GÉANT Campus Best Practices

Produced by the GN3/NA3/T4 task team

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Executive Summary

This paper summarizes the experiences and results that so far are achieved in the GÉANT task "Campus Best Practices" (GN3/NA3/T4). The overall objective of this task is to address key challenges for European campus networks, organise working groups and provide an evolving and to-the-point set of best-practice documents for the community. An important goal is to harmonise NREN functionality with the campus networks and thus provide viable end user services. The "Campus Best Practices" experiences give input to strategic decisions NRENs should consider regarding their campus involvement.

Four NRENs are contributing to this work; UNINETT from Norway, CSC/Funet from Finland, CESNET from the Czech Republic and AMRES from Serbia. Work started in April 2009 and the working methods build upon experiences from the Norwegian GigaCampus project (2006-2009) and are coherent with the findings of the EARNEST study (2006-2007).

Based on experiences from the four participating countries this paper gives recommendations on how a national "Campus Best Practices" effort could be organised. A staircase of 6 steps is proposed, where each step requires a gradually stronger NREN commitment on campus. The steps are:

1. Organise workshops to share campus network experiences
2. Set up working groups to discuss campus best practices
3. Develop your own national campus best practices
4. Manage national procurements
5. Do active consulting on campus
6. Assist with implementations on campus

Focus in the GÉANT project is on the first three steps. 2.5 years into the project each participating country has operational working groups that all are producing national best practices. These documents are in turn translated to English and published at the GÉANT and TERENA web sites. Currently 34 documents from six different focus areas are available. The areas are: physical infrastructure, campus networking, mobility, security, network monitoring and real-time communications.

The Campus Best Practices team has also organised workshops and training events at the European level and team members have actively presented results and findings at national and European conferences.

Work will continue for (at least) the last 1.5 years of the GÉANT project. When more NRENs are ready to strengthen their campus focus the team will gladly contribute with lessons learned.

1   Introduction

"Campus Best Practices" is a part of the GÉANT project [1] funded by the European Union. The project runs for four years, from April 1 2009 – March 31 2013. The overall objective of GÉANT is to enable universities and research communities across Europe to transform the way they collaborate. The project is about enhancing the GÉANT network and ICT services and in the process fight the digital divide across Europe. 40 NREN organisations participate in the project and the work is divided into 45 different tasks.

One of the tasks is "Campus Best Practices" (GN3/NA3/T4) [2]. Four countries (NRENs) are contributing to this work; Norway (UNINETT), Finland (CSC/Funet), the Czech Republic (CESNET) and Serbia (AMRES). Our focus is on the campus level. The overall objective is to address key challenges for European campus networks and provide an evolving and to-the-point set of best-practice documents for the community. Our working methods involve setting up working groups within each country. Each working group has a particular area of expertise. Six focus areas are covered; physical infrastructure, campus networking, mobility, security, network monitoring and real-time communications. The working groups are lead by the NREN and technical expertise from universities within the country are participating in the groups. Current challenges and experiences are shared and common best practices are discussed, iterated and finally agreed upon.

The working methods build upon experiences from the Norwegian GigaCampus project (2006-2009) [3]. Recommendations from the EARNEST Report on Campus Issues [4] are adopted in our work.

2   EARNEST Report on Campus Issues

The predecessor of today's GÉANT project was the GN2 project running from 2005 – 2009. One of the achievements of GN2 was the EARNEST foresight study that looked at the expected development of research and education networking in Europe over the next 5-10 years. The study was carried out between March 2006 and November 2007. The EARNEST study focused on seven study areas, where one of them dealt with campus issues. The EARNEST report on campus issues [4] presents a summary of findings. A total of 53 recommendations for the European campus networks are given, most of them still very relevant. In particular:

- Set aggressive replacement policies for network equipment with a maximum life expectancy of five years.
- Adopt institution-wide specifications for networking infrastructure, including elements controlled by departments or faculties.
- Ensure seamless end-to-end connectivity where a particular quality of service is required.
- Provide support and training for performance optimisation, especially to the research community.
- Adopt security measures that are appropriate for the purpose and do not hinder the effective use of the network.
- Establish an institution-wide security team with a high degree of independence.
- Provide the eduroam service to take advantage of mobility across Europe.

The report also had some important recommendations for collaboration on the national level; between the NREN and the institutions and among institutions. There is an emphasis on training:

- Strengthen the collaboration between National Research and Education Networking organisations and institutions to improve the deployment of key services: share strategic information, raise awareness of innovative services at senior levels, co-ordinate working groups, and obtain feedback from end-users and especially from those with demanding requirements.
- Organise more regular workshops between NREN engineers and institution engineers.
- The network support team should be adequately staffed and have appropriate expertise. ICT keeps evolving at a fast pace. It is vitally important that they are properly trained to carry out the tasks expected of them.

3 The Norwegian GigaCampus project

Where the EARNEST work was a theoretical study, analysing collected information from a large number of Universities across Europe, the Norwegian GigaCampus project (2006-2009) was a highly practical effort. The GigaCampus *working methods* are consistent with the EARNEST recommendations and have indeed proven to work in *reality*. Similar working methods now lay the foundation for the GÉANT Campus Best Practices effort and are implemented in Finland, the Czech Republic and Serbia.

To better understand the GigaCampus setting, let us give some background information. Norway is a small country of only 5 million inhabitants. It is sparsely populated with a challenging geography. There are approximately 40 universities and university colleges distributed around the country. The size of the institutions vary, where the larger universities have 10000-30000 students, while the colleges typically have 1000-6000 students. The level of IT expertise will vary from institution to institution. Prior to GigaCampus a number of challenges were identified at the campus network level. It was evident that the challenges were more or less the same around the country.

In 2005, in response to the Norwegian Ministry of Education and Research, the Norwegian Association of Higher Education Institutions and the higher education (HE) sector, UNINETT launched the four-year project entitled GigaCampus 2006-2009. The project was granted financial support amounting to NOK 45.8 million for the entire project period. With these funds at its disposition, the project has worked systematically for four years to achieve a standardised upgrade of the campus networks, their basic services and the local ICT expertise at Norwegian universities and colleges.

The management of the GigaCampus project was assigned to UNINETT. The projects's management team has reported to the project board in which a group of ICT managers from the universities and colleges have been elected. The board's most important responsibility has been to ensure that the available funding has been used to the maximum benefit of the sector's institutions, and that the project has achieved results according with the original intentions.

The vision of GigaCampus was a *co-ordinated, world-class campus ICT infrastructure around Norway which encourages innovation, collaboration and efficient research and education.* A key objective was to strengthen the community of ICT personnel from the various universities and colleges around Norway. By creating working groups, seminar and workshops GigaCampus attracted the national experts and encouraged them to share their experiences for the benefit of the whole HE sector. GigaCampus worked within seven areas of focus:

- physical infrastructure
- campus networking
- mobility
- real-time communications
- security
- network operations and monitoring.

During the four years of GigaCampus a total 47 seminars and workshops were organised. The working groups produced a total of 22 best practice documents. The GigaCampus project team and working groups gave advice based on the recommendations and participated on site in meetings and workshops discussing design

and even assisting in implementations. An important factor was always knowledge transfer to the local ICT team who would take over and operate the systems after initial deployment. Examples of such implementations include wireless setups with eduroam, core campus network upgrades with increased capacity, functionality and resilience, IPv6 implementations, security architecture design, network monitoring setup, and more. GigaCampus was also involved in building projects giving recommendations to the design of data centre and communication rooms. This would include cabling, power, cooling and fire protection.

A factor that contributed to the success of GigaCampus was the funding that allowed the project to provide investment support to projects that followed established recommendations. As a general rule, there was a condition that projects should be at least 50 per cent self-financing. This support was significant and often *the necessary trigger* that made projects kick off.

GigaCampus also ran a number of national level procurement processes for ICT equipment. 30 agreements within 10 principal fields were signed in the four year period. The co-ordination of these purchasing operations has resulted in substantial volume advantages for ICT equipment with regard to price and contractual terms.
An independent consulting firm (Capgemini) has carried out an assessment of the profitability of GigaCampus, concluding that the activities had a solid financial rationale and form the basis for a range of qualitative benefits. Co-ordinating and standardising infrastructure, bringing together technical communities for technical gatherings and agreeing on joint best practices by means of technical specifications (best practice documents) has clearly been of enormous value. The pay-back factor of the project budget was calculated to a ratio of 3.7.

In retrospect three factors were essential to the success of GigaCampus:

- government support
- NREN commitment
- university level participation

The initial funding from the Ministry of Education was of course important and the political support was in itself significant; the ministry showed responsibility. Further it was vital that UNINETT had a dedicated campus project team that could facilitate the various work processes in a good manner. Last, but not least, without the commitment and dedication of the ICT experts at the university level many of the results could not have been achieved.

When GigaCampus was near its completion in 2009 more than 90% of the ICT directors in the HE sector in Norway stated that they wanted the activity to continue in many areas. The Government suggested a financial model were the UNINETT membership fee was slightly increased to finance a permanent activity. This was accepted and is still the running model.

4   The Campus Best Practices staircase

Analyzing the GigaCampus working methods in a structured manner deduces the work efforts to six areas, or steps, as shown in figure 1. We can look upon this as a staircase where step 1 is the easiest to organise and thus a natural starting point for a setup in another country. Step 6 will require the most, both in terms of budget and man hours. It requires a mature community and an NREN confident in its campus role, but it will also give most benefits back to the universities. We elaborate on the staircase in chapter 6.
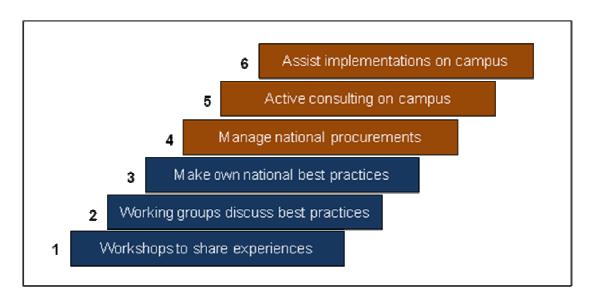

Figure 1: The Campus Best Practices staircase

A key role for an NREN is to provide inter-connectivity between campuses. When the campuses are using the same best practices, this gives saved costs in terms of less time spent on setting up new services and less effort on troubleshooting. Keep in mind that the underlying objective is always to harmonise NREN functionality with the campus networks and thus provide viable end user services. NREN development and enhancements on campus should be well coordinated for mutual benefits and a best total solution.

A general recommendation would be to start with step 1 and gradually move to the next level as organisations mature to the idea of cooperation. A key factor here is community building, and community building does take time. It is also about building trust in the working groups between the NREN and the institutions and among the institutions themselves.

The NREN should play the role as organiser and facilitator. It is of course possible to organise this way of working without NREN involvement. The initiative could come from the universities themselves. This may work, or it may not, as the focus may be biased and competitive issues may arise. The advantage of having the NREN organise is that it is neutral and it has a national perspective and interest on behalf of the Government in lifting the community as a whole.

Another point is whether the organisational setup should be at the national level versus the European level. We strongly believe in building the initial communities at the national level where culture and language is familiar and people feel more "at home" and confident. For the larger European countries, like France, Germany and the UK, a regional level may be the best starting point, as the national level would encompass too many universities.

In any circumstance, the *results* from the local working groups should be spread across borders. The best practices should be translated to English and representatives from the working groups should give talks at European workshops and conferences. In fact, this is exactly the way we work in GÉANT Campus Best Practices. We are now 2.5 years into the project and have obtained some valuable experiences from all four contributing countries.

5 Focus in the GÉANT project

In the GÉANT "Campus Best Practices" task, the focus is on the three blue levels in figure 1. Moving beyond level 3 would require larger budgets and a stronger NREN commitment. The "Campus Best Practices" budget is limited to 3.5 man years per year split among the 4 countries (as a comparison GigaCampus had 8 man years per year at its disposal). Further, there is no budget for investing in projects on campus. Running national procurements is also outside the scope. Our focus is on creating communities, building working groups and producing common best practices. This can be done with limited funding – and it can still give a significant impact!

So far Finland has established two working groups; MobileFunet focusing on wireless and mobility on campus and AccessFunet, dealing with the campus networks themselves, including network monitoring and new demands for lightpaths. The working groups have 2-4 meetings a year where they discuss challenges at hand. So far the groups have produced 6 best practice documents.

In the Czech Republic three working groups are active; IPv6, network monitoring, IP telephony and real-time communications. The Czechs has so far contributed with 9 best practice documents. Serbia also has three working groups operating. The areas are physical infrastructure, network monitoring and security. At this stage, 10 best practices are published on the national level.

All the best practice documents are in turn translated to English. The English documents are branded under a common template and published at the GÉANT [2] and TERENA [5] web sites. An open announcement mailing list is set up to announce the publishing of new documents. At the time of writing 34 documents are published.

Some of the best practice documents cover the same topic. Do to local circumstances a best practice in one country is not necessarily the best practice for another country.

By publishing the nationally developed best practices in English on well established and recognized web sites, we attract a greater audience and stimulate interaction and collaboration across borders. This is complemented by the task team's effort to organise workshops at the European scene. So far a network monitoring workshop has been organised in Belgrade in October 2009 (6 countries participated) and a SIP/VoIP workshop was set up in Prague April 2010 (10 countries participated). In Espoo in Finland a joint Finnish/Norwegian wireless workshop was set up in October 2010 and a European level workshop focusing on IPv6 deployment at campus was held in March 2011 (10 countries participated).

In addition to workshops, training courses are also conducted. A wireless training course was held in Belgrade in September 2011. The course will be repeated later in other parts of Europe.

In the last 1.5 years of the project the task team will devote even more effort to dissemination. More workshops will be organised. Results from the best practice documents have been and will continue to be presented at national and international conferences. Collaboration between working groups from different countries will strengthen the best practices. Last, but not least the task team will promote our working methods to other countries and encourage them to develop a similar activity.

Of course one cannot expect a small task as "Campus Best Practices" with only 3.5 man years per year to have an impact on all universities across Europe. This would obviously require a lot more resources and much more time. Being realistic, the task team sees itself as demonstrators of what can be done in other countries. The EARNEST report on campus issues concludes that it is vital for the NRENs to reinforce their national efforts and get engaged in campus challenges. After all, services are end-to-end, and the ends are inevitably on campus. If and when more NRENs would like to strengthen their campus focus, the task's pilot NRENs will be happy to contribute with our experiences.

6 How to set up a national activity

Based on the experiences from the GÉANT project and in reference to the Campus Best Practice staircase in figure 1, some recommendations are given in this final chapter.

Step 1: Organise workshops to share experiences

Step 1 is fairly easy to organise for the NREN. Probably most NRENs do this to some extent already. It is about organising workshops within a given technical area and inviting engineers from the universities to participate. The topic should be to the point in addressing current challenges at hand relevant for the campus level. The agenda should be interesting, making it tempting for people to join in. A practical, equipment oriented approach, focusing on day to day problems may work well.

The workshop should be open and free of charge. Make sure there are enough long coffee breaks allowing for discussions between talks. Strive for a positive and informal atmosphere where there is room for any type of question or contribution to the discussions. If possible, a social setting with dinner will further strengthen the possibility of building strong and good relationships.

Building arenas and meeting grounds like this where engineers from different institutions that perhaps never have met before, is highly valuable in itself. There are mutual benefits for the participants and corresponding organisations. It opens up for informal talks and discussions on related topics as well.

Step 2: Set up working groups to discuss best practices

Step 2 can be achieved after the community matures a bit. Establishing a working group means being a bit more formal. The working group should have a specific technical area of focus. There should be a leader and a secretary (can be the same person). Initially it is natural that the NREN hosts these functions. This way the NREN does the overhead work, being the organiser and facilitator. Working group membership should be open, but effort should be taken into recruiting the key experts from the major universities.

There should be 2-4 meetings a year where a specific topic is discussed. The published GÉANT Campus Best Practice documents or similar may serve as starting points for discussions. A round table meeting is a good setting. Each participant should be given time to give an update on recent experiences and challenges from his/her university on the topic at hand.

A mailing list should be set up to encourage discussions between meetings. This can be complemented by a web forum, social network group and/or a wiki.

The universities may be reluctant to participate at first. Questions may arise; "why should I share my knowledge?", "I know this stuff and have nothing to learn", "what's in it for me?", or "are they taking our jobs now…". But sharing knowledge is not only about giving, it is more about learning from others and in turn

becoming even better. The working group meetings can provide the necessary steps for campus networks to develop and thus better cope with tomorrow's challenges.

We believe it is important with open working group membership. There are typically different skill levels in the higher education community. Smaller institutions can most often not compete with the larger. It is essential that they all feel welcome. The working group leader must know the topic well, preferably also from a practical point of view; else it can prove difficult to manage the meeting and "control" the experts of the larger universities. The working group leader should not himself run the show, but rather make the experts contribute and let them be the real "stars" of the meeting.

Step 3: Develop your own national best practices

As the working group matures, the group should discuss and decide on new best-practice topics themselves. This should be a hot topic that everyone is struggling with. An example could be implementation of IPv6 on campus. How should this be done? Where to start and what are the pitfalls to avoid?

For most fruitful discussions it is better if a small group (or one person) drafts an initial version of a new best practice and present it at the meeting. This will kick start the discussion. Discussing without a starting point can be hard. The starting point should not be too perfect. There should be room for improvements. In reality there almost always are anyway.

The documents should not be textbooks elaborating on theory, but instead have a rather practical approach. It should be to the point about lessons learned. This is the *real* value. The documents should not be too long either, maximum 15-30 pages. Too long texts means no one will read.

Ideally the authors should be from the universities where the hands on experiences are taking place. In many cases this may turn out challenging. The best experts are always very busy; this seems to be a law of nature. They may also be reluctant to write; i.e. they may be good at designing and implementing new solutions, but not writing about them. There are of course exceptions to this, but a way about could be to interview the experts and have technical writers from the NREN with adequate knowledge do the writing.

The document should in any circumstance be discussed and iterated upon within the working group. When consensus is reached the document should be sent on an open hearing to the whole higher education community for a period of 3-4 weeks. The hearing can i.e. be announced on a mailing list reaching all higher education ICT directors. Such confrontation of the content and the expert's conclusions may give opinions by the ICT directors or others not present at the working group meetings.

After the hearing period, all received suggestions and comments will be considered by the working group and changes will be made when appropriate. The document will then have reached the status of a national approved best practice and will be published at the national level.

This democratic process is important. It means everyone can influence and that the ICT directors in particular are part of the approval process. Thus the best practice is not an NREN enforced document, but rather a community agreed best practice. Nevertheless it must be stated clearly that the best practices are just recommendations that the universities may adopt as they see fit.

Figure 2 summarizes our recommended best practice development process. This process is implemented in the four countries of GÉANT Campus Best Practices.
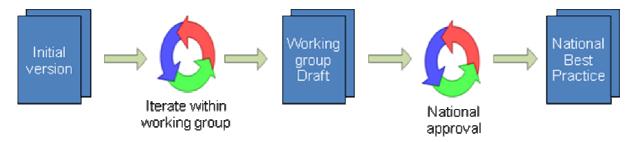
Figure 2: Best practice development process

Step 4: Run common national procurements

Step 4 is beyond the focus of the GÉANT project, but was and is still successfully done in Norway. This also requires well established communities. It is important that the procurement processes are done in joint working groups with the major players (and major buyers) as members. In Norway the technical working groups also played a role, as information from the best practices, or indeed some best practice documents themselves, would serve as requirement specifications in the procurement processes.

The benefits of national procurements speak for them self. Instead of each university doing tedious procurement processes, they are done once and for all. This gives volume advantages, lower process cost and potentially better technical specification work. It does however require that the end agreement contains a menu to purchase from where more than one vendor is included. It is not realistic that all universities will accept to buy from the same vendor. There should also be a focus on price models, not fixed prices, as equipment prices change rapidly in this market.

In Norway the national procurements processes have given substantial cost savings.

Step 5: Do active consulting on campus

Step 5 will get the NREN and/or recruited personnel from the working groups even more engaged on campus. Instead of just publishing the best practice documents, step 5 involves giving active advice and support in real scenarios on campus. This is done and can be done in several ways. The easiest is to assist the community on phone, video conference or mail. A more comprehensive effort is to visit them on site. In any circumstance this work requires more funding. GigaCampus had this opportunity and the project staff was a lot in the field. They travelled the country and had meetings with local ICT staff on site, discussing current challenges and suggested solutions in terms of new designs and implementations.

Step 6: Assist with implementations on campus

The last step on the Campus Best Practice staircase does not stop with giving advice to the institutions. It also involves participation in actual implementations on campus. These implementations are mainly based on the best practice documents. For those cases where there are no best practice established yet, the work gives valuable input to new best practices. Of course this will cost even more man hours, but from a national perspective it can pay off. It will ensure good quality and consistent implementations and if done in a correct way, it will in the process train the local ICT personnel making them capable of doing similar configurations next time.

7 A strategic choice for the NREN

The EARNEST report on campus issues gives very strong recommendations for the NRENs to get involved in campus challenges. This might imply that a decision to be involved should be taken on a strategic level.
As the staircase in figure 1 shows, the NREN involvement can happen in different ways and on different levels. It is possible to start with activities on higher steps, but it is recommended to start with level 1.

An important decision for the NREN is how much resources (manhours, money) the NREN wants to invest in a Campus Best Practice activity. In general the resources required increases with each step in the staircase. The first 2 steps do not require so much resources and is an excellent way to gain experience with the campus area. However, an essential question to answer is whether this will be sufficient to meet the EARNEST recommendations.

The staircase model gives the NREN means of controlling the extent of campus activity and managing it accordingly.

When it comes to funding of these activities, the NREN must be prepared to do the initial funding, unless the government can be convinced already at this stage to contribute to this kind of activity. Once an activity like this is up and running the universities/customers might see the benefits more clearly and will be willing to contribute.

The experiences from the participants in the GÉANT Campus Best Practices task are that there are great benefits for the whole NREN community in their country already by engaging in the first 3 steps.

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