

# History of the Internet in Slovakia

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**Abstract.** The origins of computer networks in Slovakia can be dated back to 1984 when the network EPOS (Experimental Network) started its operation, operated and programmed both in ÚAK (Institute of Applied Cybernetics) in Bratislava. Its operation was limited both technically (unavailability of foreign technology) but also politically (directively limited communication). But fortunately while creating this network the experts who became acquainted with the issue of networks grew. One of the workers ÚAK Gejza Buchler and his colleagues started already in October 1989 (one month before the Velvet Revolution) operate the first node providing services for electronic services (iac.cs). The node used communication protocol UUCP for communication through normal telephone lines. After the revolution in November 1989 this way of communication quickly spread in Slovakia, mainly in academia (universities and Slovak Academy of Sciences). In late 1990 emails were also sent out through the network IBM BITNET. In Slovakia was formed one BITNET network node in Banská Bystrica. In 1990 was also founded an association of users of academic networks SANET covering network activities and representing academic network abroad. The first international line was the line Bratislava - Vienna with a transmission rate of 14.4 kb/s. Even via this line it was possible to use TCP/IP and thus we began to use full Internet services. SANET network nodes originated in Bratislava, Banská Bystrica, Košice and Žilina and later were joined by other cities. After the split of Czechoslovakia in the course of 1993 resulted in not using TLD.cs and began to use TLD.sk. In the early stages of the Internet in Slovakia it was almost exclusively about academic field and later played (and still plays) Academic Network an important role in the development of the network. In 1997 in Bratislava was established the first international network node EBONE (European backbone) and international connectivity became considerably cheaper. Significant milestone was the year 2002 when almost the entire backbone network was built on optical fibers and operation of the network was built at new (now global) level, with the speed of the backbone 1 Gb/s, while technically the backbone was built on LAN products.

**Keywords:** Internet, Slovakia, SANET, TCP/IP, unirradiated optics, Ethernet, LAN.

## **1 Introduction**

The Internet is a nowadays phenomenon. Today without the Internet we can not imagine life. On the Internet we can find answers hopefully on all of our questions . But it was not so long ago when we did not have anything like that available. From time to time it is useful to look back and recall how we built the Internet in Slovakia. I am one of those lucky ones who were there. In this article we will discuss true history of networking in Slovakia. In developing the Internet in Slovakia we can find several important milestones which we will discuss in detail.

## **2 The beginnings of networking in Slovakia**

### **2.1 Experimental computer network EPOS**

In 1976 the Institute of Applied Cybernetics started to solve the state project "Computer network". The network was built by employees from scratch. Except software equipment it was necessary to make hardware modifications to transfer information from one computer to another. The network was put into trial operation in 1986. It was built on computers SMEP (copies of PDP-11 computers). Core of the network consisted of three kinds of computers built on the SMEP basis:

1. node computer is used to interconnect other computers,
2. terminal server had the opportunity to connect up to 32 terminals, both directly or through a modem and a remote terminal,
3. The front end processor used to connect large computers based on IBM computers (called the EC).

The network had three nodes in Bratislava and one node in Prague UVTEI (Headquarters of scientific, technical and economic information) UTZ (Central Technology Base). Users of the network used the network very one-sided, basically just for doing mostly library search in UVTEI UTZ. The network had technical as well as operational limits. The connections between computers was limited up to 38 kbit/s even if the computers stood side by side. It was caused by the speed of communication interfaces used.

Modems to connect to the terminal server worked with speed of maximum up to 1200 bit/s. Terminals and modems were almost impossible to buy and connecting the modem to the telephone line was a major administrative problem. But substantial restrictions were social restrictions. The regime had no interest to make communication between people easier and therefore for the operation of the network were established two very important limitations:

1. The network was not allowed to enable communication between two network users, only communication between man – machine was allowed,
2. Network in any case could not be linked to abroad.

We can not even imagine these limitations today because without connection we could not get any information (for example Google, Facebook, Youtube).

Despite these limitations and lack of applications which would attract more users had this task big importance. While working on the creation of networks grew a lot of workers who have gained view and experience. I dare to say that at that time were people from the Institute of Applied Cybernetics more experienced like any expert in the west because our staff had to make, think up and manufacture everything they needed with their own hands and minds. These workers later used their experience. I will not name everyone, but for the development of networking in Slovakia made very much Gejza Büchler, Peter Prónay and Vladimír Kašša.

## 2.2 Beginning of using E-mails

Paradoxically, the first beginning of using e-mail communication even abroad goes back before November 1989. It started of course at the Institute of Applied Cybernetics and it started Peter Prónay with Gejza Buchler and other colleagues. They used contacts abroad. The first protocol for sending e-mails was UUCP (Unix to Unix Copy) protocol. All communication consisted in the fact that each node collected the mail and had defined the node to which it sent the mail, which it could not deliver itself. This mail was sent out by using a normal telephone line first to Vienna, then to Amsterdam.

The first addressing e-mails looked like this:

ucbvax!philabs!mcvax!inria!devill This was an e-mail address of Yves Devillers from Inria in France. Only later was introduced addressing as we know it today. Not surprisingly, the first address of the registered domain .cs was iac.cs (Institute of Applied Cybernetics). Domain .cs for Czechoslovakia was administrated by Peet Beertema working at CWI in Amsterdam on a computer mcsun.

Since the first e-mails were sent under totality all emails were archived. After November 1989 node iac.cs became an important point for e-mail communication for the rest of Czechoslovakia because all computers were sending their e-mails through phone lines just through this node. In Prague at the University of Chemical Technology was developed similar node that collected e-mails from the Czech Republic and then sent to iac.cs. Administrator of the node was Jirko Orság. During 1990 there was a change of the node for e-mail because all important workers of Institute of Applied Cybernetics left the institute and established their own company SWH. The node of electronic mail was moved to the Faculty of Mathematics and Physics of Comenius University (MFF UK) and became a part of the European network EUNET. SWH sponsored the network node by hardware and by personnel.

Since all communications run over telephone lines it was necessary to share the costs of international phone calls. At the beginning very slow modems (1200 bit/s)

were used for communication so operation of e-mails was very expensive while one kilobyte of a sent mail abroad but also of a received mail from abroad cost at the time seven crowns (approximately 0,20 Eur). Imagine, that at that time pictures were transmitted. Sending or receiving one quality picture would cost 35,000 crowns (about 1000 Eur). Therefore the first e-mails were very brief and everyone tried to write as little as necessary.

### **3 Building networks after Novemebr 1989**

After November 1989 not only e-mail communication was developed but also support of networking started in Czechoslovakia from abroad. For exaple IBM developed own activities which at that time was building its network BITNET built on a mutual communication between IBM mainframes. Through the network BITNET it was possible to send e-mails and transfer files. IBM sponsored one node computer placed in the Czech Technical University (CTU) in Prague, sponsored link between Prague and Linz and also sponsored the terminal workplaces together with the connection in Brno and Bratislava (Slovak technical university, Electrotechnical Faculty- FEI STU). Between the network EUNET and Bitnet in Czechoslovakia was no connection so the paradoxical situation happened when workers of Institute of Chemical Technology in Prague were sending mail to CVUT essentially to the next building and the data went through Amsterdam.

Another activity started the Vienna University of Technology (TU Vienna) which decided to sponsor the line between Vienna and Bratislava. It is quite interesting that the first negotiations about the line failed on the fact that people in Bratislava could not find an agreement where to end the line. Employees of TU WIEN did not know at the beginnig with whom to negotiate in Slovakia. At UAK worked EPOS network at MFF UK was a node of EUNET network and at FEI STU there was Bitnet network node. Fortunately in January 1991 on the gorund of the Computing center of the Slovak Academy of Sciences began discussions about the next steps in building networks in Slovakia. These negotiations resulted in establishment of Asociation of academic network SANET users (Slovak Academic Network).

#### **3.1 Establishment of SANET association and beginnings od SANET network**

The Constituent General Assembly of the Association of SANET academic users was held on April 10, 1991. It was attended by 17 representatives of the founding organizations. As a chairman of the Board SANET was elected Pavel Horváth working in Computing centre of the Slovak Technical University. By the way he is a Chairman of SANET until now. A very good thing happened. All interested parties agreed on a common project. SANET representatives actively participated in the project of the Federal Academic Network (FESNET).

SANET from the establishment tried to create a backbone network in Slovakia because initially there was a line from Bratislava to Vienna, from Banská Bystrica to Prague and also from Košice to Prague. After long negotiations with Slovak Telecom was sucessfully established a backbone network Bratislava - Banská Bystrica - Košice.

On the backbone network did over the years 1991-1992 connect other towns: Žilina, Nitra Zvolen, Presov, Martin. Speed lines today seem very slow 14.4 kbit/s to 19.2 kbit/s. It should be also noted that at that time it was not easy to obtain sufficiently powerful routers. To get Cisco routers with 64 kbit/s interface was necessary to obtain permission from the COCOM (Coordinating Committee for Multilateral Export Controls). To get a permission sometimes lasted more than a year.



SANET ( November 1992 )

International connectivity was provided by line to Vienna. It was agreed that the fixed lines offered from TU WIEN will end at FEI STU and its capacity (14.4 kb/s) will be divided into two parts. One part used protocol X.25 and was used for connecting the network ACONET (Austrian academic network based on X.25 protocol) and network UAK (successor of network EPOS). The second was used to link the Austrian and Slovak EUNET network node via TCP/IP protocol. The line was set up in October 1991.

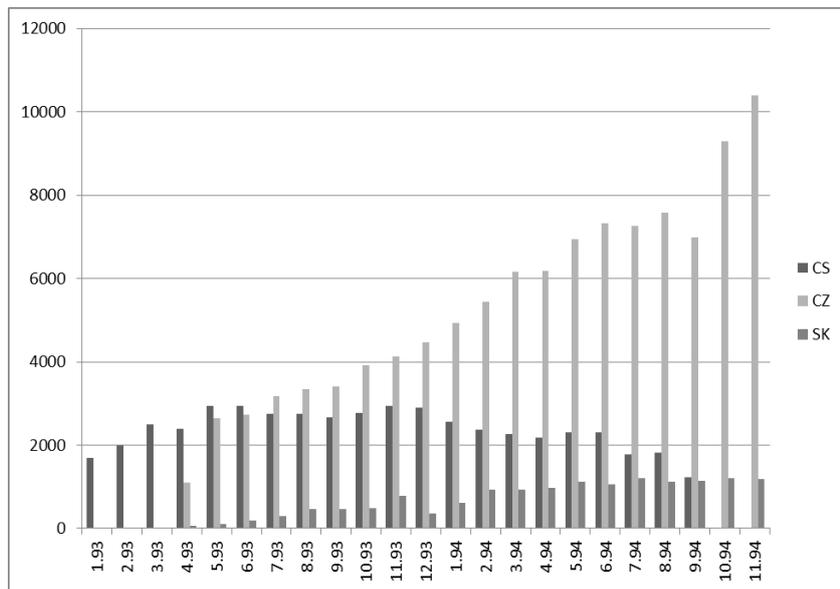
After six months of international line usage the dividing of line was evaluated and the entire line was used for TCP/IP protocol although at that time was by the European countries preferred X.25 protocol. It was also due to the fact that on the Austrian side the line was transferred to Vienna University (UNI Wien) which preferred TCP/IP protocol.

SANET association immediately after the foundation was deeply involved into the activities of international academic organizations. In 1992 SANET organized the General Assembly of the organization RARE (Réseaux Associés pour la Recherche Européenne) and became an associate member of this important academic organization. In 1993 at the meeting in Luxembourg became SANET a full member. In late 1992 SANET actively participated in the foundation of the organization CEENET (Central and Eastern European Network). This new organization started to

promote the connection using TCP/IP protocols. This activity did not meet with general agreement of DFN (Deutsche Forschung Netz) leaders who accused CEENET that inclined from the standards held in Europe specifically from X.25 protocol. Finally the decision was good because after a few years all academic networks converted to TCP/IP protocol.

#### 4 Dividing Czechoslovakia and a change of TLD

In 1993 when Czechoslovakia was separated we used in the Internet domain .cs. The new domains for the Czech Republic and Slovakia were decided in April 1993. The Czech Republic got the domain .cz and Slovakia .sk. The Czechs tried to keep .cs domain but since the domain .cz was allocated they also had to change the domain. The change was not easy while it was necessary to provide DNS server on the central level for the new domain and also for each connected organization was needed to ensure that e-mails run on the new and the old domain. The whole process lasted roughly until the end of 1994. The attached table shows how the number of computers connected to the Internet developed from .cs, .cz and .sk domains.



After the split of Czechoslovakia the development in building networks in the Czech Republic was diametrically different from Slovakia. The Czech Republic has managed to convince the Ministry of Education to support projects to build networks but Slovakia was not so successful. There were even recorded attempts to abolish Sanet network. Fortunately it never happen.

## **5 Development of SANET network and first applications**

SANET network was developed very slowly because it was necessary to fight hard for the support of the Ministry of Education. Even technological conditions were not good. For example to upgrade of lines between Banská Bystrica and Košice took nine months and were upgraded in 1995. The international lines were upgraded to 128 kbit/s thanks to IBM. It should be noted that at that time still existed monopoly of Slovak Telecom in providing fixed-lines. Despite these facts the network launched the first applications that were of interest to other countries. While in 1992 the proportion of traffic from abroad and to abroad was 4:1 in 1996 it was already the ratio of 1.3:1. The first application after electronic mail was the application GOPHER where it was possible to expose a variety of information on the internet but only in a text form. In 1993 already begun using the World Wide Web facility as we know it today. The first web page of the .sk domain was www.uakom.sk from Banska Bystrica. In Slovakia as one of the first countries in 1994 were accessible newspaper articles on the Web (without pictures). Pages with newspapers were very helpful for the Slovaks abroad to see the news from home. Even our embassy thanked us a lot because the printed newspapers were received by air only once a week. But because of the slow lines at that time downloading one edition of the newspaper took several hours.

From 1994 other private companies began to provide Internet services too. Initially each of the networks has its infrastructure and its international connectivity. Therefore it happened that the communication between two entities connected through various providers traveled halfway around the world. It was important where the provider ended its international line. This problem was solved in 1996 by creating the Slovak peering center on the ground of CVT STU.(Computer centre of Slovak Technical University) Despite initial distrust the peering center is a very useful workplace till today.

A very important milestone in the development of the Internet in Slovakia was the location of the network EBONE (European backbone) node in Bratislava. This eliminated the need to pay international lines while it was enough to set up the line into a Ebone node. Coincidentally or on purpose the node EBONE was set up in CVT STU. Development of networks in Slovakia got to another level.

## **6 Optical backbone**

The SANET II project was launched in the years 2001 and was solved till 2013 . An important technological change was the implementation of the network on leased dark fibers. At that time use of this technology was unique in Europe and representatives of several academic networks dissuaded us from the idea. But finally the decision showed that in Slovakia it is possible to build on dark fibers a nationwide LAN network which is fully functional and in the network development in Slovakia it represents a significant leap. With this solution SANET network became one of the most advanced academic networks in Europe.



**Map of Sanet network in 2002**

Comparing the map of SANET network from 1992 and from 2002 we can see that in ten years the capacity of the backbone network increased almost 70,000 times. I think this is mainly due to people who were not afraid to step out on new unknown paths.

The greatest credit for enforcing dark fibers have in my opinion Julius Binder and Marian Ďurkovič.

## 7 Conclusion

Finally I would like to mention a few thoughts.

First of all it is a good feeling that one is lucky enough to be involved in building of such an important issue as the Internet is. While there are not the most important used technologies, routers or optical fibers. The most important are people with whom we cooperate. I do not know any other project in Slovakia where occurs such cooperation among all universities and institutes of the Academy of Sciences. Not to mention it is selfless and enthusiastic cooperation. Without dedicated people would such a project never been accomplished.

Internet beginnings were difficult. It was not clear what to do and which protocol to use. We often did not know how things work and it took long to set up things the way it should be. But even so the beginnings of the Internet were beautiful. Indeed in the early Internet times they were just good people connected always willing to help. There was no spam or junk mail. Unfortunately that time will never come back.