

# Development of the Monitoring System for the CICC JINR Resources

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In 2011 a number of works on the development and expansion of functionality of the system of local monitoring for the Central Information and Computer Complex (CICC) JINR LIT resources has been executed. The system was developed based on the open-source software product Nagios [1], a number of its add-ons and plugins (pluggable software modules) are written specifically for the needs of the CICC. It is based on the architecture characterized by universality and scalability, which can be usable in the development of various monitoring instruments [2]. Objects of local monitoring are distributed over three levels in accordance with the specificity of their monitoring and maintenance.

1) At the bottom there is a hardware level which includes collecting and displaying data on individual nodes of the network, their hardware and software, checking their network accessibility, processor and memory load, state of power supply, temperature control etc. To date, the system performs monitoring of these objects:

- servers (about 350 units) using NRPE (Nagios Remote Plugin Executor): state of processors, memory and disk, their hardware and software;
- uninterruptible power supply (APC) – SNMP-monitoring;
- ventilation units of server racks (APC) – SNMP-monitoring;
- climate control device (Stulz) – SNMP-monitoring.

2) The network level considers devices and services that support the operation of local networks as well as the availability of external networks necessary for the operation of the complex. The system monitors:

- HP Procurve switches (state of the memory and CPU utilization, ports characteristics) – SNMP-monitoring;
- aggregated connections (trunks) - SNMP-monitoring, MRTG;
- backbone state.

3) At the top the service level system controls the functionality of services provided to end users:

- basic services, such as SMTP, POP, DNS, E-mail (using standard Nagios-plugins);
- DCACHE filesystem (based on scripts running through NRPE to collect necessary metrics);
- gFTP service;
- RAID disk arrays (3Ware, Adaptec), supplying DCACHE work (with the help of monitoring tools from RAID manufacturers integrated into a single plug-in).

In addition, during Tier3-monitoring researches the possibility of monitoring the XRootd storage system using Nagios module for passive checks named NSCA (Nagios Service Check Acceptor) has been successfully investigated. Besides, the system was expanded with means for the elementary statistical analysis of the collected data: search of average value, a standard deviation and a dispersion; finding of correlation between certain parameters.

The current web interface of the system was implemented mainly in PHP using XHTML and Javascript for page layout. AJAX (jQuery) was used for building real-time graphics. The main mode represents an object tree where the upper level nodes are hostgroups, and leaves of the tree are single hosts and in certain cases – individual services (<http://litmon.jinr.ru>). The following groups of objects are available: UPS, Cooling Units (ventilation blocks of server racks), Cisco, HP Procurve (switches of the respective manufacturers), RAIDs (servers with RAID controllers), DCache, Common Servers, Servers WLCG, Servers WN (groups of servers for different purposes), Web and DNS. Each host is presented with a dynamically generated page containing all the data on the services defined for it (a current condition, a schedule of values for the last few days and other auxiliary data).

A group of special views were created to allow a more detailed visualization of particular groups of services and to track interrelations between objects. For this purpose we involved NagVis – a powerful Nagios addition possessing ample opportunities for visualization of hosts and the services condition, allowing us to place objects on graphic maps and to visualize IT processes. So, with its help a survey display was created where the markers characterizing a condition of the monitored objects are imposed on a network block diagram. For the group



Figure 1: dCache usage metrics for Atlas and CMS experiments

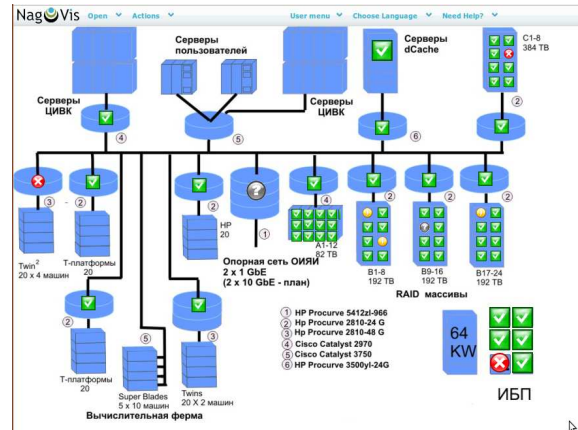


Figure 4: Network overview

of the services concerning to dCache, an additional display is created, allowing one to compare observable values of checked parameters between ATLAS and CMS experiments. A number of displays/views was created without the aid of NagVis. The first of them is an accounting table on disk array units containing a brief review of each controller condition and a type of a critical situation in case of its presence; also there is a report page of all servers condition (with their distribution on racks, UPS, usage groups). These views are shown on Figs. 1-4.

In case of any critical situation (or successful restore after it) the system dispatches the employees responsible for problem services and the devices with corresponding notifications.

Figure 2: Overview of servers with RAID controllers

## References

- [1] Barth W. Nagios System and Network Monitoring: No Starch Press, 2006.
- [2] Korenkov V.V., Dmitrienko P.V.: Architecture and ways of realization of local monitoring system for the resource center. In: System Analysis in Science and Education, N3, 2011, Dubna, Russia.

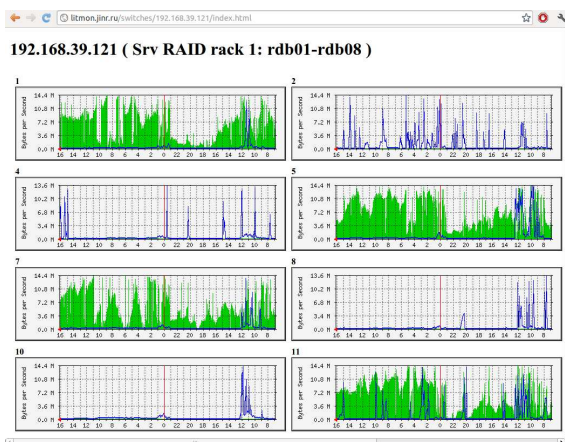


Figure 3: Load graphs of HP Procurve switch ports