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THE CURRENT STATE OF DATA TRANSMISSION CHANNELS FROM PUSHCHINO TO MOSCOW AND PERSPECTIVES

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ABSTRACT. Since the work of a unique space radio telescope in the international VLBI project "Radioastron" extended to 2017 the transmission and storage of large volumes of scientific and telemetry data obtained during the experiments is still remains actual. This project is carried out by the Astro Space Center of Lebedev Physical Institute in Moscow, Russia. It requires us to maintain in operating state the high-speed link to merge into a single LAN buffer data center in Puschino and scientific information center in Moscow. Still relevant the chanal equipment monitoring system, and storage systems, as well as the timely replacement of hardware and software upgrades, backups, and documentation of the network infrastructure.

Keywords: Radioastron: monitoring: telecommunications.

1. Introduction

The spacecraft radiotelescope ground support is carried out by tracking stations. One of which is located in the Pushchino Radioastronomical Observatory. The dataflow of scientific data and telemetry information received by servers of tracking station can reach 128 Mbit/s speed. The direct communication channel witch capacity of 1 Gbit/s established for efficient data exchange. The buffer data-center created for network communication and file storage accomodation. The reliability of the channel (Fig. 1) is highly dependent on continuous monitoring of network and server equipment and communication lines. An important prerequisite for the smooth operation of the channel and the equipment to minimize downtime is monitoring 24x7x365. Monitoring involves the collection of system messages, access control, telemetry of network devices, availability of power and power consumption, temperature control in the equipment rack, as well as information about changes in the network traffic.

2. Monitoring system

As the monitoring system we still use well-proven over several years Zabbix system which provides availability and SLA reporting, collection of any data and great graphs and network maps. Zabbix is updated now to version 3.2, which has improved functionality and increased performance when working with a database for storing the changes history in various parameters of the "Radioastron" transmission channel equipment and servers.

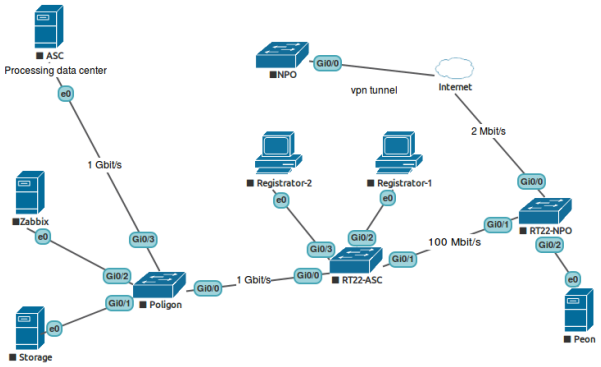

Figure 1: Radioastron data chanells.

This monitoring system collects data on the performance and availability of servers, LAN and polls active network equipment by snmp. The monitoring system is installed on two servers, one of which is the virtual - is itself Zabbix server, database Postgress and Lighttpd web server. Zabbix proxy server with database Sqlite is installed on a dedicated physical server It aggregates monitoring data collected from the network equipment via SNMP and ICMP protocols. Zabbix uses postgres 9.5 database to store the history of events and

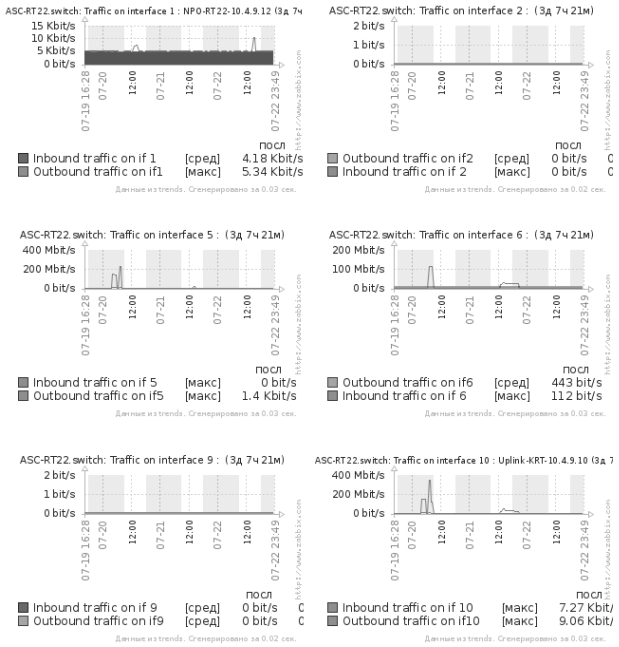

Figure 2: Graphs of channel loading.

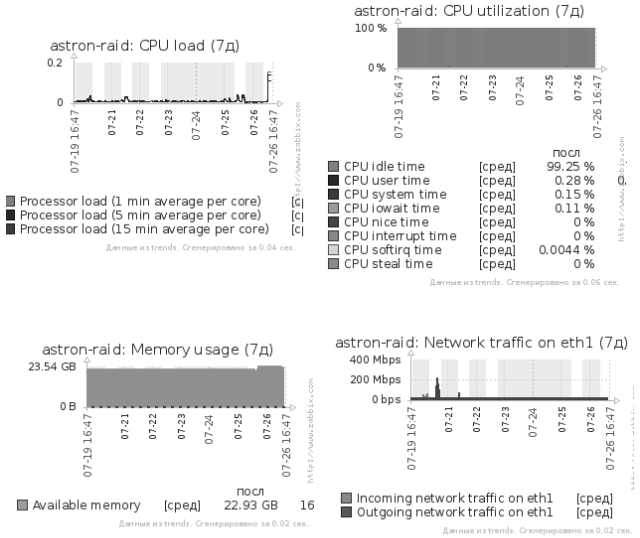

Figure 3: Graphs of storage server cpu, memory and network interface usage.

data for graphs construction of the changing parameters. Every monitoring systems settings are made via web-interface. Monitoring system collects information about the status of the main switch interfaces, loading them (Fig. 2) and the resulting errors.

Zabbix agent is installed on the buffer storage server and sends data about status and utilization of its resources sach as filling of hard disks space, as well as the status of the disks themselves, memory and cpu usage, cpu temperature (Fig. 3). Part of the equipment is monitored using the icmp ping and simple checks to identify delays and packet loss in data transmission channel. And the main features of monitoring system is alerts engineers when a fault occurs and storage of events history in DB.

3. Conclusion

The work of unique Russian space radio observatory in international space VLBI project "RadioAstron" extended until the end of 2017. Therefore, management and monitoring of communication channels between the tracking station in Pushchino and treatment centers in Moscow for the transmission of scientific and telemetry data is still relevant and necessary. The reliability of communication channels is highly dependent from continuous monitoring and scheduled maintenance of network, server equipment and optical communication lines.

Failsafe operation of the communication channel is especially relevant for the space telescope. For example, uninterrupted reception of telemetry data allows specialists to take further decisions on the correction of its orbit and receive important information about the performance of the onboard equipment. The success of the scientific experiments directly related to the reliability of the transmission of scientific data. This requires solutions that can automatically detect and respond to threats and channel performance issues in real time, as well as predict possible issues in the future. Monitoring system gives us the opportunity to have the right information about data transmission at the right time.

The average data rate of the channel is typically 300-400 Gbit/s. Every day about 50 to 300 GB of unique information about the structure and evolution of various astrophysical objects (quasars, pulsars and black holes) is transmitted through the channel. The same amount of data backed up in the PRAO ASC LPI buffer data storage. The project plans to connect the new link speed 10 Tbit/s to reduce the transmission time. And we are currently performing the new channel testing and selection of appropriate equipment. The 1 Gbit/s old channel, we plan to use as a backup in the future.

The monitoring system over the past two years, allows us quickly resolved emergency situations caused by the power failure and failures of the network equipment, and cooling system of the buffer data center, as well as identify the causes of failures of channel associated with the failure of the individual switching devices and optical modules. We were promptly detected and eliminated two cases of the optical lines damage, allowing to minimize the idle time of the channel work. Monitoring of disks in buffer storage allows us for timely replacement of failed drives, that would prevent the destruction of RAID-array and prevent permanent loss of scientific data.