

EARN Document

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- 1 Introduction & Executive Summary (to be completed)
- 2 OSI Transition Strategy

The EARN Board of Directors formally adopted ISO/OSI as the technical goal for EARN in 1987 and agreed the EARN OSI Strategy.

The overall OSI Transition Strategy has a number of elements:

- 2.1 To provide continuity of service to existing EARN users and ensure no disruption of service as the new OSI protocols are introduced.
- 2.2 To implement a better sub-network to carry the EARN traffic using X.25 protocols.

2.3 To introduce ISO/OSI applications and the necessary application gateways to provide continuity of service between the existing EARN applications which are based on the network job entry protocols and the OSI applications.

2.4 Eventually to phase out the EARN applications when the ISO/OSI applications provide the services needed. This will take place progressively as EARN sites implement the introduction of ISO/OSI applications.

This is summarised in EARN's Policy Document No. 3, published by EARN in ????. In addition to the above elements, the EARN Policy Document provides for the use of non-OSI protocols as an interim measure; includes co-operation with the national X.25 network plans; and encourages EARN in each country to co-operate with national plans for the transition to ISO/OSI.

### 3 Current OSI Transition Activities (to be completed)

- \* X.25 Network.
- \* NJE/OSI.
- \* OSI applications.

## 4 CURRENT ENVIRONMENT, ASSUMPTIONS AND CONSTRAINTS

### 4.1 Current Environment

The current research networking environment in Europe is complex with many parallel and perhaps competing activities. Many of these activities have a bearing on EARN's plans for the introduction of ISO/OSI protocols and applications. The key activities are:

- \* COSINE
- \* IXI
- \* RARE
- \* EASINET
- \* EUNET
- \* HEPNET
- \* National Networks

The funding of the EARN network and the EARN OSI transition is also complex, and the source of funds will be affected by some of the activities described above.

## 4.2 Assumptions

A number of general assumptions have been made in drawing up this OSI development plan:

\* EARN's goal is to serve the broadest possible academic research community and the associated industrial research community in Europe, the Middle East and Africa. Thus, EARN is a non-discipline oriented and non-supplier oriented network with the goal to provide computer networking services to all scholars, whether in the sciences, engineering, the arts or humanities.

\* EARN currently uses the network job entry (NJE) protocols and applications, with electronic mail gateways connecting EARN to all the other research networks in the world. It is a basic assumption that the introduction of ISO/OSI protocols and applications will improve the quality of the services available to EARN users, extend the range of services, and broaden the community with which the EARN users can communicate.

\* EARN services are primarily electronic mail, file transfer and interactive one-line messages. In addition, Remote Job Entry (RJE) is supported, and although the number of users is small, the volume of RJE traffic is high. It is a basic assumption in this development plan that these store and forward services, and associated electronic mail and file servers, will remain the priority services for EARN. Introduction of additional international services, including interactive terminal session (dialogue) services, have a lower priority until the requirements for bandwidth, interactive response time, network reliability and other implications are more clearly understood, and the required bandwidth is available. EARN's priorities within each country may vary, and dialogue services may be supported.

\* It is important to note that EARN is an application network and network services provider. It is not a communications carrier. EARN's focus is the introduction and development of applications of benefit to EARN users.

### 4.2.1 Assumptions: Continuity of Service

\* The assumption in this OSI development plan is that continuity of service to the EARN users has the highest priority and that the introduction of OSI protocols and OSI applications will take place in an evolutionary manner, and that no discontinuity of service will be introduced between existing EARN users and those EARN users who have

access to the new ISO/OSI protocols and applications. This, EARN believes, is the correct approach and it is encouraging that continuity of service for existing network service providers like EARN has been endorsed as part of the COSINE Implementation Phase.

\* In addition, it is assumed that the NJE/OSI technical approach to ensuring continuity of service is the appropriate approach for EARN. This approach was developed by a special EARN OSI technical team, and recommended in the OSI-Team Report published in ????. An obvious corollary is that the various implementations of NJE/OSI on the different types of EARN computers must interoperate successfully, especially on the Digital (VAX/VMS), and IBM (VM/CMS and MVS) international backbone nodes. It is worth noting that this approach is similar to the approach adopted in 1985 by BITNET in the United States for the continuity of NJE services during the introduction of TCP/IP protocols and services.

#### 4.2.2 Assumptions: X.25 Sub-Networks

\* Since EARN is basically an applications network and network services provider, it is an assumption in this OSI development plan that EARN does not need to manage and operate an X.25 sub-network, provided that an appropriate X.25 sub-networking infrastructure is available in the geographic areas where EARN operates, which is reliable, cost effective and well-managed, and that EARN has the appropriate input to the management and control of the X.25 sub-network. If this is not the case then EARN has to implement, manage and operate its own X.25 sub-network. At the present time no appropriate X.25 sub-network is available to EARN.

\* It is further presumed that the COSINE IXI Network will for the first 16 months be a pilot X.25 network and not a service network. However, the potential importance of IXI to the european research community means that networks such as EARN should participate in the pilot and in the evaluation of the IXI network. Suitable support for such participation in the COSINE IXI pilot network project should be provided by COSINE.

\* It is further presumed that the success of the COSINE IXI Pilot, and the future financing of any COSINE IXI service network, are not assured at this time. COSINE discussions on the possibility of seeking tenders for the provision of a replacement for the IXI network after the 16 month pilot phase confirm that the future of the IXI service network is not assured at this time. In addition, while the pilot will take place, it is clear that the projected costs of the pilot phase appear to be excessive when compared to the projected costs of running EARN's own X.25 network. As a consequence, it is

assumed that EARN cannot, at this time, commit to the use of the IXI Network to provide the basic network for transport of EARN traffic, and therefore EARN must continue with the current EARN X.25 backbone plans.

\* It is assumed that EARN will participate in the IXI pilot network and in the evaluation of this network. It is presumed that the IXI project will proceed on schedule, so that EARN can participate, and so that EARN can gain sufficient experience to fully evaluate the IXI Network by December 1990.

\* It is assumed that COSINE will decide on the IXI project before December 1989, that a contract for the pilot phase of the network will be signed at that time, and that the duration of the pilot project will be 16 months as currently planned.

\* In considering connections between the EARN X.25 backbone network and other international and national networks, it is assumed that X.75 may not be available and that it will be necessary to use gateway X.25. However, both X.75 and X.25 will be investigated. It is further assumed that all national and international networks involved will adopt the X.25 1984 version during 1989/90.

#### 4.2.3 Assumptions: ISO/OSI Applications

In developing this EARN OSI Development Plan, it has been assumed that the priority for the introduction of ISO/OSI applications is as follows:

\* First, the introduction of X.400 electronic mail and the associated RFC987 electronic mail gateways between X.400 and existing mail services.

\* Second, the introduction of directory services based on the X.500 standards.

\* Third, the introduction of the FTAM applications and appropriate gateways to ensure that existing EARN file transfer mechanisms can interwork with FTAM applications.

\* In all of the above, it is assumed that EARN will participate with RARE in the determination and adoption of functional standards for the transition of EARN to ISO/OSI.

\* A major and basic assumption in the plan is that the COSINE Implementation Phase will include support for the transition of existing operational service networks towards the use of ISO/OSI

protocols, and therefore that funding will be available to provide the manpower and facilities to ensure that EARN's OSI Transition Programme proceeds rapidly and is successful.

## 4.2 Constraints

This OSI development plan for the transition to the use of ISO/OSI protocols and applications is constrained by a variety of considerations.

\* First, and most importantly, the major constraint is that of continuity of service. This means that all sites which continue to run the NJE protocols and applications during the transition phase (and this phase may take several years), must be able to communicate with all EARN nodes without diminution of the quality of service provided.

\* Second, all countries in EARN, whether in Europe, the Middle East or Africa, must be assured that this development plan protects the interests of their users. This is particularly important for countries which are members of EARN but are not participants in the COSINE Programme.

\* A major constraint, as always in these matters, is the limits on the funding available to EARN from the member countries. Additional funding and sponsorship will be required to ensure that the development plan described here can be implemented. It is anticipated that these funds will be provided as part of the COSINE implementation phase.

\* The EARN OSI Transition Programme is substantially sponsored by a number of international computer and communications suppliers - namely, IBM Europe (IBM), Digital Equipment International Europe (DEC) and Northern Telecom Europe (NT) - and this support puts a number of constraints on the activities in the plan.

First, at the X.25 level, the funding available for the line upgrades involved in the current EARN X.25 backbone activities, has been provided by DEC. The agreement between DEC and EARN is for DEC to support a large-scale OSI pilot project. Consequently, the agreed constraint on the use of leased lines wholly or partially funded by DEC is that the protocols used on the lines will be limited to ISO/OSI or NJE/OSI protocols.

Second, the Northern Telecom X.25 switches, which have been accepted by EARN for use on the X.25 backbone, provide X.75 functions for interconnecting X.25 networks, and Gateway X.25 prototype

implementations will not be available until the last quarter of calendar year 1989.

\* A major opportunity for EARN at the X.25 level, although possibly one which will give rise to additional constraints, is IBM's offer of bandwidth sharing with the IBM EASINET Project. This offer has been welcomed by the EARN Board and detailed planning activities have been incorporated in this Plan.

\* A major constraint on the success of the continuity of service is that the NJE/OSI implementations on at least IBM and DEC systems interoperate successfully.

\* A further constraint is that NJE to OSI application gateways for VAX/VMS computers must be available if EARN is to take advantage of the DEC offer of MicroVAXs (the so-called G-Boxes) to act as OSI application gateways in each country. These application gateways will include X.400 to RFC987 electronic mail gateways and NJE/FTP to FTAM gateways. In addition, where countries choose to use existing EARN backbone nodes as gateways, appropriate software implementations will be required.

\* More generally, all the ISO/OSI protocols applications and gateways to be implemented in the EARN OSI Transition must conform to common functional standards, and

\* Possibly most importantly, there are funding and staffing constraints. The existing staff levels and funding levels budgeted by the EARN Board will not be sufficient to ensure that the development programme described here proceeds as rapidly as planned. Additional COSINE funding will be required.

#### 5 PROPOSED OSI DEVELOPMENT ACTIVITIES (JANUARY 1990 - DECEMBER 1991)

The OSI development activities proposed fall into three distinct categories: (1) The development of a suitable X.25 sub-networking infrastructure to support the EARN traffic and the development of OSI applications; (2) Provision of continuity of EARN services by the implementation of the NJE protocols over OSI Session and Transport (NJE/OSI) on Digital (VAX/VMS) and IBM (MVS and VM/CMS) computers and the comprehensive testing of the interoperation of the implementations. In addition, the installation of G-Boxes in each EARN country where required to support the NJE/OSI approach, and to provide a standard Application Gateway for each country; (3) The introduction of OSI Applications and NJE to OSI Application Gateways on the EARN G-Boxes.

Each category of activity - X.25, Continuity of Service and OSI Applications - is discussed in detail below. Figures 5.1, 5.2 and 5.3 show the estimated timescales and durations for each activity. In addition, the funding and staff resources required to support these activities are outlined.

## 5.1 EARN X.25

In overview, the EARN X.25 activities will include the implementation of the planned EARN X.25 backbone network currently under test; the connection of this X.25 backbone to the various national X.25 research networks; the connections of the EARN backbone to the IXI pilot network; the evaluation of the IXI network as EARN's possible future X.25 sub-network; and, if the evaluation of IXI is positive and the decision is agreed to by the EARN Board of Directors, the transition to the use of the IXI network. In addition, the possibilities of sharing line bandwidth with other international network service providers will be investigated.

### 5.1.1 EARN X.25 Backbone

The EARN X.25 Backbone network, as currently planned, will be implemented by linking together NT switches installed in RAL, CERN, Montpellier and CWI. The network configuration will be a triangle linking CERN, CWI and Montpellier at 64Kbps, with a 64Kbps link spur from CWI to RAL. The network will be managed from the EARN OSI Centre (EOC) in Amsterdam, where an NT X.25 management switch and a microVAX management computer are currently being installed. The implementation of the EARN X.25 backbone should be completed in the first quarter of 1990, and thereafter regular monthly statistics and management reports are planned.

TABLE 5.1: EARN X.25

	1990	1991
	+Q1+Q2+Q3+Q4	+Q1+Q2+Q3+Q4
EARN X.25 BACKBONE		
Implementation of EARN X.25 backbone service network	+---+---	
Consolidation of X.25 network management at EOC	+---+---	
Production of monthly statistics and management report		+---+---
Agree funding model for 1991 for connection to EARN	+---+	

backbone

Connections to national X.25 networks

Establish criteria for X.25 connections

+---+

Testing of X.25 connections

+---+---+

Implementation of X.25 connections

+---+---+

IXI X.25 connections

Testing of IXI X.25 connections

+---+

Implementation of IXI X.25 connection

+---+

Evaluation of IXI connection methods

+---+

IXI evaluation

Determination of evaluation criteria

+---+

Evaluation of IXI network

+---+

Decision on future use of IXI network

\*

Transition to IXI network

Transition to use of IXI network

+---+---+---+---+

Line sharing

Investigate line sharing possibilities

+---+

The current model for the funding of this EARN X.25 backbone network is as follows: The X.25 backbone will be funded by a combination of central EARN funds, plus contributions made by each country where the switches are located. This contribution is paid to central EARN funds once the backbone network has been brought into service, and the country connects to the service network. The contribution is in lieu of the country paying for a 9.6Kbps link to a neighbouring country in the "traditional" EARN manner. Thus, once the EARN X.25 backbone becomes operational, the UK, France, Switzerland and the Netherlands

will be expected to connect to the EARN backbone and to contribute to the costs. This funding model will be reviewed during 1990.

#### 5.1.2 Connections to National X.25 Networks

Countries connect to the current EARN NJE backbone by linking their national EARN backbone node to the national EARN backbone node in a neighbouring country, typically using a 9.6Kbps leased line. After the implementation of the EARN X.25 backbone, countries may continue to use these NJE links, or may choose to link some or all of their EARN nodes to a national X.25 network, and to connect this national X.25 to the EARN X.25 backbone. Such connections require agreement on the X.25 addressing conventions to be used, and these need to be tested thoroughly in each case before implementation. It is expected that these connections will be implemented using the Gateway-X.25 conventions. Gateway X.25 software will be available in the EARN NT switches in the final quarter of 1989. In addition to the technical addressing issues, care will have to be taken to implement these X.25 connections in a way which will protect the EARN X.25 backbone network bandwidth for EARN services.

#### 5.1.3 IXI X.25 Connections

By January 1990, it is expected that the IXI Pilot Network will become available, and that a 64Kbps circuit will be available as part of the IXI Network to link an EARN backbone switch (probably at CWI) to an IXI backbone switch (probably in Amsterdam). It is expected that the link between the two networks will be established using the Gateway-X.25 conventions, and this will be tested in early 1990, and brought into service later that year. In addition, it is probably that a number of EARN national backbone nodes and EARN G-Boxes will connect directly to the IXI backbone (see below). An evaluation of the methods of connection to the IXI Pilot Network is planned for late 1990.

#### 5.1.4 IXI Evaluation

Assuming that the IXI Pilot Network situation will be stable in the latter half of 1990, it will be possible for EARN, once some experience has been gained with both the EARN X.25 backbone network and with the IXI pilot X.25 network, to evaluate the IXI network to determine whether it could provide the EARN X.25 sub-networking infrastructure for the future. This evaluation will take place in the final quarter of calendar 1990, according to criteria established in early 1990. Once the evaluation has been completed it will be

presented to the EARN Executive Committee for decision by the end of 1990. The EARN Board will be asked to ratify the Executive decision in early 1991.

In addition to the EARN evaluation there will be an evaluation of the IXI pilot undertaken by COSINE during the latter half of 1990, and this evaluation will be taken into account by EARN when considering the future use of any planned IXI Service Network.

#### 5.1.5 Transition to IXI Network

The X.25 activities for the second year of this EARN OSI Development plan are somewhat more difficult to predict and plan for than the activities in the first year.

A variety of scenarios may exist. For example:

IXI Network - Scenario A: Based on the COSINE evaluation of the IXI Pilot Network, a decision may have been taken by COSINE to extend the IXI pilot service for a further two years and the terms and funding of the extended IXI X.25 network service may be clear. In addition, the EARN evaluation of the IXI pilot project may have concluded that the IXI pilot network's capacity, performance, reliability, availability, serviceability, etc. is sufficient to support EARN traffic and is acceptable, and that the IXI funding model is acceptable and appropriate for EARN in Europe.

In this case, it is anticipated that the EARN Board of Directors will decide to use the IXI network for EARN's traffic in Europe. A decision will then be taken to stop any further development of the EARN X.25 backbone in Europe, to progressively transfer all traffic to the IXI X.25 network, and to discontinue the EARN backbone in Europe. If this decision is taken by the EARN Board, then it is possible that it could start to be implemented in early 1991. However, EARN may need to continue to provide an EARN X.25 backbone linking the other EARN countries.

IXI Network - Scenario B: The decision on the future funding of the IXI Service Network may be quite unclear by the end of 1990. In addition, the EARN evaluation may not have had time to come to a firm conclusion on the suitability of the IXI X.25 network for EARN's purposes. Alternatively, the COSINE evaluation may have concluded that the Pilot phase of the IXI Network should be extended for further testing and evaluation.

In this case, it is anticipated that the dual approach proposed above for the first year of the EARN OSI Development Plan will be continued. In that extended period, further evaluation work by COSINE may clarify

the future and the funding of any IXI Service Network, and further evaluation of IXI by EARN may result in a clear statement on the use of the IXI network by EARN.

IXI Network - Scenario C: A further possibility is that a decision may have been taken by COSINE to discontinue the IXI network, or to replace the IXI X.25 network by a different network provided by a different supplier. The tendering process for this new network may be under way. Alternatively, EARN may have decided that the IXI network, or its replacement, is unsuitable for EARN's purposes, and that EARN will use its own X.25 network or that provided by other suppliers.

In this case, it is anticipated that EARN will discontinue use of the IXI network and concentrate on the development of the EARN backbone network.

At this point in time, it is not clear which of the above scenarios will be correct. However, if the outcome is as outlined in the first scenario, A above, then it is expected that EARN will decide to make the transition to the use of the IXI X.25 Service Network from early 1991. It is expected that the funding model for IXI beyond the initial 16 months pilot phase will be the key factor in determining this decision.

#### 5.1.6 Line Sharing

In addition to the EARN X.25 backbone network and the IXI pilot X.25 network, it is expected that there will be several other international X.25 networks available in Europe in 1990 - including networks planned by ESA, IBM's EASINET, EUNET and HEPNET.

During the first half of 1990, EARN will investigate the possibility of co-operating with these other network service providers. In particular, the possibility of sharing line bandwidth with these networks will be investigated.

#### 5.2 Continuity of Service

In overview, the EARN Continuity of Service activities will include the installation and testing of the NJE/OSI software on the EARN G-Boxes already installed, and the testing of the interoperation of the NJE/OSI implementations on the G-Boxes and on existing national EARN backbone nodes; the implementation of an EARN NJE/OSI backbone on completion of the testing; the investigation of alternative approaches to the provision of continuity of service in case the NJE/OSI approach should encounter difficulties; the installation of

additional national G-Boxes; and the testing and implementation of G-Boxes to IXI Pilot Network connections.

### 5.2.1 NJE/OSI Testing

The latest version of NJE/OSI software developed by Joiner Associates will be installed on the four G-Boxes currently installed in RAL, CERN, Montpellier and Dublin, and on the microVAX support system installed in the EARN OSI Centre (EOC). These G-Boxes will be connected to the EARN X.25 backbone and the NJE/OSI software tested exhaustively and under load conditions. The reliability, availability and performance of the VAX NJE/OSI software will be tested and a report produced. In addition, the management of the NJE/OSI software, routing tables, etc. from the EOC will be tested and evaluated, using a variety of NJE and dialogue access (xxx) tools.

NJE/OSI software has been developed for the EARN OSI Transition by Joiner Associates for VAX/VMS systems, and by Heidelberg University for IBM MVS and VM/CMS systems. The specifications have been coordinated by the developers, and the NJE/OSI implementations should interwork. A programme of testing this interoperability has already started, and will be completed in the first quarter of 1990. This will include testing under load conditions, and the overall performance of the interoperating implementations will be tested, and a report produced.

In the second quarter of 1990, on satisfactory completion of the NJE/OSI testing, the line EARN traffic will be traffic will be transferred to the NJE/OSI backbone running over the EARN X.25 Backbone Network.

### 5.2.2 Alternate Approaches (This section to be completed)

TABLE 5.2: Continuity of Service

	1990	1991
	+Q1+Q2+Q3+Q4	+Q1+Q2+Q3+Q4
NJE/OSI Testing		
Test NJE/OSI on G-Boxes	+++	
Test NJE/OSI Interoperability	+++	
Test NJE/OSI under load and evaluate	+++	

Prepare report \*  
 Implement NJE/OSI backbone +---+---+---+

Alternate approaches

Technical working group to  
 look at NJE/OSI alternatives +---+  
 Design fall-back (if  
 necessary) +---+  
 Implement fall-back +---+

Additional G-Box installations

Develop plans for G-Box  
 installation in all EARN  
 countries +---+  
 Install G-Boxes in all EARN  
 countries +---+---+---+---+---+

IXI NJE/OSI connections

Testing of IXI G-Box  
 connections +---+  
 Implementation of selected IXI  
 G-Box connections +---+---+

IXI Evaluation

Evaluation of IXI Network +---+

\* Establish a technical working group to investigate a fall-back approach to the provision of continuity of NJE services in an OSI environment should the NJE/OSI approach fail to provide satisfactory results. Examples of such fall-back approaches could include the use of NJE over SNA, DECNET, or TCP/IP.

\* If the NJE/OSI approach is successful, reliable, and available, then proceed with the implementation of NJE/OSI.

\* If the NJE/OSI approach is not successful, either due to unreliability, performance constraints, or lack of interoperability between systems, then test and implement the fall-back approach for supporting NJE in an OSI environment.

\* Establish the basis on which suppliers will provide continuing development and support for the NJE/OSI software implementations.

## 5.3 OSI Applications and Gateways

### 5.3.1 X.400

\* Evaluate X.400 and RFC987 gateway implementations available for the EARN G-Boxes. Install and implement the selected solution. (An interim solution may be required.)

\* Test interoperability of the various EARN X.400 implementations and the G-Box X.400 implementation.

\* Test interoperability of the EARN X.400 implementations and the national network implementations of X.400.

\* Participate in the RARE X.400 pilot projects and co-ordinate with RARE X.400 and RFC987 gateway plans.

TABLE 5.3

	1990	1991
	+Q1+Q2+Q3+Q4	+Q1+Q2+Q3+Q4
OSI APPLICATIONS		
X.400		
Evaluate X.400 and RFC987 implementations to G-Boxes	+---+	
Select (interim) solution	*	
Test X.400 and RFC987 gateways with national gateways	+---+---+---+	
Implement EARN X.400 and gateways	+---+---+---+	
Test with other EARN and national implementations		+---+---+---+
Establish X.400 and RFC987 management criteria for EOC	+---+	
Investigate charging and accounting issues	+---+---+---+	
Evaluate X.400 for LISTSERV and NETSERV		+---+---+
Evaluate X.400 to support EARN unsolicited File Transfer		+---+---+

### X.500

Evaluate X.500 implementations	+--+
Select (interim)solution	*
Test and participate in X.500 project	+--+--+--+
Test with other EARN and national implementations	+--+--+--+

FTAM

Investigate FTAM options	+--+
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JTM

Investigate JTM options	+--+
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VTP

Investigate VTP options	+--+
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\* Ensure the X.400 and RFC987 gateways chosen can be managed by the EOC.

\* Establish accounting and charging model for the transfer of EARN traffic to and from national and other networks using X.400 (this may be necessary since some networks may be using public X.25 networks and will have to bear the transmission costs).

\* Co-ordinate the EARN RFC987 gateway tables with other implementations in international, and national networks, and with the multiplicity of institutional RFC987 gateways which will be implemented.

\* Evaluate X.400 as a support mechanism for LISTSERV and NETSERV functions and other EARN E-Mail applications. Develop plans for the introduction of such X.400-based functions and for the replacement of existing software and the maintenance and support of the new software.

\* Evaluate X.400 as a support mechanism for the EARN unsolicited file transfer service.

### 5.3.2 X.500

\* Evaluate X.500 implementations available for the EARN G-Boxes. Install and implement an appropriate solution. (Interim solutions may be required.)

- \* Test interoperability with other EARN X.500 implementations and with X.500 implementations on other international and national networks.
- \* Participate in the RARE pilot X.500 directory projects, and co-ordinate with RARE.
- \* Ensure solution chosen can be implemented and managed by the EOC.
- \* Establish accounting and charging models for the support of X.500 traffic between the EARN network and national and other international networks. (Other networks may be using the public data network X.25 services and will have to pay these costs.)
- \* Co-ordinate with other X.500 activities.
- \* Evaluate X.500 as a substitute for the NETSERV tables storage and maintenance, and design and implement transition to X.500.
- \* Investigate approaches to the collection and maintenance of directory entries for all EARN users. Implement selected solution for the EARN community of users.

#### Additional OSI Applications

- \* FTAM
- \* JTM
- \* VTP
- \* TELL Messages

#### 5.4 Funding and Staff Resources

During the period of this development plan, EARN has budgeted for two groups of staff under an EARN Manager. The first group is comprised of two or three technical support staff, funded by EARN, plus one staff member funded by EARN France, located at Paris and at other EARN sites. These staff will be responsible for the existing operational EARN services. The second group consists of one EARN senior technical support staff member, funded by EARN, plus three staff members funded by Digital International Europe, located at the EOC in Amsterdam. This second group of staff will be responsible for the implementation of the EARN OSI Transition Programme. In addition, it is anticipated that various sub-projects will be undertaken by EARN in a number of countries, and these activities will be managed and co-ordinated by the EOC.

The funding for this level of EARN staffing is included in the EARN 1989 and EARN 1990 budgets, and is planned to be provided by the EARN

national contributions. However, it is clear that the aggressive programme of work outlined here cannot successfully be undertaken by the EARN staff budgeted, and additional EARN staff are required.

It is EARN's understanding that the need to support EARN's and other networks OSI transition activities has been foreseen by the COSINE Implementation Phase Programme and that funding has been allocated to support EARN, and indeed other networks, for these activities. (This allocated funding does not include support for X.25 sub-networking, since this is provided by the COSINE IXI Network.)

A high priority activity therefore is the preparation of a proposal to COSINE for funding and securing these funds required before 1 January, 1990. A preliminary estimate is that approximately 250,000 ECU per annum will be required from COSINE over the next three years for EARN's OSI Transition. It is expected that the funding requested will cover an EARN OSI Transition Manager, four technical support staff to be located at the EOC, plus support for travel and meetings and support for the acquisition of additional OSI software and hardware if required. The timescale for this proposal depends on the COSINE Implementation Phase Programme but is planned for 1 October, 1989 with funding anticipated to be available before 1 January, 1990, so that the additional staff can be hired. It is expected that funding will be available from COSINE for the three years 1990 through to the end of 1992. No substantial progress can be expected on the EARN OSI transition, unless these COSINE funds are made available.

## 6 ADDITIONAL DEVELOPMENTS

The EARN OSI Transition Programme described in this document does not take place in isolation but in parallel with several other EARN activities. In particular, EARN will be developing additional applications for users, similar to existing applications such as the Trickle Server, the ASTRA Service at CNUCE, or the MACSERV Server in Dublin. These new applications services will also need to be included in the OSI Transition Programme. A separate plan for these additional application developments will be drawn up at a later date.

In addition to the development of new EARN applications, it is anticipated that during the period covered by this Plan, there will be further development in the use of proprietary protocols in EARN, (e.g. SNA and DECNET. These protocols cannot currently be carried on that part of the EARN X.25 backbone funded by DEC.). At the present time, it is planned that these proprietary protocols will be used to carry NJE applications. However, it is also expected that there will be increased user demand for new services based on proprietary protocols and that pressure for these services will increase rapidly

unless corresponding services can be introduced as part of the OSI Transition Plan.

It is also anticipated that there will be growing pressure to support the TCP/IP protocol suite in Europe in general, and on the EARN network in particular. This protocol suite has some advantages in that it can be extended to incorporate existing workstations on campuses in addition to the mainframe service machines. At this time, it is certainly not clear how such existing workstations can be incorporated using the ISO/OSI protocol and application suites. Thus it is anticipated that additional development work to support the TCP/IP suite on EARN will be required.

As the requirement for such additional developments becomes clearer, appropriate detailed development plans for EARN will be drawn up. However, the EARN OSI Transition Programme should be unaffected by these additional developments, and this Plan assumes that they will not detract from the EARN OSI Development Programme.