

# A Xen Virtual Machine Monitor Plugin for Nagios

Prepared By Axel Schmidt <[axel.schmidt@novell.com](mailto:axel.schmidt@novell.com)>  
Version 1.0  
02 August, 2007

## INTRODUCTION

This document describes a Nagios plugin – a “Xen Virtual Machine Monitor” which can be easily integrated in an existing [Nagios](#) system environment.

[SUSE Linux Enterprise Server](#) (SLES10) features Server Virtualization with [Xen](#). When using “Xen paravirtualization or full virtualization” in the Data Center for Server Consolidation, one will discover soon the powerful Xen option of migrating Xen virtual machines (VMs) from one physical server to another. Furthermore when using “Xen Live Migration” Xen VMs can be moved under fully load from one machine to another, while the services on the VM keeps running without noticeable interruption for the users.

Migrating Xen VMs between physical servers requires new management and monitoring tools when server virtualization is used within the Data Center. According to Novell's vision of Data Center Automation the [Novell ZENworks Orchestrator](#) is the answer and the solution for Xen Management and Monitoring within the enterprise. ZENworks Orchestrator serves as the "brain" that allows policy-based automation, that automates the process of deploying and managing virtual data center assets, as well as dynamically provisioning workloads and ensuring business continuity.

The described Nagios plugin for Xen does not eliminate the need of a Xen Management tool, when using several Xen Servers running multiple Xen VMs each in your enterprise. It just provides a view on the Xen Host Servers to know where your Xen VMs are actual running. According to the Nagios functionality defining up to three return values, you are able to define a minimum number of running Xen VMs, which are expected to run in the productive Xen system environment on the Xen Hypervisors – the physical SLES10 servers. Depending on the configured values for the “Xen Virtual Machine Monitor” plugin, Nagios displays green (OK), yellow (WARNING) or red (CRITICAL) status, when using the Nagios Web interface as shown below.

The screenshot displays the Nagios web interface in a Mozilla Firefox browser window. The URL is <http://192.168.130.223/nagios/>. The interface shows a sidebar with navigation options like 'General', 'Monitoring', 'Reporting', and 'Configuration'. The main content area displays a table of monitoring data for various hosts and services.

Host	Service	Status	Last Check	Next Check	Output
webprod03	Check Users	OK	01-26-2007 14:58:59	0d 4h 53m 23s	1/4 USERS OK - 1 users currently logged in
	Current Load	OK	01-26-2007 14:59:54	0d 4h 53m 23s	1/4 OK - load average: 0.21, 0.08, 0.05
	Memory Usage	OK	01-26-2007 14:55:29	0d 4h 53m 23s	1/4 OK: Memory Usage 56% - Total: 511 MB, Used: 287 MB, Free: 224 MB
	PING	OK	01-26-2007 14:56:14	0d 4h 50m 33s	1/4 PING OK - Packet loss = 0%, RTA = 0.16 ms
	Root Partition	OK	01-26-2007 14:57:09	0d 4h 50m 33s	1/4 DISK OK [243816 kB (5%) free on /dev/sda2]
	SWAP Usage	OK	01-26-2007 14:57:44	0d 4h 50m 33s	1/4 Swap ok - (null) 0% (0 out of 16385)
	Total Processes	OK	01-26-2007 14:58:29	0d 4h 50m 33s	1/4 OK - 95 processes running
Xen Virtual Machine Monitor	CRITICAL	01-26-2007 14:59:04	0d 4h 44m 34s	4/4 Critical Xen VMs Usage - Total NB: 0 - detected VMs:	
webprod04	Check Users	OK	01-26-2007 14:59:54	0d 4h 15m 33s	1/4 USERS OK - 2 users currently logged in
	Current Load	OK	01-26-2007 14:55:34	0d 4h 14m 53s	1/4 OK - load average: 0.30, 0.60, 0.44
	Memory Usage	OK	01-26-2007 14:56:19	0d 4h 14m 13s	1/4 OK: Memory Usage 37% - Total: 511 MB, Used: 190 MB, Free: 321 MB
	PING	OK	01-26-2007 14:57:10	0d 4h 13m 23s	1/4 PING OK - Packet loss = 0%, RTA = 0.27 ms
	Root Partition	OK	01-26-2007 14:57:49	0d 4h 12m 43s	1/4 DISK OK [2848940 kB (94%) free on /dev/sda2]
	SWAP Usage	OK	01-26-2007 14:58:34	0d 4h 11m 53s	1/4 Swap ok - (null) 0% (0 out of 16386)
	Total Processes	OK	01-26-2007 14:59:09	0d 4h 16m 22s	1/4 OK - 250 processes running
Xen Virtual Machine Monitor	WARNING	01-26-2007 14:58:54	0d 4h 1m 33s	4/4 Warning Xen VMs Usage - Total NB: 1 - detected VMs: migrating-xen-vm4	
webprod05	PING	OK	01-26-2007 14:55:39	0d 4h 24m 58s	1/4 PING OK - Packet loss = 0%, RTA = 0.25 ms
	Xen Virtual Machine Monitor	OK	01-26-2007 14:59:54	0d 4h 0m 33s	1/4 OK: Xen Hypervisor "webprod05" is running 4 Xen VMs: xen-vm1 xen-vm2 xen-vm3 xen-vm4
xen-vm1	Check Users	OK	01-26-2007 14:58:09	0d 4h 17m 23s	1/4 USERS OK - 1 users currently logged in
	Current Load	OK	01-26-2007 14:57:54	0d 3h 17m 21s	1/4 OK - load average: 1.54, 1.09, 0.48
	Memory Usage	OK	01-26-2007 14:58:39	0d 3h 15m 41s	1/4 OK: Memory Usage 8% - Total: 8195 MB, Used: 676 MB, Free: 7519 MB
	PING	OK	01-26-2007 14:59:15	0d 3h 15m 21s	1/4 PING OK - Packet loss = 0%, RTA = 0.49 ms
	Root Partition	OK	01-26-2007 14:59:59	0d 3h 14m 51s	1/4 DISK OK [4196280 kB (99%) free on udev]
	SWAP Usage	OK	01-26-2007 14:55:44	0d 3h 14m 1s	1/4 Swap ok - (null) 0% (0 out of 2055)
	Total Processes	OK	01-26-2007 14:57:29	0d 4h 18m 3s	1/4 OK - 88 processes running
xen-vm2	Check Users	OK	01-26-2007 14:57:15	0d 3h 7m 41s	1/4 USERS OK - 0 users currently logged in
	Current Load	OK	01-26-2007 14:57:59	0d 3h 7m 1s	1/4 OK - load average: 0.00, 0.00, 0.00
	Memory Usage	OK	01-26-2007 14:58:44	0d 3h 6m 21s	1/4 OK: Memory Usage 6% - Total: 1023 MB, Used: 64 MB, Free: 959 MB
	PING	OK	01-26-2007 14:59:19	0d 4h 48m 14s	1/4 PING OK - Packet loss = 0%, RTA = 0.43 ms
	Root Partition	OK	01-26-2007 15:00:05	0d 1h 15m 4s	1/4 DISK OK [524220 kB (99%) free on udev]
	SWAP Usage	OK	01-26-2007 14:55:49	0d 3h 9m 41s	1/4 Swap ok - (null) 0% (0 out of 2055)
	Total Processes	OK	01-26-2007 14:56:34	0d 3h 9m 1s	1/4 OK - 52 processes running

## XEN VIRTUAL MACHINE MONITOR

The Nagios plugin `check_xenvm` is based of a simple shell script which performs the “`xm list`” command and returns the Xen VM names back to Nagios. The script should be self-explanatory for everybody, so feel free to adapt it to your own needs and flavor. The input and return values of `check_xenvm` correspond to the common used Nagios plugin interface, where the plugin can be called with a threshold to trigger a warning or critical message, which is returned by the Nagios plugin when the check on the server was performed.

Here is a sample output of the “`xm list`” command:

```
# xm list
Name                ID Mem(MiB) VCPUs State  Time(s)
Domain-0            0  256      1 r----- 742.1
xen-vm1             1  512      2 ----- 824.5
xen-vm2             2  256      2 ----- 660.6
```

When installing `check_xenvm` on your servers, you will of course only run the plugin on the physical servers and not on the Xen VMs.

**Note:** According to your Nagios configuration you need to check as which user nagios, and if used the `nrpe` daemon runs on your system. Normally you will run Nagios as user nagios. The point is that the `check_xenvm` plugin executes the Xen command “`xm list`” which needs to be run with `root` permissions, otherwise the plugin will fail. For further information see section “**Editing Sudoers**”.

## CHECK\_XENVM PLUGIN

The `check_xenvm` Nagios plugin is shown below in this section. Just copy & paste the shell script and put the plugin below the path `/usr/lib/nagios/plugins`.

Here is an overview about the necessary steps:

- Login as root
- e.g. “`vi /usr/lib/nagios/plugins/check_xenvm`”
- cut and paste the following lines below
- save file
- `chmod 755 /usr/lib/nagios/plugins/check_xenvm`

```
#!/bin/sh
#
# COPYRIGHT      : (c) 2006 SUSE Linux GmbH. All rights reserved.
#
# AUTHOR        : Axel Schmidt <axel.schmidt@novell.com>
#
# BELONGS TO    : NLPOS/SLEPOS/Xen Nagios Integration
#
# DESCRIPTION   : Runs "xm list" and returns the available xen vms
#
# $Revision: 1.0 $
#
# Permission to use, copy, modify, distribute, and sell this software
# and its documentation for any purpose is hereby granted without fee,
# provided that the above copyright notice appear in all copies and that
```

```

# both that copyright notice and this permission notice appear in
# supporting documentation.

# The above copyright notice and this permission notice shall be
# included in all copies or substantial portions of the Software.

# THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND,
# EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF
# MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT.
# IN NO EVENT SHALL THE AUTHOR OR SUSE BE LIABLE FOR ANY CLAIM, DAMAGES
# OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR
# OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR
# THE USE OR OTHER DEALINGS IN THE SOFTWARE.

PARM1=$1
WARN=$2
PARM2=$3
CRIT=$4

if [ "$PARM2" != "-c" -o "$CRIT" == "" ]; then
    echo "Usage: $0 -w <warning> -c <critical>"
# Nagios exit code 3 = status UNKNOWN = orange

if [ "$PARM1" != "-h" ]; then
    exit 3
else
    echo ""
    echo " -w = Minimum Number of Xen VMs to activate a warning message."
    echo " -c = Number of Xen VMs to activate a critical message."
    echo " -h = This help message."
    exit 3
fi
fi

RUNNING=$(sudo /usr/sbin/xm list | awk '!/[DN]/ {print $1 }')
NBVMS=$(echo $RUNNING | wc -w)
HNAME=$(hostname)

#echo "Xen Running =" $RUNNING

if [ "$NBVMS" -le "$CRIT" ]; then
    echo "Critical Xen VMs Usage - Total NB: $NBVMS - detected VMs: $RUNNING"
# Nagios exit code 2 = status CRITICAL = red
    exit 2
else if [ "$NBVMS" -le "$WARN" ]; then
    echo "Warning Xen VMs Usage - Total NB: $NBVMS - detected VMs: $RUNNING"
# Nagios exit code 1 = status WARNING = yellow
    exit 1
else
    echo "OK: Xen Hypervisor \"$HNAME\" is running Xen VMs: $RUNNING"
# Nagios exit code 0 = status OK = green
    exit 0
fi
fi

```

## CHECK\_XENVM CONFIGURATION

The Nagios plugin for Xen is designed to run on the Xen Hypervisor the physical Xen servers to monitor the running Xen VMs. Therefore we have to add the `check_xenvm` service to the corresponding Nagios configuration files for all physical servers while monitoring all Xen available machines with Nagios. The Nagios configuration files are located below the path `/etc/nagios`.

Example entry for `/etc/nagios/checkcommands.cfg`:

```
# added for Xen VM Monitoring

define command{
    command_name    check_xen_vm
    command_line    $USER1$/check_xenvm -w $ARG1$ -c $ARG2$
}
```

Example entry for `/etc/nagios/services.cfg`:

```
define service{
    use                generic-service
    host_name          localhost
    service_description Xen Virtual Machine Monitor
    is_volatile        0
    check_period        24x7
    max_check_attempts 4
    normal_check_interval 5
    retry_check_interval 1
    contact_groups     admins
    notification_options w,u,c,r
    notification_interval 60
    notification_period 24x7
    check_command       check_xen_vm!2!0
}
```

or when using the Nagios Remote Plugin Executor (NRPE):

```
define service{
    use                generic-service
    host_name          webprod02.mydomain.com,
                     webprod03.mydomain.com,
                     webprod04.mydomain.com,
                     webprod05.mydomain.com

    service_description Xen Virtual Machine Monitor
    is_volatile        0
    check_period        24x7
    max_check_attempts 4
    normal_check_interval 5
    retry_check_interval 1
    contact_groups     admins
    notification_options w,u,c,r
    notification_interval 960
    notification_period 24x7
    check_command       check_nrpe!check_xen
}
```

Example entry for `/etc/nagios/nrpe.cfg`:

```
command[check_xen]=/usr/lib/nagios/plugins/check_xenvm -w 2 -c 0
```

## EDITING SUDOERS

The “sudo” configuration file specifies what a user may execute as another user and can be used for adding system function calls like “/usr/sbin/xm list” that requires root permissions. After sudoers is configured, the user, e.g. nagios may execute “sudo /usr/sbin/xm list” without being asked to type in the root password. Adapt the sudoers entry to your Nagios or NRPE configuration!

To edit /etc/sudoers perform the following steps:

- Login as root
- Execute: visudo<sup>1</sup>
- Add the following line:  

```
nagios    ALL=(ALL)        NOPASSWD:/usr/sbin/xm list
```
- Save changes and exit visudo

## TESTING THE NAGIOS PLUGIN

Here is a short summary of the necessary steps needed to run the Nagios plugin for Xen within your Nagios system environment:

- Provide the Nagios plugin /usr/lib/nagios/plugins/check\_xenvm on all Xen Host servers.
- Edit the Nagios configuration files below /etc/nagios to provide check\_xenvm as monitoring service for all Xen Host server.
- Edit /etc/sudoers to allow your Nagios and/or NRPE daemon to execute the “xm list” command.
- Restart the Nagios and/or NRPE daemon to activate your changes:  

```
/etc/init.d/nagios restart
```

```
/etc/init.d/nrpe restart
```
- Launch the nagios GUI at <http://<Nagios Server IP address>/nagios/>
- **Have fun!**

## XEN MIGRATING MONITORING EXAMPLES

The picture below demonstrate the Nagios monitoring view, when the two Xen virtual machines xen-vm1 and xen-vm4 are migrating from the Xen Server webprod04 to webprod05.

Note that the check\_xenvm command is only executed every 5 minutes as configured in the Nagios services.cfg file. Therefore the “xm top” display from webprod04 of the first screenshot below only shows the remaining xen\_vm4 machine, before it was finally moved and migrated to webprod05. The “xm top” display from webprod05 shows all available Xen VMs (xen-vm1 to xen\_vm4), where xen\_vm4 is shown in the state paused (p) and the other Xen VMs are in the state running (r) or blocked (b = the vcpu is awaiting for an external event to happen).

---

<sup>1</sup> Do not use “vi /etc/sudoers”, it is recommended to use “visudo” for editing sudoers.

**axels@scoobie:~ - webprod04 - Konsole**

Sitzung Bearbeiten Ansicht Lesezeichen Einstellungen Hilfe

```

xenoprt - 10:18:04 Xen 3.0.2_09763-0.0
2 domains: 1 running, 1 blocked, 0 paused, 0 crashed, 0 dying, 0 shutdown
Mem: 16770560k total, 4957940k used, 11812612k free  CPUs: 16 @ 2932MHz

```

NAME	STATE	CPU(sec)	CPU(%)	MEM(K)	MEM(%)	MAXMEM(K)	NUMMEM(%)	UCRUS	NETS	NETTX(K)	NETRX(K)	SSID
Domain-0	r	1203	95.0	524388	3.1	no limit	n/a	16	8	30477553	31485760	0
xen-vm1	b	182	0.5	4194128	25.0	4282496	25.1	4	1	43	52	0

**axels@scoobie:~ - webprod05 - Konsole**

Sitzung Bearbeiten Ansicht Lesezeichen Einstellungen Hilfe

```

xenoprt - 15:19:28 Xen 3.0.2_09763-0.0
5 domains: 2 running, 2 blocked, 1 paused, 0 crashed, 0 dying, 0 shutdown
Mem: 16770560k total, 1576360k used, 15194200k free  CPUs: 16 @ 2932MHz

```

NAME	STATE	CPU(sec)	CPU(%)	MEM(K)	MEM(%)	MAXMEM(K)	NUMMEM(%)	UCRUS	NETS	NETTX(K)	NETRX(K)	SSID
Domain-0	r	1045	95.5	524536	3.1	no limit	n/a	16	8	31698246	45905942	0
xen-vm1	b	51	0.4	8392488	50.0	8408896	50.1	4	1	9	603104	0
xen-vm2	b	65	0.0	1048352	6.3	1056768	6.3	2	1	38	1476580	0
xen-vm3	r	69	100.0	1048324	6.3	1056768	6.3	2	1	40	2592764	0
xen-vm4	r	0	0.0	4282496	25.1	4282496	25.1	4	1	0	0	0

**axels@scoobie:~ - webprod04 - Konsole**

Sitzung Bearbeiten Ansicht Lesezeichen Einstellungen Hilfe

```

xenoprt - 10:22:16 Xen 3.0.2_09763-0.0
1 domains: 1 running, 0 blocked, 0 paused, 0 crashed, 0 dying, 0 shutdown
Mem: 16770560k total, 761676k used, 16008884k free  CPUs: 16 @ 2932MHz

```

NAME	STATE	CPU(sec)	CPU(%)	MEM(K)	MEM(%)	MAXMEM(K)	NUMMEM(%)	UCRUS	NETS	NETTX(K)	NETRX(K)	SSID
Domain-0	r	1253	0.3	524404	3.1	no limit	n/a	16	8	32297404	31509119	0

**axels@scoobie:~ - webprod05 - Konsole**

Sitzung Bearbeiten Ansicht Lesezeichen Einstellungen Hilfe

```

xenoprt - 15:23:40 Xen 3.0.2_09763-0.0
5 domains: 3 running, 2 blocked, 0 paused, 0 crashed, 0 dying, 0 shutdown
Mem: 16770560k total, 15445180k used, 1325380k free  CPUs: 16 @ 2932MHz

```

NAME	STATE	CPU(sec)	CPU(%)	MEM(K)	MEM(%)	MAXMEM(K)	NUMMEM(%)	UCRUS	NETS	NETTX(K)	NETRX(K)	SSID
Domain-0	r	1674	1.3	524460	3.1	no limit	n/a	16	8	31722764	47730951	0
xen-vm1	r	218	100.5	8392560	50.0	8408896	50.1	4	1	51	603156	0
xen-vm2	b	65	0.0	1048328	6.3	1056768	6.3	2	1	62	1476632	0
xen-vm3	b	130	0.1	1048412	6.3	1056768	6.3	2	1	69	2592820	0
xen-vm4	r	380	103.3	4194160	25.0	4282496	25.1	4	1	44	52	0

The second screenshot demonstrates the result after the `check_xenvm` command was performed again – 5 minutes later. All Xen VMs are shown running (state “r” or “b”) on the webprod05 Xen server VMs. The red critical entries for the servers webprod03 and webprod04 state, that there are actual no Xen VMs running on these servers, assuming when using a Xen virtualization environment, that at least one VM is running on each Xen Hypervisor.