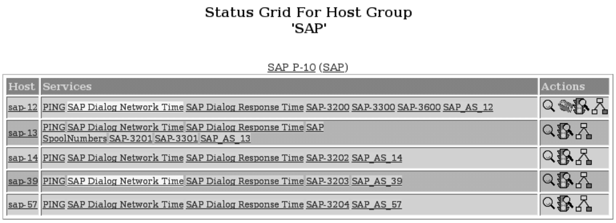


Status Summary For Host Group 'SAP'

Host Group	Host Status Totals	Service Status Totals
SAP P-10 (SAP)	5 UP	27 OK 2 WARNING

The grid style provides an extremely attractive summary in which you can see the status of each individual service by means of the color with which it is highlighted

(Figure 16.12). **detail** shows each service in detail on a separate line. The **hostdetail** output style is limited just to host information, providing detailed information with one line for each host (Figure 16.14).

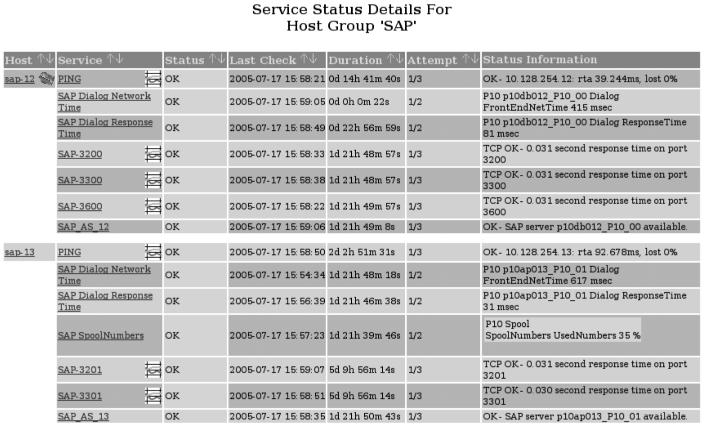


Status Grid For Host Group 'SAP'

SAP P-10 (SAP)

Host	Services	Actions
sap-12	PING SAP Dialog Network Time SAP Dialog Response Time SAP-3200 SAP-3300 SAP-3600 SAP_AS_12	
sap-13	PING SAP Dialog Network Time SAP Dialog Response Time SAP SpoolNumbers SAP-3201 SAP-3301 SAP_AS_13	
sap-14	PING SAP Dialog Network Time SAP Dialog Response Time SAP-3202 SAP_AS_14	
sap-39	PING SAP Dialog Network Time SAP Dialog Response Time SAP-3203 SAP_AS_39	
sap-57	PING SAP Dialog Network Time SAP Dialog Response Time SAP-3204 SAP_AS_57	

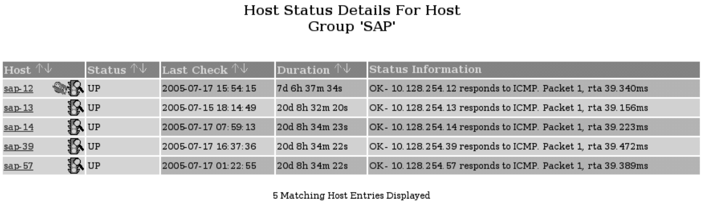
Figure 16.12: The gridoutput style



Service Status Details For Host Group 'SAP'

Host ↑↓	Service ↑↓	Status ↑↓	Last Check ↑↓	Duration ↑↓	Attempt ↑↓	Status Information
sap-12	PING	OK	2005-07-17 15:58:21	0d 14h 41m 40s	1/3	OK - 10.128.254.12: rta 39.244ms, lost 0%
	SAP Dialog Network Time	OK	2005-07-17 15:59:05	0d 0h 0m 22s	1/2	P10 p10db012_P10_00 Dialog FrontEndNetTime 415 msec
	SAP Dialog Response Time	OK	2005-07-17 15:58:49	0d 22h 56m 59s	1/2	P10 p10db012_P10_00 Dialog ResponseTime 81 msec
	SAP-3200	OK	2005-07-17 15:58:33	1d 21h 48m 57s	1/3	TCP OK - 0.031 second response time on port 3200
	SAP-3300	OK	2005-07-17 15:58:38	1d 21h 48m 57s	1/3	TCP OK - 0.031 second response time on port 3300
	SAP-3600	OK	2005-07-17 15:58:22	1d 21h 49m 57s	1/3	TCP OK - 0.031 second response time on port 3600
	SAP_AS_12	OK	2005-07-17 15:59:06	1d 21h 49m 8s	1/3	OK - SAP server p10db012_P10_00 available.
sap-13	PING	OK	2005-07-17 15:58:50	2d 2h 51m 31s	1/3	OK - 10.128.254.13: rta 92.678ms, lost 0%
	SAP Dialog Network Time	OK	2005-07-17 15:54:34	1d 21h 48m 18s	1/2	P10 p10ap013_P10_01 Dialog FrontEndNetTime 617 msec
	SAP Dialog Response Time	OK	2005-07-17 15:56:39	1d 21h 46m 38s	1/2	P10 p10ap013_P10_01 Dialog ResponseTime 31 msec
	SAP SpoolNumbers	OK	2005-07-17 15:57:23	1d 21h 39m 46s	1/2	P10 Spool SpoolNumbers UsedNumbers 35 %
	SAP-3201	OK	2005-07-17 15:59:07	5d 9h 56m 14s	1/3	TCP OK - 0.031 second response time on port 3201
	SAP-3301	OK	2005-07-17 15:58:51	5d 9h 56m 14s	1/3	TCP OK - 0.030 second response time on port 3301
	SAP_AS_13	OK	2005-07-17 15:58:35	1d 21h 50m 43s	1/3	OK - SAP server p10ap013_P10_01 available.

Figure 16.13: The detail output style



Host Status Details For Host Group 'SAP'

Host ↑↓	Status ↑↓	Last Check ↑↓	Duration ↑↓	Status Information
sap-12	UP	2005-07-17 15:54:15	7d 6h 37m 34s	OK - 10.128.254.12 responds to ICMP. Packet 1, rta 39.340ms
sap-13	UP	2005-07-15 18:14:49	20d 8h 32m 20s	OK - 10.128.254.13 responds to ICMP. Packet 1, rta 39.156ms
sap-14	UP	2005-07-17 07:59:13	20d 8h 34m 23s	OK - 10.128.254.14 responds to ICMP. Packet 1, rta 39.223ms
sap-39	UP	2005-07-17 16:37:36	20d 8h 34m 22s	OK - 10.128.254.39 responds to ICMP. Packet 1, rta 39.472ms
sap-57	UP	2005-07-17 01:22:55	20d 8h 34m 22s	OK - 10.128.254.57 responds to ICMP. Packet 1, rta 39.389ms

5 Matching Host Entries Displayed

Figure 16.14: The hostdetail output style

The third and final parameter group allows you to influence, through ***selectors***, what states and what properties are shown by **status.cgi**, such as all services in an error state for which no acknowledgement has yet been set by an administrator (see Section 16.1.2, page 278). States are passed on with the **hoststatustypes** or **servicestatustypes** parameter, properties with **hostprops** and **serviceprops**. All four parameters demand numerical values after the equals sign, and these are summarized in Tables 16.2, 16.3, and 16.4.

Table 16.2: Possible values for hoststatustypes

Value	Description
1	PENDING (a result of the very first test planned for this host is not yet available)
2	UP
4	DOWN
8	UNREACHABLE

Table 16.3: Possible values for servicestatustypes

Value	Description
1	PENDING (Service was originally planned for a check, but so far no result is available)
2	OK
4	WARNING
8	UNKNOWN
16	CRITICAL

Table 16.4: Possible values for host and serviceprops

Value	Description
1	Scheduled downtime (downtime planned)
2	No Scheduled downtime (no downtime planned)
4	Acknowledgement (status confirmed by the admin)
8	No acknowledgement
16	Host/Service check disabled
32	Host/Service check enabled
64	Event Handler disabled
128	Event Handler enabled
256	Flap Detection disabled
512	Flap Detection enabled
1024	Host/Service oscillates (flapping)
2048	Host/Service does not oscillate
4096	Hosts or services currently excluded from a notification
8192	Notification enabled
16384	Passive host/service checks disabled (Chapter 13, page 239.)
32768	Passive host/service checks enabled

continued

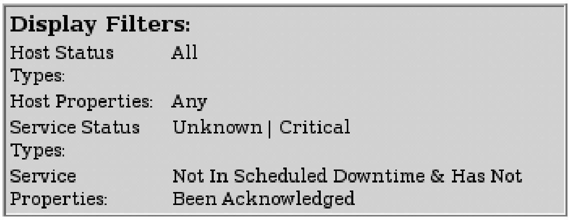
Value	Description
65536	Hosts/services for which there is at least one result determined for each passive test
131072	Hosts/services for which there is at least one active check result

If you want to query several states or properties simultaneously, you just add the specified values together: status.cgi?host=all&servicestatustypes=28 shows all services with an error status: WARNING, UNKNOWN, and CRITICAL, that is, $4 + 8 + 16 = 28$. This query is identical to the Service Problems menu item in the navigation area.

status.cgi?hostgroup=all&hoststatustypes=12&style=hostdetail corresponds to the Host Problems menu item in the navigation area. It queries all hosts which are either DOWN or UNREACHABLE (here $4 + 8 = 12$). Since only host information should be shown, but no service information, the output style is in the form of hostdetail.

status.cgi?host=all&servicestatustypes=24&serviceprops=10 is the variation of the first example: only the states UNKNOWN and CRITICAL ($8 + 16 = 24$) are shown, and only those that neither show a planned downtime, nor have already been confirmed ($2 + 8 = 10$).

The CGI program specifies the filter parameter each time in a separate checkbox. Figure 16.15 shows this for the third example.



Display Filters:

Host Status Types:	All
Host Properties:	Any
Service Status Types:	Unknown | Critical
Service Properties:	Not In Scheduled Downtime & Has Not Been Acknowledged

Figure 16.15: This information box shows what states and properties status.cgi should display

If you want, you can define your own navigation area to your own requirements or just use the existing one. The main page consists of one frame, and the navigation area itself is defined by a normal HTML file: /usr/local/nagios/share/side.html.[5] An example of a changed side.html is provided on the Nagios Demo page[6] at Netways.[7]

[5] If you have kept to the installation in this book.

[6] http://nagios-demo.netways.de/

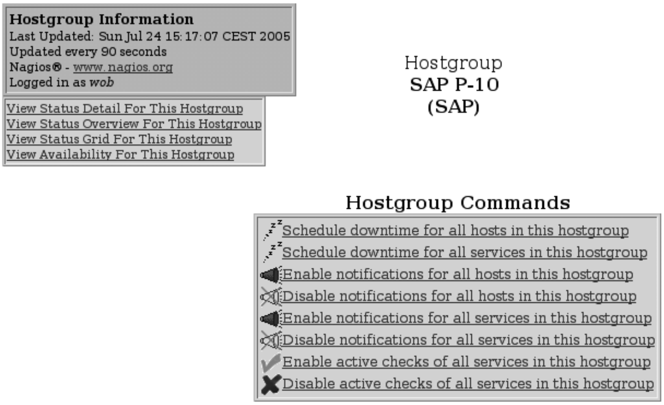
[7] http://www.netways.de/

16.2.2 Additional information and control center: extinfo.cgi

If called with the **host** or **service** parameter, **extinfo.cgi** not only provides detailed information on a specific host (Figure 16.4, page 277) or service, it also serves as a control center for hosts and services (parameter **hostgroup**) and for service groups (**servicegroup**). Depending on the object class for which it is called, you can run various commands from here.

In the area on the left, the status of the host is extensively documented and in the box on the right—overwritten with **host commands**—there is a selection of commands that can be run. The latter commands call **cmd.cgi** (Section 16.2.3, page 288) and only function if the interface for external commands (Section 13.1, page 240) is active. The lower area of the page allows you to enter object-specific comments, read them, and delete them again. The Web page that **extinfo.cgi** generates for services also follows this pattern.

Corresponding pages for service and host groups (Figure 16.16), on the other hand, allow only group-specific commands to be run and do not show any additional information. Each command applies to the entire group, sparing you from a lot of mouse clicking. **Disabling notifications for all hosts in this hostgroup**, for example, ensures that Nagios does not send any more messages for hosts in this host group.



Hostgroup Information
Last Updated: Sun Jul 24 15:17:07 CEST 2005
Updated every 90 seconds
Nagios® - www.nagios.org
Logged in as *wob*

View Status Detail For This Hostgroup
View Status Overview For This Hostgroup
View Status Grid For This Hostgroup
View Availability For This Hostgroup

Hostgroup
SAP P-10
(SAP)

Hostgroup Commands

Schedule downtime for all hosts in this hostgroup
Schedule downtime for all services in this hostgroup
Enable notifications for all hosts in this hostgroup
Disable notifications for all hosts in this hostgroup
Enable notifications for all services in this hostgroup
Disable notifications for all services in this hostgroup
Enable active checks of all services in this hostgroup
Disable active checks of all services in this hostgroup

Figure 16.16: Command center for the SAP host group: extinfo.cgi?type=5&hostgroup=SAP

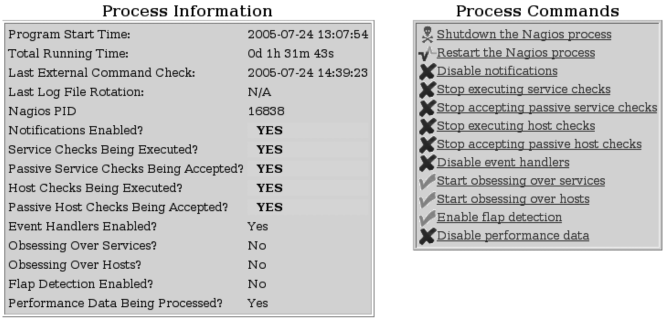
Apart from hosts, services, and corresponding groups, the CGI program has other display functions, enabled by the CGI parameter **type**:

```
http://nagsrv/nagios/cgi-bin/extinfo.cgi?type=value
```

Depending on the value specified, further parameters are required, so to display the service you also have to include the host name and service designation:

extinfo.cgi?type=0

Shows information (such as starting time and process ID) for the Nagios process itself and all global parameters (normally notifications are sent, performance data processed, etc.; see Figure 16.17). In the **Process Commands** box the global parameters can be changed, and Nagios can also be stopped and restarted.



Process Information

Program Start Time:	2005-07-24 13:07:54
Total Running Time:	0d 1h 31m 43s
Last External Command Check:	2005-07-24 14:39:23
Last Log File Rotation:	N/A
Nagios PID	16838
Notifications Enabled?	YES
Service Checks Being Executed?	YES
Passive Service Checks Being Accepted?	YES
Host Checks Being Executed?	YES
Passive Host Checks Being Accepted?	YES
Event Handlers Enabled?	Yes
Obsessing Over Services?	No
Obsessing Over Hosts?	No
Flap Detection Enabled?	No
Performance Data Being Processed?	Yes

Process Commands

- Shutdown the Nagios process
- Restart the Nagios process
- ✗ Disable notifications
- ✗ Stop executing service checks
- ✗ Stop accepting passive service checks
- ✗ Stop executing host checks
- ✗ Stop accepting passive host checks
- ✗ Disable event handlers
- ✓ Start obsessing over services
- ✓ Start obsessing over hosts
- ✓ Enable flap detection
- ✗ Disable performance data

Figure 16.17: Information on the Nagios process and global settings: extinfo.cgi?type=0

extinfo.cgi?type=1&host=*host*

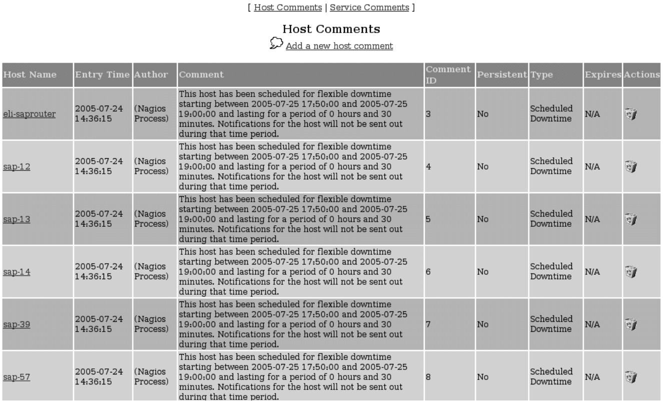
Shows commands and information on the *host* (see Figure 16.4, page 277).

extinfo.cgi?type=2&service=*service*

The same for the *service*.

extinfo.cgi?type=3

Shows all available host and service comments on a single page (Figure 16.18).



[Host Comments | Service Comments]

Host Comments

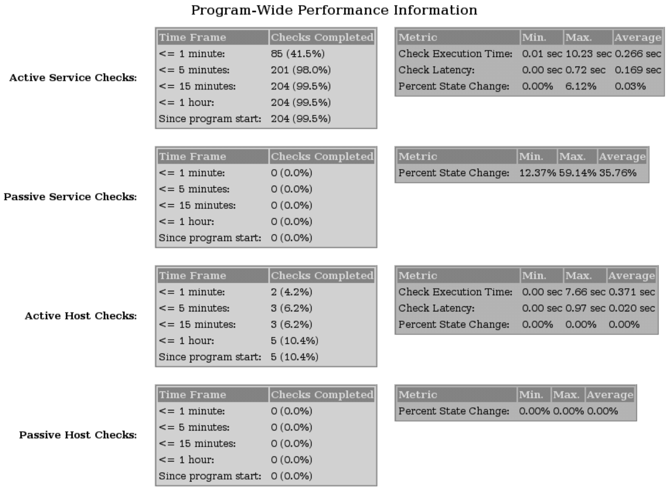
Add a new host comment

Host Name	Entry Time	Author	Comment	Comment ID	Persistent	Type	Expires	Actions
eli-saprouter	2005-07-24 14:36:15	(Nagios Process)	This host has been scheduled for flexible downtime starting between 2005-07-25 17:50:00 and 2005-07-25 19:00:00 and lasting for a period of 0 hours and 30 minutes. Notifications for the host will not be sent out during that time period.	3	No	Scheduled Downtime	N/A	
sap-12	2005-07-24 14:36:15	(Nagios Process)	This host has been scheduled for flexible downtime starting between 2005-07-25 17:50:00 and 2005-07-25 19:00:00 and lasting for a period of 0 hours and 30 minutes. Notifications for the host will not be sent out during that time period.	4	No	Scheduled Downtime	N/A	
sap-13	2005-07-24 14:36:15	(Nagios Process)	This host has been scheduled for flexible downtime starting between 2005-07-25 17:50:00 and 2005-07-25 19:00:00 and lasting for a period of 0 hours and 30 minutes. Notifications for the host will not be sent out during that time period.	5	No	Scheduled Downtime	N/A	
sap-14	2005-07-24 14:36:15	(Nagios Process)	This host has been scheduled for flexible downtime starting between 2005-07-25 17:50:00 and 2005-07-25 19:00:00 and lasting for a period of 0 hours and 30 minutes. Notifications for the host will not be sent out during that time period.	6	No	Scheduled Downtime	N/A	
sap-39	2005-07-24 14:36:15	(Nagios Process)	This host has been scheduled for flexible downtime starting between 2005-07-25 17:50:00 and 2005-07-25 19:00:00 and lasting for a period of 0 hours and 30 minutes. Notifications for the host will not be sent out during that time period.	7	No	Scheduled Downtime	N/A	
sap-57	2005-07-24 14:36:15	(Nagios Process)	This host has been scheduled for flexible downtime starting between 2005-07-25 17:50:00 and 2005-07-25 19:00:00 and lasting for a period of 0 hours and 30 minutes. Notifications for the host will not be sent out during that time period.	8	No	Scheduled Downtime	N/A	

Figure 16.18: Overview of all existing comments: extinfo.cgi?type=3

extinfo.cgi?type=4

Provides information on the performance of Nagios, separated according to host and service, as well as active and passive checks (Figure 16.19).



Program-Wide Performance Information

Active Service Checks:

Time Frame	Checks Completed
<= 1 minute:	85 (41.5%)
<= 5 minutes:	201 (98.0%)
<= 15 minutes:	204 (99.5%)
<= 1 hour:	204 (99.5%)
Since program start:	204 (99.5%)

Metric	Min.	Max.	Average
Check Execution Time:	0.01 sec	10.23 sec	0.266 sec
Check Latency:	0.00 sec	0.72 sec	0.169 sec
Percent State Change:	0.00%	6.12%	0.03%

Passive Service Checks:

Time Frame	Checks Completed
<= 1 minute:	0 (0.0%)
<= 5 minutes:	0 (0.0%)
<= 15 minutes:	0 (0.0%)
<= 1 hour:	0 (0.0%)
Since program start:	0 (0.0%)

Metric	Min.	Max.	Average
Percent State Change:	12.37%	59.14%	35.76%

Active Host Checks:

Time Frame	Checks Completed
<= 1 minute:	2 (4.2%)
<= 5 minutes:	3 (6.2%)
<= 15 minutes:	3 (6.2%)
<= 1 hour:	5 (10.4%)
Since program start:	5 (10.4%)

Metric	Min.	Max.	Average
Check Execution Time:	0.00 sec	7.66 sec	0.371 sec
Check Latency:	0.00 sec	0.97 sec	0.020 sec
Percent State Change:	0.00%	0.00%	0.00%

Passive Host Checks:

Time Frame	Checks Completed
<= 1 minute:	0 (0.0%)
<= 5 minutes:	0 (0.0%)
<= 15 minutes:	0 (0.0%)
<= 1 hour:	0 (0.0%)
Since program start:	0 (0.0%)

Metric	Min.	Max.	Average
Percent State Change:	0.00%	0.00%	0.00%

Figure 16.19: Information on the performance: extinfo.cgi?type=4

The middle column reveals how many of the planned tests Nagios has already performed in the last 1, 5, 15, and 60 minutes. As long as there are checks for which normal_check_interval is more than five minutes, the first two values can never reach 100 percent.

The right-hand columns define the actual value for this page: Check Execution Time specifies the minimum, maximum, and average time which Nagios requires to perform active host and service checks. Check Latency measures the distance between the planned start and the actual running time of a test. If this delay is considerably larger than one or two seconds, Nagios probably has a performance problem. One possible cause is that the system is processing performance data too slowly, but low-performance hardware may also play a role here. Searching for the cause can sometimes turn out to be very difficult, and the original documentation[8] provides a number of tips on the subject.

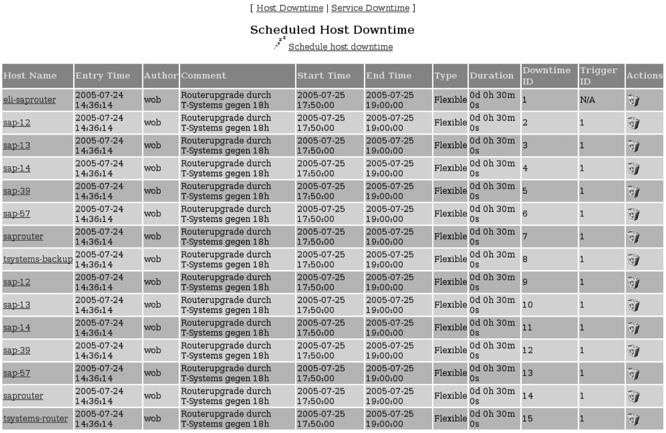
extinfo.cgi?type=5&hostgroup=*hostgroup*

Shows command center for a host group (Figure 16.16).

extinfo.cgi?type=6

Shows all planned maintenance periods for hosts and services (Figure 16.20).

[8] /usr/local/nagios/share/docs/tuning.html



[Host Downtime | Service Downtime]

Scheduled Host Downtime

Schedule host downtime

Host Name	Entry Time	Author	Comment	Start Time	End Time	Type	Duration	Downtime ID	Trigger ID	Actions
eli-saprouter	2005-07-24 14:36:14	wob	Routerupgrade durch T-Systems gegen 18h	2005-07-25 17:50:00	2005-07-25 19:00:00	Flexible	0d 0h 30m 0s	1	N/A	🗑
sap-12	2005-07-24 14:36:14	wob	Routerupgrade durch T-Systems gegen 18h	2005-07-25 17:50:00	2005-07-25 19:00:00	Flexible	0d 0h 30m 0s	2	1	🗑
sap-13	2005-07-24 14:36:14	wob	Routerupgrade durch T-Systems gegen 18h	2005-07-25 17:50:00	2005-07-25 19:00:00	Flexible	0d 0h 30m 0s	3	1	🗑
sap-14	2005-07-24 14:36:14	wob	Routerupgrade durch T-Systems gegen 18h	2005-07-25 17:50:00	2005-07-25 19:00:00	Flexible	0d 0h 30m 0s	4	1	🗑
sap-39	2005-07-24 14:36:14	wob	Routerupgrade durch T-Systems gegen 18h	2005-07-25 17:50:00	2005-07-25 19:00:00	Flexible	0d 0h 30m 0s	5	1	🗑
sap-57	2005-07-24 14:36:14	wob	Routerupgrade durch T-Systems gegen 18h	2005-07-25 17:50:00	2005-07-25 19:00:00	Flexible	0d 0h 30m 0s	6	1	🗑
saprouter	2005-07-24 14:36:14	wob	Routerupgrade durch T-Systems gegen 18h	2005-07-25 17:50:00	2005-07-25 19:00:00	Flexible	0d 0h 30m 0s	7	1	🗑
tsystems-backup	2005-07-24 14:36:14	wob	Routerupgrade durch T-Systems gegen 18h	2005-07-25 17:50:00	2005-07-25 19:00:00	Flexible	0d 0h 30m 0s	8	1	🗑
sap-12	2005-07-24 14:36:14	wob	Routerupgrade durch T-Systems gegen 18h	2005-07-25 17:50:00	2005-07-25 19:00:00	Flexible	0d 0h 30m 0s	9	1	🗑
sap-13	2005-07-24 14:36:14	wob	Routerupgrade durch T-Systems gegen 18h	2005-07-25 17:50:00	2005-07-25 19:00:00	Flexible	0d 0h 30m 0s	10	1	🗑
sap-14	2005-07-24 14:36:14	wob	Routerupgrade durch T-Systems gegen 18h	2005-07-25 17:50:00	2005-07-25 19:00:00	Flexible	0d 0h 30m 0s	11	1	🗑
sap-39	2005-07-24 14:36:14	wob	Routerupgrade durch T-Systems gegen 18h	2005-07-25 17:50:00	2005-07-25 19:00:00	Flexible	0d 0h 30m 0s	12	1	🗑
sap-57	2005-07-24 14:36:14	wob	Routerupgrade durch T-Systems gegen 18h	2005-07-25 17:50:00	2005-07-25 19:00:00	Flexible	0d 0h 30m 0s	13	1	🗑
saprouter	2005-07-24 14:36:14	wob	Routerupgrade durch T-Systems gegen 18h	2005-07-25 17:50:00	2005-07-25 19:00:00	Flexible	0d 0h 30m 0s	14	1	🗑
tsystems-router	2005-07-24 14:36:14	wob	Routerupgrade durch T-Systems gegen 18h	2005-07-25 17:50:00	2005-07-25 19:00:00	Flexible	0d 0h 30m 0s	15	1	🗑

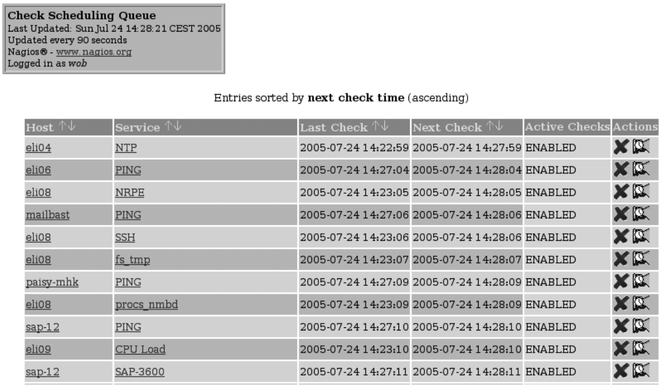
Figure 16.20: Overview of all planned maintenance periods: extinfo.cgi?type=6

extinfo.cgi?type=7

Shows an overview of all planned tests, sorted by the next implementation time (see Figure 16.21). Next to this, **extinfo.cgi** also lists the time of the last check. The **Active Checks** column shows if the respective tests are active or not, and in the **Actions** column the planned check can be deleted or moved to a different time.

extinfo.cgi?type=8&servicegroup=*servicegroup*

Shows the command centre for a service group, identical in structure to the command center of a host group.



Check Scheduling Queue
Last Updated: Sun Jul 24 14:28:21 CEST 2005
Updated every 90 seconds
Nagios® - www.nagios.org
Logged in as *wob*

Entries sorted by **next check time** (ascending)

Host ↑↓	Service ↑↓	Last Check ↑↓	Next Check ↑↓	Active Checks	Actions
eli04	NTP	2005-07-24 14:22:59	2005-07-24 14:27:59	ENABLED	✗
eli06	PING	2005-07-24 14:27:04	2005-07-24 14:28:04	ENABLED	✗
eli08	NRPE	2005-07-24 14:23:05	2005-07-24 14:28:05	ENABLED	✗
mailbast	PING	2005-07-24 14:27:06	2005-07-24 14:28:06	ENABLED	✗
eli08	SSH	2005-07-24 14:23:06	2005-07-24 14:28:06	ENABLED	✗
eli08	fs_tmp	2005-07-24 14:23:07	2005-07-24 14:28:07	ENABLED	✗
paisy-mhk	PING	2005-07-24 14:27:09	2005-07-24 14:28:09	ENABLED	✗
eli08	procs_nmbd	2005-07-24 14:23:09	2005-07-24 14:28:09	ENABLED	✗
sap-12	PING	2005-07-24 14:27:10	2005-07-24 14:28:10	ENABLED	✗
eli09	CPU Load	2005-07-24 14:23:10	2005-07-24 14:28:10	ENABLED	✗
sap-12	SAP-3600	2005-07-24 14:27:11	2005-07-24 14:28:11	ENABLED	✗

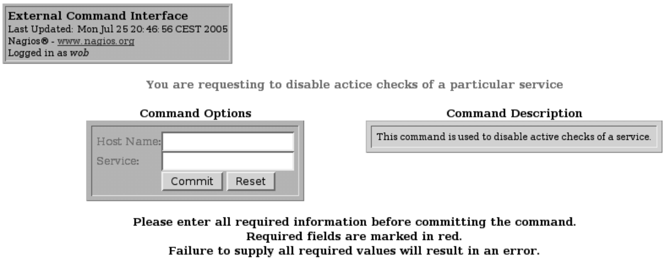
Figure 16.21: All planned tests, sorted by their planned implementation time: extinfo.cgi?type=7

16.2.3 Interface for external commands: cmd.cgi

As a real all-rounder, **cgi.cmd**, with some 100 functions, covers nearly all the possibilities that the interface provides for external commands. The **cmd_typ** parameter defines which of these the CGI program should run. The command

```
http://nagsrv/nagios/cgi-bin/cmd.cgi?cmd_typ=6
```

switches off active service checks for a specific service (Figure 16.22). In order to describe the desired service uniquely, you must specify the host and service description. If you run the CGI program manually, the Web form shown queries these values, and if **cmd.cgi** is started by another CGI program, the required data is passed through CGI parameters. Possible parameters here are **host**, **service**, **hostgroup**, and **servicegroup**, which are followed by an equals (=) sign and then the appropriate Nagios object.



External Command Interface
Last Updated: Mon Jul 25 20:46:56 CEST 2005
Nagios® - www.nagios.org
Logged in as *wob*

You are requesting to disable actice checks of a particular service

Command Options

Host Name:
Service:

Command Description

This command is used to disable active checks of a service.

Please enter all required information before committing the command.
Required fields are marked in red.
Failure to supply all required values will result in an error.

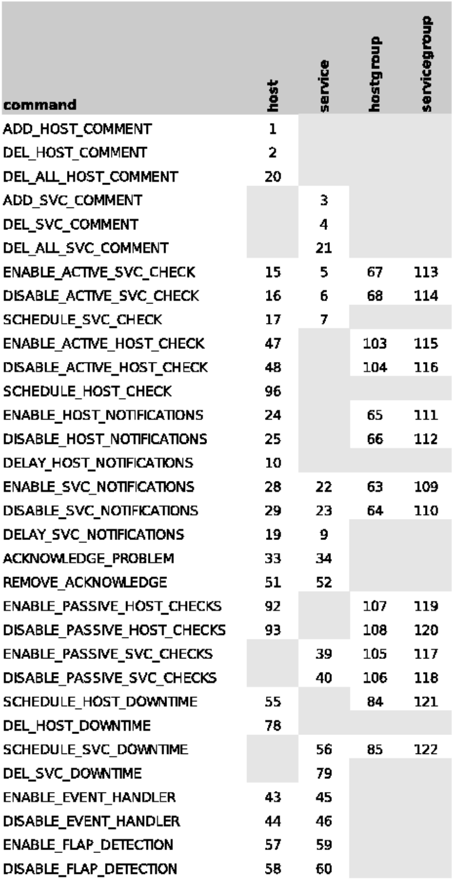
Figure 16.22: Disabling a service check with cmd.cgi?cmd_typ=6

Figure 16.23 lists the commands which refer to a host or service, and Figure 16.24 shows those that refer to the control of global parameters (corresponding to the values in the main configuration file **nagios.cfg**). The source code file **include/common.h** contains a complete list of all possible values, including ones that are planned but not yet implemented.

The first column in Figures 16.23 and 16.24 describes the function of the command: **ADD_HOST_COMMENT** adds a comment to a host, and **DISABLE_ACTIVE_SVC_CHECK** switches off active checks for a service (in abbreviated form: **SVC**).

The columns after this specify the object type to which the respective function refers. To add a comment with **ADD_HOST_COMMENT**, you must specify the host in question. For this reason the function code **1** is shown in the **Host** column. A specific active service check can only be switched off if the matching service is named, so the function code **6** is to be found in the **Service** column. With **16** you switch off all active service checks on a host to be specified; there are also corresponding codes for all active service checks for a host or service group.

With **ACKNOWLEDGE_PROBLEM**, an administrator confirms that he is taking care of a specific problem. **33** (**Host** column) refers to a host problem, and **34** (**Service** column) to a service problem. The gray fields mean that there is no corresponding function for host and service groups. The Web form that opens with **cmd_typ=33** (Figure 16.8, page 279) then allows a comment to be entered.



command	host	service	hostgroup	servicegroup
ADD_HOST_COMMENT	1			
DEL_HOST_COMMENT	2			
DEL_ALL_HOST_COMMENT	20			
ADD_SVC_COMMENT		3		
DEL_SVC_COMMENT		4		
DEL_ALL_SVC_COMMENT		21		
ENABLE_ACTIVE_SVC_CHECK	15	5	67	113
DISABLE_ACTIVE_SVC_CHECK	16	6	68	114
SCHEDULE_SVC_CHECK	17	7		
ENABLE_ACTIVE_HOST_CHECK	47		103	115
DISABLE_ACTIVE_HOST_CHECK	48		104	116
SCHEDULE_HOST_CHECK	96			
ENABLE_HOST_NOTIFICATIONS	24		65	111
DISABLE_HOST_NOTIFICATIONS	25		66	112
DELAY_HOST_NOTIFICATIONS	10			
ENABLE_SVC_NOTIFICATIONS	28	22	63	109
DISABLE_SVC_NOTIFICATIONS	29	23	64	110
DELAY_SVC_NOTIFICATIONS	19	9		
ACKNOWLEDGE_PROBLEM	33	34		
REMOVE_ACKNOWLEDGE	51	52		
ENABLE_PASSIVE_HOST_CHECKS	92		107	119
DISABLE_PASSIVE_HOST_CHECKS	93		108	120
ENABLE_PASSIVE_SVC_CHECKS		39	105	117
DISABLE_PASSIVE_SVC_CHECKS		40	106	118
SCHEDULE_HOST_DOWNTIME	55		84	121
DEL_HOST_DOWNTIME	78			
SCHEDULE_SVC_DOWNTIME		56	85	122
DEL_SVC_DOWNTIME		79		
ENABLE_EVENT_HANDLER	43	45		
DISABLE_EVENT_HANDLER	44	46		
ENABLE_FLAP_DETECTION	57	59		
DISABLE_FLAP_DETECTION	58	60		

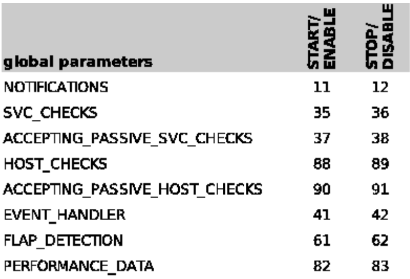
Figure 16.23: Host / Service-related codes for cmd.cgi?cmd_typ=

Functions that refer to global parameters (Figure 16.24) can normally only be switched on or off. So the value **11** in the **Start** column for **NOTIFICATIONS** means that this command code switches on all notifications globally, while **12** switches them off globally.

If you are not quite certain whether the determined function does what you really wanted, it is best to run **cmd.cgi** manually with the corresponding function code, such as shown here:

```
http://nagsrv/nagios/cgi-bin/cmd.cgi?cmd_typ=12
```

The Web page generated in this way always has a small gray box available next to the required entry fields that explains the corresponding command (Figure 16.22, on the right side of the page).



global parameters	START/ ENABLE	STOP/ DISABLE
NOTIFICATIONS	11	12
SVC_CHECKS	35	36
ACCEPTING_PASSIVE_SVC_CHECKS	37	38
HOST_CHECKS	88	89
ACCEPTING_PASSIVE_HOST_CHECKS	90	91
EVENT_HANDLER	41	42
FLAP_DETECTION	61	62
PERFORMANCE_DATA	82	83

Figure 16.24: cmd.cgi command codes for global parameters

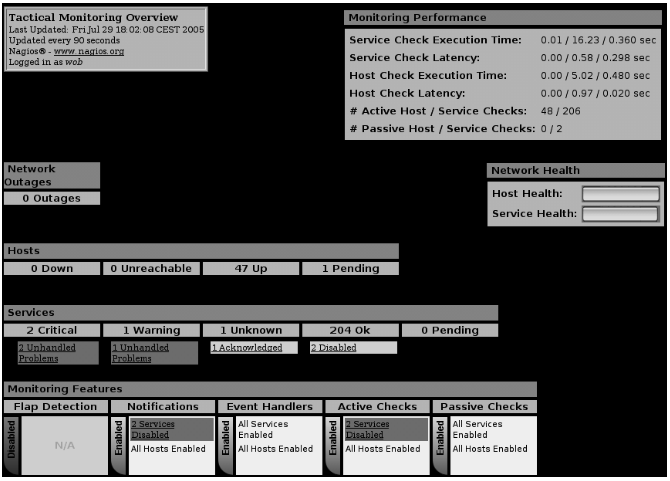
16.2.4 The most important things at a glance: tac.cgi

As a "tactical overview," tac.cgi provides a wealth of information on a single Web page, displayed in a summary (Figure 16.25). On the left-hand side of the page you can see, in order of priority, first the failure of entire network ranges (Network Outages), followed by the status of hosts and services, and at the bottom tac.cgi lists whether individual monitoring features such as notifications and event handlers are active.

Up to this final section, everything is concentrated on displaying problems. Provided everything is OK, the CGI merely shows the number of unproblematic services or hosts, highlighted in light gray (and announces 47 Up, for example, in the Hosts box). In problem cases it distinguishes between open problems, which nobody has looked at yet (highlighted in red, e.g., 2 Unhandled Problems for Services → Critical), and those for which an adminstrator has already taken responsibility through an acknowledgement (pink background, like 1 Acknowledged for Services → Unknown). If host or service checks are disabled, these are also shown with a pink background, since they are problems that do not require the immediate attention of the admin (e.g., 2 Disabled for Services → Ok).

Enabled features in the lower parts are marked by tac.cgi in green, and disabled ones, in red. The vertically written green Enabled in Notifications means that notifications are enabled globally, whereas the red background on the other hand, 2 Services Disabled, means that they were explicitly switched off for two individual services.

For all the problems displayed you are taken to a single overview specifically showing the hosts and services in question.



Tactical Monitoring Overview
Last Updated: Fri Jul 29 18:02:08 CEST 2005
Updated every 90 seconds
Nagios® - www.nagios.org
Logged in as *wob*

Monitoring Performance

Service Check Execution Time:	0.01 / 16.23 / 0.360 sec
Service Check Latency:	0.00 / 0.58 / 0.298 sec
Host Check Execution Time:	0.00 / 5.02 / 0.480 sec
Host Check Latency:	0.00 / 0.97 / 0.020 sec
# Active Host / Service Checks:	48 / 206
# Passive Host / Service Checks:	0 / 2

Network Outages
0 Outages

Network Health
Host Health:
Service Health:

Hosts

0 Down	0 Unreachable	47 Up	1 Pending

Services

2 Critical	1 Warning	1 Unknown	204 Ok	0 Pending
2 Unhandled Problems	1 Unhandled Problems	1 Acknowledged	2 Disabled	

Monitoring Features

Flap Detection	Notifications	Event Handlers	Active Checks	Passive Checks
Disabled N/A	Enabled 2 Services Disabled All Hosts Enabled	Enabled All Services Enabled All Hosts Enabled	Enabled 2 Services Disabled All Hosts Enabled	Enabled All Services Enabled All Hosts Enabled

Figure 16.25: Tactical overview with tac.cgi

On the right-hand side of the page the upper box summarizes the **extinfo.cgi? type=4** (see page 285) Nagios performance data, which can be shown in detail. The bar graph beneath it shows the health of the entire network monitored as a percentage. If you move the mouse over one of the bars, you will also see the percentage as a number.

16.2.5 Network plan: the topological map of the network (statusmap.cgi)

statusmap.cgi (Figure 16.26) provides a view of the dependencies between the monitored hosts. Starting from the central Nagios server in the middle, lines connect all hosts that the server reaches directly—and whose host definitions do not need the **parents** parameter to be specified (see Section 2.3, page 44.).

The graphics also reveal the hosts to which Nagios has only indirect access through other hosts. So between **sls-mail** and the Nagios server in Figure 16.26 lie the hosts **sls-proxy**, **hspvip**, and **pfint**. **sls-proxy**, as the comment **Down** and the red (instead of green) background suggest, has failed. Since **sls-mail** depends on this, it is in an UNREACHABLE state, which **statusmap.cgi** also marks with a red background.

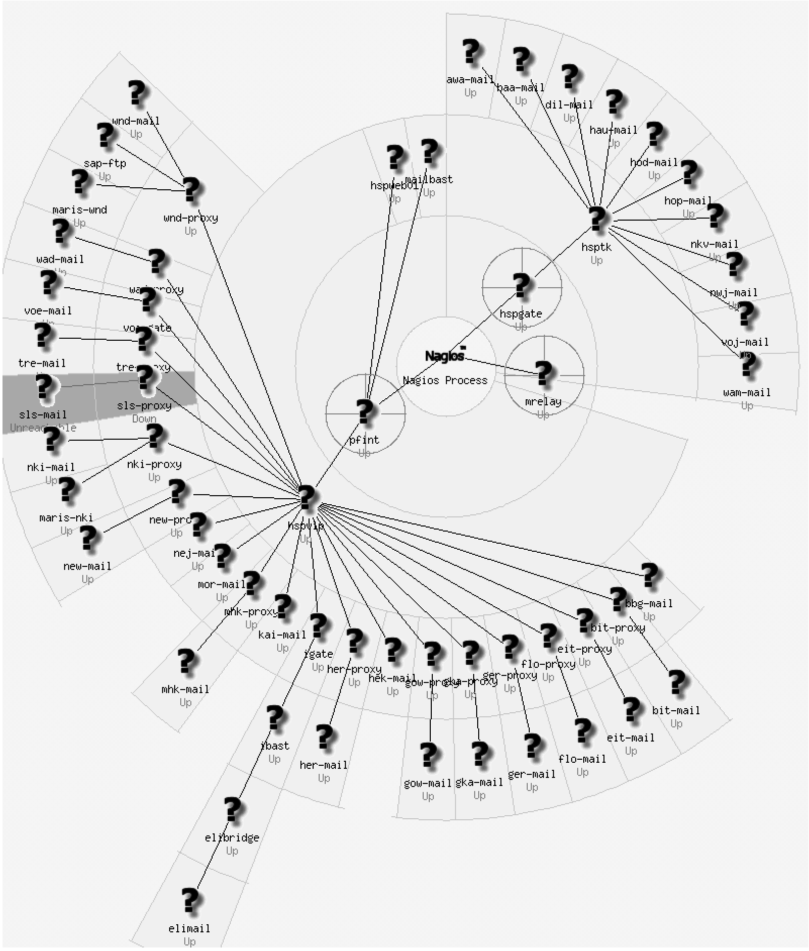
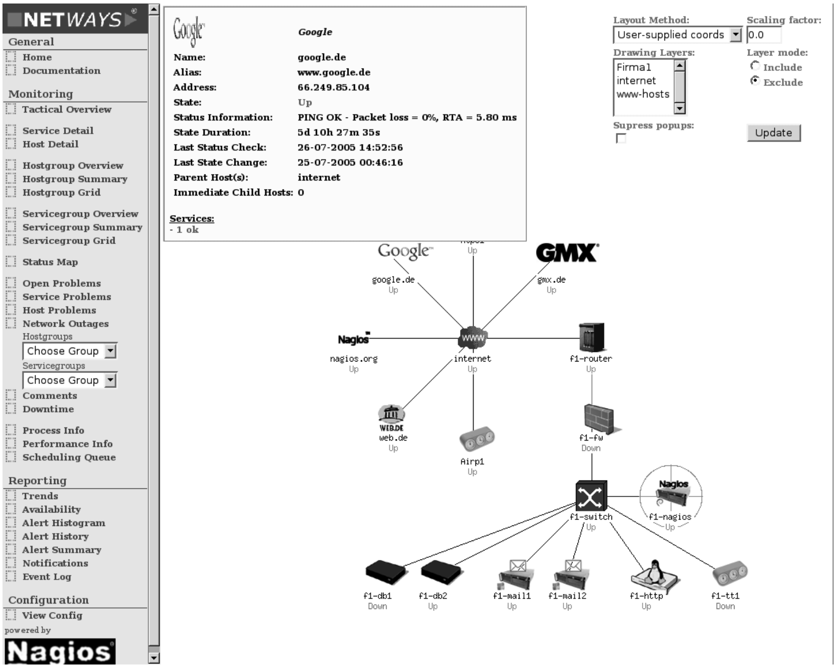


Figure 16.26: Dependencies of monitored hosts shown graphically

How Nagios arranges the hosts in the graphics is defined by the parameter **default_statusmap_layout** (page 444) in the configuration file **cgi.cfg**. The layout can also be changed with a selection window in the Web interface (at the top right in Figure 16.27). The figure shows the demo system of Netways,[9] whose appearance depends on user-specific coordinates, which in this case you have to specify individually for each host (see page 310). The question mark icon supplied by Nagios has been replaced with nicer pictures by the operator of the site. Coordinates and icons are defined with the **hostextinfo** object, described in more detail in Section 16.4.1, page 307.

[9] http://netways.de/Demosystem.1621.0.html



Google

Name: google.de
Alias: www.google.de
Address: 66.249.85.104
State: Up
Status Information: PING OK - Packet loss = 0%, RTA = 5.80 ms
State Duration: 5d 10h 27m 35s
Last Status Check: 26-07-2005 14:52:56
Last State Change: 25-07-2005 00:46:16
Parent Host(s): internet
Immediate Child Hosts: 0

Services:
- 1 ok

Layout Method: User-supplied coords
Scaling factor: 0.0
Drawing Layers: Firma1, internet, www-hosts
Layer mode: ○ Include ● Exclude
Supress popups: □

Figure 16.27: Statusmap with self-defined coordinates and icons

If you move the mouse onto a particular host, Nagios opens a yellow window at the top left with status information, which includes the IP address, current status information, and the time of the last check. At the bottom of this box, statusmap.cgi summarizes the states of the services running on this host.

If you double-click on a particular host, Nagios branches off to the usual status overview, which apart from data on the host selected, also displays all the services belonging to this host (Figure 16.13 on page 281 gives an example).

16.2.6 Navigation in 3D: statuswrl.cgi

statuswrl.cgi allows Nagios to move through a 3D representation of the network plan (Figure 16.28). In this you can zoom on to hosts, move the overall view, rotate it, etc.

A VRML-capable browser is necessary for the display.[10] Although the original documentation[11] provides links to the corresponding plug-ins, two of them are out

[10] The *Virtual Reality Markup Language* (VRML), version 2.0/1997, is used to describe the virtual "space."

[11] /usr/local/nagios/share/docs/cgis.html#statuswrl_cgi

of date, and only *Cortona*[12] could be reached at the time of going to press. This plugin does not work under Linux, however; in Windows it works with Internet Explorer, and also with Netscape, Mozilla, and Firefox.[13]

Of the VRML plugins for Linux (three well-known projects are *OpenVRML*,[14] *freeWRL*,[15] and *vrwave*[16]) the standard Linux distributions usually do not include a finished package, so you are dependent on external packages. There are binary RPM packages for OpenVRML, but the current (at the time of going to press) version 0.15.9 needs the very newest libc and cannot therefore even be installed in SuSE Linux 9.3. You should not try compiling the software yourself unless you are an experienced system administrator or software developer: there are a large number of pitfalls. If you have never worked with the Java compiler before and have not compiled complex software packages such as Mozilla or Firefox yourself, then you should leave it alone.

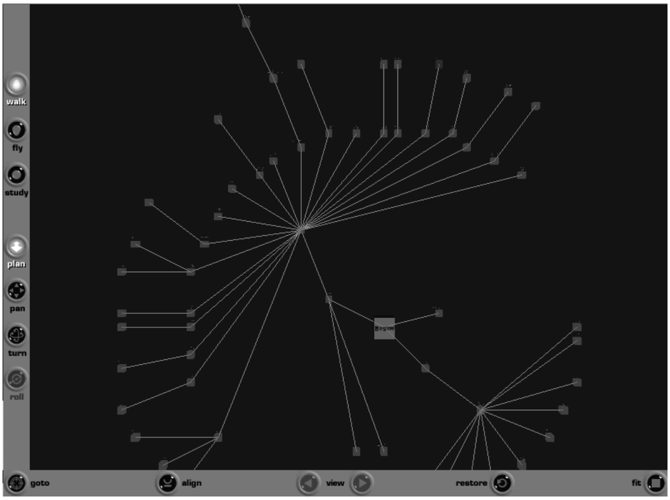


Figure 16.28: This picture marks the beginning of the tour through your own network

But all of this is no reason to despair, since the use of 3D navigation is questionable anyway, especially as the 2D view of the normal status map displays all the information required, and displaying simple flat graphics in the browser takes up considerably less time than CPU-intensive 3D rendering. Before you rush into the adventure of compiling software yourself, we recommend that you decide for yourself, using the Cortona plugin, whether it is worth the effort of compiling a project like OpenVRML.

[12] http://www.parallelgrafics.com/products/cortona/

[13] For Mozilla and Firefox you have to install it manually, select Custom instead of Typical in the installation routine, and in unsupported browsers specify the plug-in directory of the browser.

[14] http://www.openvrml.org/

[15] http://freewrl.sourceforge.net/

[16] http://www.iicm.edu/vrwave/

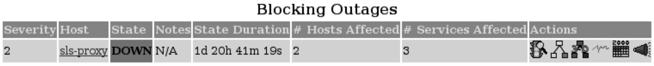
16.2.7 Querying the status with a cell phone: statuswml.cgi

In order to make the information provided by Nagios accessible for WAP[17]-capable devices without a fully functional browser, **statuswml.cgi** generates a Web page in the WML format,[18] which can be displayed with a cellphone—provided that the Nagios server is reachable in the Internet. Apart from the status query for hosts and services, it also allows the CGI program to switch off tests and notifications and to confirm existing problems with acknowledgements.

You should think carefully before you make Nagios accessible over the Internet: Nagios makes available much sensitive data that can be misused by hackers. In case of doubt, you're better off doing without it. Without direct Internet access, **statuswml.cgi** is useless, since a cellphone cannot use protected access methods such as a VPN tunnel. This is why we shall not introduce **statuswml.cgi** in great detail at this point.

16.2.8 Analyzing disrupted partial networks: outages.cgi

The CGI program **outages.cgi** only shows those network nodes in a host overview that are responsible for the failure of a partial network: In contrast to a status overview, as in Figure 16.14, page 281, **outages.cgi** specifies in the **# Hosts Affected** column how many services and hosts this affects in each case (Figure 16.29).



Blocking Outages

Severity	Host	State	Notes	State Duration	# Hosts Affected	# Services Affected	Actions
2	sls-proxy	DOWN	N/A	1d 20h 41m 19s	2	3	

Figure 16.29: As long as sls-proxy fails, Nagios cannot reach any hosts lying behind it

With the icons in the **Actions** column you call other CGI programs that selectively filter out information on the host shown here. From left to right, they show the status display in the detail view (traffic light), the topological network view (network tree), the 3D view (**3-D**), the trend display (graph), the log file entries for the host (spreadsheet), and the display of notifications which have been made (megaphone).

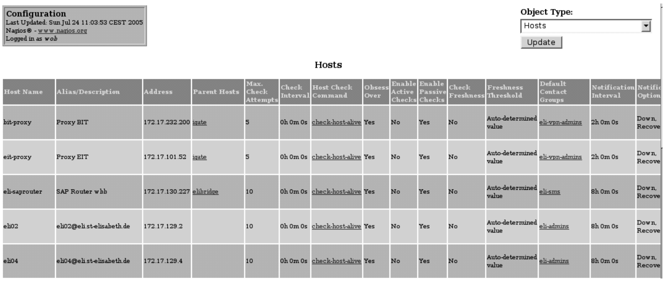
16.2.9 Querying the object definition with config.cgi

config.cgi shows a tabular overview of the definition of all objects for a type that can be specified (Figure 16.30)—the type of object involved can be defined in the selection field in the top right corner. Where the consideration itself contains Nagios objects (in the host view **Host Check Command**, **Default Contact Group**,

[17] *Wireless Access Protocol.*

[18] The *Wireless Markup Language* contains a part of HTML, heavily reduced in its functionality.

and—not visible in the picture—**Notification Period**), a link takes you directly to the configuration view of this object type.



Configuration
Last Updated: Sun Jul 24 11:03:53 CEST 2005
Nagios® - www.nagios.org
Logged in as *wob*

Object Type: Hosts

Hosts

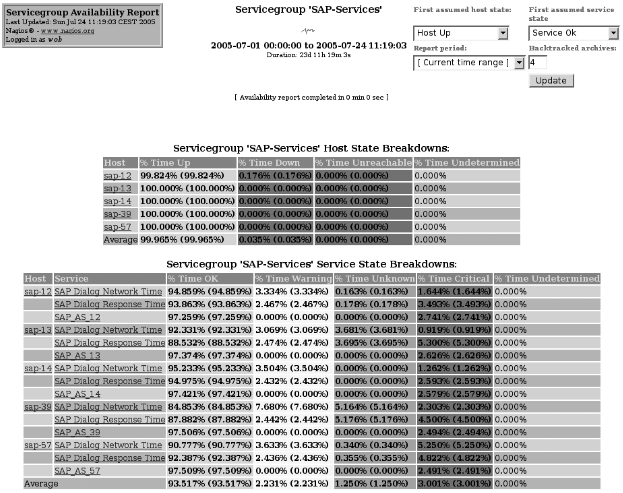
Host Name	Alias/Description	Address	Parent Hosts	Max. Check Attempts	Check Interval	Host Check Command	Obsess Over	Enable Active Checks	Enable Passive Checks	Check Freshness	Freshness Threshold	Default Contact Groups	Notification Interval	Notific Option
bit-proxy	Proxy BIT	172.17.232.200	igate	5	0h 0m 0s	check-host-alive	Yes	No	Yes	No	Auto-determined value	eli-vpn-admins	2h 0m 0s	Down, Recove
eit-proxy	Proxy EIT	172.17.101.52	igate	5	0h 0m 0s	check-host-alive	Yes	No	Yes	No	Auto-determined value	eli-vpn-admins	2h 0m 0s	Down, Recove
eli-saprouter	SAP Router wbb	172.17.130.227	elibridge	10	0h 0m 0s	check-host-alive	Yes	No	Yes	No	Auto-determined value	eli-sms	8h 0m 0s	Down, Recove
eli02	eli02@eli.st-elisabeth.de	172.17.129.2		10	0h 0m 0s	check-host-alive	Yes	No	Yes	No	Auto-determined value	eli-admins	8h 0m 0s	Down, Recove
eli04	eli04@eli.st-elisabeth.de	172.17.129.4		10	0h 0m 0s	check-host-alive	Yes	No	Yes	No	Auto-determined value	eli-admins	8h 0m 0s	Down, Recove

Figure 16.30: config.cgi displays the current configuration of the selected object class—here hosts—(extract)

The CGI program does not provide any way of changing anything in the settings. In addition, only users who are entered in the parameter **authorized_for_configuration_information** (configuration file **cgi.cfg**, page 444) have access to this view.

16.2.10 Availability statistics: avail.cgi

If you are monitoring systems, then you also take an interest in their availability. **avail.cgi** first asks if you are interested in **Hosts**, **Services**, **Hostgroups**, and **Servicegroups**. After you have selected a time period, you will see an overview, as in Figure 16.31. For **Services** and **Hosts** you can also have the availability data presented through **All Hosts** or **All Services** as a CSV file.



Servicegroup Availability Report
Last Updated: Sun Jul 24 11:19:03 CEST 2005
Nagios® - www.nagios.org
Logged in as *wob*

Servicegroup 'SAP-Services'

2005-07-01 00:00:00 to 2005-07-24 11:19:03
Duration: 23d 11h 19m 3s

First assumed host state: Host Up
First assumed service state: Service Ok
Report period: [Current time range]
Backtracked archives: 4

[Availability report completed in 0 min 0 sec]

Servicegroup 'SAP-Services' Host State Breakdowns:

Host	% Time Up	% Time Down	% Time Unreachable	% Time Undetermined
sap-12	99.824% (99.824%)	0.176% (0.176%)	0.000% (0.000%)	0.000%
sap-13	100.000% (100.000%)	0.000% (0.000%)	0.000% (0.000%)	0.000%
sap-14	100.000% (100.000%)	0.000% (0.000%)	0.000% (0.000%)	0.000%
sap-39	100.000% (100.000%)	0.000% (0.000%)	0.000% (0.000%)	0.000%
sap-57	100.000% (100.000%)	0.000% (0.000%)	0.000% (0.000%)	0.000%
Average	99.965% (99.965%)	0.035% (0.035%)	0.000% (0.000%)	0.000%

Servicegroup 'SAP-Services' Service State Breakdowns:

Host	Service	% Time OK	% Time Warning	% Time Unknown	% Time Critical	% Time Undetermined
sap-12	SAP Dialog Network Time	94.859% (94.859%)	3.334% (3.334%)	0.163% (0.163%)	1.644% (1.644%)	0.000%
	SAP Dialog Response Time	93.863% (93.863%)	2.467% (2.467%)	0.178% (0.178%)	3.493% (3.493%)	0.000%
	SAP_AS_12	97.259% (97.259%)	0.000% (0.000%)	0.000% (0.000%)	2.741% (2.741%)	0.000%
sap-13	SAP Dialog Network Time	92.331% (92.331%)	3.069% (3.069%)	3.681% (3.681%)	0.919% (0.919%)	0.000%
	SAP Dialog Response Time	88.532% (88.532%)	2.474% (2.474%)	3.695% (3.695%)	5.300% (5.300%)	0.000%
	SAP_AS_13	97.374% (97.374%)	0.000% (0.000%)	0.000% (0.000%)	2.626% (2.626%)	0.000%
sap-14	SAP Dialog Network Time	95.233% (95.233%)	3.504% (3.504%)	0.000% (0.000%)	1.262% (1.262%)	0.000%
	SAP Dialog Response Time	94.975% (94.975%)	2.432% (2.432%)	0.000% (0.000%)	2.593% (2.593%)	0.000%
	SAP_AS_14	97.421% (97.421%)	0.000% (0.000%)	0.000% (0.000%)	2.579% (2.579%)	0.000%
sap-39	SAP Dialog Network Time	84.853% (84.853%)	7.680% (7.680%)	5.164% (5.164%)	2.303% (2.303%)	0.000%
	SAP Dialog Response Time	87.882% (87.882%)	2.442% (2.442%)	5.176% (5.176%)	4.500% (4.500%)	0.000%
	SAP_AS_39	97.506% (97.506%)	0.000% (0.000%)	0.000% (0.000%)	2.494% (2.494%)	0.000%
sap-57	SAP Dialog Network Time	90.777% (90.777%)	3.633% (3.633%)	0.340% (0.340%)	5.250% (5.250%)	0.000%
	SAP Dialog Response Time	92.387% (92.387%)	2.436% (2.436%)	0.355% (0.355%)	4.822% (4.822%)	0.000%
	SAP_AS_57	97.509% (97.509%)	0.000% (0.000%)	0.000% (0.000%)	2.491% (2.491%)	0.000%
Average		93.517% (93.517%)	2.231% (2.231%)	1.250% (1.250%)	3.001% (3.001%)	0.000%

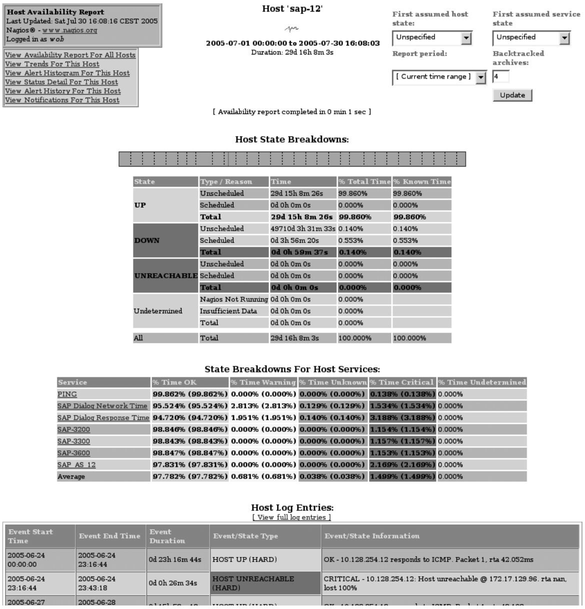
Figure 16.31: An availability report using the example of the SAP-Services service group

avail.cgi shows the hosts involved separately from the services. How long a service or host remained in a particular state can be seen from the corresponding colored column—green for OK, yellow for WARNING, red for CRITICAL (service), DOWN and UNREACHABLE (host)—in percent. The column that shows how much time the status of a service was UNKNOWN is shown in orange. Incomplete logfiles are shown in the **Undetermined** column. If there is a value larger than zero, then there are periods for which Nagios cannot make a statement concerning the state.

Below each table, the **Average** line specifies the average of the individual values. In Figure 16.31 the hosts involved were available 99.965 percent of the time.

avail.cgi shows the availability twice in each case: first as an absolute value for the evaluation period, and then (in brackets) with respect to the time during which data actually was available. As long as the **Time Undetermined** column displays **0.000%**, the two availability values match.

If you click on one of the hosts or services displayed, a detailed view will appear. Figure 16.32 shows such a view for the host **sap-12**.



Host Availability Report
Last Updated: Sat Jul 30 16:08:16 CEST 2005
Nagios® - www.nagios.org
Logged in as *wob*

View Availability Report For All Hosts
View Trends For This Host
View Alert Histogram For This Host
View Status Detail For This Host
View Alert History For This Host
View Notifications For This Host

Host 'sap-12'

2005-07-01 00:00:00 to 2005-07-30 16:08:03
Duration: 29d 16h 8m 3s

First assumed host state: Unspecified
First assumed service state: Unspecified
Report period: [Current time range]
Backtracked archives: 4

[Availability report completed in 0 min 1 sec]

Host State Breakdowns:

State	Type / Reason	Time	% Total Time	% Known Time
UP	Unscheduled	29d 15h 8m 26s	99.860%	99.860%
	Scheduled	0d 0h 0m 0s	0.000%	0.000%
	Total	**29d 15h 8m 26s**	**99.860%**	**99.860%**
DOWN	Unscheduled	49710d 3h 31m 33s	0.140%	0.140%
	Scheduled	0d 3h 56m 20s	0.553%	0.553%
	Total	**0d 0h 59m 37s**	**0.140%**	**0.140%**
UNREACHABLE	Unscheduled	0d 0h 0m 0s	0.000%	0.000%
	Scheduled	0d 0h 0m 0s	0.000%	0.000%
	Total	**0d 0h 0m 0s**	**0.000%**	**0.000%**
Undetermined	Nagios Not Running	0d 0h 0m 0s	0.000%	
	Insufficient Data	0d 0h 0m 0s	0.000%	
	Total	0d 0h 0m 0s	0.000%	
All	Total	29d 16h 8m 3s	100.000%	100.000%

State Breakdowns For Host Services:

Service	% Time OK	% Time Warning	% Time Unknown	% Time Critical	% Time Undetermined
PING	**99.862% (99.862%)**	**0.000% (0.000%)**	**0.000% (0.000%)**	**0.138% (0.138%)**	0.000%
SAP Dialog Network Time	**95.524% (95.524%)**	**2.813% (2.813%)**	**0.129% (0.129%)**	**1.534% (1.534%)**	0.000%
SAP Dialog Response Time	**94.720% (94.720%)**	**1.951% (1.951%)**	**0.140% (0.140%)**	**3.188% (3.188%)**	0.000%
SAP-3200	**98.846% (98.846%)**	**0.000% (0.000%)**	**0.000% (0.000%)**	**1.154% (1.154%)**	0.000%
SAP-3300	**98.843% (98.843%)**	**0.000% (0.000%)**	**0.000% (0.000%)**	**1.157% (1.157%)**	0.000%
SAP-3600	**98.847% (98.847%)**	**0.000% (0.000%)**	**0.000% (0.000%)**	**1.153% (1.153%)**	0.000%
SAP_AS_12	**97.831% (97.831%)**	**0.000% (0.000%)**	**0.000% (0.000%)**	**2.169% (2.169%)**	0.000%
Average	**97.782% (97.782%)**	**0.681% (0.681%)**	**0.038% (0.038%)**	**1.499% (1.499%)**	0.000%

Host Log Entries:
[View full log entries]

Event Start Time	Event End Time	Event Duration	Event/State Type	Event/State Information
2005-06-24 00:00:00	2005-06-24 23:16:44	0d 23h 16m 44s	HOST UP (HARD)	OK - 10.128.254.12 responds to ICMP. Packet 1, rta 42.052ms
2005-06-24 23:16:44	2005-06-24 23:43:18	0d 0h 26m 34s	HOST UNREACHABLE (HARD)	CRITICAL - 10.128.254.12: Host unreachable @ 172.17.129.96. rta nan, lost 100%
2005-06-27	2005-06-28	[illegible]	HOST UP (HARD)	[illegible]

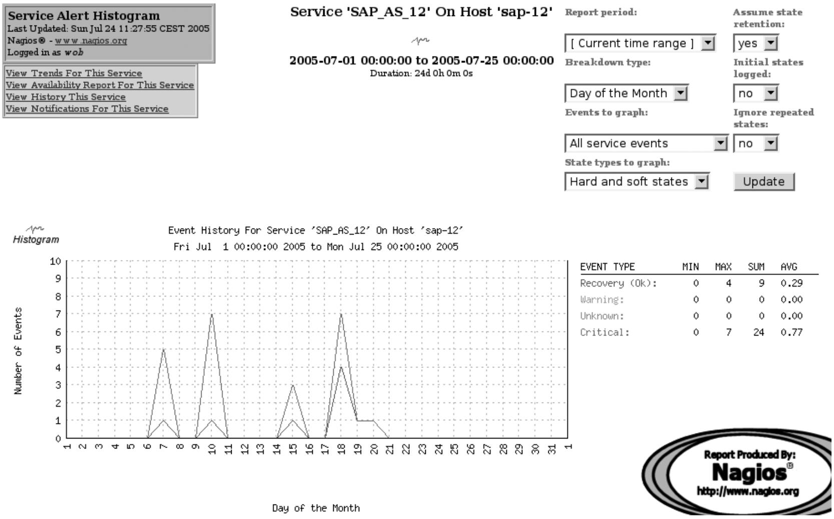
Figure 16.32: The availability of the host sap-12 explained in detail

On a bar diagram that shows the states over the selected period in color, there is detailed information on the host itself, followed by statistics on the availability of the service that is monitored on this host. This includes an extract from the logfile, which only shows the relevant entries for the availability of the host; that is, HOST UP, HOST DOWN, or HOST UNREACHABLE. The logfile entries are cut off by **avail.cgi** to save space.

16.2.11 What events occur, how often? histogram.cgi

If the state of a host or service changes, this is called an *event*. The CGI program **histogram.cgi** shows the frequency of this in different views. If you select **Day of the Month** as the **Breakdown type**, it illustrates what event took place on which day of the month, and how often (Figure 16.33). The red graph in services stands for CRITICAL, the orange one for UNKNOWN, yellow for WARNING, and green for OK. The curve for hosts in the DOWN state is marked by **histogram.cgi** in red, that for UNREACHABLE hosts in wine-red, and the green line stands, as usual, for OK.

Figure 16.33: How many events of what type were there on which day?



Service Alert Histogram
Last Updated: Sun Jul 24 11:27:55 CEST 2005
Nagios® - www.nagios.org
Logged in as *wob*

View Trends For This Service
View Availability Report For This Service
View History This Service
View Notifications For This Service

Service 'SAP_AS_12' On Host 'sap-12'

2005-07-01 00:00:00 to 2005-07-25 00:00:00
Duration: 24d 0h 0m 0s

Report period: [Current time range]
Breakdown type: Day of the Month
Events to graph: All service events
State types to graph: Hard and soft states
Assume state retention: yes
Initial states logged: no
Ignore repeated states: no

Update
Histogram
Event History For Service 'SAP_AS_12' On Host 'sap-12'
Fri Jul 1 00:00:00 2005 to Mon Jul 25 00:00:00 2005
Number of Events
0
1
2
3
4
5
6
7
8
9
10
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 1
Day of the Month
Report Produced By: Nagios® http://www.nagios.org

EVENT TYPE	MIN	MAX	SUM	AVG
Recovery (Ok):	0	4	9	0.29
Warning:	0	0	0	0.00
Unknown:	0	0	0	0.00
Critical:	0	7	24	0.77

If you choose the variation **Day of Week**, the Web page shows on which day of the week most events occur, so you can find out whether Monday really is always the worst day. In addition to this you can have the frequency presented by day (**Hour of Day**) or by the month of a year (**Month**). With **Report Period** you can adjust the report period. With **Assume state retention** you can adjust whether the previously existing states are retained and included in the evaluation (**yes**) or not (**no**).

If you have configured Nagios so that it explicitly logs the states of the monitored hosts and services for a restart or when the log file is changed,[19] and if you set **Initial states logged** to **yes**, the script includes this explicitly in the evaluation. A **no** ignores the entry; **histogram.cgi** then assumes that the state after a system start is identical to that which existed directly before the restart.[20]

[19] Parameter **log_initial_state** in **nagios.cfg**; see page 433.

[20] The subtle difference here lies in **retain_state_information** (see page 438). If this parameter is set to **0**, Nagios forgets the previous state. Without **log_initial_state** = **yes**, Nagios accepts an OK after the restart.

Ignore repeated states makes allowances if a state persists for a long time and therefore delivers the same result again and again. If you set **yes** here, the script evaluates it once instead of many times.

If you select the item **Hard and soft states** in **State types to graph:**, **histogram.cgi** also counts soft states. If a service changes from OK to CRITICAL, for example, while **retry_check_interval** is set to **4**,[21] then **histogram.cgi** counts a total of four results, three soft and one hard. If you only evaluate hard states, the statistics evaluate the value 1. If an error is rectified, there are no soft states; therefore the value for CRITICAL is usually larger that that for RECOVERY if you include soft states in the evaluation.

16.2.12 Filtering log entries after specific states: history.cgi

The **history.cgi** script allows the states of a type (soft or hard) to be extracted selectively from the logfile using the selection field **State type options** (at the top right in Figure 16.34), and specific events to be extracted (all, all related to hosts, all service events, only host-recovery, only host-down, etc.) using **History detail level for all hosts**. The entries to be shown can be restricted through parameters to individual hosts, services, or host or service groups when the CGI program is called. So the command

```
histogram.cgi?host=sap-12
```

only displays logfile entries for the host **sap-12**.

If the output should be restricted to a specific host, then the service description needs to be specified as well:

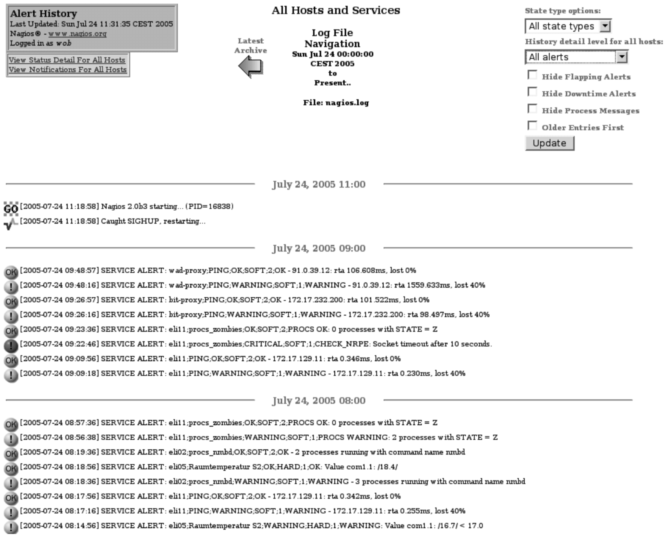
```
histogram.cgi?host=sap-12&service=PING
```

Selecting a host and service group is done in the same way:

```
histogram.cgi?hostgroup=SAP
histogram.cgi?servicegroup=SAP-Services
```

The period that **history.cgi** views depends on the archiving interval of the logfile. The script always refers to the contents of an archive file. If you set the parameter **log_rotation_method** (page 434) in the configuration file **nagios.cfg** to **d** for daily archiving, the Web page presents the entries for one day. Using the arrows (at the top in Figure 16.34) you can then scroll up and down through the days.

[21] Nagios thus repeats the test four times before it categorizes the state as "hard."



Alert History
Last Updated: Sun Jul 24 11:31:35 CEST 2005
Nagios® - www.nagios.org
Logged in as *wob*

View Status Detail For All Hosts
View Notifications For All Hosts

All Hosts and Services

Latest Archive

Log File Navigation
Sun Jul 24 00:00:00 CEST 2005 to Present..

File: nagios.log

State type options: All state types
History detail level for all hosts: All alerts
□ Hide Flapping Alerts
□ Hide Downtime Alerts
□ Hide Process Messages
□ Older Entries First

July 24, 2005 11:00

```
GO [2005-07-24 11:18:58] Nagios 2.0b3 starting... (PID=16838)
   [2005-07-24 11:18:58] Caught SIGHUP, restarting...
```

July 24, 2005 09:00

```
OK [2005-07-24 09:48:57] SERVICE ALERT: wad-proxy;PING;OK;SOFT;2;OK - 91.0.39.12: rta 106.608ms, lost 0%
!  [2005-07-24 09:48:16] SERVICE ALERT: wad-proxy;PING;WARNING;SOFT;1;WARNING - 91.0.39.12: rta 1559.633ms, lost 40%
OK [2005-07-24 09:26:57] SERVICE ALERT: bit-proxy;PING;OK;SOFT;2;OK - 172.17.232.200: rta 101.522ms, lost 0%
!  [2005-07-24 09:26:16] SERVICE ALERT: bit-proxy;PING;WARNING;SOFT;1;WARNING - 172.17.232.200: rta 98.497ms, lost 40%
OK [2005-07-24 09:23:36] SERVICE ALERT: eli11;procs_zombies;OK;SOFT;2;PROCS OK: 0 processes with STATE = Z
!  [2005-07-24 09:22:46] SERVICE ALERT: eli11;procs_zombies;CRITICAL;SOFT;1;CHECK_NRPE: Socket timeout after 10 seconds.
OK [2005-07-24 09:09:56] SERVICE ALERT: eli11;PING;OK;SOFT;2;OK - 172.17.129.11: rta 0.346ms, lost 0%
!  [2005-07-24 09:09:18] SERVICE ALERT: eli11;PING;WARNING;SOFT;1;WARNING - 172.17.129.11: rta 0.230ms, lost 40%
```

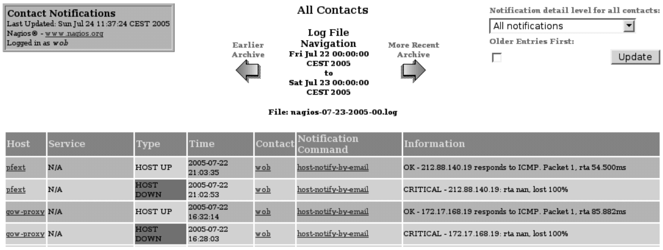
July 24, 2005 08:00

```
OK [2005-07-24 08:57:36] SERVICE ALERT: eli11;procs_zombies;OK;SOFT;2;PROCS OK: 0 processes with STATE = Z
!  [2005-07-24 08:56:38] SERVICE ALERT: eli11;procs_zombies;WARNING;SOFT;1;PROCS WARNING: 2 processes with STATE = Z
OK [2005-07-24 08:19:36] SERVICE ALERT: eli02;procs_nmbd;OK;SOFT;2;OK - 2 processes running with command name nmbd
OK [2005-07-24 08:18:56] SERVICE ALERT: eli05;Raumtemperatur S2;OK;HARD;1;OK: Value com1.1: /18.4/
!  [2005-07-24 08:18:36] SERVICE ALERT: eli02;procs_nmbd;WARNING;SOFT;1;WARNING - 3 processes running with command name nmbd
OK [2005-07-24 08:17:56] SERVICE ALERT: eli11;PING;OK;SOFT;2;OK - 172.17.129.11: rta 0.342ms, lost 0%
!  [2005-07-24 08:17:16] SERVICE ALERT: eli11;PING;WARNING;SOFT;1;WARNING - 172.17.129.11: rta 0.255ms, lost 40%
!  [2005-07-24 08:14:56] SERVICE ALERT: eli05;Raumtemperatur S2;WARNING;HARD;1;WARNING: Value com1.1: /16.7/ < 17.0
```

Figure 16.34: history.cgi filters the information from the logfile

16.2.13 Who was told what, when? notifications.cgi

Another filtered view of the logfile is offered by **notifications.cgi**: It shows all sent messages. Here the view can aso be restricted to a specific message group, through the selection field at the top right in Figure 16.35: to all notifications involving hosts, to all which are about services in a critical state, and so on.



Contact Notifications
Last Updated: Sun Jul 24 11:37:24 CEST 2005
Nagios® - www.nagios.org
Logged in as *wob*

All Contacts

Earlier Archive

Log File Navigation
Fri Jul 22 00:00:00 CEST 2005 to Sat Jul 23 00:00:00 CEST 2005

More Recent Archive

File: nagios-07-23-2005-00.log

Notification detail level for all contacts: All notifications
Older Entries First: □

Host	Service	Type	Time	Contact	Notification Command	Information
pfext	N/A	HOST UP	2005-07-22 21:03:35	wob	host-notify-by-email	OK - 212.88.140.19 responds to ICMP. Packet 1, rta 54.500ms
pfext	N/A	HOST DOWN	2005-07-22 21:02:53	wob	host-notify-by-email	CRITICAL - 212.88.140.19: rta nan, lost 100%
gow-proxy	N/A	HOST UP	2005-07-22 16:32:14	wob	host-notify-by-email	OK - 172.17.168.19 responds to ICMP. Packet 1, rta 85.882ms
gow-proxy	N/A	HOST DOWN	2005-07-22 16:28:03	wob	host-notify-by-email	CRITICAL - 172.17.168.19: rta nan, lost 100%

Figure 16.35: notifications.cgi answers the question of who gets messages when, about what

If you just want to see messages here concerning particular hosts and services, you must again specify this with parameters when running the CGI program:

```
notifications.cgi?host=host
notifications.cgi?host=host&service=service name
notifications.cgi?contact=contact
```

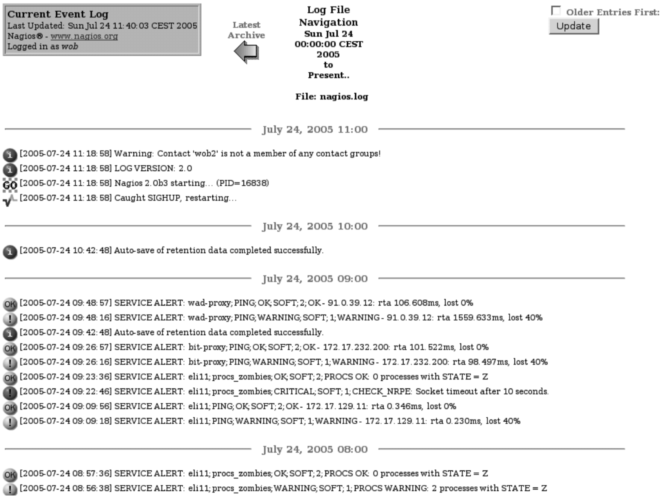
Apart from **host** and **service**, you can also select a particular contact, but selecting host or service groups is not possible.

16.2.14 Showing all logfile entries: showlog.cgi

The CGI program **showlog.cgi** shows the logfile as it is, with the few colored icons added to help you find your way: a red button marks critical service states or DOWN/UNREACHABLE hosts, a yellow button marks WARNINGs, and a green one, OK. Other buttons refer to information entries or Nagios restarts (Figure 16.36).

You only have a single option here: the chronological order. Normally **showlog.cgi** shows the newest entries first. If you enable the checkmark in **Older Entries First:** (top right), the oldest entries will be shown first.

The period represented here also depends on the archiving method: if you archive once a day, you will obtain just one day for each Web page. To reach the entries for other days you must make your way through the individual archive files of the logfile using the arrows at the top of the picture.



```
Current Event Log
Last Updated: Sun Jul 24 11:40:03 CEST 2005
Nagios® - www.nagios.org
Logged in as wob

Log File
Navigation
Sun Jul 24
00:00:00 CEST
2005
to
Present..

File: nagios.log

July 24, 2005 11:00

[2005-07-24 11:18:58] Warning: Contact 'wob2' is not a member of any contact groups!
[2005-07-24 11:18:58] LOG VERSION: 2.0
[2005-07-24 11:18:58] Nagios 2.0b3 starting... (PID=16838)
[2005-07-24 11:18:58] Caught SIGHUP, restarting...

July 24, 2005 10:00

[2005-07-24 10:42:48] Auto-save of retention data completed successfully.

July 24, 2005 09:00

[2005-07-24 09:48:57] SERVICE ALERT: wad-proxy;PING;OK;SOFT;2;OK - 91.0.39.12: rta 106.608ms, lost 0%
[2005-07-24 09:48:16] SERVICE ALERT: wad-proxy;PING;WARNING;SOFT;1;WARNING - 91.0.39.12: rta 1559.633ms, lost 40%
[2005-07-24 09:42:48] Auto-save of retention data completed successfully.
[2005-07-24 09:26:57] SERVICE ALERT: bit-proxy;PING;OK;SOFT;2;OK - 172.17.232.200: rta 101.522ms, lost 0%
[2005-07-24 09:26:16] SERVICE ALERT: bit-proxy;PING;WARNING;SOFT;1;WARNING - 172.17.232.200: rta 98.497ms, lost 40%
[2005-07-24 09:23:36] SERVICE ALERT: eli11;procs_zombies;OK;SOFT;2;PROCS OK: 0 processes with STATE = Z
[2005-07-24 09:22:46] SERVICE ALERT: eli11;procs_zombies;CRITICAL;SOFT;1;CHECK_NRPE: Socket timeout after 10 seconds.
[2005-07-24 09:09:56] SERVICE ALERT: eli11;PING;OK;SOFT;2;OK - 172.17.129.11: rta 0.346ms, lost 0%
[2005-07-24 09:09:18] SERVICE ALERT: eli11;PING;WARNING;SOFT;1;WARNING - 172.17.129.11: rta 0.230ms, lost 40%

July 24, 2005 08:00

[2005-07-24 08:57:36] SERVICE ALERT: eli11;procs_zombies;OK;SOFT;2;PROCS OK: 0 processes with STATE = Z
[2005-07-24 08:56:38] SERVICE ALERT: eli11;procs_zombies;WARNING;SOFT;1;PROCS WARNING: 2 processes with STATE = Z
```

Figure 16.36: A blue button marks information entries, the graph changing from red to green stands for Nagios restarts, and the icon marked GO with a green checked background represents restarts of the monitoring system

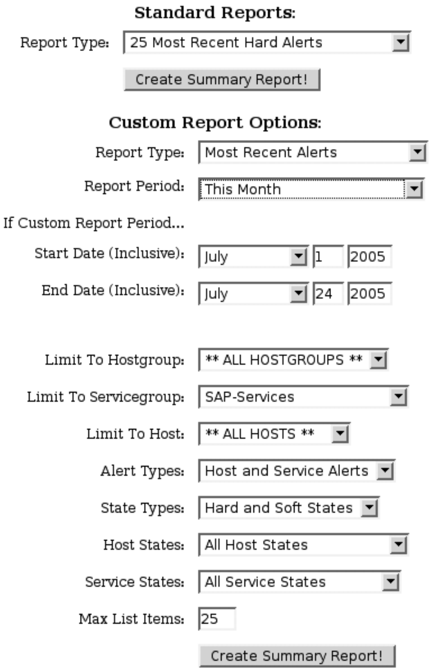
16.2.15 Evaluating whatever you want: summary.cgi

If the display and selection options are introduced so far are not sufficient for you, you can create your own report with **summary.cgi**, which generates the selection dialog shown in Figure 16.37. The upper section, **Standard Reports:**, provides a quick summary in which just one fixed report type can be selected. Clicking on the button directly below this generates the report.

The second section is more sophisticated. The field **Report Type:** with the report type **Most Recent Alerts** provides an individual listing of the last *n* of individual events. The number *n* is defined further down in the selection dialog in **Max List Items:**.[22] **Report Type:** can also be used to show all events individually on a separate line, with **Most Recent Alerts**, or you can have statistics displayed, for the number of events that have occurred overall, for each host group, etc., with **Alert Totals**, **Alert Totals by Hostgroups**, etc..

One particularly interesting report type is **Top Alert Producer**: such reports show in a hit list of who has caused most trouble during the report period.

In **Report Period:** you can either choose the desired report period from predefined intervals (this week, the past seven days, this month, last week, last month, etc.), or you can specify **CUSTOM REPORT PERIOD** and define any period you choose. If you forget to specify **CUSTOM REPORT PERIOD** explicitly, the CGI program ignores the dates you have set and selects what is currently entered in **Report Period**.



Standard Reports:

Report Type: 25 Most Recent Hard Alerts

Custom Report Options:

Report Type: Most Recent Alerts

Report Period: This Month

If Custom Report Period...

Start Date (Inclusive): July 1 2005

End Date (Inclusive): July 24 2005

Limit To Hostgroup: ** ALL HOSTGROUPS **

Limit To Servicegroup: SAP-Services

Limit To Host: ** ALL HOSTS **

Alert Types: Host and Service Alerts

State Types: Hard and Soft States

Host States: All Host States

Service States: All Service States

Max List Items: 25

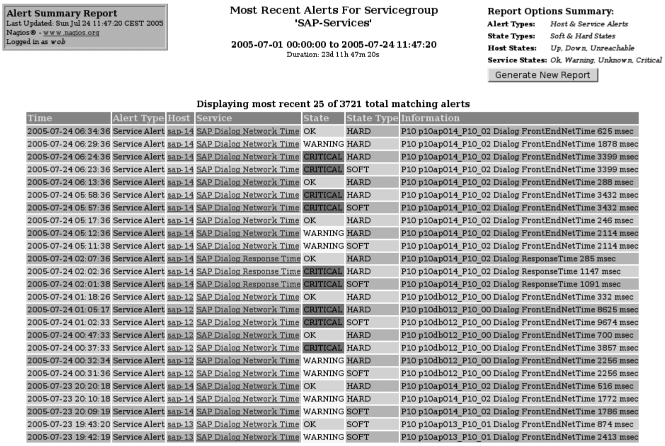
Figure 16.37: Selection template for parameters in summary.cgi

The details that follow the report period filter according to host, services or their groups, state types, and/or individual states (e.g., only services in a CRITICAL state).

[22] If the number of events in the report period is less than specified in **Max List Items:**, the report covers all the events that have happened during this period.

It is important to specify **Max List Items** at the end: **summary.cgi** always shows only as many entries as are specified here. The default is a little small; if you want all the entries in the selected period to be shown, you should enter **0** as the value. The largest value that can be given explicitly here is 999. The **Create Summary Report!** button then generates the requested report (Figure 16.38).

The header of the report contains details of the report period and the selection made. The detail directly above the table is interesting: **Displaying most recent 25 of 3721 total matching alerts** shows that the selection criteria matched a total of 3721 entries, but that the CGI script restricted the output to the 25 most current entries, thanks to **Max List Items:**.



Alert Summary Report
Last Updated: Sun Jul 24 11:47:20 CEST 2005
Nagios® - www.nagios.org
Logged in as *wob*

Most Recent Alerts For Servicegroup
'SAP-Services'

2005-07-01 00:00:00 to 2005-07-24 11:47:20
Duration: 23d 11h 47m 20s

Report Options Summary:
Alert Types: *Host & Service Alerts*
State Types: *Soft & Hard States*
Host States: *Up, Down, Unreachable*
Service States: *Ok, Warning, Unknown, Critical*

Displaying most recent 25 of 3721 total matching alerts

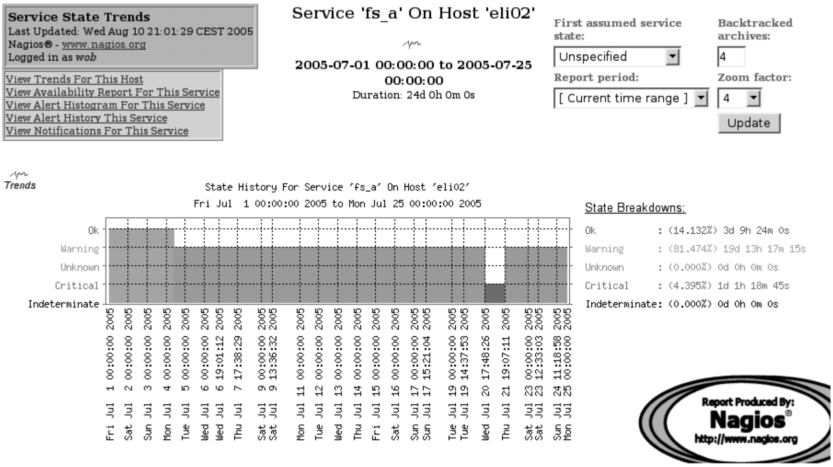
Time	Alert Type	Host	Service	State	State Type	Information
2005-07-24 06:34:36	Service Alert	sap-14	SAP Dialog Network Time	OK	HARD	P10 p10ap014_P10_02 Dialog FrontEndNetTime 625 msec
2005-07-24 06:29:36	Service Alert	sap-14	SAP Dialog Network Time	WARNING	HARD	P10 p10ap014_P10_02 Dialog FrontEndNetTime 1878 msec
2005-07-24 06:24:36	Service Alert	sap-14	SAP Dialog Network Time	CRITICAL	HARD	P10 p10ap014_P10_02 Dialog FrontEndNetTime 3399 msec
2005-07-24 06:23:36	Service Alert	sap-14	SAP Dialog Network Time	CRITICAL	SOFT	P10 p10ap014_P10_02 Dialog FrontEndNetTime 3399 msec
2005-07-24 06:13:36	Service Alert	sap-14	SAP Dialog Network Time	OK	HARD	P10 p10ap014_P10_02 Dialog FrontEndNetTime 288 msec
2005-07-24 05:58:36	Service Alert	sap-14	SAP Dialog Network Time	CRITICAL	HARD	P10 p10ap014_P10_02 Dialog FrontEndNetTime 3432 msec
2005-07-24 05:57:36	Service Alert	sap-14	SAP Dialog Network Time	CRITICAL	SOFT	P10 p10ap014_P10_02 Dialog FrontEndNetTime 3432 msec
2005-07-24 05:17:36	Service Alert	sap-14	SAP Dialog Network Time	OK	HARD	P10 p10ap014_P10_02 Dialog FrontEndNetTime 246 msec
2005-07-24 05:12:36	Service Alert	sap-14	SAP Dialog Network Time	WARNING	HARD	P10 p10ap014_P10_02 Dialog FrontEndNetTime 2114 msec
2005-07-24 05:11:38	Service Alert	sap-14	SAP Dialog Network Time	WARNING	SOFT	P10 p10ap014_P10_02 Dialog FrontEndNetTime 2114 msec
2005-07-24 02:07:36	Service Alert	sap-14	SAP Dialog Response Time	OK	HARD	P10 p10ap014_P10_02 Dialog ResponseTime 285 msec
2005-07-24 02:02:36	Service Alert	sap-14	SAP Dialog Response Time	CRITICAL	HARD	P10 p10ap014_P10_02 Dialog ResponseTime 1147 msec
2005-07-24 02:01:38	Service Alert	sap-14	SAP Dialog Response Time	CRITICAL	SOFT	P10 p10ap014_P10_02 Dialog ResponseTime 1091 msec
2005-07-24 01:18:26	Service Alert	sap-12	SAP Dialog Network Time	OK	HARD	P10 p10db012_P10_00 Dialog FrontEndNetTime 332 msec
2005-07-24 01:05:17	Service Alert	sap-12	SAP Dialog Network Time	CRITICAL	HARD	P10 p10db012_P10_00 Dialog FrontEndNetTime 8625 msec
2005-07-24 01:02:33	Service Alert	sap-12	SAP Dialog Network Time	CRITICAL	SOFT	P10 p10db012_P10_00 Dialog FrontEndNetTime 9674 msec
2005-07-24 00:47:33	Service Alert	sap-12	SAP Dialog Network Time	OK	HARD	P10 p10db012_P10_00 Dialog FrontEndNetTime 700 msec
2005-07-24 00:37:33	Service Alert	sap-12	SAP Dialog Network Time	CRITICAL	HARD	P10 p10db012_P10_00 Dialog FrontEndNetTime 3857 msec
2005-07-24 00:32:34	Service Alert	sap-12	SAP Dialog Network Time	WARNING	HARD	P10 p10db012_P10_00 Dialog FrontEndNetTime 2256 msec
2005-07-24 00:31:36	Service Alert	sap-12	SAP Dialog Network Time	WARNING	SOFT	P10 p10db012_P10_00 Dialog FrontEndNetTime 2256 msec
2005-07-23 20:20:18	Service Alert	sap-14	SAP Dialog Network Time	OK	HARD	P10 p10ap014_P10_02 Dialog FrontEndNetTime 516 msec
2005-07-23 20:10:18	Service Alert	sap-14	SAP Dialog Network Time	WARNING	HARD	P10 p10ap014_P10_02 Dialog FrontEndNetTime 1772 msec
2005-07-23 20:09:19	Service Alert	sap-14	SAP Dialog Network Time	WARNING	SOFT	P10 p10ap014_P10_02 Dialog FrontEndNetTime 1786 msec
2005-07-23 19:43:20	Service Alert	sap-13	SAP Dialog Network Time	OK	SOFT	P10 p10ap013_P10_01 Dialog FrontEndNetTime 874 msec
2005-07-23 19:42:19	Service Alert	sap-13	SAP Dialog Network Time	WARNING	SOFT	P10 p10ap013_P10_01 Dialog FrontEndNetTime 2413 msec

Figure 16.38: An individual report, as generated by summary.cgi

16.2.16 Following states graphically over time: trends.cgi

A rapid overview of what state occurred when for a particular host or service is provided by the graphic output of **trends.cgi** (Figure 16.39). After selecting a specific host or service, you can define a period, as with **summary.cgi**. The states are color-coded by **trends.cgi**, which makes the overview easier to follow.

The zoom function of the CGI program is an interesting detail. If you click in the colored area on a particular section, the selected area is enlarged or reduced in size by the zoom factor specified at the top right. Negative entries (**-1**, **-2**, **-3**, and **-4** are possible) expand the report period instead of reducing it.



Service State Trends
Last Updated: Wed Aug 10 21:01:29 CEST 2005
Nagios® - www.nagios.org
Logged in as *wob*

View Trends For This Host
View Availability Report For This Service
View Alert Histogram For This Service
View Alert History This Service
View Notifications For This Service

Service 'fs_a' On Host 'eli02'

2005-07-01 00:00:00 to 2005-07-25 00:00:00
Duration: 24d 0h 0m 0s

First assumed service state: Unspecified
Backtracked archives: 4
Report period: [Current time range]
Zoom factor: 4

State History For Service 'fs_a' On Host 'eli02'
Fri Jul 1 00:00:00 2005 to Mon Jul 25 00:00:00 2005

State Breakdowns:

```
Ok           : (14.132%) 3d 9h 24m 0s
Warning      : (81.474%) 19d 13h 17m 15s
Unknown      : (0.000%) 0d 0h 0m 0s
Critical     : (4.395%) 1d 1h 18m 45s
Indeterminate: (0.000%) 0d 0h 0m 0s
```

Figure 16.39: trends.cgi represents the chronological sequence of states—here using the example of a service

16.3 Planning Downtimes

In every system environment maintenance work accumulates from time to time that the administrator can normally plan, so that users can be informed accordingly beforehand. Nagios refers to such maintenance windows as *Scheduled Downtime*; the adminisntrator enters these either in the information page for the host or service generated by **extinfo.cgi** (Figure 16.4, page 277) or for the corresponding host or service group (Figure 16.16, page 284). In doing this, **extinfo.cgi** makes use of **cmd.cgi** (Section 16.2.3, page 288), which can also be called selectively:

```
http://nagsrv/nagios/cgi-bin/cmd.cgi?cmd_typ=55
```

opens the import template for maintenance times for a single host. The values for **cmd_typ** are summarized by Figure 16.23 on page 289.

A further method of recording maintenance periods is provided by addons, which, like the CGI programs, use the external command interface, but which can be automated, in contrast to the interactive Web interface. Such addons can also be found on the Nagios Exchange.[23]

For scheduled downtimes, Nagios prevents notifications from being sent. This ensures that the administrator is not flooded with false alarms. When checks are made to see whether messages should be sent, a downtime is the third item in the

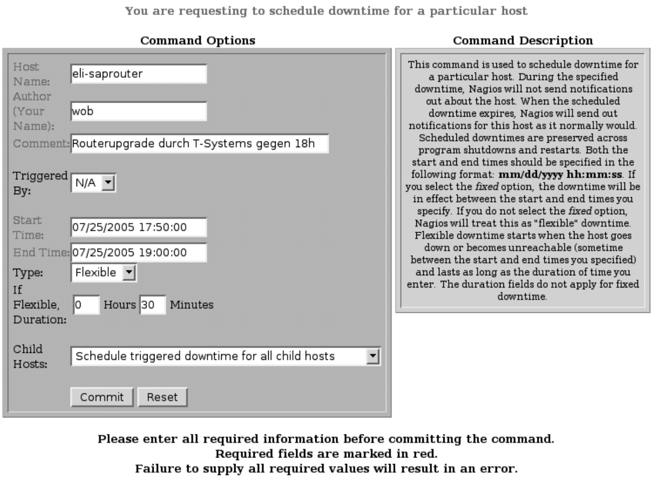
[23] http://www.nagiosexchange.org/Downtimes.38.0.html.

list (Figure 16.2, page 218). In addition, **avail.cgi** (Section 16.2.10, page 296.) takes account of the downtime when evaluating the availability of individual hosts and services, and assigns error states that occur during these times not as error states, but as OK.

Maintenance periods can overlap. If one maintenance window lasts from 8:00 A.M. till 12:00 P.M., and a second one involving the same host or service, from 10:00 A.M. to 2:00 P.M., then Nagios does not send any error messages between 8:00 A.M. and 2:00 P.M., and the whole period is also ignored in the availability statistics.

16.3.1 Maintenance periods for hosts

What data is required to record the maintenance window can be explained quite clearly using the Web interface. Figure 16.40 shows the input template for the downtime of a host (**cmd.cgi?cmd_typ=55**).



You are requesting to schedule downtime for a particular host

Command Options

Host Name:	eli-saprouter
Author (Your Name):	wob
Comment:	Routerupgrade durch T-Systems gegen 18h
Triggered By:	N/A
Start Time:	07/25/2005 17:50:00
End Time:	07/25/2005 19:00:00
Type:	Flexible
If Flexible, Duration:	0 Hours 30 Minutes
Child Hosts:	Schedule triggered downtime for all child hosts

Command Description

This command is used to schedule downtime for a particular host. During the specified downtime, Nagios will not send notifications out about the host. When the scheduled downtime expires, Nagios will send out notifications for this host as it normally would. Scheduled downtimes are preserved across program shutdowns and restarts. Both the start and end times should be specified in the following format: **mm/dd/yyyy hh:mm:ss**. If you select the *fixed* option, the downtime will be in effect between the start and end times you specify. If you do not select the *fixed* option, Nagios will treat this as "flexible" downtime. Flexible downtime starts when the host goes down or becomes unreachable (sometime between the start and end times you specified) and lasts as long as the duration of time you enter. The duration fields do not apply for fixed downtime.

Please enter all required information before committing the command.
Required fields are marked in red.
Failure to supply all required values will result in an error.

Figure 16.40: The downtime for a host in the Web interface is recorded using this dialog

The first line defies the host, and in the second line Nagios automatically enters the login with which you have logged in to the Web interface. In the input field after the **Comment:** keyword, you can describe the reason for the planned downtime. Specifying the trigger shows whether it was generated indirectly through another entry. When recording a new downtime, you should leave the value **N/A** (*not available*, that is, no trigger) as it is.

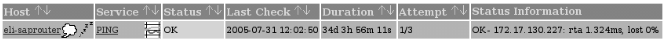
In the next four lines you have the option of entering two different downtime types: fixed ones (**Type: Fixed**) or variable periods (**Flexible**). The first has a fixed start and a fixed end. In this case Nagios ignores the period entry in hours and minutes in the **Flexible Duration:** fields completely.

A flexible downtime starts when the first-ever event occurs in the period specified. From this point in time Nagios plans the downtime for the length of time that was specified here in hours and minutes. This may certainly exceed the end point specified in End Time:.

If further hosts are dependent on the computer specified in Host Name: (perhaps because a router is involved, which other host objects have entered as parents), you have the possibility of extending the downtime to all dependent hosts with the last item, Child Hosts:. Schedule triggered downtime for all child hosts passes on flexible downtimes to all "child hosts," Schedule non-triggered downtime for all child hosts does the same for fixed downtimes, and Do nothing with child hosts ignores dependencies, so that Nagios does not plan for any downtime for any hosts other than the one specified here.

How this hereditary behavior takes effect in Figure 16.40 is shown by the overview of all scheduled downtimes in Figure 16.20 on page 287. The first line contains the downtime just described for the host eli-saprouter with the Downtime ID number 1. Entries that are caused by inheriting this timeout contain the Downtime ID of the downtime causing them in the Trigger ID column: for sap-12 this is 1, since the maintenance of eli-saprouter also affects this host.

Nagios simultaneously generates a comment entry when planning a downtime, which is automatically removed when this period has passed. This is why a speech bubble appears in the status display. During the downtime Nagios supplements this with a "snoring sign," which is meant to represent a sleep state (Figure 16.41).



Host ↑↓	Service ↑↓	Status ↑↓	Last Check ↑↓	Duration ↑↓	Attempt ↑↓	Status Information
eli-saprouter	PING	OK	2005-07-31 12:02:50	34d 3h 56m 11s	1/3	OK - 172.17.130.227: rta 1.324ms, lost 0%

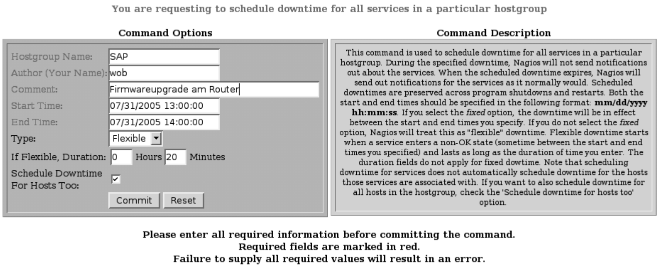
Figure 16.41: The snoring sign zzzzz shows that the downtime for the host has begun

16.3.2 Downtime for services

Downtimes for services differ from those for hosts in two small details. Apart from host name, the service description must be included, and the possibility of inheritance is excluded, since there are no corresponding dependencies for services.

A downtime for a host does not automatically apply to the services running on it. But since they are also not available if the host is down, it is recommended that you plan the same downtime for all dependent services. It can be quite strenuous to enter all the services individually. It is much easier to do this using a host group (cmd_typ=85), as shown in Figure 16.42. With this you can define the downtime for services in a specific host group with a single command, and much more as well: a checkmark in Schedule Downtime For Hosts Too at the same time defines the same downtime for all hosts belonging to this group.[24]

[24] In the Nagios-2.0 beta versions the checkmark had no effect, however; there you have to enter the downtime of the hosts separately by running cmd.cgi?cmd_typ=84 again.



You are requesting to schedule downtime for all services in a particular hostgroup

Command Options

Hostgroup Name: SAP
Author (Your Name): wob
Comment: Firmwareupgrade am Router
Start Time: 07/31/2005 13:00:00
End Time: 07/31/2005 14:00:00
Type: Flexible
If Flexible, Duration: 0 Hours 20 Minutes
Schedule Downtime For Hosts Too: ☑

Command Description

This command is used to schedule downtime for all services in a particular hostgroup. During the specified downtime, Nagios will not send notifications out about the services. When the scheduled downtime expires, Nagios will send out notifications for the services as it normally would. Scheduled downtimes are preserved across program shutdowns and restarts. Both the start and end times should be specified in the following format: **mm/dd/yyyy hh:mm:ss**. If you select the *fixed* option, the downtime will be in effect between the start and end times you specify. If you do not select the *fixed* option, Nagios will treat this as "flexible" downtime. Flexible downtime starts when a service enters a non-OK state (sometime between the start and end times you specified) and lasts as long as the duration of time you enter. The duration fields do not apply for fixed dowtime. Note that scheduling downtime for services does not automatically schedule downtime for the hosts those services are associated with. If you want to also schedule downtime for all hosts in the hostgroup, check the 'Schedule downtime for hosts too' option.

**Please enter all required information before committing the command.
Required fields are marked in red.
Failure to supply all required values will result in an error.**

Figure 16.42: One downtime for all services of a host group

16.4 Additional Information on Hosts and Services

With the objects **hostextinfo** and **serviceextinfo** you can take in additional information in the Web interface and also brighten this up somewhat, using suitable icons. Both objects only have an effect in the Web interface, and they do not influence the capabilities of Nagios.

16.4.1 Extended host information

hostextinfo objects allow you to enhance the display of hosts in the Web interface through additional functions in the form of links and enhancement features in the form of icons and coordinates:

```
# -- /etc/nagios/mysite/hostextinfo.cfg
define hostextinfo{
   host_name        linux01
   notes            Samba Primary Domaincontroller
   notes_url        /hosts/linux01.html
   action_url       /hosts/actions/linux01.html
   icon_image       base/linux40.png
   icon_image_alt   Linux Host
   vrml_image       base/linux40.png
   statusmap_image  base/linux40.gd2
   2d_coords        120,80
   3d_coords        70.0,30.0,40.0
}
```

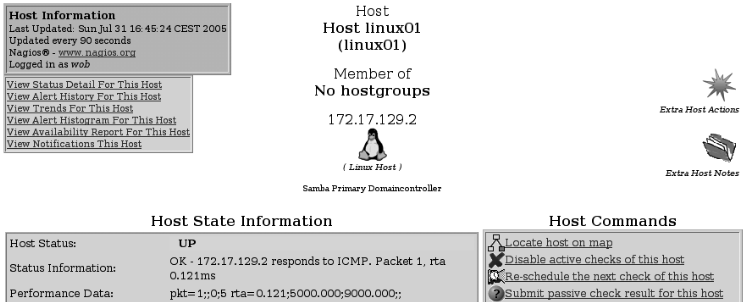
The only obligatory parameter when these are defined is the specification of the host, with **host_name**; everything else is optional:

host_name

This is the name of the host object whose Web pages are to be expanded by the following properties.

notes

Use this for additional information that **extinfo.cgi** takes into account in its information pages. (The entry specified in the above example, **Samba Primary Domaincontroller**, can be found in Figure 16.43 below the Linux icon.)



Host Information
Last Updated: Sun Jul 31 16:45:24 CEST 2005
Updated every 90 seconds
Nagios® - www.nagios.org
Logged in as *wob*

View Status Detail For This Host
View Alert History For This Host
View Trends For This Host
View Alert Histogram For This Host
View Availability Report For This Host
View Notifications This Host

Host
Host linux01
(linux01)

Member of
No hostgroups

172.17.129.2

(Linux Host)

Samba Primary Domaincontroller

Extra Host Actions

Extra Host Notes

Host State Information

Host Status:	**UP**
Status Information:	OK - 172.17.129.2 responds to ICMP. Packet 1, rta 0.121ms
Performance Data:	pkt=1;;0;5 rta=0.121;5000.000;9000.000;;

Host Commands

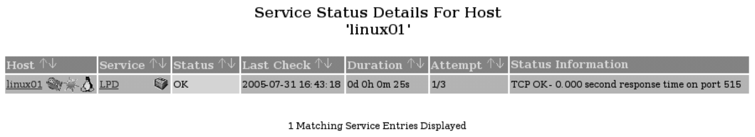
Locate host on map
Disable active checks of this host
Re-schedule the next check of this host
Submit passive check result for this host

Figure 16.43: Next to the three icons for Extra Host Actions, Extra Host Notes and the Linux penguin, extinfo.cgi also shows an alternative text here for the Linux icon (beneath the Tux in brackets) and the additional information from the parameter notes (beneath the alternative text)

notes_url

This is the URL of a (HTML) file with additional information on the host in question, to which you are linked by an icon in the form of a red, slightly opened manual, both in the status overview (Figure 16.44) and in the info page generated by **extinfo.cgi** (Figure 16.43). If the documentation on the host involved is stored in the Intranet, then maintenance contracts, hotline numbers, system configuration, etc. are then just a mouse click away.

The parameter may contain an absolute path (from the view of the Web server) or a complete URL (**http://...**).



Service Status Details For Host
'linux01'

Host ↑↓	Service ↑↓	Status ↑↓	Last Check ↑↓	Duration ↑↓	Attempt ↑↓	Status Information
linux01	LPD	OK	2005-07-31 16:43:18	0d 0h 0m 25s	1/3	TCP OK - 0.000 second response time on port 515

1 Matching Service Entries Displayed

Figure 16.44: This status detail view additionally shows an icon each for notes_url (open, read booklet), action_url (pink star), and icon_image (here, Linux penguin)

action_url

This is a link pointing to an action to be run for the host, which executes a CGI program such as **cmd.cgi**, for example, with just a mouse click. Since a link in the browser is always just a link, this does not have to be a command, and you can just as easily link another web page. Both in the status overview

(Figure 16.44), and on the **extinfo.cgi** info page (Figure 16.43) it is hidden behind the pink star.

As a value, absolute paths from the view of the Web server or complete URLs can be used.

icon_image

This is an icon to enhance the Web interface, but also to provide help: if you systematically use pictures here that represent the operating system (e.g., the Tux for Linux, the Windows window for Microsoft operating systems, the Sun logo for Solaris computers, etc.), this helps you to keep an overview of the operating systems in the status view—especially if you have a large number of hosts (Figure 16.44). **extinfo.cgi** also uses this icon (Figure 16.43).

Icons should be approximately 40x40 pixels large and be available as a GIF, JPEG, or PNG file. If you specify a relative path (or none at all), then this begins with the directory **/usr/local/nagios/share/images/logos/**.[25]

icon_image_alt

This alternative text for the icon appears if the browser does not show a picture (for example for reading devices or output devices for Braille). From the icon and the icon text details, Nagios generates the following HTML code:

```
<IMG SRC=icon_image ALT=icon_image_alt>
```

vrml_image

This is an image symbolizing the host in the 3D representation of **statuswrl.cgi**. Permissible formats are again GIF, JPEG, or PNG. You should avoid slides, since the image is placed on a cube, and the transparent parts in the 3D interface may lead to unexpected results.

statusmap_image

This is the image with which **statusmap.cgi** (see Section 16.2.5, page 291) symbolizes the host in its topological map. The Nagios demo page of Netways,[26] (Figure 16.27 on page 293) shows a nice example.

Although GIFs, JPEGs, and PNGs are allowed, it is better to use the GD2 format, because then Nagios requires less computer time to generate the status map. Using the program **pngtogd2**, which ought to be available as a component of the utilities for Thomas Boutells GD library in most Linux distributions, PNG files can be easily converted. Again the image size of 40x40 pixels is recommended.

[25] If you have kept to the paths suggested in this book.

[26] http://netways.de/Demosystem.1621.0.html

2d_coords

This parameter specifies coordinates for a user-defined layout of the topological map. Details are given in pixels, with the origin, (0,0), at the top left, and values must be positive: a positive x value counts the number of pixels from the origin to the right, a positive y value from the origin downwards.

Figure 16.27 works with fixed coordinates for individual hosts. Nagios ignores 2d_coords details if the status maps a different layout to the user-defined one.

3d_coords

These are the coordinates for the 3D representation. Positive and negative floating-point numbers are allowed. (0.0,0.0,0.0) is used as the origin. In the start view, statuswrl.cgi scales the 3D image so that all existing hosts appear on the screen. Where the starting point lies on the screen can therefore not be predicted.

On The Nagios Exchange there is a wide range of finished icons in the category Logos and Images.[27] It is best to unpack these into separate subdirectories, and then the individual packages will not get in each other's way:

```
linux:~ # cd /usr/local/nagios/share/images/logos
linux:images/logos # tar xvzf imagepak-base.tar.gz
base/aix.gd2
base/aix.gif
base/aix.jpg
base/aix.png
base/amiga.gd2
...
```

imagepak-base.tar.gz contains a basic selection of icons, which can be supplemented as you please with other packages. The base subdirectory created, as with the object definition at the beginning of this chapter, must also be included.

16.4.2 Extended service information

serviceextinfo objects are more or less identical to their host equivalents, so that we will only mention the differences. In addition to the host name, the service description in service_description is obligatory, but the details on the 2D (status map) and 3D views are omitted:

[27] http://www.nagiosexchange.org/Image_Packs.75.0.html

```
# -- /etc/nagios/mysite/hostextinfo.cfg
define serviceextinfo{
   host_name           linux01
   service_description LPD
   notes               Linux Print Services
   notes_url           /hosts/linux01-lpd.html
   action_url          /hosts/linux01-lpd-action.html
   icon_image          base/hp-printer40.png
   icon_image_alt      Linux Print Server
}
```

In contrast to **hostextinfo**, the status overview for this example only shows the printer icon specified in **icon_image**, but not the two icons defined in **notes_url** and **action_url** for the two links **notes_url** and **action_url**. They only appear in the page generated by **extinfo.cgi** with the same icons as for the extended host information (Figure 16.43, page 308).

16.5 Configuration Changes through the Web Interfaces: the Restart Problem

The CGI program **cmd.cgi** (Section 16.2.3, page 288) enables a series of changes to be made to the current configuration through the Web interface.[28] In this way notifications or active checks can be switched on and off, for example.

Nagios does not save such changes in the accompanying configuration file, but notes the the current status in a separately defined file, with the parameter **state_retention_file** in **nagios.cfg** (see page 441). But what happens if you restart Nagios after many changes using the Web interface?

Whether Nagios retains the interactive changes made after a restart or forgets them is dependent on the parameter **retain_state_information** in the configuration file **nagios.cfg** (page 438). The default **0** tells the system to forget interactive changes. For Nagios to remember this, you have to set

```
# /etc/nagios/nagios.cfg
...
retain_state_information=1
...
```

But this causes a new problem: settings made in the Web interface do not have priority over the details in the configuration files. If you change the **active_checks_enabled** parameter there for a service, a direction of the parameter in the configuration file is ignored, since the current, temporarily stored setting in the file defined

[28] The CGI program makes use of the External Command File interface when doing this.

with state_retention_file will always "win out." This behavior affects all parameters for external commands that can be changed in the interface, and therefore also via the CGI program cmd.cgi. The original documentation of Nagios[29] labels these with a red star.

Two approaches provide a remedy in this case: on the one hand you can set the parameter retain_state_information to 0 shortly before a restart. Then Nagios forgets all the changes when it restarts and reads the configuration files in from scratch. This procedure is recommended only in exceptional cases, as in large environments it will hardly be possible to go through all the interactive changes in the configuration files. Alternatively you can get into the habit, whenever you make changes in the configuration file, of making them a second time in the Web interface. Although this means slightly more work, there is never a danger that current, and perhaps very important settings, will be lost.

Two additional parameters in the host and service definitions provide opportunities for fine-tuning:

```
define host{
   ...
   retain_status_information    1
   retain_nonstatus_information 1
   ...
}
define service{
   ...
   retain_status_information    1
   retain_nonstatus_information 1
   ...
}
```

retain_status_information specifies whether the current state of a host or service should survive the Nagios restart: 1 means that the system temporarily stores the state, and 0, that it forgets it. 1 is certainly the more sensible value for states, and you should depart from this only in cases that can be justified.

retain_nonstatus_information, on the other hand, refers to all information that describes *no* status. This includes, for example, whether active checks are switched on or off, whether passive checks are allowed or not, or whether admins are to be informed of status changes for this object. With a value of 1, the system stores this information temporarily and uses it again after a restart, whereas with a value of 0, Nagios forgets the current settings and reads the settings from the configuration file when it restarts.

[29] usr/local/nagios/share/docs/xodtemplate.html

Chapter

17

Graphic Display of Performance Data

When Nagios reports to the administrator quickly and selectively on problems that have occurred, it can basically only distinguish between OK states and error states, sparing the admin a flood of information on problematic services and hosts. The graphic display of measured values over a time period cannot be integrated into this "traffic light approach," but it is available through third-party software. Nagios supports external processing of values with an interface created specifically for this. The data processed through it is referred to in Nagios jargon as *performance data*.

Nagios has two different classes of performance data. The first is Nagios-internal performance data, statistics on the performance times of tests and on the difference between the actual test time and the planned time (the *latency*). The second class includes performance data that the plugin passes on with the test result. This involves everything that the plugin can measure: response times, hard drive usage, system load, and so on. These are the very things that are of interest to an administrator, which is why the book concentrates on how they are processed.

Nagios extracts this data and either writes it to a file where it can be processed by other programs, or passes it on directly to the external software that is run after every service or host check.

17.1 Processing Plugin Performance Data with Nagios

Performance data provided by service and host checks can be processed only if the corresponding plugin delivers it in a predefined format. As shown here using the check_icmp plugin (Section 6.2, page 88), it is preceded by a | sign and is not shown in the Web interface:

```
nagios@linux:libexec/nagios$ ./check_icmp -H vpn01
OK - eli02: rta 96.387ms, lost 0%| rta=96.387ms;200.000;500.000;0; pl=0%;
40;80;;
```

This standardized form is provided by most plugins only after version 1.4.[1] The performance data itself consists of one or more variables in the following form:

```
name=value;warn;crit;min;max
```

The variable *name* may contain spaces, but then it must be surrounded by single quotation marks. After the equals sign comes first the measured value as an integer or floating-point decimal, with or without a unit. Possible units are % (percentage), s (time in seconds), B (data size in bytes), or c (counter, an incremental counter).

This is followed, separated by a semicolon, by the warning and critical limits, and then the minimum and maximum value. Percentage values can be left out by the plugin. You can also specify 0 for minimum/maximum, as well as for the warning or critical limit, if there is no such threshold value. If there are several variables, these are separated with spaces, as in the check_icmp example. However, in contrast to this, the final specification should *not* end with a semicolon, according to the Developer Guidelines.

17.1.1 The template mechanism

Nagios has two methods of processing performance data: either the system saves the data to a file using a *template*, or it executes an external command. If you just

[1] Some tools such as Nagiosgraph and NagiosGrapher make use of the fact that the remaining text normally contains performance data as well. If they are correspondingly configured, they are able to extract the performance data contained there. In this way they can further process data that does not conform to the standard format.

want to write data consistently to a log file, the template procedure is somewhat easier to configure.

In order that Nagios can process performance data at all, the parameter

```
# /etc/nagios/nagios.cfg
...
process_performance_data=1
...
```

must be set to 1. The file to which Nagios writes the host or service performance data is specified by the *_perfdata_file parameters:

```
# /etc/nagios/nagios.cfg
...
# host_perfdata_file=/varr/nagios/host-perfdata.dat
service_perfdata_file=/var/nagios/service-perfdata.dat
# host_perfdata_file_template=[HOSTPERFDATA]\t$TIMET$\t$HOSTNAME$\t\
    $HOSTEXECUTIONTIME$\t$HOSTOUTPUT$\t$HOSTPERFDATA$
service_perfdata_file_template=[SERVICEPERFDATA]\t$TIMET$\t\
    $HOSTNAME$\t$SERVICEDESC$\t$SERVICEEXECUTIONTIME$\t\
    $SERVICELATENCY$\t$SERVICEOUTPUT$\t$SERVICEPERFDATA$
...
```

If host_perfdata_file is commented out, as in this example, Nagios does not save any performance data of host checks. But since they are only used if all service checks fail, it lies in the nature of host checks that they only provide data sporadically and at irregular intervals. This is why it is not worth evaluating them in most cases.

The *_perfdata_file_template parameters define the output format. The definition shown above, service_perfdata_file_template, delivers (one-line) log file entries in the following pattern:

```
[SERVICEPERFDATA]       1114353266      linux01 PING    0.483   0.104
    OK - 10.128.254.12: rta 100.436ms, lost 0%
    rta=100.436ms;3000.000;6000.000;0; pl=0%;40;80;;
```

Each line begins with a [SERVICEPERFDATA] "stamp," followed by the test time in epoch seconds ($TIMET$), the host name and service description ($HOSTNAME$ and $SERVICEDESC$), the time Nagios requires for the test ($SERVICEEXECUTIONTIME$), and the latency between the planned and actual time of performance ($SERVICELATENCY$), each separated by a tab. Then Nagios writes the output for the Web interface to the log file ($SERVICEOUTPUT$) and finally the actual performance data ($SERVICEPERFDATA$). \t in the parameter definition ensures that a tab separates the individual details from each other in the log.

With the *_perfdata_file_mode parameters you can define whether Nagios appends the data to an existing file (a) or overwrites the existing file (w):

```
# /etc/nagios/nagios.cfg
...
host_perfdata_file_mode=a
service_perfdata_file_mode=a
...
```

This is suitable for external programs that can read the data from a (previously set up) named pipe. This method provides better performance and does not require any space on the hard drive. If the processing software is not running, however, the data may be lost: Nagios does try for a time to continue writing to the pipe, but aborts this process after a timeout if the data cannot be read out.

Programs that read from a log file generally delete it afterwards, to prevent the file system from overflowing. If the program does not retrieve any data, the file will grow quickly, but nothing will be lost as long as there is still space on the file system.

It is best to run external evaluation software as a permanent service. But you can also configure Nagios so that it regularly triggers a program for further processing:

```
# /etc/nagios/nagios.cfg
...
# host_perfdata_file_processing_interval=0
# service_perfdata_file_processing_interval=0
# host_perfdata_file_processing_command=process-host-perfdata-file
# service_perfdata_file_processing_command=process-service-perfdata-file
...
```

With the *_perfdata_file_processing_interval parameters you set an interval in seconds after which Nagios will carry on running the corresponding *_perfdata_file_processing_command at specific intervals. This command is defined as a normal Nagios command object:

```
# misccommands.cfg
...
define command{
    command_name   process-service-perfdata-file
    command_line   /path/to_the/evaluation_program
}
...
```

As long as the external software itself looks after the further processing of the file with the performance data, you do need to use the *_perfdata_file_processing_* parameters.

17.1.2 Using external commands to process performance data

As an alternative to the template method, Nagios can also directly call a command that takes over further processing of data. This is done directly after each test result; so after each individual check, an external program is started. If you have a large number of services to be checked, this can, depending on the software, considerably degrade performance.

The command itself is defined with the **process_perfdata_command** parameter instead of the **perfdata_file** parameter:

```
# /etc/nagios/nagios.cfg
...
process_performance_data=1
service_perfdata_command=process-service-perfdata
...
```

In the same way as with service performance data, you can also process the results of host checks, using the **host_perfdata_command** parameter. **process-service-perfdata** itself again refers to a normal Nagios command object:

```
# misccommands.cfg
...
define command{
    command_name   process-service-perfdata
    command_line   /path/to/program "$LASTSERVICECHECK$||$HOSTNAME$||\
        $SERVICEDESC$||$SERVICEOUTPUT$||$SERVICEPERFDATA$"
}
...
```

This opens the external program, which is given the necessary information as arguments. This should include at least the timestamp of the last service check (**$LASTSERVICECHECK$**), the host name (**$HOSTNAME$**), and the service description (**$SERVICEDESC$**), as well as the actual service performance data (**$SERVICEPERFDATA$**). The delimiter depends on the program used: this example uses **||**, as is used by the Nagiosgraph program.

17.2 Graphs for the Web with Nagiosgraph

With the program Nagiosgraph from **http://nagiosgraph.sf.net/**, performance data supplied by plugins can be displayed graphically in a Web interface in chronological form. The software consists of two Perl scripts. The script **insert.pl** writes the Nagios performance data to a round-robin database, a ring buffer in which the newest data overwrites the oldest.[2] The advantage of this is the small amount of space required, which can be defined beforehand.

The trick consists of saving data in various resolutions, depending on its age: older data with a lower resolution (e.g., one measurement value per day), current data with a high resolution (e.g., one measurement every five minutes). When setting up the database, you also define how long the data is retained. This defines space requirements right from the beginning.

Provided that Nagiosgraph detects the performance data, the program creates a separate round-robin database for each new service, when it appears for the first time. The map configuration file included describes just a few services, so that usually some manual work—and a basic knowledge of Perl—is required.

The second Nagiosgraph script show.cgi, a CGI script, represents the information from the database in a dynamic HTML page. To do this, it is run (after configuration is completed) in the form

```
http://nagsrv/path/to/show.cgi?host=host&service=service_description
```

Nagiosgraph then displays four graphs (a daily, a weekly, a monthly, and a yearly summary) for the desired service.

17.2.1 Basic installation

An installed RRDtool package, which is contained in most Linux distributions, is a prerequisite for Nagiosgraph. Alternatively you can obtain the current source code from http://www.rrdtool.org/.[3] For reasons of performance, it is recommended here that you also install the included Perl module RRDs.

The Nagiosgraph tar file itself is preferably unpacked in the directory /usr/local/nagios:

```
nagios@linux:local/nagios$ tar xvzf nagiosgraph-0.5.tar.gz
nagiosgraph/INSTALL
nagiosgraph/README
nagiosgraph/README.map
nagiosgraph/insert.pl
nagiosgraph/insert_fast.pl
nagiosgraph/map
nagiosgraph/nagiosgraph.conf
nagiosgraph/show.cgi
nagiosgraph/testcolor.cgi
nagiosgraph/testentry.pl
```

[2] Further information on this topic can be found at http://www.rrdtool.org/.

[3] To install, see page 330.

insert.pl extracts the data transferred by Nagios and inserts this into the RRD database. If this does not exist, however, the script will create it. Alternatively insert_fast.pl can take on this task. This script uses the Perl module RRDs, which is considerably more efficient than calling up rrdtool as an external program each time, which is what insert.pl does.

Another Perl script called testentry.pl helps if you are testing your own map entries. But since you have to write these directly into this file, you can also change the map file itself (as shown below)—provided you have made a backup copy first. The CGI script testcolor.cgi looks more like a developer's utility left over in the package, rather than a tool that is of any use for users.

Apart from the already mentioned map configuration file, there is a second one, nagiosgraph.conf, and its path must be defined correctly in both insert.pl (or insert_fast.pl) and show.cgi, so it is recommended that you check this:

```
my $configfile = '/usr/local/nagios/nagiosgraph/nagiosgraph.conf';
```

17.2.2 Configuration

The configuration file nagiosgraph.conf

All other relevant paths—such as those to the map file and to the rrdtool—are adjusted in nagiosgraph.conf:

```
rrdtool = /usr/bin/rrdtool
rrddir  = /var/lib/rrd/nagiosgraph
logfile = /var/nagios/nagiosgraph.log
mapfile = /usr/local/nagios/nagiosgraph/map
debug   = 2
colorscheme = 4
```

Nagiosgraph creates the RRD databases in the rrddir directory. Here the user nagios must have write access and the user with whose rights the Web server is running must have read access:

```
linux:~ # mkdir -p /var/lib/rrd/nagiosgraph
linux:~ # chown nagios.nagcmd /var/lib/rrd/nagiosgraph
linux:~ # chmod 755 /var/lib/rrd/nagiosgraph
```

The log file, for which both users need write access (the Web user because the CGI script also records information to the log file), is also critical:

```
linux:~ # touch /var/nagios/nagiosgraph.log
linux:~ # chown nagios.nagcmd /var/nagios/nagiosgraph.log
linux:~ # chmod 775 /var/nagios/nagiosgraph.log
```

How verbose Nagiosgraph is can be adjusted with **debug**. The possible debug levels are documented in the configuration file included: **2** means "errors," **4** "information"—here Nagiosgraph is already so verbose that you must watch out that the file system does not overflow. Except for debugging purposes (such as when setting up the system), it is better to choose **2**.

With **colorscheme**, which can accept values from 1 to 8, you can influence the amount of color in the graphs—it is best to try out the options to see which color scheme matches your personal taste best.

Nagios configuration

Nagiosgraph grabs the performance data directly from Nagios. For this reason **nagios.cfg** does not require any ***_perfdata_file_*** parameters.

```
# /etc/nagios/nagios.cfg
...
process_performance_data=1
service_perfdata_command=process-service-perfdata
...
```

process_performance_data switches on processing of performance data in general; **service_perfdata_command** refers to the Nagios command object that contains the external command:

```
# misccommands.cfg
...
define command{
    command_name   process-service-perfdata
    command_line   /usr/local/nagios/nagiosgraph/insert_fast.pl \
        "$LASTSERVICECHECK$||$HOSTNAME$||\
        $SERVICEDESC$||$SERVICEOUTPUT$||$SERVICEPERFDATA$"
}
...
```

The definition of the parameter **command_line** must be written on one line (without the backslashes \\), as usual.

So that the CGI script can run directly from the Nagios Web interface, a **serviceextinfo** object is defined:

```
define serviceextinfo{
    service_description PING
    host_name        *
    notes_url        /nagiosgraph/show.cgi?host=$HOSTNAME$&service=PING
    icon_image       graph.gif
    icon_image_alt   show graphics
}
```

If the graphic defined in **icon_image** is in the directory **/usr/local/nagios/share/images/logos**, the Web interface marks the **PING** services for all hosts in the status display with this.[4] Here the strength of **show.cgi** can be seen: only because this script is called explicitly with host and service names is a definition like the one above possible. Instead of an individual host name, you can also specify a host group, or, as in this example, a *. A requirement for this is that **PING** really is defined as a service for every host.

The **$HOSTNAME$** macro then automatically inserts the appropriate host. The additional information for a specific service type (which must have the same service description in all hosts) can therefore be catered for with just one single definition.

Apache configuration

So that the Apache Web server can accept the CGI script as it is, a **ScriptAlias** is created, for example:

```
ScriptAlias /nagiosgraph/ /usr/local/nagios/nagiosgraph/
```

This entry is best placed in the configuration file discussed in Section 1.3 (page 33), **nagios.conf**. Only after Apache is reloaded can the CGI script be run from the URL specified on page 318.

Adjustments to the map

Depending on the service, the round-robin database may also save several series of measurements, which can be requested individually through the CGI script:

```
http://nagsrv/path/to/show.cgi?host=host&service=service_description&db=
database,entry1,entry2&db=database,entry3
```

The database used here contains at least three different series of measurements, the first two of which are shown together in one graphic, while the third is shown in a separate graphic. What is shown together and what is separate depends on the standardization. It makes little sense to display the percentage load of a hard drive and the absolute value in bytes in the same graphic, since the Y axis can only have one scale. It is better here to display percentage values in one graphic and absolute byte values in a second one. On the other hand you can display the various average values of the system load (for one, five, and 15 minutes) in a single graphic. If you

[4] A more detailed description of the **serviceextinfo** object is contained in Section 16.4.2, page 310.

leave out all db= specifications, Nagiosgraph always displays all measured values for a service in a single graphic.

What individual databases and measured values display is defined by the map file. To understand how the instructions contained there influence the extraction of data, you just need to switch the debugging level to 4 and take a look at the output in the log file nagiosgraph.log. Each time the insert function is run, Nagiosgraph rereads the configuration files, so that this does not cause any kind of reset.

In the following extract from the log file the three dots mark sections which we will not print, for the sake of clarity:

```
... INSERT info:... servicedescr:PING
... INSERT info:... hostname:linux01
... INSERT info:... perfdata:rta=99.278ms;3000.000;7000.000;0; pl=0%;60;
80;;
... INSERT info:... lastcheck:1114853435
... INSERT info:... output:OK - 172.17.4.11: rta 99.278ms, lost 0%
```

The output is from the check_icmp plugin. The host name, service description, performance data, (perfdata:) and the standard output line (output:) each have their own line. In the performance data the plugin announces the *round trip average* with the variable rta, and the number of packets that have gone missing with pl (*packet loss*).

The map file contains Perl instructions that filter these outputs and extracts the corresponding data if there are hits. Each of them starts with a search instruction:

```
/perfdata:rta=([.\d]+)ms.+pl=(\d+)%/
```

The classic Perl search function consists of the two forward slashes / with a search pattern in the form of a regular expression in between. Round pairs of brackets enclose partial patterns with which the text found in this way can later be accessed using the variables $1, $2, etc.

The pattern in the first bracket thus matches a single digit (\d) or a dot,[5] and the next + states that there can be several of them (or none at all). In the second round brackets, though, one or more digits are allowed, but no period. In concrete terms $1 delivers the numerical value of the response time, $2 provides the packet loss in percent.

The full instruction in the map file links two Perl statements with the and operator:

```
# -- check_icmp
# perfdata:rta=100.424ms;5000.000;9000 .000;0; pl=0%;40;80;;
/perfdata:rta=([.\d]+)ms.+pl=(\d+)%/
and push @s, [ ’ping’,
```

[5] A pair of square brackets contains alternatives.

```
              [ 'rta',      'GAUGE', $1 ],
              [ 'losspct', 'GAUGE', $2 ],
            ];
```

If the first one—the search function—is successful, then it is the turn of the push statement. It adds the expression in square brackets following to the array @s. The instruction ends with a semicolon. If the search function provides no result, the map instruction will not save any entry in the @s array. The expression to be included in the array has the following format:

```
[ db-name,
   [name_of_data_source, type, value ],
   [name_of_data_source, type, value ],
   ...
]
```

The file name for a Nagiosgraph database file consists of the host name, service description, and the database name together, for example, linux01_PING_ping.rrd. The desired string for the database name is entered instead of the placeholder *db-name* into the map file (in this case, ping).

The name of the data source can be chosen freely, but should contain an indication of the data that is stored here, such as rta for the response time or losspct for percentage of packets that have been lost.

What *type* you specify is determined by the RRD tools. GAUGE stands for simple measured values that are displayed simply as they are. DERIVE is recommended by Nagiosgraph author Soren Dossing for processing counters, such as in querying a packet counter on the network interface. Counters grow incrementally and, when they run over, start again at zero. What is of interest here is the difference between two points in time. The RRD database determines these automatically if the data source type DERIVE is specified.

The database name, data source, and type should always be placed in single quotation marks in the map file, so that no name conflicts can occur with keywords reserved in Perl.

The measured value itself is determined using Perl methods, and the placeholder *value* is substituted with the corresponding instructions. In the simplest case, you take over the values found with the search pattern in the performance data with $1, $2, etc. (see example above), or calculate new values from these by multiplying[6] by 1024 or by calculating the percentage:

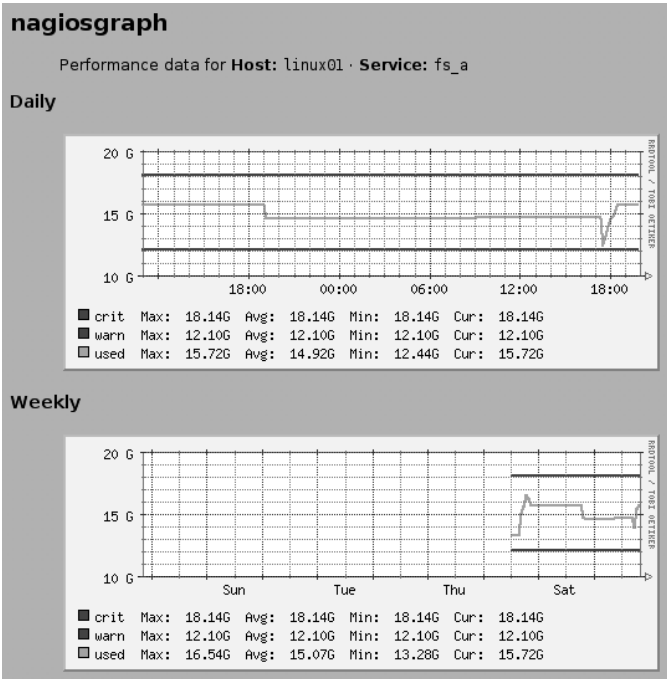
```
# -- check_nt -v USEDDISKSPACE
# perfdata:C:\ Used Space=1.71Gb;6.40;7.20;0.00;8.00
/perfdata:.*Used Space=([.\d]+)Gb;([.\d]+);([.\d]+);([.\d]+);([.\d]+)/
```

[6] This turns kilobytes into bytes.

```
and push @s, [ 'disk',
               [ 'used', 'GAUGE', $1*1024 ],
               [ 'usepct', 'GAUGE', ($1/$5)*100 ],
               [ 'freepct', 'GAUGE', (($5-$1)/$5)*100 ],
             ];

# -- check_disk (unix)
# perfdata:/=498MB;1090;1175;0;1212
m@perfdata:.*/([^ =]+)=([.\d]+)MB;([.\d]+);([.\d]+);([.\d]+);([.\d]+)@
and  push @s, [ $1,
                [ 'used', 'GAUGE', $2*1024**2 ],
                [ 'warn', 'GAUGE', $3*1024**2 ],
                [ 'crit', 'GAUGE', $4*1024**2 ],
              ];
```

The first entry evaluates the query of hard drive space on a Windows server with **check_nt** (see Section 18.1, page 359). The performance data also contains, apart from the occupied space in **$1**, the size of the data carrier in **$5**. This can be used to calculate the percentage that is available (**freepct**) and the percentage used (**usepct**).



nagiosgraph

Performance data for **Host:** linux01 · **Service:** fs_a

Daily

```
■ crit  Max:  18.14G  Avg:  18.14G  Min:  18.14G  Cur:  18.14G
■ warn  Max:  12.10G  Avg:  12.10G  Min:  12.10G  Cur:  12.10G
□ used  Max:  15.72G  Avg:  14.92G  Min:  12.44G  Cur:  15.72G
```

Weekly

```
■ crit  Max:  18.14G  Avg:  18.14G  Min:  18.14G  Cur:  18.14G
■ warn  Max:  12.10G  Avg:  12.10G  Min:  12.10G  Cur:  12.10G
□ used  Max:  16.54G  Avg:  15.07G  Min:  13.28G  Cur:  15.72G
```

Figure 17.1: Used space and limit values for the file system /net/linux01/a on the host linux01, as Nagiosgraph represents them

The second example evaluates data obtained on a Unix host, with **check_disk**, by multiplying the free hard drive space specified in MB by 1024^2 to convert it to bytes.

The critical and warning limits always remain constant, which leads to horizontal lines, as seen in Figure 17.1: the lower line at 12.1 GB represents the warning limit, the middle line the current load, and the top line at 18.1 GB, the critical limit. The keys for the individual graphs each list minimum, maximum, and average as a numerical value. This differentiation for the two limit values is not of any use, but it cannot be avoided, since Nagiosgraph does not know that these are constant values: it treats warning and critical limits just like any other measured values.

If a plugin does not provide any performance data, but values that are used in normal output, the search function can be applied to the output (/output:.../) instead of to the performance data. Help is provided, for example, by the Nagiosgraph Forum at http://sourceforge.net/forum/forum.php?forum_id=394748.

Changes to the map are critical. It is therefore recommended that you copy the file first and edit the copy, and then perform a syntax check, using perl -c:

```
nagios@linux:libexec/nagios$ cp map map.new
nagios@linux:libexec/nagios$ vi map.new
nagios@linux:libexec/nagios$ perl -c map.new
nagios@linux:libexec/nagios$ mv map.new map
```

If the syntax check is in order, you can install the new file as map.

17.3 Preparing Performance Data for Evaluation with Perf2rrd

Another tool which transfers Nagios performance data to an RRD database is the Java application Perf2rrd. This requires an installed Java Runtime Environment (1.4.2, or preferably 1.5). Since the virtual machine generates a noticeable load on less powerful computers, and also requires a large amount of memory, the requirements made of the Nagios server by Perf2rrd are significantly higher than those made by Nagiosgraph.

On the other hand there is no more work after the installation as far as generating the RRD databases is concerned, because Perf2rrd uses the template mechanism of Nagios (see Section 17.1, page 314). For each service and each variable contained in the template, the tool creates a separate RRD database using the following naming pattern:

```
host+service_description+variable_name.rrd
```

So to evaluate the check_icmp variables rta (*round trip average*) and pl (*packet loss*), the file names are linux01+PING+pl.rrd and linux01+PING+rta.rrd.

Perf2rrd only looks after the storage of data in an RRD database and does not provide any tools to graphically display the data saved there. The Perf2rrd author Marc DeTrano refers here to the drraw tool (see Section 17.4, page 330). It can be advantageous to use this, because on the one hand drraw allows far more than just the one display provided by Nagiosgraph, and on the other hand you do not have to struggle with regular expressions in Perl.

17.3.1 Installation

For the installation you should get hold of the archive in tar format from http://perf2rrd.sf.net/, and copy it, preferably to the /usr/local hierarchy:

```
linux:~ # cd /usr/local
linux:usr/local # tar xvzf /path/to/perf2rrd-1.0.tar.gz
...
perf2rrd/run
...
```

The executable program that is later run is a script called run, which in turn calls the Java bytecode interpreter, java. Besides this the directory contains the Java class files and other utilities, with which you can recompile the included shared library librrdj.so, if required. This is normally not necessary for the newer distributions.

In order for run to be able to find the java program, it must be located in /usr/bin. If this is not the case (because you have installed the Java archive from http://www.sun.com/, for example), then you should set a link:

```
linux:~ # ln -s /usr/local/jre1.5.0_02/bin/java /usr/bin/java
```

A short test shows whether or not Perf2rrd starts correctly:

```
nagios@linux:local/perf2rrd$ ./run
perf2rrd starting
Using Nagios Config: /etc/nagios/nagios.cfg
Using RRD Repository: /var/log/nagios/rrd
Unable to create RRD Repository
```

The error message issued in the last line is not a problem at the moment, since we have saved the RRD databases in a different directory anyway (page 329).

17.3.2 Nagios configuration

Perf2rrd searches in the Nagios configuration for all the data it requires: to what file Nagios should write the performance data, the write mode used for this,[7] and the format of the template:

[7] With a, Nagios appends the data to a normal log file; with w it makes it accessible through a named pipe. See Section 17.1, page 314.

```
# /etc/nagios/nagios.cfg
...
process_performance_data=1
...
service_perfdata_file=/var/nagios/service-perfdata.dat

service_perfdata_file_template=$TIMET$\t$HOSTNAME$\t\
   $SERVICEDESC$\t$SERVICEEXECUTIONTIME$\t$SERVICELATENCY$\t\
   $SERVICEOUTPUT$\t$SERVICEPERFDATA$

service_perfdata_file_mode=w
...
```

The named pipe used here, thanks to service_perfdata_file_mode=w, must be created manually—Perf2rrd 1.0 in Nagios 2.0 has problems with the normal file interface (service_perfdata_file_mode=a):

```
linux:~ # mknod /var/nagios/service-perfdata.dat p
linux:~ # ls -l /var/nagios/service-perfdata.dat
prw-r--r-- 1 nagios nagios 0 May 1 10:49 /var/nagios/service-perfdata.dat
```

In the template the introductory [SERVICEPERFDATA] stamp is missing (see Section 17.1), since Perf2rrd 1.0 does not parse this correctly. Changes to the Nagios configuration require a reload:

```
linux:~ # /etc/init.d/nagios reload
```

Finally you create the directory for the RRD databases:

```
linux:~ # mkdir /var/lib/rrd/perf2rrd
linux:~ # chown nagios.nagios /var/lib/rrd/perf2rrd
```

17.3.3 Perf2rrd in practice

Program start

Loading the Java Virtual Machine each time Perf2rrd is started requires considerable resources. For this reason you should not use the method of starting Perf2rrd with the parameter service_perfdata_file_processing_command at specific intervals of Nagios, and also should not use the *one-shot mode*, with ./run -o, in which the software processes one file at a time. In theory this would make it possible to run Perf2rrd regularly with a cron job. Instead, it is recommended that you keep the program running permanently.

When using this for the first time, we recommend that you switch on the debugging mode, which will show any problems that occur. The option -d specifies the directory in which the tools should create and update the RRD databases:

```
nagios@linux:local/perf2rrd$ ./run -d /var/lib/rrd/perf2rrd -x
perf2rrd starting
Using Nagios Config: /etc/nagios/nagios.cfg
Using RRD Repository: /var/lib/rrd/perf2rrd
Debug Mode is on
Reading perfdata from named pipe.
Perf Data File is : /var/nagios/service-perfdata.dat
I believe we are using Nagios ver. 2
Object Cache File is : /var/nagios/objects.cache
Nagios interval_length 60
called update with: .../eli02+PING+rta.rrd 1114938329:0.079
called update with: .../eli02+PING+pl.rrd 1114938329:0.0
/var/lib/rrd/perf2rrd/sap-14+SAP-3202+time.rrd created.
called update with: .../sap-14+SAP-3202+time.rrd 1114938688:0.030775
...
```

The output of the Nagios configuration file, the RRD repository, and the data transfer mode (named pipe) is followed by the time unit used by Nagios (and set with the interval_length parameter). Normally this is 60 seconds, that is, a check interval of 5 is five minutes long. It is extremely important that this parameter is correctly recognized, since Perf2rrd determines the *step interval* of the RRD database by multiplying the normal_check_interval and interval_length parameters together.

All measured values that occur during a step interval are averaged by the database. If this time period is too small, it is possible that the database will never issue any values, since it expects considerably more data than it obtains for saving.

While Nagiosgraph works with a fixed five-minute interval, Perf2rrd adjusts itself to the Nagios configuration. The software only takes into account the interval when creating the RRD database, however; changing the Nagios configuration later on has no further consequences. The only thing you can do here to alter this is delete the RRD database and set it up again.

Perf2rrd in permanent operation

Operating Perf2rrd on a named pipe has one disadvantage: if Nagios restarts, it closes the pipe before opening it again. Unfortunately when the pipe closes, Perf2rrd closes as well.

This can be prevented by the use of the Daemon Tools by Daniel J. Bernstein. They monitor programs and restart them, if these programs should ever stop. They are themselves started through an /etc/inittab entry by the init process, and are restarted if they were to shut themselves down at some point.

The Daemon Tools tar file can be obtained from http://cr.yp.to/daemontools/install.html and it is unpacked in the directory /usr/local/src:

```
linux:~ # cd /usr/local/src
linux:local/src # tar xvzf /path/to/daemontools-0.76.tar.gz
admin
admin/daemontools-0.76
admin/daemontools-0.76/package
admin/daemontools-0.76/package/README
...
admin/daemontools-0.76/src
```

This creates the directory admin/daemontools-0.76, with the subdirectories package and src. From there you should run the install script, which compiles and installs the program:

```
linux:local/src # cd admin/daemontools-0.76
linux:admin/daemontools-0.76 # package/install
```

The binaries land in the newly created directory daemontools-0.76/command and remain there. The installation routine also sets up symbolic links pointing to them from the—also newly created—folder /command.

The install script also includes the following line in the file /etc/inittab, which ensures that the Daemon Tools run permanently:

```
SV:123456:respawn:/command/svscanboot
```

The program svscanboot searches regularly for new or crashed daemons. For this purpose it scans the /service directory, which is also created during the installation. Just one symbolic link is required to have Perf2rrd monitored:

```
linux:~ # ln -s /usr/local/perf2rrd /service/perf2rrd
```

The Daemon Tools search in this directory for a script called run and start it. In order for run to be able to find the path to the RRD repository, an actual command-line option is entered in the script file instead of $*:

```
# exec java -cp $classpath perf2rrd $*
exec java -cp $classpath perf2rrd -d /var/lib/rrd/perf2rrd
```

Starting and ending Perf2rrd is now taken over by the program svc:

```
linux:~ # /command/svc -d /service/perf2rrd
linux:~ # /command/svc -u /service/perf2rrd
```

The -d option (for *down*) stops the service specified, and -u (*up*) starts it again. It is not necessary to run it at the beginning, since the Daemon Tools regularly scan the /service directory for new services and automatically start them.

This is important insofar as the Nagios-2.0 beta versions, on which this book is based, had problems if the configured named pipe was not read. Then it might not deliver any more data at all until a reload or restart. Whether this problem has been fixed in the final version 2.0 of Nagios could not be clarified at the time of going to press.

17.4 The Graphics Specialist drraw

From the RRD databases, generated for example by Perf2rrd or Nagiosgraph, the CGI script drraw creates interactive graphics—simple ones relatively quicky, whereas for more complex ones you need to know a bit more about the RRDtools.[8]

17.4.1 Installation

For the drraw installation, you need to obtain the current tar file from http://www.taranis.org/drraw/ and unpack it to its own subdirectory in the CGI hierarchy [9] on the Web server:

```
linux:~ # cd /usr/lib/cgi-bin
linux:lib/cgi-bin # tar xvzf /path/to/drraw-2.1.1.tar.gz
drraw-2.1.1/
...
drraw-2.1.1/drraw.cgi
drraw-2.1.1/drraw.conf
drraw-2.1.1/icons/
...
```

The version-dependent directory created by this is then renamed to drraw:[10]

```
linux:lib/cgi-bin # mv drraw-2.1.1 drraw
```

drraw.cgi itself requires, apart from Perl, the Perl CGI module (CGI.pm), and the RRDtools, from at least version 1.0.47; nothing will work below version 1.0.36. If your distribution does not include a current version, you should obtain the sources from http://www.rrdtool.org/ and compile them yourself:

```
linux:~ # cd /usr/local/src
linux:local/src # tar xvzf /path/to/rrdtool-1.0.49.tar.gz
```

[8] Apart from the documentation on the homepage http://www.rrdtool.org/, the tutorial included (man rrdtutorial) is a useful starting point, as well as the manpage man rrdgraph.

[9] Which directory this is depends on the distribution or Apache configuration you are using.

[10] A symbolic link would also be possible, but then Apache must be configured so that it follows symbolic links, which is normally not automatically the case.

```
linux:local/src # cd rrdtool-1.0.49
linux:src/rrdtool-1.0..49 # ./configure
linux:src/rrdtool-1.0..49 # make
linux:src/rrdtool-1.0..49 # make install
linux:src/rrdtool-1.0..49 # make site-perl-install
```

The CGI script drraw.cgi uses the Perl module RRDs, which after the installation with make site-perl-install, is found automatically.

17.4.2 Configuration

The drraw configuration is contained in the file drraw.conf:

```
linux:cgi-bin/drraw # egrep -v '^#|^$' drraw.conf
...
%datadirs = ('/var/lib/rrd'  => '[RRDbase]',
            );
$vrefresh = '120';
@dv_def  = ( 'end - 6 hours', 'end - 28 hours', 'end - 1 week', 'end - 1
month', 'end - 1 year' );
@dv_name = ( 'Past 6 Hours', 'Past 28 Hours', 'Past Week', 'Past Month',
'Past Year' );
@dv_secs = ( 21600, 100800, 604800, 2419200, 31536000 );
$saved_dir = '/var/lib/drraw/saved';
$tmp_dir = '/var/lib/drraw/tmp';
...
```

The extract shown specifies the RRD repository (here: /var/lib/rrd) as the most important detail, but several directories can also be specified:

```
%datadirs = ('/var/lib/rrd'  => '[RRDbase]',
             '/data/rrd'     => '[RRDdata]',
            );
```

The text in square brackets (e.g., [RRDbase]) appears later on the Web interface, which allows a distinction to be made between various different repositories. The variables @dv_def, @dv_name, and @dv_secs influence the layout and number of graphics.

The configuration shown above generates one graphic more than the standard configuration. This represents the past six hours: the extended statement 'end—6 hours' in @dv_def describes the time period for rrdtool (see man rrdgraph), in @dv_name the representation is given a suitable title with 'Past 6 Hours', and @dv_secs contains the six hours, converted into (21600) seconds, displayed by drraw as a time period in a separate graphic.

The repository must be readable for the user with whose rights the Web server is running, and the directories specified in $saved_dir and $tmp_dir must also be readable. If a user other than **www-data** runs this, the following command must be adapted accordingly:

```
linux:~ # mkdir -p /var/lib/drraw/{saved,tmp}
linux:~ # chown -R www-data.www-data /var/lib/drraw
```

Data arrives in the temporary directory **$temp_dir**, whose contents can be deleted at any time, whereas in **$saved_dir drraw** stores configuration data which the program needs in order to access already created graphics later on. This data must not be lost.

drraw implements a simple access protection in three stages: read-only (0), restricted editing (1), and full access (2). Users logged in to the Web server automatically obtain level 2. Nonauthorized users are treated as **guests** and assigned level 0. To avoid the hassle with authentication at the beginning, you can grant the user **guest** full access via the following directive in the configuration file:

```
%users = ( 'guest' => 2 );
```

17.4.3 Practical application

The CGI script in the CGI directory of the Web server can be addressed through the following URL:

```
http://nagsrv/cgi-bin/drraw/drraw.cgi
```

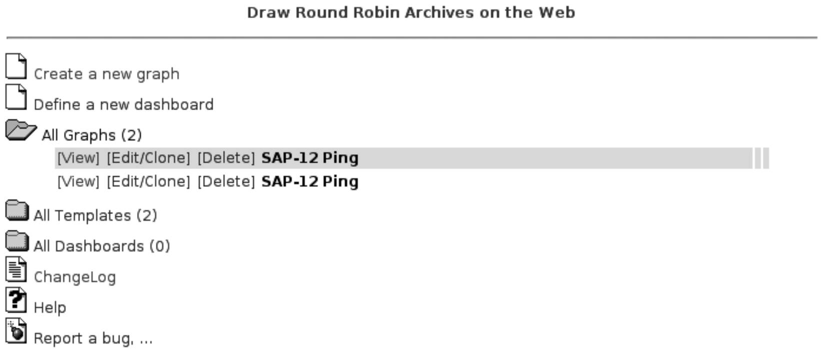


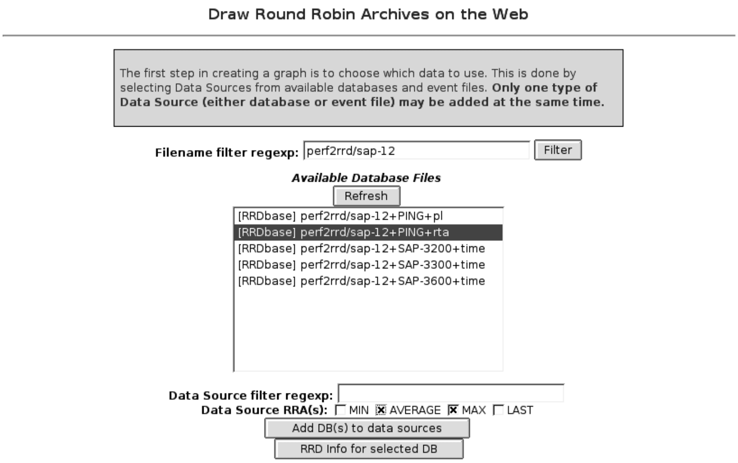
Figure 17.2: The drraw start menu

Draw Round Robin Archives on the Web

Create a new graph
Define a new dashboard
All Graphs (2)
[View] [Edit/Clone] [Delete] **SAP-12 Ping**
[View] [Edit/Clone] [Delete] **SAP-12 Ping**
All Templates (2)
All Dashboards (0)
ChangeLog
Help
Report a bug, ...

New graphics are generated in the menu item **Create a new graph** in the start picture, which is shown in Figure 17.2. The dialog shown in Figure 17.3 allows the appropriate RRD database to be selected. Using a regular expression[11] in the **Data Source filter regexp** field, the data sources available can be further restricted; this expression can also be a simple literal text, such as **sap-12**.

Once you have chosen an RRD database, you just need to specify the ***round-robin archive*** (RRA) to be used. Each of these archives saves data in a particular form, processed with a consolidation function: the AVERAGE function averages all measurement data that accumulates in a measurement period, MIN saves only the minimum value of the data in an interval, and MAX saves only the maximum. Since the original data is lost, the archives must be specified when the round-robin database is created; maximum values can only be recalled later if this was taken into account at the time.



Draw Round Robin Archives on the Web

The first step in creating a graph is to choose which data to use. This is done by selecting Data Sources from available databases and event files. **Only one type of Data Source (either database or event file) may be added at the same time.**

Filename filter regexp: perf2rrd/sap-12

Available Database Files

[RRDbase] perf2rrd/sap-12+PING+pl
[RRDbase] perf2rrd/sap-12+PING+rta
[RRDbase] perf2rrd/sap-12+SAP-3200+time
[RRDbase] perf2rrd/sap-12+SAP-3300+time
[RRDbase] perf2rrd/sap-12+SAP-3600+time

Data Source filter regexp:
Data Source RRA(s): □ MIN ☒ AVERAGE ☒ MAX □ LAST

Figure 17.3: Selecting the data source

If you cannot remember what archives exist, you can display them using the button **RRD Info for selected DB**. Clicking on the **Add DB(s) to Data Sources** button takes you to a dialog where you first have to scroll down a bit to reach the item **Data Source Configuration** (Figure 17.4). There you can fine-tune the desired graph—now or later. You can define your own colors, and whether a line or a surface will be shown. You should only make use of the other possibilities if you are familiar with the concepts of the RRDtools and the way they work.[12]

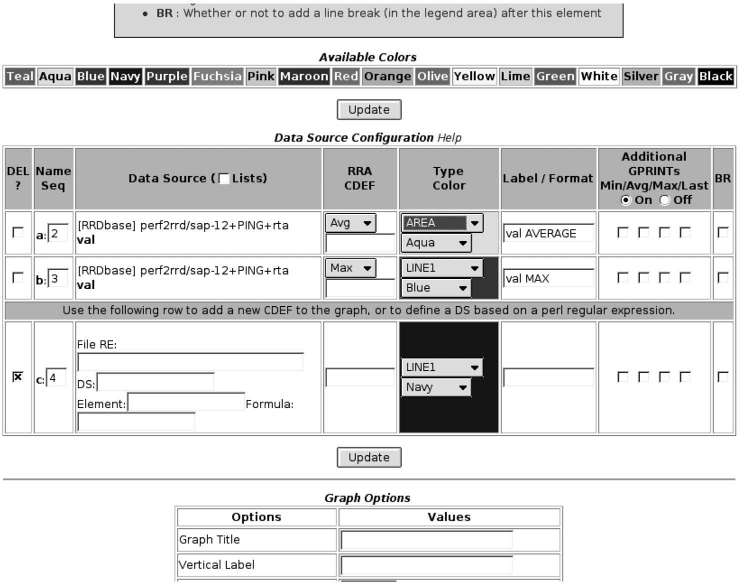
The **Update** button provides a preview of the finished graphic, which at the same time reveals the **rrdtool** options used (Figure 17.5). When you save, with **Save Graph**, you obtain a link in the form

[11] POSIX regular expression; see **man 7 regex**.

[12] There are a number of tutorials on the homepage of the RRDtools author, Tobias Oetiker, at **http://people.ee.ethz.ch/~oetiker/webtools/rrdtool/tut/index.en.html**.

```
http://nagsrv/cgi-bin/drraw/drraw.cgi?Mode=view;Graph=11149589.4932
```

with which the graphic can be accessed at any time. Alternatively you can now find the graphic in the **drraw** starting menu under **All Graphs**.



- **BR** : Whether or not to add a line break (in the legend area) after this element

Available Colors

Teal	Aqua	Blue	Navy	Purple	Fuchsia	Pink	Maroon	Red	Orange	Olive	Yellow	Lime	Green	White	Silver	Gray	Black

Update

Data Source Configuration *Help*

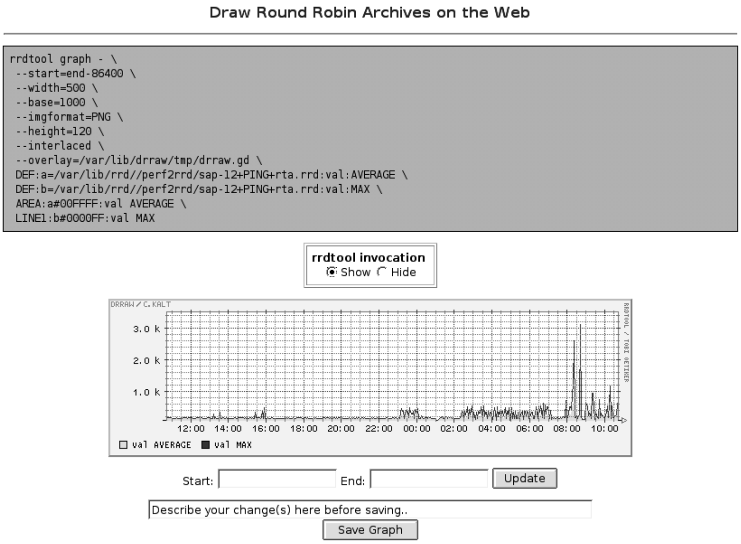
DEL ?	Name Seq	Data Source (□ Lists)	RRA CDEF	Type Color	Label / Format	Additional GPRINTs Min/Avg/Max/Last ● On ○ Off	BR
□	a: 2	[RRDbase] perf2rrd/sap-12+PING+rta **val**	Avg	AREA Aqua	val AVERAGE	□ □ □ □	□
□	b: 3	[RRDbase] perf2rrd/sap-12+PING+rta **val**	Max	LINE1 Blue	val MAX	□ □ □ □	□
Use the following row to add a new CDEF to the graph, or to define a DS based on a perl regular expression.							
☒	c: 4	File RE: DS: Element: Formula:		LINE1 Navy		□ □ □ □	□

Update

Graph Options

Options	Values
Graph Title	
Vertical Label	

Figure 17.4: Fine-tuning the graphic configuration



Draw Round Robin Archives on the Web

```
rrdtool graph - \
 --start=end-86400 \
 --width=500 \
 --base=1000 \
 --imgformat=PNG \
 --height=120 \
 --interlaced \
 --overlay=/var/lib/drraw/tmp/drraw.gd \
 DEF:a=/var/lib/rrd//perf2rrd/sap-12+PING+rta.rrd:val:AVERAGE \
 DEF:b=/var/lib/rrd//perf2rrd/sap-12+PING+rta.rrd:val:MAX \
 AREA:a#00FFFF:val AVERAGE \
 LINE1:b#0000FF:val MAX
```

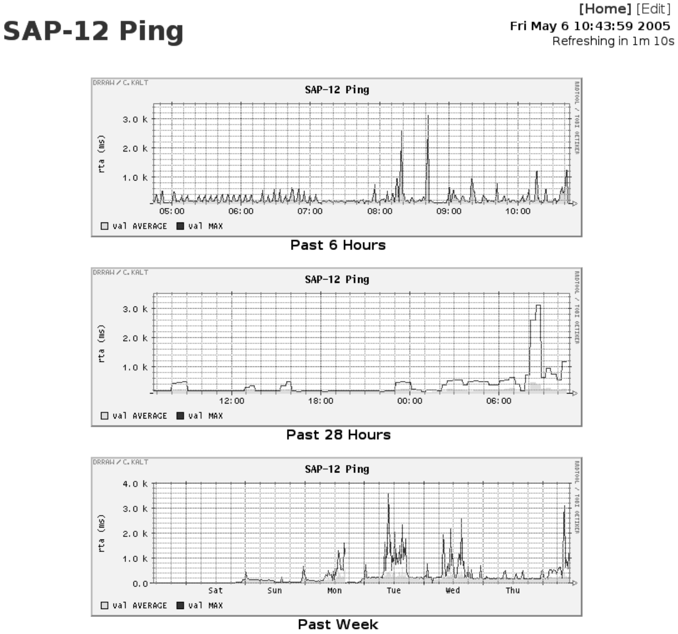
rrdtool invocation
● Show ○ Hide

Start: End: Update

Describe your change(s) here before saving..

Save Graph

Figure 17.5: Preview and specifying the rrdtool options



SAP-12 Ping

[Home] [Edit]
Fri May 6 10:43:59 2005
Refreshing in 1m 10s

Past 6 Hours

Past 28 Hours

Past Week

Figure 17.6:
The finished graphic represents different time periods

The link mentioned when you save a graphic can be recorded in a **serviceextinfo** object, making it directly accessible through the Nagios interface:

```
define serviceextinfo{
    service_description PING
    host             sap-12
    notes_url /nagiosgraph/drraw/drraw.cgi?Mode=view;Graph=11149589.4932
    icon_image       graph.gif
    icon_image_alt   View graphics
}
```

With templates and dashboards, **drraw** includes other features, which cannot be discussed in detail here, for reasons of space. Templates allow several sources of the same type to be shown in the same graphic. What these are can be specified in **Create a new Graph** (see Figure 17.3). Since you can only add one source at a time there, you must click the **Add** button for each separate source, before moving on to the next one.

A dashboard presents a display containing several preview graphics. If you click on one of the graphics, you are shown the detailed representation. The interactive menu **Create a Dashboard** contains brief instructions where you can obtain help on the two features.

17.5 Automated to a Large Extent: NagiosGrapher

NagiosGrapher from Netways, the host of The Nagios Exchange Platform http://www.nagiosexchange.org/, is a brand-new representation tool for performance data, but already a very powerful one. This also saves data in round-robin databases and uses the RRDtools for processing and representation.

It claims to be easy to install and to work automatically to a large extent in contrast to the "competition." The latter promise has so far not been kept; as in Nagiosgraph, you have to configure search patterns in order to interpret the plugin output or performance data correspondingly. The RRD databases are generated by NagiosGrapher automatically; in addition to this, the tool serviceextinfo also generates entries.

As soon as it once recognizes the performance data, you don't have to worry any more about integrating it into Nagios. A reload is sufficient to make the serviceextinfo entries generated in the meantime usable in Nagios. The entries are created "intelligently," so that if you click on the corresponding icon in the service summary (see Figure 17.7 on page 340), you are taken directly to the graphic display of the performance data.

As far as functionality and installation efforts are concerned, NagiosGrapher lies somewhere between Nagiosgraph and Perf2rrd: the initial configuration needed is somewhat more than for Nagiosgraph, but the possibilities of variations in the graphic output are considerably larger, and you do not have to generate each graphic individually, as is the case with Perf2rrd/drraw.

17.5.1 Installation

NagiosGrapher requires the Perl modules GD, CGI, RRDs, XML::SIMPLE, XML::Parser, and Data::Dumper.[13] From version 1.3-dev, Data::Dumper replaces the XML modules, but they are still necessary here to convert data from previous versions, if required.

Normally all the standard Linux distributions will include corresponding packages. These can also be downloaded and installed in the modules provided by CPAN, following the pattern:

```
linux:~ # perl -MCPAN -e 'install CGI'
```

The NagiosGrapher sources can be obtained from The Nagios Exchange[14] and they are unpacked to the directory /usr/local/nagios:

[13] Data::Dumper is a component of the Perl base distribution, the module RRDs belongs to the RRDtools package and is not available through the Comprehensive Perl Archive Network (CPAN).

[14] http://www.nagiosexchange.org/Charts.42.0.html., entry nagios_grapher

```
linux:~ # cd /usr/local/nagios
linux:local/nagios # tar xvjf /path/to/NagiosGrapher_1.3-dev.tar.bz2
linux:local/nagios # ln -s NagiosGrapher_1.3-dev nagiosgrapher
```

So that you can later on use paths which are not version-specific, you should create a symbolic link, nagiosgrapher, to the current directory NagiosGrapher_1.3-dev. Change to this directory and copy the CGI scripts to the Nagios CGI directory, or to /usr/local/nagios/sbin/ if you have installed this yourself:

```
linux:local/nagios # cd nagiosgrapher
linux:nagios/nagiosgrapher # cp *.cgi /usr/local/nagios/sbin/.
linux:nagios/nagiosgrapher # chown nagios.nagcmd \
    /usr/local/nagios/sbin/{graphs,rrd2-graph}.cgi
linux:nagios/nagiosgrapher # ln -s \
    /usr/local/nagios/nagiosgrapher/NagiosGrapher.pm \
    /usr/local/nagios/sbin/.
```

In order for Debian Sarge to be able to find NagiosGrapher.pm, the symbolic link mentioned must be located in /etc/perl:

```
ln -s /usr/local/nagios/nagiosgrapher/NagiosGrapher.pm /etc/perl/.
```

The example configuration file ngraph.ncfg[15] is copied to the directory /etc/nagios, and two icons to the logos directory of the Nagios installation:

```
linux:nagios/nagiosgrapher # cp cfg/ngraph.ncfg /etc/nagios/.
linux:nagios/nagiosgrapher # cp graph.png dot.png \
    /usr/local/nagios/share/images/logos
```

Before the start script nagios_grapher is stored in /etc/init.d, the path to collect2.pl contained in it is adjusted (this script reprocesses the data passed on by Nagios and writes it to the RRD databases):

```
# nagios_grapher start script
...
DAEMON=/usr/local/nagios/nagiosgrapher/collect2.pl
...
```

So that the script also runs in the individual runlevels, corresponding symbolic links are set in the rc?.d directories.[16] Here is an example for Debian:

[15] In versions up to 1.2 the file extension was .cfg!

[16] Depending on the distribution, these are directly in /etc (Debian) or in /etc/init.d (SuSE, Red Hat).

```
linux:nagios/nagiosgrapher # cp nagios_grapher /etc/init.d/
linux:nagios/nagiosgrapher # cd /etc/init.d
linux:etc/init.d # ln -s nagios_grapher /etc/rc2.d/S99nagios_grapher
linux:etc/init.d # ln -s nagios_grapher /etc/rc3.d/S99nagios_grapher
linux:etc/init.d # ln -s nagios_grapher /etc/rc4.d/S99nagios_grapher
linux:etc/init.d # ln -s nagios_grapher /etc/rc5.d/S99nagios_grapher
```

17.5.2 Configuration

The configuration file ngraph.ncfg

The configuration file **ngraph.ncfg** contains a global **config** section with paths and general settings. This is followed by as many **ngraph** definitions as you want, each of which describes a graphic.

Even from the global details, it is not difficult to see that the syntax sticks close to the concept used by Nagios:

```
# /etc/nagios/ngraph.ncfg
define config {
    pipe                    /var/nagios/ngraph.pipe
    step                    60
    heartbeat               600
    rrdpath                 /var/lib/rrd/nagiosgrapher
    tmppath                 /tmp/nagiosgrapher/
    serviceext_type         MULTIPLE
    serviceextinfo          /etc/nagios/serviceextinfo.cfg
    serviceext_path         /etc/nagios/serviceext
    url                     /nagios/cgi-bin/graphs.cgi
    nagios_config           /etc/nagios/nagios.cfg
    cgi_config              /etc/nagios/cgi.cfg
    icon_image_tag          dot.png' border="0"></a><A TARGET="_blank" \
        HREF="graphs.cgi?###URL###" BORDER="0"> \
        <img src="/nagios/images/logos/graph.png" border="0"
    log_file                /var/nagios/ngraph.log
    log_level               1

    # -- rrd display options
    rrd_color_background    fcfcfc
    rrd_color_font          333333
    rrd_color_arrow         ff0000
    rrd_color_frame         333333
    rrd_color_grid
    rrd_color_canvas        ffffff

    # -- browser
    fe_use_browser_all      1
    fe_use_browser_for      nagios
    fe_use_browser_url      0
}
```

It contains the following parameters:

pipe

This defines a named pipe to which Nagios writes the data with the script write_fifo.pl and from which the collection script collect2.pl reads it out again. It must be set up manually, and needs to be readable and writable for the user nagios:

```
linux:~ # mknod /var/nagios/ngraph.pipe p
linux:~ # chown nagios.nagios /var/nagios/ngraph.pipe
```

step

This defines the step size in seconds for the RRD database. All values recorded during this period are summarized by the RRDtools in a single value. step therefore also describes the smallest time resolution of data in the RRD database. The value only has an effect on newly created RRD databases, and a modification made later on has no effect on existing databases.

heartbeat

The heartbeat defines a time period in seconds, during which the RRD database always expects data. If no measured value at all arrives during this period, NagiosGrapher generates an invalid entry (nan, *not a number*).

In order for valid entries to materialize in the above example, at least one measured value must arrive every 600 seconds. Since the resolution is 60 seconds, the database contains ten entries for the period of the "heartbeat." If one of these values is missing, NagiosGrapher simply replaces it with the last valid one. If just one measured value arrives in ten minutes, it will be recorded ten times in the database.

rrdpath

This specifies the directory for the RRD databases. It must be writable for the user nagios and (along with the database files) readable for the Web server user:

```
linux:~ # mkdir /var/lib/rrd/nagiosgrapher
linux:~ # chown nagios.nagcmd /var/lib/rrd/nagiosgrapher
linux:~ # chmod 755 /var/lib/rrd/nagiosgrapher
```

tmppath

This defines where NagiosGrapher temporarily saves internal XML files.

serviceext_type

This describes how the serviceextinfo objects are created. With the SINGLE type, NagiosGrapher writes everything to the file specified in serviceextinfo. Nagios 2.0 can also read directories recursively, and in this case it is better to use the MULTIPLE type. Then NagiosGrapher creates a separate file for each host with the corresponding **serviceextinfo** object. The directory is specified with the **serviceext_path** parameter. This must be made known to Nagios through the **cfg_dir** directive.

url
: This contains the path to the CGI script **graphs.cgi** from the point of view of the Web server (a path starting from the server root) or of the browser (that is, the complete URL).

nagios_config
: This reveals to NagiosGrapher where the standard configuration file of Nagios is located.

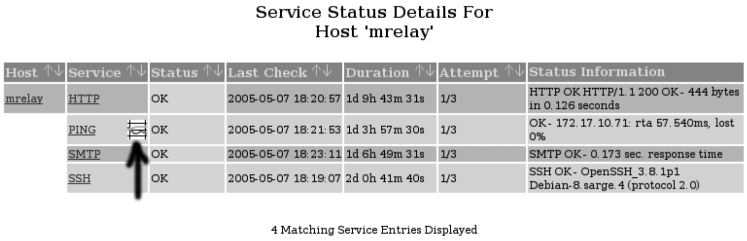
cgi_config
: This specifies the Nagios CGI configuration file. NagiosGrapher uses this to find out who, apart from the contact groups, has the right to query information on all hosts.

icon_image_tag
: This parameter corresponds to the entry that is later to be found in the **serviceextinfo** object as the **icon_image** parameter. In the **serviceextinfo** object, NagiosGrapher replaces the text **###URL###** with the host and service names.

Here the program outwits Nagios with a trick: **dot.png** is a graphic that is one pixel in size, which is invisible on the screen. To create a second, visible icon, **graph.png**, around it, a hyperlink is set to the CGI script **graphs.cgi**.

Normally if you click on an image specified in **icon_image**, Nagios will take you to the **Extended info** page, and the graphic can be reached at **url** (Nagios: **notes_url**) only with another mouse click. With the trick used here, you can do this directly.

The specification following **icon_image_tag** must be written on a single line (without the \ sign used here). Figure 17.7 shows the icon **graph.png**, which is visible on the Nagios interface, thanks to the automatically generated **serviceextinfo** objects.



Service Status Details For
Host 'mrelay'

Host ↑↓	Service ↑↓	Status ↑↓	Last Check ↑↓	Duration ↑↓	Attempt ↑↓	Status Information
mrelay	HTTP	OK	2005-05-07 18:20:57	1d 9h 43m 31s	1/3	HTTP OK HTTP/1.1 200 OK - 444 bytes in 0.126 seconds
	PING	OK	2005-05-07 18:21:53	1d 3h 57m 30s	1/3	OK - 172.17.10.71: rta 57.540ms, lost 0%
	SMTP	OK	2005-05-07 18:23:11	1d 6h 49m 31s	1/3	SMTP OK - 0.173 sec. response time
	SSH	OK	2005-05-07 18:19:07	2d 0h 41m 40s	1/3	SSH OK - OpenSSH_3.8.1p1 Debian-8.sarge.4 (protocol 2.0)

4 Matching Service Entries Displayed

Figure 17.7: The NagiosGrapher icon (arrow) in the Nagios Web interface indicates a time-related evaluation for this service

log_file

This defines the log file to which the NagiosGrapher writes information. If you want log rotation, you have to set it up yourself, as NagiosGrapher does not clean up automatically. Because Nagios requries write permissions for the file, it is better stored in the Nagios **var** directory (in this case: /var/nagios).

log_level

This parameter specifies what information the log file should contain. Possible values are **1** (detected services and values), **2** (performance data delivered by Nagios which has not been recognized by NagiosGrapher), **4** (program states), **8** (information on the **serviceextinfo** object), **16** (RRD actions), and **32** (input which is read from the pipe). If you want to log several of these information types, you just add the relevant values together, so the most extensive output is obtained with **63**; page 349 shows an example of this. It is recommended that you only use these log levels for debugging purposes, and you should normally use **0** or **4**.

rrd_color_*

The **rrd_color** options bring color to the Web interface (Figure 17.8): **rrd_color_background** defines the background color for the entire image, **rrd_color_font** the font color, **rrd_color_arrow** the color of the arrow tips, **rrd_color_frame** the frame color for the keys, **rrd_color_grid** the grid color, and **rrd_color_canvas** the background of the diagram itself. Colors are specified as RGB values in hexadecimal notation, with a preceding **#**, as is the norm for Web pages.

Changes to these options take effect immediately the next time the Web page is reloaded.

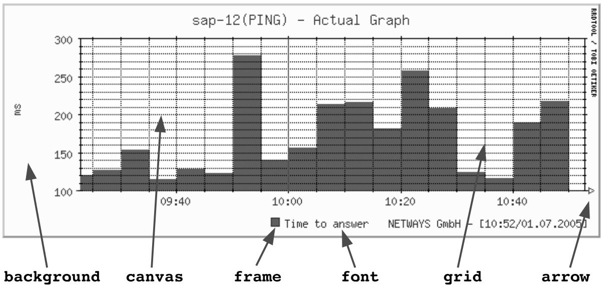
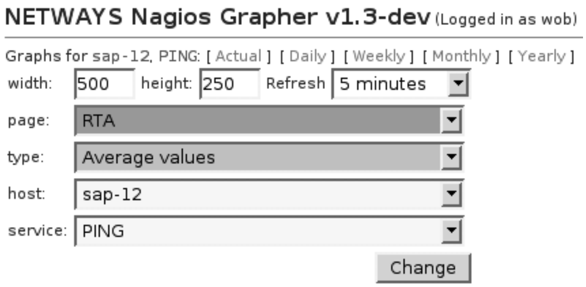


Figure 17.8: The influence of the rrd_color_* color options

fe_use_browser_all

From version 1.2, NagiosGrapher provides a method of switching from the display of a specific service to that of other services for any host at all. To do this it integrates a selection window into the **graphs.cgi** display (see Figure 17.9).

The value **1** activates the pulldown menus **host** and **service**, **0** hides them.



NETWAYS Nagios Grapher v1.3-dev (Logged in as wob)

Graphs for sap-12, PING:

width: 500 height: 250 Refresh 5 minutes

page: RTA

type: Average values

host: sap-12

service: PING

Figure 17.9: Whether NagiosGrapher shows the host and services fields is determined by the fe_use_browser parameters

fe_use_browser_for
: This option allows particular users to use the host/service selection. Several users can be specified, separated by commas. So that only the users specified here can see the selection fields for **host** and **service**, **fe_use_browser_all** must also be set to **0** at the same time.

fe_use_browser_url
: This option allows the selection fields for **host** and **service** to be inserted through the URL **graphs.cgi?browser=1**, provided the value is **1**. This is not possible if the value is **0**.

Since version **1.3-dev**, NagiosGrapher has two other configuration parameters: **cfg_dir** and **cfg_file**. **cfg_file** allows configuration details in a file specified as an argument to be taken into account as well, and with **cfg_dir** you can specify a directory that contains additional configuration files:

```
cfg_dir=/etc/nagios/ngraph.d
```

NagiosGrapher examines it recursively for configuration files of any name; they just need to end in **.ncfg**.

Both parameters must stand outside the **config{}** block and all **ngraph{}** blocks; there has to be an = sign between the parameter and the value.

Configuring the graphics—the basic principle

ngraph objects are used to define what data is to be extracted and written to an RRD database, but the objects also contain information on the display form. While the data collection script **collect2.pl** only reads the configuration file **ngraph.ncfg** when it starts or after a reload, the CGI script **graphs.cgi** accesses it constantly. So changes to the graphic display take effect immediately the next time the Web page is loaded, but other corrections only appear after a reload with **/etc/init.d/nagios_grapher reload.**

So that NagiosGrapher can graphically display the average response time **rta** (*round trip average*) and the **pl** (*packet loss*) from the performance data of the **check_icmp** plugin,

```
nagios@linux:libexec/nagios$ ./check_icmp -H linux01
OK - eli02: rta 96.387ms, lost 0%| rta=96.387ms;200.000;500.000;0; pl=0%;
40;80;;
```

the following **ngraph** objects are used:

```
# ngraph.ncfg
...
# Ping Packet loss
define ngraph{
        service_name            PING
        graph_perf_regex        pl=([0-9]*)%
        graph_value             Loss
        graph_units             %
        graph_legend            Packet Loss
        page                    Packet Loss
        rrd_plottype            LINE2
        rrd_color               ff0000
}
# Ping RTA
define ngraph{
        service_name            PING
        graph_perf_regex        rta=([0-9]*[0-9]*)
        graph_value             RTA
        graph_units             ms
        graph_legend            Time to answer
        page                    RTA
        rrd_plottype            AREA
        rrd_color               00a000
}
```

service_name

This consists of a regular expression,[17] with which the NagiosGrapher identifies the service to be displayed in the data passed on. If the service description in service objects that use the same plugin is provided with the same prefix, one **ngraph** definition is enough for all: **Disk_** matches both **Disk_usr**, as well as **Disk_var** or **Disk_tmp**. In order for this to work, the

[17] Since we have a Perl script on our hands, this is, of course, a Perl regexp.

performance data must be structured identically, which is always the case if the same plugin is used.

graph_perf_regex

With this regular expression, NagiosGrapher finds the value being searched for in the performance data. The pattern in the round brackets must match the value itself.

If a plugin does not provide any performance data, you can use **graph_log_regex** instead. The search pattern specified there is applied by NagiosGrapher to the normal text output of the plugin.

graph_value

The name of the variable in the RRD database must be unique for each service and may not contain empty spaces or special characters (exception: _ is allowed).

graph_units

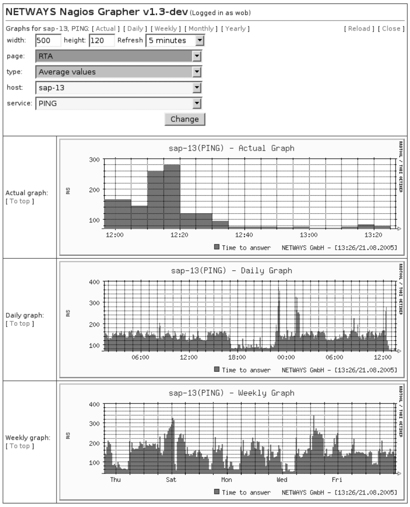
This parameter defines the unit of the y axis.

graph_legend

This contains the key for the variables.

page

This optional parameter ensures that NagiosGrapher displays the variables in different diagrams if the standardization does not match. All values which are to be used in a single graphic are given the same **page** entry. For the selection of the "page" to be displayed, the CGI script contains its own **page** entry field (see Figure 17.10).



NETWAYS Nagios Grapher v1.3-dev (Logged in as wob)

Graphs for sap-13, PING: [Actual] [Daily] [Weekly] [Monthly] [Yearly] [Reload] [Close]

width: 500 height: 120 Refresh 5 minutes

page: RTA

type: Average values

host: sap-13

service: PING

Figure 17.10: The average response time to pings, represented by NagiosGrapher

For the two **check_icmp** outputs, it is recommended that the percentage of **Loss**, which is in the value range from 0 to 100, be separated from **RTA**, which can be several thousand milliseconds.

If you leave out the **page** parameter, both graphs—the one for **Packet Loss** and that for **RTA**—are displayed in one graphic.

rrd_plottype
This parameter defines which drawing function the RRDtools should use:

- **LINE1**: simple line,
- **LINE2**: double line,
- **LINE3**: extra-fat line,
- **AREA**: filled out surface,
- **STACK**: adds the current value to the previous one. In this case the display (line or surface) depends on the previous value.

rrd_color
This is the color of the graph in RGB hexadecimal notation (rrggbb).

Figure 17.10 shows how NagiosGrapher displays the average response time **RTA** for the **PING** service on the host **sap-13**. The respective output page **page** can be selected at the top of the Web form. In addition you can adjust the **width:** and **height:** of an individual graphic, as well as the **refresh** rate.

Advanced options of graphic reprocessing

You may not always want the measured values to be displayed directly. With the *CDEF* feature of the RRDtools you can add new values that are calculated from the ones recorded.

As an example, we will use the output of the **check_disk** plugin (section 7.1, page 134), which determines amount of a file system occupied:

```
DISK OK - free space: /usr 287 MB (19%);| /usr=1225MB;1359;1465;0;1511
```

The used space is shown as an orange area, the free capacity as a green one. The performance data provides the current used space (**1225MB**) and uncritical warning limits, as well as the minimum and maximum (the size of the file system). The capacity that is still free is determined as the difference between the maximum and the current occupied space. In addition, the unit of MB is somewhat unfortunate: the graphic would show 10 GB as **10k** MB.

For this reason you first determine the value that the plugin returns, so that you can then scale it as you wish:

```
# (1) readout current occupancy of hard drive space,
#     but do not show it as a graphic
define ngraph{
    service_name            fs_
    graph_perf_regex        =([.]+)MB;[.]+;[.]+;[.]+;[.]+
    graph_value             disk_used
    graph_units             Bytes
    graph_legend            used space
    rrd_plottype            AREA
    rrd_color               00a000
    hide                    yes
}
```

The regular expression specified after **service_name** matches all service descriptions that start with **fs_** (short for *file system*), that is, **fs_root**, **fs_usr**, **fs_var**, **fs_tmp**, etc. The parameter **hide** ensures that the CGI script does not show the graphs. Instead, NagiosGrapher just stores the data in a database.

In the second step, the values determined are standardized with the RRD feature **CDEF**:

```
# (2) display used hard drive space in scaled form
define ngraph{
        service_name            fs_
        type                    CDEF
        graph_value             DISK_USED
        graph_legend            used space
        graph_calc              disk_used,1024,1024,*,*
        rrd_plottype            AREA
        rrd_color               FFaa00
        hide                    no
}
```

type identifies the entry as a **CDEF** definition, which calculates new values from already existing ones. **graph_value** must be unique, which is why the entry here is given its own name.

graph_calc finally processes the data. This parameter expects the instructions in reverse Polish notation (RPN).[18] In this, the values to be processed are pushed, in turn, onto a stack, to be removed and operated on later.

Adding 2 + 3 is noted in RPN accordingly as **2,3,+**. In the example we multiply the variable defined on page 345, **disk_used**, by 1024^2 so that the result is in bytes. **hide no** now ensures that this value is displayed.

To display available space according to the same pattern, we first determine the entire space available (**disk_max**), which NagiosGrapher should not display, calculate the difference between **disk_max** and the above **disk_used** value, and convert the result to bytes:

[18] An introduction to RPN can be found at **http://people.ee.ethz.ch/~oetiker/webtools/rrdtool/tut/rpntutorial.en.html**.

```
# (3) defining the space available,
#     but not displaying it in the graphic
define ngraph{
    service_name            fs_
    graph_perf_regex        =[.]+MB;[.]+;[.]+;[.]+;([.]+)
    graph_value             disk_max
    graph_legend            max space
    rrd_plottype            LINE2
    rrd_color               0000a0
    hide                    yes
}
# (4) calculate and display free space
define ngraph{
    service_name            fs_
    type                    CDEF
    graph_value             DISK_MAX
    graph_legend            free space
    rrd_plottype            STACK
    rrd_color               44FF44
    graph_calc              disk_max,disk_used,-,1024,1024,*,*
    hide                    no
}
```

The corresponding formula is (**disk_max** – **disk_used**) × 1024^2. The plot type **STACK** ensures that the value determined from the previous **disk_used** value is placed on top of this. Figure 17.11 shows a corresponding output.

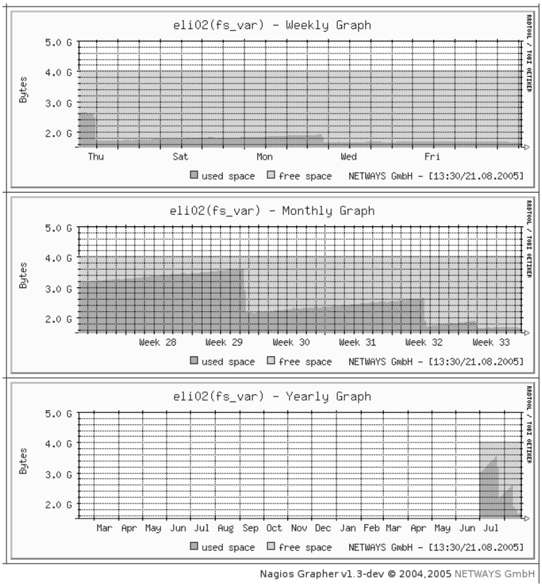


Figure 17.11:
The lower part of the screen represents the current used space on the file system for the past week, month,and year, and the top part shows the remaining free hard drive space

At this point it should again be emphasized that with this definition, NagiosGrapher automatically records all services that begin with fs_ and are matched by the search pattern, writes the data to an RRD database, and generates a corresponding serviceextinfo entry, which appears automatically in the Web interface after a Nagios reload (see Figure 17.7 on page 340).

After changes have been made to the configuration file ngraph.ncfg, the file collector collect2.pl must also be restarted:

```
linux:~ # /etc/init.d/nagios_grapher restart
```

Nagios configuration

Nagios passes on data for NagiosGrapher through the command interface, that is, each individual result leads to an external command being started. Correspondingly, the Nagios main configuration file contains the following parameter:

```
# /etc/nagios/nagios.cfg
...
process_performance_data=1
service_perfdata_command=process-service-perfdata
...
```

The definition of the command object process-service-perfdata in the file misccommands.cfg is as follows:

```
# misccommands.cfg
...
define command{
   command_name  process-service-perfdata
   command_line  /usr/local/nagios/nagiosgrapher/fifo_write.pl \
     /var/nagios/ngraph.pipe \
     '$HOSTNAME$\t$SERVICEDESC$\t$SERVICEOUTPUT$\t$SERVICEPERFDATA$\n' 3
}
...
```

process-service-perfdata calls the script fifo_write.pl, which is given three arguments as parameters: the named pipe, a string with the performance details, and a timeout in seconds. The latter ensures that the script aborts the action if the data cannot be written within three seconds. The command_line must, as usual here, be writen on one line (without the \ used here, as in the rest of the book, as a line continuer).

If changes are made to the Nagios configuration, it needs to be reloaded:

```
linux:~ # /etc/init.d/nagios reload
```

The success of this can be easily seen in the log file if you set the log level to 63:[19]

```
PRG: Restarting collect2.pl ...
PIPE: eli02 fs_root DISK OK - free space: / 378 MB (80%): /=92MB;423;446
;0;470
VALUES: [eli02][fs_root]: disk_used=92 disk_max=470
RRD: rrdtool update /var/lib/rrd/nagiosgrapher/eli02/959ca0df9516ad1f52c
05490202f1a6d.rrd --template=disk_used:disk_max N:92:470
PIPE: eli02 Room Temperature S1 OK: Value lpt1.1: /22.67/
VALUES: [eli02][Room Temperature S1]:No Action taken...
```

The label PRG identifies program states, such as the restart here. PIPE reproduces in full all the data taken from the named pipe (host name, service description, plugin output, and performance data, each separated by a tab). RRD reveals the commands performed with rrdtool and VALUES shows the recognized (fs_root) or unrecognized values (room temperature S1).[20]

17.6 Other tools and the limits of graphic evaluation

Apart from the tools introduced here, http://www.nagiosexchange.org/ provides further tools for the graphic evaluation of performance data. Many of these are also based on the RRDtools and round-robin databases, the consequence of which is that they are not much use for exact evaluations over several years, just like the ones described here.

Several tools, such as the current APAN[21] version, save their data in an SQL database, thus enabling long-term statistics without data loss.

PerfParse (http://perfparse.sf.net/) is relatively new, but very extensive, and it stores data in a MySQL or PostgreSQL database and also includes its own wide range of evaluation tools. Because it uses various current libraries which are not included in every distribution, the installation hurdles are quite high. In Debian Woody, PerfParse cannot even be compiled from the source code without the installation of several additional libraries, and even in Debian Sarge there are still problems with the PostgreSQL database. For this reason, this book will not go into a detailed description of the program.

For all the options it offers, the graphical display of Nagios performance data also has its limits. If you check WAN connections with a ping to a remote host and measure the average response time, all the pretty graphics don't mean much if the check interval is only every five minutes. You will receive only a momentary

[19] To keep the output clearer, we have omitted the timestamp at the beginning of the line.

[20] For this last item we have not created an ngraph entry.

[21] http://apan.sf.net/.

snapshot every five minutes, which does not provide any serious clues to the traffic load of the connection over a period of time.

To be able to sensibly assess the load of a Unix computer reported by a plugin every one, five, and 15 minutes, the check interval should be one minute. Less critical data are such things as used hard drive space or temperature. Equally noncritical is the display of network traffic, for which the plugin displays the values as a counter. RRD-based tools can automatically detect the difference between two measurements and display them; it makes no difference here whether the check interval is one, two, or five minutes; no data is lost.

If the measuring precision of Nagios leaves something to be desired, you can deploy other tools in parallel, such as Cricket[22] or Cacti.[23] If the external tool works with RRD databases, you can check these for critical values, so that they are included in the sophisticated Nagios notification system. Alternatively the external tool can provide an interface with which recorded data can be further processed. These can be passed on as a passive test result to Nagios, for example using NSCA (see Chapter 14).

But an additional tool always has the disadvantage of adding to the configuration effort. Whether this is justified, or whether Nagios performance monitoring is sufficient, depends on the information required in a particular situation.

[22] http://cricket.sourceforge.net/

[23] http://www.cacti.net/

Special Applications

18 Chapter

Monitoring Windows Servers

You don't always deal with a homogeneous server landscape consisting of just Linux or Linux/Unix computers. As long as you are just monitoring pure network services, operating systems make no difference. But if you want to query local, non-network-capable resources, that is a different matter altogether.

With Unix-based systems such as Mac OS X, you can normally use the tools described so far (local plugins, NRPE, NSCA). In Windows you have to find other solutions. To some extent, local plugins can be run and/or compiled in an environment emulating Unix (for example, Cygwin[1]). Because of the different philosophies of the operating system families, there are peculiarities as well, features in one operating system that are not comparable with anything in the other operating system. So although the Windows Eventlog fulfils much the same purpose as syslog in Unix, it is queried in a completely different way, seen from a technical point of view. Here you cannot simply compile the Unix plugin in Windows and then use it.

[1] http://www.cygwin.com/

One monitoring approach for Windows servers is to use SNMP, for which Microsoft includes a native implementation that just needs to be installed. Since the SNMP query of a Windows agent does not differ in principle from that of other SNMP agents, we refer you to Chapter 11, page 177. The Microsoft implementation, however, does not always work reliably where the display of figures—particularly CPU load and hard drive space—is concerned.

But local Windows resources can also be queried if you install a service on the Windows server that can be addressed over the network. The services include *NSClient* and *NC_Net*. Alternatively, *NRPE_NT*, NRPE can be used. This opens up the entire world of Windows scripting: every Windows script that queries local resources can be extended so that it provides a return value and a one-line text output, just as a Nagios plugin does.

18.1 NSClient and NC_Net

The packages NSClient and NC_Net install services in Windows that can be queried with the plugin check_nt. NSClient is older, more widely tested, and in widespread use, but it is no longer being actively developed. The last current version is from October 2003; the package can be downloaded from the Nagios Exchange.[2] It also runs in Windows NT, Windows 2000, Windows XP and Windows 2003.

NSClient's successor, NC_Net by Tony Montibello,[3] can replace NSClient on the Windows server without the need to change anything in the Nagios configuration. This package is currently being developed very actively, and it is based on the .NET framework, so it requires at least Windows 2000.

With *NSClient++*[4] by Michel Medin there is yet another development branch that is intended to replace NSClient, and ultimately NRPE_NT as well. But it does have the disadvantage that it is not run-compatible with NSClient or NC_Net. The project is still in a very early stage of development. Even its author does not currently recommended it being used in a production environment, which is why we shall not discuss it further here.

18.1.1 Installation

NSClient

For the NSClient installation, you unpack the archive nsclient_201.zip. This creates subdirectories named according to the architecture: Win_NT4_Bin for Windows

[2] http://www.nagiosexchange.org/Windows.49.0.html
[3] http://www.shatterit.com/NC_Net
[4] http://nscplus.sourceforge.net/

NT and Win_2k_XP_Bin for Windows 2000 and higher. Copy the contents of the appropriate folder to the directory C:\Programs\NSClient and install NSClient from there as a service:

```
C:\Programs\NSClient> pNSClient.exe /install
C:\Programs\NSClient> net start nsclient
```

Running pNSClient.exe /install installs the service, and the switch /uninstall removes the service again. Using the services management you should make sure that the operating system starts automatically.

NSClient has two parameters: port and password, with the defaults port 1248 and password none. The values can only be changed (with regedit) in the registry under HKEY_LOCAL_MACHINE\SOFTWARE\NSClient\Parms.

NC_Net

Before you install the most current version from http://www.shatterit.com/NC_Net, it is essential that any previous version installed is first uninstalled. Since NC_Net uses the Microsoft Installer, you do this through the software administration utility. Even an NSClient that might exist should be removed first.

Double clicking on the file NC_Net_setup.msi installs the service, but you should check in the service management that it really is running, and whether or not automatic is entered as the starting type.

NC_Net has the same parameters as NSClient, with password and port, but these can also be specified in the services management under properties in the Start parameters line:

```
port 4711 password password
```

18.1.2 The check_nt plugin

When installing the standard Nagios plugins, the check_nt plugin is automatically loaded to the hard drive. It only has the same range of functions as NSClient, however. To make use of the extensions of NC_Net, you must download the extended source code (the file check_nt.c) from http://www.shatterit.com/NC_Net and compile it yourself.

The actual effect that the check_nt parameters have, described below, depends on the command that is specified with the -v option, and which you can read about in more detail in Section 18.1.3 on page 356:

-H *address* | --host=*address*
: IP address or host name of the host on which the NSClient/NC_Net is installed.

-v *command* | --variable=*command*
: The command to be executed.

-p *port* | --port=*port*
: This defines an alternative port for NSClient/NC_Net. The default is TCP port 1248.

-w *integer* | --warning=*integer*
: This defines a warning limit. This option is not available for all commands.

-c *integer* | --critical=*integer*
: The critical limit option is also not available for all commands.

-l *parameter*
: This is used for passing parameters along, such as the drive for the hard drive check or the process name when checking processes.

-d *option*
: When checking services or processes, you can specify several services or processes simultaneously. Normally check_nt then only shows the defective ones (-d SHOWFAIL). To have all of them displayed you must specify SHOWALL as the *option*.

-s *password*
: A password for authentication is only required if NC_Net or NSClient starts the corresponding service with the password parameter.

-t *timeout* | --timeout=*timeout*
: After *timeout* seconds have elapsed, the plugin aborts the test and returns the CRITICAL state. The default is 10 seconds.

18.1.3 Commands which can be run with NSClient and NC_Net

For the commands introduced here, it makes no difference whether NSClient and NC_Net is installed; they can be run with the unpatched check_nt.

Querying the client version

The version of the installed NSClient or NC_Net service is returned by running the command

```
check_nt -H address -v CLIENTVERSION
```

All other arguments are ignored:

```
nagios@linux:nagios/libexec$ ./check_nt -H winsrv -v CLIENTVERSION
NC_Net 2.21 03/13/05
```

Command and service definitions are not very spectacular, but the latter is extremely useful in describing dependencies:

```
define command{
    command_name check_nt_nsclient
    command_line $USER1$/check_nt -H $HOSTADDRESS$ -v CLIENTVERSION
}

define service{
   host_name           winsrv
   service_description NSClient
   check_command       check_nt_nsclient
   ...
}
```

If NSClient/NC_Net fails on the Windows server, Nagios normally informs the administrator of all services which have presumably failed. This problem is similar to one with NRPE, which in that case was solved through the definition of dependencies (see Section 12.6, page 234). This is also the case when using NSClient/NC_Net:

```
define servicedependency{
    host_name                     winsrv
    service_description           NSClient
    dependent_host_name           winsrv
    dependent_service_description Disks,Load,Memory
    notification_failure_criteria c,u
    execution_failure_criteria    n
}
```

With NSClient as a master service on which the other services are dependent, Nagios does not trouble the admins with messages from these other services, as long as NSClient is in a CRITICAL or UNKNOWN state.

CPU load

How heavy the load is on the processor is revealed by the command CPULOAD:

```
check_nt -H address -v CPULOAD -l interval,warning limit,critical_limit
```

It expects a triplet of parameters, separated by commas, consisting of the length of the time interval that is to be averaged, in minutes, and the two thresholds for the warning and critical limits in percent. So CPULOAD, with 5,80,90, forms the average over five minutes and issues a warning if the value determined exceeds 80 percent. If there is over 90% CPU load, the command returns CRITICAL:

```
nagios@linux:nagios/libexec$ ./check_nt -H winsrv -v CPULOAD -l 5,50,90
CPU Load 10% (5 min average) |   '5 min avg Load'=10%;50;90;0;100
```

The output here also contains additional performance data after the | sign, which Nagios ignores in the Web interface. If you are interested in average values over several intervals, you just add further triplet values following to the first one:

```
nagios@linux:nagios/libexec$ ./check_nt -H winsrv -v CPULOAD \
    -l 5,80,90,15,70,80
CPU Load 10% (5 min average) 10% (15 min average) |  '5 min avg Load'=10
%;80;90;0;100 '15 min avg Load'=10%;70;80;0;100
```

In this example CPULOAD checks two intervals: the past five minutes and the past 15 minutes. In the second case there are deviating limit values. The plugin always returns the more critical value; for example, it returns CRITICAL if one interval issues CRITICAL and the other just a WARNING.

The command and service definitions therefore look like this:

```
define command{
    command_name check_nt_cpuload
    command_line $USER1$/check_nt -H $HOSTADDRESS$ -v CPULOAD -l $ARG1$
}

define service{
   host_name           winsrv
   service_description CPU Load
   check_command       check_nt_cpuload!5,80,90,15,70,80
   ...
}
```

Main memory usage

When specifying the limit values, the command for monitoring the amount of main memory used—in contrast to CPULOAD—is based on the syntax of "normal" Nagios plugins:

```
check_nt -H address -v MEMUSE -w integer -c integer
```

MEMUSE returns the memory usage in percent. It should be remembered that Windows refers here to the sum of memory and swap files, that is, the entire available virtual memory. The command expects the warning and critical limits as percentages, given without a percent sign:

```
nagios@linux:nagios/libexec$ ./check_nt -H winsrv -v MEMUSE \
    -w 70 -c 90
Memory usage: total:4331.31Mb - used: 257.04Mb (6%) - free: 4074.27Mb (9
4%) | 'Memory usage'=257.04Mb;3031.91;3898.18;0.00;4331.31
```

On the example host, winsrv, only six percent of the virtual memory is used. The fact that the physical size of the main memory itself (here: 256 MBytes) is already exceeded is not shown in the output.

It does not necessarily make sense, however, to request the memory usage as in Unix: Windows regularly swaps program and data code from the main memory, even when it still has spare reserves. In Unix, programs and data land in the swap partition only if more space is required than is currently free. In this respect the load of the entire virtual memory in Windows is the more important parameter.

The command mentioned above is again packed into a command and a service object:

```
define command{
    command_name check_nt_memuse
    command_line $USER1$/check_nt -H $HOSTADDRESS$ -v MEMUSE \
        -w $ARG1$ -c $ARG2$
}

define service{
   host_name           winsrv
   service_description MEM Usage
   check_command       check_nt_memuse!70!90
   ...
}
```

Hard drive capacity

The load on a file system is tested by USEDDISKSPACE:

```
check_nt -H address -v USEDDISKSPACE -l drive letter -w integer -c integer
```

in Windows fashion, the file system is specified as drive letters, the limit values in percent:

```
nagios@linux:nagios/libexec$ ./check_nt -H winsrv -v USEDDISKSPACE\
    -l C -w 70 -c 80
```

```
C: - total: 4.00 Gb - used: 2.06 Gb (52%) - free 1.94 Gb (48%) | 'C: Use
d Space'=2.06Gb;2.80;3.20;0.00;4.00
nagios@linux:nagios/libexec$ echo $?
0
```

In the example, **check_nt** should issue a Warning if drive **C** is more than 70 percent full, and a CRITICAL if the load exceeds 80%. The current value lies at 52 percent, so **check_nt** therefore returns an OK, which you can check with **echo $?**.

The corresponding command and service objects would look something like this:

```
define command{
    command_name check_nt_disk
    command_line $USER1$/check_nt -H $HOSTADDRESS$ -v USEDDISKSPACE \
        -l $ARG1$ -w $ARG2$ -c $ARG3$
}

define service{
   host_name           winsrv
   service_description Disk_C
   check_command       check_nt_disk!C!70!80
   ...
}
```

Uptime

How long ago the last reboot was performed is revealed by the command **UPTIME**:

```
check_nt -H address -v UPTIME
```

Defining a warning or critical limit is not possible, which is why such a query is only for information purposes (the plugin returns either OK, or UNKNOWN if it is used wrongly):

```
nagios@linux:nagios/libexec$ ./check_nt -H winsrv -v UPTIME
System Uptime - 17 day(s) 9 hour(s) 54 minute(s)
```

so the host **winsrv** has already been running for 17 days. The definition of the corresponding command and service objects is trivial:

```
define command{
    command_name check_nt_uptime
    command_line $USER1$/check_nt -H $HOSTADDRESS$ -v UPTIME
}
```

```
define service{
   host_name           winsrv
   service_description UPTIME
   check_command       check_nt_uptime
   ...
}
```

Status of services

The current status of Windows services can be checked with SERVICESTATE:

```
check_nt -H address -v SERVICESTATE -d SHOWALL -l service1,service2,...
```

The optional -d SHOWALL ensures that the output text lists all services. If you leave this option out, the plugin provides information only on those services that are *not* running.

To find the name of the service description to be specified for NSClient after the -l option is quite a challenge. It is not the *display name* which is displayed by the services management (e.g., Routing and RAS), that is being sought, but the registry entry that corresponds to this. Accordingly you search with the Registry editor regedit in the partial tree HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services for the node with the corresponding display name. It contains the service description being sought, which in the case of Routing and RAS is something like RemoteAccess.

If you use NC_Net, you have an easier task: the software accepts both the service description and the display name, in which no distinction is made between upper and lower case. The following two examples use the display name:

```
nagios@linux:nagios/libexec$ ./check_nt -H winsrv -v SERVICESTATE \
   -l "Routing and RAS"
Routing and RAS: Stopped

nagios@linux:nagios/libexec$ ./check_nt -H winsrv -v SERVICESTATE \
   -l "VNC Server"
All services are running
```

The service *Routing and RAS* is currently not running, and check_nt returns the return value 2 (CRITICAL). The fact that the VNC server is performing its services correctly is only revealed indirectly without -d SHOWALL, on the other hand. The plugin here returns 0 (OK) as the return value. Several services can be included in a single command, separated by a comma. The corresponding return value is dictated by the “worst case.”

The matching command and service objects look something like this:

```
define command{
    command_name check_nt_service
    command_line $USER1$/check_nt -H $HOSTADDRESS$ -v SERVICESTATE \
        -l $ARG1$
}

define service{
   host_name           winsrv
   service_description Routing and RAS
   check_command       check_nt_service!"Routing and RAS"
   ...
}
```

Status of processes

As with the services, PROCSTATE monitors running processes:

```
check_nt -H address -v PROCSTATE -d SHOWALL -l process1,process2,...
```

The process name, which almost always ends in .exe, is best determined in the process list of the task manager; upper and lower case are also ignored here:

```
nagios@linux:nagios/libexec$ ./check_nt -H winsrv -v PROCSTATE \
WinVNC.exe,winlogon.exe,notexist.exe
 notexist.exe: not running
```

As with the services, you can also specify a list of several processes, separated by commas. Without -d SHOWALL, PROCSTATE shows only those processes that are not running, in this example, notexist.exe.

The corresponding command and service definitions look like this:

```
define command{
    command_name check_nt_process
    command_line $USER1$/check_nt -H $HOSTADDRESS$ -v PROCSTATE \
        -d SHOWALL -l $ARG1$
}

define service{
   host_name           winsrv
   service_description WinVNC
   check_command       check_nt_process!winvnc.exe
   ...
}
```

Age of files

It is worth monitoring the time since the last modification of critical files with **FILEAGE**, particularly for log files and other files that change regularly:

```
check_nt -H address -v FILEAGE -l path -w integer -c
integer
```

The command needs the filename together with its complete path, and backslashes must be doubled, as in C:\\xyz.log. The units for threshold values are minutes, and if they are exceeded, FILEAGE will issue a WARNING or CRITICAL. The time since the last modification is given by the command, by default, in epoch seconds (seconds since January 1, 1970):

```
nagios@linux:nagios/libexec$  ./check_nt -H winsrv -v FILEAGE \
    -l "C:\\test.log" -w 1 -c 20
1113158517

nagios@linux:nagios/libexec$ echo $?
1
```

The status can again be checked with echo $?. Here as well, the command and service definitions do not hold any secrets:

```
define command{
    command_name check_nt_fileage
    command_line $USER1$/check_nt -H $HOSTADDRESS$ -v FILEAGE \
        -l $ARG1$ -w $ARG2$ -c $ARG3$
}

define service{
   host_name           winsrv
   service_description Log file
   check_command       check_nt_fileage!C:       xyz.log!60!1440
   ...
}
```

18.1.4 Advanced functions of NC_Net

NC_Net's range of functions is expanding constantly; this chapter describes the possibilities that go beyond NSClient for version 2.21. Many of them, especially the ENUM* functions, are only suitable for direct use in Nagios in exceptional cases. But they are very useful if you need to find out the precise name of a service, a process, or a *Windows Performance Counter*.

The extensions require an up-to-date check_nt plugin, whose source code consists of a single file, check_nt.c. It is copied to the hard drive during the installation of NC_Net, but it can also be downloaded separately from http://www.shatterit.com/nc_net.

The source can currently be compiled without problems only in combination with the entire Nagios plugin package (see Section 1.2, page 30). To do this, you overwrite the existing file check_nt.c in the subdirectory plugins with the extended version. The old check_nt binary must be deleted; then you run make check_nt to recompile the source file. Afterwards you copy the binary to the libexec directory of Nagios, along with the other plugins:

```
linux:~ # cp check_nt.c /usr/local/src/nagios-plugins-1.4/plugins
linux:~ # cd /usr/local/src/nagios-plugins-1.4/plugins
linux:nagios-plugins-1.4/plugins # rm check_nt
linux:nagios-plugins-1.4/plugins # make check_nt
linux:nagios-plugins-1.4/plugins # cp check_nt /usr/local/nagios/libexec/.
```

Windows Performance Counter

Through so-called Performance Counters, Windows provides values for everything in the system that can be expressed in numbers: hard drive usage, CPU usage, number of logins, number of terminal server sessions, the load on the network interface, and many more things.

```
check_nt -H address -v ENUMCOUNTER -l category1,category2
```

If you omit the -l parameter, ENUMCOUNTER will display a list of all performance counter categories:

```
nagios@linux:nagios/libexec$ ./check_nt -H winsrv -v ENUMCOUNTER
... Processor; ...  Terminal services;  .NET CLR loading procedure;  tot
al RAS services;  Process; ...
```

Otherwise, it shows all counters in the category specified with -l. Several categories are separated with commas. The Terminal services category contains three counter objects in all:

```
nagios@linux:nagios/libexec$  ./check_nt -H winsrv -v ENUMCOUNTER \
    -l Terminal services
Terminal Services: Total Sessions; Active Sessions; Inactive Sessions


nagios@linux:nagios/libexec$ ./check_nt -H winsrv -v ENUMCOUNTER \
    -l "Terminal Services","Process"
Terminal Services: Total Sessions; Active Sessions; Inactive Sessions -
Process: % Processor Time; % User Time; % Privileged Time; Virtual Bytes
Peak; Virtual Bytes; Page Faults/sec; Working Set Peak; Working Set; ...
```

The precise object name is important for later use, in which the % sign (as, for example, in % Processor Time) is part of the name. If the counter or category name contains spaces, you must remember to place it within quotation marks when formulating the the request.

The description stored in the Windows Performance Counter objects are shown, by the way, with the command ENUMCOUNTERDESC.

Several counter categories contain instances, which you must specify when querying a counter object. For this reason you should always check first, using the INSTANCES function, whether the category you want works with instances:

```
check_nt -H address -v INSTANCES -l category1,category2
```

For the terminal services, this is not the case:

```
nagios@linux:nagios/libexec$ ./check_nt -H winsrv -v INSTANCES \
    -l "Terminal Services"
  Terminal Services:
```

Typical categories with instances are Processor or Process:

```
nagios@linux:nagios/libexec$ ./check_nt -H winsrv -v INSTANCES \
    -l "Process"
  Process: svchost#6,svchost,Idle,explorer,services,...
```

Here it becomes apparent what is meant by instances: Windows views every running process as an instance in the Process Performance Counter category. As can be seen on page 364, the counter object (% Processor Time), which contains the percentage use of processor time), is in this category. It can be queried only for individual instances, such as for the explorer process, or for all processes together—then you specify _Total instead of an instance.

In order to access a Windows Performance Counter, therefore, you always need to give the following details:

```
\category\counter object
\category(instance)\counter object
```

The instance is specified only if the category has instances available. There must be no space between the category name and the first bracket. The corresponding query command is called COUNTER; the placeholder *name* is replaced by the combination just described:

```
check_nt -H address -v COUNTER -l name,format description -w integer -c integer
```

This function asks after the Windows Performance Counter object that is specified after the -l option with its exact name. The warning and critical limits given as integer values refer to the size measured: if an object is involved that has a percentage figure (e.g., the processor load), just imagine a percent sign added to it; the numbers of processes, sessions, etc., are just values that are not specified in units.

The number of active sessions is checked with the Active Sessions object, for which there are no instances:

```
nagios@linux:nagios/libexec$ ./check_nt -H winsrv -v COUNTER \
    -l "\Terminal Services\Active Sessions"
1
nagios@linux:nagios/libexec$ ./check_nt -H winsrv -v COUNTER \
    -l "\Process(Idle)\% Processor Time"
98
```

Because the Idle instance always looks at the difference between used and spare processor load, so that the sum of the two is always 100 percent, querying the _Total pseudo-instance in the second example does not make much sense.

Normally COUNTER does not format its output. This can be changed by following the object name with a description in the printf format,[5] separated from it with a comma:

```
nagios@linux:nagios/libexec$ ./check_nt -H winsrv -v COUNTER \
    -l "\Process(Idle)\% Processor Time","Idle Process: %.2f %%"
Idle Process Usage is: 54.00 % | 'Idle Process Usage is: %.2f %%'=54.000
000%;0.000000;0.000000;
```

Not only does this cause the output to be clearer, it also returns additional performance data.

The Nagios command and the corresponding service definition then look like this:

```
define command{
    command_name check_nt_counter
    command_line $USER1$/check_nt -H $HOSTADDRESS$ -v COUNTER \
        -l$ARGV1
}

define service{
  host_name           winsrv
  service_description Idle Time
  check_command check_nt_counter!"\Process(Idle)\% Processor Time","Idle \
 3     Process: %.2f %%"
   ...
}
```

[5] man 3 printf

The two functions COUNTER and INSTANCES also belong to the NSClient range of functions, but they are extremely difficult to handle there. If you want to use them, you are well advised to switch to NC_Net.

Listing processes and services

To find out the names of processes, you can work your way through the Task Manager—or have a list of all running processes displayed with ENUMPROCESS:

```
nagios@linux:nagios/libexec$ ./check_nt -H winsrv -v ENUMPROCESS
System Idle Process;  System;  smss.exe;  csrss.exe;  winlogon.exe;
services.exe;  lsass.exe;  svchost.exe;  svchost.exe;  svchost.exe;
...
```

The equivalent command for listing all installed services is ENUMSERVICE:

```
check_nt -H host -v ENUMSERVICE -l typ,short
```

The optional -l restricts the output to specific categories (see Table 18.1):

```
nagios@linux:nagios/libexec$ ./check_nt -H winsrv -v ENUMSERVICE
    \ -l manual,short
ALG;  AppMgmt;  BITS;  COMSysApp;  dmadmin;  EventSystem;  HTTPFilter;
LPDSVC;  MSIServer;  Netman;  Nla;  NtFrs;  NtLmSsp;  NtmsSvc;  RasAuto;
...
```

With the short option, ENUMSERVICE displays the service names as they are entered in the registry; if you leave out the keyword, it shows the display names.

Table 18.1: Limiting options for ENUMSERVICE

Type	Description
all	all services
running	all currently active services
stopped	all services which have been stopped
automatic	services starting automatically
manual	services which must be started manually
disabled	disabled services

Querying the Windows event log

With the **EVENTLOG** command, the Windows Event Log can be queried:

```
check_nt -H address -v EVENTLOG -w integer -c integer
    -l eventlog,event type,interval,source filter,description filter,
    id-filter
```

Using it does take some getting used to, however:[6] the first three parameters to follow **-l** select the events to be taken into account by type and by time. The placeholder ***eventlog*** is replaced with one of the three log areas **application**, **security**, or **system** that you want to look at. If **EVENTLOG** is to include all three, you just specify **any**; but you cannot choose only two of the three areas.

For the ***event type*** you can choose from **error**, **Warning**, **Information**, or **any** for all three.

In place of ***interval*** you specify a time interval in minutes: **5** limits the selection to events which occurred in the last five minutes, for example; **1440** stands for a whole day.

The last three parameters in effect work as filters with which specific results can be determined from the preselection that all originate from a particular source (the ***source filter*** placeholder), that contain a specific pattern in their descriptions (***description filter***), or that have a specific event ID (***id-filter***).

Each of these filters consists of two parts: in the first an integer reveals how many search patterns are to follow (formulated as regular expressions in accordance with the .NET-**Regexp** class), and then the actual filter entries are specified, separated by commas. If one of the filters is not used, its placeholder is replaced with a **0**, which searches for exactly zero search patterns. A source filter which only looks for **NC_Net** events would be called **1,NC_Net**; if you want to search for **NC_Net** and **Perflib** events, it would be called **2,NC_Net,Perflib**.

-l any,any,5,0,0,0 evaluates all entries from all event ranges from the last five minutes. **-l application,error,1440,0,0,0** determines all events of the type **error**, which occurred in the event range **application** within the last 24 hours. With **-l application,error,60,1,NC_Net,0,0**, the time window is set to 60 minutes and filters the event source using the string **NC_Net**. Finally **-l application,any,60,0,2,start, stop,0** searches the event description for two keywords: **start** and **stop**.

With the warning and critical limits you can specify how many matching entries are needed before the plugin returns a WARNING or CRITICAL value. If you leave out these two parameters, Nagios shows OK as long as *no* events occurred; otherwise, it shows CRITICAL.

[6] According to his own comments, author Tony Montibello wanted to change the syntax for defining services in version 2.25. But up to and including version 2.28, this resolution has not yet been implemented.

The following example asks how many messages there were within the last 24 hours in the **applications** area:

```
nagios@linux:nagios/libexec$ ./check_nt -H winsrv -v EVENTLOG \
    -l "Application,any,1440,0,0,0"
9 Errors with ID: 13001;2003;1010;6013;1111;262194;26;262194;26 LAST -
ID 262194;Not all data for the file "\Device\LanmanRedirector" were
    saved.  Possible causes are computer hardware or the network
    connection. Please specify a different file path.
```

The error message displayed here **LAST - IDD 262194;Not all data...** belongs to the last entry found.

A command definition that omits details of warning and critical limits could look like this:

```
define command{
    command_name check_nt_eventlog
    command_line $USER1$/check_nt -H $HOSTADDRESS$ -v EVENTLOG \
        -l $ARG1$
}
```

On this basis a service could be defined that, for example, searches for errors in all classes in the **System** area which occurred in the past five minutes. (When specifying the time period you should generally ensure that it correlates with the time period in **normal_check_interval**.) The service examines the descriptions of the entries found for the text **data loss**. The source and ID filters are not used here:

```
define service{
   host_name            winsrv
   service_description Eventlog data loss
   check_command        check_nt_eventlog!System,any,5,0,1,data loss,0
   is_volatile            1
   normal_check_interval 5
   max_check_attempts    1
   ...
}
```

Log files have the characteristic of pointing out a problem only once under certain circumstances, even if the problem continues. You must therefore ensure that Nagios immediately makes a notification the first time the event occurs, and leaves out repeated tests and soft states. This can be achieved with **max_check_attempts 1**: this immediately sets off a hard state, and notification is given right away.

But if the hard state remains, this would mean in practice that new errors might occur in the meantime (the next test after five minutes no longer records the old states), while the state has not changed; the admin would only be informed again after the **notification_interval** has expired. For such cases, Nagios has available the **is_volatile** parameter (see Section 14.5.2, page 257), with which the system provides notification on every single error.

Displaying and manipulating the NC_Net configuration

The **ENUMCONFIG** function displays the current settings of NC_Net in a readable form:

```
nagios@linux:nagios/libexec$ ./check_nt -H winsrv -v ENUMCONFIG
Date: 16.04.2005 18:15:10;
Version: NC_Net 2.21 03/13/05;
NC_Net Config Path: c:\Programs\shatter it\nc_net\config\;
Startup Config: c:\Programs\shatter it\nc_net\config\startup.cfg;
Debug Log: c:\Programs\shatter it\nc_net\config\deb.log;
...
Port: 1248;
Pass: None;
...
```

Date shows the current query date, **Version** the NC_Net version used. **NC_Net Config Path** describes the path to the configuration directory, **Startup Config** the configuration file used. **Debug Log** specifies the log file containing the debugging output, but only if the **MYDEBUG true** parameter is set in the configuration file. **Port** reveals the port on which NC_Net is listening, and **Pass** shows whether a password has been used for the connection (**None**: no password).

There is also the command **CONFIG** to manipulate the configuration of the NC_Net installation over the network. For reasons of security you should use this for test purposes only, and otherwise keep the function switched off. Accordingly you should keep the following default set in the configuration file**startup.cfg**:

```
lock_passive_config true
lock_active_config true
```

This means that the configuration cannot be changed from the outside.

Other functions

NC_Net's range of functions is growing all the time, and to describe all the functions in detail would need a separate book. We'll just mention a few quite useful commands:

FREEDISKSPACE
: The equivalent of **USEDDISKSPACE** (page 359) expects the free hard drive capacity (instead of the used space) in percent for warning and critical limits

WMIQUERY

This function enables the SQL-capable WMI[7] database to be queried, which contains the .NET configuration data.

WMICOUNTER

Objects comparable to the Windows performance counters also exist in the WMI area (only .NET); they can be queried with this.

Passive Checks

From version 2.0, NC_Net also supports passive checks based on the NSCA mechanism (see Chapter 14, page 247). A short documentation can be found in the included passive.cfg file.

More information can be found in the file readme.html, included in the installation, but it can also be viewed directly at http://www.shatterit.com/nc_net/files/readme.html.

18.2 NRPE for Windows: NRPE_NT

With NRPE_NT there is a version of the Nagios Remote Plugin Executor, introduced in Chapter 10, ported for Windows. Its task is to execute plugins on the target system if a particular test is only possible locally and no suitable network protocol exists to query the resource concerned. As with the Unix version, the desired plugins must be installed locally on the target system, apart from the daemon (in this case: NRPE_NT) and the tests must be entered in a local configuration file.

NRPE_NT is based on NRPE version 2.0. This means that the same check_nrpe plugin can be used for querying as the one for the Unix NRPE.

On the Internet a series of plugins executable in Windows can be found which work together with NRPE_NT. The first place to look is again The Nagios Exchange, which has a separate subcategory.[8] On the one hand these programs are based on the same source code as their Unix equivalents, and were just compiled for Windows. The ported programs also include some Perl scripts, which require an installed version of Perl—in most cases the script language will first have to be installed.

NRPE_NT can also be used for other purposes: once installed on the Windows server, you can use the mechanism to run other scripts remotely, apart from Nagios plugins. If you want Nagios to restart a service remotely through the Eventhandler, this can be done just as easily with NRPE_NT.[9]

[7] Short for *Windows Management Instrumentation*.

[8] http://www.nagiosexchange.org/NRPE_Plugins.66.0.html

[9] To execute scripts remotely on a Windows server, you can also use the Windows version of the Secure Shell, a topic that is too large to go into in this book.

18.2.1 Installation and configuration

The current zip archive from The Nagios Exchange or http://www.miwi-dv.com/nrpent is unpacked to a suitable directory, such as D:\Programs\Nagios\nrpe_nt:

```
D:\Programs\Nagios\nrpe_nt> unzip  nrpe_nt.0.8-bin.zip
```

It contains a subdirectory bin, in which are found the daemon NRPE_NT.exe, two DLLs for using SSL (libeay32.dll and ssleay32.dll), an example of a simple plugin script (test.cmd), and the configuration file nrpe.cfg.

The service is installed from this directory with the command nrpe_nt -i, after which it just needs to be started, either in the Windows services manager or from the command line:

```
D:\Programs\Nagios\nrpe_nt\bin> nrpe_nt -i
D:\Programs\Nagios\nrpe_nt\bin> net start nrpe_nt
```

The configuration file nrpe.cfg is only slightly different from the Unix version of NRPE 2.0 (see Section 10.3, page 170): only the directive include_dir does not function in NRPE_NT.

The file in Windows also has the classical Unix text format, so either you require a suitable editor (notepad.exe is not sufficient) or you must edit it in Linux and copy it afterwards to the test system.

Since there is no inet daemon in Windows, you must specify the port (standard: server_port=5666) and the hosts from which NRPE should be addressed (you should only enter the Nagios server here; for example: allowed_hosts=172.17.129.2)[10] in nrpe.cfg. The parameters nrpe_user and nrpe_group have no meaning in Windows, and the other parameters correspond to those discussed in Section 10.3.

In the definition of executable commands (here for the included test plugin) you must remember the Windows-typical syntax with hard drive letters and backslashes:

```
command[check_cmd]=D:\Programs\nagios\nrpe_nt\plugins\test.cmd
```

In this example the plugins are in a separate subdirectory called plugins. After changes to the configuration file you should always restart NRPE_NT:

```
D:\Programs\Nagios\nrpe_nt\bin> net stop nrpe_nt
D:\Programs\Nagios\nrpe_nt\bin> net start nrpe_nt
```

[10] This security measure, however, is restricted to a simple comparison of IP addresses.

18.2.2 Function test

Before putting NRPE_NT into service, you should check whether it is functioning correctly. To do this, run the plugin **check_nt** on the Nagios server as the user **nagios**, with just one host specification and no other parameters:

```
nagios@linux:nagios/libexec$ ./check_nrpe -H winsrv
NRPE_NT v0.8/2.0
```

If the service has been correctly installed and configured, it will reply with a version number. Another simple test is performed by the included **test.cmd** plugin. It provides a short text and ends with the return value **1**:

```
@echo off
echo hallo from cmd
exit 1
```

The command to be executed (defined in the previous section) is passed to the plugin **check_nt** with the **-c** option:

```
nagios@linux:nagios/libexec$ ./check_nrpe -H winsrv -c check_cmd
hallo from cmd
nagios@linux:nagios/libexec$ echo $?
1
```

The return value, determined with **echo $?**, must be **1** in this case, since the script exits with an **exit 1**.

18.2.3 The Cygwin plugins

In the **Check Plugins** → **Windows**[11] category, Nagios Exchange includes the **CygwinPlugins** package for downloading. It consists of Nagios standard plugins, which have been compiled for Windows with the help of the Cygwin Tools.[12] Apart from the executable plugins (***.exe**) the package also contains all the necessary DLLs. It is therefore sufficient to unpack the zip archive into a directory:

```
D:\Tmp> unzip CygwinPlugins1-3-1.zip
D:\Tmp> dir NagPlug
check_dummy.exe   check_ssh.exe   check_udp.exe        cygwin1.dll
check_http.exe    check_tcp.exe   cygcrypto-0.9.7.dll  negate.exe
check_smtp.exe    check_time.exe  cygssl-0.9.7.dll     urlize.exe
```

[11] http://www.nagiosexchange.org/Windows.49.0.html.

[12] These are ported versions of a large number of GNU tools, including compilers, libraries, and shells. Thanks to their open license (a GPL derivative) they have become an unofficial standard for those who wish to port Open Source programs from the Unix world to Windows.

For the sake of simplicity, just copy the contents of the directory that is created, NagPlug, to the plugin directory of NRPE_NT:

```
D:\Tmp\NagPlug> copy * D:\Programs\Nagios\nrpe_nt\plugins
```

The plugin functions in the same way as in Linux. Table 18.2 refers to the corresponding sections in this book.

Table 18.2: Cygwin Plugins for NRPE_NT

Plugin	Page	Description
check_dummy.exe	154	Test plugin
check_http.exe	98	Reachability of a Web site
check_smtp.exe	92	Testing a mail server
check_ssh.exe	108	SSH availability
check_tcp.exe	110	Generic plugin
check_time.exe	146	Clock time comparison of two hosts
check_udp.exe	112	Generic plugin
negate.exe	155	Negates the return value of a plugin
urlize.exe	156	creates a link to the plugin output in the Nagios Web interface

As in Unix, each of the corresponding command definitions in the configuration file nrpe.cfg must be written on a single line:

```
command[check_web]=D:\Programs\nagios\nrpe_nt\plugins\check_http \
-H www.swobspace.de
command[check_identd]=D:\Programs\nagios\nrpe_nt\plugins\check_tcp \
-H linux01 -p 113
```

The first line checks whether a Web server is running on the HTTP standard port 80 of the host www.swobspace.de. The second line tests whether an identd daemon (TCP port 113) is active on the host linux01.

18.2.4 Perl plugins in Windows

Unfortunately the Cygwin plugins do not contain a check_ping or check_icmp. You can use the Perl script check_ping.pl instead, which is available for download on The Nagios Exchange in the Networking category.[13] It uses the Perl module Net::Ping for the network connection. In contrast to check_tcp, check_ping.pl

[13] http://www.nagiosexchange.org/Networking.53.0.html

sends several packets, so it can make a more precise assessment of response times and packet losses.

An up-to-date and simple to install Perl for Windows can be obtained from ActiveState[14]. To download the *Active Perl Free Distribution*, no registration is required, even if the download procedure would suggest otherwise. Of the versions offered, you should use the latest Perl version (currently 5.8.7), and only fall back on the older version 5.6.1 if this should cause problems.

The plugin script itself contains a BEGIN statement, which you must comment out for use in Windows:

```
# BEGIN{
#       push @INC, "/usr/lib/perl5/site_perl/...
# }
```

It sends a TCP echo request to port 7, alternatively you can also explicitly set a different port by adding the following line after the Net::Ping->new statement:

```
$p->port = 80;
```

This would cause a TCP ping to port 80 (HTTP). So that NRPE_NT can execute the script, you must explicitly start the Perl executable:

```
command[check_ping_eli02]=C:\Perl\bin\perl.exe \
    D:\Programs\nagios\nrpe_nt\plugins\check_ping.pl \
    --host 172.17.129.2 --loss 10,20 --rta 50,250
```

The command has been line-wrapped for the printed version, but in the configuration file the whole command must be written on a single line. With the --host parameter you specify a host name which can be resolved or an IP address, --loss is followed by a pair of values for the warning and critical limits for packet loss in percent, separated by a comma, (so values between 0 and 100 are possible here). The --rta option also demands a threshold value pair as an argument, for the average response time in milliseconds. Since this is a Perl script, it does not matter if these are specified as integers or floating comma decimals.

[14] http://www.activestate.com/store/languages/register.plex?id=ActivePerl

Chapter 19

Monitoring Room Temperature and Humidity

There are a number of sensors for monitoring room temperature and humidity. Most of them are integrated into the network as independent network devices, and are normally addressed via SNMP. But you have to spend at least three hundred dollars on your first sensor. Searching for a cheaper and modular system, the author finally came across http://www.pcmeasure.com/; it has met all his requirements until now. The fact that this chapter is restricted to this sensor is not meant to detract from other systems, but is down to the fact that this topic alone would be enough for a separate book.

19.1 Sensors and Software

A complete monitoring system for physical data normally consists of three components: a sensor (for temperature or humidity, for example), an adapter to connect to the serial or parallel port of a PC, and software to query the sensor.[1]

There are adapters for the PCMeasure system in variations from one to four sensors, which can be operated simultaneously. For the power supply the adapters need an available USB interface; alternatively a separate "USB power supply" is available. Instead of the adapter solution, there is also an optionally available Ethernet box with four sensor connections, which is somewhat more expensive, that can be expanded to accept 12 sensors.

The measurement querying software PCMeasure is available for both Linux and Windows.[2] Some features are exclusive to the Windows version, which is why it is slightly more expensive. For use with Nagios, the Linux version is totally sufficient, since only the measurement values are transmitted over a simple network protocol.

The sensors themselves are interesting: as well as those for temperature and humidity (as well as combinations of the two) there is also a contact sensor, a smoke and water alarm, a movement detector, and voltage detectors. These are normally connected with a twisted-pair cable (RJ45 connector); according to the FAQ,[3] they can be used up to 100 meters from the adapter or Ethernet box, provided you have good cables, that is, throughout a building.

19.1.1 The PCMeasure software for Linux

The tar archive pcmeasure.tar.gz with the Linux software is unpacked in its own directory, such as /usr/local/pcmeasure. The configuration file pcmeasure4linux.cfg is also installed here. The port entries in this file need to be adjusted so that only those ports are listed to which a sensor is actually connected:

```
[ports]
com1.1=01
```

com1 stands for the first serial port; if you are using the first parallel port instead, the entry before the period is lpt1. The digit following the port refers to the adapter slot used by the sensor, so depending on how many adapters you have, this is a number from 1 to 4. The = sign is followed by the sensor type: 01 stands for a

[1] The PCMeasure Web site showed the following prices as of March 2006: simple temperature sensor 30101, $ 27; serial single-port adapter 30201 $ 39; Linux software, $ 29 (Windows: $ 39).

[2] The access data for the download comes with the invoice.

[3] http://www.pcmeasure.com/faq.php

temperature sensor, 03 for a humidity sensor. An additional humidity sensor on the second slot of the same adapter would then be addressed as com1.2=03.

The query program **pcmeasure** requires the configuration file to be specified as an argument:

```
linux:local/pcmeasure # ./pcmeasure ./pcmeasure4linux.cfg
```

It runs as a daemon in the background and only ends if it is terminated with **kill**. In principle, any user can start it who has read permissions for the corresponding interface.

19.1.2 The query protocol

The software opens TCP port 4000 by default and accepts requests from the network. The protocol used is quite simple: you send a text in the format

```
pcmeasure.interface.slot<CR><LF>
```

(that is, with a DOS line ending) and you receive a response in the format

```
port;valid=validity;value=value;...
```

The *validity* placeholder is replaced by a 1 for a valid value or 0 for an invalid one. The port specification complies with the internal numbering system: lpt1.1 corresponds to port1, com1.1 to port13. Whether everything functions correctly or not can be tested with **telnet**:

```
user@linux:~$ telnet localhost 4000
Trying 127.0.0.1...
Connected to localhost.
Escape character is '^]'.
pcmeasure.com1.1
port13;valid=1;value=22.59;counter0=10627;counter1=14373;
Connection closed by foreign host.
```

The current temperature in this example is 22.59 °C, and the value is valid.

19.2 The Nagios Plugin check_pcmeasure

The plugin **check_pcmeasure.pl**[4] enables a single sensor to be queried over the network. It enters the values received into a round-robin database in the following form:

[4] http://linux.swobspace.net/projects/nagios.

```
timestamp:value
```

A script called **create-rrd.sh** to create this database and a CGI script to display the graphics generated (**temp.cgi**) can also be found at the link specified.

To be able to work with a round-robin database (see page 317) you require the RRDtools,[5]) which contain the Perl module **RRDs** used by the plugin. If you do not use this, you should comment out the line

```
use RRDs;
```

in the Perl code of the plugin by placing a # at the beginning of the line. The plugin has the following options:

-H *address* | --host=*address*
: This is the host name or IP address of the measuring computer on which the software is running and to which the sensors are connected.

-S *sensor port* | --sensor=*sensor port*
: This switch defines the sensor port, such as **com1.1** or **lpt1.2** (see above).

-p *port* | --port=*port*
: This sets alternative port specifications for the TCP port of the software. The default is port 4000.

-w *floating_point_decimal* | --warn-min=*floating_point_decimal*
: If the measured value falls below the given threshold value, **check_pcmeasure** sets off a warning.

-W *floating_point_decimal* | --warn-max=*floating_point_decimal*
: If the measured value lies above this warning limit, the plugin gives a warning. Upper and lower thresholds can be combined.

-c *floating_point_decimal* | --crit-min=*floating_point_decimal*
: The plugin issues CRITICAL if the value drops below this limit.

-C *floating_point_decimal* | --crit-max=*floating point decimal*
: The plugin issues CRITICAL if the value goes above this threshold. It can be combined with **-c**.

-R *file* | --rrd-database=*file*
: This option specifies the round-robin database. If this option is missing, the RRD Perl module can be commented out.

[5] http://www.rrdtool.org/

-V / --version

This is the output of the plugin version and a short help. The plugin does not query any sensor in doing this.

In the following example the plugin asks for the temperature of the sensor connected to the host with the IP address 172.17.193.6:

```
nagios@linux:nagios/libexec$ ./check_pcmeasure.pl -H 172.17.193.6 \
    -S com1.1 -W 22.0 -C 25.0
WARNING: Value com1.1: /22.6/ > 22.0
```

Since the measured value lies above the warning limit of 22 °C, but below the critical limit of 25 °C, there is a WARNING.

The corresponding Nagios command can be specified with or without a round-robin database:

```
define command{
    command_name  check_temp_max
    command_line  $USER1$/check_pcmeasure.pl -H $HOSTADDRESS$ \
                  -S $ARG1$ -W $ARG2$ -C $ARG3$
}
define command{
    command_name  check_temp_max_rrd
    command_line  $USER1$/check_pcmeasure.pl -H $HOSTADDRESS$ \
                  -S $ARG1$ -W $ARG2$ -C $ARG3$ -R $ARG4$
}
```

If it is without, you only need the maximum and critical warning limits, apart from the sensor details. In the second variation the RRD file predefined in $ARG4$ additionally saves the measured data. The file must be created beforehand and must be writable for the user nagios.

The following service uses the file /var/lib/rrd/temperatur-serverraum1.rrd for this purpose:

```
define service{
    host_name             linux01
    service_description   Room temperature
    max_check_attempts    1
    normal_check_interval 2
   check_command  check_temp_max_rrd!com1.1!23.0!27.0!\
      /var/lib/rrd/temperatur-serverraum1.rrd
   ...
}
```

With max_check_attempts set to 1, Nagios does *not* repeat the query in case of an error at intervals of retry_check_interval. Instead the temperature is measured constantly every two minutes.

Since room temperatures normally change very slowly, you could use a normal_check_interval of five minutes. If you choose larger measuring intervals you can set max_check_attempts to more than 1 and repeat the measurement at shorter intervals in case of errors (e.g., retry_check_interval 1).

Chapter 20

Monitoring SAP Systems

There are several ways of monitoring an SAP system. The simplest is just to check the ports on which the corresponding SAP services are running. Normally these are TCP ports 3200/3300 for system number 00, 3201/3301 for system number 01 etc. This can be done with the generic plugin described in Section 6.7.1, page 110. But it is possible that no user is able to log in, even though the port is reachable, because SAP-internal services fail, making it impossible to work with the system.

To really test the complex interaction of various SAP components, you require a program that communicates on an application layer with the SAP system. There are two alternatives here: the more simple one uses the program sapinfo, which queries the available information without a direct login—like the SAP-GUI at the start. With somewhat more effort you can communicate with the SAP system over an SAP standard interface. This is no use, however, unless you have an SAP login with corresponding permissions. With the *Computing Center Management System* (CCMS), SAP provides its own internal monitoring system, which can also be queried with the RFC[1] interface, and which can be put to excellent use in Nagios, with the right plugins.

20.1 Checking without a Login: sapinfo

The program **sapinfo** is part of an optional software package for the development of client-side RFC interfaces. The Linux version which you require, RFC_OPT_46C.SAR, can be obtained either at ftp://ftp.sap.com/pub/linuxlab/contrib/ or you can log in to the *SAP Service Marketplace* at http://service.sap.com/ (a password is required for this) and use the search help there to look for the keyword "RFC-SDK".

20.1.1 Installation

SAP has its own archiving format in which the precompiled software is stored. To unpack programs you require the program SAPCAR, which can also be obtained through the FTP link mentioned or through the SAP Service Marketplace. It is operated in a way similar to tar:

```
linux:~ # mkdir /usr/local/sap
linux:~ # cd /usr/local/sap
linux:local/sap # /path/to/SAPCAR -xvf RFC_OPT_46C.SAR
SAPCAR: processing archive RFC_OPT_46C.SAR
x rfcsdk
x rfcsdk/bin
x rfcsdk/bin/sapinfo
...
```

The data contained in the archive lands in its own subdirectory, rfcsdk. If you run SAPCAR without any parameters, a short operating manual is displayed.

20.1.2 First test

The program sapinfo can be tested now without further configuration. To do this you require the so-called *connect string*; if the connection is running through an SAP gateway, this is a string such as /H/*ip_of_the_sap-gateway*/S/3297/H/*ip_of_the_sap_system*; without a gateway you simply specify an IP address or a host name that can be resolved, instead of this complex expression. In case of doubt, the administrator responsible for the SAP system will reveal the exact connect string. In addition you must specify the system number,[2] in this example, 01:

[1] *Remote Function Call.*
[2] The SAP administrator will also know this.

```
nagios@linux:~$ cd /usr/local/sap/rfcsdk/bin
nagios@linux:rfcsdk/bin$ ./sapinfo ashost=10.128.254.13 sysnr=01

SAP System Information
-----------------------------------------------

Destination             p10ap013_P10_01

Host                    p10ap013
System ID               P10
Database                P10
DB host                 P10DB012
DB system               ORACLE

SAP release             620
SAP kernel release      620

RFC Protokoll           011
Characters              1100
Integers                LIT
Floating P.             IE3
SAP machine id          560

Timezone                3600
```

The output provides various information on the SAP installation, including the SAP release (620), the SAP system ID (P10), the host on which the database is located, and the database system used, which in this case is Oracle.

With the ashost parameter you query a specific application server. For a message server, sapinfo requires the following details:

```
nagios@linux:rfcsdk/bin$ ./sapinfo r3name=P10 mshost=10.128.254.12 \
    group=ISH
```

The r3name parameter specifies the SAP system ID, mshost defines the IP address of the server, and group describes the logon group. As long as the PUBLIC group exists, you can leave this parameter out, and then the default, PUBLIC, will be used.

If the query ends with an error message such as

```
ERROR       service 'sapmsP10' unknown
```

then the definition of the sapmsP10 service is missing for the Nagios server[3] in /etc/services:

```
sapmsP10    3600/tcp
```

[3] Instead of P10, the appropriate system ID will always be shown here.

For the port you define the TCP port on which the message server is running. Which one this is depends on the particular SAP installation; the standard port is 3600.

20.1.3 The plugin check_sap.sh

The plugin check_sap.sh, a shell script based on sapinfo, is included in the standard Nagios Plugins package, but it is in the contrib directory and is not automatically installed. You can copy it manually to the plugin directory:

```
linux:~ #  cp /usr/local/src/nagios-plugins-1.4/contrib/check_sap.sh \
   /usr/local/nagios/libexec/.
```

Then you look in the plugin for the variable sapinfocmd and adjust the path for sapinfo:

```
sapinfocmd='/usr/local/sap/rfcsdk/bin/sapinfo'
```

Like sapinfo, the plugin can be run in two ways: with the argument as it queries an application server, and with ms, a message server. The second argument in each case is the connect string, and if no SAP gateway is used, then it is the IP address or the host name of the host to be queried:

```
check_sap.sh as connect_string system_number
check_sap.sh ms connect_string SID logon_group
```

The first variation demands the two-digit system number of the application server as the third parameter, the counting of which starts at 00:

```
nagios@linux:nagios/libexec$  ./check_sap.sh as 10.128.254.13 01
OK - SAP server p10ap013_P10_01 available.
```

This means that the application server running on the host 10.128.254.13 is available.

When the message server is queried, the plugin displays the application server belonging to the specified login group (given as the fourth argument). If this information is missing, it determines the application server for the PUBLIC group.

For a message server, you specify the SAP system ID (*SID*), for example, P10,[4] instead of the system number:

```
nagios@linux:nagios/libexec$  ./check_sap.sh ms 10.128.254.12 P10 ISH
OK - SAP server p10ap014_P10_02 available.
```

[4] The first instance of this has the system number 00, the second one, 01, etc.

In this example the message server running on 10.128.254.12 detects p10ap014_P10_02 as the application server for the logon group ISH and also reveals that this is reachable.

The following two command definitions assume that it is sufficient to use the IP address, and that no SAP connect string is required:

```
define command{
    command_name  check_sap_as
    command_line  $USER1$/check_sap.sh as $HOSTADDRESS$ $ARG1$
}
define command{
    command_name  check_sap_ms
    command_line  $USER1$/check_sap.sh ms $HOSTADDRESS$ $ARG1$ $ARG2$
}
```

If this is not the case, the command_line for querying an application server could look like this:

```
$USER1$/check_sap.sh as /H/sapgw/S/3297/H/$HOSTADDRESS$ $ARG1$
```

The following service definition can be used for all application servers:

```
define service{
   service_description   SAP_AS
   host_name             sap01
   check_command         check_sap_as!00
   ...
}
```

Since there is only a single message server in an SAP system, it makes more sense to define a separate service for each logon group. The following example shows this for the group ISH:

```
define service{
   service_description   SAP_MS_ISH
   host_name             sap09
   check_command         check_sap_ms!P10!ISH
   ...
}
```

In this way you can test whether a user may log in without actually logging in. If there are interruptions between the database and the application server that make it impossible to log in, sapinfo provides a corresponding error message after a time-out. The author was able to observe several times that sapinfo and check_sap.sh reported an error in such a situation, while the TCP port-only test of the application server, check_tcp, returned an OK, although no user could log in any longer. So check_sap.sh, even without a login, provides more reliable information than a port-only check.

20.2 Monitoring with SAP's Own Monitoring System (CCMS)

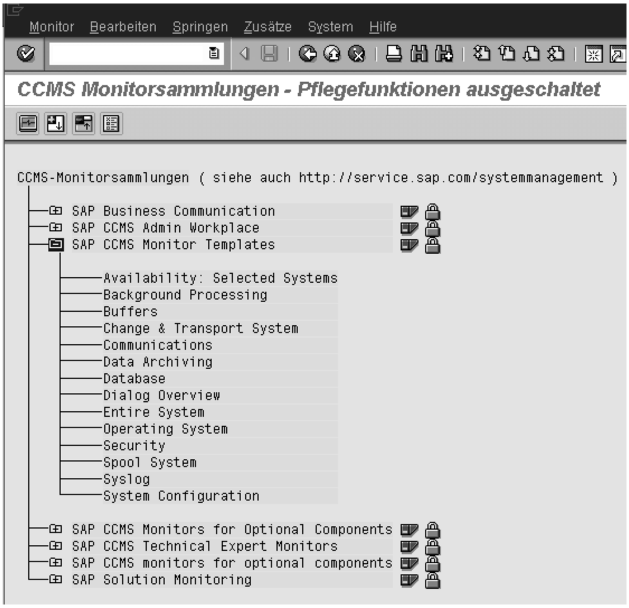
With SAP's own *Computing Center Management System* framework (CCMS), not only SAP systems, but also external applications can be monitored. Here local agents collect data from each of the hosts, which, since Release R/3 4.6C,[5] can be queried from a central component. The data examined includes not only SAP-specific features such as SAP buffers or batch jobs, but also operating system data such as memory and CPU usage, or disk IO and swapping. Even information on the database used or the average response times of applications can be queried.

The data of the CCMS can also be queried externally through RFC (*Remote Function Calls*, a standard SAP interface). Corresponding libraries for Unix and Windows platforms, with which a Linux program, for example, can query information from the CCMS over the network, are provided by SAP.

20.2.1 CCMS—a short overview

Within the SAP world you gain access to this data through the CCMS Alert Monitor (transaction RZ20) (Figure 20.1). The illustration shows so-called monitor connections that categorize various information in groups.

Figure 20.1: The SAP CCMS Alert Monitor



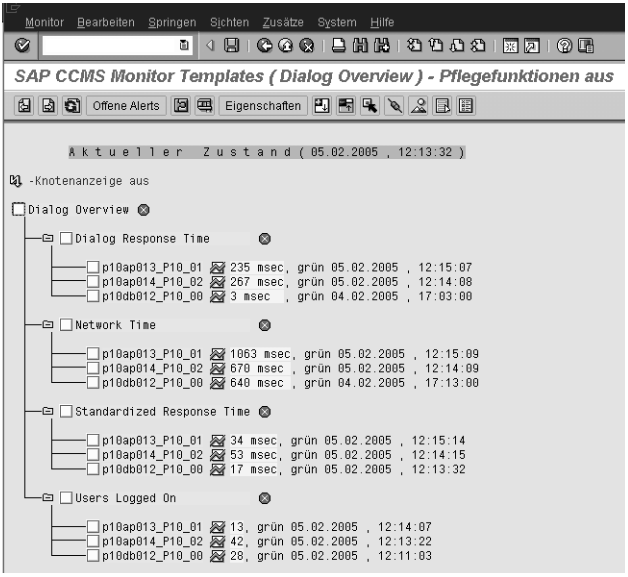
CCMS Monitorsammlungen - Pflegefunktionen ausgeschaltet

```
CCMS-Monitorsammlungen ( siehe auch http://service.sap.com/systemmanagement )
 ├─⊞ SAP Business Communication
 ├─⊞ SAP CCMS Admin Workplace
 ├─⊟ SAP CCMS Monitor Templates
 │    ├─────Availability: Selected Systems
 │    ├─────Background Processing
 │    ├─────Buffers
 │    ├─────Change & Transport System
 │    ├─────Communications
 │    ├─────Data Archiving
 │    ├─────Database
 │    ├─────Dialog Overview
 │    ├─────Entire System
 │    ├─────Operating System
 │    ├─────Security
 │    ├─────Spool System
 │    ├─────Syslog
 │    └─────System Configuration
 ├─⊞ SAP CCMS Monitors for Optional Components
 ├─⊞ SAP CCMS Technical Expert Monitors
 ├─⊞ SAP CCMS monitors for optional components
 └─⊞ SAP Solution Monitoring
```

[5] Central evaluation was not possible in earlier releases.

SAP provides several monitor collections with preconfigured values in its distribution. A trained SAP administrator can create and operate monitors at any time. We shall restrict ourselves here to the monitor collection **SAP CCMS Monitor Templates** and focus on the **Dialog Overview** monitor (Figure 20.2).

The dialog response times specified there (accessible through the ***monitor attribute*** **Dialog Response Time**) provide a measurable equivalent for performance problems corresponding to what the user feels is a "slow system." This value specifies the average processing time of a transaction (without network transmission time and without the time needed to render the information in the GUI of the client).



SAP CCMS Monitor Templates (Dialog Overview) - Pflegefunktionen aus

```
   Aktueller Zustand ( 05.02.2005 , 12:13:32 )

-Knotenanzeige aus

□Dialog Overview
 ├─□ Dialog Response Time
 │   ├──□p10ap013_P10_01  235 msec, grün 05.02.2005 , 12:15:07
 │   ├──□p10ap014_P10_02  267 msec, grün 05.02.2005 , 12:14:08
 │   └──□p10db012_P10_00  3 msec  , grün 04.02.2005 , 17:03:00
 ├─□ Network Time
 │   ├──□p10ap013_P10_01  1063 msec, grün 05.02.2005 , 12:15:09
 │   ├──□p10ap014_P10_02  670 msec , grün 05.02.2005 , 12:14:09
 │   └──□p10db012_P10_00  640 msec , grün 04.02.2005 , 17:13:00
 ├─□ Standardized Response Time
 │   ├──□p10ap013_P10_01  34 msec, grün 05.02.2005 , 12:15:14
 │   ├──□p10ap014_P10_02  53 msec, grün 05.02.2005 , 12:14:15
 │   └──□p10db012_P10_00  17 msec, grün 05.02.2005 , 12:13:32
 └─□ Users Logged On
     ├──□p10ap013_P10_01  13, grün 05.02.2005 , 12:14:07
     ├──□p10ap014_P10_02  42, grün 05.02.2005 , 12:13:22
     └──□p10db012_P10_00  28, grün 05.02.2005 , 12:11:03
```

Figure 20.2: The SAP CCMS monitor Dialog Overview

The monitor attribute **Network Time** reveals how much time the system needs to send data during a dialog stage from the client (the SAP GUI) to the SAP system and back again.

For each of the attributes, the monitor shows which context defined in the SAP system—normally, which SAP instance—is involved in the measured values specified. Most measurement parameters have a warning and a critical limit. If the value lies beneath the warning limit, the monitor displays the line in green; for monochrome devices the color is listed as text. If the warning limit is exceeded, **yellow** is shown, and if the critical limit is exceeded, **red**. If an entry of a partial tree lies outside the green limit, the monitor also sets the overlying nodes to yellow or red, so that the administrator can see that something is not right, even when the menus are not open.

You do not normally need to worry about the thresholds. The settings configured by SAP are sensible and should only be changed if there is a sound reason to do so.

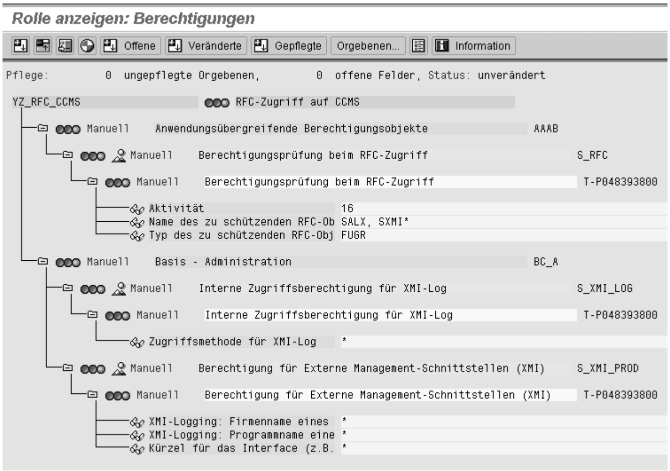
The Nagios plugins for the CCMS query, described in Section 20.2.4 (page 394), return the status defined in the CCMS: OK if the traffic light is on green, WARNING for yellow, and CRITICAL for red. The thresholds are therefore set by the SAP system, and not by Nagios.

If you want to find out more about CCMS, we refer you to the documentation at **http://service.sap.com/monitoring** (password required). There SAP provides detailed information on the installation and operation of CCMS. The SAP online help also has an extensive range of information available. If you just want a short summary of the subject and are more interested in the way the Nagios plugins work, you can find two informative PDF documents at **http://www.nagiosexchange.org/Misc.54.0.html** under the keyword **SAP CCMS**.

20.2.2 Obtaining the necessary SAP usage permissions for Nagios[6]

Retrieving information from the CCMS is done through RFC (*Remote Function Calls*), which requires a login on the SAP side. Luckily the user only needs a minimal set of permissions.

A new role is set up in the role generator (transaction PFCG) with a name that conforms to the company-internal conventions. It is not given any transaction assignment in the menu.



```
Pflege:        0  ungepflegte Orgebenen,        0  offene Felder, Status: unverändert

YZ_RFC_CCMS                     RFC-Zugriff auf CCMS
 ├─ Manuell   Anwendungsübergreifende Berechtigungsobjekte                AAAB
 │   └─ Manuell   Berechtigungsprüfung beim RFC-Zugriff                      S_RFC
 │       └─ Manuell   Berechtigungsprüfung beim RFC-Zugriff                  T-P048393800
 │           ├─ Aktivität                       16
 │           ├─ Name des zu schützenden RFC-Ob  SALX, SXMI*
 │           └─ Typ des zu schützenden RFC-Obj  FUGR
 └─ Manuell   Basis - Administration                                      BC_A
     ├─ Manuell   Interne Zugriffsberechtigung für XMI-Log                   S_XMI_LOG
     │   └─ Manuell   Interne Zugriffsberechtigung für XMI-Log               T-P048393800
     │       └─ Zugriffsmethode für XMI-Log     *
     └─ Manuell   Berechtigung für Externe Management-Schnittstellen (XMI)   S_XMI_PROD
         └─ Manuell   Berechtigung für Externe Management-Schnittstellen (XMI)  T-P048393800
             ├─ XMI-Logging: Firmenname eines   *
             ├─ XMI-Logging: Programmname eine  *
             └─ Kürzel für das Interface (z.B.  *
```

Figure 20.3: For access from Nagios you require these SAP authorization objects

[6] This section is intended for SAP authorization administrators. If you do not maintain SAP authorizations yourself, you can skip this section.

When maintaining permissions, the following permission objects are added manually: S_RFC, S_XMI_LOG, and S_XMI_LOG (see also Figure 20.3).

Whether these permissions are sufficient or not can be tested with the plugin check_sap_cons described in Section 20.2.4, page 394 check_sap_cons. If a function group (such as SALG) is missing from the permission object S_RFC, the plugin shows name of this in plain text in the error message.

The login data is stored on the Nagios server in the file /etc/sapmon/login.cfg. When doing this, various target hosts (called *RFC destinations* in SAP) can be configured simultaneously. Such a login configuration for a target system is called an *RFC template* in the language of the CCMS plugins (Section 20.2.4, page 394). It has the following form:

```
[LOGIN_template]
LOGIN=-d target -u user -p password -c client-id -h address
-s system_number
```

The complete LOGIN definition must be written on a single line, and it is essential that it contain the following details:

-d *target*

This is the name of the SAP system, also referred to as *SID* or *system ID*.

-u *user* -p *password*

These parameters state the SAP user and corresponding password. Remember that a newly created dialog user has to change his or her password on first logon.

-c *client-id*

This is the three digit client ID, also called *client*.

-h *address*

The host name of the host on which the named user should log in. This must resolve to an IP address.

-s *system_number*

The SAP system number. The first SAP instance is normally 00, then increased incrementally.

Below, the *user* with the password *secret* should login from the client with the ID 020 to the host p10ap013 whose SAP installation has the system number 01:

```
[LOGIN_P10]
LOGIN=-d P10 -u user -p secret -c 020 -h p10ap013 -s 01
```

The RFC template name in square brackets consists of the text LOGIN_ and the SAP system ID (SID). The RFC template defined here belongs to the SAP system P10.

20.2.3 Monitors and templates

The interface provided by SAP that is used by the plugins does not have a simple and extendable variant. Only additional functions enable all information from the CCMS to be retrieved, which is why we are omitting the description of the simple interface.[7]

For the extended interface, templates define the monitor data to be used. These are stored on the Nagios server in the file **/etc/sapmon/agent.cfg** and have the following format:

```
[TEMPLATE_name]
DESCRIPTION=description
MONI_SET_NAME=monitor collection
MONI_NAME=name_of_the_monitor
PATTERN_0=SID\context\monitor_object\attribute
```

The placeholders written in italics are replaced as follows:

name
: This is the name with which the plugins later address the template. When this book was written, only template names that began with two digits worked, so **00_sap13** worked, for example, but not **TEST**.

description
: This consists of a freely selectable, simple text.

monitor collection
: This is the name of the monitor, set exactly as it is in the CCMS (including upper/lower case and spaces).

name_of_the_monitor
: The name of the monitor must also match the SAP name exactly.

context
: This pattern filters out the desired values from those contained in the monitor. In most cases you specify the identifier for the SAP instance, such as **p10ap013_P10_01** (**p10ap013** is the host name, **P10** the SID of the SAP system, and **01** is the system number).

monitor_object
: This is the name of the desired monitor object, for example **Dialog**. Unfortunately the term demanded here rarely corresponds to the one shown in the SAP GUI. It is best to determine it using **PATTERN_0=***, as described below.

[7] Information on this is provided by the PDF documents mentioned on page 390.

attribute

This is the variable to be queried. Each monitor object may contain severable variables. Dialog, for example, has, apart from the ResponseTime variable, the FrontendNetTime variable, which reveals the average processing time of a transaction, restricted to the network transmission time and processing time on the client.

The challenge here is in specifying the filter in PATTERN_0. It must exactly match the SAP-internal names, and these are not identical to the terms that are displayed in the CCMS Alert Monitor (Transaction RZ20).

It is best to start with PATTERN_0=*, which ensures that the entire tree appears. We shall call the template for this simply 00:

```
[TEMPLATE_00]
DESCRIPTION=Dialog response time
MONI_SET_NAME=SAP CCMS Monitor Templates
MONI_NAME=Dialog Overview
PATTERN_0=*
```

With this entry in /etc/sapmon/agent.cfg you query the complete list of all monitor entries, in this case those of the system with the ID P10, using the check_sap_cons plugin:

```
nagios@linux:nagios/libexec$ ./check_sap_cons 00 P10
...
P10 p10ap013_P10_01 Dialog ResponseTime 262 msec
P10 p10ap014_P10_02 Dialog ResponseTime 61 msec
P10 p10db012_P10_00 Dialog ResponseTime 11 msec
...
```

The entries contain the following information—with items separated by spaces:

```
SID context monitor_object attribute value
```

The information for the P10 system queried above first gives the SAP instance, such as p10ap013_P10_01, then the monitor object (Dialog) and the attribute (ResponseTime) together with values. In the SAP GUI (Figure 20.2) this latter is called Dialog Response Time, and since each empty space is significant, this is a completely different name.

In a template that is only interested in the response time of the instance p10ap014 _P10_02, the PATTERN_0 is defined as follows:

```
PATTERN_0=P10\p10ap014_P10_02\Dialog\ResponseTime
```

If you want to query all the entries of a query level, you must use the wildcard *. The following example defines templates for the dialog response time, the network response time, and the average CPU load for all instances of the system **P10**:

```
[TEMPLATE_00]
DESCRIPTION=Dialog response time
MONI_SET_NAME=SAP CCMS Monitor Templates
MONI_NAME=Dialog Overview
PATTERN_0=P10\*\Dialog\ResponseTime

[TEMPLATE_01]
DESCRIPTION=network response time
MONI_SET_NAME=SAP CCMS Monitor Templates
MONI_NAME=Dialog Overview
PATTERN_0=P10\*\Dialog\FrontEndNetTime

[TEMPLATE_10]
DESCRIPTION=System load in five-minute average
MONI_SET_NAME=SAP CCMS Monitor Templates
MONI_NAME=Operating System
PATTERN_0="P10\*\CPU\5minLoadAverage"
```

20.2.4 The CCMS plugins

SAP demonstrates the use of the RFC interface to the CCMS with the CCMS plugins for SuSE. In Debian you can convert the RPM package **nagios-plugins-sap-ccms-0.7.2**[8] to a tar file with **alien**, or alternatively you can obtain the source RPM from a SuSE FTP mirror[9] and compile the source code yourself. This will give you the plugins listed in Table 20.1.

Table 20.1: The SAP-CCMS plugins

Plugin	Description
check_sap	Output of the monitor data in HTML format
check_sap_cons	Ditto, but without HTML formatting and without hyperlinks for the output on the command line
check_sap_instance	Dialog response time and number of logged-in users on a particular application server (requires CCMS Ping[10])

[8] It can be found at **http://www.rpmseek.com/**, for example, if you search there for **nagios-plugins-sap-ccms**.

[9] e.g., **ftp://ftp.gwdg.de/pub/linux/suse/ftp.suse.com/suse/i386/9.3/suse/src/nagios-plugins-sap-ccms-0.7.2-45.src.rpm**.

[10] As components of the CCMS monitoring system, CCMS Ping monitors the availability of the application server belonging to the SAP system.

continued

Plugin	Description
check_sap_instance_cons	Ditto, as text output without HTML markup
check_sap_multiple	HTML-formatted output of data of a monitor template, which returns more than one value
check_sap_mult_no_thr	Output of multiple values with simple HTML formatting, without hyperlinks, in contrast to check_sap_multiple
check_sap_system	Shows the application servers of the SAP system and their states (requires CCMS Ping)
check_sap_system_cons	Like check_sap_system, only without HTML formatting

The plugins that end in _cons are especially suitable for test purposes: they simply pass the data on to the command line, without further formatting. The output of the others contains HTML formatting for a Nagios version modified by SAP; with Nagios 2.0 they usually lead to an incorrect view and are therefore useless.

Individual values are best retrieved with check_sap_cons, but then the monitor definition must really only return a single value. The remaining ones would be returned on additional lines, ignored by Nagios.

If Nagios is to display several return values, it is best to use check_sap_mult_no_thr, which provides these values with some HTML formatting elements which also work with Nagios 2.0.

All plugins demand two arguments: check_sap, check_sap_cons, check_sap_multiple, and check_sap_mult_no_thr first require the name of the monitor template from the file /etc/sapmon/agent.cfg, such as 00, 00_sap13, 01, or 10 (see page 392), followed by the name of the RFC templates, as defined in /etc/sapmon/login.cfg (in the examples in this book we use the system ID P10).

For check_sap_system/check_sap_system_cons and check_sap_instance/check_sap_system_cons, the first argument changes: instead of the monitor template, check_sap_system demands the system ID (here, P10), and check_sap_instance demands the SAP instance, consisting of the host name, the SID, and the system number (for example, p10ap13_P10_01).

First steps with check_sap_cons

The plugin check_sap_cons is probably best suited to your first attempts. Only after this has worked for you properly on the command line should you move on to the actual Nagios configuration. The example on page 393 already showed how you determine the dialog response time with the monitor template 00, and the following example queries the network time which the SAP GUI requires till the result of the transaction appears in the SAP GUI, using the monitor template **01**:

```
nagios@linux:nagios/libexec$ ./check_sap_cons 01 P10
P10 p10ap013_P10_01 Dialog FrontEndNetTime 383 msec
P10 p10ap014_P10_02 Dialog FrontEndNetTime 673 msec
P10 p10db012_P10_00 Dialog FrontEndNetTime 1491 msec
```

The definitions in the two templates can be found in Section 20.2.3 on page 392. In both examples, **check_sap_cons** returns multiple values, only the first line of which would be noticed by Nagios in the Web interface and in notifications. If the instance **p10ap014_P10_02** displayed a critical status, but **p10ap013_P10_01** did not, the plugin would return a CRITICAL, but the Web interface would only present the first line (like the notification), which would not give any reason to worry. This means that the admin would not see the very thing that has set off the critical state.

If **check_sap_cons** only returns error messages instead of the data you want, there could be several reasons for this. In the following example the login fails:

```
nagios@linux:nagios/libexec$ ./check_sap_cons 00 P10
<==  RfcLastError
FUNCTION: SXMI_LOGON
RFC operation/code SYSTEM_FAILURE
ERROR/EXCEPTION
key     :
status  :
message : User account not in validity date
internal:
<==  RfcClose
```

The reason is given in the **message:** field: the user currently does not have a valid account. If the following message were to be found there

```
message : User 910WOB has no RFC authorization for function group SXMI .
```

this would mean that the user **910WOB** does not have the necessary permission in the authorization object **S_RFC**. In order to grant it, that user should be assigned to the function group **SXMI**.

The plugins record such RFC error messages in the file **dev_rfc** in the current working directory. If Nagios runs the plugin, then it will generate this file in the Nagios home directory (**/usr/local/nagios**, if you have followed the installation description in this book).

In the next case the login works perfectly, but the plugin does not return any values:

```
nagios@linux:nagios/libexec$ ./check_sap_cons 01 P10
No information gathered! System up?
```

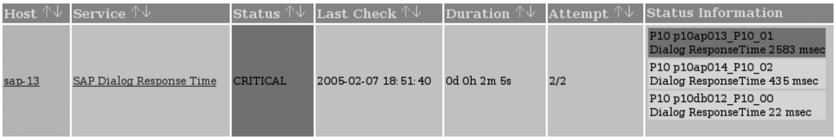
The error here lies in the monitor definition: often the name of the monitor set or the monitor is written wrongly, or the pattern does not match the monitor used. The intersection of monitor and pattern is then empty, and SAP also does not warn explicitly if the monitor or monitor set do not even exist.

Checking multiple values with check_sap_mult_no_thr

If Nagios is to represent multiple queried values in the Web interface, you should use check_sap_mult_no_thr:

```
nagios@linux:nagios/libexec$ ./check_sap_mult_no_thr 00 P10
<table>
   <tr><td CLASS='statusOK'>P10 p10ap013_P10_01 <br>
           Dialog ResponseTime 785 msec</td></tr>
   <tr><td CLASS='statusOK'>P10 p10ap014_P10_02 <br>
           Dialog ResponseTime 352 msec</td></tr>
   <tr><td CLASS='statusOK'>P10 p10db012_P10_00 <br>
           Dialog ResponseTime 22 msec</td></tr>
</table>
```

The output is given in a single line, which we have reformatted manually here so that it can be more easily read. With the HTML code, the plugin ensures that each value (thanks to the CLASS specifications) is shown on a separate line in the color matching its status. The status of the Nagios service changes to CRITICAL if at least one measured value is critical. Such a case is shown in Figure 20.4.



Host ↑↓	Service ↑↓	Status ↑↓	Last Check ↑↓	Duration ↑↓	Attempt ↑↓	Status Information
sap-13	SAP Dialog Response Time	CRITICAL	2005-02-07 18:51:40	0d 0h 2m 5s	2/2	P10 p10ap013_P10_01<br>Dialog ResponseTime 2583 msec P10 p10ap014_P10_02<br>Dialog ResponseTime 435 msec P10 p10db012_P10_00<br>Dialog ResponseTime 22 msec

Figure 20.4: check_sap_mult_no_thr uses HTML markups which Nagios 2.0 also understands

In this case as well you should remember that Nagios altogether processes no more than 300 bytes of the plugin output, and cuts off the rest. For HTML-formatted output, not only is information then missing, there are also side effects in the table layout in the Web interface. In case of doubt, you must share the test among several service checks.

In the definition of the Nagios command objects, the host name, exceptionally, does not play a role for the CCMS plugins. This means that the $HOSTADDRESS$ macro is not used:

```
define command{
    command_name  check_sap_ccms
    command_line  $USER1$/check_sap_mult_no_thr $ARG1$ $ARG2$
}
```

If you request several values simultaneously, they will normally belong to different hosts. This means that services can only be assigned to a host in one-to-one single value queries. Nevertheless, Nagios expects a specific host in the service definition:

```
define service{
   service_description   SAP Dialog Response Time
   host_name             sap01
   check_command         check_sap_ccms!00!P10
   ...
}
```

20.2.5 Performance optimization

Since the monitor always transmits all the data it has available over the RFC interface, filtering always takes place on the client side through the plugin. For this reason it is not recommended that you query single values from a large monitor one after another: this consumes considerable resources.

You should either have a single service provide all the values,[11] or you should define a separate monitor yourself containing precisely those values you would like to test. This latter method is recommended by SAP.

If you want to check several monitors, or even single values of the monitor one after the other, you should keep an eye on the necessary network bandwidth. Within a local network this is normally not a problem, but it can place a considerable burden on narrow-bandwidth long-distance connections (ISDN, simple VPNs). In such cases you should measure the network traffic when starting operation, so that you can increase the check intervals accordingly in case of problems.

[11] Using a plugin predestined for the output of multiple values.

Appendixes

Appendix A

Rapidly Alternating States: Flapping

If the state of a host or service keeps on changing over and over, Nagios inundates the administrator with a flood of problem and recovery messages, which can not only be very irritating but also distract the administrator's attention from other, perhaps more urgent problems.

With a special mechanism, Nagios quickly recognizes alternating states and can inform the administrator of these selectively. The Nagios documentation refers to such alternating states as ***state flapping*** and to their detection as ***flap detection***.

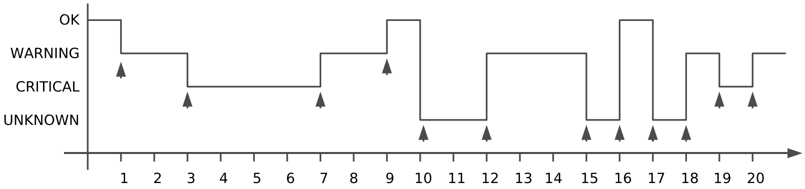
Whether these alternating states involve hosts or services has no influence on the detection mechanism itself. The differences are more to be found in the nature of host and service checks: Nagios carries out service checks periodically, and therefore regularly. In this way the system continuously receives new information on the current status. Host checks, on the other hand, normally only take place if they are necessary, so Nagios has to obtain the appropriate information in other ways.

A.1 Flap Detection with Services

To detect alternating states you need a complete list of all states that occurred during the last service checks. For this purpose Nagios stores the last 21 test results for each service and then overwrites the oldest value in each case in the memory. In these 21 states, a maximum of 20 changes can occur.

Figure A.1 shows an example. The x-axis numbers the possible alternating states in each case from 1 to 20, and the heads of the arrow indicate alternating states that have actually occurred.

Figure A.1: Nagios saves the last 21 states to detect frequently alternating states. This service changed its state twelve times



In the period specified, the state of the system shown changed 12 times out of a possible 20, which as a percentage is 60 percent. At 0 percent, not one alternation state has taken place, and 100% means that the service really was in a different state every time it was recorded.

When determining the percentage value, Nagios assigns less significance to older changes of state than to more recent ones. Accordingly it weights the oldest change in state at **1** in Figure A.1 with 0.8, and the most recent at **20** with 1.2. From left to right, the factor increases each time by approx. 0.02,[1] resulting in a linear progression.

This weighting does not have any major effects on the end result in this example: for Figure A.1, this results in 62.21 percent (instead of 60), a slight shift, since the state in the second half changed more often. If there was only a single change of state at **20**, the weighting would have the most effect: instead of 5% (that is, one change out of a possible 20) this would result in 5 * 1.2 = 6 percent.

Using threshold values which can be defined—two for services, two for hosts—Nagios defines whether a service or host is "flapping". Both the upper and lower

[1] (1.2-0.8)/19 = 0.0211

limits are specified as percentages. If the detected change state exceeds the upper threshold, Nagios categorizes the service as *flapping*. This has consequences: Nagios logs the event in the log file, adds a nonpermanent comment,[2] and stops any notifications concerning this from being sent.

If the percentage value falls below the lower limit, the system undoes this step; that is, the comment disappears, notifications are sent again, and the result also appears in the log file.

A.1.1 Nagios configuration

Flap detection is configured at two locations: in the central configuration file and in the definition of the service object. In **nagios.cfg** the feature is switched on generally with the parameter **enable_flap_detection**, and global limit values are also defined here, which will always apply if nothing else is defined for the service in question:

```
# /etc/nagios/nagios.cfg
...
enable_flap_detection=1
low_service_flap_threshold=5.0
high_service_flap_threshold=20.0
...
```

The value **1** set here for **enable_flap_detection** enables flap detection, and **0** switches it off.

The lower limit **low_service_flap_threshold** lies at 5 percent in this case, the upper **high_service_flap_threshold** limit at 20. This means that Nagios categorizes a service as flapping if the history saved detects at least five changes in state (more than four out of a possible 20).[3] The lower five percent limit corresponds to one change in state. To drop below this, all 21 states must be identical.[4]

In the definition of a service object, you have another chance to decide whether flap detection is desired in this case. You also have an option to specify threshold values for this service that differ from the global settings:

```
define service{
    host_name               linux01
    service_description     NTP
    ...
```

[2] Nonpermanent comments disappear after the monitoring system is restarted, but permanent ones remain.

[3] If the changes in state took place recently, the weighting would ensure that four changes in state would already be enough to exceed the 20 percent limit.

[4] If a single change of state takes place in the first half, the weighting results in a value of less than 5 percent.

```
    flap_detection_enabled 1
    low_flap_threshold     5.0
    high_flap_threshold    20.0
    ...
}
```

The value **1** in **flap_detection_enabled** switches on the feature for this service, and **0** (the default) switches it off. The two limit values **low_flap_threshold** and **high_flap_threshold** define the limit values that override the globally defined values. If they are set to **0**, or are omitted, the global thresholds will apply.

A.1.2 The history memory and the chronological progression of the changes in state

Since the history only saves hard states and soft recovery, the sections on the x-axis cannot be allocated so easily on a chronological basis, because the intervals between possible changes of state are not equal. Assuming that the service object has the following definitions:

```
max_check_attempts     3
normal_check_interval  5
retry_check_interval   1
```

Nagios checks the service two more times after a change in state from OK to WARNING has taken place, before the service changes to the hard state WARNING (state 1 in Figure A.1 on page 402). Since the last check, which returned OK, a total of seven minutes[5] has elapsed, since the two soft states after five and six minutes are not included in the history.

If the next service check, as in Figure A.1, again detects a WARNING (i.e., the state does not change this time), then only five minutes elapse this time between states 1 and 2. The x-axis therefore only illustrates time in a linear form in exceptional circumstances—if no change of state occurs, for example.

A.1.3 Representation in the Web interface

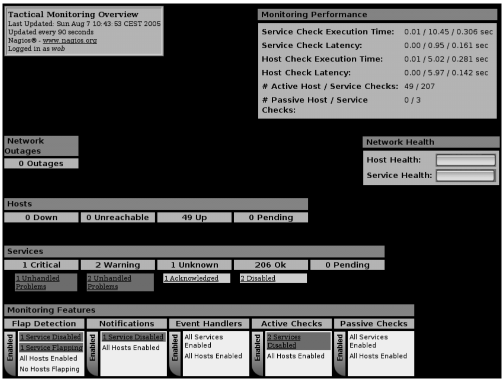
Services that Nagios categorizes as flapping are visible in the Web interface at three points: in the summaries generated by **tac.cgi** (Section 16.2.4, page 290) and **status.cgi** (Section 16.2.1, page 279), as well as on the information page created by **extinfo.cgi** (Section 16.2.2, page 284).

The quickest way to get there is through **tac.cgi** (Figure A.2): a link in the **Monitoring Features** section marked by **x Services Flapping** takes you to the status overview of services which continually change their state. The status overview

[5] 5 + 2 * 1 = 7

shown in Figure A.3 can also be opened directly with **status.cgi?host=all&style=detail&serviceprops=1024**.

serviceprops=1024 describes all services that Nagios categorizes as flapping. **style=detail** provides a detailed view (in contrast to **overview**, as can be seen in Figure A.10 on page 280), and **host=all** includes all hosts.



Tactical Monitoring Overview
Last Updated: Sun Aug 7 10:43:53 CEST 2005
Updated every 90 seconds
Nagios® - www.nagios.org
Logged in as *wob*

Monitoring Performance	
Service Check Execution Time:	0.01 / 10.45 / 0.306 sec
Service Check Latency:	0.00 / 0.95 / 0.161 sec
Host Check Execution Time:	0.01 / 5.02 / 0.281 sec
Host Check Latency:	0.00 / 5.97 / 0.142 sec
# Active Host / Service Checks:	49 / 207
# Passive Host / Service Checks:	0 / 3

Network Outages
0 Outages

Network Health
Host Health:
Service Health:

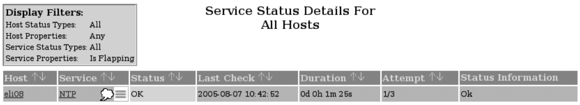
Hosts			
0 Down	0 Unreachable	49 Up	0 Pending

Services				
1 Critical	2 Warning	1 Unknown	206 Ok	0 Pending
1 Unhandled Problems	2 Unhandled Problems	1 Acknowledged	2 Disabled	

Monitoring Features				
Flap Detection	Notifications	Event Handlers	Active Checks	Passive Checks
Enabled	Enabled	Enabled	Enabled	Enabled
1 Service Disabled 1 Service Flapping All Hosts Enabled No Hosts Flapping	1 Service Disabled All Hosts Enabled	All Services Enabled All Hosts Enabled	2 Services Disabled All Hosts Enabled	All Services Enabled All Hosts Enabled

Figure A.2: tac.cgi notes changing states in section Monitoring Features

In the status view in Figure A.3, a white field with several horizontal gray bars moving to and fro reveal that a flapping service is involved. At the same time a white speech bubble denotes the existence of a comment on this (generated automatically by Nagios).



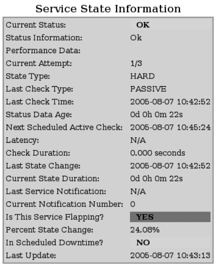
Display Filters:
Host Status Types: All
Host Properties: Any
Service Status Types: All
Service Properties: Is Flapping

Service Status Details For
All Hosts

Host ↑↓	Service ↑↓	Status ↑↓	Last Check ↑↓	Duration ↑↓	Attempt ↑↓	Status Information
eli08	NTP	OK	2005-08-07 10:42:52	0d 0h 1m 25s	1/3	Ok

Figure A.3: Animated horizontal bars in the status display denote flapping states

If you click in the status view on the flapping icon next to the service in question, **extinfo.cgi** generates additional information on the service (Figure A.4), showing the changes in state in percent next to the flapping category, depicted by a red bar labeled with **YES**.

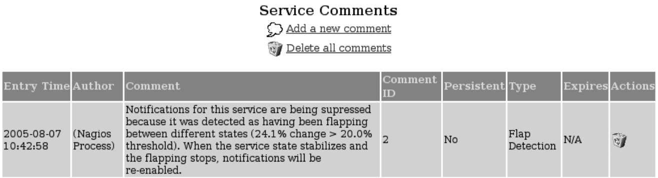


Service State Information

Current Status:	OK
Status Information:	Ok
Performance Data:	
Current Attempt:	1/3
State Type:	HARD
Last Check Type:	PASSIVE
Last Check Time:	2005-08-07 10:42:52
Status Data Age:	0d 0h 0m 22s
Next Scheduled Active Check:	2005-08-07 10:45:24
Latency:	N/A
Check Duration:	0.000 seconds
Last State Change:	2005-08-07 10:42:52
Current State Duration:	0d 0h 0m 22s
Last Service Notification:	N/A
Current Notification Number:	0
Is This Service Flapping?	YES
Percent State Change:	24.08%
In Scheduled Downtime?	NO
Last Update:	2005-08-07 10:43:13

Figure A.4: Percent State Change: reveals how often the hard state changed, as a percentage

The page also contains the nonpermanent comment generated by Nagios (Figure A.5), which points out that the sending of messages has been stopped until the status of the service becomes stable again. It disappears, therefore, when Nagios is restarted.



Service Comments

Add a new comment

Delete all comments

Entry Time	Author	Comment	Comment ID	Persistent	Type	Expires	Actions
2005-08-07 10:42:58	(Nagios Process)	Notifications for this service are being supressed because it was detected as having been flapping between different states (24.1% change > 20.0% threshold). When the service state stabilizes and the flapping stops, notifications will be re-enabled.	2	No	Flap Detection	N/A	

Figure A.5: With this comment, Nagios categorizes a service as flapping

A.2 Flap Detection for Hosts

Nagios only performs host checks if all available services are in an error state—that is, extremely irregularly. The system therefore cannot rely exclusively on these reachability tests when detecting changes in state for hosts. As long as at least one service check returns OK, Nagios deduces from this that the host itself is also reachable, and is therefore in an OK state. The software therefore checks for flapping states for each host and each service check.

The result of each host check that returns a hard state or soft recovery is saved by Nagios. During the period in which the reachability test is not available, the system assumes, after a time period which it defines itself, that the state has not changed, and stores the current state again in the history. The time period corresponds to the average of all service check intervals.

On the basis of this history, the same flap detection mechanism is used for hosts as for services. So the difference is only in how Nagios determines the corresponding data basis.

Whether flap detection is desired for hosts is revealed by the central configuration file **nagios.cfg** and the definition of the host objects. The global parameter **enable_flap_detection**, which applies equally to hosts and services, must be set to 1:

```
# /etc/nagios/nagios.cfg
enable_flap_detection=1
low_host_flap_threshold=5.0
high_host_flap_threshold=20.0
```

The threshold parameters for hosts include **host** in their names, but they have the same effect as their **service** equivalents.[6]

[6] Cf. page 403.

For the host object itself, detection is switched on with flap_detection_enabled 1 and off with 0:

```
define host{
    host_name               linux01
    ...
    flap_detection_enabled 1
    low_flap_threshold      5.0
    high_flap_threshold     20.0
}
```

The two optional parameters low_flap_threshold and high_flap_threshold allow for host-specific thresholds. If these are omitted, the global threshold values are used.

Appendix

B

Event Handlers

If the state of a host or service alternates between OK and error states, you can use an *event handler* to run any programs you want. You can make use of this if a service fails, for example, and Nagios should attempt to restart it. This provides an opportunity to solve minor problems without the administrator needing to intervene.

Use of the *event handlers* is not just restricted to self-healing, however: with an appropriate script you can just as easily log current values or the event itself in a database. But there are more suitable methods for doing this, described in Section 17.1, page 314.

A failed printer service serves as an example here of using an event handler for self-healing. In this example the printer service lpd is used, but this method can be applied in general to any service for which a start-stop script is available.

B.1 Execution Times for the Event Handler

The following parameters in the service definition ensure that Nagios tests the service under normal circumstances every five minutes, but in cases of error, every two minutes:

```
normal_check_interval  5
retry_check_interval   2
max_check_attempts     4
```

An error state becomes hard after four tests leading to the same result.

Figure B.1: When does Nagios run the event handler?

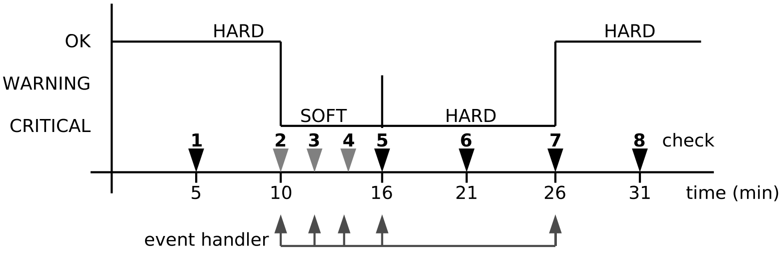


Figure B.1 shows an example of the change of the lpd service from an OK state to CRITICAL, and back again. After 10 minutes test No. 2 detects that the service is no longer available. The soft state that results causes Nagios to examine lpd more closely at two-minute intervals (checks No. 3, 4, and 5). Test No. 5 returns a CRITICAL for the fourth time, causing Nagios to categorize this as a hard state and to go back to the normal, five-minute test interval. In check No. 7 the service is functioning again, and the state changes from CRITICAL to OK (for hard state, see Section 4.3, page 75.).

Event handlers are carried out by Nagios for soft error states (in checks No. 2, 3, 4), the first time a hard error state occurs (in check No. 5), and in the resetting of the OK state after an error (irrespective of whether this is a hard or soft recovery).

Since hard error states lead to the administrator being notified, it is recommended that the repair attempt is moved to the time of the soft error states. If it succeeds at this point in time, the administrator is spared these minor details. Ideally the service will be running again before a user even notices that it has failed.

The fact that Nagios only executes the event handler when a hard error state first occurs prevents periodic attempts at repair that do not lead to the desired result after all (if the attempt had succeeded, no further hard error states would have occurred).

B.2 Defining the Event Handler in the Service Definition

Although Nagios executes the event handler for every event, it does not have to carry out an action each time. In our example the handler should attempt to reset the printer service on the third soft error state (check No. 4) and on the first hard error state (check No. 5), and do nothing at all the other execution times.

For this purpose, the service definition is modified as follows:

```
define service{
   host_name                printserver
   service_description      LPD
   ...
   event_handler            restart-lpd
   ...
}
```

The **event_handler** parameter expects a Nagios command object that will run the handler script:

```
define command{
   command_name  restart-lpd
   command_line  $USER1$/eventhandler/restart-lpd.sh \
                    $SERVICESTATE$ $SERVICESTATETYPE$ $SERVICEATTEMPT$
}
```

In this example it is called **restart-lpd.sh** and is not located directly in the Nagios plugin directory **/usr/local/nagios/libexec**, but in a subdirectory called **/usr/local/nagios/libexec/eventhandler**, as suggested in the Nagios documentation. The script receives three macros as parameters: the current state **$SERVICESTATE$** (OK, WARNING, CRITICAL, or UNKNOWN), the state type **$SERVICESTATETYPE$** (**SOFT**, or **HARD**), and the number of the current (possibly repeated) attempt **$SERVICEATTEMPT$** (e.g., **3** if the test is being performed for the third time). If the event handler is to be used for host checks, then the macros **$HOSTSTATE$**, **$HOSTSTATETYPE$**, and **$HOSTATTEMPT$** are used instead.

B.3 The Handler Script

The actual treatment of the error—depending on the current event—is dealt with by the script defined in the command definition. So that we can concentrate on the essential aspects in this context, we shall assume that **lpd** is installed on the Nagios server itself. This enables the service to be restarted locally, without the need for a remote shell such as the Secure Shell.

The script **restart-lpd.sh** checks to see exactly what event is involved, using the macros passed on to it, and either does nothing at all or tries to restart **lpd**:

```
#!/bin/bash
# /usr/local/nagios/libexec/eventhandlers/restart-lpd.sh
# $1 = Status, $2 = status type, $3 = attempt

case $1 in
   OK)
      ;;
   WARNING)
      ;;
   CRITICAL)
      if [ $2 == "HARD" ] || [[ $2 == "SOFT"  &&  $3 -eq 3 ]]; then
         echo "Restarting lpd service"
         /usr/bin/sudo /etc/init.d/lpd restart
      fi
      ;;
   UNKNOWN)
      ;;
esac
exit 0
```

The **case** statement first checks to see what state exists. Only if it is CRITICAL will the script do anything; it does not carry out any action for other states. If the service is in a critical state, either the state type must be HARD or (||) a corresponding soft state must occur for the third time in succession, so that **restart-lpd.sh** can execute the **lpd** init script with the argument **restart**.[1]

The script is executed with the permissions of the user **nagios**, who may neither stop nor restart system services. This is why **sudo** is used, which provides temporary **root** permissions exclusively for the start-up script **/etc/init.d/lpd**, just for this user. The corresponding configuration can be found in the file **/etc/sudoers**, but if it is edited then you must use the program **visudo** rather than a standard editor (this checks the configuration file for syntax errors when it is saved):

```
linux:~ # visudo
```

Then you add the following line to the configuration file:

```
nagios  nagsrv=(root) NOPASSWD: /etc/init.d/lpd
```

In plain language this means: the user **nagios** may run the command **/etc/init.d/lpd** on the host **nagsrv**. The command is run as the user **root**, but no password is required for this.

[1] If you want to get to know Bash programming more closely, we can recommend the excellent *Advanced Bash-Scripting Guide* (http://www.tldp.org/LDP/abs/html) by Mendel Cooper.

B.4 Things to Note When Using Event Handlers

If you restart a service that is already in a soft error state as described here, the administrator will not receive any notification as long as the action was successful. Although the log file records the restart, it will scarcely be noticed unless you search the log file explicitly for such events. This means that the administrator will seldom investigate the cause of the service failure.

You should therefore bear in mind that eliminating the problem is the best solution, and that a restart is only second best. Like air bags in automobiles, the event handler should just be regarded as an additional security measure, and should certainly not represent the primary method of handling errors. If you carry out the restart only when a hard error state occurs, the administrator is confronted with the problem through the notification mechanism.

In addition, not every service is suitable for an automatic restart. With OpenLDAP in versions before 2.1.17, a problem occurred sporadically in the replication through **slurpd**, which left behind a corrupted replication file. Although the replication service could be restarted, it died again after a short time. To really get the replication up and running again, you would have to repair the replication file manually.

You should always remember this example and never have complete faith in self-healing. In the worst case, restarting a service repeatedly and without thought could lead to loss of data, which might be rectified only by retrieving data from the backups.

Appendix C

Writing Your Own Plugins: Monitoring Oracle with the Instant Client

The following chapter will not introduce any finished plugins, but illustrate how you can build your own Oracle plugin, using an example that monitors Oracle. Some plugins do already exist for this DBMS, such as check_oracle, one of the standard Nagios plugins, or check_oracle_writeaccess[1] by Mathias Kettner. But both of them require the normal Oracle client, and most non-Oracle administrators will be out of their depth attempting to install it.

[1] http://mathias-kettner.de/nagios_plugins.html.

Luckily there is an easier solution: For some time now, Oracle has been offering an *instant client*, which drastically reduces the installation work: unpack the zip files, set the variables, and the installation is finished—the command-line tool sqlplus can be used immediately. The latter can be used in a plugin—just like the Perl script introduced in this chapter does, which sends a request to the Oracle database using sqlplus and evaluates the response.

C.1 Installing the Oracle Instant Client

Even though the instant client has been available only since Oracle version 10g, it can be used just as well with older Oracle databases such as 8i or 9i. The software is available in the form of zip files at the Oracle homepage,[2] provided you have previously registered on the Web site of the company. When downloading, you are asked some additional questions on export conditions.

Although the software costs nothing, you must observe Oracle's license terms. If your Oracle database is licensed on a CPU basis, you do not need to worry about additional access by another user (Nagios).

For sqlplus you require two zip files,[3] instantclient-basic-linux32-10.1.0.3.zip and instantclient-sqlplus-linux32-10.1.0.3.zip.

The instantclient-basic package, some 31 MB in size, contains all the necessary libraries, and the instantclient-sqlplus included, only 320 kB in size, contains a short documentation (READFROM_IC.htm) as well as the client itself with a further library. It does not matter for the installation where the files are unpacked; in this case we will use /usr/local/oracle:

```
linux:~ # mkdir /usr/local/oracle
linux:~ # cd /usr/local/oracle
linux:local/oracle # unzip instantclient-basic-linux32-10.1.0.3.zip
Archive:  instantclient-basic-linux32-10.1.0.3.zip
  inflating: instantclient10_1/classes12.jar
...
linux:local/oracle # unzip instantclient-sqlplus-linux32-10.1.0.3.zip
Archive:  instantclient-sqlplus-linux32-10.1.0.3.zip
  inflating: instantclient10_1/READFROM_IC.htm
  inflating: instantclient10_1/glogin.sql
  inflating: instantclient10_1/libsqlplus.so
  inflating: instantclient10_1/sqlplus
```

[2] http://www.oracle.com/technology/software/tech/oci/instantclient/

[3] Apart from the Linux version introduced here on Intel x86-32 systems, the client is also available for Linux x86-64, Linux Itanium, MAC OS-X, HP-UX (32- and 64-bit, for both PA-RISC and Itanium), Solaris SPARC (32- and 64-bit), Solaris x86-32, AIX 5L (32- and 64-bit), and HP Tru64 UNIX.

This creates a subdirectory instantclient10_1, containing all the required files. After setting two environment variables, the instant client is ready for use:

```
LD_LIBRARY_PATH=/usr/local/oracle/instantclient10_1
SQLPATH=/usr/local/oracle/instantclient10_1
```

LD_LIBRARY_PATH ensures first that all shared libraries from the instant client directory are taken into account when programs are run, before the libraries installed system-wide are loaded. SQLPATH reveals to sqlplus where it needs to look for the file glogin.sql. This file makes a number of default settings for accessing the Oracle database, and no adjustments are necessary for our purposes.

C.2 Establishing a Connection to the Oracle Database

sqlplus requires the following details to make contact with the database:

```
sqlplus user/password@//host/database
```

The placeholder user is replaced by a user who exists in the database, and the password is followed by a forward slash. After the @// sign comes the host name or IP address, followed by the name of the database to which sqlplus should make a connection. In the following example we will use the database DEMO:

```
user@linux:~$ sqlplus wob/password@//192.168.1.9/DEMO

SQL*Plus: Release 10.1.0.3.0 - Production on Sat Aug 13 14:12:52 2005
...
SQL> quit
Disconnected from Oracle8i Release 8.1.7.0.0 - Production
JServer Release 8.1.7.0.0 - Production
```

On the connect you are shown the version of the instant client used (here: 10.1.0.3.0) as well as a note on the version of the Oracle database used, in this case 8.1.7.0.0. The quit command terminates the connection. If the password is wrong, or if the user does not exist, Oracle explicitly requests the user to enter both again.

C.3 A Wrapper Plugin for sqlplus

To query an Oracle database, sqlplus is given the appropriate SQL statement via standard input and receives a reply via the standard output:

```
user@linux:~$ echo "select trash from nothing" |\
    sqlplus -i wob/password@//192.168.1.9/DEMO
select trash from nothing
                  *
ERROR at line 1:
ORA-00942: table or view does not exist
```

The switch **-s** (*silent*) prevents the output of things like version and copyright, and restricts the reply to the really interesting part. If the query fails, as above, the text merely points out the error that has occurred. **sqlplus** itself only returns an error status as a return value if the error occurred when using the client itself, otherwise it just returns OK (command executed). This is why **sqlplus** cannot be used directly by Nagios. Instead, a ***wrapper*** must be written around the actual query which evaluates the reply of the database, which in the above example generates a CRITICAL return value appropriate for Nagios from the **ERROR** reply, and adds a short one-line reply.

sqlplus can in principle be run with any scripting language that enables the text response to be interpreted. Since this is one of the strengths of Perl, we shall use this language for the wrapper plugin—but it could also be written in a shell like Bash; the basic principle is always the same.

C.3.1 How the wrapper works

The wrapper plugin is constructed on the following lines:

```
sql-statement | sqplus arguments | output_processing
```

sqlplus receives an SQL statement on the standard input, and the plugin retrieves the result from the standard output. Wrappers can be built around (almost) any program which does not provide sensible return values, but "hides" the result in text.

Perl itself does not provide a direct way of checking standard input and output at the same time. But Perl would not be Perl if there were not a module created specifically for this purpose. **ICP::Open2**[4] fullfils exactly this purpose:

```
use IPC::Open2;

open2(*READFROM, *WRITETO, program, list_of_arguments);
print WRITETO "instruction_via_standard_input\n";
```

[4] The module is included in the standard package of Perl 5.8.

```
while (<READFROM>) {
   processed_standard_output;
}

close(READFROM);
close(WRITETO);
```

The routine **open2** requires two file handles. Their names, **WRITETO** and **READFROM**, describe the interaction from the point of view of the wrapper, and seen from **open2** its behavior is exactly the opposite: **open2** reads from its standard input (**WRITETO**) and writes to its output (**READFROM**), where no distinction is made between standard output and error output. The third argument is a program with its complete path, followed by any number of arguments for the program, each separated from the next by a comma.

With the **WRITETO** file handle, the desired commands are sent with **print**. Each line for **sqlplus** should end here with a correct end-of-line (Perl: '**\n**'). With the **while (<READFROM>)** construction, Perl reads line by line from the standard (or error) output until there are no more lines. Then **close()** closes the two file handles.

Using **IPC::Open2** can cause problems, however: it is conceivable that the program used (in our case, **sqlplus**) gets blocked, because it continues processing a part of the input only after it has written something. If the plugin only processes the output once all the input is completed, you have the classic situation of a deadlock. For this reason you must make sure there are no blocks when reading and writing. Luckily the danger of this happening in our simple application is minimal.

C.3.2 The Perl plugin in detail

A good Perl script starts with the instructions **use strict** and **use warnings**. Then all variables must be declared, and in other ways Perl is very particular with syntax.[5]

```
#!/usr/bin/perl -w
use strict;
use warnings;
use IPC::Open2;

my $ipath = "/usr/local/oracle/instantclient10_1";
my $sqlplus = "$ipath/sqlplus";
my $connectstring =  "wob/password@//192.168.1.9/DEMO";
```

[5] Some programmers get very irritated, especially at the start, because Perl reacts very pettily with **use strict**. Without this instruction, variables do not need to be declared. One single typing error in a variable name is sometimes sufficient to keep you searching for hours to find out why the value at a certain position is always **0**.

```
# -- Set environment variables
$ENV{'LD_LIBRARY_PATH'} = $ipath;
$ENV{'SQLPATH'} = $ipath;
```

$ipath contains the path to the directory in which the instant client is located, and $sqlplus has the absolute path to the program sqlplus. The connect string was already explained above. With the hash %ENV, the script sets the two required environment variables. Hash entries are referenced by Perl with $ENV{'*variable name*'}.

The database query statement is defined for this example in a variable:

```
# -- SQL-Statement
my $select = "SELECT table_name FROM all_tables ";
   $select .= " where table_name = 'VERSION';";
```

The instruction .= appends the following text to that already existing in $select. The SQL statement therefore selects, from the Oracle system table all_tables, which contains all the names of existing tables, the column table_name, in this case with an additional restriction to the table name VERSION.

In the next step the plugin opens the standard input and output with the routine open2:

```
# -- open2 with error processing
eval {
   open2(*READFROM, *WRITETO, $sqlplus, "-s", $connectstring);
};
if ($@) {
   die "Error in open2: $!\n$@\n";
}
```

The sqlplus switch -s prevents unnecessary connect output. For adequate error processing, we embed the open2 command in an eval environment: since open2 aborts directly if there is an error, the programmer would otherwise have no chance to display a sensible error message. If it is needed, the error output is obtained in the eval environment through $@. die outputs this and aborts the execution of the Perl script.

The only thing remaining now is to send the SQL statement, with print WRITETO, to sqlplus (afterwards we close down the standard input WRITETO, to be on the safe side) and evaluate the output:

```
# -- Write instruction
print WRITETO $select;
close(WRITETO);
```

```
# -- Process reply
while (<READFROM>) {
   print $_;
}
```

while <READFROM> reads the output line by line. The contents of the current line are contained in $_. With your first attempts, we recommend that you have the output of all lines displayed with print $_; so that you can determine whether everything is working.

If this is the case, the actual logic can be expanded: if the table name sought exists in the database, Oracle first displays the column header, then (separated by hyphens) the actual contents, that is, the name of the table being sought:

```
TABLE_NAME
------------------------------
VERSION
```

If such a table does not exist in the database, the response is:

```
no rows selected
```

If an error occurs in the query, perhaps because the column sought, table_name, is missing or the table all_tables does not exist, sqlplus returns a message containing the keyword ERROR, as in the initial example on page 418.

The while loop now looks like this:

```
# -- Process response
while (<READFROM>) {
   if ( /^VERSION/i ) {
      print "OK - Table VERSION found\n";
      exit 0;
   } elsif (/no rows selected/i) {
      print "WARNING - Table VERSION not found\n";
      exit 1;
   } elsif (/ERROR/i) {
      print "CRITICAL - SQL-Statement failed\n";
      exit 2;
   }
}
close(READFROM);
print "UNKNOWN - unknown response\n";
exit 3;
```

The search instruction /^VERSION/i contains two special features: the i at the end ensures that the comparison ignores upper or lower case. The ^ at the beginning ensures that the text VERSION must stand at the beginning of the line. If the SQL statement sent by Oracle was incorrect, the error message repeats this first—but then the text VERSION is *not* at the beginning of the line.

If the plugin finds the sought table name VERSION in the response sent, an OK text message is displayed and it terminates with the return value 0.

If the database issues no rows selected or even an ERROR, however, the script feeds Nagios a corresponding reply and terminates with exit and the corresponding return value. If none of the three search patterns match, a return value must also be accounted for; otherwise the script will end with the status 0, and Nagios will announce: "Everything in order." Here we take advantage of the UNKNOWN status, which is actually reserved for error processing for the plugin.

Armed with this background knowledge, it should not be too difficult to write your own Oracle plugin. Its use here is not restricted to read access: provided you have write permissions for the user in question, you can just as well formulate SQL statements with UPDATE, INSERT, or DELETE, and evaluate the answer.

D Appendix

An Overview of the Nagios Configuration Parameters

Nagios contains two independent main configuration files: nagios.cfg controls operation of the Nagios daemon, cgi.cfg configures the Web interface. Both files should be located in the Nagios configuration directory, which is normally /etc/nagios.

nagios.cfg specifies a series of further configuration database and log files, and their functions for the respective parameter will be briefly described in the following reference. The notation ⇒*parameter* refers to the description of the parameter in the configuration file currently being discussed.

Unless specified otherwise, parameters may have either the value 0 (disabled) or 1 (enabled). If a parameter has a default value, this is specified accordingly. For some path details, the standard value is defined by options during compiling. The values listed in this case correspond to the paths used in the book (see Table 1.1, page 28).

For some parameters there are no defaults. If these are missing from the configuration, Nagios does not provide the corresponding function (so, for example, without the cfg_dir parameter, Nagios ignores the object definitions stored in separate directories).

D.1 The Main Configuration File nagios.cfg

accept_passive_host_checks

Global switch for passive host checks; the value 0 suppresses them. Even though passive host checks are allowed according to nagios.cfg, this feature must be explicitly enabled when defining the host object. Default value:

```
accept_passive_host_checks=1
```

accept_passive_service_checks

Global switch for passive service checks. Even though the value 1 allows corresponding tests, this feature must be explicitly enabled when defining the service object. Default value:

```
accept_passive_service_checks=1
```

admin_email

The e-mail address of the administrator responsible for the Nagios server, to which you have access through the macro $ADMINEMAIL$. If there is no explicit configuration of a contact object, Nagios will not send an e-mail to this address. Example (no default value):

```
admin_email=nagios
```

admin_pager

Pager number, SMS number, or e-mail address for a pager gateway/SMS gateway through which the administrator of the Nagios server can be reached. Accessible through the macro $ADMINPAGER$. Example (no default value):

```
admin_pager=pagenagios
```

aggregate_status_updates

Specifies whether Nagios writes status information from hosts, services, and its own programs for the time interval ⇒*status_update_interval* in a block to the ⇒*status_file*. The value 0 means Nagios updates this file immediately after every event. Default value:

```
aggregate_status_updates=1
```

auto_reschedule_checks

With this experimental feature, Nagios spreads tests equally over the time period, to avoid peaks. This can considerably reduce performance and in particular is of no use if Nagios is already struggling to keep on schedule because of poor performance. Normally this option should be switched off. Default value:

```
auto_reschedule_checks=0
```

auto_rescheduling_interval

Every so many seconds, specified here, Nagios distributes tests which are to be executed in the next auto_rescheduling_window seconds, so that there is an equal load. Experimental feature! Default value:

```
auto_rescheduling_interval=30
```

auto_rescheduling_window

All tests that are to take place in the next number of seconds specified here are rescheduled by Nagios so that they are spread equally over this time period. Checks specified for a future time that lie outside this interval are not (yet) taken into account. Experimental feature; use only in exceptional cases! Default value:

```
auto_rescheduling_window=180
```

cfg_dir

The directory in which the configuration files containing object definitions are located. Nagios searches through it recursively for configuration files with the extension .cfg. Files with other names are ignored, so that you can place help files in this directory, such as a CSV file from which host definitions are generated automatically by a script. To integrate individual files ⇒*cfg_file*. The directive may be specified as often as you want (see also Section 2.1, page 38). Example (no default value set):

```
cfg_dir=/etc/nagios/servers
```

cfg_file

Integrates a single file with object definitions. More on this in Section 2.1, page 38. The directive can be specified as often as you want. Example (no default value set):

```
cfg_file=/etc/nagios/checkcommands.cfg
```

check_external_commands

Enables the interface for external commands. Necessary for passive checks or if commands are to be executed through the Web interface. More on this in Section 13.1, page 240. Default value:

```
check_external_commands=0
```

check_for_orphaned_services

If the results of a service check are not received after a certain time, this is referred to as an *orphaned service*. Since Nagios only reschedules service checks if a result exists, it could be the case under certain conditions that a service is never again tested. Normally this only happens if a running service check is terminated manually from outside.

If there is a suspicion that such orphaned services have occurred, you should set check_for_orphaned_services to 1 for debugging purposes. This is then confirmed if Nagios writes a corresponding error entry to the logfile. Whether this is justified or not can easily be seen in the Web interface: you can have all services displayed independently of their status, and sorted by the last test time, in ascending order. Normally the execution of an active check should not be longer ago than specified in normal_check_interval. Default value:

```
check_for_orphaned_services=0
```

check_host_freshness

Allows a passive host check to be tested actively if no check result has arrived for a long time. If Nagios considers the test result to be too old, ⇒*host_freshness_check_interval* steps in. More on *freshness checking* in Section 13.4, page 243. Default value:

```
check_host_freshness=1
```

check_service_freshness

The service equivalent to **check_host_freshness**. The time after which Nagios considers the test result to be too old is defined by the parameter ⇒*service_freshness_check_interval*. Default value:

```
check_service_freshness=1
```

command_check_interval

Defines the time interval in which Nagios tests the External Command File (see Section 13.1, page 240) for new entries. For this to happen at all, ⇒*check_external_commands* must be enabled.

A simple number as the value refers to the time unit specified by ⇒*interval_length* (normally 60 seconds, so that **1** stands for one minute). The value **-1** means that Nagios tests the interface as often as possible. If the number is supplemented (without a space) with the unit **s**, seconds can also be explicitly specified.

The interval dependent on passive checks may not be too large, since the operating system in the External Command File, a named pipe, can normally only save 4 KB. Default value:

```
command_check_interval=-1
```

command_file

The named pipe that serves as an External Command File. It should only be writable for the user **nagios** and the group **nagcmd** (see also Section 13.1, page 240). Default value:

```
command_file=/var/nagios/rw/nagios.cmd
```

comment_file

File in which Nagios stores the comments, which can be specified through the Web interface. Default value:

```
comment_file=/var/nagios/comments.dat
```

date_format

The date format that Nagios displays in the Web interface or uses in the date and time macro. Possible values are us (*mm*/*dd*/*yyyy hh*:*mm*:*ss*), euro (*dd*/*mm*/*yyyy hh*:*mm*:*ss*), iso8601 (*yyyy-mm-dd hh*:*mm*:*ss*), and strict-iso8601 (*yyyy-mm-ddThh*:*mm*:*ss*). Default value:

```
date_format=us
```

downtime_file

File in which the downtime details are saved, which can be specified through the Nagios Web interface for hosts and/or services (see Section 16.3, page 304). Default value:

```
downtime_file=/var/nagios/downtime.dat
```

enable_event_handlers

Globally switches the option on (or off) to work with event handlers for service and host checks. More on this in Appendix B, page 409. Default value:

```
enable_event_handlers=1
```

enable_flap_detection

Defines whether Nagios is generally able to detect continually changing states (*flap detection*, more on this in Appendix A, page 401). Default value:

```
enable_flap_detection=0
```

enable_notifications

Defines whether Nagios can send notifications. Switching off this feature normally only makes sense on the central hosts of a distributed installation, which themselves cannot generate notifications, and instead forward their test results to a central Nagios instance (see Chapter 15 from page 265). Default value:

```
enable_notifications=1
```

event_broker_options

The event broker as a new interface in Nagios 2.0 allows third parties to add some features to Nagios in the form of loadable modules, for example to save test results to a database instead of to a file. At the time of going to press there were not yet any functional modules. Possible values are **0** (switched off) and **-1** (accept all broker modules). Default value:

```
event_broker_options=0
```

event_handler_timeout

The time after which Nagios terminates the event handlers which have not yet finished. Default value:

```
event_handler_timeout=30
```

execute_host_checks

Enables/disables active host checks globally. This is only worth switching off in distributed environments with a central Nagios instance that only accepts passive results from other Nagios servers (see Chapter 15, page 265). Default value:

```
execute_host_checks=1
```

execute_service_checks

Like **execute_host_checks**, but for service checks. Default value:

```
execute_service_checks=1
```

global_host_event_handler

Defines a global host event handler, in addition to the host-specific event handlers defined with **event_handler**. For this, both the global parameter ⇒*enable_event_handlers* as well as the parameter **event_handler_enabled** must be enabled in the host definition. Nagios executes the global event handler, a normal command object, before the host-specific one. Example (no default value set):

```
global_host_event_handler=name_of_the_command-object
```

global_service_event_handler

The service-specific equivalent to global_host_event_handler. Apart from ⇒*enable_event_handlers*, the parameter event_handler_enabled in the service definition must also be enabled. Example (no default value set):

```
global_service_event_handler=name_of_the_command_object
```

high_host_flap_threshold

Upper limit of flap detection for host checks. Details are given in Appendix A, page 401. Default value:

```
high_host_flap_threshold=30.0
```

high_service_flap_threshold

Upper limit of flap detection for service checks (see Appendix A). Default value:

```
high_service_flap_threshold=30.0
```

host_check_timeout

Time in seconds after which Nagios aborts a host check if this has not yet returned a result. Default value:

```
host_check_timeout=30
```

host_freshness_check_interval

Interval between two *freshness checks* in seconds. Default value:

```
host_freshness_check_interval=60
```

host_inter_check_delay_method

Controls how Nagios processes host checks after a restart. A sophisticated procedure aims to prevent Nagios in this situation from executing all tests simultaneously, and thus overloading the server. Possible values are: s (*smart*, intelligent, automatic distribution of the host checks), n (*no*, all checks start simultaneously), d (*dumb*, Nagios processes the tests at intervals of seconds), and an interval specified in seconds, in the format *x.xx*. Default value:

```
host_inter_check_delay_method=s
```

host_perfdata_command

A Nagios command object that should check the performance data after every host check. Requires the ⇒*process_performance_data* parameter to be set.

This parameter only makes sense in a few cases, since Nagios executes host checks only if necessary, and therefore at very irregular intervals. It is used if performance data are to be processed without a template (Section 17.1, page 314). Example (no default value set):

```
host_perfdata_command=process-host-perfdata
```

host_perfdata_file

Specifies a file or named pipe through which Nagios forwards performance data from host checks via a template mechanism to an external program (see Chapter 17, page 313). ⇒*process_performance_data* must be set. Example (no default value set):

```
host_perfdata_file=/tmp/host-perfdata
```

host_perfdata_file_mode

Defines how data is passed on to the file ⇒*service_perfdata_file*. Possible values are a (*append*, append to a normal file) or w (*write*, write to a named pipe). Example (no default value set):

```
host_perfdata_file_mode=a
```

host_perfdata_file_processing_command

Nagios command object that is called after host performance data is passed on to the ⇒*host_perfdata_file* interface. The parameter is only used with the template mechanism and is optional. Programs such as **perf2rrd** (Section 17.3, page 325) have their own tool that permanently reads data from the interface as a daemon. Example (no default value set):

```
host_perfdata_file_processing_command=process-host-perfdata-file
```

host_perfdata_file_processing_interval

If this interval—specified in seconds—is larger than 0, the command belonging to it (⇒*host_perfdata_file_processing_command*) is run periodically at these intervals. 0 ensures that it is not used. Example (no default value set):

```
host_perfdata_file_processing_interval=0
```

host_perfdata_file_template

Describes the output format of the performance data. The Nagios macros and format details in it, such as **\t** (tabulator) or **\n** (linefeed) are replaced in the output. More on the use of templates in Section 17.1, page 314. Example (no default value set):

```
host_perfdata_file_template=$TIMET$\t$HOSTNAME$\t$HOSTEXECUTIONTIME$\t\
   $HOSTOUTPUT$\t$HOSTPERFDATA$
```

illegal_macro_output_chars

Lists characters that are discarded when macros are substituted for notifications, to avoid problems such as interpretation by the shell. The parameter has no influence on the substitution of macros in host or service definitions. Example (no default value set):

```
illegal_macro_output_chars=‘~$&|’"<>
```

illegal_object_name_chars

Specifies impermissible characters in the names of Nagios objects. It is recommended that at least the characters listed in the following example be specified (no default value set):

```
illegal_object_name_chars=‘~!$%^&*|’"<>?,()=
```

interval_length

Defines the time unit in seconds to which time details in object definitions (such as with **normal_check_interval** or **retry_check_interval**) refer. If **interval_length** is **60** seconds, the time specification is **5** five minutes. You should only change the default of 60 seconds if there is good reason to do so. **interval_length** has no influence on time parameters in **nagios.cfg**, however. Default value:

```
interval_length=60
```

lock_file

Specifies a lock file for the Nagios daemon containing the process ID (PID) of the daemon running. Is required for start/stop purposes. Default value:

```
lock_file=/var/nagios/nagios.lock
```

log_archive_path

The archive directory for rotating Nagios log files. Evaluations are based on the archive files copied there. If one of the files is deleted, the information contained in it is lost. Nagios uses the directory only if log rotation is enabled with the ⇒*log_rotation_method* parameter. Default value:

```
log_archive_path=/var/nagios/archives
```

log_event_handlers

Should event handler actions appear in the log file? The parameter is used primarily to search for errors. Default value:

```
log_event_handlers=1
```

log_external_commands

Should Nagios log external commands (see Section 13.1, page 240) in the log file? Default value:

```
log_external_commands=1
```

log_file

The central log file. Apart from errors and problems, it also retains all events. All history evaluations use this file. For log rotation, Nagios provides a separate mechanism, with ⇒*log_rotation_method*, and you should not use external programs here. Default value:

```
log_file=/var/nagios/nagios.log
```

log_host_retries

Specifies whether Nagios should log host check repeats because of an error state. This is absolutely essential if event handlers (see Appendix B, page 409) are used which are to react to soft states. Default value:

```
log_host_retries=0
```

log_initial_states

Specifies whether the start state of services and hosts should appear in the log file when the Nagios system is started. Default value:

```
log_initial_states=0
```

log_notifications

Defines whether Nagios should also log notifications in the log file. Default value:

```
log_notifications=1
```

log_passive_checks

Specifies whether Nagios should log passive checks in the log file. Default value:

```
log_passive_checks=1
```

log_rotation_method

Defines whether the log file ⇒*log_file* should be saved periodically to the archive ⇒*log_archive_path*. Log rotating should always be left to Nagios itself, rather than any external programs, or otherwise the software will have difficulties in evaluating history data. Possible values are n (*none*, no archiving), h (*hourly*, at the beginning of each hour), d (*daily*, each day at 00:00 hours), w (*weekly*, at midnight from Saturday to Sunday), and m (*monthly*, the first day of each month at 00:00 hours). Default:

```
log_rotation_method=n
```

log_service_retries

Should Nagios log the repeat of a service check because of a soft state error? This is useful for debugging when developing event handlers, but otherwise it is best to leave this out. Default value:

```
log_service_retries=0
```

low_host_flap_threshold

Lower limit for flap detection for hosts checks. Details are described in Appendix A, page 401. Default value:

```
low_host_flap_threshold=20.0
```

low_service_flap_threshold

Like low_host_flap_threshold, but for service checks. Default value:

```
low_service_flap_threshold=20.0
```

max_concurrent_checks

Specifies how many checks Nagios may execute simultaneously. The value 0 allows an unlimited number. A restriction through a value larger than zero may, under unfavorable circumstances, lead to the test not being executed in time. Default value:

```
max_concurrent_checks=0
```

max_host_check_spread

At what time interval (in minutes) should Nagios have started all host checks after a restart? Prevents all tests from being executed simultaneously, which would overload the Nagios server. Default value:

```
max_host_check_spread=30
```

max_service_check_spread

Like max_host_check_spread, but for service checks. Default value:

```
max_service_check_spread=30
```

nagios_group

The group with whose permissions the Nagios daemon runs. Default value (is defined during compilation):

```
nagios_group=nagios
```

nagios_user

The user with whose permissions the Nagios daemon runs. Default value (is defined during compilation):

```
nagios_user=nagios
```

notification_timeout

After how many seconds should Nagios abort the attempt to deliver a notification? Some actions, such as sending an SMS message, require a certain amount of time, since the system first waits for confirmation from the recipient. The value should therefore not be too low. Default value:

```
notification_timeout=30
```

object_cache_file

The file in which Nagios stores all objects after it starts. Since the Web interface uses this file, the normal configuration files with the object definitions can be edited while Nagios is running, without jeopardizing the functionality of the Web interface. Default value:

```
object_cache_file=/var/nagios/objects.cache
```

obsess_over_host

Defines in general whether host check results are forwarded to a central Nagios instance. If the parameter is enabled, the command defined in ⇒*ocsp_command* is run. This is used in distributed environments; a description can be found in Chapter 15, page 265. Default value:

```
obsess_over_host=0
```

obsess_over_services

Defines in general whether service check results should be forwarded to a central Nagios instance. If the parameter is enabled, the command defined in ⇒*ohcp_command* is used. This feature is used in distributed environments (see Chapter 15, page 265). Default value:

```
obsess_over_services=0
```

ochp_command

Defines the *obsessive compulsive host processor*, a Nagios command object that forwards all host check results in a distributed environment to a central instance (see Chapter 15, page 265). Example (no default value set):

```
ochp_command=name_of_the_command_object
```

ochp_timeout

Defines the timeout for the ⇒*ochp_command*. After this time has expired, Nagios aborts the execution of the command. Default value:

```
ochp_timeout=15
```

ocsp_command

Specifies the command object that, as the *obsessive compulsive service processor*, should forward all service check results in a distributed environment to a central instance (see Chapter 15, page 265). Example (no default value set):

```
ocsp_command=name_of_the_command_object
```

ocsp_timeout

The timeout for the ⇒*ocsp_command*. After the time specified here has expired, Nagios aborts the execution of the command. Default value:

```
ocsp_timeout=15
```

perfdata_timeout

Defines after how many seconds a performance command (⇒*host_perfdata_command*, ⇒*service_perfdata_command*, ⇒*host_perfdata_file_processing_command* or ⇒*service_perfdata_file_processing_command*) should be aborted. Default value:

```
perfdata_timeout=5
```

process_performance_data

Switches on processing of performance data. This parameter should be enabled only if performance data really is evaluated. Otherwise it only uses up resources on the Nagios server. Default value:

```
process_performance_data=0
```

resource_file

The configuration file containing the definitions of the (maximum of 32) $USER*x*$ macros. $USER1$ normally specifies the path to the Nagios plugins. Otherwise you could save passwords here, for example, which should not be readable in the normal Nagios configuration files. The file must then be protected from all external access, and only the user **nagios** should be able to read it. Example (no default value set):

```
resource_file=/etc/nagios/resource.cfg
```

retain_state_information

Determines whether Nagios will save current states to a file on shutdown (⇒*state_retention_file*) and read these again when it starts. Default value:

```
retain_state_information=0
```

retention_update_interval

Every how many minutes should Nagios store current state information in the ⇒*state_retention_file*? With a value of 0, the system only saves information if Nagios is shut down. The parameter ⇒*retain_state_information* must be enabled for this. Default value:

```
retention_update_interval=60
```

service_check_timeout

Number of seconds after which Nagios aborts a service check if this has not returned a result by then. Default value:

```
service_check_timeout=60
```

service_freshness_check_interval

Interval between two freshness checks in seconds. Default value:

```
service_freshness_check_interval=60
```

service_inter_check_delay_method

Controls how Nagios processes service checks after a restart. An "intelligent" procedure should prevent them from all starting at the same time, to avoid putting an unnecessary load on the server. Possible values are s (*smart*, automatic distribution), n (*no*, start all tests simultaneously!), d (*dumb*, one second interval between checks), as well as an explicitly specified interval in seconds, in the form *x.xx*. Default value:

```
service_inter_check_delay_method=s
```

service_interleave_factor

Prevents the checks accumulating for a specific host from being executed at the same time (⇒*max_concurrent_checks*, 435), through Nagios distributing the planned checks for all hosts "intelligently" over a period of time. Possible values are s (*smart*, automatic distribution) or an integer larger than 0. With a value of 1, Nagios does not carry out any distribution, with a value of 4, Nagios initially plans every fourth service check (that is, from the amount of intended checks, the 1st, 5th, 9th, etc.), then the following number (that is, the 2nd, 6th, 10th, etc.), and so on. The test sequence is shown by the **Service Detail** item in the Web interface. In case of doubt, the default value can be left as it is:

```
service_interleave_factor=s
```

service_perfdata_command

The Nagios command object that is run after each service check to process performance data. A requirement for this is that ⇒*process_performance_data* must be set.

The parameter is used if the performance data is to be processed without a template (Section 17.1, page 314). Example (no default value set):

```
service_perfdata_command=process-service-perfdata
```

service_perfdata_file

Path to the file or named pipe through which Nagios forwards performance data from service checks via a template mechanism to an external program. This only works if ⇒*process_performance_data* is set. More on processing performance data in Chapter 17, page 313. Example (no default value set):

```
service_perfdata_file=/tmp/service-perfdata
```

service_perfdata_file_mode

Defines the mode in which data is passed on to ⇒*service_perfdata_file*. Possible values are a (*append*, append to a normal file) or w (*write*, write to a named pipe). Example (no default value):

```
service_perfdata_file_mode=a
```

service_perfdata_file_processing_command

A command object that is executed after Nagios has passed on service performance data to the ⇒*service_perfdata_file*. The parameter is optional and is only used together with the template mechanism. As long as programs that further process the data, such as perf2rrd (Section 17.3, page 325), include their own service that permanently reads out the service_perfdata_file, you can manage without defining a command for reading out. See also Chapter 17, page 313. Example (no default value set):

```
service_perfdata_file_processing_command=process-service-perfdata-file
```

service_perfdata_file_processing_interval

Interval in seconds in which the command defined in ⇒*service_perfdata_file_processing_command* is periodically run. Setting the value 0 ensures that it is never used. Example (no default value set):

```
service_perfdata_file_processing_interval=0
```

service_perfdata_file_template

The output format for performance data; Nagios macros and format details such as \t (tabulator) or \n (linefeed) are substituted in the output. See also Section 17.1, page 314. Example (no default value set):

```
service_perfdata_file_template=$TIMET$\t$HOSTNAME$\t$SERVICEDESC$\t\
   $SERVICEEXECUTIONTIME$\t$SERVICELATENCY$\t$SERVICEOUTPUT$\t\
   $SERVICEPERFDATA$
```

service_reaper_frequency

Every how many seconds should Nagios process accumulated service test results? Default value:

```
service_reaper_frequency=10
```

sleep_time

Pause in seconds for which Nagios waits before searching again in the scheduling queue for checks to be performed. Default value:

```
sleep_time=0.5
```

state_retention_file

The file in which Nagios stores status information on shutdown, and from which the information is read in again when Nagios is started. This is used only if the ⇒*retain_state_information* parameter is set. Default value:

```
state_retention_file=/var/nagios/retention.dat
```

status_file

Path to the file in which Nagios saves all current status values and from which the Web interface retrieves them. Default value:

```
status_file=/var/nagios/status.dat
```

status_update_interval

At what interval should Nagios store status values in the file ⇒*status_file*? If ⇒*aggregate_status_updates* is not set, the system ignores this parameter and immediately writes the status values to this file (not recommended). Default value:

```
status_update_interval=60
```

temp_file

Path to a temporary file that Nagios uses if necessary, and deletes each time when it no longer requires it. Default value:

```
temp_file=/var/nagios/tempfile
```

use_regexp_matching

Defines whether the wildcards * (any character) and ? (a single character) are allowed in object definitions. If you want to work with regular expressions, ⇒*use_true_regexp_matching* must be used. Default value:

```
use_regexp_matching=0
```

use_retained_program_state

Should changes to the parameters ⇒*enable_notifications*, ⇒*enable_flap_detection*, ⇒*enable_event_handlers*, ⇒*execute_service_checks* and ⇒*accept_passive_service_checks* on the Web interface survive a Nagios restart? Only works if ⇒*retain_status_information* is enabled. Default value:

```
use_retained_program_state=1
```

use_retained_scheduling_info

Should Nagios save current scheduling information on shutdown so it can read it in again when it restarts? You can temporarily disable the parameter if you are adding a large number of tests; otherwise it is sensible to keep it enabled. Default value:

```
use_retained_scheduling_info=1
```

use_syslog

Ensures logging of all Nagios activities in the syslog. Default value:

```
use_syslog=1
```

use_true_regexp_matching

In contrast to ⇒*use_regexp_matching*, allows the use of real regular expressions in accordance with the POSIX standard.[1] Default value:

```
use_true_regexp_matching=0
```

[1] See man 7 regex.

D.2 CGI Configuration in cgi.cfg

D.2.1 Authentication parameters

Through the contact and the contact group, Nagios allocates responsibilities to users from which permissions for the Web interface can likewise be inferred: each contact may normally only see those hosts and services for which he is also responsible. This is why the name of the Web login must match the contact name.

The parameters listed below work around this concept to some extent. They are not intended to solve problems, however, caused by contact and Web user names not matching.

cmduse_authentication

Determines whether you normally need to log in to the Web interface. Like the username, the contact name is always used; how you store passwords is described in Section 1.3, page 33.

In general you should never permit this authentication, but if you do, you should make sure that the interface for external commands (Section 13.1, page 240) is switched off completely. Default:

```
use_authentication=1
```

authorized_for_all_host_commands

Allows the users specified here to run commands through the Web interface for all hosts, without them belonging to the appropriate contact group. Example (no default value set):

```
authorized_for_all_host_commands=nagiosadmin
```

authorized_for_all_hosts

Allows the users specified here to look at all host information, irrespective of their actual responsibility. Example (no default value set):

```
authorized_for_all_hosts=nagiosadmin,guest
```

authorized_for_all_service_commands

Allows the users defined here to run commands for all services via the Web interface, independently of membership of contact groups. Example (no default value set):

```
authorized_for_all_service_commands=nagiosadmin
```

authorized_for_all_services

Allows the users specified to view all service information, irrespective of their own permissions. Example (no default value set):

```
authorized_for_all_services=nagiosadmin,guest
```

authorized_for_configuration_information

Enables the users specified to view all configuration data via the Web interface. This should be reserved for the Nagios administrators. Example (no default value set):

```
authorized_for_configuration_information=nagiosadmin,jdoe
```

authorized_for_system_commands

Allows the specified users to shut down or restart Nagios via the Web interface. Normally, nobody has this authorization. Example (no default value set):

```
authorized_for_system_commands=nagiosadmin
```

authorized_for_system_information

Allows the specified users to view Nagios process information. Normally, nobody may do this. Example (no default value set):

```
authorized_for_system_information=nagiosadmin,theboss,jdoe
```

D.2.2 Other Parameters

default_statusmap_layout

Defines the layout for the status map. Possible values are 0 (coordinates defined through a hostextinfo object), 1 (the user must move by mouse click from one layer to the next one), **2** (compressed tree—somewhat confusing, because branches cut across each other in the picture), **3** (balanced tree, the branches are displayed so that there are no crossovers in the graphic—clearer, but requires much space), **4** (circular representation, with Nagios at the center: hosts that can be reached directly[2] are shown in the inner circle, while on other circles are located those hosts that can be reached from hosts already entered in the graphic), **5** (circular, like **4**; the area around the host is marked in color—gray for OK, red for DOWN or UNREACHABLE; Figure D.26 on page 291 shows an example), and **6** (circular; the hosts are shown as balloons). The settings can also be changed in the Web interface without the need to adjust the configuration file each time, which makes it easier to try things out. Example:

```
default_statusmap_layout=5
```

default_statuswrl_layout

Determines the layout for the VRML representation of the status page through **statuswrl.cgi**. Possible values are **0**, **2**, **3**, and **4**; the corresponding appearance is based on the values of the same name for ⇒***default_statusmap_layout***. Example:

```
default_statuswrl_layout=4
```

default_user_name

Name of a guest user who may use the Web pages without authentication. You should only use this parameter if the Web server is protected from unauthorized access, and you should look closely at what permissions this user is allocated through the contact groups. Example (no default value set):

```
default_user_name=guest
```

main_config_file

The Nagios main configuration file. Default value:

```
main_config_file=/etc/nagios/nagios.cfg
```

[2] That is, without the "diversion" via **parents**.

nagios_check_command

A command that checks the status of the Nagios daemons. You can omit this parameter, since the CGI programs already contain an equivalent built-in function. If Nagios is not running, they issue a corresponding error message. If you still want to define a separate command here, you can use the plugin **check_nagios** (Section 7.11, page 150):

```
nagios_check_command=/usr/local/nagios/libexec/check_nagios
    -F /var/nagios/nagios.log -e 60 -C /usr/local/nagios/bin/nagios
```

physical_html_path

Path in the file system that leads to the Nagios directory for documentation and images. See also ⇒*url_html_path*. Default value:

```
physical_html_path=/usr/local/nagios/share
```

refresh_rate

Specifies at what intervals the Web page is automatically updated. Default value:

```
refresh_rate=60
```

statusmap_background_image

The background image for the status map display. Example (no default value set):

```
statusmap_background_image=smbackground.gd2
```

statuswrl_include

A file with its own VRML objects used in the VRML representation. The path is specified relative to ⇒*html_physical_path*. Example (no default value set):

```
statuswrl_include=myworld.wrl
```

url_html_path

The logical path to the Nagios documents and images from the point of view of the browser, starting from the document root of the Web server. If you use this path in an URL, you will be taken to the Nagios start page. Default value:

```
url_html_path=/nagios
```

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