

Development of a software suite for testing server hardware

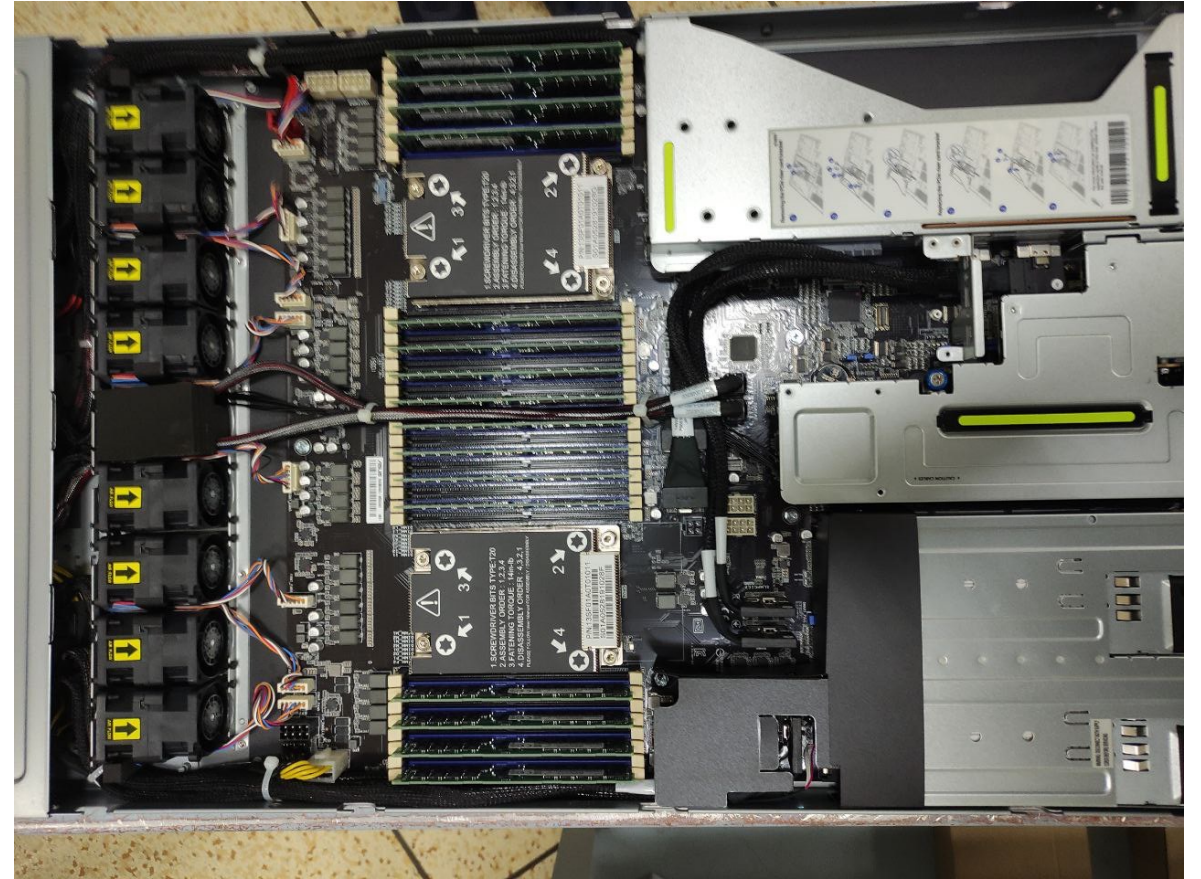
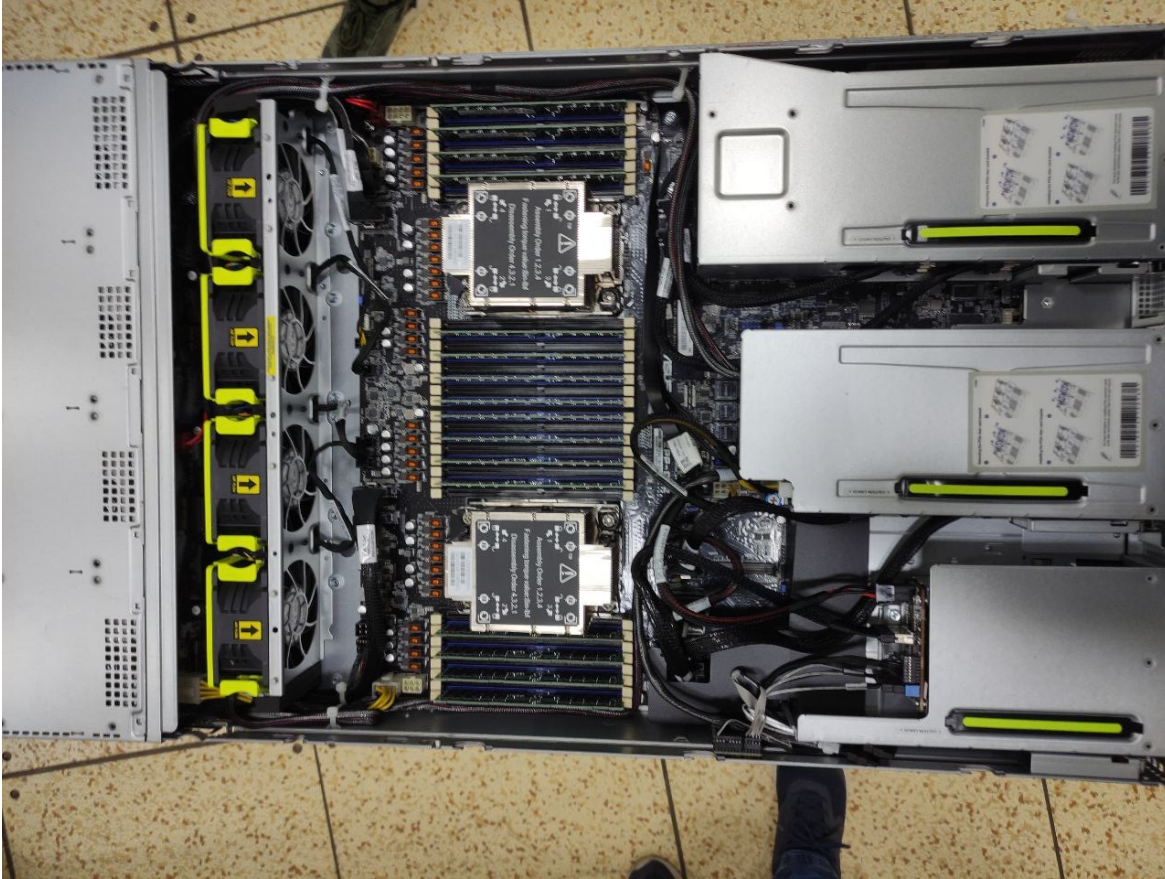
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Motivation

Motivation – testing server hardware before it goes into operation to ensure reliable and uninterrupted performance of deployed systems.

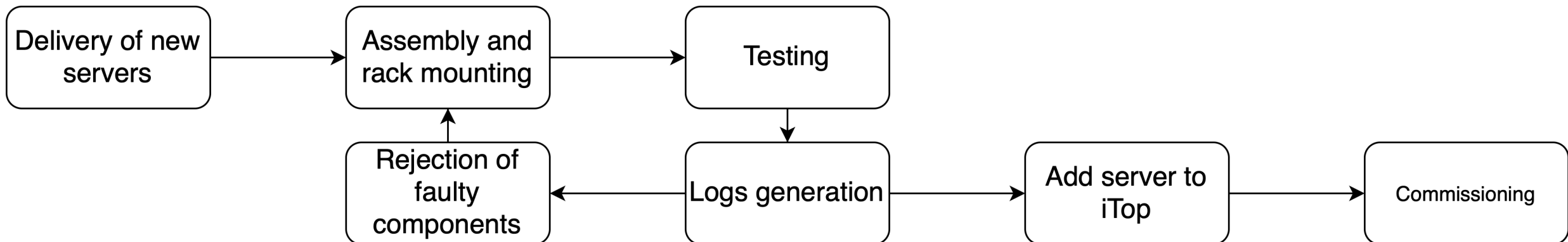


Objective and Tasks

Objective – development of a software solution for testing server hardware.

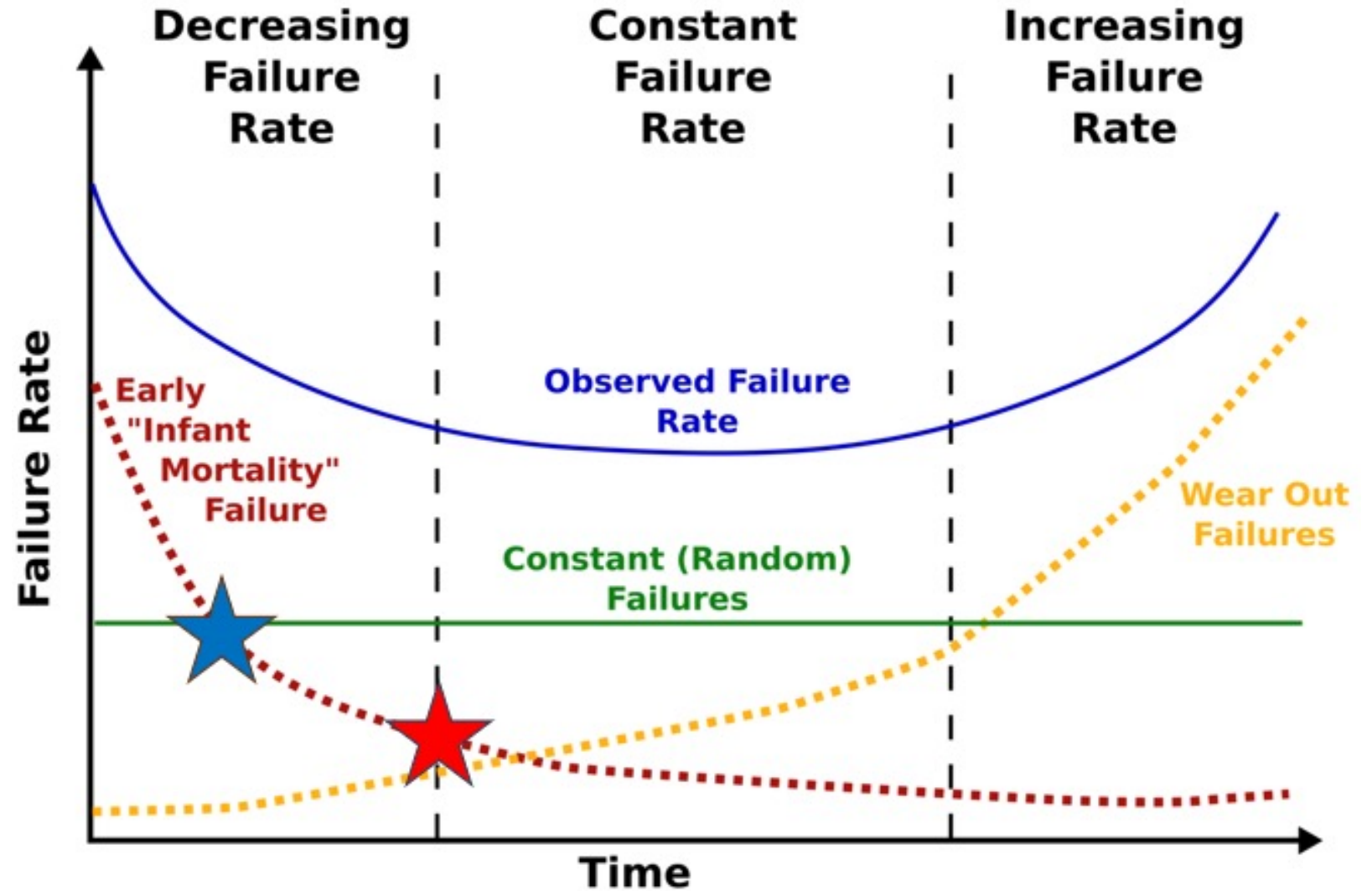
Tasks:

1. Search of existing methodologies for testing server hardware to detect faulty components
2. Analysis and selection of software tools for testing
3. Preparation of a monitoring system based on the Prometheus, Grafana, Node Exporter technology stack
4. Analysis of testing methods, trial run, analysis of results
5. Integrate developed solution to inventory system based on iTop



Hardware Testing Method

- ★ - moment of purchase
- ★ - moment of commissioning



Failure Rate Graph of Equipment at Different Stages of the Lifecycle

HASS Testing Method (Highly Accelerated Stress Test)

$$t = - \frac{\ln(1 - SS)}{0.0017 * (Tr + 0.6)^{0.6}} \quad (1),$$

SS – screening strength, Tr – temperature range above ambient, t – testing time.

AMD EPYC 7413 processor testing using the first method – 12 days (99% screening strength)

$$\frac{t}{t_{\text{cycle}}} = - \frac{\ln(1 - SS)}{0.0017 * (Tr + 0.6)^{0.6} * [\ln(e + \text{grad}T)]} \quad (2),$$

Tr – difference between max and min temperature along one cycle, gradT – temperature change rate, t – overall testing time, t_{cycle} - one cycle duration (heating-cooling).

Testing by the second method of the same processor – 9 hours (99% screening strength)

Selection of Software Tools for Stress Testing

There are a huge number of testing tools, and it is impossible to test each one, so several of the most popular ones were selected.

Main criteria – ability to test particular component.

Based on the data obtained, it was decided to use stress-ng to test the operation of the monitoring.

Name	Distribution model	CPU	HDD	RAM
sysbench	free	1	1	1
Phoronix Test Suite	free	1	1	1
stress-ng	free	1	1	1
mprime	free	1	0	1
linpack	free	1	0	0
systester	free	1	0	0
geekbench	subscription	1	0	0
hdparm	free	0	1	0
fio	free	0	1	0
smartctl	free	0	1	0
vdbench	free	0	1	0
iozone	free	0	1	0
memtest86	free	0	0	1

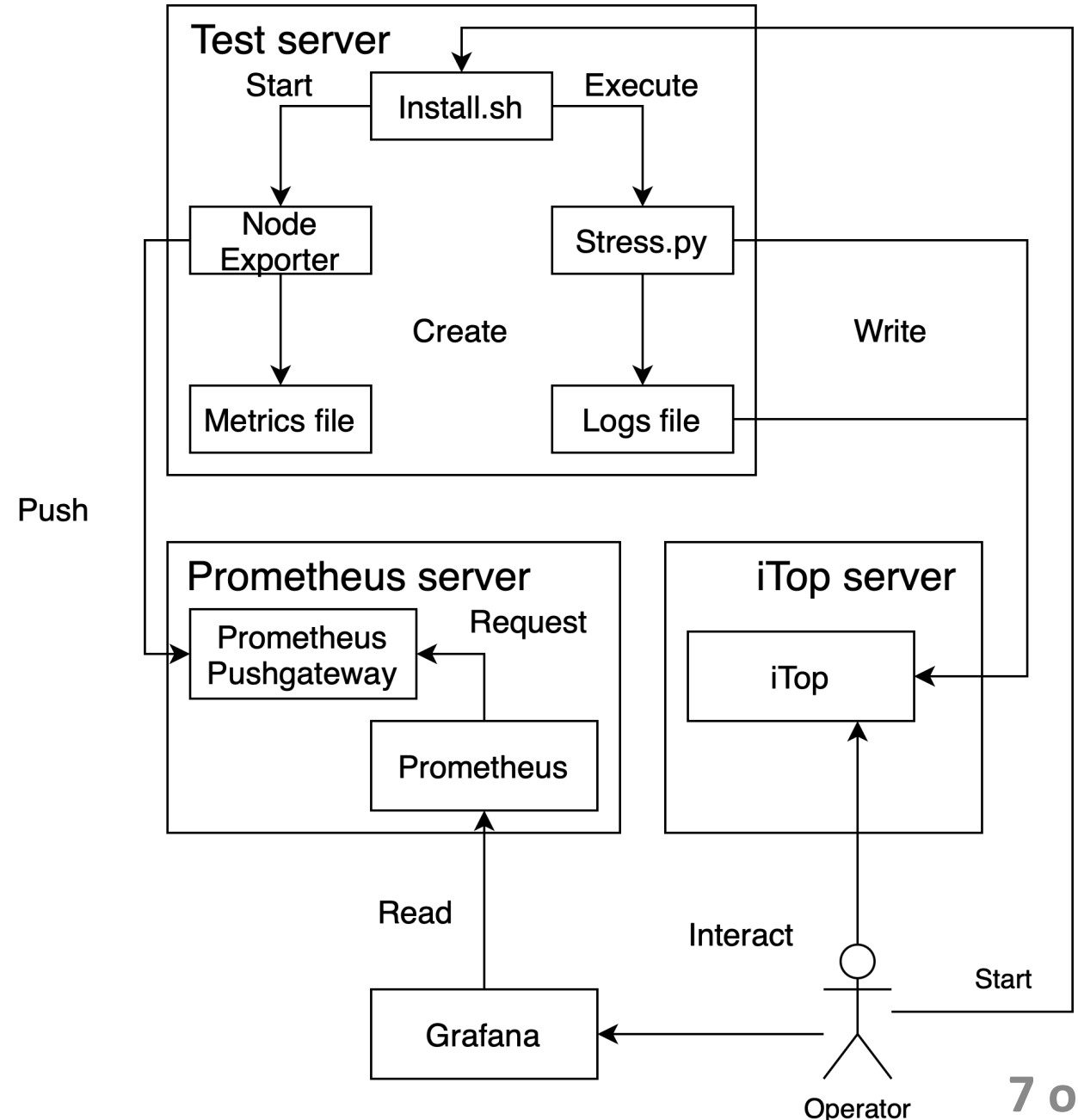
Test System Logic

Three parts included: Test server, Prometheus Server and iTop Server.

Test server – performs test, creates metrics and log files.

Prometheus server – a server where metrics of testing process stores.

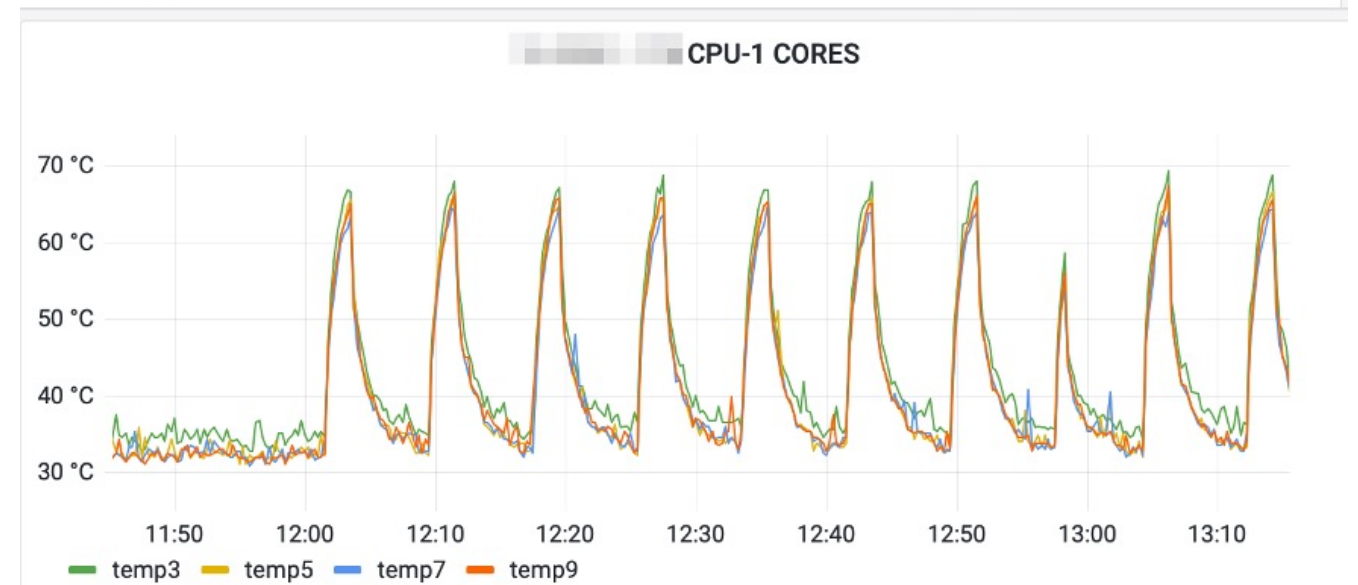
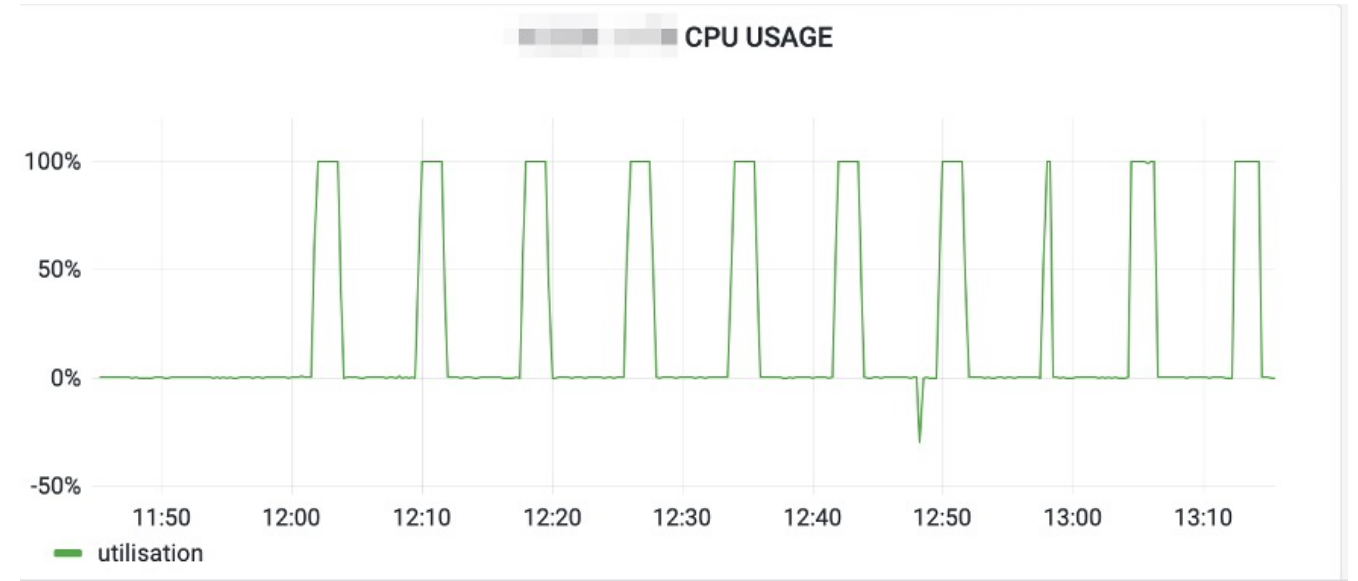
iTop server – a system that used as an inventory system.



Preparation of the Monitoring System

The monitoring system based on the Prometheus, Grafana, Node Exporter technology stack was deployed on a virtual machine in the JINR cloud.

A CPU test run results performed using one of new servers. Monitoring is vital to track and evaluate the testing process.



Test Logs

Logs file structure:

1. Host info
2. Monitoring url
3. Calibration start-up
4. Evaluating the duration of testing
5. Current index of cycle
6. Cycle result

```
{'hostname': 'localhost-live', 'ip_address': '0.0.0.0', 'n_cpus': 96}
```

Full temperature and utilisation graphs available at:
https://mon-service.jinr.ru/*****

phase one run started at 1718885289

phase one run ended at 1718886490

maximum temperature is 75.950000 and minimum temperature is 36.387500

phase two run started at 1718886490

phase two run ended at 1718886956

heating time is 125 seconds and cooling time is 341 seconds

Tr = 39.562500000000001

gradT = 6.9611436950146635

26 cycles for 0.990000 screen strength

one cycle duration is 7 minutes. estimated termocycling duration is 3 hours

started 0 of 26 cycles at 1718886956.000000, heating

started 0 of 26 cycles at 1718887084.000000, cooling

cycle 0 of 26 cycles ended at 1718887428.000000

started 1 of 26 cycles at 1718887428.000000, heating

iTop Integration

Integration goals:

- Automatic addition of a record about new server to database
- Automatic filling of great part of server fields
- Link test logs file to server record

The screenshot displays the iTop web interface for a server record. At the top, there is a navigation bar with tabs for Properties, Softwares, Contacts, Documents, Application solutions, Network interfaces (2), and FC ports. Below this, a secondary bar contains tabs for Logical volumes, Provider contracts, Services, Accessories, hdd list, Active Tickets, and History. The main content area is divided into several sections:

- General information:** Name (cwn****), Organization (ОИЯИ), Status (production), Business criticality (high), Location (Location), Rack (1**), Enclosure (undefined), Position? (13U), Height? (1U).
- Dates:** Move to production date, Purchase date, End of warranty, Поставлено на бух. учет, Выведено из эксплуатации, Утилизировано, № заявки в 1С ЛАД, Даты выдачи, Даты изъятия, Даты ремонта.
- More information:** Brand (Asus), Model (RS700A-E11-RS12U), OS family (AlmaLinux), OS version (9.4), Management ip (0.0.0.0), OS licence (undefined), CPU (AMD EPYC 7413 2.65 GHz / 24core), RAM (1024(32x32), 2666MHz), Serial number, Asset number.
- Power supply:** PowerA source (undefined), PowerB source (undefined), Redundancy (The device is up if at least one power connection (A or B) is up).
- Other information:** Description (DLNP KVM CN).

Current Results

Current results:

- Testing methods have been selected and developed
- An analysis and trial run of the testing software tools have been conducted
- A monitoring system has been deployed
- The entire equipment testing process has been validated

In progress:

- iTop integration

Thanks for your attention!