



# Monitoring system of the JINR Tier-1 and Tier-2



Kashunin I., Mitsyn V., Dolbilov A., Trofimov V.  
ROLCG 2015 Conference, Cluj-Napoca, 28-30 October 2015

# The monitoring system: conceptual phases

**Study analysis of existing systems**

**Definition of primary criteria for the monitoring system development**

**Model building of the monitoring system**

**Implementation of a monitoring system obeying the requirements**

**Use of the monitoring system**

# Tier-1 hardware: Control and monitoring facilities

- **Control, computing and disk servers:**  
ssh, ipmi
- **Tape library:**  
http, snmp
- **Cooling system:**  
http, snmp
- **Uninterruptable power supply:**  
http, snmp



General view  
of the complex



The cooling  
system



Control, computing  
and disk servers



The tape  
library



The UPS module

# Tier-2 hardware

- **Control, computing and disk servers:**  
ssh, ipmi
- **Uninterruptable power supply:**  
http, snmp
- **Cooling system:**  
http, snmp

**General view  
of the Tier-2 complex**



**The UPSs**



**The control, computing  
and disk servers**



# The monitoring system: Suitability

- ❖ **Tier-2 and Tier-1 hardware has similar control and tracking facilities**
- ❖ **Problems needing solution:**
  - **Implementing a united tracking system**
  - **Implementing a united storage system of hardware data sensors**
  - **Implementing a prompt response to hardware failure**

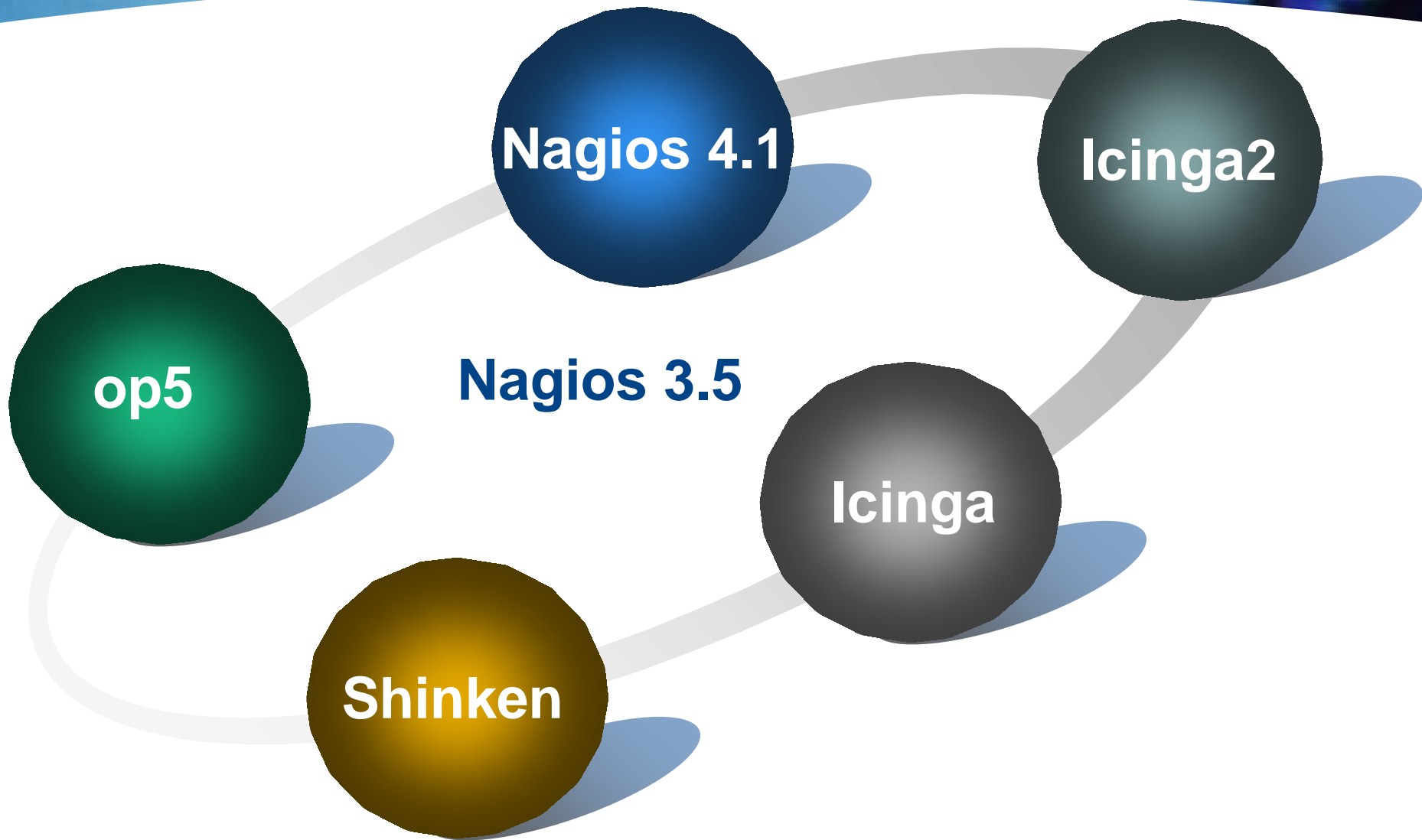
# The monitoring system: Selection Criteria

- ❖ **Versatility**
- ❖ **Organize encompass and comfortable interface**
  - The chart system and history storage
  - The notification system
  - The data visualization system
- ❖ **Inclusion in the monitoring system of the new hardware**
  - Home-made plugins for gathering sensor data
- ❖ **Authentication system**
  - Kerberos support
- ❖ **Module structure**
  - Addon instalations

# Overview of existing monitoring systems

	Expandable	Kerberos	Modularity	Versatility
Nagios	Yes	Yes	Yes	Yes
Ganglia	Yes	No	No	Cluster monitoring system
Zabbix	Yes	Yes	No	Yes
Icinga	Yes	Yes	Yes	Yes
Icinga2	Yes	Yes	Yes	Yes

# Nagios monitoring system family





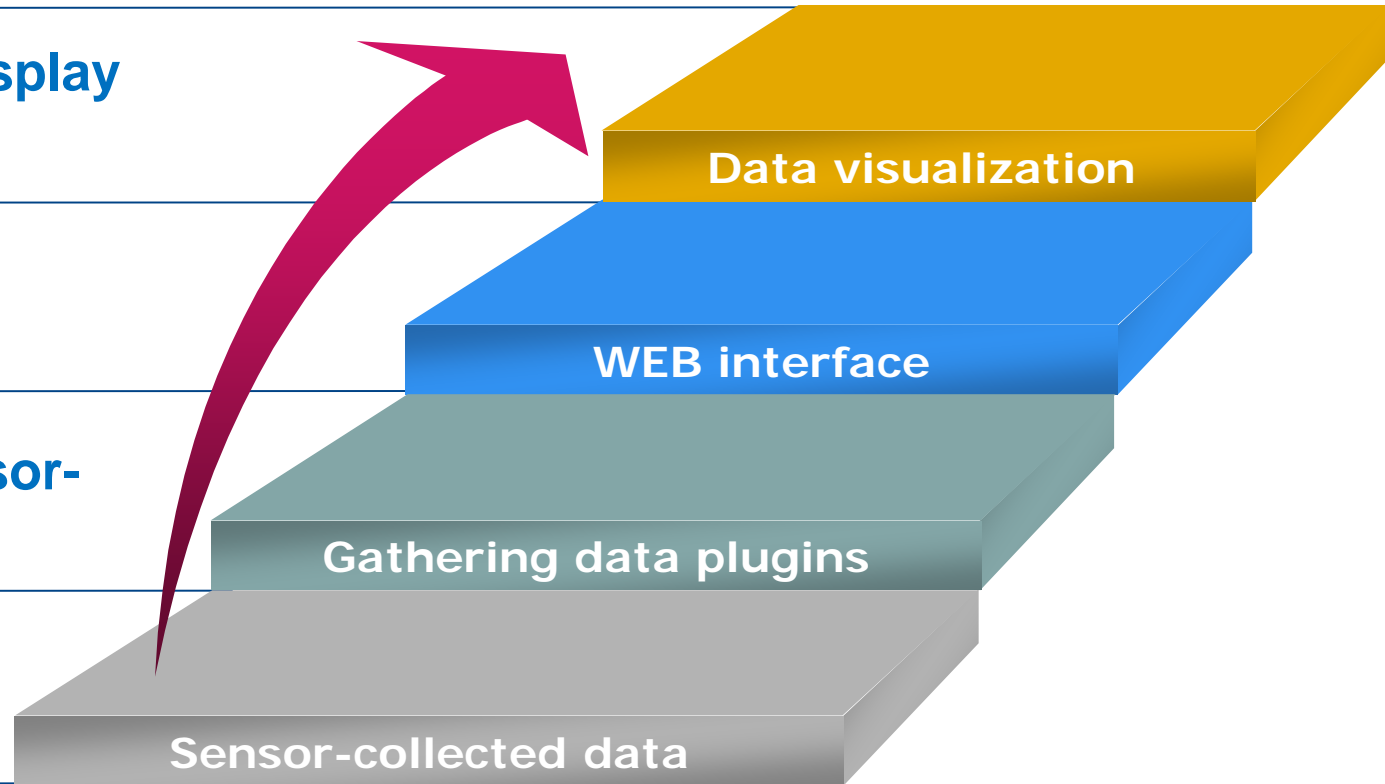
# The monitoring system: processing data algorithm

❖ Informational display show

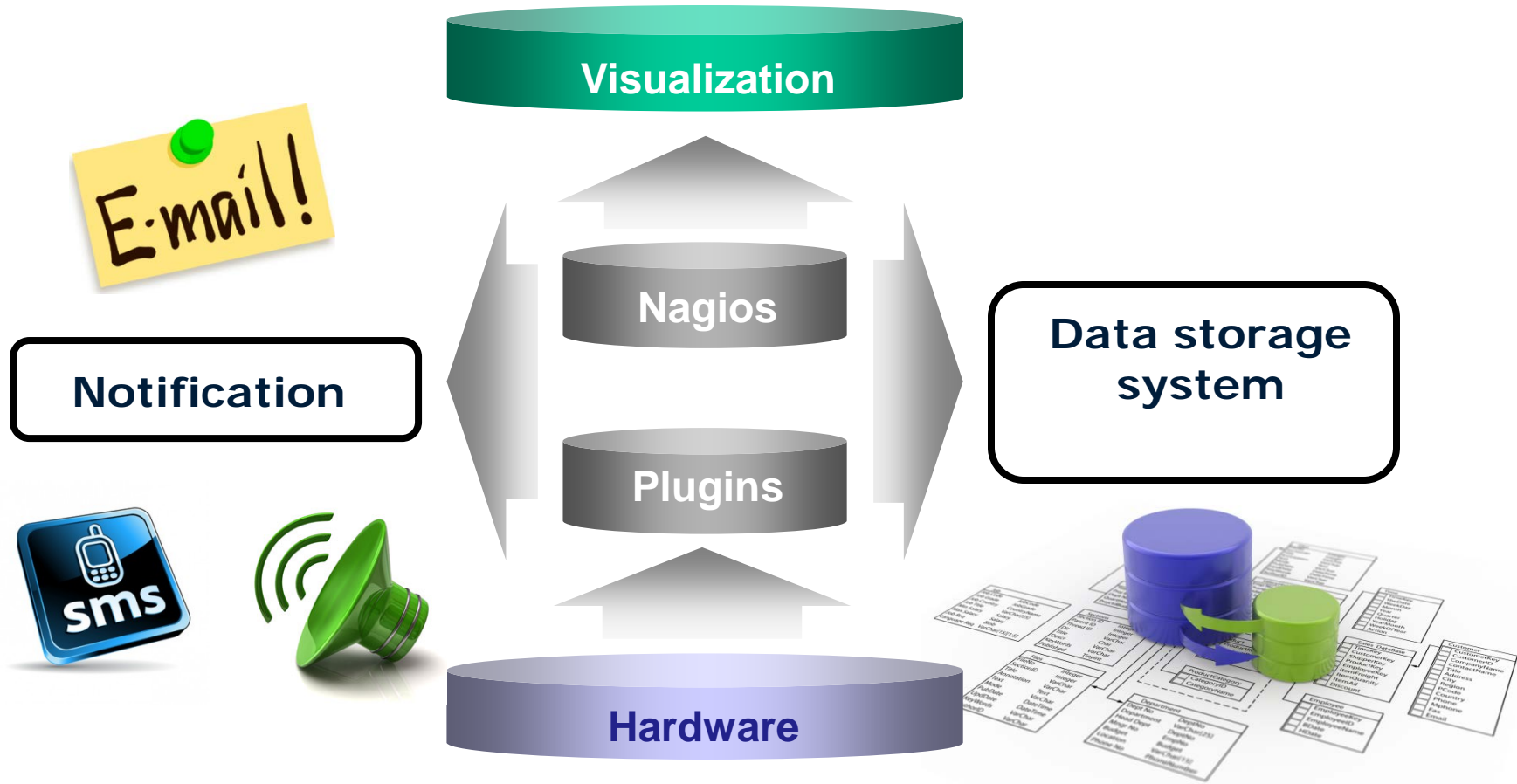
❖ State table show

❖ Processing sensor-collected data

❖ Hardware



# The monitoring system: Principle of work



# The monitoring system structure scheme

Level 3 Visualisation and data

Conventional  
- developed  
- tuned  
- upheld

Level 2 Software and data pro

Notification system

Status

## Host Group

Linux Servers (linux-servers)

lit-cooling-doors (lit-cooling-doors)

lit-dcache (lit-dcache)

lit-network-switch-tier-1 (lit-network-switch-tier-1)

lit-network-switch-tier-2 (lit-network-switch-tier-2)

lit-other-servers (lit-other-servers)

lit-tier-1-batch-system (lit-tier-1-batch-system)

lit-tier-1-computing-servers (lit-tier-1-computing-servers)

lit-tier-1-raids (lit-tier-1-raids)

lit-tier-1-tape-library (lit-tier-1-tape-library)

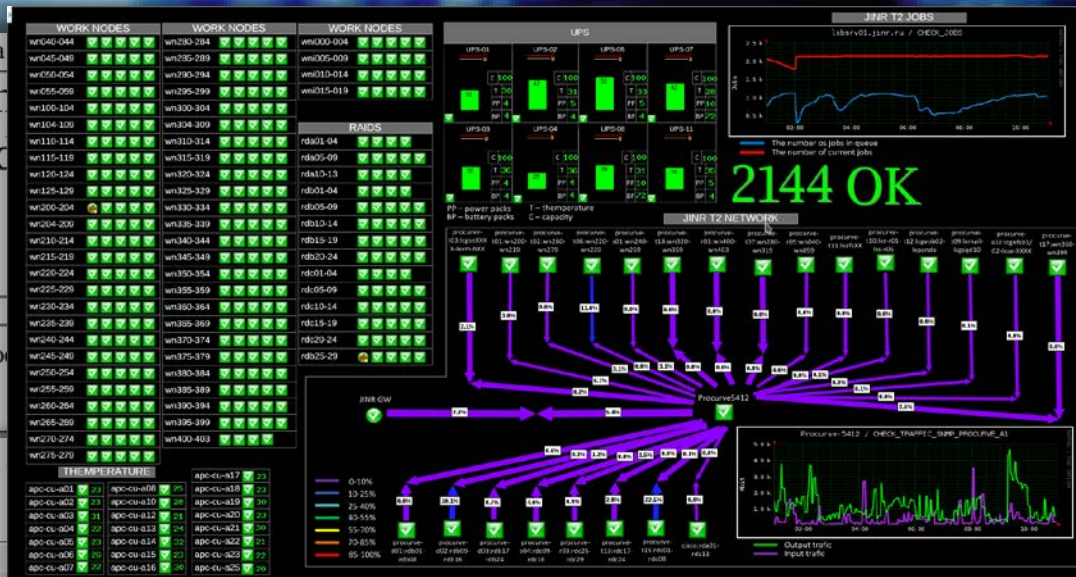
lit-tier-1-thermometer (lit-tier-1-thermometer)

lit-tier-2-batch-system (lit-tier-2-batch-system)

lit-tier-2-computing-servers (lit-tier-2-computing-servers)

lit-tier-2-raids (lit-tier-2-raids)

lit-ups (lit-ups)

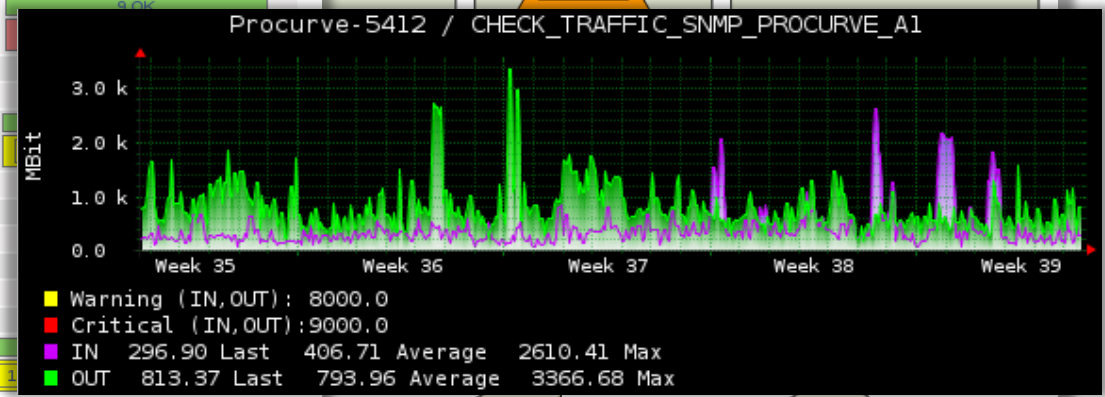


Pnp4nagios charts



Storage system data

chart templates php



Switches and Routers

Cooling system

UPS

Computing servers

RAID servers



COMPANY LOGO

# Hardware gathering data

```
cmd1=netsnmp.snmpget(  
netsnmp.Varbind('.1.3.6.1.4.1.318.1.1.14.3.3.1.5.1'),  
Version = 2,  
DestHost=argHost,  
Community="public")
```

**Special plugins**  
carry out data gathering

**Libraries used for gathering data:**

```
def make_command(command):  
    return Popen(command, shell=True, stdout=PIPE, stderr=PIPE).communicate()[0].strip()  
  
failed_status = make_command("/root/sbin/twstatshort | awk '{print $3}' | grep u0 | awk '{print $1}'")
```

**Computing servers**

```
Check_smart  
Check_cpu  
...
```

```
Check_capacity  
Check_load  
...
```

**UPS**

**Gathering data plugins**

**The tape library**

**The cooling system**

# Organization of the SMS notification system

## Failure

Defined by the gathering data plugin

## Analysis

Notification system uses configuration files to define which notification it will use.

## Notification

The monitoring system runs sms notification script:  
Notify-service-by-sms

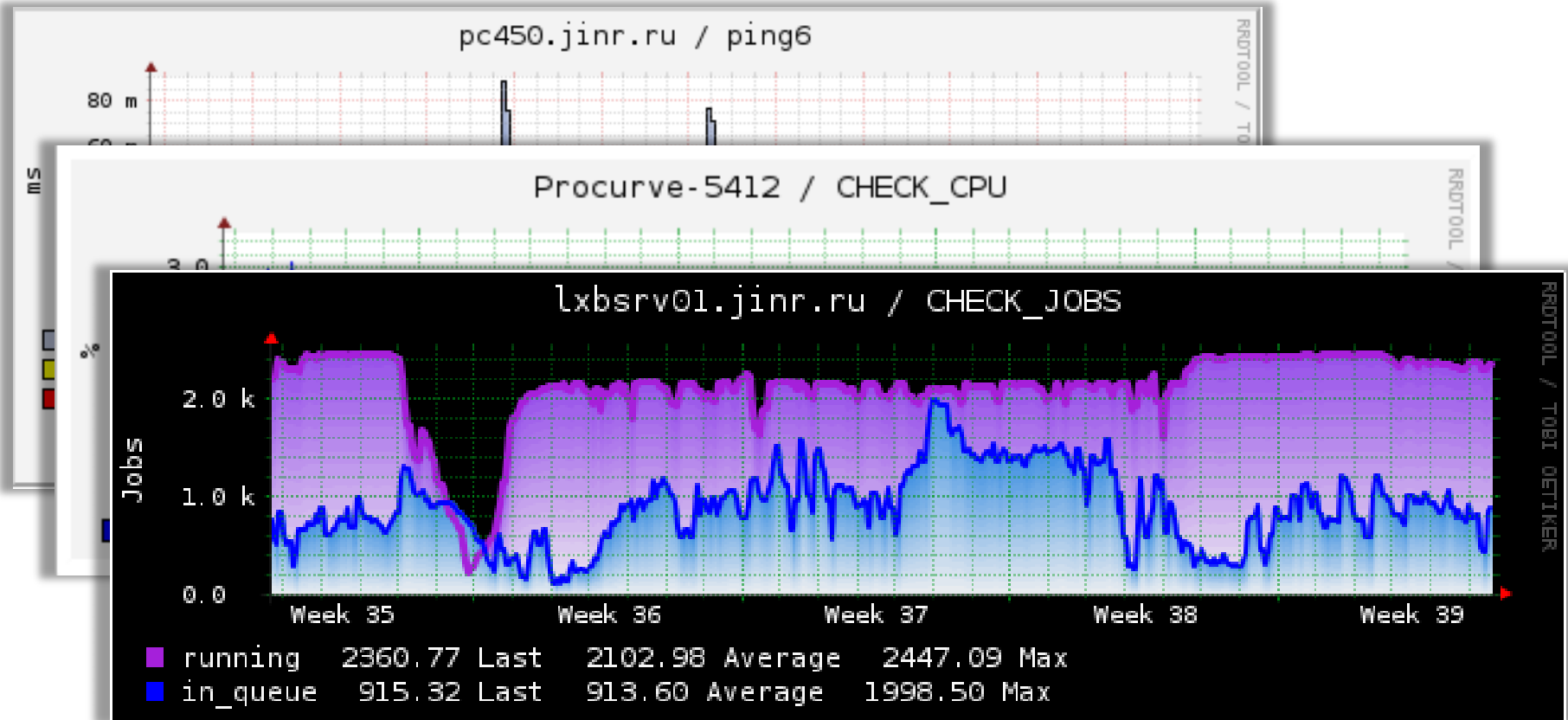
SMS sending service  
sms.jinr.ru

Sms notification plugins

```
""INSERT INTO outbox  
(DestinationNumber,TextDecoded,Coding)  
VALUE ('"+str(argNumber)+"", '"+str(argOption)+""  
"+str(argHost)+" _ "+str(argInterface)+"",  
'Default_No_Compression');""
```

# Pnp4nagios: Template creation

Pnp4nagios by default use “Default Template”



Pnp4nagios allows flexible tuning charts by using own templates

The monitoring system allows issuing notifications. If the servers are down, it allows changing their states to “downtime” or “acknowledgement”

### Command Options

Host Name:

Author (Your Name):

Comment:

Triggered By:

Start Time:


















End Time:

Type:

If Flexible, Duration:  Hours  Minutes

Child Hosts:

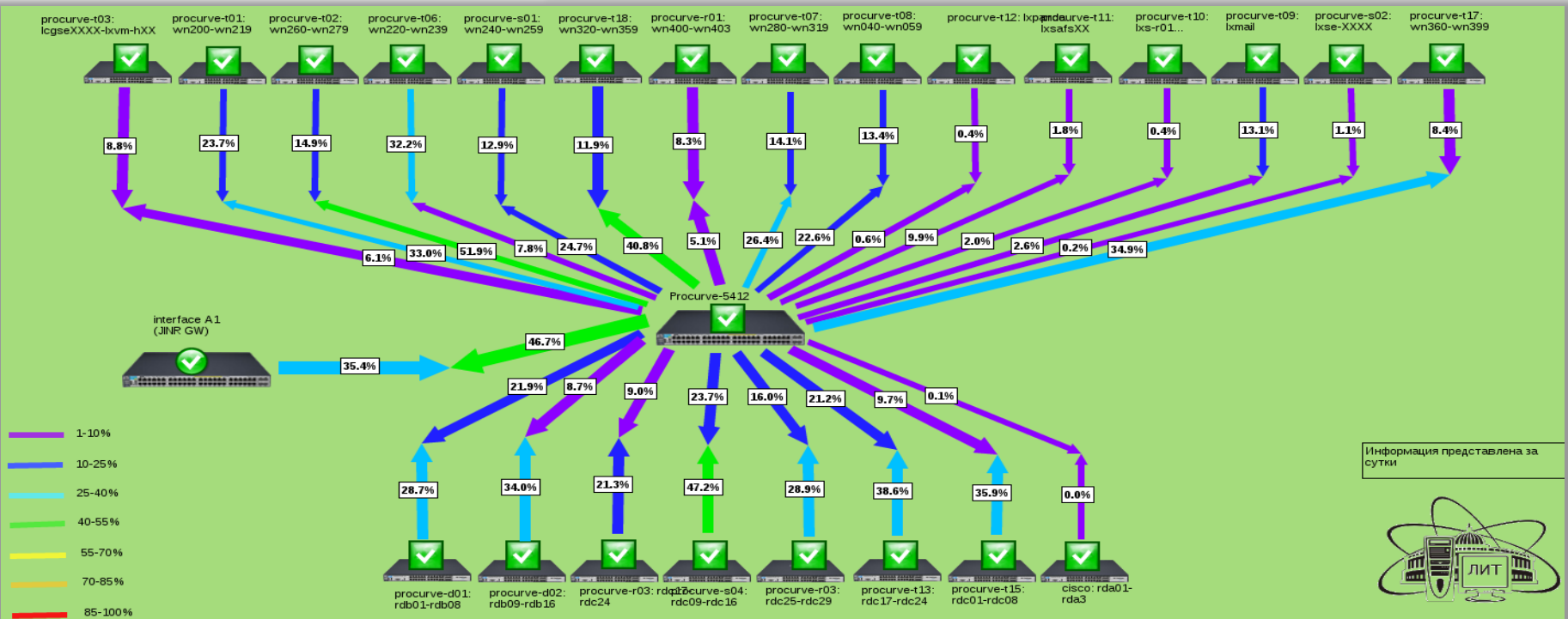
### Host Commands

-  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
-  Stop accepting passive checks for this host
-  Stop obsessing over this host
-  Disable notifications for this host
-  Send custom host notification
-  Schedule downtime for this host
-  Schedule downtime for all services on 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

# Data visualization system

- ❖ Information panel
- ❖ Network maps
- ❖ Unified state tables

Map Index					
CICC	❌	Cooling_doors	✅	Tier-1_WN	✅
Tier-1_tape_library	✅	Tier-1_therometer	✅	Tier-2_Dashboard	🌐
Tier-2_network	✅	<b>Tier-2_network_max</b>	✅	Tier-2_raid	🌐
dCache	❌	other_servers	🚨	test	📄
				UPS	✅

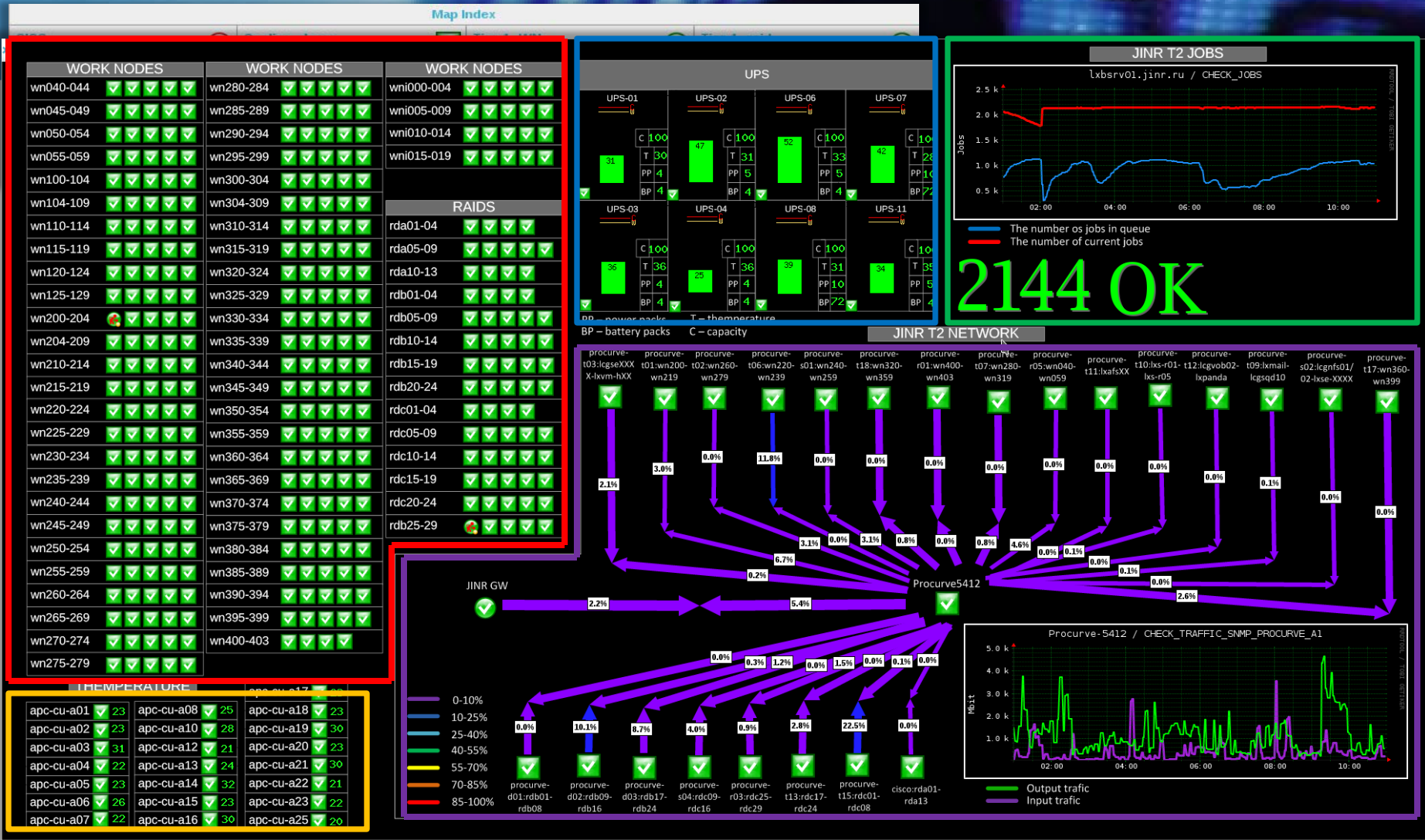


Информация представлена за сутки





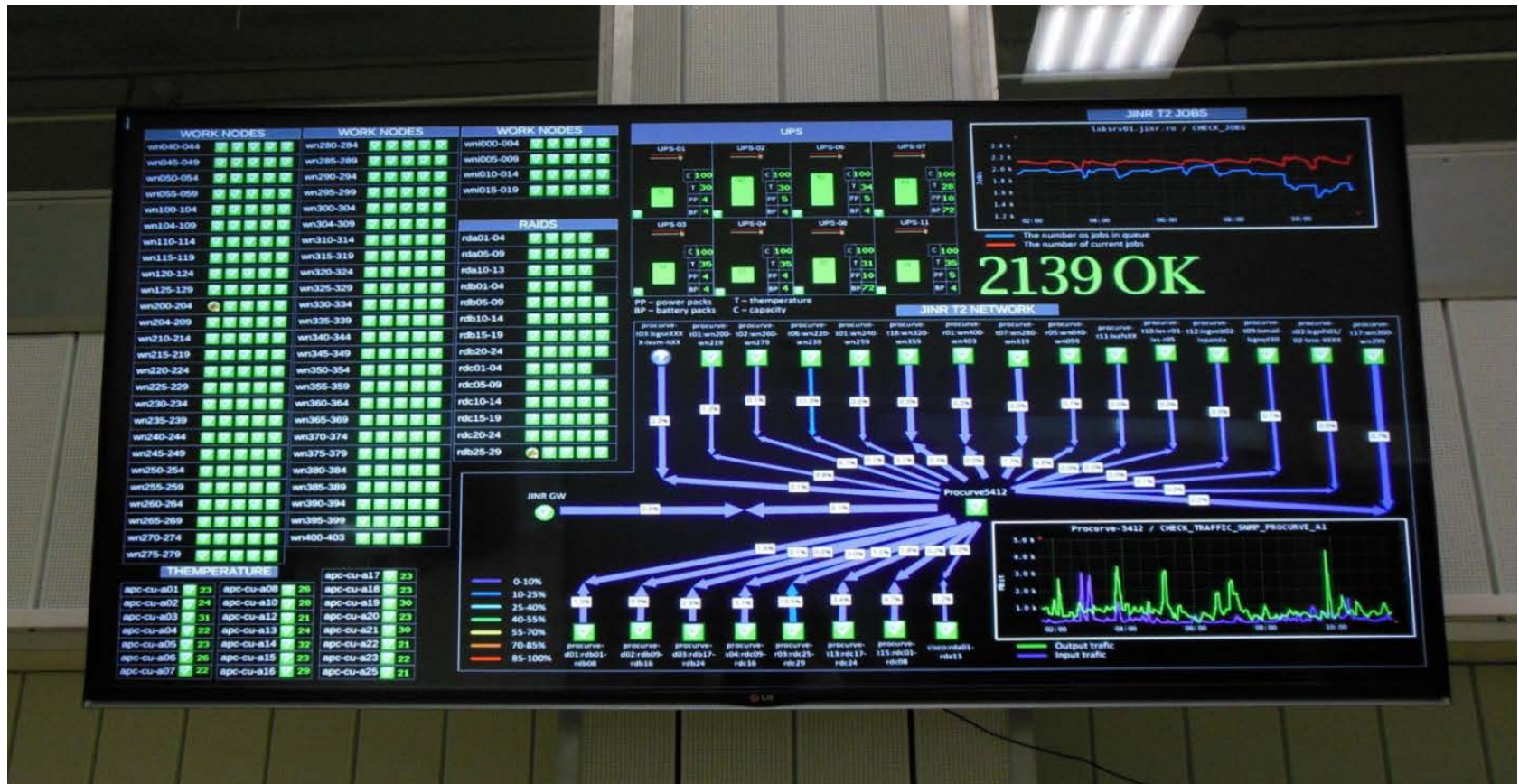
# Informational displays



- Computing and storage servers
- UPS
- Network
- Computing cluster load
- Cooling system

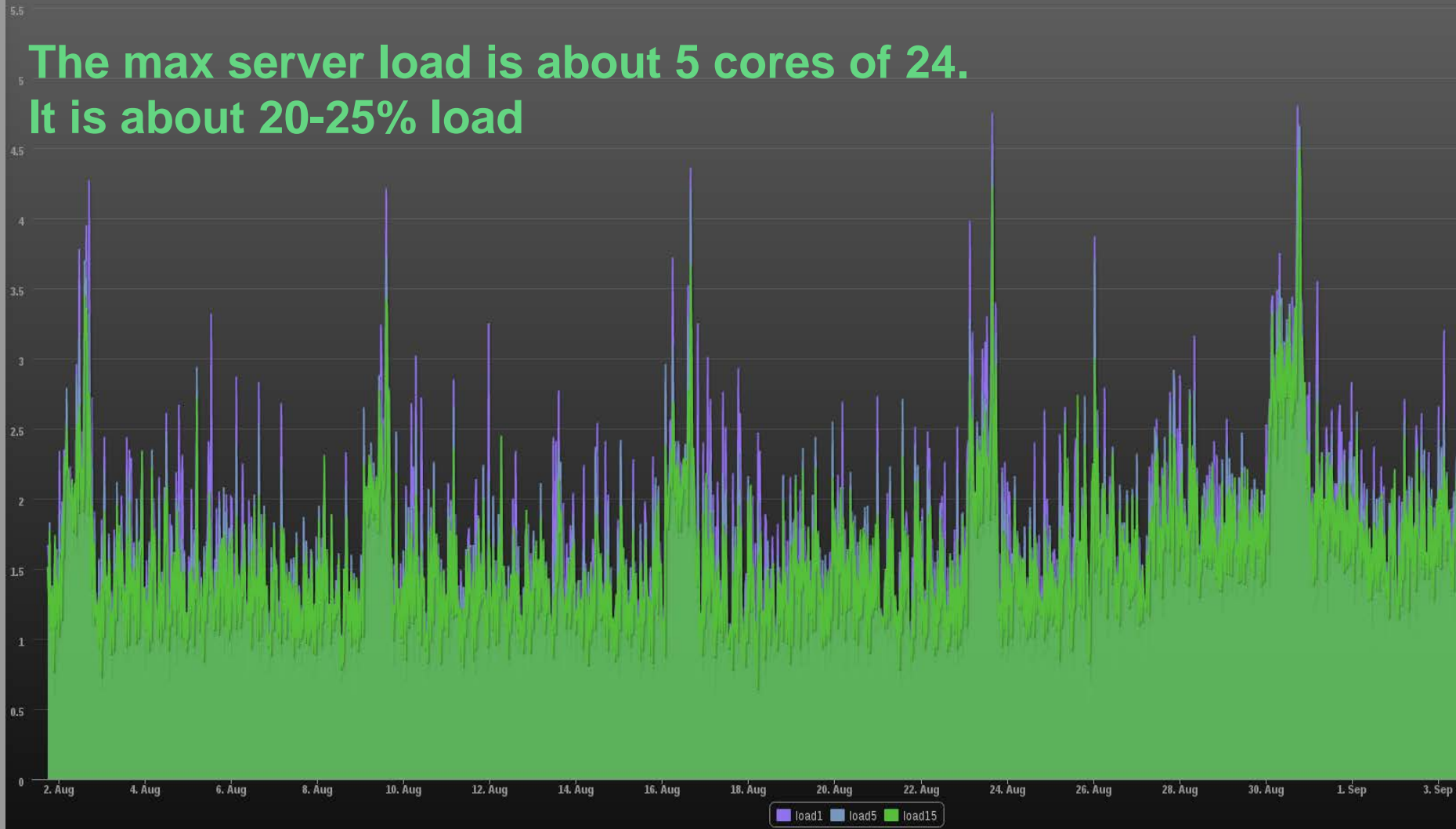
# Monitoring system: implementation and usage

The Nagvis web interface allows running the monitoring system on a TV screen without any supplementary device



# Monitoring system performance

The max server load is about 5 cores of 24.  
It is about 20-25% load

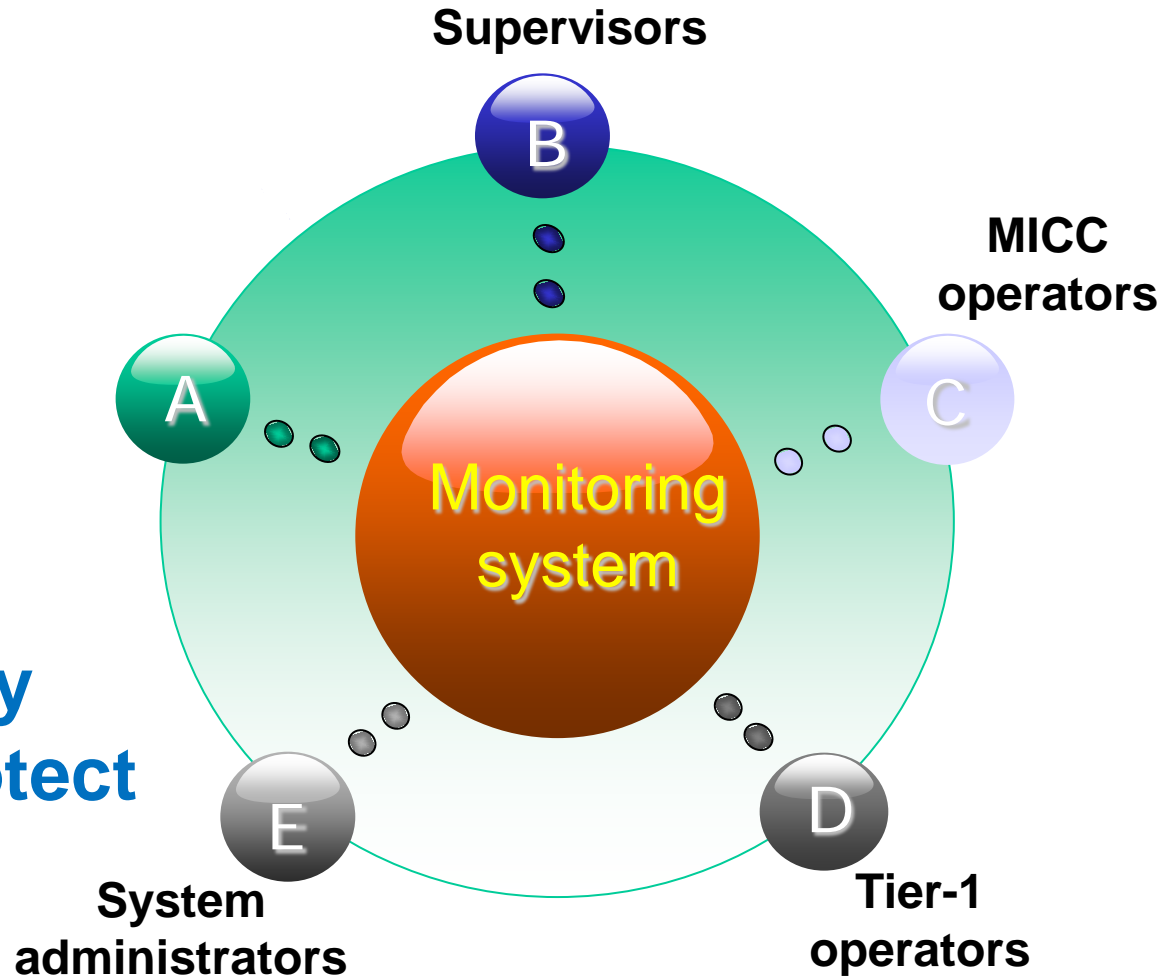


# Monitoring system usage

Monitoring system access based by kerberos

Cooling hardware operators

https protocol carry out connection protect



# Conclusions

Written plugins for gathering and processing data from hardware

Written configuration files, which allow gathering data from hardware to United system

Written plugin allows to organize SMS notification

Designed visualization chart templates

Organized operational reporting system about Tier-1 and Tier-2 in real time

**As a result the monitoring system of the JINR Tier-1 and Tier-2 has been developed and put into operation**

Thank you for your time!



# Backup



# Nagios web interface

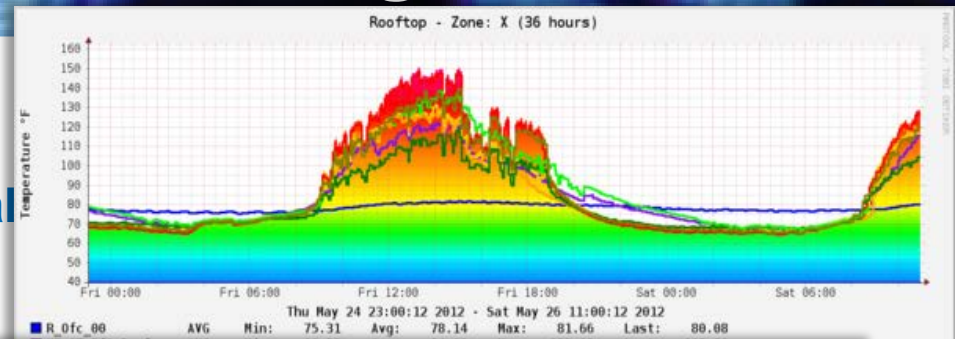
- ❖ Currently the monitoring system includes about 700 hosts
- ❖ Number of service for stable work equal about 3.5k

Host Group	Host Status Summary	Service Status Summary
Linux Servers (linux-servers)	1 UP	10 OK
lit-cooling-doors (lit-cooling-doors)	22 UP	44 OK
lit-dcache (lit-dcache)	4 UP	9 OK 1 CRITICAL : 1 Unhandled
lit-network-switch-tier-1 (lit-network-switch-tier-1)	1 UP	20 OK
lit-network-switch-tier-2 (lit-network-switch-tier-2)	24 UP	245 OK
lit-other-servers (lit-other-servers)	69 UP	85 OK 2 WARNING : 2 Unhandled
lit-tier-1-batch-system (lit-tier-1-batch-system)	1 UP	2 OK
lit-tier-1-computing-servers (lit-tier-1-computing-servers)	169 UP	845 OK
lit-tier-1-raids (lit-tier-1-raids)	38 UP	266 OK
lit-tier-1-tape-library (lit-tier-1-tape-library)	13 UP	79 OK
lit-tier-1-thermometer (lit-tier-1-thermometer)	1 UP	1 OK
lit-tier-2-batch-system (lit-tier-2-batch-system)	1 UP	2 OK
lit-tier-2-computing-servers (lit-tier-2-computing-servers)	274 UP	1369 OK 1 WARNING : 1 Acknowledged
lit-tier-2-raids (lit-tier-2-raids)	66 UP	460 OK 1 WARNING : 1 Acknowledged 1 CRITICAL : 1 Unhandled
lit-ups (lit-ups)	8 UP	56 OK

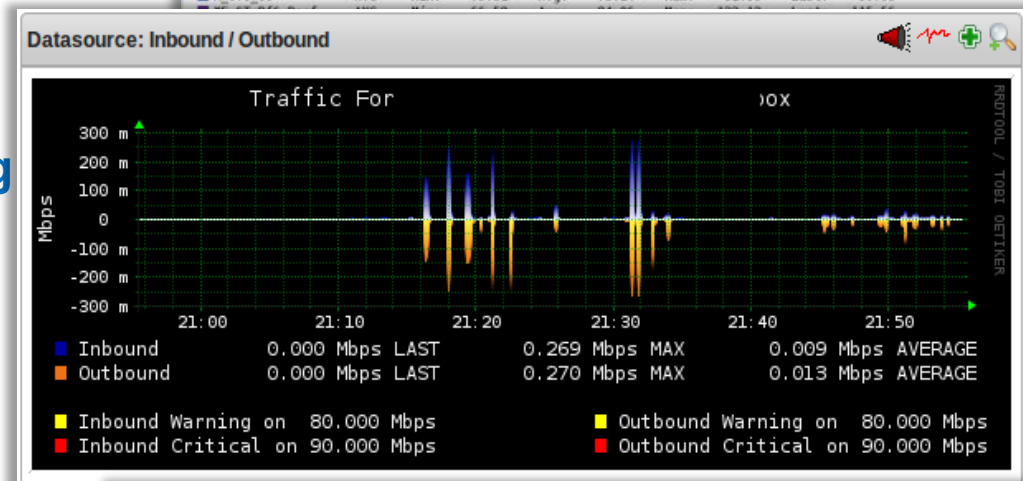


# Pnp4nagios chart system

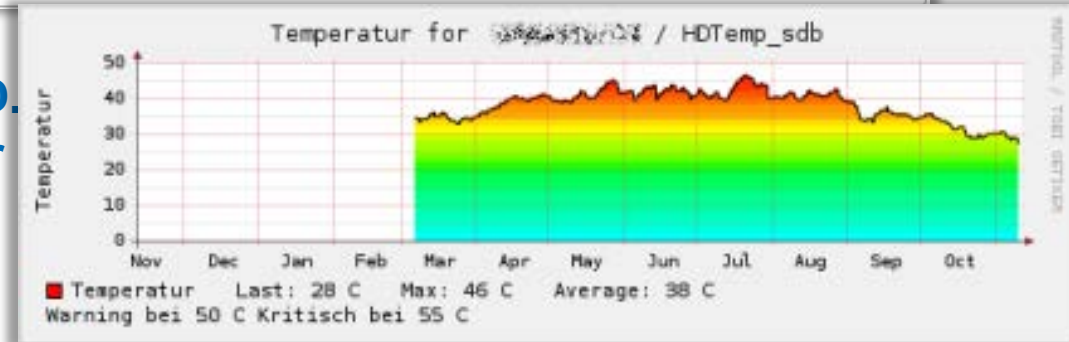
❖ Pnp4nagios allows to draw several lines per chart



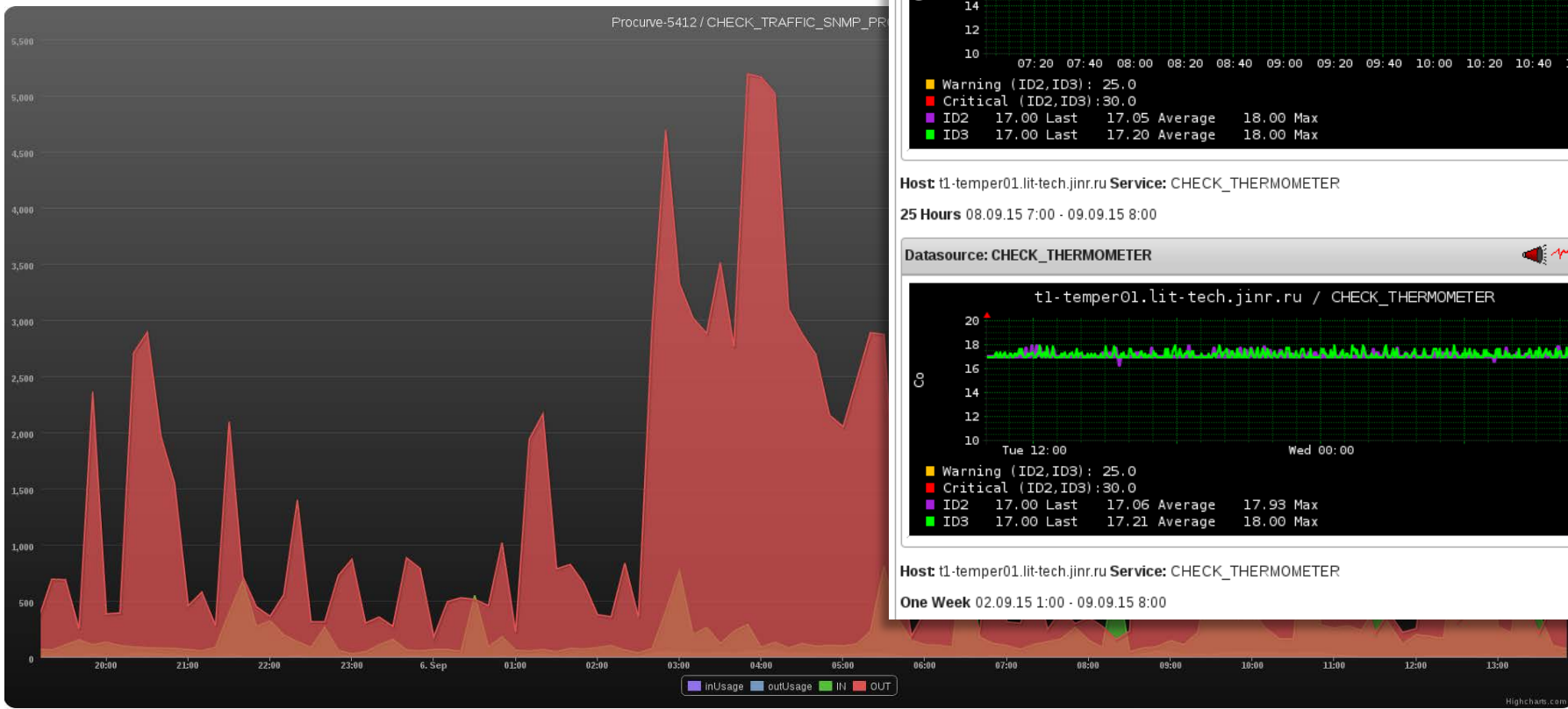
❖ Pnp4nagios allows tuning charts



❖ Pnp4nagios stores data in RRD. It's allow to use many addons for chart customization



For organize chart system used  
pnp4nagios templates +  
nagios\_hightchart addon



Service details t1-temper01.lit-tech.jinr.ru -> CHECK\_THERMOMETER

Host: t1-temper01.lit-tech.jinr.ru Service: CHECK\_THERMOMETER

4 Hours 09.09.15 4:00 - 09.09.15 8:00

Datasource: CHECK\_THERMOMETER

t1-temper01.lit-tech.jinr.ru / CHECK\_THERMOMETER

Warning (ID2, ID3):	25.0
Critical (ID2, ID3):	30.0
ID2	17.00 Last 17.05 Average 18.00 Max
ID3	17.00 Last 17.20 Average 18.00 Max

Host: t1-temper01.lit-tech.jinr.ru Service: CHECK\_THERMOMETER

25 Hours 08.09.15 7:00 - 09.09.15 8:00

Datasource: CHECK\_THERMOMETER

t1-temper01.lit-tech.jinr.ru / CHECK\_THERMOMETER

Warning (ID2, ID3):	25.0
Critical (ID2, ID3):	30.0
ID2	17.00 Last 17.06 Average 17.93 Max
ID3	17.00 Last 17.21 Average 18.00 Max

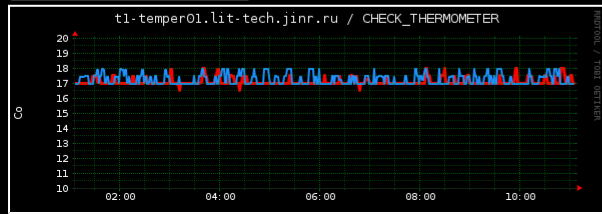
Host: t1-temper01.lit-tech.jinr.ru Service: CHECK\_THERMOMETER

One Week 02.09.15 1:00 - 09.09.15 8:00

# Tier-1 Informational display

WORK NODES				WORK NODES				RAIDS			
wna000-004	✓✓✓✓✓	wna130-134	✓✓✓✓✓	rda000-004	✓✓✓✓✓						
wna005-009	✓✓✓✓✓	wna135-139	✓✓✓✓✓	rda005-009	✓✓✓✓✓						
wna010-014	✓✓✓✓✓	wna140-144	✓✓✓✓✓	rda010-014	✓✓✓✓✓						
wna015-019	✓✓✓✓✓	wna145-149	✓✓✓✓✓	rda015-019	✓✓✓✓✓						
wna020-024	✓✓✓✓✓	wna150-154	✓✓✓✓✓	rda020-024	✓✓✓✓✓						
wna025-029	✓✓✓✓✓	wna155-159	✓✓✓✓✓	rda025-029	✓✓✓✓✓						
wna030-034	✓✓✓✓✓	lxvh000-004	✓✓✓✓✓	rdt000-004	✓✓✓✓✓						
wna035-039	✓✓✓✓✓	lxvh005-009	✓✓✓✓✓	rdt005-007	✓✓✓✓✓						
wna040-044	✓✓✓✓✓										
wna045-049	✓✓✓✓✓										
wna050-054	✓✓✓✓✓										
wna055-059	✓✓✓✓✓										
wna060-064	✓✓✓✓✓										
wna065-069	✓✓✓✓✓										
wna070-074	✓✓✓✓✓										
wna075-079	✓✓✓✓✓										
wna080-084	✓✓✓✓✓										
wna085-089	✓✓✓✓✓										
wna090-094	✓✓✓✓✓										
wna095-099	✓✓✓✓✓										
wna100-104	✓✓✓✓✓										
wna105-109	✓✓✓✓✓										
wna110-114	✓✓✓✓✓										
wna115-119	✓✓✓✓✓										
wna120-124	✓✓✓✓✓										
wna125-129	✓✓✓✓✓										

### TEMPERATURE

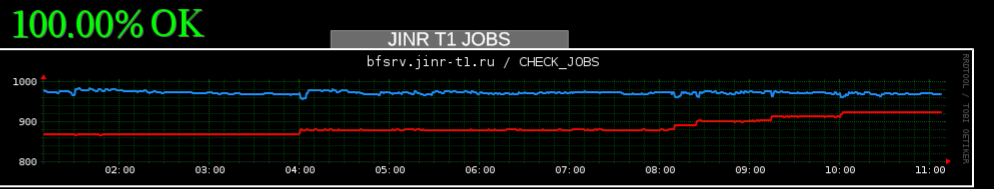
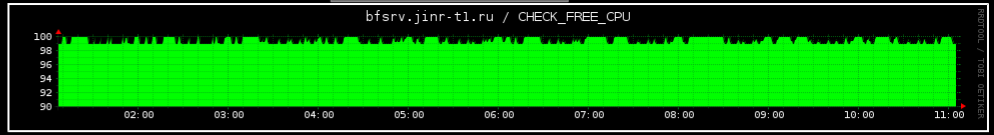


### UPS

apc-gl-01  
C 100  
T 20  
L

apc-gl-02  
C 100  
T 17  
L

T - temperature  
C - capacity  
L - load



**100.00% OK**

**926 OK** (The number of jobs in queue)

**971** (The number of current jobs)

### JINR T1 NETWORK

Legend for traffic volume:

- 0-10%
- 10-25%
- 25-40%
- 40-55%
- 55-70%
- 70-85%
- 85-100%

Legend for traffic direction:

- Output traffic (Mbit)
- Input traffic (Mbit)

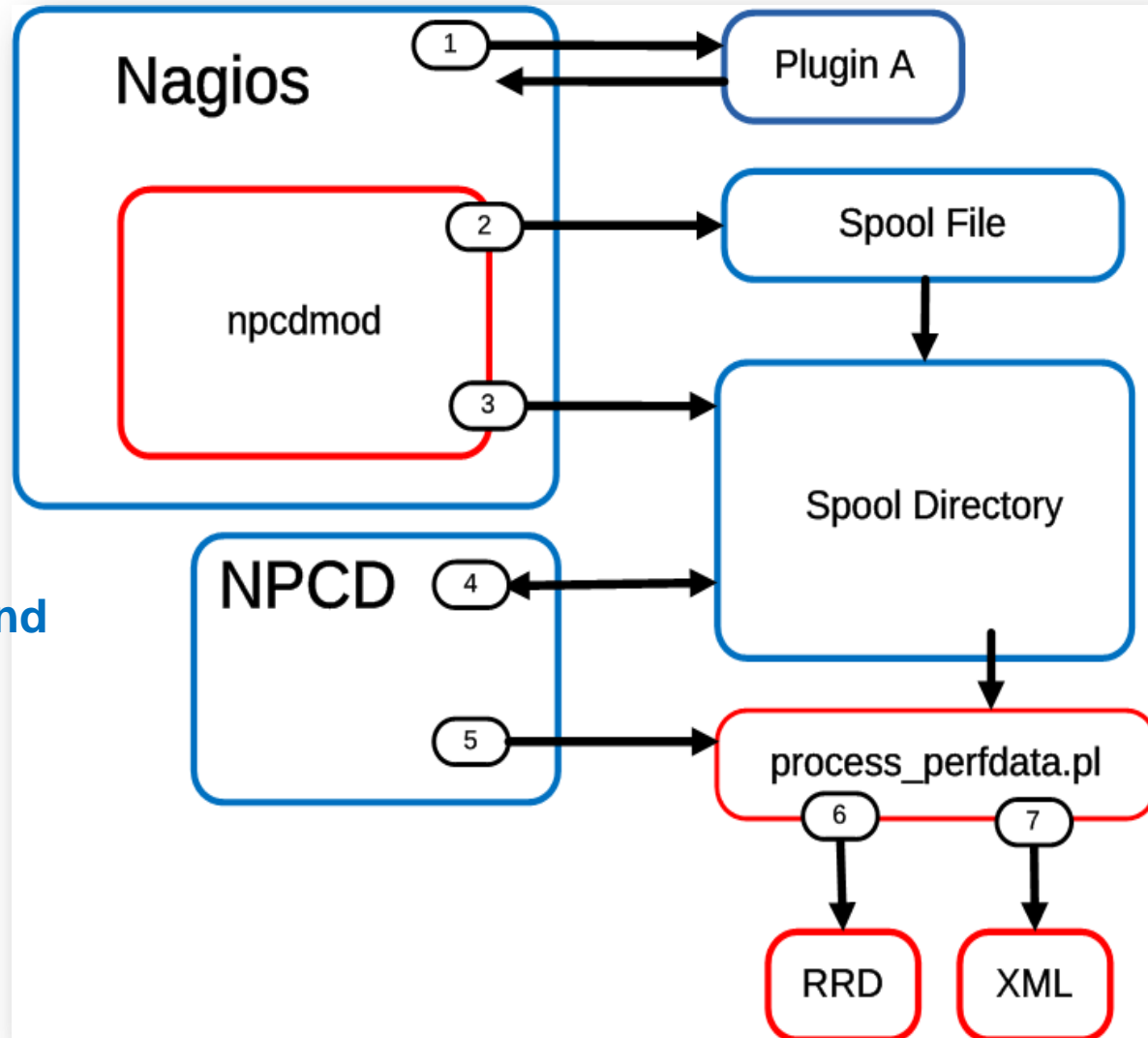
Brocade-factory / CHECK\_TRAFFIC\_SNMP\_BROCADE\_TenGigabitEthernet48

ERROR: The needed parameter "perfdata" is missing.

ERROR: The needed parameter "perfdata" is missing.

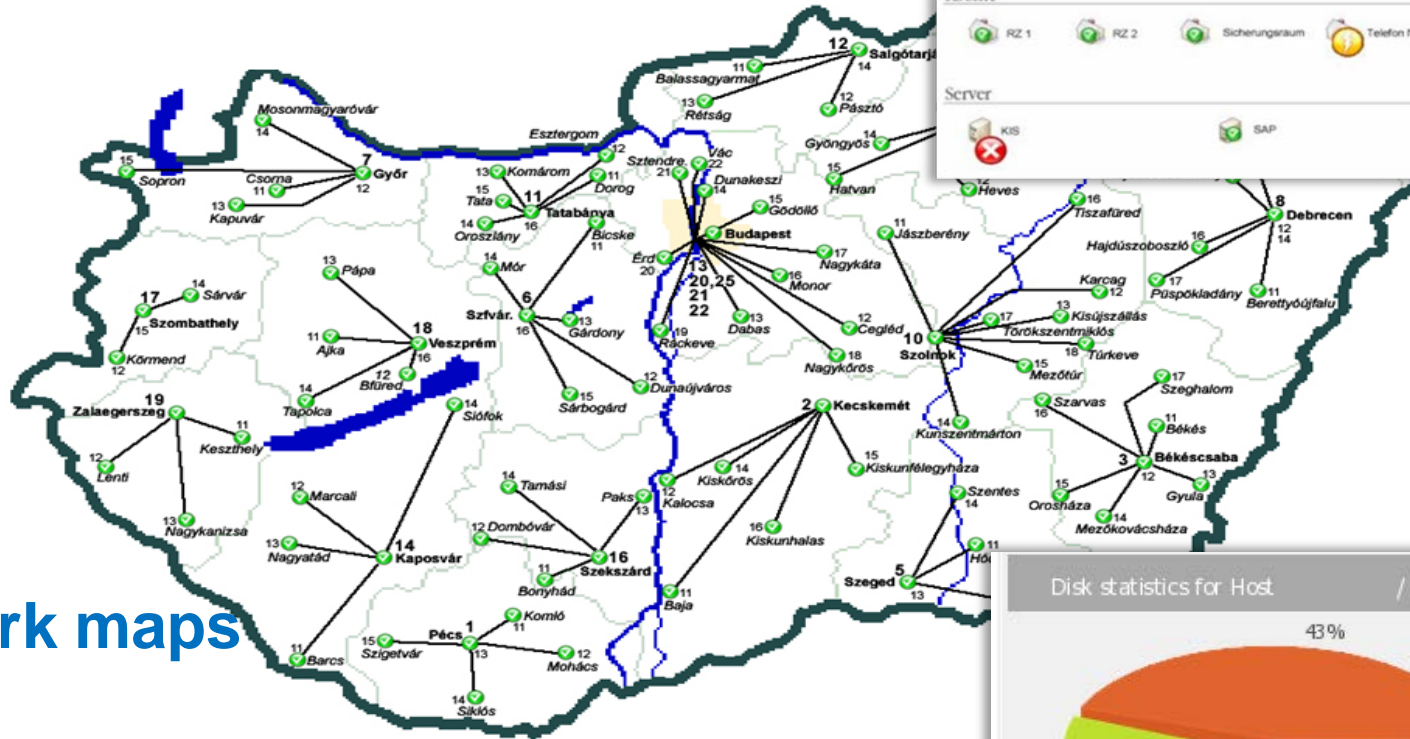
# Алгоритм работы системы графиков

1. Execute plugin
2. Store Perfddata into Spool files
3. Move Spool File into Spool directory
4. Scan Spool directory
5. Execute Perfddata Command
6. Update RRD Database
7. Write XML Meta Data



# NagVis visualization system

various sensors  
and images



### Systemstatus

Netze

- LAN Bitburg
- WAN
- Wireless Bitburg

Räume

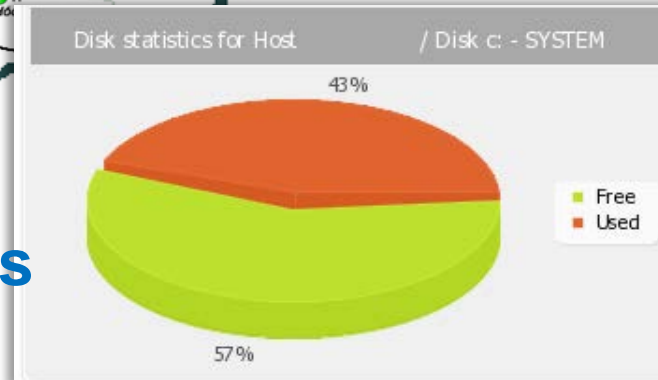
- RZ 1
- RZ 2
- Sicherungsraum
- Telefon N
- Telefon S

Server

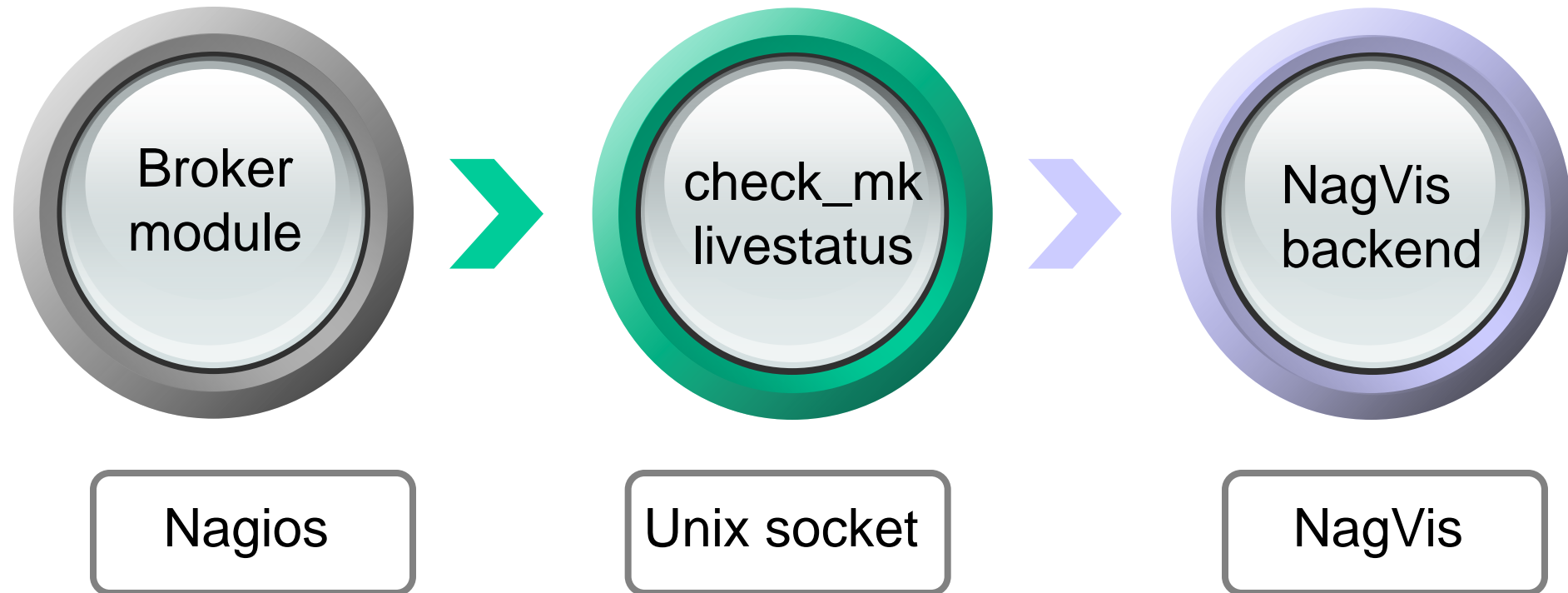
- KIS
- SAP
- Telefonanlage

Network maps

Gadget for display various  
parameters



# Gathering data from Nagios



## Check\_mk\_livestatus:

- 1) Allow doesn't use database;
- 2) Allow export configs to different servers.