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1 INTRODUCTION

1.1 Background

One of the most urgent actions for the European Research Networking community is to progress the establishment of a well managed pan-European multi-protocol backbone service. The recognition of this need was expressed by the RARE CoA in its May 1990 meeting in Killarney and documented in the EEPG report tabled to the CoA in May 1991 in Blois. The EEPG report confirmed the urgent need for 2Mbps bandwidth and tabled two options for the technical preparation of the multi-protocol backbone itself:

- X.25 with embedding of other layer 3 protocols;
- or - TDM with native support of layer 3 services.

An ad hoc task force was initiated by SURFnet to work out a plan of action to implement the second EEPG strategy, concentrating on the technical and operational aspects of the backbone. The start-up meeting was held in Amsterdam on 2nd September 1991.

The task force reviewed the EEPG strategy, drew up an outline "acceptable use" statement, and recommended a two step approach:

- o creation and growth during 1992 of a kernel backbone by combining and enhancing existing facilities;
- o merging the resultant backbone into the RARE Operational Unit plans for 1993.

1.2 Strategy for a Shared Infrastructure

This strategy as laid out in the EEPG report treats the provision of networking services based on a shared infrastructure as the key issue and recognises that the underlying technology to provide the transmission facilities is a rapidly evolving area and must be managed as a process of continual change. The European telecomms regulatory environment may also exhibit some developments that a well orchestrated research community could play to its advantage.

The approach is to evolve the currently available facilities into a shared and managed infrastructure for the European research network community. It is recognised that a range of carrier level protocols are in heavy use and developments in technology such as ATM and Frame Relay will provide increasingly flexible methods to manage bandwidth and share the expensive transmission facilities between services.

Thus management attention can be divided between:

- o Provision of Services (OSI Layer 3)
- o Bandwidth Management (OSI Layers 1-2)

The Ebone 92 strategy is to start the provision of parallel Layer 3 services on a backbone NOW in such a way that future technology can be "slid underneath". The benefits are savings in line costs through better use of high speeds (cheaper per bit) and better service through a redundant topology linking both European and USA networks.

1.3 Acceptable Use

The target group for Ebone 92 is all the national and international networks and international research institutions (hereafter referred to as Regionals) providing network services for users at higher education and research sites, including those involved in industrial research.

In principal, the Ebone 92 will have no restrictions on traffic. It will be up to participating networks to restrict traffic according to their own norms.

1.4 The Two Step Approach

The two step approach generates two streams of activity: short term implementation in 1992 and a parallel tender/procurement process aimed at 1993.

o Ebone 92 - The Short Term

This document defines and details proposals for the immediate establishment of a common managed interim pan-European Internet IP backbone based on the current ad hoc Internet IP backbone infrastructure(s). Recommendations also include the provision of pilot CLNS services in 1992. The exclusion of X.25 at this step is not because X.25 is considered less important than IP: the pan-European provision of X.25 is well covered already by the current COSINE IXI service and its planned enhancements.

Chapter 2 details Ebone 92.

o 1993 Multi-protocol Backbone

An immediate action is recommended for RARE to prepare a draft Call for Tender document for a pan-European Multi-protocol Backbone Service to be in operation by the beginning of 1993. The execution of this step is to be the responsibility of the Operational Unit currently under establishment.

Chapter 3 outlines the planning for 1993.

2 EBONE 92 - THE SHORT TERM STEP

2.1 A model for a network of networks

Ebone 92 is to be a multi-protocol high-bandwidth pan-European backbone for a network of networks. This model describes Ebone 92 in terms of its boundaries:

- the functional components of the boundary;
- the services available at the boundary;

in terms of its topology:

- the connectivity;
- the redundancy;

and presents the organisational elements:

- the management and operational functions and interfaces;
- the funding mechanisms.

2.2 The Ebone 92 Boundary

The boundary of the Ebone 92 is described in terms of the functionality of the systems at either side and the specifications of their common interface. The defined functions are handled by the Ebone 92 Boundary System (EBS) and the Regional Boundary System (RBS). See

Fig. 1.

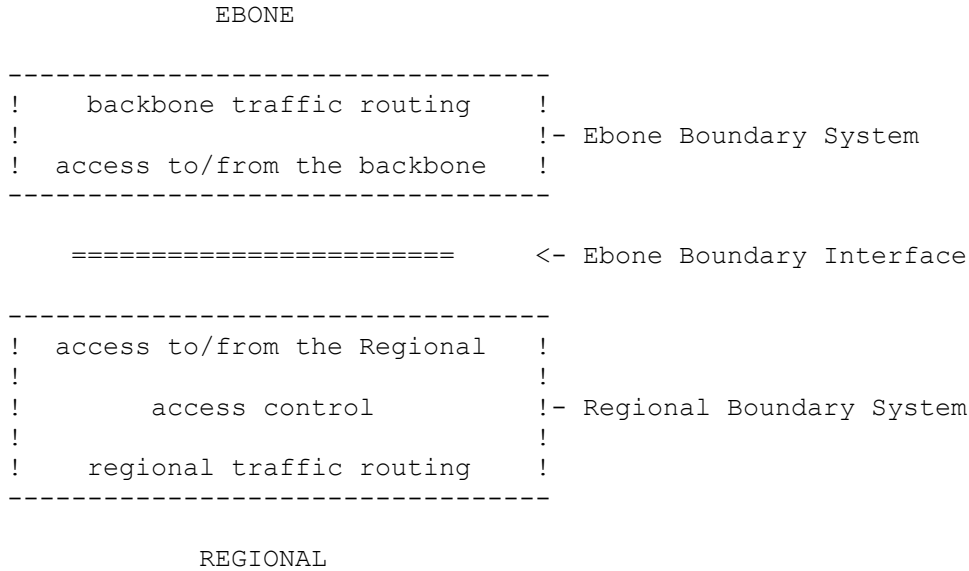


Figure 1: The Ebone 92 Boundary Interface and Connected Systems

The Ebone 92 Boundary Interface is defined for Layers 1 & 2, for routing as appropriate for the Layer 3 services, and for network management procedures.

The Interim Specifications for the Ebone 92 Interface for IP and CLNS working is:

Layers 1 and 2

- Ethernet (AUI Male Port provided by the EBS)
- FDDI (Dual Attachment)
- V.35 or HSSI with PPP (RFC 1171) or Frame Relay (CCITT I.122) encapsulation

Routing

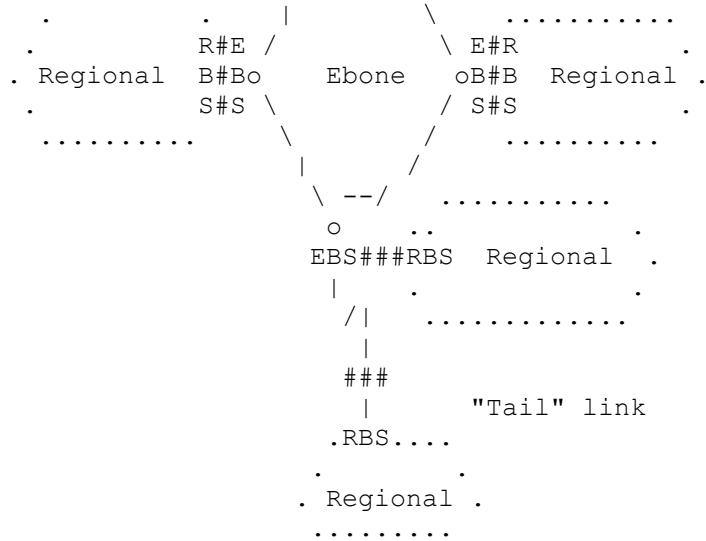
- IP with BGP (RFC 1163) or static routes
- CLNS with IDRP (ISO CD 10747) or static routes

Management

- SNMP (RFC 1157) with MIB-II (RFC 1213)

The Boundary between Ebone 92 and the connected Regionals can be conceptually viewed as in Fig. 2. The physical connection between the EBS and RBS can be a local link, a national wide area link, or an international wide area link. These last two could be called "tail" links.





Ebone European Backbone Network
Regional Regional Wide Area Network
EBS Ebone Boundary System
RBS Regional Boundary System
the Ebone/Regional boundary

Figure 2: Ebone 92 - joining the Regional Networks

2.3 The Ebone 92 Services

The EBONE 92 access modes are:

- Internet IP
- ISO-CLNS (Pilot)

These services can be considered as pins on a "multi-protocol socket".

The interim "Ebone 92 Socket" is shown in Fig. 3.

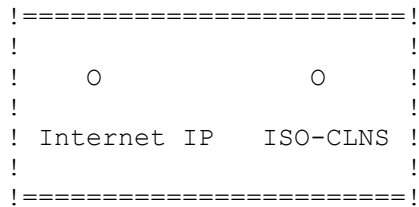


Figure 3: The "Ebone 92 Socket"

In general, service specifications will be those in common usage in the research community, e.g.:

- Internet IP as per Internet standard for IP in RFC 791 et seq;
- ISO-CLNS as per the specifications used by the RARE/COSINE CLNS Pilot Project.

2.4 Topology

The Ebone 92 topology will be developed in two phases.

The goal of Phase 1 is to establish an Ebone kernel by combining existing facilities at existing network sites into a coherent design that will exhibit the benefits of a backbone by providing practical connectivity and high availability both pan-Europe and to the USA. It is to be achieved with minimal upgrading of existing "available" lines and node equipment.

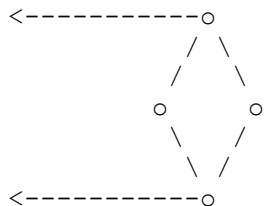
Phase 2 grows the Ebone by incorporating other sites into the backbone. Each new backbone site must have at least two links to existing Ebone sites (EBS to EBS links) so that a robust mesh topology is formed. Single "tail" links can extend Ebone access to regions (EBS to RBS links).

2.5 Ebone 92 Initial Configuration

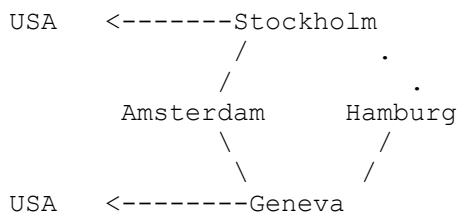
A robust Ebone 92 kernel must provide:

- a three node (triangle) or four node (diamond) basic topology;
- two links to the USA.

Simple symmetry denies the triangle and suggests a balanced ring structure to achieve a robust kernel:



This diamond principle could lead to the following initial configurations. Taking the map of the higher capacity European Internet IP international links and transforming this to a diamond could give the following initial kernel:



Adding the regional networks and some readily achievable extensions could give:

point for incident handling. Initially one support person or Full Time Equivalent (FTE) is needed for this function, to be supplied by consortium members. Each attached Regional will be required to nominate a contact person to liaise with the EOT.

- o Clearing house

An Ebone Administration Unit (EAU) will be needed to balance out the costs and contributions. SURFnet BV has offered to contribute such facilities for the 1992 interim period.

The initial consortium members need to agree on the division of costs for the 1992 situation.

3 THE EUROPEAN BACKBONE - IN 1993 AND BEYOND

3.1 Preparation for 1993

A full multi-protocol service is required to be up and running at the beginning of 1993 provided by a contracted service via a Call for Tender procedure. The rationale behind this step is that the scope of the backbone service together with good procurement practices necessitate a proper tender process. There is an urgent need for a group to start work on this activity. It is recommended that a RARE Task Force be charged with preparation of the Call for Tender and evaluation criteria for the 1993 Backbone.

3.2 The Call for Tender

The Call for Tender document will specify requested services in terms of technical and functional specifications of the services to be supported (notably X.25, Internet IP and CLNS), the required Quality of Service parameters and the location and capacity of the access points.

The design and implementation details of the backbone service will be at the discretion of the Tenderers. The depth and breadth of contracting out services is to be discussed during the tender process.

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