Management Plan For ESnet Network Access To The Russian Federation

7/5/93

By

The Russian Connectivity Task Force
of the
Energy Sciences Network Steering Committee

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1.0 Introduction

Within the scope of scientific activities of the Department of Energy, Office of Energy Research (DOE/ER), many collaborative initiatives exist with researchers and facilities within the Russian Federation (RF). Most recently there has been an increasing emphasis on expanding the collaborative efforts to include actual DOE funded contracts in addition to international agreements for performance of specific works. These increased activities have heightened the importance of having good, reliable networking communications to not only improve scientific interchange, but to facilitate construction of key components for scientific projects here in the USA.

The Energy Sciences Network (ESnet) is the computer data communications network supporting the multi-program scientific research conducted under the auspices of DOE/ER. It provides the networking infrastructure for widely distributed scientific collaborations and access to unique scientific facilities. ESnet supports open network connectivity to fulfill the broad networking needs of DOE/ER community, and is a significant element in the worldwide Internet.

The development of network links will be an important step forward in scientific cooperation between the United States and the Russian Federation. The Energy Sciences Network has been tasked to establish network links to a clearly defined set of Russian scientists at their respective institutions and scientific facilities.

When ESnet provides international connectivity, the usual practice is to establish a single link into the country where the requirement exists. However, in the case of Russia, there is virtually no national networking infrastructure at this time. Thus the approach will be to establish connectivity to three separate regions; Moscow, St. Petersburg and Novosibirsk. ESnet will also encourage and assist the development of local and national infrastructure in and between these areas. An important strategic element of ESnet's plan is to utilize links provided for by other entities. For example, connectivity to the Russian Space Research Institute (IKI) is planned by NASA which will establish a networking hub in the Moscow area. This hub will also be used to fulfill some of the DOE/ER requirements in this region. This and other inter-agency collaborative efforts will save government funds by eliminating unnecessary expensive links.

Unlike most other countries, Russia does not have a communications infrastructure on which networking can be built, thus most of the sites we wish to network to currently only have dial-up modems over less than ideal telephone circuits to provide their network connectivity.

The ability to effectively conduct DOE/ER's research program is dependent upon good quality communications between members of scientific collaborations. The USA is spending significant funds to bring about the timely execution of these research programs. The office of Scientific Computing, ESnet management, and the related committees will assure the most effective use of funds and other resources for networking support of these collaborations.

2.0 Organization of Networking Within DOE/ER

The Office of Scientific Computing is chartered to provide national and international wide-area networking for all of the energy research programs. The Energy Sciences Network (ESnet) provides these resources and is managed and operated from Lawrence Livermore

National Laboratory. ESnet maintains all of its network resources as well as the interfacing between other "peer" networks such as the National Science Foundation Network (NSFnet), NASA Science Internet (NSI), and many regional and mid-level networks. Network interfacing is maintained with networks in several foreign countries that are involved in scientific collaborative efforts with DOE/ER programs.

2.1 International Networking

International connectivity is also provided by ESnet and Energy Research. Links to sites in Japan, Germany, Italy, and Switzerland are maintained to support specific programmatic needs in the ER community.

2.2 Related Committees

ESnet functions with the assistance of two committees which provide support and information for the management of its resources. The ESnet Steering Committees provides a forum for the programs within the ER community to evaluate networking requirements with proposed implementations. The ESnet Site Coordinators Committee is a technical body that helps define common strategies and plans for networking issues across programmatic and institutional boundries.

3.0 DOE/ER Programmatic Requirements

There are numerous collaborations between researchers at USA Energy Research (ER) facilities and Russian Federation (RF) facilities sharing common scientific research interests. Some of these efforts are DOE-funded contracts and/or international agreements for specific work. Some are one-to-one collaborations between scientists in very specialized areas. Many of these collaborations have been in place for years and many involve additional third-party collaborators who are located at neither USA or RF facilities. An annotated listing of program requirements for communications with the RF that exist at the time of preparation of this document is given in Appendix "A" according to ER program elements. Highlights are discussed herein.

Given the proper authority and export licenses the Energy Sciences Network (ESnet) plans to support (with appropriate access and routing controls) the electronic exchange of information required by these collaborations to the extent resources are available and justified. A staged approach consistent with finite resources available is discussed below following a description ER program priorities. In formulating this approach individual programmatic priorities and cross-cutting program requirements of lesser priority were considered along with the present networking environment in the USA and Europe. The approach is also consistent with encouraging development of network infrastructure in the RF.

3.1 Basic Energy Sciences

The Applied Math Sciences program within Basic Energy Sciences identified connectivity to support the Topaz project as its highest priority programmatic need. Multiple Russian sites are collaborators in this space reactor program. In order of priority they are at Central Design Bureau at St. Petersburg, Kurchatov, Podulsk and the Institute of Power at Obinisk.

3.2 Fusion Energy

The priority sites for Fusion Energy collaborations are the Kurchatov Institute in Moscow, the Efremov Institute in St. Petersburg and the Ioffe Institute in St. Petersburg.

The International Thermonuclear Experimental Reactor (ITER) is a joint collaboration between four countries/groups of countries; USA, Japan, European Community and Russian Federation. A conceptual design for the reactor has been completed and the collaboration is now focusing on producing an engineering design and determining the site for construction. Principle sites in the RF that are involved in this collaboration are Kurchatov and Efremov. There is also some work being conducted at Ioffe.

Two DOE funded contracts are in place between General Atomics and the Plasma Physics Division of the Kurchatov Institutes for research on the T-10 tokamak located there. A third contract, also administered by GA, is with the Troitsk Institute for Innovation and Fusion Research, for research on the TSP machine and hardware for the DIII-D program.

Collaborations at Ioffe include efforts for diagnostics support for the tokamak experiments on TFTR at PPPL and theory work there as well as at other fusion sites in the US.

3.3 Health and Environmental Research

There are two priority sites identified to support molecular biology and environmental collaborations conducted by this program at Novosibirsk and St. Petersburg. The Human Genome project works with the Siberian Energy Institute and the Institute of Cytology and Genetics, Novosibirsk. Since biotechnology is an emerging cross-cut research area within the US government agencies, this was deemed their highest priority. The second priority is Main Geophysical Observatory located in St. Petersburg.

3.4 High Energy Physics

The three high priority sites for High Energy Physics are located in the Moscow area. The first priority is for the Institute of High Energy Physics (IHEP) at Protvino located south of Moscow. Second priority site is located north of Moscow at Dubna. Third priority is the Institute for Theoretical and Experimental Physics in Moscow.

3.5 Nuclear Physics

The highest priority for Nuclear Physics is the Yerevan Physics Institute in Armenia to support collaboration on Detector Fabrication for CEBAF. Second priority is Dubna at the Joint Institute for Nuclear Research to support scientific collaborations. The third priority is ITEP, Moscow.

3.6 Super Collider

The Super Collider project has identified Novosibirsk as its highest priority site, and the Moscow Radiotechnical Institute as its second. Both of these institutions will be constructing important components for the Super Collider accelerator which represent contracts and international agreements between the USA and Russia.

3.6.1 Novosibirsk

We have contracted with the Budker Institute for Nuclear Physics (BINP) to produce LEB magnets for the project. To facilitate the construction of the magnets, design information, drawings, and coordination of efforts can be accomplished in real time with a reliable communications link. It will be very difficult to manage our contracts without reliable telecommunications.

3.6.2 MRI/Moscow area and Others

The SDC and GEM detector collaborations include 200-300 scientists affiliated with institutions in this area. Dubna is near an existing satellite station, and appears to be a potential focal point for some communications. In addition to scientific activities associated with the experiments, major detector and accelerator components will be built at these sites, most notably the Moscow Radiotechnical Institute (MRI). The requirements for construction activities are similar to those associated with the magnet activities in Novosibirsk. Other sites of interest include IHEP, INR, and ERI and PNPI in the St. Petersburg region.

SITE	Priority #1 site	Priority#2 site	Priority #3 Site	Comments	Possible solution
Kurchatov	FS	AMS	NP	Leased line to GARR	Probable provision via NASA
Novosibirsk	SSC,OHER		NP,FS,HEP	Over Russian Satellite	Possible collaboration with euro sites
IHEP	HEP		SSC,NP	Over NASA	Possible collaboration with NASA
St. Petersburg	AMS	FS,OHER	FS,NP,HEP	Leased line to Duseldhorf	Possible collaboration with NASA/ euro sites
MRI		SSC	HEP,NP	Over NASA line	Possible collaboration with NASA/ euro sites
DUBNA		NP,HEP		Via GARR	GARR link in place today 64kb
DUBNA			NP,HEP, SSC	Via DFN	DESY and CERN link in place today 9.6x2 >64kb

(Table 1 Site and Program Analysis)

4.0 Consolidated Priorities and Strategy

A summary of the individual program site priorities discussed above is given in Table 1. This table also identifies other ER programs that have access requirements for those sites. In formulating the approach to satisfy these connectivity requirements, the main consideration was providing access to the sites identified as having the highest priority. As can be seen from

the following discussion, this is satisfied. Moreover, it can be seen that the approach chosen will provide also access to those sites identified as having second and third priorities.

Kurchatov is identified by Fusion Energy as its highest priority site. It is also ranked by the Applied Math Sciences program within Basic Energy Sciences as their second highest priority. An additional program requirement was expressed by Nuclear Physics. It is expected that this site will be accessible through the NASA Science Internet connectivity to Russia (pending authorization/export licensing by the Department of Commerce). Since NASA and DOE have a history of cooperation in keeping with their acceptable use policies, if the NSI connectivity is established, no further action will be required for the Kurchatov site since NASA has agreed to carry that traffic.

The site at Novosibirsk is ranked as the highest priority by two program elements, the Super Collider and Health and Environmental Research. Since additional program requirements were identified by all the ER programs with network connectivity needs, there is a strong justification for connecting this site. The approach for establishing this connectivity is discussed in detail in a later section of this document.

The Institute for High Energy Physics in the Moscow region is identified as the top priority for High Energy Physics and as the third priority for the Super Collider. Nuclear Physics also has programmatic requirements for access to this site. This is another of the Moscow region sites that may be accommodated by the NSI connectivity.

The final top priority site is in the St. Petersburg region, as identified by the Applied Math Sciences program. Fusion Energy has two institutes in St. Petersburg as its second and third priorities. The second priority site for Health and Environmental Research is also located in St. Petersburg. Both Nuclear Physics and High Energy Physics have lower priority requirements for connectivity with this site. In addition, NASA science requirements exist for sites which will not be accommodated by their implementation of the NASA/IKI hub--St. Petersburg is one such site. Establishing connectivity to this region thus offers opportunity for beneficial collaborations with NASA and European sites that is discussed further in the section addressing the technical implementation.

Three additional sites round out the list for all program's top three priority sites. MRI, requested by SSC as second priority by SSC with lower priority needs expressed by both High Energy Physics and Nuclear Physics, is located in the Moscow area and hence appropriate to be included in the NSI implementation, given that collaborations with NASA and European sites are accepted. Finally, access to both Dubna and ITEP is possible using links that are in place today. The GARR link serves Dubna at 64 kb. The DESY and CERN link is 9.6 Kb. with 64 kb. planned.

5.0 Implementation Strategy

Because the connectivity requirements divide up into three distinct regions within Russia, the implementation strategy will attempt to capitalize on the consolidation within a specific geographic area. The three regions, Moscow, St. Petersburg, and Novosibirsk, each will be implemented separately to address their specific technical needs, even though together they comprise the scope of this overall plan. By developing and submitting independent technical implementation plans, it should be easier to facilitate the documentation and implementation for each region. In addition, it should be possible to share connectivity with other entities (like NASA) so that we can minimize the duplication of efforts.

6.0 Export Control

Some of the technology associated with contemporary networking and computing is subject to export control regulations based on COCOM restrictions imposed in the interest of national security. DOE will work with the Department of Commerce, (and any applicable governmental entities) to assure that DOE's connectivity to Russian sites is properly authorized and licensed, complies with USA. export control regulations, and does not create a threat to national security.

In order to export this technology, and the associated technical data needed to implement and operate the network connectivity, an export license must be granted to DOE by the Bureau of Export Control within the Department of Commerce.

7.0 Access Control and Site Computer Security

DOE/ER networks have, for sometime been a part of the Global Internet with its million plus computers in over a hundred countries around the world. This allows DOE/ER researchers to collaborate with researchers in most of the world; the exception being those states associated with COCOM restrictions. Access control and computer security has been effectively handled on "system within site" basis. Thus the responsibility for security requirements is put on the computers or computer systems, i.e. hosts. There may be direct monitoring of the network to see that hosts are not sending out incorrectly configured packets of information or creating improper routing of information, but the responsibility of protecting the information and resources on any host is the with the host.

The DOE Order 1360.2A, "Unclassified Computer Security Program" in part defines computer security to be host system oriented. This order specifies how sites with unclassified computer systems are to arrange the security of their systems with the understanding that they may be connected to the Global Internet. Issues such as the securing of sensitive information, access by on- and off- site users, etc. are included in individual site plans and procedures developed for 1360.2A compliance. The DOE site and/or field offices review and approve the unclassified computer security program plans of the sites. Another aspect of DOE Order 1360.2A is that it specifies that sites set up access controls for use of computer systems by all on-site and off- site personnel, users, visitors, etc. Russian Federation visitors currently are present at many DOE/ER sites. Their on-site access to ESnet and the US Internet is already covered by the sites' implementations of DOE Order 1360.2A. This request will facilitate their off-site access to ESnet and US personnel's access to CIS/FSU/COCOM networks.

Considering that DOE networking (ESnet) is already a part of the Global Internet, the addition of traffic to-and-from the Russian Federation would not create the need to change security plans and procedures already in place. DOE/ER sites have been protecting their computer and information resources under the implementation of DOE order 1360.2A for over four years.

8.0 Technical Approach

It is expected that cooperative efforts to network to Russia will be established and maintained between ESnet and other scientific and/or research oriented entities both foreign and domestic. These cooperative efforts will allow routing of network traffic between Russian

institutions (over existing network paths), to ESnet sites, and will result in considerable cost savings.

At this time there is no established Russian national network infrastructure connecting these regions. While this requires a direct connection to each region to meet program goals, these connections need to be established in a manner that will encourage development of local infrastructure as-well-as minimize intra-Russian communications having to transit through the USA. For these reasons, preference will be given to solutions that keep European and intra-Russian traffic from transiting the Atlantic.

The Russian facilities targeted by the programs lie in three distinct geographic areas, Moscow, St. Petersburg, and Siberia (Novosibirsk). In cooperation with international Internet engineering efforts, ESnet strives to implement international access through a single connection to a national network. Work then continues with both the national network and the identified sites to assure performance that will meet program needs.

7.1 Moscow

There are several efforts underway which will, or could with modest extension, address our five initial requirements in the Moscow area. NASA is in the process of establishing a connection and hub into the Russian Space Research Institute (IKI). They have offered to connect the Kurchatov facility and will consider one or two more. The German research network DFN, is upgrading the line connecting DESY/WIN to ITEP , and has expressed a strong interest in helping the Russians to develop their own infrastructure RELARN. Finally, the Italian research network INFN/GARR, has established a connection to Dubna.

7.2 St. Petersburg

The St. Petersburg area is not currently being addressed by other efforts. Among our five initial requirements in this region is the ITER engineering team at the Efremov facility. Detailed implementation plans will require consultation with the facilities involved. It is likely that a plan similar to the NASA/IKI hub will be developed.

7.3 Central Siberia (Novosibirsk)

An initial proposal was developed for an SSC only connection and will be used as a starting point for a general purpose connection. Because of the geographical location, this region can only be reached by a Russian satellite. The Russian satellite footprint only extends as far west as Western Europe. International collaborate efforts will be needed to connect this location to ESnet.

9.0 Network Operation and Management

The following responsibilities of the ESnet Network Operations Center and the Russian Network Operations Center are defined to provide connectivity to DOE sites of interest, at the levels of reliability, performance, and security ordinarily provided by ESnet.

9.1 ESnet Network Operations Functions

ESnet's Network Operations Center (NOC) at LLNL continuously monitors ESnet circuits and routers to ensure constant availability of network services to users; this monitoring is performed 24 hours per day, seven days per week. The ESnet NOC will extend this monitoring to Russian circuits and any ESnet-provided routers located at Russian sites. When circuit problems occur, ESnet will report these problems to the Russian NOC for resolution.

ESnet will make every attempt to remotely diagnose and repair problems with the ESnet routers deployed in Russia. If local site assistance is needed, ESnet will contact the Russian support group. The Russian support group will send a technician to the site to provide the necessary assistance.

ESnet will maintain configuration control of all ESnet-provided routers. Software upgrades and router configuration changes will be by ESnet staff through the network or remotely from ESnet NOC through out-of-band (i.e., dial-in) access to the routers.

9.2 Russian Network Operations Functions

The Russian NOC will operate all communication links to sites inside Russia and will operate and maintain the telecommunication equipment (i.e., modems and terminal servers). A technician will be on call 24 hours a day, seven days a week to answer trouble calls. ESnet expects the technician who answers trouble calls to speak English in order to communicate effectively with the ESnet NOC staff. Sites within Russia will call the Russian NOC to report problems, and the ESnet NOC will report Russian circuit problems to the Russian NOC for resolution.

The Russian NOC will provide technical consultation and support to Russian sites, and will diagnose and resolve problems with the communication links or the telecommunications equipment. The Russian NOC may call the ESnet NOC for technical assistance.

10.0 Summary

Collaborative scientific ventures between researchers, scientists, engineers, and educators at USA and Russian Federation institutions and facilities need adequate network connectivity. This plan outlines the current communications requirements between the Energy Research community and the Russian Federation and optimizes costs by:

1) Cost sharing with NASA and others as appropriate.
2) Focusing on specific regions of interest.
3) Fostering the development of infrastructure in the Russian Federation.

The provision of effective networking connectivity is essential for the support and continued growth of mutually beneficial scientific efforts between the two countries.

APPENDIX "A"