Experiences with Regional Satellite Internet Acces for the Southern Caucasus and Central Asia: The "SILK" Project

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ABSTRACT

The ancient Silk Road was not only a trade route but also an all-important road for the transfer of information and knowledge between major regions of the world. The SILK Project is bringing cost-effective, global Internet connectivity to the Caucasus and Central Asia through state-of-the-art satellite technology, thus creating a virtual Silk information highway. Consequently, the project has been called the 'SILK Project'. The aim of the SILK Project is to increase significantly the exchange of information with, and between, academic and educational institutions in these regions.

Under the auspices of the NATO Science Programme, its Computer Networking Panel (called the Panel) has been one of the major supporters of academic networking in these regions, helping to create an appropriate National Research and Education Network (NREN) in most of the Newly Independent States. Recently it has been concentrating on the Southern Caucasus (comprising Armenia, Azerbaijan and Georgia), and Central Asia (comprising Kazakhstan, Kyrgyz Republic, Tajikistan, Turkmenistan and Uzbekistan). These countries are located on the fringe of the European Internet arena and will not be in reach of affordable optical fibre connections within the next few years. However, Internet connectivity via satellite is also an expensive, and therefore a scarce, resource for the science and education community in these countries. To alleviate the shortage of Internet bandwidth, the Panel has taken the initiative to launch the SILK Project with a grant to DESY in Hamburg, as the Western Co-Director, and the NRENs of the above eight countries.

With a limited budget of $2.5 million over the period 2001-2004 for this project, we are installing initially a VSAT system with the 5.6 m hub at DESY, and 8 VSAT Stations (2.4 m or 3.8 m) –– one in each of the above countries. This size of deployment was required partially for political reasons – in the paper we will give more details of our thinking. However we have also received a generous donation of a router, switch and 155 GB Content Engine at each site from Cisco, to connect the Earth Stations with their

NRENs. Moreover, several Non-Governmental Organisations (NGOs) are proposing to make additional investments in the SILK system.

Most similar projects start with NRENs, and the international bandwidth is an after-thought. Moreover the control is usually exercised on a strictly national basis. The SILK Network is an exception, and is more like GEANT in this respect; it is principally an international network, with a central Network Operating Centre; the interface to the NRENs is at a clear point of demarcation, where the SILK responsibilities end.

The SILK Network has been designed with good price-performance for the small number of Earth Stations envisaged. We use a SCPC technology to transmit from the VSAT Stations, and a common return channel. Moreover, there is a network cache, in the form of the Cisco Content Engine, at each VSAT Station. Since the cost of the receive and transmit channels differ in cost by only about 20%, this permits us to put in receive bandwidth only when it is required from the total usage of all the countries. While it is partly a political decision how much transmit capacity we provide for each country from the central SILK funds, it is a technical decision how much total receive capacity we provide. The ratio of the two depends partly on the efficiency provided by the cache, partly on the type of traffic, and partly on the degree of interaction required.

The siting of the VSAT Earth Stations is sometimes a political factor in the countries concerned. It has proved difficult to explain why, if we are guaranteeing to provide only 500 Kbps transmit and 2 Mbps receive bandwidth to a country, we insist on requiring Fast Ethernet speeds between the Earth Station and the routers. The reasons are, of course, because the cache will receive the total data in the SILK system, and may cache Web data destined for other sites; access to the cache may also generate substantial national traffic. It is necessary, therefore, to have intelligent filtering already near the Earth Station. However we need to control remotely the characteristics of the router and the cache; this is not a desirable provision to use in a large Earth Station complex run as the central satellite park of the telecommunications of a country (as is supposed to happen, for example, in Uzbekistan).

Even before we are fully functional, a number of NGOs are considering making additional investments. Since these are all at a rather delicate stage of negotiation at the time of writing this abstract, we will provide details only at the final presentation. Suffice to say that one organisation is considering providing an extra two Earth Stations, a second is considering providing five video conferencing terminals for distance education – one in each Central Asian republic. A third is discussing the provision of national connections to the SILK router for schools and libraries. A fourth would like to make the SILK Network the vehicle for its provision of access to digital libraries.

Not only is the satellite channel usage fairly sophisticated, so are the applications. For example, we have a steering group, which has a teleconference every two weeks. Most of this group use the normal audio-conferencing system used internally by Cisco with local number dial-in for the countries where Cisco has offices. In order to bring in some of the Partner countries, we use Voice/IP (VoIP), through a voice server controlled by UCL – with dial-out into the teleconference. Of course we keep sharp control of the way this can be used, to head-off criticism from the national Carriers of the partner countries. We are also planning to extend this usage to multimedia conferencing.

Most of the Panel's grants are fairly straightforward; a part-time consultant, and the NATO secretariat, can carry out their monitoring. The SILK Project is different. It needs considerable management skills to set up and control the project. It also requires

considerable technical activity to monitor performance, keep the system running, tune cache parameters, ensure Quality of Service, provide Web services and set up teleconferencing services. The Network Operations Centre is provided by DESY, through a subcontract with Moscow State University. The Panel is not permitted (by NATO rules) to provide much finance to non-Partner countries. For this reason we have secured a project from the European Commission the NRENs,. the SILK Project Operations Networking and GEANT Extension Project (SPONGE), to manage the project and to provide these additional services. This project runs up to March 2005 – roughly the end of the current NATO funding.

At the time of writing this abstract, only three VSATs are operational – in Georgia, Uzbekistan and the Kyrgyz Republic. However, all eight VSATs are scheduled to be operational before Q2 of 2003. We have a very flexible contract with EurasiaSat, who provides the satellite capacity. This allows us to increase capacity in small increments. At the time of writing, we are providing 1.5 Mbps of transmit capacity and 5 Mbps of receive capacity – but these figures will more than double by the end of Q2 of 2003.

The project is not only technical; one of our aims is to set up management, technical and user groups involving the Partner countries. Thus we have a SILK Board, with representation from the NRENs, the funders and the SPONGE project. We are starting user and technical groups on subjects of mutual interest – e.g., measurements, caching parameters, Quality of Service provision, and the needs of electronic libraries. By the time of the TERENA conference, we will have had our third SILK Board meeting, so that the pattern of management and technical activities should be starting to become clearer.

In the paper we will provide further technical details of the measurements done on the system, the services provided, and the gains achieved from some of the novel features such as multi-country caches.

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