GigaPort Next Generation Network

SHINING EXAMPLE OF VISION, COURAGE AND COLLABORATION

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PREFACE

GigaPort Next Generation Network

Shining example of vision, courage and collaboration

I visited SURFnet in 2007. I was impressed with the achievements and the impact this extremely fast network has on the international research community. SURFnet6 has to be the most important achievement. This research network combines familiar internet technology with optical connections. It gives us more capacity, security and reliability than is possible on the 'regular' internet. The Netherlands receives world-wide acclaim as well as envious looks for this hybrid network. During my economic missions abroad I readily and often point out to my conversation partners that the ICT infrastructure of the Netherlands is one the best in the world.

Our fast and secure network has become an integral feature of Dutch higher education and research institutions. We can now connect hospitals, university faculties and R&D departments in the industry over broadband for the exchange of large amounts of scientific data. We can also watch remotely 4K cinema images, for instance. Each of these achievements is the result of the GigaPort project (1999 – 2003) and its successor, GigaPort Next Generation Network (2004 – 2008), which we conclude now.

But more has been achieved. The Netherlands has built up a phenomenal track record internationally in the field of computer networking. The hybrid network concept of SURFnet6 has been adopted all over the world. This is partly due to the successive GigaPort projects and research that was conducted within that framework. It has gained the Netherlands the first place in the Earnest Foresight Study in 2008. The founding of the optical network node NetherLight in Amsterdam is another direct result of GigaPort. With Amsterdam Airport and the Rotterdam harbour we have been the physical gateway to Europe for decades. With NetherLight and the AMS-IX we now hold the world's largest internet node. Therefore we are now also the digital gateway to Europe! This situation makes our country very appealing for international companies, investors and scientists.

Digital infrastructures play an ever larger societal and economic role in the information society. Those infrastructures are converging: people can use the internet not only to mail and surf, but also to watch television and make telephone calls. In the future the internet will even bring many more areas together – from media and communication to energy, the environment, mobility, health care, education and housing. As is often the case, scientists and researchers of R&D departments of companies will pioneer new applications.

For me the conclusion of the GigaPort project is not an ending, but a launch pad to achieve new successes. At the end of last year ICTRegie presented the recommendation "Towards a competitive ICT Infrastructure for scientific research in The Netherlands" to my colleague Plasterk and myself. Together we are preparing a Cabinet Response in which we will indicate the direction in which the Dutch ICT research infrastructure will need to develop.

I am convinced of the necessity of continuing to strengthen the ICT facilities for science in the Netherlands. Only in this way can we ensure that the Netherlands remains an internet country, which will further increase our appeal to foreign companies.

Frank Heemskerk
Minister for Foreign Trade

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THE BEGINNING

Rolling out new fibres

A fair amount of digging occurred in many places over the past years to lay new fibres underground, in order to enable all institutions to make use of the fast and secure SURFnet6 network.

What went before...

The first GigaPort project, which had both a network component and an application component, ran from 1999 to 2003, as part of a stimulation initiative by the Dutch Ministry of Economic Affairs together with the Ministry of Transport, Public Works & Water Management and the Ministry of Education, Culture & Science. GigaPort became a splendid example of public-private collaboration between the government, industry and science. As a result, from the autumn of 2001 over 170 connected institutions with approximately half a million users had at their disposal what was then the fastest and most advanced operational research network in the world. The application component in the first GigaPort project was carried out by the Telematica Instituut.

That state-of-the-art network was not the only result. The first GigaPort project gave the Netherlands a global lead position in the field of networks, grids and e-science. It meant a great incentive for the knowledge and expertise in this field. Another side-effect was the fact that GigaPort stimulated the roll-out and use of broadband internet: in 1999 a first pilot was launched with fast ADSL connections to the home, and various local councils rolled out fibre-optic rings that benefited education as well. Last but not least the first GigaPort project was also a testbed for new applications. Among other things this yielded user-friendly solutions for storage, access and transmission of high-grade video images over broadband, and in television programmes over the internet. GigaPort also made a significant contribution to the development of DigiD, the login code for citizens used by the Dutch government.

The success of the first GigaPort project and the strong wish of all involved to continue its innovative power, led to a project proposal submitted by SURFnet to the government at the beginning of 2003 for the GigaPort Next Generation Network (NG). Later that year the project was awarded 40 million euros in the framework of the Bsik subsidy scheme. This investment incentive totalling 800 million euros was a successor of two previous subsidy initiatives, which were implemented in 1994 and 1998 as ICES/KIS-1 and ICES/KIS-2. In November 2003 37 out of 67 submitted Bsik proposals were awarded a subsidy; GigaPort NG was one of them.

GigaPort NG was launched in 2004. The aim of the five year project was the construction of a hybrid network that allowed various types of traffic streams over the same optical network, without any interference between them. SURFnet carried out the project, and 52 institutions joined the GigaPort consortium. Agreements on collaboration were also concluded with the universities of applied sciences. An industrial consortium was created through an open tender in 2004 to take on the construction and roll-out of the new network. Partners from science and industry supported the project by researching essential issues on hybrid networks.

GREAT FUN

Erwin Bleumink
director SURFnet

Erwin Bleumink, then a senior consultant at Stratix, was the project secretary of the network component of the first GigaPort project. With a small team he wrote the plan for a follow-up in the early spring of 2003. Thus he was involved in GigaPort Next Generation Network (NG) long before the start.

'A committee was appointed to think about a follow-up of the first GigaPort project already two years after its launch. I became the secretary of that committee,' Erwin Bleumink recalls. 'At first this primarily meant creating a broad outline and achieving wide support for the project. Eventually this needed to result in a concrete project plan. The definitive conditions for subsidy became known only a short time before the deadline for submitting the plan, which in our case had great consequences for the structure of the proposal. It made writing the plan a race against the clock. With three colleagues from Stratix we spent six weeks in an office at SURFnet in the winter of 2003. Each day brought new information which had to be processed quickly.'

SURFnet asked Bleumink to stay on as the project secretary of GigaPort NG. 'The job was great fun; it involved organising many new activities because GigaPort NG was managed fully by SURFnet - in contrast with the first GigaPort project. So I assumed additional activities: maintaining relations with external parties such as the subsidisers and the Steering Committee, and setting up a User Board. It was a challenge for me to take it all on.'

Bleumink's role in both GigaPort NG and SURFnet changed drastically when he joined the SURFnet Board of Directors in the summer of 2006. 'I remained involved in the fate of the project, of course: from the sideline at first, but much more extensively after Boudewijn Nederkoorn left. Then I became responsible for GigaPort NG's finances, dissemination and communication.'

> 'Writing the project plan was a race against the clock'

A VOTE OF CONFIDENCE

GigaPort NG was awarded 40 million euros by the Dutch government in 2003. This was preceded by an eventful and exciting time. Boudewijn Nederkoorn, former director of SURFnet, looks back.

Boudewijn Nerderkoorn
former-director SURFnet

‘The connected institutions for higher education and research have funded the operational costs of the research network from the launch of SURFnet in 1988. The government funded the required innovation without guarantees for success’, recounts Boudewijn Nederkoorn. ‘So that was the case again with the first GigaPort project, which came about as a result of the stimulation initiative by three Dutch Ministries. This financing model appeared to change when the government organised a kind of competition in 2002, the Bsik-subsidies. Instead of asking institutions to carry out projects that the government had defined, the institutions had to come up with research proposals, which the government subsequently assessed. The projects were to be entered by collaborations of research institutions and companies, and should contain a strong research component. That was a radical change, which did not fit our plans for a new research network very well.’

Firstly because the network that SURFnet provides is the infrastructure that other projects that are submitted will need to rely on. That does not go well together with a competition. The requirement to collaborate with market parties in the consortium provided complications as well. ‘It was diametrically opposed to our policy of public tenders’, explains Nederkoorn. ‘Complaints arose when we decided to come to an agreement with a specific supplier, and the government decided that we were allowed to issue a tender after all.’ Moreover, SURFnet is not a research institute, and it consequently failed to meet the requirement of carrying out scientific research. It was a complex situation. ‘We even proposed to position the network alongside the other projects in the Bsik framework and to finance it separately. But the Bsik framework had by then been submitted to Brussels for approval and could not be amended anymore.’

SURFnet then decided to use the possibilities offered by Bsik after all. The required scientific research would be carried out by the University of Amsterdam as the major partner. By then it was December 2002 and the deadline for submissions was in mid-February. Nederkoorn remembers: ‘We decided to invite all institutions for scientific education and research to become part of the required consortium . This would give us a sufficiently broad support as well as a long-term commitment by the participants. We needed to obtain the signatures of the chairmen of all the Boards during the busy period between Christmas and the end of January, and to help complete the internal decision processes in all those institutions before then. The SURFnet account advisors worked very intensively and highly concentrated. We were hoping that 20 institutions would join, but in the end there were 49. That was a fantastic achievement. And for us it was a vote of confidence from the institutions.’ NCF also declared its willingness to allocate financial support for the duration of the project.

The results of the ‘Bsik-competition’ were announced in September 2003. It turned out that nine ICT projects had been awarded subsidies, of which GigaPort NG shared first place with the VL-e e-science project. Instead of the requested 50 million euros GigaPort NG was awarded 40 million. ‘It meant we had to skip some parts of our plan. It was a pity, but not a disaster’, says Nederkoorn. ‘Getting together the required matching finances was a challenge, but we had a strong basis in the commitment from the 49 institutions. Later on the industrial partners showed willing to invest heavily themselves.’

> ‘We were hoping that 20 institutions would join, but in the end there were 49. For us that was a vote of confidence from the institutions.’

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THE SET-UP

Luuk Oostenbrink of SURFnet (middle)
'In the GigaPort project I was responsible for the technological coordination of the institutions' connections to the SURFnet network.'

Set-up GigaPort

GigaPort NG was launched in January 2004. The project, which ran for five years, consisted of two components: ‘Networks for Research’ and ‘Research on Networks’. In the first subproject the actual network was being designed and constructed. The second subproject, which was called Research on Networks, aimed at tackling research issues involved with building and managing a hybrid network.

GigaPort NG was a consortium in which 52 partners (universities, academic hospitals, research institutions) eventually participated, with Stichting SURF being the main contractor. The management of the project and its execution were the responsibility of SURFnet. For Networks for Research SURFnet was assisted by the Industry Partner, a collaboration of Nortel, Avici Systems and Telindus. The Research on Networks subproject was carried out by the Partners in Research.

The management of the new network was contracted out to the NOC Alliance. A User Board was established to involve the users in the design of future services. A Steering Group, advised by an international Scientific Advisory Committee, supervised the project on behalf of the Dutch government and the GigaPort consortium.

A PROJECT THAT WENT VERY WELL

The GigaPort NG Steering Committee supervised the project on behalf of the Dutch government and the GigaPort consortium. President Reinder van Duinen is of the opinion that the SURFnet project team put forth an excellent effort by completing the complex project in time and within budget.

Reinder van Duinen
President Steering Committee GigaPort NG

‘The societal acceptance of this huge investment was an important issue’

‘It is the task of the Steering Committee to regularly review the project plan against the developments in the real world’, Reinder van Duinen explains. ‘If there are discrepancies you want to know not only how they emerged, but especially what the project leaders are going to do about them. This remote supervision is undertaken four times a year; we want to know if what was agreed is being done, and if not what is being done about it.’

Looking back Van Duinen finds the most striking aspect of GigaPort NG that the Steering Committee hardly had to intervene. ‘The project went well technologically, financially and organisationally speaking. We had very few concerns. An important issue for us was the societal acceptance of this huge investment – including the contribution from the partners on the order of 85 million euros.’ For this reason much was done to convince parties outside the education and research communities to utilise the possibilities of the new network.

And they did, despite the fact that there was no initial financing from GigaPort for such advanced applications. Van Duinen mentions 4K-cinema as a good example of an application for which the speed of the network is crucial. In 2007 music fans in California could enjoy a live performance of the opera ‘Era la Notte’ in Amsterdam at the Holland Festival, thanks to a lightpath between Amsterdam and San Diego.

The national breast cancer population screening is an application where security and privacy are of major importance. The use of SURFnet6 created an excellent solution for the secure distribution of digital X-rays to the assessing radiologists.

The appointment of an international external committee with the required technical expertise to advise the Steering Committee in this respect was special for GigaPort NG. Van Duinen considers it a very sensible addition. ‘It helped us complete our tasks better. Not only because of the strong technological component of the project, but also to keep in touch with international developments.’

In all Van Duinen is impressed with how the GigaPort NG project went. ‘Again it became clear that SURFnet as an organisation is excellently capable of completing such complex projects in time and within budget. That is worth a compliment.’

GREATER THAN THE SUM OF THE PARTS

Kees Neggers
general director SURFnet

SURFnet was responsible for managing the GigaPort NG project. Kees Neggers, general director of SURFnet and also overall project leader of GigaPort, is satisfied with the synergy between the two GigaPort NG subprojects.

'Already in 2001 it was starting to dawn on us that we would need a fundamentally different network architecture to remain of service to data-intensive areas in science such as astronomy and high-energy physics', says Kees Neggers. 'The architecture of SURFnet5, the existing network, split the network traffic into packets. Traffic controllers, the routers, sent them to their destination. It was not technologically and economically feasible to meet the ever growing demands of our large-scale users with routers. So our idea was to create direct connections, without routers. In the new network architecture the large-scale users were given their own fast lane, the lightpath, with their own private junctions. And since no other traffic can join it the connection is a very reliable solution, and an extremely secure one at that.'

The construction of a hybrid network, which supports both regular internet traffic and lightpaths, took place in the Networks for Research subproject. Neggers: 'This part of GigaPort NG was carried out by SURFnet together with the Industry Partner. The basis for this was the existing fibre-optic network, the user rights of which we had already acquired in the first GigaPort project.' SURFnet6 became operational in the summer of 2005. By the beginning of 2006 the first 10 Gbit/s lightpath was established between the Rijksuniversiteit Groningen, SARA Computing and Networking Services in Amsterdam, in the framework of the LOFAR project. Things moved fast after that: the 220th lightpath was delivered by the end of 2007. The 160 connected institutions for higher education and research showed an interest in lightpaths that was many times greater than was expected, even for applications that had not been foreseen. 'The lightpaths sold like hot cakes. They turned out to be more than a solution for scientific data traffic; they were also ideal for connecting locations of universities of applied sciences and academic universities over broadband', says Neggers. 'Using an Optical Private Network (OPN) they can set up one LAN-environment covering multiple locations, and manage it far more simply. We had not expected that OPNs would be the killer application of SURFnet6.'

In order to stimulate the usage of lightpaths by researchers, the 'Enlighten Your Research' competition was launched in 2007 in collaboration with NWO. Neggers: 'We observed that too little use was made of them in the academic environment. It turned out that the main obstacles were the financing and the roll-out of a lightpath within a university. The competition was meant to support individual researchers, and to get them thinking about the benefits of lightpaths for them.' It was a success: fourteen detailed proposals were submitted, out of which five were awarded with a lightpath and 20,000 euros in June 2007. The proposed applications included a wide range of science areas and varied from genome-wide analyses to intelligent CCTV-monitoring, and from the distribution of radiology images to an online computer cluster. Lightpaths can be used not only to share equipment or data over the network, but also for group communication, or for making back-ups at different locations. A new edition of Enlighten Your Research will be launched in 2008-2009. The prize this time is a dynamic lightpath, which can be set up flexibly between various locations.

The second GigaPort NG subproject, the 'Research on Networks' research project, was carried out by the Partners in Research. 'The Bsik framework aimed to stimulate the collaboration between research institutions and businesses in order to achieve high-grade networks in the knowledge infrastructure', says Neggers. 'The emphasis of the assessment of the submitted proposals was on the scientific quality. Since SURFnet is not a research institution, we relied heavily on the Universiteit van Amsterdam, which took on major part of the research as well. Though this subproject came about more or less of necessity, and was carried out without direct SURFnet involvement, it turned out to provide a valuable synergy between the research institutions and our organisation. The 'Research on Networks' and 'Networks for Research' subprojects have strengthened each other and what they have delivered is greater than the sum of the parts. It is an experience that we will certainly make use of in the next project. For me GigaPort is a shining example of what can be achieved with vision, courage and collaboration.'

> 'GigaPort is a shining example of what can be achieved with vision, courage and collaboration.'

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THE TENDER

Paul Wielinga of SARA Computing and Networking Services (middle)

'The NetherLight international optical network node is located at SARA. The first successful experiments with lightpaths took place in 2002 between the brand new NetherLight node and StarLight in Chicago. Together with Telindus SARA Computing and Networking Services is responsible for the management of SURFnet6 en NetherLight.'

SURFnet6

On 23 January 2006 the then Minister Brinkhorst of the Ministry of Economic Affairs officially launched the new ‘highway’. Two years of hard work preceded this festive occasion. The project started with the tender which led to the selection of an Industry Partner. The main contractor was the Canadian company Nortel, which provided the advanced equipment together with Avici Systems. Network and system integrator Telindus provided the installation. Juniper Networks took over the role of Avici after they had withdrawn from the market for core routers. Nortel was also a participant in Research on Networks of GigaPort NG. The management of SURFnet6 was the responsibility of the NOC Alliance (a collaboration between Telindus and SARA Computing and Networking Services), which was also contracted in a tendering procedure.

> ‘The concept for the hybrid network has proved itself and is now being adopted all over the world’
>
> **Erik-Jan Bos**

COLLABORATION IS NECESSARY

Erik-Jan Bos
director SURFnet

The creation of a national infrastructure according to a completely novel concept is not something SURFnet can do by itself. It requires collaboration with industrial partners. A consortium under the leadership of Nortel came out on top in the European tender.

Erik-Jan Bos, GigaPort NG project leader, summarizes the need for close collaboration with industrial partners: ‘We harboured an extremely high ambition in wanting to create a hybrid network. This means that you need to partner up with global players. As a manner of speaking you need to sit down with them in their kitchen, rather than in their restaurant. We talked about our vision with a lot of organisations, not only with suppliers, but also with our sister organisations abroad.’

SURFnet started with the European tender even before the official launch of GigaPort NG. Bos: ‘The first step in 2003 was to make it generally known that we were looking for a partner for the design, construction and maintenance of the new concept for a hybrid network. Because many aspects were still undetermined we wanted to do business with a single party. This means we needed a main contractor who could present a complete proposal.’ Seven consortiums turned out to be interested, four of them were invited by SURFnet to enter the next stage, the actual selection. ‘Then we described our ambition in more detail. This involved extensive discussions with key figures from the consortium participants.’

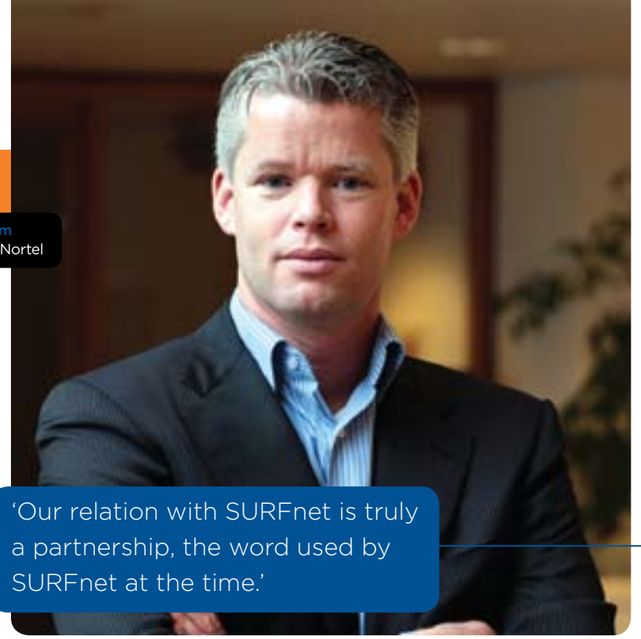
Criteria for awarding the tender were the consortium’s readiness to meet the challenge, their ability to work within the available budget, and good chemistry with SURFnet. ‘It was exciting to make a choice, because they were four powerful consortiums’, Bos remembers. ‘Nortel, Telindus and Avici Systems presented the most far reaching proposal that fit within the budget, and so they came out on top. Their long-term vision proved parallel to ours. It was the best possible match.’

After the choice was made for this Industry Partner the network was designed in detail and the first orders were placed. The equipment for the test network was delivered and installed by the end of 2004, and then the technology could be tested. Because Avici announced in 2006 that they were withdrawing from the market for network routers, the four core routers at SURFnet were replaced by routers from Juniper Networks in 2008. ‘The collaboration with the consortium has been going very well up to this day’, says Bos. ‘that is special in the fast changing world of datacommunication. I am proud of what we have achieved together. The concept for the hybrid network has proved itself and is now being adopted all over the world.’

CLOSE COLLABORATION

Paul van der Vorm
accountmanager Nortel

The consortium consisting of Nortel, Telindus and Avici Systems was responsible for the design, roll-out and maintenance of the new network. Paul van der Vorm, account manager at the Dutch branch of the Canadian Nortel, considers GigaPort NG a very successful project.



‘Our relation with SURFnet is truly a partnership, the word used by SURFnet at the time.’

SURFnet is a special customer, says Paul van der Vorm. ‘When other customers introduce a new network, it will last them for years. SURFnet on the other hand innovates continually. As a supplier of network equipment you need to be able to participate in the development through your solutions.’ When GigaPort NG came into the picture in the course of 2003 Van der Vorm was business development manager of optical products at Nortel. Soon afterwards he became account manager for SURFnet, and he became involved in the project for the entire duration of GigaPort NG.

‘Competing in a European tender was not new to us, but what was new was that this customer had its own clear ideas on the future of optical networks’, Van der Vorm explains. ‘Fortunately this vision matched our own long term plans excellently. But as a supplier it is essential not just to understand what your customer wants at a technical level, but also to have a clear view of what SURFnet expected from us as a partner. Apart from supplying products and services SURFnet wanted us to conduct research and development and to share the risks.’ This was the message that Van der Vorm brought back to the Nortel organisation.

In Canada he managed to convey his enthusiasm to the chief technology officer, the R&D people and the product team. As SURFnet wished to outsource the supply of the equipment, the installation and the maintenance to a single party, Nortel sought collaboration with Telindus and Avici Systems. They already had some experience with system integrator Telindus; it had the manpower and the quality within their organisation to turn this into a success. Just at that time an alliance had been forged between Nortel and Avici Systems, the supplier of the core routers. The companies combined forces. ‘We spent quite a few long nights in producing a proposal that had the best possible fit’, Van der Vorm remembers. ‘It was a great moment when SURFnet called me to say they wanted to do business with us.’

Van der Vorm looks back on the past five years with much satisfaction. ‘Our relation with SURFnet is truly a partnership, the word used by SURFnet at the time. Though we met quite some challenges along the way, we solved everything in close collaboration. SURFnet visits Nortel in Ottawa at least once a year. There we have joint open and interesting discussions that are brimming with energy. This is proof that the collaboration is very much alive at both parties.’ The advantages are more than clear to Nortel, Van der Vorm concludes. ‘SURFnet has an outstanding reputation both in the Netherlands and internationally. The joint research is to both our advantage. And SURFnet is an excellent reference for us.’

A TRUE PARTNERSHIP

Kris Verheye
director Telindus

ICT service provider Telindus is not only part of the Industry Partner, the company is also responsible for the management of SURFnet6 together with SARA Computing and Networking Services. Kris Verheye, director of Telindus in the Netherlands, explains what the collaboration means for his company.

‘We have a true partnership with SURFnet, and we are really satisfied. One of the reasons is that we have pleasant personal contact with SURFnet staff at all levels, from operations and engineering to the management. Their open company culture completes the collaboration.’

Kris Verheye has had many dealings with SURFnet since he became director of Telindus Nederland in 2006. He is very positive about the manner in which SURFnet interacts with Telindus as a supplier. And especially on the technical aspects of the collaboration, in which Telindus is responsible not only for the installation, transition and implementation of the new network, but also for its administration.

When Verheye came into contact with SURFnet for the first time, the quality of Telindus’ operational services was not at the level required by SURFnet. He recounts: ‘At such moments SURFnet is a demanding customer – and rightly so. I really appreciated their willingness to think along with us about solutions. I learnt a lot from that period. Fortunately we were able to improve the situation quickly. I was really content with SURFnet’s satisfaction.’

‘Our engineers always work on the very latest developments because SURFnet wants its research network to be continuously in the lead’, says Verheye. ‘That leading edge technology is a tremendous challenge for our engineers and it keeps them motivated. Moreover it is a collaboration in which SURFnet and Telindus complement each other superbly. SURFnet has the technological knowledge to be able to be a global leader, but it lacks the manpower to carry out the work. We can provide it.’ This interaction has given Telindus high profile both in the Dutch market and abroad. ‘Of course that helps in acquiring new business.’

‘SURFnet is a demanding customer – and rightly so’

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NETWORKS FOR RESEARCH

Henk Dijkstra of Utrecht University

‘Using a 1 Gbit/s lightpath and a tiled panel display (TPD) of four times four screens I can now visualise gigantic amounts of climate data in my office. We can simultaneously watch simulations and study phenomena as a group by using a lightpath. New ideas for research emerge on the basis of our discussions. It is great to be able to do this as a group.’

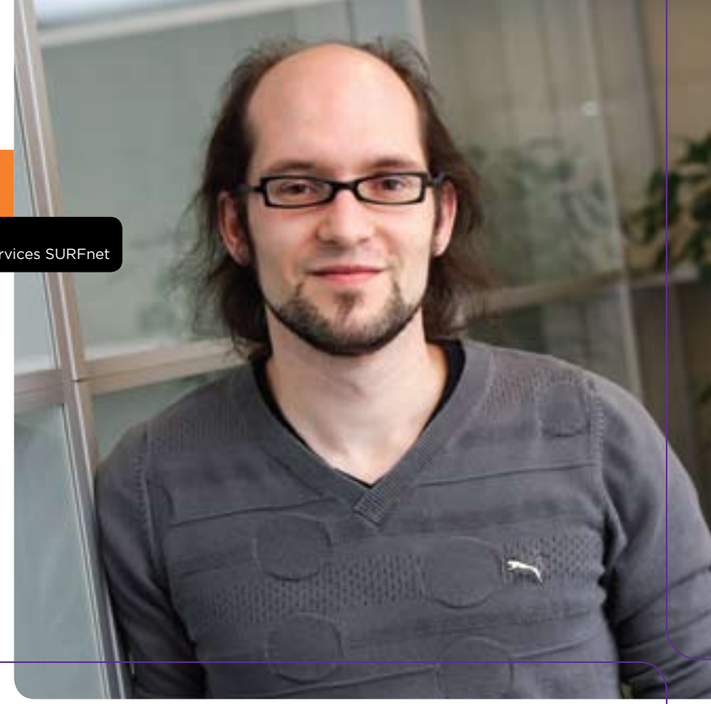
THE ROLL-OUT

Construction, delivery and roll-out

The construction of the hybrid network and the roll-out to all 160 connected institutions took place in 2005 and 2006. It was a gigantic operation which involved a large number of parties. SURFnet worked together with the institutions, the Industry Partner and the NOC Alliance. The then Minister Brinkhorst of Economic Affairs launched the new 'highway' officially in January 2006. The transition to SURFnet6, which in some cases was more complex and had a larger impact than expected, was completed in the summer of 2006. Its predecessor, SURFnet5, was finally taken off the air on 1 July of that year.

A MAJOR OPERATION

Bram Peeters
manager Network Services SURFnet



The hybrid SURFnet6 network has an entirely new architecture. One and the same optical highway caters for separate lanes for the regular internet traffic and for large-scale users. A great quantity of equipment was replaced at SURFnet in order to make this happen. Moreover the configuration at the connected institutions was changed. Bram Peeters, head of SURFnet Network Services, was closely involved.

'It was a major operation, from which we learnt a great deal', Bram Peeters looks back on the transition to SURFnet6. 'The blueprint of the new network was based on using the existing fibre-optic rings, the long-term user rights of which we had already acquired in the first GigaPort project. The foundation had been laid already. The Industry Partner completed our blueprint with equipment, and a transition plan was made in collaboration with the Network Operations Center. In all, a team of at least 25 people were involved.'

The transition had consequences for all 160 institutions. For this reason SURFnet organised information sessions for the contacts at the institutions. The roll-out was a more or less complex operation, depending on the institution's usage of the network and its existing equipment. For the majority of the institutions only minimal changes were necessary.

'Those who are ahead of market developments are among the first users of the required equipment,' says Peeters. 'And though the technology had been tested extensively, we still encountered all sorts of unexpected problems. With that knowledge we extended the network readiness check for the institutions, for example, to be able to determine with certainty that all was ready for their transition, both at their side and ours. Fortunately SURFnet is good at solving incidents; the roll-out certainly was not uneventful.'

The delay of the roll-out necessitated SURFnet5 and SURFnet6 to coexist for longer than had been foreseen. The fact that some leased lines used by SURFnet5 could not be assumed to be available after 31 December 2005 further complicated things. 'We worked very hard for six weeks to make it possible for SURFnet5 to run on top of SURFnet6. This was relatively simple to achieve technologically due to the extensive bandwidth of SURFnet6.'

> 'It was an operation from which we learnt a great deal'

EFFORTLESS TRANSITION

Bert Kremer
head of ICT ArtEZ

In 2005 ArtEZ Hogeschool voor de Kunsten was a frontrunner among the institutions that migrated to SURFnet6. Head of ICT Bert Kremer was the project leader responsible for the execution of the work.

Bert Kremer reports: ‘We had started to work on a new design for our network environment already in the spring of 2005. ArtEZ Hogeschool voor de Kunsten has 850 staff and 3,000 students dispersed over three cities. It offers study programmes in the visual arts and design, theatre and music. Their interests and requirements in the field of ICT are quite diverse. A Finances Department or P&O set totally different security requirements for the network than students developing games. The latter group need a lot of freedom, while the first want airtight security. For this reason we arrived at a design with five separate virtual LAN-environments.’

The project that implemented this design and at the same time allowed the transition to SURFnet6 was launched in August 2005. The arrival of SURFnet6 made it possible to consolidate the servers, allowing for more efficient management from our Arnhem location. ‘It seemed ever so practical to combine the execution of all the work in one project’, says Kremer. ‘We replaced all network switches and routers in order to be able to handle the Gigabit network traffic, and at the same time we switched to equipment from a single supplier. Everything was ready at the beginning of February 2006 and our transition as the fourteenth institution out of 160 was effortless. There were some teething problems with the redundancy of the network, but that was it.’ Kremer is referring to the redundant connections with SURFnet6, which could not be accomplished in the first months. Fortunately there were no calamities during that period. The problem was solved in the course of 2006, so ArtEZ did not experience any adverse effects from a broken cable near Amersfoort at Pentecost Sunday and Monday 2008. ‘Our network has been stable for three years.’

The only thing that Kremer thought was less than ideal was the communication with the Network Operation Center. As a result of the experiences of ArtEZ, among others, SURFnet has drawn up an extensive checklist. In all, Kremer is highly satisfied with SURFnet6: ‘It is much more affordable and the bandwidth is considerable. We previously had 2 to 10 Mb/s lines at our disposal between our eight buildings in Arnhem, Enschede and Zwolle; now we have a 1 Gb/s connection everywhere. That is ample: only during the exams and assessments does our usage reach 700 Mb/s. However, the data volumes in art education are on the increase, due to the use of HD and Blu-ray. The network traffic will also get more intensive with the expected introduction of telephone traffic on the basis of Voice-over-IP. But for now we have ample bandwidth to last us a long time.’

> ‘SURFnet6 has ample bandwidth to last us a long time.’

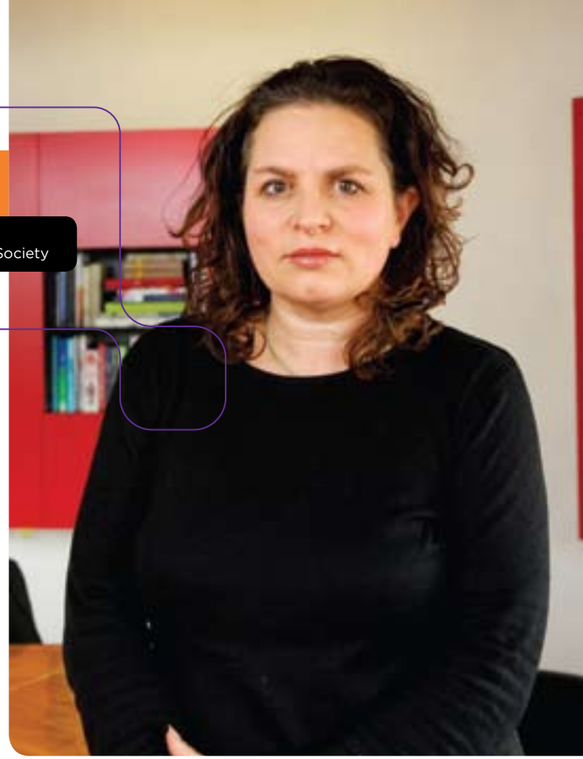
THE USAGE

‘4K-cinema seems more real than life itself: it is so sharp that the eye can hardly take it in.’

Marleen Stikker

SUPER-REALISTIC IMAGES

Marleen Stikker
director Waag Society



‘CineGrid is an international collaboration between academic researchers and creatives, aimed at the production, transmission and projection of 4K-cinema. There are currently 4K-facilities in five places in the world. Amsterdam is one of them – thanks to SURFnet, SARA, the University of Amsterdam and Waag Society. SURFnet asked us to bring together the worlds of scientific and the creative minds in the Netherlands. After all, to realise 4K-cinema you need not only state-of-the-art technological knowledge and equipment, but also the imaginative power of the creative industry. Only then can one arrive at new types of content and new modes of use.

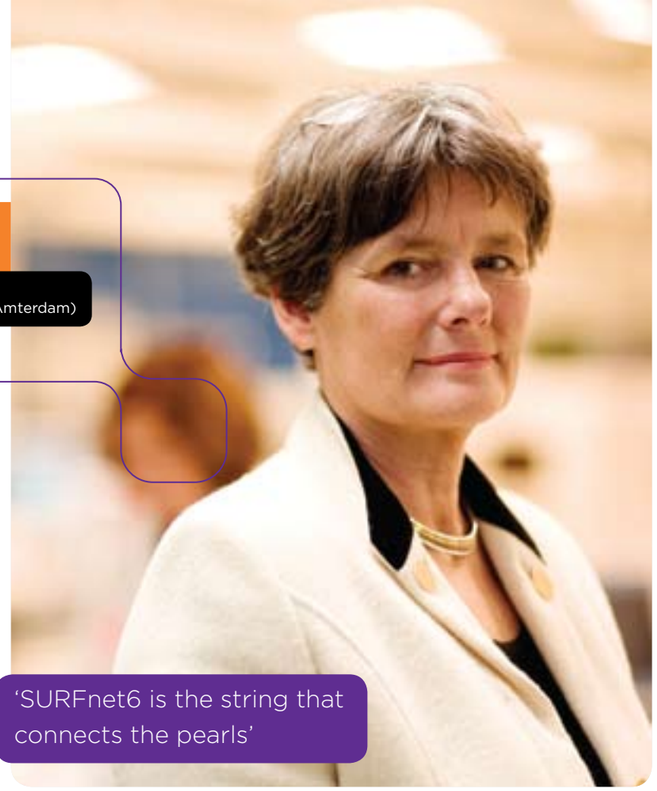
The quality of 4K-cinema is super-realistic. The image is larger and sharper than reality. It is four times as good as HDTV and sixteen times better than regular TV. It offers many technological challenges as well as all sorts of new possibilities. Like experiencing special moments from a different location. During the Holland Festival 2007, for instance, hundreds of people in Californië experienced live the performance of soprano Anna Catharina Antonacci in the Amsterdam ‘Muziekgebouw aan ’t IJ’. They told us that the audiovisual quality was so good that they had the feeling of actually being present. CENIC, Corporation for Education Network Initiatives in California, awarded the innovative character of this experiment with an Innovative Networking Award for Experimental / Developmental Applications in March 2008.

4K-cinema also offers interesting dramaturgical possibilities. In the Netherlands there is a blossoming community in the field of LiveArt, a new art form positioned between media and theatre. Waag Society ran the Connected! programme for this target group between 2003 and 2005. It turned out that 4K-images are the only realtime images of sufficient quality, which really requires lightpath connections. 4K-cinema seems more real than life itself: it is so sharp that the eye can hardly take it in. Any form of flicker that the brain has become used to is absent.

The use of lightpaths offers the possibility to deploy the creative industry’s expertise internationally. In the Netherlands we are very good at making animated movies, games, interactive TV and cross-media concepts. You can imagine that we could work more distributed globally, so we could produce an animated movie in the Netherlands, and the sound could be edited in Florida. This will require huge bandwidths. A beginning has already been made: an international CineGrid node in Amsterdam. A three year programme is currently being devised to deliver facilities for remote collaboration. We do this together with a large number of parties in the Netherlands and abroad.’

BIOBANK CONNECTIONS

Louise Gunning-Schepers
chairman of the Board AMC (Amterdam)



‘SURFnet6 is the string that connects the pearls’

‘The eight University Medical Centres (UMCs) give tertiary health care to all patients in the Netherlands that suffer from a large number of specific disorders. By linking the clinical data and the genetic information on all those patients one can conduct outstanding research. An example is research into the relation between genetic make-up and the chances of success of a certain treatment.

The eight UMCs are a close network, like a string of pearls. Each UMC is an initiator for a specific disorder: Leiden for rheumatism, Rotterdam for leukaemia, Amsterdam for chronic intestinal diseases, etcetera. The initiator has devised a system for a databank with clinical data and a biobank with DNA material for that disorder. The other UMCs follow this standard for their patients with the same disorder. All data are stored in their own location.

The anonimised data can be combined into a single research databank, but only when someone wants to carry out specific research. Then it becomes relatively simple to make a selection, for instance of all female patients suffering from rheumatism who have not been treated with medication X and of whom biopsies have been taken from the joints. This kind of facility requires a lightpath connection between the UMCs, not only because of the large amounts of data – MRI scans, CT scans and DNA sequences – but also because the data transport needs to be absolutely secure. The lightpath is the string that connects the pearls.

In 2006 we began the roll-out of the lightpaths, which involved negotiating agreements on the collection and storage of the data. Moreover we needed the consent of the Medical Ethical Committee. We were able to include data on the first patient in a biobank in December 2008. It is developing rapidly now that we are adding data to the biobanks from eight UMCs. We are also researching the possibilities of how to add existing data and existing DNA material according to the standard that was laid down.

Thanks to the lightpaths, the Netherlands is the first country that can gather data in this manner to form a single virtual national biobank, in which clinical data on the progress of the disorder and the result of the treatment are linked to data about genes, proteins and metabolites. It may sound simple, but it is very hard work to get this done. On the other hand we can look forward to the first publications, in a year or two. Other countries look on in envy. To be the first to be involved means to be the first to discover the most interesting relations between genetic and clinical information.’

FINANCIALLY APPEALING NETWORK

Rens van der Vorst
ICT coordinator Fontys Hogescholen

‘SURFnet6 gives us ample growth opportunities in services for education’

‘Fontys Hogescholen is one of the larger institutions in higher education in the Netherlands. We have 37,000 fulltime students, 6,000 staff and locations in most large cities in the south of the country. Since 1 July 2006 we have been making use of a set of lightpaths to connect these cities through an Optical Private Network (OPN).

Even before the arrival of SURFnet6 Fontys Hogescholen had moved from a distributed to a centralised design of its ICT environment. Two shared service centres were set up in Eindhoven in 2005, and all local servers were moved there. At that time the locations were interconnected via 100 Mb/s lines leased from a commercial provider. Right in the middle of the transition stage we learnt of the possibility of an OPN via SURFnet6. It was an easy choice for us.

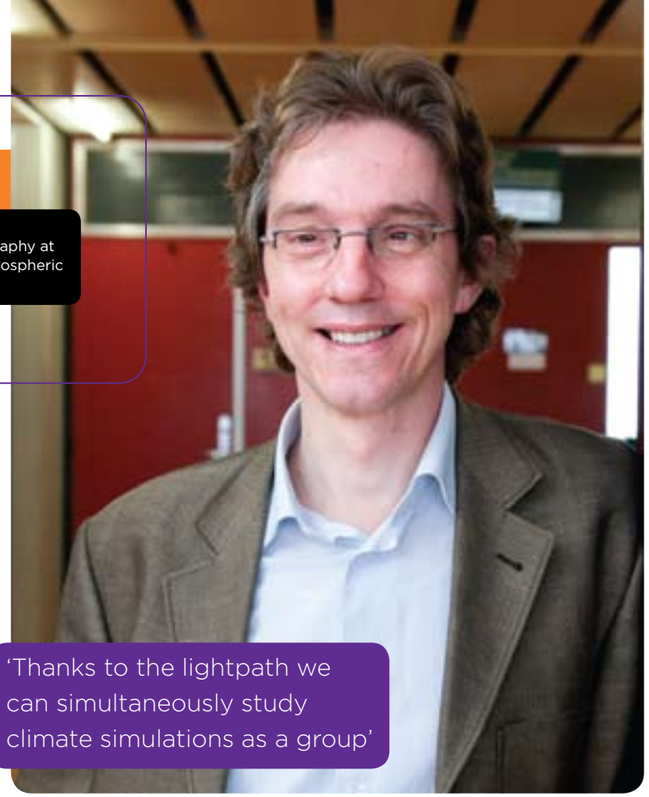
First of all it cut our expenses by half. The links via SURFnet6 also meant that we no longer needed any separate telephone and data lines. We were able to reduce the two connections to just one, because an OPN makes use of a point to point connection. And the agreements with SURFnet regarding availability are many times better than those offered by our previous supplier. The lightpaths have a redundant configuration in order to minimise the impact of any calamities. Our 45,000 users do not even notice when one connection fails.

Moreover it gives us ample growth opportunities in services for education. The current bandwidth of SURFnet6 will last us for the coming years in the fields of video telephony, video conferencing and remote classes using streaming video. Teachers can start doing a lot more with multimedia content now, because the bandwidth is at their disposal.

The great advantage of the current centralised model of Fontys is the drastic reduction of the total costs. Staff mobility is no problem. They all log on to the same central servers. This also means that, say, a printing task of a staff member in Venlo is sent to the server in Eindhoven via the OPN, and is then sent back to the printer in Venlo. This does not produce any noticeable delays. I sometimes hear from other universities of applied sciences that they fear loss of performance; but there is no need for that.’

VISUALISED CLIMATE MODELS

Henk Dijkstra
professor of Dynamic Oceanography at the Institute for Marine and Atmospheric Research, Utrecht University



‘Thanks to the lightpath we can simultaneously study climate simulations as a group’

‘Among other things climate research is performed on the basis of models, which include representation of the oceans’ circulations, the presence of clouds, the land surface and the radiation balance. The ocean and the atmosphere are divided into three-dimensional areas, the so-called grid boxes. Reducing the size of the grid boxes makes the models more finely meshed. This gives us a better resolution and allows us to look at more details, and that leads to better projections of our future climate.

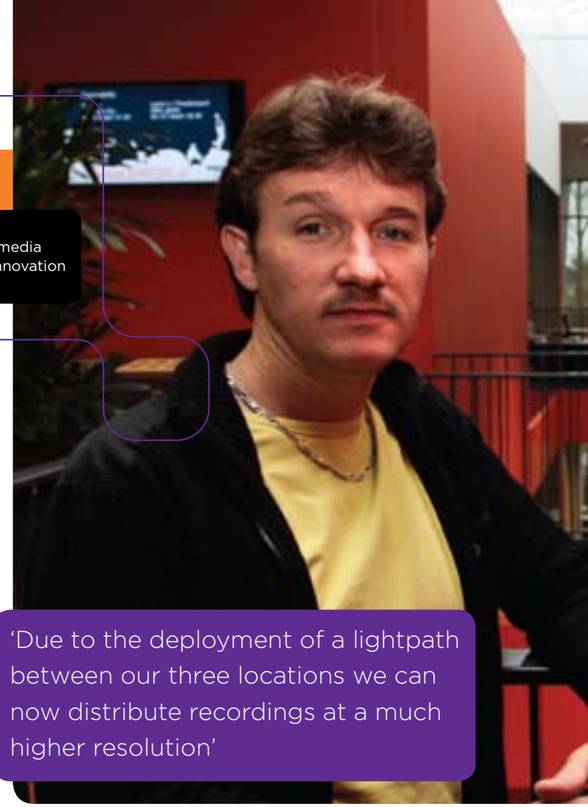
The calculations involved in climate models typically take times in the order of several months. One requirement besides ever faster computers is decent storage capacity. In our last project we produced 50 terabytes of data, which comes down to 10,000 DVDs. Those data were transported from the supercomputer in Stuttgart to SARA in Amsterdam, where we can analyse them. My work station is in Utrecht, so the new option of remote analysis is very convenient. Needless to say I am really happy to have won a lightpath in the Enlighten Your Research competition of NWO and SURFnet.

Using this 1 Gbit/s lightpath and a tiled panel display (TPD) of four times four screens I can now visualise gigantic amounts of data in my office. The ground work, the processing of the data and the creating of the images is done in Amsterdam. Pixel by pixel the graphic images are subsequently sent to Utrecht over the lightpath, and are shown on the 16 screens. Establishing the lightpath and the TPD configuration took its time. We managed only when we found someone who could spend enough time to achieve this. Utrecht University and SARA did an excellent job supporting the project, especially Utrecht University, because the optical fibre had to be extended to my office in our building.

As a group we can simultaneously watch simulations and study phenomena by using a lightpath. For instance we recently studied what happens when the quantity of freshwater in the North Atlantic Ocean increases strongly due to the melting of the Greenland Ice Sheet. In order to research the climate’s global response to this change of the ocean’s circulation, we investigate such matters as where the temperature drops fastest and how it affects the sea level. As we do this together we can react immediately to the images. New ideas for research emerge on the basis of our discussions. It is great to be able to do this as a group.’

MULTIMEDIA EDUCATION

Gert de Heer
operational Coordinator Multimedia support in the Learning and Innovation Centre, Avans Hogeschool



‘Due to the deployment of a lightpath between our three locations we can now distribute recordings at a much higher resolution’

‘Since Avans Hogeschool has made use of SURFnet6 we can do a lot more with video. The deployment of a 10 Gigabit lightpath between our three locations in the cities of Breda, Tilburg and ‘s-Hertogenbosch allows us to distribute the recordings at a higher resolution than used to be possible. The opening of our new building in Breda in December, for instance, could be watched live in our entire universities of applied sciences via a multicast 8 Mb/s videostream. Until recently, such high-quality recordings could only be distributed on DVDs.

In Breda, Tilburg and ‘s-Hertogenbosch we set up multimedia zones, which include a studio, a direction room and multimedia labs. Students and teachers can go there for instance to edit raw video recordings into a swanky end product. The ten multimedia support staff of the Learning and Innovation Centre (LIC) provide hands-on support. Students are increasingly required to demonstrate the competences they have learnt while working on the job using video recordings. They can do the final editing in a multimedia lab and hand in the result through Blackboard, our electronic learning environment.

A number of web classes was produced in our professionally equipped studio for the physiotherapy education programme discussing muscular strength, muscle physiology and motor system. Students can download those classes, taught by their own teacher, and watch them on their pda, iPod or smartphone whenever and wherever they want. The recordings are also made available in a streaming version through SURFmedia.nl. We use a green screen for the recordings in the studio. The green screen is a background into which you can later edit a PowerPoint presentation or animation.

At the request of physiotherapy students a supporting video environment has been equipped for learning mobilisation techniques. It turned out to be very tricky to learn from lecture notes which manipulations are required to mobilise joints such as the shoulder or the pelvis. The students can watch those recordings as often as they like.

A testbed project in the field of embedded systems is being prepared in collaboration with Hogeschool Zuyd, the industry in the Netherlands and Belgium and with European support. Using high-quality video conferencing those involved, i.e. students and companies, can have a remote look in the laboratory for embedded systems at Avans Hogeschool, for instance. This is similar to how students of medicine can watch a surgical procedure remotely. This is another thing that is not easy to achieve without lightpath connections.’

5

RESEARCH ON NETWORKS

Cees de Laat of University of Amsterdam

'I am very enthusiastic about the large research component of GigaPort Next Generation Network. GigaPort has given the Netherlands a lead position in the field of network research. It is an excellent environment for trying out ideas about future internet usage.'

THE RESEARCH

Lightpaths explained

In regular internet traffic all data are traditionally split into packets, which are all inscribed with the address of their destination. The traffic controllers in the network, the routers, determine at each step what is the best next route for each data packet to reach its destination. Many traffic streams are combined in this manner on one and the same path. This is effective for the transport of relatively small amounts of data from many different users, but it is a cumbersome and expensive method for large data streams from a single user between previously established fixed points in the network. Even in this case the route for each packet will need to be assessed in each of the routers. Moreover this process requires many parallel lines, and therefore additional routers. There is a limit to what can be done in this way. Eventually just adding extra routers would not be sufficient to compensate for the growth in network usage, and the large data streams would greatly interfere with the smaller ones.

The solution was found in an optical network model with different layers, in which the various sorts of internet traffic can be streamed independently of each other. Direct optical connections, the lightpaths, can be established for transporting large amounts of data. The traffic does not need to pass through routers en route, because a lightpath has only a single user and the termination points are known. This makes the transport through lightpaths more secure, and it is kept from interfering with other network traffic. Lightpaths can be established for longer periods of time, but they can also be set up dynamically, similar to setting up a telephone call. Through the arrival of lightpaths, large-scale users and regular internet traffic now have separate lanes on one and the same (optical) 'highway'.

Research on Networks

SURFnet collaborated with about a dozen research institutes and suppliers in Research on Networks in order to extend the functionality of the hybrid network and to support the institutions in using lightpaths. Originally there were three Partners in Research: University of Amsterdam, Telematica Instituut and TNO ICT. Other consortium members joined later, including the technical universities, the Industry Partner and the NOC Alliance.

The research focused on five areas: optical networking technologies, high-performance routing and switching, management and monitoring, grids and access, and testing. Due to the close collaboration the developments ensuing from the Research on Networks programme could be promptly introduced and used in Networks for Research. Examples include an open source toolkit for the management of hybrid networks, the Spotlight network monitoring toolkit, the Dynamic Resource Allocation Controller, and a Network Description Language that facilitates multi-domain lightpaths. And dozens of publications appeared in international journals.

LEAD POSITION FOR DUTCH NETWORK RESEARCH

Cees de Laat
senior university lecturer and leader of the System and Network Engineering group of the University of Amsterdam

Research and development are essential in managing and monitoring a hybrid network and optimising the use of domestic and international lightpaths. From the beginning an important part in Research on Networks was played by Cees de Laat, senior university lecturer and leader of the System and Network Engineering group of the University of Amsterdam.

'The University of Amsterdam was one of the three Partners in Research when the GigaPort Next Generation Network started. Even before then I was involved in outlining the research plan in order to make it not only technically meaningful, but also scientifically sound. To my estimation my group did 50 percent of the research when the plan was approved', Cees the Laat summarizes his involvement in Research on Networks. Research on Networks was not exclusively conducted in the Netherlands, the collaboration extended to research groups at the University of Illinois and Northwestern University in Chicago, Nortel in Ottawa, the Canadian network organisation CANARIE, the University of California in San Diego and Keio University in Tokyo.

It all started with outlining a shared frame of thought. This model was to clarify that a network was required that consisted of multiple layers [see inset]. 'In order to underpin this requirement we drew up a graph with three types of network usage and their projected growth', De Laat explains. 'That usage varied from ordinary internet traffic to demanding scientific applications, such as the exchange of large amounts of data between telescopes, or between high-energy physicists. Our graph became known world-wide as the ABC slide, because it made it very clear what the advantages are if you can route several types of traffic through various layers of one and the same network.' The idea for such a multi-layered network produced a large number of research questions, which were divided into five themes: optical networking technologies, high-performance routing and switching, management and monitoring, grids and access, and testing.

De Laat mentions a few examples of research questions that he and his group addressed. ‘Just like in a subway system there are various ways to get from A to B. So you need a map, a topology, which moreover needs to be suitable for use by several organisations from all over the world. The research made it possible to exchange those maps and to plot routes across borders.’ Another research question concerned the monitoring of a multi-layered network. Systems were needed that can detect the causes of problems in the network and their location, to detect where data packets still arrive, and where in the network there is still light showing.

A large experiment within Research for Networks was the StarPlane project, to which NWO also contributed. StarPlane aims to use dynamic lightpaths to facilitate on demand deployment of additional bandwidth by the DAS-3 computer clusters, which are interconnected in a grid on five locations in the Netherlands. ‘The network traffic in a lightpath from, say, Delft to Amsterdam needs to ‘transfer’ at Leiden. This transfer can be made in several ways. We want to achieve this with light switches only, rather than using electrical switches’, De Laat explains. ‘It has great advantages. First of all, you require fewer laser transmitters and receivers at the nodes, which saves both money and energy. On top of that it takes very little effort to extend the capacity of the connection for applications if that should be required. We have implemented this system as an experiment and at the moment we are working to let applications operate the equipment. It is then up to the user to determine which topology he requires and to pass that preference directly on to the network. So far this is unique; it will certainly be adopted by other network organisations.’

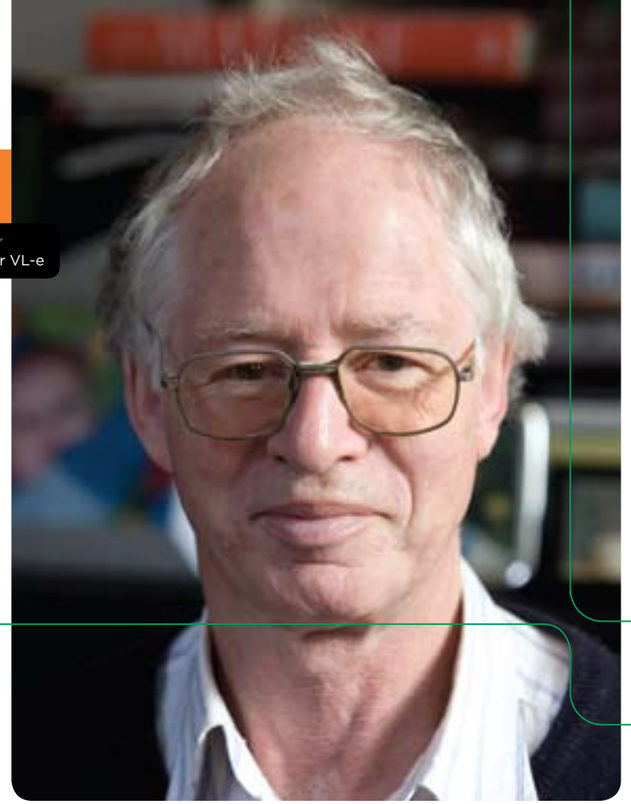
Looking back De Laat is very enthusiastic about the large research component of GigaPort Next Generation Network. ‘GigaPort has given the Netherlands a lead position in the field of network research. It is an excellent environment for trying out ideas about future internet usage. Other academic fields of science, such as astronomy, high-energy physics and life sciences, can participate in international research projects thanks to GigaPort. They have the technology at their disposal to make connections with scientific instruments in laboratories all over the world.’ In this respect it is especially valuable that NetherLight, the important international network node, is located in Amsterdam. ‘It gives the Netherlands a high profile. On top of that it is very convenient to have NetherLight here. It is a flexibility that SURFnet has earned by making the node extremely accessible based on open policies.’

> ‘The Netherlands has an excellent environment for trying out ideas about future internet usage’

E-SCIENCE

HAND AND GLOVE

Though a fast research network is a good start, scientists require more to be able to use lightpaths. Scientific director VL-e Bob Hertzberger converses on e-science services and the importance of multi-disciplinary collaboration.



Bob Hertzberger
scientific director VL-e

‘Scientific researchers have to excel and in order to do so they need an excellent network infrastructure,’ says Bob Hertzberger, emeritus professor of Computer architecture at the University of Amsterdam and scientific director of the Bsik project Virtual Laboratory for e-Science (VL-e). ‘GigaPort NG has delivered an excellent advanced research network to that effect, and SURFnet as an organisation innovates continually. But the rest of the technology chain is lagging behind.’

In Hertzberger’s opinion there is a large gap between the realisation of lightpaths and their actual use. ‘It is a misconception to think that scientists will automatically start using the possibilities of such a great network. Research is a very conservative discipline and innovation in this area is needed much more than we think. So therefore you need to offer the researcher something to bridge the gap between his scientific application and the network. It is a good thing that SURFnet limited itself to the network in GigaPort NG. Parallel to that the required e-science services were designed in a separate project, VL-e.’

In the VL-e project information specialists together with scientists from various domains investigated which e-science services they require for their virtual lab. Such a lab environment makes it possible to share facilities world-wide, not only specialised equipment (such as telescopes or mass spectrometers) but also computing and data storage capacity and information sources. Hertzberger: ‘Our idea is that re-usable solutions can be formulated when information specialists and domain scientists collaborate on things like visualisation methods, workflow tools and tools for handling large data files. Those e-science services do not come about without multi-disciplinary collaboration, because scientists build ad-hoc solutions and ICT people have no knowledge of the domain and the scientific aspects. Only together can they ensure that the enabling technology is an integral part of science.’

The experience with VL-e has shown that such collaboration has been accomplished in some domains, and the project created re-usable services. It was trickier to make the services generic enough to be applicable in other domains as well. Hertzberger explains: ‘Standardisation turns out to be more easily achieved within a domain than across domains. I am optimistic, though: what is now still thought of as generic within a domain will become more widely applicable in the course of time. Another thing we have noticed is that the entire application must be allowed to evolve before you start dividing it into services. People must be allowed to discover the possibilities of the technology by themselves, without us shoving it down their throats. This could be done in a playground like VL-e. ’
In Hertzberger’s opinion the multi-disciplinary experiments have been of great value. ‘What is more, e-science services are indispensable for scientists to work with this research infrastructure. It is a superb highway, but you need to design cars that can use it. E-science services is hand and glove with the network.’

‘Scientific researchers have to excel and in order to do so they need an excellent network infrastructure’

6

INTERNATIONAL APPEAL

Gert de Heer of Avans Hogeschool

'Since Avans Hogeschool has made use of SURFnet6 we can do a lot more with video. The deployment of a 10 Gigabit lightpath between our three locations in the cities of Breda, Tilburg and 's-Hertogenbosch allows us to distribute the recordings at a higher resolution than used to be possible.'

NetherLight

Amsterdam has become the major gateway to Europe thanks to both GigaPort projects. It has become the node for multiple research networks, such as the world-spanning GLORIAD network and the European GÉANT2. Both are hybrid networks, following the model of SURFnet6. High-energy physicists in countries such as Russia and the US, for instance, receive the distributed data from the Large Hadron Collider project at CERN in Geneva via Netherlight in Amsterdam. This international optical network node is located at SARA. The first successful experiments with lightpaths took place in 2002 between the brand new NetherLight node and StarLight in Chicago.

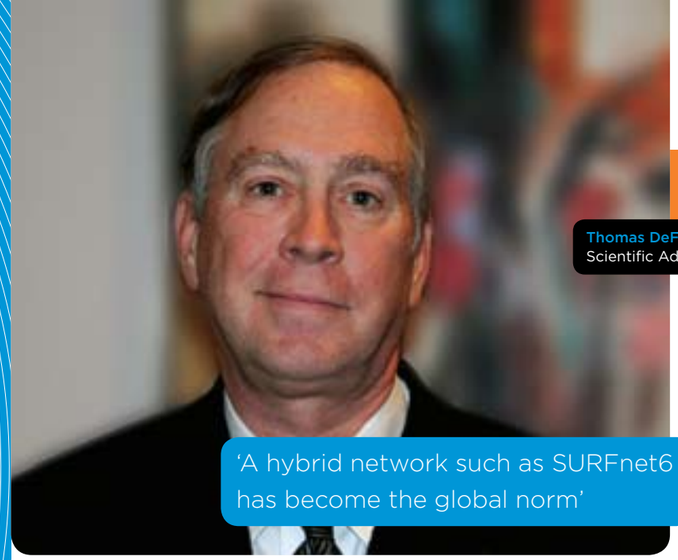
As NetherLight makes it possible to route lightpaths between hybrid domains, it has become an indispensable link for an increasing number of countries. In addition, the growing demand for international lightpaths between the European national research networks has prompted SURFnet to construct fiber-optic connections across the border with DFN, the German research network, between Enschede and Münster and between Maastricht and Aachen. LOFAR, Philips Research and SARA are among the users of the connection with Aachen, and a major connection for the high-energy physics network of the Large Hadron Collider runs over the link with Münster. There is also a direct link with the Nordic NORDUnet over the cross-border fibre-optic connection between Amsterdam and Hamburg.

GLIF

A research network does not stop at the border. International connectivity, collaboration, adjustment and standardisation are indispensable. Consequently SURFnet collaborated with researchers and network organisations in the Netherlands and abroad right from the start of the first GigaPort project. Accordingly GLIF, the international collaboration forum for knowledge exchange on optical network technology, was founded in 2003 as a result of workshops in 2001 and 2002, to a certain extent through the agency of SURFnet. GLIF provides a platform for the exchange of ideas through the annual meetings and it promotes and coordinates global lightpath connectivity. The focus that this requires is achieved in the various GLIF working groups.

Scientific Advisory Committee

The GigaPort Steering Committee established a Scientific Advisory Committee in 2004. Every year since then three international experts came to Utrecht to evaluate the project results and to report their findings to the Steering Committee. The members of the Scientific Advisory Committee are three globally recognised experts in the field of network technology and e-Sience. Thomas DeFanti is a distinguished professor emeritus at the University of Illinois at Chicago, and a research scientist at the California Institute for Telecommunications and Information Technology, University of California, San Diego. Anthony Hey is a professor at the University of Southampton and used to be until recently Director of the UK e-Science Core Programme. At present he is also Corporate Vice President External Research at Microsoft Research. Jun Murai is Vice President of Research and professor at the Keio University in Japan and Chairman of the WIDE Project, a Japanese Internet research consortium.



‘A hybrid network such as SURFnet6 has become the global norm’

DEEPLY IMPRESSED

Thomas DeFanti
Scientific Advisory Committee (SAC)

The Scientific Advisory Committee convened for the fourth and last time in November 2008. After a long day in Utrecht filled with presentations and discussions Thomas DeFanti and Anthony Hey are looking back as well as forward. Over these years, DeFanti, Hey and Murai discussed the quality of the network facilities, the research results and the technological choices.

Where necessary they pointed out the weaknesses. DeFanti: ‘We advised early on that one should not limit oneself to network hardware. It is the software that brings people together.’ GigaPort responded in a very good way, says Hey. ‘A lot of software has become available that was not foreseen in the original project plan. The user interface that enables you to dynamically set up a lightpath, for instance.’

Another issue that the three raised with the Steering Committee was the financing of applications. ‘The ‘Enlighten Your Research’ lightpath competition is a great idea’, says Hey. ‘But the first time only five out of eighteen participants received a budget to carry out their plans. Where do the others find the money? It’s a terrible shame if they are not funded and encouraged. You need pioneers to bring the technology to the next level.’

Though their work for GigaPort is completed, DeFanti and Hey have plenty of ideas for the future.

‘One area that needs to be addressed is energy consumption’, says DeFanti. ‘The key issues used to be speed and functionality, but now we need to turn a critical eye to the possibilities for energy saving and CO2-emission reduction. The technology is available; what is lacking is funding and focus.’ Hey also argues for a focus on datacentric science. He explains: ‘We are entering a new phase and an era of supercomputers and extremely fast networks. Scientists are confronted with an overload of data, and they need to learn to deal with that. This requires new skills, tools and technologies.’

‘We did not always agree among ourselves’, Hey concludes. ‘But we are deeply impressed with what has been achieved. In Utrecht today we see the future: a hybrid network such as SURFnet6 is the global norm. This can only be achieved through excellent leadership, through collaboration beyond organisational borders and by an innovative organisation.’ Defanti adds that this is because a project like GigaPort not only consists of developing and delivering network technology. ‘At least half of the job is politics. You need consensus in all sorts of areas. And for that you need to make clear to the organisations involved what it is you wish to achieve and why. That has been done thoroughly.’

Anthony Hey
Scientific Advisory Committee (SAC)

7

THE FUTURE

Niels van Yperen of the NOC Alliance

'The role of the NOC Alliance is monitoring and managing the entire SURFnet6 network. We take care of all incidents, problems and changes on the network according to ITIL methods 24 hours a day, 7 days a week. The NOC Alliance consists of engineers of the specialised companies SARA Computing and Networking Services in Amsterdam and Telindus in Utrecht.'

SURFnet7

SURFnet6, the Dutch research network, has become known as the most advanced in the world. But the roll-out of this hybrid network and the successful completion of the GigaPort NG project do not signal the end of developments. Science benefits from access to highly advanced networks. It is of major importance for the Netherlands to retain our lead in the fields of knowledge and expertise, both in SURFnet and in the research institutions. As was the case with the first GigaPort project, the investments have again produced clear and often unexpected advantages.

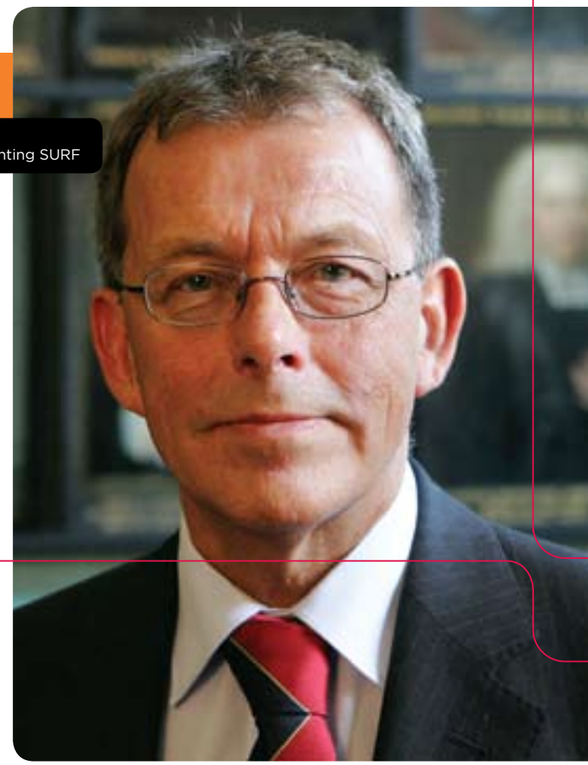
For these reasons SURFnet outlined in 2008 a new innovation project proposal for SURFnet7, the scalable hybrid network. The aim of SURFnet7 is to continue the development of the existing hybrid network through the period 2009-2012 with a proposed incentive scheme of 32 million euros from the FES, the Dutch fund for strengthening the national economic structure. Building on the existing optical network, SURFnet intends to use this project to make progress on four fronts. Firstly, SURFnet intends to improve the flexibility and the manageability of lightpaths by making optimum use of new network standards. Secondly, photonic technology will be deployed to offer made-to-measure cost-effective bandwidth that is delivered on demand. Furthermore the services for dynamic lightpaths will be extended, which will allow applications to set up a lightpath without human interference. The fourth improvement concerns a further professionalisation of the international node, NetherLight.

The proposal for SURFnet7 is not an isolated phenomenon. The innovated network is part of the ICT research infrastructure in the Netherlands. In December 2008 ICTRegie presented a recommendation to Minister Plasterk of the Ministry of Education, Culture and Science, Minister for Foreign Trade Heemskerk and Director General De Visser of the Netherlands Organisation for Scientific Research (NWO).

ICTRegie makes a number of pressing recommendations to further strengthen the ICT infrastructure for science and to keep it internationally competitive. One recommendation is to combine all the activities and responsibilities concerning the ICT research infrastructure that are currently fragmented in Stichting SURF. This comprises the network itself, the required computing power and storage capacity as well as the generic e-science services. Moreover ICTRegie advocates a structural annual budget for sustained innovation of 62.5 million euros. The Dutch Cabinet will respond in 2009.

STRUCTURAL FUNDING FOR SUCCESS

With the two GigaPort projects, the Netherlands has again set the standard for a new network architecture in SURFnet6. In the opinion of Willem te Beest, structural funding is necessary in order to remain in the lead, not only for the continued development of the network, but also for the ICT research infrastructure as a whole.



Willem te Beest
president of Stichting SURF

‘GigaPort is of national importance for the Netherlands. It is one of the reasons why our country is ranked relatively high on lists that compare countries in terms of their innovative power’, says Willem te Beest, President of Stichting SURF and vice president of the Leiden University Executive Board. ‘There is the considerable achievement of realising the world’s first fully operational hybrid network with a million users. Moreover, the prestige of GigaPort also has an impact on society in various ways.’

The first effect that Te Beest mentions is the founding of NetherLight, the open optical node in Amsterdam. ‘We have the GigaPort projects to thank for this major node for international connections. Such a node attracts researchers as well as new industries which are eager to establish themselves near a digital mainport. We saw this earlier with the Amsterdam Internet Exchange. Our country tends to underestimate that effect.’ Moreover Te Beest states that GigaPort has markedly sped up the roll-out of fibre-optic networks in the cities. For instance, Leiden has its own fibre-optic ring that connects all schools, the city council and the public institutions. The far-reaching societal importance of GigaPort is evident: ‘Just think of applications in health care, such as remote observation of surgical procedures, or the distribution of X-ray images in the context of the breast cancer population screening.’ Security and authentication are areas that SURFnet focused on, partially due to GigaPort. This situation has resulted in the development of the DigiD authentication code, which citizens use for their communications with the Dutch government. ‘These are all bonuses with the implementation of a project like that. It also makes other parties think of new ideas, which adds momentum to the developments.

For Te Beest there is no question that GigaPort should be given a follow-up. ‘Continued innovation is essential if we want to ensure that the infrastructure matures in line with the requirements of scientists. In all sorts of fields, in the arts, the hard sciences and the humanities there are issues that require ever more bandwidth. However, the problem with project funding is that there is always a high risk of failing to follow through. Innovation does not come about in jolts, it is a continuous process. You need to be able to plan ahead for years. That goes for the research network proper, as well as the corresponding grid computing, data storage and e-science services. Structural funding is a must.’ Needless to say this also involves a ‘strategic programming board’, in which stakeholders jointly carry out the long-term planning for the entire domain and from the perspective of the entire domain.

To conclude, Te Beest finds it important to mention that a major part of the GigaPort costs have been contributed by the industry. ‘The users in higher education and research pay for the operation of the network, but half of the costs of the development is paid for by private parties. Companies are happy to play in this playground especially because SURFnet is ahead in networks. Here suppliers can experiment, with people who know what they are doing. If only there were more examples where we are so successful in making the industry participate. To me this collaboration is SURFnet’s formula for success.’

> ‘It also makes other parties think of new ideas, which adds momentum to the developments.’

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