



# Researchers' Requirements

## Discussion note

In recent years, the development of research and education networks and services has been of increasing importance for the work of researchers in Europe:

- In the last five years, the use of network-related tools and services has become common among the overwhelming majority of European scientists. Still, considerable growth in awareness of these tools and use is anticipated over the next decade.
- The most common and frequently used tools are email, distribution lists, wireless access and transfer of large files.
- The most common and frequently used services are access to digital libraries and access to remote databases.
- However, among "light users" there still appears to be a widespread lack of (detailed) knowledge of many of the main network-related tools and services. Future growth may be dependent on better dissemination of technical information about available facilities.

Scientists spend an average of 15 hours each week interacting with other researchers and academic teachers via a range of different media. The majority of this time is dedicated to face-to-face meetings and email interaction. However, use of other media, such as video-conferencing, is still increasing and in certain fields it is already more frequent. A large amount of time is spent actively using data networks for research or teaching; a majority of researchers spend more than an hour each day on such activities.

Among researchers, three categories of users have been identified. In different research disciplines, a majority of users can be linked to one of these categories:

- Light network users – Environmental, Mathematical and Social Sciences
- Moderate network users – Humanities, Life and Medical Sciences
- Heavy network users – Physics and related sciences, Materials Science and Mechanical Engineering, IT and Computer Science, Chemistry and Chemical Engineering

Among researchers, there is a widespread lack of knowledge and awareness of National Research and Education Networks (NRENs) and of the pan-European network GÉANT. Overall, only 5% of researchers think that the network at their workplace is connected to GÉANT. Typically, awareness of a technology and related services rises when the technology and services fail. Hence, the lack of awareness could be seen as an indication that the NRENs and GÉANT provide smooth services.

Developments in network-related services over the last five years are considered to have had a (very) positive effect on a number of aspects of research and teaching. In particular, more than 60% of researchers state that access to publications and to other information needed for their research has increased considerably over the last decade. A large number of examples and explanations were provided as to the positive benefits that have been experienced as a result of network developments, while few drawbacks were identified.

Very many researchers use research and education networks mostly for simple applications such as Web browsing and email. A smaller number of end-users engage applications that require streaming media or Virtual Private Networks. Their bandwidth requirements exceed ADSL and extend up to Gigabit Ethernet. Finally, there is a third category of researchers who use special scientific applications such as Grid computing and virtual presence. They need network capacities of one or more Gigabits per second.

Researchers feel that research networking organisations should increase the flow of information - including road maps of future service developments - to their end-user communities. Likewise, research networking organisations should make more educational material available. They should take account of the growth in user expectations in the form of more complex services. They should also plan for good broadband remote access capabilities for researchers at work, at home or when away from their regular place of work.

In the next 5-10 years, considerable changes are expected in the way in which researchers and academics work. These changes are expected to have implications for the development of networks and related services. Most researchers expect international collaboration and participation in large-scale collaborative projects to increase substantially in the coming decade. Comments on how people envision their future data network use suggest that there is a widespread desire to increase network-related tools and services for research and teaching activities.

Overall, researchers are satisfied with the network infrastructure at their workplace. However, nearly half of them desire more adequate training in network use to improve the quality of their research and teaching. Researchers in environmental sciences and life sciences express a dramatic lack of training in network use. IT and computer science researchers express great dissatisfaction regarding privacy and especially security issues.

In general, the use of computing Grids, Virtual Organisations and, in particular, lightpaths is hampered by a widespread lack of information and knowledge.

Improvements needed to provide better network services include higher-speed guaranteed and extended bandwidth, and easier, user-friendlier interfaces and infrastructure.

More than 60% of researchers do not use nor expect to use large computing facilities and large storage facilities within the next five years. The majority is unaware of the size of these large facilities. In consequence, the facilities appear to be adequate to users' needs today. Nevertheless, a majority expects both large computing facilities and large storage facilities to be inadequate for their needs in 5-10 years' time.

Regarding the future networking requirements of members of the European research community, the following can be noted:

- There is substantial evidence that the network is becoming an essential element in the scientific landscape in all areas of research.
- There is a distinct high level of satisfaction in the services provided today.
- e-Infrastructure is generally accepted as a major facilitator for research and teaching.
- The expectations of network users are evolving beyond the provision of pure bandwidth towards the supply of more complex services. (*..cont*)

- There are now concerns about the lack of user knowledge of existing services, tools and software.
- There is the general desire of end-users that research and education networking organisations give more attention to end-to-end aspects of communication, including issues related to quality of service.

In general, researchers expect and desire only incremental improvements of current technologies and trends. One interpretation is that networking and Grid technologies have passed through a phase of technology innovation and have now entered a phase of technology implementation, in which services are improved and put on a wider application basis.

Another trend is a growing demand for network facilities to support scientific collaboration. However, standardisation, quality control and security issues should be addressed in this context. It is foreseen that in the future effective exploitation of trans-national connectivity and the resulting capability to make the correct decisions will become increasingly critical for the success of individual projects and research strategies.

#### **For discussion**

Do you agree that researchers are more satisfied users of research networks than five years ago because capacity bottlenecks (especially on, and in the links to, the campuses) have been removed thanks to large investments?

The revolutionary change that research networks have brought to the ways in which researchers do their work appears to be related most of all to access to remote databases and in particular to publications. Should the research networking community establish closer ties with the digital library community, and are there opportunities for more collaboration between the two communities?

Should action be taken to make researchers more aware of the network-related tools and services that are available today? If so: how?

Many researchers would like to receive training in the use of networks and related tools and services. Who is responsible for providing such training? Is there a case for national or even European collaboration between those responsible for providing user training at the local level?

Is it a problem that most end-users are not aware of their NREN and of GÉANT? Should large-scale actions be undertaken to make them more aware?

It seems that there are very few researchers whose future networking requirements go beyond what is already available or will undoubtedly become available. Given the lack of "demand pull", is "technology push" the way forward to continue innovation in research networking?

Which of the findings regarding researchers' requirements are the most important ones that should be incorporated and highlighted in the overall Summary Report of the EARNEST Foresight Study? Which recommendations can be formulated?