Bringing Internet to North-West of Russia - RUSNet N/W project

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Abstract

During last years the computer networks in Russia have been developed without an appropriate governmental coordination as well as concentration of resources of funds and governmental organizations aimed to solving of the common problem -- the creating of the united national computer network integrated into Internet. The absence of such a network holds the science and education development in the country.

Taking in account these facts, Ministry of Science and State Committee for High Education have made a decision to realize the project of building the united academic network of Russia. This project is supposed to be implemented upon the regional basis, drawing the companies possessed the modern channel infrastructure. The first stage of the project - Regional University & Science Network of the North/West of Russia (RUSNet N/W)-is currently being realized by State Technical University of St.Petersburg (STUSP) and Institute of Robotics and Technical Cybernetics (IRTC) jointly with the leading provider of data communication facilities -- LENENERGO Inc.

The project is focused on implementation of modern high-speed data network with gateways to global Internet via NORDUNet.

1. Introduction

Due to a lack of large backbone IP network in Russia, the penetration of computer communications has been almost limited to research institutes and universities. To break this bottleneck, State Committee for High Education and Ministry of Science have made a decision to develop a joint project of creation of the modern networking infrastructure built on the regional basis. This project is supposed to be implemented in a cooperation with industrial and commercial enterprises which are proprietors of the modern telecommunications lines.

This paper reveals the current activities and the practical approaches of the pilot networking project that has been launched by State Technical University and Institute of Robotics and Technical Cybernetics in collaboration with LENENERGO Inc. - owner of data channel infrastructure at North-Western part of Russia. Currently, the project is being implemented.

2. Basic concept

The basic concept of modern network in N/W region of Russia has been offered by the Analytic research group of STUSP in 1993 [1].

Many universities and research institutions as well as industrial, commercial and academic organizations have the need to have the networks able to fill the today and future demands.

In accordance to the concept, the network consists of the three adjusted parts: channel infrastructure, transmission system and basic services. Many networking projects in Russia have failed as their building had been begun from the last part and the first and second ones were neglected. The distinct feature of the project is that its implementing did start from the creation of the channel infrastructure.

Optical fiber technology is crucial in building the modern telecommunication infrastructure. With its enormous transmission capacity, optical fiber has already become the medium of choice for Internet links. Therefore, the project is oriented to the fiber technology.

Interconnection of networks and their interoperability are the primary functions of the transmission system. Indeed, there are few choices of the potent technologies. Some are well known and stable, some are in the process of generating of standard. Besides, the absence of existing infrastructure in Russia makes the network building a lot easier -- there is no need to repeat all that long Western way to the modern networking. Now ATM is attracting much of attention due to its remarkable capacity and ability to carry data voice and video. Taking the fiber technology as a basis, we have an ability to realize the most promising and approved transmission methods - Synchronous Digital Hierarchy (SDH). This technology has several advantages:

1. The existing services such as E1 and E3 can be mapped into SDH payloads.

2. LANs and WANs can be built based on a common SDH switching multiplexing.
3. The standard for transporting ATM cells over SDH networks has already been accepted.

The concept takes into consideration service aspect. According to the project, all network services should be based on IP technology, with development of information services towards mixed-media traffic. The basic services have also included the ATM Forum's "LAN emulation", standard which allow PCs to reach servers through ATM muxes, routers and switches. RUSNet N/W is an experimental WAN for research on data networking. The primary service offered over RUSNet N/W is a fast IP interconnection via backbone FDDI ring (LN, ASN WellFleet routers) and an Internet gate. This large available bandwidth makes RUSNet an ideal testbed for experiments on multimedia communication.

3. Channel provider

Now the construction of advanced communications networks requires a huge investments and a long time. The key of the project to successful evolution towards the future network is optimum distribution of regional resources: industrial - of the commercial enterprises and intellectual ones - of the R&D institutions. LENENERGO Inc. is the Saint-Petersburg leading power company that joins the companies engaged in energy-related operations in generation, electrification and communication services. LENENERGO telecom division (that specializes in the construction and implementation of the digital telecommunication networks) and its Finnish partner in telecommunication have joined their forces to establish Optic Ground Wire (OPGW) constructed on the 232 km long 330/400 kV power transmission line from Lappeenranta in Finland to Saint-Petersburg in Russia [2].

The modern concept of constructing the OPGW on existing lines helps to produce the efficient telecom lines rapidly and economically. The method is environmentally friendly and optical fiber is insensitive to electromagnetic interference and well protected from mechanical damage by special construction.

Now this line is highly efficient, providing power and telephone operators in the St.Petersburg area with a radical improvement in telecommunications. The line is based on SDH transmission system and enhances international telecommunications for N/W part of Russia: giving the access via Finland to/from global networks infrastructure. This line has already been used for cable TV transferring during Goodwill Games at St.Petersburg in 1994.

4. The pilot project

The project is supposed to be implemented in 3 stages.

The first stage includes the construction of basic backbone segment. According to the project, the main provider of academic network will be LENENERGO Inc. with its lines spanning across urban and suburban territory of Saint-Petersburg and over the N/W region and abroad. This allows to test main technical solutions, to make technical staff training and certification, to create a base of information services. This stage should results in working high-speed FDDI backbone segment in St.Petersburg connected to global Internet. This stage has already implemented.

The second stage of the project includes the development of backbone infrastructure and technical base and the improving of the international cooperation. The broadening of an information services range will take place. We suppose to:

1. found the education and certification center for specialists in modern network technologies at this stage.
2. create an electronic access to world famous museums and libraries.
3. start the research in switched internetworking technology.

At the third stage, side by side with the future regional network development, we intend to migrate to ATM - the most actively being researched network technology in the industry. At this stage the infrastructure will be improved and ATM applications can be implemented. These applications will be used in different scenarios, depending upon needs for increasing bandwidth at different points in the network.

5. Project design

First of all, it concerns implementation of ATM that offers a number of significant advantages including scaleable bandwidth, virtual networks and integrated traffic support.

The project includes following aspects:

Functional;

Technological;

Service;

Organizational;

The functional aspect defines the basic elements of network, their purpose and the principles of their interoperability. Historically, there have been

separate methods used for transmission of information on a LANs versus on the WANs. Such an approach has heavily increased the functional complexity of the base network. The using of ATM allows to avoid of the such increasing by having one international standard. So the base network consists of the ATM switches+backbone high-performance routers web. This functional structure does not need the separate networks: once connected, PCs can derive the benefits of virtual LAN.

Technological aspect defines the technical and technological solutions used for building of the network. At the time, in most cases, separate networks used to carry data, voice and video information because these types of traffic have different characteristics. To unite them via the base network it is offered to use two types of ATM switches - workgroup switches (have LAN and PBX-G.703 interfaces) and WAN switches to create SDH/SONET trunks.

Service aspect defines network services available for customers. Besides the traditional services (file transfer, e-mail, telnet etc.), now there is a need for the new levels of services, such as ones that have requests for bandwidth and delay (voice, video).

Organizational aspect defines the order of the project implementing and includes the creating of analytic research group (STUSP), planning group (IRTC) and technical administrative staff (STUSP & LENENERGO).

According to virtual network concept, the project includes a first step towards new transmission and switching systems for native IP and mixed-media traffic based on Bay Networks (Weelfleet and SynOptics) BaySIS switched internetworking technology.

6. Conclusion

This paper reveals basic idea, current activities and the practical approaches of the pilot networking project that has been launched by leading universities and scientific centers of Saint-Petersburg. The project is an example of how academic and research community in the North-Western region of Russia adapt to the new market reality in close collaboration with major industrial data-communication facilities providers of both domestic and foreign dispositions.

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