

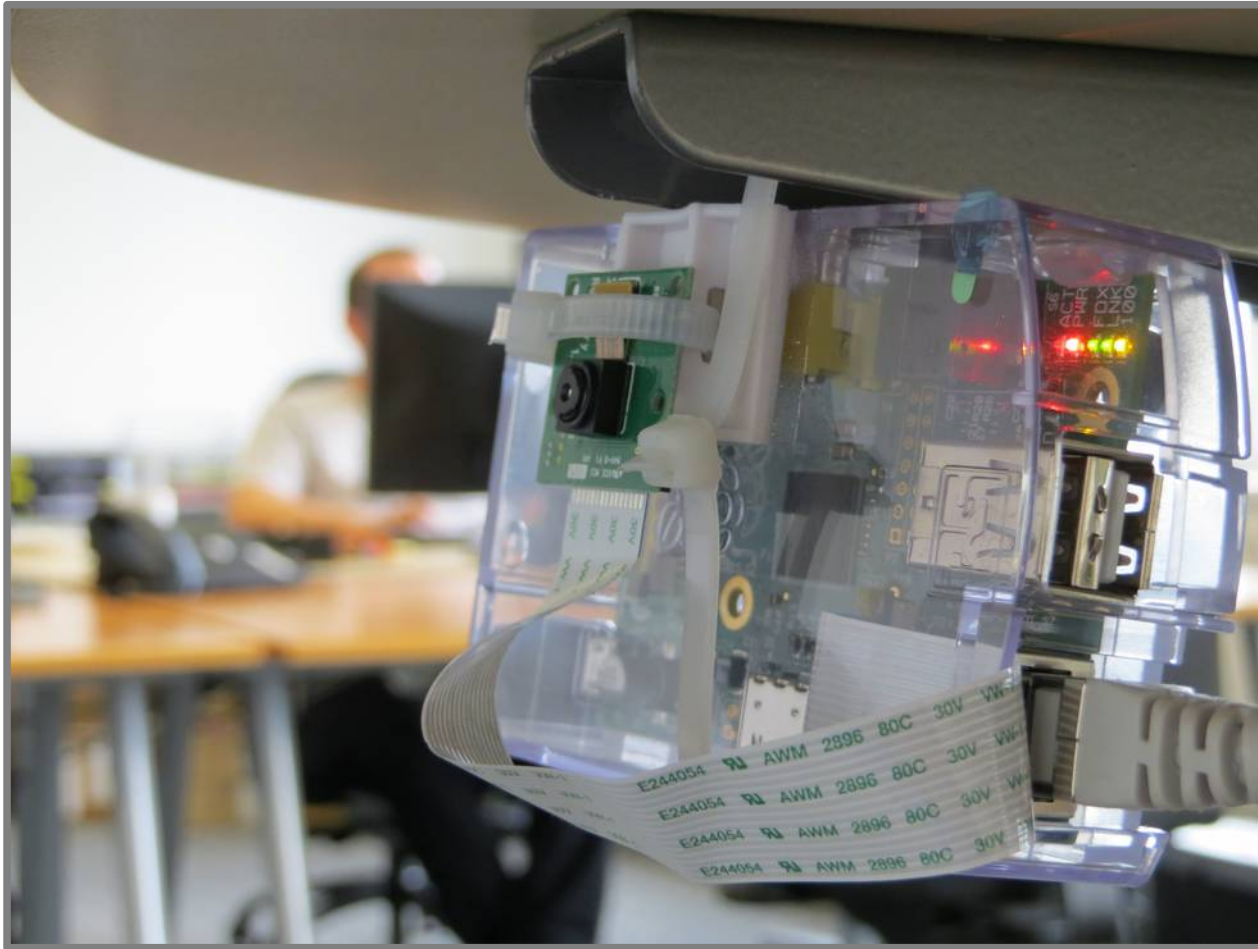
# Hardware-Monitoring bei Thomas-Krenn

*Georg Schönberger, Thomas-Krenn.AG  
20150707*

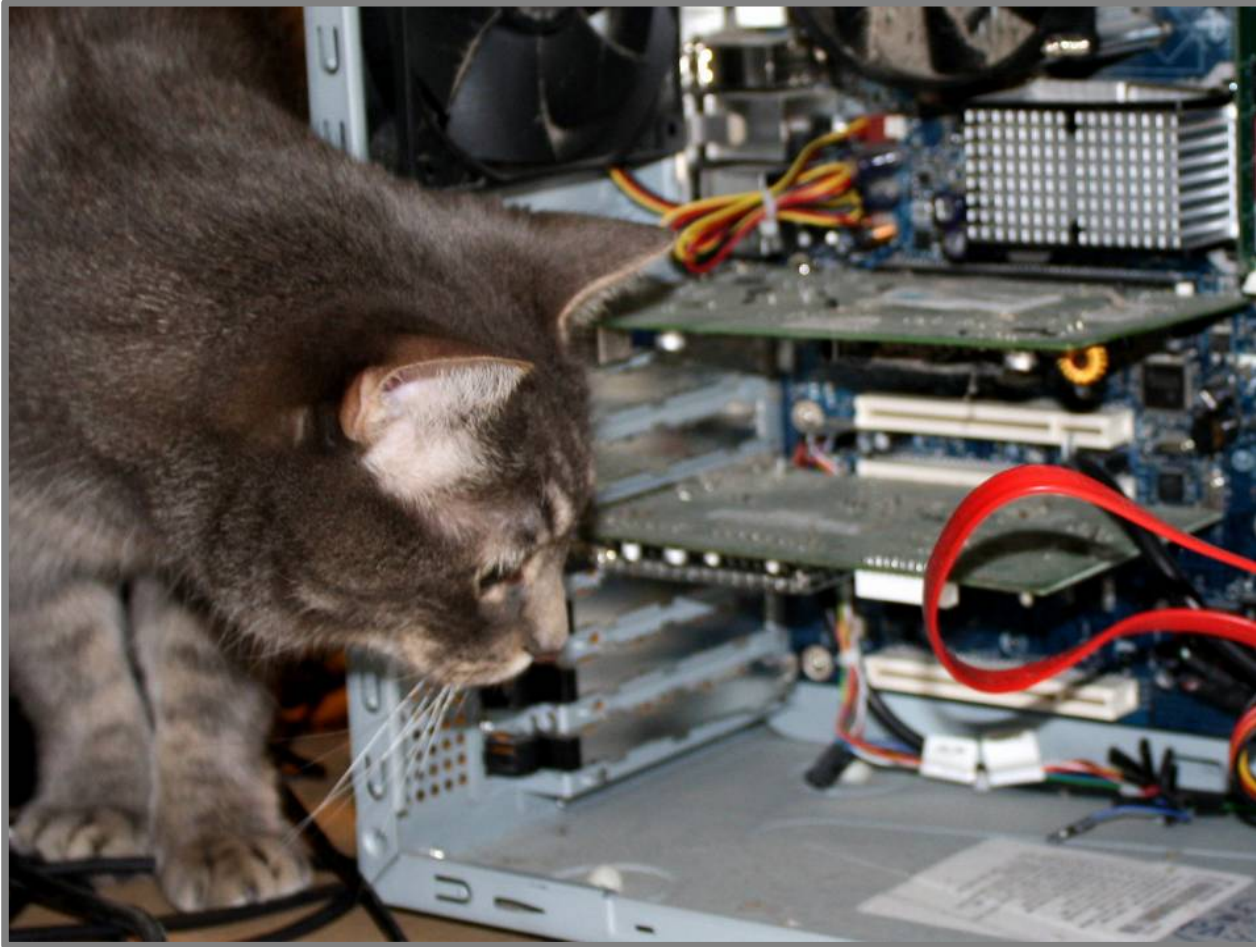


Nach diesem Vortrag  
überwachen Sie **sicherer**  
und **umfangreicher**

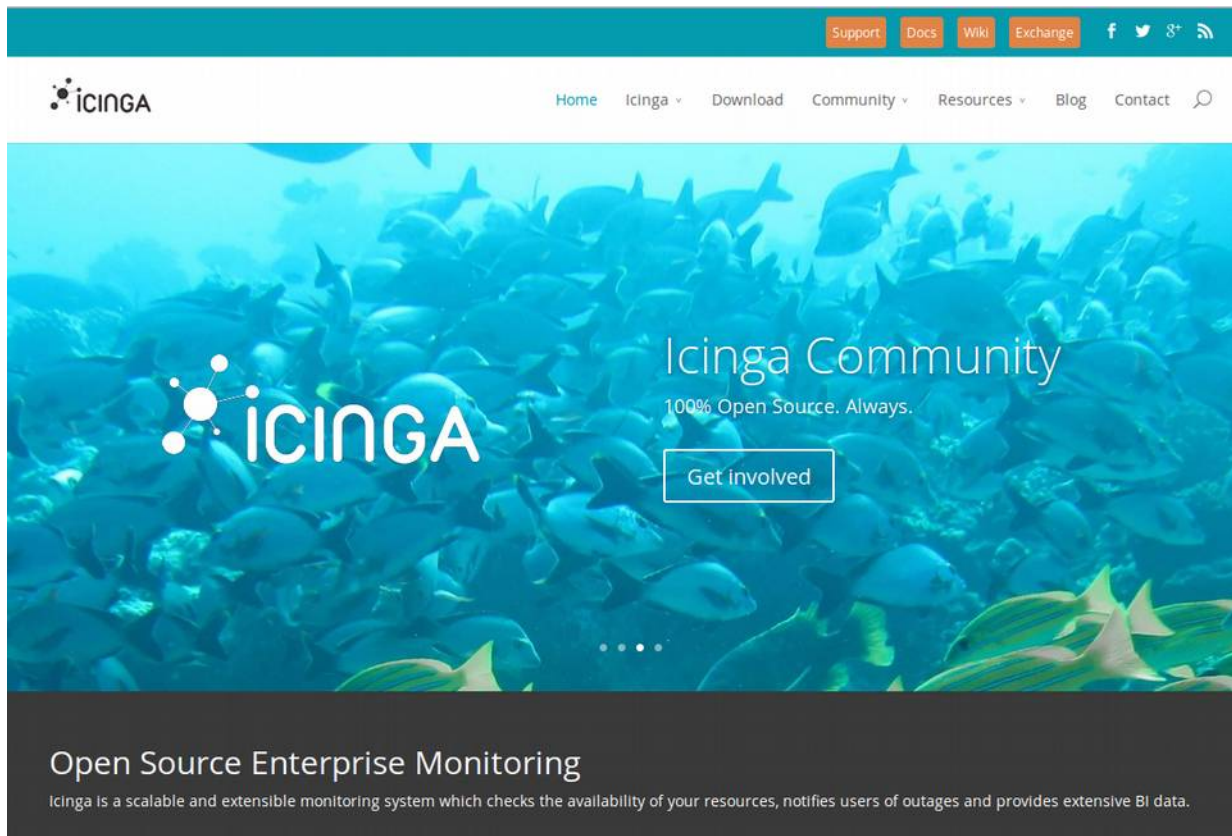
# CAMera



# CATinspection



# Icinga und NETWAYS



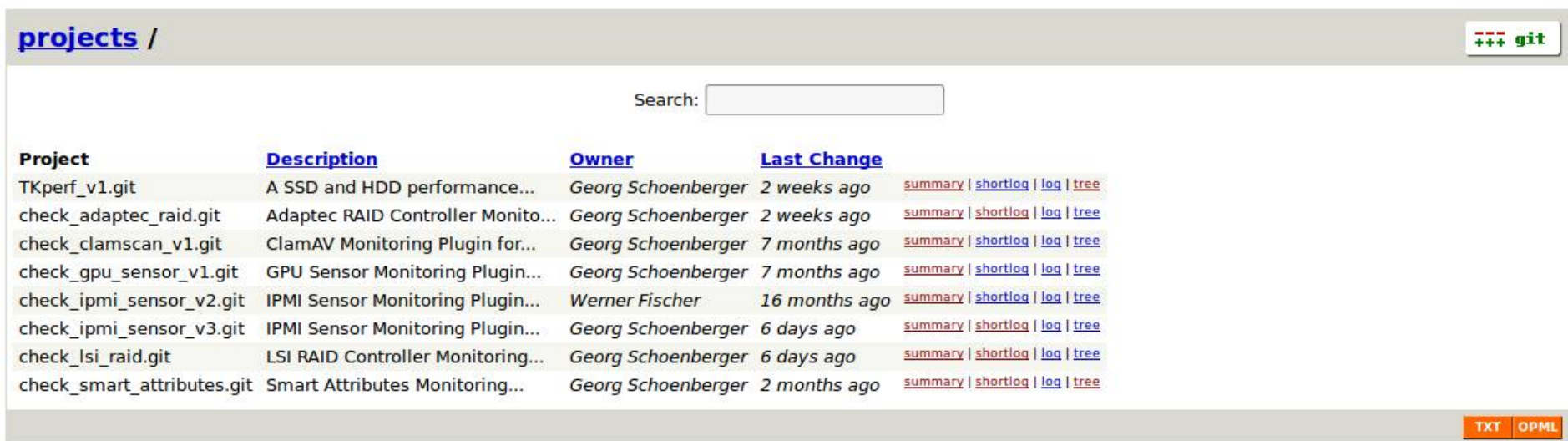
# Agenda


- Plugins bei Thomas-Krenn
  - IPMI
  - SMART
  - RAID
- VMWare
- TKmon
- Fragen und Antworten

# Plugins bei Thomas-Krenn

— Open Source

— <http://git.thomas-krenn.com/>



**projects /** 

Search:

| <b>Project</b>             | <b>Description</b>                | <b>Owner</b>       | <b>Last Change</b> |   |
|----------------------------|-----------------------------------|--------------------|--------------------|---|
| TKperf_v1.git              | A SSD and HDD performance...      | Georg Schoenberger | 2 weeks ago        | <a href="#">summary</a>   <a href="#">shortlog</a>   <a href="#">log</a>   <a href="#">tree</a> |
| check_adaptec_raid.git     | Adaptec RAID Controller Monito... | Georg Schoenberger | 2 weeks ago        | <a href="#">summary</a>   <a href="#">shortlog</a>   <a href="#">log</a>   <a href="#">tree</a> |
| check_clamscan_v1.git      | ClamAV Monitoring Plugin for...   | Georg Schoenberger | 7 months ago       | <a href="#">summary</a>   <a href="#">shortlog</a>   <a href="#">log</a>   <a href="#">tree</a> |
| check_gpu_sensor_v1.git    | GPU Sensor Monitoring Plugin...   | Georg Schoenberger | 7 months ago       | <a href="#">summary</a>   <a href="#">shortlog</a>   <a href="#">log</a>   <a href="#">tree</a> |
| check_ipmi_sensor_v2.git   | IPMI Sensor Monitoring Plugin...  | Werner Fischer     | 16 months ago      | <a href="#">summary</a>   <a href="#">shortlog</a>   <a href="#">log</a>   <a href="#">tree</a> |
| check_ipmi_sensor_v3.git   | IPMI Sensor Monitoring Plugin...  | Georg Schoenberger | 6 days ago         | <a href="#">summary</a>   <a href="#">shortlog</a>   <a href="#">log</a>   <a href="#">tree</a> |
| check_lsi_raid.git         | LSI RAID Controller Monitoring... | Georg Schoenberger | 6 days ago         | <a href="#">summary</a>   <a href="#">shortlog</a>   <a href="#">log</a>   <a href="#">tree</a> |
| check_smart_attributes.git | Smart Attributes Monitoring...    | Georg Schoenberger | 2 months ago       | <a href="#">summary</a>   <a href="#">shortlog</a>   <a href="#">log</a>   <a href="#">tree</a> |

**TXT** **OPML**



## wiki

Unsere Experten teilen ihr Wissen mit Ihnen.

- Server-Hardware
- Server-Software
- Storage
- Virtualisierung
- Netzwerk+Zubehör
- Themenschwerpunkte
- Projektvorstellungen
- Archiv

- ▼ Werkzeuge
  - Links auf diese Seite
  - Änderungen an verlinkten Seiten
  - Datei hochladen
  - Spezialseiten
  - Druckversion
  - Permanenter Link
  - Seiteninformationen

- ▼ In anderen Sprachen
  - English
  - Polski

## Kategorie:Monitoring

Hauptseite > Netzwerk+Zubehör

### Kategorie Monitoring

In dieser Kategorie finden Sie Informationen zum Thema Monitoring und Netzwerk-Überwachung.

Artikel zur Monitoringlösung **TKmon** finden Sie in der eigenen **Kategorie TKmon**.

### Neueste Artikel dieser Kategorie

- **SMS Gateway mit dem Thomas-Krenn LES v2** (28.05.2015)
- **Icinga2 NRPE Plugin** (18.05.2015)
- **Icinga2 Graphen mit PNP unter Ubuntu 14.04 Trusty** (28.04.2015)

## Seiten in der Kategorie „Monitoring“

Es werden 50 von insgesamt 50 Seiten in dieser Kategorie angezeigt:

### A

- **Adaptec RAID Monitoring Plugin**
- **Adaptec RAID Monitoring Plugin unter Windows Server 2012 einrichten**

### B

- **Braintower SMS Gateway S Advanced**

### C

- **CEP CT63 Modem Installation unter Ubuntu 12.04 LTS**
- **Clamscan Monitoring Plugin**

### G

- **GPU Sensor Monitoring Plugin**

### H

- **Host Definition in Nagios 3**
- **HP 1910 Switches mit Icinga überwachen**

### I (Fortsetzung)

- **Icinga Testbenachrichtigung**
- **Icinga Web 2**
- **Icinga Web 2 mit Icinga 1.x verwenden**
- **Icinga Web 2 mit Icinga 2 verwenden**
- **Icinga2 Graphen mit PNP unter Ubuntu 14.04 Trusty**
- **Icinga2 Host und Service Konfiguration**
- **Icinga2 NRPE Plugin**
- **In NSClient++ eigene Plugins integrieren**
- **Installation von Icinga2 unter Ubuntu Server 14.04**
- **IPMI Monitoring Benutzer einrichten**
- **IPMI Sensor Monitoring Plugin**
- **IPMI Sensor Monitoring Plugin Version 1.x**

### L

- **Linux Software RAID Monitoring Plugin**

### M (Fortsetzung)

- **Monitoring Plugins für Thomas-Krenn-Server**

### N

- **Nagios Installation in Debian 5.0 Lenny**
- **NagiosGrapher Konfiguration**
- **NSClient++**
- **NSClient++ unter Windows installieren und konfigurieren**

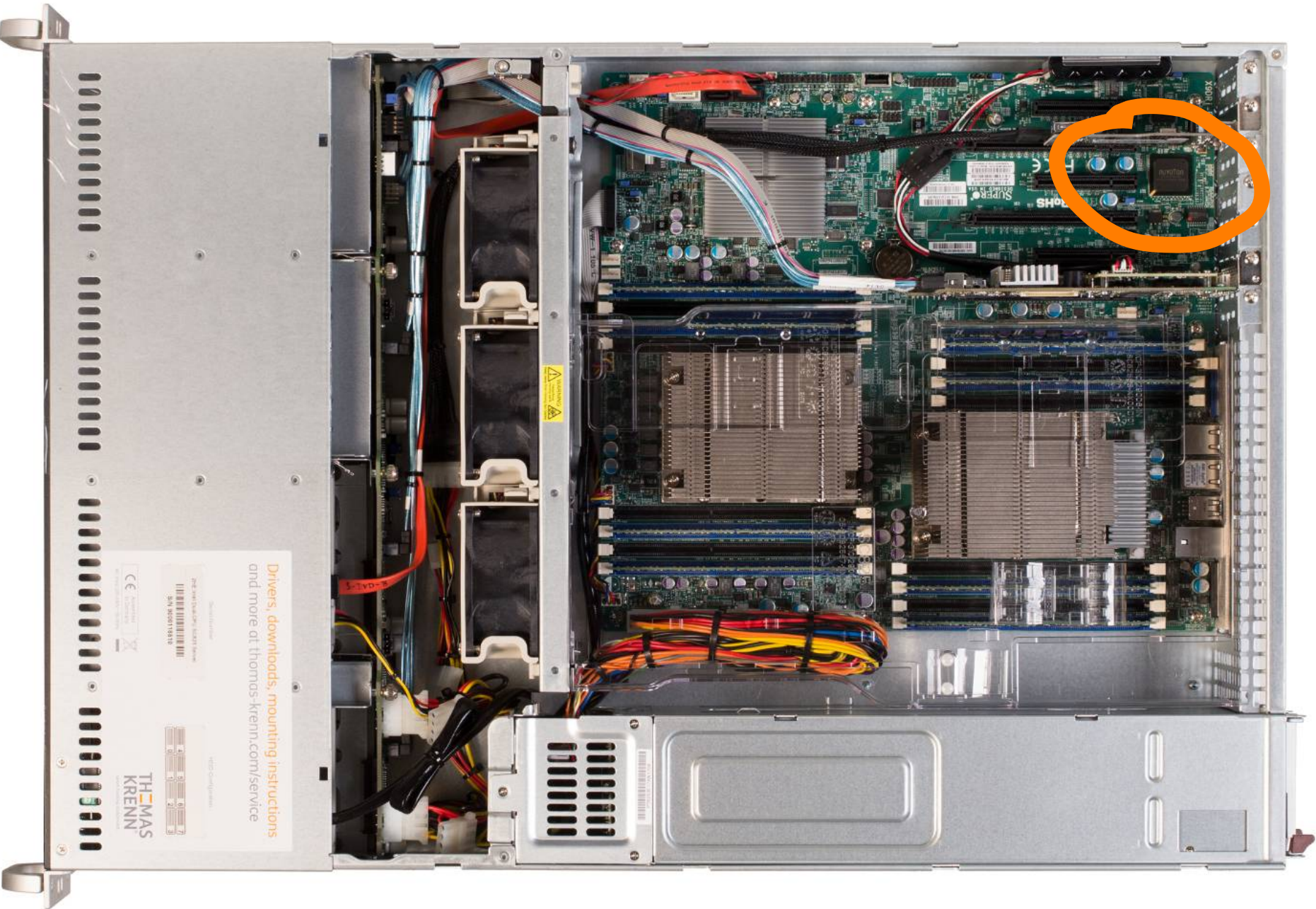
### P

- **Performance Graphen für check\_procs erstellen**

### S

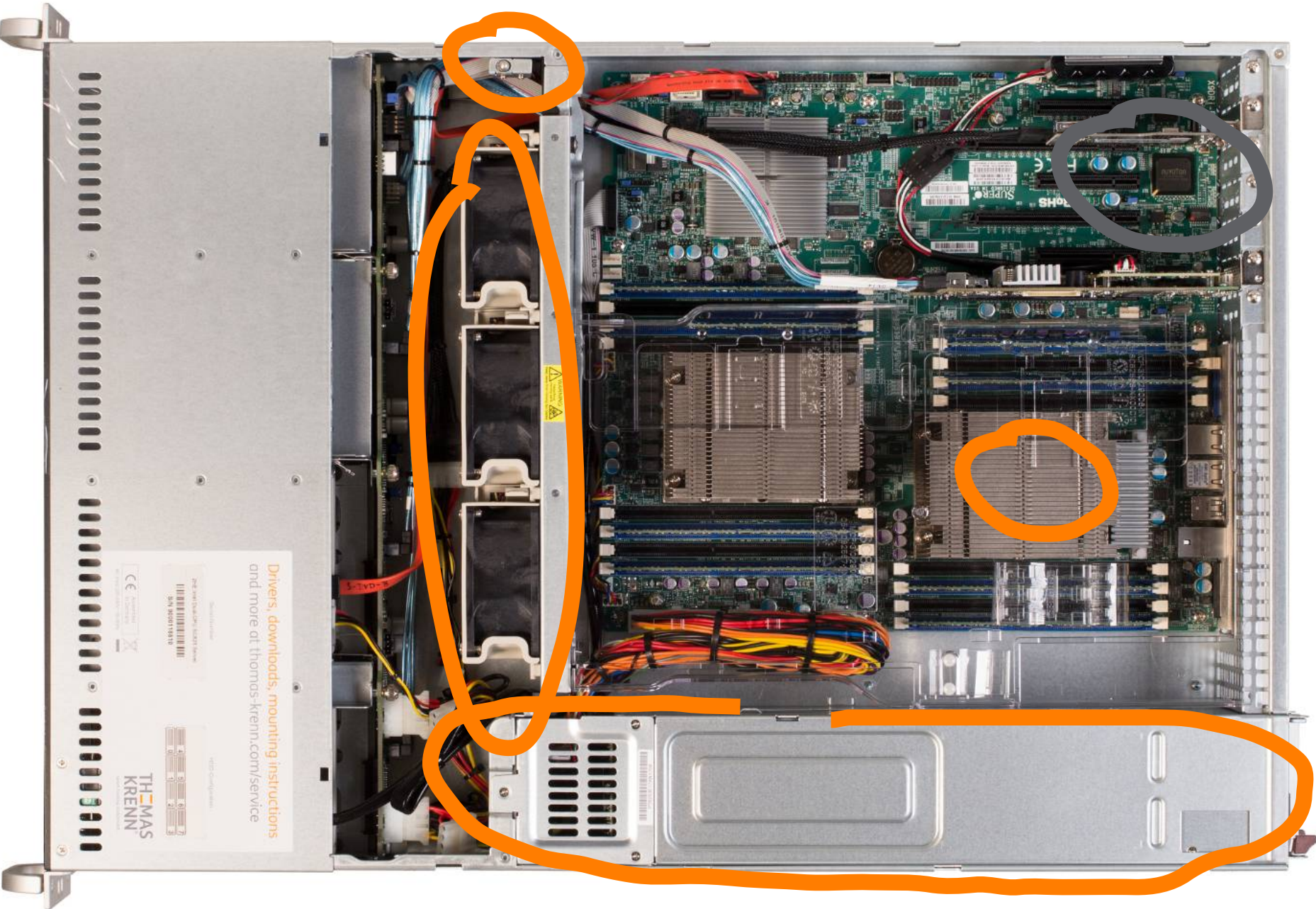
- **SMART Attributes Monitoring Plugin**
- **SMS Benachrichtigungen mit Icinga**
- **SMS Benachrichtigungen mit Icinga und Braintower SMS Gateway S Advanced**

# IPMI Sensor Monitoring



Drivers, downloads, mounting instructions  
and more at [thomas-krenn.com/service](http://thomas-krenn.com/service)





Drivers, downloads, mounting instructions  
and more at [thomas-krenn.com/service](http://thomas-krenn.com/service)

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2017-01-10  
S/N: 1800719818



# Intelligent Platform Management Interface

# Funktionen

1

Monitoring  
(Temp., Lüfter, ...)

2

Recovery Control  
(on/off/reset)

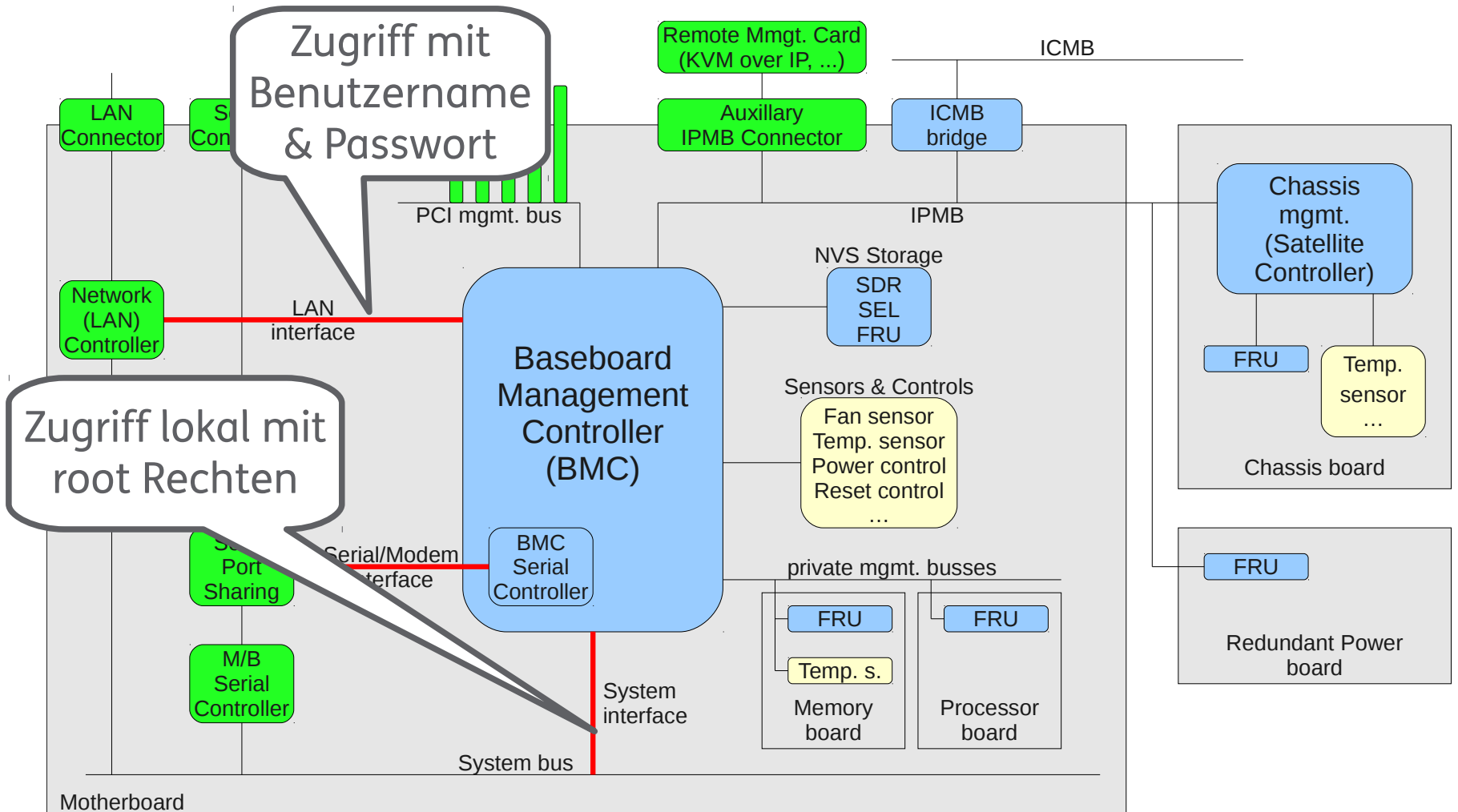
3

Logging  
(System Event Log)

4

Inventory  
(FRU information)

# Aufbau



# IPMI Sensor Klassen

| Discrete (True/False)  | Threshold (Schwellwerte)  |
|--|---|
| <p>Mehrere Zustände möglich:</p> <ul style="list-style-type: none"><li>• bis zu 15 Status möglich</li><li>• jeder Status = 1 Bit</li><li>• mehrere aktive Statusbits möglich</li></ul> | <p>Zustand abhängig von:</p> <ul style="list-style-type: none"><li>• Vergleich analoger Messwert mit den Schwellwerten (Thresholds)</li></ul> |
| <p>Liefert:</p> <ul style="list-style-type: none"><li>• allgemeine Zustände</li><li>• Sensor-spezifische Zustände</li></ul>  | <p>Liefert:</p> <ul style="list-style-type: none"><li>• analogen Messwert</li><li>• diskreten Status</li></ul>                                |
| <p>Ähnliche Klasse OEM</p> <ul style="list-style-type: none"><li>• Bedeutung der Zustände werden vom OEM definiert</li></ul>   |   |



# IPMI Sensor Klassen

## Discrete

```
[root@test ~]# ipmitool sdr get "PS2 Status"
Sensor ID          : PS2 Status (0x71)
Entity ID         : 10.2 (Power Supply)
Sensor Type (Discrete): Power Supply
States Asserted   : Power Supply
                   [Presence detected]
                   [Power Supply AC
lost]
Assertion Events  : Power Supply
                   [Presence detected]
                   [Power Supply AC
lost]
Assertions Enabled : Power Supply
                   [Presence detected]
                   [Failure detected]
                   [Predictive failure]
                   [Power Supply AC
lost]
[... ]
Deassertions Enabled : Power Supply
[... ]
```

## Threshold

```
[root@test ~]# ipmitool sdr get "Fan 1"
Sensor ID          : Fan 1 (0x50)
Entity ID         : 29.1 (Fan
Device)
Sensor Type (Analog) : Fan
Sensor Reading     : 5719 (+/- 0) RPM
Status            : ok
Nominal Reading    : 6708.000
Normal Minimum     : 2451.000
Normal Maximum     : 10965.000
Lower critical     : 1720.000
Lower non-critical : 1978.000
Positive Hysteresis : 86.000
Negative Hysteresis : 86.000
Minimum sensor range : Unspecified
Maximum sensor range : Unspecified
Event Message Control : Per-threshold
Readable Thresholds : lcr inc
Settable Thresholds : lcr inc
Threshold Read Mask : lcr inc
Assertion Events    :
Assertions Enabled  : lnc- lcr-
Deassertions Enabled : lnc- lcr-
```

# IPMI Sensoren

OK

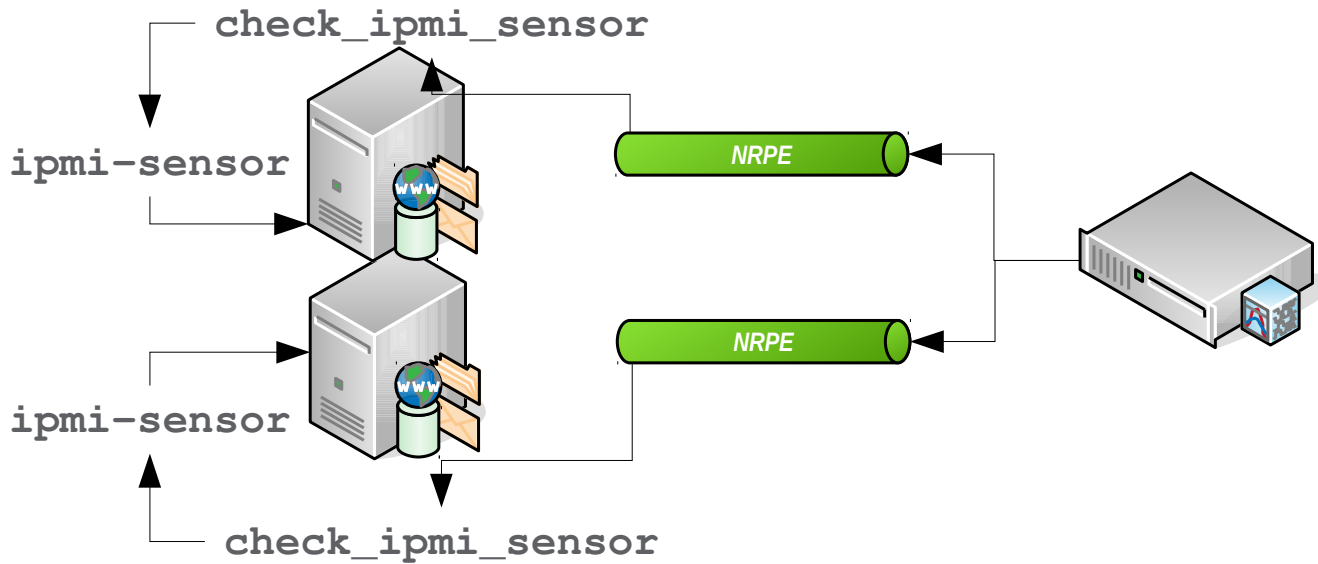
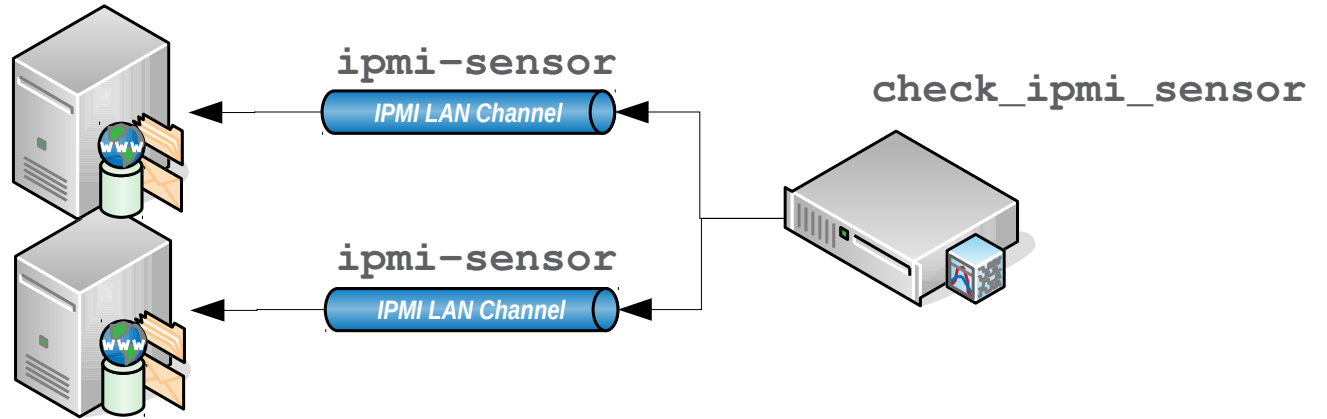
```
$ sudo ipmi-sensors --output-sensor-state --interpret-oem-data
```

```
Password:
```

| ID   | Name            | Type              | State    | Reading | Units | Event    |
|------|-----------------|-------------------|----------|---------|-------|----------|
| 4    | System Temp     | Temperature       | Nominal  | 27.00   | C     | 'OK'     |
| 71   | Peripheral Temp | Temperature       | Nominal  | 35.00   | C     | 'OK'     |
| 138  | CPU Temp        | OEM Reserved      | Nominal  | N/A     | N/A   | 'Low'    |
| 205  | FAN 1           | Fan               | Nominal  | 1800.00 | RPM   | 'OK'     |
| ...  |                 |                   |          |         |       |          |
| 942  | VBAT            | Voltage           | Nominal  | 3.15    | V     | 'OK'     |
| 1009 | VSB             | Voltage           | Nominal  | 3.34    | V     | 'OK'     |
| 1076 | AVCC            | Voltage           | Nominal  | 3.38    | V     | 'OK'     |
| 1143 | Chassis Intru   | Physical Security | Critical | N/A     | N/A   | 'Gen...' |

Critical

# Plugin konfigurieren



# IPMI Plugin Konfiguration

## — IPMI Sensor Monitoring Plugin

## — Packages - Voraussetzungen

- freeipmi-tools, libipc-run-perl
- check\_ipmi\_sensor
  - Per git oder per Package
  - [Thomas Krenn Ubuntu Repository](#)
  - Section optional, nagios-plugins-thomas-krenn

# IPMI Plugin Konfiguration

## — Blueprint

### — Icinga Server (LAN Channel)

- apt-get install freeipmi-tools libipc-run-perl
- git clone [http://git.thomas-krenn.com/check\\_ipmi\\_sensor\\_v3.git](http://git.thomas-krenn.com/check_ipmi_sensor_v3.git)
- vi /etc/nagios-plugins/config/check\_ipmi.cfg
- vi /etc/icinga/objects/ipmi\_host.cfg
- /etc/init.d/icinga reload

# check\_ipmi\_sensor

```
$ ./check_ipmi_sensor -H 192.168.255.5 -f ipmi.cfg -vv
IPMI Status: OK | 'System Temp'=27.00 'Peripheral Temp'=35.00 'FAN
1'=1800.00 'Vcore'=0.98 '3.3VCC'=3.36 '12V'=11.93 'VDIMM'=1.53
'5VCC'=5.09 '-12V'=-12.09 'VBAT'=3.15 'VSB'=3.34 'AVCC'=3.38
System Temp = 27.00 (Status: Nominal)
Peripheral Temp = 35.00 (Status: Nominal)
CPU Temp = 'Low' (Status: Nominal)
FAN 1 = 1800.00 (Status: Nominal)
Vcore = 0.98 (Status: Nominal)
3.3VCC = 3.36 (Status: Nominal)
12V = 11.93 (Status: Nominal)
VDIMM = 1.53 (Status: Nominal)
5VCC = 5.09 (Status: Nominal)
-12V = -12.09 (Status: Nominal)
VBAT = 3.15 (Status: Nominal)
VSB = 3.34 (Status: Nominal)
AVCC = 3.38 (Status: Nominal)
Chassis Intru = 'OK' (Status: Nominal)
```

# Stolpersteine



# Stolpersteine

## \_ „Unsaubere“ Firmware Implementierungen

- \_ Anstatt N/A, liefert Sensor Wert 0
  - \_ Keine sinnvollen Thresholds
- Sensoren ausnehmen

```
# echo 'System Temp      | Temperature' > sensor.exclude  
# /usr/lib/nagios/plugins/check_ipmi_sensor -H  
10.1.102.130 -f ./ipmi.cfg -xx ./sensor.exclude
```

## \_ System Event Log

- \_ Seit Version v3.7
- \_ **clear** oder Sensoren ausnehmen → **-SX**

```
# ipmi-sel -h 10.1.102.130 --config-file ./ipmi.cfg --clear
```

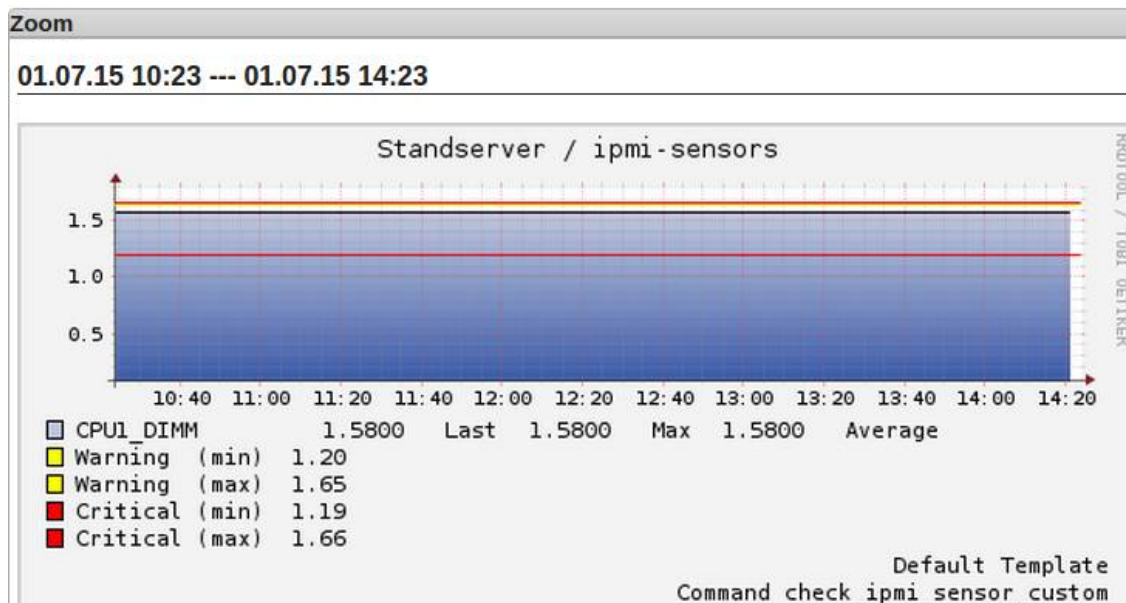
# Goodies

## \_ Serial Number

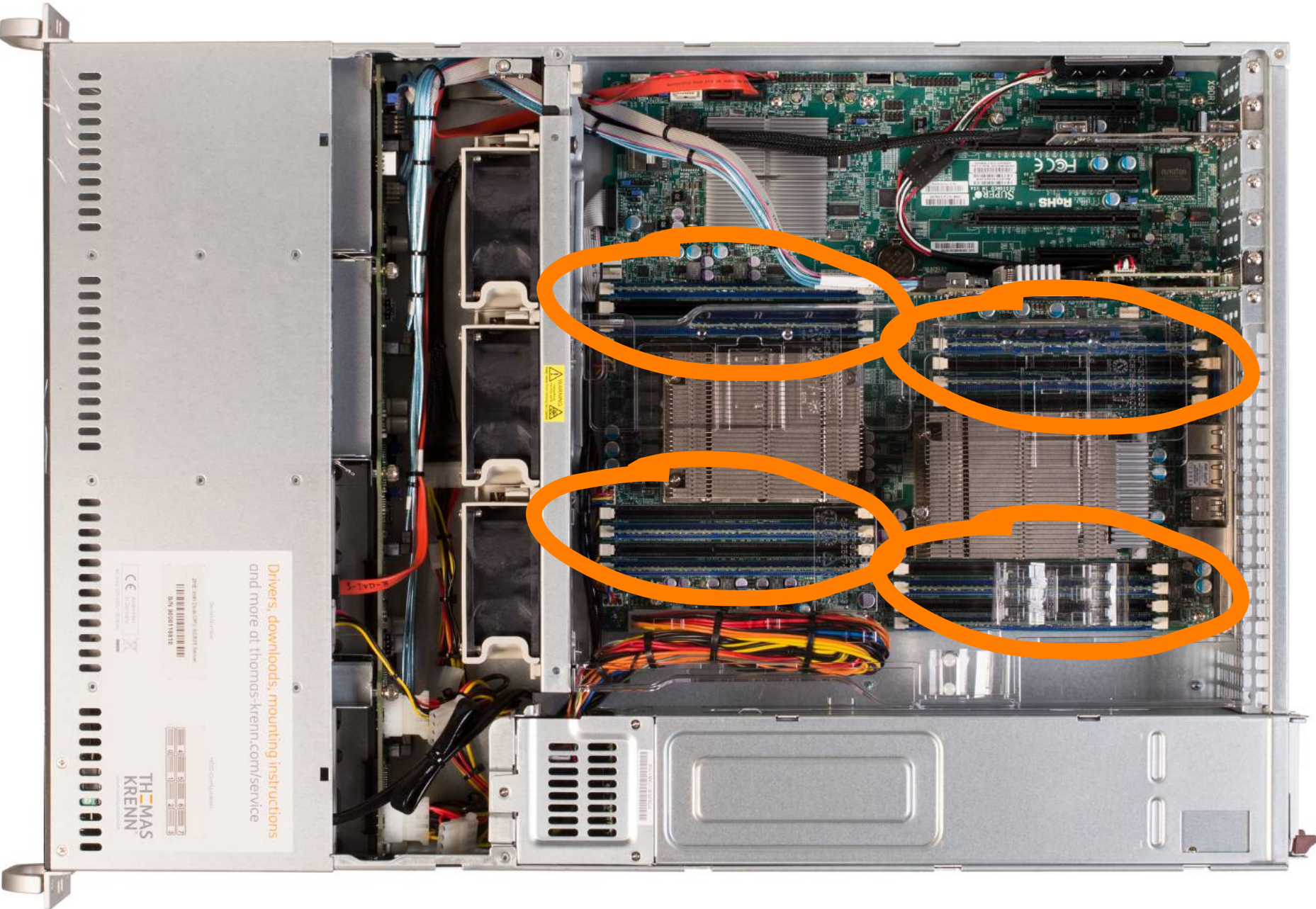
```
# /usr/lib/nagios/plugins/check_ipmi_sensor -H 10.1.102.130 -f ipmi.cfg --fru  
IPMI Status: OK (9000096781) | 'System Temp'=27.00;-5.00:31.00;-7.00:32.00  
'Peripheral Temp'=29.00;-5.00:80.00;-7.00:85.00[...]
```

## \_ Grenzwerte

\_ Seit freeipmi 1.2.1, **--output-sensor-thresholds**



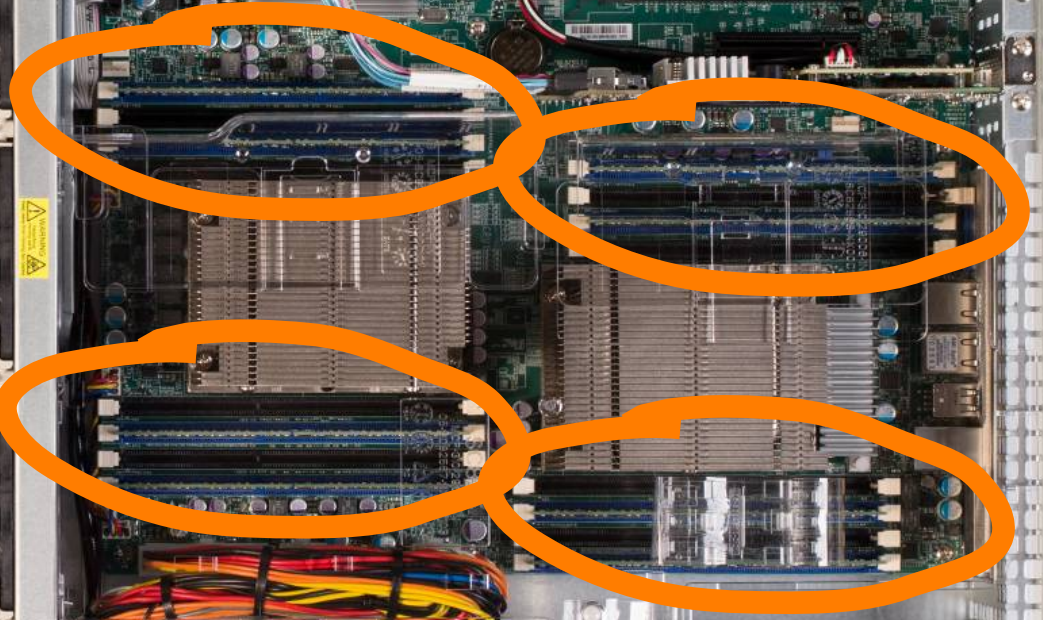
Monitor your **RAM!**  
(it's ECC, isn't it?)



Drivers, downloads, mounting instructions  
and more at [thomas-krenn.com/service](http://thomas-krenn.com/service)

CE mark and other regulatory information.

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# IPMI SEL (System Event Log)

```
$ ipmi-sel
ID | Date           | Time           | Name           | State   | Event
1  | Feb-03-2012    | 10:31:58      | CPU0 DIMM0    | Warning | Correctable memory error
2  | Feb-13-2012    | 22:28:58      | CPU0 DIMM0    | Warning | Correctable memory error
3  | Feb-14-2012    | 00:29:03      | CPU0 DIMM0    | Warning | Correctable memory error
4  | Feb-14-2012    | 01:29:06      | CPU0 DIMM0    | Warning | Correctable memory error
...
```

Unterstützung ab  
**check\_ipmi\_sensor v3.7**

# IPMI SEL (System Event Log)

```
$ ipmi-sel
ID | Date                | Time          | Name           | State   | Event
1  | Feb-06-2012         | 10:31:58     | CPU0 DIMM0    | Warning | Correctable memory error
2  | Feb-13-2012         | 22:28:58     | CPU0 DIMM0    | Warning | Correctable memory error
3  | Feb-14-2012         | 09:29:03     | CPU0 DIMM0    | Warning | Correctable memory error
4  | Feb-14-2012         | 09:06:06     | CPU0 DIMM0    | Warning | Correctable memory error
...
```

OS unabhängig



# Sicherheit – Monitoring User

## S. a. IPMI Sicherheit – Best Practices

**ADMIN**







→ Configuration

→ Alerts

→ Date and Time

→ LDAP

→ Active Directory

→ RADIUS

→ Mouse Mode

→ Network

→ Dynamic DNS

→ Remote Session

→ SMTP

→ SSL Certification

→ **Users**

→ Port

→ IP Access Control

→ Fan Mode

## → Add New User

Enter the information for the new user below and press Add. Press Cancel to return to the user list.

User Name:

Password:

Confirm Password:

Network Privileges:

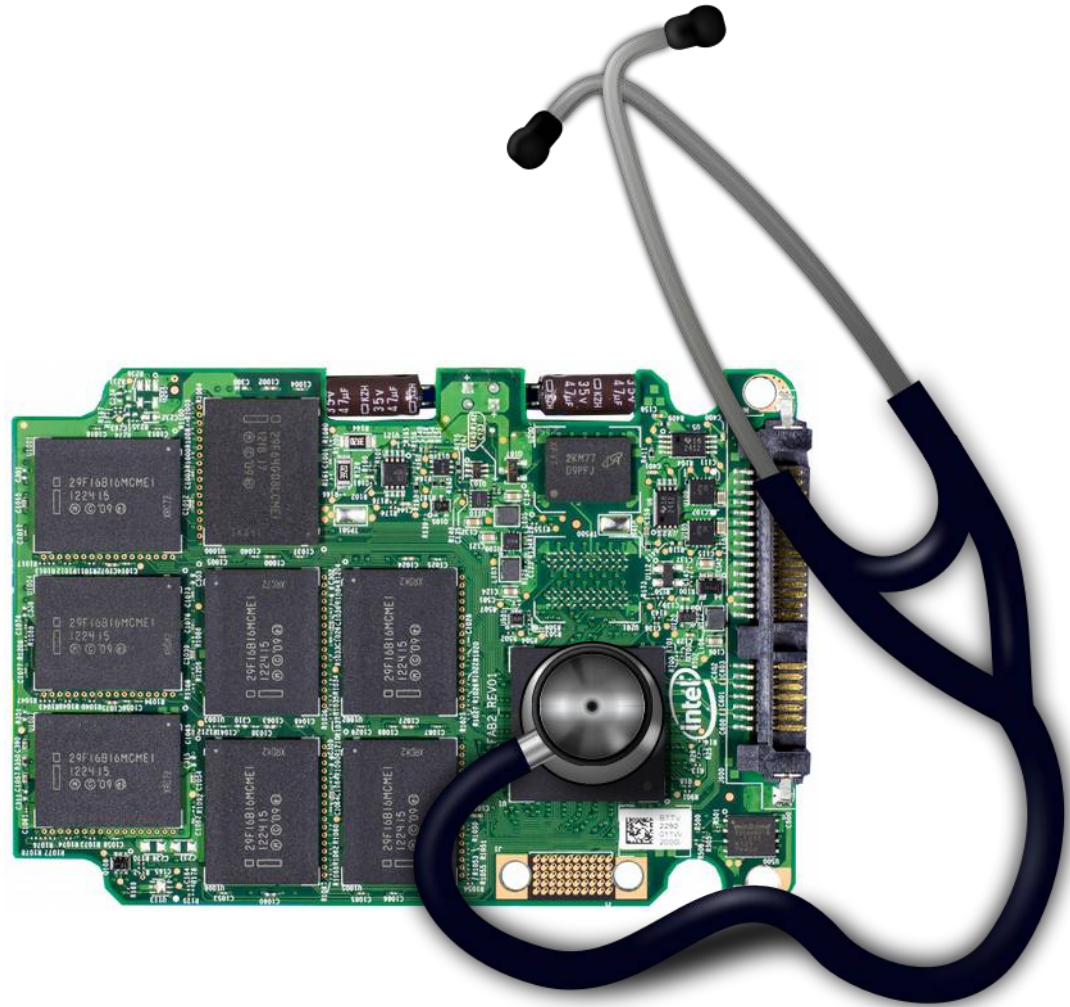
Administrator ▲▼  
Administrator  
Operator  
User  
No Access

Add

Cancel

Be smart,  
use SMART ;-)

# Self- Monitoring, Analysis & Reporting Technology



# Stolpersteine

## \_ „Unsaubere“ Firmware Implementierungen

- \_ Anstatt N/A, liefert Sensor Wert 0
  - \_ Keine sinnvollen Thresholds
- Sensoren ausnehmen

```
# echo 'System Temp      | Temperature' > sensor.exclude  
# /usr/lib/nagios/plugins/check_ipmi_sensor -H  
10.1.102.130 -f ./ipmi.cfg -xx ./sensor.exclude
```

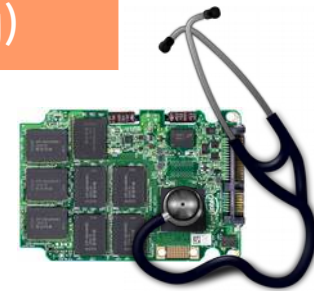
## \_ System Event Log

- \_ Seit Version v3.7
- \_ **clear** oder Sensoren ausnehmen → **-SX**

```
# ipmi-sel -h 10.1.102.130 --config-file ./ipmi.cfg --clear
```



| Standardisiert                                 | NICHT standardisiert  |
|--|---|
| Datenformat<br>Kommandos<br>Errorlogs<br>Tests | <b>Attribute</b><br><br>Dokumentation<br>vom Hersteller<br>erforderlich<br>(zum Teil nicht<br>öffentlich, außer<br>Intel/Samsung) |



# Intel DC S3700

## Vendor Specific SMART Attributes with Thresholds:

| ID# | ATTRIBUTE_NAME          | FLAG   | VALUE | WORST | THRESH | TYPE     | RAW_VALUE          |
|-----|-------------------------|--------|-------|-------|--------|----------|--------------------|
| 5   | Reallocated_Sector_Ct   | 0x0032 | 100   | 100   | 000    | Old_age  | 0                  |
| 9   | Power_On_Hours          | 0x0032 | 100   | 100   | 000    | Old_age  | 19864              |
| 12  | Power_Cycle_Count       | 0x0032 | 100   | 100   | 000    | Old_age  | 35                 |
| 170 | Available_Reservd_Space | 0x0033 | 100   | 100   | 010    | Pre-fail | 0                  |
| 171 | Program_Fail_Count      | 0x0032 | 100   | 100   | 000    | Old_age  | 0                  |
| 172 | Erase_Fail_Count        | 0x0032 | 100   | 100   | 000    | Old_age  | 0                  |
| 174 | Unsafe_Shutdown_Count   | 0x0032 | 100   | 100   | 000    | Old_age  | 31                 |
| 175 | Power_Loss_Cap_Test     | 0x0033 | 100   | 100   | 010    | Pre-fail | 498613813844       |
| 183 | SATA_Downshift_Count    | 0x0032 | 100   | 100   | 000    | Old_age  | 0                  |
| 184 | End-to-End_Error        | 0x0033 | 100   | 100   | 090    | Pre-fail | 0                  |
| 187 | Reported_Uncorrect      | 0x0032 | 100   | 100   | 000    | Old_age  | 0                  |
| 190 | Temperature_Case        | 0x0022 | 086   | 083   | 000    | Old_age  | 14 (Min/Max 13/17) |
| 192 | Unsafe_Shutdown_Count   | 0x0032 | 100   | 100   | 000    | Old_age  | 31                 |
| 194 | Temperature_Internal    | 0x0022 | 100   | 100   | 000    | Old_age  | 14                 |
| 197 | Current_Pending_Sector  | 0x0032 | 100   | 100   | 000    | Old_age  | 0                  |
| 199 | CRC_Error_Count         | 0x003e | 100   | 100   | 000    | Old_age  | 0                  |
| 225 | Host_Writes_32MiB       | 0x0032 | 100   | 100   | 000    | Old_age  | 868923             |
| 226 | Workld_Media_Wear_Indic | 0x0032 | 100   | 100   | 000    | Old_age  | 65535              |
| 227 | Workld_Host_Reads_Perc  | 0x0032 | 100   | 100   | 000    | Old_age  | 4294967295         |
| 228 | Workload_Minutes        | 0x0032 | 100   | 100   | 000    | Old_age  | 65535              |
| 232 | Available_Reservd_Space | 0x0033 | 100   | 100   | 010    | Pre-fail | 0                  |
| 233 | Media_Wearout_Indicator | 0x0032 | 100   | 100   | 000    | Old_age  | 0                  |
| 234 | Thermal_Throttle        | 0x0032 | 100   | 100   | 000    | Old_age  | 0                  |
| 241 | Host_Writes_32MiB       | 0x0032 | 100   | 100   | 000    | Old_age  | 868923             |
| 242 | Host_Reads_32MiB        | 0x0032 | 100   | 100   | 000    | Old_age  | 2829731            |

# check\_smart\_attributes

- Device
- JSON Datenbank
- smartctl

```
$ /usr/lib/nagios/plugins/check_smart_attributes \  
>     -d /dev/sda \  
>     -dbj /etc/nagios-plugins/config/check_smartdb.json  
OK (sda) |sda_Media_Wearout_Indicator=098;16;6  
sda_Host_Writes_32MiB=575272 sda_Host_Reads_32MiB=723527
```

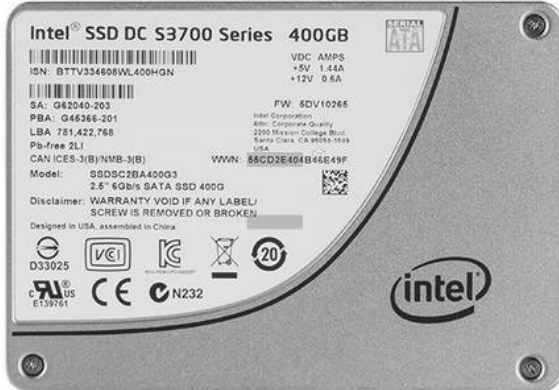
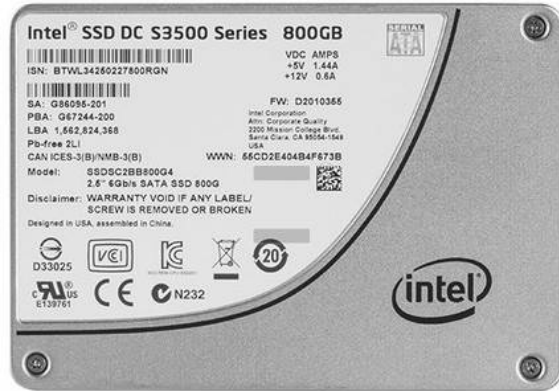


```

# vi /etc/nagios-plugins/config/check_smartdb.json
...
"Intel DC S3700" : {
    "Device" : ["Intel DC S3700 Series SSDs","INTEL
SSDSC2BA100G3",
    "ID#" : {
        "5" : "RAW_VALUE", # Re-allocated Sector Count
        ...
        "194" : "RAW_VALUE", # Temperature - Device Internal
Te
        ...
        "232" : "VALUE", # Available Reserved Space
        "233" : "VALUE", # Media Wearout Indicator
        "234" : "VALUE", # Thermal Throttle Status
        "241" : "RAW_VALUE", # Total LBAs Written (32MiB)
        "242" : "RAW_VALUE", # Total LBAs Read (32MiB)
        "1024" : "VALUE" # ATA error count (custom)
    },
    "Threshs" : {
        "5" : ["20","40"],
        ...
        "232" : ["16:","11:"],
        "233" : ["16:","6:"],
        "1024" : ["0","10"]
    },
    "Perfs" : ["194","233","241","242"]
},
...

```

# /etc/nagios-plugins/config/check\_smartdb.json



/etc/nagios-plugins/config/check\_smartdb.json

[projects](#) / [check\\_smart\\_attributes.git](#) / summary

summary | [shortlog](#) | [log](#) | [commit](#) | [commitdiff](#) | [tree](#)

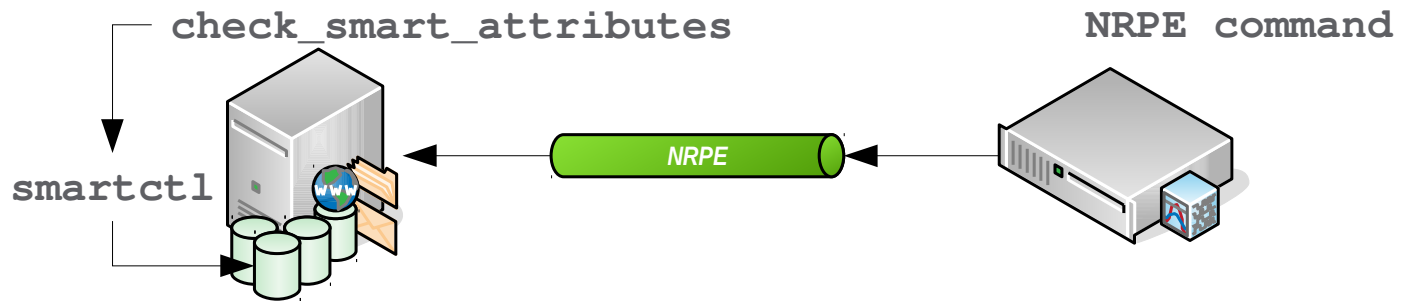
description Smart Attributes Monitoring Plugin for Nagios/Icinga, written  
owner Georg Schoenberger  
last change Fri, 10 Oct 2014 14:48:27 +0100 (15:48 +0200)  
URL [git://git.thomas-krenn.com/check\\_smart\\_attributes.git](git://git.thomas-krenn.com/check_smart_attributes.git)  
[http://git.thomas-krenn.com/check\\_smart\\_attributes.git](http://git.thomas-krenn.com/check_smart_attributes.git)

**shortlog**

|            |                   |  |                        |                        |
|------------|-------------------|--|------------------------|------------------------|
| 2014-10-10 | Georg Schönberger | <b>Added new IDs for SanDisk X300s</b>                         | <a href="#">master</a> | <a href="#">commit</a> |
| 2014-08-05 | Georg Schönberger | <b>Added device strings for SanDisk X210 to smartdb</b>        |                        | <a href="#">commit</a> |
| 2014-08-01 | Georg Schönberger | <b>Remove unexpected power loss checking for SanDisk X300s</b> |                        | <a href="#">commit</a> |
| 2014-08-01 | Georg Schönberger | <b>Fix iregex for smart attributes line checking</b>           |                        | <a href="#">commit</a> |
| 2014-08-01 | Georg Schönberger | <b>Fix smart threshold for SanDisk X300s</b>                   |                        | <a href="#">commit</a> |
| 2014-08-01 | Georg Schönberger | <b>Added SanDisk X300s to smartdb</b>                          |                        | <a href="#">commit</a> |
| 2014-07-17 | Georg Schönberger | <b>Update version, README and changelog</b>                    | <a href="#">v1.1</a>   | <a href="#">commit</a> |
| 2014-07-17 | Georg Schönberger | <b>Add support for adaptec sg devices</b>                      |                        | <a href="#">commit</a> |

Git(t) sei  
Dank ;-)

# Plugin konfigurieren



# SMART Plugin Konfiguration

## \_ SMART Attributes Monitoring Plugin

## \_ Packages - Voraussetzungen

- smartmontools, libfile-which-perl
- check\_smart\_attributes
  - Per git oder per Package
  - [Thomas Krenn Ubuntu Repository](#)
  - Section optional, nagios-plugins-thomas-krenn

# SMART Plugin Konfiguration

## — Blueprint

### — Target Host

- apt-get install smartmontools libfile-which-perl
- git clone [http://git.thomas-krenn.com/check\\_smart\\_attributes.git](http://git.thomas-krenn.com/check_smart_attributes.git)
- vi /etc/nagios/nrpe.d/smart.cfg
- vi /etc/sudoers.d/check\_smart\_attributes
- /etc/init.d/nagios-nrpe-server restart

### — Icinga Server

- vi /etc/nagios-plugins/config/check\_smart.cfg
- vi /etc/icinga/objects/raid\_host.cfg
- /etc/init.d/icinga reload

# Und mit RAID Controllern?

...

```
[-d|--device <path to device being checked>]
```

Specify the device being monitored. If multiple devices should be checked provide the '-d' option multiple times.

E.g. '-d /dev/sda -d /dev/sdb'

**For devices behind LSI RAID controllers** specify 'megaraid' and then the device number, e.g. '-d megaraid6'. Use storcli to find out the corresponding device numbers.

**For devices behind Adaptec RAID controllers** specify '/dev/sg<X>' where <X> is the number for your device. Use e.g. sg\_scan to find the device.

You must also use '-O sat' or '-O scsi' according to the device interface. This are extra options only necessary for '/dev/sg<X>' devices.

...

```
# /usr/lib/nagios/plugins/check_smart_attributes -dbj /etc/nagios-  
plugins/config/check_smartdb.json -d megaraid7,/dev/sda  
# /usr/lib/nagios/plugins/check_smart_attributes -dbj /etc/nagios-  
plugins/config/check_smartdb.json -d /dev/sg2 -d /dev/sg3 -d /dev/sg4 -O  
sat
```



# Und mit RAID Controllern?

## Service State Information

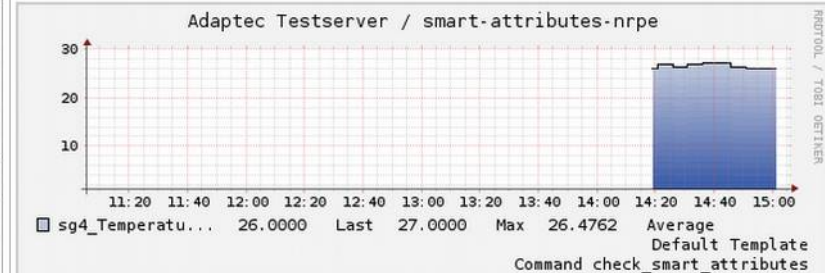
Current Status: **OK** (for 0d 2h 40m 45s)  
Status Information: OK (megaraid7)  
Performance Data: megaraid7\_Temperature\_Internal=34 megaraid7\_Media\_Wearout\_Indicator=085;16;6 megaraid7\_Host\_Writes\_32MiB=933806 megaraid7\_Host\_Reads\_32MiB=1121873  
Current Attempt: 1/4 (HARD state)  
Last Check Time: 2015-07-03 14:16:47  
Check Type: ACTIVE  
Check Source / Reachability: N/A  
Check Latency / Duration: 0.025 / 0.106 seconds  
Next Scheduled Active Check: 2015-07-03 14:21:47  
Last State Change: 2015-07-03 11:36:47  
Last Notification: N/A (notification 0)  
Is This Service Flapping? **NO** (0.00% state change)  
In Scheduled Downtime? **NO**  
Last Update: 2015-07-03 14:17:31 ( 0d 0h 0m 1s ago)  
Modified Attributes: None  
Executed Command: Command Expander

## Service details Adaptec\_Testserver -> smart-attributes-nrpe

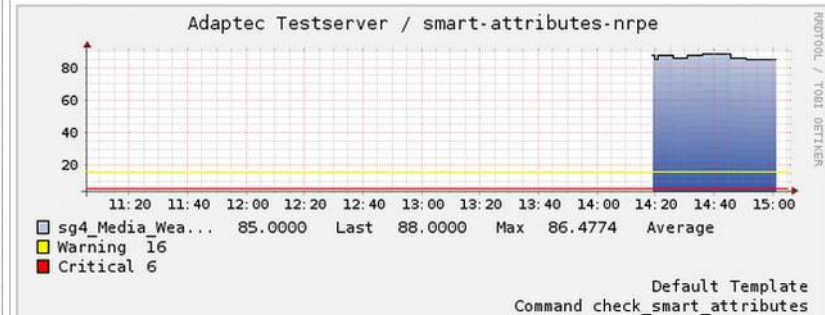
Host: Adaptec Testserver Service: smart-attributes-nrpe

4 Hours 03.07.15 11:05 - 03.07.15 15:05

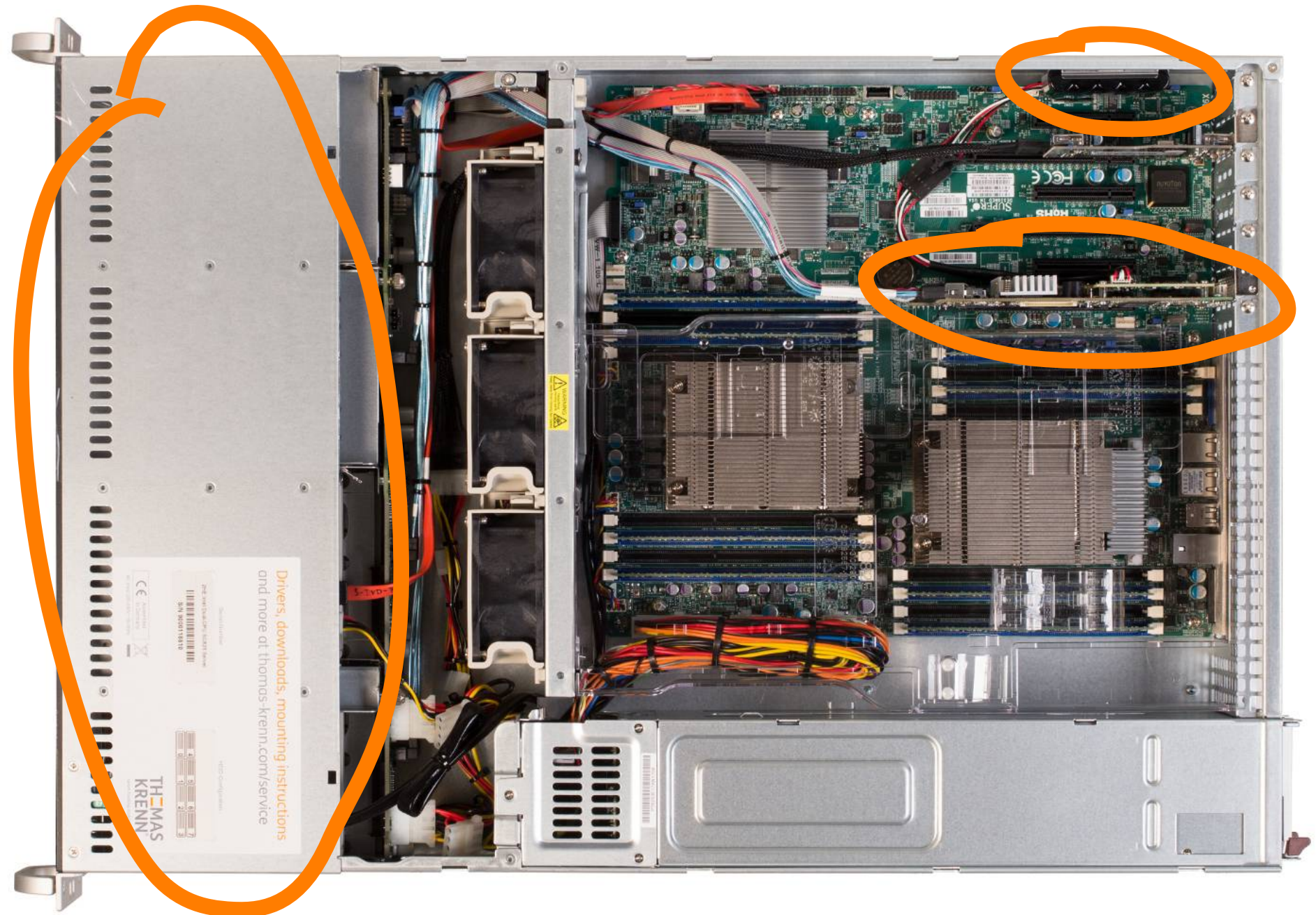
### Datasource: sg4\_Temperature\_Celsius



### Datasource: sg4\_Media\_Wearout\_Indicator



# RAID Monitoring



Drivers, downloads, mounting instructions  
and more at [thomas-krenn.com/service](http://thomas-krenn.com/service)

2012-01-15 10:00:00  
SIN 300719310

THOMAS  
KRENN

# Avago MegaRAID (LSI)



```
# storcli
```

```
Storage Command Line Tool Ver 1.15.12 Apr 23, 2015
```

```
(c)Copyright 2015, AVAGO Corporation, All Rights Reserved.
```

```
help - lists all the commands with their usage. E.g. storcli help  
<command> help - gives details about a particular command. E.g. storcli add  
help
```

```
List of commands:
```

| Commands  | Description   |
|-----------|---|
| add       | Adds/creates a new element to controller like VD,Spare..etc |
| delete    | Deletes an element like VD,Spare                            |
| show      | Displays information about an element                       |
| set       | Set a particular value to a property                        |
| get       | Get a particular value to a property                        |
| compare   | Compares particular value to a property                     |
| start     | Start background operation                                  |
| stop      | Stop background operation                                   |
| pause     | Pause background operation                                  |
| resume    | Resume background operation                                 |
| download  | Downloads file to given device                              |
| expand    | expands size of given drive                                 |
| insert    | inserts new drive for missing                               |
| transform | downgrades the controller                                   |

# check\_lsi\_raid



**NEW!**

```
$ sudo /usr/lib/nagios/plugins/check_lsi_raid -vv
Warning (LD Warn) [c0/v0_Consist = Warning (No)]|CV_Temperature=22;70;85
ROC_Temperature=57;80;90 c0/e252/s0_Drive_Temperature=21;40;15
c0/e252/s1_Drive_Temperature=21;40;45
Used storcli commands:
- /usr/bin/sudo /usr/sbin/storcli64 /c0 /cv show status
- /usr/bin/sudo /usr/sbin/storcli64 adpallinfo a0
- /usr/bin/sudo /usr/sbin/storcli64 /c0/vall show all
- /usr/bin/sudo /usr/sbin/storcli64 /c0/vall show init
- /usr/bin/sudo /usr/sbin/storcli64 /c0/eall/sall show all
- /usr/bin/sudo /usr/sbin/storcli64 /c0/eall/sall show initialization
- /usr/bin/sudo /usr/sbin/storcli64 /c0/eall/sall show rebuild
Warning sensors:
- c0/v0_Consist (No)
```

# Warum adpallinfo a0?

*„storcli /c0 show all ...  
blocks the whole raid card  
i/o for ... upto ~4 seconds“*

# Warum **adnallinfo** a0?



The screenshot shows a Mozilla Firefox browser window with the address bar containing the URL `https://lists.thomas-krenn.com/pipermail/tk-monitoring-plugins-user/2014-5e`. The page title is "[TK-monitoring-plugins-user] check\_lsi\_raid: storcli calls block I/O". The sender is Thomas Müller, with the email address `mueller at puzzle.ch`, dated Thursday, September 11, 2014, at 14:24:06 CEST. The message content includes a list of navigation links, a greeting, a description of a problem with the `storcli` command, performance details, and steps to reproduce the issue.

[TK-monitoring-plugins-user] check\_lsi\_raid: storcli calls block I/O

Thomas Müller [mueller at puzzle.ch](mailto:mueller at puzzle.ch)  
Thu Sep 11 14:24:06 CEST 2014

- Next message: [\[TK-monitoring-plugins-user\] check\\_lsi\\_raid: storcli calls block I/O](#)
- Messages sorted by: [\[ date \]](#) [\[ thread \]](#) [\[ subject \]](#) [\[ author \]](#)

---

Hi

We have discovered a problem regarding the storcli commands called within the check\_lsi\_raid script.

On a servers which needs fast I/O response times, we discovered that calls to storcli (which is called by check\_lsi\_raid) blocks the whole raid card i/o for ~0.5 (IBM ServeRAID M5110e) upto ~4 seconds ( LSI MegaRAID SAS 9260-4i) .

Without storcli calls the ioping max. time is ~1.2 - ~20ms.

steps to reproduce:  
\* start the storcli-loop.sh (script below)  
\* start "ioping" utility (full command: "ioping -D -c 60 /path-to-mounted-fs-which-resides-on-controller")

- Thomas

bl  
i/c

ard  
ts“



# Adaptec by PMC



**adaptec**  
by PMC

```
$ sudo arconf
```

```
| UCLI | Adaptec by PMC uniform command line interface  
| UCLI | Version 1.6 (B21062)  
| UCLI | (C) Adaptec by PMC 2003-2014  
| UCLI | All Rights Reserved
```

```
ATAPASSWORD | setting password on a physical drive  
COPYBACK | toggles controller copy back mode  
CREATE | creates a logical device  
CONSISTENCYCHECK | toggles the controller background consistency check mode  
DELETE | deletes one or more logical devices  
ERRORTUNABLE | sets error tunable profiles on the controller  
EXPANDERLIST | Lists the Expanders Connected to the Controller  
EXPANDERUPGRADE | updates expander firmware  
FAILOVER | toggles the controller automatic failover mode  
GETCONFIG | prints controller information  
GETLOGS | gets controller log information  
GETPERFORM | gets the parameters for a performance mode  
GETSMARTSTATS | gets the SMART statistics  
GETSTATUS | displays the status of running tasks  
GETVERSION | prints version information for all controllers  
IDENTIFY | blinks LEDs on device(s) connected to a controller  
IMAGEUPDATE | update physical device firmware  
KEY | installs a Feature Key onto a controller  
MODIFY | performs RAID Level Migration or Online Capacity Expansion  
PHYERRORLOG | displays PHY error logs for controller or device or an  
 | expander PHY  
PRESERVECACHE | changes the cache preservation settings on the controller  
RESCAN | checks for new or removed drives  
RESETSTATISTICSCOUNTERS | resets the controller statistics counters  
ROMUPDATE | updates controller firmware  
SAVESUPPORTARCHIVE | saves the support archive  
SETALARM | controls the controller alarm, if present
```

```
...
```

# check\_adaptec\_raid



**NEW!**

```
$ sudo /usr/lib/nagios/plugins/check_adaptec_raid --version
check_adaptec_raid: Nagios/Icinga plugin to check Adaptec Raid Controller
status
```

Version: 2.1

arconfg version:

| UCLI | Version 1.4 (B20859)

```
$ sudo /usr/lib/nagios/plugins/check_adaptec_raid -vv
```

```
Critical (ZMM Crit) [ZMM_State = Critical (Preparing)][ZMM_SCap_Status =
```

```
Warning (Preparing)]|CTR_Temperature=52;80;90 ZMM_Health=100
```

```
ZMM_Temperature=28;60;75 ZMM_Voltage_Present=4942
```

Used arconfg commands:

```
- /sbin/arconfg GETCONFIG 1 AD
```

```
- /sbin/arconfg GETCONFIG 1 AD
```

```
- /sbin/arconfg GETCONFIG 1 LD
```

```
- /sbin/arconfg GETCONFIG 1 PD
```

Critical sensors:

```
- ZMM_State (Preparing)
```

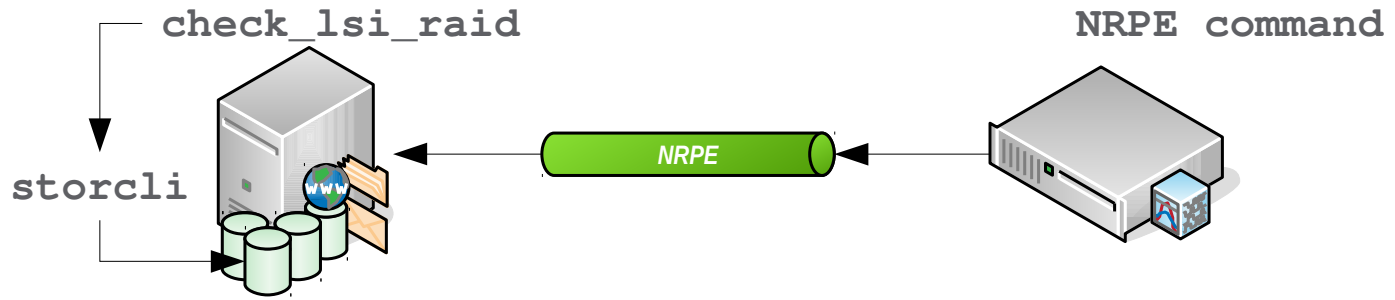
Warning sensors:

```
- ZMM_SCap_Status (Preparing)
```

# check\_adaptec\_raid

```
# /usr/lib/nagios/plugins/check_adaptec_raid -vvv | grep -A 2 information
CTR information:
  - Adaptec ASR8405:
    - Serial No=4B3613XXXXX
--
LD information:
  - ld0:
    - Block Size of member drives=512 Bytes
--
PD information:
  - pd0:
    - Block Size=512 Bytes
--
ZMM information:
  - ZMM_Charge_Level=100
  - ZMM_Health=100
```

# Plugin konfigurieren



# RAID Plugins Konfiguration

- LSI RAID Monitoring Plugin
- Adaptec RAID Monitoring Plugin
- Unter Windows
  - Adaptec RAID Monitoring Plugin unter Windows Server 2012 einrichten
  - LSI RAID Monitoring Plugin unter Windows Server 2012 einrichten
- Voraussetzungen
  - storcli, arcconf
  - libfile-which-perl

# RAID Plugin Konfiguration

## — Blueprint LSI

### — Target Host

- apt-get install storcli libfile-which-perl
- git clone [http://git.thomas-krenn.com/check\\_lsi\\_raid.git](http://git.thomas-krenn.com/check_lsi_raid.git)
- vi /etc/nagios/nrpe.d/raid.cfg
- vi /etc/sudoers.d/check\_ipmi\_sensor
- /etc/init.d/nagios-nrpe-server restart

### — Icinga Server

- vi /etc/icinga/objects/raid\_host.cfg
- /etc/init.d/icinga reload



# VMware Monitoring

# VMware – Health Status

10.1.102.11 | vmware-neufelden VMware ESXi, 5.1.0, 1065491

Getting Started | Summary | Virtual Machines | Resource Allocation | Performance | Configuration | Local Users & Groups | Events | Permissions

**Hardware**

- Health Status
- Processors
- Memory
- Storage
- Networking
- Storage Adapters
- Network Adapters
- Advanced Settings
- Power Management

**Software**




- Licensed Features
- Time Configuration
- DNS and Routing
- Authentication Services
- Virtual Machine Startup/Shutdown
- Virtual Machine Swapfile Location

| Sensor                                    | Status | Reading      |
|---|--------|--------------|
| Supermicro X8DT3                          | Normal |              |
| Processors                                | Normal |              |
| Temperature                               | Normal |              |
| Memory Device 12 P2-DIMM3B Temp --- No... | Normal | 51 Degrees C |
| Memory Device 11 P2-DIMM3A Temp --- No... | Normal | 55 Degrees C |
| Memory Device 10 P2-DIMM2B Temp --- No... | Normal | 49 Degrees C |
| Memory Device 9 P2-DIMM2A Temp --- No...  | Normal | 50 Degrees C |
| Memory Device 8 P2-DIMM1B Temp --- No...  | Normal | 48 Degrees C |
| Memory Device 7 P2-DIMM1A Temp --- No...  | Normal | 49 Degrees C |
| Memory Device 6 P1-DIMM3B Temp --- No...  | Normal | 47 Degrees C |
| Memory Device 5 P1-DIMM3A Temp --- No...  | Normal | 47 Degrees C |
| Memory Device 4 P1-DIMM2B Temp --- No...  | Normal | 48 Degrees C |
| Memory Device 3 P1-DIMM2A Temp --- No...  | Normal | 47 Degrees C |
| Memory Device 2 P1-DIMM1B Temp --- No...  | Normal | 45 Degrees C |
| Memory Device 1 P1-DIMM1A Temp --- No...  | Normal | 48 Degrees C |
| System Board 1 System Temp --- Normal     | Normal | 40 Degrees C |
| Fan                                       | Normal |              |

Sensoren zurücksetzen Aktualisieren

| Sensor  | Status | Lesen                    |
|---|--------|--------------------------|
| Supermicro X8DT3  | Alarm  |                          |
| Prozessoren   | Normal |                          |
| Speicher  | Alarm  |                          |
| Controller 500605B00418BB20 (LSIMegaRAID SAS 9260-4i)   | Normal |                          |
| Battery 0 on Controller 500605B00418BB20  | Alarm  | Battery Status : Unknown |
| Drive 252_5 on controller 500605B00418BB20 Fw: 3.03   | Normal |                          |
| Drive 252_4 on controller 500605B00418BB20 Fw: 3.03   | Normal |                          |
| RAID 1 StorageVolume Logical Volume 500605B00418BB20_0 on controller 500605B00418BB20, Drives(252_5,252_4)- | Normal |                          |
| Port 0 on Controller 500605B00418BB20   | Normal |                          |
| Port 1 on Controller 500605B00418BB20   | Normal |                          |
| Temperatur  | Normal |                          |
| Memory Device 12 P2-DIMM3B Temp --- Normal  | Normal | 41 Degrees C             |

# VMware? → Plugin

| <code>check_esxi_hardware.py</code>  | <code>check_vmware_esx.pl</code>  |
|--|---|
| Hardware   | VMware allgemein  |
| python-pywbem  | VMware Perl SDK   |
| Claudio Kuenzler et.al.  | Martin Fürstenau  |
| Infos:<br><br>powered by Thomas-Krenn | <br><br>22.-24. OCTOBER 2013   NUREMBERG |

# check\_esxi\_hardware.py

## Service State Information

Current Status: **OK** (for 0d 6h 30m 45s)

Status Information: OK - Server: Supermicro X8DT3 s/n: 1234567890 System BIOS: 2.0a 2010-09-14

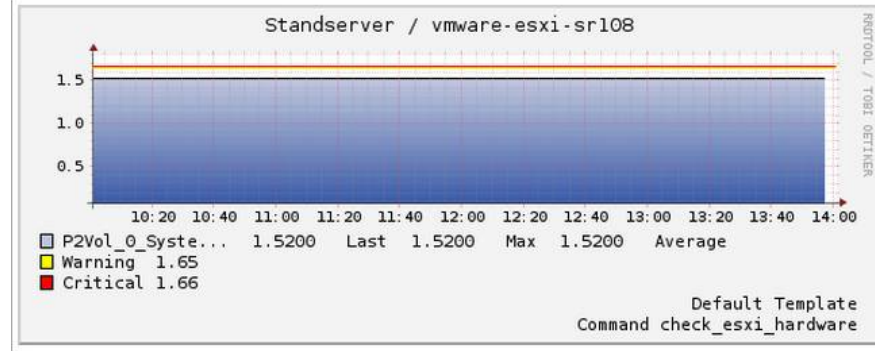
Performance Data:  
P2Vol\_0\_System\_Board\_1\_+1.5V=1.52;1.65;1.66 P2Vol\_1\_System\_Board\_1\_+12V=12.03;13.25;13.3 P2Vol\_2\_System\_Board\_1\_+3.3V=3.28;3.64;3.67 P2Vol\_3\_System\_Board\_1\_+3.3VSB=3.24;3.64;3.67  
P2Vol\_4\_System\_Board\_1\_+5V=5.02;5.53;5.56 P2Vol\_5\_System\_Board\_1\_CPU1\_DIMM=1.58;1.64;1.65 P2Vol\_6\_System\_Board\_1\_CPU1\_Vcore=0.92;1.35;1.36 P2Vol\_7\_System\_Board\_1\_CPU2\_DIMM=1.58;1.64;1.65  
P2Vol\_8\_System\_Board\_1\_CPU2\_Vcore=0.93;1.35;1.36 P2Vol\_9\_System\_Board\_1\_VBAT=3.24;3.64;3.67 P4Tem\_0\_Memory\_Device\_10\_P2-DIMM2B\_Temp=49;80;85 P4Tem\_10\_Memory\_Device\_8\_P2-DIMM1B\_Temp=48;80;85  
P4Tem\_11\_Memory\_Device\_9\_P2-DIMM2A\_Temp=50;80;85 P4Tem\_12\_System\_Board\_1\_System\_Temp=40;75;77 P4Tem\_1\_Memory\_Device\_11\_P2-DIMM3A\_Temp=55;80;85 P4Tem\_2\_Memory\_Device\_12\_P2-DIMM3B\_Temp=52;80;85  
P4Tem\_3\_Memory\_Device\_1\_P1-DIMM1A\_Temp=47;80;85 P4Tem\_4\_Memory\_Device\_2\_P1-DIMM1B\_Temp=45;80;85 P4Tem\_5\_Memory\_Device\_3\_P1-DIMM2A\_Temp=47;80;85  
P4Tem\_6\_Memory\_Device\_4\_P1-DIMM2B\_Temp=47;80;85 P4Tem\_7\_Memory\_Device\_5\_P1-DIMM3A\_Temp=47;80;85 P4Tem\_8\_Memory\_Device\_6\_P1-DIMM3B\_Temp=47;80;85 P4Tem\_9\_Memory\_Device\_7\_P2-DIMM1A\_Temp=49;80;85  
P5Fan\_0\_Fan\_Device\_1\_Fan1=1080;34155;34290 P5Fan\_1\_Fan\_Device\_2\_Fan2=1080;34155;34290 P5Fan\_2\_Fan\_Device\_5\_Fan5=945;34155;34290 P5Fan\_3\_Fan\_Device\_7\_Fan7=2025;34155;34290  
P5Fan\_4\_Fan\_Device\_8\_Fan8=2025;34155;34290

### Service details Standserver -> vmware-esxi-sr108

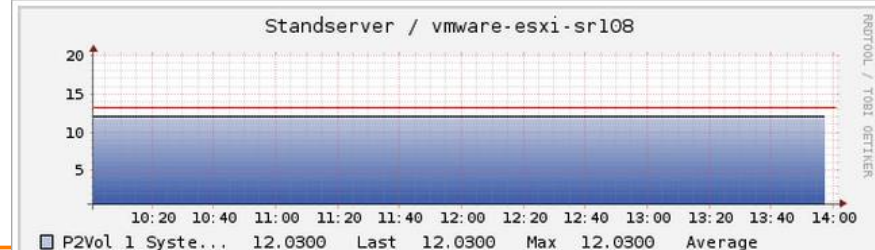
Host: Standserver Service: vmware-esxi-sr108

4 Hours 02.07.15 10:00 - 02.07.15 14:00

Datasource: P2Vol\_0\_System\_Board\_1\_+1.5V



Datasource: P2Vol\_1\_System\_Board\_1\_+12V



# check\_esxi\_hardware.py

```
#!/usr/bin/python
# -*- coding: UTF-8 -*-
#
# Script for checking global health of host running VMware ESX/ESXi
#
# Licence : GNU General Public Licence (GPL) http://www.gnu.org/
# This program is free software; you can redistribute it and/or
# modify it under the terms of the GNU General Public License
# as published by the Free Software Foundation; either version 2
# of the License, or (at your option) any later version.
[...]
#
# Pre-req : pywbem
#
# Copyright (c) 2008 David Ligeret
# Copyright (c) 2009 Joshua Daniel Franklin
# Copyright (c) 2010 Branden Schneider
# Copyright (c) 2010-2015 Claudio Kuenzler
# Copyright (c) 2010 Samir Ibradzic
# Copyright (c) 2010 Aaron Rogers
# Copyright (c) 2011 Ludovic Hutin
# Copyright (c) 2011 Carsten Schoene
# Copyright (c) 2011-2012 Phil Randal
# Copyright (c) 2011 Fredrik Aslund
# Copyright (c) 2011 Bertrand Jomin
# Copyright (c) 2011 Ian Chard
# Copyright (c) 2012 Craig Hart
# Copyright (c) 2013 Carl R. Friend
# Copyright (c) 2015 Andreas Gottwald
```

# VMware und RAID Controller

## — CIM Provider

- VMware ESXi Hardware mit Nagios oder Icinga überwachen
- Für Megaraid Controller im Health Status ersichtlich
- Für Adaptec
  - Früher remote arconf
  - **Adaptec RAID Controller in VMware überwachen**
  - Aktuell kein CIM Provider, der sich direkt in den Health Status integrieren würde

Service Status Details For All Hosts

Page 1 of 1 Results: 50

| Host  | Service              | Status  | Last Check          | Duration      | Attempt | Status Information  |                          |
|-------|----------------------|---------|---------------------|---------------|---------|---|--------------------------|
| test1 | IPMI Sensors         | OK      | 2013-07-18 13:34:27 | 0d 0h 13m 10s | 1/4     | IPMI Status: OK   | <input type="checkbox"/> |
|       | Ping check           | OK      | 2013-07-18 13:32:34 | 0d 0h 15m 3s  | 1/4     | PING OK - Packet loss = 0% RTA = 0.70 ms  | <input type="checkbox"/> |
|       | VMware ESXi Hardware | WARNING | 2013-07-18 13:35:53 | 0d 0h 4m 44s  | 4/4     | WARNING : RAID 5 StorageVolume Logical Volume 500605B005D31680_1 on controller 500605B005D31680, Drives( - DEGRADED - Server: Supermicro X9SCL/X9SCM s/n: 0123456789 System BIOS: 2.0b 2012-09-17 | <input type="checkbox"/> |
| tkmon | linux-disc           | OK      | 2013-07-18 13:36:21 | 0d 4h 56m 16s | 1/4     | DISK OK   | <input type="checkbox"/> |
|       | linux-load           | OK      | 2013-07-18 13:35:06 | 0d 4h 52m 31s | 1/4     | OK - load average: 0.03, 0.03, 0.05   | <input type="checkbox"/> |
|       | linux-processes      | OK      | 2013-07-18 13:33:51 | 0d 4h 48m 46s | 1/4     | PROCS OK: 79 processes  | <input type="checkbox"/> |
|       | linux-smtp-server    | OK      | 2013-07-18 13:32:36 | 0d 4h 45m 1s  | 1/4     | SMTP OK - 0.010 sec. response time  | <input type="checkbox"/> |
|       | linux-updates        | OK      | 2013-07-18 13:36:21 | 0d 4h 41m 16s | 1/4     | APT OK: 0 packages available for dist-upgrade (0 critical updates).   | <input type="checkbox"/> |

# TKmon

# TKmon – Call Home

- TKmon

- Inkl. Hands-On Video

- Call-Home-Service

- Nicht TKmon spezifisch, auch „nur“ mit Icinga/Nagios verwendbar

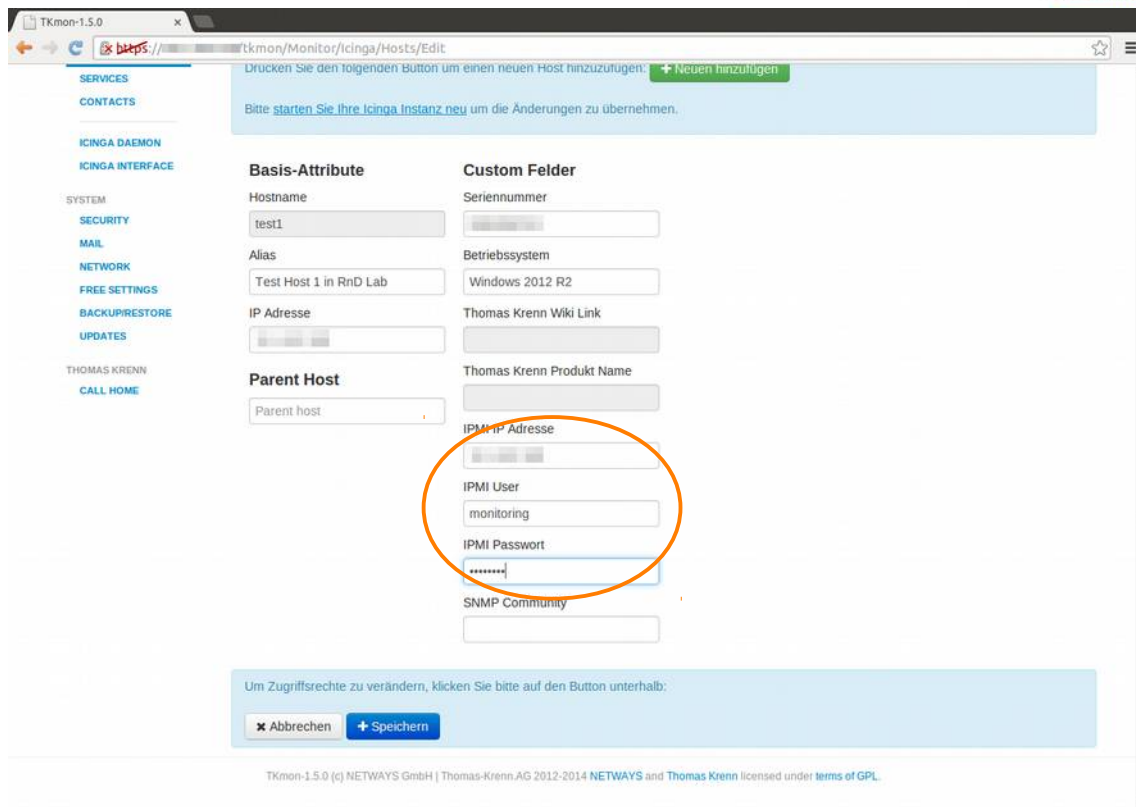
- GPG verschlüsselt
  - Open Source

- Automatische Benachrichtigung bei Hardware-Fehlern



# TKmon

## Kategorie:TKmon



TKmon-1.5.0

tkmon/Monitor/Icinga/Hosts/Edit

Drücken Sie den folgenden Button um einen neuen Host hinzuzufügen: [+ Neuen hinzufügen](#)

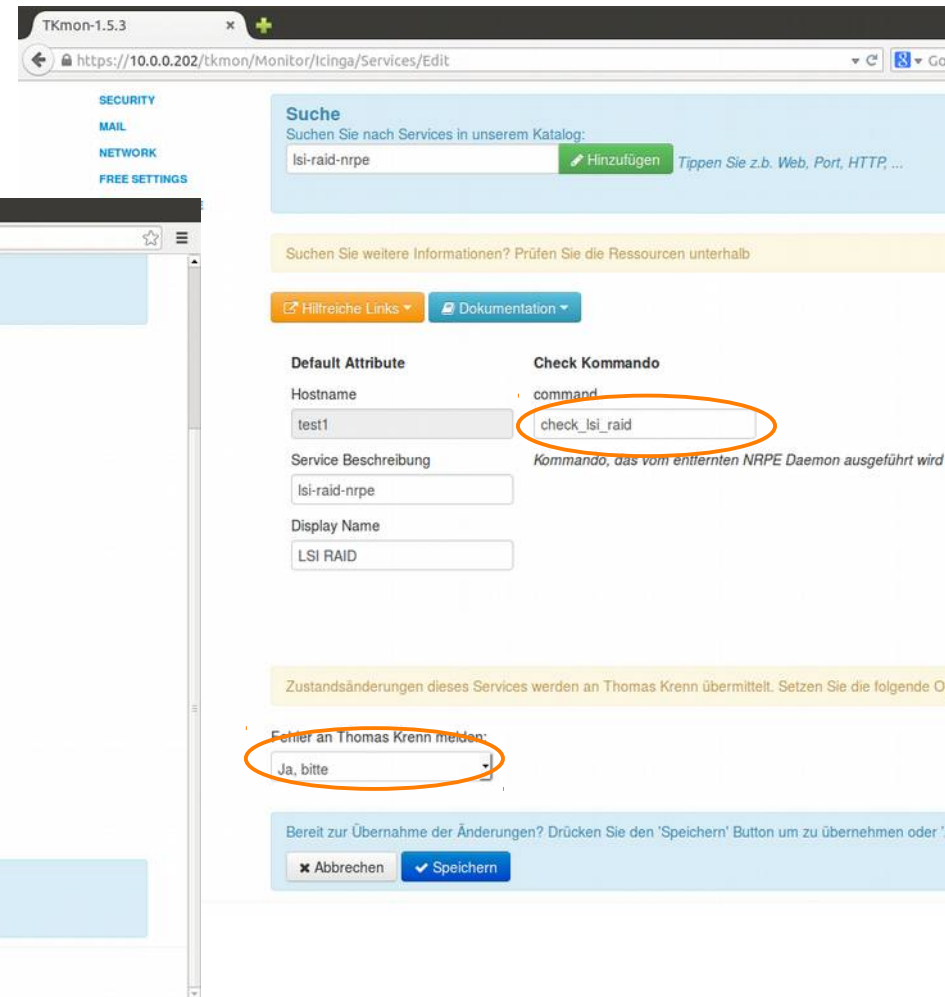
Bitte [starten Sie Ihre Icinga Instanz neu](#) um die Änderungen zu übernehmen.

| Basis-Attribute                 | Custom Felder                           |
|---------------------------------|---|
| Hostname<br>test1               | Seriennummer<br>[redacted]              |
| Alias<br>Test Host 1 in RnD Lab | Betriebssystem<br>Windows 2012 R2       |
| IP Adresse<br>[redacted]        | Thomas Krenn Wiki Link<br>[redacted]    |
| Parent Host<br>Parent host      | Thomas Krenn Produkt Name<br>[redacted] |
|                                 | IPMI IP Adresse<br>[redacted]           |
|                                 | IPMI User<br>monitoring                 |
|                                 | IPMI Passwort<br>*****                  |
|                                 | SNMP Community<br>[redacted]            |

Um Zugriffsrechte zu verändern, klicken Sie bitte auf den Button unterhalb:

[Abbrechen](#) [Speichern](#)

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TKmon-1.5.3

https://10.0.0.202/tkmon/Monitor/Icinga/Services/Edit

SECURITY  
MAIL  
NETWORK  
FREE SETTINGS

**Suche**  
Suchen Sie nach Services in unserem Katalog:  
Isi-raid-nrpe [Hinzufügen](#) *Tippen Sie z.B. Web, Port, HTTP, ...*

Suchen Sie weitere Informationen? Prüfen Sie die Ressourcen unterhalb

[Hilfreiche Links](#) [Dokumentation](#)

| Default Attribute                     | Check Kommando  |
|---------------------------------------|---|
| Hostname<br>test1                     | command<br>check_isi_raid                                       |
| Service Beschreibung<br>Isi-raid-nrpe | <i>Kommando, das vom entlernten NRPE Daemon ausgeführt wird</i> |
| Display Name<br>LSI RAID              |   |

Zustandsänderungen dieses Services werden an Thomas Krenn übermittelt. Setzen Sie die folgende O

Fehler an Thomas Krenn melden:  
[Ja, bitte](#)

Bereit zur Übernahme der Änderungen? Drücken Sie den 'Speichern' Button um zu übernehmen oder

[Abbrechen](#) [Speichern](#)

So, was nun?

# Relax ...

- \_ Alle Plugins unter [git.thomas-krenn.com](http://git.thomas-krenn.com)
  - \_ [gschoenberger@thomas-krenn.com](mailto:gschoenberger@thomas-krenn.com)
- \_ Alle Plugins erfüllen die Nagios Plugin Developer Guidelines (-h für **Hilfe**)
- \_ Zu allen Plugins gibt es einen **Wiki**-Artikel
  - \_ Verbesserungsvorschläge per Wiki-Feedback
- \_ Auf der **Mailing Liste** erreichen Sie uns!
  - \_ Feature Requests
  - \_ Bug Reports



# Relax, start ...

Serverliste  
erstellen

IPMI  
sicher  
konfigurieren

Relevante  
Plugins  
einrichten



Danke,  
für die Webinar-Teilnahme

**THOMAS**  
**KRENN**<sup>®</sup>  
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