



The system for monitoring computing cluster resources

Authors: Gennadii Karpov, Maksim Skazkin, FEFU, Vladivostok;
Maksim Zuev, Dmitry Belyakov,
MLIT, JINR, Dubna.
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 icon, and the number '2'. Below the navigation bar, there are several filter buttons: 'hit', 'gvr:gpu', 'jhub', 'service', 'storage', 'vm', 'hlit:wn', 'gvr:casade', 'gvr:icelake', 'gvr:knl', and 'gvr:dgx'. The 'hlit:wn' button is currently selected. Below the filters, there are two icons: a refresh icon and a bar chart icon. The main content area features a table with the following columns: id, name, cores, load, sys, user, nice, lowait, idle, used, cached, total, Write, Read, In, Out, GPU's, Usage, Used mem., and Total mem. The table contains five rows of data for blades 01 through 05. The 'cached' column for blades 02, 03, and 04 is highlighted in yellow.

		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



System data



Web framework



Proxy and server

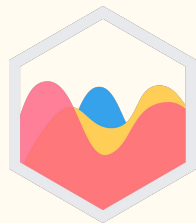


Technology stack. Frontend

Reactive framework



Charts



Data storage



Data streaming



Language



Design

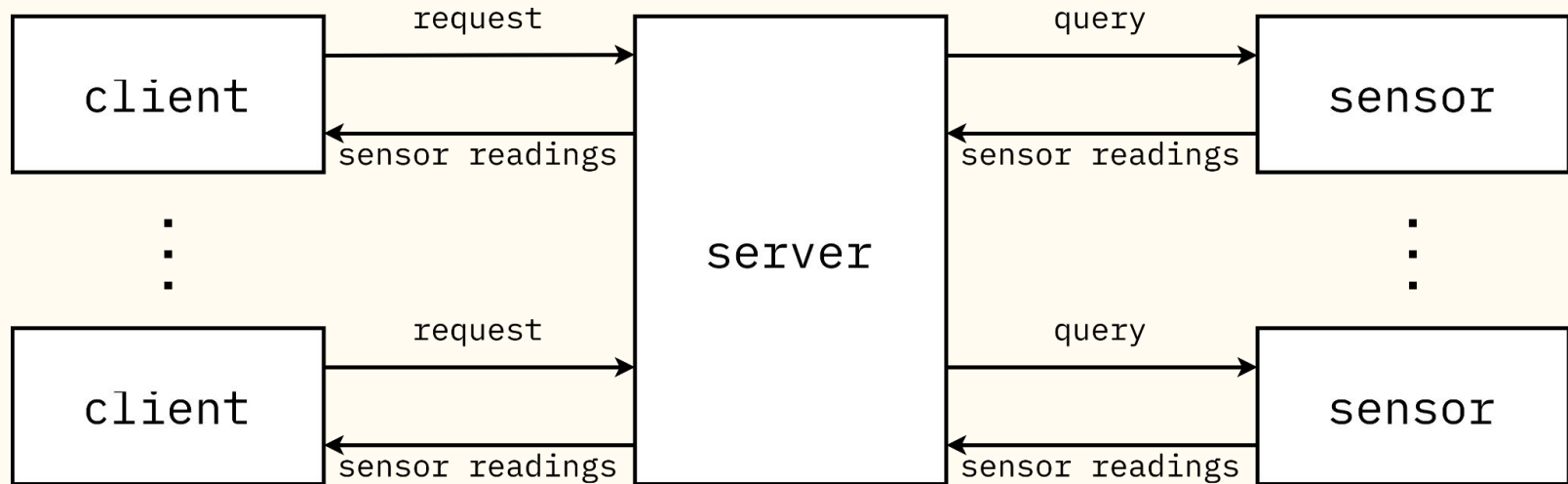


HTTP requests



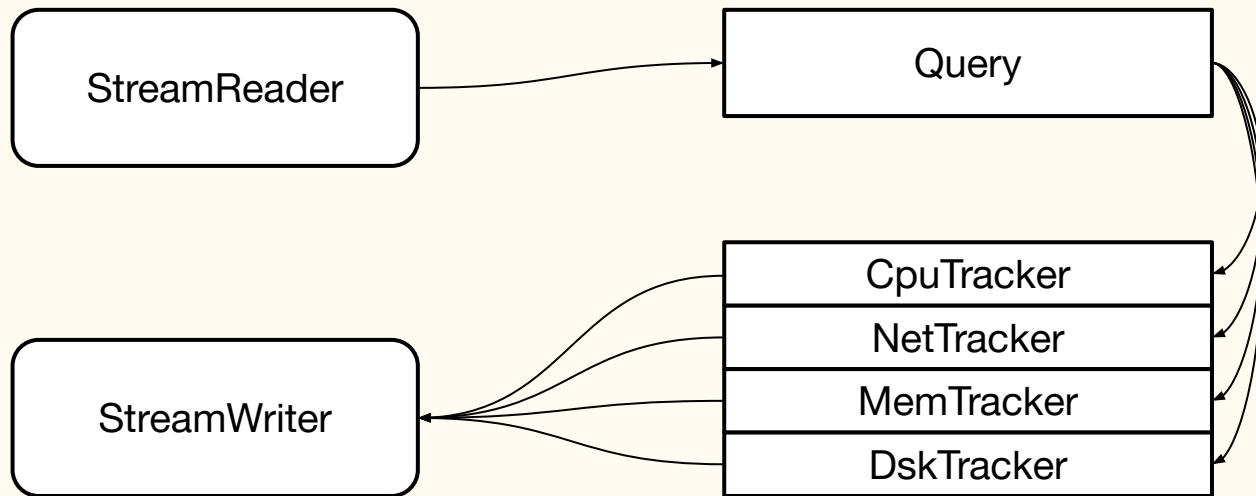
Architecture

overall architecture of the system



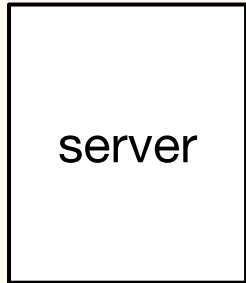
Architecture. Sensor

sensor architecture



Architecture. Protocol

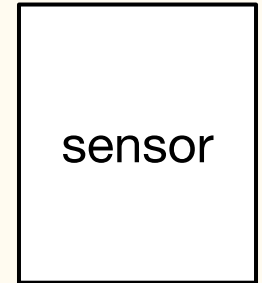
server-sensor protocol



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

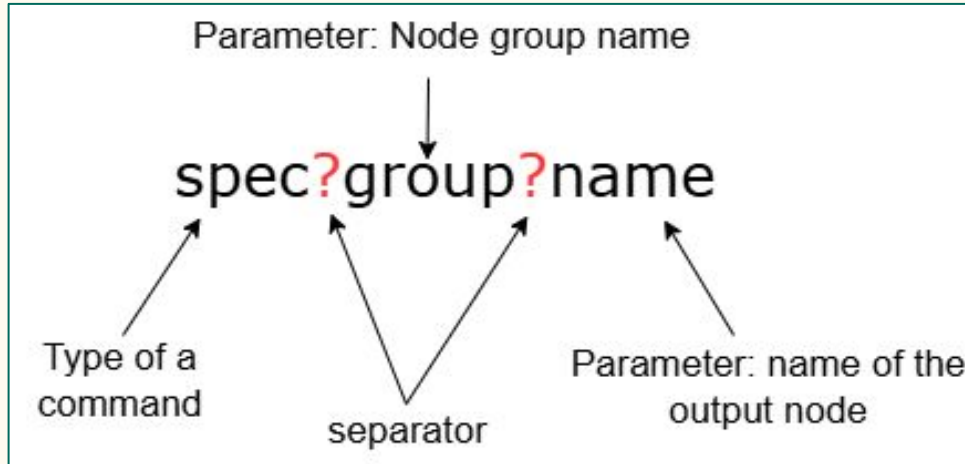


```
{  
  "cpu": {  
    "system": 2.3,  
    "user": 5.4,  
    "iowait": 10,  
    "idle": 83.3  
  },  
  "net": {  
    "recv": 10424,  
    "sent": 239  
  }  
  ...  
}
```



Architecture. Protocol

client-server protocol

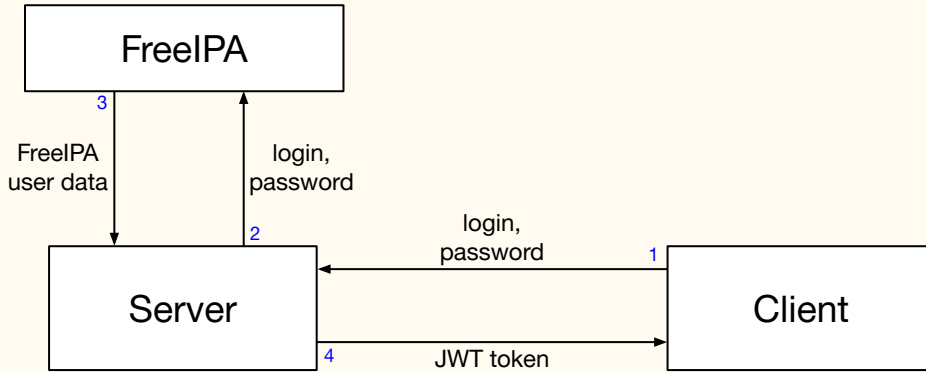


Structure of a request from a client

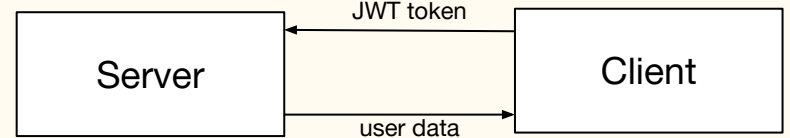
```
{  
  "header": "spec!group!name",  
  "field1": {  
    ...  
  },  
  "field2": {  
    ...  
  }  
}
```

Example of a JSON response from the server

Architecture. Authorization



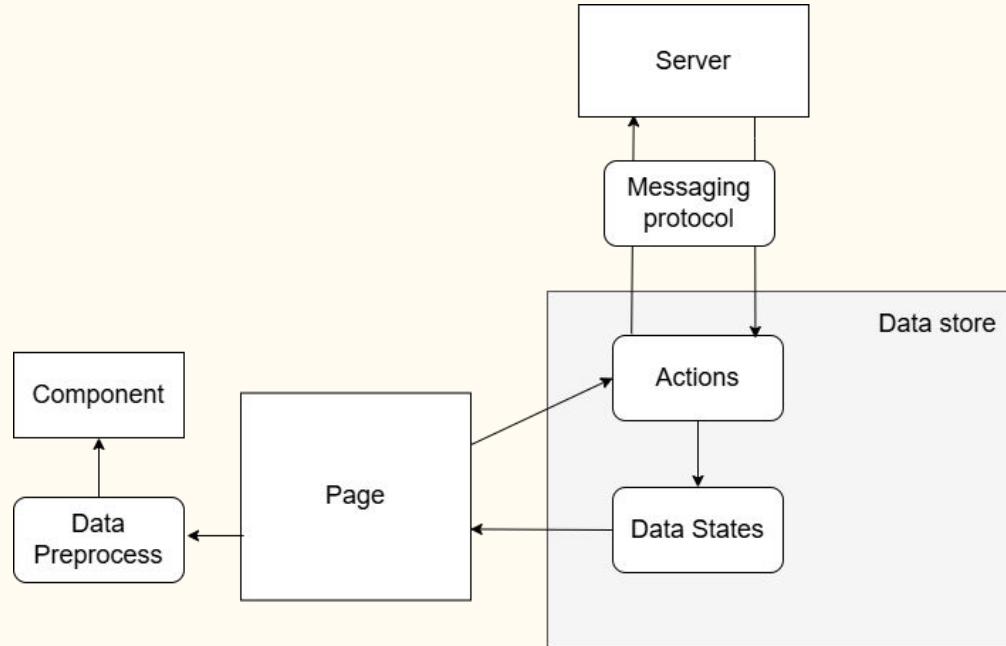
Initial authorization



Reauthorization

Architecture. Frontend

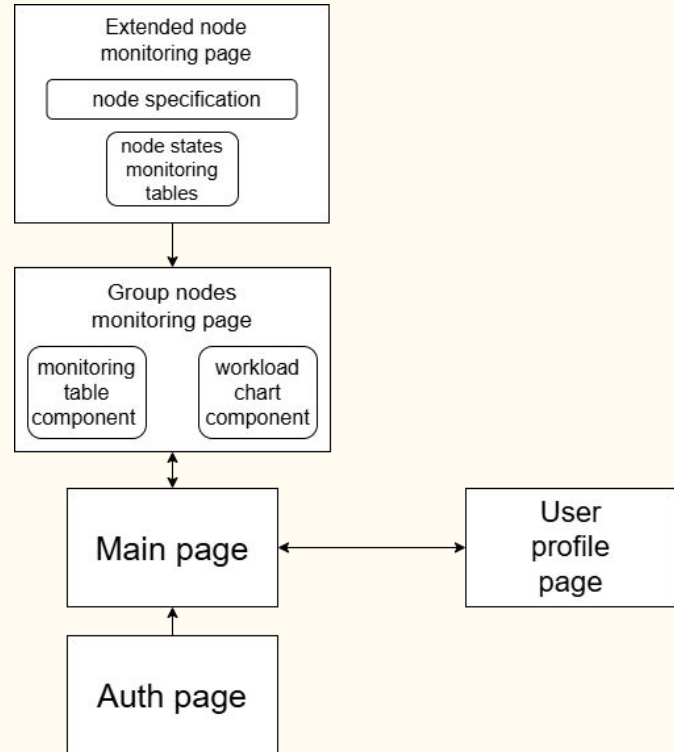
Data visualization processing scheme



Functionality

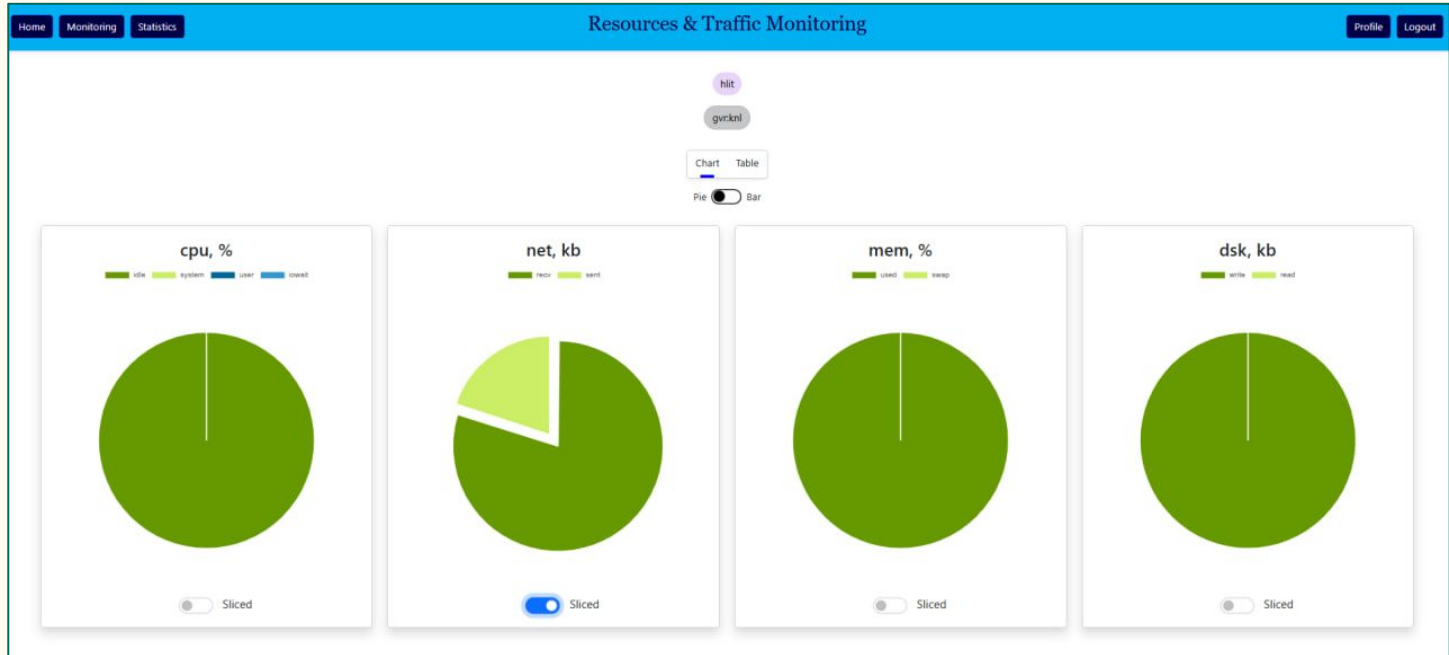
Pages:

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



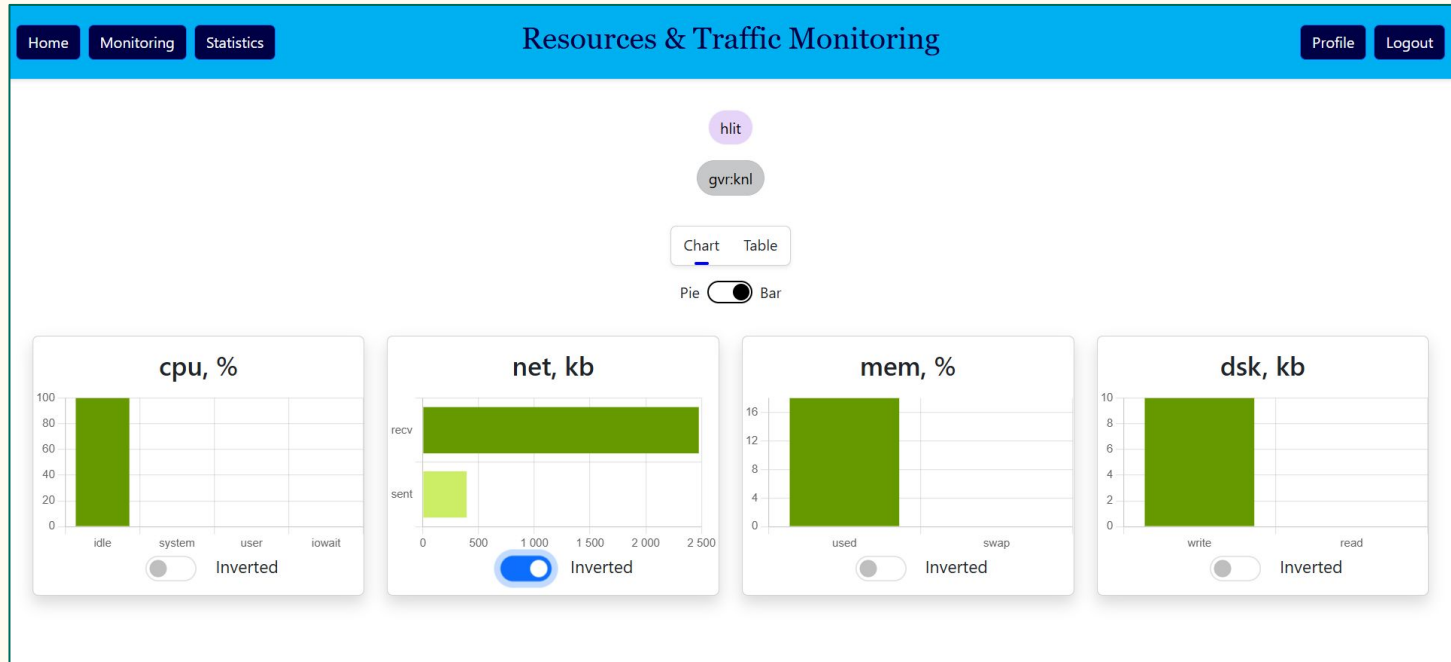
Functionality

Charts page



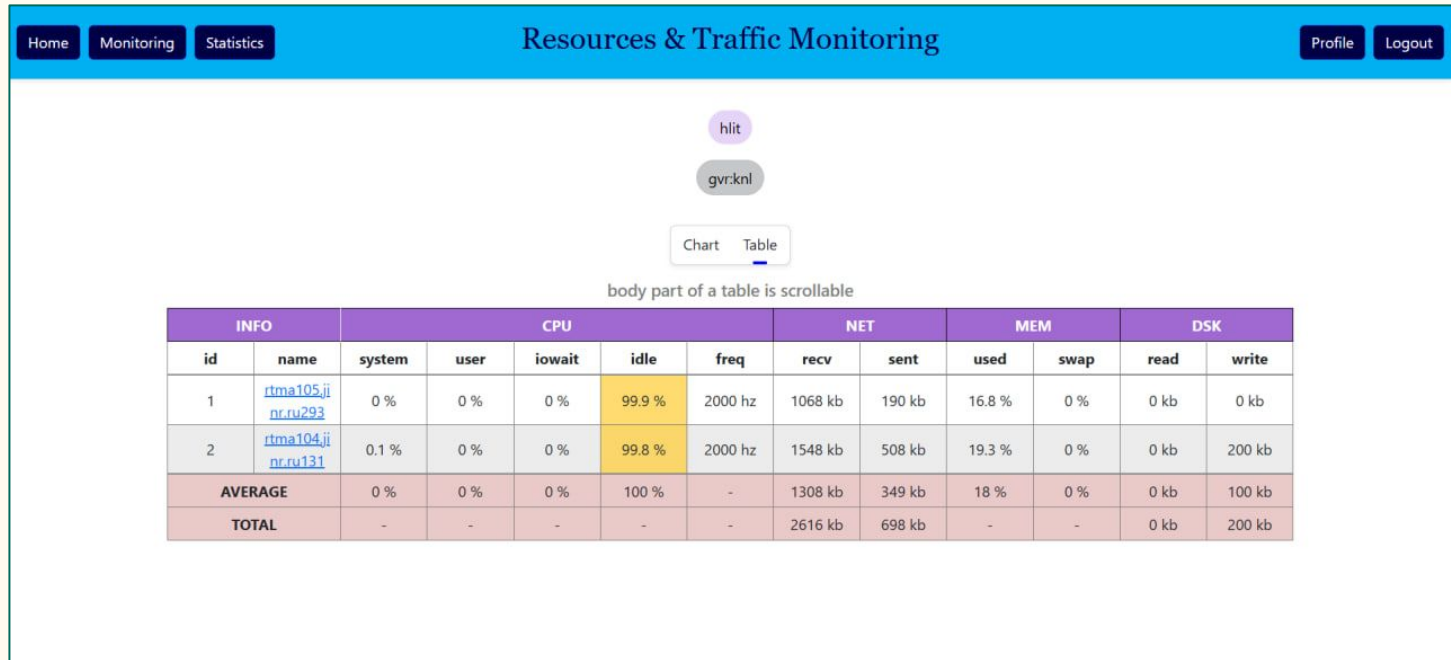
Functionality

Charts page



Functionality

Group nodes monitoring page



Functionality

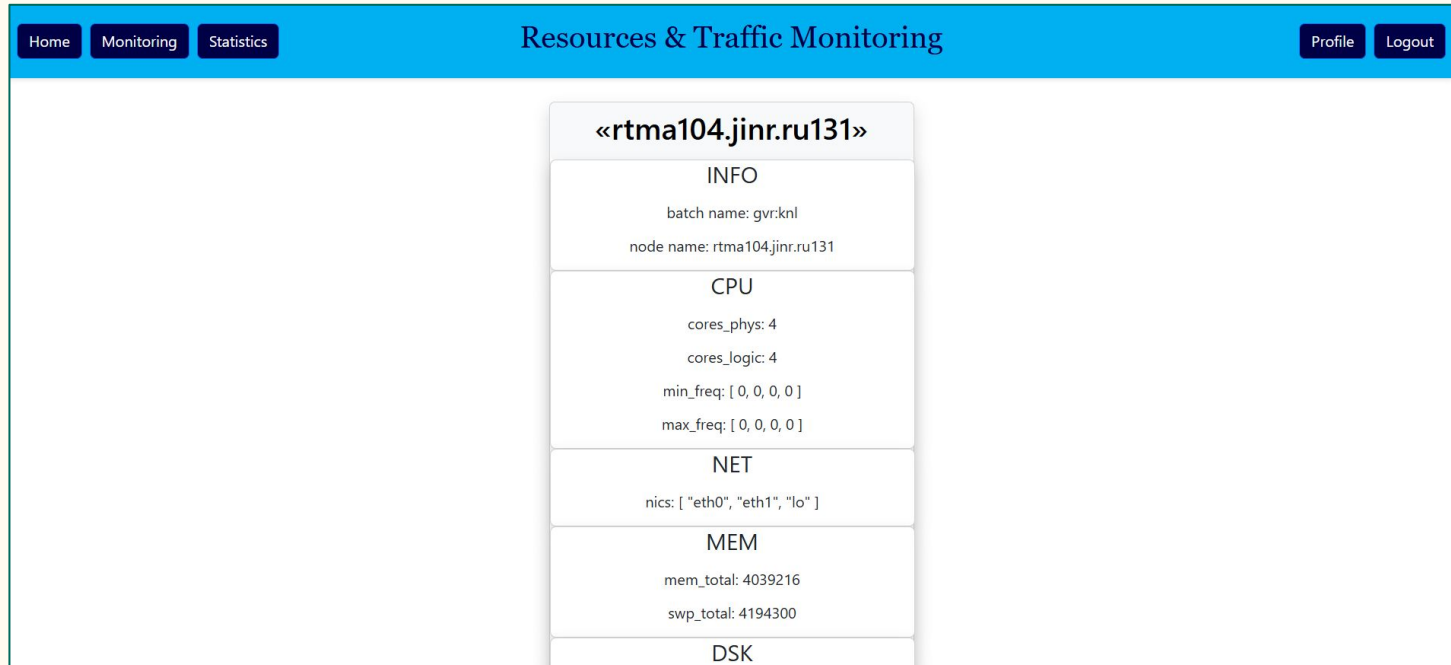
Tables of the state of the components of the computing node

The screenshot shows 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 displays the node name '«rtma104.jinr.ru131»' and a tabbed interface 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). Summary rows for 'AVERAGE' and 'TOTAL' are also present.

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 the specifications for a computing node named '<<rtma104.jinr.ru131>>'. The specifications are organized into sections: INFO, CPU, NET, MEM, and DSK.

Section	Value
INFO	batch name: gvr:kn1 node name: rtma104.jinr.ru131
CPU	cores_phys: 4 cores_logic: 4 min_freq: [0, 0, 0, 0] max_freq: [0, 0, 0, 0]
NET	nics: ["eth0", "eth1", "lo"]
MEM	mem_total: 4039216 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!

Acknowledgements:

Far Eastern Federal University, Vladivostok;
Meshcheryakov Laboratory of Information Technologies, JINR;
University centre, JINR.