conferences

NATO Advanced Study Institute

22 August–2 September 1983, Chateau de Bonas, France

Information technology and the computer network

This was the third conference on networking to take place at Bonas following successful meetings in 1979[1] and 1981[2]. Both the technical aspects of the subject and its application have developed considerably in recent years, and the title of this years meeting, with its reference to information technology, reflects the major impact that these developments are having in the provision of user services.

Standardization

A key theme at the meeting was standardization of protocols and other interconnection and user procedures. At a previous meeting, the development of the ISO seven-layer hierarchical model was reported along with the realization of working systems from draft procedures[3]. In this meeting, the development of agreed procedures was described, commencing with an address by Professor Helms of the Commission of European Communities (CEC). The CEC has invested heavily in international standardization since 1979, applying a strategy similar to that proposed under the ESPRIT programme and Euronet, with which it has close cooperative links. The number of agreed and operational standards within the various levels of the ISO seven-layer protocol model is already very impressive, 47 in layer 7 and 18 in layer 6 — over 100 in all, plus 75 standards which do not involve datalinks. The manufacturers' response to these standards has been good and often extends beyond the minimum requirements dictated by commercial practice. The user response has not, however, been equally good, and this points to an educational need which is far from completely satisfied.

As with many such organizations, the CEC is currently considering a strategy for the introduction of OSI standards to ensure that systems which are now being planned to use data transmission facilities (both wide-area and local-area networks) can be structured so that they use OSI standards as they become available. This is known as the 'intercept strategy' and was described in one form or another by several speakers. The Director of the UK's South West Universities Regional Computer Centre (SWURCC) academic network, J Brookes, gave the universities' interpretation of this strategy. He described protocol standards as a mechanism for holding together a dispersed collection of user services. The benefits are connectivity and protection of user investment in hardware and software. A large computing centre servicing the needs of a number of universities over a wide geographical area cannot change its mode of operation abruptly, and SWURCC is seeing a gradual change from 'home-grown' network protocols to full X.25 international protocols using expendable gateway protocol converters.

PABX linkages

An area of protocol development that is less successful is that of PABX linkages, where at present acceptable standards do not yet exist. J Houldsworth of ICL stated the view that PABX and LAN (local area networks) must be connectable in the long term if we are to realize the advantages of voice and mixed-mode text and graphics communications. The key is probably a gateway which must fit into standard system architecture. In many ways, he believes that the chip manufacturers are getting ahead of the agreed standards organizations, and that perhaps greater attention should be paid to the activities of these manufacturers. There is a great need to bring these together to ensure that the standards agreed are actually implemented correctly.

The current situation *viz-a-viz* OSI standards was described by W A McCrum of the Department of Communications, Ottawa, Canada. He defined open systems interconnection as, 'a concept whereby information processing systems may communicate without needless constraints engendered by equipment choice'. The achievement of openness in systems interconnections demands that many fundamental components of information technology and the computer network should be structured around these standards, and he left no doubt in the delegates' minds that this is a top priority for all present-day inter-networking activity.

Fifth generation

An area of considerable interest to the conference was the planning and initiative shown by European and US organizations in meeting the challenge of Japan and their ICOT programme for the fifth generation of computers and their application to information technology.

The meeting was particularly fortunate in the attendance of B Oakley, the UK Director of the Alvey Programme for Information Technology[4] (see Figure 1). Mr
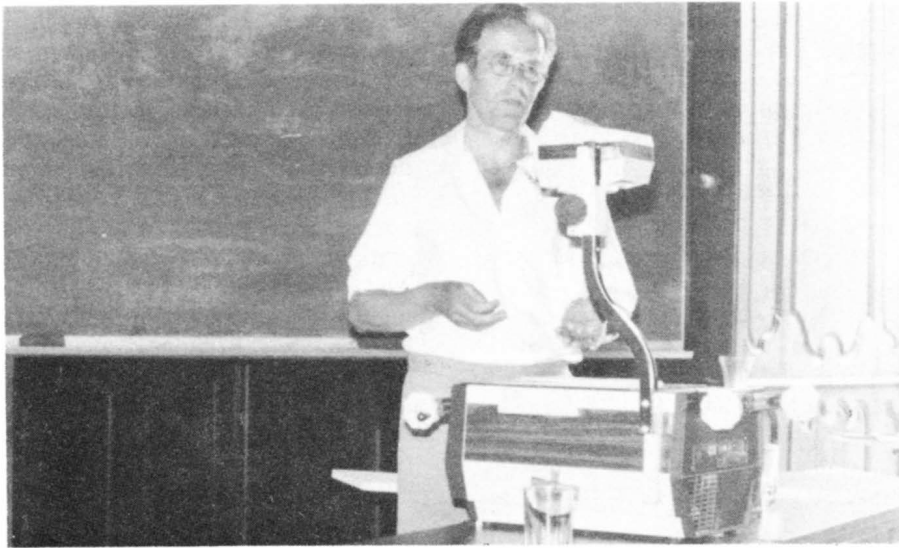
Figure 1. *B Oakley describing the Alvey programme to the conference*

Oakley described the current activities in the implementation of this programme in terms of its constituent parts, VLSI, software engineering, intelligent knowledge-based information systems, computer power and the man–machine interface.

It was the shock of realization of Japan's determination to go ahead fully in these areas through their long-term ICOT programme that led to the formation of not only the UK's Alvey Programme, but also the European ESPRIT scheme, and several USA initiatives such as the MCC and DARPA programmes for powerful networks and computers.

Tribute was paid to the enthusiasm and initiative of the Alvey team and particularly to Sir Robert Telford of GEC and Kenneth Baker, the Minister concerned, for getting the work started. This is probably the first time outside a wartime situation that the nation has cooperated in such a way over a single technical project and he expects that the programme will double research manpower in the UK within the next five years.

Although the programme he is managing is UK based, he anticipates full cooperation with ESPRIT and many other similar world-wide programmes, and that this will enhance the benefits arising from the work for the remainder of this decade.

In the USA, several 'super-computer' projects have commenced and Professor F Kuo of SRI International gave some details of these. The two principle projects are the $46M Fifth Generation Computer Project, the DARPA technology-based supercomputer project for which $40M has been allocated, and the Microelectronics Computer Technology Corporation — a joint project for ten US companies. The goals of these projects were described as leading to knowledge-based information systems, speech and natural language understanding, vision processing, parallel architecture and a supporting network hierarchy. The reward is technology leadership and market dominance and in Professor Kuo's view, we can expect to see the emergence of those presently little-known small companies who can afford to be innovative and take risks that the large organized corporations feel unable to take.

Two network projects have also been started in the USA to support these computer developments. One is USERNET, which makes use of the currently available X.25 protocol common carriers such as Telenet, Tymnet, Arpanet and satellite communication. The second is SPREAD — a project for research, access and development. This is a distributed wideband experimental facility for prototype computers and makes use of PROLOG and similar languages for its organization.

Message systems

D Steedman of Bell-Northern Canada, referred to the importance of a growing area in information technology, namely voice, video and mail traffic. In his own organization considerable use is being made of high-quality print transmission; text, digital facsimile and mixed-mode data. He claimed that message handling was one of the earliest applications for OSI and that the specifications proposed originally by IFIP have now been taken up and incorporated by CCITT in their internationally agreed standards. He stressed that message handling in IT is for people, and that suitable directory information and distribution lists must be available addressed by attributes and not by means of an identification number or code. An

French experience

An interesting insight into message handling for another large organisation, the French Societè International de Telecommunications Aeronautiques (SITA), was given by G Giraudbit. He referred to the telematics revolution which has affected many business organizations through the progressive introduction of videotex, teletext, telefax and teleconferencing, where the world-wide availability of low-cost data communications has made possible the international deployment of data networks and satellite systems. These are likely to induce lasting changes in many aspects of human activities of similar importance to the introduction of computers 30 years ago.

The problems and technical issues relating to multimedia computer-

based message systems were outlined by Professor F Kuo in an address which highlighted the issues that will dominate the next decade. These are nontrivial issues which range from new mechanisms for the distribution of multimedia mail to the design of editing tools for nontext media.

A particular problem is how to handle the linkage of message systems, perhaps across international borders. Users will find it quite inconvenient to have to refer to one another using system-oriented addresses with dissimilar formats. A framework for the design of a distributed directory system was described, which has the goal of providing ways of mapping the user naming standards to system-oriented addresses.

Satellite communications

One of the most sophisticated open networking systems available at the present time is Project Universe, an imaginative concept involving cooperation between GEC-Marconi, Logica, British Telecom, SERC,

Cambridge, Loughborough and London Universities and funded at a current level of £3M by the UK Department of Industry over 1981–84. C Adams of the Science and Engineering Research Council described the basic components of the Universe network and some of the communications experiments currently being carried out with it.

Universe is a large WAN/LAN project involving satellite communications via an orbital test satellite (OTS). Unlike many other systems described at the meeting, the Universe network is a packet-switching system which uses 'lightweight' protocols, considerably simpler than the X.25 protocols used in the interuniversity network. They enable data to be transmitted via 'virtual circuits'. These virtual circuits do not have error recovery or flow control imposed by the network. Instead it is left to the end user to arrange these management functions. An advantage claimed for this method is that widely different applications such as packet voice, slow-scan television and file transfer can be handled fairly efficiently, and

this may be important in future 'add-on' services for IT communications. The hardware for the Universe project has been engineered by the participating companies (the 3 m diameter communications dish aerial is shown in Figure 2) supported by university research. An interesting account of the low-noise satellite transmission and reception equipment was given by Professor Biglieri of Milan University. This operates at a pulse-shift keying rate of 4–8 MHz using multiplex transmission.

Services and security

Many speakers considered value-added services, such as videotex, teletext, voice and video in some detail. An important service to airline users, SITA had been described by G Giraudbit of France. His presentation concerned the SITA advanced network architecture and its implementation for the world's major airlines.

Rosner of London University discussed the progress of the UK universities packet-switching system, while J Norton of British Telecom gave an overview of services and resource management for LAN/WAN network.

Encipherment

An entire session was concerned with the recent developments in data security and integrity and the meeting was fortunate to have W Price of the National Physical Laboratory available to provide an overview of the latest methods of data encipherment in the public domain. The subject is complex, and the development of standards for this to fit into a communications context using OSI architecture needs to be not only effective but also efficient in terms of computer performance. Perhaps the most important area of encipherment at the present time is the authentication of signatures for
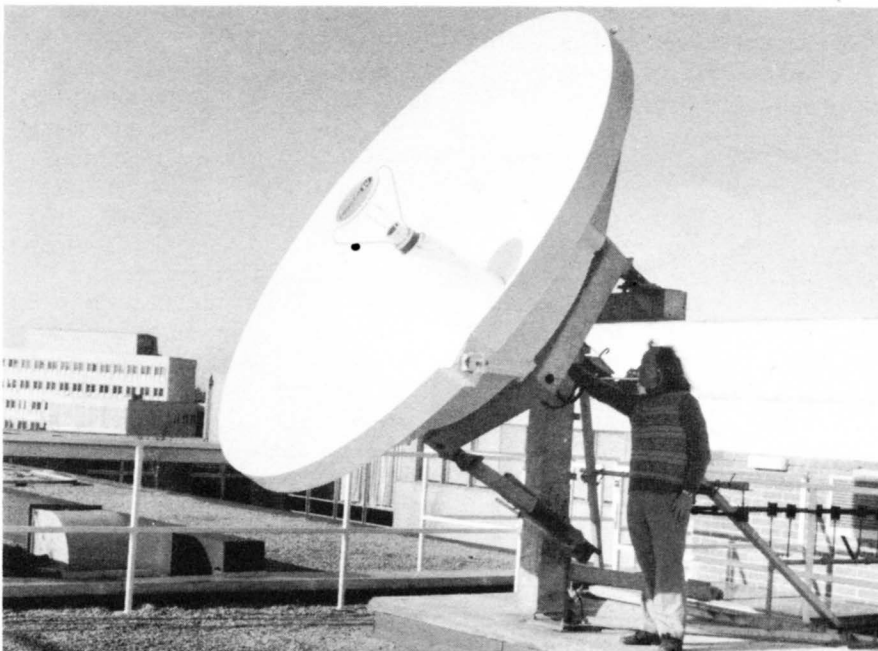

Figure 2. 3 m diameter dish aerial located at the SERC laboratory for satellite communication within project Universe

message handling. With a secret key system it is possible to produce a message authentication field which can be checked by a receiver possessing the same key as the sender. Public key cryptosystems on the other hand, offer a way of generating a signature on data to identify the sender in a reliable way.

About 65 scientists from 14 countries attended the meeting in Bonas. The full proceedings of the Advanced Study Institute are to be edited by K G Beauchamp of the University of Lancaster and are available from Springer Verlag in the FRG.

References

1   **Beauchamp K G (Ed.)** *Inter-linking of computer systems* Netherlands (1979)
2   **Beauchamp K G (Ed.)** *New advances in distributed computer systems* Netherlands (1981)
3   'Nato Advanced Study Institute' *Comput. Commun.* Vol 4 No 5 (October 1981) pp 243–245
4   *A program for advanced information technology* HMSO, UK (1982)