# GigaPort3 and SURFworks

# End Review Report 2014

## Strategic Advisory Committee

Commissioned by the Governing Board GigaPort3 and SURFworks

# Contents

# Executive Summary

On September 29 and 30, 2014, the Strategic Advisory Committee (SAC) executed an end review of the project GigaPort3 and SURFworks.

The goal of GigaPort3 is to deliver SURFnet7, a service-oriented generic networking framework for research and education. GigaPort3 aims not only to provide advanced networking facilities but also services in the resource management layer above it. SURFworks' objective is to deliver a collaboration infrastructure on top of SURFnet7 for higher education and research institutions in the Netherlands.

The aim of the review by the SAC is to assist the Governing Board in assessing the quality of the GigaPort3 and SURFworks projects and to provide recommendations for the strategic objectives for the continued development of the network infrastructure and services for research and education in view of new or expected developments.

Since the start of the GigaPort3 and SURFworks projects ICT and the world around it have changed dramatically. Services that were first scarce and expensive have taken a gigantic leap with the emergence of industrialized commercial cloud services. The enormous growth of connectivity and huge flows of data suddenly posed new challenges to more secure use of ICT and to protect privacy. In this increasingly complex environment SURFnet has strongly innovated and successfully accomplished the GigaPort3 and SURFworks project goals. SURFnet did so in close engagement with the user community. SURFnet proved to be a highly skilled organization that is very familiar with its users, able to successfully increase its skillset, and organize knowledge transfer for using the latest technology for education and research.

As a consequence of SURFnet's budget shortage for the coming years, the question arises if SURFnet is able to continue to be at the forefront of network research and innovation while at the same time maintain both a world class network infrastructure and a suite of advanced network and collaboration services.

Given the rapidly maturing commercial network technology it is tempting to abandon network research and focus on community niches. The SAC strongly recommends to avoid this forced choice. In order to provide both high quality and innovative services, guaranteed proper funding must be obtained without delay. *If this cannot be realized and SURFnet abandons network research, then Dutch networking and services innovation is abandoned forever and international partnerships will disappear.* The amassed expertise will quickly evaporate and the Netherlands will no longer be the attractive contender for international cooperation and partnerships it currently is. Innovation in networking and the facilities depending on it will move to other regions that *are* on the forefront of innovation.

The rapid uptake by the users of the new SURFnet7 infrastructure and collaboration services are evidence that SURFnet is very successful in connecting supply and demand, push and pull. SURFnet has emerged as a valuable coordinating entity between all the stakeholders.

The importance of this position -nationally and internationally- and the attracted expertise cannot be overstressed. SURFnet has a preeminent position in the international networking community and gives the Netherlands a unique coordinating entity for the e-infrastructure for research and education. It is an example for other countries struggling with seemingly competing activities of the stakeholders. *Coordinating this set of activities is an extremely important role for SURFnet that cannot be supplied by the commercial market.*

The SAC strongly and urgently recommends appropriate funding to enable SURFnet to continue to provide *and* to continue to boldly innovate by:

1. Developing advanced networking nationally and internationally, as the enabling technology;
2. Discovering needs and developing services for the research and education community and introducing new ideas into the network community;
3. Creating advanced collaboration services and increasing the skills across the research and education community to use these services.

If these recommendations are heeded, the SAC is confident that SURFnet will continue to push the envelope and will remain a world leading network organization for the benefit of research and education in the Netherlands.

# 1 About GigaPort3, SURFworks and SURFnet

## 1.1 GigaPort3

GigaPort3 started in January 2009 and runs up to and including the year 2014, including a one year extension.

GigaPort3 builds on the results of GigaPort Next Generation Network, SURFnet6, the world's first nationwide hybrid optical and packet switching network infrastructure.

Technology, research and education are constantly evolving, leading to new demands from the users of the network infrastructure and services. The GigaPort3 project ensures that the Netherlands can meet these demands even as they evolve.

GigaPort3 resulted in the new SURFnet7 network, a service-oriented framework in which networking, computing and storage facilities, as well as scientific instruments and data sets, are elements of a generic framework for e-Science. GigaPort3 provides not only advanced networking facilities but also a significant part of the services in the resource management layer above it.

## 1.2 SURFworks

The SURFworks project under evaluation started in 2011 and runs up to and including 2014 and delivers an advanced collaboration infrastructure (internet services) on top of SURFnet7 for higher education and research institutions in the Netherlands.

A growing number of students, lecturers, researchers and those employed in higher education and research are taking their own devices with them to the campus. Apart from the ICT facilities provided by their own institutions, these users also want to be able to use external (cloud) services for collaboration. SURFworks provides these users the facilities to accomplish this safely and transparently both in the Netherlands and abroad, on their own devices or those of their institution.

## 1.3 About SURFnet

SURFnet - the National Research and Education Network organization in the Netherlands – has the overall responsibility for the GigaPort3 and SURFworks projects, and carries out the general program management of these programs. The GigaPort3 and SURFworks Program Director is responsible for the execution and management of the projects and reports to the GigaPort3 Governing Board installed and appointed by Stichting SURF.

# 2 Remit of the Strategic Advisory Committee

The Governing Board appointed the Strategic Advisory Committee (SAC) to perform a mid-term and an end-term review of the project. (See Appendix 1 for the list of members of the SAC.)

This report to the Governing Board contains the findings and recommendations of the SAC end review that took place on September 29 and 30, 2014 in Utrecht.

**Objective and scope**

The aim of the review by the SAC is to assist the Governing Board in assessing the quality of the GigaPort3 and SURFworks projects measured against the objectives and plans, according to international standards with the objective to maintain a world leading research network and services.

Given the fact that the GigaPort3 and SURFworks projects are nearing their completion, the Governing Board asks the SAC to specifically address the following issues in its final review:

- The activities and results towards the end of the projects, amongst others on quality, coherence of the activities and project progress, including the response to and actions resulting from the committee's previous recommendations.
- The projects in their entirety: a critical analysis of the approach taken, the results achieved and the lessons learned.

- General assessment of the uptake by users and organizations of the hybrid infrastructure and collaboration services, also in view of maintaining public support in the future.
- Reflection on and recommendations for the strategic objectives for the continued development of the network infrastructure and services for research and education in view of new or expected developments.

# 3   The meeting of September 29 and 30, 2014

The Strategic Advisory Committee met for the end review in Utrecht on September 29 and 30, 2014. During these days the SAC was extensively briefed on the history, goals, deliverables, and status of the projects by the project director, the project team members, partners and users. During the presentations there was ample opportunity for the SAC to address specifics of the project and to engage in discussions about the approach and choices made.

The presentations were given from the perspective of the User, the Institution and the International context.

**Day one**

General introduction and financial overview

- *GigaPort 3 and SURFworks end review*
  Erik Huizer, project director and Chief Technology Officer, SURFnet

User perspective:

- *Enlighten Your Research*
  Sylvia Kuijpers, Community Manager Research, SURFnet
- *SURF Support4research (S4R)*
  Sylvia Kuijpers, Community Manager Research, SURFnet
- *Authentication & Authorization Infrastructure for Virtual Research Communities (OpenConext)*
  Paul van Dijk, Community Manager Research, SURFnet
- *Adding value for education and research using 4G technology*
  Maurice van den Akker, Team Leader Mobile and Wireless, SURFnet
  Kirsten Veelo, Community Support, SURFnet
- *SURFspot cloud store (cloud.surfspot.nl)*
  Hans-Peter Ligthart, Channel Manager, SURFmarket
- *Strong authentication via SURFconext*
  Eefje van der Harst, Product Manager SURFconext, SURFnet;

Institutional perspective

- *SURFconext*
  Femke Morsch, Product Manager SURFconext, SURFnet

**Day two**

Institutional perspective (cont.)

- *SURFnet7 & first thoughts on SURFnet8*
  Niels den Otter, Network Services, SURFnet
- *Access to the Cloud*
  Alexander van den Hil, Product Manager and International Relations, SURFnet
- *VUmc ICT – Campus Challenge*
  Christiaan Geertsma, ICT Manager Research & Education, VU University Medical Center
  Ronald van Schijndel, Information Analyst, VU University Medical Center
- *WireFree program*
  Maurice van den Akker, Team Leader Mobile and Wireless, SURFnet

International Perspective:

- *SURFnet International Affairs*
  Harold Teunissen, Head of Virtualization, Mobility and Security Services, SURFnet
  Alexander van den Hil, Product Manager and International Relations, SURFnet

Peter Hinrich, Community Support, SURFnet
- *Enlighten Your Research Global*
  Jason Maassen, eScience Engineer, Netherlands eScience Center
- *GÉANT[1] – cloud services*
  Andres Steijaert, Account Advisement, SURFnet

The SAC's review is based on the presentations, the subsequent discussions and on the documentation provided. Appendix 2 lists the available documentation.

On September 30, after the review sessions, the SAC presented its preliminary findings and recommendations to the members of the Governing Board during a separate meeting in Utrecht.

A list of the members of the Governing Board is presented in Appendix 1.

Governing Board member Th.C. de Graaf, LL.M., was represented by dr. J.H. de Ruiter, member of the Board Committee ICT and Research of the Netherlands Association of Universities of Applied Sciences.

The GigaPort3 and SURFworks project director, prof.dr.ir. E. Huizer, attended the meeting of the Governing Board.

Additional guests of the Governing Board were:

Drs. J. de Jeu, Board Member of Stichting SURF;

Drs. E. Bleumink, General Director of SURFnet.

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[1] GÉANT is the European collaborative project in which all European NRENS participate to establish a common European research network and a common set of services.

# 4 Findings

This chapter presents the SAC's findings. They are organized along the lines of the preliminary presentation given to the Governing Board by the SAC at September 30, 2014.

## 4.1 General observations – since the Midterm Review.

Since the start of the GigaPort3 and SURFworks projects information and communication technology and the world around them have changed dramatically.

### Rapidly changing playing field

Services that were first scarce and expensive have taken a gigantic leap with the emergence of industrialized commercial cloud services. In a short time, their usability and low or no-cost model have attracted large numbers of users, creating an upward spiral of innovation and brand consciousness. For example, Dropbox was officially launched in 2008 and within one year had 1 million users. In April 2011 Dropbox had 25 million users. Three years later, May 2014, they had 300 million users. Similarly, Gmail started out of beta in 2009 and currently has over 425 million users. Its app is installed on over one billion Android devices.

Research and education have profited and stimulated these developments. Data science or "big data" science is not a prospect, it is a reality permeating all sectors of science. Equally swift was the emergence of online education for large numbers of students from all around the world in the form of Massive Open Online Courses.

Furthermore, advances in the integration of wired and wireless networking strengthened the opportunities to connect users to the online services. In just a few years it was no longer common to find a network socket to plug-in to the Internet. The opportunity to be always on and connected became a reality.

The importance of these new uses for works, research and education has made software, including cloud services, vital to all organizations and now constitutes an *incompressible* part of IT budgets.

### New challenges

The enormous growth of connectivity and huge flows of data suddenly also posed new challenges. It turned out that these large volumes of data presented enormous risks for large-scale data breaches, potentially and sometimes actually exposing the personal information of millions of customers, employees and citizens. The Snowden disclosures made us aware of the lack of privacy and security in all sectors. The need for better security stimulated the use of improved authentication. Consequently, two-step authentication for security enhancement is now more common and its implementation is rapidly spreading out. The same holds for the encryption of data, at rest and during transport.

### Innovation implies taking risks

Operating at the forefront of network innovation and being a world leader, like SURFnet, has brought the Netherlands many advantages but not without risk. Driven by the increased need for communication, even 100Gb/s connections have become commoditized very quickly, worldwide.

Global market speed and choices and the (lack of) agility of innovation partners to change course are parameters that are at best hard to control. In the case of SURFnet, these issues created an unexpected major problem that has impacted the scheduled delivery of new services based on Next Generation Ethernet at 100Gb/s. This poses the question whether to implement these services later than planned, or to skip that phase and make the leap to the next generation network, SURFnet8.

In addition, the current funding from the Dutch government for the future innovation of the e-infrastructure is insufficient, despite the significantly increased contribution of the Dutch institutions. The funding cuts spurred major organizational changes within SURF and SURFnet. This made the context in which SURFnet successfully accomplished the GigaPort3 and SURFworks project goals less than ideal.

## 4.2   SURFnet strongly innovated with GigaPort3 and SURFworks

### Close engagement of SURFnet with the user community

One of the recommendations of the SAC in the 2011 review was to address the lack of expertise at the institutions' IT departments and the innovation lag that results from this deficiency while networking technology continuously grows more complex. SURFnet successfully followed-up on this recommendation in two ways: 1) the campus challenge to invest in the quality of campus network infrastructure and 2) the Support4Research program in cooperation with the individual institutions.

These are fine examples that show the close engagement of SURFnet with the user community through various initiatives. It also shows the major advantage of SURFnet for Dutch higher education and research: a highly skilled organization that is very familiar with its users and that is able to successfully organize knowledge transfer to use the latest technology for education and research.

### Realization of the original plans

SURFnet has successfully realized all the original innovation plans from 2009, and in addition followed up on the SAC's recommendation to initiate internationally relevant and visible projects by implementing the *Enlighten Your Research* and *Enlighten Your Research Global* projects.

As recommended by the SAC, SURFnet also promoted the health of NetherLight, the next generation Internet exchange for lightpaths. NetherLight is now a healthy, valuable and growing open lightpath exchange for commercial services and international partners. Similar to the Amsterdam Internet Exchange, the growth and openness of NetherLight makes the Netherlands a very attractive location for organizations in need for reliable high-speed connections to other organizations and to their customers. At NetherLight a whole range of (cloud-) service providers have been connected for the educational and research community. Among others, this resulted in a cloud-based telephony service from a commercial provider to an educational institution. By realizing integrated lightpath services and Internet services through the Multi Service Port approach, the connection costs for institutions are significantly lowered while the opportunities for special purpose connections are increased.

### Leadership in the collaboration infrastructure

SURFnet showed leadership in developing a collaboration infrastructure. A fine example of this leadership is the SURFworks deliverable called SURFconext.

SURFconext provides a managed coordination between suppliers and customers and it offers a trust framework for users, institutions and suppliers. Unquestionably there still is work ahead, such as in the customization for the end users (e.g., via the app store approach) and the need for international expansion to support the users' international collaboration. Furthermore, SURFconext has become a critical part of the infrastructure and needs to be treated as such. This means that SURFnet must address the issue of SURFconext being a single point of failure.

Another example of leadership is the 2-step authentication strengthening based on tiqr[2] (invented by SURFnet), SMS and Yubikey[3]. This is a valuable security addition to SURFconext.

SURFnet also achieved important results on the subject of seamless WireFree for research and education, by collaborating with KPN and Tele2 on the use of 4G, the fourth generation of mobile communication. The collaboration also showed that although wifi is very valuable to the end user, it poses many technical challenges for the institutions. This led SURFnet to start investigating wifi-as-a-service.

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[2] tiqr uses Quick Response Codes (QR-codes) and a PIN code to authenticate users. It is available for iOS and Android and is open source.
[3] Yubikey is a proprietary hardware authentication token.

## Contributing to international cooperation

Last, but not least, is the realization in 2013 of the Advanced North Atlantic 100Gb/s (ANA-100G) between Europe and North America, in collaboration with Internet2 (USA), NORDUnet, (Nordic countries), ESnet (U.S. Department of Energy), CANARIE (Canada), and GÉANT (Europe). This advanced high-speed connection addresses several problems, such as the demand for bandwidth by big science applications. Until ANA-100G, 10Gb/s was the production maximum and these lines had to be leased for a specific purpose. The ANA-100G is an example for bigger and stronger collaborations between national research and education networks to support the most demanding users. It strongly contributes to the Netherlands' ambition to keep being the digital gateway to Europe.

## In general

The SAC concludes that SURFnet has successfully realized the goals set at the beginning of the GigaPort3 and SURFworks projects. The SURFworks advanced collaboration infrastructure has significantly increased the added value of the GigaPort3 advanced network infrastructure for research and education, both nationally and internationally. SURFnet's national leadership on the collaboration infrastructure and the network infrastructure, is evidenced by the rapid uptake by the users of the new SURFnet7 collaboration services and infrastructure. Similarly, SURFnet plays an eminent international leadership role in advanced high speed international connections and the use of the collaboration infrastructure. The importance of developing both an advanced network infrastructure and advanced collaboration services reaches further than research and education alone, as evidenced by the market interest in NetherLight and the collaboration infrastructure. This combination is an innovation success formula that cannot be provided by the market.

# 5　Raison d'etre for SURFnet – The Future

**Time to focus?**

As a consequence of SURFnet's budget shortage for the coming years, the question arises if it is time for SURFnet to focus. Is it possible to maintain both a world-class network infrastructure *and* a suite of advanced network services to support efficient, effective and secure use of the network for research and education?

In the current world market, users have become choosers. They are now capable of choosing advanced services as cheaply as possible from around the world. Advances in network technology are maturing rapidly commercially, as evidenced by the rapid uptake of 100Gb/s technology. Indeed, most applied research and innovation are happening in the commercial sector, particularly in online services.

However, wherever it comes from, an advanced networking infrastructure is needed as a basis to support service delivery. Having *an advanced network and collaboration infrastructure* has become *a condition sine qua non*, not only for the innovation of research and education, but also as an supporter for existing and new business initiatives.

Innovation in science, engineering, and education services will always be needed and is a chief raison d'etre for SURFnet. To focus solely on a collaboration infrastructure without an advanced network infrastructure as basis is not an option.

**What if SURFnet is forced to choose?**

With the GigaPort3 and SURFworks projects, SURFnet has proven to be a successful innovator and service provider.

However, there are unavoidably costs to providing advanced and innovative broad services. The uncertain funding poses the question if SURFnet can remain both a research organization and a service provider?

Without guaranteed and immediate proper funding SURFnet will be forced to choose. The SAC strongly recommends to avoid this forced choice because the consequences are clear:

*If SURFnet abandons network research, Dutch networking innovation is abandoned forever and international partnerships will disappear*.

The amassed expertise will quickly evaporate and the Netherlands will no longer be the attractive contender for international cooperation and partnerships it currently is. Innovation in networking and collaboration services and the facilities depending on it will move to regions that *are* on the forefront of innovation.

**Future funding**

The level of future funding determines whether or not SURFnet can afford to develop a general e-infrastructure that is not provided for by the market. It determines if SURFnet should address only community niches, or if SURFnet can continue to focus on high-risk innovation (i.e., the leap to SURFnet8, the next generation of the e-infrastructure).

*Fact is, in order to provide high quality innovation and advanced services, the funding obtained must pay for them.*

The same can be said of the services provided by SURFsara.

# 6  Conclusions and recommendations

Based on the review findings, the SAC concludes that SURFnet has successfully delivered a high quality world class SURFnet7 network with equally innovative and high quality services. The rapid uptake by the users of the new SURFnet7 collaboration services and infrastructure are evidence that SURFnet is very successful in connecting supply and demand, push and pull. SURFnet has emerged as a valuable coordinating entity between all the stakeholders:

- Service providers and users;
- Service providers and institutions;
- Institutions and users;
- Institutions and institutions;
- Users and users.

A major factor that enables SURFnet to accomplish this is its excellent staff. During the two-day review they have exhibited not only excellent technological skills, but also an outstanding knowledge of the market, their institutions, their end users and their work.

The importance of this position and the attracted expertise cannot be overstressed. With SURF/SURFnet, the Netherlands has a unique coordinating entity for the e-infrastructure for research and education. It is an example for other countries struggling with seemingly competing activities of the stakeholders.

*Coordinating this set of activities is an extremely important role for SURFnet that cannot be supplied by the commercial market.*

Therefore, the SAC strongly recommends that SURFnet should be funded without hesitation to continue to provide and innovate by

1. Developing advanced networking nationally and internationally, as the enabling technology;
2. Discovering needs and developing services for the research and education community;
3. Creating common services across the research and education community.

If these recommendations are heeded, the SAC is confident that SURFnet will be able to attract and hold the level of expertise needed to continue to be a world-leading network organization for research and education.

## Closing remarks

The SAC wishes to thank the project management and the SURFnet organization for all the work they invested in elucidating the subjects they are working on and how these interrelate. Their efforts were imperative in the preparation of this final review report.

Similar to the midterm evaluation of 2011, the review also created an opportunity for the SAC to learn about new ideas, solutions and approaches. It shows that reviews are not only a good means for evaluating projects, they also provide an excellent opportunity to exchange information.

The SAC wishes to express its gratitude to the Governing Board for providing the opportunity to learn more about the GigaPort3 and SURFworks projects and for its confidence, trust and hospitality during the review. The SAC hopes that this review report is instrumental in supporting SURFnet to continue delivering the world-class infrastructure and services for Dutch research and education and to continue its strong international collaborations.

# Appendix 1. Governing Board and Strategic Advisory Committee

The GigaPort3 and SURFworks Governing Board, chaired by Dr. S.J. Noorda, supervises the execution of the projects on behalf of Stichting SURF.

**Members of the Governing Board GigaPort3 and SURFworks**

Dr. S.J. Noorda ..................Chair, in personal capacity;

Dr. K.L.L.M. Dittrich ...........President of the VSNU;

Dr. J.J. Engelen .................President NWO;

Th. C. de Graaf, LL.M. .......President of the Netherlands Association of Universities of Applied Sciences;

Prof.dr.ir. J.G.H. Joosten ...Director Corporate Technology, DSM;

Drs. G.J.H.C.M. Peeters ....President Board of Directors, NFU.

Secretary, Dr. L.A. Plugge.

**Members of the Strategic Advisory Committee**

Dr. Th.A. DeFanti............Distinguished Professor Emeritus in the department of Computer Science at the University of Illinois at Chicago, founding director of the Electronic Visualization Laboratory (EVL), Research Scientist at the Qualcomm Institute of the California Institute of Telecommunications and Information Technology at the University of California, San Diego;

Dr. D.G. Foster ...............Deputy Head of IT at CERN. Manager of the strategy for international networking;

Dr. G. Høst.....................Director of the Nordic e-Infrastructure Collaboration (NeIC) at NordForsk;

Dr. J. Lee .......................Director of the Supercomputing Center and Networking at the Korean Institute of Science and Technology Information (KISTI).

Dr. L.A. Plugge was appointed secretary to the committee.

# Appendix 2. List of available documentation

Remit of the Strategic Advisory Committee:

GB-GP3 21.483 Invitation SAC 2014

Program for the GigaPort3 and SURFWorks Review:

GB-GP3 21.490 Program Gigaport3 and SURFworks Review 2014

## *Gigaport3 Documents*

Complete Project Plan 2009-2013:

GB-GP3 09.2611 GigaPort3 Project Plan 2009-2013

Annual Plans 2013 and 2014:

GB-GP3 18.498 GigaPort3 Annual Plan 2013 v1.0 (def 26 nov 2012) GB-GP3
20.829 GigaPort3+ Annual Plan 2014 for GB

Annual Reports 2011-2013:

GB-GP3 16.436 Jaarverslag 2011 (SAC)
Progress Report GigaPort3 2011 –   Technical Report in English, introduction and financial
                                                        paragraph in Dutch
GB-GP3 19.757 GigaPort3 Jaarverslag 2012 final for GB
Progress Report GigaPort3 2012 –   Technical Report in English, introduction and financial
                                                        paragraph in Dutch
GB-GP3 21.371 GigaPort3 Jaarverslag 2013
Progress Report GigaPort3 2013 –   Technical Report in English, introduction and financial
                                                        paragraph in Dutch

Progress reports 2014

GB-GP3 21.404 Progress report GP3+ Q1 2014 final
GB-GP3 21.484 GigaPort3+ Progress Report Q2 2014

SAC midterm review report

GB-GP3 14.273 SAC Mid-Term Review Report 2011 GigaPort3 Project (1.1 final)

## *SURFworks Documents*

Annual Plans 2013 and 2014:

GB-GP3 21.486 SURFworks Annual plan 2013
GB-GP3 21.487 SURFworks Annual Plan 2014 - revised version

Annual Report 2013:

GB-GP3 21.488 SURFworks Annual Report 2013

Progress reports 2014

GB-GP3 21.405 Progress report SW Q1 2014 final
GB-GP3 21.485 SW Progress Report Q2 2014

Conclusion and recommendations by the CP (Committee Project monitoring)

The CP has yearly reviewed the SURFworks project. The reviews are in Dutch. We have
translated the conclusions and recommendations given by the CP in order for the SAC to read
them.
GB-GP3 21.494 SURFwork CP review 2011 – conclusions and recommendations
GB-GP3 21.495 SURFwork CP review 2012 – conclusions and recommendations
GB-GP3 21.496 SURFwork CP review 2013 – conclusions and recommendations

## Documents from the Midterm review in 2011

### Annual Reports 2009 and 2010:

Annual Report GP3 2009
Annual Report GP3 2010
GB-GP3 13.225 Voortgangsrapportage GigaPort3 2009
Progress Report GigaPort3 2009 –   Technical Report in English, introduction and financial
                                    paragraph in Dutch
GB-GP3 13.226 Voortgangsrapportage GigaPort3 2010
Progress Report GigaPort3 2010 –   Technical Report in English, introduction and financial
                                    paragraph in Dutch

### Annual Plans 2009-2012:

GB-GP3 09.2623 GigaPort3 Summary Annual plan 2009
GB-GP3 09.2686 Annual Plan 2010
GB-GP3 13.118 Annual Plan 2011
GB-GP3 13.274 GigaPort3 midterm progress report
GB-GP3 13.119 GigaPort3 Progress Report Q2 2011
GB-GP3 13.227 GigaPort3 Progress Report November 1 2011

### Earlier SAC review reports (GigaPort Next Generation Network project):

S-GP 07.5223    SAC Annual Review Report 2007 GigaPort Next Generation Network
                project
S-GP 08.2642    SAC End Review Report 2008 GigaPort Next Generation Network project