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TEN-34: A 34 Mbit/s Infrastructure for European Research

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TEN-34 - The background

DANTE (Delivery of Advanced Network Technology to Europe Ltd) was established and is owned by the National University Networks to provide international network services to complement the network services they provide on a national level. As its name implies DANTE is interested in advanced technology and so Asynchronous Transfer Mode (ATM) is high on the company's agenda of technologies to implement. Unlike our owners, who can generally insist on a single vendor solution to their networking problems, DANTE has to deal with a potentially diverse set of hardware. The problems of multi-vendor implementation are among the issues that we have to solve.

The research network community is probably the most demanding in terms of network technology. Nationally, throughout Europe, plans are well advanced for the implementation of high speed networks. There is real operational experience of broadband networking and many of the multimedia applications that demand higher network speeds and performance are being developed by this community. The research community is already able to demonstrate multi-media applications as diverse as multi-media mail and broadcast teleconferencing. This is, however, all implemented on a platform based not on the advanced ATM networking technology but on good old fashioned Internet Protocols (IP).

There is a further major challenge in providing advanced networking facilities to researchers in Europe. This is the lack of availability of bandwidth at what in Europe are regarded as higher speeds. International 34 Mbit/s circuits are hard to find and when they are on price lists they are expensive and the search for a reference sale is as elusive as the Holy Grail. In contrast 45 Mbit/s is a routine offering in the USA. where such facilities have been available for several years now.

This is the networking context for the TEN-34 project. TEN-34 stands for: Trans-European Network Interconnect at 34 Mbit/s. The project is supported by the European Commission under the Fourth Framework Program. Its main aim is to provide a ubiquitous pan-European 34 Mbit/s network to connect together all the national university networks. DANTE is the co-ordinating partner of the project. TEN-34 has two principal technology goals. Firstly to establish a 34 Mbit/s IP service based on an underlying infrastructure of ATM and leased lines. In this context the ATM technology is only used as a multiplexing mechanism. The second goal is to pilot the use of ATM technology to seek to exploit the practical benefits that it promises.

Internet versus ATM

ATM represents a major new technology. It has the potential to meet the emerging requirements of the generation of multi-media applications that are under development. Within the networking research community there is considerable interest in its usage. However, ATM will only succeed if it learns the hard lessons demonstrated by earlier networking technologies.

In contrast the research networking community's interest in Internet goes back to the protocol wars of the late eighties when connection oriented and connectionless devotees fought an ideological battle reminiscent of something out of Gulliver's Travels. Now that a truce has broken out and IP has proved to be for the moment the winner, it is relevant to consider the issues and challenges raised by ATM technology. ATM is a connection oriented approach which derives from the ordered world of the Telecom's operator rather than from the precious anarchy of the Internet. Such a pedigree would tend to lead to a difficult birth for the new networking technology in the world of research networking, where

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the recent commitment has been to connectionless protocols.

Nevertheless ATM offers sufficient potential benefits that sections of the research networking community are taking ATM seriously, despite its pedigree. This is an indication that there are real issues and challenges relating to ATM. The third world war of the protocols is likely to be fought on these issues and challenges.

The last major development to emerge from the telecommunications standardisation stable was ISDN. It is possible to cast one's mind back to the heady days of the late seventies and early eighties when the conference circuit was full of details of ISDN technology and national plans for implementation of ISDN. In the more sober nineties when ISDN services are only just starting to become a reality, it is interesting to reflect that the only beneficiaries of ISDN to date have been conference organisers. Is ATM destined to follow the fate of ISDN? In practice there is considerable more technical merit in ATM than ever was the case for ISDN. ISDN represented a bid by the telephony world to take control of data communications. It failed because of this. In contrast ATM as a technology offers some real benefits.

The real benefits of ATM

The variety of multi-media and video applications now under development require significantly differing levels of bandwidth. It is possible, even in Europe, to dream of a world where bandwidth can be squandered in the same way that CPU power can be squandered today, but it is rather unrealistic. ATM offers the possibility to provide switchable isochronous bit streams. This is in practice an essential requirement to support multimedia applications. It is true that such applications run over IP today. This is, however, more of a tribute to the lack of Quality of Service expected by Internet users than it is to the appropriateness of IP to carry services which require synchronous transmission. No doubt this is one of the very issues the third world war of protocols will be fought on.

ATM offers two potential benefits over current switching and transmission technology. Firstly it is capable of providing a more flexible division of bandwidth enabling both synchronous and asynchronous connections to be provided on the same link. Secondly, as the switching technology develops, it will allow dynamic allocation of bandwidth to meet the requirements of individual applications, thereby permitting greater flexibility and more efficient use of network capacity. It is probable that the more ambitious pre-emption and negotiation algorithms are doomed to failure. Nevertheless, it can represent an improvement in resource allocation.

The real challenges of ATM

Here is one of the great challenges of ATM. A great success of Internet is fixed access pricing. It encourages some less than optimum usage of network resources and actually imposes Quality of Service by rationing rather than by price. But predictable bills are popular with users. If ATM services are expensive, never mind the fact that they can be managed economically, they will not prove popular. The technology cost reductions that are apparent in the personal computer market place apply equally well to telecommunications technology both from a switching and transmission perspective. The difference is that telecommunications prices, cosseted by a monopoly marketplace, have only reduced marginally. ATM represents a potential for future telecommunications services but will only succeed if the real cost reductions in technology are actually made available to the user.

The market for ATM needs to be driven by increasing supply through low prices rather than by rationing demand through high prices. Users will stick to the simple Internet if demand is to be rationed. There is a major challenge to the emerging marketing departments of the European PNOs to see ATM as a commercial opportunity to be exploited rather than as a cash cow to be milked.

The second major issue is the lack of maturity in the technology. Although the basic ideas of cell relay are well understood, the control mechanisms that take a technology to the point where it can be used as a real service still require development effort. This lack of maturity is reflected in the European PNO ATM pilot where the facsimile machine was used as the signalling system. Facsimile is one of the few success stories of PNO standardisation efforts, but it was not really specified as a signalling system for advanced network technology.

Large scale international standardisation efforts do not have a good track record of success in creating international products. By contrast, where

the market has been dominated initially by a single supplier who has been able to impose a defacto solution, standardisation has proceeded quite quickly. The standardisation process for ATM has cut some corners. It will remain to be seen whether it will produce reliable products from a variety of vendors that will interwork. It is a measure of DANTE's belief in the need for this process to succeed that we are investing effort in establishing an ATM test network. It is also a measure of our scepticism that it will succeed that we need to invest such effort.

TEN-34 will provide some early benchmarks for success

ATM has the potential to meet the emerging requirements of the next generation of multi-media applications. However, there are serious challenges to its success. The standards must be there and be implementable. Shopping list standardisation, with many options and the potential for conformant implementations that will not interwork, will fail as it has always failed. If standardisation is truly effective and a multi-vendor market emerges for ATM hardware, there is a real chance for ATM, provided the telecommunications service providers address the market seriously with attractively priced products.

A major work item of the TEN-34 project is the testing of ATM initially as the basis for a data-transport mechanism, subsequently as a switching technology in its own right. The first phase of the project will define an acceptance test for the overall TEN-34 service. In parallel with this a suite of tests aimed at proving the operational capability of ATM and exploiting its benefits as both a switching and transmission technology will be defined co-operatively with the JAMES consortium of PNOs.

In the context of TEN-34 the first pan-European ATM network aimed at the serious provision of service will emerge, providing some early answers and interesting experiences to the viability of ATM as a serious telecommunications technology. It is expected that TEN-34 will provide very valuable insight into the planning and operational implications of ATM and act as a performance and technology benchmark to its success.

Biographical details

Dai Davies is General Manager of DANTE (Delivery of Advanced Network Technology to Europe Ltd). He has degrees in Engineering and Computer Science from the University of Cambridge and twenty years of technical and commercial experience in the telecommunications sector, working at BT, Deutsche Telekom and the UK Department of Trade and Industry.