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# International network services in Europe and the role of DANTE

Howard Davies, Josefien Bersee

## *Abstract*

The history of network services for European researchers demonstrates a complex, but progressive rationalisation. This article provides a description of the current situation and its evolution. It concentrates on the activities of RARE and on the role of DANTE, a company set up last year by 12 national research networks in Europe to provide international network services for the research community. As a result of 7 years co-ordinated European research networking a firm base now exists from which further new services can be developed more easily and efficiently.

## **The need to co-ordinate European research networking**

For many years the introduction of cross-border services between European countries was the result of independent, bi-lateral agreements between pairs of national organisations, each of which had their own technical goals and administrative constraints. The result was anarchy - and a clear inefficiency in the use of resources. The magnitude of the problem was made visible with the publication in 1991 of the report of the European Engineering Planning Group [1] which, among other things, listed all the international data communications lines used by the European research community.

The existence of the general problem, which resulted from a lack of co-ordination between the many national and international organisations involved in the provision of network services, had been recognised for a long time. RARE (Réseaux Associés pour la Recherche Européenne) had been created in 1986 as a forum for the national

networking organisations to discuss matters of common interest and, in particular, to resolve the problems of interworking between national services that had been created independently. Shortly afterwards, the Eureka COSINE project was established and one of RARE's first major tasks was to co-ordinate the technical work necessary for the COSINE Specification Phase.

The broad goals of COSINE were to create a pan-European networking infrastructure for the whole European research community (academic, governmental and commercial) based on the use of OSI protocols. Mainly for organisational reasons - consensus between representatives of the eighteen countries involved had to be reached before each major decision was taken - COSINE developed more slowly than was originally planned.

## **IXI, first step towards a shared pan-European backbone**

The first concrete result was the creation of the IXI (International X.25<sup>1</sup> Infrastructure) Pilot network which started service between all the COSINE countries in July 1990. The service was provided by PTT Telecom (Netherlands) under a contract with the Commission of the European Communities. This contract was originally set up independently of the COSINE framework - the CEC was a party in COSINE and provided the project officer function but also took the initiative in pressing ahead with the establishment of the IXI service. IXI provided X.25 service at 64 kbps to 18 access points and also had connections to the public X.25 services in the 9 countries where suitable tariff arrangements could be agreed with the national PTT. Although the technical characteristics of the IXI service were not especially advanced even when the service started, IXI nevertheless represented a significant step forward as a managed network providing a common service between many European countries. It also provided valuable lessons in the creation and

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operation of such services which are being applied to new developments.

1989 saw the start of the COSINE Implementation Phase. RARE was contracted to set up the COSINE Project Management Unit (CPMU) with the task of carrying out the set of sub-projects which made up COSINE through the selection and subsequent supervision of sub-contractors. Supervision of the operation of the IXI Pilot service was included in the CPMU's portfolio of activities, as was the specification and tendering for a 2 Mbps production service to supersede it. The result of the tender was the setting up in October 1992 of EMPB (European Multi-Protocol Backbone) which offered a 2 Mbps multi-protocol (X.25, TCP/IP<sup>2</sup>, CLNP<sup>3</sup>) service in all COSINE member states. The other principal results of COSINE have been the creation of the COSINE MHS Service which provides operational support (for example, the exchange of routing and addressing information) to national X.400 messaging services, support for discipline oriented user groups, and the use of network security techniques. Other CPMU activities have covered network management and quality of service issues with results that can be applied for future developments.

#### **Ebone, EMPB's IP counterpart**

COSINE, constrained by its internal organisational procedures, was overtaken to some extent by the explosion in European usage of TCP/IP and the higher level protocols which they support. TCP/IP had been adopted as the basis

of the national network service in a number of countries, notably Switzerland and the Nordic countries. Since other countries were also introducing TCP/IP for at least part of their national service, it was essential that the new pan-European backbone could handle multiple protocols.

While the details of the new managed services were being negotiated with potential contractors, the large TCP/IP users set up Ebone92 as an IP backbone service with access points in five countries. Ebone92 was later transformed into Ebone93 with a greater number of participants and higher speed lines. Ebone93 provides two distinct services to the IP community: a backbone service between networks in different European countries and a neutral interconnect service between the participating service providers, including commercial networks.

#### **EMPB goes IP**

EMPB operates according to the terms of a "framework" contract between RARE and PTT Telecom. The framework contract also provided for IP services at access speeds up to 2 Mbps in the form of both IP tunnelled over X.25 and of native IP. As PTT Telecom had no previous experience of IP, a pilot phase for the IP service was specified in the framework contract. The IP pilot successfully concluded last Summer and EuropaNET<sup>4</sup> has been providing IP services since to a growing number of customer networks (up to 20 in December 1993).

**Table 1. EuropaNET vs. Ebone - organisation and service characteristics**

<b>EuropaNET</b>	<b>Ebone</b>
Managed service, specified in detail and contracted to professional operational suppliers (including the national research networks).	Co-ordinated service, taking advantage of latest developments; development and operations closely linked.
Quality of Service (availability, performance) defined in specifications and operational contract.	Best efforts - usually very committed - maximum use of capacity given priority over performance for individual user.
Imposition of Management Discipline (labelled bureaucracy by technicians).	Try it and see if it works; if so OK, if not then deal with problem. Rapid adoption of new techniques.
More orderly (but slower) progress. Predictable behaviour, performance dependable (even if not high).	Actual performance unpredictable, depends on load imposed by others; priorities determined by technicians rather than users.

Since many countries (including for example the Nordic countries) were relying on Ebone for their international connections and since the national networks of two of the largest European countries (Germany and Italy) have connections to EuropaNET but not to Ebone, there was a clear need for a gateway service between the two networks in order to provide complete connectivity for users throughout Europe. Two such gateways, each with a capacity of 512 kbps were set up during the second half of 1993, one in Amsterdam and one in London (this arrangement changed in January 1994 : there is now one gateway in Amsterdam, operating at 1 Mbps)

### **The establishment of the Operational Unit and DANTE**

One of the goals of the COSINE project was to ensure that the services it set up would continue to be available to the user community after the end of the project's fixed lifetime in March 1993. The CPMU was charged, as one of its tasks, with managing the necessary detailed arrangements but more general questions of organisation and funding had to be dealt with by the community as a whole.

Following discussions over many months, RARE decided in principle in January 1991 to create an Operational Unit which would have the role of managing network services for the European research community in a commercial manner. A planning group set up by RARE carried out a detailed analysis of service requirements and the possible ways of meeting them. It was proposed to set up the Operational Unit as a non-profit, limited liability company.

A subsequent decision to restrict shareholdings in the company to the national networks greatly simplified matters. All the national networks have broadly similar interests and constraints and it became easier to specify a structure that all participants could accept. More importantly, voting power could be set as a function of size and national funds are channelled via a single route. This shareholding restriction does not prevent the Operational Unit from supplying services to non-shareholding organisations.

Further planning, managed by the steering committee set up by the potential shareholders in the Operational Unit, led to the creation of a "Heads of Agreement" [2] which defined the principal terms on which the new company would

be set up and regulated. Important principles laid down in the Heads of Agreement were limits on the number of shares that could be held by any one country, restrictions on the transfer of shares, and voting rights in proportion to shareholding.

Cambridge was chosen as the location of the Operational Unit in October 1992 and Operational Unit Ltd. was set up in April 1993 as an interim arrangement. The Company's name was changed into Delivery of Advanced Network Technology to Europe Ltd. (trading name DANTE) in June 1993 and the company started operations in July 1993.

### **DANTE: current service portfolio**

Managing and developing EuropaNET is currently by far the most important element of the DANTE portfolio. A total of 6 national networks (Belgium, Germany, Italy, Netherlands, Spain, United Kingdom) now have 2 Mbps connections to EuropaNET; Switzerland also has a total access capacity of 2 Mbps split between two separate accesses for European and for US traffic. Other countries and organisations (CERN, ESA, Greece, Ireland, Portugal, Slovenia) have connections at lower speeds. Access to a further group of European countries is available via the gateway to Ebone. NORDUnet has decided to switch from Ebone to EuropaNET on 1 July 1994.

For six months from 1 January 1994, DANTE is acting on behalf of SURFnet and a number of other EuropaNET-connected networks as an Ebone partner with 1 Mbps access to Ebone in Amsterdam (and with responsibility for Ebone's Amsterdam-Geneva line which will remain in place during this period).

DANTE is also involved in the provision of EuropaNET services to Central and Eastern Europe, where radical political changes have created major new demands for research network services. Among a number of initiatives, the CEC is providing 64 kbps links to some of the Central European countries using an extension of its IXI Pilot contract and funding from its PHARE programme. It is expected that the 1994 PHARE budget will allow a continuation of these accesses as well as the extension of EMPB connections to other CEEC countries. As a second important service DANTE is providing international MHS Co-ordination Service, MailFLOW, under a contract with SWITCH.

## **EuropaNET extensions and other planned activities this year**

1994 will see the introduction of significant EuropaNET extensions. A 2 Mbps transatlantic link has been ordered between Amsterdam and the Washington GIX (Global Internet eXchange, the neutral interconnect service); DANTE will use this line to provide US connectivity to networks such as ARIADNEt (Greece) and RedIRIS (Spain) as well as SURFnet (Netherlands) which do not have direct access to a transatlantic link of their own.

US connectivity for SWITCH (Switzerland) and CERN (Geneva) is provided by means of a second transatlantic line, at T1 speed (1536 kbps), between Washington and Geneva. DANTE has been asked by the CEC to make 64 kbps connections to EuropaNET from Canada and from Korea. Initial preparations have already been made; the connections will be finalised once formal contracts are in place.

DANTE plans for 1994 include the development of an Applications portfolio including co-ordinated international directory services which will provide a continuation from the PARADISE pilot service and information services which have still to be defined.

To support and monitor the performance of its services the company is currently setting up a liaison desk, called DANTEAM, which will start operating in Spring 1994. The first priority is to provide support with respect to EuropaNET Services and to act as liaison between Unisource - the company operating the EuropaNET backbone - and staff at the operational departments of the national networks. DANTEAM will develop and utilise a trouble-ticket system to register and contribute to the resolution of each reported problem. DANTEAM will also act as a first contact point for customers facing difficulties in accessing or making use of its Applications Services. For the first time customers will have at their disposal a single liaison desk in support of a range of international services.

DANTE has taken the initiative to address another major issue in 1994: setting up an international networking infrastructure with a much higher capacity than 2 Mbps. Whereas in the US and a number of European countries 34 Mbps and even higher speed networks are now being implemented, nothing of the sort exists on an

international (European) level. Such high capacities are required for the use of sophisticated applications such as Multi-Media, video, interactive CAD/CAM and High Performance Computing. DANTE is currently preparing the procurement of a 34 Mbps backbone in Europe.

## **An Outstanding Issue**

Even though the setting up of DANTE has solved one major issue from an organisational point of view, another outstanding issue for the development of European research networking remains: the lack of a "central" funding and support organisation (equivalent to the Federal Government in the US) whose responsibilities cover the whole of Europe. A governmental organisation which can co-ordinate the funding of a new network infrastructure is still missing. The CEC has been very supportive within the limits of its authority but these limits do not currently extend far enough in the direction of support for operational services (as opposed to development projects) and, in any case, there are many countries in Europe, but outside the EU which need to communicate with others.

This issue was clearly identified by the European Consultative Forum on Research Networking (ECFRN) which published a report in May 1993 describing the problem [3] and which has since taken steps to increase awareness of the need for co-ordinated action among high-level officials from national governments.

In the same context the EUREKA EuroCAIRN (European Co-operation for Academic and Industrial Research Networking) Project aims to realise an upgrade of the current European telecommunications infrastructure and thereby the early adoption of relevant advanced telematic applications. DANTE was asked to produce a proposal outlining a scenario along which to proceed with this task. The proposal was approved by the EuroCAIRN Project Board in January 1994.

## **7 years of co-ordinated European research networking: the foundations have been laid**

From the somewhat confused and chaotic state which characterised international network services in Europe during the late 1980s, a more rational picture is beginning to emerge. There are now solid backbone services at speeds in the range 1 - 2Mbps. The setting up of DANTE creates a firm basis from which new services, including a 34

Mbps backbone, can be developed. RARE will continue to co-ordinate technical discussions of development needs whereas DANTE will be capable of organising the provision of the required services in an efficient and flexible way.

### *References*

- [1] EEPG - Final Report, Amsterdam 1991
- [2] Operational Unit "Heads of Agreement", OU Steering Committee, August 1991
- [3] The organisation of Computer Networking in Europe for Researchers, ECFRN, May 1993

### *Notes*

- 1 Most public networks in Europe are based on the X.25 packet interface standard.
- 2 The TCP/IP protocol suite originates in the US, where it was first introduced in ARPANET (US Department of Defence Network) during the Seventies.
- 3 CLNP is a more recently developed protocol quite similar to the IP concept; it forms the basis for the latest version of DECnet.
- 4 The name EuropaNET has been used since the establishment of DANTE last Summer to indicate the connectivity package as a whole, combining backbone services, gateway facilities, and intercontinental connectivity.