2008-2009 JINR Networking Results

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This is a brief overview of the most significant networking projects and activities realized at JINR LIT for the last few years.

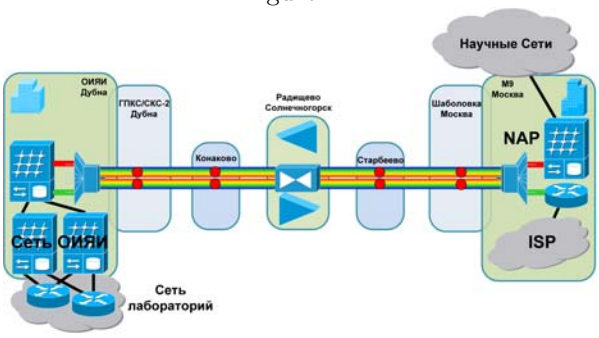
Development of the external JINR communications

The crucial project of the 10 Gbps fiber data communication channel between JINR and Moscow Internet Exchange (MSK-IX) proceeded by five partners: Joint Institute for Nuclear Research, Russian Satellite Communication company, RosNiiROS, Moscow Internet Exchange, Jet Infosystems, was launched in May 2009.

The diagram (Fig.1) shows three places where the devices of the photonic data communication equipment were installed: the central telecommunication node (JINR LIT), settlement Radishevo, and Moscow Internet Exchange (MSK-IX).

The total length of the fiber optic communication line is about 250 km. This is almost the maximum distance for the typical optical transport equipment for regional applications. To prepare the data channel, technical specialists made preliminary measurements of the signal parameters along the optical communication line, to be able to make the precise adjustments of the optical I/O equipment in all three telecommunication locations along the data link and to put the new 20 Gbps data channel into operation.

Figure 1:



The equipment for the data channel is manufactured by the Canadian vendor Nortel Networks, and installed, tested and tuned with the assistance of the Jet Infosystems specialists (Moscow). The Nortel Optical Multiservice Edge 6500 terminals and Nortel Common Photonic Layer multiplexers are installed in LIT and in MSK-IX, and one Nortel Common Photonic Layer multiplexer is installed in Radischevo. The Nortel company calls these pieces of equipment the "40G ready", what means that the data link capacity can be easily increased significantly.

This data communication channel uses DWDM (Dense Wave Division Multiplexing) and 10 Gbps Ethernet technologies for the data transport. Currently 2 optical light-path (*lambda*)are in use gaining 20 Gbps throughput. The throughput can be increased up to 800 Gbps by use of 80 virtual lines through the implementation of additional photonic modules.

Currently the JINR network infrastructure has the following virtual lines:

- direct communication line with CERN – 1 Gbps;
- with RBnet – 10 Gbps;
- with RASnet – 10 Gbps;
- with RadioMSU – 10 Gbps;
- with GEANT – 10 Gbps;
- with GLORIAD – 1 Gbps;
- with Moscow – 10 Gbps;
- with Internet – 10 Mbps.

The structure of the system for the intra-Dubna network traffic exchange was optimized on the basis of the Cisco 7606 platform. Dubna Internet exchange is used by the local internet providers, like Contact, LANPolis, Telecom-MPK, JINR.

Network Security issues

Security is gained with the implementation of hard- and software products in the network infrastructure. To protect the computing and informational servers, users' workstations and active routing and switching network equipment at JINR, we use the industry–approved AAA approach – Authentication, Authorization, and Accounting. *Authentication* provides the method of identifying users, including login and password dialog, challenge and response, messaging support, encryption. *Authorization* provides for remote access control, including one-time authorization or authorization for

each service, per-user account list and profile, user group support. *Accounting* provides the method for collecting and sending security server information used for reporting.

Monitoring and control of the JINR network environment with IPDB

During the last two years, the AAA system has been successfully gradually integrated into LIT-developed product IPDB – a network data base with multiple features of monitoring and control based on IP-addresses. The IPDB became the main tool for the network and system administrators to maintain their everyday administrative tasks. This system was developed on the basis of MySQL software packet, equipped with the web interface, written in the *php* language, and incorporates a number of specialized front-end programs (written in *perl* and *c* programming languages) to deploy needed functions.

By this web interface, LIT network operation centre (NOC) specialists and network administrators in the Laboratories have access to the users' personal profiles, can monitor the IP addresses of the network elements, can change the state of these elements when necessary. They have an opportunity to verify the users' accounting records and the state of different network services, the most important of which are DNS, VPN, AFS, electronic libraries, IP telephony.

The IPDB modular design principles allow us to add a new feature when the need in such a service become evident. Thus, in 2007 the AFS system was adapted, in 2008 - the types of the network traffic, and in 2009 - IP telephony system (it is in the process of adaptation now).

The following is a summary of the various IPDB features developed for the last years:

- A software control module for the AFS accounting records to be accessed from the IPDB directory;
- The support of the electronic libraries users is added into the IPDB inventory; a new user of an electronic library is also added via the IPDB interface;
- The method of the password encryption to protect users' email accounting records on the central email cluster *mail.jinr.ru*, when connecting through the external networks, was adapted;
- Due to legal SSL-encryption certificate *Thawte*, it became possible to transfer the number of critical applications as email, network remote control, remote access to some internal sites to be used through the secured virtual channels;
- The server *wsus.jinr.ru* with the mirror of new Microsoft updates to increase the speed of updating and to limit incoming traffic is designed as a new service, the sever of NOD32 antivirus updates is created too;
- The network statistics is enriched with a module to calculate the traffic between JINR network and the networks of different research centers (Table 1); besides this, the network traffic statistics can be presented by the traffic categories: scientific, local (Dubna), file exchange, etc., 700 grades. The scientific data traffic exchange in 2009 (in Terabytes) is shown in Table 1. As seen from the Table 1, CERN has only a 4-th rank.

Table 1: Top 10 scientific data traffic exchange in 2009

	Research center	Alias	To JINR	From JINR	%
1	Fermi National Accelerator Laboratory (US)	FNAL	84	2	24
2	Science Park Watergraafsmeer Amsterdam (NL)	SARA	61.78	15.49	18.11
3	Nationaal instituut voor subatomaire fysica (NL)	NIKHEF	49.06	0.9	14.38
4	European Organization for Nuclear Research (SE)	CERN	40.6	27.73	5.24
5	Institut National de Physique Nucleaire (FR)	IN2P3	17.89	15.9	5.24
6	Rutherford Appleton Laboratory (GB)	RAL	13.54	5.54	3.97
7	National Grid Initiative (TR)	TR-GRID	10.96	0.2	3.21
8	Consorci Institut de Fisica Altes Energies (ES)	PIC	10.35	0.6	3.03
9	Deutsches Elektronen-Synchrotron (DE)	DESY	7.42	3.19	2.17
10	Forschungszentrum Karlsruhe (DE)	KFK-ULTRA	6.71	2.25	1.97

- A system to detect the computers infected with harmful content: viruses, trojans, mulware, has been designed;

Table 2: The statistics of IPDB

IPDB Statistics	
Operator (Network and System administrators in the JINR divisions)	43
User	3618
Network Element	6690
IP address	7772
Remote Access (total in month)	1275 / 15
Electronic Library Access	814 / 20
AFS	365
Transaction per year	160 000
Scientific Networks	270

Table 3: Dynamics of the JINR external traffic

2007	242 Tb
2008	376 Tb
2009	523 Tb (December 15)

- A system to detect network intrusions and attacks *snort* has been created;
- The monitoring of the network state through the ICMP and SNMP protocols is put into deployment, serving more than 100 network elements;
- The new anti-spam packets help to filter about 1 million email spam-messages every 24 hours.
- There is a temperature monitoring proposal to be able to keep the network and telecom room environment under permanent automatic control, as a part of the general monitoring system.

The following are some data on monitoring and control topic:

- NOC team supports 18 specialized servers which carry the main network services supporting the overall JINR network environment: DNS, T-mail, DHCP, statistics, data bases, remote access. If to add the active routing and switching equipment to the mentioned quantity of servers, we'll get around 70 units of the active network equipment.
- More than 50 users' requests are served during the working day.
- About 20 network incidents related to the security violation issues are investigated each month.
- The volume of the external traffic is about 20 Terabytes per month.
- There are 1700 active subscribers to the central E-mail service.

Table 2 gives the statistics of IPDB use by the specialists of the different profiles and different services.

The dynamics of the JINR external traffic (140 Terabytes/year) is shown in Table 3.

Table 4 presents the traffic distribution by category.

Table 4: JINR traffic distribution by category

Scientific & educational networks	87.00%
File exchange (torrent, ftp)	10.45 %
Web-resourses	1.65%
Software	0.45%
Multimedia	0.45%