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Report on User Group Consultations

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Abstract:

> *This deliverable describes the methodology used for the TEN-34 survey, its results and possible implications for the TEN-34 successor service.*

Keywords:

TEN-34, User Survey

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EXECUTIVE SUMMARY

A TEN-34 user survey was conducted in November 1997. It addressed TEN-34 users in non-telematics and telematics related research, as well as scientists in European-wide operating research sites and individual users at Universities and research sites all over Europe.

This deliverable describes the methodology used for the survey, the survey results and possible implications for the TEN-34 successor service. It is to be noted that the users addressed were not a random selection. Therefore the results of the survey may not be representative.

We received an overwhelmingly positive response about the performance of TEN-34. Almost all responders had witnessed significant improvements in the communication with their European partners since the launch of TEN-34 in May 1997. This response clearly shows that TEN-34 is on the right track regarding European networking for research purposes. However, we cannot and must not ignore the anxiety the responders expressed when considering the future: it was mutually pointed out that TEN-34 was performing well now and had -for the first time in Europe- provided researchers with an adequate European backbone, but that application developments and an ever-increasing use of the network will in the near future lead to congestion in the network, thus lessening its performance. For this reason a vast majority of researchers would like to see TEN-34 upgraded to a higher bandwidth backbone.

INTRODUCTION

The potential TEN-34 users are a diffuse group of some 700,000 European researchers. Most of them will have relatively little awareness of the national university infrastructure that they use, let alone any serious knowledge or understanding of the pan-European infrastructure. Within this diffuse group, there is a small number of well-established user groups for which European communication is essential. These users typically have a high level of computer and communication literacy and have high expectations on pan-European networking. Among this group of users there are two distinct interests. On the one hand there are users that use pan-European networks, i.e. TEN-34 for their own research in their own specialist, "non-Telematics" field. Then there are the researchers who use the network as a platform for their own research and development in Telematics itself. Both of these types of researchers have high demands, but it is very likely that those using the network for Telematics R&D have a clearer view on the current technical possibilities and what the future technical demands might be.

In addition to these two groups, there are a number of European research sites whose prime interest is communication and last but not least the vast group of individual users who are connected to TEN-34 through their respective university network.

The TEN-34 User Survey made use of this segmentation of the TEN-34 user community. Therefore the user community was separated into four clusters:

1)   Existing user groups whose primary interest is focused on co-operative working within Europe and who have a knowledge and awareness of the issues of research networking to support their own field of research;

2)   Existing user groups whose primary interest is focused on the use of networking for the purpose of telecommunications applications developments via co-operative work within Europe;

3)   Sites who have a significant interest in international and particularly pan-European connectivity;

4)   General purpose research users.

METHODOLOGY

Given the difficulties of eliciting useful and sufficient user feedback via one or several consultation meetings, TEN-34 has opted for a "virtual meeting" to consult users via electronic means over a period of a month.

The basic approach of the survey was to use a structured electronic questionnaire (see Appendix 1) targeted at the clusters. The questionnaire was sent out via e-mail and put on the DANTE web pages. A Microsoft Word version was always attached to the e-mail questionnaire.

For the clusters 1 to 3 the relatively small number in the group enabled us to approach a representative sample of 10-12 per group directly.

Concerning cluster 1 altogether twelve established research groups outside the Telematics field were asked to respond to the questionnaire. The response rate of seven out of twelve showed a satisfying level of interest.

Nine different Telematics oriented research groups were approached in cluster 2, of which five responded.

Cluster 3, the research sites, showed the greatest interest in participating in the TEN-34 user survey. Ten of the eleven research sites we had asked to complete the questionnaire responded.

The approach of direct contact via e-mail was not suitable for the big, diverse and anonymous group of individual users of TEN-34 at Universities all across Europe which made up cluster 4. Therefore the National Research Networks were asked to identify a small number of individual users. This was done in some cases, in other cases the respective National Research Network decided to send the questionnaire out on one of their mailing lists. The latter and also the use of

the TEN-34 web page as a tool to publish the questionnaire make it difficult to determine how many individual users were approached and how many of those approached actually responded. Altogether, we received responses from 30 individual users.

It is important to mention that we received responses from individual users in many of the countries connected to TEN-34, who make thorough use of their pan-European connectivity, thus delivering a clear picture of their experience with TEN-34.

RESULTS

Cluster 1 - Researchers in non-Telematic related fields

Researchers from EMBL, ONERA, ECMWF, Meteo-France, ERCIM and ESRIN used the possibility to voice their experience with the pan-European connectivity as provided by DANTE and TEN-34.

Their main activities range from molecular biology, to aerospace research, collaborative work and dissemination of data and images from satellites. All responders make use of e-mail and WWW technology, six out of seven use TEN-34 for large file transfers, four for the transfer of data-bases, whereas only two use video-based applications and three use imaging. Interactive remote applications are executed by four of the responders and one research group uses TEN-34 for coupled super computer applications.
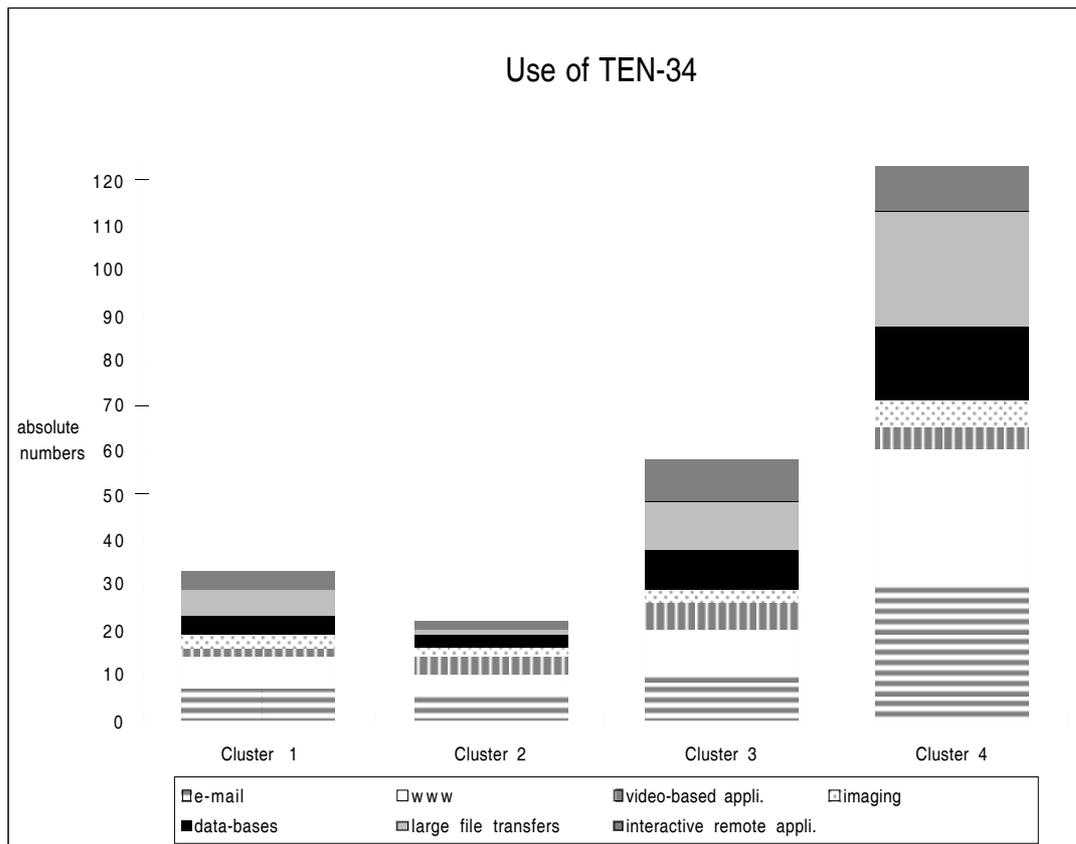

Concerning the European countries the research groups are currently operating in, all of them named Germany, five named the UK and Italy, four the Netherlands and France, three Spain and two stated activities in Belgium, Finland and Russia.

The connectivity to the National Research Network ranges from a 64 kbps to 34 Mbps link.

Asked about the impact TEN-34 has on the daily work of these research groups, all of them pointed out the significant improvement in response time, performance and reliability. In

particular the improvement was felt in WWW, interactive remote applications, imaging and large file transfers. None of the research groups noticed a change in the performance of e-mail. It was pointed out that video-based applications are still not feasible. Five of the seven responders mentioned that they increased their pan-European communication as a consequence to the introduction of TEN-34.

Only one research group had started to use new applications (FTP, telnet). Three of the seven had changed the pattern of their European communication and stated that due to TEN-34 they could run applications during the day now that were formerly only feasible to be run at night.

Impact of TEN-34
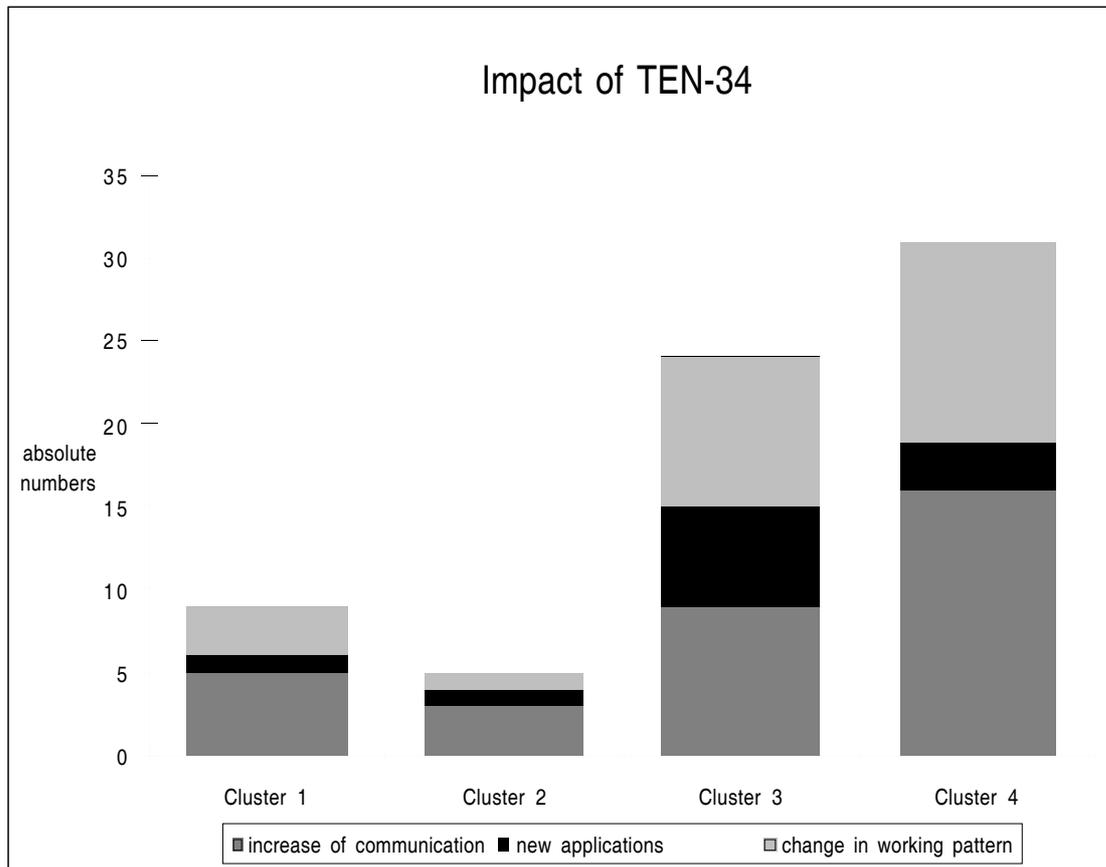
Asked if TEN-34 met their application needs, six of the seven research groups responded positively, but all of them pointed out that it will only be a matter of time until the bandwidth of TEN-34 will be used up by more demanding applications. As one research group put it:

> *"Yes it does! Congratulations. This year you have brought us a good improvement. However, I can already foresee that TEN-34 will be saturated soon. At present we are in this good phase of a technology being just operational. It would be nice to see today plans for a 'TEN-622'."*

One group asked for better Quality of Service and more reliability. Future applications these research groups would like to run include video-/teleconferencing, voice applications and the tunnelling of Intranet and Internet links. One group asked for a reservable bandwidth for VC and the live transmission of seminars. The minimum bandwidth/speed requirement for such applications was generally put down with 2 Mbps. One research group pointed out the need for guaranteed Quality of Service such as data rates and availability.

Cluster 2 - Researchers in Telematics applications

Concerning this cluster, researchers in the Telematics Applications Programme of the EU DG XIII, were approached. Responses were received from projects such as CoBrow, Merci, Web4Groups, ADVISER and Manicoral.

The main research activities of these projects lie in the development of new Internet and multicast services and the ameliorated access to EU research results via the Internet. All of the projects make use of e-mail and WWW for their communication with their European partners, four of the five use video-based applications, three transfer data-bases, two use imaging and interactive remote applications and one project transfers large-files.

One project stated that its activities were world-wide. Activities in Austria were named three times, partners in Germany, the UK, Switzerland, Denmark, France, the Netherlands, Italy and Sweden were given twice. Belgium, Norway, Portugal, Hungary and Slovenia were named once.

The connectivity of the projects ranges from a 64 kbps line to a private network to an 8 Mbps dedicated line to a National research network. One project has a connection into the JAMES network (this project answered the questionnaire in relation to JAMES and not TEN-34, therefore the answers have been excluded from the survey), another project is only in one country linked to TEN-34.

Questioned about the impact of TEN-34 made on the daily work within the project, the responses go from one extreme to another. Whereas one project talks of dramatic improvements concerning the communication with partners, another project has not experienced any improvement at all. One project stated that the performance is terrible due to the fact that only one partner is connected to TEN-34.
Again, no improvement was experienced concerning e-mail. The WWW and transfer of data-bases were stated to have a 'local feel', imaging and file-transfers were said to be possible now.

Two projects stated that the introduction of TEN-34 did not lead to an increase of use of the network for their European communication. One project had witnessed a slight increase, whereas another one noticed that the network traffic had increased and all partners could now participate in the project. Three of the projects denied the introduction of new applications as a consequence of TEN-34, one project started to run distributed collaborative visualisation applications. Regarding the pattern of their European communication three projects did not witness any changes, whereas one project pointed out that it was now possible to run certain applications during the day.

None of the projects thought that their application needs are satisfied. The reasons for this are that video and audio applications are still plagued by jitter and delay, TEN-34 could not offer multicast adequate Quality of Service, that there is still congestion in the network and that audio applications are still very critical. One project pointed out that the separation of research vs. commercial networking is very damaging.

Although only distributive collaborative visualisation applications were named as future applications, the projects stated clear views about their minimum bandwidth and speed requirements. These range from ISDN equivalent to 1 Mbps. One project stated very precise requirements for interactive data, saying that lossless delivery is essential and priority over back-ground best-efforts traffic (such as bulk data traffic) is highly desirable. Quality of Service requirements were named with a delay<50ms, packet loss of <10%, a continuous bit rate (CBR) capable of supporting basic videophone and a multipoint or multicast basis during synchronous CSCW sessions, as well as point-to-point or unicast.

Does TEN-34 meet your applications' needs?
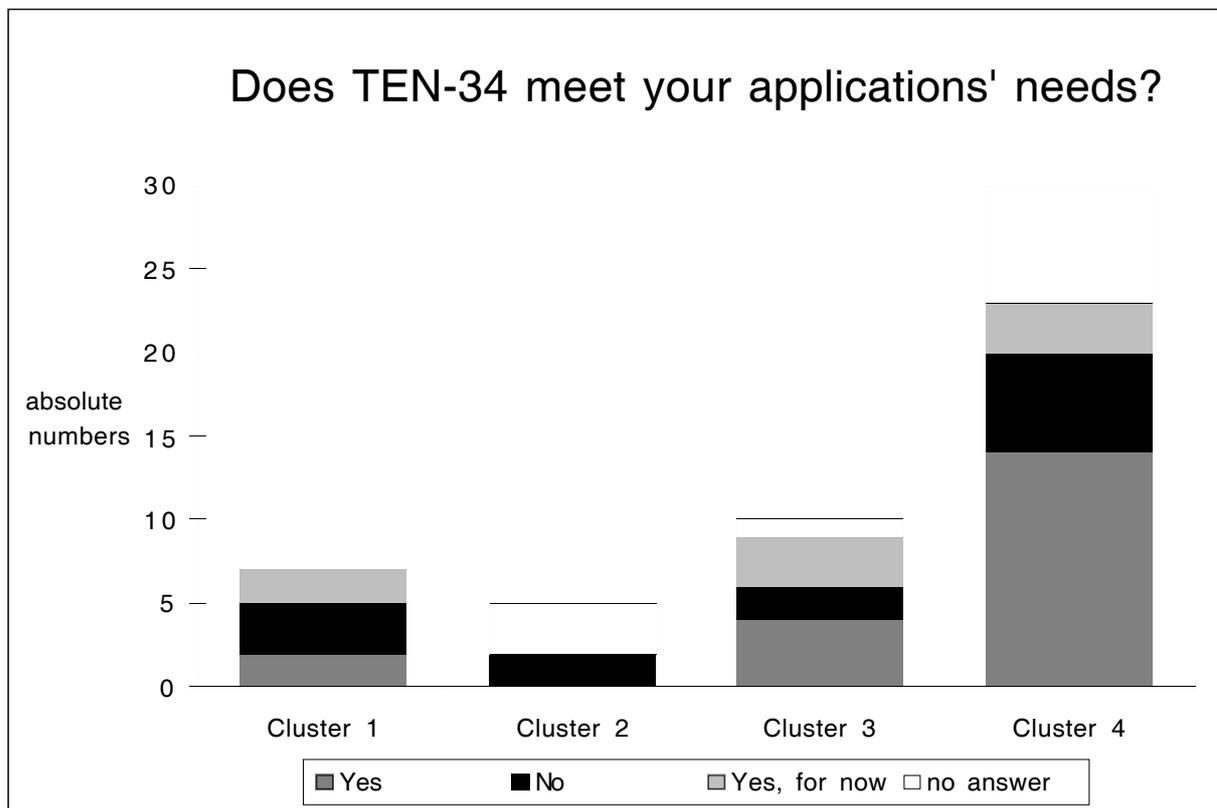
Cluster 3 - Researchers in established European research sites

In this group we have received responses from researchers at CERN (Switzerland), DESY (Germany), the Niels Bohr Institute in Copenhagen, the Instituto des Fisica de Cantabria, the Research Institute for Particle and Nuclear Physics in Budapest, the PPNCG representing the networking interests of 15 British universities and research centres working in Particle Physics and Astronomy. The questionnaire was also completed by High Energy Physics (HEP) Sites in Austria, the UK and France.

Since almost all of the above named sites are involved in High Energy Physics, their main activities centre around the communication with CERN in Geneva, including remote computing, the transfer of data, the remote monitoring of experimental activity and data analysis. One site stated an involvement in the network planning for future HEP/LHC experiments. All sites make use of e-mail, WWW, data-base transfer, interactive remote applications and the transfer of large files. Five sites run video based applications and three sites use imaging. The partners of the sites are truly European. Obviously, all sites named Switzerland, seven collaborated with Germany, six named Italy, five the UK, four France, Denmark, Belgium, Austria, the Netherlands, the Czech Republic and Sweden, three named contacts in Hungary, Portugal, Spain, Russia and Norway. Two sites were collaborating with partners in Slovenia.

The sites enjoy a very good connectivity to the relevant National Research Network, starting from 2 Mbps to 34 Mbps connections.

Asked about the impact TEN-34 has had on their daily work, all sites expressed extremely positive views, having noticed a continuous improvement, faster running applications, a remarkable improvement enabling remote collaborative work and a considerably increased response time at any time of the day. Again, changes in the performance of e-mail were not noticed, whereas WWW, interactive remote applications, imaging, data-bases and file-transfer were named as considerably improved. Although one site said that it routinely used TEN-34 for packet video-based conferencing, it also stated that video-based application still suffer from a low Quality of Service. Except for one site, all others had increased the use of their network applications as a consequence of TEN-34, two sites stated an increase by a factor of 100. One site praised the fact that now working from the home institute was finally feasible. Four sites had not yet started to run new applications on TEN-34, the others had recently included remote database applications, video-conferencing and remote file access (AFS). Questioned about

changes to the working pattern, the responses varied from a clear negative from one of the sites to dramatic changes noticed by other sites. One site pointed out that the response time was much less dependent on the time of the day than before, whereas another site replied that response time was still a lot better during the night.

Asked whether the needs of the applications run were satisfactorily met, six sites agreed. One site stated that TEN-34 was a little running behind the developments, another site stated:

> *"Of course not. Any further increase in capacity will easily be utilised. However, the current performance is closer to acceptable than it has been in the past."*

Notably, all sites expressed concern about the future, mentioning that projections for the future involve ever increasing quantities of data. Furthermore they expressed that interactive applications performance is still not predictable enough and that the remote feel needs to be put closer to the local feel. Another site explained that the bottleneck to successful European networking now lies with the affordability of greater individual access capacities.

New applications, the sites would like to make use of include remote X11-applications, reliable video and audio conferencing, the remote supervision of experiments and the mirroring of very large databases. The required bandwidth was named at 10 Mbps. Quality of Service requirements are named as stability, reliability and low packet loss. Transit delays of app. 5% of transaction time were thought to be acceptable by one site. Yet another site stated that a transit delay <100ms with 20% delay variation (jitter) and near to zero packet loss would be acceptable. One site hoped that in the future interactive work would receive priority over other kinds of traffic, for this site even a small guaranteed bandwidth for interactive access is perceived as a very valuable facility to users. As one scientist put it:

> *"A reliable, fast European (and world-wide) network is absolutely critical to our work in High Energy Physics. TEN-34 is a definite improvement over the previous network at the moment. Hopefully future improvements will be made to allow for the inevitable increase in traffic."*

Cluster 4 - Individual Users

Thirty individual users responded to the TEN-34 User Survey, representing individual researchers, lecturers, students and staff at universities, research organisations and libraries in Europe. We received responses from Hungary, Germany, the UK, Spain, Switzerland and France.

Almost all responders stated they were using the European network to do WWW browsing. For some this was the main activity. Other users saw their main activities in a wide range of communication, such as accessing software archives, virtual libraries, co-operation with partner laboratories, communication with project partners in the respective European Union funded project, mirroring technical servers and distance learning. As mentioned before, all individual users have e-mail and WWW communication, twenty-five use the network for large file transfers, seventeen for database transfers, about one third for interactive remote applications and five for video-based applications. Again the picture of their communication is truly European. Sixteen individual users have contacts with the UK, fifteen with Germany, thirteen with France eleven with the Netherlands and ten with Austria. Nine individual users stated contacts to Sweden and Italy, seven to Portugal, Spain and Belgium, six to Switzerland, five to Norway, four to Denmark, three to Greece and two to Hungary and the Czech Republic.

Quite unexpectedly, the responders had a very clear idea about their connectivity to the relevant national Research Network. These range from a 64 kbps to a 155 Mbps line, clearly distinguished by countries.

Concerning the impact TEN-34 made on their daily work, it is nice to learn that individual users (who cannot in general be expected to keep an eye on the developments concerning the connectivity of their respective National Research Network) have noticed a striking change since the implementation of TEN-34. More than three quarters of the users expressed that their connectivity has significantly increased, they have dramatically improved access to European sites, the response time has been reduced and communication in general became notably faster. Concerning e-mail, most of the individual users could not make out any difference in performance. Five noticed a marginal improvement. However, when asked to judge the WWW, database transfer and the transfer of large files, the majority of the individual users pointed out significant improvements. Those of the users who also run interactive remote applications and

imaging also pointed to an improvement in the network reliability. Video-based applications were said to be better, but far from being good.

The majority of individual users had increased their use of European connectivity since the introduction of TEN-34. It was stated that a general switch from US hosts to European hosts has taken place. The users also pointed out that they were increasingly looking for European mirror sites first and had extended their European research. One third of the individual users stated that no increase of their use of their European connectivity had taken place.

Only three individual users said that they had started new applications. Asked if the pattern of their European communication had changed, twelve stated that it had changed, pointing out that applications could be run now, no matter what time of the day. Others stated that there was still too much variation and that the available bandwidth was not yet sufficient.

Just over 50% of the individual users stated that the needs of their applications were met by TEN-34. Again it was pointed out that it would probably be only a matter of time, until the first congestion would appear. Those who were not satisfied pointed out that the transfer of larger files was still not reliable enough, interactive work was not feasible during peak times and stated that connectivity to some partners in Europe was still too slow.

The largest part of the individual users named video-conferencing as an application they would like to run if the network permitted it. Audio-conferencing, the transfer of big data files and the setting up of a digital library for Europe were also named. Not too many individual users could respond to the questions concerning minimum bandwidth. Those who did asked for dedicated bandwidths ranging from 5 kbps to 6 Mbps. None of the individual users was able to respond to the question related to the required Quality of Service.

IMPLICATIONS FOR THE TEN-34 SUCCESSOR SERVICE

The TEN-34 User Survey clearly shows that although we can cluster the users of TEN-34 into four different groups, the responses received are more similar than one would maybe expect. Clearly all four groups have witnessed significant improvements concerning the performance of European connectivity since the launch of TEN-34. At the same time all user groups show concern about the future performance of the network taking into account an ever increasing line load. Therefore one very clear implication for the TEN-34 successor service is an inevitable increase of bandwidth.

The second clear point made by all the user groups is the wish to be able to conduct video based applications. These applications require a dedicated bandwidth and reliable Quality of Service. For this reason, the successor service should implement guaranteed Quality of Service on top of a best efforts IP service. The service needs to offer stable performance parameters based on ATM technology and/or developments in IP.

Users also expressed the necessity of dedicated bandwidth between certain partners at certain times. Point-to-point links should therefore be offered in the future European Research Network.

Furthermore the TEN-34 successor should provide quick and reliable access for all participating research networks.

GENERAL REFERENCES

TEN-34 Homepage   http://www.dante.net/ten-34

APPENDIX 1

TEN-34 User Survey

TEN-34 (Trans-European-Network at 34 Mbps) is a high speed pan-European network between National Research Networks. In May 1997 TEN-34 was launched interconnecting the National Research Networks of France, the UK, Germany, the Netherlands, Scandinavia, Italy Switzerland, Austria and Hungary. During August 1997 the National Research Networks of Greece, the Czech Republic and Belgium joined. By the end of this year Slovenia, Portugal and Luxembourg will also be connected to TEN-34. DANTE is co-ordinating partner in the TEN-34 consortium.

Now that TEN-34 is up and running for half a year, we (DANTE) would like to hear from you about your experience with the new network.

Therefore, we would like to ask you to take a bit of your time to answer the following questionnaire. Your input will help us to evaluate the current service as well as give us valuable insights into what YOU expect from future network developments.

Thank you very much for your co-operation.

PART I: About you

Q1

1.1   Please state the name of the organisation/university you work at/for:

        _____

1.2   What is your name (name of the person completing the questionnaire)

        _____

1.3   What is your position ?

        _____

1.4   Please let us have your phone number:

        _____

1.5   and your contact e-mail address:

        _____

Q2

2.1   What is your main European network activity ?

        _____
        _____
        _____

2.2   What kind of network applications do you use? (please tick)

                        - e-mail
                        - WWW
                        - video based applications
                        - imaging
                        - data-bases
                        - large file-transfer
                        - interactive remote applications
                        - other (please specify)

2.3   Please let us know the European countries you are currently dealing with?

        _____
        _____

2.4   Please name the locations from which European connections are currently undertaken and indicate the city/country:

        _____
        _____

Q3

3.1   How are you connected to your relevant National Research Network?
        (Please make sure to let us know the path for each site from which you operate.)

        _____
        _____
        _____

PART II: About your experience with TEN-34

        Please note: The following questions relate to your experiences in communicating with your **European** partners.

Q4

4.1   What impact has the new TEN-34 European backbone had on your daily work with respect   to European communication?

        _____
        _____
        _____

4.2   Please indicate how the use of the following applications has improved:

- e-mail

_____

-WWW

_____

- video based applications

_____

- interactive remote applications

_____

- imaging

_____

- databases

_____

- large file-transfers

_____

- other applications (please indicate)

_____

_____

4.3   Has your use of the network for European communication increased in the past six
        months?

_____
_____
_____

4.4   Have you started to use new applications?

_____
_____
_____

4.5   Has the pattern of your European communication changed due to the improved
network   performance? (e.g. can you now run applications during the day that you could
only   run at night before?)

_____
_____
_____

PART III: About the future

Q5

5.1   Does the current network performance satisfactorily meet your current
        application needs?

_____
_____

5.2   if not, please tell us where your applications are limited:

_____
_____
_____

Q6

6.1 Which new applications would you like to use, if an improved network service permitted it?

_____
_____

6.2 Please let us know the minimum bandwidth/speed requirements for each application:

_____
_____
_____

6.3 Please indicate additional Quality of Service parameters required (such as transit delay, jitter etc.)

_____
_____
_____
_____

Thank you very much for your co-operation. Please return this questionnaire to the following address by **3 November 1997**.

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