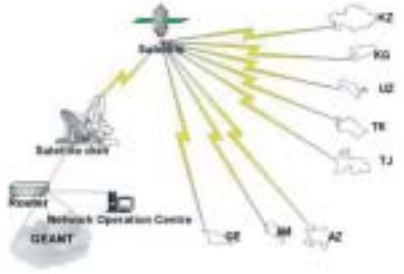
NATO OTAN

The Virtual Silk Highway Project

In today's high-technology world, the Internet has become a fundamental communication tool. Not only does it link people together across the globe, but it also provides access to a wealth of information, as well as valuable educational resources that would otherwise be unreachable. Indeed, the Internet has evolved to become an indispensable tool for research, teaching and learning.

While many people in Western Europe and North America enjoy easy and dependable access to the Internet, others around the world are restricted by inadequate technology and financial shortcomings. By designing and undertaking a revolutionary new project initiated by its Advisory Panel on Computer Networking, NATO's Science Committee has found a way to provide the scientific and academic communities of several NATO Partner countries with reliable and affordable Internet access. The Virtual Silk Highway Project (known as the "SILK Project") involves installing a satellite-based network that will provide Internet access to scientists and researchers in eight countries of the Southern Caucasus and Central Asia. Not only does the project have direct practical benefits for those concerned, giving them access to the global information network, but it also serves to enhance the principle of partnership which is inherently linked to NATO's strategic concept and contributes to peace and stability in the Euro-Atlantic area.



The SILK Network configuration consists of satellite dishes and network equipment in each of the eight participating countries, a central distribution point (hub) with a dish and network equipment in Western Europe, a contract with a satellite vendor and Internet access. A common satellite beam will connect the academic and educational communities of the eight countries to the Internet.

Did you know?

The Virtual Silk Highway Project has been named after the legendary trade route linking Asia and Europe – the Great Silk Road – which was developed during the first centuries AD. In addition to trade, the Great Silk Road facilitated the exchange of information and knowledge between major regions of the world.

>> The problem defined

The NATO Science Committee has been supporting computer networking projects in the Caucasus and Central Asia regions since 1994. These past and, in some cases, ongoing projects have focused on helping the scientific communities in these countries – the Southern Caucasus countries of Armenia, Azerbaijan and Georgia and the Central Asian countries of Kazakhstan, Kyrgyz Republic, Tajikistan, Turkmenistan and Uzbekistan – create the appropriate infrastructure for their communication needs. Rudimentary Local Area Networks (LANs) and Wide Area Networks (WANs) have already been established and the existing technology improved to better connect regional research and educational institutions together. With this terrestrial infrastructure in place, it quickly became evident that, in order to make full use of the new infrastructure and improved technology and to facilitate research contacts with the global scientific community, it would also be essential for these countries to have reliable Internet connectivity.

The Virtual Silk Highway Project will connect the academic communities of eight Central Asia and Caucasus countries: Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyz Republic, Tajikistan, Turkmenistan and Uzbekistan.

Since these countries are located beyond the European Internet zone for research and higher education, they do not have affordable access to the high-speed optical fibre connections currently in use in Europe. The only alternative – Internet connectivity via satellite – is also very expensive and generally beyond the reach of the region's scientific and research communities. As a result, the entire scientific community of the eight countries concerned can only receive information at a rate of 64 Kbps (Kilobits per second) to 384 Kbps compared to 56 to 500 Kbps for one person in the average Western European home. Without outside help, these Partner countries are not able to provide the resources needed to upgrade and enhance their Internet connections. Furthermore, without adequate access to the Internet, the region's scientists and researchers remain isolated and cannot exchange expertise with their counterparts around the world.

>> Project Overview

The SILK Project is a computer networking project. It is designed specifically to facilitate the exchange of information between academic and educational institutions in the Caucasus and Central Asia with peers in the rest of the world, by providing basic and reliable Internet connectivity. The project was approved on 29 October 2001 at the Autumn NATO Science Committee meeting in Georgia and subsequently launched by the Science Committee's Advisory Panel on Computer Networking. Each of the eight participating countries received state-of-the-art satellite technology, linking them to the Internet and creating a modern information network – the SILK Network which was fully operational in Spring 2003.

National Research and Education Networks (NRENs) are being established in each participating country, with the help of NATO, to take care of the national networking needs of the education and research institutions. NRENs are responsible for determining the acceptable use policy for their networks, including who the users are, the eligibility requirements for network use and for what type of research and projects the network can be used. However, to the extent that these NRENs use the SILK Network, they must abide by the acceptable use policy applicable to the European NRENs through which traffic must pass. While these policies are not unduly restrictive, they do constrain the traffic to be non-commercial.

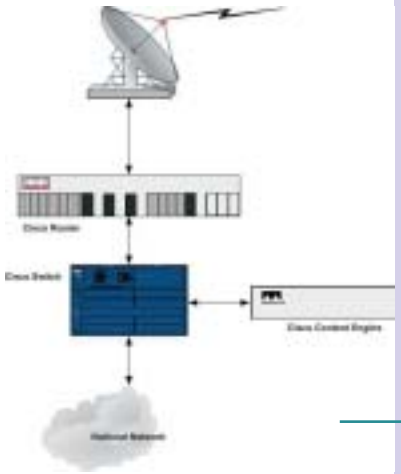
The type of technology used for the SILK Network includes the ability to employ modern data caching techniques. A caching engine is located at each SILK site in the eight participating countries so that when a user requests information, there will first be a check to see whether the information is already in one of these caches. If it is found to be in one of the national caches, the information will be retrieved from there rather than through the satellite connection. These caching techniques allow for further improvements in the effective bandwidth achieved (the time required to transmit and receive bandwidth), resulting in savings of bandwidth of 30 per cent and a generally more efficient and economical network. Information can be cached according to a variety of criteria, including content, ageing policies or size.

→ What is "bandwidth"?

The term "bandwidth" refers to the ability of a computer network or other telecommunication system to transmit signals. The concept of "bandwidth" can best be understood if you think of trying to fill a bathtub with water from a pipe. A thick pipe (in network terminology: with Megabits per second) will fill your bathtub in just a few seconds (time to download information from the web). A thin pipe on the other hand (in network terminology: with kilobits per second), will take significantly longer to fill the bathtub. Each of the participating countries in the SILK Project will be allocated a minimum bandwidth capacity of 3 Mbps and will also be entitled to make use of the unused bandwidth of the other participating countries. This represents a significant improvement from the existing system and will lead to much more reliable, efficient and rapid Internet connectivity for the eight recipient countries.

The SILK infrastructure also includes an Internet Exchange Point which is a meeting place for local Internet Service Providers. The Internet Exchange Point allows the Internet Service Providers to exchange national Internet traffic, thereby bypassing the use of expensive international connectivity for domestic interactions. This particular feature of the SILK Network has significant financial benefits for the domestic Internet economies of the participating countries.

The whole system is monitored and controlled by the SILK Network Management, Monitoring and Control Centre (NMMC). It is crucial for the system to be monitored for several reasons, for instance to ensure that an accepted quality of service is maintained, detecting when maintenance is required and providing an indication when upgrades are necessary. Effective management of the system is also necessary to make certain that the satellite bandwidth of each user country remains within acceptable limits and they receive the bandwidth levels allocated to them successfully, without depriving the other participating countries of their allocated share. In addition, it will be necessary to allocate supplementary bandwidth to special events and to change the cache characteristics when required. A SILK Network Operations Centre (SNOC) has been set up in Hamburg offering a Help Desk (with Russian-speaking staff) to answer networking questions, to report problems, to provide maintenance support and to liaise with EurasiaSat – the satellite provider. The Help Desk also monitors bandwidth capacity in order to determine whether there is too much or too little available for the network's needs.



Schematic of the configuration at each national SILK site

One earth station, composed of a satellite dish and a router to direct the Internet traffic, will be set up in each of the participating countries. NRENs are responsible for installing and maintaining their earth station and deciding which research and education facilities will be connected to it.

NATO has received considerable support from other sources to help make the project a success, including from Cisco Systems and Deutsches Elektronen-Synchroton (DESY). Cisco, a multinational electronics company, has donated US$400,000 worth of equipment to be installed at the eight national stations. DESY, a German research institute based in Hamburg, volunteered to host the European hub and provide technical management of the network – a service valued at US$350,000. DESY has also agreed to connect the SILK Network to GÉANT – the European Union's pan-European Gigabit research network – which will link SILK users to numerous other research networks around the world. This service is valued at US$125,000. In addition, the European Commission is providing funding (at US$220,000) to two European universities – University College of London and Groningen University – to provide project management and infrastructure support services.

Highway Project

>> Working together for results

The SILK Project is the largest project so far to be sponsored by the NATO Science Committee. It is a three-year project worth US$2.5 million – an equivalent of 40 per cent of the computer networking budget. This investment reflects the value attributed to the development of information technology knowledge and skills in the academic communities of the eight Partner countries.

The SILK Project is expected to yield several positive outcomes. By equipping highly-educated scientists, researchers and academics with access to an effective and valuable educational tool, they have greater access to information. This is not only the key component for success in science in the 21st century, but also of open and democratic societies. In addition, the SILK Project will lead to improvements in education and help close the gap between information-rich and information-poor societies. It also requires all eight participating countries to cooperate closely together and therefore contributes to enhancing peace and security in the region.

The SILK Network will serve as a positive and constructive tool for the scientists and researchers of eight NATO Partner countries to share information and exchange ideas between themselves and their peers around the world.

>> Project Expansion

While the SILK Project will deliver several improvements to the communication systems in the participating countries, it is only a medium-term solution to the Internet connectivity problems in the region. NATO sponsorship is providing the required infrastructure and connectivity to meet the region's immediate needs. However, funding is available only until 2005. Therefore, steps are being taken concurrently with project development to transfer the knowledge and expertise required to maintain and manage the SILK Network.

A major priority to guarantee the continued success of the project and to ensure the SILK infrastructure continues to be updated along with technological developments in the field, is to secure additional sources of funding for use in the long-term. Additionally, it is critical to provide proper project management structures for the SILK Network. As a result, NRENs have been tasked with seeking out and contracting sustainable financial and managerial structures that will allow the SILK infrastructure to continue to be useful in the years to come, following the termination of NATO funding.

There is also a possibility that the SILK Project may expand to include use by various international organisations and non-governmental organisations (NGOs) that are active in the region. The United Nations Development Programme (UNDP), which is involved in enhancing connectivity with governments and NGOs in the region, and the SOROS Foundation, an NGO seeking to promote democracy in the area through connectivity, are the two first organisations to consider this possibility.

>> The NATO Science Programme

The NATO Science Programme brings scientists from NATO member and Partner countries together to share scientific knowledge and to cooperate in the advancement of science. In addition to promoting the international cooperation essential to the progress of science, the Science Programme also serves to promote peace by fostering trust and understanding and by forging enduring links between scientists throughout the Euro-Atlantic region.

The Science Programme is grouped into four sub-programmes: Science Fellowships (to provide training for young researchers), Cooperative Science and Technology Grants (to initiate research cooperation and establish enduring links between scientists), Research Infrastructure Support (to help Partner countries structure the organisation of their research and create the required basic infrastructure for computer networking) and Science for Peace (to provide support to Partners in their transition towards a market-oriented, environmentally-sound economy). The NATO Science Committee, which is composed of representatives from each NATO member country, provides overall guidance and direction for the Science Programme.

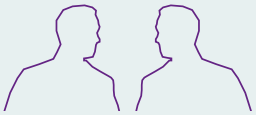
The Research Infrastructure Support component of the NATO Science Programme provides support in the areas of computer networking and science and technology policy and organisation. Its aim is to install the basic infrastructure required for scientific research and development in those countries which lack the required technology, thereby bringing local and regional scientists into contact with others in the international scientific community.

Did you know?

The NATO Science Programme was founded in 1958 by the “Three Wise Men” – Foreign Ministers Lange (Norway), Martino (Italy) and Pearson (Canada) – who made the argument that scientific and technological developments can be decisive factors in determining the security of countries and their positions in world affairs.

Did you know?

- Each year, approximately 10,000 scientists from EAPC countries are involved in the NATO Science Programme.
- Approximately 1,100 NATO Science Fellowships are awarded each year.
- There are about 100 scientific meetings held each year with over 5,000 participants from NATO member and Partner countries.



One Minute Interview >> Professor Peter Kirstein, Project Leader

The Virtual Silk Highway project will affect many people in many different countries. What do you think will be its most positive outcome?

This project employs the broad range of knowledge gained through years of international cooperation in NATO and various international organisations. It uses modern technology in a manner which will surely benefit numerous people in universities, research institutes, libraries and schools. The broad access to the worldwide information network will provide these people with what will clearly have an immense impact on their ability to conduct research and cooperate with colleagues around the world. For many of the people involved, this will be the first time that they have direct contact with their peers in other countries. The SILK Highway project includes the building of significant national infrastructure in each participating country leading many people to a qualitatively new experience with the modern information network.

One Minute Interview >> Rolf Nordhagen, Panel Chair

What is the most challenging task associated with this project and how is it being met?

I think that the most challenging task associated with this project is to get the research communities in both Central Asia and the Southern Caucusus to work together on the common goal of establishing a regional research and education network. User Groups and Technical Groups are being set up to address and resolve any problems that may arise as the participant countries begin and continue to work together. Local scientists and network engineers involved in the technical side of the project are being encouraged to actively participate in these groups and to come up with regional solutions to any problems. Each of the national networks in the eight participating countries will gain from the strengthening of any component of the regional network. NATO is providing the technical means that will allow these countries to cooperate; however, it is necessary for the countries themselves to take the initiative to use this infrastructure collectively to achieve their common goal.

For more information:

- NATO Homepage - www.nato.int
- NATO Science Programme - www.nato.int/science
- SILK Webpage - www.silkproject.org