Esprit
Information Exchange System

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The IES User Forum

One of the major innovations of this year's ESPRIT Conference, which was attended by nearly 2.000 participants and visitors, was the open evening meeting on Tuesday, November 15, at which IES Services reviewed briefly the past, outlined future plans and presented themselves to questioning by users. There were two plessant surprises: having feared a poor attendance at the late hour of 19.15, the 70 or so users had to be cut short in their questions at 21.00 when the hall was closed and far from being at the receiving end of brickbats, the Services gathered several bouquets and, more importantly, some suggestions for the future.

The Forum was introduced and moderated by Richard Sanderson of DG XIII who touched on the essential reasons for providing IES Services and the rationale governing future developments. The first formal presentation was by your Editor who showed how readership had grown from less than 1.000 for issue 1 to 10.000 by now, the geographic distribution roughly corresponding to the presumed scientific and technological population in Member States – some 800 copies circulated outside the Community. It was hoped that readers would indicate their preference for an ESPRIT Forum section or a separate ESPRIT publication, and would also contribute more letters. In the ensuing discussion, the wish was expressed for some more contentious constributions, which might even be printed on a differently coloured page to indicate that these texts did not reflect either editorial or Commission views – but this was the only criticism offered. The consistently high quality of the newsletter was stressed. (Since the Forum, arrangements have been finalised for regular contributions from CEN/CENELEC, with the first articles to appear in the February issue). The interest in the newsletter was also shown by the large number of address changes notified (unusual for a gratis publication) and the steady growth in readership.

Next, John Conroy presented developments at EuroKom

LATE NEWS

BRITE/EURAM Technological Days

The Second such meeting will be held in Brussels between January 31 and February 2, 1989, with the last day being designated Proposer's Day. Further information from the Directorate for Technological Research, CEC, B-1049 Brussels (+32-2-235-2345).

First Optical Fibre Leased Line to Japan

Mercury and IDC have been commissioned to install an optical fibre leased line between London and Tokyo for a Japanese securities firm.

E-Mail on Minitel

An electronic mail service will be one of the innovations planned for the Minitel service in 1989 by France Telecom.

LATE NEWS

Luxembourg Videotex

Two years after its introduction, nearly 300 subscribers are using the service provided by the Luxembourg PTT. Average use is about 3 hours per month. Users can access both the French Minitel and the German BTX services.

IMPACT: the New Name for the Information Market Program of DG XIII.

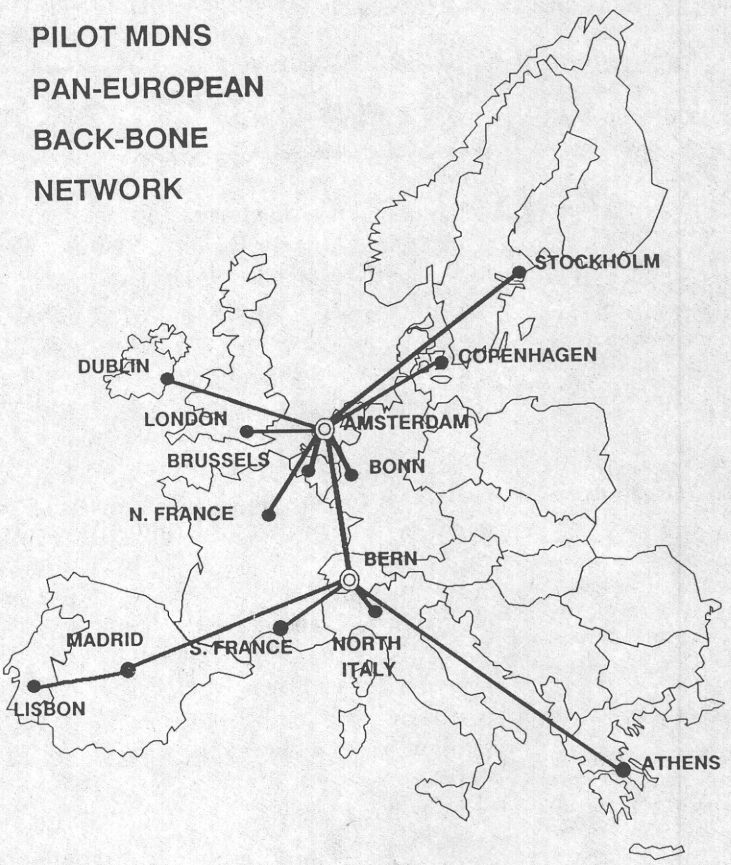
The first calls for declarations of interest for the Intelligent Interface and Image Databank topics of the IMPACT (Information Market Policy Actions) Program have been issued by DG XIIIB. Further details from J. Cardos, Jean Monnet Building B4-46, L-2920 Luxembourg (+ 352-4301-2906).

THIS ISSUE:

The IES User Forum

and EuroContact. Over the years, there has been a significant spread in EuroKom geographically and in functionalities. Thus whilst three years ago, users came from only 9 countries, this has now grown to 22, although futher geographic growth is not anticipated on this scale. Also, whilst initially the user population was accounted for entirely by ESPRIT participants, there were now 24 identifiable user groups with ESPRIT accounting only for 50% of active users. The diversity of groupings is likely to remain steady with the strategic target for the next three years being to focus on key groupings with service being concentrated on these. In addition to mail and conferencing services, which were the first to be made available, new facilities such as Telex, Intermail and databases such as EuroContact, had been introduced smoothly and successfully. Further services are to be introduced once the planning process for the new now activities in ESPRIT II has been concluded: dates and particulars will then be released. The growth in services was also reflected in increases in staffing from 5 to 18, and the opening of European mainland offices for country-based support. As regards EuroContact, there is a growing usage of these databases (this trend was also in evidence in HelpLine enquiries). Questions from the floor concerned reasons for the location of this service at the periphery rather than the centre of the Community Member Countries, but since the service was transparent, location was felt to be of secondary importance. Users complimented EuroKom on the smooth transfer from one host to the new machine, during which there had been no loss of even one word, an unprecedented happening in system transfers, with breaks in service being held to a barely noticeable minimum. Some users indicated that they had developed software for "downloading" information, mail etc. onto a local host, which could then be accessed by local users in a fully transparent manner. It was agreed that coordination and eventual availabilily of these potentially useful additions should initially be handled through EuroKom.

The next presentation was by Manos Castrinakis of DG XIII and covered the topic of information services. Future intentions were to expand information provision by services such as CORDIS (Community Research and Development Information Services), and integration of information and other network services. Improved effectiveness of means of access to information, was also high on the list of priorities. It was however important to ensure that the potentials of the existing services were fully realised. Promotion had been and would continue through the IES News, by participation at conferences and EuroKom announcements. User participation would be assisted as hitherto through EuroContact and the HelpLine. The Data Collections were fulfilling the important role of increasing knowledge about ESPRIT and other Commission programs. The newly instituted Proteas (Prototypes) database would be supported fully to meet the aim of catalysing product development. Other efforts



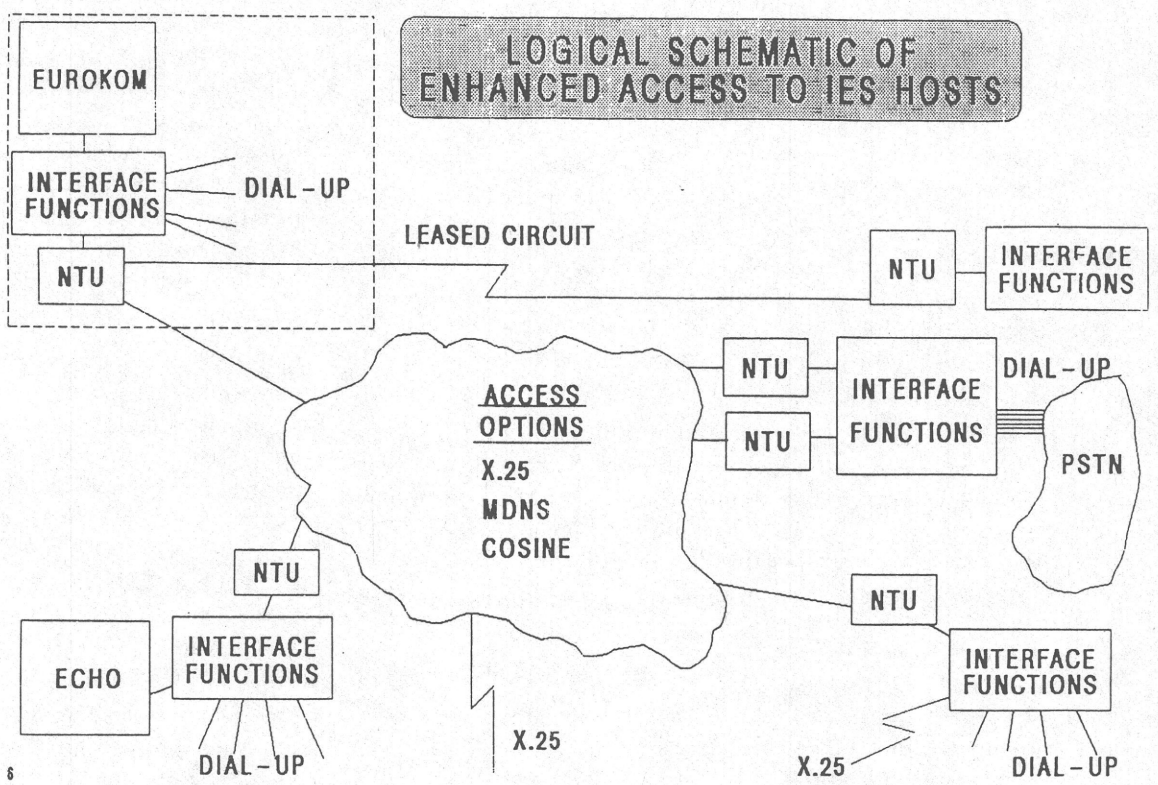
The IES User Forum

were going into such information provision activities as RARE Databases, the Cosine News section of IES News, Bulletin Boards on EuroKom, including the successful one on ITPress Releases.

Finally, Colin Sorrill proceeded to sketch new services which included the establishment of National Support Centres as a sort of distributed HelpLine to give users support in their national language both by telephone and visits, to promote IES services on a national level, to provide where necessary training in service, to act as reference points for local data collection and feedback, and to assist the Euroguichets put up under the SME Task Force. Other plans concerned expanded data collection activities, support for the MDNS (Managed Data Network Services) pilot plans, in relation with the COSINE implementation phase, provision of intelligent interfaces for information access, and evaluation of such services as ISDN, FTAM and data compaction.

Two diagrams can best serve to illustrate the proposed plans. The first, outlining the MDNS Backbone Network, should be realised over the next three years and should logically lead to enhanced access facilities to IES hosts shown in the second diagram. The user requirements resulting from the planned new services included telecommunication gateways to the various services, access control and authentication, service switching at the session level, national language commands, X-400 message transfer agents and mail service capabilities, directories (X-500) and help functions.

Discussion had to be drastically curtailed because of the late hour, but there was time for a brief announcement by Nick Newman of DG XIII, responsible for COSINE activitites, on discussions under way to ensure, that the pilot MDNS backbone would be open for access to both public and private X-25 networks, so that interconnection between these would be a reality. Eager groups of participants were still exchanging views and ideas when the lights went out in the meeting room. Altogether therefore a very successful first User Forum with participants looking forward to the next opportunity to share ideas.



Implementation of OSI Protocols in the ESPRIT INFORMATION EXCHANGE SYSTEM

The ROSE project (Research Open Systems for Europe) is one of the first projects launched under the ESPRIT Program by the Commission of the European Communities. It is a major development and demonstration project funded through the IES (Information Exchange System) budget.

The project has brought together five major European computer manufacturers (Bull, GEC, ICL, Olivetti and Siemens), with Bull as Prime Contractor, and a number of smaller companies and research organisations in the development of software for Open System Interconnection (OSI).

The main features of the project are:

- conformance to ISO and CCITT-OSI standards,
- development and/or integration of communication and network management services required by European collaborative research and industrial cooperation,
- demonstration of the interoperability of those standardised services implemented on different makes and types of computer hardware,
- use of the UNIX operating system as development and demonstration environment.

The ROSE project started in 1984 and lasted up to 1988, through three phases, conventionally referred to as "Year":

- Year O was devotes to specification and implementation of the lower layer services (X-25, Ethernet, Transport), and adaptation of existing UNIX communication services.
- Year 1 concentrated on intermediate services, such as Session, PAD software and first versions of applications (Message Handling System, File Transfer).
- Year 2 demonstrates industrial implementations of X-400, MHS and FTAM file transfer, simultaneously with prototyping of a Basic Network Administration (BNA) conforming to the OSI management architecture.

For those readers who could not attend the ESPRIT CONFERENCE just concluded in Brussels, we have much pleasure in presenting summaries of the five papers presented during the IES Technical Session.

From the very beginning of Year 0 to the latest phase, detailed objectives of the project have been adapted with respect to the progress of the European research and industrial activity in the area of Information Technology, in conformance to the overall objectives of the ESPRIT Program.

The main concern of the project was to develop prototypes of OSI communication software, conforming to CEN/CENELEC and SPAG/GUS profiles, in order to:

- validate and reinforce standardisation work,
- accelerate the availability of OSI products from the ROSE partners.

Initially the UNIX system was selected as development environment since it offered the most favourable preconditions for the project as well as being recommended by the Commission. Additionally, there were available, at the start-up, some communication tools and applications such as uucp and mail.

During Year 0, services provided were X-25 WAN, CSMA-CD LAN, ISO Transport (classes 2 and 4), LAN-WAN gateway at Transport level and ISO session. In order to achieve full OSI visibility, a soft migration path was adopted involving adaptation of existing UNIX services to the ISO architecture, and thus allowing early intercommunication for the ROSE partners.

Setting up a Pilot Network

In Year 1 the aim was to consolidate the achievements of Year 0 through the use of available software in a pilot network of the partners and a few external pilot sites. In addition, there was parallel development to keep up with UNIX evolution (UNIX System V, X/Open, POSIX) and addition of class 0 to transport implementations, BAS and BAS subsets to Session and triple X standard support for terminal access through PAD. The main effort was on starting to build standard OSI applications on top of the OSI session services.

Thus a File Transfer Service was implemented according to ISO DP 8571, allowing file exchange with any UNIX or non-UNIX system implementing FTAM on top of OSI architecture. A Message Interchange Service (MIS) model was implemented in accordance with CCITT X-400 recommendations and with the CEN/CENELEC A3211 profile.

The main thrusts of Year 2 were the reinforcement of interconnectivity by allowing interconnections of LANs using the connectionless In-

Implementation of OSI Protocols in the ESPRIT INFORMATION EXCHANGE SYSTEM

ternet protocol. A further point was the demonstration of interoperability of different OSI Application implementations (X-400 mail, FTAM). Network administration software conformant to OSI management architecture was also developed and pilot network tests were continued. It should be noted that three different implementations of the CEN/CENELEC ENV 41201 profile for X-400 mail were integrated, harmonised and tested to prove interworkability. X-400 mail was also used as a demonstration application for Basic Network Administration. As regrads FTAM, again three different implementations conforming to ENV 41204 and ISO 8571 were examined for harmonisation and interworking. In addition, an implementation of the Remote Operation Service to X-ros standards has been developed and ported.

Network Management tested

The rapidly converging activities on standardisation in the system management area were encouraging to start work on implementing network management in a real environment based on these emerging standards. The ROSE environment was an excellent platform for such an enterprise.

At the conclusion of the project, this software is demonstrated between the partners' machines. The network management project provides for a set of management functions in order to support:

- communication between a (human) network manager on an operator terminal and the management system,
- control of access right,
- logging,
- event reporting and filtering,
- access to performance related data of the Session and Transport layers including calculation of average values,
- exchange of management information between remote systems.

Obviously this project does not cover alle the management functional areas, but it is probably one of the first implementations of the OSI management architecture running in a multi-vendor environment.

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- J. COLASSE
- C. REMY

* GEC Research Laboratories, U.K.:
- T. COOK

* ICL BRACKNELL, U.K.:
- A.J. KIMBER

* SIEMENS AG, Germany:
- W. BLUMANN
- B. WINTER

EXPERIENCE WITH THE USE OF THORN

The THORN project (**TH**e **O**bviously **R**equired **N**ameserver) is an ESPRIT project to develop a Directory Service aligned to the emerging standards. There are a number of Industrial and Research partners. The Industrial partners are: Olivetti, Bull, GEC, ICL, Siemens, and SW (an Italian Software House). The Research partners are: DFN (the **D**eutsches **F**orschungs-**N**etz), INRIA, and the University College London.

The aim is to develop a pre-competitive implementation of a directory service in line with the emerging standards. The first phase of the project has produced an implementation according to ECMA TR 32, with simple replication facilities specified by the project. The second phase of the project has two components:

- The **L**arge **S**cale **P**ilot E**X**ercise (LSPX). This utilises the system produced in the first phase of the project, and aims to gain real experience with usage of directory services.
- The implementation of a new system conforming to X-500.

The LSPX has a number of aims:

- To gain experience of providing a directory service containing "real" data, and accessed by "real" users (as opposed to simply being a demonstrator).
- To test and gain experience of update, query and management facilities.
- To gain experience of replication and distribution of data.
- To provide an early, non-trivial, test-bed for the THORN X-500 system.
- To align the LSPX with the preferred standards.

EXPERIENCE WITH THE USE OF THORN

Despite the last aim, the LSPX is primarily being operated with the TR-32 based system. This is because many of the problems can be tackled by use of the existing system, and feedback is needed as possible. The LSPX experimental service is being provided within the sites of the THORN partners, and in selected parts of the French, German and British Academic Communities. The major focus of the LSPX is on human access to data. There have been few experiments in this area where the service is truly distributed, and it is considered to be where most experience is needed. Some more limited experiments are being done with process access to the Directory. The main focus is intended to be data associated with people, and properties appropriate to support X-400 Messaging. However, it is hoped to experiment with a range of different types of data.

THORN has developed:

- DUA (a Directory User Agent is the component which a directory user utilises to access the directory over an OSI association), and a
- DSA (a Directory System Agent is a server which holds a part of the distributed directory databases. A collection of DSAs collaborates to provide the whole directory service).

Although the project is not primarily considering user interfaces and HCI issues, a number of interfaces has been developed to explore the problems of accessing directory services:

- Two interfaces fall into the "form filling" category.
- A "second generation" schema-driven interface, which does not hide the hierarchy.
- A experimental interface, using a daemon process, and accessed from the UNIX command interpreter in the manner of the MH program.
- There is a restricted interface called "thumb" (after the UNIX "finger" program). This takes single keywords as input, and uses them as search keys in the local environment.
- There is a mail based interface at INRIA called "epine"

The most active LSPX partners have been UCL and INRIA, and the first two LSPX-DSAs have been operated at these sites since January 1988. More recently, there has been a DFN-DSA at GMD (**G**esellschaft für **M**athematik und **D**atenverarbeitung) in Bonn. There are additional DSAs in UK Academic Community sites, which contain useful data, and also DSAs at the sites of the commercial partners. The latter are primarily for testing purposes, although two of them have some data on selected users. The major DSAs have been accessed by DUAs at the following locations:

- Several dozen hosts at UCL (Vax, SUN, Pyramid) and INRIA (SPS-7).
- Hosts of most of the other THORN Partners: ICL (Perq), Siemens (BS-2000), Bull (Mini-6), Olivetti (382), and DFN (SUN).
- A number of UK Research Sites: Rutherford Appleton Labs., Nottingham University, Brunel University, Cambridge University.

The LSPX DSAs now contain a wide range of data. Some of the more interesting data are:

- INRIA Staff (400)
- Users from other French Organisations (100)
- UCL Staff and Students (500)
- Users from some UK Universities (700) and a Research Lab. (100)
- Data from the UK Name Registration Scheme (1.000)
- Information on MTAs in the French Aristote Network
- Users from GEC (50) and ICL (100)

There are about 4.000 person entries, and about 1.000 other entries in the distributed database.

Some work has also been undertaken to extract data from the Commission's ECHO host in Luxembourg. This has proved awkward, due to the free-form text nature of this database. Directories need to have consistent representations of a given object. These data are being tested.

THORN has also been experimenting with access by processes, including "automata", and other OSI components. It is hoped to provide more information on this at a later date.

One of the most important lessons has been the amount of effort required to bring this type of system into operation. It took about a year from the initial demonstration of a "working" system to get it to a state where the mythical "real user" will accept it. This contrasts to the almost immediate start-up which was planned. A further 6 months was needed to make the distributed operations work correctly. There are a lot of difficulties in debugging a system of this nature. In particular, dealing with failures in a manner which is not too painful to the end user is an awkward problem. When the DUA starts "hinting", this should in principle be transparent to

EXPERIENCE WITH THE USE OF THORN

the end user. In practice, it usually means establishing connections to remote DSAs which can cause delays (typically about 5 seconds, but potentially as long as 40 seconds), which is very visible. Therefore, the interface must display some of the underlying activity.

Getting the system out beyond the immediate participants of the project was a major problem. However, quite a number of sites has made a significant effort to install the THORN software, and to provide data. Collection and maintenance of data are not the easiest of tasks. There is a real "chicken and egg" situation, since data must be accumulated to build the service, but it is hard to justify the effort of gathering it until the service is in place.

Further LSPX work is planned in the following areas:

- More data, particularly from the research partners.
- A larger number of DSAs with significant amounts of data, and more substantial use of the hinting and replication facilities.
- Increased usage.
- Migration to X-500, which will lead to the following initial advantages:
  - ° full alignment to standards
  - ° provision of "yellow pages"
  - ° enhanced searching capabilities
  - ° more flexible naming
  - ° natural handling of non-leaf entries
  - ° a shift of functionality from DUA to DSA, which should reduce demands on the network
- Use of Directory Service to support FTAM and MHS routing.

It is hoped that the LSPX will be continued beyond the current THORN project, which ends in 1989. The continuation might be under the aegis of a continuation of the THORN project, or as a part of some other directory pilot service.

The major achievements to date are:

- Provision of a distributed OSI Directory Service.
- Evaluation of a numer of user interface approaches.
- Directory Service usage by "real users".

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The THORN X-500 DISTRIBUTED DIRECTORY ENVIRONMENT

The Directory is a distributed service being jointly defined by ISO and CCITT. It provides Service Elements for accessing, browsing and maintaining a database (Directory Information Base, or DIB) distributed over an OSI network. The DIB is structured as a tree, named the Directory Information Tree (DIT), and it is partitioned in subtrees or Naming Contexts, each one under the responsibility of a given server, called a Directory System Agent (DSA).

DIT entries are transparently accessed, regardless of their location on the network, by providing their Distinguished Name, e.g. a path name from the root of the tree down to the entry itself. This implies that each server has to maintain a database containing not only the entries belonging to the local Naming Contexts, but also Knowledge Information to locate (in one or more steps) the servers responsible for the remote ones.

Each Directory entry is a collection of Attributes, each one being a set of values of a specific type. Some of the attribute values provide a (relative) name to the entry itself and are therefore called distinguished Attribute Values.

Structure, type and naming of each Directory Entry conform to a set of data integrity rules called Directory Schema.

Each Directory user is represented in accessing the Directory by an Application Process called Directory User Agent (DUA). Each DUA may read, modify or search for specific Directory entries, by contacting one or more DSAs through the Directory Access Protocol (DAP). Whenever the entry required is not under the jurisdiction of the first DSA contacted, the DSA may provide its user with the address of a new DSA (referral), ask another DSA to provide the service required (chaining) through a different protocol (Directory System

The THORN X-500 DISTRIBUTED DIRECTORY ENVIRONMENT

Protocol – DSP), and possibly contact various DSAs in parallel (multicasting).

X-500 is a standard that is going to be adopted by CCITT in 1988. ISO is in parallel going to adopt it as a DIS which is the finalisation of DP 9594. The design of THORN, started from the Tokyo version of DP 9594, has been updated to the changes introduced in the Gloucester meeting, and it is moving towards the Washington version. Changes in the syntactic aspects of the protocol can easily be accomodated without impact on the implementation. THORN is being implemented in the C language under UNIX, and it is being ported to a number of different dialects of UNIX. It fully adopts the X-500 protocol profile, namely ACSE, ROS, Session and Transport, and requires the Operation Class 2 asynchronous ROS to implement fully the Directory Service Protocol. All the ASN-1 coding and decoding functions are implemented by means of an ASN-1 compiler.

Furthermore, THORN includes the full implementation of X-500, both in terms of operations and services. A large numer of the selected object classes and attributes have already been implemented.

A DUA library is available which offers to upper layer applications the access to the Directory Service. The DSA supports both DAP and the DSP. It is possible to configure the DSA to offer DAP only, or both DAP and DSP. The DSA supports Chained operations both as client and as server, and the distributed Abandon operation.

THORN supports the concept of a Directory schema which defines allowed object classes, attribute types and name structures. The addition of a new object class does not require regenerating the DSA code. Modification of existing object classes and attribute types requires rebuilding the Directory database to ensure that the new database schema is enforced.

THORN includes a proprietary special purpose database to support direct access to variable length records with variable length keys. The database is based on a hashed access method which virtually guarantees two disk accesses per record only, and it just makes use of plain byte stream files. The database puts no constraint on the size and number of the attributes of a Directory object, and it does not require to rebuild the database if a new object class or a new attribute is introduced.

THORN introduces a number of extensions to the X-500 standard.

Strictly speaking, the only extension is the support offered to partial replication of the global Directory database, namely the shadow naming contexts.

The extensions concerned with Access Control, Schemas and Knowledge Representation are just specifications of areas that the standard defines as local matter.

THORN represents as attribute types the Knowledge Information that is needed to perform navigation in the distributed Directory, and supports the mandatory Superior Reference and the Subordinate References of X-500, and also the Cross References which are instead only optional.

The Management Support includes Shadow Update, Schema Management, Configuration Management, and Bulk Loading and Unloading.

The THORN environment is equipped with testing tools to perform some limited conformance testing of the Directory implementation. They are an invaluable tool for testing nonregression during development or extension.

Since the testing tools work at the level of ROS, they can be used also as preliminary interoperability tests, when one has to interwork with another implementation of X-500.

The THORN design has been driven towards obtaining a high performance Directory. DSA processes are not spawned when an incoming call arrives but are configured in a static way on the machine. A spawned-on-request configuration can easily be obtained if the use of Directory Service is very limited and no requirements exist on response time.

The minimal configuration of a THORN DSA consists of a single process which performs all the operations. It may support DAP only, or DSP as well. The bottleneck of such configuration is certainly the secondary storage system.

Interactive management utilities are available to perform basic Directory data management functions such as creating, modifying and removing new entries, and administering passwords and ACLs.

The THORN X-500 DISTRIBUTED DIRECTORY ENVIRONMENT

The Schema and Knowledge Information management utilities have been already mentioned, and together with installation and configuration utilities constitue a complete set of management tools.

THORN contains also some end-user interfaces, i.e. applications that allow an end-user to have a friendly interactive access to the Directory system. This interface includes facilities for local caching of information and nicknames, allows to browse, list and search the Directory base, and makes intelligent use of the Directory schema for presenting the data in a friendly way and for requiring minimal information from the user to perform a query.

THORN can be packaged easily to respond to different needs. Since it stems from a cooperative pre-competitive project among several companies, the design had to depend heavily on modularisation to allow different and distant design groups to work in parallel.

The THORN environment is a complete set of tools for accessing and setting up a Directory Service complying with the X-500 Recommendations. It constitutes the ideal base to integrate these services into applications, OSI lower layer implementations and network management services.

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CACTUS: OPENING X-400 TO THE LOW-COST PC WORLD

The CACTUS project (**C**arlos **A**ddition for **C**lustered **T**erminal **US**er agents) is an extension of the CARLOS project which implements the CCITT X-400 series of recommendations in a form suited to medium-sized private organisations. The project provides components which enable existing users of personal computers to access the X-400 world via the telephone network or asynchronous lines. Initially, the connection to the OSI environment is via the Session service from CARLOS. A CACTUS system may be connected to the Public Messaging Transfer Services and directly to other Private Messaging Systems thereby saving the cost of using the public service. To do this, CACTUS supports the P1 and P2 protocols to other **M**essage **T**ransfer **A**gents (MTAs) and Messaging Systems. The CACTUS MTA is essentially an endpoint and it therefore does not act as a relaying transfer agent. Components called the Mailbox Service Agent, Mailbox Client Agent and Reliable Operations Server have been implemented to enable the user to be remote from the CACTUS Box and permits mail to arrive or to be sent from the Box without the user being present. CACTUS is intercepting the ECMA version of the P7 protocol standard (upon which the CCITT88 message store access version is based).

The user can utilise the PC for other functions and, at intervals, will log into the Mailbox Server which has been holding any incoming messages. These are then transferred to the PCs' disk for perusal by the user. The user can also transfer messages prepared on the PC (probably using a standard PC word processing package) into the Mailbox System for onward routing via the MTA.

From the above description, it is clear that CACTUS comprises two main components:

1. CACTUS Box:
   a piece of dedicated hardware running UNIX that supports a community of PC users. It contains most of the X-400 software (including all user mailboxes), management facilities, etc. Most of the points highlighted in the paper come from the work done on this side.
2. CACTUS PC:
   basically containing an user interface, a mailbox client and the underlying communication software needed to connect to the CACTUS Box.

The current (84) MHS model provides two methods of access for standalone **P**ersonal **C**omputers (PCs) and other intelligent workstations.

CACTUS: OPENING X-400 TO THE LOW-COST PC WORLD

In the first method, the UA provides most of the required functionality. The PC emulates a teletype and connects to a remote UA, co-located with a MTA, in that mode. No MHS protocol is required between the PC and the service provider.

In the second method, the PC provides much of the required functionality. The UA is impiemented in a physically separate system (standalone UA). The PC implements the Submission and Delivery Protocol (P3) and connects to a remote MTA using it. In this arrangement, the PC handles the creation, editing, storage and retrieval of messages. The MTA assists the PC by accepting outgoing messages for submission and by delivering incoming messages.

Shortcomings, such as inflexible message control flow, excessive storage demands, inadequate message redirection capability and cumbersome BAS session requirements, seem to be rooted in the model upon which P3 is based, rather than in simple oversights in the specification of the protocol.

The Role of Message Stores

All these considerations led the **E**uropean **C**omputer **M**anufacturers **A**ssociation (ECMA) to reconsider the relationship between small machines and a MTA. They drew on a model which generalises the CCITT model for Teletex access to MHS described in Recommendation X-430. This model provides a Document or **M**essage **S**tore (MS), colocated with a MTA, into which messages destined for the Teletex terminal are delivered and retained for subsequent retrieval by the terminal.

ECMA took the concept of a Message Store, but extended it to provide the kind of services which had hitherto been provided on the textual mailbox services, whilst retaining X-400 features of data transparency. In the ECMA model, the **U**ser **A**gent (UA) functionality is distributed into one part which offers stroage, the **M**ail **B**ox **S**erver (MBS), and one part which contains the more user-oriented functions of a UA, the **M**ail **B**ox **C**lient (MBC).

From the MTS point of view, a MBC acts on behalf of a User, it requests services provided by the MBS invoking remote operations. From the MTS point of view, a **M**ail **B**ox **S**erver (MBS) is a set of UAs, each of which is termed a Mailbox and represents a special case of the general UA concept, in that as well as fulfilling the User Agent Sublayer Services, it embodies specific service extensions. These additional services, described as the Mailbox Service, do not need standardisation when the MBC is local to the system providing the MBS, but have been standardised to allow the definition of a Mailbox Access Protocol (P7) to support this service and for use when the MBC accesses the MBS from a remote system.

The P7 Protocol for Distributed UAs

The P7 is a protocol for the interworking of distributed UAs whose main advantages are:

1. P7 puts the workstation in complete control of the association with their Mailbox (e.g. which messages should be read and which discarded). All the operations defined in P7 are initiated by the workstation.
2. P7 uses a lightweight protocol stack for the interconnection between the workstation and the mailbox system.
3. P7 allows User Agent software in the workstation to be considerably simplified compared with a P3 UA. This is of particular benefit when mounting a UA in a machine with limited main and secondary memory.
4. The supporting OSI protocols are made more efficient by removing the **R**eliable **T**ransfer **S**erver (RIS) function, and mapping the **R**emote **O**peration **S**ervice (ROS) directly onto Presentation/BCS session services.

Alle the facilities provided by P7 and its advantages over P3, led the members of the actual CACTUS project to decide in 1986 to launch a proposal for an ESPRIT project. Some of the developments that formed part of the proposal were:

a) UNIX User Agent Entities:
A full UA Entity should be developed in the UNIX machine. Its functionality will be distributed between a MBC and a MBS, colocated in the same machine. This kind of environment has mainly been used to test locally the P7 protocol (in a way lower layer independent).

b) PC User Agent Entities:
A Mailbox Client should be developed in a PC. The Mailbox Access Protocol (P7) will allow

this MBC, that is remote from its MBS (in the UNIX machine), to obtain access to the services of the MBS.

The MBC entity has been formally specified in ESTELLE and later translated to C code using automatic tools. The integration of the MBC in the CACTUS Box environment is being finished now and its porting to the PC environment is scheduled for the near future. The developed MBC (in UNIX and in MS-DOS) will provide the User with the encoding/decoding of all P7 operations.

The MailBox Service

In CACTUS the MBS functionality has been split in two main parts:

1. **M**ail**B**ox **D**elivery (MBD):
   It includes that part of the MBS which is mainly related with the delivery of messages from the MTS.
2. **M**ail**B**ox **A**ccess (MBA):
   It includes that part of the MBS which is mainly related with the execution of the requested P7 operations.

CACTUS Mailbox Service will provide all the ECMA Mailbox services classified as mandatory and the majority of the optional services. The same will apply to the attributes that will form the entries (MS Entries, Inlog Entries, etc.) of the different Mailbox Objects.

For providing the Mailbox Service, a **M**ail**B**ox **D**atabase (MDB) has been developed inside the CACTUS project. Due to legal, economic and portability reasons, the use of a comercial DB was rejected. Thus, the only possibility available was to build a DB using UNIX files. All the information handled by the CACTUS MBS is contained in a directory named mb sa. Mailboxes are implemented as subdirectories within that main directory, whose names coincide with their respective Mailbox Names. Each Object is a subdirectory within its mailbox directory.

As mentioned before, the CACTUS MBS will provide Task Mailboxes, that is mailboxes having a pseudo-user which is a software task run by the system, that extracts messages from the Mailbox and takes actions according to the content of the message. This concept is useful for the execution of system functions, which are initiated upon user request. Four task mailboxes have been recognised and will be implemented:

1) **D**irectory **S**ervice **M**ail**b**ox (DS-Mbx):
   provides the access to the CACTUS Directory System.
2) **M**anagement **F**unction **M**ail**b**ox (MF-Mbx):
   allows the CACTUS manager the execution of management functions.
3) **D**istribution **L**ist **M**ail**b**ox (DL-Mbx):
   performs the expansion of a CACTUS **D**istribution **L**ist (DL) following the expansion algorithm defined in CACTUS.
4) **P**rinting **S**ervice **M**ail**b**ox (PS-Mbx):
   prints received messages in the printer of the CACTUS Box.

The ECMA work on P7 was completed and adopted as an ECMA standard in June 1987. ISO has based its mailbox protocol on ECMA work, and a Draft International Standard should be available in 1988 when CCITT ratifies the X-400 88 Version (Blue Book), and the joint work between ISO and CCITT finishes.

By 1988, it could be expected that public services of X-400 would be committing to support the Message Store Access Protocol (P7) or the Message Transfer System Access Protocol (P3), and that terminal and workstation vendors would be developing the capability to attach these services. Equally, the Office Automation vendors are likely to adopt P7 for LAN based office systems with distributed processing capability. We can expect LAN based mail hosts which allow P7 access from workstations on the LAN.

In spite of the CCITT-ISO agreement, there will be several differences between CCITT MHS (1988) and ISO MOTIS. In relation with the Message Store, ISO are planning a Part 2 (addendum) to the MS. These extensions will be in the form of additional information-bases (inlog and outlog) and in a range of new general-attributes to support these additional information-bases.

A detailed discussion of the development methodology is followed by a description of the system management.

The use of the ASN.1 toolset, specially in higher layer protocol where the encoding/decoding of PDUs is a big task, has been proven successful in avoiding much repetitive and error prone work at various levels.

Management considerations have led to the definition of an architecture suitable for future extension without the effort of recompiling the whole system. In addition, the mapping and relation with CAR-

CACTUS: OPENING X-400 TO THE LOW-COST PC WORLD

LOS management blocks has been taken into account.

Finally, it can be concluded that the migration of the CACTUS P7 implementation to the ISO P7 may be done with relatively little effort and in a short time. Since the Draft International Standards have reached a high level of stability, it is now possible to perform this migration as part of the future exploitation of CACTUS results. This will place the CACTUS products in an advantageous situation in the market place.

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A USER INTERFACE FOR DISTRIBUTED APPLICATIONS

A description is given of the **U**ser **I**nterface (UI) aspects of CACTUS.

This has been carefully designed in order to be easy to handle, modify and extend. Modularity has been one of the main issues in the design work. The UI also follows ISO ideas on distributed applications.

ISO is developing a general framework in which to define distributed office applications. The aim of the work is the definition of a general **D**istributed **O**ffice **A**pplications **M**odel (DOAM) to be used for the description of services and protocols needed in the development of distributed applications. Examples of intended distributed applications are message transfer, document filing and retrieval, printing, etc.

The DOAM uses what is called the "**U**ser-**C**lient-**S**erver model" to define the functionalities of the general model. The User-Client-Server (U-C-S) model is initially related to one single application. This model considers that a single application is split between a client and a server. In addition, the user always has an application-interface to the application (in case this application is distributed, the interface is to the client). This application-interface is defined as proprietary, and, so, not proposed for standardisation.

The DOAM document defines an extension of the U-C-S model to handle several applications in the same process. This is the situation when a human user wants to have access to several applications (message transfer, document filing and retrieval, printing, etc.) in the same system, and in an integrated manner. In a distributed office system, client and server of each application are located in different machines.

The User Interface for a Message Handling System has these principles:

- It is aligned with the ISO concepts (User-Client-Server model or User-Application-Process, for instance).
- It is intended for a Message Handling System, following the X-400 series of recommendations, accessible from a PC (by means of the ECMA P7 protocol).
- An extension is possible to handle, simultaneously, other distributed processes, such as access to non-standard messaging systems.

The main goals have been modularity and expandability.

One of the goals is to build a user-friendly UI. For this reason, the "top-level" of the UI (that part that interacts directly with the human user, i.e. keyboard, screen, printer, mouse, etc.) has also to be very flexible.

On the other hand, it is necessery to bear in mind that there may be some restrictions in the hardware, such as memory size, processor power, disk size and speed, etc. In many cases, the user-application-process will have to fit in a PC. Hence, execution speed and memory and disk usage should be optimised.

The user task can be decomposed into three building blocks: **M**an-**M**achine **I**nterface (MMI), **U**ser **C**ommand **M**anager (UCM), and **O**perations **S**equencer and **T**ranslator (OST).

The MMI block is in charge of interacting directly with the human user. It presents the information and reads user inputs, providing a high

A USER INTERFACE FOR DISTRIBUTED APPLICATIONS

level multiple channel interface between human user and system. This interface should be adaptative enough to meet ergonomic and functional human user requirements.

The UCM parses and completes (gives values to all command parameters) the input information given by the human user through the MMI. It is also responsible for the completeness and correctness of the commands that have to be passed to the OST.

The OST block of the user interface is in charge of transforming the complete human user commands, passed from the UCM, into operations to the other blocks related to it. It also gives the responses from those blocks to the UCM (in its way to the human user.)

The OST needs other blocks to provide the requested services. These blocks exist to support the different applications the user can run. That implies that as many extra blocks as different applications are needed. Examples of extra blocks are:

- N clients to access to the corresponding N remote servers, in order to run N applications-processes.
- A local database to store data related to the application, as an example of non-distributed application. This block could be included in the UT.

The main features of the CACTUS solution are:

- It is easy to handle, with different possibilities for different kinds of users.
- The messages are stored locally; hence, communication costs are reduced, and the average message access speed increases. Furthermore, the availability of the system is very high.

The modular structure of the user interface, that is being maintained during all the development, allows of very easy expansion.

When more applications are desired, it will be necessary to add the corresponding clients (and servers, if it is a non-distributed application). And, inside the user task, some little modifications should be made:

- MMI block:
  no modification is needed.
- UCM block:
  extra profile information, and extra knowledge base information related to the new application.
- OST block:
  to add new operations related to the new applications. Furthermore, to add the desired new external blocks.

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How Janet (Joint Academic Network) Adjusted to the X-25 Update

Introduction

JANET, in common with most other X-25 networks, currently supports the version of the X-25 standard agreed by the CCITT in 1980. A major revision of the standard took place in 1984 and a number of new facilities were included which are summarised later in this article. The most important changes are the new DTE facilities introduced to allow a network call to be made across a number of concatenated subnetworks, each with its own addressing scheme. The Yellow Book interim standard provides this capability within the Coloured Book architecture and the enhancements in the X-25 standard will allow use of the Yellow Book to be phased out.

The International Standards Organisation (ISO) has developed an addressing addendum for X-25 level 3 which introduces the concept of a Network Service Access Point (NSAP). An NSAP is a globally unique number for a given networked service which is, in principle, independent of the route taken to reach the service. The carriage of NSAPs together with the specification of quality of service parameters has led to the introduction of what are called CCITT-specified DTE facilities to support the OSI Network service. These facilities form an important enabling part of the UK Academic Community's transition to OSI Standards and must be implemented early to support other parts of the transition.

X-25(80) is a subset of X-25(84) and it is possible to support both styles of working over the same network with each DTE configured for either X-25(84), in which case it can

How Janet (Joint Academic Network) Adjusted to the X-25 Update

support both styles of working, or for X-25(80) only. Clearly, to obtain full connectivity with a mix of DTEs on the same network some form of interworking unit is required.

The CCITT works in 4-year cycles, so a new revision of X-25 is being agreed this year. Indications are, however, that the changes this time are not so dramatic, although some additional new features have been added. It is too early yet to even speculate how long it will be before implementations appear, but if the 1980 to 1984 change is anything to go by it is likely to be serval years yet before X-25(88) is in widespread use.

Differences between X-25(80) and X-25(84)

The 1984 version of the X-25 specification contains a small number of major changes and a much larger number of more trivial changes, most of which seek to clarify rather than modify the sense of the text. Within the scope of this article it is only possible to deal with the major differences, which for convenience are split into the following four areas:

- link level changes
- call level changes associated with provision of dial-up/dial-out
- call level changes associated with OSI Network Service
- other call level changes

Link Level Changes

In X-25(80) the link level frame sequencing has been modulo 8. To cater for fast links, in particular satellite links with comparitively long transit delays, a modulo 128 scheme has been introduced. This has an impact only on those who wish to implement the option.

Another new feature is the Multi-Link Procedure which allows the sharing of several links between the network and an attached DTE. Pakkets for a given virtual circuit can be routed down any of the available links. This provides increased resilience against link failure and can also be used to increase link bandwidth. This is an optical facility and may not be available in all implementations.

Finally, there has been a number of changes in the details of the actual procedures used across the interface between the network and a host. It is somewhat difficult to predict exactly what impact this will have, if a host running a 1980 implementation is connected to a network which supports 1984 facilities, or vice versa. Likely problem areas would be with link set-up/disconnect and error recovery during data transfer.

Call Level Changes Associated with Dial-Up/Dial-Out

X-32, a new standard, allows the connection of a packet mode DTE via the telephone network or a circuit switched network. In this case, there has to be some form of dialogue to identify what is being connected and what facilities are required. To assist in these activities, two new packet types have been introduced into the X-25 specification:

1) registration request

   to allow a connecting entity to specify what facilities it wants

2) registration confirmation

   to allow the network to complete negotiation of same

A new facility in call request packets, the network user identifier, can be used as one way of identifying who is making the call.

Call Level Changes Associated with Provision of OSI Network Service

Five new facilities for call negotiation have been introduced to cater for requirements associated with the OSI Network Service. These are

1) Calling Address Extension
2) Called Adress Extension
3) Minimum Throughput Class
4) End-to-End Transit Delay
5) Expedited Data Negotiation.

The address extensions are aimed primarily at the carrying of NSAP addresses across concatenated networks. These addresses are independent of the subnetwork addressing scheme, and will be used at the boundary between subnetworks to derive the SubNetwork Point of Attachment (SNPA) for the next stage of a call. For an X-25 network, the SNPAs are the calling and called DTE addresses carried at the start of a call request packet immediately after the packet type identifier. The CCITT originally assumed that the address extension field needed to cater for 32 decimal digits. ISO subsequently settled on 40 and this is expected to become the standard in the 1988 version of X-25. In the meantime we expect implementors to go beyond the letter of the 1984 standard and support the full 40 digits in their implementations. Work has still to be done on specifying how the conversion between NSAP

How Janet (Joint Academic Network) Adjusted to the X-25 Update

and SNPA addresses will be achieved.

Minimum Throughput Class and End-to-End Transit Delay allow the user to specify the quality of service required over the whole network in terms of throughput (bits/sec) and transit delay (millisecs). Because concatenated subnetworks may be involved, the numbers represent the result of summing the effects of individual subnetworks. It should be noted that it is not the subnetworks themselves, but the relays at the boundaries between them, which alter the contents of these parameter blocks. It should also be noted that analogous facilities exist in the subnetwork-specific facilities, called throughtput class negotiation and transit delay selection and indication, which apply to each hop of a connection rather than to the total connection.

Expedited Data Negotiation is intented to allow a user to specify a requirement to send expedited data, e.g. to force through an interrupt regardless of the state of the connection. A capability to send a single byte interrupt already exists in X-25(80); the new facility allows up to 32 bytes of expedited data to be sent.

Other Call Level Changes

Datagrams, single packets sent through the network without acknowledgement or call establishment, have been deleted from the standard. This feature of the 1980 standard was not implemented.

A number of other new facilities have been introduced. These include additional types of Closed User Group (a mechanism for restricting who can call whom); facilities associated with charging; hunt groups (with a similar meaning to telephone hunt groups); and facilities for redirecting calls and telling the new called systems and the original caller what has happened.

Other changes include extending the facilities field in call request packets to 109 bytes (to cater for the extra space likely to be needed to carry the OSI facilities), larger packet sizes for data (2048 and 4096 bytes), and some new clearing codes, including one which indicates 'ship absent' to be used in associated with the provision of maritime X-25 services.

The JANET Transition

JANET uses Packet Switching Exchanges (PSEs) supplied by GPT. GPT has been contracted to provide an implementation of X-25(84) for these PSEs supporting the new features required for the OSI Network Service. It will be possible to mix X-25(80) and X-25(84) traffic and the PSEs will be able to identify which version of the standard each attached DTE is capable of supporting. Since the Transition is expected to take several years, it is clear that it could also be necessary for hosts to be able to select, on a per call basis, which version they use. Accordingly, a host connected via a link which supports X-25(84) can set up calls using either version, but those connected via an X-25(80) link can only set up calls using this version and any calls using X-25(84) facilities will be cleared.

GPT are now working on a full implementation of all the new X-25(84) features, which will be available in a later release of their software.

The GPT software has been delivered and tested and installation on JANET service network has begun. We expect to complete installation on all the PSEs before X-mas. This software is also available to site networks based on GPT PSEs . SEEL has an implementation of X-25(84) for the MULTIPAC PSE although some parts of the development have still to be completed. Accordingly the majority of sites in the Academic Community should soon be able to start providing an X-25(84) service.

The immediate requirement is for each site to upgrade at least part of its network to complement the JANET upgrade. Not all PSEs need to support X-25(84) calls immediately, but can be used to cater for hosts which still operate only to the 1980 specification. It may be that some hosts will never be used in 1984 mode, in which case it may be possible to retain 1980 mode only on some switches during their active lifetime. This is a matter for each site to decide, and due consideration needs to be given to various aspects, including projected lifetime of equipment.

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Summary of Suppliers' OSI Products and Plans (First Update)

	X-25		NETWORK SERVICE				TRANSPORT					UPPER LAYERS					
			CONS		CLNS												
	80	84	LAN	WAN	LAN	WAN	0	1	2	3	4	SES	PRES	ACSE	MHS	FTAM	VTP
British Telecom	◪	[8]	☐	☐			◪☐		☐			Gold 400	☐	☐	◪☐		
CAP	■	■	■	■	■	■	■		■		■	■	■	■	■	■	[8]
Concurrent	■	☐	■	■	[8]		[8]		☐	■		[8]	[8]	[8]	[8]	[8]	
DEC	■	■	S	■	■	■	■		■		■	■	[8]	[8]	■	[8]	
Data General	■	☐	■	■	◪	◪	◪				◪	■	■	[8]	■	[8]	
Ferranti	■	☐		■	■		■	■	■	■	■	■			■		
GEC	■	[7]	[8]	[8]	■		■		■		■	☐			☐		
Honeywell Bull	■	◪	☐	[8]	[8]	[8]	S		S	S	S	☐	☐	☐	☐	☐	
Hewlett-Packard	■	☐			■	■	■		■		S	[8]	☐	☐	◪	☐	
IBM	■	◪		◪	◪	◪	◪		◪		◪	◪	◪	◪	◪	◪	
ICL	■	◪	S	◪☐	■		■		■	■	■	◪☐			◪☐	◪	S
ITL	■	◪		■	■		■		☐	◪☐	■	■			■	◪	☐
Logica	■	S		S			◪					◪			[7]		
McDonnell Douglas	■	◪[8]			◪				◪		◪						
Mercury	■	[7]								■	■						
NCR	■	☐	☐	☐	☐	☐	S		S		S	S	☐	☐	☐	S	
Nixdorf		■	◪	◪	◪	◪	■		■		■	◪	◪	◪	■	[9]	
Norsk Data	■				☐		■		■			☐	☐	☐	☐	☐	
Olivetti	■	[9]		■	■	■	■		■		■	■	■	■	■	■	
Philips TDS	■	■		◪	■	◪	■		■		■	■	◪	◪	◪	◪	
Plessey	■	◪					☐					☐			☐		
Prime	■	[7]	☐	☐	☐	☐	☐		☐			☐	☐	☐	☐	☐	
Siemens	■	☐		■	■		■		■		■	■	◪	☐	◪	☐	
Spider	■	■	■	■	[9]	[9]	[9]		[9]		[9]						
Sun	■				■	■					■	■	■	■	■	■	☐
Sydney	■	◪☐	■	■	■	■	■	■	■	■	■	■	[8]	[8]	■	[8]	
Tandem	■	☐		■	☐		■	■	■	■	☐	◪☐	☐	☐	☐	☐	
Unisys	■	☐			◪[8]		☐		☐		☐	☐	☐	☐	☐	☐	
Wang	■	[8]			[7]	[7]	[7]		[7]	[7]	[7]	[7]	[8]	[8]	[8]	[8]	

Key to table

■ Available

◪ Available on part of product range

☐ Planned

◪ Planned for part of product range

[9] Figure in box indicates year planned; 9 = 1989; 8 = 1988; 7 = 1987

S Special product or prototype for demonstration purposes

Two boxes in the same column, e.g. ◪☐ means available on part of the product range and planned for other parts.

Further updates will be published when relevant data are available. Please submit to the Editor.

COSINE NEWS

Cooperation for Open systems Interconnection Networking in Europe.

COSINE News intends to cover viewpoints of all parties with interest in COSINE.

COSINE defines requirements Implementation Phase

COSINE has defined the work program for its three-year Implementation Phase. At its meetings in early October in Athens and on 29 – 30 November near Brussels, the COSINE Policy Group (CPG) adopted a set of conclusions on the Specification Phase and a set of proposals for the three-year Implementation Phase. This phase will be coordinated at an international level by the COSINE Program Management Unit (CPMU). The CPG has recommended that the CPMU be installed as soon as possible. COSINE has set out to secure the formal commitment of funds from all the participating nations and the European Commission. These funds should enable the installation of the CPMU and especially the carrying out of a set of well-defined pilot projects and supporting services such as directories and gateways. The COSINE Specification Phase Overview report that will be available in a few weeks time, recommends that additional resources are made available to enable end-users and facilities managers to participate in the continuing process of defining their requirements and enhancing the scope of COSINE specifications.

Functional profiles to support procurement actions

As a top priority in the work program for the Implementation Phase, the provision of COSINE functional profiles is identified, which will support the procurement of COSINE-compatible systems. Here alignment with the EPHOS (European Procurement Handbook for Open Systems) development has to be established. Other priorities are the specification of the communications requirements for interworking with commercially available services; and the establishment of coordinated national purchasing policies to take the best possible advantage of the significant volume of equipment required to implement COSINE. During the COSINE Specification Phase it became clear that very early in the Implementation Phase a follow up must be made of a number of specific technical requirements: addressing issues, registration responsibilities, accounting principles and security policy. In accounting issues, COSINE aims at a 'one-stop-shopping' system for billing purposes. At the earliest possible stage COSINE wants to install mechanisms for the uniform interoperability testing of products intended for use in the COSINE environment. Finally, COSINE calls for the establishment of a number of pilot projects to demonstrate the feasibility of European interoperability.

Management nucleus for COSINE

The work program for the COSINE Implementations Phase (CIP) indentifies tasks to be undertaken on three levels: the international, the national and the local level. The CPMU will be the nucleus of COSINE providing guidelines and support for all levels participating in the Implementation Phase. The unit will assume responsibility for a range of international tasks. Among these are:

- to operate and maintain the COSINE Business Plan, including liaising with suppliers on products availability;
- promotion of COSINE, attraction of new users;

The COSINE pages in this issue are almost entirely devoted to the results of the COSINE Specification Phase, as described in the Overview Report. The description of the work carried out is further supported by short summaries of four of the set of separate reports issued. The reports will be published and made availabele from the RARE Secretariat, Postbus 41882, NL-1009 DB, Amsterdam.

- to establish and manage projects which are agreed as part of the Implementation Phase;
- to stimulate, co-ordinate and monitor services required in the Implementation Phase;
- to maintain and extend, where necessary, the COSINE specifications;
- to undertake the international harmonisation role of COSINE;
- development of common documentation, catalogues and user handbooks;
- to manage the transition from Implementation Phase to an operational phase which accords with the principles of COSINE.

The CIP incorporates specific operational services, such as an X-25 infrastructure; gateway services to North America; international directories; COSINE Information, Advisory and User Support; and Security Key Management. The transatlantic gateway services include electronic mail, file transfer and remote access to computer services. However, a significant part of the CIP will consist of projects, to develop, test and demonstrate concepts and facilities. The list of projects and the total funds available for them will be agreed at the start of the CIP. In one such project, pilot gateway services to North America will be provided, offering FTAM (file transfer, access and management) and terminal access services. Some other projects are: pilot international directory services, associated support and information services; pilot activities to support typical international user groups; pilot projects on migration to OSI; development of tools and techniques for OSI adoption or migration, including protocol conversion and diagnostic packages for operating within an Open Systems (multi-domain) environment; and pilot implementations or demonstrations of multi-vendor product interworking conforming to COSINE specifications in: FTAM, full screen access, X-400 and X-500 services, conformance and interoperability testing.

National organisations responsible for COSINE must undertake the tasks of migration of existing networks and systems to OSI, and procurement of new systems conforming to OSI standards. The national organisations will implement pilot projects and international gateways as appropriate. They will be responsible for the maintenance of the security of any nationally provided service according to COSINE guidelines. Furthermore, they will assume responsibilty for the provision of a registration authority or input to a national registration authority, and for the provision of a national directory. Any technical guides and awareness material should be produced by the national entities.

On the local level finally, the facilities managers will be asked to participate in migration activities, to procure new systems using OSI standards and to implement pilot projects and gateways to external networks. They will also provide a help desk and fault-reporting services and implement the security policy. At all levels in COSINE, a framework for reporting on quality of service will be established. The activities of the end-users will provide COSINE with information for evaluating the project.

Criteria and constraints

The budget for the COSINE Implementation Phase is estimated to be 30 MECU over three years for international projects. This does not yet include subsidies for X-25 services or additional resources for less favoured regions. Apart from this there are of course funds which are already being allocated through national funding bodies or institutional budgets, for the financing of computing and networking services for academia.

With respect to procurement activities, the decision of the European Council of Ministers concerning the use of OSI standards in public procurement (Council Decision 87/95 EEC) affects COSINE in a direct way. The Directive implies that COSINE will recommend the use of standards laid down in the European Norms, except in areas where stable standards are not available. The Directive applies to procurements of more than 100 KECU in value.

Networking services for the research community exist in some form in all of the COSINE countries. These services are message handling, file transfer, remote login facilities, screen-oriented terminal access, directory services, remote job entry and distributed document preparation. COSINE will ensure that the transition to OSI causes no lowering of quality of service currently supplied to end-users in participating countries. With respect to the provision of public services, a number of issues need to be resolved. International connectivity of national packet-switched networks is still of relatively poor quality. A commonly available X-25 (1984) service is highly desirable to minimise the technical difficulties of connecting between networks and providing an end-to-end service accross networks.

The COSINE community

The research community for which the COSINE infrastructure is devised is considerable in scope. Over 2.500 institutions with about 530.000 researchers and 500.000 support staff will benefit from the provisions and services. In the proposals for the COSINE Implementation Phase, the end-users, facilities managers and the national domain managers are specifically addressed at their own levels. The requirements of the facilities manager dictate the operational requirements of COSINE. The national domain managers are bodies such as today's Joint Network Team in the U.K. or the DFN Central Project Team in Germany.

An overall estimate is that in all COSINE countries at least 10.000 medium and large scale computers are in use which should be provided with OSI communication software and hardware. In Europe there are about 30 research networks in existence. At present they serve some 120.000 users, clearly only a minority of the target group for COSINE. Current users reside on about 5.000 end systems, most of which are interconnected to more than one research network. It appears that at least 20 different manufacturers are represented, running roughly 25 different implementations of operating systems.

Protocol Profiles

The COSINE Specification Report 4 provides a definition and evaluation of the service requirements for the COSINE Project in terms of a set of functional standards (ENVs) as defined by CEN/CENELEC and CEPT. Where appropriate, a determination of the options and priorities within the profiles is made as well as noting any problems or limitations of the ENVs. Recommendations for user interface functionality are also given.

The European functional standards are an appropriate basis on which to achieve harmonised interworking between different implementations of software conforming to the ISO OSI model. They do not remove all options, however, and it is incumbent upon those specifying computer systems which will be part of COSINE to understand their users' requirements and convey them to their potential suppliers in the form, for example, of an Operational Requirement. This is not meant to be a criticism of the functional standards, they constitue a significant level of refinement of the base standards. The COSINE Reports referred to in this report give a further level of refinement and seek to define a set of mandatory requirements which are considered to be appropriate for the whole COSINE community. Choices have to be made where the facilities are considered desirable but where the cost of increased functionality has to be carefully weighed against its value for the community concerned.

The first round of functional standardisation activity is now complete and, with the creation of EWOS (the European Workshop for Open Systems) and ETSI (the European Telecommunications Standards Institute) and the corresponding activities in other parts of the world, an evaluation from the user viewpoint is considered to be important.

The studies undertaken of the functional standards for:

- remote terminal access
- file transfer
- electronic mail
- the underlying transport and X-25 network services

together with the ENVs themselves constitute a definition of these initial COSINE services. Complete procurement specification requires, as mentioned above, a careful analysis of the particular local end user situation as well as the inclusion of various requirements identified within COSINE Specification Report 7 on Operational Requirements. The functional standards themselves tend to make conformance to a basic service level mandatory and leave an enhanced service level as an option or series of options. The recommendation for COSINE is that many of these options are required to provide the functionality that the user needs. In addition, these studies also consider the functionality required of the user interface to the services concerned.

The conclusions of this report are that for COSINE:

* it is not possible to determine a single set of options that will suit all users. The end user therefore needs expert and impartial advice to ensure that the correct set of options is requested for his needs. This requires action at the national level to provide the necessary funding and co-ordination:

* it is necessary that a reasonable; level of functionality is available on all end systems to ensure that the end user can benefit from the facilities he has available. For communication at a certain level to be effective, all co-operating systems must reach this level of functionality;

* the functional standardisation process must take account of end user needs with a precise definition of enhanced options for those users for whom a good quality of the service concerned is critical in their work. COSINE must therefore fund the effective participation of its user representatives in the appropriate ETSI and EWOS Expert Groups and should promote the rapide development of the File Access profile (A/122) and the Remote User Agent profile (A/332) as well as ensuring that the maintenance of existing functional standards is not overlooked.

Considering the specific service areas:

* Remote Terminal Access should be implemented according to the CCITT XXX Recommendations for 1984 in line with ENV 41901;

* File Transfer should be implemented according to the ISO FTAM standard in line with ENV 41204 with the Limited File Management and Recovery and Restart functions to provide a simple file transfer service;

* Electronic Mail should be implemented according to the CCITT X-400 (84) series of recommendations in line with the ENV 41202 and ENV 41201 used as a necessary but not sufficient condition. In the absence of an agreed enhanced option, the detailed recommendations of COSINE Specification Report 4 should be followed. It should be noted that it has been agreed that these ENVs will not achieve EN status;

* the Lower Layers should be implemented according to Part II of ENV 41104 to provide a Connection Mode Transport Service and a Connection Mode Network Service, noting that the mandatory DTE Facilities must include an Address Extension Field able to accomodate a 40 digit NSAP. The use of the single data octet Interrupt Packets for X-29 terminal access over X-25 networks as specified in ENV 41901 is also required.

User Interface Functionality should be recognised as an essential for use of the above facilities by a broad user community and the detailed recommendations of the COSINE Reports should be followed.

Source: Summary COSINE Specification Report 4.

Future Services

The Report on Future Services considers those services which were not included in the initial service list because the standardisation activity is not yet mature. There is also discussion of services where the precise definition of what is encompassed is not clear enough for standardisation to start.

COSINE needs to determine which of these services are an urgent general requirement for its user community. There is unlikely to be a single solution for each problem; however an approach on the following lines is recommended, bearing in mind COSINE's scope:

1. if appropriate standards exist ensure that functional standards are defined and that early products are encouraged;
2. if standardisation is making slow progress determine whether this reflects too broad a scope for the standard or inherent technical difficulty of the area or lack of resources;
3. if standardisation is not started consider the appropriateness of interim solutions to gain a better understanding of the area.

In some cases there appears to be supplier reluctance to invest in product development. Consideration should be given to funding pilot implementations as demonstrators, having understood the reasons for this reluctance. Collaboration with other user communities, e.g. GOSIP, may well enable a larger potential market to be defined. ESPRIT may also be an appropriate mechanism to undertake such activity.

Full Screen Services

It is considered that the ISO Virtual Terminal Protocol (Basic Class) together with, in particular, the second draft addendum forms a suitable base for the development of a COSINE 'full screen' service. The importance of this area is indicated by the number of interim solutions which have been developed. *It is recommended that EWOS should be encouraged to create an Expert Group in the Virtual Terminal area and that support is provided to ensure the involvement of appropriate experts on behalf of the user community. Early implementations should be piloted to test and demonstrate the concepts involved.*

Job Transfer and Manipulation

In order to provide the necessary Remote Job Entry facilities, COSINE should encourage implementations following the recommendations given in the COSINE Report on Interim Remote Job Entry Facilities Based on FTAM. The present state of the ISO JTM standardisation and the need for COSINE of the facilities offered by this protocol should be reviewed in the light of the UK Academic Community's experience with their Interim Protocol, JTMP, and the use by other groups of Remote Job Entry protocols.

Higher Speed Services

The present public PSDN services have a somewhat limited throughput and a significant subset of the COSINE community has identified a short-term need for higher bandwidth services up to and including 2 Mbps access. The need to increase the capacity of the bearer network is generally acknowledged and is included, for example, in the specification given to the CEPT MDNS Project Team by COSINE Working Party A. The capacity of all elements in the chain, (i.e. host interface, LAN/WAN gateway, Packet Switch Exchange) needs to be increased if the overall throughput needs are to be met. A number of initiatives in this area is starting or underway; COSINE should define the specifically international aspect to this question and determine whether projects are best undertaken in an existing framework, such as RACE, or whether completely new initiatives are needed.

Directory Services

The proposal to establish a pilot project in this area is discussed in the Report on Operational Requirements. The 1988 CCITT Recommendations will cover in the X-500 series the provisions of an OSI Directory Service.

Management Services

Good progress continues to be made in the definition of standards in this area but the work is not sufficiently mature for services to be established. COSINE should follow the recommendations made in the Report on this topic and maintain a "watching brief" on the area, if necessary further studies should be commissioned and pilot projects created. The necessary immediate actions on network management are considered in the report on Operational Requirements.

Source: Summary COSINE Specification Report 5.

Public Services

The evaluation of the present and planned communication services, carried out by various parties, covers the availability, tariffs and performance of the public X-25 data network services, the status of public X-400 services and an outlook towards ISDN.

From various studies it becomes clear that the provision of data network services in Europe is still in its infancy. In the late 1970's CEPT introduced a new type of public telecommunication networks accross Europe: the public packet-switched data networks (PPSDN). By 1984 most Eur-

opean countries had established their national packet switched networks and made them commercially available for national and international interconnections. However, the profileration of the national networks followed different timetables and different commercial priorities, thereby delaying the implementation of a harmonised European packet switched data network. As these public services are of great importance to COSINE a study was made of their availability and tariffs.

The present situation resembles the early stages of postal and telephone services developing from local services to national/international services, namely: islands of services, developing in different timescales with different characteristics and widely varying tariffs. Although most European countries do have national packet-switched networks, international connectivity is still of poor quality. Many countries offer access to the networks for asynchronous terminals by dial-in PAD's (X-28), the first dial-in packet switched service will emerge only in 1988 (X-32). However, the coordinated development and harmonisation of the services has had a lot of attention, as is indicated in recent information from CEPT.

In the context of lowering intra-European barriers, the moves towards liberalisation of communication services in Europe and the increasing competitive possibilities in Europe, it is important to have a synchronisation and harmonisation of similar services and a more uniform tariff structure. These needs were also strongly expressed by the Round table of European Industrialists in a report "Clearing the Lines".

Performance of the public services has not been given proper attention in the past, the attention being focussed on the introduction of the services. Performance is a complicated issue and had led to many misunderstandings and some unfounded criticism. Afer all, you don't blame your PTT 30% of your telephone calls being unsuccessfull because the called number is engaged or the person called is absent! This happens with data transfer and if a call cannot be established the PTTs are blamed, although most of the time other links in the chain are at fault.

A survey was made of existing information on the performance of international PPSDNs. Two studies have been carried out to take a closer look at the performance of the PPSDNs. For one study a controlled experiment was carried out between four sites in Europe transferring files of varying sizes at different times of day and night. Another study analysed the operational performance data from an international node of the RARE pilot Message Handling Service. Some early results are presented in the COSINE Specification Report 6 on Public Services.

Whilst the X-25 services are still developing, a new era has been announced: ISDN. For operational purposes ISDN will probably not play an important role until the 90's, which is beyond the present COSINE horizon. Nevertheles a study was commissioned on the impact of the projected services for packet switched traffic. This shows that while ISDN services are developing, ISDN could play a role as carrier for X-25 traffic: the X-31 scenario which used to be called the "minimum integration scenario". In the absence of international ISDN connectivity, this facility may be appropriate in individual countries, but is of limited use internationally. In the future, the use of ISDN virtual circuit services, which used to be called the "maximum integration scenario" of X-31, offers more promise by virtue of its potential for functional integration of services. However, the present non-integrated signalling of channel and circuit demands in this scenario represents an unbalanced, complex use of the channels. The basic transport services discussed until now are and will be offered by PTTs and PTOs. Value-added services, publicly or privately operated, will be offered combining basic transport services with network management functions, conversion tools, gateway services etc. The COSINE community has recognised this situation and has formulated requirements to ensure connectivity and quality of service.

An interesting development in this respect is the entering of the VANS market by the PTTs with the widely discussed CEPT initiative to provide European-wide Managed Data Network Services (MDNS). This initiative can be of great benefit to the R&D community.

Using the basic transport services many application services will be offered by many operators. One of the important application service requirements in the COSINE community is an open Message Handling Service based on the international standard X-400. In many countries public Message Handling Service are offered, but connectivity is poor because the implementations are not based on international standards. Most PTTs have recognised the need for standardisation and are executing pilots and planning to implement X-400 thereby offering the required connectivity and coverage.

The European-wide public packet switched data network services leave much to be desired in terms of synchronisation, functionality, performance and tariffs. Immediate action is required to improve the international PPSDN service. Bandwidth should be increased and access facilities should be improved.

National administations are urged to implement the CEPT Recommendations to enhance the PPSDN service. Although the planned enhancements are probably adequate, the time scale envisaged is too long (especially regarding the X-25 (84) availability).

National and international tariffs for packet switched traffic should be harmonised, charging users throughout Europe in a comparable way with less penalty for cross-border traffic and more emphasis on the volume of data transferred rather than on the connect time.

Call set-up charges should not be made for failures due to network errors.

The performance of the PPSDN is subject to much unfounded criticism. Often the basic transport service is operating correctly, but the problem occurs at the level of the application, the access to the host or the local facilities. During a comprehensive file transfer experiment between four sites in Europe the average throughput at night

was 70% of the available gross bandwith (9.600 bps). Throughput at daytime was 20-30% less.

The reliability of the public networks measured during the file transfer experiment was over 96%. Although on average only 70% of the transfers were successful at first try, the large majority of the unsuccessful attempts could be traced to other than network reasons. Failures due to network reasons were less than 4% of the total number of transfers.

Performance of PPSDN traffic (throughput and reliability) should be clarified and monitored in close cooperation between users and service providers. A joint CEPT/COSINE project on this subject is recommended. The national administrations are urged to implement the CEPT Recommendations concerning performance monitoring.

The introduction of X-32 services to allow X-25 access through switched circuits to PPSDNs should be speeded up.

In the absence of international ISDN connectivity, the X-31 minumum integration scenario for transparent X-25 traffic over ISDN will be of limited use to the COSINE community.

The X-31 maximum integration scenario integrating packet-switched services in ISDN offers promise for the future, but many problems still have to be solved (signalling, addressing, frame relay). The potential for the COSINE community in the future needs further investigation following availability of the CCITT 1988 recommendations.

Public X-400 services are slowly emerging and should be speeded up. National Naming Authorities should be established. For the time being the COSINE community will be dependent on its own resources. It is therefore recommended to support the further development of the pilot RARE MHS service into an operational distributed COSINE MHS service.

Source: Summary COSINE Specification Report 6.

Migration Strategies

This report makes recommendations of the necessary steps for migration from interim services based on agreed standards. By its nature, this depends upon a prior determination of the target services which the migration or transition is meant to reach; these are defined in other reports which are referenced as necessary. In many cases, the transition will need to be supported by conversion services; the operation of such convertors is discussed in Report 7. The importance of this issue and hence the need for a wider understanding of the issues involved has resulted in this chapter being longer than would otherwise have been appropriate.

Plans for transition to use the OSI protocol stack have been prepared by a number of groups: the UK Academic Community, EARN, EUnet. The situation in each case is that a service is being provided and that the service providers decided that a move to use OSI protocols, where available, was in long-term interest of their users, because:

- connectivity to a wider community would be possible;
- cost-effectiveness would be increased as the product development cost would be shared over a larger number of systems.

These, and other reasons for making the transition, are discussed in other reports. A different approach was taken in the COSINE Specification Phase where the analysis was made in terms of specific services, e.g. how to achieve a transition to FTAM. Secondly, the need to match the facilities provided by current services, which is one of the harder parts of achieving the transition, was already taken into account when, for example, the protocol profiles were defined.

It is useful to distinguish two types of transition:

- From a proprietary implementation or interim standard to OSI;
- from one generation of an OSI standard to another.

The second category arises, for example, with the four-year cycle of CCITT Recommendations, which usually take account of previous Recommendations. Examples for this second category are the transition from X-25 (1980) to X-25 (1984) and from X-400 (84) to X-400 (1988); a third example arises from the recommendations to use XXX (1984) for the initial remote terminal access service (interworking mechanisms for this are discussed in ENV 41901).

The feasibility of making the proposed transition requires a careful analysis of the facilities provided by the two services and how these facilities are currently used by the user community. There may well not be a precise match between the facilities currently provided and those available from the OSI application and in this case other solutions, e.g. use of a different OSI application to support the particular service concerned must be considered. In the extreme case the service management may have to determine that a particular facility can no langer be supported or that a particular feature is sufficiently important to justify not making the transition.

High priority is rightly given to continuity of user service during the transition. Some change is almost inevitable, as with the 'totally transparent' change (when a new version of an Operating System is installed, users expect a certain amount of disruption). Management responsibility must be to minimise the disruption and ensure support mechanisms are in place for when changes have to be made. Transitions will be easier to manage if it is possible to develop a convertor facility between the old and new service. These are difficult software packages to develop and maintain and it may not be possible to ensure that all features that can be mapped from one application to the other are so mapped –

the cost in development effort may be too high.

Convertors will ease the transition but once started for a particular application the transition should be as rapid as possible.

During a transition users should ideally not need to be aware of whether their colleague with whom they wish to communicates is in the 'before' or 'after' category. This requires that local address tables are regulary updated or that the detailed routing, whether through a convertor and, if so, which convertor, is determined by look-up in a remote database or otherwise. This issue has not been considered in any detail in the Specification Phase and it is clearly an urgent issue to determine whether and how any interim directory service can be used to hide the transition from the user.

Source: Summary COSINE Specification Report 8.

CERN, OSI and Advanced Networking

The European Organisation for Nuclear Research CERN represents a major collaborative international group of scientists. Since the early days of CERN this community has generated a challenging demand for large-scale and effective communication services. In recent years this demand has been focussed on data communications. CERN is established as an international treaty organisation of 14 member states aiming at centralising resources to conduct research programs in high-energy physics (HEP). CERN, located close to the French border near Geneva, is the biggest particle physics laboratory in Europe with 3.500 staff members and 5.000 visiting scientists. In addition to researchers from the member states, hundreds of physicists from North America, Eastern Europe and Asia participate in the CERN program. All this gave rise, over the last 30 years, to the creation of probably the biggest single international community of researchers, consisting of perhaps 10.000 people in Europe and double this number world wide. In addition to more than 100 ongoing experiments, four major collaborative experiment programs involving more than 1.200 physicists in various institutes will study in the near future electron-positron collisions. The major project of this decade at CERN is the construction of the Large Electron-Positron storage ring (LEP). This is the largest particle collider ever built in the world, an underground 27 km ring, to be brought into operation in 1989.

CERN and the existing international networks

CERN is the major European hub for a set of particle physics facilities, informally called HEPNET. In Europe HEPNET is organised around a Coordination Committee under chairmanship of CERN and a User Requirements Committee. HEPNET, spanning from Europe to Japan via North America, is probably the biggest subject-oriented network in the world with more than 5.000 interconnected systems. It uses a mixture of protocols, mainly X-25/XXX, DECNET, RCSC/NJE, Coloured Books, and more recently also X-400 and SNA. HEPNET, serving such a complex and demanding community, needs to be tolerant and therefore accepts a reasonable level of diversity. CERN is also a major user of EARN (European Academic Research Network), and contributes actively to its transition to OSI and uses EUnet (European UNIX Network), which is of growing importance, especially for communications with the industrial world. Finally, connections to NORDUNET are planned to improve access to CERN for its Nordic colleagues.

Historical successes in networking

CERNET is a packet-switching network based on the datagram technique and mesh topology, designed in 1975 for high-speed file transfers on the CERN site. In use succesfully since 1978, it will be phased out in the early 1990s. CERNET is an unique example of a full stack of protocols, from Physical to Application: File Transfer and Virtual Terminal, entirely designed and implemented on a wide range of machines by a single organisation. Its development required more than 100 man-years. CERNET was for some years the fastest packet-switching network in existence, incoporating data links up to 5 Mbps, as early as 1978.

GIFT is a multiprotocol file transfer converter developed jointly by several organisations, initially the HEP community: INFN (Italy); Rutherford and Appleton Laboratory, and Oxford University (United Kingdom); SARA (the Netherlands) and CERN (Switzerland/France). It can translate between the following protocols: JANET Blue Book, CERNET FTP (File Transfer Protocol), DECNET FTP, TCP/IP FTP and CDC RHF. Developments are on the way to add other protocols, especially ISO/OSI FTAM. GIFT has been in operation at CERN since 1985.

MINT is a multiple protocol convertor system for Electronic Mail, based on a central multi-protocol machine and a set of satellite bi-protocol systems. It is probably the largest concentration of mail convertors on a single site, with conversion between any pair of: UNIX Mail (UUCP), UMS Mail, EARN Mail (RSCS), X-400 Mail, Norsk Data Mail, MUS/Wylbur Mail, TCP/IO Mail (SMTP). MINT, entirely designed and developed by CERN, was put into operation in 1986, and has been widely, if unofficially, used by a large fraction of the European academic and research community. The mission of CERN is to perform a research program in physics. Computing and networking are strategic components for this program, and the sole duty of the network service providers is the provision of better services at lower cost, as constrained by

the deadlines due to the precise scheduling of the enormously expensive facilities used in particle physics. How does OSI fit into this?

In order to reduce diversity of protocols and techniques, and manufacturer dependency, CERN adopted OSI as a strategic direction several years ago. Indeed, CERN has been one of the research centres in Europe which has made the maximum possible use of OSI solutions as early as possible, and often as a pioneer:

1981: first customer of the Swiss X-25 PPSN TELEPAC; local X-25 network;

1983: installation of private international X-25 connections; installation of IEEE/ISO LANs;

1984: CERN representative to chair the XXX "CEC-Zander" group;

1985: introduction of a pre-X-400 service (EAN); CERN representative to chair the RARE Working Group on FTAM;

1986: ISO Transport Protocol over LANs;

1987: RARE FTAM pilot experiment; ISO 8802/3 declared to be the CERN standard for LAN;

1988: in-depth study on ISDN at CERN; initial purchases of FDDI equipment (fibreoptic technology designed in line with IEEE LAN standards); commitment to EARN OSI migration.

It would have been difficult to do more, for an organisation not dedicated to networking, in the field of early use, significant expansion, and development of OSI solutions. However, several services will continue to be based on non-OSI products, due to performance needs or technological lags of OSI product implementations. Consistent with COSINE's principles, CERN will use OSI products whenever available, preferably on a commercial basis and if these are at least equivalent to alternative solutions in terms of functionality, performance and cost-effectiveness. The organisation will have to continuously improve other multi-vendor and proprietary services, whilst pursuing its policy of early introduction of OSI where appropriate, keeping a leading position in OSI pioneering.

CERN and COSINE

The priority of COSINE is the rapid introduction of initial services based on OSI; an X-25 backbone, interactive data communications (XXX), mail and file transfer. In the area of long distance networking (high speed links, Wide Area Networking) it is likely that CERN will make use of among others of COSINE Specifications. Meanwhile, the needs of CERN in these fields are currently relatively well satisfied through various OSI and non-OSI solutions and through convertors. Other services (RJE, full screen access, news and information) are also available through combined use of HEPNET, EARN and EUnet, which will all move to OSI. The initial COSINE services are well placed to attract new network users. In addition to this service package, advanced services can be developed in the COSINE framework, in collaboration with the existing, experienced international user communities. In the evolution process of OSI services, the gateway program of COSINE could certainly benefit from the considerable experience of CERN in the field of actual operation of international protocol converters. More generally, CERN could contribute expertise in the very difficult field of management of complex international research networks, based on more than a decade of experience, although the precise shape these contributions would take has to consider the actual list of COSINE projects retained.

It is particulary in the area of the advanced services that COSINE and CERN could collaborate for the best mutual benefit. The LEP program requires an increase in performance of more than 2 orders of magnitude in CERN's computing and networking facilities. Each LEP experiment will generate around 10.000 tapes (200 Megabyte each) of raw data per year. These will have to be transferred to and/or accessed from hundreds of sites in Europe, America and Asia. Although bulk data will most likely be shipped on tape cartridges, a set of 2 Mbps links is required by the end of 1990 between CERN and regional processing centres, to allow collaborative decentralised analysis of these data. Even links at 140 Mbps need to be envisaged. The services on such links will be like those on LAN's: a combination of rapid file transfers, and of distributed computing using workstations (including remote windowing, etc.). Within 18 months, 2Mbps links must be planned and all these services will have to be provided to an international community of researchers. Furthermore, HEP is preparing a very high speed project in collaboration with DFN. OSI products for X-25 at normal speeds are available today, but there is little hope that strict OSI solutions for high speeds will be available in time.

CERN is convinced that, in addition to opening the conventional COSINE services to new users, the experienced user communities such as HEP must be involved in advanced collaborative projects. This will help COSINE keeping a sufficiently high profile, as recommended in the COSINE Specification Phase, in the networking areas for advanced pre-OSI services which are not in competition with other existing activities. With immediate actions of this type, the COSINE project could be more instrumental for network development not only for new users of networks, but also for the existing international user communities.

By: Brian Carpenter & Francois Fluckiger, CERN, Data Handling Division.

The above report, which has just been published by the Commission (EUR 11833/1) shows the importance attached both by the Program Management and the Review Panel to the provision of services closely related to those provided by the IES. CUBE, the Concertation Unit for Biotechnology in Europe, is in general responsible for concertation, which the evaluators consider to be required per se. They see concertation as essential when a given R&D activity, such as biotechnology, is located in many different centres of both decision-making and implementation, separated by institutional boundaries. Different types of concertation can be identified within this general area: intercountry, inter- and intrainstitutional and interdisciplinary.

In order to effect these different forms of concertation, it requires:

- Information gathering and dissemination/communication. This implies locating and storing the right kind of information, identifying relevant audiences who might be interested in it and adapting and communicating the information to those audiences.
- Acting as an operational linkage in setting up decision-making processes, which in turn implies gathering and communicating information as well as providing means of communication.

It is stressed that these requirements are not unique to the two programs under evaluation, but arise in many others.

Reference is also made to the CUBEDOC database, containing some 20.000 articles, mission reports, papers etc. on biotechnology but it is noted that this database is not as well used as it could be and re-examination of ease of access etc. should be instituted.

It should be noted however that we have here highlighted a small part of this extensive and positive evaluation, which contains much useful information and outlines future directions to be taken.

Evaluation of the Biomolecular Engeneering Program (BEP) and the Biotechnology Action Program (BAP)

The importance attached to information exchange by the relevant Program management is further underlined by a commissioned report on "The Role of Information Technology and Services in the Future Competitiveness of Europe's Bioindustries". This document, prepared by Dr Jack Franklin of ARSA, reaches the following conclusions:

1. Biotechnology is increasingly dependent upon information: scientific, analytical, regulatory or commercial.

   Because their subject is interdisciplinary and multisectoral, biotechnology practitioners need to identify collaborators, suppliers and information outside their immediate field of knowledge. The most appropriate information sources and contacts are likely to be dispersed throughout Europe and the world.

   An European biotechnology network (with global connections) is therefore essential to facilitate communication, provide access to databases, and hence promote effective performance and competitiveness.

2. Basic science databases are especially important for the future health of academic and industrial research.

   Much scientific data, such as nucleotide sequence information, does not yet lend itself to commercial exploitation.

   Therefore a degree of public support will be required to ensure the long-term survival of these sources.

3. Europe is in danger of becoming totally dependent upon the USA for biotechnology information delivery through secondary databases (which indicate the location of primary data and articles).

3. Europe currently lacks initiatives such as the U.S. National Biotechnology Information Center, companies such as Chemical Abstracts, and innovative actors in the biotechnology information market such as the U.S. National Library of Medicine and the American Type Culture Collection.

   Europe's remaining actors in such fields must be supported to ensure that effective alternative information sources survive.

4. In summary, Europe lacks a biotechnology information policy.

   Such a policy can be developed only if the scientists, science-based companies and associations, governmental institutions and the information supply industry, act in a coordinated manner.

Developing Satellite Business Networks

A two-day conference, organised by Johannesson & Associates in Luxembourg in the first November week, brought together nearly 100 representatives from European PTTs, service providers, manufacturers of satellite communication systems and users. In the words of the organisers, "progressive deregulation, operational and cost benefits, and mature technology" had created the climate for a timely meeting.

Our readers will be particularly interested in the current state of regulation and the Commission's views on this, as well as in some of the advantages which my be found in such systems, especially the Very Small Aperture Terminals and their use in "hub systems". A hub system consists of one central station (the network control station or hub), which may be operated by one user or may be shared by several users, and is linked by two-way communication with the individual sites belonging to one operator. These cannot intercommunicate directly, with all traffic passing through the central hub (there are more sophisticated systems, where traffic between site stations is possible, such traffic also being copied to the central hub).

At present, most European PTTs permit one-way systems, with receipt of information or data being generally free of charges except for the groundstation licence fee. Some PTTs accept private ownership of the Network Control Centre, but all, except for the UK, require the uplink to be owned and operated by the PTT. The whole cost of the space segment transmission capacity is allocated at the uplink. Ground terminals may be privately owned in Denmark, Finland, France, the Netherlands, Sweden and the UK, with PTT ownerhip being mandatory in the other countries. A change in ownership attitude is imment in the F.R. of Germany. Reception from "foreign" hubs seems to be accepted, but such systems will be under local PTT control. Two-way communication and its regulatory framework are still in the drawing-board stage.

A presentation by Tim Howells, Special Adviser on Communication Satellite Systems, DG XIII, reviewed Commission thinking and options for microterminals under consideration. These are limited to VSAT equipment communicating at up to 64 kb/s with higher capacity terminals considered to be part of the basic network infrastructure still intended to be reserved for PTT provision. Regulation is intended to ensure minimally that owners can be certain that equipment is fit for the intended purpose and that its operation causes no impediments to others. For service provision it is suggested that the following guidelines be adopted:

- Voice telephony should not be carried.
- Telecommunication transmission services should be regulated to avoid interference and to ensure compliance with international statutory obligations.
- Opportunities for bypass of the public network infrastructure should be limited through definition of interconnection rights between VSAT-based and public networks.
- National and international VSAT networks should be encouraged within the constraints outlined above.

It is considered that groundstations for entertainment reception of data broadcast services constitutes a parallel to conventional TV aerials and therefore is a consumer goods item not requiring licensing or registration, but national regulations for size etc. may be appropriate provided they do not introduce a market restriction. As regards VSAT Receive Only groundstations, these pose no threat either to Telecommunication Administrations in terms of diverting potential revenues or to other earth station users/operators, since these terminals have no transmit capability. It is therefore suggested that:

- there should be no restriction on the supply, ownership, operation or maintenance of VSAT Receive Only terminals,
- that VSAT Receive Only terminals should not be licensed, but may be subject to regulation,
- that a NET (Normes Europeenes de Télécommunications) for network attachment conditions applying to VSAT Receive Only terminals should be prepared and given mandatory status.

As it is standard practice to require a licence for radio transmission, this should also apply to VSAT terminals capable of sending (and receiving) data transmissions. It follows from this that such terminals must each be licensed. Since an operator might be a transnational entity, such licensing should be on an European level for class approval, with National re-

Developing Satellite Business Networks

gulations governing matters of detail such as local standards and domestic procedures for frequency coordination. Such VSAT terminals should be type-approved for network attachment and for service operation, with standards being mandatory and issued as NETs. On the other hand, there should be no restrictions on ownership of VSATs, which should have a defined total usable band width per earth channel. Also, the class of terminal should be restricted to digital operation only and not allow of conveyance of interactive voice. Interconnection with leased lines would be permitted fully, but linking to public switched services would be allowed at only one end of a satellite link.

In considering VSAT Receive Only services by a terrestrial hub station, the view is that operators must be licensed by an European authority with operation of each individual hub being subject to administration on a National level. Type approval is obvious, but there should be no service restrictions.

The above brief notes summarise the current Commission thinking and were presented to stimulate feedback from potential users and operators. Proposals for further deregulation should be included for later implementation.

A very detailed paper by David Shorrock of Logica dealt with the economic aspects of VSAT technology and disclosed some interesting data, showing under what conditions such data transmissions could offer advantages over packet-switched networks. One important aspect repeatedly mentioned was the speed with which a VSAT station could be installed. One speaker quoted the experience of one large hotel chain, with some 2.000 properties: up to 20 properties were bought or sold per month and required either linking or decoupling from the telecommunication network: a mobile VSAT could be in place in a matter of hours whilst other line provisions could take days, if not weeks. Such a network consisted of a central hub through which communications passed between the individual VSAT stations. Other ambitious plans mentioned included the equipping of all petrol stations of one large supplier with VSAT stations: all purchases would be affected by credit card, and stock control would be incorporated, so that such stations would only require refilling without necessarily requiring permanent staffing – the enormous savings are obvious.

Whilst most of the case histories presented were of non-European applications, there was much evidence of European activities and interest. The only commercial European network is in France, but pilot tests are underway in many other countries, and technological development too is not only a non-European one. Given the lead by the Commission there is certainly a bright future for such systems in Europe.

ELECTRONIC INFORMATION USERS IN EUROPE

The first of series of surveys commissioned by DG XIII B with BIS Mackintosh Ltd of Luton (UK) has just been published. The data were collected by mail from a panel, composition of which was determined to reflect accurately the geographical breakdown by market value, with attention also being given to ensure a representative ratio of organisational users and sizes of these. Allowance was also made for usage patterns of information media (online, magnetic/optical, print products and broadcast) and for functionality (end-user or intermediary).

It is estimated that the 500 panel members account for almost 1% of the total European expenditure on information acquisition, the total for the panel being approx. 15 million ECU. The average annual expenditure on electronic information sources is less than 8.000 ECU per panel member, with 11% of the panel members however spending more than 10 times this amount. As regards information required, 80% of users needed scientific or technical data, but the total interest in financial and business information (subdivided into 5 categories) was more than double this figure (each category is rated as a percentage of users: no market values are given for the different areas). For further information, please contact S. Lustach DG XIII B, Jean Monnet Building, L-2920 LUXEMBOURG.

"VALUE": Dissimination and utilisation of results from scientific and technological research (1988-92)

The Commission has recently made a proposal (COM(88) 260 final) for a new, four-year, 38 million ECU program for the dissimination and utilisation of results from scientific and technological research in the Community.

This new initiative has been launched within the Framework Program for Community RTD (Research and Technological Development) adopted in September 1987. It is intended to complement the various R&D programs and activities of the Community by giving new priority to the dissemination and commercialisation of the results of such work. It covers both the results from the Joint Research Centre's activities wholly financed by the Community and results from Community shared-cost contracts with firms, research centres and universities.

This program will be called VALUE and will comprise two sub-programs.

Sub-program I

The four priorities of this main part of the program are:

1. **Provision of information about Community RTD programs and projects**

   The aim is to provide interested groups in industry, universities and research centres with advance information in the public domain on planned or current RTD programs and projects, so that contacts between them may be more easily established.

   The provision of selected information which safeguards the legitimate interests of its owners but is adapted to user's needs should therefore be developed using appropriate means, including existing or new databases and associated services.

2. **Identification, screening and protection of results**

   This chapter concerns the continuation of the patenting activity for results of Community research for which industrial and intellectual property rights have not been claimed directly (e.g. by the contract partner).

   This activity resembles that of the patents department of an industrial company engaged in its own research. Some 8.700 first and second patent applications were made between the commencement of this activity in 1960 and the end of 1987. VALUE contains some measures for improved identification, screening and protection of R&D results.

3. **Dissemination of results judged to be without commercial value in the short to medium term**

   The dissemination of R&D results should be carried out using traditional means (private and public publishing houses – including the Office for Official Publications of the European Communities – libraries, documentation and translation bureaux). Emphasis will be placed on computerised databases and associated information services.

4. **Support for the active exploitation of results**

   To ensure that potentially exploitable results from Community RTD activities may benefit fully from the completion of the internal market it is proposed, where necessary,

   a) to use professional marketing consultants to identify Community-wide (or even extra-Community) market opportunities;

   b) in the event of a favourable outcome of (a), to use consultants to prepare outline business plans and, if appropriate, to undertake (pre)feasibility studies defining the technical and economic hurdles which remain to be overcome;

   c) to use exhibitions, technology transfer agents and other consultants to identify any missing partners;

   d) to conduct licensing negotiations in the case of Community-owned inventions and to advise on them in other cases;

   e) to support the development and testing of any prototypes and/or pilot or demontration installations which may be necessary to reduce technical risks.

Sub-program II – "Computer communication networks"

The objective of this sub-program is to contribute to the creation of a common integrated computer communications infrastructure and associated services, accessible to the various public and private research centres in Europe.

The intention is to give positive support to the COSINE project

which is commited to providing an OSI conformant infrastructure connecting the "research and development world" of Europe, since European RTD activities increasingly involve close collaboration between teams and individuals spread across the Community. This is particulary true of Community-sponsored research projects within the Framework Program and others in which the Community is active, such as EUREKA.

Such distributed research projects need efficient computer communications networks in order to carry the information they require and give access to their results, thus stimulating the process of innovation and the industrial exploitation of research results.

The VALUE Program is now being discussed by Parliament, the Economic and Social Committee and the Council.

Further information on the VALUE Program can be obtained from Mr B.B. GOODMAN, Commission of the European Communities, DG XIII-C, Jean Monnet Building, B4/069, L-2920 Luxembourg, Tel.: + 352-4301-2959, Tlx: 3423, 3446 COMEUR LU, Fax: + 352-4301-4129.

Field Demonstration of Coherent Optical Systems

A technique which can increase the call-handling capacity of existing optical fibres at least ten-fold has been recently demonstrated by us at British Telecom Research Laboratories. This means that the hair-thin strands of glass currently carrying up to 7.500 calls at the same time could be capable of carrying 75.000 or more conversations.

This technique, coherent modulation, allows the frequencies of the transmitters on the system to be spaced much more closely than is allowed by current techniques. The principle of coherent optical modulation was established many years ago and is well known in the research community. The problem has been its practical realisation, calling as it does for not only very stable, noiseless transmitters which can be tuned over vast bandwidths, but also for continuous control over the polarisation of the received light relative to that of a local oscillator.

The systems in use today are referred to as direct detection systems, and are analogous to switching on and off a lamp as a means of transmitting morse code. However, light has many colours; by switching on and off each colour separately, and having a reference colour (local oscillator) in the receiver, each colour can be selected separately while in the presence of all the other colours, in much the same way as a radio receiver picks out one radio station from all the rest that are transmitting simultaneously. For this reason some time ago we christened this the optical ether; through this optical spectrum transmitters which are geographically scattered can communicate with receivers also scattered using a network of interconnecting optical fibres, with no regenerator.

Whereas previous demonstrations of coherent transmission have been made on the laboratory bench or under other controlled conditions, these trials are the first to be made over an existing optical fibre cable, in this case more than 170 km long and without any intermediate signal amplification.

The main results of this exercise were the demonstration of coherent transmission techniques for the first time in the operational network environment, and transmission at 565 Mbit/s over 176 km of fibre without repeaters. This compares with 77 km for direct detection systems on installed fibre at the same bit-rate. Moreover, spans of this order indicate a capability to link major cities in the UK without repeaters.

Avoiding Expensive Repeaters

The demonstration system was installed at the BT trunk exchange in Cambridge. It operated at 565 Mbit/s, using differential phase shift key (DPSK) modulation and heterodyne detection. The transmitter comprised a miniaturised long external cavity (LEC) laser (developed at BTRL), followed by a single 30 dB optical isolator. Differential phase shift key modulation was applied to the optical carrier by a lithium niobate phase modulator, and the optical signal power was then boosted by a semiconductor laser amplifier to a level of +1 dBm in the single-mode fibre. The signal was then transmitted through 176 km of conventional single-mode fibre contained in an 18-fibre cable installed between Cambridge and Bedford; ten of the fibres carried live traffic. The receiver was also located at Cambridge: it comprised an LEC laser as the local oscillator (LO) source, an automated endless polarisation controller (also developed by BTRL), a fused tapered fibre coupler to combine the signal and LO waves, and a wideband receiver with an optically-balanced input.

The system was mounted in a 19-in. rack which was installed alongside suites of operational transmission equipment at Cambridge. The mean loss of the 176 km of fibre was almost 0.3 dB/km: lower incremental losses in cabling and installation could allow repeaterless link lengths approaching 250 km, whilst further developments in the devices and components could extend this to 300 km, or provide sufficient margin for error-free operration.

The two key components required are the laser transmitter, and the polarisation matcher. For the laser, our field experiment used an external cavity laser.

The long external cavity (LEC) laser has been widely used in laboratories, and uses a relatively simple laser chip with one facet anti-reflection coated, coupled via a collimating lens to a diffraction grating. Such assemblies tend to be sensitive to vibration, but we have successfully miniaturised and ruggedised the assembly to make it suitable for use outside the laboratory. Its wavelength can be adjusted over 40 nm, and contiunuously tuned over

Field Demonstration of Coherent Optical Systems

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0.4 nm (50 GHz); it provides a spectral linewidth less than 100 kHz, and an output power of 0 dBm. It requires less than 30 dB of optical isolation, which can be provided outside the package. Further work is needed to examine its mode stability over the long term, but initial tests using temperature stabilisation are very encouraging.

The second requirement is for a means of ensuring that the states of polarisation (SOPs) of the received signal and the local oscillator are matched. We wish to use the conventional single-mode fibre that is already installed throughout the network, but changes in stress or temperature can alter the SOP of the transmitted signal.

Special Components Developed

There are several approaches, one of which is to provide a polarisation-diversity receiver which responds to the transmitted signal regardless of its SOP. However, such receivers require optical components which are only now becoming available (polarisation beam-splitting fibre couplers, polarisation-maintaining fibre couplers), and may also involve optical loss and sensitivity penalties. In contrast, we have provided a means of adjusting the SOP of the local oscillator to track that of the received signal, with unlimited tracking range, and have developed two types of transducer which are suitable for the purpose. The field demonstration used one based on polarisation-maintaining fibre wound on piezo-electric cylinders, which require a mechanical strain of only 10^4 to produce the required change in SOP. This device has an insertion loss of only 3 dB.

The span of conventional direct detection systems is limited by thermal noise in the receiver; the spacing of separate wavelength channels is limited by the resolution of optical filters; and the ability to amplify several wavelength channels simultaneously may be limited by crosstalk.

In contrast, the operation of a coherent system is based on the use of a very pure optical sine-wave, whose phase, frequency, or amplitude is modulated to carry the transmission. Demodulation requires that the received optical signal be combined with an unmodulated optical wave (provided by a "local oscillator" laser) of almost identical frequency prior to detection. However, the sensitivity of the receiver need not then be limited by thermal noise, and different wavelength channels are separated according to the electrical characteristics of the receiver rather than by optical means, and hence can be spaced more closely. Moreover, phase or frequency modulated waves are not affected by the crosstalk mechanism that applies to amplitude or intensity modulated signals, caused by the non-linearity of optical amplifiers at high power levels: hence it may be possible to transmit more channels through a larger number of amplifiers using coherent techniques than for direct detection, thus providing very high capacity transmission over many hundreds of kilometres.

Future European Competitor for CRAY?

After four years the development of the first German super computer, the SUPRENUM 1, has reached the final stages. This project is mainly sponsored by the German Ministry for Research and Technology (BMFT) and carried out by the SUPRENUM company which is a joint venture of leading German technology companies and research institutes.

SUPRENUM 1 will contain 256 parallel working node computers with a capacity of 20 MFLOPS each, which means a peak performance of 5 thousand million instructions per second, a capacity which is reached now only by the leading American and Japanese super computers.

SUPRENUM will work internally under the specially developed operating system PEACE and externally under UNIX-V. The Parallel Programing Languages available are SUPRENUM-Fortran and Modula-2.

More information about this project will folow in one of the next issues.

The European Telecommunications Standards Institute (ETSI)

The European Conference of Postal and Telecommunications Administrations (CEPT) has, since its start in 1959, been producing technical recommendations with the aim to promote standardisation of the telecommunications network in Europe.

For many years no great importance was attached to the speed at which such recommendations were normally produced nor was there a need for a form of specification more binding than just a recommendation.

However, in the late 70's and certainly in the 80's it became clear within the CEPT itself that something had to be done in both areas if it was to be at all possible to meet the growing demands of the market in general, to say nothing of the coming single market within the Community, scheduled to come into being in 1992.

Giving specifications a more binding form than just recommendations is of course a purely formal problem to which there are several solutions.

The first solution chosen generally in Europe (EEC and EFTA countries) was the creation in 1986 of so-called NETs (Norme Européenne de Télécommunication) by means of a special autonomous body called TRAC (Technical Recommendations Application Comittee). The NETs are based on existing recommendations from CEPT, CEN/CENELEC and ITU.

By signing a Memorandum of Understanding (MOU) the signatories commit themselves to make the NETs mandatory in their respective countries.

In addition, a Community Directive, establishing the mutual recognition of terminal conformance test results, has been adopted by the Council of Ministers in July 1986, which makes mandatory the application of NETs by any organisation within the Community.

Another possible solution is of course a Directive from the EEC.

The production of specifications within the CEPT has been somewhat lacking in speed, and there are two reasons for this:

The first has to do with the organisation of the work. The CEPT is a classical organisation, i.e. a pyramid, with Working Groups, Committees and a Commission (the Telecommunications Commission), and the formal approval of any recommendation must take place in the Commission, which meets only once a year.

The second reason is a result of a problem that, in my opinion, faces all organisations working in the standardisation area, namely that all participation in the work is done on a marginal basis, with the consequence that the work in the groups or sub-groups normally amounts to little more that a week or two a year during 2-3 meetings. This of course means that a concrete piece of work – ready to be carried out, i.e. no further development work needed – will last for a relatively long time compared to the necessary number of man-months.

There are very good reasons of course for working this way, the primary one being that the work can only be done by experienced engineers working daily in the specific area. It is unrealistic to believe that it is possible to form a team of engineers to do standardisation work exclusively year after year at a qualified level.

In order to solve the problem of speeding up the production it is necessary to establish some sort of permanent structure to which one can connect small "nuclei" of very qualified engineers working full-time on a specific project for a given short period of time.

The connection of such a nucleus to one of the member Administrations has been proven by the CEPT, in a few instances, to be a very effective solution to fulfilling a specific urgent task.

But despite an attempt to improve the productivity of the CEPT by making structural changes in the relevant Committee (CCH – Comité de Coordination de l'Harmonisation) and, contrary to its own rules, by letting industry participate in the Working Groups, only little progress was made, and it became obvious after the publication by the Commission of its Green Paper on the Development of the Common Market for Telecommunications Services and Equipment that the time had come to take drastic steps.

And the member Administrations of the CEPT acted with surprising boldness and speed!

In a timespan of little more than 6 months they created by 1st April 1988 an Institute, the European Telecommunications Standards Institute (ETSI), as a private organisation with no formal connection to the CEPT, and turned over all the CEPT activities and resources rela-

The European Telecommunications Standards Institute (ETSI)

tive to technical specifications to ETSI.

For the first two-year period some principles for the internal Rules of the Institute were laid down by the CEPT members, but otherwise an open invitation was given to industry and user organisations to join the Institute as full and equal members and the Commission and the EFTA Secretariat were asked to sit in as special Counsellors.

The advantages in setting up the Institute are:

1) Participation of all interested parties in Europe, giving the possibility for the Institute to draw upon the best qualified resources.
2) The possibility of forming small so-called Project Teams working permanently somewhere in Europe on a well-defined task for a given period of time and, if necessary, of paying in one form or another the costs of the Project Team members.
3) A full public enquiry throughout Europe paving the way for a speedy formal adoption of a draft standard in the Technical Assembly of the Institute.

Members and observers

Membership may be obtained by administrations, public network operators, manufacturers, users including private service providers offering services to the public and research bodies. One condition is that members belong to a country falling within the geographical area of the CEPT. National or European organisations concerned with telecommunications may also become members.

Observer status may be obtained by European organisations who are entitled to become members but do not wish to do so, and by European organisations concerned with telecommunications who are not entitled to become members.

Representatives from non-European organizations concerned with telecommunications may be invited to participate as observers in the meetings of the General Assembly, the Technical Assembly and the Technical Committees.

Structure

The Institute has been given the following structure:

a) A General Assembly

b) A Secretariat

c) ATechnical Assembly

d) Technical Committees

e) Project Teams

The General Assembly (GA). The GA's functions are mainly to lay down the formal framework of the Institute, to adopt the annual budget, to approve financial statements and to appoint – and dismiss – the Director and the Deputy Director.

The Technical Assembly (TA) is the highest authority within the Institute for the production and approval of technical standards, called ETSs. It approves – unanimously – the costed annual work program and decides upon the creation of Technical Committees and Project Teams. The TA also approves the work to be undertaken outside the costed work program, i.e. work not having been adopted unanimously and paid for either by voluntary contributions from members or by contributions from outside (EC Commission or the EFTA Secretariat).

One further important obligation of the TA is to ensure that a public enquiry has been carried out before approval of a draft standard.

The Technical Committees exist to provide a forum for consenus-building among European experts, and for harmonising an European view for worldwide standards organisations (mainly the CCIR and CCITT).

The Project Teams are, as indicated above, the real "worker bees" of the Institute. All members are entitled to propose experts for the Project Teams, but only the necessary few will be chosen.

Location

The location of the Institute was decided upon at a meeting in January 1988. After a series of secret ballots Sophia Antipolis (between Nice and Cannes) was chosen. France Telecom is now constructing a building to house the Institute. The transfer from the temporary premises to the permanent ones is scheduled to take place in the summer of 1989.

Languages

It is well-known that translation of technical documents and simultaneous interpretation at meetings is a

The European Telecommunications Standards Institute (ETSI)

very heavy item on the budget of any international organisation. Furthermore the whole process is delayed if all documentation must be worked out and be ready at any meeting in all recognised languages.

It has therefore been agreed to use one working language in relation to the production of standards, namely English, and this agreement should be seen as an encouraging example of cooperation and good will.

When draft standards have been made, official translation into French and German may be made as a special service paid for by the Administration(s) requesting such service.

In the General Assembly all three languages hold equal status.

Finances

In broad terms the budget of ETSI falls into 4 categories:

1) The common operating costs of the Institute paid for by the group of members consisting of Administrations.
2) The costs of the work program adopted by the Technical Assembly and paid for by all members in accordance with the class of contribution chosen by each member. The class chosen is either related to the GDP of a country (for Administrations) or to the annual telecommunications turnover (for Manufacturers etc.).
3) The costs of the special voluntary program, paid for by members adhering to this program. This part of the program may also contain special tasks performed for and paid by the EC Commission.
4) The costs in relation to the special "language account" paid for by member Administrations having agreed to share these costs.

Formal Status

The question of the formal status of the Institute has been a particular problem.

In order to obtain the EC Commission's recognition of the Institute as a standardisation body in relation to the Directive 83/189, the Rules of Procedure of the Institute had to contain provisions in relation to 3 areas:

- Transparency. Valid information must be given to the Institute (and the EC Commission) concerning the organisation(s) in a given country that are responsible for establishing a national position in relation to the voting in the Technical Assembly on a draft standard, together with the rules which govern the manner in which these functions are carried out.
- Standstill period. The national organisations mentioned above must not publish a new or revised national standard which is not completely in line with an ETS or EN (from CENELEC) in existence or in preparation or take any other action which could prejudice the harmonisation intended. The period for such a standstill is defined by the Technical Assembly and generally should not exeed 15 months.
- Transposition arrangements. When an ETS has been approved by ETSI the national organisations must, at a given date set by the Technical Assembly, ensure that all conflicting national standards on the specific matter are withdrawn, and they must refer interested parties enquiring about such standards to where the ETS can be obtained.

At the General Assembly of ETSI in October this year such provisions were adopted and included in the Rules of Procedure. Consequently, as stated by the EC Counsellor, the Commission will formally recognise ETSI as a European Standards organisation, i.e. include ETSI in the annex to the Directive 83/189.

Relations with other organisations

One particular area of interest is the so-called "grey area" between Telecommunications and Information Technology. In order to obtain the necessary coordination of work a Committee, called the ITSTC (Information Technology Steering Committee), was set up between CEPT and CEN/CENELEC.

Now that ETSI has taken over all the technical standardisation work from CEPT, an agreement between the Institute and CEN/CENELEC is being drafted and ETSI representatives will join the ITSTC.

Furthermore, preliminary discussions will take place between CEN/CENELEC and ETSI in order to evaluate the possibility of forming, without creating unnecessary bureaucracy, a formal common stand-

The European Telecommunications Standards Institute (ETSI)

ards organisation, in which the three existing organisations will keep their individuality.

Participating in the creation of ETSI has been a very positive experience. A lot of good will and cooperation has been demonstrated by the different groups of members showing great promise for future work together. Now that the necessary framework has been set up for the best possible organisation for the production of technical standards it is important for the members to demonstrate that good results can be produced faster than before. This calls for willingness on behalf of the members to put the necessary human resources at the disposal of the Institute, especially of the Project Teams.

The next few years will of course be a trial period for ETSI. I firmly believe that ETSI will pass the test and become an important element in European telecommunications in future.

I.B. LONBERG
General Directorate PZT
Copenhagen

ISDN in the Federal Republic of Germany

The 4th German ISDN Congress took place this year in Wiesbaden, Germany, from October 25 to 26, having the motto "ISDN - A Challenge to Europe". The main emphasis of the 1988 congress was the effort to gain internationally accepted norms and standards in communications and the prospects for the telecommunications industry in the future ISDN market. The congress was attended by nearly 1.000 national and international experts.

The conference was opened by Prof. T. Schuringa, DG XIII, who pointed out that there were remarkable advances in ISDN in Europe but that for the Single European market in 1992 the creation of an European terminal equipment market was essential. The technical requirements for this would be the compatibility of services and the portability of terminals across Europe. The European technical developments in ISDN were complemented by reports on work in Japan and the USA by J.L. Johnson (AT&T) and Y. Kume (NTT), and showed that the Europeans are on a world level.

The user requirements of ISDN were clearly expressed; demand for a cost reduction of the service itself and for suitable hard- and software. The use of international norms and standards and a degree of planning security for the future were voiced.

It was stressed that ISDN will offer chances especially for small- and medium-sized companies in the usage of new telecommunication technologies because of the possibility of using several services in one network, where in the past it was necessary to have several separate connections to special networks, e.g. telephone, telex, teletex or PSDN, which was expensive.

Another demand in this context was the consideration of the present office infrastructure to avoid investments made to be proven wrong, because the acceptance and usage of ISDN will be dependent, in a high degree, on economic factors. No one will use ISDN for its own sake if there will not be an economic advantage.

Concerning the PTTs, it was emphasised that they have to care for connections with the networks of other countries to offer an European and worldwide ISDN service. But this can only be reached when, in the framework of the CCITT, internationally accepted standards can be established to ensure the compatibility of telecommunication networks across Europe and the world.

RARE European User Meeting of High-Speed Networking

A one-day meeting of up to 100 users with short presentations on the needs of academic and industrial research communities over the next 15 years will be held on February 28 in Brussels. Organisers are RARE WG6 with Commission support. User answers to questions such as what facilities are already in use or will be required, together with new initiatives needed in the short term for high-speed networking are to be solicited. Further information from J. Prevost, CEA-SG/DI, 31 rue de la Federation, F-7505 Paris (+33-1-4056-2499).

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Issue No 19, December 1988

Elsewhere in this issue we report meetings and conferences at which we were present. The most important was the IES User Forum, held on the evening of Tuesday, November 15, as part of the ESPRIT Conference. Summaries of the papers presented during the IES Technical Session are also included in this issue for those who were not present in Brussels.

Why the mention of conferences – well everywhere the European angle is stressed and the coming of the Single Market in 1992 welcomed. The reality is however rather different. Take satellite communication for instance. Although the Commissions's approach to regulation is liberal, there are still some necessary constraints. On the other hand, an European satellite, launched by an European rocket, gladly sells its capabilities to non-European operators, who promptly will provide Europeans with an endless stream of non-European television shows and adverts for non-European products, especially of the high technology type.

It is becoming apparent, that from being a researcher's tool, IES Services are slowly showing the way to better communication and improved interconnectivities for all users of networks. The progress with directories makes universal electronic mail

Editor's Corner

connections in Europe not remain a cherished dream, with the proposed MDNS backbone doing much in this direction. It is important however that all users of IES Services, and other network users also, help in shaping the future. It is for this reason, that we hope to use the existing IES Services, especially IES News, to obtain user feedback and views how they, and that means each one of our readers, see developments happening. During the year ahead, we will ask you to cooperate in such ventures, none of which should tax your time by more than a few minutes. We also look forward to having your ideas, comments and suggestions on all matters related to the concept of IES.

The Single Market will give the required European economy of scale, but this advantage will be vitiated if urgent steps are not taken to strengthen the European base of technological and cultural development. Cuts in expenditure on research and education, not by the Commission (who are adopting an exemplary expanding approach), but by National governments, are certainly not designed to expand the pool of trained personnel for future research activitites.

Europe has an unique tradition of pre-eminence in science, learning and culture established over more than 3.000 years. Is this to be frittered away in the same number of days?

FUTURE EVENTS

International Telecommunications. World Trade Centre, Brussels. January 16 - 17, 1989.

Online 89 (Twelfth European Conference on Technical Communication). Online Gmbh. Hamburg, January 31 - February 2, 1989.

PanEuropean Digital Cellular Radio. IBC Technical Services. Munich, February 8 - 9, 1989.

International ISDN Users' Conference. Deutsche Bundespost. Hanover, March 13 - 14, 1989.

Microelectronics: Manufacture and Applications. VDE/VDI. Baden-Baden, March 13 - 15, 1989.

Intelligence in Networks. IDATE. Bordeaux, March 14 - 17, 1989.

FUTURE EVENTS

Olympus (ESA Telecommunications Satellite) Utilisation. Eutelsat. Vienna, April 12 - 14, 1989.

Reliability of Technical Components. VDI. Munich, April 20 - 21, 1989.

Europe Through Technology. Internationale Vakbeurs voor Nieuwe Technologien (Flanders Technology International). Gent, April 24 - May 1, 1989.

ISDN in Europe. Delft University. The Hague, April 25 - 27, 1989.

Command, Control Communications and Managen in Information Systems. IEE. Bournemouth, May 2 - 5, 1989.

Expert Systems and their Applications. ECCAI, Avignon, May 29 - June 2, 1989.