

The information system of the Kola Science Centre RAS as an element of the integrated information structure of the Barents Region

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Abstract

The Kola Science Centre of the Russian Academy of Science (KSC RAS) includes 11 research institutes and is the biggest scientific institution in the Barents Region. That's why the integration of the KSC RAS' information system into common information structure of the Barents Region is of grave importance.

In the report which follows, the description is given of the information system (IS) of KSC RAS. The system ensures the information access to the national and international resources.

The IS KSC consists of local area nets of the institutes which are integrated into a common information system by means of the communication centre. Recently the KSC network is integrating of 270 computers. Spatially, the IS KSC represents a "star" with the communication centre in the middle, and local nets of the institutes in the periphery. Such connection enables the fluent diagnostics of break-downs and their removal without switching-off the whole system.

The solution of these tasks is assured by the use of three separate subsystems in the frames of the communication centre:

- the file-server
- the server of applications
- the server of global communications.

The file-server is carrying out the storage of common information funds, as well as the router of the information flows. The server of applications is guaranteeing the access to the IS KSC resources via commutated telephone channels. The server of global communications is intended for arranging of information exchange in course of on-line and off-line access to the resources of Internet and Relcom networks.

I Preface

Information system of the Kola Science Center (KSC) is developed to improve the efficiency of researches by creating integral system of information support. Science is a major “manufacturer” and at the same time consumer of information, so it is very important to make efficient information support system available for scientists. This means creating and giving to end-users (researchers) efficient tools for information intercommunications, publishing and access. The system aims to make this tools easy, reliable and speedy.

Generally, an information system may be considered as the aggregate of information transportation means and set of different information services aimed to store, process, represent and interchange information. Modern information systems are based on computer networks. In this case data communication network is transportation medium and computers - are information storage/processing platform.

Modern computer based information technologies is subject of rapid development. Computer hardware and software and data communication technologies are changing for the better. Development of information system (IS) of KSC mirrors these changes.

2 Pre-history

According to progress of information technologies, IS KSC was developed in several stages. At the first stage it was based on territorial isolated computers. Punched cards, punched and

magnetic tapes were used for information interchange. There were not efficient means of computer-user interaction. Information services was limited by file storage systems.

Appearance of multiuser and multitask operating systems marks next stage in IS KSC history. Centralized computation model with distributed terminals became available. At this time the core of the system was based on two IBM-compatible computers interconnected by common field of peripheral devices. This systems had dialog users interface and relatively big computation power. But technology of processing and representing of information still left much to be desired.

Big improvement of information technologies became possible when personal computers became widely available. A possibility of creating distributed information systems based on computer networks had appeared. At this time, the development of Information system of KSC was used in its present meaning.

At this time the differentiative trends was popular in KSC. Since 1989 subdivisions of KSC have been funded separately. Probably that is why local networks of separate Institutes and subdivisions were formed spontaneously and asynchronously. So, by 1993 we had several independent local networks with its own information services. But later it became obvious that for further development it is necessary to integrate isolated information networks of KSC’s Institutes and subdivisions into a common information infrastructure. Fortunately, there was great popularity of Novell NetWare

network operating system (NOS) and of Thin Ethernet cable system. Therefore local networks had similar cable systems and based generally on Novell NetWare NOS that made their integration easy.

3 Present condition

Due to extremely limited funding of Russian science the main criteria for choice of technical solutions was as minimum cost of integration as possible.

It is clear that we didn't need to change from NetWare NOS to any other. Shared files and printers were the mostly used network resources

as well as E-mail was the mostly used service. NetWare is able to serve all of them. In addition NetWare is able to route IPX and IP traffic (for the same price).

As was mentioned above, information system based on data communication network in general consists of two main parts – data communication infrastructure and information services running on it. Let us see IS KSC from this point of view.

3.1 Data communication infrastructure

There are several subnetworks connected to one communication centre (Fig 1). As can be seen, interconnec-

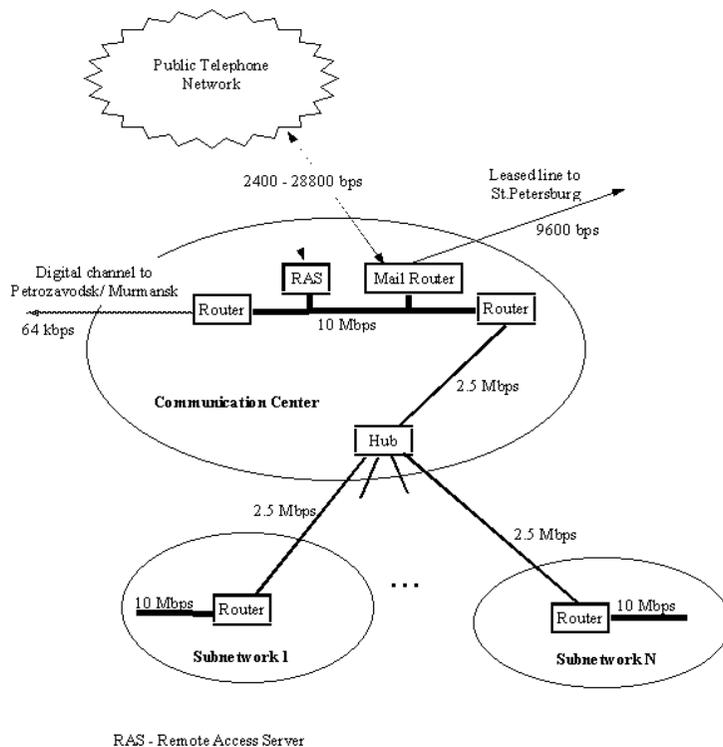


Figure 1. The general communication infrastructure of IS KSC.

tion is made by ARCnet network. Internal software routers of network servers are used to route internetwork IP and IPX traffic.

Such a structure gives the following advantages:

- Subnetworks are able to be developed relatively independently.
- Troubles in one subnetwork does not directly affect any other (because of a general star topology).

At present we use following communication channels and technologies for local and remote communications.

3.2 Local communications

Local networks are dispersed within a radius of less than a kilometer. For interconnection an ARCnet network on coaxial cable had been used (Fig. 2).

ARCnet isn't a very fast network. Coaxial isn't the most reliable. But we relied on their following perfect characteristics:

- Low cost
- Maximum covered distance is acceptable (1.2 kilometers for star topology)
- Token passing media access method that ensures real channel throughput available for each network station
- Star topology that facilitates troubleshooting

3.3 Long distance channels

At present we use analog leased line to St.Petersburg to communicate with our neighbour UUCP host. The quality of this channel leaves much to be desired. Using two absolutely identical V.32bis modems on both

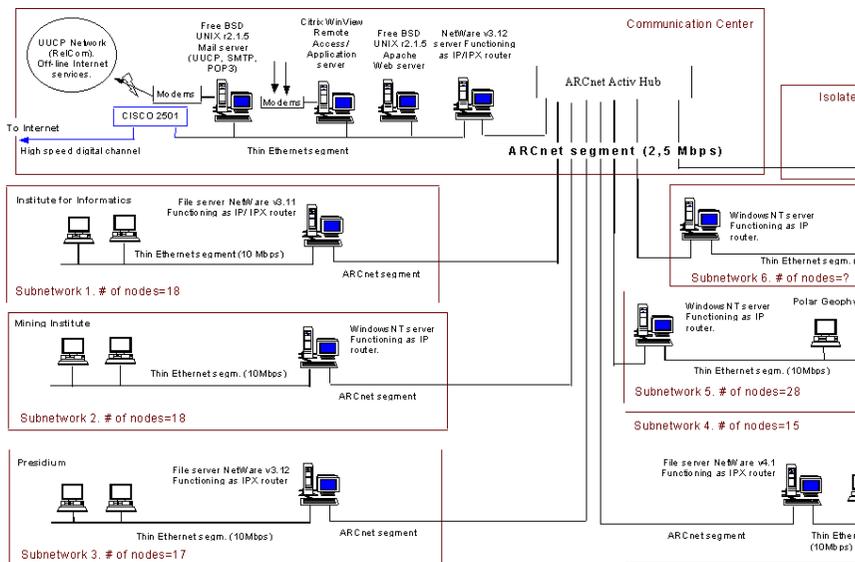


Figure 2. A detailed view of the network infrastructure of IS KSC.

ends of the line we've got only 9600 bit rate.

As can be seen, long-distance communication channel, we to use for Internet connections, has got a capacity of 64 Kbps. This is digital channel to Petrozavodsk and further to RUNnet (256K to St.Petersburg/Moscow).

We have to note that such decisions of communication channels problem give us really working system with very low cost. But the question of communication throughput is rising. Let us see communication infrastructure of IS KSC from this point of view.

Rough calculations show that for internetworks communications inside KSC there will be available 2500 Kbps–64 Kbps » 2.4 Mbps (It is assumed that Internet connected channel is used at its maximum throughput). Dividing this value to the number of ARCnet connected stations (six) we get 400 Kbps available for each subnetwork. These 400K will be used for internetwork communications inside IS KSC and for Internet connections. It isn't very much but as we think it is enough for the beginning. In addition, at the point of IS/Internet router (Cisco2501) we have ratio of 96 % local traffic to 4 % cross-over traffic. This indicates that long distance channel in this circumstances is bottleneck.

3.4 Information services

To answer needs of efficient information support of science researches IS must consist different information processing means, such as informa-

tion interchange, representing, searching and other. IS KSC aims to provide following main information services:

- Information interchange (E-Mail);
- Access to IS for remote users;
- Access to outside information sources;
- Granting access to local information sources for outside users.

Nowadays most used, most efficient and most quickly developed information technologies realizing such services are ones called Internet technologies. This fact and possibility of global range communications through global network Internet makes very attractive to use such technologies for building information system. Therefore, IS KSC nowadays represents some kind of Intranet-information system based on local area network and Internet information technologies. At the same time Novell networking technologies are still been used for file and print services and NetWare file servers are used as internetwork IP and IPX routers.

To minimize expenditures and to simplify management, expensive hardware and software facilities are installed on the communication center (Fig. 1, Fig. 2). This facilities are shared by all IS's clients. Shared servers installed in the communication center are used as providers of most popular Internet services such as WWW, FTP, SMTP mail. Follows the list of shared servers.

- The Apache Web server running on FBSD Unix machine. A FTP server is installed on the same machine.

- The Mail routing server running on another FreeBSD Unix machine. The Sendmail software is used to route mail messages. Server can route mail to the UUCP and SMTP ports. POP3 server is installed on this machine too.
- The Citrix WinView Remote Access/Application server is used generally for remote access to IS KSC through telephone lines.
- The Novell NetWare 3.12 server is used for routing network traffic. It is planned to use it as a platform for network applications too.

This structure of the IS covers today needs of users in information services. But information technologies are rapidly developed and user's necessities grows. This force us to consider further development of the system.

4 Prospects

Further development of the system assumes extending and improving both communications infrastructure and information services running on the system.

The first and major task of developing of the IS KSC's communication infrastructure is to make it's full value connection to Internet. It is problem of high speed long-distance channel to Internet provider. Due to weak development of communication infrastructure on the North-West of Russia this problem is not so simple. But we hope to get digital channel with capacity 128 Kbps in near fu-

ture. For the first time capacity of the long-distance channel - 64 Kbps, but further development of the system envisages establishing faster communication channels both for local and remote communications.

As mentioned above, developing of the local communications infrastructure assumes establishing faster communication channels connecting IS's subnetworks. In addition, perspectives of extending the Information system by connecting additional subnetworks is being envisaged.

In spite of merits of the present IS's communications infrastructure, it has several disadvantages. One and maybe worst of them is that it is platform dependent because software routers are used. So, with further growing of the system perhaps we will face up with necessity of comprehensive rebuilding of the local communications infrastructure.

In field of developing of information services major problem is to make information services efficient and at the same time easy accessible for local and remote users.

Accessibility of the services depends on information technologies used. Best results can be obtained if standardized technologies are used. The most popular modern information technology is WWW and information representation standard - is HTML. In addition this technology is very flexible due its perfect features such as refers and possibility of binding with other types of data formats.

5 Conclusion

The information system of KSC is an example of obtaining maximum practical results with minimum cost and minimum efforts. This system have both advantages and disadvantages, but looking to IS's structure and information technologies used we have to remember that funding of developing of the system was extremely limited.

Further development of the system depends much on solving of financial problem. But science and engineering potential accumulated in KSC in addition to some kind of enthusiasm of people involved into the system developing allows to hope that this system will live and be developed in any case.