



Campus Issues

Discussion note

There has been a significant investment in network infrastructure in research and education institutions since the SERENATE study in 2002-2003. There is now little evidence of persistent bottlenecks at the campus level, although there are still places with low bandwidth and obsolescent equipment and cabling that needs to be upgraded. Some bottlenecks are probably caused by unnecessarily elaborate security arrangements.

In general, the network infrastructure is satisfactory. However, often this appears to be so by accident rather than by good planning. In institutions, networking strategy needs to be addressed systematically and at the highest level, and coherent networking policies need to be developed in conjunction with end users. This is especially important where there are demanding applications and projects.

There is a strong message from the surveys conducted by EARNEST that some users are not aware of the availability (or even the existence) of many network and network-related services. Steps should be taken to promote greater awareness and training. A typical example is videoconferencing.

In institutions, the team providing network support is often too small to meet present-day demands. As a result, team members spend much of their time "fire fighting". They do not dare to offer new services to their user community, because they would not be able to cope with the extra workload. Often there is not sufficient staff or expertise to provide adequate training and support. Senior managers must recognise that their institutions are increasingly dependent on network services, and they must allocate sufficient funds and resources when they plan future strategy.

In some countries there is good collaboration between NRENs and institutions, but in other countries there is room for improvement. Effective networks depend crucially on good human collaboration. Technological problems are much more easily solved than they used to be.

There is an important paradigm shift now taking place in networking, from only providing connectivity to offering and supporting network services. Institutions should carefully assess whether they are sufficiently equipped to support the rapidly changing nature of networking, and they should take appropriate steps if necessary.

The EARNEST study of campus issues has carried out a survey of technologies in the lower-layer and middleware domains of networking, and it has taken account of the work of the EARNEST study of technical issues. The outcome of this investigation suggests that there is no clear evidence of new upcoming technologies that are likely to revolutionise campus networking in the near future.

This conclusion may seem comforting to IT management and network teams, but it may be far from reality. Most areas of technology are evolving incrementally. They require very close attention and serious planning when upgrading the technological infrastructure at campus level, particularly the infrastructure for researchers who use very demanding applications. Strong coordination and collaboration between institutions and NRENs should help the coherent deployment of several of these technologies, improve interoperability levels between NRENs, MANs, regional networks and campuses, and thus ensure seamless end-to-end services with quality of service (QoS).

Institutions should pay special attention to the following technologies, particularly where research or higher-education projects need to access remote resources at higher speeds and with a guaranteed quality of service:

- Optical infrastructures need to be upgraded so that end-to-end wavelengths can be established at higher speed than 10 Gb/s (optic-fibre quality, WDM equipment if there is a lack of fibres).
- The Ethernet infrastructure will have to integrate the new specifications under development for providing end-to-end Ethernet circuits with QoS and OAM&P functionalities.
- Configuration and management tools (e.g., control plane): it is not yet clear when the campus networks will have to integrate and master these technologies (GMPLS, UCLP).
- Monitoring tools (e.g., perfSONAR) must be installed and run in collaboration with the NREN to control and improve the behaviour of the network.

All campuses, with or without demanding high-end users, should plan to deploy, and/or to upgrade to, the following technologies:

- Provide ubiquitous wireless access with higher speeds and better security mechanisms for mobility (eduroam).
- Control access to the network and secure the flows in a way transparent to end-users, with NAC-like technologies.
- The sharing of resources, the extensive use of collaborative platforms, authenticating for mobility, etc. imply that better Identity Management and Identity Federation mechanisms must be developed progressively and implemented universally among end users.

For discussion

Do you agree with the recommendations below? What would you like to change? Are there any other recommendations that you would like to add? Which of the recommendations are the most important ones that should be incorporated and highlighted in the overall Summary Report of the EARNEST Foresight Study?

Recommendations for institutions

Network policy

- Define network policy at the highest level within institutions, covering the following topics:
 - Strategic plans to meet the aims and objectives of end users
 - Annual budgets to deliver the planned objectives and keep infrastructure and services up to date
 - Provision of a well-resourced network support team
 - Rules for network security
 - Arrangements for end-user participation in policy making
 - Adoption of national guidelines.

Infrastructure and services

- Set aggressive replacement policies for equipment with a maximum life expectancy of five years
- Adopt institution-wide specifications for network 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 demanding users
- Provide IPv6 services for all users at all layers (network, transport and application).

Security

- Adopt effective security measures which are appropriate for purpose and do not hinder the effective use of the network
- Create a formal, independent security team with a wide remit and a considerable degree of independence from the institution's central IT service.

End-user representation and awareness

- Ensure that end users are involved in defining network policy
- Establish formal procedures to identify end-user requirements
- Circulate an Acceptable Use Policy to all end users which sets out clearly their rights and obligations when they use the network.

Collaboration

- Establish strong, formalised arrangements for collaboration with other management domains, e.g., NRENs, intermediate networks, other institutions
- Encourage network teams to share their expertise with colleagues in other management domains.

Raising awareness and training

- A major cultural change in networking is taking place: the emphasis is moving from providing connectivity to network services. In order to speed up this change of focus, institutions should:
 - Provide training courses and good-quality documentation for end users to raise awareness of network services available and promote their use, including videoconferencing, multicast, video broadcasting, video on demand, IP telephony
 - Make arrangements for network support teams to be re-trained, in order to keep up with fast changing technologies.

Recommendations for NRENS

- Collaborate more closely with institutions in the following areas:
 - Deploying key services
 - Sharing strategic information
 - Organising training for innovative services
 - Coordinating working groups of network staff to share expertise
 - Understanding the demands of high-end users
- Ensure support is available for institutions to make a smooth transition to IPv6
- Assist institutions to provide to end users support and training about performance optimisation, especially in the case of demanding users
- Provide guidelines for institutional networking policies.