The Virtual Silk Highway: a project to bridge the digital divide

M. Stella Atkins, Robert F. Janz, and Walter Kaffenberger

Abstract— In June 2001 NATO agreed to fund a non-military project to bring Internet connectivity to the countries in the Southern Caucasus and Central Asia, using satellite dishes located at key academic institutions in each country. The Internet connection is hosted by a research facility DESY, based in Hamburg. The last connections were made to Ashgabat in Turkmenistan in August 2003. This "Virtual Silk Highway" project is ambitious, innovative and exciting, both technically and sociologically. We present the story of some of the issues, unexpected problems encountered, and some of the surprise successes of this project to bridge the digital divide.
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Index Terms—Internet, Internetworking, Global Development, Satellite

1 Introduction

A far-reaching decision by the Computer Networking Panel of the NATO Science Division [1] in June 2001, led to the development of the Virtual Silk Highway project [2] (a.k.a. "The Silk Project") to digitally connect the countries along the ancient Silk Road; countries which have fallen behind the digital divide since they have achieved their independence after 1991. These 8 countries connected to the Internet via the Virtual Silk Highway are shown highlighted in bold on the map in Fig. 1: from West to East: Georgia, Armenia, Azerbaijan, Kazakhstan, Turkmenistan, Uzbekistan, Tajikistan, and the Kyrghyz Republic.

The motivation for the NATO Science Programme [1] is that bringing scientists together for progress and peace may improve the world for all. The knowledge available on the Internet may help establish open and democratic societies in these countries, which were members of the former USSR, under Russian influence for more than 50 years. By providing the necessary (communication) infrastructure for the scientists and educators, they will be able to take part in the global academic society.

The first satellite dish was installed in Tashkent in Uzbekistan in August 2002, and the last hookup, to Ashgabat in Turkmenistan, was completed in August 2003. Since then, the Silk project has taken a life of its own [3], although NATO is still providing funding for most of the bandwidth. An excellent overview and summary of the project can be found at [4].

- *M.S. Atkins is with the School of Computing Science, Simon Fraser University, Burnaby, BC, Canada V5A 1S6. E-mail: stella@cs.sfu.ca*
- *Robert Janz. is technical director of the Computing Centre of the University of Groningen, The Netherlands. E-mail: R.F.Janz@rc.rug.nl*
- *Walter Kaffenberger is Programme Director for Computer Networking with the NATO Science Programme, NATO HQ, Brussels, Belgium. E-mail: w.kaffenberger@hq.nato.int*

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2 Technical Issues

2.1 Technical Approach

Technically, the approach was straightforward and academic in nature: the research community in each country should have all the knowledge that is necessary to run their own network, so the project intended just to buy the various components that were required and build the network. Satellite equipment was bought from Kalitel (USA) [5], Cisco [6] donated the network equipment, EurasiaSat (Turkey/France) [7] provided the satellite connection and DESY (Germany) [8] offered facilities to host the Western hub. The satellite dishes and additional equipment were tested at DESY in Hamburg, and then shipped to each country, where they were usually installed at an academic institute to serve as national Internet entry point for the academic community.

2.2 Technical problems

There were of course technical problems, only one of which will be mentioned here. This problem arose when two (frequency-wise) adjacent dishes were transmitting simultaneously. It was found that they interfered with each other's allotted frequency. This problem did not manifest itself in the early stages of the project while the dishes were being tested individually and installed, and only became apparent after the dishes were installed in the field. Tedious transport and custom procedures (in the Caucasus and Central Asia as well as in the United States!) stood in the way of a swift repair cycle, so the problem has taken an extraordinarily long time to repair.

3 Sociological Issues: Challenges and Successes

3.1 Establishment of NRENs

The local management of the project within each country was established before approval of the funding for that specific country. Each country had to establish a National Research and Education Network (NREN), representing most of the education and research institutions. Each NREN was to coordinate joint ICT activities for the academic community in each country. NRENs are responsible for determining the acceptable use policy for their networks, including who the users are and the eligibility requirements for the network. As these NRENs use the Silk Network, they must abide by the acceptable use policy applicable to the European academic NRENs through which traffic must pass. While these policies are not unduly restrictive, they do constrain the traffic to be non-commercial.
Several visits to each country were necessary in order to determine which academic institution could provide the leadership necessary to manage the satellite connection and manage a fair access to the (still limited) bandwidth.

However, establishing a single NREN in each country proved to be very challenging, and has been the cause of most grief, yet also, paradoxically, can be measured as one of the unexpected successes of the project. The first challenge to be overcome was to establish an organization, more or less independent of governmental structures and the national telecommunications monopolist, to provide Internet connectivity within the country. There is a long tradition of governmental management and censorship of the information that is available for the population in these countries, so free Internet was, and still is, seen as a threat to the central function of government. And, during the preamble of the project, the dotcom hype was still proliferating and the Internet was seen as a cash cow by the national telecom companies. As a result the establishment of the eight NRENs was not a sinecure; politics and commercial interests played significant parts.

Furthermore, in some countries the management of the Silk project was confronted with more than one party that claimed to represent science and education in the country. It proved to be impossible for the NATO Networking Panel to make a sound decision in such issues, so alternative decision structures were sought. With the assistance of EU funding a second project, parallel to the Silk project, was initiated that, amongst other issues, was to set up a management structure for the Silk project. SPONGE (Silk Project Operations Networking and Geant Extension) is funded as an Accompanying Measure, under the Research Networks portion of the IST Framework 5 Programme of the European Commission [9]. As a result the Silk project is currently being governed by the Silk Board with representatives from the eight countries and from other bodies involved in the project, whereas everyday management of the project is done by the Executive Committee. The Silk Board meets three times per year, and decides on strategic issues such as usage and approves decisions made by the Executive Committee. The Silk Board also discusses the future sustainability of the infrastructure.

3.2 The upcoming universities

During the period of Soviet domination students went to Russia to complete their education beyond the level of undergraduate. As a result the universities were small and missed the teaching structure for graduate and Ph.D. level. On the other hand the Academy of Science with its many, Russia funded, scientific institutes was very powerful. Within the academic setting of the Silk countries the NATO Science Department was mostly dealing with research institutes, so it is therefore not surprising that most of their contacts were within the Academy of Science. But when providing Internet to the whole academic community, education activities are becoming increasingly demanding for bandwidth and services.
Within the Silk context it proved to be rather challenging to bring more balance into the use of the Internet connection by both these academic sub-communities, and also have universities play a more important role in the decision making fora of the the NRENs. The Academy of Science was not only afraid of losing its dominant position in favor of the upcoming universities. Scientists were also afraid to see the sparse Internet bandwidth evaporate when all those thousands of students got connected (in most of the countries 50% of the population is younger than 20 years, all of whom are potential users of the Silk connection).
The scale is now gradually tipping over from the Academy of Science side to the university side: national funds for scientific research have diminished (on its own, reason for great concern) and the universities are becoming mature players at the decision making level. As a consequence the available bandwidth per user has fallen below any level that would acceptable in the west.

3.3 Expansion beyond the capital city

The ultimate objective is to make the Internet accessible to the whole country. Towards that objective, several countries including Azerbaijan, Georgia, Uzbekistan and Kyrgiz Republic are already providing Internet connectivity to the research and educational community not only in the capital city but in regional cities as well.

3.4 Collaborations with other development projects

Another huge success has been the collaborations with other development partners in these Silk countries. The Silk project under the NATO funding had a sound project plan and funding and a governing structure that guaranteed continuity for several years. This attracted several major development funding organizations to participate in the project, either directly by chipping in for the expensive satellite bandwidth, or indirectly by setting up projects within the countries to strengthen the knowledge capacity in the NRENs. For example the Open Society Institute (OSI) [10] and the United Nations Development Project (UNDP) [11] are jointly and separately supporting projects in Georgia, Azerbaijan, Tajikistan, Turkmenistan and Uzbekistan. These projects enable NRENs to hire staff, set up educational programmes and implement a national ICT infrastructure. These initiatives were only made possible with the Silk project providing the national focus point.

3.5 University of Central Asia

An additional project recently announced [12] which has roots in the Virtual Silk Highway project is the Aga Khan foundation's newly established University of Central Asia, with 3 campuses in the mountainous regions of the Kyrghyz Republic, Kazakstan and Tajikistan [13]. This is a bold project to help the 40 million people who live in these high mountainous regions, many of them in great poverty, by establishing a secular University with a focus on economic and social development in fields and disciplines that are relevant to mountain economies and societies. Access to the internet will be crucial for the mountain campuses, planned for each of the three countries.

3.6 Networking between Technicians

Another unexpected benefit that has arisen during the early stages of the VSH, is that the technicians are working together across the region. The technical staff meet at the technical training workshops held in the common Russian language, and then continue to communicate using email over the Internet which they are supporting. As each new country joins the VSH, the technical staff already using the Internet in the other countries provide advice and encouragement to the newcomers to the VSH.

4 Role of Workshops

The whole project required technical and non-technical workshops for the participants; initially for training in computer network administration and management, and more recently for education in issues such as security, distance education and general management. The funding of such workshops proved to be challenging. There were donors, such as the NATO Science Programme and OSI, that were willing to fund some workshops, but it was difficult to set up an educational programme that had some kind of long-term perspective. One of the activities of the Silk Board was to make an inventory of the most pressing needs with regard to education and training and to publicize this. The first (technical) workshop of this programme was held in Tashkent (Uzbekistan) in October 2003 and at the end of 2003 the Internet Society provided a major grant ($ 122,000) that made a series of workshops possible. With this budget and additional funds from other parties, the first part of a coherent educational programme has been implemented and executed in 2004, and to date three more technical workshops have been held; in Yerevan (Armenia), Hamburg and Baku (Azerbaijan). The workshops will usually be held in one of the Silk countries and the working language will be Russian. In this way the Silk Board hopes to achieve optimal effectiveness of the workshops.

5 Role of Consultants

We found we needed consultants to advise the NRENs in the member countries, and to monitor progress in establishing and managing the Internet connection and the policies for its use. Without the consultants the project would surely have fallen into the category of misguided technical assistance from the developed world, where equipment boxes would have remained unopened, and where the first problems would have rendered the connections unavailable.

One of the most important activities of the consultants is to evaluate information coming from the countries. With this project, where the project team is spread out over 17 time zones and spread among various groups within the Silk countries, sometimes with conflicting interests, it is mandatory to have direct links into the countries.

Some of the consultants speak Russian, but some do not – the main requirement is a strong technical knowledge, a sound management perspective, and a strong committment to the project.

6 Summary and Future Work

The Virtual Silk Highway project has brought together scientists and researchers from bandwidth-challenged countries in the Caucasus and in Central Asia through the virtual world of the Internet. Many lessons have been learned. We know that we first need to establish a single NREN in every country, which will be the focal point for the Internet connection. We also know how important it is to collaborate and co-ordinate with other donors in the region, in order to lever the funding to enable enhanced Internet activities. We are also aware of the importance of the training of the technical personnel, which is efficiently provided by workshops. Finally, the role of the NATO consultants is critical, to keep the operations running smoothly, to ensure that technical problems are efficiently dealt with, and that the bandwidth is indeed used as specified in the policies.

Future work will include the addition of content to the bandwidth, possibly in the form of distance education programs.

Another concern is regarding the increase of the bandwidth; the satellites have limited potential for expansion, so fibre-optic land lines may be necessary in the future.

At this moment the bandwidth provided by Silk usually only reaches the research institutes and universities in the capitals where the Silk dish is situated. Various initiatives are underway to expand the scope of the project to the regions within the countries.

Finally, it is proposed to add a ninth member country, Afghanistan, to the Virtual Silk Highway project. The lessons learned from establishing NRENs in the existing Silk countries will help in establishing a single NREN and establishing a satellite dish to operate in Afghanistan. Delivery of the dish has already been made in September 2004, and it is expected to be in operation by the end of 2004.

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First Author:
M. Stella Atkins: BSc. Chemistry, Nottingham, U.K. 1966, M.Phil. Computer Science, Warwick, U.K. 1975, PhD. Computer Science, University of British Columbia, Canada, 1985. Currently a Professor of Computer Science at Simon Fraser University 1985-2004. Member IEEE, SPIE, SCAR. Current research interests: computers and medicine, including medical image display and analysis, telemedicine, sleep studies, and computer networks.

Fig. 1: Countries connected to the internet via the Virtual Silk Highway (in bold)—from West to East: Georgia, Armenia, Azerbaijan, Kazakhstan, Turkmenistan, Uzbekistan, Tajikistan, the Kyrghyz Republic