



SANET NETWORK NODE AT CVT STU

2007

15_{Years} of SANET Association

Ing. ŠTEFAN KOHÚT: FIFTEEN YEARS OF SANET ASSOCIATION
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1991 – 2006



Introduction

The data network development in Slovakia became evident in 1991, when the Association of the users of Slovak Academic Data Network (SANET) has been established by Slovak universities, the Slovak Academy of Sciences and research organisations, with the aim to build up a data network infrastructure performing network services for academic institutions, including interconnection with data networks abroad. At the beginning, the SANET data network used to provide basic network services only, such as FTP, TELNET, SMTP, but primarily electronic mail services for the growing number of users. As for information services, the GOPHER service development has started, as well as X.500 directory service, and later first experiments with www server as well. Currently, approximately 320 organisations and institutions are connected to SANET, including all Slovak universities, state driven organisations, selected primary and secondary schools, institutes of the Slovak Academy of Science, research institutes, cultural institutions such as libraries and museums, medical institutions, hospitals, clinics, as well as ministries and their organisations. Nowadays the SANET data network performs all network services common in other academic data networks.

Infrastructure of the network underwent significant development as well. Initially, it consisted of few nodes in Bratislava, Košice, Banská Bystrica, Žilina and Nitra; gradually it has developed to current 26 nodes in all academic centres in Slovakia. It was rather exceptional in Europe when SANET came with a new technology of building private networks using dark fibres and developing own control and purpose-oriented network topology. Between 2001 and 2003, realisation of the SANET II project

resulted in the creation of homogeneous optical infrastructure with switched Ethernet technology, at 10 Gb/s transmission speed.

Connection of SANET network to international networks has been developing in a similar manner: the initial speed was 19,2 Kb/s, and currently it is 10 Gb/s. SANET has initiated an optical interconnection between academic networks in Czechia, Austria and Poland, and currently has its own optical interconnection there, with 10 Gb/s transmission speed.

In the academic community there has been incredible development of use of the Internet and remote information resources all over the world: new web portals based on dynamic principle are occurring, as well as videoconferences without limitation, and VoIP; first virtual teams are being formed, and grid computation systems are used.

Slovak Academic Data Network has contributed significantly to the development of data networks in Slovakia. It is true to say that SANET has been the basis of the data network development in Slovakia, both in relation to application of new network technologies, and to human resources – SANET has been the generator of new network administrators and current users. Numerous managers of private organisations providing Internet services in Slovakia had started their career in SANET environment. SANET is further maintaining its significant position – it became a member of GEANT international consortium, as well as of the GN2 project which is currently under preparation; within the EU research plan, GEANT realises development and operation of multigigabit network infrastructure for science, research and education in Europe.

In this occasion, I would like to thank all former and current members of the SANET bodies, network node administrators, university managements, SAS organisations and ŠVS (School Computer Centre) directors for their effort which was far beyond their compulsory service; they have advanced significantly the use of the Internet and of modern information and communication technologies in Slovakia. Last but not least, my thanks go to all managements of the Ministry of Education who have understood the need and usefulness of building academic data network in Slovakia, and have been supporting our activities.

Prof. Ing. Pavol Horváth, PhD.
Chairman of SANET Directorate

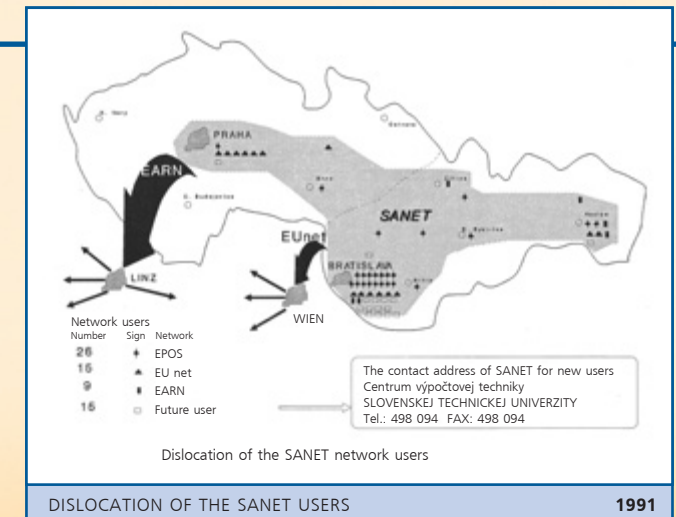
Network activities before SANET was established

In the second half of the 1970's, first efforts to interconnection of computers for their automatic cooperation without human intervention occurred at research and university workplaces; import of multiprogrammable PDP-11 minicomputers enabled first experimental transmissions among computers in 1976.

On 3 July 1979, first remote transmission was realised at ÚTK SAV (Institute of Technical Cybernetics, Slovak Academy of Sciences), on the route Bratislava – Banská Bystrica, between PDP11/40 and PDP11/10 computers, under RT11 operation system and with REMOTE communication system. However, development of networks with service character had not been the ambition of ÚTK SAV. In 1976, the task covering interconnection of SIEMENS 4005 and EC 1021 computers had started at the Department of Computer Science of the Faculty of Electrical Engineering of the Slovak University of Technology. In 1980, data had been transmitted to TESLA 200/270 computer by help of ZPD1200 punched paper tape reader at the Institute of Forest Ecology in Zvolen. At Institute of Medical Bionics in Bratislava, research task “Computer network in a health care institution” had been solved in 1980, using PDP-11 and SMEP computers with RSX-11M (DOS RV) and MUMPS (DIAMS) operation systems. In 1990, interconnection of the University of Technology and P. J. Šafárik University had been prepared in cooperation with IBM in Košice, as the germ of CANET metropolitan network.

In 1976, government-controlled research task “Computer network” had started at the Institute of Applied Cybernetics (Ústav aplikovanej kybernetiky – ÚAK). As soon as in 1986, successful accomplishment of the task resulted in realisation of the first professionally operated data network in the ČSFR, using SMEP and JSEP computers, with three nodes in Bratislava and one in Prague. At ÚAK, e-mail service using switched line with uucp protocol had been verified experimentally for local purposes in 1983. The network nodes could be connected to international networks after 1989.

In 1989, the European computer network EUnet has started its use in



Slovakia as EUnet-CS, with the main node at ÚAK in Bratislava, which started its operation in October 1989. In March 1990, the CSUUG (Czechoslovak UNIX Users Group) with the head office in Prague has started its operation, and in June 1990 EUnet started its operation in Czechia as well, connected to the main node at ÚAK in Bratislava; this node was used as the backbone – interconnection with the world. The node operated during working hours and on work days only. The connections were realised by switched lines at 1200b/s. Connection with the world was provided by the node at Technische Universität Wien with e-mail service only, and with 500 KB of transmitted data in a month. In 1990, the main Czechoslovak network node was moved to Faculty of Mathematics and Physics of Comenius University in Mlynská dolina (Bratislava). The faculty had provided technical facilities and rooms at own cost. Everyday operation of the equipment, know-how, software and further development was provided by SWH s.r.o. Bratislava at their own cost.

EUnet has brought network services such as e-mail, Network News, and InterEUnet (connection to the Internet by TCP/IP protocol) to Slovakia.

In the above described environment, SANET was established as non-governmental association integrating all individual efforts of various organisations into one goal – development of a computer network for science, research and education.

Establishment of the civic association SANET

The ÚAK and EUnet networks have become the basis of the new SANET network. The organisations which have developed these networks, along with the users of their services, were the founding members of the SANET association. On 23 January 1991 twenty computer network experts met at the Computer Centre of the Slovak Academy of Sciences to determine the possibilities and terms of further development of data networks under new political conditions. On 10 April 1991 the establishing General Assembly of the Association of the users of Slovak Academic data Network (SANET) took place, attended by 17 representatives of the establishing organisations, and by 18 representatives of the organisations interested in this activity. The goal was in creating an organisation covering the activities related to data networks in Slovakia. Such organisation would provide for operation of nodes in international networks such as EARN or EUNET, and/or of other networks, and would be the responsible partner for similar organisations abroad, as well as the partner for negotiations with organisations and/or governmental authorities involved in Slovakia.

The founding organisations:

- CVT STU Bratislava (Computer Centre of Slovak University of Technology),
- ÚAK Bratislava (Institute of Applied Cybernetics), SWH Bratislava,
- VS SAV Bratislava (Computer Centre, Slovak Academy of Sciences),
- ÚTK SAV Banská Bystrica (Institute of Technical Cybernetics, Slovak Academy of Sciences),
- PF UK Bratislava (Faculty of Natural Sciences, Comenius University),
- MFF UK Bratislava (Faculty of Mathematics and Physics, Comenius University),
- VŠDS Žilina (University of Transport and Communications),
- X-systém,
- SAV (Slovak Academy of Sciences),
- ÚTK SAV Bratislava (Institute of Technical Cybernetics, Slovak Academy of Sciences),

- ÚVT VŠE Bratislava (Computer Science Institute, University of Economy),
- LF UK Bratislava (Faculty of Medicine, Comenius University),
- TU Košice (University of Technology),
- ÚIP UK Bratislava (Institute of Informatics and Prognostics, Comenius University),
- VŠP Nitra (University of Agriculture),
- EF STU Bratislava (Faculty of Electrical Engineering).

During the General Assembly the Charter of the Association has been approved, and the members of the SANET Board were elected. During its first session, the Board has elected the following officials:

| | | |
|--------------------------------|------------------------|---------------|
| Doc. Ing. Pavol Horváth, CSc. | CVT STU Bratislava | Chairman |
| Doc. RNDr. Peter Mederly, CSc. | MFF UK Bratislava | Vice-Chairman |
| RNDr. Marta Kundríková | ÚVT VŠT and SAV Košice | Treasurer |
| Ing. Ján Zelem, CSc. | ÚVT VŠDS Žilina | Minutes clerk |
| RNDr. Jaroslav Bobovský | VS SAV Bratislava | member |
| Ing. Vladimír Kašša, CSc. | ÚAK Bratislava | member |
| Ing. Peter Prónay | SWH Bratislava | member |

The General Assembly has charged the Board to provide for registration of the Association as an independent legal person pursuant to Act No. 83 Coll. on association of citizens.

On 13. 5. 1991, the Preparatory Committee (Doc. Ing. P. Horváth, CSc., Doc. RNDr. P. Mederly, CSc., and Ing. Vladimír Kašša, CSc.) applied for registration of the Association of users of the Slovak academic data network (SANET) at the Ministry of Interior of the Slovak Republic.

The Association was registered on 17. 5. 1991. This date is understood as the official start of SANET's activities.

SANET became an independent legal person with head office in Bratislava; its activities cover the whole region of Slovakia in the academic field (universities, research and development institutes and other institutions and organisations). As stipulated in the SANET Charter, the main aim of the association is "to develop and support scientific, technical and organisation background for establishing, operation and use of computer-orien-

ted and supported information and communication system for scientific, research and university spheres in the Slovak Republic, making use of public communication media, and considering corresponding international standards and rules.”

The following (second) General Assembly was held on 25. 6. 1991. During this session, the Revision Board was elected, consisting of the following members:

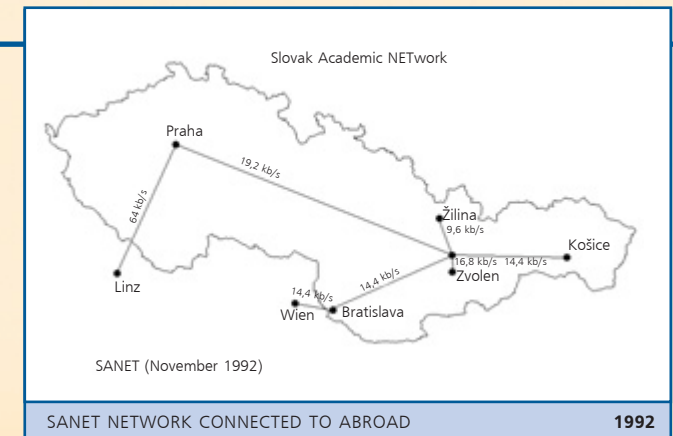
| | |
|-------------------------|-------------------------|
| Ing. Karol Fabián, CSc. | ÚTK SAV Banská Bystrica |
| Ing. Ján Masár | EF STU Bratislava. |

The sessions had also been attended by RNDr. Ľuboš Elias from ÚTK SAV Banská Bystrica.

As of the above date, the Association includes 17 registered members, and 12 new members submitted their applications during the session.

First steps in developing the SANET network (1991 – 1992)

In April 1991 the members of the Board of the SANET Association developed the material for the negotiation of the Board of the Government of the Slovak Republic titled “Project of the Slovak Academic Data Computer Network – SANET”. Within the project, the manner of building the network in Slovakia during 1991 and 1992 was proposed. According to the project, interconnection of Bratislava, Banská Bystrica, Zvolen, Žilina, Martin, Liptovský Mikuláš, Košice, Prešov, Nitra and Trnava was planned using the public data network EUROTEL with X.25 protocol. In 1991, the Federal Ministry of Communications granted exclusive licence “for telecommunication services of data transfer” to EUROTEL. The above project assumed that technological solution of the network, as well as telecommunication equipment will be provided by SANET.



On the basis of the above material and of other development projects, on 31. 3. 1992 Resolution No. 228 of the Government of the Slovak Republic was passed, related to “support for selected projects in the field of education and informatics”, where the SANET network was quoted explicitly. On the basis of this resolution, the Minister of Education of the Slovak Republic was supposed to provide for realisation of the Project of the Slovak Academic Data Computer Network – SANET. By this resolution of the Government of the Slovak Republic, SANET has been appointed to be the organisation providing for data communications in the academic field.

During SANET General Assembly on 25. 6. 1991, Ing. Vladimír Kašša, CSc. presented the proposal related to open integration of the ÚAK network into the SANET network. He also informed about the possibilities of connecting additional organisations to ÚAK network, and about the project of ÚAK, DEC and Technische Universität Wien (under preparation then), to connect the ÚAK network to Austrian network ACONET via TU Vienna, and thus to obtain connection to the Internet. The connection was paid by TU Vienna, and the communication equipment was provided by DEC. The first year of operation was free of charge for the users. The connection was put into operation in October 1991; the telecommunication connectivity had two channels – one for the ÚAK network, using the X.25 protocol, with 9,6 Kb/s speed, to ACONET network, and the second channel with 4,8 Kb/s speed for EUnet. Electronic mail service was realised via this channel with TCP/IP protocol, and from April 1992 full connection to the Internet (9.6 Kb/s) was realised via central EUnet node in Amsterdam. In September

1992, the telecommunication connectivity was transferred from ÚAK and MFF UK to future SANET backbone node in VS EF STU (Computer Centre of the Faculty of Electrical Engineering, STU). The protocol change resulted in one channel only for X.25 and TCP/IP, with 14,4 Kb/s speed. The same interconnection was established between EF STU and ČVUT (Czech Technical University) in Prague. Later this year, leased line was established from Banská Bystrica (ÚTK SAV) to Prague, and from there to the EARN network. At that time, connection using IP protocol to EARN network in the node at VŠCHT (Institute of Chemical Technology) in Prague had been established already on the Prague-Linz route.

First Slovak domain – uakom.cs – was activated on DNS server sun.uakom.cs. Simultaneously, routing abroad was realised from Banská Bystrica via Prague, using CISCO MGS and IGS devices obtained from the PHARE project. This interconnection provided backup connection with the world for the common network of the Czech and Slovak republics.

In 1991, optical route among VS SAV and SAS institutes was developed, with 23 multimode optical cables. In 1992, new EUnet nodes were established at VŠDS Žilina, TU Košice and VÚMI (Research Institute of Medical Informatics), Bratislava.

Development of SANET network in independent Slovakia (1993 – 1996)

In 1993, independent Slovak Republic has been established, and the common network was split into two national networks – CESNET and SANET. There was no problem in continuing the network development because SANET had had two years' experience in operating the network as independent legal person. Network monitoring, transmission measurement, financing of international connectivity and of network operation have been introduced. At that time, the number of SANET members increased to 93, and there was enormous interest in connection to the new



academic network. Within SANET service tariff draft three groups of network users were determined, namely:

- a. Organisations within the field of education and science
- b. Non-profit organisations outside the field of education and science
- c. Commercial organisations.

SANET network was performing the following network services: Remote terminal, E-mail, Dial-up IP (switched line), Full IP (leased line).

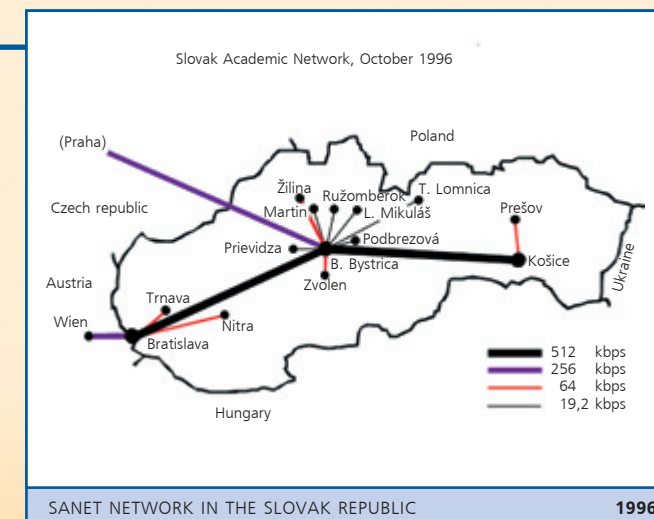
During the General Assembly on 8. 9. 1993, modified Charter of the Association had been approved. The term of office of the SANET Board was extended from 2 to 4 years, with “repeated election for a Board member” allowed. The number of the Board members has changed from fixed number of 7 to variable number between 7 and 9 members. Definition of the Association was changed as well, namely: “The Association is a public benefit non-profit organisation, performing its activities according to relevant applicable laws of the Slovak Republic.” The Ministry of Education and Science of the Slovak Republic granted a financial support to the Association amounting to 7,95 mill. Sk; the Association, in turn, was obliged to request reimbursement of the costs of the network services from organisations outside the field of education and science.

The Association was successful in gaining other funding resources as well; as early as in 1993, it joined international projects funded by the EC, such

as TELESERV and WWW within the COPERNICUS project. In this period, the Austrian government continued to pay the costs for the Austrian part of Bratislava-Vienna interconnection (64 Kb/s transmission speed). Negotiations on increasing throughput of international SANET network lines were held with IBM and with Slovak Telecommunications. In 1994, the grant from the Ministry of Education and Science of the Slovak Republic increased to 8,2 mill. Sk; the sum included financial support for investments amounting to 1.5 mill. Sk, which was used to purchase the network equipment for CISCO 7000 router to CVT STU node in Bratislava, and 5 modems for new nodes in Martin and Prievidza. To extend its services, SANET has purchased the licence for ASPI (the legal information system).

In 1994, the number of SANET members increased to 234, thereof 69 organisations within the field of education and science (so-called regular members), and 165 organisations from other fields and from commerce (associate members). Regular SANET members had the right to decide upon distribution of grants from the Ministry of Education and Science of the Slovak Republic. In 1995, SANET's expenses amounted to 15.7 mill. Sk, and the support from the Ministry of Education and Science amounted to 9.2 mill. Sk. From October 1995, the transmission speed of the Bratislava-Vienna line was increased to 128 Kb/s. The Austrian government continues in paying the costs of this interconnection (65 thousand Sk in a month). SANET negotiates about connection to EUROPANET with transit via Prague, and to CESNET within COSINE II project. The General Assembly recommended to the SANET Board to invite Ing. Miroslav Bórik from Martin to its sessions as "a representative of non-school organisations" – members of the SANET Association.

1996 is the year when the network interconnection point – the "peering" centre SIX (The Slovak Internet eXchange Center) – was established in Slovakia. SANET has concluded peering agreements with three network operators in Slovakia – PUBNET, NETLAB and EUNET. Interconnection of networks in a common point in Slovakia resulted in considerably lower load of international lines. SANET backbone transmission speed increased to 512 Kb/s, and that of the connecting networks increased to 64 Kb/s. The speed of international interconnections Bratislava – Vienna and Banská Bystrica – Prague increased to 256 Kb/s. The SANET – CESNET interconnection has been realised already, on the basis of agreement on transit to EUROPANET. Due to the necessity to provide for adequate services to the payments according to SANET service tariff system, international lines were



divided into two queues – one for the organisations within the field of education and science, and the other for the remaining organisations, including the commercial ones.

On the basis of the requirements related to improvement of the network performance, CISCO 7505 switch and router was installed in the node at ÚVT TU Košice (Institute of Computer Science, Technical University Košice). 20 modems and 10 CISCO 2501 routers were purchased for new nodes at ŠVS. Within the COPERNICUS – INSIGHTE project, an information server was purchased. A new project – COPERNICUS-ESATT – occurred, covering the establishment of regional information centre in Slovakia. In 1996, SANET has gained 9.4 mill. Sk from the above international grants. In this year, the Ministry of Education and Science granted 13 mill. Sk to SANET. The costs of the network operation amounted to 33.7 mill. Sk in this period.

New topology of SANET network (1997 – 2001)

In 1997 new nodes were established in School Computer Centres in Piešťany, Liptovský Mikuláš, Michalovce, Banská Bystrica and Bratislava, within development of information system for the field of education. New nodes were also established at the universities in Ružomberok (FRI ŽU – Faculty of Control and Informatics, Žilina University) and Trenčín (TU – Trenčín University); thus, their number increased to 19.

Cooperating with Slovak Telecommunications and Eurotel, a node of European network EBONE was established at CVT STU in Bratislava; this resulted in considerable improvement of international connectivity of the network. Slovak Telecommunications provided two telecommunication circuits (2 Mb/s each) to Munich. In Bratislava, the international network EBONE is administered by SANET. The node has reduced the costs of international connection to the Internet considerably.

The network requirements have nearly exceeded its capacity. At the Board sessions the possibilities of access limitations for certain network information resources with extreme line load are being discussed; primarily, student hostels are concerned in this relation. The Board suggested that SANET should request financial support from relevant ministries in case of connecting new organisations from fields other than education and science. At that time, this suggestion was accepted by the Ministry of Defense of the Slovak Republic and by Slovak Academy of Sciences only.

Transmission speeds have increased to 128 Kb/s (Bratislava – Nitra) and 64 Kb/s (Banská Bystrica – Prievidza).

In 1977, Regional information centre (RICE) was established at ÚVT TU Zvolen within the COPERNICUS-ESATT project. This grant was used to purchase the server for SANET web page as well.

At the General Assembly held on 14. 10. 1998 new Charter of the SANET

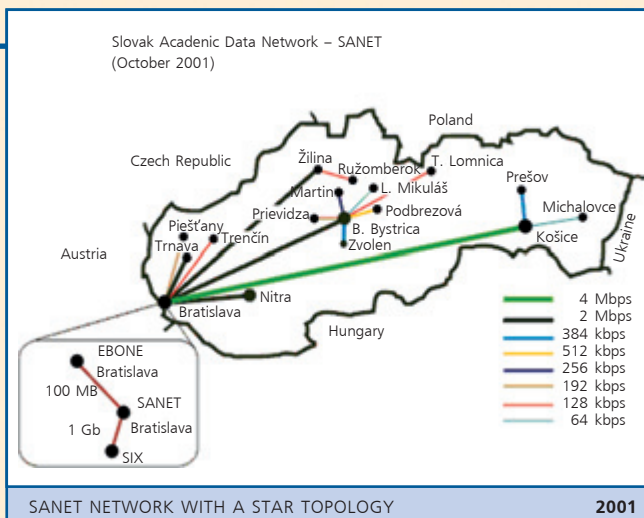


SANET RADIOCOMMUNICATION ANTENNAS ON STU BUILDING ROOF

2000

Association have been approved, whereby the structure of the managing authorities was changed. The Association Board was replaced by Association Directorate, and the membership thereof was increased to 9-11; the Treasurer function was revoked, the Board of Node Administrators was established to handle technical issues related to network development and management, and Arbitration Panel to handle questionable issues within the Association. New “Charter of the SANET Association” was registered at the Ministry of Interior of the Slovak Republic on 30. 11. 1998. In 1998, SANET Association expenses amounted to 27,9 mill. Sk.

During 1999 the Association Directorate has developed the “SANET II Project”, approved by the Government Board for Informatics on 22. 10. 1999. The problem of insufficient network transmission capacity and the need to limit access to the Internet (primarily from student hostels) persist. Transmission speeds have increased to 256 Kb/s (Banská Bystrica-Zvolen and Košice-Prešov), 128 Kb/s (Banská Bystrica-Prievidza, Martin, Tatranská Lomnica), and 1 Mb/s (Bratislava-Košice). Nitra, Trnava and Žilina are connected to the CVT STU node with 2 Mb/s transmission speed.



SANET has cooperated in the connection of the first 25 secondary schools within the INFOVEK project. SANET has applied to join the QUANTUM project with the goal to incorporate the network into the TEN-155 network and GEANT (Gigabit European Advanced Network Technology) projects underway then within 5FP. Participation in the above projects would allow to increase international connectivity of SANET network to 10-34 Mb/s. In 1999, SANET Association expenses amounted to 30,4 mill. Sk.

In 2000, transmission speeds are increased again – namely to 256 Kb/s (Banská Bystrica-Tatranská Lomnica), 128 Kb/s (ŠVS Michalovce-Košice) and 4 Mb/s (Bratislava- Košice). International connectivity to EBONE increased to 40 Mb/s.

On the basis of SANET's application to join the GEANT project, on 26. 9. 2000 SANET-GEANT and SANET-EC contracts on accession of the Slovak Republic to this project have been signed. The contract implies the obligation to extend internal infrastructure of the SANET network considerably, and to pay 60 % of international connectivity to European gigabit GEANT. The European Union will grant 40 % of the costs.

The Board of Node Administrators approved recommendations related to limited access to certain information resources and to the manner of

connection for student hostels. In 2000, SANET Association expenses amounted to 36,8 mill. Sk. SANET has 371 members, 171 thereof from the field of education (including primary and secondary schools).

The SANET II Project (2001 – 2003)

The basic goal of the SANET II Project, approved in 1999, was developing a cheap but powerful network based on Ethernet protocol, with 1 Gb/s speed, to connect Bratislava, Trnava, Piešťany, Trenčín, Žilina, Martin, Banská Bystrica, Ružomberok, Liptovský Mikuláš, Prešov, Košice, Michalovce, Prievidza, Tatranská Lomnica, Zvolen and Nitra, possibly also other towns with academic and/or university institutions. It was supposed to develop the network with either own or leased fibre optics, without any external telecommunication service, i.e. specific transmission speed, provided by a telecommunication operator.

On 2 May 2001, the Government of the Slovak Republic has passed Resolution No. 383 related to draft measures to improve the status of information technologies utilisation at universities; the B3 task thereof charges the Minister of Education as follows:

“to develop high speed communication infrastructure SANET with connection to European communication network, and to provide for connection of university centres to the infrastructure”

This resolution was the approval of the SANET II Project, and realisation of the project could start. On 28. 6. 2001 the Minister of Education appointed the SANET II Project Managing Board, with the following membership:

Ing. Emil Bárta, SANET Auditing Commission, FEI STU Bratislava
Ing. Július Binder, SANET Directorate, CVT STU Bratislava

Ing. Marian Ďurkovič, SANET Directorate, CVT STU Bratislava
RNDr. Luboš Elias, SANET Directorate, UAKOM UMB Banská Bystrica
prof. Ing. Pavol Horváth, PhD., Chairman of SANET Directorate, CVT
STU Bratislava

Ing. Emil Hutňan, SANET Auditing Commission, CIKT UPJŠ Košice

Ing. Štefan Kohút, SANET Directorate, VS SAV Bratislava

Ing. Martin Marušák, FP PU Prešov

Mgr. Pavol Mederly, UMI UK Bratislava

Ing. Jozef Mužík, SANET Directorate minute clerk, ÚVT ŽU Žilina

prof. Ing. Ján Sarnovský, Ph.D., SANET Directorate, ÚVT TU Košice

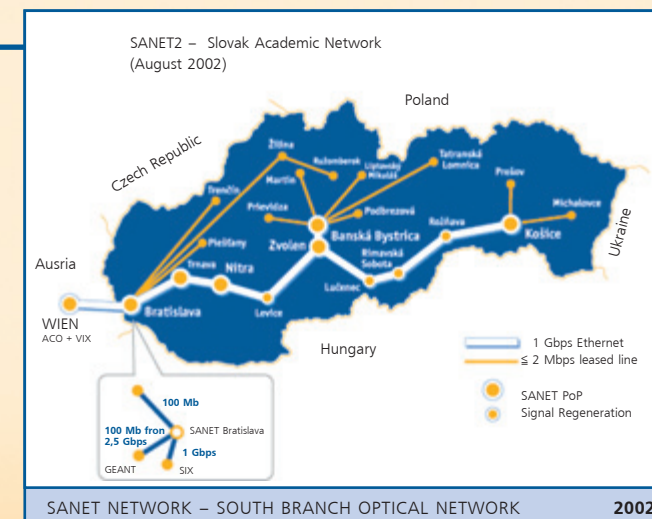
Ing. Daniela Šipošová, SANET Directorate, Ministry of Education of the
Slovak Republic

RNDr. Peter Škrovina, SANET Directorate, CIKT SPU Nitra

Ing. Tibor Weis, Vice-Chairman of SANET Directorate, ÚVT TU Zvolen

Ing. Anton Zdarílek, SANET, Auditing Commission, ÚVT EU Bratislava.

The first session of the Project Managing Board was held on the same day at 10.00 at CVT STU Bratislava. During this session letters of appointment were distributed, and the Chairman was elected – Ing. Pavol Horváth, PhD., Chairman of SANET Directorate; Ing. Mužík, the SANET minute clerk, was appointed for the same function in the Board. The Project Managing Board sessions took place regularly (every other week), and urgent tasks had been handled by circulation e-mail messages. The Board sessions were attended by Ing. Peter Gerda from ÚVT TU Košice as well. On 7. 6. 2001 the contract between SANET Association and the Ministry of Education of the Slovak Republic (MŠ SR) on funding of the SANET II Project was concluded, related to 150 mill. SK from ST (Slovak Telecommunications) privatisation and 88 mill. Sk from state budget; later (in 2002), the financial support was increased by additional 40 mill. Sk. During the first year of the project already, SANET concluded a contract within a tender with Orange related to 10 years lease of 550 km of optical fibres for the backbone; network equipment and optical switches had been purchased according to approved engineering solution, and works on realisation of the new optical network infrastructure had started. It was also necessary to ensure the operation of the original SANET network. In district towns, development



of optical routes and metropolitan networks had started. The first metropolitan networks were built in Bratislava – 11 km, Nitra – 3.5 km, later in Zvolen and Košice.

Following the decision of the international coordination consortium of the GEANT project, on 1. 12. 2001 a GEANT node was established in the SANET central node at CVT STU in Bratislava. Agreement about operation of this node was concluded between SANET Association and DANTE company operating the GEANT network. This way, SANET had direct connection to GEANT (European academic network), with 155 Mb/s speed. SANET's costs related to international connectivity to GEANT network amounted to 5.6 mill. Sk. International connectivity of SANET to the Internet is still ensured through EBONE(GTS), the worldwide operator, at 100 Mb/s speed.

In 2002 the works related to development of the SANET optical network within the SANET II Project were accomplished. On 26. 3. 2002 the opening ceremony of the optical route Bratislava – Zvolen – Košice was held, attended by doc. RNDr. Milan Ftáčnik, PhD, the Minister of Education. In May 2002, operation on the Bratislava – Nitra route has started; in October and November, the operation has started on the Bratislava – Trnava – Piešťany – Trenčín – Žilina and Košice – Prešov routes, respectively.

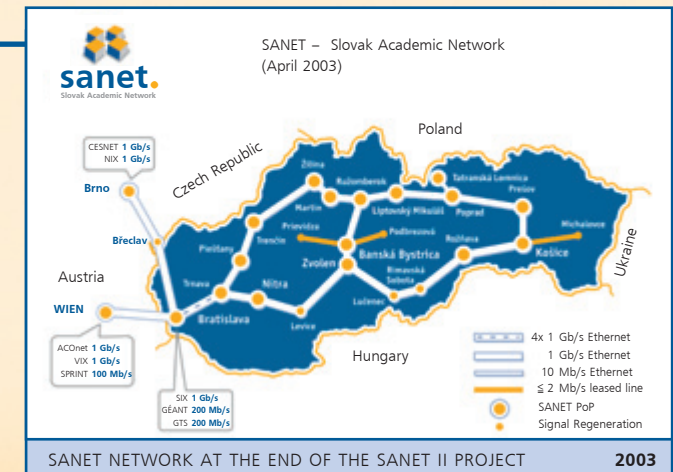


INSTALLATION OF THE SANET NETWORK NODE

2003

On 17. 5. 2002 the network of the Slovak Academy of Sciences at Patrónka (Bratislava) was connected to SANET by an optical route with 1 Gb/s speed, leased from Slovak Telecommunications, replacing the 2 Mb/s radio connection used so far. The optical backbone includes 1100 km of dark optical fibres. Negotiation is underway with ŽSR (Slovak Railways) on acquiring more routes to allow to double the existing infrastructure and to provide for protection against outage at the optical route. The following network nodes remain to be connected: Michalovce, Prievidza, Stará Lesná, Rimavská Sobota, Lučenec. New SANET nodes are being developed in Rožňava and Púchov; realisation of the last backbone infrastructure route (Martin - Ružomberok - Liptovský Mikuláš - Poprad - Prešov) is underway. Realisation of the SANET II Project resulted in the development of large metropolitan networks; in 2002, there are 15 km of own optical routes (line structures owned by SANET) in Bratislava; in Nitra, 3.5 km long metropolitan network optical route is operating; in Košice complete infrastructure of metropolitan network optical routes has been accomplished; in Banská Bystrica, the first stage of metropolitan network is being accomplished, and the second one is being prepared. In Trnava, Žilina, Trenčín and Prešov the optical routes are being accomplished. The speed of connection to the Internet via GTS CZ increased to 200 Mb/s.

In 2003 the nodes in Púchov and Prievidza were connected to the backbone. Metropolitan networks were being accomplished - in Bratislava (the north-western branch in the city), in Žilina, Trnava, Trenčín, Prešov, Banská



SANET NETWORK AT THE END OF THE SANET II PROJECT

2003

Bystrica and Košice. Starting from 1. 12. 2003, SANET is connected to GEANT, the European academic network, at 200 Mb/s speed via the GEANT node at CVT STU.

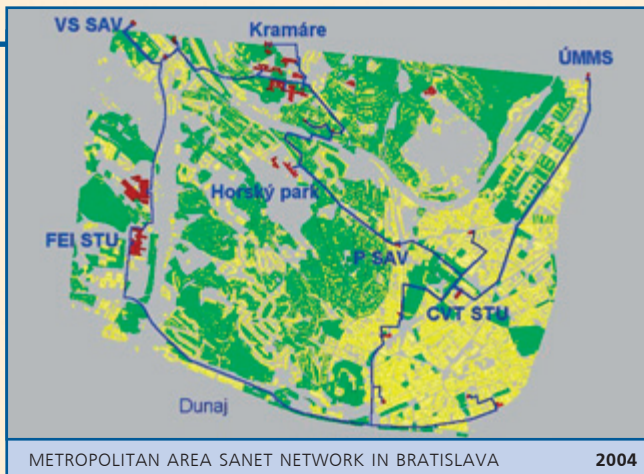
In 2003, international connectivity to the Internet was realised by two operators as follows: at 200Mb/s via EBONE (GTS), and at 100Mb/s via ACONET (Vienna) through SPRINT company.

In the end of 2003, the Association had 311 members, thereof 118 primary and secondary schools.

The final opponency of the SANET II Project took place on 10.12.2003; in the Opponency Board's resolution the following was stated:

Complete backbone network has been realised, connecting all university centres by means of dark optical fibres with switched Ethernet, at 1Gb/s. The SANET II network, realised in the above manner, fully corresponds to American standard for Internet 2 network, and also to GEANT high-speed network. The engineering solution and performance parameters of SANET II allow to include this network among the first ten most powerful and technologically best network of the world.

The SANET II Project results and their implementation into routine operation have allowed to include Slovakia among the advanced countries enabling top quality access to a network with top parameters for their academic communities and other research- and education institutions, allowing them to utilise information resources and communication media needed for their scientific, research and education activities.



The Opponency Board took the following final standpoints:

- a. Granting the necessary financial resources for operation of SANET II network, including the resources for staffing of individual network nodes administration.
- b. In 2004 and 2005, granting of specific resources for accomplishment of connection of the remaining university and SAS organisations to SANET II network.
- c. Preparing a further stage of the project aimed at development of applications for SANET II network, such as VoIP, distance learning, etc.

The conference “SANET in Europe” (2004)

The high technical level of the developed optical network required proper presentation, as well as a solemn accomplishment of a significant stage of SANET Association activities in the Slovak Republic. On October 20-29, 2004 the conference “SANET in Europe” was held in SAS Congress Centre

at Smolenice. The aim of the conference was to evaluate positive impacts of the realised project of SANET II optical network as a nationwide network for science and education in Slovakia. The conference was attended by representatives of 19 SANET nodes and of 12 partner organisations which have contributed considerably to successful accomplishment of this very ambitious project.

The conference was visited by doc. RNDr. Martin Fronc, PhD., the Minister of Education; he pointed out the positive impact of SANET II optical network for the development of education in Slovakia, and also the fact that functioning high speed network of world level has been realised at relatively low financial cost. In the end of the conference, the Minister awarded Prof. Ing. Pavol Horváth, PhD., the SANET Association Chairman, with St. Gorazd Medal in appreciation of his lifelong work in the field of developing computer networks in education and science in Slovakia, as well as for his long pedagogic work. At the ceremony the SAS Vice-President Prof. MUDr. Ján Slezák, DrSc. was present.

Then, SANET Association chairman gave votive letters to representatives of ŽSR, ORANGE and CISCO, the organisations with the highest contributions to the success of the entire project.

In the professional section of the conference there were speeches about current state and further development perspectives of SANET network in Slovakia, in regions and in towns. Following the papers presented by the cooperating companies related to modern communication techno-



VIDEOCONFERENCE AT SMOLENICE CASTLE

2004

logies the section called Projects inspired by SANET II optical networks began.

From the Hunters Room at Smolenice, a videoconference “SLOVAKIA POINT '04” was held. The title expressed the fact that videoconferencing connection of eight universities in Slovakia by SANET optical network has reduced the geographic distances, so that it seems as if all participants were at one place. The videoconference was also attended by guests from the CERN centre in Switzerland.

Further development of SANET II network (2004 – 2006)

For SANET II network, this was the period of increasing transmission capacities, backbone reliability improvements by help of developing new network circuits, and accomplishment of the SANET II Project goals by connecting remote localities without any optical infrastructure at the time of the project. SANET has shown interest in connecting primary and se-



TRANSMISSION OF SURGERY FROM FACULTY HOSPITAL IN MARTIN

2005

condary schools in cooperation with towns and municipalities; this issue was discussed with representatives of local authorities. The SANET Directorate has approved the intention to connect libraries, hospitals, museums, local authorities with the aim to extend SANET II optical network to regions. In 2004, the transmission capacity increased to 4 Gb/s, to allow backup in case of failure or outage on the route.

Following the accomplishment of SANET II Project and completion of the work of its Managing Board, realisation of new projects has been controlled by SANET Directorate and Auditing Commission. The manner of submitting projects and performing tenders remained the same as in SANET II Project. The Directorate together with the three members of the Auditing Commission represents the managing team (14 members) for approval and realisation of new projects. As before, during selection of contractors the Public Procurement Act is strictly observed.

The fast network required higher international connectivity. In 2004, connection to GEANT has increased to 300Mb/s, and connection to the Internet to 400 Mb/s; thereof, 200 Mb/s via the ACONET network.

On the one hand, high throughput of the new optical network has resulted in new chances within the network services; on the other hand, troubles with security of equipment and information systems occurred. This is why in 2005 two workshops took place within SANET Association; the first one – Data Security in SANET Network – was held in Ružomberok at the

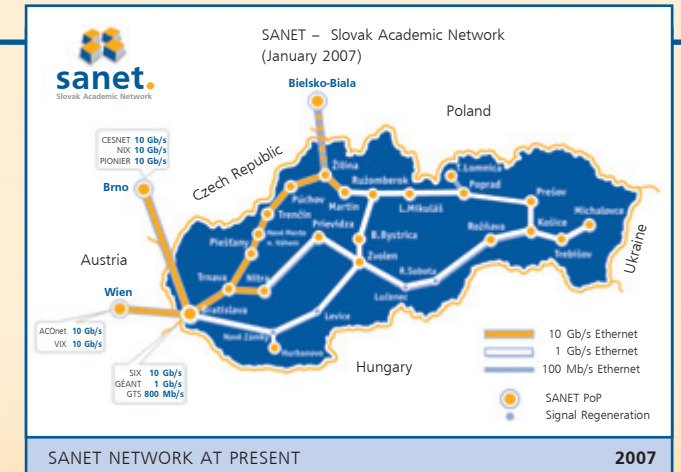


VIDEOCONFERENCING CLASSROOM AT VS SAV IN BRATISLAVA 2006

The year 2007 and further development of SANET

Recalling the 15th anniversary of the SANET Association is a virtual standstill only, for the work on development of the SANET network cannot be interrupted. The information and communication technologies develop fast, and after several years of optical network operation the requirements of universities and other network users as to top quality, fast and secure communication and to new network services start to rise. High reliability and sufficient transmission capacity have become a matter-of-course already. The network development is ensured by efficiency and creativity of teachers, scientists and researchers from Slovak universities and from the Slovak Academy of Sciences, in which the network nodes are installed and operated. These organisations are the most important members of SANET Association.

SANET network is an inseparable part of developing a knowledge society, of integration of information sources, development of computing grid technologies, of extending the research teams and of common European scientific and research space.



In the first half of 2007, the backbone speed has been increased from 1 Gb/s to 10 Gb/s on the northern route (Trnava – Piešťany – Trenčín – Žilina – Martin); accomplishment of transmission speed increase in the entire SANET infrastructure is assumed before the end of 2007.

Surely enough, SANET's perspective is given by its usefulness for the academic community in Slovakia; thus, the network would perhaps deserve legislative recognition as the Slovak national data network for education and science, with stabilised funding of its operation and international connectivity. In perspective, SANET network must allow the access to new forms of education and to information resources for schools and school facilities at all levels all over Slovakia, without any geographic discrimination, including utilisation of intellectual capacity of our handicapped fellow citizens. The SANET Association is interested in extension of the network to such regions as Orava, Kysuce, Šariš, Zemplín, Novohrad, Gemer, and in connecting as many schools of all types to the high speed optical network as possible.

This aim is supported by the project now under preparation, named "SANET to schools"; after its successful accomplishment, this project would allow to connect above 600 schools to optical network, and thus it would help increase the quality of education in Slovakia.

Officials of the SANET Association

SANET Association Directorate (before 1998, Board of Directors) and Auditing Commission (AC)

| | | |
|--------------------------------|-------------------------|------------------------------|
| doc. Ing. Pavol Horváth, CSc. | CVT STU Bratislava | Chairman 1991 – today |
| doc. RNDr. Peter Mederly, CSc. | MFF UK Bratislava | Vide-Chairman 1991 – 1998 |
| RNDr. Marta Kundríková | ÚVT VŠT a SAV Košice | Treasurer 1991 – 1994 |
| Ing. Ján Zelem, CSc. | ÚVT VŠDS Žilina | Minute clerk 1991 – 1994 |
| RNDr. Jaroslav Bobovský | VS SAV Bratislava | member 1991 – 1998 |
| Ing. Vladimír Kašša, CSc. | ÚAK Bratislava | member 1991 – 1993 |
| Ing. Peter Prónay | SWH Bratislava | member 1991 – 1991 |
| Ing. Karol Fabián, CSc. | ÚTK SAV Banská Bystrica | AC member 1991 – 1994 |
| Ing. Ján Masár | VS EF STU Bratislava | AC member 1991 – 1993 |
| Ing. Anton Jusko | UEF SAV Košice | AC member 1993 – 1995 |
| RNDr. Luboš Elias | ÚTK SAV Banská Bystrica | member 1994 – today |
| Ing. Ján Šandrej | ÚVT VŠT Košice | Treasurer 1994 – 1996 |
| Ing. Jozef Mužík | ÚVT VŠDS Žilina | member 1994 – 1998 |

| | | |
|--------------------------------|----------------------|-------------------------------|
| Ing. Emil Bárta | VS EF STU Bratislava | AC member 1994 – 1996 |
| Ing. Tibor Weis | ÚVT TU Zvolen | minute clerk 1995 – 2000 |
| Ing. Peter Matej | ÚVT VŠT Košice | member 1996 – 1996 |
| Ing. Juraj Škoda | VS FEI STU | AC member 1996 – today |
| RNDr. Peter Škrovina | CIaKT SPU Nitra | member 1996 – today |
| Ing. Dezider Guspan | ÚVT TU Košice | member 1996 – 1998 |
| Ing. Anton Zdarílek | ÚVT EU Bratislava | AC member 1998 – today |
| RNDr. Jaroslav Bobovský | VS SAV Bratislava | Vice-Chairman 1998 – 2000 |
| Ing. Július Binder | CVT STU Bratislava | member 1998 – today |
| Ing. Miroslav Bórik | VS JLF UK Martin | member 1998 – today |
| Prof. Ing. Ján Sarnovský, CSc. | ÚVT TU Košice | member 1998 – 2002 |
| Ing. Karol Gombík | MŠ SR | member 1998 – 1999 |
| Ing. Jozef Hucec | ÚVT VŠT Košice | AC member 1998 – 2001 |
| Ing. Jozef Mužík | ÚVT VŠDS Žilina | minute clerk 2000 – today |
| Ing. Daniela Šipošová | MŠ SR | member 2000 – today |
| Ing. Štefan Kohút | VS SAV | member 2000 – 2006 |
| Ing. Tibor Weis | ÚVT TU Zvolen | Vice Chairman 2000 – today |

| | | |
|----------------------|-------------------|---------------------------|
| Ing. Marián Ďurkovič | CVT STU | member 2000 – today |
| RNDr. Emil Hutňan | CIaKT UPJŠ Košice | AC member 2001 – today |
| Ing. Peter Gerda | ÚVT TU Košice | member 2003 – today |
| Ing. Tomáš Lacko | VS SAV | member 2007 – today |

SANET in international network organisations

1992

- The SANET Association becomes a regular member of RARE (Réseaux Associés pour la Recherche Européenne), an European international network organisation associating academic network organisations in Europe, and of RIPE (Réseaux IP Européens Network Coordination Centre).

1994

- SANET is one of the founding members of CEENET (Central and Eastern European Network Association), a new organisation for the development of computer networks in Central and Eastern European countries.

1995

- SANET takes part in the COSINE II project – connection to EUROPA-NET network, and organises a common General Assembly of CEENET countries and of the PHARE COSINE project – connection to EUROPA-NET network, held in October 1995.
- SANET becomes a member of EBONE (European Backbone) Consortium (later: Association), a pan-European academic data network, and takes part in European ESSAT and INSIGHT within the COPERNICUS program.
- Following the merger of RARE and EARN, SANET becomes a member of TERENA (Trans European Research and Education Networking Association), a new pan-European association of academic networks.

1998

- SANET organises the 4th CEENET Workshop in Bratislava, with 95 participants, representatives of the member organisations.
- On behalf of the Ministry of Education of the Slovak Republic, SANET becomes a member of ENPG (European Network Policy Group).

1999

- SANET joins the QUANTUM project with the aim to include SANET into the TEN-155 network and to running GEANT projects (Gigabit European Advanced Network Technology) within 5FP.

2000

- Following contract execution, SANET becomes a member of the GEANT Consortium, which manages the project with the same title related to European high-speed data network for science, education and research.

2001

- A GEANT node was established in Bratislava at CVT STU. Agreement between the SANET Association and DANTE company was signed, related to operation of the GEANT node in Bratislava.

2002

- SANET takes part in the work and sessions of RIPE, CEENET, TERENA, ENPG, GEANT PC and GEANT APM.

2004

- SANET is charged with pilot implementation of network telephony, where it cooperates primarily with Austria and ITU.

2005

- SANET organises ENPG General Assembly in Bratislava, with 18 participants (members of the organisation).

2007

- SANET organises a meeting of GEANT PC Consortium and of EARNEST Foresight Study Team, attended by 45 representatives of European academic network organisations and study team members.

SANET's current international activities

As a member of international computer network associations, SANET represents the data communication interests of Slovak academic institutions. SANET is a member of the following associations:

- RIPE – Réseaux IP Européens Network Coordination Centre
- RARE – Réseaux Associés pour la Recherche Européenne
- EBONE – European Backbone
- TERENA – Trans European Research and Education Networking Association,
- CEENET – Central and Eastern European Network Association
- GÉANT2 – pan-European Research and Education Network, successor of GÉANT pan-European Multi-Gigabit Research Network
- ENPG – European Network Policy Group.

Within numerous meetings and/or General Assemblies of network organisations (RIPE, CEENET, TERENA, ENPG, GEANT PC and GEANT APM), the Directorate members take part in development of pan-European documents on management and technology of academic data networks for science, research and education, and cooperate in developing pan-European network strategies.

During meetings of the PC GEANT Consortium, and during other sessions as well, the SANET II Project of optical infrastructure was evaluated as a significant success, on the one hand because of considerable improvement of the access to information sources for Slovak academic community both at home and above all abroad, and, on the other hand, as a unique organisation- and technological approach to developing large national academic networks.

Chronology

1976

- Start of working on the research task “Computer network systems” at ÚAK.

1979

- On 3. 7. 1979, the first remote transmission was realised at ÚTK SAV, on Bratislava – Banská Bystrica route between PDP11/40 and PDP11/10 computers, under RT11 operation system, with REMOTE communication system (supplied by DEC).

1980

- In October the operation of the first experimental three-node computer network with packet interconnection started at ÚAK (own design), with 2x SM3/10 and PDP11/34 computers.

1982

- In September, test operation of the ÚAK network started, with four nodes in Bratislava (three nodes at ÚAK and one at ÚVTVŠ – University Computer Centre) and one in Prague (ÚVTEI-ÚTZ – Institute of Scientific, Technical and Economic Information).

1983

- The first experimental e-mail operation via EUNET at ÚAK (switched line).

1986

- Start of professional functioning of ÚAK computer network, named EPOS (Electronic computer network), with the following organisations connected in Bratislava (ÚAK, ÚVTVŠ, VS SAV, SHMÚ (Slovak Hydrometeorological Institute), ÚVT SVŠT – Computer Institute of Slovak University of Technology) and in Prague (ÚVTEI-ÚTZ, MTTU – International Telephone and Telegraph Central, ČVUT – Czech Technical University)

1989

- The EUNET-CS organisation was established, with the main EUNET node at ÚAK in Bratislava, which started its operation in October 1989.

1990

- Innovation of the ÚAK network to UAKnet with X.25 protocol. In March 1990, the activities of CSUUG (Czechoslovak Unix Users Group) Association with the head office in Prague started. In June 1990, EUNET was established in Czechia as well, and was connected to the EUNET node at ÚAK, which functioned as backbone – interconnection with the world.

1991

- On 10 April 1991 the founding General Assembly of the users of Slovak academic data network took place. **The Association was registered at the Ministry of Interior of the Slovak Republic on 17. 5. 1991. This date is considered as the official start of SANET activities.** In July the UAKnet network was interconnected with ACONET. By help of leased line, EUNET interconnected the electronic mail service to Amsterdam via ACONET. In the end of the year, leased line from Banská Bystrica (ÚTK SAV) to Prague and from there to the EARN network was established. The number of founding organisations: 17.

1992

- First draft topology of SANET network was developed. SANET becomes a regular member of RARE, an international network organisation associating European academic network organisations. The first Slovak domain – uakom.cs – was activated on DNS server sun.uakom.cs. Routing from Banská Bystrica to Prague and vice versa was provided using CISCO MGS and IGS equipment, obtained from the PHARE project.

1993

- Due to tariff system, SANET has divided its users into three groups (organisations within the field of education and science, non-profit organisations outside the field of education and science, and commercial organisations). SANET network was rendering the following services: Remote terminal, E-mail, Dial-up IP (switched line), Full IP (leased line). SANET had 93 members.

1994

- SANET is obliged to request reimbursement of the costs of the network services from organisations outside the field of education and science. SANET became one of the founders of CEENET, a new network organi-

sation associating academic network organisations. Projects: TELESERV and WWW within the COPERNICUS project. SANET had 234 members.

1995

- Starting from October, speed of the Bratislava-Vienna line increased to 128 Kb/s. The Austrian government continues in paying the costs of this interconnection (65 thousand Sk in a month). SANET negotiates with CESNET about transit to EUROPANET.

1996

- Establishment of the SIX peering centre. SANET – EUROPANET interconnection is realised via CESNET. Work on the COPERNICUS – ESATT project (establishment of regional information centre) has started. As of 12. 2. 1996, SANET has 715 members.

1997

- New network nodes established at ŠVS Piešťany, Liptovský Mikuláš, Michalovce, Banská Bystrica, Bratislava, and at universities in Ružomberok and Trenčín. The number of nodes increased to 19. EBONE node established at CVT STU in Bratislava, with 2x2 Mb/s interconnection to Munich. Regional Information Centre (RICE) established at ÚVT TU Zvolen. SANET had 1120 members.

1998

- New SANET Statutes approved; SANET Board is replaced by SANET Directorate, the Board of Node Administrators is established to handle technical issues, and Arbitration Panel to handle questionable issues within the Association. SANET had 455 members.

1999

- The SANET II project approved by the Government Board for Informatics on 22. 10. 1999. SANET joined the QUANTUM project with the aim to be included into the TEN-155 network. The Association is included in the budget of the Ministry of Education of the Slovak Republic. Cooperation with INFOVEK has started. SANET has 373 members.

2000

- SANET joined the GEANT project. The Board of Node Administrators approved the recommendations related to limited access to certain information resources and to the manner of connection for student hostels. In cooperation with INFOVEK, 25 schools have been connected. SANET has 371 members.

2001

- On 28. 6. realisation of the SANET II project started. The work is managed by the Project Managing Board (16 members), headed by Professor Horváth. Starting from 1. 12. 2001, a GEANT network node is established at CVT STU. SANET has 308 members, thereof 171 school organisations.

2002

- On 26. 3. 2002, operation of SANET II network started on the southern optical route Bratislava – Zvolen – Košice. In May 2002, operation on the Bratislava – Nitra route has started; in October and November, the operation has started on the Bratislava – Trnava – Piešťany – Trenčín – Žilina and Košice – Prešov, respectively. SANET has 303 members.

2003

- New nodes were established at Púchov and Prievidza. The route Žilina – Martin – Ružomberok – Liptovský Mikuláš – Poprad – Prešov was established. Final opponency of the project took place on 10. 12. 2003. SANET has 311 members.

2004

- Extension of SANET II network continues. Libraries, hospitals, museums, city and local authorities connect to the network. The “SANET in Europe” conference was held in September 20-22 at Smolenice, attended by the Minister of Education, as final evaluation of the SANET II project. New services rendered (TVoIP, multicast and VoIP). SANET has 321 members.

2005

- Metropolitan services were extended. New municipal networks were



SANET NETWORK NODE AT TU KOŠICE

2007

established at Martin, Ružomberok and Michalovce. The network backbone was extended by the route Košice – Trebišov – Michalovce. A new SANET node was established at Trebišov. Workshops were held in Ružomberok and Martin. Charged by the Ministry of Transport, Post and Telecommunications, the Association becomes the pilot organisation of the ENUM project for the implementation of network telephony. SANET has 360 members.

2006

- New SANET node was established at Hurbanovo. On 6. 11. 2006 the CESNET, ACONET and SANET networks were interconnected by 10 Gb/s speed. Speed of the Slovak network backbone increased to 10 Gb/s on the route VS SAV – FEI STU – CVT STU – Trnava. SANET has 312 members.