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DANTE and EuropaNET:
a profile

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Introduction

For many years the introduction of cross-border network 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. RARE (Réseaux Associés pour la Recherche Européenne) was created in 1986 as a forum for the European national networking organisations to resolve the problems of inter-working between those national services.

The first ideas about the creation of a pan-European service provider offering international services appeared in the late 1980's. It was not however until 1991 that a task force was established under the auspices of RARE. The first blueprint for such an organisation was established quite quickly and by December 1991 a specific proposal had been produced for the creation of a limited liability company with 14 European National Research Networks as shareholders. In February 1993 the company DANTE was established; the acronym stands for Delivery of Advanced Network Technology to Europe Limited.

It was formally launched and took on its first employees on 5 July 1993.

DANTE: Company Structure

The choice of a limited liability company was made for both legal and financial reasons. As the sums of money involved in providing international network services are significant it is important to have a commercial arrangement with the correct financial controls and limitation of risk. A limited liability company automatically limits risk and allows the control of expenditure to be related directly to the shareholders obligation to pay. Company control is exercised by shareholders' weighted voting, a reflection of shareholding size. Shareholdings fall into four categories, and are related to country size as measured by GNP.

Figure 1. illustrates the company's structure. The shareholders are represented by a board of five members. The two joint general managers were appointed in the Summer of 1993; 9 other staff have been recruited since, covering the following areas: Network Planning and Development
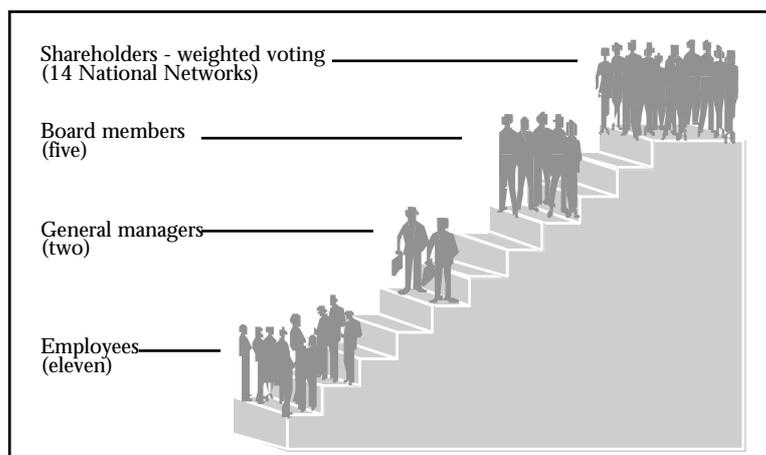

Fig.1 DANTE Company Structure

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(2), Network Management and Customer Liaison (2), Applications Planning and Development (2), Customer and Public Relations (1) and General Support and Administration (2).

The Gestation of EuropaNET

The X.25 part of EuropaNET originated in the IXI (International X.25 Infrastructure) Pilot network, which provided connectivity at 64 kbps between countries participating in the CEC COSINE Project (concluded in April 1993) from July 1990 onwards. COSINE, constrained by its internal organisational procedures and technical orientation towards OSI protocols, was overtaken to some extent by the explosion of usage of TCP/IP in Europe, the result of which was the setting up of the Ebone IP backbone in 1992.

In the specification and tender for a 2 Mbps production service to supersede IXI, it had already been determined to be essential that the new backbone should handle multiple protocols. The result of the tender was the setting up in October 1992 of the European Multi-Protocol Backbone (EMPB) as the pan-European component of EuropaNET which offered a 2 Mbps service in all COSINE member states. DANTE's own transatlantic capacity was added to the EuropaNET service at the beginning of 1994.

EuropaNET and Ebone have co-existed since; a comparison of the 'styles' of both services is presented in Table 1.

Today EuropaNET offers an international connectivity package consisting of three components.

• A pan-European backbone linking the European research networks

EuropaNET's main technical and/or value adding features are:

- IP-IP with the external routing protocols EGP and BGP3 (BGP4 is about to be tested)
- CLNP-CLNP with Static Routing and the Inter-Domain Routing Protocol IDRP
- X.25/X.75 interconnections
- IP-X.25/X.75 interconnections
- CLNP-X.25/X75 interconnections
- IP/CLNP policy based routing
- Address authentication and accounting for IP, CLNP and X.25/X.75
- High-quality network management and help desk service
  available 24 hours per day, 7 days per week, with fault handling and escalation in accordance with agreed procedures
- Service Level Agreements:
  * network service availability guarantee, including availability of access lines;
  * guaranteed end-to-end throughput and delays.

The EuropaNET backbone nodes are normally installed in each country where there is a point of attachment. At each node location there may be one or more nodes. Each node is connected to at least two other nodes and each node location is connected to at least two other node locations, up to now in two different countries.
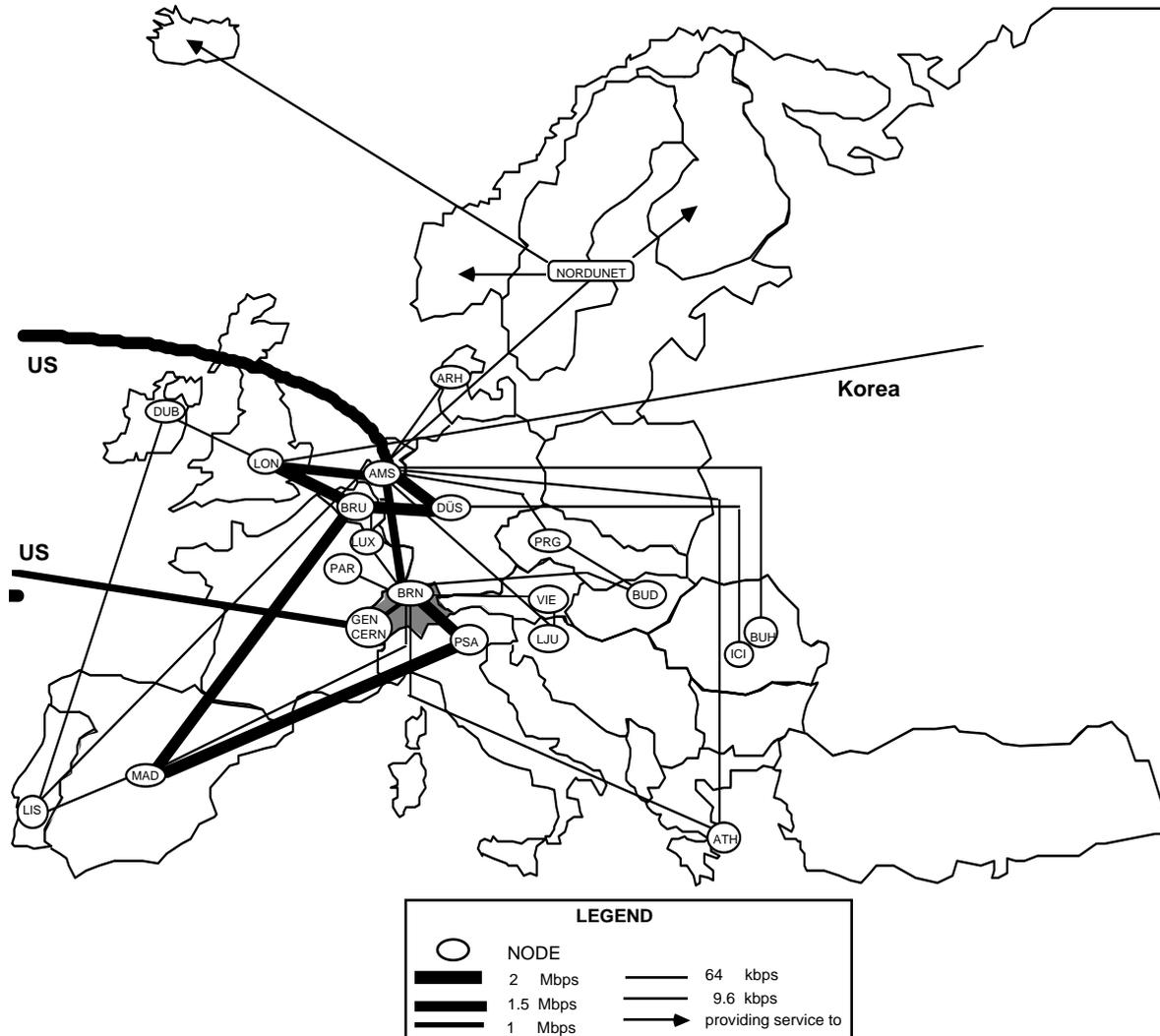
Table 1. EuropaNET vs. Ebone - organisation and service characteristics

EuropaNET	Ebone
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.

DANTE

EuropaNET*

Lines ordered or planned, January 1994
*EuropaNET is trademark of DANTE

US

NORDUNET

ARH

Korea

DUB

LON
AMS
BRU
DÜS
LUX
PRG
PAR
BRN
VIE
BUD
GEN
CERN
PSA
LJU
BUH
ICI
MAD
LIS
ATH

US

LEGEND

NODE

2 Mbps		64 kbps
1.5 Mbps		9.6 kbps
1 Mbps		providing service to

Nodes are present in nearly all western-European countries and in a growing number of Eastern European countries. DANTE is co-operating with the CEC's PHARE program to extend EuropaNET eastwards.

The main building blocks in the node equipment are the INMOS Transputer from SGS Thomson Microelectronics and the XPC controller from Motorola. The Transputer provides true parallel processing with very slow switching delays and high switching capacity. With the current version of the Transputer and XPC controller, transit delays are 0.7 msecs, access delays are 4 msecs and nodes can be built up to switch several hundreds of thousands of packets per second.

The system is capable of handling trunk line speeds of 8 Mbps with full utilisation of the bandwidth. At the end of 1992 a new version of the INMOS Transputer, the T9000, was released. With an appropriate line interface the T9000 is capable of handling 34 Mbps trunk and 8 Mbps access lines.

• A gateway to other European countries and services

For a transitional period, access to a further group of European countries and services - not yet connected to EuropaNET - is available via a gateway to Ebone. The gateway is located in Amsterdam and operates at 2 Mbps.

• Connections from Europe to other continents

Transatlantic connections have historically been provided on a bilateral basis between the US and individual European countries. In order to cater for the needs of those countries which do not have their own intercontinental circuits, DANTE has provided two intercontinental circuits to the USA, an E1 (2 Mbps) circuit between Amsterdam and Washington and a T1 (1.5 Mbps) circuit between Geneva and Washington.

Lines to Germany, Italy and the UK are currently managed independently of EuropaNET but the national networks concerned have agreed to integrate them with the EuropaNET service for routing and backup purposes. NORDUnet has indicated its intention of doing the same with the US-Stockholm line when it switches from Ebone to EMPB in June 1994. DANTE is currently discussing the opportunities for rationalising intercontinental connectivity with the other European circuit operators with the aim of increasing total capacity in a cost effective way.

In the course of 1994 DANTE will also be providing intercontinental connectivity to Korea - a contract for this was signed in January between DANTE and the CEC - and Canada. It is reviewing the possibility of a new direct connection between Europe and Japan.

A next generation backbone

The establishment of EuropaNET was a milestone in the development of European research networking. However, a network access capacity of 2Mbps is still only the beginning, in particular when European national networks are starting to operate national services at 34 Mbps and higher speeds. The introduction of these services will create a demand for complementary international facilities. DANTE has taken up the challenge to define and procure a 34 Mbps and 155 Mbps backbone for the European research community.

A challenge indeed, taking into account the political and technical setting in Europe. A major 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. Without such an organisation to take initiatives and to seed the creation of a new infrastructure, the collection of necessary funds is a significant management challenge.

The setting up of a high speed backbone represents an opportunity to extend the capacity of the existing backbone. In addition, new developments in the area of network technology and in particular the deployment of Asynchronous Transfer Mode (ATM) offer the possibility for European researchers to gain early experience of the benefits and new applications which ATM will enable. Other important issues to be tackled are topology planning, connectivity requirements to other continents, options with respect to management, operation and payment of the service, and an assessment of relevant applications.

DANTE Applications

In addition to providing the pan-European backbone network service DANTE organises a range of Value Added Applications. Foremost among these is the X.400 Mail Co-ordination Service, MailFLOW. The Service was established to ensure the efficient inter-working of the X.400 e-mail services provided by the national research networks.

MailFLOW co-ordinates activities between and among the national networks and offers a single information and contact point for the international MHS community. The MailFLOW team, at the Swiss national network SWITCH, maintains an information server with operational documentation such as routing tables and mapping tables, provides trouble ticket and monitoring functions, supports new MHS services and organises communication between MHS managers, both through e-mail and meetings.

As well as mail co-ordination, plans are well advanced to build on the pilot directory service PARADISE set up as part of the COSINE Project. DANTE is preparing to offer a co-ordinated international directory service from May 1994.

DANTE's other important area of activity in the field of Value Added Applications is Information

Services. This is a particularly challenging issue. More than any other area, information services are regarded as 'free'. Neither users nor funding bodies are eager to pay charges that DANTE, with its commercial structure, is obliged to make for all its services. In practice the costs associated with operation of an Information Service platform are significant as is the data management overhead. As a consequence, quality of service and topicality of data are very variable. DANTE is committed to offer cost-based, unbundled prices and to avoid cross subsidy. Information services are more than just a simple technical challenge within this commercial environment.

A Liaison Desk

The requirement of a liaison desk in support of the international service package was part of the blueprint for the setting up of DANTE. A particular need was identified for centralising support for EuropaNET. DANTE's liaison desk, DANTEAM, will start operating in Spring 1994.

DANTEAM will act as liaison between Unisource - the company operating the EuropaNET backbone - and staff at the operational departments of the national networks. A trouble-ticket system will be used to register and contribute to the resolution of reported problems. As DANTE's involvement with network development and management gradually grows, operational and administrative responsibilities will increase as well. The liaison desk will play a central role in implementing and co-ordinating this process.v Despite its predominant technical orientation, the liaison desk will also be a first point of contact with regard to Application Services.

Conclusion

After seven years of co-ordination efforts in European research networking DANTE has appeared on the stage to look after the international networking needs of the European research community. The company has been successful in the first half year of its existence and a firm basis now exists from which new services can be developed.

While RARE will continue to co-ordinate technical discussions of development needs, DANTE organises, purchases and manages services on behalf of its customers, the national research networks in Europe.