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Deliverable DN3.4.1,3: Annual Report on Campus Best Practices

Deliverable DN3.4.1,3

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Abstract

Campus Best Practice is the name of one of the Tasks (Task 4) in Networking Activity 3, Status and Trends (NA3), of the GN3 project. The overall objective of the Task is to address the 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. The current GN3 deliverable reports on the work carried out in the Task during the third year of the GN3 project (April 2011 – March 2012) and the results of that work.

Table of Contents

Table of Figures

Table of Tables

Executive Summary

Campus Best Practice is the name of one of the Tasks (Task 4) in Networking Activity 3, Status and Trends (NA3), of the GN3 project. The overall objective of the Task is to address the key challenges for campus networks in Europe, organise working groups and provide an evolving and to-the-point set of best-practice documents for the community. The current GN3 deliverable reports on the work carried out in the Task during the third year of the GN3 project (April 2011 – March 2012) and the results of that work.

The working methods in the Task build on the experiences from UNINETT's GigaCampus project (2006–2009). As part of that project, UNINETT organised a number of working groups in Norway dealing with campus issues in different technical areas. Participants from the relevant technical units at the universities were invited to participate in the working groups that proposed recommendations in best-practice documents.

Four pilot National Research and Education Network organisations (NRENs) are participating in the current Task of the GN3 project, namely UNINETT from Norway, CSC/Funet from Finland, CESNET from the Czech Republic and AMRES from Serbia. Each NREN has organised working groups in its country. Initially, work was done in nine technical areas. To allow a stronger concentration of results, from the start of Year 3 the number of working areas was narrowed down to six. Icons identifying each area were also introduced:

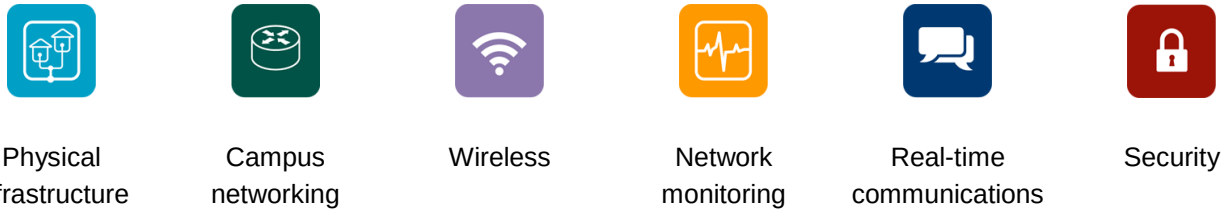

Figure ES.1: Campus Best Practice work areas and icons

As new best-practice documents are approved at the national level, they are translated into English and published on both the GÉANT and TERENA websites [GÉANT-BP, TERENA-BP]. In Year 3, seventeen new best-practice documents were published, generating a total of 42 documents.

With this comprehensive toolkit of best practices available, it is still a major challenge to get the message out to campus network managers across Europe. In this process, it is important to establish contact with more NRENs and inform them about results and working methods. In Year 3, the Task team has done this in various ways: talks at conferences, direct dialogue with NRENs, workshops in new countries, and training courses. In addition,

a roadmap document for recommended campus commitments by NRENs was prepared. A staircase of six steps was proposed, where each step requires a gradually stronger NREN commitment on campus.

In Year 3, the team gave a total of sixteen presentations at European- and national-level networking conferences. These included the TERENA Networking Conference (TNC), NORDUnet, Institute of Electrical and Electronics Engineers (IEEE), European University Information Systems Organisation (EUNIS), Forskningsnettet, and Les Journées Réseaux (JRES). In addition, kick-off Campus Best Practice Workshops were organised in Macedonia (hosted by MARNET) and in Slovenia (hosted by ARNES). A wireless training workshop was held in Serbia with wireless experts from five countries contributing.

Further dissemination plans have been prepared for Year 4, and another fifteen documents are expected to be published. The Team has proposed the continuation of Campus Best Practices for the successor project to GN3, GN3+, and would like to see new NRENs commit to this work.

1 Introduction

Campus Best Practice is the name of one of the Tasks (Task 4) in Networking Activity 3, Status and Trends (NA3), of the GN3 project. The overall objective of the Task is to address the key challenges for campus networks in Europe, organise working groups and provide an evolving, and to-the-point set of best-practice documents for the community.

The Task challenges individual National Research and Education Network organisations (NRENs) to reinforce their national efforts in promoting best practices in campus networking. Better synchronisation of campus-directed efforts at the national level of research networking and on campus itself is essential for viable end-to-end services. Another target is to find the means to develop and maintain national best-practice recommendations.

The working methods in the Task build on the experiences from UNINETT's GigaCampus project (2006–2009). As part of that project, UNINETT organised a number of working groups in Norway dealing with campus issues in different technical areas. Participants from the relevant technical units at the universities were invited to participate in the working groups, which worked to propose recommendations in best-practice documents.

Four pilot NRENs are participating in the current Task of the GN3 project, namely UNINETT from Norway, CSC/Funet (hereafter Funet) from Finland, CESNET from the Czech Republic and AMRES from Serbia.

This deliverable reports on the third year of the GN3 project. See deliverables [DN3.4.1,1] and [DN3.4.1,2] for reports on the first and second years.

Vidar Faltinsen from UNINETT is the Task Leader. He reports to the NA3 Activity Leader, Karel Vietsch of TERENA. The leading coordinators from the other pilot NRENs are Ivan Ivanovic[1] (AMRES), Jiri Navratil (CESNET) and Wenche Backman-Kamila (Funet). At the end of the third year, the Task team had nineteen members. They have a key role in organising and leading working groups and producing best-practice documents. To achieve good results it is crucially important to attract a wide set of participants in the working groups organised at national level. These include participants from the NREN itself and from universities and colleges.

A high level of management commitment of the NRENs involved is considered essential. In order to succeed with this work, the NREN must be willing and dedicated to get involved with addressing the issues and problems at the campuses of its prime customers.

[1] Mara Bukvic was the leading coordinator from AMRES until February 2012.

2 Approach

2.1 Technical focus areas

As reported in the Year 2 report [DN3.4.1,2], the Task team has reduced the number of technical focus areas from nine to six, beginning in Year 3. This allows a stronger concentration of results[2]. Table 2.1 gives an overview of the areas and the NRENs that are contributing. The "(√)" notation in the table means that this is not a main contribution area for the NREN in question, but that work is, to some extent, conducted.

Area		UNINETT	AMRES	CESNET	CSC/Funet
Ref	Name				
0	Task management and dissemination	√	√	√	√
1	Physical infrastructure	√	√		
2	Campus Networking, including IPv6	√	(√)	√	√
3	Wireless	√	(√)	(√)	√
4	Network monitoring	√	√	√	(√)
5	Real-time communications	√		√	
6	Security	√	√		
	Number of technical focus areas:[3]	**6**	**3 (5)**	**3 (4)**	**2 (3)**

Table 2.1: The narrowed-down list of focus areas applicable from Year 3

A brief description of the focus areas follows, along with new icons identifying each area.

[2] Results from discontinued areas are not abandoned. The results are still published. The discontinued areas are: procurement, audio visual (AV) and lightpath services. The last area has, in reality, been incorporated into the area of campus networking, while audio visual is published under physical infrastructure.
[3] Not counting area 0 (task management and dissemination).

Physical infrastructure. This area addresses the requirements for generic cabling systems on campus, both fibre and twisted pair. The requirements of the infrastructure in telecommunications and server rooms are also dealt with. This includes power supply, ventilation and cooling, and fire protection, as well as general Information and Communications Technology (ICT) room-plan guidelines. Recommendations for building an audio-visual (AV) infrastructure in lecture halls and meeting rooms are also covered.

Campus networking. This area deals with the campus network itself, with the routers and switches as its basic building blocks. Requirements to both Layer 2 and Layer 3 are covered. Recommendations for a redundant design are given. There is a particular emphasis on guidelines for implementing IPv6 on campus. Lightpaths on campus are also dealt with.

Wireless. This area focuses on the wireless infrastructure on campus. Radio planning, design of the wireless network, security considerations, including the implementation of IEEE 802.1X are covered. eduroam requirements and radius setup are dealt with. Cookbooks for controller-based implementations are given. Legal aspects are examined.

Network monitoring. This area focuses on network monitoring of the campus network. General requirements and framework conditions for monitoring are given. NetFlow/ Internet Protocol Flow Information Export (IPFIX) analysis is covered. Security monitoring, anomaly detection and behaviour analysis are also dealt with. Particular considerations for IPv6 monitoring are given. References to a number of open source tools are given, many of which have been developed within the GÉANT community.

Real-time communications. This area recommends infrastructures for real-time communications with an emphasis on open standards, and Session Initiation Protocol (SIP), in particular. The infrastructure itself should be media transparent, coping with voice, video, messaging, document sharing, and presence. Particular focus is given to Voice over IP (VoIP) and IP telephony. Best practices from a number of NRENs in Europe are given. Security concerns are discussed and implemented solutions are recommended. Performance issues are also covered.

Security. This area deals with security considerations for the campus network. A template for a security policy is proposed, based on core principles, as defined in International Organisation for Standardisation / International Electrotechnical Commission (ISO/IEC) 27002. An ICT security architecture for higher education is recommended. Traffic filtering technologies are discussed and general applications are recommended. Adoption of digital certificates in a public key infrastructure (PKI) is covered.

2.2 Development process for best-practice documents

The NREN-led working groups within each country have continued to develop best-practice documents (BPDs) in Year 3. Appendix A gives an overview of the active working groups within each area in the contributing countries. The development process is unchanged. Figure 2.1 captures this process.

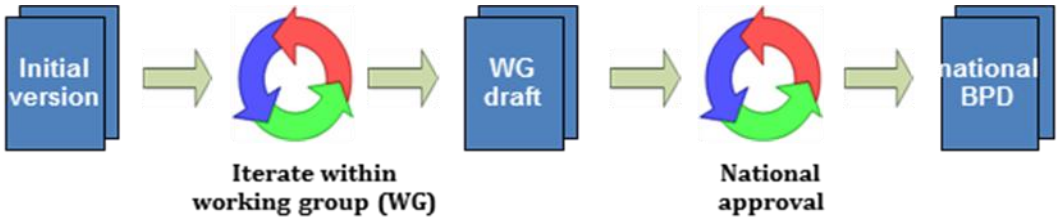

Figure 2.1: The development process for best-practice documents (BPDs)

2.3 Translation into English and web publishing

The Task team's approach to translation and web publishing has continued in Year 3. After a document is approved at the national level, it is translated into English and published on both the GÉANT and TERENA websites [GÉANT-BP, TERENA-BP].

An open-announcement mailing list, campus-bp-announcements@terena.org, is used for announcing new documents when they become available.

The way the documents are published on the GÉANT website was improved in Year 3. New icons were introduced and better descriptions of the areas and the individual documents were given. This work was done in collaboration with Networking Activity 2, Communication and Promotion (NA2).

2.4 Task management

In Year 2, the Task team made a plan for the final two years of the project. It was decided to continue the development of best-practice documents and, in addition, to strengthen the focus on disseminating the results across Europe. In April 2011, a more detailed, internal Year 3 plan was agreed upon. Work in Year 3 has followed this plan. Each NREN has reported monthly on its progress and milestone status. These written reports have been complemented by monthly videoconference meetings. In addition, two internal face-to-face meetings were organised: one in Reykjavik, Iceland on June 6 2011, and another in Vienna, Austria on October 19 2011 (in conjunction with the GN3 symposium).

The monthly reports have been used as the basis for quarterly reports to the NA3 Activity Leader, who in turn used these to prepare his contribution to the quarterly progress reports of the GN3 project as a whole. These were submitted to the European Commission.

3 Results

The main product of the Task team's work is the growing toolkit of best-practice documents. The dissemination efforts are of complementary importance. The Task needs to get the message out to the campus network managers across Europe. In this process, it is important to establish contact with more NRENs and inform them about results and working methods. The Task team does this in various ways: talks at conferences, direct dialogue with NRENs, workshops in new countries, and training courses.

3.1 Best-practice documents

As mentioned in Section 2.3, the best-practice documents are published in English on both the GÉANT and TERENA websites [GÉANT-BP, TERENA-BP]. By the end of Year 2, twenty-five documents had been published. In Year 3, another seventeen documents were published: a total of 42 documents. Table 3.1 shows how these documents are distributed in the six working areas.

Area		Documents published
Ref	Name	
1	Physical infrastructure and AV	9
2	Campus networking, including IPv6	10
3	Wireless	7
4	Network monitoring	7
5	Real-time communications	5
6	Security	4
	Total	**42**

Table 3.1: An overview of documents published in English within each area at the end of Year 3

The best-practice documents that were published in Year 3 are listed in Table 3.2 below.

No.	Document	NREN	Area	Published
1	Securing Service Access with Digital Certificates	AMRES	Security	April 2011
2	Practical IPv6 Monitoring on Campus	CESNET	Network monitoring	May 2011
3	Use of Lightpaths in Campus Networks	Funet	Campus networking	May 2011
4	Edge Device for a Campus Network	Funet	Campus networking	May 2011
5	WLAN Network Infrastructure	Funet	Wireless	May 2011
6	Monitoring Tools for Network Services and Systems	Funet	Network monitoring	May 2011
7	VoIP Anomaly Detection	UNINETT	Real-time comm.	Aug 2011
8	Traffic Filtering – an overview of the technologies and their application in AMRES	AMRES	Security	July 2011
9	Framework Conditions and Requirements for Network Monitoring in Campus Networks	UNINETT	Network monitoring	Oct 2011
10	IPv6 Autoconfiguration	CESNET	Campus networking	Aug 2011
11	IPv6 Address Space	CESNET	Campus networking	Aug 2011
12	Evaluating the Progress towards and Implementation of IPv6	CESNET	Campus networking	Sept 2011
13	Recommendations for a Redundant Campus Network	UNINETT	Campus networking	Dec 2011
14	Network Security Monitoring and Behaviour Analysis	CESNET	Network monitoring	Sept 2011
15	Recommendations for Network Traffic Analysis Using the NetFlow Protocol	AMRES	Network monitoring	Nov 2011
16	Evaluating the Performance of SIP Infrastructure	CESNET	Real-time comm.	Sept 2011
17	The Legal Aspects of WLAN Networks	Funet	Wireless	Jan 2012

Table 3.2: Best-practice documents published in Year 3

In addition two new reports were published in Year 3:

No.	Document	NREN	Area	Published
1	Taking Lightpaths into Use for End Users.	Funet	Campus networking	March 2012
2	Procurement Cooperation in the HE Sector in Norway	UNINETT	Procurement	March 2012

Table 3.3: Reports published in Year 3

3.2 Dissemination

3.2.1 Presentations at conferences

The Task team has been active in Year 3, and has presented results at a number of conferences. A total of sixteen presentations were given, as shown in Table 3.4. In some cases, the results of individual best practices were presented; in other cases, an overview of the Task team's results and working methods, in general, were given.

No.	Date	Event	Presentation	Presenter
1	May 16 2011	TNC 2011, Prague, the Czech Republic	Managing Information Security while Enabling Communities	Kenneth Høstland, UNINETT
2	May 16 2011	TNC 2011, Prague, the Czech Republic	VoIP Anomaly Detection Engine	Gurvinder Singh, UNINETT
3	May 17 2011	TNC 2011, Prague, the Czech Republic	Campus Best Practices	Gunnar Bøe, UNINETT
4	May 19 2011	TNC 2011, Prague, the Czech Republic	Monitoring of Electrical Power Consumption in ICT rooms	Ivan Ivanovic, AMRES
5	May 19 2011	TERENA General Assembly, Prague, the Czech Republic	Experiences with National Procurement Processes in Norway	Lars Skogan, UNINETT
6	May 23-27 2011	IFIP/IEEE IM, Dublin, Ireland	Practical IPv6 Monitoring – Challenges and Techniques (poster)	Tomas Podermanski and Matej Gregr, CESNET
7	June 7 2011	NORDUnet 2011, Reykjavik, Iceland	Aiming for Wireless Network Excellence for Research and Education	Wenche Backman, CSC/Funet
8	June 7 2011	NORDUnet 2011, Reykjavik, Iceland	Automatic Topology-detection in the Network Monitoring Tool, NAV	Morten Brekkevold, UNINETT

No.	Date	Event	Presentation	Presenter
9	June 15 2011	EUNIS 2011, Dublin, Ireland	Campus Best Practices	Vidar Faltinsen, UNINETT
10	June 16 2011	EUNIS 2011, Dublin, Ireland	Managing Information Security	Gunnar Bøe, UNINETT
11	June 16 2011	EUNIS 2011, Dublin, Ireland	Funet Working Groups (poster)	Janne Oksanen, CSC/Funet
12	Nov 16 2011	Forskningsnettet 2011, Korsør, Denmark	UNINETT@campus	Vidar Faltinsen, UNINETT
13	Nov 22 2011	JRES 2011, Toulouse, France	Campus Best Practices	Vidar Faltinsen, UNINETT
14	Nov 24 2011	JRES 2011, Toulouse, France	Deploying IPv6 in University Campus Network – Practical Problems	Tomas Podermanski, CESNET
15	Feb 9 2012	Task Force mobility meeting (virtual meeting)	Campus Best Practices and Suggestions on a Liaison with Task Force Mobility	Wenche Backman-Kamila, CSC/Funet
16	March 1 2012	IT 2012, Zabljak, Montenegro	AMRES Experience with “Campus Best Practices”	Mara Bukvic, AMRES

Table 3.4: Presentations at conferences in Year 3

3.2.2 Roadmap document for NREN campus commitment

A Campus Best Practice overview report [GÉANT-CPB] was published in November 2011. The report gives recommendations on how a national Campus Best Practices effort can be organised in other NRENs. A staircase of six steps is proposed, in which each step requires a gradually stronger NREN commitment on campus. The steps are listed below and shown in Figure 3.1.

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.

The focus in NA3 Task 4 is on the first three steps. UNINETT is working on all steps in its campus activities in Norway.

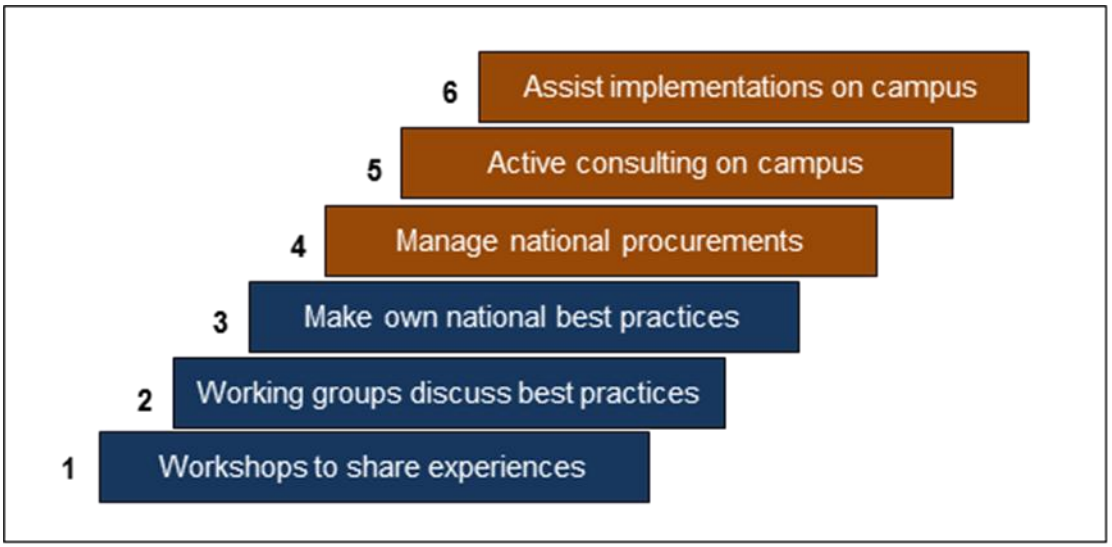

Figure 3.1: The Campus Best Practices staircase

The report concludes that campus involvement is a strategic choice for an NREN. An important decision for the NREN is the amount of resources (man-hours, money) the NREN wants to invest in a Campus Best Practice activity. In general, the resources required increase with each step in the staircase. The first two steps do not require many resources and are an excellent way to gain experience in the campus area.[4]

When it comes to the funding of these activities, the NREN must be prepared to do the initial funding, unless the government can be convinced, at this early stage, to contribute to this kind of activity. Once an activity like this is up and running, the universities/customers may see the benefits more clearly and may be willing to contribute. Figure 3.2 illustrates the two different roles the NREN must play in the process.

[4] For further details on the Task team's experiences see Chapter 6 ("How to set up a national activity") of the overview report [GÉANT-CPB]. For an evaluation of the Norwegian GigaCampus project (2006-2009), see Chapter 4 of the GigaCampus final report [GIGACAMPUS]. This includes an assessment of profitability and lessons learned.

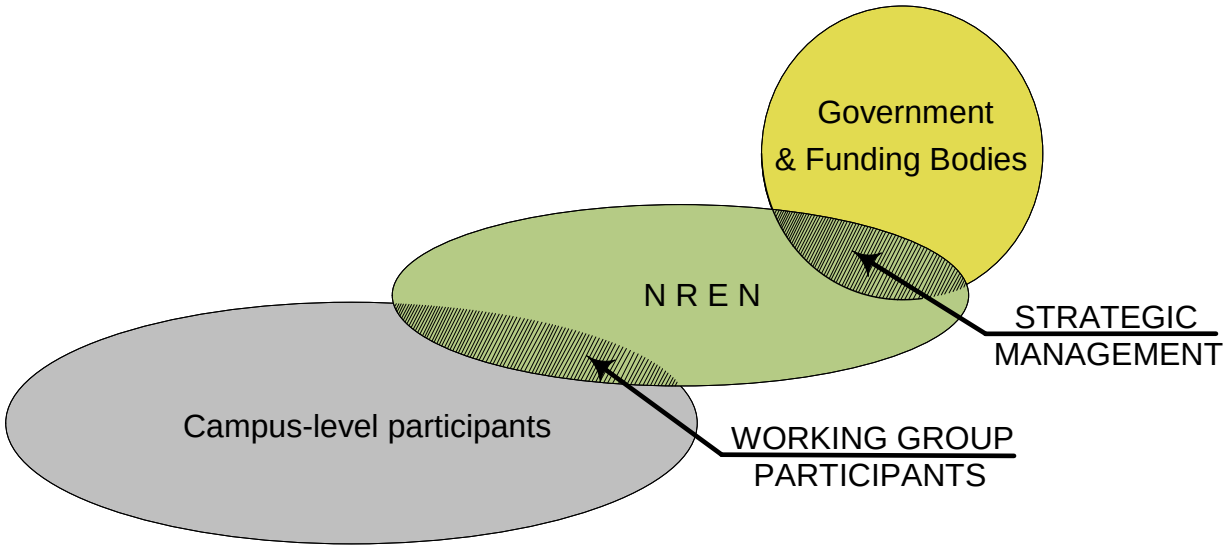

Figure 3.2: NREN involvements required for viable campus involvement

3.2.3 Workshops and meetings

To capture the interest of new NRENs, the presentations that the Task team gives at conferences are vital. In a number of cases, this has led to a follow-up interest. The natural next step is further dialogue with these NRENs, through email, videoconferences, and/or face-to-face meetings. The Team then seeks to provide a more in-depth understanding of what Campus Best Practice is about and how the NRENs and the campuses can benefit from this work.

In Year 3, the Task has been working in this manner with all three Baltic countries. Team members have had separate meetings in each country, with the respective NRENs, i.e., EENet in Estonia, SigmaNet in Latvia, and LITNET in Lithuania. This is likely to develop into a workshop in at least one of these countries in Year 4.

Similarly, the presentations at the French networking conference JRES 2011 in Toulouse captured the attention of RENATER and has resulted in a follow-up videoconference meeting and further dialogue. The presentation the Task team gave in Montenegro also attracted interest and may very well develop into a workshop in Year 4.

In two cases in Year 3, the Task team achieved the milestone of organising a Campus Best Practice workshop in a new country. The team has found this to be a good way of initiating the process in a new country. Naturally, this is done in close collaboration with the local NREN, which hosts the workshop and invites campus people from their community. Representatives from the Task team contribute with presentations of both results and working methods.

The two workshops that were successfully organised in Year 3 were in Macedonia, hosted by MARNET, and in Slovenia, hosted by ARNES. Table 3.5 gives an overview. Details of the agenda and the presentations are given in Appendix C.

Workshop site	Hosted by	Date	Participants
Skopje, Macedonia	MARNET	September 15 2011	30
Ljubljana, Slovenia	ARNES	October 21 2011	40 + remote viewers

Table 3.5: Campus Best Practice workshops in new countries in Year 3

Figure 3.3: Campus Best Practice Workshop in Ljubljana hosted by ARNES

ARNES conducted a survey after the workshop in Ljubljana and concluded that there is significant interest for continuing with a campus activity in Slovenia. 95% replied they were satisfied with the workshop and 42% said they would be willing, in the future, to contribute to a best-practice document. With regard to the areas of most interest, the number-one area was cloud computing (Infrastructure as a Service (IaaS)), while network monitoring was the second most popular. See further details on the statistics in Appendix C.

3.2.4 Wireless training course

Another way to disseminate results is to set up training courses focused on one particular area. This was done in the wireless area in Year 3. The Task team organised a training course in Belgrade on September 12 2011. Wireless experts from Finland, Norway, Sweden, Slovenia and Serbia contributed with talks. There were 50 participants, predominantly from various universities in Serbia. See Appendix D for the agenda. The workshop was streamed and archived. Statistics, as of March 15 2012, show that there is a great deal of interest in this material:

No.	Presentation	Presenter	Number of viewings
1	WLAN Network Planning	Anders Nilsson, SUNET	626
2	802.1X and eduroam	Rok Papez, ARNES	491
3	Controller-based Solution	Vidar Stokke, NTNU (Norway)	615
4	FreeRADIUS	Marko Stojakovic, AMRES	473
5	eduroam Debugging	Gunnar Bøe, UNINETT	418
6	WLAN Information Security	Wenche Backman-Kamila, Funet	336
7	WLAN Infrastructure Monitoring and Supplicants	Wenche Backman-Kamila, Funet	809

Table 3.6: Number of viewings, September 2011 – March 2012, of the presentations from the wireless training course

4 Plans for Year 4

The work on producing best-practice documents will continue in Year 4. The Task team estimates that another fifteen documents will be published, making a total of 57 documents. In addition, the oldest documents will be revised and updated, in accordance with established processes. Further, the team will continue to focus on dissemination. Continued collaboration with NA2 is important in this work. The Task will enhance its presence on the web and use the Connect magazine as a channel to reach more NRENs. The team will continue to present both results and working methods at conferences across Europe.

Further dialogue and discussions with other NRENs that would like to organise an activity is also important in Year 4. The initial Year 3 meetings in the Baltic will hopefully lead to a workshop in Year 4. Montenegro is also a good candidate for a workshop as a follow-up after the presentation given at the conference in Zabljak in February 2012. The presentations at JRES in Toulouse in November 2011 have resulted in an interesting dialogue with RENATER. These talks are likely to develop in Year 4.

The team will also follow up in Slovenia in Year 4 and is likely to take an initiative in Bosnia-Herzegovina. The team has already been invited to present at the national conference in Romania in November 2012. The team will present at the TERENA Networking Conference (TNC) and European University Information Systems Organisation (EUNIS) and NORDUnet conferences in 2012. In May 2012, the team will present at the AfREN conference in Gambia, reaching out to a number of NRENs in Africa.

The team submitted a proposal for the successor project to GN3, GN3+, in early January and would like to see new NRENs commit to this work. In preparation for a potential GN3+ effort, the Task team should revise the working methods. For example, the procedures for selecting candidate topics for new best-practice documents could be formalised more, and potential overlaps in documents should be dealt with. It is important to ensure that the toolkit of campus best-practice documents is up to date and of the highest possible quality.

Appendix A Working Groups

A list of active working groups in each country is given below. In some cases, there have been changes in the leadership of the working groups. The leaders listed are those that are active at the time of writing. Working-group leaders that are marked with an asterisk in the tables below are not members of the NA3 Task 4 team. This means that the costs of their work are not charged to the GN3 project budget, but are borne entirely by the NREN.

A.1 UNINETT

Area	Group	Current leader	Founded
1	Physical infrastructure	Helge Stranden*	Jan 2006
2	Network architecture	Gunnar Bøe	Jan 2006
3	Mobility	Tom Myren*	Dec 2006
4	Network monitoring	Vidar Faltinsen	Jun 2005
5	Real-time communications (SIP)	Jardar Leira	Jan 2006
6	Security	Rolf Sture Normann*	Jun 2008

Table A.1: Norwegian working groups

A.2 AMRES

Area	Group	Current leader	Founded
1	Physical infrastructure	Ivan Ivanovic	Nov 2009
4	Network monitoring	Ivan Ivanovic	Sep 2009
6	Security	Mara Bukvic	Sep 2009

Table A.2: Serbian working groups

A.3 CESNET

Area	Group	Current leader	Founded
2	IPv6	Martin Pustka	Jan 2010
4	Network monitoring	Tomas Podermanski	Nov 2009
5	IP telephony	Jan Ruzicka*	Nov 2009

Table A.3: Czech working groups

A.4 Funet

The AccessFunet working group covers two areas: campus networking (2) and network monitoring (4).

Area	Group	Current leader	Founded
2,4	AccessFunet	Janne Oksanen and Juha Hopia	Feb 2010
3	MobileFunet	Wenche Backman-Kamila	May 2009

Table A.4: Finnish working groups

Appendix B Workshops Organised at the National Level

The following workshops were organised at the national level in Year 3.

No.	Date	Area	Topic	Country	#days	Participants
1	May 2011	2	Campus networking	Finland	1	8
2	May 2011	3	Wireless	Finland	1	6
3	September 2011	2	Campus networking	Norway	2	48
4	September 2011	3	Wireless	Finland	1	6
5	October 2011	4	Network monitoring	The Czech Republic	1	60
6	November 2011	2,3,4	Network, wireless, monitoring	Finland	1	48
7	November 2011	3	Wireless	Norway	1	23
8	November 2011	2	IPv6	The Czech Republic	1	31
9	February 2012	5	VoIP/SIP	Norway	1	73
10	February 2012	2	IPv6 address planning, implementation and security	Norway	2	12
11	March 2012	4	Network monitoring	Norway	1	32

Table B.1: Workshops organised at the national level

Appendix C Workshops in new countries

C.1 Macedonia – September 15 2011

Time	Presentation	Presenter
0900	Welcome	Margita Kon-Popovska, MARNET/UKIM
0915	Organisational approach talk	Gunnar Boe, UNINETT
0945	Q&A, short discussion	All
1000	WLAN information security	Wenche Backman-Kamila, Funet
1030	Coffee	
1100	FreeRADIUS	Marko Stojanovic, AMRES
1130	End-user database	Marina Vermezovic, AMRES
1215	Q&A	All
1230	Lunch	
1400	Resilient campus design	Matej Gregr, CESNET
1440	NetFlow monitoring	Ivan Ivanovic, AMRES
1520	Q&A	All
1530	Coffee	
1600	Deploying of IPv6 in university campus networks	Tomas Podermanski, CESNET
1640	Traffic filtering	Mara Bukvic, AMRES
1720	Q&A	All

Table C.1: Campus Best Practice workshop in Macedonia

C.2 Slovenia – October 20 2011

Time	Presentation	Presenter
0900	Introduction from the Ministry of Education	Peter Sterle, Ministry of Education
0915	Welcome to the Campus Best Practice workshop	Marko Bonac, CEO, ARNES
0920	New services from ARNES	Tomi Dolenc, ARNES
1000	Presentation of Campus Best Practices	Vidar Faltinsen, UNINETT
1100	Coffee	
1115	Best practices in resilient campus networks	Tomas Podermanski, CESNET
1200	Best practice on campus network monitoring	Vidar Faltinsen, UNINETT
1245	Lunch	
1315	Challenges with IPv6 deployment at campus level	Tomas Podermanski, CESNET
1400	Experiences from the development of a national SIP infrastructure in Norway and the deployment of SIP on campus	Vidar Faltinsen, UNINETT
1445	End of workshop	

Table C.2: Campus Best Practice workshop in Slovenia

C.3 Excerpt from the Slovenian workshop survey results

A survey was conducted after the Campus Best Practice workshop hosted by ARNES in Ljubljana on October 20 2011. The results of three of the questions (A-C) are shown in Figure C.1, Figure C.2 and Figure C.3.

A: Did you like the workshop?

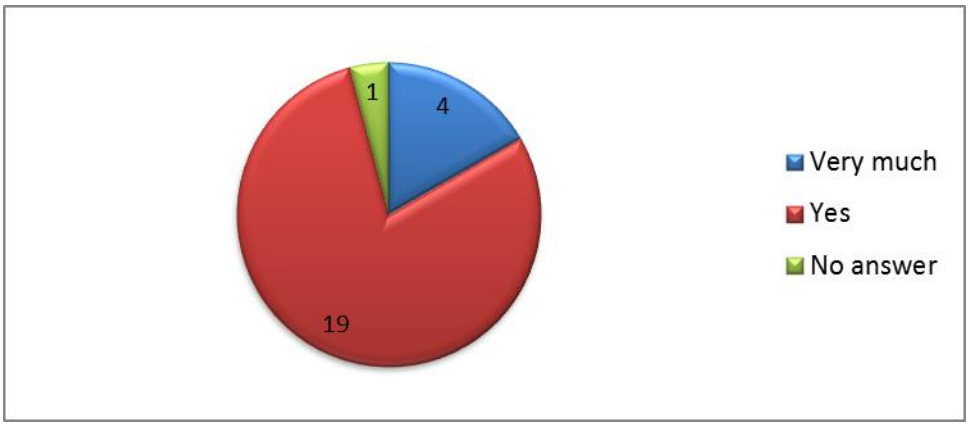

Figure C.1: Results of Q.A from survey conducted by ARNES after Campus Best Practice workshop

B: Would you be willing to participate in the preparation of Best Practice Documents?

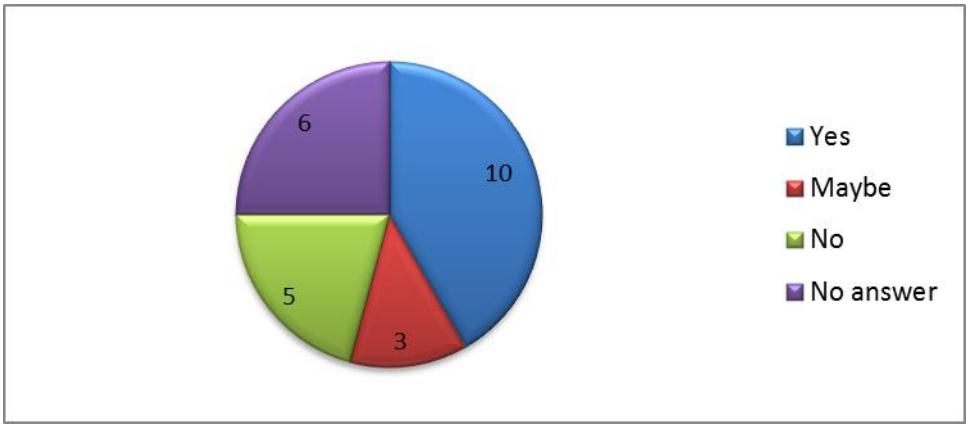

Figure C.2: Results of Q.B from survey conducted by ARNES after Campus Best Practice workshop

C: Which topics would you like to learn more about?

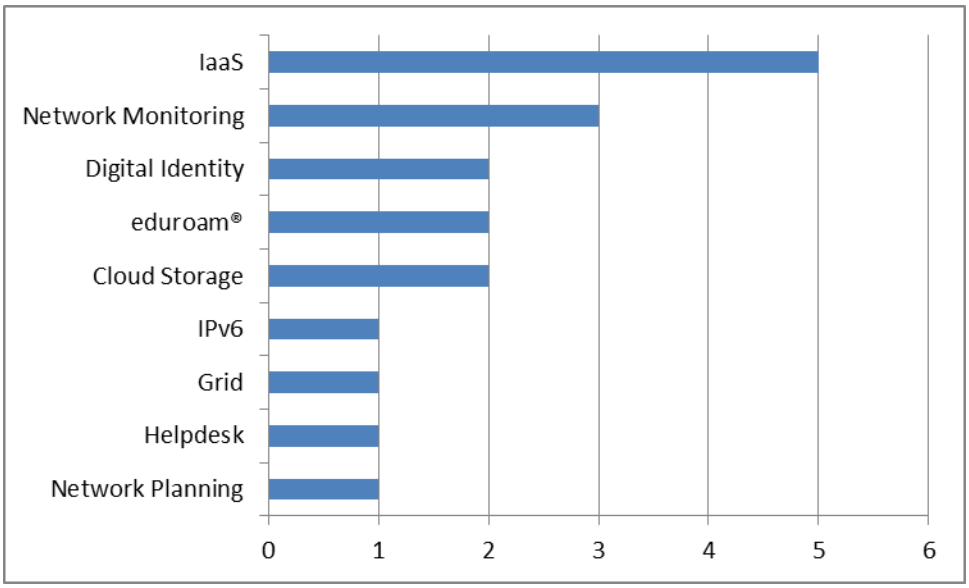

Figure C.3: Results of Q.C from survey conducted by ARNES after Campus Best Practice workshop

Appendix D Wireless Training Course in Belgrade, Serbia

A wireless training course was organised in Belgrade on September 12 2011. The agenda is shown below.

Time	Presentation	Presenter
0900	Welcome	Wenche Backman-Kamila, CSC/Funet; Gunnar Bøe, UNINETT; Mara Bukvic, AMRES
0915	WLAN network planning	Anders Nilsson, SUNET
1030	Coffee	
1100	802.1X and eduroam®	Rok Papez, ARNES
1130	WLAN information security	Wenche Backman-Kamila, Funet
1200	WLAN infrastructure monitoring and supplicants	Wenche Backman-Kamila, Funet
1230	Lunch	
1400	Controller-based solution	Vidar Stokke, NTNU (Norway)
1445	FreeRADIUS	Marko Stojakovic, AMRES
1530	Coffee	
1600	eduroam® Debugging	Gunnar Bøe, UNINETT
1645	Q&A – all topics	
1730	End of workshop	

Table D.1: Wireless training course in Belgrade, Serbia

References

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[GÉANT-BP]	www.geant.net/About_GEANT/Campus_Best_Practice/
[TERENA-BP]	www.terena.org/campus-bp
[GIGACAMPUS]	"GigaCampus 2006-2009: Final Report" www.terena.org/activities/campus-bp/pdf/gigacampus_final_report.pdf

Glossary

AV	Audio Visual
BPD	Best-Practice Document
EUNIS	European University Information Systems Organisation
HE	Higher Education
IaaS	Infrastructure as a Service
ICT	Information and Communications Technology
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IFIP	International Federation for Information Processing
IP	Internet Protocol
IPFIX	Internet Protocol Flow Information Export
IM	Integrated Network Management
ISO	International Organisation for Standardisation
JRES	Les Journées Réseaux (Networking Days)
NA2	GN3 Networking Activity 2, Communication and Promotion
NA3	GN3 Networking Activity 3, Status and Trends
NA3 Task 4	NA3 Task 4, Campus Best Practice
NREN	National Research and Education Network organisation
PKI	Public Key Infrastructure
SIP	Session Initiation Protocol
TNC	TERENA Networking Conference
VoIP	Voice over IP
WLAN	Wireless Local Area Network