

# The system for monitoring computing cluster resources

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AYSS, 2024

# HybriLIT

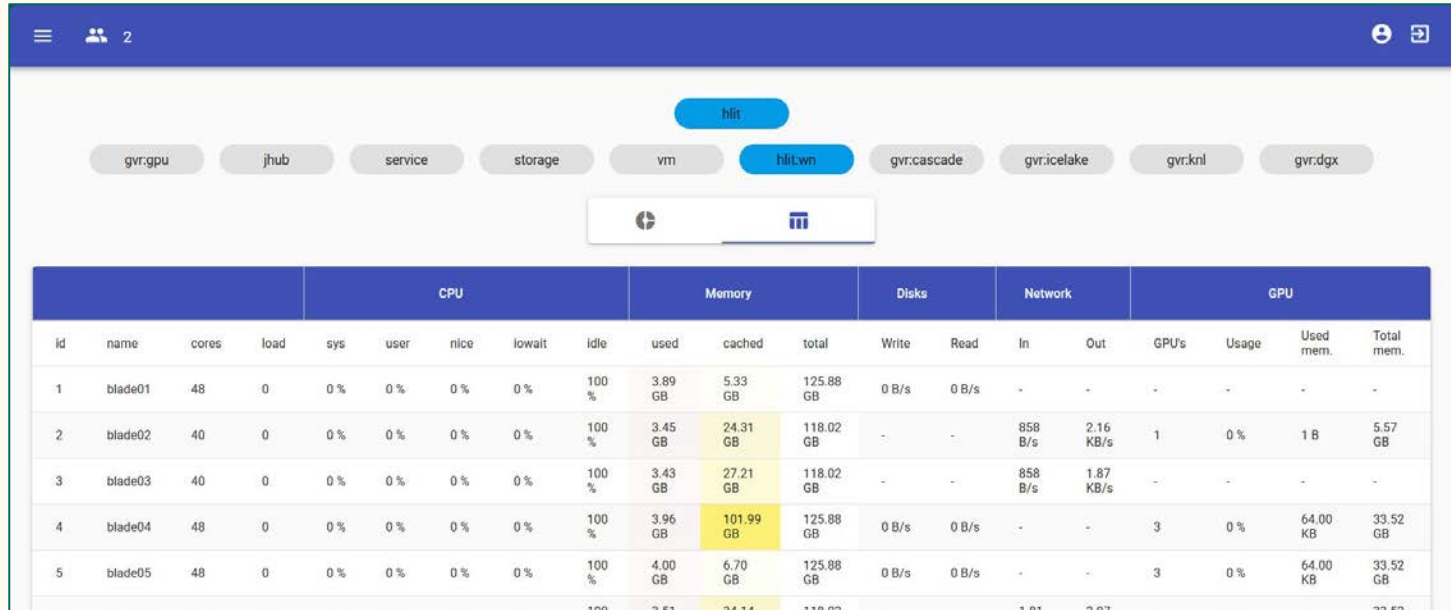
The heterogeneous platform HybriLIT is part of the Multifunctional Information and Computing Complex (MICC), Laboratory of Information Technologies, JINR, Dubna.

The heterogeneous platform consists of the Govorun supercomputer and the HybriLIT training and test polygon.



# Existing solution

## «Salsa» monitoring



The screenshot displays the «Salsa» monitoring interface. At the top, there is a navigation bar with a menu icon, a user count of 2, and a refresh icon. Below the navigation bar, there are several filter buttons: gvr.gpu, jhub, service, storage, vm, hlit.wn (selected), gvr.cascade, gvr.icelake, gvr.knl, and gvr.dgx. A central control panel contains a refresh icon and a bar chart icon. The main content area features a table with columns for CPU, Memory, Disks, Network, and GPU metrics.

|    |         | CPU   |      |     |      |      |        |      | Memory  |           |           | Disks |       | Network |           | GPU   |       |           |            |
|----|---------|-------|------|-----|------|------|--------|------|---------|-----------|-----------|-------|-------|---------|-----------|-------|-------|-----------|------------|
| id | name    | cores | load | sys | user | nice | lowait | idle | used    | cached    | total     | Write | Read  | In      | Out       | GPU's | Usage | Used mem. | Total mem. |
| 1  | blade01 | 48    | 0    | 0%  | 0%   | 0%   | 0%     | 100% | 3.89 GB | 5.33 GB   | 125.88 GB | 0 B/s | 0 B/s | -       | -         | -     | -     | -         | -          |
| 2  | blade02 | 40    | 0    | 0%  | 0%   | 0%   | 0%     | 100% | 3.45 GB | 24.31 GB  | 118.02 GB | -     | -     | 858 B/s | 2.16 KB/s | 1     | 0%    | 1 B       | 5.57 GB    |
| 3  | blade03 | 40    | 0    | 0%  | 0%   | 0%   | 0%     | 100% | 3.43 GB | 27.21 GB  | 118.02 GB | -     | -     | 858 B/s | 1.87 KB/s | -     | -     | -         | -          |
| 4  | blade04 | 48    | 0    | 0%  | 0%   | 0%   | 0%     | 100% | 3.96 GB | 101.99 GB | 125.88 GB | 0 B/s | 0 B/s | -       | -         | 3     | 0%    | 64.00 KB  | 33.52 GB   |
| 5  | blade05 | 48    | 0    | 0%  | 0%   | 0%   | 0%     | 100% | 4.00 GB | 6.70 GB   | 125.88 GB | 0 B/s | 0 B/s | -       | -         | 3     | 0%    | 64.00 KB  | 33.52 GB   |

# The purpose of the work and the tasks

The purpose of the work:

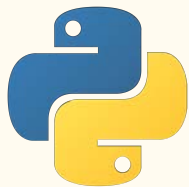
- Develop a monitoring system based on a modern technology stack, with advanced functionality and the possibility of support and modernization.

Tasks for developing of the monitoring system:

- Define the functionality based on requirements of the product;
- Develop the architecture;
- Develop the design of the web application;
- Develop data exchange protocols between clients, sensors and the server;
- Implement authentication and authorization functionality;
- Deploy the product on resources of Heterogeneous platform HybriLIT.

# Technology stack. Backend

Language



Asynchronous  
support

**asyncIO**

System data

**psutil**

Web framework



Proxy and server

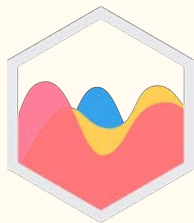
**NGINX**

# Technology stack. Frontend

Reactive framework



Charts



Data storage



Data streaming



Language



Design

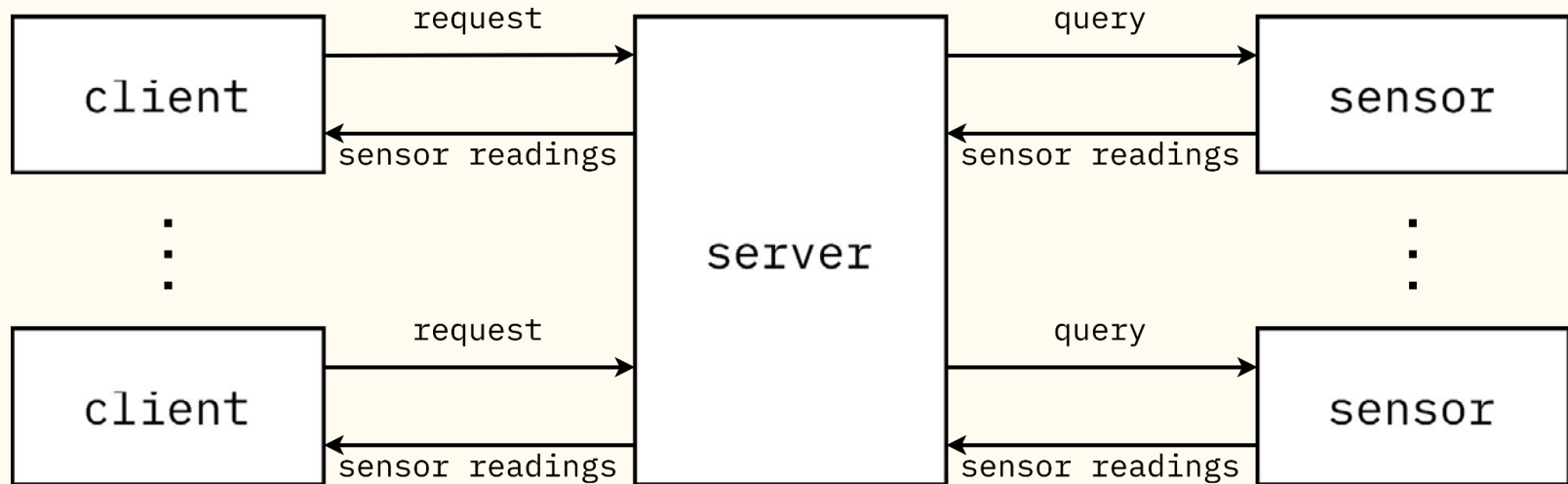


HTTP requests



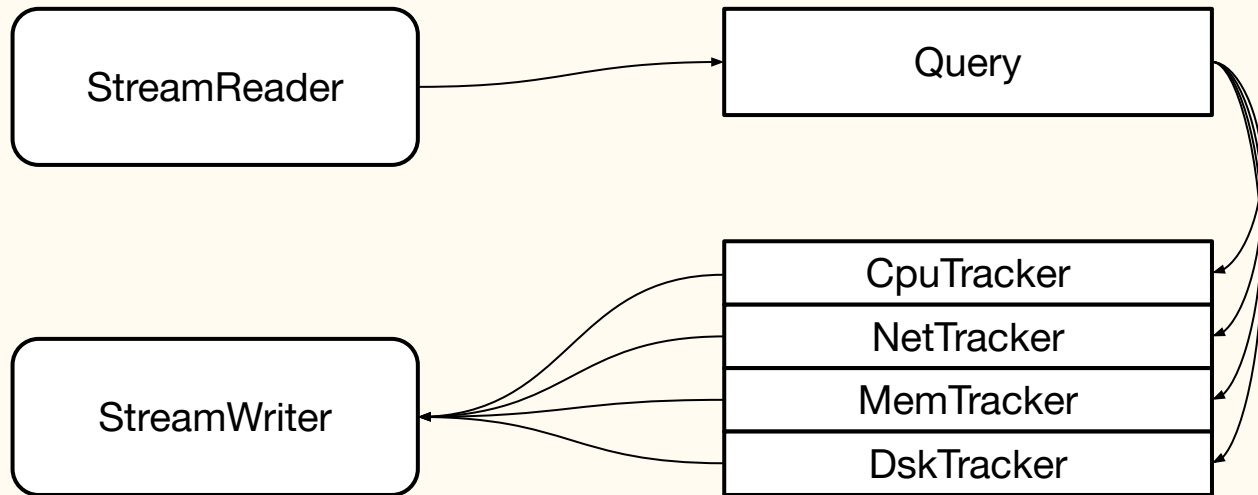
# Architecture

## overall architecture of the system



# Architecture. Sensor

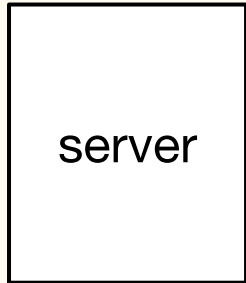
## sensor architecture





# Architecture. Protocol

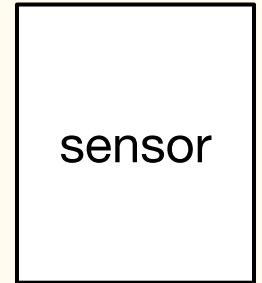
## server-sensor protocol



```
{  
  "interval": 1,  
  "cpu_fields": [  
    "system",  
    "user",  
    "iowait",  
    "idle"  
  ],  
  "net_fields": [  
    "recv",  
    "sent"  
  ],  
  ...  
}
```

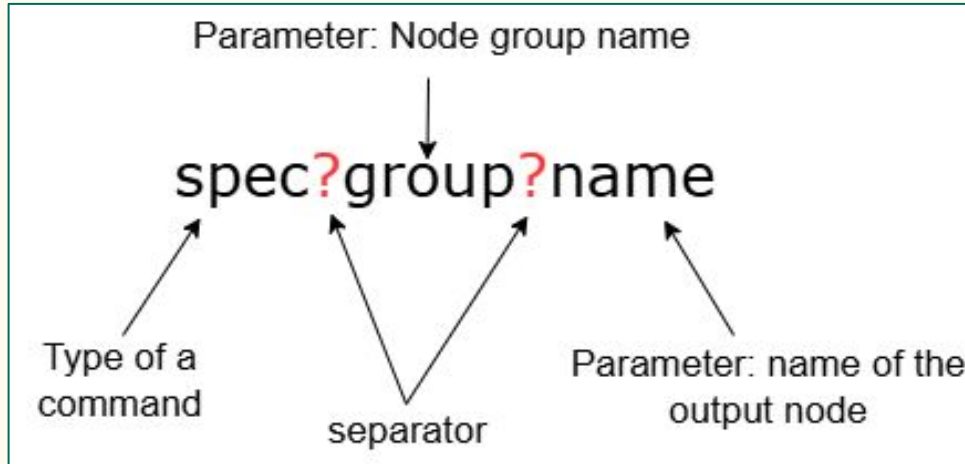


```
{  
  "cpu": {  
    "system": 2.3,  
    "user": 5.4,  
    "iowait": 10,  
    "idle": 83.3  
  },  
  "net": {  
    "recv": 10424,  
    "sent": 239  
  }  
  ...  
}
```



# Architecture. Protocol

## client-server protocol

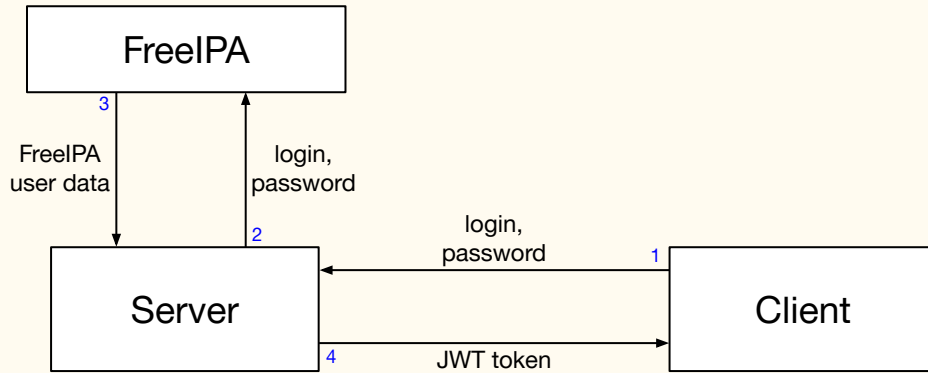


Structure of a request from a client

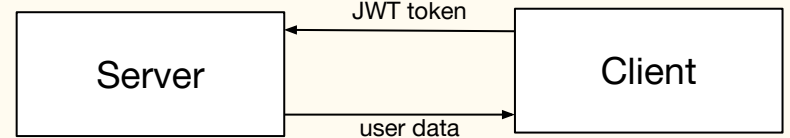
```
{  
  "header": "spec!group!name",  
  "field1": {  
    ...  
  },  
  "field2": {  
    ...  
  }  
}
```

Example of a JSON response from the server

# Architecture. Authorization



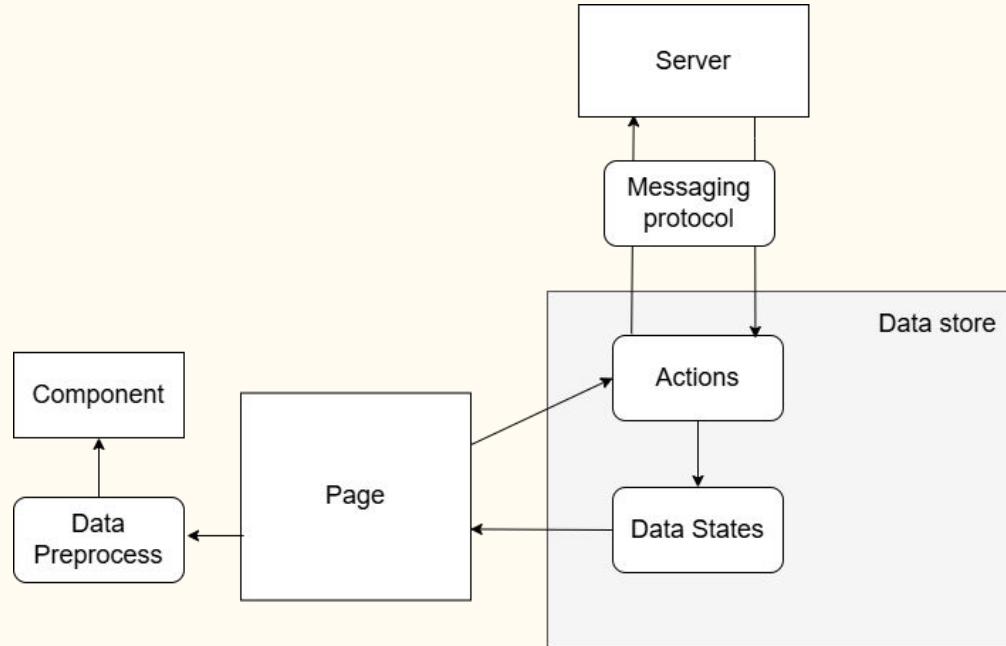
Initial authorization



Reauthorization

# Architecture. Frontend

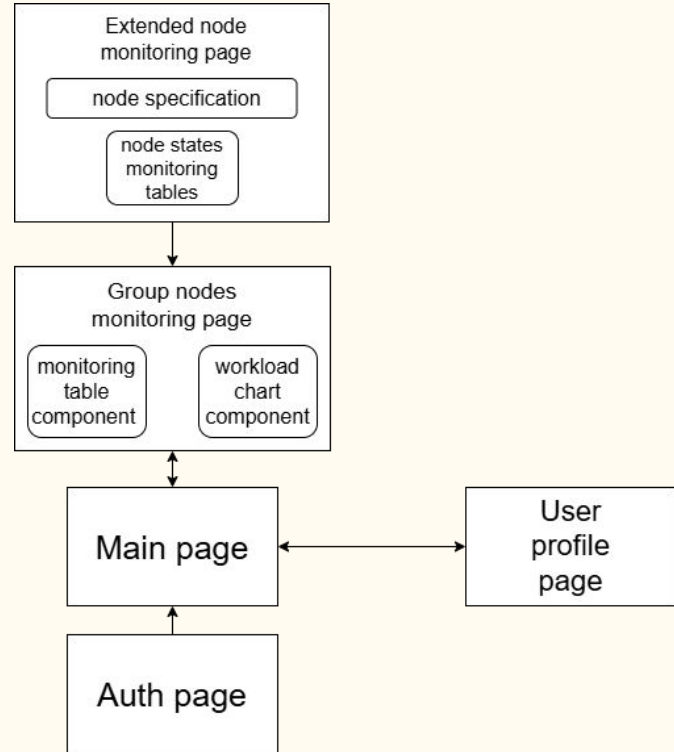
## Data visualization processing scheme



# Functionality

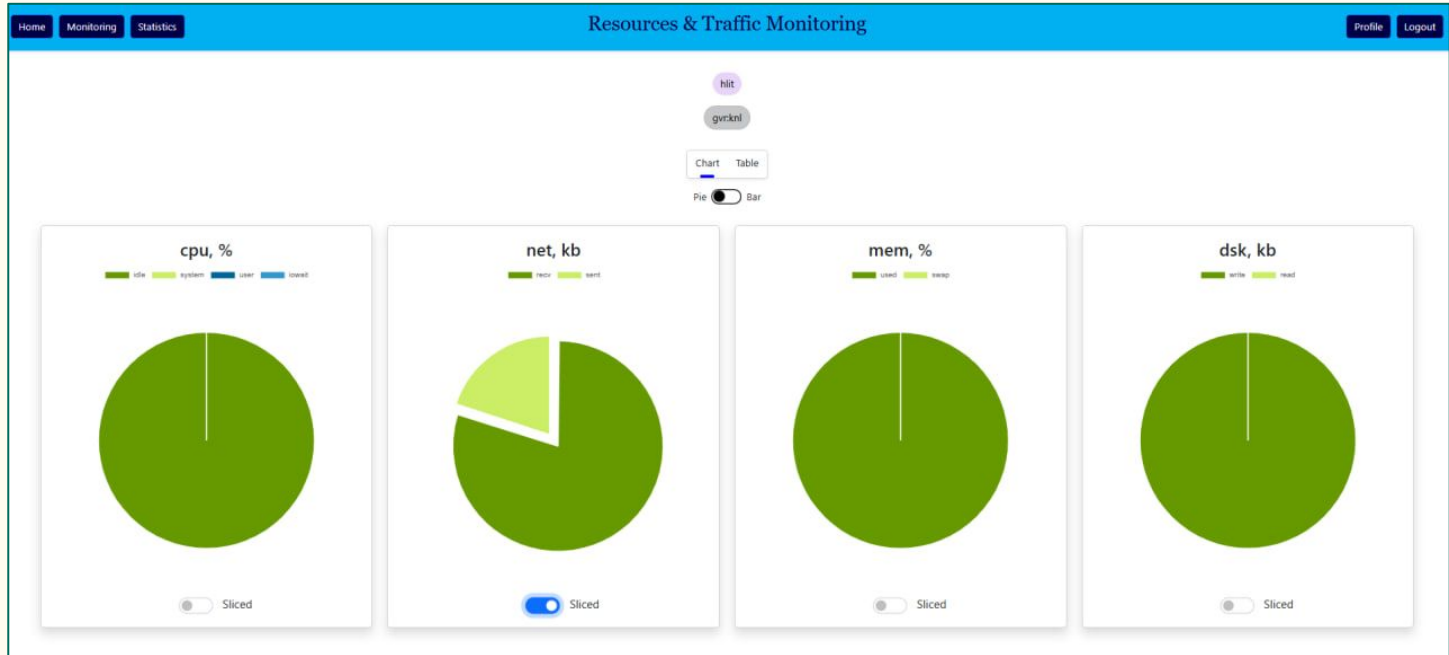
## Pages:

- Auth page
- User profile page
- Main page
- Group nodes monitoring page
- Extended node monitoring page



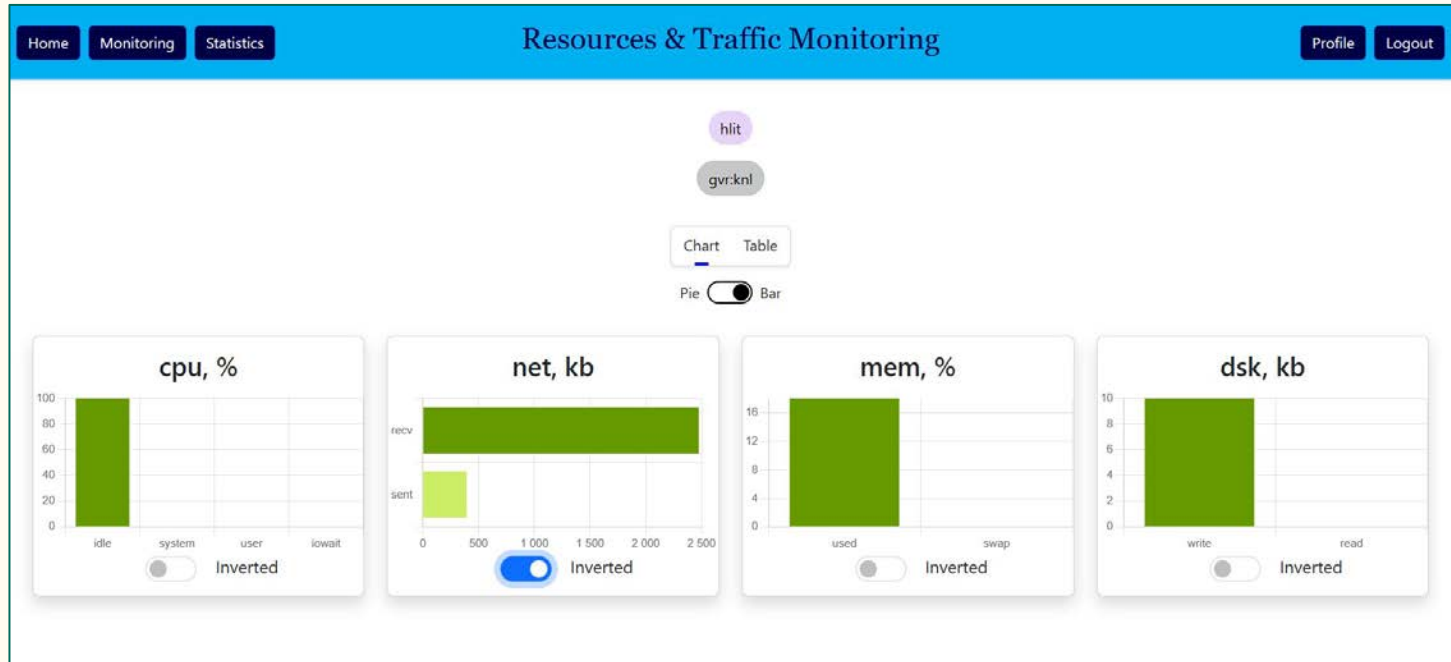
# Functionality

## Charts page



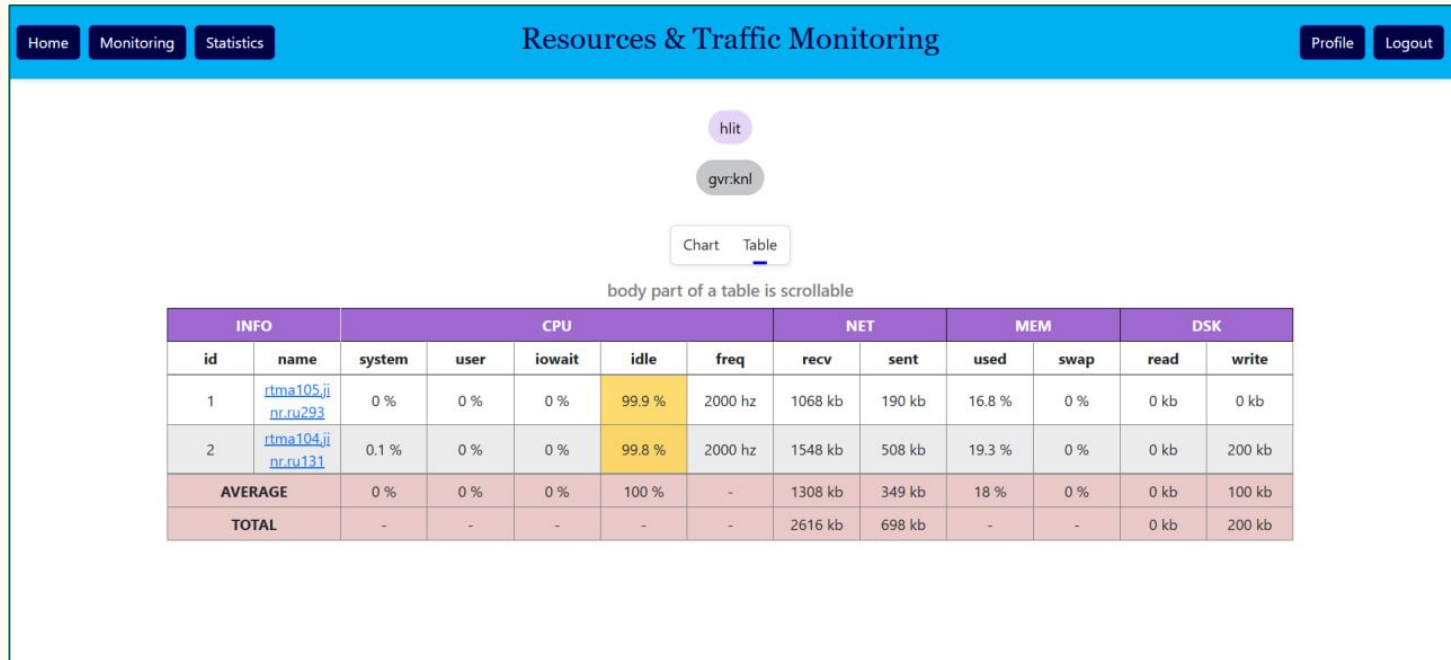
# Functionality

## Charts page



# Functionality

## Group nodes monitoring page





# Functionality

## Tables of the state of the components of the computing node

The screenshot displays a web interface for 'Resources & Traffic Monitoring'. At the top, there are navigation buttons for 'Home', 'Monitoring', and 'Statistics' on the left, and 'Profile' and 'Logout' on the right. The main content area shows the node identifier '«rtma104.jinr.ru131»' and a tabbed menu with 'cpu', 'net', 'mem', and 'dsk'. The 'net' tab is selected. Below the tabs, a note states 'body part of a table is scrollable'. A table with a purple header and a pink footer provides network statistics for three interfaces: eth0, eth1, and lo. The table includes columns for interface ID, name, received (rcv), sent, errors (errin, errout), and drops (dropin, dropout).

| INFO    |      | NET     |         |          |          |         |         |
|---------|------|---------|---------|----------|----------|---------|---------|
| id      | name | rcv     | sent    | errin    | errout   | dropin  | dropout |
| 1       | eth0 | 858 kb  | 222 kb  | 0 errors | 0 errors | 0 drops | 0 drops |
| 2       | eth1 | 460 kb  | 0 kb    | 0 errors | 0 errors | 0 drops | 0 drops |
| 3       | lo   | 1550 kb | 1550 kb | 0 errors | 0 errors | 0 drops | 0 drops |
| AVERAGE |      | 956 kb  | 591 kb  | 0 errors | 0 errors | 0 drops | 0 drops |
| TOTAL   |      | 2868 kb | 1772 kb | 0 errors | 0 errors | 0 drops | 0 drops |

# Functionality

## Computing node specification component

The screenshot displays a web interface for 'Resources & Traffic Monitoring'. The navigation bar includes 'Home', 'Monitoring', 'Statistics', 'Profile', and 'Logout'. The main content area shows a detailed view for the node «rtma104.jinr.ru131» with the following specifications:

| Category | Value   |
|----------|---|
| INFO     | batch name: gvr:kn1<br>node name: rtma104.jinr.ru131                                    |
| CPU      | cores_phys: 4<br>cores_logic: 4<br>min_freq: [ 0, 0, 0, 0 ]<br>max_freq: [ 0, 0, 0, 0 ] |
| NET      | nics: [ "eth0", "eth1", "lo" ]  |
| MEM      | mem_total: 4039216<br>swp_total: 4194300  |
| DSK      |   |

# Conclusion. Current results

- The functionality of the monitoring system was defined;
- The architecture of the sensor, server, and client has been developed;
- The design of the web application was developed;
- Data exchange protocols between sensors, clients and the server have been developed;
- Auth functionality based on FreeIPA was implemented;
- Additional monitoring functions have been developed;
- The system for monitoring was successfully deployed on resources of Heterogeneous platform HybriLIT.

# Conclusion

## **Future plans**

- Add user roles that provides a different level of functionality within the web application;
- Add a monitoring of network traffic sources and destinations;
- Add methods to collect system status and usage statistics;
- Prepare a manual for deploying sensors and web application.

# Thank you for your attention!

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