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Deliverable DS2.3.2:
Multi-Domain Service Performance Experience

Deliverable DS2.3.2

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Abstract

This Deliverable describes GN3 SA2's experiences with the federated PERT service eduPERT.

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Executive Summary

A Performance Enhancement and Response Team (PERT) is team of network engineering experts who help end users whose applications are sensitive to network characteristics. This could include, for example, network degradation or inherent limitations such as long distance.

The first operational PERT was set up by European NRENs in 2003 and later expanded into a production service as part of the GN2 project. The GN2 PERT was a highly centralised operation, with National Research and Education Network (NREN) experts on a roster to take turns in assisting users with new reported cases.

From the outset it was envisaged that the PERT would evolve into a federation of multiple groups, similarly to the Computer Emergency Response Teams (CERTs), operating in an independent but collaborative manner. Accordingly, at the end of GN2, the centralised element of PERT was reduced to a set of core services (PERT Knowledge Base (PERT-KB), PERT Training, PERT website, monthly reporting (based on NREN feedback), registration and accreditation of new PERTs), and the responsibility for managing new cases (and communicating with end-users) was transferred to the National Research and Education Network (NREN) PERTs. The new-look service was named eduPERT, in keeping with other GÉANT-developed services such as eduroam.

eduPERT has been a mixed success. The PERT-KB and the training function, for example, have been well used, while other elements, such as accreditation, have generated minimal or no interest. It is, therefore, important that appropriate changes are made to eduPERT. A PERT workshop is planned to be run on the first day of the TERENA Networking Conference (TNC2012), and the views and experiences of those present will help decide what recommendation is made to the GN3 Project Management Team (PMT).

1 Introduction

The idea of a Performance Enhancement and Response Team (PERT) dates back more than 10 years. The term was coined by the Internet2 community and was used to refer to a group of expert network engineers who would investigate and resolve network performance issues, similar to the way that computer security experts form a CERT.

For Internet2 the PERT remained a theoretical idea for discussion but the European NREN community went on to develop the idea. This began with a small-scale proof of concept which evolved, in GN2, to a full-scale production service. The work of a PERT is complicated by the fact that it often has to work with many organisations of diverse types (see Figure 1.1 below), often in different countries or even continents, trying to resolve a problem whose root cause might not even be a faulty or degraded system, but expected behaviour from, for example, a long distance network path. As such PERT engineers are just as likely to advise users how they can tune their end-systems to optimise data transfer performance, as they are to advise NOC engineers where low level packet loss may be occurring.
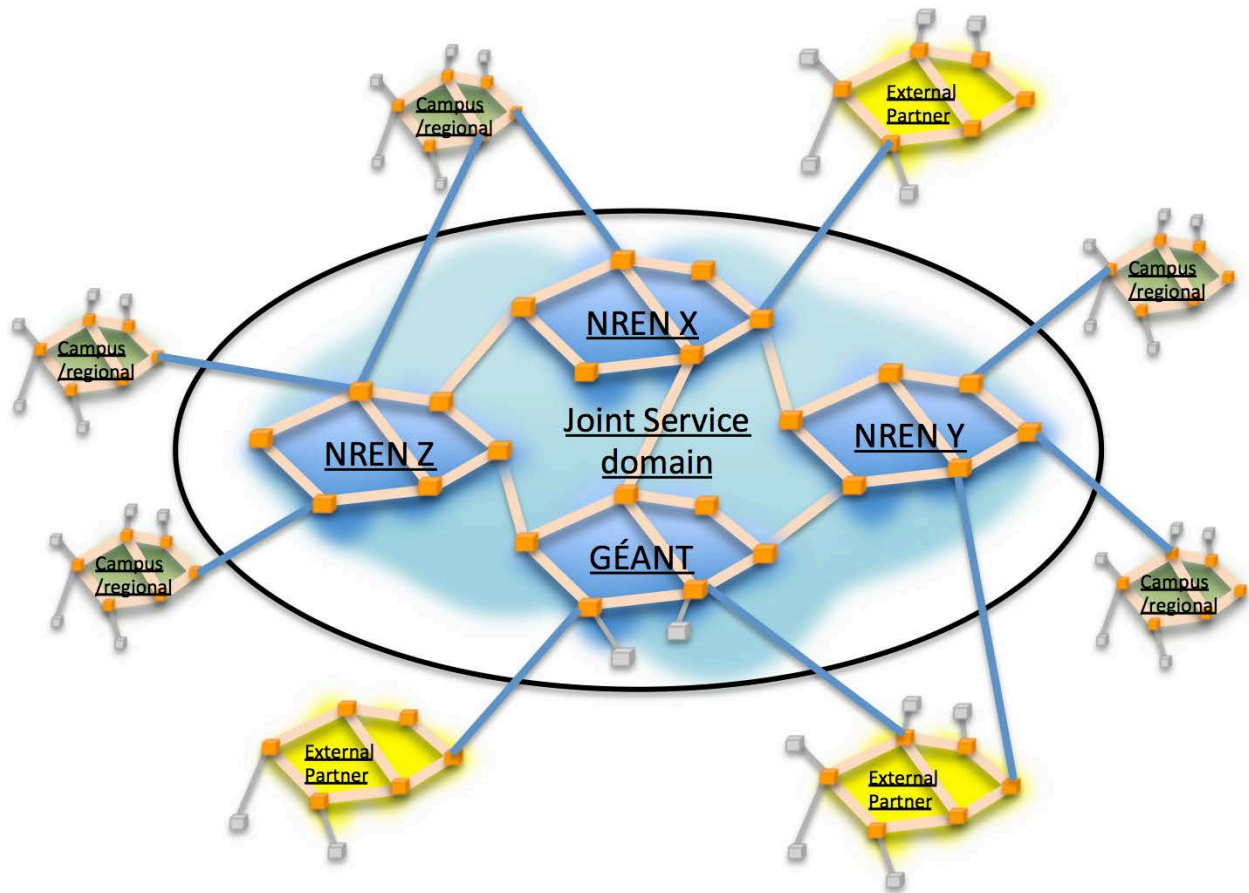
Figure 1.1: Interaction of PERTs and different organisations

This Deliverable describes the operation of GN3's federated PERT, contrasting it with the previous centralised PERT operated during the GN2 project. The lessons learned to date will help determine the future of the PERT, both for the remainder of GN3 and beyond. The decision regarding the future development of the PERT, to be taken by the GN3 Project Management Team, will be very much guided by the advice of the key members of GN3 SA2 (Multi-Domain Network Services), who themselves will take into careful consideration the thoughts and experiences of those attending the next PERT Workshop, to be held in Reykjavik in May 2012.

2 Centralised PERT: The GN2 Experience

The first production-quality PERT was designed and delivered by GN2 SA3 (Support for Multi-Domain Services) [DS3.6.2]. As is common with a new service, the PERT began with a pilot of six months duration from October 2004 to March 2005. During the pilot, the duty PERT staff worked on a part-time basis (three hours a day). Once in full production eight NRENs participated in the GN2 PERT:

- CARNet [CARNet]
- CESNET [CESNET]
- FCCN [FCCN]
- GARR [GARR]
- Hungarnet [Hungarnet]
- PSNC [PSNC]
- RENATER [RENATER]
- SWITCH [SWITCH]

Together with DANTE, they provided over 75 Person Months of effort over four years of the project to run day-to-day operations of the PERT.

2.1 The Structure of a Centralised PERT

Each person contributing to the PERT fulfilled one or more of the following four roles:

- PERT Manager (PM)

  The PERT managers were responsible for the overall functioning of the PERT. There were two PMs; one from DANTE, one from SWITCH.

- Duty Case Manager (DCM)

  The Duty Case Manager was the first point of contact for the end users submitting their cases. DCMs opened cases, conducted initial investigations and were responsible for the day-to-day PERT operation. They were also responsible for managing the progress of unresolved cases. They worked with a roster from (changed every week) from the nine GN2 member organisations.

- Special Case Manager (SCM)

    Special Case Managers were volunteers who adopted specific cases (of their choosing) and conducted the investigation through to resolution.

- Subject Matter Expert (SME)

    Subject Matter Experts were contributors, often outside of the GN2 consortium, who gave their time 'pro bono' in as much as they did not receive any funding from the GN2 project. SMEs typically had in-depth knowledge of one or more areas of network engineering and/or end-systems. SMEs were invited to join the PERT or offer their services directly.

    The PERT had mixed success with SMEs, with fewer people joining than hoped, and even fewer being active participants.

The users of the PERT (which is to say anyone requesting help) were divided into two categories. The first category of users comprised NREN staff who were able to open a PERT case directly. The second category comprised end users who had to rely on an NREN to forward their request to the PERT.

The centralised PERT operated during European working hours (weekdays 0900-1700 CET). During these periods there was always at least one designated DCM progressing open cases and ready to receive new ones. The number of cases grew steadily and the DCM worked as 1 Full Time Equivalent (FTE), changing on a weekly basis. Some NRENs preferred to provide cover for a whole week at a time, whilst others shared the work with another NREN, e.g., each providing 0.5 FTE for the week.

2.2 Tools of the Centralised PERT

Two dedicated systems were put in place to support the PERT: The PERT Ticket System (PTS) and the PERT Knowledge Base (PERT-KB). There were also a number of PERT related mailing lists.

- PERT Ticket System (PTS)

    The PERT Ticket System was developed, maintained and administered by PSNC. The PTS was designed to fulfil the identified requirements for PERT operations: a generic issue tracker (where cases can be added, updated and closed) and also other functions such as the DCM roster. After centralised PERT operations ended, the PTS was shut down.

- PERT Knowledge Base (PERT-KB)

    The PERT Knowledge Base is a wiki-based public website containing advice and guidance on a wide range of subjects relating to network performance. The PERT-KB was implemented by SWITCH (SWITCH staff remain the most regular publishers). From the outset the PERT-KB was (and still is) recognised as a very valuable and comprehensive source of information that helps end users to diagnose and fix their network performance problems.

    The PERT-KB is also an excellent source of information to help non-experts learn about the subject of network performance; both from its own articles as well as the carefully selected links that lead to external sites and articles.

- PERT Mailing Lists

  There were three PERT mailing lists:

  ○ pert-managers@geant2.net – A list just for PERT Managers.

  ○ pert-report@geant2.net – A list for primary customers to report problems to the PERT duty case manager.

  ○ pert-discuss@geant2.net – A list for the PERT (Case Managers and SMEs) to discuss open cases.

  Although a very basic tool, the mailing lists were nevertheless very important as they tended to be where most ideas where exchanged, and new issues raised. With the closure of the centralised PERT all lists except "pert-discuss" were removed and 'pert-discuss' itself has seen very little activity during GN3.

3 Federated PERT

3.1 The Creation of the Federated PERT

As described in the Deliverable DS3.12.4 "*Policy for a Federated Performance Enhancement Response Team (PERT)*" [DS3.12.4], the GN2 project's centralised PERT was a mixed success. While the PERT's assistance in solving problems was generally appreciated by end users, they had gained a lot of the knowledge required to solve network performance issues through the developed and populated PERT-KB. Therefore, a smaller number of cases was raised than expected (one or two per month on average). This was also due to the low level of awareness of GN2 PERT operations outside the European NRENs.

Discussion on the future of the PERT began at the second GN2 technical workshop in June 2006. It was eventually agreed that the PERT should be de-centralised and its investigative responsibilities (the most high-profile and expensive part of the service) handed over to organisations (particularly NRENs) that would host their own PERTs and be responsible for resolving cases in a federated manner. The other supporting functions would remain centralised and be funded by the project. A detailed description of the plan for this decentralised PERT is given in the Deliverable "*Description of a Decentralised PERT*" [DS3.12.1].

3.2 The Overall Goal of the Federated PERT

The GÉANT community's federated PERT is called eduPERT to emphasise its GÉANT origins alongside services like eduGAIN and eduroam. eduPERT's purpose is to help users to get optimal performance from their networked applications. End users can contact the PERT in their network domain directly or, more likely, through their standard Information Technology (IT) support channel. The federated model of collaboration means that individual PERTs should be able to quickly and easily contact the PERTs in other network domains from whom they need help, particularly when troubleshooting a multi-domain issue.

3.3   Organisation

The federated PERT consists of a central PERT service, and a collection of registered and accredited PERTs (the difference between which is described below). The detailed structure of the federated PERT is presented in [DS3.12.4]. The current list of PERTs is as follows:

- ARNES [ARNES]
- CSC [CSC]
- SWITCH [SWITCH]
- RESTENA [RESTENA]
- PIONIER [PIONIER]
- FCCN [FCCN]
- GÉANT [GEANT]
- DFN [DFN]
- e-Arena [eArena]
- SANET [SANET]
- AMRES [AMRES]
- GRENA [GRENA]
- BASNET [BASNET]
- GARR [GARR]
- HEAnet (HEAnet X-PERT) [HEAnet]
- ACOnet [ACOnet]
- RENATER [RENATER]

With the exception of the GÉANT PERT, all of the above are of the 'national PERT' type and were set up as a function of an existing group (normally a Network Operations Centre (NOC) team).

To encourage participation in the federated PERT, the commitment required from an NREN to register with eduPERT are intentionally minimal. These requirements are described in [DS3.12.4] but can be summarised as providing public and private contact details for inclusion on the eduPERT website [eduWeb] (private details are only accessible to other PERTs with login privileges).

After registering, a PERT can seek accreditation. This requires a greater degree of commitment and willingness to offer support, and more information about their network. To date only one PERT has been granted accreditation, and that is SWITCH. No other PERT has sought accreditation and, whilst the reasons for this have not been rigorously investigated, informal feedback indicates that PERTs see insufficient benefits for the effort of going through the accreditation process (described in [DS3.12.4]).

3.4 Functions

3.4.1 Case Management

Since the PERT was first conceived, the main purpose of any PERT has been to help users get optimal performance from their network-dependent application, predominantly by identifying and addressing issues related to network performance, which can have a disproportionately adverse effect on high-end applications (e.g., sending large data sets over long distances). This activity is referred to as 'case management' and is a responsibility shared by all PERTs participating in eduPERT, with the lead PERT in any given situation being the team a problem was first submitted to by a user.

Although problems can be submitted by any user, they are usually submitted by more skilled users from Grid communities, research institutions or programmers. They are normally able to provide a detailed illustration of the problem, often described in terms of their own technical speciality, and a history of their efforts to find a solution. In such cases, a PERT engineer will usually work directly with the user. In cases where the problem is reported by less technically-skilled users, or users from another (external) domain, the PERT will typically contact and liaise with other network or system administrators or the PERT of the users' domain (if one exists).

In cases where a network problem is diagnosed, the responsibility for fixing the problem will normally reside with the relevant domain's Network Operations Centre (NOC). Nevertheless, PERTs should be ready to advise NOCs or system administrators on what work is required to restore or improve network performance. They may also be able to recommend possible workarounds to end users. PERT engineers also have greater privileges when using perfSONAR tools to run multi-domain performance tests.

It should be emphasised that even if the root cause of a problem lies beyond a PERT's domain, the PERT should cooperate actively with the end user, articulating its concern to the other relevant domain(s).

Although case management is currently the main focus (see Table 3.1), the number of PERT cases reported by the European PERTs is low – just 37 for the whole of 2011, spread across 16 PERTs.

	NEW	CLOSED - cancelled	CLOSED – no solution found	CLOSED - resolved
2011/01	2	1	0	0
2011/02	5	0	0	0
2011/03	10	2	1	7
2011/04	6	1	0	7
2011/05	2	0	0	4
2011/06	5	2	0	3
2011/07	3	0	0	3

	NEW	CLOSED - cancelled	CLOSED – no solution found	CLOSED - resolved
2011/08	0	0	0	0
2011/09	0	0	0	0
2011/10	0	0	0	0
2011/11	2	0	0	3
2011/12	2	2	0	1
SUM	**37**	**8**	**1**	**28**
2012/01	6	0	0	3
2012/02	1	0	0	1
2012/03	2	0	0	2
SUM	**9**	**0**	**0**	**6**

Table 3.1: Number of PERT cases reported by members of eduPERT

3.4.2 Central Services

When the federated PERT was established a number of centralised support services were defined. Some of these were carried over from the GN2 centralised PERT and others were newly created. These services were:

- Registration and accreditation of member PERTs.
- Arrangement of eduPERT meetings.
- Delivery of PERT training.
- Administration and maintenance of the Knowledge Base [eduPKB].
- Generation of regular reports on PERT activity.
- Administration of the PERT discussion list [eduPdisc].
- Deployment and maintenance the eduPERT website [eduWeb].

These services have in the main part been run independently of one another, and with varying degrees of success. Where services have not been as active or as prominent as expected, this has largely been due to a lack of resource to promote and implement them. In decentralising the PERT and giving more responsibility to individual PERTs, there has not been the usual level of public relations support normally associated with GN3 services. For example, while the number of registered PERTs post-GN2 expanded, only one PERT progressed to become accredited (SWITCH).

The PERT Knowledge Base and the PERT Training workshops have proved to be the most successful elements of the central support services; both have persisted from the early days of the GN2 PERT. It is a credit to all who have contributed to the PERT-KB (particularly SWITCH) that the number of visitors over the years has remained consistently high. It is also worth noting that when the web server hosting PERT-KB crashed in January 2012, the problem was reported (on the pert-discuss mailing list) almost straight away. The web server was quickly restored and plans are now being made to re-home the PERT-KB on a GÉANT backbone server.

Figure 3.1 shows the statistics for PERT-KB unique visitors between December 2010 and March 2012. The number of visitors per month typically averages over 3000. Of these about 30% are from the US, 7% from India, 6% from the UK, 5% from Germany, 4% from France and Canada, and 2% from each of Brazil, Russia, Slovenia and Switzerland.
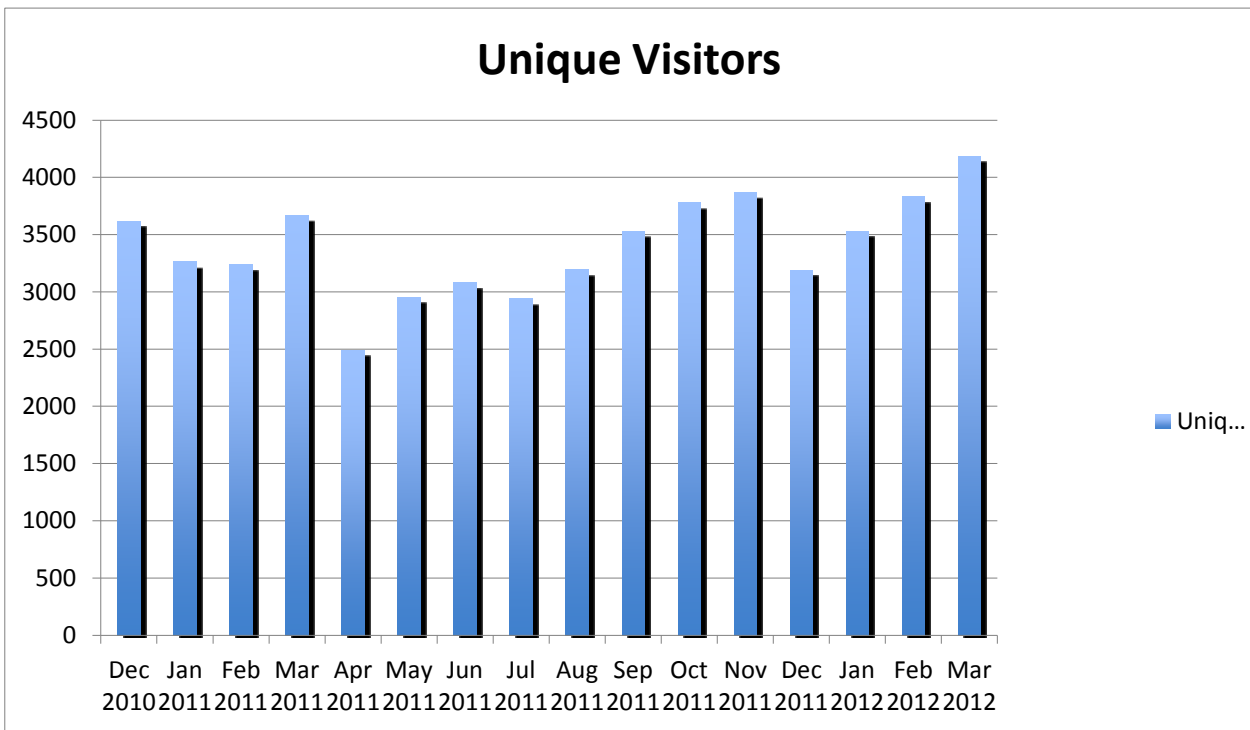

Figure 3.1: PERT-KB website statistics

4 Conclusions

Like the centralised GN2 PERT before it, GN3's federated PERT has been a mixed success. The continued popularity of the PERT-KB and the SWITCH-run training courses are the highlight of the service, but the other core services (such as PERT registration and accreditation) have had few recent results. There is also no strong sense of a PERT community. This is key to a loose federation of teams who have no focussed, centralised public relations effort to raise their profile.

Therefore, based on the views, experiences and wishes of the PERT community the current key individuals supporting the GN3 PERT must propose a sensible and realistic proposal for beneficial changes to eduPERT, or run the very real risk that eduPERT will be quietly dropped from the portfolio of services planned for GN3+. This proposal, when it is made, must have the backing of the current PERT community (what there is of it), and there is an ideal opportunity to seek consensus and support at the PERT Workshop in Reykjavik (21 May 2012).

References

[ACOnet]	NREN for Austria, http://www.aco.net/acohome.html?&L=1
[AMRES]	Academic Network of Serbia, http://www.amres.ac.rs/index.php?lang=en
[ARNES]	Academic and research network of Slovenia, http://www.arnes.si/en.html
[BASNET]	United Institute of Informatics Problems of the National Academy of Sciences of Belarus, http://www.bas-net.by/index.php
[CARnet]	Croatian education network, http://www.carnet.hr/en
[CESNET]	Czech research network, www.ces.net
[CSC]	Finnish IT centre for science administered by the ministry of education, http://www.csc.fi/english
[DFN]	German research and education network, http://www.dfn.de/en/
[DS3.12.4]	T. Rodwell, S-M. Thomas, Deliverable DS3.12.4: "Policy for a Federated Performance Enhancement Response Team (PERT)", http://www.geant2.net/upload/pdf/GN2-08-101-DS3-12-4_Policy_for_a_Federated_PERT.pdf http://www.geant2.net/upload/pdf/GN2-08-191-MS3-7-5_Report_on_Passive_Monitoring.pdf
[DS3.6.2]	T. Rodwell, Deliverable DS3.6.2, "Report of the PERT Group", http://www.geant2.net/upload/pdf/GN2-06-096v5-DS3-6-2_Report_of_the_PERT.pdf
[DS3.12.1]	B. Belter, S. Leinen, T. Rodwell, M. Sotos, Deliverable DS3.12.1: "Description of a Decentralised PERT", http://www.geant2.net/upload/pdf/GN2-06-310v5-DS3-12-1_Description_of_a_Decentralised_PERT.pdf
[eduHub]	http://www.eduhub.ch/
[eduPKB]	http://kb.pert.geant.net
[eduPdisc]	http://mail.geant.net/mailman/listinfo/pert-discuss
[eduWeb]	http://edupert.geant.net
[eArena]	National association of research and educational e-Infrastructures, http://en.e-arena.ru/en/
[FCCN]	Foundation for national scientific computing, http://www.fccn.pt/en/
[GARR]	Italian research and education network, http://www.garr.it/b/eng
[GEANT]	High bandwidth, pan-European research network, http://www.geant.net
[GRENA]	Georgian research and educational networking association, http://grena.ge/eng/main
[MS2.3.7-8]	B. Gajda (PIONIER), S. Leinen (SWITCH), T. Rodwell (DANTE), P. Savola (FUNET), N. Simar (DANTE), S. Ubik (CESNET), C. Welti (SWITCH)"Milestones MS2.3.7 and 2.3.8: Specification of the Backbone and Campus PERT Support Monitoring Infrastructure" https://intranet.geant.net/sites/Services/SA2/T3/Documents/eduPERT/GN3-10-094-MS2-3-7-MS2-3-

8_Specification_of_the_Backbone_and_Campus_PERT_Support_Monitoring_Infrastructure.pdf

[HEAnet]   Ireland's national education and research network, http://www.heanet.ie/

[Hungarnet]   Hungarian academic and research network association, www.hungarnet.hu

[Infiniband]   http://en.wikipedia.org/wiki/InfiniBand (accessed on 01 May 2012)

[PIONIER]   Polish Optical Internet, http://www.pionier.net.pl/online/en/

[PSNC]   Poznan supercomputing and networking centre, http://www.man.poznan.pl/online/en/

[RENATER]   NREN for France, http://www.renater.fr/?lang=en

[RESTENA]   Réseau Téléinformatique de l'Education Nationale et de la Recherche,
                   http://www.restena.lu/restena/en/EN-Index.html

[SANET]   Slovak academic network, http://www.sanet.sk/en/index.shtm

[SWITCH]   Swiss education network, www.switch.ch

Glossary

CERT	Computer Emergency Response Team
DCM	Duty Case Manager
FTE	Full Time Equivalent
IT	Information Technology
LAN	Local Area Network
NOC	Network Operations Centre
NREN	National Research and Education Network
perfSONAR	Performance Focused Service Oriented Network Monitoring Architecture
PERT	Performance Enhancement and Response Team
PERT-KB	PERT Knowledge Base
PM	PERT Manager
PMT	Project Management Team
PTS	PERT Ticket System
SA	Service Activity
SCM	Special Case Manager
SME	Subject Matter Expert
TNC2012	TERENA Networking Conference 2012