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ABSTRACT

The objective of this study has been to prepare a report which identifies the major issues concerning the use of computer networks, and particularly computer conferencing, in education and training. The report is divided into four sections: (1) a discussion of the major themes and issues as they apply in education, training, and community networking, including reasons for using teleconferencing, provision of hardware and software, costs and funding, organizational impact, introducing networking, and obstacles to use; (2) case studies that describe the issues in contexts such as vocational education and training in Denmark, training for the United States Armed Forces, networking in primary and secondary schools, networking in the corporate sector and the community, teachers and computer networking, technology based training, and computer conferencing in university education; (3) a complete listing of all European applications including projects in the United Kingdom, Belgium, Denmark, Finland, France, Germany, Italy, The Netherlands, Norway, and Spain with references for obtaining further details; and (4) appendices consisting of a glossary of technical terms, an overview of technological choices for learning networks, a report on computer networking in France, descriptions of nine currently used computer conferencing systems, and a 29-item bibliography. A report on the Training Agency Workshops is included as an addendum. (DB)

THE USE OF COMPUTER NETWORKS FOR EDUCATION AND TRAINING

REPORT TO THE TRAINING AGENCY 1989

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CONTENTS

OVERVIEW OF THE REPORT

The objective of this study has been to prepare a report which identifies the major issues concerning the use of computer networks in education and training. At the most basic level this has involved the investigation and compilation of activities and applications using this technology, primarily in the UK, although secondarily in Europe and North America. It has also involved discussions with a wide variety of experts in this area, and the analysis of most of the current literature in the field.

The focus of this study has been successively refined over the past 12 months to concentrate on one of the three main uses of computer networking: computer conferencing. The other two, online databases and remote-host computer based training, are discussed primarily in relation to the first.[1] The applications of computer conferencing have been most closely investigated, and the products associated with it have received the most attention.

For the purposes of this study, the terms 'education and training' have been interpreted in a very broad way to include specific training for a specific task, the education sector from primary to tertiary levels, and general access to information both by particular working groups and by members of the public.

A considerable amount of data and information has been gathered in the course of this study. In order to present this coherently to the reader, the report has been divided into a number of different sections:

- Part One - a discussion of the major themes and issues as they apply in education, training and community networking.
- Part Two - case studies which describe these issues in a particular context.
- Part Three - a complete listing of all European applications identified during the study with references for obtaining further details.
- Part Four - appendices consisting of a glossary of terms, a technological overview, a report on computer networking in France, a summary of current computer conferencing software and finally, a bibliography.

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[1] For an explanation of these and other technical terms, see the Glossary of Terms in Appendix One.

PART ONE:
ISSUES IN NETWORKING

INTRODUCTION

As a means of categorising the range and variety of applications of computer networks, and synthesising the complex issues involved in their use, the field has been grouped into three areas of concentration: use in education, in training, and in community services. These areas are not intended to be mutually exclusive, but merely to be demarcations for drawing out complex perspectives and controlling influences. The seven major issues to be discussed will each be elaborated from these three points of view. These major issues are: reasons for use, provision of hardware, networking costs and forms of funding, organisational impact, software considerations, introduction to conferencing, and finally obstacles to use. A concluding section to this part will draw out the elements of good practice derived from the discussion.

1 REASONS FOR USE

1.1 REASONS FOR USE IN EDUCATION

Although the idea that education should be interactive has a long-standing pedigree, its re-emergence in the last few years has dominated educational debate. At the same time various forces - economic, social and technological, have combined to induce a tremendous expansion in the area of distance education. Falling enrollments at campus based universities, the decline in school aged population and the increased necessity for 'life-long learning', the rising cost of full-time education, and the growth of interest in self-paced study and learner-centred approaches, have all had the effect of interesting 'place-based' institutions in the methods and technologies of distance education. At the primary and secondary levels of education, there is some recognition of the need to move from parochialism to national and international awareness, and the concept of the 'global village'.

> As the vision of 'classrooms without walls' is realized, the question of what we are educating children for, and how we are to form a consensus on this crucial issue, takes on a new urgency. Assuming even moderate success in initiating new activities, networking educators eventually are sure to be the focus of intense public scrutiny. (Dowdy, 1987)

The information technologies which rely on computer networks can be divided into two groups: those involving selective interactivity and those involving full interactivity. The databases and data banks of the first category, are constantly being enlarged and updated, so that course designers must re-think the role of print and fixed curricula in favour of individual,

personalised, self-selected course content. The selective interactivity of computer aided learning (CAL) and technology based training (TBT) offers the advantage of self-pacing and individualised learning, even though the interaction is with a machine, or more accurately with the programmer of it. The second group of technologies consists of all forms of computer-mediated communication, email, bulletin boards and conferencing, where the computer is used merely as a vehicle for the written exchanges amongst users.

Computer conferencing software was developed expressly to facilitate the interactivity of group communication, maintaining an ongoing common transcript of the interactions among the many people discussing a topic. By using computer conferencing to 'mediate' discussions, there are increased opportunities for everyone to express their ideas and to receive feedback on them from a wide variety of people, and in a format which is easily retrievable (unlike audio-conferencing).

One of the most serious drawbacks in distance education has always been the limited opportunity for dialogue and group interaction amongst individual students, and between students and tutors. The potential of computer conferencing to transform distance education has led to considerable excitement about this new medium and a variety of applications in both distance and campus based institutions (see Case Studies Nine and Ten).

> In today's and tomorrow's world, where knowledge is our most powerful resource, most educators would agree in theory, though it is certainly not carried out in practice, that passive, one-way communication of ideas, should be put aside. The emphasis on memorizing should give way to problem solving, critical thinking, creativity, and cooperative learning. (Weintraub, 1988)

The educational value of interactive communication is recognised just as keenly at the primary and secondary level. Here the problem is not lack of opportunity, but the need to expand the network of communicators outside the classroom. Second only to its potential for interactivity, is the facility computer conferencing offers for overcoming distance and time. Although most conferencing software can be used synchronously (participants logged on at the same time), its primary use and value comes in asynchronous mode (participants logging on at their convenience and reading the messages input by others at any time of the day or night). American school children can interact in this way with British children, Japanese and Australian, no matter how remote or urban the setting (see Case Study Three).

1.2 REASONS FOR USE IN TRAINING

The use of computer conferencing in company training is, as yet, very undeveloped. The benefits of interaction are frequently intangible ones, and those responsible for devising and implementing training schemes are usually constrained by very tight budgets, a high priority on proven effectiveness, and company politics, which often dictate what are the skills required by employees. More significantly, however, whilst hardware and communication networks in educational institutions are usually dedicated to the teaching function, those in the corporate sector rarely are. Any training involving a computer network must usually be squeezed in around its primary function in the business of the organisation (see Case Studies One and Eight).

Experienced users of computer conferencing in the corporate sector are generally agreed that for this medium to be an effective support technology, it must be used by the organisation to conduct work generally, not just for training or instructional exercises (Maryland Report, 1988; MetaSystems Design Group Report, 1988). As discussed later in the issue of organisational impact, implementing computer conferencing transforms not just the way meetings and training are conducted, but the whole communication structure of the organisation. Consequently it would be difficult and indeed pointless, to separate the use of computer conferencing for training from its use in the company as a whole (see Case Study Four).

Stevens, the founder of one of the major conferencing systems, Participate, writes most knowledgeably about the changing climate of the business world which lies behind its growing interest in computer networking.

> Competitiveness of the United States in global markets will improve with improvement of product development teams, of innovative new enterprises, and of industry-wide consortia. We need better theory and technology to support intra-corporate teamwork, enterprise formation, and consortia management. . . That theory should focus not only on traditional hierarchical coordination but also on new forms of cooperative work, collaboration, conflict management, and competitiveness directly. Comparisons need to be made among: teamwork organisation *internal* to organisations; enterprise formation by bringing autonomous units together *external* to any current organisation; and consortia management for *collaboration* among competitors in pre-competitive research, training, and export market-organising - - to complement traditional corporate management. (Stevens, 1989)

These ideas of how networking should be used in business are confirmed in a study of computer conferencing in American corporations commissioned by

a Japanese consortium of corporations and government agencies. The authors, MetaSystems Design Group, are specialist consultants in the design and implementation of computer networks, and they have documented applications of computer conferencing in many facets and functions of US enterprise:

> They range from communications between individuals and departments in an organization, across various functional areas of a firm and in some cases span or extend the boundaries of an organization to include communications with clients, vendors and colleagues in other corporations, research organizations or information services. (Metasystems Design Group, 1989)

If *interactivity* is the current buzz word in education, *teamwork* is probably its counterpart in business circles. The advantages of computer conferencing in promoting teamwork in business are:

- asynchronous participation means there is no need to coordinate schedules of participants
- the system provides an automatically organised and written record of the group discussions
- it allows rapid and multiple feedback to an idea from a wide sector of the company
- it can provide significant savings on travel time and expenses
- it permits discussion of multiple topics with all members of the group and private communications with particular individuals at the same time
- it supplements face-to-face meetings by airing issues, setting agendas, and following up details afterwards.

1.3 REASONS FOR USE IN THE COMMUNITY

This category identifies the growing availability of computer networking facilities for the general public. Many of these have a particular orientation, such as the databases of information for the disabled or the unemployed (see Lists 18 and 19), bulletin boards for computer enthusiasts, or for world peace promoters, and even computer conferencing for art lovers, senior citizens, or those interested in personal growth and spiritual awakening.

Apart from the specialist networks, a variety of general service providers have sprung up to meet the demand for access to networks, for database information, for purchasing software and for advice about implementing computer networks on both a technical and social level. Some of these

services market conferencing systems and back-up support some have their own host system on which organisations can buy time or space instead of going to the expense of mounting their own network. Several large networks exist in the US, and a number of smaller ones in the UK, which cater for the networking requirements of a wide variety of business, educational, and individual needs (see Lists 13, 14, 15, 23, 36 and 37). Links with Russia and open dialogues with Soviet participants give testimony to the power and scope of this direction in networking.

By far the most notable examples of community networking, however, are those districts in the US which have networked all aspects of the community - local government agencies and departments, schools, libraries, administration, police, and have adopted a policy of 'open access' by providing local terminals and encouraging the community to interact electronically (see Case Study Five). The guiding principle here is the *empowerment* of the people and the enhancement of the democratic process.

2. PROVISION OF HARDWARE

2.1 PROVISION OF HARDWARE IN EDUCATION

The hardware required to use computer networks consists, in simplified form, of a host machine where the conferencing system, CAL or TBT material and databases are resident, a network of access (either a LAN, WAN, PSS, or satellite) and either a terminal or personal computer plus modem for the participants. Educational institutions which do not already have a host computer and network can buy space on systems of other institutions or providers (see Lists 3,5,10 and 17). Many universities have their own host and in the case of the Open University, a dial-up network throughout the country (see Case Study Nine). The JANET and EARN networks provide an invaluable link between educational institutions throughout Europe. Campus 2000 provides this service for primary and secondary schools in the UK.

By far the greatest hardware problem for educational institutions is equipping users. A number of American universities expect students to arrive on campus with a personal computer and/or add a flat fee to tuition to pay for a networked campus. Plans for networking the buildings, dormitories and even the local community and industrial park, are well underway at several UK universities (see Lists 1 and 2). Online courses at various North American distance teaching institutions presuppose that the student has the necessary equipment. Concern about disadvantaging poorer or non-computer literate students has led, especially in the UK, to considerable unease about moving too quickly down this path. Furthermore, the percentage of women who opt for computer based courses is often alarmingly

low, although research indicates that once the hardware problems have been solved, women are very successful with computer conferencing. Courses which require a computer for other purposes are therefore the primary applications of computer conferencing - courses in Information Technology, in programming and in business management. A number of distance teaching institutions operate a system of study centres, which have, or relatively inexpensively could have, a communications workstation. The extent to which students are prepared to go to study centres to use communication facilities varies in different cultural traditions and the degree of remoteness of the learner. On the whole, computer networking, and especially conferencing, is much more successful when participants all have direct access to a machine, preferably in their home or workplace.

Place-based institutions have more options for equipping students, as one workstation can service quite a few students. Primary and secondary schools are usually equipped with a minimum of one computer and many have a modem as well. Apart from the many examples of school children using this hardware for communication, the most frequent non-technology based applications are with teachers - for in-service training, for practice teachers and for teacher trainees (see Case Study Six and Lists 5 and 26).

2.2 PROVISION OF HARDWARE IN TRAINING

The hardware problem in most training situations, is not with the provision of computers, but with the use of them for training. Where computers and/or the network are used for conducting the work of the company, training which relies on this hardware frequently takes a very low priority. In some instances, employees are regarded as wasting company time and resources when using the network for their own education. Even in more enlightened situations, employees often find that trying to fit their educational or training uses of the company network and equipment in and around their daily work, leads to conflict and lack of focus on study.

Nevertheless, the area of greatest expansion in the educational exploitation of computer networks is in management courses and degrees. MBAs which include an element of computer conferencing are quite common in the UK as well as abroad (see Case Study 10 and Lists 6 and 7). Courses designed around a computer network for specific clients by a training organisation or university have also been identified (see Case Study Two and Lists 30 and 35). In most of these cases, the hardware is supplied by the corporation requesting the training, though the network and host machine are often supplied by the course providers. Print is usually the primary medium for delivering the course, with the network being used for tutorial support, for electronic delivery of assignments, for discussion of course issues, for technical help, or for group project work. The networking element of the course may be as much as 75% of the course or as little as 5% or even optional.

In the use of TBT, whether a company opts to use stand-alone machines or network access to a host machine, depends on a variety of circumstances. Before the advent of the personal computer, many companies had installed mainframes and communicating terminals. Training was often 'embedded' into the hardware and TBT lessons were made available. However, stand alone TBT has become more popular as the cost of personal computers (PCs) has come down. The issues surrounding the choice between mainframe and stand alone training are complex and the 'goal posts' are continually shifting as the technology develops (see Case Study Eight and Appendix Three). For example, graphics and colour are best exploited at the present on stand alone PCs. On the other hand, up-dating, monitoring progress and managing resources are much more efficient with a host system. The quality of the network, the number of employees to be trained and their location in a distributed company, and the available hardware, also have a bearing on the choice.

2.3 PROVISION OF HARDWARE IN THE COMMUNITY

A survey carried out by Empire State University, New York in 1987 identified 2.5 million homes which had both a PC and a modem. Undoubtedly private ownership of this equipment is much lower in the UK and the rest of Europe. Nevertheless, a number of communications services aimed primarily at the general public are operating for profit in Europe, offering computer conferencing interaction, various online services and even adult education courses (see Lists 13, 14, 15 and 36).

The concept of telecottages, developed in the Scandanavian countries, is also spreading to the UK. Telecottages, or Community Teleservice Centres, exist to provide isolated village communities with access to data-processing and telecommunications services, and to computer-assisted learning. Instead of linking individual households to the network, IT facilities have been concentrated within a teleservice centre, containing telecommunications, EDP and, sometimes, video equipment which is thus at the disposal of the entire local community. The facilities available are intended to integrate a number of different business and community activities (Qvortrup, 1989). A description of the way in which this concept has been applied in the Highlands and Islands is contained in Case Study Seven.

The networked communities which are springing up in the United States are based on the concept of the public library:

> In the middle of the last century there was no such thing as the free public library. Eventually the literacy rate increased enough (and the cost of books decreased enough) that the public library became feasible. In this century, we believe we have reached the point where computer 'literacy' has increased enough (and the cost of equipment decreased

> enough) that a similar demand has formed for free, public-access, community computer systems. (T. M. Grundner, Community Telecomputing Laboratory)

Terminals to access the system are provided in public buildings, especially libraries, and obviously there is considerable encouragement in such areas for home ownership of a PC and modem. In some cases the community networking was simply an extension of the need to connect the various governmental agencies within the community for more efficient information exchange. Technically there is little difference in extending the network to the whole community, although the social and political implications are profound.

3 Costs and Funding

3.1 Costs and Funding in Education

The question of 'who should pay the bill' for the high cost of telecommunications is a hot coal which is tossed around from governments to funding agencies, to telephone companies, to institutions and finally to students. Certainly governments have invested heavily in computer literacy, and a variety of funding agencies have sponsored telecommunications programmes (see Case Study Seven and Lists 17, 22 and 34). The Annenberg Foundation and the National Science Foundation are notable examples in the US, and the Training Agency and the European Economic Community are examples in Europe. Through the PACE, COMETT and DELTA programmes, the EEC funds a wide range of computer networking projects with educational objectives (see Lists 20, 21, 22 and 23). A number of the projects funded by the Training Agency in the UK have a communications element (see Lists 1, 3, 6 and 17). Computer manufacturers have also funded educational uses of networking, both in supplying hardware and in research and development.

In some countries, the telephone company offers a discount for educational use of its network. Telephone companies also sponsor research and development of educational networking, and figure largely as co-partners in many of the projects listed in Part Three. In other instances, telephone companies seem to be the chief obstacles to progress in computer networking, having outmoded practices and regulations, outdated equipment and a general focus only on the more lucrative business market.

Individual telephone costs for using a computer network off campus are invariably borne by students. In most of North America, local calls are still free; in the UK extensive use of computer conferencing, online database searching or CAL even within the local call range can produce a sizable

quarterly charge, and these uses from *a* and *b* band ranges are for most students prohibitively expensive (see Case Study Nine). The Open University has made extensive investigation of the possibilities for providing local call access to its regional network for all students, but to date, has not found a financially viable method.

Telephone charges for computer networking can also be a significant deterrent in state primary and secondary schools in the UK. In most cases, logging on to the system is carried out only by the teacher, sometimes even out of sight of students due to the positioning of equipment.

In situations like campuses, where a Local Area Network connects all the machines, and hence there are no telephone charges, use of computer conferencing has developed in somewhat different directions. Lecturers keep 'electronic office hours', or invite questions and discussion after the lectures, or run online writing courses.

Considerable funding is now devoted to developing systems which reduce time online; these include: high speed modems, improved networks such as ISDN, 'front ends' to conferencing systems, and more integrated on and offline working. However, on packet switched systems, costs depend on data transmitted, so reductions in connect time will not significantly reduce costs.

3.2 COSTS AND FUNDING IN TRAINING

The substitution of networking for travelling is often cited in business as a cost-saving advantage of computer conferencing. Those who have considerable experience of the corporate use of computer networking find the evidence is more complex.

> We do not mean to say that teleconferencing cannot help reduce travel or eliminate certain types of undesirable travel. But there is more to it than unlocking the door to the teleconferencing room and adding up the travel savings. Teleconferencing, if it works, will change the way business communicates. Travel patterns may change but probably not predictably, and almost certainly, teleconferencing will not substitute directly for travel. Nevertheless, travel statistics are the easiest and the safest quantitative justification for acquisition of the equipment. (Johansen and Bullen, 1988).

Funding of computer networking within an organisation is also an interesting issue - should it be considered a general facility or should its use be costed to individual departments? This is how the matter was debated within Hewlett-Packard:

> As attention naturally turned to internal efficiency and cost cutting, CONFER came under increasing scrutiny. How to measure, and then

> justify, its costs, benefits, and return on investment, is a difficult problem for which we have not developed satisfying solutions. The more 'free-market' oriented managers promote the suggestion that we bill back CONFER services to its users, on some sort of participation basis, rather than continue to carry all costs centrally. A partial move in this direction is now being worked out. We didn't want to place our seedling service out to be trampled under economic pressures until its roots have been adequately established. On the other hand, if CONFER is truly like a hot-house flower that cannot survive in a free-market economic environment, might it not still be a justifiable central overhead expense based on organization-wide needs? (Fanning and Raphael, 1986)

As in the educational exploitation of computer networking, the corporate sector is discovering that conferencing is not a replacement for face-to-face meetings, mail, and telephone communication. Instead it should be seen as a powerful complement to these. But to regard computer networking as an extension of these older methods, and therefore merely an additional cost to be met, is to fall prey to the 'horseless carriage syndrome'.

> Face-to-face meetings and electronic meetings will become less and less alike as we move beyond the current 'horseless carriage' stage. It will become easier to gather the right people at meetings, to have better preparation before and during meetings, to coordinate better with decentralized sites, and to spread human expertise within the company. . .The emerging capabilities of electronic media will be used to pursue business goals in aggressive new ways, rather than to imitate the characteristics of face-to-face meetings. . . Since the physical location of employees will become less important in selecting the best person to do a given job, companies may not have to sacrifice valuable employees when a spouse's career change requires relocation. (Johansen and Bullen, 1988)

There are a variety of tangible ways in which computer conferencing has been known to provide cost advantages:

- catching problems that might otherwise go unnoticed, by the ability of staff at remote locations to connect with all parts of the organisation
- reducing equipment downtime when the repair person is at another site
- lessening duplication of effort by geographically separated sites
- reducing unproductive time while travelling
- shortening business cycles and facilitating important decisions.

The intangible benefits of a networked organisation derive from the possibility for holistic communication - the total organisation at all levels (strategic, tactical and operational) can see and act on the same information at the same time (Menzies, 1989).

3.3 COSTS AND FUNDING IN THE COMMUNITY

A number of community networking projects are publically funded, either directly by the communities which use the services or more generally by the state. Some of the Danish and Swedish telecottages are financed by public subsidies, while other Nordic examples are publically supported during an initial phase, but must become self-financing within a limited number of years.

Computer companies have sponsored initiatives in community networking, as have telephone companies (see Case Study Five). Although many of the specialist networks operate at a profit by charging for their services, others are not-for-profit or part of registered charities. Governments sponsor an increasing number of networks, either to make information more accessible to the public in the form of a database with email query service or to provide help to the disabled or the unemployed (see Lists 18, 19 and 23).

An extensive programme in one large county in the United States brought together the people of the county and the 7 community colleges, in a bid to provide equal opportunity to education for the citizens of the county - all paid for by the people:

> Maricopa's commitment to technology could not have occurred without major support from the community. On September 25, 1984, Maricopa put together, for the community's consideration, a $150 million capital development plan of which $75 million would be supported by bond funds requiring citizen support of an over-ride. The bond election was the largest ever passed in the history of community colleges in the United States. . . The district has also financed technology through the combination of certificate of participation bonds, revenue bonds, general obligation bonds, and state funding allocations from formula driven capital support. (Baltzer, undated)

4 ORGANISATIONAL IMPACT

4.1 ORGANISATIONAL IMPACT IN EDUCATION

In campus-based education, the impact of computer networking is most obvious where the whole campus is networked, and students check into vast computer halls, as once they did into libraries. Assignments can be sent electronically, and marks and feedback received much more quickly than in the traditional paper based system. Parts of a course, for example the discussion of a particular reading, can be carried on electronically, as can other supplements to the face-to-face lectures - administrative matters, access to grades, enrollment, and multiple choice exams. Entire courses can be delivered online even at campus-based institutions (see Case Study Nine).

Several universities in North America have had a computer conferencing system available on campus for over 5 years. One report analysing the organisational impact of the medium on the university describes the subtle way in which roles and expectations change - communities of interest quickly develop over controversial issues and criticism of decisions are easily voiced; technical support staff have to learn to communicate with technically illiterate students; and new pathways to management decisions can be carved out electronically. Perhaps the most significant organisational problem in campus use of computer conferencing is the need for a suitable reward system for faculty who adopt electronic teaching.

> Some faculty are experiencing discomfort with expectations placed on them to adopt technologies when the accountability procedures with their administrators do not adequately acknowledge the new form of invisible work, the time it entails, and inequities in teaching effort. (McCreary, 1989).

A number of distributed teaching institutions are linked electronically, and report that computer conferencing shapes and defines the structure of the organisation:

> CMC provides an opportunity for group discussion and decision making, implementation of new policy, technical trouble shooting and social communications amongst a group of people who work on a common task, yet meet face to face only once a year. (Anderson,1989)

The most profound organisational impacts of this medium will undoubtedly be felt in distance teaching institutions. The cost structure of these organisations is based on high investment in course development which replaces the traditional labour-intensive approach of campus based education. As long as the course is repeated over several years to a large

number of students, distance teaching can make significant savings over traditional forms of education. Whilst being an excellent medium for connecting distributed students in interactive discussion, computer conferencing is in fact highly labour intensive. Groups of 25 students to one tutor are considered manageable for tutorial support, and even fewer students if the course is delivered entirely online. With this kind of teaching requirement, the costs of distance teaching would inevitably shift from course development to course delivery, just as they are in campus-based institutions.

> This could lead to a massive change in the way resources are used by distance teaching institutions such as the British Open University. In effect, there would be a move away from the capital intensive (and costly) development of mass-produced instructional materials, which would be replaced by bought-in materials (books, offprints, etc.) acquired at a much lower cost. The savings generated could be used to teach and counsel students through CMC systems. The role of academics in distance teaching institutions, which, because of their role as writers, has been largely divorced from that of academics in conventional universities, would change again, becoming closer to the traditional role of academics in conventional universities, but with a subtle and important difference: they would be conference moderators and personal advisors, not lecturers and seminar leaders. (Rumble, 1989)

Because computer conferencing allows for much more openly structured curricula, the role of the teacher is also likely to change. The 'locus of control' may shift from the teacher and the teaching material to the processes generated by the group. However this shift does not imply that teachers will become redundant:

> The most important function of the teacher in computer-mediated distance teaching will be to keep track of the processes taking place and developing throughout a course. One very negative effect of the change in locus of control is that the sense of overview and perspective, both within the individual learner and within the group, may vanish, disappearing behind the dark of the terminal screen. The teacher will have a very important function in securing continuity in the learning process, according to the overall aims and objectives of the course. Open communication structures and open learning processes may otherwise result in confusion and disintegration. (Nipper, 1989)

4.2 ORGANISATIONAL IMPACT IN TRAINING

The effect of computer conferencing on the hierarchical structure of businesses and corporations has been noted by all evaluators in this field. The ease with which junior staff or staff in remote locations can communicate directly with those in power tends to flatten - or at least change - corporate hierarchies. A report to the US Army on the potential of computer conferencing in executive leadership development concludes that this medium is not the best tool for communications in hierarchical organisations, because of its strong tendency to subvert formal communications structures (University of Maryland, 1988). The report distinguishes between *associations*, which are groups of individuals with a common goal, and in which conferencing has been used extensively in the US, and *bureaucracies*, such as the US Army or larger commercial and governmental organisations, which are hierarchically stratified managerial employment systems where people are employed to work for a wage or salary. (The report nevertheless goes on to recommend that executive development in the Army must be pursued using this medium, as it promotes leadership through actual experience dealing with the challenges of the executive's world). Evaluation of the use of computer conferencing by Hewlett-Parkard points to the attitude of management as a significant factor in the success of the medium in the company:

> The Hewlett-Packard Company's style emphasizes arriving at decisions by consensus rather than by direction. Extraordinary concern for every individual's potential contribution, and confidence that people at all levels will make the right choices for the company once they understand the goals and the constraints, are part of a corporate culture that includes strong encouragement for 'management by wandering around.' One might expect such an outlook to provide fertile ground for computer teleconferencing, and in many respects it has; a more traditional top-down style of company could well have much less success than we have experienced. (Fanning and Raphael, 1986)

At the opposite end of the spectrum, networking carries the not unjustified fear of 'Big Brother' control over employees. LANs are capable of performing 'audit trails' which allow a supervisor to keep tabs on staff. Measuring and monitoring office workers' performance may not be part of the management philosophy, but it is still technically possible. The written record of all messages stored in a computer conferencing system can also backfire on employees (Zuboff, 1988). The case study by Zuboff of the DrugCorp implementation of computer conferencing analyses the issue of hierarchy and what she calls the 'textualization of sociality'. In the DrugCorp experience, employees used their Computer Coffee Break conference to fulfill many of the functions of face-to-face social breaks - chatting, humour,

complaints about work and a place to 'blow off steam'. When print-outs of the conference were circulated amongst managers, it became known that participation in this conference was considered a sign of 'nonproductivity' and a 'negative element' in performance evaluations. Zuboff concludes that the management did not appreciate the social and emotional needs of people to communicate, and that the conference participants did not realise the consequences of the 'textualising' power of the medium.

If the role of managers is changing with information technology, the role of support staff is changing in line with it.

> "People have to understand that the way they work changes drastically with networks. A big reorganization has to take place, especially in the relationship between work groups. Let's say there are three departmental and project relationships. Instead of having to go through a chain of command to get things done, you're in direct communication with everyone else. You check your electronic mail on your computer screen, and there is no more going through a secretary. You can probably get 20 to 40% of your people back into the job rather than doing support stuff". (quoted by Morantz, 1989)

4.3 ORGANISATIONAL IMPACT ON COMMUNITIES

It is a fact that the computerized information services remain largely in the hands of commercial vendors and their users are overwhelmingly white, male, well educated and well off. The community networking projects aim to extend these services to people of all socio-economic levels. Just as libraries and booksellers co-exist, so too can publically accessed information services and commercial information systems.

Email, voting options and computer conferencing are beginning to change political campaigns in the US, and the ease with which special interest groups can be formed electronically leads to the formation of whole new networks of people (Electronic Citizenship, 1988).

Computer networking feeds on the increasing 'privatisation' of society - the tendency of people to prefer private rather than public activities:

> The argument that lifestyles are becoming increasingly private is based on the observation that affluence and technology allow us to access many things in our homes that once were only accessible by leaving them. . .Whether it be home swimming pools or video-cassette recorders, wherever a product has enabled a previously public act to be carried out in the convenience and privacy of home (or work), that product has been a success. (Smith, 1987)

Computer conferencing is an example, *par excellence*, of a product which enables the previously public act of attending libraries, meetings or group activities to be carried out in the privacy of the home.

A number of programmes have been developed to assist small and medium sized enterprises (SME's) in a community to access the benefits of computer networking. Normally, the high cost of involvement is a significant deterrant to SME's, and offering training, access to databases and space on a host system, is seen as a way of increasing their competitive edge against larger firms (see Case Study Seven and Lists 30 and 37).

5 SOFTWARE CONSIDERATIONS

5.1 SOFTWARE CONSIDERATIONS IN EDUCATION

The syndrome identified as 'not invented here' often applies to software considerations in educational institutions. Where computer expertise exists within the organisation, there is usually a corresponding sense that the software needs to be tailor-made for its special requirements. The one conferencing system which provides the source code along with the license is CoSy, and it is no coincidence that this system is quite common in educational applications. The Open University made a number of modifications to CoSy in order to adapt it to the needs of mass distance education (for example, the facility to send a mail message to all 1300 students). Other educational institutions have developed their own systems, in some cases because of hardware incompatibilities with existing software (see Case Study Six and Lists 7 and 32). The development of 'front ends' to the major conferencing systems is certainly the most common form of personalising - providing an educational metaphor to the electronic space, as well as offline editing, windows or menus for easier access and sometimes integration of CAL material (see Case Studies Two, Four and Nine and List 37).

The growth and demand for conferencing software is such that developments frequently take place in ignorance of other research and products. Some of this 're-invention' may be inevitable in leading edge technology - it may even lead to better invention, but it is ironic that in a field which espouses the value of connectivity, there is often little of it amongst its champions.

A number of smaller educational organisations have tested the networking waters before making large scale investments. Electronic mail through the JANET network is, at the present time, free to users. Several networking applications have taken advantage of this to establish what need there might be for more elaborate software (see Case Study Six). A number of applications

within the school system also rely on the subsidised services of PRESTEL, now Campus 2000 (see Case Study Three). Other institutions rent space on a commercial system to make pilot studies and build up expertise within the organisation, before choosing and investing in their own system (see Lists 3,5 and 8). Another common option is to begin with CAL material - available to students either on disk or on the remote host, but supported by an email system for contact with a tutor (see Case Study Fight, Lists 4 and 28, and Appendix Three).

The development of software tools for easy authoring of teaching material is a major focus of research especially in America, and these tools often presuppose a networked class of students. The Thoughtbox project supported by the Training Agency and developed at the Open University, is a major example of British research in this field (Alexander and Lincoln, 1989). Another technology which is being developed for networked education is that of electronic whiteboards. Unlike computer conferencing, this medium requires synchronous access, though over any distance. Its main advantage is the ability to share graphics rather than just text, and in those cases where the computer graphics, video images and voice are transmitted through a single telephone line, the transmission cost is relatively low. The audience in every site watch the same picture, that is, they have a common screen. Anyone is able to modify the contents of the screen, and the modification will be shown on the screens at all sites. Therefore it retains the interactive capability of computer conferencing. A number of initiatives using this technology exist in the UK to link remote secondary schools and allow students to stay in their communities rather than board away from home (see List 17).

While the next generation of computer conferencing software is being developed to include much more powerful tools for group working, a number of imaginative uses of existing conferencing systems are being explored. Simulations of political conflicts are regularly used with school children role-playing different political figures (see Case Study Three), and joint online authoring of distance teaching material is being explored amongst European educators (see List 21).

The primary considerations for educational applications of computer networks are almost invariably pedagogical - how does this technology help students to learn, and the institution to create an effective teaching environment? The majority of educational organisations which have experimented with networking have concluded that computer conferencing has great pedagogical potential.

5.2 SOFTWARE CONSIDERATIONS IN TRAINING

The primary concern of corporation sector use of networks is security. The spread of computer viruses and the increase of hacking and network

vandalism are genuine concerns, but some organisations go to almost irrational lengths in keeping their conferencing activity entirely separate from their central host computer. Many firms will rent space on an external system rather than allow employees access to their own computer system.

> While security is an important issue, computer professionals continue to devise better methods of securing access and controlling other kinds of computer crime. The concern over security has probably negatively affected managers' interests in computer mediated communication as much as any other issue. The concern over security may be greater than is warranted because of its sensational treatment by the press. (University of Maryland, 1988)

Developing software to support group working is the area of greatest interest; this includes asynchronous and synchronous models (see List 11, 12 and 21). Methods of using Hypertext to give users more control over conference messages, and conferencing systems which handle graphics are just a few of the many areas of exploration. Johansen and Bullen suggest that the guiding question in this area should be:

> What might the medium allow us to do that we cannot do now? The companies that take this question seriously will be the ones that exploit its great promise. Potential users must determine their requirements, understand their needs, and design a system to suit those needs. So far the teleconferencing industry has been driven by the technology producers, which is not unusual in an infant business. Until users begin pressing for capabilities to meet their needs and wants, the industry will remain technology driven and confused about what teleconferencing is and can become. (Johansen and Bullen, 1988)

The corporate sector frequently commissions training packages from various educational providers - dedicated training organisations, universities and semi autonomous offshoots of the commissing organisation. In many cases, these providers are turning to computer networks to mount training packages for client employees (see Case Studies One, Two and Ten, Lists 5, 7, 20, 29, 30, 33, 34, 35 and Appendix Three). These most often include TBT packages accessed remotely and downloaded to a PC. In other cases they involve computer conferencing for group project work, discussion and tutorial support.

5.3 Software Considerations in Community Networking

The question of whether public databases are more accessible via a network or in a stand alone format is a complex one, and many of the same considerations apply here as with TBT. Information which needs to be updated frequently is obviously more appropriate online. Information

which is less time-dependent, may be cheaper to access on a floppy than on a network for which the user pays the dial-up charge. A database of training courses in the UK was originally available to the public through terminal access to PRESTEL. The database was switched to CD-ROM format, updated every 6 months, as this proved cheaper to operate. It also solved the problem of slow response times, which resulted in users walking away from the terminal thinking it was broken or that no courses they required were available (the TAPS project).

A new service industry of networking entrepreneurs has grown up to provide a variety of online services. The Minitel example in France has demonstrated the unexpected public interest in online group communication (see Appendix Three):

> One reason for early videotex failures was that their mass media sponsors assumed that their customers would just want to retrieve information on an individual basis; those pioneers did not provide group oriented cotechnology that we now know is most wanted. One of the earliest quasi-videotex services, which did survive, is called The Source[1] . As its name implies, it still advertises to new customers that it can be treated as 'the source' of such databases as airline schedules, stock information, and news wires, which can be searched rapidly. The Source practices an advertising policy that some might call 'bait and switch', since most of their new customers switch from accessing advertised databases to using The Source's communication services, which include electronic mail, bulletin boards, a real-time CHAT system, and PARTICIPATE computer conferencing. . . In this business, potential customers can not be expected to understand the services they themselves choose to switch to once they experience cotechnology, since cotechnology tends to run counter to individualistic mindsets that are deeply engrained in our culture and make advertisements about self-reliant searches of databases appeal more. (Stevens, 1989)

In this excerpt, Stevens identifies one of the interconnections between databases and the fully interactive software, email, bulletin boards and computer conferencing - that the former can act as a carrot to the latter.

Although a number of commercial bulletin boards and conferencing systems rely only on interaction amongst participants, the large community networking projects combine conferencing with many other online services - local library holdings, databases of government information, public domain software and other local information.

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[1] The Source has now merged with its rival, Compuserve.

6 INTRODUCING NETWORKING

6.1 INTRODUCING NETWORKING IN EDUCATION

Most early uses of computer conferencing in education relied on at least one face-to-face meeting to train students how to use the medium, and to get acquainted before communication became purely textual. Many evaluations of applications stress the importance of this meeting to the success of the medium. There is little doubt that a face-to-face meeting is highly desirable, and with enough terminals or PCs, a highly effective way of teaching students how to use a computer conferencing system. Nevertheless, many educational applications are proving successful without an initial meeting. The Open University, for instance, trains 1300 students each year to use CoSy through printed exercises and an audio tape to 'talk students through' the initial log ons. (It also provides a help-desk, where students can ring and discuss their technical difficulties.)

Despite a variety of training methods, results show that users take far longer to become competent and comfortable about inputting messages than planners anticipate. On short courses, students are often just beginning to use the system as the course finishes. This problem may fade away in time, as the medium becomes an accepted and integral part of many courses.

Electronic mail and remote databases are much easier to introduce to new users than computer conferencing, as the metaphors for using these tools are so close to postal mail and libraries or books. Nevertheless, educational networking projects using email still need careful coordination and ongoing support, otherwise communication tends to peter out (see Case Studies Three and Six).

Conferencing software usually assumes that one person will 'moderate' each conference. The moderator has the power to remove any messages in the conference, whereas participants can only remove their own messages. Moreover, the moderator is expected to organise the discussion - set out topics, initiate discussion and welcome new members. In fact, the success of a conference is very largely dependent on the skill and quality of the moderator.

> One of the most important things a moderator does is create the framework for discussion. This means setting out an interesting agenda, raising key questions, suggesting threads of discussion, and generally laying out some ideas about where the discussion can go.
>
> It is usually a good idea to think about creating a series of opening items which move from a description of the broad topic and purposes

for the conference to one or two specific suggestions for what to talk about first.

The beginning of a conference can often be stimulated by an initial question to which everyone can contribute - something which can be drawn from people's experience rather than their 'expertise'...

While creating the framework, it is important to clarify the role of the moderator and the participants for this particular topic. Sometimes the moderator is the 'teacher' for a group on a specific subject. Sometimes the moderator is a 'facilitator' and the group is expected to fill in the content. This should be made clear at the beginning. Unless it is an in-house group who know each other very well, it is helpful for the moderator to introduce him/herself ...very much the way they would if the discussion was taking place face-to-face.

Moderators should expect to put a lot of energy into the initial stages of a discussion to get it off to a good start. (Lisa Carlson, MetaSystems Design, 1986)

Much has been written about the skill of moderating, but although there are some tips which are unique to conferencing, moderating is essentially like facilitating any discussion or chairing a meeting.

6.2 INTRODUCING NETWORKING IN TRAINING

Training employees in a business context to use networking can usually be carried out face-to-face, and with the benefit of technical support and back-up. A greater problem is introducing the concept to the company in the first place. Experience shows that in almost all significant uses of computer conferencing within an organisation, a 'champion' within the company blazed the trail until the followers could make a start. Strict cost/benefit analyses rarely persuade managers to adopt this technology, but the enthusiasm and persistence of an internal advocate is usually more successful.

The principle applications of computer conferencing in business are at the project or division level, not company wide Furthermore, senior management is often not involved. Executive use of computer conferencing tends to be for communication not with those directly above or below, but with the world beyond their own organisation - especially with executives in other companies. There are examples of executives who 'access' computer networks through their secretary - many assume this is more efficient than learning to use the system themselves.

Conferences in the business sector require just as much careful moderating as those in education. The Hewlett-Packard evaluation confirms this:

When we were beginning our selection process, we talked at some length with Murray Turoff and Roxanne Hiltz of EIES about their studies of successful computer conferencing. They had found that the factor with highest correlation with the success of a conference -- so high that nothing else came close -- was *the activity level of the confe.ence leader. . .*

Of course, we were a computer/electronic instruments company, so we took with a small grain of salt the conclusions about a computer teleconferencing system which lived in the heart of Academia. Surely, the cultures of Hewlett-Packard and the New Jersey Institute of Technology (and electronic extensions) would prove sufficiently different from each other that other factors might dominate in our case!

In fact, our experience completely agrees with theirs, despite the differences in system and culture. Very soon after we began pilot operations, we began to see that we should choose Organizers carefully if we wanted CONFER to succeed. We began to *screen* prospective Organizers. (Fanning and Raphael, 1986)

6.3 INTRODUCING NETWORKING IN THE COMMUNITY

A number of promotional activities are taking place to raise the community awareness about the value of networking. These take the form of short courses, meetings, and hands-on sessions where the public can try out the system for themselves. In attempting to attract SME's, one organisation discovered that targetting specific businesses with short, focussed meetings was more successful than making general appeals. Similarly, specialist bulletin boards and conferencing systems target their advertising to reach a very specific audience. Most users of these systems are computer enthusiasts and little training is needed or given.

Moderating on public systems is usually handled by SIGs (special interest groups). An expert in the particular interest volunteers or is asked to moderate - usually in return for free time on the system. These SIGs are the unsung heroes of the public systems, sometimes devoting many hours and giving of their expertise unstintingly. There is a move in some circles to find a more remunerative way of paying SIGs, but many public systems, commercial and not-for-profit, have a fairly precarious financial position.

7 OBSTACLES TO USE

7.1 OBSTACLES TO USE IN EDUCATION

In his assessment of the status of technology in higher education in the US, McNeil concludes:

> I was struck by the fact that with a few exceptions, the use of technology in education remains minimal. The structural, attitudinal and social obstacles to technology usage endure. . . The vast majority of administrators and faculty simply have no sense of the implications or the possibilities of using technology to teach. They either have ignored it or stubbornly resisted it. (McNeil, 1988)

This kind of review is a useful antedote to glib talk of electronic education and to any tendency to regard the numerous programmes listed here as more potent or abundant than they really are.

Many institutions are reluctant to commit themselves to a system or technology which will be out of date in a few years, or will be incompatible with the market standard. However, technologies will continue to evolve:

> There is no point in time where an institution can become involved in technology with any assurance that, over time, their acquisitions too, will *not* become outmoded. (Lewis and Wall, 1988)

The attitude of teachers and faculty members is often an obstacle:

> In most institutions, there is little in the reward system to encourage faculty to become involved with technology. Neither salary increa nor credit toward promotion or tenure are generally offered or given to those who might become involved in utilizing technology either in the classroom, in research, in advising, or in distance teaching. (McNeil, 1988)

Those teachers who have become involved in computer networking are described in one report as part of a 'grassroots movement':

> The strength of the telecommunication movement in the United States, Canada and Europe lies in its grass roots support. Many educators, becoming involved with computers through word processing or programming or joining a local BBS, have had powerful learning experiences involving the computer, experiences which they wanted to share with their students. . . Anyone who has spent time in schools anywhere in the world observing students, knows that attention needs to be paid to finding ways of involving young people

> in their own learning. Some of the teachers who had these powerful computer experiences in their own homes began to develop projects which utilized computers and telecommunication in their classrooms. (Weintraub, 1988)

At this very early stage in the development of educational networking, one of the problems has been a proliferation of technology-led projects. Connecting schools via email, or accessing educational databases without strong foundations in the curriculum, can prove to be a technical hassle with very little educational benefit.

The identification of what types of teaching and learning electronic communication is best suited for, what areas of the curriculum it best serves, and how best to integrate it with other educational media - these are the kinds of questions which must be answered before networking will be adopted by a significant number of educationalists.

Perhaps the most damning comment of all about computer networking is that never has there been a technology with so much potential, which has been so elusive to capture. Certainly, evaluations of computer conferencing wax eloquent on its potential, but few overwhelming successes are reported. The obstacles to the exploitation of this medium are varied, and often not easy to pinpoint exactly. Some are speculations of the evaluators. The following list describes many of them:

- Group working is inherently difficult, and textual group interaction is particularly so.
- Computer conferencing lacks a simple conceptual model and cannot be compared directly with any other single form of communication - it combines some of the features of face-to-face meetings, of letter writing, of casual conversation, of formal colloquia, and even of letters to the editor in printed media.
- Those who lack the skills of written discourse, or are unconfident about projecting their ideas, or are not using their first language are all disadvantaged by this medium.
- Many education systems encourage students to be passive recipients of information rather than active searchers after knowledge, so that even when offered an interactive medium, they 'force' the teacher to remain in the traditional role of knowledge provider.
- Learning through interaction, through dialogue does not have the kind of tangible outcomes that rote learning and other forms of information exchange deliver.

- Computer conferencing is frequently a time-consuming, inefficient and labour intensive way of learning, and is highly dependent on the quality of input from the other participants.

7.2 Obstacles to Use in Training

Just as the educational use of networking must be integrated with the other elements of a course, so the training uses of networking must be an integral part of the rest of the employees' working environment. Networked training is best integrated when it is used to train employees how to use the services which the company already has online (see Case Study Four). Computer conferencing systems are designed with the assumption that users will access from any kind of PC or terminal. Consequently, only text using ASCII code can be transmitted and stored. When identical machines are networked together, however, graphics and colour as well as text can be transmitted and stored. This kind of working environment has a real place in business life and hence in training. When computer conferencing reaches this sophistication, many obstacles to its use will be removed. One expert in the field predicts, however, that computer conferencing as such, will not survive technological development - but the way of working it has pioneered, 'store and forward communication', will form the backbone of the technologies of the future.

The results of several American surveys of Fortune 500 companies report that perhaps less than 5% of large industrial organisations are currently using computer conferencing for any purpose.

> Even if this estimate is considerably off the mark, the clear conclusion is that ACC [computer conferencing] is not widely known or used in leading private sector organizations. And it must be stressed that this is so even though computer conferencing has been available as a communications technology for nearly twenty years, and even though computer and communications technologies have been among the most impressive growth industries of that same twenty years. (University of Maryland, 1988)

The authors of the Maryland report offer a number of hypotheses to explain the lack of penetration of this medium: lack of familiarity with the group communication applications of computers, and lack of understanding of the distinctive benefits of computer conferencing over the more familiar ones of electronic mail.

The rapid pace of technological change and, increasingly, the complexity associated with combining technologies, makes the choice of hardware and training systems daunting. Even if money were no object, it would still be difficult to make intelligent decisions about what paths to go down.

Incompatibility and lack of industry-wide standards constitutes perhaps the greatest technical obstacle. The advent of ISDN over the horizon appears only to exacerbate the problem, as incompatible versions seem inevitable.

The one point of agreement seems to be that networking can only expand, and one way or another become pervasive in business. For this reason, the corporate sector, and those responsible for training, can neither ignore it nor avoid it.

7.3 Obstacles to Use in the Community

Techno-phobia, and particularly computer-phobia, is apparent in education and business, but is probably stronger in the public at large. In addition, the belief that the computer, like television, is an opiate which robs us of our humanity, downgrades our emotional life, and leads to lack of imagination and personal relationships, is not uncommon in certain sectors of the population. Publicity given to computer freaks and indeed, conferencing adicts, confirms and strengthens this attitude.

At the other end of the spectrum, lack of access, lack of resources to initiate bold schemes and lack of perceived need by the general public are the chief obstacles to the widespread growth of computer networking. Funding and support by government or government agencies are necessary for putting in place the kinds of structures necessary for significant growth to occur. Furthermore, large scale networking requires a clear vision of the future to co-ordinate the various partners involved - the telephone company, hardware and software manufacturers, value-added service providers, and so on.

Summary of Elements of Good Practice

Several American reports containing case studies of public school uses of computer networks conclude that the justification for investing in this technology is that it allows students and teachers to work in ways that are not otherwise possible (Weintraub, 1988; Dowdy, 1987). In short, the best uses of educational networking do not replicate other technologies or ways of learning - they provide new kinds of educational benefits. The Dowdy report goes through the curriculum in detail pointing out the areas in which computer networking has already made a significant contribution.

As we have seen, the same conclusions apply to networking in the corporate sector - the introduction of networking changes the way business is conducted; it does not simply substitute for other forms of communication. Using a network to access databases or TBT is fine as far as it goes, but the best

training practices use the network to improve the networking aspect of the company.

We can only begin to imagine the implications of fully networked communities, as the few examples are in their infancy. Indications are that offering a variety of services provides a solid user base. A comparison between two companies marketing conferencing software shows that the one which offers communication expertise in addition to technical support, is flourishing, while the other which spent large sums on marketing the product has not survived.

> In evaluating the past two years of CONFER activity, we have noticed that the serious problems have rarely been technical ones. Apart from the initial access hurdles we experienced, the true issues have been personal, sociological, and political.
>
> This is probably not surprising when dealing with a medium for interactive communication among bright and lively human beings. (Fanning and Raphael, 1986)

Across the diversity of conferencing uses for education and training, three conditions are generally acknowleged to be vital for successful outcomes:

- Access must be easy (at home or on each participant's desk). Proper training must be given and support should be available either through a help line or by a simple interface.
- The purpose for using the system must be made very clear. The task should be well defined and well integrated into a course or made part of working practice.
- The organiser or moderator of the discussion must direct the interaction so that useful discussion ensues. [1]

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[1] These three principles were first elucidated by Lisa Carlson, MetaSystems Design Group, Washington.

PART TWO:
CASE STUDIES

CASE STUDY ONE: OPEN LEARNING IN VOCATIONAL EDUCATION AND TRAINING IN DENMARK[1]

The concept of learning as a socially mediated process has always been a fundamental principle in Danish education. Traditional distance learning with its fixed, printed materials and lack of two-way interaction, has never been popular in Denmark. The advent of computer networking has therefore been the means by which the country could expand its distance teaching whilst remaining true to its cultural traditions.

A variety of network media have been investigated:

- real time communication (slow scan TV, electronic blackboards)
- asynchronous communication (computer conferencing)
- storage of information (hypertext systems, interactive video database systems)

The aim is to provide localised and tailored courses for a specific client, to integrate work, education and organisational development, and to offer a high degree of interactivity and fast feedback from learning process to course production.

Three courses are described in detail:

1.1 FOOD, ENVIRONMENT AND NEW HEALTH STRATEGIES

This course was developed and implemented as a cross-institutional venture between Aarhus University and Aarhus Technical College, and was funded by the Danish Ministry of Interior and the Ministry of Education.

The main concept behind the course was that different groups of professionals working within the primary health sector and related areas, could get their knowledge updated through exchange and discussion of professional experience with geographically dispersed colleagues working in related fields. The teachers of the course functioned as consultants rather than as traditional tutors. The course had an 'open curriculum' structure with projects and sub-themes being defined by the participants in the initial phase through the guidance and support of the teachers.

[1] This study is based on a report specially commissioned for the project and written by Mette Ringsted and Hanne Shapiro.

The course was actually planned via the conferencing system PortaCOM, as the project group was physically dispersed and had different working schedules. A number of significant requirements were agreed:

- a prior formal training within primary health service or education and training
- easy access to a PC either at home or at work
- an agreement with the employer about participation, including the finding of a substitute corresponding to the length of the course
- maximum geographical dispersion, preferably one participant per workplace
- some computer experience on an end-user level.

One month before the start of the course participants received modems, cables, and a self-installing communication software package with an easy 'front end'. In addition, introductory material with exercises using the basic commands was designed especially for the course.

At the first week-end seminar the structure of the course was presented and participants learned to up and download material. Groups of four students were formed and began to formulate their projects. When the final seminar was held, several participants had already initiated local activities based on what had happened within the course.

Technical Evaluation

Attitudes of participants often caused unnecessary difficulties - fear of 'destroying things' online, blaming system problems on themselves, and lack of an experimenting, problem solving approach to difficulties.

It was obvious that the initial start up phase must be made as simple as possible for the naive user. Access to the system should not be a goal in itself, but merely a tool to support the learning activity. The positive elements of this design were:

- the use of identical modems and software for all participants, so that problems could be easily identified
- technical guidance material written in a non-technical way
- a two-phase organisation, whereby during the first phase participants only concentrated on learning to use the system, and during the second, on the actual course material
- an extended help desk service able to solve typical novice user problems.

Organisational Considerations

Earlier experiences in the Center for Distance Education had proved that it is a crucial factor that organisational barriers are recognised and overcome if open learning activities are to function as an integrated part of a working situation, whether the participants actually are students within job hours or are home-based.

Within this course the solution was a 'learner contract' with the participants' individual employers. Employers had to sign a contract guaranteeing that the participants had free access to the necessary equipment and that the students' working hours would be covered by a substitute. Nevertheless, there were still problems:

- lack of family support when working activities appeared in the home
- substitution hours ended up, for some participants, as payment for overtime
- too short and interrupted study hours because of pressure at work
- lack of study facilities at work
- difficult access to hardware during working hours
- problems with access to external telephone lines.

Pedagogical Considerations

In this course where computer conferencing was the dominant medium, and where users and teachers had no previous experience with this form of communication the following problems were experienced:

- Sometimes it was difficult to perceive and signal consensus as to when one task was accomplished and another was to begin. In the beginning discussions would easily go in circles or even stop if someone didn't take charge of moving on according to the group plan. Because of fear of being regarded as too dominant by the peer-group, the individual participants would rather let the discussions and work phases draw out longer than they would normally find acceptable. In groups where the teacher took on an active moderator role, this problem didn't arise.
- Participants often made excessive use of email for purposes that were of general interest because of reticence about 'speaking' in front of the whole group.
- Especially in a flat system like PortaCOM as opposed to hierarchical systems like EIES it can be difficult to create a proper conference design. It is not possible to create branches or sub-conferences, so one easily ends up creating too many conferences. This makes it difficult for participants to

have a total overview of the course, and to easily identify which conference serves which purpose.

- A restrictive moderator who moves or removes somewhat inappropriate messages in the initial stages, can turn first time users from active participants into lurkers.
- It is important to establish a consensus between the participants and the teachers as to the frequency, degree, and norms of activity on the system. This must be textualised throughout the course. If not, it becomes very difficult to maintain continuity in the group processes. At worst they might even stop, for example when participants wait for a long period for everybody to comment or to agree, or when signals are misinterpreted. Lack of activity is read differently by different participants - drop out from the course, lack of interest, or serious disagreement with the rest of the group.
- The evaluation material very clearly showed that the groups that were most successful with their projects and expressed the highest degree of satisfaction with the course were those where the teachers took on a direct, warm and humorous moderator role in the initial phase of the project.
- Though the course was built on a simple media mix - computer conferencing, printed material, access to one external database, and some face-to-face meetings, this type of course structure seems viable to meet the growing need for continuous education and training in the public sector. Both for social and economic reasons this need cannot be met through traditional courses alone.
- Many of the participants found the course more relevant than traditional courses because they were forced to be responsible for their own learning processes and because the textual character of the medium forced them to be precise in their formulation of projects, hypotheses, and questions to the other participants. As such it became clearer to them what they knew, and what they would like to learn.

1.2 COMPUTER AIDED DESIGN

This project was also a cross institutional venture between Jutland Telephone, Aarhus Technical College and B&O, an electronic enterprise in Denmark. The aim of the project was to create an interactive communication and learning environment, constituted as an ordinary classroom but localised in an electronic network. This 'virtual classroom' included not only computer conferencing, but a multi-media environment consisting of:

- a 2 Megabyte net plus the telephone net
- a picture phone for real time communication, consisting of a slow scan TV and sound based on the 2 Megabyte channel

- a PC connected to a computer conferencing facility, a database with video desk access, a menu structured course guide with exercises and access to the video desk and word processing facilities
- a stand alone PC for CAD exercises.

The course was organised as on-the-job training for skilled workers, middle level managers, technicians, and engineers. The course was organised to support lectures, classroom education, group work and self study in a variety of methods from project and problem oriented learning to skill acquisition. In addition to upgrading the qualifications of the participants, the project aimed to test new pedagogical strategies based on interactive technologies.

This project demonstrated how little is known about the educational potential of each media - which media are best suited to which type of task performance and content, and about how different types of media interact.

1.3 PLASTIC CONSTRUCTION: DESIGN, TOOLS AND PRODUCTION

This course is an example of continuous vocational education using computer-mediated communication. The course was originally a two day intensive face-to-face course that was converted to a two-month on-the-job distance education training course.

The development of the course was a cross institutional venture between Danish Engineers' Center for Posteducation, Danish Center for Computing and Research, and Center for Distance Education at Aarhus Technical College. The course was organised with study groups at the individual plastic construction companies. The participants met at their work place and went through the course modules together. The local study groups worked through the various assignments together, and discussed and exchanged ideas on solutions through PortaCom with the three other study groups throughout Denmark. The course was tailored to the participants' actual work situation by a close cooperation with the departments of training in the enterprises concerned.

Evaluation

One of the groups hardly used the oonferencing system. The participants found it slow and tedious working with one finger typing skills. Furthermore, they lacked the graphical possibilities which form an integrated part of their usual way of communication. In two of the groups there was a high degree of activity, especially within the group where the participants were located in different departments of the enterprise. They felt they had learned not only the course content, but had come to understand the tasks and problems in other departments of the enterprise.

Nevertheless, the communication between the groups at the different enterprises didn't function optimally. This was due to a number of factors:

- lack of familiarity with the conferencing system
- too short a course to justify learning to use the system
- lack of structure in the course itself.

CASE STUDY TWO: ALLEN CORPORATION: TRAINING COURSES FOR THE US ARMED FORCES[1]

The Allen Division of CAE-Link Corporation ('Allen') has its headquarters in Alexandria, Virginia and field offices in 40 other locations. It has over 600 employees and $30 million in revenue. Allen h - long been a leader in the field of TBT applications and has recently - ended this capability by integrating the latest videodisk WORM te- -gy into TBT equipment. Allen has also integrated AI and expert system technology into an intelligent computer-a sisted Instructional system for the US Air Force - to train avionics technicians in diagnostic trouble shooting.

In addition to using computer conferencing as a mechani m to solve distributed training problems, Allen is presently applying digitised video teleconferencing technology as a cost–saving training measure. This work has been undertaken for the US Navy in upgrade training for crews returning from the Persian Gulf.

Allen have completed three years of cost-development and research of engineering training and have delivered training courses on highly technical subjects for US Army reserve officers. As part of the effort about 30 officers in the Engineering Corps had completed the US Army Engineer Advance Course using only a computer network. The Advance Course is required for officers of the rank of Captain to further their professionalism and in order to advance to the next rank. This course was conducted on a timesharing basis using Confer II computer conferencing software offered by The University of Michigan. Allen leased space and paid hourly connect charges to conduct this project.

Peter Tuddenham is a Systems Research Scientist with Allen where he has been responsible for promoting the use of online computer networks. Following the initial work with the Confer systems he saw the potential for cost savings and control that an in-house system offered. He also recognised the added value that would accrue to Allen in operating its own host system. This was particularly timely since they had developed, during the work with the Army Advanced Course, a body of people with experience and expertise in delivering online training.

Allen purchased the Caucus conferencing system, which bears a strong resemblance to Confer II, and mounted it on a DEC VAX 750 in December 1987. This system was christened AllenNet and, most importantly, the President of Allen Corporation was one of the first to sign on. The system

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[1] This case study was written by John Coll of X-On Software, as part of a report commissioned for the project.

can be accessed both via dial-up, including a toll-free 800 telephone number, and throughout the Continental United States via the Compuserve network.

Caucus accounts were issued by Allen Corporation when requested whilst two separate articles were written for corporate magazines. Over half of the accounts on the AllenNet system are for internal use.

"One impact has been to draw together people who have felt remote and unconnected," comments Tuddenham. For example one key component in Allen's training projects relates to Aviation Training. The Caucus network has pulled together the individuals who are working on the project even though they are geographically located hundreds, even thousands, of miles apart.

Internal Application Areas:

- NewsNet was established as a central conference, to make corporate news available and to be used as a central meeting space for all users.
- The DirectNet conference is used by Directors as a private conference.
- ExecNet serves a project on Executive Development and Technological Scanning.
- CADMTS is a user-support and training conference for a CAD product developed within Allen Corporation.
- Six or more project management applications are also supported.

Externally the network is being used for project management and training with clients.

The Federal Training Excellence Network (FTEN) was begun in 1985 primarily, but not exclusively, for federal training managers in the Washington DC area. Allen corporation agreed to provide host facilities to FTEN as they saw an opportunity to build even closer links with key people in one of Allen's main areas of activity - they are contractors to the US Government's Office of Personnel Management. The Federal Training Excellence Network was inaugurated to improve the practice of Human Resource Development and Training. The FTEN provided a rich opportunity for this work since it is a true network, made up of training professionals in many different government agencies, and outside of government, who are dedicated to the pursuit of excellence in training. When FTEN was started in 1985 some of its members were familiar with computer conferencing and the transfer to a properly maintained and supported system was attractive.

The FTEN conference was started in March 1988 with the Chief of Management and Support Development of the Defense Communications Agency and a senior member of the National Institute of Health as

coordinators. The support of these organisations and people ensured that the system would develop a cooperative framework which would encourage others working in the area to participate.

The system has been very active with about 50 members. In approximately 9 months, 33 discussions items have been entered with the majority generating 10 and 20 responses, though some have generated over 100 responses to date. This shows a strong level of participation.

The Distance Training and Education Network (DTEN) provides a similar base for those involved in distance training.

The Masters Degree program in Instructional Technology for Military Trainers

There are two major objectives of this program: to reformat traditional classroom instructional materials so that it can be distributed to a non-resident student population and to prepare and conduct training for instructors and students on the use of computer conferencing as a medium for managing a Masters Degree program for non-resident students.

The Army National Guard has a need for members to have advanced degrees in the area of Informational Technology. Boise State University offers a suitable Master's Degree.

Boise State University and Allen have worked together so that Boise are about to offer their course over the networks using computer conferencing.

Command and General Staff College Reserve Study

The College's School of Corresponding Studies (SOCS) currently delivers training to non-resident students in two different ways. One is through a correspondence source program and the other is through the US Army Reserve Forces School's Programme. Together these two ship over 600 tons of printed materials a year. The Allen project is to develop a plan to introduce various training technologies aimed at reducing the quantity of print material.

Computer conferencing is seen as a major contributor in that it has the potential to solve many of the deficiencies currently experienced, particularly in the area of feedback, currency of instructional materials and instructor quality.

The plans developed here will be tested on active Army, Army Reserve and National Guard officers.

CASE STUDY THREE: NETWORKING IN PRIMARY AND SECONDARY SCHOOLS

The following examples of school networking are choosen to show a range of applications - regional, national and international, and a variety of uses of the medium - in various subjects, and degrees of complexity. For further examples in the US the reader should consult two excellent reports: Dowdy, 1987 and Weintraub, 1988.

3.1 UK/USA COMMUNICATIONS PROJECT[1]

During 1986-7, teachers in 5 secondary and 3 primary schools in Cambridgeshire used email with their pupils as a means to open curriculum links with the USA. Initial ideas included:

- collaborative story writing over a distance, with groups in 3 secondary schools writing first installments to be passed on to groups in other schools for "middles" and "endings"
- communications between a mysterious Mary Tudor (played by secondary pupils) and children in a primary school engaged in the 'Mary Rose' project.

It soon became clear that to use email in this way required teachers to engage in joint lesson planning of a quite detailed kind. Locally, it was possible to arrange regular meetings but further afield, email itself became the link and it proved ineffective in enabling the necessary creative interaction. Extended time lapses before any communication came back, and different conceptions of the aims of the work caused difficulties.

> In effect, successful use of email, fully integrated into the curriculum for two classes in different schools, necessitates team-teaching over a distance. (Somekh, 1987)

Somekh concludes that classrooms are not structured around the notion of communicating interactively with others. They are more like closed boxes, so that communication with other closed boxes is a complex business requiring extensive planning between teachers.

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[1] This report is taken from 2 articles by Bridget Somekh, University of East Anglia: Somekh, 1987 and 1989.

3.2 NATIONAL COUNCIL FOR EDUCATIONAL TECHNOLOGY: COMMUNICATIONS COLLABORATIVE PROJECT

Ros Keep is the National Coordinator for this project and editor of *Communique*, a journal which updates participants on the networking activities of the project. This journal is the best source of information on UK schools involved in networking.

Derbyshire Live Adventuring[1]

The project involved a GCSE English class writing a fantasy adventure game and sending it via Campus 2000 email system to 4 junior schools. The children wrote back with their comments on the story on a daily basis, and became completely involved with the adventure.

The authors divided into smaller groups to devise problems, puzzles, characters and life histories. Computers had to be mastered, punctuation and spelling had to be checked, and once the messages had been created, pupils had to ensure the messages were typed on disk correctly and sent to the right schools. The Campus 2000 system had to be loaded and used accurately, the messages sent out and any incoming mail dealt with, ready for the next lesson. A log was kept of what messages had been sent and received, and the time spent online had to be recorded.

The benefits of such a project stretch far beyond learning English and computer skills. The pupils were expected to work on their own for much of the time. It was their decision-making that created the messages sent to the junior schools. They were responsible for the appropriateness of the message and any effect on the children of the junior schools. A sense of sharing, a sense of community and a sense of group and individual responsibility was very quickly realised.

The English class were invited to visit the junior schools and were shocked to see the enormous amount of work that had been created around their email story - poetry, art, language work, science and maths. This added to their sense of achievement.

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[1] This description is taken from the secondary teacher, Jacky Williams' report on the project in *Communique*, July 1989.

3.3 THE INTERCULTURAL LEARNING NETWORK[1]

Faculty at the University of Illinois, the University of California, Aoyama Gakuin Women's University, Tokyo, and Hebrew University, Jerusalem, have collaborated to develop personal computer-based activities in which geographic distance and cultural differences become useful devices to focus student interest. International networking provides depth to the study of the natural and social sciences and scope to the development of written communication skills.

Using public dial-up satellite links (Telenet) and a commercial information utility (The Source) to pass email messages, the Inter-cultural Network has linked classrooms in four states and three foreign countries. Students in upper elementary, middle and high schools work together on projects in which they compare observations of the different ways that local people handle problems and organise activities that are common around the world.

For example, a set of sites in Israel, Japan, Mexico, Alaska, California, Connecticut and Hawaii were selected because each had problems with local water supplies. Students collected information on how their localities obtained, purified, stored and distributed water. Students noted the similarities and differences in how water resources were handled from the shared descriptions. They used email to ask questions and obtain details on specific procedures at different sites. Then students wrote and shared reports on whether and how their localities might adopt some of the solutions that distant places used to deal with water supplies. One school in California invited in a local municipal official and quizzed him quite sharply on how and why particular ideas were or were not used.

The Intercultural Network is stimulating a number of exciting lines of inquiry and innovative ideas. Researchers are experimenting with activities in which students may design, implement, and report their work on a continuing basis. Tele-science fairs, computer newswires, and electronic science journals are some examples of the types of forums that students may participate in, developing and sharpening their skills in observing human and natural events, in writing articles and responses, and in cooperating and competing in world-wide contexts. Teachers, both in elementary and secondary classrooms and in colleges and universities, may use these activities as a focus for hands-on involvement in the processes of learning and sharing knowledge. Practical and familiar phenomena serve as the focal subjects of activity. For example, projects are planned or in progress on such activities as:

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[1] This study is reported in Dowdy, 1987.

- comparing the boiling point of water at different sites, asking students to hypothesize explanations for differences, such as altitude or water purity
- comparing local severe weather phenomena and indications to watch for in different locations
- comparing eating preferences and the reasons for these habits among people in different cultures
- comparing pollution problems and solutions in different settings.

Organisers hope that these computer networking projects may be used to teach the basic techniques of science and th attitudes of scientists toward natural phenomena. They may also encourage an appreciation of the differences among people. Networking can also show both children and adults the difficulty of basic human problems and the need for and value of active participation in community affairs.

One organiser estimates that the cost to a school -- one which already has a computer and modem -- for active and continual involvement in a system such as this may be as little as $50 per month, which includes the price of an account with an information utility such as The Source, and the supplies needed to involve one or more classrooms in a set of projects. Telecommunications charges are kept low by using a dial-up network with a local node and communicating when the rates are cheap, at night or on weekends. Messages are sent and received in batches at the convenience of users.

3.4 INTERACTIVE COMMUNICATION SIMULATIONS[1]

One of the most interesting projects involving telecommunications is the ICS programme, Interactive Communication Simulations, started at the University of Michigan's School of Education 5 years ago. Over 200 schools have been involved with their computer-mediated exercises for secondary and primary school students in 18 different states and 5 countries.

During the first four years the only simulation offered was on the Arab-Israeli conflict. In 1987, two others were added, one on the US Constitution, and another called Environmental Decisions Simulation.

Each simulation runs for three months of about one class period per school day. The three months are broken down into four phases:

- three weeks of preparatory activities, including team assignments, role development and technical mastery

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[1] This report is taken from Weintraub, 1988, and from the University of Michigan's School of Education information package written by Professor Howard Zinn.

- one week exploring the role, developing an agenda and learning to master the simulation environment
- five weeks for developing and pursuing individual and group goals and taking advantage of all the options available in the simulation
- three weeks for 'debriefing' during which time those involved reflect on the various decisions made, the consequences of those decisions and other choices available to them.

The purpose of the simulations are:

- to engage in a high level of critical thinking
- to achieve understanding of the dynamics of political affairs, history and mathematics of science
- to learn to look at problems from different perspectives
- to develop a variety of research skills as well as insight into the research process
- to create opportunities to practice the writing of clear, forceful and effective prose
- to have the opportunity to make important decisions and experience the consequences of the choices.

The University of Michigan provides the schools with extensive resource materials in the form of notebooks, human assistance such as online help and workshops. Furthermore, as involvement grows, the network of experienced 'neighbors' who can help grows as well. Each group that works through a simulation becomes a resource, both technical and substantive, for new groups. Research shows that slightly more experienced learners teaching new learners has important educational and social value for both groups.

The simulations of ICS are different from the usual computer simulation in that individual Team Facilitators at each school and the Control Group at the University organise the exercises. In the usual computer-based simulation a predetermined computer program does the organising and controls the game parameters. The Control Group is made up of University of Michigan faculty, graduate and undergraduate students. Together with the Team Facilitators, they are responsible for organising and trouble-shooting the exercises, as well as facilitating and stimulating the widest possible level of participation. This group controls appropriate degrees of reality and accuracy, using sophisticated software when applicable.

One of the main goals of the Team Facilitators, who are not expected to be either computer experts or subject matter experts, is to work with their teams to stimulate reflective participation. They do this by utilising a form of 'Socratic questioning' and most of their energy is given to encouraging participants to think carefully and creatively.

Stimulating critical and creative thinking and using collaboration in a simulated though clearly functional environment in which the consequences of action can be measured and discussed -- this is a project which provides many opportunities for meaningful learning.

CASE STUDY FOUR: COMPUTER NETWORKING IN THE CORPORATE SECTOR

The following examples of networking in business give an indication of the range of possible uses in national and international settings.

4.1 SHELL EXPRO[1]

Shell UK Exploration and Production (Shell Expro) is the part of Shell UK which discovers and produces oil from the North Sea. Eleven production platforms and 4,500 staff are controlled from the operations base in Aberdeen. Half of Expro staff are users of their office automation system, ALL-IN-1. Staff who are mobile can access their electronic 'in' trays, shared and personal files, shared diaries and working documents anywhere - even in a hotel room or at home using portable terminals.

Continuous improvements to ALL-IN-1 facilities and interfaces is made, and in 1987 the most important new facility offered to office system users was introduced: VAXnotes computer conferencing system. This system was chosen because of its advanced features and because of the company's strong commitment to ALL-IN-1. A close interface has been established between VAXnotes and the Expro office system. By linking VAXnotes via an ALL-IN-1 script file any ALL-IN-1 user may enter VAXnotes easily and effectively by typing "NOTES". Similarly by a single keystroke, return to ALL-IN-1 is achieved. This close interface to ALL-IN-1 has proved vitally important and has increased the effectiveness of Expro's use of computer conferencing.

Having successfully set up the software and started several trial conferences, it quickly became apparent that the acceptance of the system was not as high as had been hoped. The conferences were dominated by contributions from Information and Computing staff, and although a few successful conferences existed these were mainly on computer oriented topics. The main hurdle to be overcome was that the main user departments did not realise the potential benefits of conferencing as they didn't realise the potential applications.

It became obvious that what was needed was some sort of Public Relations exercise to explain the potential benefits. A number of initiatives were tried: open days in both Aberdeen and London, online adverts on the ALL-IN-1 system, surveys to find out what users wanted and finally canvassing. The most successful idea however, was the creation of a public conference to act as a model and demonstrate the communications potential and business

[1] The information on this application was gathered from Alastair Menzies, the 'advocate' of computer conferencing in Shell Expro, Aberdeen.

benefits of conferencing. The subject of the discussion was the usefulness of computer conferencing in the business environment. This conference was international, with moderators from Scotland, Canada, England and the Netherlands each looking after a topic within the conference. A non-specialist approach to the topics for discussion was deliberately adopted in order to appeal to new participants. It also had the effect of turning users who had previously been readers into contributors.

This conference was successful beyond all expectations, achieving a very high level of response - over 500 notes in 5 months, with 400 participants of which 100 were contributors. As a direct result over 50 private conferences were begun in business areas, and the conference played an important part in achieving management acceptance for the system within Expro.

The VAXnotes system was justified with Expro on hard cost savings on travel, accommodation and time out of the office. Additionally, conferencing is expected to achieve intangible benefits such as improved communications, more holistic communication within the organisation, and savings in duplication of effort through improved communications.

Computer conferencing now makes a big impact in many areas of Expro's business, with around 90 conferences and many 'successes'. Expro are investigating the possibility of using their system for formal training of staff.

4.2 ALITALIA[1]

Alitalia has traditionally carried out its training of internal staff (in ticket offices, reservations offices and cargo handling offices) as well as its external clients (travel agents, freight agents, handling agents, and some school and university students) through face-to-face training at its headquarters in Rome, or to a lesser extent, at other sites (eg. New York). During the last few years the cost of running such programmes has escalated, and consequently a three-point programme was introduced in 1983 to reduce costs and improve training efficiency. The three elements of this programme are:

- The preparation of self-study packages in print and video, which trainees are required to work through before coming on face-to-face courses. This has permitted significant reductions in the length of meetings and hence in accommodation and subsistence costs.
- From 1985, the company has begun to use its world-wide computer network for training of sales and reservations staff in new procedures. This innovation followed on from the joint introduction of an entirely new reservations system by Swiss Air and Alitalia, which required the

[1] This material was prepared for the report by Tony Kaye.

immediate re-training of over 6000 Alitalia staff all over the world. The training is provided by simulation material on Alitalia's mainframes (UTS: Universal Training Simulator). This facility is used for specific on-the-job training prior to the introduction of new reservations, billing and ticketing procedures which require staff to use the terminals. There are plans to complement this training with real-time messaging support (this is an existing feature of the computer system), although there are no plans for incorporating email or conferencing support. The UTS system does not keep a record of any individual trainee's progress, as the individuals are not identified. Courseware for the UTS application is developed by the Training Department's staff, using a simple authoring language. Costs of UTS courseware development are very low. UTS training material is available on the system in Italian and English, and is accompanied by printed study manuals.

- CAL material on disks, with accompanying print materials, is sent out to specific groups of staff for training in languages, or in procedures such as loading and balancing aircraft prior to take-off. Most Alitalia agencies have at least one PC, but those without are lent a machine by the Training Department. The development of this CAL material is a far more expensive operation than the UTS material.

Since these innovations were introduced, there has been a 70% reduction in the costs of running face-to-face training courses, because of the reduction in training days (from 14,428 in 1983 to 6,000 in 1988). However, some staff are complaining about missing out on all-expenses-paid trips to Rome and New York!

CASE STUDY FIVE: COMMUNITY NETWORKING

The 2 examples of community networking described here are both American - no examples or even plans for such a venture have been identified in the UK.

5.1 SANTA MONICA, CALIFORNIA

Santa Monica considers itself a pioneer in the use of interactive computer networking to enable the public to communicate with government. The public access computer network is a natural evolution from a decision four years ago to start up an internal email system for council members and top administrators. Using software (CAUCUS conferencing system) donated by Metasystems Design Group in Washington, and hardware donated by Hewlett Packard, the citizens of Santa Monica now use free, walk-up computer terminals in community centres, libraries and city offices to communicate with city officials. About 30% of residents have their own PCs. The Santa Monican system is probably the most complete municipal information network in the USA, and includes the following elements:

- Through a bulletin board, citizens can consult bus schedules, job openings, library acquisitions, and agendas, minutes and staff reports from city agencies.
- Through email, citizens can message city hall officials, who have promised to respond individually.
- Through computer conferencing, citizens can discuss local issues such as drug enforcement, city developments and services.

When officials considered creating a public computer system, security inevitably was a major concern. Santa Monica consulted numerous security experts who tested the system, and officials believe that they have taken adequate precautions to stop computer hackers from getting into private files and to prevent viruses from entering the system and destroying data or programs. The network that residents will access is entirely separate from the city staff's internal computer system.

Though many are enthusiastic about this extension of the democratic process, and some predict that the public will find unanticipated uses for the network, others are more cautious. Offering a sophisticated electronic system before the public is ready to use it may make demands on officials which they are unable to handle.

5.2 CLEVELAND FREE-NET COMMUNITY COMPUTER SYSTEM

The Cleveland Free-Net is a free, open-access community computer system operating out of the Community Telecomputing Laboratory at Case Western Reserve University in Cleveland, Ohio.

Established in July 1986, Free-Net offers a wide range of electronic services and features: email, information on health, education, technology, government, arts, recreation and the law. The key to the economics of operating a community computer system is the fact that the system is literally run by the community itself. Everything that appears on the system is there because there are individuals or organisations in the community who contribute their time, effort and expertise to bring it online and operate it over time.

As a prototype system, the Free-Net attracted over 6,000 registered users and averaged between 500 and 600 logons a day on 10 incoming phone lines. The Free-Net will be moving out of prototype stage in the summer of 1989, and is expected to eventually generate a user base of 12-15,000 registered users in the Cleveland area.

Equipment

Free-Net II consists of 6 IBM-RT Model 135 super-microcomputers linked together to provide 96 megabytes of RAM, 2.3 gigabytes of hard disk storage, and the capacity to service 360 users simultaneously. In addition to connecting to Case Western Reserve University's new fiber-optic campus network, approx. 80 telephone lines will be available for modem access. The software that operates the Cleveland Free-Net is available, on a lease basis, for $1 a year to qualified parties from any other city who wish to start a similar service.

Funding

The Cleveland Free-Net was originally made possible by donations from the Information Systems Division of AT&T and the Ohio Bell Telephone Company. These corporations were later joined by University Hospitals of Cleveland, Case Western Reserve University, and by the Free-Net users themselves who contributed over $10,000 in voluntary donations during the early days of the project. The project continues to operate via grants and donations from private foundations, corporations, governmental sources, and private donors.

The Community Telecomputing Laboratory

Case Western Reserve University authorized the development of the Community Telecomputing Laboratory in Sept. 1988. This is the first non-proprietary research facility devoted exclusively to research on telecomputing as a new information and communications medium for the general public. Its four-fold mission revolves around research, education, community service, and Information Age technological development.

Network One

Free-Net II is an affliliate of Network One, which will provide inter-system email handling and other services. Eventually they expect to develop the concept of "cybercasting", whereby a wide variety of quality news and information services will be provided to the affiliates via Network One feed -- a concept very similar to that of National Public Radio or the Public Broadcasting System.

For more information contact: T.M. Grundner, Ed.D. - Director
Community Telecomputing Laboratory
319 Wickenden Building
Case Western Reserve University
Cleveland, Ohio, 44106

CASE STUDY SIX: TEACHERS AND COMPUTER NETWORKING

Three examples of computer networking in teacher training and in-service upgrading have been choosen from the UK, Spain and the USA.

6.1 PLUTO[1]

The purpose of PLUTO is to establish an educational infrastructure for European Teacher Training Institutions. It presently links together teacher educators, classes of students training to be teachers, and teachers undergoing further professional training in 10 European countries. It aims, in the longer term, to create a robust pan-Europe electronic network for many activities related to teacher education at all levels and in all countries of Europe.

The project is directed from the Centre for Information Technology in Education of Manchester Polytechnic, and supported initially by IBM Europe and now by several European Companies. An important grant has been awarded by the ERASMUS Programme of the Commission of the European Community. The Manchester node is the co-ordinating node for the network and provides project management and development strategies. At the present stage of development, there is a single, very active node in each of the participating countries. This will be the development network for the early stages, though it is intended to build up to a full European PLUTO open-access, self-funding network infrastructure by 1992.

The project has three overall educational goals:

- The first is to introduce into teacher training, skills in the use of information and communication technologies, which are expected to be commonplace by the end of the century.
- The second, and ultimately the more important, goal is that of identifying those new forms of classroom activity, and changes in the learning environment, which are brought about by the use of new information and communication technologies.
- The third is to establish practical collaborative projects which practise these activities and to disseminate the results of these into the wider teacher training environment through a widening of the participation in the network.

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[1] Details for this description are taken from various writings by the Director, Rhys Gwyn and the Chairman, Norman Longworth.

The central concept of the PLUTO project has been identified as 'collaborative distance learning'. That is to say, the project explores the new modalities of learning that become possible when educators who are geographically - and sometimes culturally - remote from each other are enabled to work together on shared projects and to become resources for each other. This approach has the dual advantage of developing their understanding of the technologies and their international perspectives at the same time and by the practical use of the technology itself. In this way it creates an awareness of and a respect for, the cultural diversity which is part of Europe's educational heritage.

PLUTO's management style devolves the ownership of its projects to the nodes themselves. Each participating insitution is expected to run and manage at least one major activity or project and to take part in four additional ones run by other nodes. In this way the central group co-ordinates and manages rather than imposes, and the flexibility of a wide range of projects which are of real interest to the regional organisations is emphasised. The results are made available to the whole network, and these should be in the form of deliverable items such as teaching materials and databases.

Costs

Any participating institution needs one or more appropriate microcomputers - a minimum of five is recommended; a modem for telephone connection, and database and communications software.

It is highly desirable to ensure that at least one teacher-tutor is able to devote up to 50% of a timetable to managing the project. This input of personal commitment and time is the key to successful participation.

Finally, there are the costs of using the network carrier. At present, the EARN-BITNET-JANET links are used, so that users need pay only the costs of local calls if they do not have direct mainframe links. (It is hoped to move from email to full computer conferencing in the future.)

Activities

Examples of activities so far are:

- exchanging class data which allows for comparative analyses of different distributions within each country
- undertaking each year to create and supply to the network one major database resource
- preparing for each other resource packs which give a micro-picture of their respective environments

- exchanging expertise on satellite weather data in geography
- collaborating in the field of English as a foreign language.

Further details of the PLUTO project may be obtained from

The PLUTO Project
Centre for Information Technology in Education
Manchester Polytechnic
799 Wilmslow Road, Manchester
UK M20 8RR

6.2 PROGRAMA DE NUEVAS TECNOLOGIAS

This programme is part of a five year project to introduce new information technologies to teachers and schools in the central region of Spain. At the centre in Madrid there are facilities for in-service training of teachers in the use of video, audio and computer technologies. The small teacher training centres in each district are now linked by computer and modem to the central host on the Ministry of Education mainframe. Computer conferencing software developed in Spain will be available shortly, to encourage discussion amongst the centres and with the central training centre in Madrid. The programme is negotiating special educational rates for data transmission from Iberpac, the Spanish public utility, as the normal rates are higher in Spain than in any other European country. (The Secretary for Education is responsible for the negotiations.)

The programme organisers are deliberately moving slowly in the implementation of new technologies, because of teacher and parent resistance. Although computers are considered 'acceptable' now, telecommunications are very new in Spain. Progress must go in step with other social developments in the country. In the first phase, 30 of the most remote schools and teacher centres will be connected to the network. Videotex, gateways to Minitel, email and computer conferencing will be available, but the uses initially will be primarily for management. In the second phase more centres will be connected and some teaching centres will become resource centres for the area. In the third phase modems will be supplied to any schools which request them, and the host machine act as a centre for collecting and distributing educational information and databases.

Further information from: Juan Madrigal
Programa de Nuevas Tecnologias
c/ Torrelaguna 58
28027 Madrid

6.3 UNIVERSITY OF MICHIGAN, SCHOOL OF EDUCATION[1]

In order to reduce the isolation of student teachers, the School of Education introduced the University's in-house conferencing system, CONFER II, as a means of increasing teachers' contact with their peers and with a variety of experienced teachers and staff at the University.

First of all the School of Education strengthened its working relationships with local school districts and invited 60 outstanding teachers and administrators from the surrounding districts to become members of a 'Professional Teacher Corps.' Members received small stipends as adjunct faculty at the University and were asked to participate in the conferences set up for the project. Computers and modems were loaned to any student teacher or member of the Teacher Corps who needed equipment. Instruction was provided by the University.

In the Autumn of 1987, about 25 Teacher Corps members and 80 student teachers began to interact. The discussion began in one conference, but soon sub-conferences were added to accommodate interests of special groups - teaching in elementary school, math teaching, and other specific subjects.

Students were very positive about the value of the system to their experience of student teaching and to their professional development. The two main problems in the first year were: technical problems, and lack of time to participate.

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[1] These details are taken from an article by K. Swift and A. Coxford in the University of Michigan, School of Education magazine, Innovator, vol 19, no. 3, 1988.

CASE STUDY SEVEN: HIGHLANDS AND ISLANDS INITIATIVES

The Highlands and Islands of Scotland have been the focus of a number of networking initiatives.

7.1 RURTEL

The Rurtel project began in 1986 providing the CoSy conferencing system to voluntary, educational and research groups in Scotland. By special arrangement with British Telecom, all users have local call access. Apart from its use by various management committees for preparing agendas for meetings, a number of organisations are using, or planning to use, it for training schemes.

Arkleton Trust

The Trust is primarily a research centre looking into the training needs of remote communities. Members work out many of their ideas in conferences and liaise on a daily basis, so that for their occasional face-to-face meetings, they are more prepared.

Robert Gordon's Institute of Technology

Robert Gordon's Institute of Technology Business School is currently involved in a 3 year, EEC-funded Comett project. Through the use of computer conferencing, interactive video and computer-based distance training packages, the project aims to overcome distance and cut costs of information exchange and training for widely dispersed enterprises.

Visits to the Shetlands have consolidated relationships with the Salmon Farmers Association, the Shetland Island Council and the newly established multimedia franchise centre. A similar exercise will take place in Lewis. A detailed training programme for managers and staff of the communications centres has been given, with hands-on training and supporting material.

Several databases required by the Shetland Salmon Farmers will be accessible on the system and a 'buyers guide' to oxygen monitoring equipment will be distributed using CoSy. A number of aquaculture experts will also be available online for consultation and discussion.

The course consists of two modules of three hours study time, and the text, prepared by the Aberdine Marine Biology Unit is being readied for distance

delivery. Although some material will be available on CoSy, the conferencing system is primarily for tutorial support and for developing a network amongst the very isolated, small salmon farms (64 farms in the Shetlands alone).

Contact: Alan Hunt
RGIT Business School
Hilton Place, Aberdeen
Scotland, AB9 1FP

Highland ITEC: LearnLink Training Scheme[1]

The LearnLink project is an innovatory scheme supported by the European Social Fund, the HRC and the Highlands and Islands Development Board to help young unemployed adults increase their skills and improve their job prospects. It also aims to test methods and materials for providing training in business applications without the need for a traditional tutor. Training is provided in small centres in Kirkwall, Wick and Portree, each with a part-time tutor, and accommodating up to five trainees. Courses are part-time, three days a week for 15 weeks. The scheme will operate six times, and the total number of students will be about 86.

Training consists of an introduction to general computing concepts, and practice in the use of common business applications programs. Aside from the local tutor, additional support is provided by a communications link with the ITEC base in Inverness, and the Rurtel conferencing system.

The direct computer links are controlled by one of two commercially available programs which basically enable a computer to be operated from a distant site by means of a telephone connection. This makes it possible for a distant tutor to observe a trainee actually using a program, to intervene and run the program if necessary, and for tutor and trainee to converse by means of a message screen and instantly switch back into the application program.

A number of attempts were made to run the local centres without a tutor, relying on the remote link with Inverness. Moffat makes the following evaluation of this remote link:

> The program (CarbonCopy) is very successful at solving some problems on a remote trainee's computer by allowing the remote tutor to take over control of the computer and act directly. However, it is not so successful at allowing the tutor to explain what is happening. The Chat facility of CarbonCopy is not really adequate for this type of

[1] Information on this scheme was provided by Peter Moffat of Highland ITEC.

discussion which tends to be come slow and one sided, with the tutor doing most of the typing. This is caused by the speed at which trainees can type, and the additional time required whilst typing to compose ones thoughts. An improvement on this was to use the telephone in conjunction with CarbonCopy. The program could then be used to demonstrate some point, whilst an explanation was given over the telephone. (Moffat, 1988, Interim Report)

7.2 BRITISH TELECOM HIGHLANDS AND ISLANDS INITIATIVE

The Network Services Agency, a BT subsidiary company, will provide a sophisticated managed host computer system for the development of IT applications and value added data services in various locations throughout the Highlands and Islands. NSA Ltd will provide expertise and support to businesses in the development of applications of information technology either to increase operational efficiency or develop online systems giving them a marketing edge.

System hardware, manufactured by DEC, is fully duplicated to guarantee maximum reliability. System software includes the ALL-IN-1 management package, VAXnotes and CoSy conferencing software and RDB Database package, supported by a flexible accounting and billing system.

Serving the computer will be a highly sophisticated communications system designed by the combined expertise of BT and DEC providing an initial capacity for 80 simultaneous users which will be increased with demand. User connection to the agency will be by private circuit, by direct dial-up through the telephone network or through the Data Access Network provided under the Initiative. User charges will be dependent upon applications but the company objective is to keep them as modest as possible to encourage development and use. Two hours per month free connection time will be provided for Highlands and Islands users accessing the system through the Data Access Network.

Integrated Services Digital Network and Data Access Network

Investment in the network infrastructure and provision of the dedicated data access network accounts for the largest proportion of the £16m Highlands and Islands Initiative. The three year programme commencing in 1989 will provide digital exchanges and ISDN facilities in 43 Highlands and Islands locations. The trunk and junction network will be upgraded to the same high quality digital standards.

Services supported by ISDN include high speed, high quality data transmission (enabling applications such as transfer of graphics, CAD/CAM),

high speed high quality facsimile, slow scan television, photo videotext and electronic funds transfer. The Data Access Network will provide high quality local telephone call charge rate access to the Public Data Network and to the Network Services Agency. Service is likely to be provided to all parts of the Highlands and Islands during 1990.

Further information: Colin Pavey, British Telecom, Aberdeen (0224 752258).

7.3 THE APPLE SUPPORT NETWORK

Since June 1986 Alternative Data Ltd., a computer consultancy based in Findhorn, Scotland, has been developing the Apple Support Network (AppleNet) for Apple (UK). Apple is one of the largest manufacturers of personal computers in the world, and Alternative Data has specialised in the use of their top of the range computer, the Macintosh. AppleNet has been designed in order to:

- meet the Apple user's need for on-going support and information
- offer services such as email, telex, computer conferencing
- provide an easy-to-use environment for connection and use
- create a forum for a community of users
- assist dealers in providing continuing, quality after-sales support.

The AppleNet host computer will be operated by the Network Services Agency in Inverness, and is a joint venture between the Highlands and Islands Development Board and British Telecom.

AppleNet Connect is a HyperCard stack developed by Alternative Data which provides a Macintosh interface complete with icons, pop-up menus and graphics. Many Macintosh users have found text-based information systems difficult to learn and operate, and the AppleNet software is designed to make online communication easy and enjoyable by using the well-known Macintosh interface to provide a familiar environment.

Further information from: Stephan Wic,
Alternative Data,
Findhorn, Scotland

CASE STUDY EIGHT: TECHNOLOGY-BASED TRAINING

The following examples of the use of TBT make the case for and against networking this kind of training.

8.1 ISFOL AND THE USE OF FORTEL

ISFOL is an Italian organisation similar in conception to the British Training Agency. One of its latest projects is the use of the FORTEL (*Formazione Telematica*) network for the training of college teachers in the use of new technologies.

FORTEL is a specially designed training network, aimed at vocational training applications in large companies, commercialised by SEVA, a joint venture of SIP (the Italian PTT) and Olivetti. The FORTEL system has been used by SIP for several years for their own in-company training, and SEVA is now marketing the service commercially.

FORTEL is essentially designed for storing and delivering CAL and TBT material on behalf of specified groups of users. There is a central library service for filing the training software, which can then be accessed remotely via ITAPAC by local teaching directors and tutors. The latter select the courseware they require, and download it onto networked PCs on a LAN, where it can be accessed in local mode by the actual trainees. This design cuts down considerably the connect time and costs for accessing the central machines. A bulletin board and email facility also exists, which can be used by local teaching directors and tutors. A further facility is a standard evaluation questionnaire which trainees complete, and which is uploaded by local course directors and collated centrally.

The interface to the FORTEL system is extremely well designed, and gives automatic dial-up and logon. The system runs at 2400 baud, and will keep on trying the necessary ITAPAC numbers to get through to the central server in Milan until a valid connection is established. The opening menu gives access to: user statistics, central courseware library directory, feedback questionnaires, user list management functions and service functions. The bottom line of the screen always has the help and escape commands displayed. A local tutor or teaching director using the system would go into the courseware library and select and download the courseware needed on a given occasion for a specific group of trainees. It is also possible to communicate with other teaching directors in other locations, or with the courseware librarian, using the bulletin board and email facilities.

The ISFOL trial currently being planned and due to start late in 1989, is concerned with the training of teachers in publicly financed (but private)

colleges (*Centri de Formazione Professionale*), in the use of new information technologies in teaching. The project involves 12 colleges, with 56 connected workstations, and 250 users in all. The colleges are spread all over Italy, from the Alps to Palermo.

There is some scepticism about whether the trial will be a success, entirely because of the major difficulties in Italy at the present time of obtaining reliable noise-free PSTN connections, and problems in getting into the ITAPAC packet-switched network. Generally, networked TBT is justified when some or all of the following conditions pertain: the need for quick or frequent updating of material, a large-scale enterprise with many trainees scattered over many sites, a large number of TBT packages to distribute, the need to keep records of student progress through the material, and a network which is reliable and inexpensive to use. SEVA plans to commercialise on a large scale in the future - this is a small experiment along the way.

8.2 ABBEY NATIONAL BUILDING SOCIETY

About three years ago it was decided within Abbey National to change from face-to-face training to a dedicated TBT training resource. It was realised that a change of attitude would be needed by employees having to adapt to computer rather than in-person training. It was decided that TBT must have a high profile, be easy to use and seen as a resource in its own right, not an appendage.

In conjunction with the National Computing Centre, a number of authoring systems, both PC based and online, were investigated. The NCC recommended a pilot test using both on and offline systems. A six month pilot was set up in 20 branches: 10 had PCs and 10 had MacDonald Douglas viewdata terminals to dial up the computer in Bletchley to receive training. The programs were similar in content and level, but they looked different because the online training had only block graphics.

Extensive questionnaires and interviews were carried out on staff and managers. The results were:

- Although they preferred the online system because they 'thought it was doing them more good', they felt they were being watched. They enjoyed the PC version more, and on this system, more courses were completed and staff went back for more training.
- The managers preferred the offline version because of scheduling problems. The online versions used the same delivery machines as for getting quotations for customers. As customer services have a higher priority than training, there were poor completion rates for the online training.

- It was discovered that 45 mins to one hour is the optimum length for a training session.
- Although the online version would permit detailed logs to be kept automatically of each training session, Abbey National are not interested in keeping records of this sort on their staff.
- The stand alone version was more versatile and looked more attractive.
- Although the online version would be much easier to update, staff felt a greater sense of ownership of the offline training material, which arrived through the post in a package with some print materials nicely presented together.

Consequently, offline TBT training was the hands-down choice. There is now an 85% coverage of PCs in branch offices and all remote branches are covered. The training packs are all developed from a standard package (Tencore) and thus each pack looks the same and uses the same icons and colour codes. The function keys can be standardised from one package to the next and the use of cursor keys rather than keyboard typing is used throughout. By 1990 the majority of the paper-based training and face-to-face training will be delivered by TBT. In some cases 'front ends' have been written to the 'soft training', that is, report writing, selling, customer contact etc., so that the face-to-face training can be carried out productively in one day, rather than three, and the rest handled by TBT.

However, after two very successful years of offline TBT training and 22 in-house courses produced, major re-considerations are now in hand. Online training has become more appropriate because:

- 25 further TBT courses are planned and the storage needs for nearly 50 TBT packages in each branch are considerable.
- The major hurdle of two years ago - to make TBT acceptible to staff - is now over due to the success of the training project.
- The maintenance and updating of the offline training packs in every branch throughout the country is becoming an increasing burden. At the moment a letter is sent to every branch to return a particular package, for instance wherever the interest rate changes. The old disks are scrapped and new ones issued.
- Online systems have improved in the last three years.

CASE STUDY NINE: COMPUTER CONFERENCING IN UNIVERSITY EDUCATION

Two examples are described below: one, an American campus-based university and the other, a mass distance education institution.

9.1 THE VIRTUAL CLASSROOM[1]

From 1985 to 1987, with major funding from the Annenberg/CPB Project, The New Jersey Institute of Technology constucted a prototypical Virtual Classroom, offering many courses fully or partially online (Hiltz, 1989). Students and professors, using PCs, communicate with each other through the Electronic Information Exchange System (EIES), which was enhanced with special software to support education delivery.

The project included iterative development of both software and teaching techniques. Innovations were implemented, studied, and then incorporated into software modifications. Three kinds of software innovations resulted:

- branch activities which could be attached to a class conference in order to support special types of assignments or delivery materials for activities that were to involve the whole class
- a set of teaching support tools to help the instructor manage assignments, and grading and quizzes for individual students
- microcomputer-based software for the integration of graphical information with text information.

The Virtual Classroom project involved the online teaching of a number of undergraduate courses at both Upsala College and at NJIT. The two colleges provide very different implementation environments. Upsala is a small liberal arts college with little computer equipment and very little prior integration of computing into the curriculum; NJIT is a technological university where for the last three years, incoming freshmen have been issued IBM-PC compatible micros to take home, and computers are used in all freshmen-level courses (Hiltz, 1989). Some of the courses were offered entirely online, others in mixed or adjunct mode. These included courses on a variety of subject areas: organisational communications, writing, anthropology, business, French, introductory sociology, and computer science.

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[1] This study was written by Linda Harasim as part of a report to the Infotech Committee, British Columbia, called The Case for Computer-Mediated Communication, by Tony Kaye, Robin Mason and Linda Harasim.

Most of the online courses used some form of collaborative designs, including one or more 'seminar' type segments in which the students became the teachers. Individual or small groups of students were responsible for reading the material not assigned to the rest of the class, preparing a written summary of the most important ideas in the material, and leading a discussion on the topic for the class.

Another course design used was the role-play or simulation. In the Virtual Management Lab, NJIT management students applied the theories and techniques that they were studying to a simulation of the first fiscal year of a hypothetical corporation. They decided how to organise the corporation, selected the individuals to play roles such as President and Vice President for Finance, and developed various product and marketing plans that would be needed in a 'real' organisation. The instructor played the role of the market, the government, and other event-generating entities in the environment. Another strategy used in the Virtual Classroom is that of peer learning groups. Students worked together to assist one another in various tasks (ie. individual writing assignments) and responded to specific questions from the instructor on how the product could be improved.

The conclusions reached from the Virtual Classroom project were that learning outcomes were at least as good as outcomes for traditional face-to-face courses. The average student who participated in the online experiment felt that both access to and quality of the educational experience were improved.

However, the improved outcomes are contingent upon providing adequate access to equipment, as well as other factors such as faculty effort and skill in teaching online, and student characteristics. Students who are motivated to work online and who are self-disciplined, with average or better than average verbal skills are likely to produce superior outcomes, as compared to traditional courses (Hiltz, 1989). Students who lack this motivation, or who are deficient in basic college level skills, or who must travel to access a computer, are more likely to drop out of an online class, or to participate more irregularly, or perform more poorly than they would in a traditional course.

9.2 THE BRITISH OPEN UNIVERSITY

The Open University began its use of computer conferencing as a small part of a multi-media course, *Introduction to Information Technology: Social and Technological Issues*. This application was the first to use computer conferencing for mass distance education. Each of the 1300 students was equipped with a PC, printer and modem, and logged onto the central host computer in Walton Hall, from their homes all over the country. The course was part of the second level undergraduate program, and lasts for nine

months. Although steps were taken to integrate the conferencing element into the course as a whole, there is no doubt that many students regarded it as a marginal extra in an already overloaded course. Lack of time to participate was cited as the main deterrent to use. The conclusions from this experience summarised below are based on an evaluation of the first year of presentation in 1988 (Mason, 1989).

Access to CoSy was facilitated by the in-house development of front end software, which provided automatic logon facilities, an offline editor for preparation and downloading of conference messages, and an optional menubar online so that commands could be selected rather than remembered. Although this software was by no means bug-free, feedback from students shows that these features were well used and appreciated. Nevertheless, cost of accessing the system was the most dominant complaint in the first year of operation. Due to the nature of the University's dial-up network, only half of the students were within the local call charge band and the other half faced steep telephone charges even at off-peak times.

One of the aims of introducing the medium was to offer students practical experience in using the technology. In addition, as distance learners, students were provided with half of their normal tutorial provision online. Each of the 65 tutors was given a closed conference in which to hold discussions with 25 assigned students. One conference (the Forum) which everyone could access was provided for socialising and general discussion of course issues and difficulties. Contrary to expectations, this general conference became the 'working' space for almost all who made use of the system, and the individual tutor conferences were used largely for chit-chat and for information exchange about assignments.

The Forum conference consisted of many topics, one for each block of the course, for the practical work, for assignments, for technical difficulties and so on. Discussions were dominated by about 100 regular contributors (students, tutors and staff) and by the end of the course many of the topics had between 200 and 700 messages. Consequently the volume of messages for all but the very frequent and regular users was very difficult to manage. The tools within CoSy to manage large conferences - the *skip*, *list headers*, and *read by reference* commands etc. really do not address the problem of the infrequent user wanting to get information efficiently, let alone to contribute to a discussion.

Approximately one third of the 1300 students contributed one or more messages to the course conferences; another third participated only by reading, and the final third, who logged on less than five times, did not take part. Extensive evaluation of student opinion shows, nevertheless that students were very positive about the value of computer conferencing for distance education. Convenience was one of the main benefits cited by students, who are often reticent about contacting their tutors by telephone. In

this regard the mail facility within CoSy was an invaluable, less intrusive alternative to the telephone. Increased access to help was another major benefit of the system. The *gremlins* topic of the Forum conference, where students were to report practical problems was the first exchange to take off, with over 500 messages generated in the first three months. A number of students and tutors took a very active part in supplying 'fixes' for the many difficulties reported there. Indeed, these active participants were in most cases considerably ahead of the central staff in providing useful advice and support to students (both questioners and the many lurkers). This topic was outstanding as a vehicle for those with expertise to become known on the system and to offer the benefit of their experience to the course team and students alike. Although CoSy was primarily envisaged as a tutorial medium, members of the central staff who wrote the course contributed extensively to Forum topics, extending and developing areas of the course, and explaining and interweaving parts of the course material.

The OU experience shows considerable equalising of status and breaking down of established hierarchies. In certain respects, the use of CoSy increased students' ability to participate equally. For instance, the status and personal appearance of users are not evident on the system, and students who work unsocial hours or are housebound, were suddenly able to take as much advantage of what was offered as other students. Disabled students were not identifiable as such and tutors were not distinguishable from students by their ID. The peculiarly personal yet detached atmosphere of conferencing obviously encouraged many students to express their opinions, whether positive or negative, and to contribute information from their previous experience with all the hallmarks of equal members of a group. The feeling shared by some students and tutors of being involved and even influential participants, rather than passive recipients of a course, has played its part in sparking real enthusiasm for the course. CoSy has also been a vehicle for open criticism of course material, and vigorous complaints and outright condemnations have appeared in conferences for all to read.

In addition to correcting bugs in the software, a number of major changes have been made to the structure of the conferences in order to increase the level of participation and reduce the overload for the following years of the course's delivery.

A number of important lessons can be drawn from the extensive evaluation of this case study:

- For those who take part, computer conferencing can be an exciting and satisfying way of increasing interaction in distance learning.
- Relegating computer communication to a very small part (in this case, about 5%) in a course inevitably leads to marginalisation and lack of use.

- Cost of access is a significant deterrent to use, particularly when initially learning to use a conferencing system, and when developing confidence in the early stages has to be carried out at the student's expense.
- It is possible with adequate support facilites (both software and human) to teach large numbers of students the rudiments of conferencing entirely at a distance.
- The exploitation of conferencing to achieve educational goals requires careful and extensive structuring of the online environment so that both students and tutors can make productive contributions.
- Conferencing can tap the invaluable resource of adult students' experience and expertise to the benefit of all concerned.

CASE STUDY TEN: UNIVERSITY COURSES FOR CORPORATIONS

Three examples are described here of the growing practice of university-run courses using networking to train employees in the business sector.

10.1 THE TÉLÉ-UNIVERSITÉ TRAINING FOR BANK EMPLOYEES[1]

The Télé-Université of Québec was asked to develop a distance training programme on financial preparation for retirement, aimed at advisory staff in branches of the Mouvement Desjardins, a province-wide cooperative bank.

The overall aim of the study was to discover whether the use of telematics (computer conferencing and email) would permit a more effective management of trainees' learning efforts and training activities. The period of the project ran from May to December, 1988, with the actual course lasting for a period of six weeks. Eleven trainees, working in small bank branches in Eastern Québec, as well as 12 other staff, were involved. The researchers wished to investigate the following three hypotheses concerning the potential advantages of using computer conferencing:

- that it would reduce the isolation of trainees in remote areas of the province
- that it would permit better integration and application of learning through the development of a pedagogical model based on the interactive nature of the medium
- that it would lead to a better understanding of the potential of new information technologies, through their use as a support for training.

The use of computer conferencing was integrated in the study with pre-existing text-based self-training materials, prepared by the bank's training department.

The conferencing environment

The bank personnel involved in the project had no prior experience of any significance in the use of new technologies. Other than the 11 trainees, there were nine subject-matter experts and three training staff involved in the project, as well as two conference moderators from the Télé-Université.

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[1] This report was written by Tony Kaye and is based on the study by J. Lescop and F. Henri: *La Communication Assistée par Ordinateur dans l'Entreprise.*

Those involved in the project were provided with an IBM or compatible PC, a modem, Procomm software, a public domain word-processing package and access to the University of Québec's INFOPUQ system, which provides email and conferencing facilities, plus user help services.

Results

Despite the lack of previous experience of users, participation rates in the course were high. Over the six-week period of the course, each trainee spent, on average, 40 hours on the course, of which 11 hours were online time, 8 hours on study of the self-teaching texts, and 21 hours in preparation of messages. There was little evidence of 'lurking', with a total of 389 accesses to the system by trainees for 506 messages uploaded (an average of 1.3 messages per trainee for each access). The trainees overwhelmingly used the public conferences for their communication, rather than email, and over two-thirds of the messages were entered into the content-related conferences, the remainder going to the 'café'. Only 1% of messages went to the help conference. Classification of the messages indicated that the single largest percentage was concerned with cognitive activity related to the course content (42%), the remainder being split between administrative matters (14%), socialising (31%), technical queries (7%) and others (6%).

The subject-matter experts contributed around 11% of the total messages, primarily (64%) as email messages to individual trainees. Only 8% of the conference messages were from the experts. The moderators contributed 32% of the total messages, 19% via email, and 13% into the conferences.

Attitudes towards the use of new technologies in training were high before the trial, and were maintained after it, with 'computer conferencing + self-study texts' being given a higher preference rating than 'group meetings + self-study'.

10.2 CRANFIELD SCHOOL OF MANAGEMENT

Cranfield School of Management have begun to use networking on their two-year, part-time Executive MBA programme. The programme began in 1988 with 57 students from all over the country, who meet every other fortnight, and for three residential weeks. The programme is very case-based, and students work in study groups of five to eight people. In between weekend meetings, they are expected to interact at a distance to progress their group-based case work. Previously, students mainly used telephone contact for this, backed up by Fax. This proved inconvenient and expensive.

This year, it was decided to introduce a computing element into the programme (word processing and spread sheets), so it was an easy

incremental step to add communications. Cranfield have purchased, to loan to students for the two-year duration of the course, a Zenith Supersport laptop with harddisk, a Pace Linnet modem, a printer, and software. They have also negotiated a special group deal with Dialcom for restricted access to Telecom Gold for all the students - a closed user group arrangement, with no access to Gold's other facilities such as fax and databases. The Management School pay all the Dialcom costs - students only pay the telephone call to the nearest PSS node (there are 24 in the UK).

Total investment in this 'experimental' programme (the laptops, software, printers, modems and Gold costs) is around £250,000. They assume that future students will be given the same facilities, but that the course fee will be adjusted upwards to cover the outlay.

The first year's intake received their laptops and printers in mid-March, the modems in mid-April, and all the students had mastered the use of comms without any major problems by mid-May. Initial evalutation indicates that students are very enthusiastic about the comms element. They are using the group mail facility to conduct their small group activites between the face-to-face meetings. Most of the students use their modems from home, though many have terminals or PCs in their offices which they use for course work. Several executives don't word process themselves, but get their secretaries to do it for them.

10.3 NKS College, Oslo

In 1986 the NKS College was established, offering university level programmes within the areas of finance, management and administrative data processing. The networking project at NKS uses an interdisciplinary approach and combines pedagogical research, social science, humanities and technology. The distance education model used at NKS is multi-media based: printed material, TBT in combination with communication channels, correspondence tuition, telephone contact and face-to-face seminars. After an evaluation of a range of conferencing systems, NKS decided to use PortaCOM, which is hosted by the University of Oslo. It is important to note that datapac charges are the same throughout Norway. Furthermore, Datapac are interested in experimenting to see whether lower charges will increase their traffic.

From the autumn of 1989, a variety of courses using PortaCOM will be launched: 400 students on a Business and Management course, 100 students in Computer Science and a number of short courses for private companies. Norsk Hydro, one of the biggest companies in Norway have invited NKS to mount a trial of distance training using networking. Similarly, an insurance training centre and the Norwegian Postal company have asked NKS to prepare courses in business and management. NKS hope to use PortaCOM to add an element of group project work to these short training courses.

PART THREE:
EUROPEAN APPLICATIONS

The list of applications which follows is by no means complete or comprehensive. Nevertheless, it does include some little known applications, and forms a base from which to begin a systematic database of telecommunications projects. The case studies presented in Part Two are not repeated here.

UNITED KINGDOM

1 Bradford University

Contact: Professor Tom Stonier, University of Bradford, Bradford, West Yorkshire BD7 1DP.

Programme: The University of Bradford's plan is to network the whole campus, eventually including student residences as well as the campus buildings. By the autumn of 1989 the ethernet within the buildings will be operational, giving on-campus students 24 hour access to the library catalogues and to the departmental computers. A loan scheme with the Midland Bank has been arranged for student purchase of computers, and free software and training will be offered to students. This project is partially supported by the Training Agency.

2 Aston University

Contact: Dr. Andrew Jordan, Aston University, Aston Triangle, Birmingham B4 7ET.

Programme: This £4m project involves the installation of a high capacity campus-wide communications network, serving all parts of the campus, including the high technology Science Park and the Technology Transfer Centre. It will incorporate existing facilities including satellite dishes, microcomputer networks and campus gateways to national and international networks. The project is funded by the Department of Trade and Industry.

3 Birkbeck College

Contact: Birkbeck College, Malet Street, London, WC1 E7HX.

Programme: The conferencing system CAUCUS is being used to support distance learners in post-graduate occupational psychology courses. Face-to-face meetings take place once a term and in between, the students maintain contact with each other and the tutors through interactive discussion. The project is supported by the Training Agency.

4 Wakefield District College

Contact: Mr Paul Channell, Wakefield District College, Margaret Street, West Yorkshire, WF1 2DH.

Programme: A course on Computer Aided Engineering for about 100 students all over the country is based on the concept of 'open learning'. Students are sent a terminal with which they dial up the Vax cluster at

Castleford and access a number of advanced computer-aided design packages and work through the associated exercises. If they run into problems, students can leave an email message for their tutor. Although some of the students are sponsored by industrial concerns, many are tutors at colleges and polytechnics, who take the course as part of a DES sponsored train-the-trainers scheme.

A follow-on to this course will be a similar package offered to students in Spain, Portugal and Greece, using IPSS, probably in 1990.

5 Southampton Institute of Higher Education

Contact: Dick Davies, Cecomm, Southampton Institute of H.E., East Park Terrace, Southampton SO9 4WW.

Programme: Cecomm, the Centre for Electronic Communications and Open Support Systems in Education, is located at the Southampton Institute of Higher Education. Cecomm was established in April 1988 under the DES 'ESG programme' for Information Technology in Non-Advanced Further Education. The following are examples of their use of networking:

- Joint Examining Board: This course consists of 100 hours of study spread over 30 weeks. It is run by Highbury College, Portsmouth, in association with Cecomm. Participants are given an integrated software package for the IBM PC or BBC micro, as well as a communications package to access the conferencing system CAUCUS, for tutorial support. The course is expected to appeal to teachers and trainers who wish to add some Business Studies skills to their capabilities.

- Electronic Communication Systems in Education: This is a 12 week electronic course, delivered and supported using CAUCUS, run by Cecomm. There are two meetings and printed background materials, but the remainder of the course is online. The course is aimed at teachers and lecturers who wish to develop an appreciation of the use of electronic communications systems in teaching and learning.

One of Cecomm's aims is to provide training both in the use and applications of electronic communications systems, and in wider curriculum areas using communications technology as a delivery vehicle. Their Research and Development is funded by IBM UK, and current work involves using communications and group coordinating tools on LANS, developing educational versions of tools which were designed primarily for business use, and the production of simple simulation software for use by teachers and students.

6 University of Lancaster

Contact: Dr. David McConnell, Management School, University of Lancaster, Gillow House, Bailrigg, Lancaster LA1 4YX.

Programme: The University of Lancaster has purchased the conferencing system, CAUCUS, and the School of Management plan to use it on their distance teaching programme. They aim to transfer the pedagogical principles of their highly successful face-to-face programme - peer learning and peer assessment - to the new distance version, using electronic communication. Students will supply their own hardware, although many are sponsored either by a local authority or by a private company. The two year trial will begin with 10 - 15 students in January, 1990.

The ITOL project, funded by the Training Agency, aimed to investigate means of reducing traditional barriers to the formal learning processes and matching learning experiences to professional needs. The project has finished its first phase with a model for 'open learning'. The model develops ideas for a totally online learning environment, with no 'package learning' materials. The resources will be other people as well as data on the mainframe. The target user population includes. students of continuing education, professional development and post graduates, all at a distance.

7 Henley The Management College

Contact: David Birchall, Henley The Management College, Greenlands, Henley-on-Thames, Oxon RG9 3AU.

Programme: Henley has used the software development firm, Brainstorm, to design and host a conferencing system for their distance MBA programme. At the moment, Henley is using the system in-house to identify any problems, make modifications for educational use and to discover the best ways of using the system. Henley operate a number of tailored MBAs for specific clients, and this would seem to be the most appropriate place to use conferencing, rather than on their 'open' MBA. Henley report encountering considerable concern about security from clients, but are keen to move ahead. At first they expect conferencing to play a social role, but they envisage putting case studies online and encouraging interactive discussion.

8 Shell International

Contact: Graham Galer, Planning Department, Shell Centre, London.

Programme: The Planning Group within Shell UK has been using computer conferencing since 1985. They use an external conferencing system, Notepad, based in California, and accessible from most countries in the world. All

communication is via the international packet switch network X25. Participants in London, and The Hague have direct access to X25, but others require modems connected through the local public telephone system. Although originally intended as a vehicle of communication between the planning departments of this very distributed company, the way that it has proved most successful is through the introduction of quite a number of senior consultants to Shell, primarily in the USA. About 200 members are registered, of which about 50 are active. Participants amongst Shell employees tend to come from the smaller, more isolated planning groups, like Hong Kong and CapeTown. Participation from Europe is patchy (apparently they have greater difficulty making the PTT connection). The Planning Group in the UK pays a fee to Notepad for the time and disk space used.

Its primary use to date is 'keeping in touch' with a wide range of people and ideas. Most of the conferences are associated with business projects of various kinds, but one conference, Open Forum, is less focussed. Successful projects include planning with Shell Française a large scale meeting, discussions about computer problems, idea generation and generally making the views of external, senior consultants available to Shell employees. Regular print-outs are sent to all planning departments whether or not they have members online. An edited version of the Open Forum conference has also been made available for wider dissemination.

9 100 Schools Network Project

Contact: Graham Turnbull, Scottish Council for Educational Technology, Dowanhill, 74 Victoria Crescent Rd., Glasgow G12 9JN.

Programme: In 1988 The Scottish Council for Educational Technology began preparations for the UK and European element of the 100 Schools' Network Project in which 50 USA schools were to be linked with 50 schools throughout Europe. All transatlantic charges were met by McGraw Hill, who also provided the host system, MIX. The Scottish Council has produced a case study report of the Scottish involvement, including details of curriculum areas covered, evaluations and recommendations.

10 Campus 2000

Contact: Julia Cooper, Marketing Manager, The Times Network Systems Ltd., PO Box 7, 214 Grays Inn Road, London, WC1X 8EZ.

Programme: Campus 2000 represents the integration of two services, The Times Network for Schools and Prestel Education, and aims to pool resources, particularly people, and therefore create a 'quality service' for educational users. Under this new service, Prestel Education (now known as

Dialcom Education) will provide the network services, the computer resources, the database and email services and look after the accounts and billing of subscribers. TTNS will take care of the marketing, sales and customer support services. Campus 2000 offers the following services: access to Dialcom email service, computer conferencing, international mailing, LEA databases, Campus Directory of Users, the Primary Database, the Special Needs Database and all the sponsored databases currently available.

11 University of Nottingham

Contact: Steve Benford, Dept. of Computer Science, University of Nottingham, University Park, Nottingham, NG7 2RD.

Programme: A two year project funded by the UK Joint Network Team has just been announced for the specification and prototyping of group communication services based on OSI protocols. The overall goal of the project is to produce demonstration applications for services such as conferencing and bulletin boards. These applications will provide strong support for the distrbuted management of information and of the communication process itself. In addition, they will incorporate a number of more novel features such as support for multimedia messaging.

12 Cosmos

Contact: Paul Wilson, Computer Sciences Co. Ltd., Computer Sciences House, Brunel Way, Slough SL1 1XL.

Programme: Cosmos is a project designed to investigate group working over computer networks. It is a £1.4m, three year project aiming to develop a new breed of system to support group work processes. It is Alvey funded and the participants include British Telecom, Computer Sciences Co. Ltd., Queen Mary College, University of Manchester and the University of Nottingham.

The project has identified five areas for research: Communications Tasks, Communication Structure, User Interface, Systems and Evaluations. The third year of the project is already finished. The first prototype has been mounted on three separate sites, and several new versions are planned.

13 X-ON Software

Contact: John Coll, X-ON Software, 65 Victoria Rd., London N22 4XA.

Programme: This company markets the conferencing system CAUCUS in the UK, as well as developing bespoke CET software. X-ON hosts 'London CAUCUS' which is ported each evening to the American CAUCUS, and provides an easy network of contacts worldwide for those interested in this field.

14 CIX

Contact: Tony Wright, Suite 2, The Sanctuary, Oak Hill Grove, Surbiton, Surrey KT6 6DU.

Programme: Modelled on its American counterpart, BIX, this service caters for both amateur enthusiasts of networking, and the professional market. Using the CoSy conferencing system as host, CIX has 3000 users accessing the system on 40 telephone lines. In addition to closed user groups, the system has many open conferences for general chat and special interests. One of its growing uses is as a support medium for manufacturers and suppliers of hardware and software to offer advice and information to buyers and users of their products. One company uses CIX to communicate in closed conferences with their dealers all over the country.

15 Direct Connection

Contact: The Information Desk 01-853 2283.

Programme: Direct Connection is an online information service for professional computer users and serious enthusiasts. The service aims to provide computer users with a complete online information service, offering vital sources of information at reasonable cost. (No time or data volume access charges are levied.) It offers gateways with many major external networks and offers the following services: outgoing fax gateway, newsbytes weekly computer news, specialist technical newsletters, conferences, file libraries and real time multi-user teleconferencing.

16 Frontline Initiative:

Contact: The Project Administrator, Tile Barn House, Woolton Hill, Newbury, Berkshire RG15 9UZ.

Programme: The Frontline Initiative aims to recruit, train and employ people in selected Inner City areas, to undertake work on a contract basis for companies in London and the South East who face the worst problems of skill and labour shortages. The initial plans for Frontline's network include five major IT centres in Inner City areas of the Midlands and North. The planned headcount for each IT Centre is 150. The total planned headcount is around 800. The Centres are to be equipped with full computing and office automation facilities, providing 'desk to desk' communications right across the organisation. Depending on the nature of the work being undertaken for a particular client, this network can be extended to the client organisation, to provide immediate service - if necessary, 24 hours a day.

The proposed funding of the Frontline programme is through a membership 'club' (constituted as an industrial and provident society). This approach provides companies with a highly practical way to demonstrate their commitment to the revival of our Inner Cities, and the benefit of 'first call' access to a growing pool of the skilled resource which will be in the most critically short supply over the next decade.

17 British Telecom Electronic Writing Board

Contact: Rendezvous Products Division, Unit 7, Leatherhead Industrial Estate, Station Rd., Leatherhead, Surrey KT22 7AF.

Programme: The White Board allows a tutor (without any special technical skill) to illustrate a remotely presented lecture to pupils equipped with compatibly linked colour monitors. The board allows for use of up to four different colour markers, and makes use of ordinary telephone lines. An important early user of the White Board is the TVEI Centre (supported by the Training Agency) and Gwynedd Technical Vocational Education Initiative Unit at Llangefni, which is currently running some highly sophisticated trials in the use of the equipment for the remote teaching of 6th form students at a number of high schools in Anglesey.

The subjects to be used with this medium include electronics, computing, business studies and higher maths, and some students will be taught bi-lingually. The remote learning project has solved a number of problems related to the geographical location of the schools in the region and availability of specialist teaching in certain subjects. The project organisers hope that the White Board in addition to audio-conferencing will provide a popular and effective method of teaching specialist subjects without moving pupils into larger cities.

18 Chatback

Contact: The Chatback Project, Computer Centre for the Disabled, 115 New Cavendish St., London W1A 8JS.

Programme: The Chatback Project was set up in 1987 to provide an email facility for up to 40 children with speech and/or communication difficulties. Each participant was given a mailbox for email with access to some part of Prestel for reference information. As wide a selection of young people as possible was included. The common factor is that they normally use a PC to assist them to communicate. The project encourages young people to correspond with each other through BT Gold/Prestel, for social interaction and where a curriculum is being followed, for work on classroom subjects.

It has involved exchanges not only between individual students in the UK, but also with students in many other countries. Initially, the project was set

up for one year to assess the benefits gained by children with special education needs. Now a Trust Fund has been set up in order to establish the project on a more permanent footing.

19 FidoNet

Contact: David Laycock, Director of the Computer Centre for the Disabled, Polytechnic of Central London.

Programme: Fido is a bulletin board catering for disabled people and those who work with them. The Computer Centre for the Disabled operates a modem loan scheme, and has 18 machines which it lends for up to 3 months.

See also

Case Study Three: Uk/USA Communications Project and NCET Communications Collaborative Project

Case Study Four: Shell Expro

Case Study Six: Pluto

Case Study Seven: Rurtel, British Telecom Highlands and Islands Initiative and Apple Support Network

Case Study Eight: Abbey National Building Society

Case Study Nine: The British Open University

Case Study Ten: Cranfield School of Management

EUROPEAN ECONOMIC COMMUNITY FUNDED PROJECTS

20 Europace

Contact: Pe. Morgen, EuroPACE, 7, Place de la Défense, 92090 Paris, Cedex 26, France.

Programme: Europace is a unique distance learning environment which offers, via satellite transmission, courses on state-of-the-art technologies across all of Europe. For a tutorial support medium, it uses PortaCOM computer conferencing system. Course presenters, chosen from various European universities, are available online for several weeks after transmission of their topic to answer questions arising from their presentation. The computer network also provides remote support for events transmitted live on the Europace satellite channel. Participants viewing these events can post questions to the presenters as the programme progresses, by typing at their workstation linked to the network.

21 Action Line III of the DELTA Programme

Contact: Dr. Peter Zorkoczy, The Open University, Walton Hall, Milton Keynes, MK7 6AA.

Programme: The overall purpose of the DELTA programme is to enhance global competitiveness of industry and the quality of life of its citizens, while redressing regional, social and special imbalances. Action Line III of this programme aims to take full and early advantage, in the interest of learning, of advances in telecommunications. Two important telecommunications facilities, ISDN and Satellite networking, are the focus of the various projects. The JANUS project is the main testbed for exploring possibilities for joint authoring of distance teaching and training materials for delivery on a European-wide basis. During the pilot phase, members of various institutions will use computer conferencing as a medium for planning, drafting and producing course material.

22 EPOS

Contact: Dr. Peter Zorkoczy, The Open University, Walton Hall, Milton Keynes, MK7 6AA.

Programme: Three European telecommunication Authorities, SIP, Deutsche Bundespost, and Telefonica, have pooled their individual development efforts related to distance learning systems in this DELTA project to lay the foundation for an integrated European open learning system. Several task forces will be constituted and assigned to specific works. They will exchange knowledge and experiences, aims and projects, tools and technicians in order to maximise the results of a cooperative based activity.

The plan is to use telecommunications to deliver training courses for internal PTT staff. The material would largely be CBT, but it would be supported by tutors via a conferencing system.

23 EuroKom

Contact: UCD Computer Centre, Belfield, Dublin 4, Ireland.

Programme: EuroKom is a conferencing and file transfer service designed to support research teams, businesses and government organisations in their national and international communications requirements. The host for the system (a version of PortaCom) is situated in Dublin at the UCD Computer Centre. EuroKom was established by the Commission of the European Communities to support the communications requirements of research participants in the ESPRIT programme. It now plays a vital role in the coordination and management of these activities, enabling the development

of a transnational 'group culture' while strengthening the local group effort in each participating country.

BELGIUM

24 Network of University Science Departments

Contact: Piet Henderikx, Studiecentrum Open Hoger Onderwijs v.z.w
Trierstraat, 100, 1040 Brussels

Programme: Computer-mediated communication on the topic of informatics takes place between all the science departments of universities in Belgium. This network is used for teaching, developing programs and software.

DENMARK

25 Jutland Open University

Contact: Jorgen Bang, Jutland Open University, Aarhus, Denmark

Programme: Computer conferencing is used at this distance teaching university in various arts courses as a tutorial support between face-to-face meetings. Experiments have been tried with students accessing the system from local study centres and from PCs at home. It was discovered that students made very little use of study centre terminals. A considerable amount of time was spent discussing technical difficulties on the system, and little pedagogical use was made of its interactive capabilities. Tutors were not paid extra for using the system, and students complained that nothing was happening in the conferences. From these early experiments, a good deal was learned about how to design a course using conferencing for the Danish setting.

See also

Case Study One: Vocational Education and Training in Denmark

FINLAND

26 Lahti Research and Training Centre

Contact: Irene Hein, Lahti Research and Training Centre, Kirkkokatu 16, SF-15140 Lahti, Finland.

Programme: The Lahti Research and Training Centre started a distance teaching project in 1987 using various telecommunication media. In 1989

they start experimenting with computer conferencing - an in-service course for teachers, to upgrade their knowledge of distance teaching. About 30 teachers initially will start the course, using PortaCOM, hosted by Helsinki University.

27 University of Jyvåskylå

Contact: Professor Raimo Konttinen, Institute for Educational Research, University of Jyvåskylå, Seminaarinkatu 15, SF-40100 Jyvåskylå, Finland.

Programme: With the aim of encouraging campus-based students to exchange ideas and not just rote learn, Professor Konttinen plans to introduce computer conferencing on his Introduction to Education course. Four books will be discussed online, and results of Finnish students' interactions will be compared with British students.

FRANCE

See Appendix Three:

F1: UAP
F2: Service SA
F3: Educâble
F4: CNED + CCETT
F5: Didaotel
F6 & F7: CNAM
F8: University of Paris-Dauphine
F9: CUEEP, Lille.

GERMANY

28 Institute of Computer Science, Munich University

Contact: Christof Newmann, Institut fuer Informatik, der Technischen Universitaet Muenchen, Postfach 202420, D-8000 Muenchen 2, Fl. of Germany.

Programme: The Institute of Computer Science is involved in a project to integrate computers into higher education. They lend IBM computers to about one-quarter of their 400 students, who pay only a small fee for insurance and repair. The Institute finds that their students who work from home, accessing CAL material remotely miss the camaraderie of their on-campus peers. For this reason, the Institute is planning to install a conferencing system and hope that through electronic interactivity, students will feel more part of university life.

ITALY

29 SEVA

Contact: Sn. Maniscalco, Divisione FORTEL, Via Pantano, 26, 20122 Milano

Programme: In addition to the uses of FORTEL described in case study eight, SEVA is also working in collaboration with CUD, a federation of distance teaching partners in Italy. The plan is to produce course material on Sun workstations to transmit through SEVA's network to local study centres all over Italy. Because of the problem of sending the right number of texts of each subject to each study centre, the idea is to equip each centre with a laser printer, and to download exactly what is required on site.

30 TEAM

Contact: Sn Enrico Rovida, TEAM, Via Interiano,1, 16124 Genova.

Programme: Team is a consultancy company in Genoa, involved in a variety of networking programmes. For example, it acts as an intermediary between the EEC and small and medium sized enterprises in Genoa, and throughout Italy. At the moment 10 SME's are connected to their network, but through the contacts of Genova Ricercho, they will have access to many others and plan to build up this network by providing information on EEC contracts, reports and database information.

Team is also involved in mounting distance training courses for local businesses. The problem in Italy with most training schemes is lack of attendance. Team hope to improve in-service training by using computer conferencing. Pilot schemes will start in Sept. 1989 and the full programme will be operational in June, 1990.

In a proposal to coordinate the various partners in the Action Line III programmes of DELTA, Team would moderate conferences on EuroKom.

See also

Case Study Four: Alitalia

Case Study Eight: Isfol and the use of Fortel

THE NETHERLANDS

31 The Dutch Open University

Contact: F. Mofers, The Open University of the Netherlands, Valkenburgerweg 167, 6419 AT Heerlen.

Programme: In collaboration with the PTT, Phillips and Kluwer Publishing Co., the Dutch OU experimented with electronic distance learning. Students were provided with a Phillips MSX computer, which the company wanted to trial. The publishing company participated as they were interested in developing software to work on the MSX. The students used the machine for CAL material, and also to network with their tutor and other students. However, the aims of the four partners in this scheme were somewhat divergent, and the experiment was not particularly successful as electronic distance teaching. Nevertheless, the Dutch OU is pursuing its interest in networking, and other plans are in the pipeline.

NORWAY

32 NKI

Contact: Morten Paulsen, NKI College of Computer Science, Stabekk, Norway.

Programme: NKI is one of the largest private educational institutions in Norway, and it runs an engineering college, a college for computer science and a distance learning institute. It has developed the computer conferencing system, EKKO specifically for distance teaching applications. EKKO is used for communication between full-time and part-time academics and administrators and students. It is used both on-campus and at a distance through more than 60 campus terminals and from PCs off campus.

EKKO has four main modules: the user directory, email, bulletin boards and conferences. NKI's first experiment with distance teaching took place in 1987 after some pilot trials on campus. During 1988 three courses were offered, 'Introduction to computer science', 'Structured programming' and 'System analysis and design'.

33 Finmark Research Centre

Contact: Lars Krogh, Finmark Research Centre, PO Box 1183, N-9501 Alta, Norway.

Programme: Finmark Research Centre is coordinating the activities of six FUNN centres in developing distance education services. Through networking, the FUNN centres will bring outlying areas of Norway into closer contact with the knowledge and resources available in the major population centres of the country. The programme aims to demonstrate that decentralised research and development can be performed when a first-class computer network with sufficient computing resources are made available to users.

See also

Case Study Ten: NKS College

SPAIN

34 Fundesco

Contact: Rogelio Segovia, Fundesco, Alcala 61, 28014 Madrid, Spain.

Programme: The Foundation for the Development of the Social Function of Communication (Fundesco), was created by the Spanish Telephone Company in 1970. One of its many fields of action is to optimize the use of advanced technologies for education and training. Fundesco would like to use the new EIES II system to develop various training programmes. The reasons for their choice are: EIES II is Unix-based, which they feel is the operating system of the future; EIES II already has development plans for PTEIES (personal, tailorable EIES); it uses windows as in Unix; and EIES is modular, so combinations can be made into a distributed system.

35 FYCSA

Contact: José Femenia, FYCSA, Condesa de Venadito, 5A, 28027 Madrid, Spain.

Programme: Fycsa is the largest training company in Spain and offers training courses for many major corporations - Alcatel, Iberia and the Spanish railway. Most of this training has been face-to-face. Three years ago they began to investigate other methodologies. They plan to use PortaCOM to deliver updating courses to local government agents..

Fycsa are also involved in the Latino Project, which will provide CBT courses accessed through public data networks to businesses, university students, teachers and private individuals. The aims of the project are to solve the problems arising from trainees dispersion, diversity of working schedules, lack of uniformity in the quality of training material and overbooking of

training facilities. Latino is a European project and has Italian and Portuguese partners.

36 NEXUS

Contact: Joaquin Ballester, Nexus, Capdevila, General Mitre 95, Barcellona, 08022, Spain.

Programme: Nexus offers the CoSy conferencing system as a networking service in Spain. By paying the very high IBERPAC charges for all users, Nexus hopes to build up a solid base of participation throughout the whole country. At the moment, the service is directed at individual enthusiasts and small business enterprises. As a way of increasing interest, Nexus plans to offer 'evening classes' and pay the moderators who teach them. Some of these adult education courses might be run in 'real time', rather than asynchronously. By the end of 1989, Nexus aims to build its user base from 400 to 1000.

37 Spritel

Contact: Roberto Beitua, c/ Gran Via 2, 4a Pta, 48001 Bilbao, Spain.

Programme: Spritel is a society for the promotion of industry in the Basque region of Spain. It is a public company, funded by the Basque government, to introduce micro-electronics into small businesses. In particular, the programme aims to improve competitiveness, reduce overheads and facilitate information exchange through networked communication. Spritel has set up the network, which includes databases and the PortaCOM conferencing system, and works to bring together the users and the providers of information. A pool of 350 terminals is available for loan without cost to interested companies for up to three months, and promotions and training sessions are run by Spritel. A new law liberalising the sale of modems in Spain has now been implemented and will make a significant improvement in all the networking projects in Spain.

Spritel has used a local company to develop a tailor made front end to PortaCOM, which among other features organises the billing for database access. Spritel has also translated PortaCOM into Spanish and Basque. The target is 1500 users by the end of 1989 and 4000 for 1990. Spritel expects the conferencing system to be more useful than email: as a way of reducing face-to-face meetings and of facilitating team work. At the moment, the use of email and conferencing is free and only the database use is billed.

Spritel sees itself as pioneering a new concept of business in Spain, which requires considerable promotion and marketing. The organisation spent two years studying the field, looking at other experiences and picking the best ideas from each.

See also

Case Study Six: Programa de Nuevas Tecnologias

PART FOUR
APPENDICES

APPENDIX ONE:
TECHNICAL GLOSSARY

Prepared for the Training Agency
by
Dr. Nick Heap

analogue (signal)

A signal that is continuously variable over its full range of values. For example, the electrical output of a telephone microphone is an analogue voltage signal.

animateur

In this context, a person, online, on certain Télétel services in France who encourages user participation in the service.

ASCII

American Standard Code for Information Interchange. An internationally accepted binary code for representing alphabetic, numerical and special control characters. Each binary code consists of 7 bits.

ASCII file

A file which only contains characters stored as their 7 bit ASCII codes with no information about formatting - i.e. about the presentation of the textual material.

asynchronous transmission

A transmission protocol in which each character is transmitted in its own timeframe, independent of all other characters that are transmitted.The receiver detects the start and end of each individual character by means of additional bits, known as the start and stop bits.

audio graphics

Simultaneous transmission of audio and graphical information across a telecommunications network (e.g. Cyclops, Telewriter).

audio-conferencing

More than two people, in different locations, communicating by voice via a private or public telecommunications network.

audit trail

A method of tracing the progress of a message through a telecommunications system which allows any problems to be traced.

auto-answer (modem)

A modem with an auto answer capability can respond to incoming messages and control the transfer of data without human intervention.

auto-dial (modem)

A modem that has an auto-dial capability can automatically dial the number of a computer to which access is required.

auto-log on

Automation of the procedure to log-on to a remote computer network or individual host.

bit

An abbreviation for binary digit, of which there are two, O and 1.

bits per second

A measure of the transmission speed of a network.

bridge

An electronic device that enables the interconnection of different local area networks. The bridge provides the necessary protocol conversion between the networks.

broadcasting

The simultaneous transmission of data bytes (or packets) to several different receivers.

bus network

A network topology in which each device is connected to a single message highway, as illustrated in Figure A1.1. Any message transmitted by one of the nodes is received without intervention by every other node.

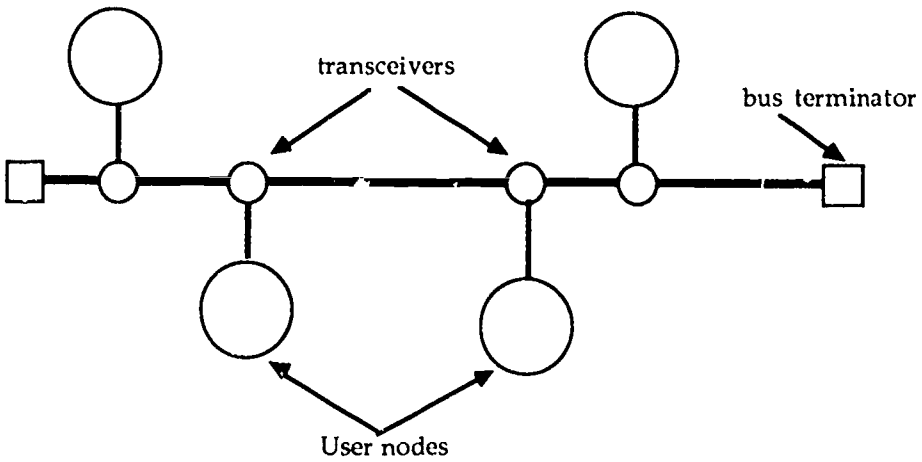


Figure A1.1 Bus Network

byte

A binary code comprising 8 bits. The byte is commonly used as the unit of measurement for data storage capacity (e.g.memory and disk storage). The term 'octet' is now preferred, since some manufacturers use other than 8 bits in a byte (e.g. 'ASCII byte' requires only 7 bits). There are always eight bits in an octet.

capacity

In a telecommunications system the capacity of a transmission link (e.g. a telephone trunk) is a measure of the number of individual messages or calls that can be carried by the system simultaneously.

CCITT

International Telephone and Telegraph Consultative Committee. The acronym is derived from the French name - *Comit Consultatif International Télégraphique et Téléphonique.*

CD - compact disc

An optical disc storing data in digital form which is read by a laser and reproduced either as music, video pictures or data for a computer.

CD-audio - audio compact disk

Audio recordings (speech and music) stored on a compact disc.

CD-ROM - compact-disc read-only memory

Compact (optical) discs used for mass data storage. Data is stored on the optical disc as a series of small pits in the surface, which can be read by a low-power laser. These surface pits are created during the manufacturing process, hence the data cannot be modified.

character

Any letter, number, punctuation mark or special graphic symbol used in text or processed by a computer.

coaxial cable

A cable consisting of a conductor surrounded by, and protected from, a tube of braided copper. They are used for long-distance telephone lines and for connecting users of LANs.

collision

In networking, a collision occurs when two nodes attempt to use the same communication channel at the same time.

communications port (see also serial port)

The output unit of a computer to which a modem is attached. It converts data from the internal format of the computer to a form more suitable for communication and it controls the communication process.

communications software

Programs that control some of the actions of the communications port and handle the rules of communication (protocols).

compatibility

1. Pairs of devices are compatible if their codes, speeds and signal levels allow for direct interconnection between them.

2. Computers are compatible if their programs can be interchanged and executed without appreciable modification.

computer conferencing

The computer equivalent of a telephone conference, whereby participants can exchange textual messages on a group basis. Such exhanges need not occur simultaneously (synchronously), but can occur over a period of hours, days, or even weeks, as time permits (asynchronous).

Computer conferences are normally structured into a set of associated topics, which helps users find relevant contributions and organise their own entries.

computer network

A system of interconnected computer systems that allows data to be transferred between them.

computer-aided instruction - CAI

Computer programs designed to interface with the user in such a way as to simulate an encounter between a teacher and a student. It usually refers to branching dialogue forms of teaching, but it may also include simulations and computer-controlled media such as interactive video. The most commonly used term in United States.

computer-assisted learning - CAL

Similar to computer-aided instruction but usually includes simulation and sometimes interactive video programs as well as branching tutorials. The most commonly used term in Britain.

computer-based instruction CBI

Synonymous with computer-aided instruction but less commonly used.

computer-based learning - CBL

Synonymous with computer-assisted learning. It is often used to contrast with computer-based training.

computer-based training - CBT

This term covers the same types of program as computer-assisted learning and computer-based learning but in a training context, i.e. computer programs designed to interface with the user in such a way as to simulate an

encounter between a trainer and a trainee. The term can refer to all forms of teaching program, including tutorial dialogues and simulations.

computer-mediated communication - CMC

The general application of computer and telecommunications technology to enable inter-personal communications.

CoSy

Acronym of COnferencing SYstem. A computer conferencing and electronic mail system developed at Guelph University, Ontario, Canada.

data

1. Facts, concepts or instructions presented in a formalised way which can be communicated, interpreted or processed by human or automatic means.

2. In computing, information which can be represented by a computer. It is first input, then processed in some way, and then stored for subsequent output.

DELTA

Development of European Learning through Technological Advance: a European Commission funding programme to develop and establish a European capability in distance learning and supporting communications software.

digital

The representation of data or physical quantities by means of digits.

digital signal

An electronic signal that is defined in terms of a set of discrete and discontinuous values, one whose various states are at discrete intervals apart. Computers use data in digital form.

download

The process of obtaining a data file or computer program from a distant location by means of a communications channel, such as a telephone line. Commonly used as a verb and as a communications program command.

duplex systems

1. Full duplex system . A telecommunications system which allows data or messages to travel in both directions simultaneously. Although in common use full-duplex is tautological. 'Duplex' implies 'full duplex'.

2. Half duplex system. A telecommunications system which allows information to travel in both directions but only in one direction at a time. It requires a special procedure to change the direction of information flow.

electronic mail

A means of sending text messages to individuals or groups of individuals using a computer network. The sender inputs a message to the computer via a terminal, and the receiver also uses a terminal to read and respond to messages.

embedded CBT

Embedded computer-based training. A training program which is embedded in the computer's memory alongside the program which is being learnt in such a way that it acts as a front end to that program. It checks the user's input to the main program and offers help and advice where necessary.

error-correction

A variety of techniques used to correct errors that arise during the transmission of digital signals.

error-detection

A variety of techniques used to detect when errors arise during the transmission of digital signals. Parity checking is one such technique used with ASCII data. It relies on adding an extra bit to the binary codeword. For even parity this bit is chosen such that the total number of 1s transmitted, including the parity bit, is always an even number (0,2,4...etc). The receiver calculates the value of the parity bit from the received data and compares it with the transmitted value. If these two values differ on transmission, the receiver assumes that an error must have occurred. If the two parity bits are the same, it is assumed the transmission was error free.

ESPRIT

European Strategic Programme of Research and Development in IT. Launched in 1984 to aid long-term research in IT within the EEC.

even parity

In order to detect data transmission errors in digital systems a parity bit is selected so that there are an even number of ones in each character transmitted.

facsimile (fax)

A technique for transmitting text and black and white pictures over the telephone network using synchronized scanning at the transmitter and receiver. The image to be transmitted is broken down into lines of pixels,

each of which can be represented by a single bit. To minimise the transmission time, the transmitter uses special codes to represent long sequences of black or white pixels.

fibre optic

A very fine fibre of glass or plastic through which light can be transmitted by total internal reflection. In telecommunications, electrical signals are converted to pulses of light for transmission and then converted back into electrical signals at the end of the cable. These fibres have a very large bandwidth, so many more items of information can be transmitted down a fibre optic cable than down a conventional copper telecommunications cable.

file server

A computer in a networking system which provides program and data storage, but does not execute a user's program.

gateway

A device which enables two systems using different network protocols to communicate with one another.

GEISCO

General Electric Information Service Company; one of the largest commercial global telecommunications networks.

host system

A computer system connected to a network and capable of executing general purpose programs on demand (see also file-server).

information provider

Organisations which provide information for services such as Prestel. They also have to create a system of cross references to enable the user to access the information required.

intelligent computer-aided instruction - ICAI

A teaching program which embodies: 1. a model of the teaching-learning process; 2. a model of teaching interactions; 3. a user model which is updated through interaction with the user.

INTELSAT

INternational TELecommunications SATellite Consortium. An international, non-profit making co-operative of member states, to facilitate communications between countries. In 1988 INTELSAT had 112 members, plus 56 more non-member users. It operated 15 satellites, giving global coverage.

interactive computer systems

Computer systems in which the users can interact directly with their programs, entering data and commands as required.

interactive video - IV

A form of computer-based learning in which a video disc or cassette is controlled by a computer, enabling film, stills and sound to be incorporated into the teaching or training program.

interactive videotex

A videotex service, such as Prestel or Télétel which provides a two-way communication link, via telephone and/or packet-switched systems for consulting and receiving text and graphics stored in computer databases, and for inputting messages and instructions. Videotex systems are designed to be simple to operate, low-cost and able to cater for large numbers of users. In the UK the term viewdata is sometimes used as a synonym for videotex.

interface

In terms of the hardware of IT systems, an interface represents the shared boundary between two devices or sub-systems (e.g.processor and memory, computer and peripherals) which specifies the type and form of signals passed between them. In terms of the software, the interface is represented by the input and output operations performed by the programs for the purpose of communicating data.

ISDN

Integrated Services Digital Network. An integrated all-digital telecommunications network capable of supporting more than one service e.g. telephony, data transfer, facsimile, and video. All links in the network, including those from domestic subscribers' premises, would be digital and offer higher capacity, speed and reliability. The current proposals are based on a basic transmission link providing 64kbps, building up to 2Mbps links. The service would enable users to mix services and provide telephony, fax, telex and video communications simultaneously over a single link and reconfigure the mix on demand.

ISO

The International Organisation for Standardisation, which promotes the development of international standards. Members consist of national organisations, manufacturers and academics most concerned with national standards.

Kiosque

One of several tarif systems available on Télétel. Kiosque covers the highest number of public Télétel services accessed from the home. Users connecting to any one of the 1500 or so services available 'in the kiosk' are charged on their phone bill solely on the basis of connect time. Subscriptions to these services are not necessary.

local area network

A medium speed electronic data network implemented with direct links between individual devices and operating over a restricted geographical area.

megaserver

A mainframe computer that forms part of a networking system and which can be used simultaneously by several hundred different users.

message

An arbitrary amount of information whose beginning and end are defined or implied.

microserver

A microcomputer forming part of a networking system.

minitel

A generic term for the range of terminals provided by the French Post Office to telephone subscribers to access the Télétel videotex services.

modem

Modulator-Demodulator: a device that converts the digital signal from a computer to an analogue signal suitable for transmission over a telephone system and vice versa.

multiplexing

In telecommunications, the process of combining a number of signals so that they can share a single transmission channel. There are two types: frequency division multiplexing and time division multiplexing.

MultiStream

A packet-switching service offered by British Telecom.

multiuser system

A system in which several users are connected to the main system via terminals and can run their programs at the same time. They can also share access to information stored in the main system.

networking protocols

The rules for integrating networks so that different types of equipment can communicate with each other.

node

In micro-electronics a node is an identifiable point in a circuit which can be connected to other identifiable points within the same circuit. In telecommunications, a node is a single connection point to a telecommunications channel.

NUI

Network User Identifier, the means of identifying a PAD by a unique 12-digit code including country, network, area and location.

ODETTE

Organisation for Data Exchange and Tele Transmission in Europe.

offline

Used to describe data processing equipment that is not connected to a computer or network.

online

Used to describe data processing equipment which is connected to a computer or network.

online database

A database which is continuously accessable via a computer network (e.g. airline booking systems).

packet

A discrete block of data with a predefined format that identifies both control and data fields.

packet-switched network

A digital telecommunications network in which the messages are broken into a series of discrete chunks or packets which are transmitted independently.

PAD

Packet Assemblers / Disassemblers. Equipment that prepares information for transmission by packet switching and assembles it again on receipt.

parity bit

An extra bit which is added to the binary codes for each character being transmitted so that errors can be detected. The parity bit is chosen so that the total number of 1s in each character is odd (odd parity) or even (even parity).

PBX / PBAX

Private Branch (Automatic) Exchange, as used by large companies requiring many telephones. It is connected to the public network by the equivalent of a trunk.

PC

Personal Computer. Although often assumed to be synonomous with the IBM personal computer, the term as used in this report includes all desk-top sized computers.

PDN

public data network.

portability

The ability to transfer programs and data between computer systems of different manufacturers.

protocol

A set of rules governing the input and output of a telecommunications system.

PSDN

Packet Switched Digital (Data) Network. A network of devices which communicate with each other by transmitting packets addressed to particular destinations.

PSS

Packet SwitchStream, a packet-switching service offered by British Telecom.

PSTN

Public Switched Telephone Network. Individual lines connect subscribers to local exchanges which in turn connect to switching centres and hence by trunks to other switching centres across the country. The public telephone network as operated by British Telecom and Mecury..

remote host

A remotely located computer system capable of running general purpose computer programs. (see also remote-server).

remote server

A remotely located file-server, which can be accessed via a telecommunications network.

remote-host computer based training

Computer based training for which the actual training software (including embedded training software) is executed on a remotely located host computer.

ring network

A network topology in which the transmission medium forms a continous ring with peripheral devices connected to it via transceivers, as illustrated in Figure A1.2. No one device has controlling authority over the network, but failure of a single device may cause failure of the entire network.

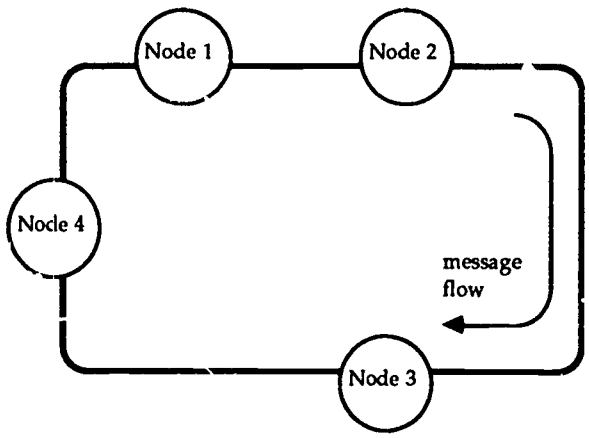


Figure A1.2 Ring Network

serial port

An input-output device that transfers data in serial fashion along a single pair of wires. Typical examples include RS-232 ports used for modems or serial interface printers.

serial transmission

A method in which data bytes are transmitted as a stream of bits one after the other along a single pair of wires. It is slower than parallel transmission, but is normally cheaper over long distances.

service providers

The organisations and individuals who are responsible for running services on a videotex system. They were originally called information providers, but now, in France at least, many services other than provision of information are available.

star network

A network topology in which all the nodes are connected directly to a central hub, as illustrated in Figure A1.3. This hub has full control over the transfer of messages between the individual nodes of the network.

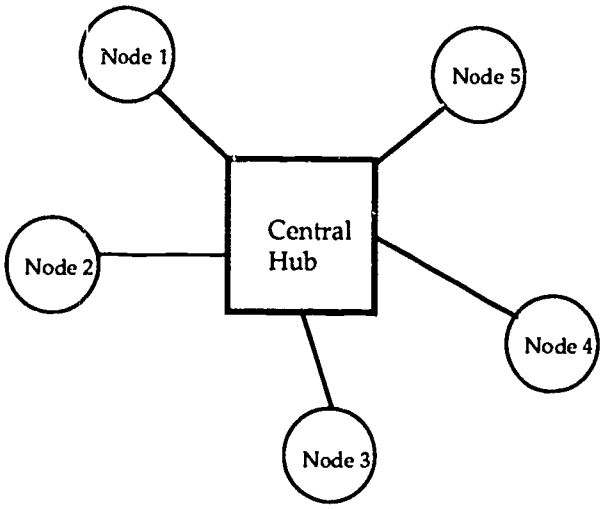


Figure A1.3 Star Network

statistical multiplexer

Many channels are connected to a system, but only gain access when they become active. This enables active channels to gain access more often than if they were assigned a fixed set of times.

statistical time division multiplexing - STDM

A form of time division multiplexing in which devices are allocated time on a network in proportion to the amount they use the network, thus leading to more efficient network sharing.

TBT

Technology based training includes all types of computer-based training, as well as non-computer technologies such as audio and video conferencing.

telecommunications

Communication over a distance; the transmission of messages and information by means of electrical signals, cables and electronic circuits.

telephone network

The public telephone system which can also be used to transmit data once it has been suitably processed.

teleservices

Services such as telephony and teletext.

Télétel

1. The French public videotex system.
2. The network which connects individual telephone subscribers to service providers. It is made up of:
   - a PSTN telephone link to a videotex access point which connects through to the Transpac packet-switched network;
   - the Transpac packet-switched network;
   - the computers which host the services available.

teletext

An information service which is broadcast by the major television companies. It is available on special television sets and specific pages of information may be requested by the user by means of a special keypad. It is a one-way service, the viewer cannot input information into the system.

teleworking

Working at home, usually linked either by a computer terminal or telephone to a central office.

terminal

A generic term used to describe any electro-mechanical device providing keyboard and display facilities and connected to a computer, either directly or via a network. A PC can provide the facilities of a terminal by means of 'terminal emulation' software (e.g. Kermit).

time division multiplexing

A means of using a high-capacity channel for several messages. Each message is allocated time intervals in the channel and the separate parts of each message are reconstructed at the end. It can only be used for digital messages.

token

A special message passing round the nodes in a network, its only function being to grant permission to use the transmission medium.

token passing

A network protocol where each node in turn is passed a token giving it permission to transmit data around the network.

topology

The way in which the items such as terminals, printers and storage devices, in a network are interconnected.

transceiver

A device with the capability to both receive and transmit messages, and through which peripheral devices can access a ring network.

transmission

In telecommunications, transmission is the action of sending information, unchanged, from one place to another.

transmission protocols

Rules for transferring data over transmission channels. They include both electrical and data format standards.

Transpac

A packet-switching service offered by the French telecommunications authority. In 1985 it was the largest and busiest in the world handling 1.5 to 2 million calls a day. Charges are independent of distance.

value added network - VAN

A network that offers customers a service over and above the simple transfer of data, for example electronic mailbox facilities.

videotex

Information services that include teletext systems and interactive videotex (viewdata) systems. Teletext type systems are broadcast by the major television companies and are available to anyone with a special television set. The user can request specific pages but cannot input information. Interactive videotex (e.g. Télétel) is a service which is available on subscription via the telecommunications network. Users can input information into such a system.

viewdata

An interactive videotex information system (such as Télétel) which is available on subscription. It provides information faster than teletext services and enables the user to input information into the system e.g. details of hotel vacancies can be seen followed by a form enabling a booking to be made.

wide area network - WAN

An electronic data communications network usually spread over a wide geographical area and using public or intermediate carriers to effect transmission.

X25 protocol

An international standard for packet switched networks.

APPENDIX TWO: TECHNOLOGICAL CHOICES FOR LEARNING NETWORKS

Prepared for the Training Agency
by
Dr. Nick Heap

INTRODUCTION

In the context of computing and telecommunications, a 'network' is a combination of microelectronic components, cables and fibres, switching centres, and in today's world of digital telecommunications, appropriate software to manage the flow of information throughout. Twenty years ago it would have been possible to draw clear distinctions between a 'computer network' and a 'telecommunications network', based on such characteristics as, enabling technologies, transmission medium, transmission speed, geographic coverage and ownership. But with the rapid development of digital telecommunication techniques, the liberalisation of the telecommunications industry and the growth of electronic data transmission, the boundaries are no longer clear.

The centralised computer department is no longer the preferred solution to the information and data processing requirements of corporate business. The trend is towards distributed processing, with its increased flexibility, better access provision and rapid communication. Personal Computers and Engineering Workstations place the processing power on the individual's desk, while networks provide the links to the corporate databases, external information services, customers, and production and quality control systems. Portable, or 'laptop' computers offer greater mobility if required and can be purchased with an internal modem ready for connection via a dial-up telephone line to any point on the globe.

Public and private telecommunications services have also grown to meet the increasing demands of subscribers for more flexible data and voice transmission. British Telecom and Mercury, the United Kingdom's licensed telecommunications operators, have been investing in the provision of new digital switching and transmission systems, the latter based on high capacity fibre-optic cables. In addition, both companies offer subscribers packet-switched services for national and international data transmission. The corporate sector has also been updating its telecommunications equipment; to take advantage of the increased flexibility offered by modern systems. It has been estimated that during the period 1983-1985 over 60% of PABX equipment in the United Kingdom was replaced by digital switching systems (Telecommunications, April 1988), better able to satisfy in-house requirements for voice and data transmission.

The combination of computers and telecommunications has enabled increased accessibility of existing information services and the development of new services. Online databases covering financial news, library stock holdings, commercial directories and messaging services, such as Telecom Gold, Gold 400, Mercury Link 7500 and One-to-One can be accessed via dial-up lines from the office, the home, or even the car and the train. Current estimates give Telecom Gold market leadership, with some 138,000 users.

Corporate computer systems can now be readily inter-linked via the public telecommunication services to permit real-time commercial transactions (e.g. holiday booking, stock ordering, electronic payment systems) as well as inter-personal communication. The central computer is no longer isolated or insulated from external access, but has become one element in the corporate information network. Users need not be constrained to work within the old boundaries of the 'computer network', as these boundaries are pierced by the public and private 'telecommunications networks'. New networks are emerging, distinguished not by technical specifications, but by the type of service provided, such as electronic document exchange, library searches, management information or learning.

A 'learning network' could provide the opportunity for open access to learning materials, training in the use of new technology and access to public information services. Such a network could also provide corporate training agencies with solutions to several old problems, such as costly withdrawal of staff from their workplace for face-to-face sessions, restricted availability and access to course materials, outdated course materials, monitoring progress of individuals and the isolated learner.

However, there are many factors that will inhibit the development of such networks, not least the strategic decisions of Corporate Management. The case studies cited in this report illustrate the enormous potential for such systems, as well as some of the difficulties of implementation. Rarely is the technology cited as a limiting factor. Nevertheless, there are limits to the technology available at any instant in time and choices have to be made and problems overcome.

This Appendix explores some of these limits and looks at possible solutions, but rather than adopt an engineer's viewpoint, which might concentrate on technical specifications, the emphasis is placed on practical considerations as they might influence the decisions of training management.

CLASSIFYING NETWORKS

The traditional classification of networks has been based on technical specifications, embracing contruction, capacity, and topology. Whilst such classifications are appropriate for network designers, they are not suited to corporate management, educators and trainers, and users. These groups have their own sets of goals, directly related to their function within their organisation, as illustrated in Figure A2.1. This Appendix specifically addresses the management goals, but briefly touches on those of the educator/trainer and the user.

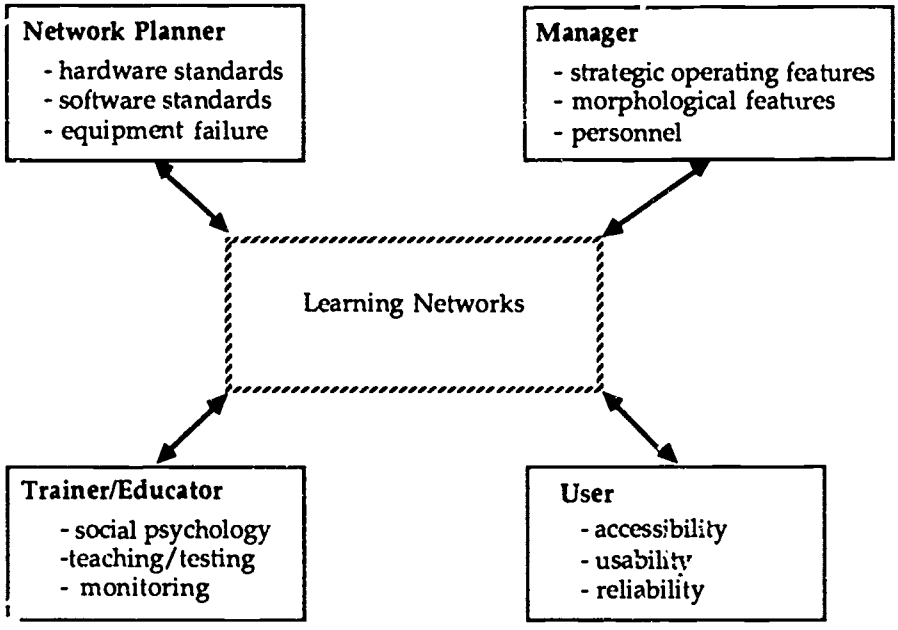


Fig A2.1 Perspectives on Learning Networks

However, even managers need to be conversant with the basic characteristics of modern computer networks. This section sets out to provide an appropriate overview in a language comprehensible to lay readers, covering: departmental and corporate local area networks (LANs); inter-linked local area networks; and wide area networks (WANs). No attempt has been made to describe in detail the different transmission protocols of these networks, but if required such details are available by consulting one of the many standard texts (e.g. Black,1983 or Gee, 1982).

For the purposes of the following discussion, it is convenient to define a 'network' as the combination of cables and electrical interfaces that link together the various computers, peripherals and users, and of increasing importance, the software that makes the network operational.

The individual access points on the network are generally referred to as 'nodes', but it is useful to identify specific types, as follows:

User - an individual connected to the network either via a terminal or a PC functioning as a terminal.

Host - typically a mainframe or mini-computer capable of executing a range of programs

Server - a mainframe, mini or micro-computer optimised for high speed file operations for a number of network users.

Peripheral - typically a printer, disk drive or tape back-up unit shared by the users of the network.

Bridge - a device for linking compatible local area networks.

Router - a device for inter-linking different types of local area networks.

Gateway - a device to inter-link local and wide area networks.

The bridge, router and gateway devices provide essential facilities for expanding and inter-linking networks and are described in more detail later in this Appendix.

LOCAL AREA NETWORKS

A local area network, or LAN, is a network providing limited geographic coverage, such as within a single department or building. As a general rule they offer medium to high speed data transmission, typically in the region of 0.4 - 1.0 million characters per second and anywhere between 8 and 500 user access points. More recent developments, such as the fibre-optic based Fibre Distributed Data Interface (FDDI) system are set to deliver twelves times this speed and should be capable of providing for the distribution of video-tape and video-disc based material and live TV.

For the majority of LANs, special cabling must be installed to link the users and their associated hardware to the various host computers and file-servers. This cabling typically consists of copper wire, either in the form of 'twisted pairs' or the more expensive coaxial cables. Fibre-optic cabling is available, but because of cost it is normally limited to high capacity systems or networks in industrial environments which are subject to electrical interference.

LANs can be extended to cover adjacent buildings on a single site by employing special electronic equipment which boosts the signal levels, so as to counteract the losses exhibited by long cables. Furthermore, several independent LANs can be inter-linked to permit access to shared files and peripherals.

An alternative to dedicated cabling, is to use the existing cables provided for internal telephone systems. The technique is referred to as 'data-over-voice', and the data is routed to its destination via the company's private automatic branch exchange (PABX). Some 'data-over-voice' systems employ modems at each terminal which then dial a central bank of modems at the PABX, whereas newer designs can accomodate the digital signals from the terminal directly (Gee, 1982).

British Telecom offer a proprietary system known as DOVE (data over voice equipment) providing transmission rates up to 19,200 bits per second over distances of two miles. Modems at the exchange provide the final connection between the user and the host computer. Although this type of network can be cheaper to install (by saving on cable installation) it does not offer the

same degree of interconnectivity of other networking products; it is primarily intended to link individual terminals to a host computer.

DEPARTMENTAL LANS

Typical of the LANs available for departmental coverage are those based on PCs and capable of supporting 5 - 60 users. The lower priced systems utilise one of the PCs with harddisk as the file server, whilst the more expensive employ a dedicated high-speed file server. Amstrad and Sage both offer systems costing less than £200 per user.

The top end of the market includes networks such as Apple's LocalTalk for the Macintosh range of PCs, and the 3Com+ network for IBM PCs (and compatibles). Each of these networks requires as a minimum, a dedicated PC with harddisk to act as the file server, a configuration that speeds up operation and simplifies the provision of shared peripherals such as printers or CD-ROM mass storage. All these networks are able to support file sharing and electronic mail.

The Apple network interface is built into each Macintosh - all that is required is a connector and cable, but the technology is proprietary and can only be linked to other manufacturer's networks by means of routers and gateways.

The 3Com+ network requires a special card to be fitted inside each networked PC, and currently this card can cost as much as a complete PC. The main advantages are greater transmission speed and reliability. Furthermore, the 3Com+ network is build around international standards and will support cards from several vendors.

The length of these 'departmental' networks is limited by the combination of electronic circuits and cables employed, and most manufacturers quote maximum lengths under 1000 metres. Apple's LocalTalk for example, uses low cost twisted pair cables and the maximum length is about 200 metres, whereas the 3Com+ network employs coaxial cables and is limited to approximately 500 metres.

Although in principle the departmental network might support as many as 60 users the practical limit is nearer 8-10 users, especially if the work involves file intensive activities such as online databases.

Setting up and configuring departmental networks is not a simple task and should not be left to individual users. A network manager should be assigned to be responsible for configuring user addresses, assigning file access privileges and performing regular backups. However, most vendors claim that the essential skills can be aquired from a two or three day training course.

It is difficult to generalise about the costs of departmental networks because of the diversity of configurations. A simple starter network to share files between two PCs can be bought for under £400, whereas a 6-8 user system with a dedicated server, mirroring disk drives and high security access control may cost in excess of £10,000. Given that the network exists, adding single users will cost in the range of £200-£500.

CORPORATE LANS

When distances or user numbers exceed the capacity of the departmental network, or when computers from several vendors must be interconnected, one solution is to employ a 'standard' LAN technology such as Ethernet, Token Ring or Token Bus. Alternatively one can purchase manufacturer specific products such as those offered by IBM (Systems Network Architecture) and DEC (DecNet).

The specifications for Ethernet, Token Ring and Token Bus are covered by standards published by the IEEE and ISO, but it is important to appreciate that these standards only cover the electrical and signalling specifications. Appropriate software must be purchased before files and electronic mail can be exchanged.

Ethernet relies on broadcasting messages as they arise from each user, hence special provision has to be made to handle the event of two users broadcasting simultaneously. The solution employed is simply to retry at random intervals. Although this technique works well on lightly loaded networks, it can create noticeable delays on heavily loaded networks leading to anxious or frustrated users.

The Token Ring and Token Bus networks regulate message transmission, ensuring that only one user is transmitting at any moment. Furthermore, individual users can be assigned access priorities, thereby guaranteeing a maximum response time for transferring messages across the network.

The corporate LAN can extend to several thousand metres, given the necessary electronics and cabling, and can support hundreds of users. Furthermore, they can also be used to create a 'super' network of interconnected departmental networks, to provide electronic mail and file sharing facilities. As an example, General Motors Inc employs interconnected LANs in many of its car production plants as part of its Computer Integrated Manufacturing strategy.

These 'standard' networks are offered by all the major computer vendors and are also available as plug-in cards for PCs, thereby enabling PC users to access corporate databases for local data processing.

Networking PCs and central computer systems has enabled a number of developments in training for new technology. A typical example might require new staff to be trained to use a database, running on a networked host computer, to ensure a minimum proficiency level prior to permitting free access to the central files.

One solution that might be adopted combines the processing power of a PC with a PC-to-host network link. A TBT application running in the PC could connect the trainee to the central computer, start up the database program and then lead the user through the data entry and retrieval procedures. Mistakes could be highlighted as they arose and a progress report retained on a disk in the PC. Electronic mail could also be employed for trainee and trainer communication.

Clearly the investment required to produce this scale of network is substantial and cabling costs alone may amount to tens of thousands of pounds. The management of such a network requires specialist knowledge and equipment, and is not the sort of task to be delegated to an individual user. It is therefore unlikely that such a network would be installed solely as a 'learning network', but once such a system becomes available the potential for interactive communication can be exploited.

INTER-LINKING LANS

The availability of low cost microcomputers and networks has led to a distinct shift in the purchasing patterns of large and medium sized companies. Instead of centralised and tightly controlled equipment purchases with a high degree of co-ordination, the majority of PCs are authorised at the departmental level. Whilst these PCs remain isolated and self contained, such ad-hoc purchases present few problems, apart from that of co-ordinating maintenance, but as networking increases much of the existing equipment base will require upgrading or total replacement.

The scale of the problem can be seen from recent purchasing patterns in the USA, where it is estimated that during 1989 20% of all PCs (about 100,000 per month) were purchased to be networked and that by 1992 this will have increased to 60% (PC Business World, May 1989).

BRIDGES

Inter-linking departmental LANs to each other or to a corporate LAN can be achieved by employing additional hardware devices and appropriate software. The simplest solutions arise when the networks to be linked are based on the same hardware and software protocols in which case all that is required is a single bridge unit, as illustrated in Figure A2.2. In this example the bridge unit is used to link two Token Ring networks.

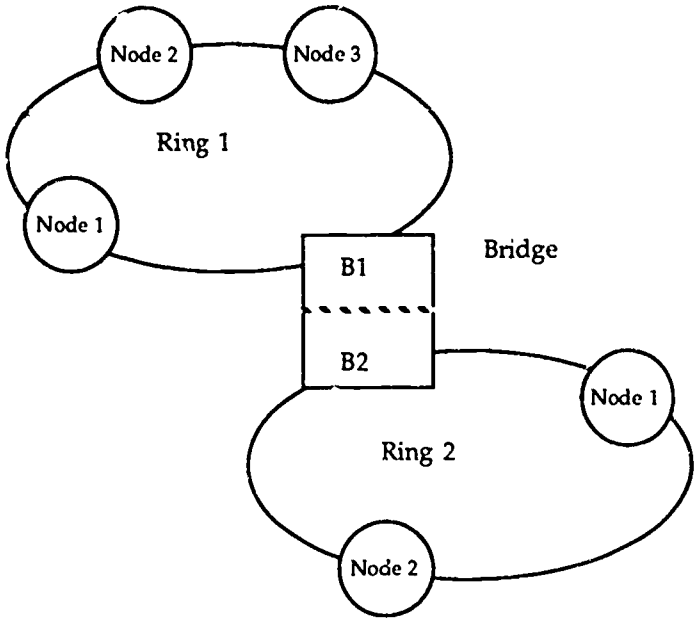


Figure A2.2 Inter-linking two LANs by a Bridge

The bridge is divided internally into two separate nodes, one connected to Ring 1 the other to Ring 2. Messages circulate around each separate ring in the usual way and the bridge node is treated exactly the same as any other user on the network. Messages passing between Ring 1 and Ring 2 are extracted by the respective node of the bridge and sent internally to the other node for circulation around the second ring network. The bridge device can be provided with a look-up table of valid node addresses and will only pass across messages between LANs if permitted by the table. This mechanism provides an additional measure of security and also minimises unnecessary network traffic.

ROUTERS

If the networks to be inter-linked employ different types of cables or network protocols, for example inter-linking Token Ring and Ethernet networks, then a router is employed. The router is designed to decode a message arriving from the first network into its component parts (e.g. address, data and error checks), extract the data and then create a new message (comprising address, data and error checks) for insertion into the second network. Clearly the task is more complex than that required of a bridge and so routers tend to be more expensive.

Routers are available to inter-link most of the common network protocols, including Ethernet, Token Ring, Apple's LocalTalk, Arcnet, IBM's SNA and Digital Equipment's DecNet. Prices typically range from £2000 - £10,000.

WIDE AREA NETWORKS

Many commercial and industrial organisations find themselves operating from more than one site and whilst separate LANs can satisfy the single site requirements, additional networking facilities are needed to link the individual sites into a single corporate network.

Networks on such a geographic scale are termed wide area networks, or WANs. But geographic scale is not the only identifying feature. Most WANs employ third party telecommunications links, such as those provided by British Telecom and Mercury, or they may utilise Value Added Networks (VANs) such as GEISCO or ODETTE.

In general WANs operate at slower speeds than LANs, typically in the 9600 - 64000 bits per second range. ritish Telecom also offers higher transmission rate services, up to 2 million bits per second, and tl.ese can be used to combine voice and data telecommunications between fixed locations.

WANs can be subdivided into two types, public and private. Public networks are built up from the public service telephone and data networks provided by British Telecom and Mercury. Any subscriber may use these facilities as required and pay only for the services used. Private networks are made up of leased circuits and are not accessible to public service subscribers.

PUBLIC NETWORKS

The most important public network is the telephone system, or to use its proper title, the public switched telephone network (PSTN). When a number is dialed on the PSTN it creates a temporary electrical circuit between the calling and called telephones, and this is subsequently broken when the caller 'hangs-up'. Although the PSTN provides an analogue service for the direct connection of phones, it can be used for data if a modem is employed.

Historically the PSTN has been regarded as slow and unreliable. Ten years ago transmission speeds were in the range of 300 - 1200 bits per second. Even at these low speeds, electrical interference could garble data and make textual messages unreadable. Today the situation is very different as developments in modem technology have pushed transmission rates to 19,200 bits per second.

The other public telecommunications service is the public data network (PDN), an ·il digital service offering transmissions speeds up to 48,000 bits per second. The British Telecom service is known as Packet Switch Stream and the Mercury service as Mercury Packet Data Service and both conform to the CCITT X.25 standard. The PDN does not create a circuit for individual transmissions, instead it uses packet switching techniques. The basic

principle is that data for transmission is broken into a series of discrete packets which are sent individually over the network. The first packet transmitted provides all the addressing information to set up the route and all subsequent packets follow the same route. The advantages of this technique are greater use of the capacity of the network's cables and fibres and dynamic routing to minimize congestion.

Public services are normally used to provide short duration links either between fixed locations (e.g. Automated Teller Machines, Travel Agent booking systems) or mobile users (e.g. sales representatives).

ACCESS TO THE PUBLIC NETWORKS

The public networks provided by British Telecom and Mecury offer national and international coverage from any telephone point in the United Kingdom. To use these services all that is required is a 'terminal' and a modem. The terminal may well be a PC running software to emulate one of the industry standard terminals (e.g. VT100, VT52).

To use the PDN from a terminal requires use of a packet assembler-disassemble (PAD), which can be provided as a peripheral on a corporate LAN, or users can connect to one of the dial-up access points provided by British Telecom and Mercury.

LANs can be directly inter-linked via the PDN by means of a special piece of equipment known as a gateway. This provides the necessary protocol conversions between the LAN and the PDN and is a useful option where the volumes of data to be exchanged do not justify leased lines. Users on the LAN can 'dial' out over the PDN to any remotely located computer on the national PDN or via the international data network.

Modems

The primary function of a modem is to convert the digital signals used by computers into a form suitable for transmission over an analogue signalling service such as the PSTN. One end of the modem connects directly to a telephone point, the other to a terminal or PC via a serial port.

In order to communicate across the PSTN two modems are required, one at the originator and another at the receiver. The user dials the telephone number corresponding to the remote modem and then waits until the two modems synchronize themselves. Once the data transfer session is complete the user disconnects the modem, which in turn breaks the link and disconnects the other modem.

The design of modems for use in the United Kingdom is covered by the international standards agreed by the CCITT, enabling communications

throughout Western Europe. The current standards provide for equipment capable of transmitting between 300 and 14400 bits per second. Due to the variety of models currently available, vendors tend to employ the CCITT designations as listed below.

V21 - 300 bits/s for use on the PSTN
V22 - 1200 bits/s for use on the PSTN
V22 bis - 2400 bits/s for use on the PSTN
V23 - 1200/75 or 75/1200 bits/s for use on the PSTN
V26 - 2400 bits/s for use on 4 -wire leased lines
V27 - 4800 bits/s manual equalization for use on leased lines
V27 bis - 4800 bits/s automatic equalization for use on leased lines
V27 ter - 4800 bits/s automatic equalization for use on the PSTN
V29 - 9600 bits/s for use on leased lines
V32 - 9600 bits/s for use on the PSTN
V33 - 14400 bits/s for use on leased lines

The majority of modems incorporate features for automatic dialing of out going calls, automatic redial, automatic detection of incoming calls, and abbreviated dialing. These features require commands to be sent from the terminal to the modem, but unfortunately modem manufacturers have not been consistent with their choice of commands. The only 'standard' that can be said to exist is based on a set of commands originally devised by the Hayes Corporation of the USA, which are incorporated into most terminal emulation software packages. Modem vendors often use the phrase 'Hayes compatible' in their sales literature.

More recent innovations incorporated into a few modems are error detection and correction and data compression, and although such features increase costs, they can significantly improve reliability and double the effective transmission rate.

Modem prices range from around £100 for V21/V23 up to £1500 or more for true V32.

The lower speed modems (V21/V23) provide a low cost means of giving individual users access to learning networks for interactive sessions and where the bulk of the data transfers consist of text messages. Typical examples might include electronic mail and conferencing. For more intensive applications, such as embedded TBT or simulation activities involving graphic displays, higher transmission speeds are required to provide a reasonable response time for the user.

PADs

As already mentioned, PADs are expensive devices intended for shared rather than individual usage and so are normally accessed via a LAN, or via one of the public network access points.

In order to use a public access point, the user requires a modem and must register with the service provider (British Telecom or Mercury) to receive a network user identity. British Telecom currently charges a joining fee of about £40 and a quarterly charge of £10. Mercury's joining fee is £15 with quarterly charges of £10.50. In addition to these fixed charges are the usage charges, somewhere between 20p and 40p per minute.

A PAD on a LAN can be accessed like any other peripheral; the user simply sends the address for the remote host, waits for the connection to be completed, then logs on in the usual manner. As far as users are aware, they have a direct terminal connection to the remote host and can execute programs, access files or transfer data.

Combining the Public Telephone and Data Networks

The telephone and data networks offer considerable flexibility when it comes to creating medium and low-speed corporate computer networks. Both services are available throughout the UK, and charges are related to usage rather than distance.

Typical of what can be achieved is the recently completed network of Anglian Windows, the doubling glazing manufacturer. The company's headquarters and manufacturing facility are based in Norwich, but sales are conducted through 48 branch offices and 140 smaller showrooms. The company's mainframe computer at Norwich is used for general accounts and payroll, as well as processing new orders and checking the status of confirmed orders. PC based LANs in the branch offices are used for processing all local orders, including those from the local showrooms and mobile sales representatives.

Until recently, order processing and progressing relied on telephone conversations, but now headquarters and branch offices are linked via the PDN. Furthermore, the showrooms have been equipped with PCs and modems, to enable them to communicate directly with the branch office via the PSTN and hence to headquarters via the PDN. The result is a two tiered network structure, as illustrated in Figure A2.3.

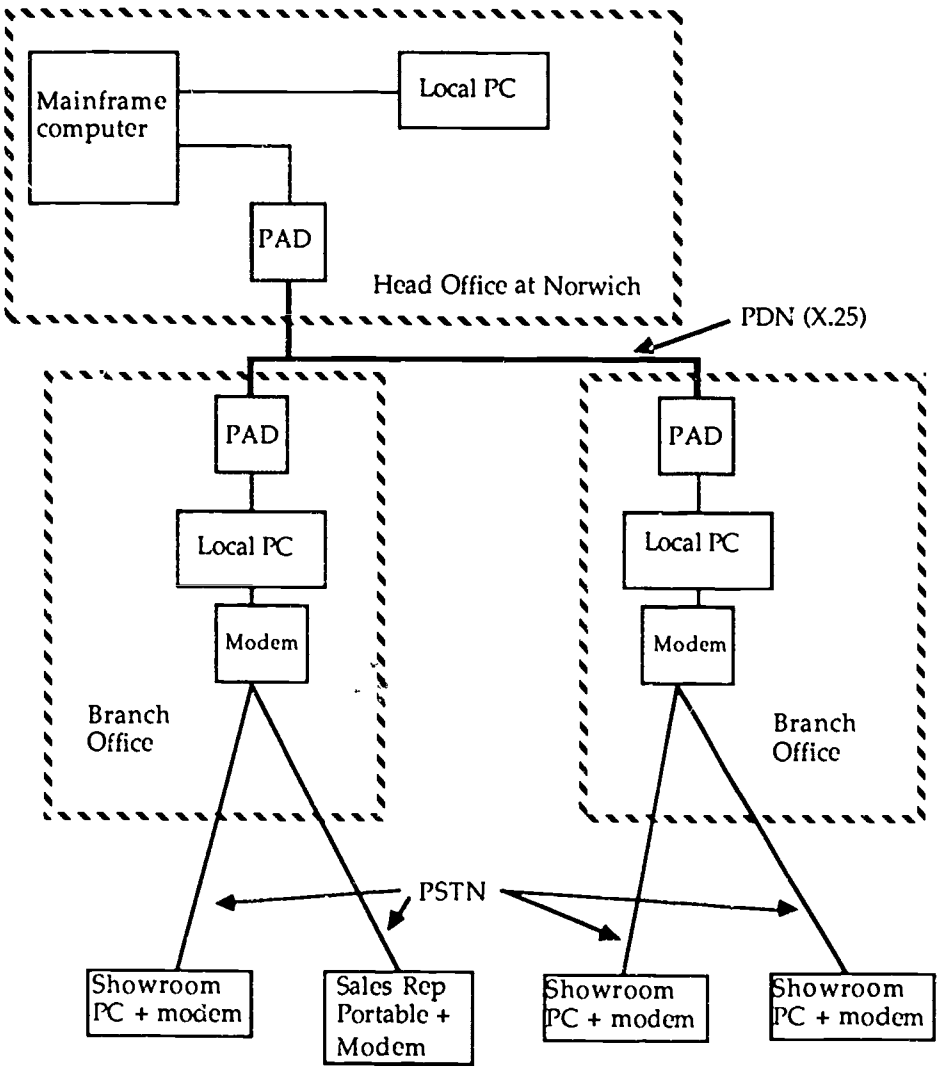


Figure A2.3 Combining the PSTN and PDN
The Anglian Windows Network

Any user, whether operating from one of the LANs or a PC, can be connected to the head office minicomputer to access the electronic mail facility, place new orders or check on the progress of confirmed orders. The network is not restricted to text. Building plans can also be transferred from the branches to head office for approval, cutting the verification period from three weeks to a few days (PC Business World, May 1989).

PRIVATE NETWORKS

Companies with large volumes of voice and data traffic between fixed locations can opt to lease telecommunications lines from British Telecom or Mercury instead of using the public networks. The lines are connected directly to a PABX or LAN and are not part of the public networks. Their main advantages are greater transmission speed and improved reliability.

The range of services offered include special analogue lines (also known as 4-wire circuits) capable of 14,400 bits/s, medium speed digital lines (two way 64,000 bits/s) and high speed digital lines (2 million bits/s). The corresponding British Telecom services are Keyline, Kilostream and Megastream.

The decision to opt for a private network is a difficult one and justifies careful planning. The voice and data traffic between the fixed locations must be estimated, along with the installation costs, fixed rental charges and variable usage charges.

Private Network Multiplexers

Apart from the reliability and speed of the Kilostream and Megastream services, it is also possible to mix voice and data transmissions or to combine several users over a single line using multiplexers. This offers considerable flexibility for companies spread over one or more locations.

The term multiplexing covers a range of techniques for combining several independent signals (voice or data) on to a single telecommunications link. Time division multiplexers provide a mechanism to combine several low speed devices on to a higher speed line. Each device gets a fixed time slot for transmitting its data, regardless of whether it has any data to transmit. For example the Keyline service offers data rates up to 14400 bits/s on a leased circuit, which is sufficient to accommodate six V22 modems operating at 1200 bits/s in each direction. So a single leased line would be sufficient for six terminals.

Of course this calculation assumes that all the modems are continuously transmitting at their maximum rate, whereas in practice this doesn't occur for terminal operations since most people can't type that fast. The result is less than maximum use of the leased line.

Utilisation can be improved by employing statistical multiplexers, which only allocate a time slot to a terminal if it has data to transmit. For example, British Telecom's Datelmux 5300 can combine up to 32 users each operating at a maximum of 2400 bits/s, and all the data is transmitted over a single 4-wire leased line operating at 19200 bits/s.

The Kilostream and Megastream services also offer considerable flexibility for private networks. Kilostream allows integration of a single digital speech signal and data simultaneously over a single line, and Megastream will support up to 200 terminals or 30 voice channels. Access to these types of services will allow users at two different sites to exchange data and conduct a conversation at the same time.

COMBINING PUBLIC AND PRIVATE DATA NETWORKS

The majority of commercial networks in current use employ a combination of public and private telecommunication services. A network based entirely on leased lines would be expensive to operate and difficult to justify without very large volumes of data for transmission. Furthermore, leased lines can only be operated from fixed locations and are time consuming to upgrade. Public networks on the other hand cannot handle high volumes and carry significant transmission charges when used during peak periods; their redeeming feature is flexibility.

The French company, UAP, provides an excellent example of the sort of network that can be built up from a combination of dial-up lines from the PSTN, digital lines from the PDN and high capacity leased lines (Appendix Three). Figure A2.4 illustrates how their network might look if built up from the services supported by British Telecom.

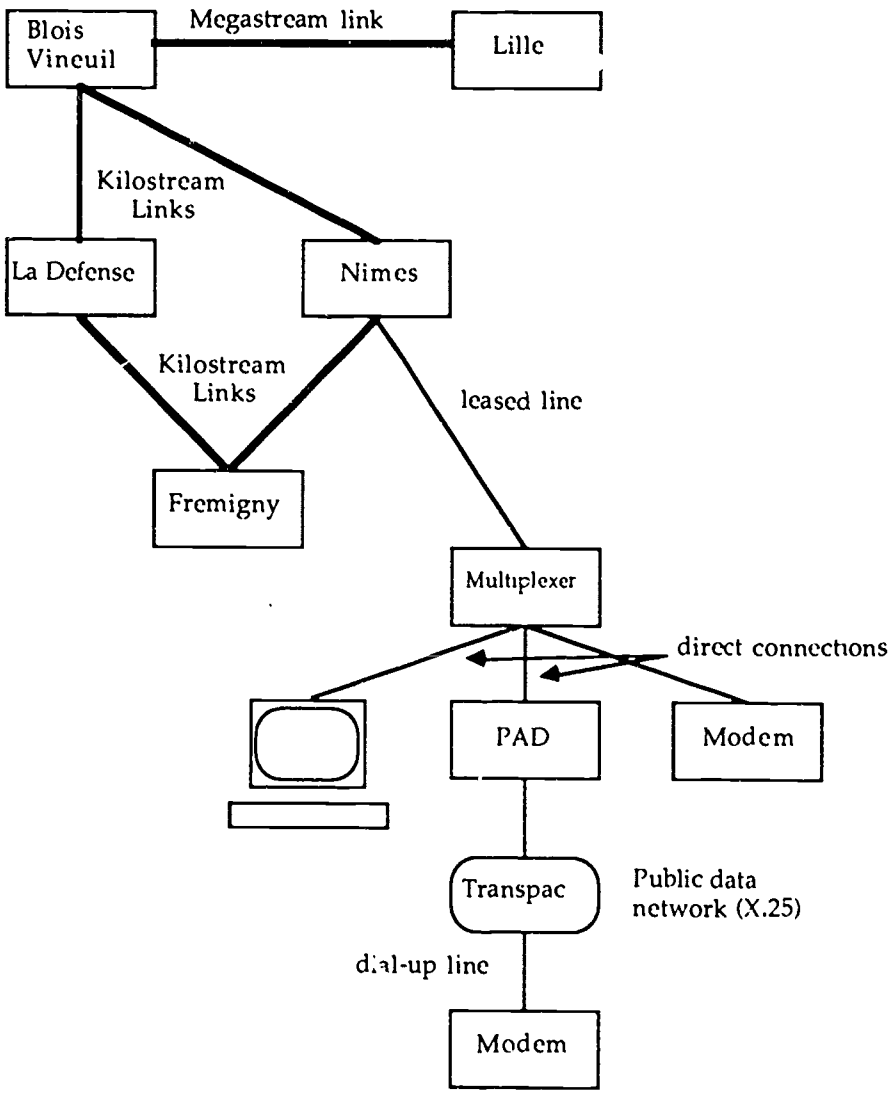


Figure A2.4 Combining Public and Private Networks
The UAP Network built up from British Telecom Services

The primary links between the various computer systems would most probably be based on Megastream (2 million bits per second) and Kilostream (64 thousand bits per second) services, which offer medium and high speed transmission between fixed locations.

The secondary links, for example that between the Nimes computer and the remote concentrator might be a 4-wire leased line, which when combined with a statistical time-division multiplexor could support up to 32 users.

The tertiary level links are intended to provide greater flexibility of access to the mainframe computers, and would most probably be used for short online sessions to complete specific transactions. The solution adopted by UAP was to provide a mixture of access options, including direct connections, dial-up via the telephone network and dial-up via the Transpac data network. The equivalent services for the UK are shown on the figure.

APPENDIX THREE: COMPUTER NETWORKING FOR EDUCATION AND TRAINING IN FRANCE

ISSUES

CASE-STUDIES OF COMPUTER NETWORKING

Company Training Schemes

Multi-media Collaborations

Publicly Accessible Services

Post-secondary Distance Education

Applications in the Universities

Prepared for the Training Agency
by
A. R. Kaye

THE POLITICAL AND ECONOMIC CLIMATE

A number of different factors seem to have coincided in recent years in France to create a favourable climate for the development of networked computer applications in the education and training sectors.

Firstly, there have been a number of government initiatives promoting training in general. Since 1972, every company with over 10 employees has been required to spend 1.1% of its total salary bill in training, or have the money deducted as a tax. This has helped create a generally favourable climate for the training industry, with funds being made available for in-house training, training consultancy, conferences, colloquia, workshops, and new developments in the use of information technology for training. In 1987, the government launched a well-publicised '*appel d'offfres de projets de formation multi-média à la carte*', with funds being made available for the best proposals for consortium bids for IT-based multi-media training initiatives. This was followed in 1988 by a second tender for '*systèmes de formation multi-médias individualisés contributant à la modernisation des entreprises*', under the initiative of the Délegation à la Formation Professionelle and a number of ministries.

Such developments seem to have created a fertile climate for collaboration between software and media producers (eg DIDAC, INA, IMEDIA), private training consultancy firms (eg *Vendôme Formation*), public bodies such as AFPA (*Association pour la Formation Professionelle des Adultes*), training departments of large companies (EDF-GDF, Renault, UAP etc), educational publishers (eg Nathan, Hatier), the Universities, research centres (eg CCETT), and local and regional bodies in mounting multi-media training and education projects. Many of the projects resulting from such collaborations are basically stand-alone applications, with CAL /TBT material playing a central role. However, some use computer networking as one element : for example, *Educâble* (case study F3), and the joint CNED/CCETT course in biotechnologies (case study F4). Both of these are in a sense demonstration projects (cable TV + electronic mail, and a course that would ideally run on an ISDN), aimed at showing the educational potential of specific new technologies.

Secondly, the education system, both through centralised and regional efforts via the Ministry of Education, and through institutional and personal initiatives, is becoming increasingly active in developing the use of new technologies, including computer networking, in its teaching programmes. Even relatively venerable and conservative institutions in the adult education/training sector (eg the CNED, the CNAM: see case studies F4, F6, and F7) are starting to develop applications in this field. Many public lycées are now well equipped with micro-computers, Minitel terminals, and access to TRANSPAC, and some municipalities make these facilities available for

adult training and education programmes (see, for example, case study F6 of the use of networked classrooms by the CNAM, *Pays de la Loire*)

Thirdly, the technological infrastructure needed for wide-scale networking applications is probably developing faster in France than in any other country in the world, and this obviously has a general catalytic effect on the growth of specific applications in both private and public sector training and education. France has developed its own rich 'telematic culture', initially as a result of the widespread availability of free Minitel terminals, the 10,000 or so videotex services available on the *Télétel* network, and the TRANSPAC packet switched service, accessible at local call rates to all telephone subscribers all over the country. The use of domestic and office-based Minitels to consult online data-bases, to send electronic mail, or to make train and hotel reservations, is now commonplace. ISDN applications are currently being developed for business use, and in a couple of years time, domestic telephone subscribers all over the country will also be able to have access to ISDN links. The PTT is currently developing a high quality sound/graphics/text terminal for the domestic ISDN market.

TÉLÉTEL

One obvious point at which to start any review of the current state of the use of computer networking for education and training in France is with the *Télétel* public videotex system, launched six years ago, after a number of experimental trials. France Telecom provides the terminals, and the network for the system (consisting of the existing telephone network, videotex access points in local exchanges, and the TRANSPAC packet switching network). By the beginning of this year there were over 50,000 access points - ie the system could handle up to that number of simultaneous calls. Services on *Télétel* - apart from the Electronic Telephone Directory and a few others run by France Telecom - are set up and run by independent service providers and users.

By the end of 1988, numbers of installed Minitel terminals exceeded 4.25 million, and there were around 10,000 services available. Over one billion calls were routed on the *Télétel* network, an increase of 25% in number of calls, and of 18% in total connect hours, over 1987. Despite recent reports questioning the overall financial viability, for the PTT, of the *Télétel* operation (eg the latest review by the *Cour de Comptes*) there seems to be general optimism that current growth rates will be maintained, as the *Direction du Programme Télétel* predicts there will be over 7 million terminals in operation by 1993, not including the new generation of ISDN terminals.

There are a large number of services on *Télétel* relevant to the training and education sectors, although the majority provide information (via electronic

mail and data-bases) rather than direct teaching. For example, many of the universities run their own services, with information on the courses available, inscription and registration details, examination results etc. In the professional training, adult education, and youth employment sectors, there are services which offer information and data-bases on training courses and opportunities, run by both private and public sector bodies.

There are a small number of publicly accessible (Kiosk) services which provide direct teaching opportunities - both via electronic mail and online CAL software. These are mainly aimed at secondary school children (eg *SOS-Devoirs*, for help with homework), but some also include training in fields such as accountancy and commercial English. Not all these services have survived - increases in tarifs for access to Kiosk services has made home-based users reluctant to spend long periods of time online. Case study F5 describes the history of one of the best of these services (DIDAOTEL) which provided online access to CAL material in a variety of subjects.

Some schools and universities run interactive teaching services on *Télétel*, accessible at reasonable cost (ie not on the public Kiosk tarif), for distance learners. These are often the result of initiatives by individual teachers. Examples included in this report are case study F7 (a course in accountancy run by the CNAM at Toulouse) and case study F8 (use of computer conferencing in an economics course, at the University of Paris Dauphine). The CNED (*Centre National d'Enseignement à Distance)* has its own information service on *Télétel*, and also provides some teaching back-up via electronic mail and CAL material for some of its courses (see, for example, case study F4).

During 1988, there was a major shift in emphasis towards professional and business applications of *Télétel*, through new access codes aimed at business users, the development of a dual standard ASCII/videotex terminal (the Minitel 1B) , and the opening of a kiosk for business information services, which already has over 1,500 services. This new kiosk includes a large number of data-bases, covering, for example, company legislation, financial and investment matters, product information etc. One of the new access codes is a 'green' number which gives users free access to specific services. Many companies have set up such codes for their salespersons and agents, so that they no longer have to administer schemes for re-imbursing staff connect costs, which are now charged automatically to the company's account via the 'green' number.

There has been significant growth during 1988 in the number of private (in-company) services. A recent survey of 154 companies, drawn at random from the 600 companies known by France Telecom to have internal videotex services running on *Télétel*, shows that 65% of the companies involved consider their service to be worth the investment, and another 20% believe this will be the case in the future. Average initial investment by the

companies surveyed was 610 KF (about £61,000), including 100 KF for software development, and 170 KF for equipment. Around 70% of these companies host their system on their own machines, and the average number of Minitels per company surveyed was 74. The two most frequently cited applications were:

- in-company electronic mail services
- stock control, linked to taking of orders directly from clients or from sales representatives, distributors, and retailers.

Although there may not be evidence of a significant number of formal training schemes being run on these in-company services, the combination of electronic mail with stock control and ordering functions, and with product information held on data-bases, is a valuable tool for providing up-to-date information, and can be seen as contributing to staff training in the broader sense. An example is included as case study F2: the use of a *Télétel* service by a member company of the Philips Group (*Service SA*) for helping retailers diagnose and repair faults in compact disk players. This originated from an earlier system which was set up for retailers to order spare parts via Minitel terminals.

Service SA is of particular interest in that it is one of the first examples of the application of AI (artificial intelligence) techniques within a service on *Télétel* - diagnosis of faults is carried out with the aid of expert system software on the host machine. It is likely that there will be a rapid development of other applications in the training/education sector as expertise in this field develops. At the moment, there are at least 30 *Télétel* services which use expert systems. Examples include:

- medical diagnosis services at the University of Toulouse
- a sales back-up and support service developed by DEC
- a service for diagnosis of plant diseases run by the *Institut National de Recherche Agricole* (INRA)
- help on establishing pension and retirement schemes, developed by Cognitech
- machine translation of European language texts (*Gachot*)
- a service that teaches users how to play bridge (*Nouvel Observateur*).

AI techniques are also being applied to the development of natural language enquiry on some *Télétel* services, including the online *Télétel* directory service, and an employment vacancies service run by *Le Monde*.

Another recent development in the *Télétel* world includes the availability, since May last year, of a smartcard reader (a *LECAM - LEcteur de CArtes à Memoire*) which can be connected to a Minitel. Passwords, access codes, and

telephone numbers of the services used are contained on the card. The cards provide total security of access, and a wide number of applications, from home banking to remote payment for goods and services, are being developed as a result. In the education sector, cards are being used in south-eastern France (by the *Rectorat de l'Académie de Nice*) for use by school staff to access, for example, confidential information on examination inscriptions and results, and on the allocation of teaching staff to posts in the region.

Despite the increasing number of peripherals and equipment that can be used with Minitels, and the diversity and range of many of the services on offer on *Télétel*, it should be pointed out that there are serious built-in limitations on the potential value of videotex services for education and training applications. Firstly, there is no local processing capacity in a Minitel terminal, and this, combined with the restricted keyboard set, makes it dificult to use a Minitel satisfactorily for the composition, reading, and downloading of text messages of more than a few lines in length. So, for example, a Minitel is not really suitable for any serious computer conferencing applications. Even for CAL/TBT applications, the functionality of the standard terminal places restrictions on what can be presented on the screen, and on user satisfaction ratings: videotex screens can take some few seconds to build up, which implies a relatively slow response time, and in the meantime the connect costs are adding up. The Minitel really comes into its own for training and education applications when it is used to access data-bases of information, and for interactive functions such as ordering materials (see case study F3) or enrolling on a course at a distance.

IN-COMPANY TRAINING SCHEMES

There are a number of large companies and organisations in France that have developed a reputation for use of computer-based and multi-media training material of varying levels of sophistication (CAL, interactive video-disk, audio-video-graphic programmes etc). Examples that spring to mind include Renault, Citroen, Air France, EDF-GDF (*Electricité de France-Gaz de France*), the *Crédit Agricole*, the UAP (*Union des Assurances de Paris*), the RATP (the Paris underground system), Bull, Philips, and *Aérospatiale*. These are all organisations with large training departments, and significant numbers of often geographically dispersed staff requiring initial training and up-dating.

Much of this material is used in stand-alone mode, even though most of these organisations have their own computer networks linking their various sites together. In some cases (for example the *Crédit Agricole*) a decision to use TBT software on stand-alone micros, moved around from one branch of the bank to another within the regional *Caisses*, was taken precisely because the bank did not want staff using their work terminals and the bank's financial data networks for training purposes. Some regional *Caisses* have, however, set up services on *Télétel* for their staff to access optional TBT

material, and email help, from home or from their offices, when revising for professional examinations. An example is the *Crédit Agricole du Sud Est*, which also hires out the facility to other *Caisses* (at 100F/hour connect time plus an annual subscription per *Caisse* of 500F). However, the service is not very popular - users complain about the time it takes for each videotex page to build up, and the small size of the Minitel screen.

Centrally, it is possible that the *Crédit Agricole* might consider establishing a national professional network for training - it has the largest in-company distance education/ correspondence education programme in Europe, with 8,000 employees taking courses each year, and an annual training budget of around 600 MF. Discussions are currently being held about the possibility of introducing networking for communication with tutors and for access to TBT material. An example of a company which has adopted this appoach with success is the UAP (see case study F1) which makes TBT courseware available via its own national computer network to agents and offices all over the country.

In some cases, networking is not currently used because the TBT software and resources are too sophisticated and varied for access via existing networks to be technically or economically feasible. For example, Bull has developed multi-media training material, incorporating advanced CAL software (running on their 'Starguide' system), computer simulations, video, hypertext, and intelligent tutoring systems installed on workstations. Citroen has recently commissioned from IPSYS (a software development firm) an interactive audio-video-graphic simulation software package for training of their sales force in selling techniques. This is only available on a PC, and although Citroen would like to see it accessible via a network, the current *Télétel* network and Minitel terminals would not be suitable. In both these cases, remote access to the training software will have to wait until the wider development of ISDN facilities (ie the networks and terminals). In other cases, the use of existing facilities (ie a Minitel) has been combined with use of videotapes on a VCR next to the Minitel (see case study F2: *Service SA*).

'OFF-THE-SHELF' TRAINING MATERIALS AND PROGRAMMES

The government initiatives taken in 1987 and 1988 to stimulate the production of multi-media training materials, and the *Plan d'Informatique pour Tous* in the schools, have led to the development of a wide range of products aimed at markets where the software producers, publishers, and other actors involved felt there would be a significant demand - either now, or in the near future, when ISDN becomes more widely available. In addition, the existence of the *Télétel* network has stimulated a number of service providers to offer access to CAL material online (eg DIDAOTEL, see case study F5).

Many of these products and programmes are aimed at the school market, at the adult basic skills market (literacy, numeracy), or for popular adult training and up-dating needs (eg languages, information technology). Of those packages aimed at adults, many are designed for stand-alone use on PC's and other equipment (eg video-disk players) at local resource centres, rather than as components of in-company training schemes. They are targetted at the unemployed youth sector, and at training needs of small businesses.

Some of these programmes involve remote access via networks. We have already mentioned the services available on the *Télétel* system, which tend to concentrate on basic literacy and numeracy training. For many years, the software company DIDAO (a subsidiary of CGI) ran a networked bureau servce for CAL and TBT material, and also developed networked CAL material for a range of companies and organisations (Peugeot, Citroen, EDF, UAP, etc). However, DIDAO have now closed down their bureau service, as the costs of providing support to the students (online help, individual student records of progress, provision of associated print materials etc) were found to be too high by many of the clients.

A more recent example of networked CAL integrated with other services is a project being developed by the AFPA in Colmar, which currently has 4000 adults following distance education programmes in the region. The project will involve multi-media training, with use of the *Télétel* network for remote access to some CAL material, and for electronic mail communication with tutors. Students will be provided with a local memory storage facility which will enable them to upload in a few minutes the results of several hours' homework exercises. The training centre's machine will not only have a large range of CAL material available, but will also keep a record of individual students' progress and needs.

In the same region, the APA (*Atelier de pédagogie et d'animation*) of Strasbourg is developing modular training materials for adults to help them to 'learn how to learn', in preparation for specific re-training courses within their firms. The programme is composed of 10 hours of interactive video-disk, and 30 hours of TBT material, accessed in the workplace from a unit consisting of a PC, a videodisk player, and monitor, linked to the remote training centre through a network. The trainers can be contacted through the system via electronic mail. The training is flexible and progressive, based on short 15 minute sequences which are extended as the user becomes more involved. Each individual's programme is drawn up, after an initial evaluation test, on the basis of a 'learning contract' between the trainee, the trainer, and the employer.

One of the most attractive multi-media training products using new technologies to have been developed recently is an introduction to office IT systems, aimed at secretarial staff, called '*Mystères et bureautique*'. This is an

interactive audio-video-graphic product, with high resolution colour graphics, and multiple branching scenarios, based loosely around the structure of a detective story, with all the motivating power of a video game. It was developed jointly by IMEDIA and the CCETT in Rennes, and (like the software for the Biotechnologies course mentioned in case study F4), can be used in local mode, or at a distance via ISDN.

THE UNIVERSITY AND ADULT EDUCATION SECTOR

There is no single public sector institution in France with a specific remit to provide tertiary level distance education courses for adults (ie there is no equivalent of the British Open University, the West German Fernuniversitat, or the Spanish UNED). Responsibility for post-secondary adult education at a distance seems to be shared between three main bodies:

- the CNED (*Centre National d'Enseignement à Distance*), run by the Ministry of Education, which is the largest correspondence education institution in Europe, with around 250,000 inscriptions each year. The main thrust of the CNED's programmes, however, is at secondary school level, although there are some courses at the tertiary level, as well as at the basic adult education level (literacy, numeracy). The CNED has started a certain number of developments in the use of networking - it runs its own information service on *Télétel*, and some courses use email and CAL material on *Télétel*.
- the CNAM (*Conservatoire National des Arts et Métiers*) which now has a regional structure, with formal responsibility for running part-time courses and evening classes for adults, mainly in vocationally oriented subjects. Several years ago, the CNAM ran for some time a well-known TV-based programme (*Télé-CNAM*); more recently, there is evidence of a number of initiatives developing in the use of computer networking (see case studies F6 and F7)
- the FIED (*Féderation Interuniversitaire d'Enseignement à Distance*) is a loosely organised grouping of the 20 or so university departments which enrol external students on their courses, mainly in languages and humanities. It is unlikely that there is significant use of computer networking on any of these courses.

The main use of remote networks by the universities, and the CNED, as already mentioned, is the provision of general information services on *Télétel*, concerning all the programmes taught, both conventionally and at a distance. One exception to this general rule is the use of computer conferencing, on the French version of PARTI (*Participe Présent*) for a few courses at the University of Paris-Dauphine (see case study F8). This is the only example of an actual application of conferencing for teaching that has been identified. Another exception is a service on *Télétel* set up by the

Université de Provence for teaching physics at a distance, through the combined use of CAL material, electronic mail, and an electronic 'forum' for group discussion.

There is some research and development work being carried out into the design of CMC systems tailor-made for educational use, by the CUEPP (*Centre Université-Economie d'Education Permanente*) at the University of Lille. This work, concerned with both real-time and asynchronous systems, is briefly described in case study F9. However, the software is not yet ready for operational use.

FUTURE DIRECTIONS AND POSSIBILITIES

Major developments seem to be on the horizon in France, both in network technology, and in software products. Although training as such is not likely to be a primary or leading application initially, there will certainly be benefits in the training/education sector as a result of these developments.

The major development on the networking technology side is, of course, the increasing availability of ISDN facilities. The French ISDN system (NUMERIS) was inaugurated in 1987, and now covers Rennes, Paris and (by the end of 1989) Lille, Lyon, and Marseille. By 1995, France Telecom expect that 92% of their customers will be connected to digital local exchanges, that 91% of exchanges will be ISDN ones, and that 100% of all trunk exchanges and transmission lines will be digital. NUMERIS will allow for end-to-end transmission at 64 kbs, with each telephone line adapted to take two 64 kbs channels, each capable of being used simultaneously for two different applications (eg access to an online data-base or conferencing system, and at the same time hold a telephone conversation or send / receive a FAX message). Bull and Cap-Sogeti have developed an ISDN terminal, currently marketed at around 60,000 F, based on a PC standard; this is being used on one of the Bull sites for internal training on a LAN.

To prepare the ground for ISDN services and applications, France Telecom has encouraged the CCITT to collaborate with software firms, media producers, and potential customers in the development of 'showcase' products (eg the audio-video-graphic material on biotechnologies and secretarial training already cited). France Telecom has also entered into collaborative partnerships with a number of major technology suppliers, each of which could, in turn, seed users of their own. These companies include Bull, DEC, EDS (Electronic Data Systems), *Télésystemes*, Apple Computer, and ICL. The underlying purpose of many of these partnerships is to carry out joint work on identifying customer needs that could be met by ISDN products and services, and to design prototypes and actual applications. At the moment, image-based applications seem to be the most popular. Current operational systems include:

- the *Gamma* photographic press agency, which now stores its photographs on an image server, and sends them to customers' terminals via ISDN
- the FNAIM (*Féderation Nationale de l'Immobilier*), a service company to estate agents, which uses ISDN to provide simultaneous access to videotex information about available properties, together with associated photographs and blueprints.

It seems probable that many large companies and organisations who have already been active in the use of computer-based training technologies, once they have connections to NUMERIS, will start using it both for new multi-media training applications, and for giving employees and clients remote access to existing PC-based training material. There are not many examples of multi-media training materials in existence. The few - very impressive - products now available include:

- the module on biotechnologies produced by the CNED and the CCITT in Rennes (see case study F4)
- modules on grammar for schoolchildren (*Marion et Nicolas*) and on marketing for sales personnel (DIDAVENTE) produced jointly by DIDAO and the CCITT.

Such interactive audio-video-graphic software products can use each medium for specific pedagogical functions, for example:

- text for straight information and literary material
- graphics for illustration, plans, diagrams
- photographic images when it is important to show real-life objects
- sound to complement graphic and photographic images, and to reduce the amount of screen-based text
- video sequences for presenting real-life situations, processes etc.

DIDAO is currently working on the development of authoring tools for planning and designing audio-video-graphic software, which will simplify the design process, and make the software development procedures more accessible.Although costly to develop, audio-video-graphic products represent a quantum leap improvement over traditional, essentially text-based, networked TBT materials. Combined with support via electronic mail and computer conferencing, and/or voicemail, they could lead to significant improvements in the quality of networked training in the future.

In conclusion, it must be pointed out that there is evidence of some scepticism conerning the likely take-up of ISDN networking facilities in France. There is by no means a universal consenus over which services are likely to prove popular, and many of the existing showcase multi-media products have proved extremely costly to develop. However, recent

experience demonstrates that it is often impossible to make accurate predictions of the popularity of new technologies - for example, there was much scepticism about the *Télétel* poject in its early days, and few people a couple of years ago would have anticipated the current widespread penetration of fax machines, and of cellular telephone technology. It will no doubt be necessary to wait for a few years before making any judgments about the impact of ISDN and broad-band communications links on the use of networking for training, and indeed for other applications.

CASE STUDIES

INTRODUCTION

The nine case studies in this section of the report have been chosen to illustrate:

- different sectors of the training and education market (company training, multi-media collaborations, publicly accessible services, post-secondary distance education, and the university sector)
- different types of applications (TBT/CAL, expert systems, data-bases, electronic mail, computer conferencing, and audio and/or video
- different network uses (*Télétel*, TRANSPAC, cable, local area networks, and ISDN).

This is illustrated in the table below, where the numbers in italics refer to the numbers of the individual case studies that follow:

Sectors/ case study	1	2	3	4	5	6	7	8	9
company training	√	√							√
multi-media			√	√					
public					√				
distance education						√	√		
university								√	

Applications/ case study	1	2	3	4	5	6	7	8	9
TBT/CAL	√			√	√	√	√		√
expert systems		√							
data-bases		√	√	√			√		
email	√	√	√	√		√	√	√	√
computer conferencing								√	
audio/video		√		√					

Networks/case study	1	2	3	4	5	6	7	8	9
Télétel		√	√		√		√	√	
TRANSPAC	√	√			√	√			
cable			√						
LAN	√			√		√			√
ISDN		√		√					

COMPANY TRAINING SCHEMES

F1. UAP: Networked TBT

The UAP (*Union des Assurances de Paris*) is one of France's biggest insurance companies. The company's operation is de-centralised to the extent that there are 12 regional *délégations* which supervise the work of the many local agencies. Total UAP salaried staff number around 10,000. UAP also employs a large number of home-based insurance salesmen (*commerciaux*), paid on a basic retainer plus commission.

UAP has an impressive training centre at Bouray-sur-Juine (Domaine de Frémigny), 45 km south of Paris, whose main role is to run face-to-face courses for successive groups of staff drawn from their offices and agencies all over the country. However, UAP also makes extensive use of its own administrative computer network (see Figure 1) for providing access to TBT material for office- and home-based training and up-dating. The network has two central mainframes (in Blois/Vineuil and Lille) interconnected to smaller machines at their offices in Paris (*La Défense*) and Frémigny. A multiplexor (*concentrateur de lignes 3809*) connects each of the regional *délégations* to each of the two mainframes (Lille and Blois) via dedicated high speed trunk lines. Within each *délégation*'s office, local workstations (SFENA and IBM) and terminals connect to the multiplexor via a control centre, and 4800 bps modems connected to the TRANSPAC network link in the terminals in the local agencies within each region. A central back-up multiplexor at the main computer centre in Blois is available should any of the regional ones fail.

The decision to use the network for TBT was taken in 1984, at the instigation of the then President of the UAP (*Mme Chassagne*). It was felt that there was a very strong need for educational upgrading and re-training of a large number of the permanent staff, many of whom had left school with fairly minimal qualifications. The TBT programme itself became operational in 1986.

Staff in the *Délégations* and agencies have a right to 3 hours per week of training time - including use of TBT material - during working hours. They can access a wide range of linear and branching (menu-based) TBT material, totalling altogether over 550 hours of study time spread over 90 different modules. All this material resides on the mainframe computer at Blois. Most of the modules are independent (ie TBT material only) although 11 are to be used with printed study guides/workbooks. An idea of the amount of material available can be judged from the following figures, drawn from the current TBT course catalogue:

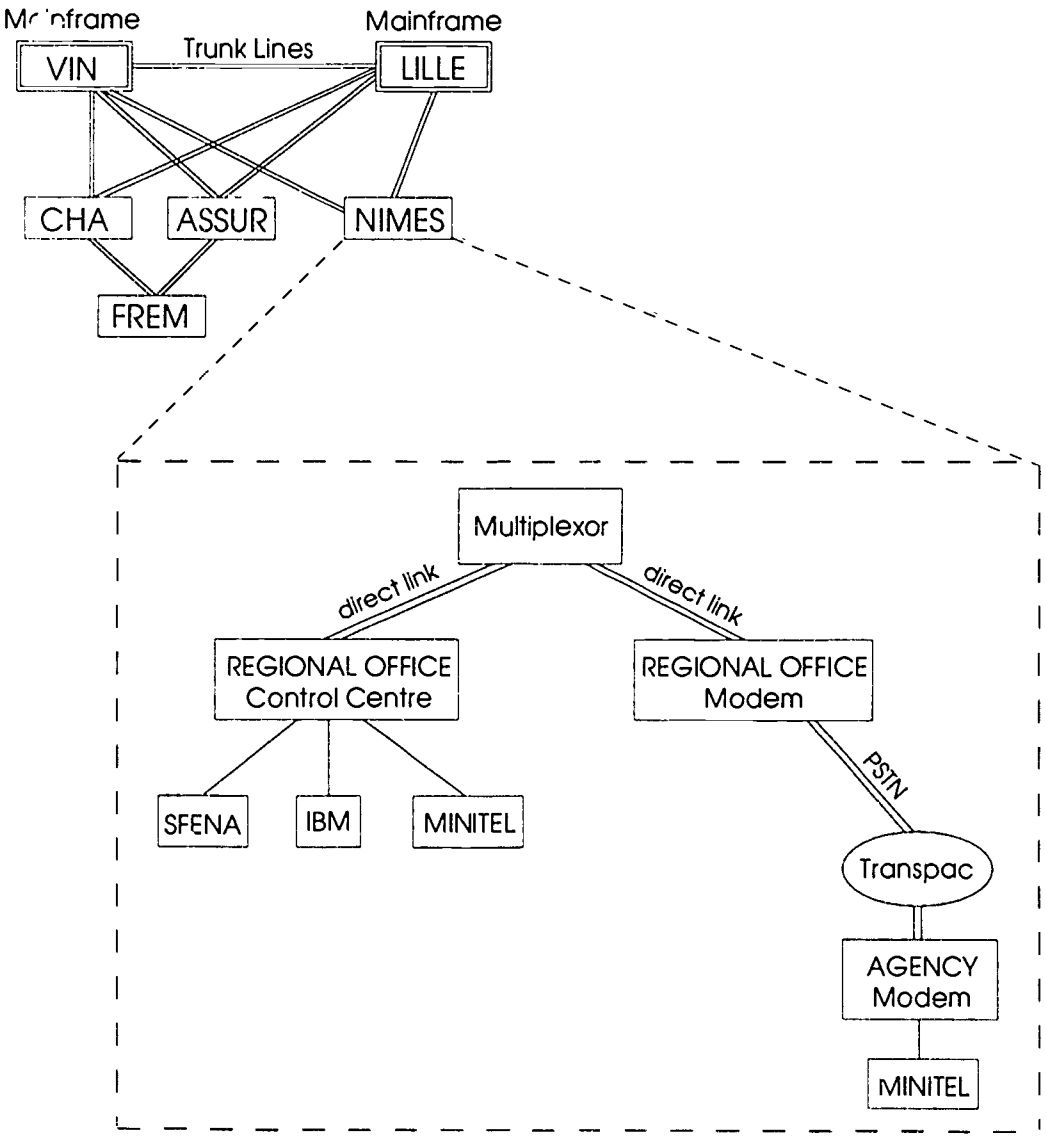


Figure 1: the UAP network

subject area	hours of TBT
French (vocabulary, grammar etc)	75.5
English (insurance vocabulary, grammar)	60
Mathematics (sets, functions, stats, arithmetic)	119.5
Physics	22
New Technologies (keyboards, WP, telecoms etc)	70.5
Law	25
Economics	23
Business studies	19
Insurance	140.5

The most popular modules are the French ones, especially those aimed at improving written skills and at helping to understand the more complex and abstruse jargon used in insurance contracts. The second most popular modules are those in mathematics, followed by the specialist insurance ones. Two principal motivations are apparent amongst staff using TBT:

- for general educational improvement, which might be helpful in changing careers, or in obtaining promotion within the UAP
- for job-related specific help in dealing, for example, with new insurance schemes and practices.

The TBT material is available during weekdays from 7.30h - 20.00h, as well as from 9.00h to 18.00h on Saturdays. Telephone helplines exist for registration, password, and comprehension difficulties throughout the week from staff in the Training Centre, and for technical problems in access throughout the TBT 'opening hours' from Computer Centre staff at Blois. For other problems and/or advice on selection of material and construction of personal training programmes, staff have access to one of 35 designated regional TBT coordinators, drawn from experienced UAP staff in the *délégations*. These coordinators are also responsible for arranging initial registration on the TBT system for those staff who want to make use of it. Once a staff member is registered she/he receives an ID and a printed guide, which is essentially a catalogue of available TBT materials, with a brief 7-page introduction to using the system. Users have to change their passwords every month as a security measure.

In addition to the actual TBT modules, the trainees can access a number of other training-based services and functions from their terminals:

- a calculator, heavily used during many of the maths, accountancy, and insurance TBT sequences (this was provided in response to user demands)
- an electronic mail service for contacting the Training Centre staff and the regional coordinators
- a regularly up-dated online course catalogue of TBT materials
- the list of all the regional TBT coordinators
- a news bulletin from the Training Centre.

The system can 'remember', for any individual trainee, which point they are at in up to eight different TBT modules, so if a module is not completed during a given online session, the trainee can re-enter it at the point he/she left off at the next log on. On completion of a module, the user is asked to fill in a standard online evaluation questionnaire. The data from these questionnaire screens are compiled automatically for each module on a monthly basis, and made available to the TBT staff at the Frémigny Training Centre.

The TBT programme is run by four staff based at the Training Centre. Their main tasks include the registration of new users, and answering telephone and email queries (which run at about 100/month). They are also involved in analyisng the feedback from users, and in helping decide on the development of new TBT material.

F2. Service SA: Networked Expert Systems

Service SA is a member of the Philips group, with an annual turnover of 300MF (about £30M), 4/5 of which is from the sale of spare parts for products marketed under the following brand names: Philips, Radiola, Schneider, Laden, Ignis, and Marentz. The company was one of the first in France to set up a service on *Télétel* : in 1982 it started up a service for retailers to order spare parts and obtain technical information via their Minitels. In 1989, over 6000 retailers use this service.

In 1986, *Service SA* decided to open a second service accessible via Minitels - in this case, the Minitel 1B (which has an 80-column ASCII display). This service, nicknamed SEXSY (for *Service EXpert SYstème*), is designed to help retailers diagnose and repair faults in compact disc players - it is, in effect, a very efficient form of on-the-job training, which will replace the need for conventional technician training in this field. Trials of the system have demonstrated that it is quite possible, for example, for washing-machine

repairmen without any formal electronics training to use it to diagnose and repair a CD player. SEXSY includes a sophisticated technical data-base which allows for complex correlations between the stored information and the responses given to multiple-choice questions by the user. Trials have shown that this system can produce an 80% success rate on repairs carried out by retailers using it. Furthermore, all the information given by the users in response to the questions on their screen is recorded, analysed, and passed on to the appropriate product development departments. This means that faults and problems in new products can be recognised very quickly, and the appropriate changes made on the production lines.

A retailer/technician logs on to SEXSY, via the 36.14 service on *Télétel*, with a personal ID number and password. He is then allocated a code number for the session, which will enable him to carry on from where he left off if the session has to be interrupted for any reason. The user then indicates the type of CD player he is trying to repair, and its serial number. A series of multiple-choice questions, sometimes associated with hands-on activity ('Insert a disk and then test the following functions....') then guides the user through the diagnostic and repair procedure to follow (see Figure 2). The average length of an online session is 30 minutes. A videotape is also used in conjunction with the service, to amplify particular points. Eventually, the images and sequences on the videotape will be stored on an optical disk image base, which the user will be able to access via an ISDN link (see Figure 3).

The success of the early trials of the system on a sample of 100 technicians has led to its gradual extension, and *Service SA* plan to make SEXSY available, eventually, to all 6000 or so retailers who use Minitels. By 1990, they plan to have 1500 using it, and are extending the products covered to TV sets, videorecorders, car radios, and videocameras.

Service SA runs its two *Télétel* services (spare parts ordering and SEXSY) on two VAX 750 machines, each connected to TRANSPAC, and each able to handle up to 40 simultaneous calls. SEXSY is hosted on a VAX 8250, and can handle up to 50 simultaneous accesses. Both software packages were developed by Philips. Average utilisation costs for accessing SEXSY work out at around 25FF for each repair.

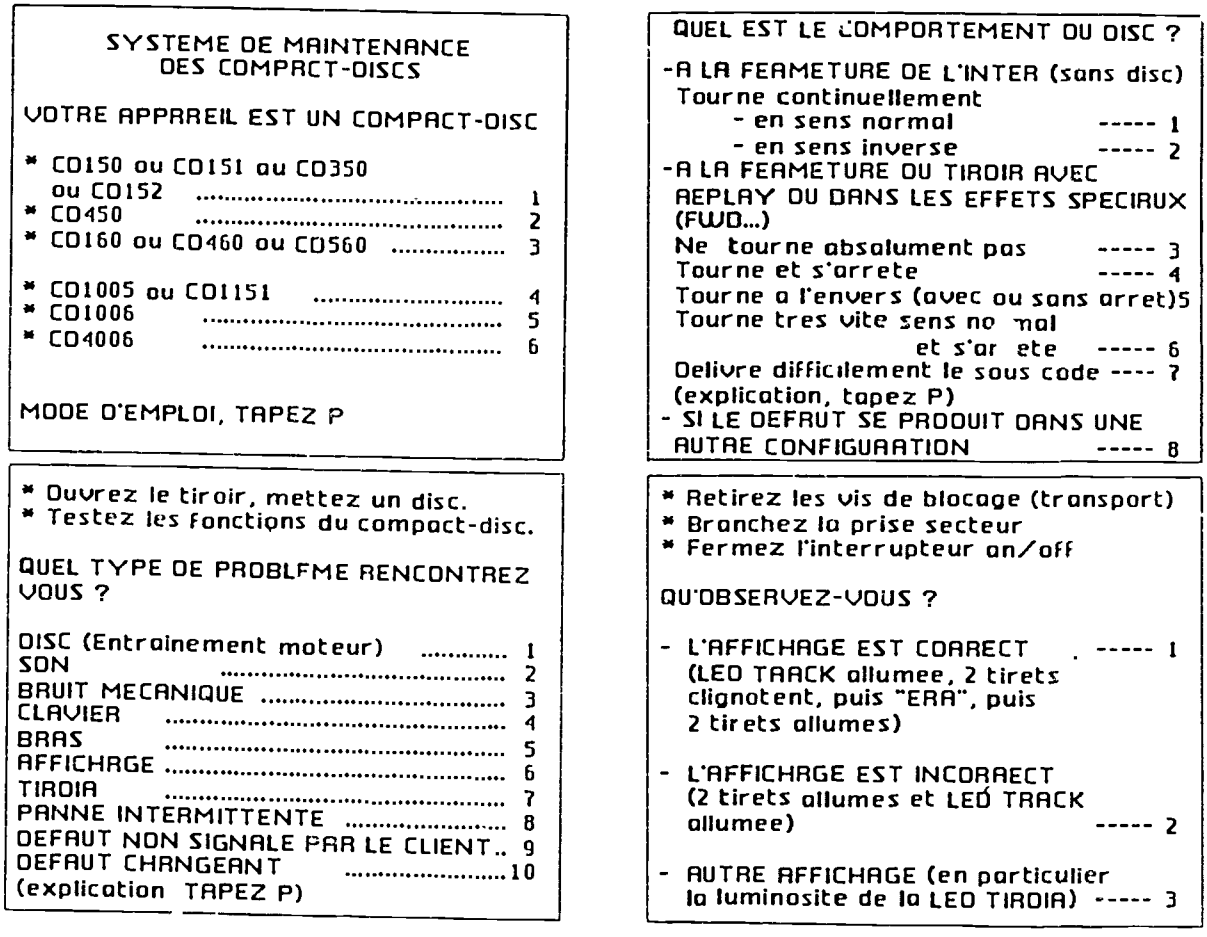


Figure 2: SEXSY - examples of screen dialogues

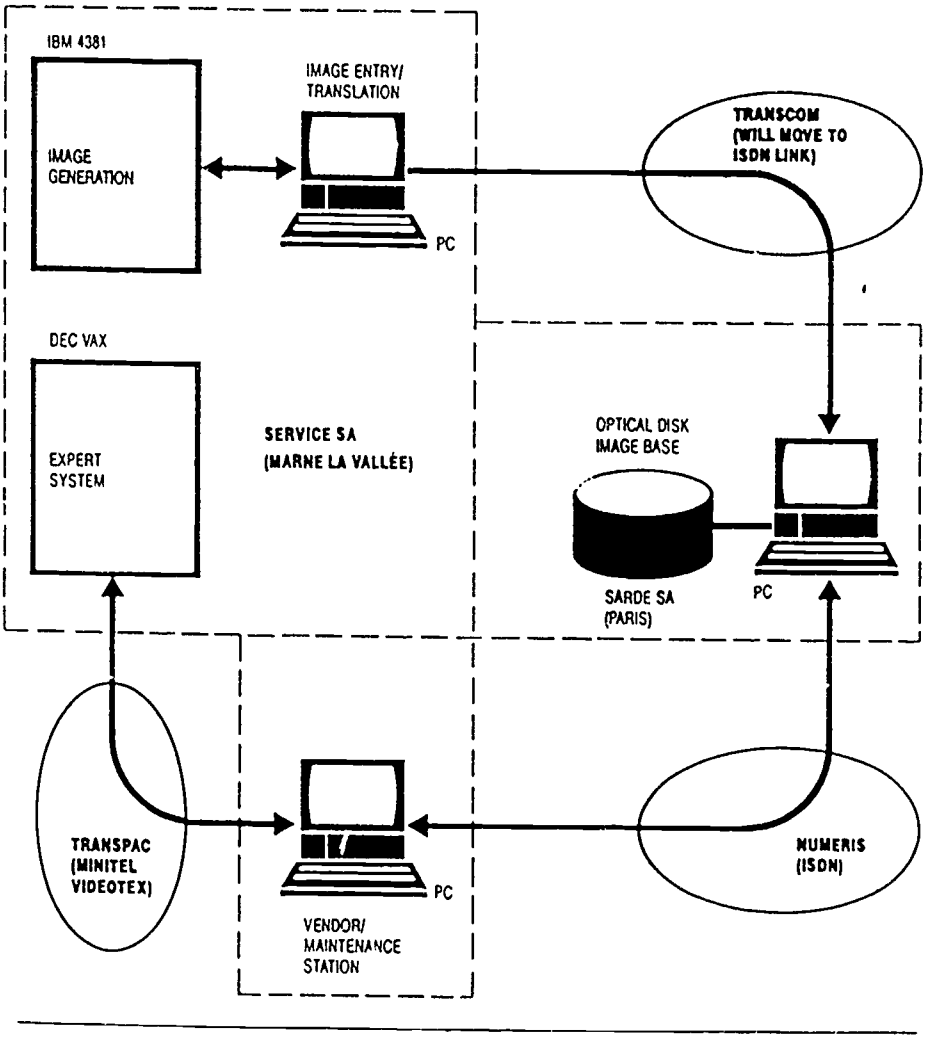


Figure 3: Service SA: network configuration with ISDN link

MULTI-MEDIA COLLABORATIONS

F3. Educâble: Cable TV + *Télétel*

This project is not, in its present form, concerned with professional training or education of adults. It is a networked resource for 15 schools, mainly at primary level, in the Montpellier area. However, it has been included for a number of reasons:

- it demonstrates how the *Télétel* network and a fibre-optic cable network can be used in tandem for ordering and delivery of video material
- it is an illustration of joint effort/consortium between three different partners (a municipality, a cable operator, and a regional PTT office)
- there are plans to set up a similar service (*Formacâble*) aimed at the professional training market.

The project is composed of two elements (see Figure 4) :

- a library of 400 films specially chosen from the holdings of the *Centre National de Documentation Pédagogique*, and transmitted to schools on request via Montpellier's optic-fibre network
- a videotex service accessible via Minitels, which allows teachers to consult the catalogue of films, choose specific ones, and select the day and time when they are to be transmitted (see Figure 5 for example of screen dialogues).

The videotex service also includes details of each film, as well as guidelines for its use in the classroom. There is also a news bulletin, and an electronic mail service for teachers to leave their comments and suggestions (each school has its own mailbox on the system).

Each school has a cable connection, a colour TV monitor and video-recorder, and a Minitel terminal. Some schools can re-transmit the films to specific classrooms via their own internal network. The project was tried out on an experimental basis in the 1986/87 school year, involving 90 teachers and an initial selection of 200 films. The teachers were asked for feedback during face-to-face meetings, and via electronic mail, and as a result the catalogue of films was extended to 400, and the service is now in its operational phase. More schools will be added to the network as the cabling of Montpellier continues (the optic fibre network is due to cover the entire city by 1990).

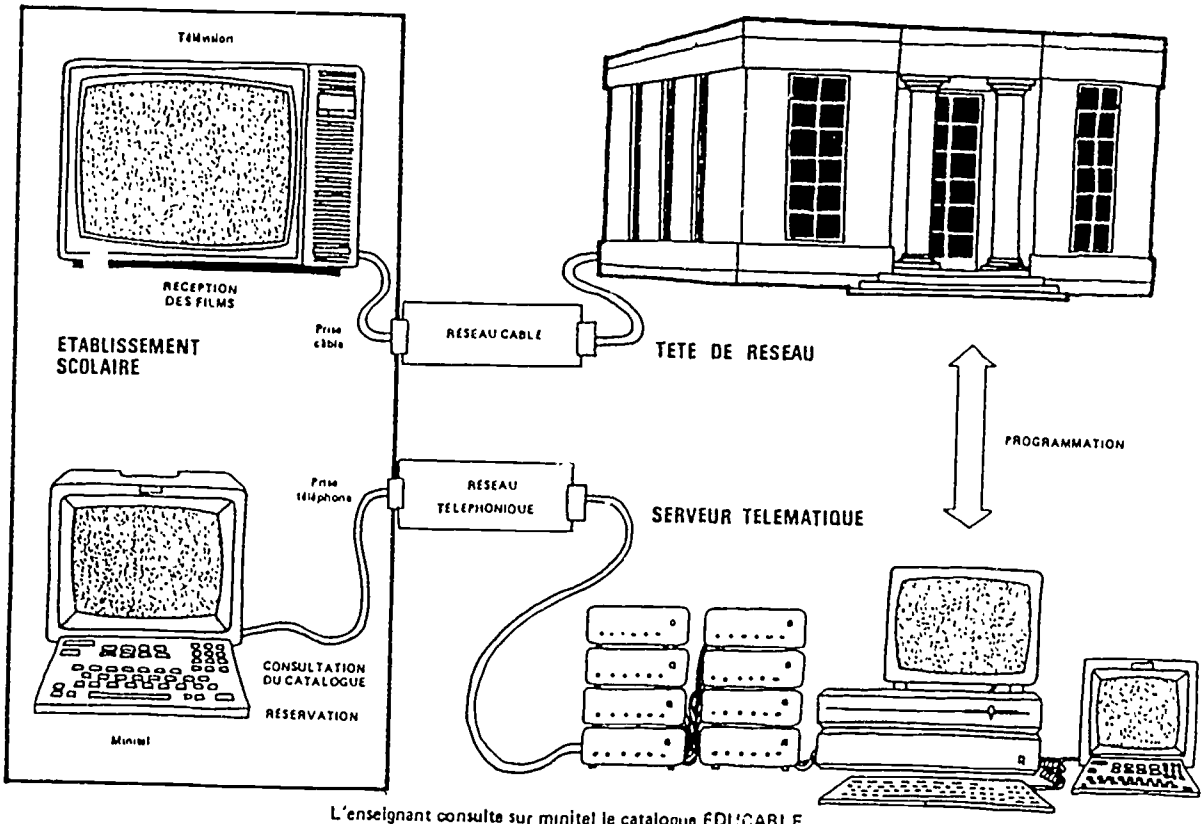


Figure 4: The Educâble Network

EDU CABLE

CHOISISSEZ LE JOUR :

1- MARDI APRES-MIDI
2- MERCREDI MATIN
3- JEUDI APRES-MIDI
4- VENDREDI APRES-MIDI

Taper le numéro choisi puis ENVOI

page d'accueil : taper SOMMAIRE

EDU CABLE

BOITE AUX LETTRES

MESSAGERIE

* Chaque établissement cable dispose d'une BOITE AUX LETTRES pour laisser des messages, avec un MOT DE PASSE personnel.

* Pour y acceder tapez M E EDUCABLE et suivez les instructions.

---

page d'accueil, taper: RETOUR

M 1-Tapez # M puis ENVOI
A 2-Donnez le code d'accès
R 3-Inscrivez le titre du film et le
D code de votre établissement dans les
I zones libres en vous déplacant par
SUITE et RETOUR

TITRE DU FILM ET CODE ETABLISSEMENT

14H
AUTHOUR DE LA DANSE AIGC
14H30
LES DAUPHINS AIGM
15H
LA PETITE HISTOIRE D'UN LIVRE TOUR
15H30
AUTHOUR DE LA PHOTOGRAPHIE AIG
16H
ARSENE LUPIN 1 MIO 1
16H30

4-Pour valider ENVOI

Jour suivant, taper : J+ENVOI
Page d'accueil taper : SOMMAIRE

MESSAGERIE **ACCES**

Tapez votre nom : .....
suivi de la touche |ENVOI|

Tapez votre mot de passe : .....
suivi de la touche|ENVOI|

Pour abandonner tapez |Sommaire|

Figure 5: Educâble - examples of screen displays (ordering films, electronic mail)

The project has ben extensively evaluated by the *Centre National de Documentation Pédagogique* and the *Mission TV-Cable*. Some of the main points that come out of this evaluation include:

- levels of use were very variable, and related to teachers' personal views about the value of film and TV in the clasroom, as well as to the practical aspects of use (eg convenience of location of the cable socket, perceived costs of using *Télétel* etc)

- a great variety in the ways in which the videotex services were used, which seems to indicate that some teachers did not really fully master the use of the online catalogue, the booking service, and the electronic mail service

- the need to re-organise the technical and functional aspects of the system, as any increase in use (eg the addition of more schools to the network) would mean that some requests for particular films at particular time could not be met

- the need for specialist 'mediators' in each school who would be able to coordinate the teachers' use of the system, and the need for a small central team of 'animateurs' to promote and maintain the service.

Future plans include the setting up of similar services in other towns that are currently being cabled, and the addition of new features such as educational discussion and magazine programmes, advice on school equipment, video co-productions, and the extension of the existing film catalogue. As was mentioned earlier, it is also planned to create a service in Montpellier specifically concerned with professional training, initially in specific areas such as language teaching, and the needs of young unemployed people.

F4. CNED + CCETT: Multi-Media Training in Biotechnogy,

The CNED (*Centre National d'Enseignement à Distance*) is the largest and most venerable publicly financed distance teaching institution in Europe, with over 250,000 students. It was set up during the war to provide teaching to children unable to attend school, is essentially based on correspondence tuition, and employs a large number of teachers who are unable, for medical or psychological reasons, to teach in face-to-face classes. The CNED's headquarters are in Paris, but its teaching is carried out through seven regional centres (Grenoble, Lille, Lyon, Rennes, Rouen, Toulouse, and Vanves).

The regional centre in Rennes is newly established and is pioneering a number of major technological innovations, ranging from bar-coding of students' correspondence assignment forms to the development of state-of-the-art multi-media teaching materials.

As far as networking technologies are concerned, the CNED has a major advantage in being based not only in Rennes (where the *Télétel* system was first developed) but also next door to the CCETT on the University's science park. The CCETT is the Joint Research Centre on Broadcasting and Communications Technologies, financed as a joint venture by France Telecom and the TDF Broadcasting Authority, employing nearly 400 staff, with a remit to conduct reaearch into :

- sound and picture services and terminals
- distribution and broadcasting networks
- experimental implementation of AV communication services.

The CNED teaches a degree-level course in Biotechnology through a combination of printed study units, correspondence tuition, day schools, a one-month working secondment, videos, electronic mail, an online bibliographic data-base, and an interactive audio-video-graphic module. This last element was developed in conjunction with the CCETT, and is composed of 5 hours of study material which combines:

- colour alpha-mosaic and alpha-geometric graphic and photographic sequences
- sound
- interactive CAL material.

This material can be accessed in local mode on CD ROM, CDI, and videodisc, or at a distance in several ways:

- through two simultaneous PSTN lines, one for sound transmisson, the other for the digitised graphics and text
- a combination of one PSTN line (for sound) and one 4800 bps videocommunication videotex line (for digitised graphics and text)
- a single ISDN line at 64 Kb/sec for simultaneous transmission of sound, graphics, and text.

Few students at the moment have the necessary equipment to be able to make use of this module, which was prepared as an example of what could be made available on a wider scale once France Telecom's ISDN network (NUMERIS) is in place. Its interest lies in the demonstration of the high quality of material that could be developed - at a not insignificant cost - in the near future. It is also a good example of multiple uses of the same material - some of the material used in the videos appears in the audio-video-graphic module, for example.

The more traditional - and less costly - networked elements of the course are the online bibliographic data-base and the electronic mail service. Both of these are available from a standard Minitel terminal. The data-base enables students to search for specific course-related references and abstracts, and the electronic mail service enables students to:

- obtain answers from the CNED to administrative queries
- send questions to, and get answers from, subject experts (unit authors) in microbiology and genetic engineering
- access a bulletin board which enables them to contact other students and eg set up self-help groups.

PUBLICLY ACCESSIBLE SERVICES

F5. DIDAOTEL: CAL via Telétél

DIDAO is the name of an educational software development company which is a subsidiary of the *Compagnie Général d'Informatique*, one of the largest and most successful computing software firms in Europe (with a turnover of 950 million Francs in 1988). Since the early days of *Télétel*, DIDAO ran a publicly accessible CAL service (called DIDAOTEL), through which Minitel users can access CAL material in BASIC programming, mathematics, and grammar, at primary, secondary, and post-secondary levels. The service has just been closed down (August, 1989) and it is of interest to analyse the reasons for this, after seven years of apparently successful operation.

The CAL material available on DIDAOTEL is summarised in the Table below:

subject	level	time
Grammar	primary	25 hrs
French	primary	20 hrs
Arithmetic	primary	100 hrs
Maths problems	primary	100 hrs
Sets	secondary +	5 hrs
Logic	secondary +	8 hrs
Functions*	secondary +	8 hrs
Probability	secondary +	4 hrs
Statistics*	secondary +	3 hrs
BASIC*	secondary +	30 hrs

* on a subscription basis only

Users could choose two options - either to access the material directly on the Kiosk, or to take out a subscription to DIDAOTEL, which gave a reduced online tarif, but included a pedagogical support service (manuals, online help, records of learner progress). Numbers of subscribers at any given time varied between 1500- 5000 during the life of the service.

Three principal reasons have been given by DIDAO for closing down their service on *Télétel*:

- Its use was not encouraged by the teaching profession, who were often critical of the CAL material available on the service; those working in the adult education and training field were influenced by the views of secondary school maths and computing teachers, and tended not to recommend its use. It should be noted that, in contrast, the consumer reviews of DIDAO which appeared in *Minitel Magazine* and elsewhere were generally positive.

- The service was very popular in its early years (1982-84), when the access tarifs were relatively low, and it was seen as a pioneer in the provision of serious educational videotex services. However, over the years, as the costs of using *Télétel* have increased, so the demand has fallen.

- The belief that, in the final analysis, it is not sufficient to merely provide online CAL material for self-study unless its use is integrated within an overall educational programme or framework (for example, as one element in a properly supported multi-media distance teaching programme).

POST-SECONDARY DISTANCE EDUCATION

F6. CNAM, Pays de la Loire: Networked Classrooms

The CNAM (along with the *Ecole Polytechnique*, the *Ecole de Mines* and other prestigious vocationally-oriented further education institutions) was set up during the Revolution, with a remit to provide the State with highly trained professional, technical, and scientific cadres. Over the years, the CNAM has extended its role into the provision of sandwich-type courses in industry and various other part-time teaching arrangements, including evening classes and distance education. For example, the CNAM ran a series of TV-based courses (*Télé-CNAM*) for many years.

To complement the activities of its headquarters in Paris, the CNAM has set up a Regional Association as part of a general trend towards de-centralisation. In 1986 this Regional Association inaugurated in the *Pays de la Loire* region a *Centre de Télé-Enseignement et d'Innovation Pédagogiques* (CTEIP). This

Centre has so far taught courses at a distance to around 300 students, through a combination of independent study and local group meetings with networked support.

The distance education programme developed in response to a need for part-time study provision for people living in smaller towns and communes too far away from the CNAM's seven main teaching centres. These teaching centres provide traditional taught evening class courses, but it was discovered that many people working in small companies in rural areas and smaller towns, who would like to benefit from these classes, were not able or prepared to travel more than 50 km or so to attend them (see map in Figure 6). The distance education programme is a response to this situation. However, the programme has been designed in such a way as to minimise many of the problems associated with traditional distance education (student isolation, lack of chances for group work, attenuated contact with teachers etc). It is, in fact, a group based distance education provision: a number of small, but well-equipped, local centres are used where students meet and study together, with a teacher accessible 'at a distance' through a CMC network. The courses provided in these centres at the moment are in computing/programming (*Bac*+2) and mathematics (*Bac*+1) only.

The local centres (6 so far, 5 more planned for next year) are based in *lycées* in small towns (around 10,000 inhabitants) and are in fact computing classrooms/labs equipped with PC's, LANs, printers, CD-ROM facilities, and access to TRANSPAC (and, in some cases, to telephone conferencing facilities). In most cases, one of the PC's is used as a server for the LAN, and, in terminal mode, for communication with the CNAM's mini-computer in Nantes (see network diagram in Figure 7). These centres are used on one or two evenings per week for the CNAM's 'distance classes' in computing and mathematics.

The 'distance classes' combine the following features:

- individual study of practical work modules at the PC, based on exercises in specially prepared printed study guides, and using the software provided for the course
- self-help and discussion between the students, sometimes with the help of a local animateur (maybe the *lycée*'s mathematics teacher)
- communication with a teacher at the CNAM's head ofice in Nantes, via TRANSPAC.

Networked communication with the teacher and the central resources in Nantes can take five forms:

- real-time interaction via keyboarded messages, with the possibility for the teacher to 'take over' the student's machine to demonstrate specific operations

- asynchronous messaging via email when one of the two (student or teacher) is unavailable - either because the teacher is in communication with another group, or because the student is using the system outside class hours

RESEAU des CENTRES d'ENSEIGNEMENT ("traditionnels")
et des CENTRES LOCAUX d'ANIMATION ("à distance") :

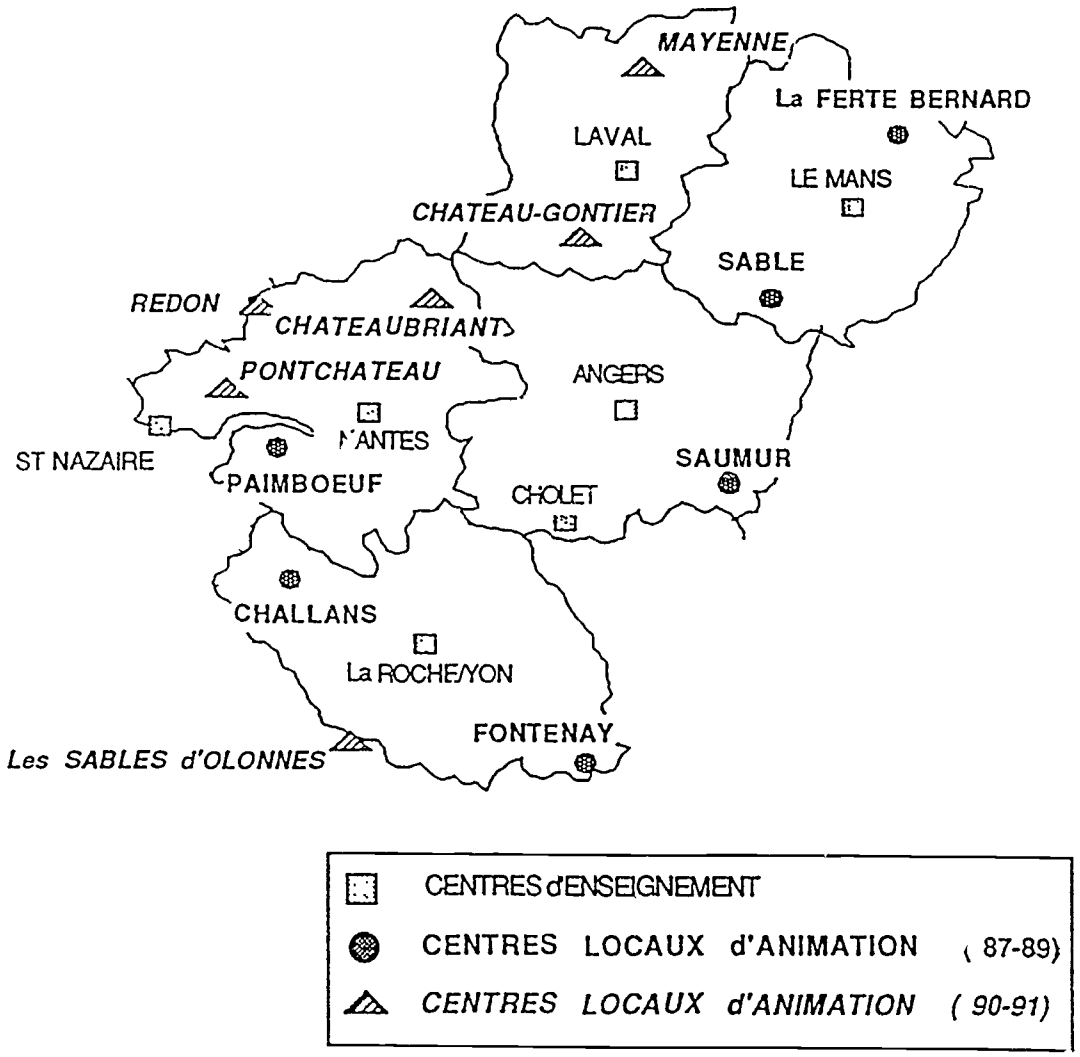


Figure 6: CNAM, *Pays de la Loire* - local teaching centres

- the submission of assignment work (eg computer files or programmes) by the student for later correction and comments

- the downloading of CAL modules from the CNAM's 'CAL bank' - the teacher can recommend specific modules to individual students to help them deal with particular learning problems

- the use of the PC by the student in terminal mode to access the central computer's power for those exercises which require it.

In some cases, these interactions have been supplemented with telephone conferences between groups and the teacher in Nantes, although these were in general judged as being less useful and less successful than the other forms of interaction.

The system functions at the moment with 150 students, in 6 local groups. Started during the 1987/88 academic year, all have wanted to continue. Analysis of students' work done for the exams at the end of the first year (taken by both the distance students and the traditional evening class students) suggests that the distance students obtained a more profound understanding of the course concepts than the evening class students. This is explained by the project organiser (Alain Meyer) as probably being due to a number of factors, including:

- the relative autonomy of the distance students, and the fact that they have to take more initiatives of their own during the classes

- the discipline of being forced to draft their questions to the teacher in writing for transmission via the network, and the clear definition of the problem that this requires (ie clear analysis of a problem is often the quickest way to finding a solution).

The local municipalities who have taken on the costs of making the rooms and equipment available for the groups, as well as the costs of TRANSPAC use, are keen to see the project continue, and indeed a number of mayors have asked for new local centres to be set up in their own towns. They are motivated by a wish to do something to slow down the rural exodus, and to provide educational opportunities for the staff of local companies. More companies are also showing an interest in the scheme, as they prefer to have staff being trained/up-dated on a flexible part-time basis, rather than sending them away on workshops and seminars. A number of local companies have signed contracts with the CTEIP for provision of *à la carte* distance training.

Currently, the overall costs/hour of providing distance classes through the CTEIP are about twice those of teaching the same courses through conventional evening classes. However, it is believed that the unit costs will fall as more centres are opened.

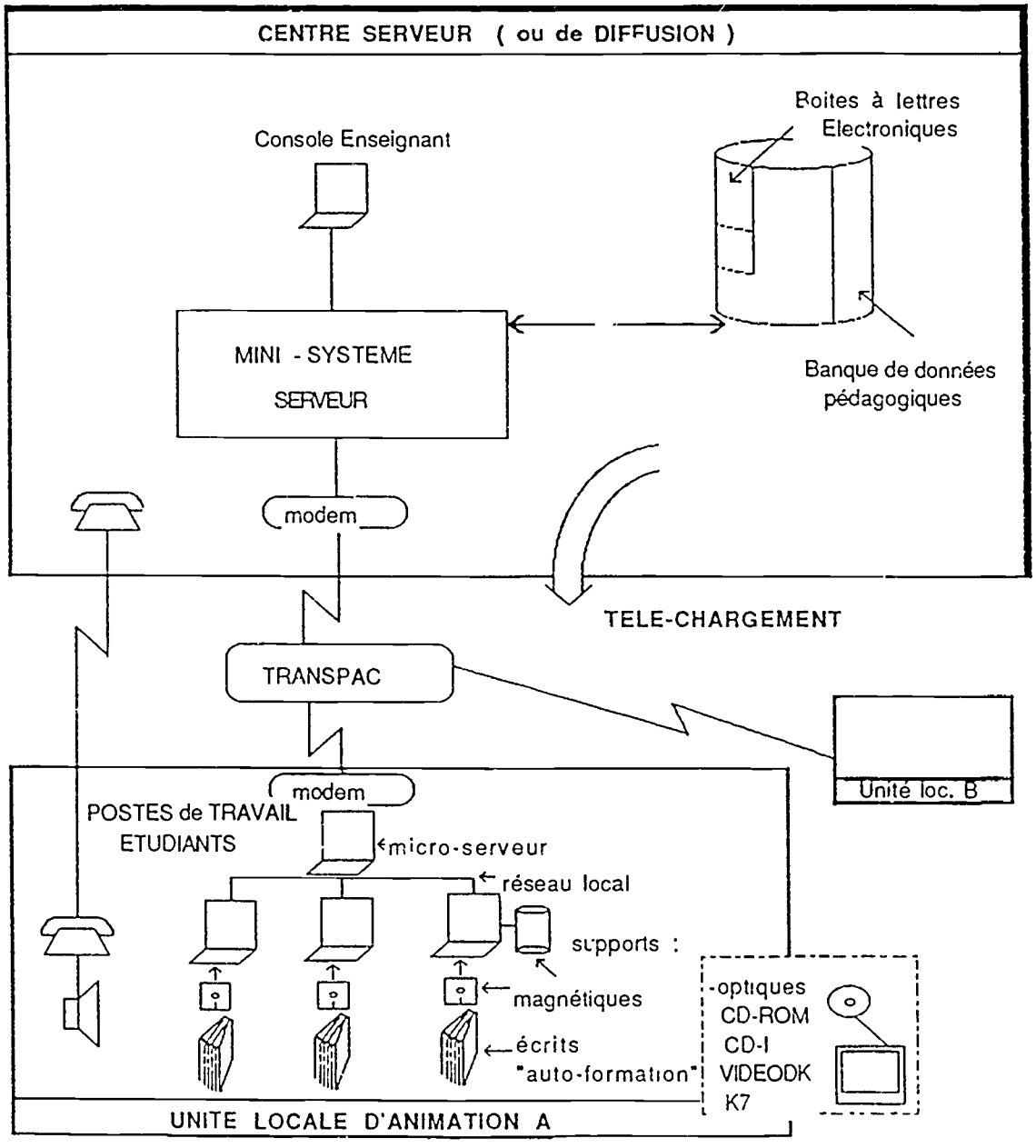


Figure 7: CNAM, *Pays de la Loire* - distance teaching network

F7. CNAM, Toulouse: Distance Teaching via *Télétel*

The CNAM in Toulouse, in conjunction with the University of Toulouse III, set up an interactive teaching service via *Télétel* in 1987 as part of an accountancy course, specifically to help the 190 enrolled students to prepare for the end-of-course examination. The service, totalling 600 Minitel videotex pages, and hosted on the University of Toulouse Computer Centre's machines, included four main elements:

- a series of multiple-choice self-test questions covering the main areas of the course
- model answers from the last four examinations (the questions having been distributed previously)
- a glossary of technical terms
- an electronic bulletin board, on which any student could post questions, to be answered by the teacher (or by other students).

The service was also used to give students instant notification of the exam results at the end of the course.

The service is accessible on *Télétel* from any ordinary Minitel via the 36.13 number (same rates to the user as an ordinary phone call). A token registration fee of 20FF was required at the start, for which each user received a password. 29 out of the 190 students registered on the system during its first year of operation (72 actually sat the exam - the CNAM's dropout rates are relatively high). The average time spent on the system by the 29 users was 1.5 hours, although the teacher who set up the system estimates that at least 3.5 hours were needed to take full advantage of it.

Evaluation of the service (by postal questionnaires and follow-up interviews) showed that the most popular element was the model answers to previous year's exams, followed by the revision material. The electronic mail component was the least used of the four elements. Overall, the student feedback was not overwhelmingly positive -many students never used the service, and, of those who did, the response was relatively lukewarm. However, many of the students said that they felt such services had a very important future, and qualified their low usage levels by pointing out that they would need more time to effectively master the use of this new medium. The teacher who set up the service (practically single-handed, and with little professional help) remains positive and intends developing further applications which students will be able to access via their Minitels.

APPLICATIONS IN THE UNIVERSITIES

F8. The University of Paris-Dauphine: Computer Conferencing

A French version of the PARTICIPATE computer conferencing system (*Participe Présent*) has been available in France through its licensee and co-developer, *Double Hélice*, since 1986. *Double Hélice* runs its own system on a Prime 2250 machine, with a capacity of up to 32 simultaneous users, accesible via the *Télétel* 1 network. User charges when the system opened were 100FF/hour plus the 7FF/hour connection charge for *Télétel* 1 use. *Double Hélice* also sells the *Participe Présent* software, in Vax VMSD, Unix V, and Primos versions, for 120,000 FF (January 1987).

The first educational application of the system has been its use by the UER (*Unité d'Enseignement et de Recherche*) of Applied Economics at the University of Paris-IX (Dauphine). Professor Marc Guillaume started the first computer conferencing activities there in 1986, on Master's level courses, with initial online help from Andrew Feenberg, of the Western Behavioral Sciences Institute in La Jolla, California. The first application was as part of a course on Public Service and Enterprise Culture; this was followed by further courses in 1987 and 1988, on the Economics and Sociology of Sport. The latter were aimed at busy athletes who often found it difficult to attend face-to-face classes. All these experiences so far have been fairly small scale, with numbers of students in a given course ranging from 12 to 35.

A number of conclusions can be drawn from these early uses of computer conferencing in a University environment. Firstly, one cannot assume that students studying at Master's level will have easy access to suitable equipment from their homes. In the largest group (35 students) only four had their own micro, and none had modems. And few members of the group had access to a domestic Minitel terminal. In any case, the basic Minitel supplied by the PTT is unsuitable for anything but the most rudimentary conferencing activities - the keyboard is too small, there are no uploading/downloading facilities, and editing has to be done online. Furthermore, the Minitel is (was) associated in peoples' minds with recreational, trivial activities (games, chat services), as opposed to serious applications such as higher education. The University therefore placed at the students' disposal a number of campus-based micros (Goupils with modem cards and printers). Students therefore had to come into the University to make any serious contributions to their course conferences, using remote Minitels only for checking mail and making brief online replies to mail and conference messages.

Secondly, students require time to master the new technologies. Few had previous experience of using a keyboard and of word-processing; none had

any experience of communications software and modems. Familiarity with a Minitel terminal is little help in learning to master a PC with a modem and communications software - precisely because the ergonomic design of the Minitel and of most *Télétel* services is so good that its use is completly transparent.

Thirdly, the predominant teaching/learning style of the course must be appropriate to a computer conferencing environment. In this respect, the UER's workshop-based methods were seen as being far more appropriate than the traditional 'magistral' and teacher-dominated style of many other university courses. These methods revolve around the students working from initial inputs and documents towards a final project - learning through and by research, in a way which encourages cooperative learning and lateral communication (as in the pedagogy espoused by the Freinet movement). Thus students must be prepared to take a more active and participative role than they would in a traditional classroom setting; and teachers must be prepared to devote more time to a 'telematic' class than they would to a face-to-face one. Marc Guillaume estimates that, in fact, he has exchanged 3 hours of traditional classroom presence for 10 hours spent in reading, preparing, and inputting electronic text messages.

Finally, the costs of the use of computer conferencing need to be properly budgetted for by the institution. These early experiments involved payments of 100FF/hour of connect time to the service provider for use of *Participe Présent*. Setting up the procedures for these payments required a certain amount of administrative negotiation, which will hopefully be resolved in the future as the University's *Centre d'Education Permanente* has now purchased its own version of the software to run on the University's machines. However, these are not the only cost implications, of course: it is also necesary to take into account user support costs, student equipment costs, and, possibly, increased salary costs to online teachers for the extra teaching time that is required of them.

F9. CUEEP, University of Lille-1: Development of CMC Systems

The CUEEP (Centre Université-Economie d'Education Permanente) at the University of Lille has just celebrated its 20th anniversary. It has a number of roles, including:

- further and continuing education of adults, in collaboration with local municipalities, companies, and training organisations
- first year university teaching (mainly in English language teaching)
- basic research and action research in educational technology, particularly in the application of new information technologies to education

- teacher training
- the design and production of multi-media training materials.

The CUEPP is currently undertaking a research project into the development of two CMC software packages - one for synchronous, real-time, communication, the other for asynchronous computer conferencing and messaging. The work is being carried out by the TOIP (*Technologie et Outils pour l'Ingénierie Pédagogique*) team under the direction of Professor Alain Derycke.

One rationale for this project is that of the 'cooperative autonomy' of distance learners - namely that, whilst maintaining a freedom in study patterns and learning styles, distance learners are generally more highly motivated, and do better in their studies, if they have opportunities for dialogue and cooperative activities with other learners and tutors, as and when it suits them. The other main rationale is an awareness that self-study material alone - even sophisticated multi-media/CAL material - is not sufficient to provide a complete learning environment, and that channels for communication with tutors, resource people, and other learners, need to be built in to any effective distance learning programme. The project aims to work towards the creation of 'virtual classrooms' and, eventually, of an 'electronic university'.

The two CMC systems being specified and tested at the moment by the TOIP team at the CUEPP are briefly described below (see Figure 8 for the appropriate prototyping diagrams).

(a) Multi-media System for Real-time Distance Tutoring

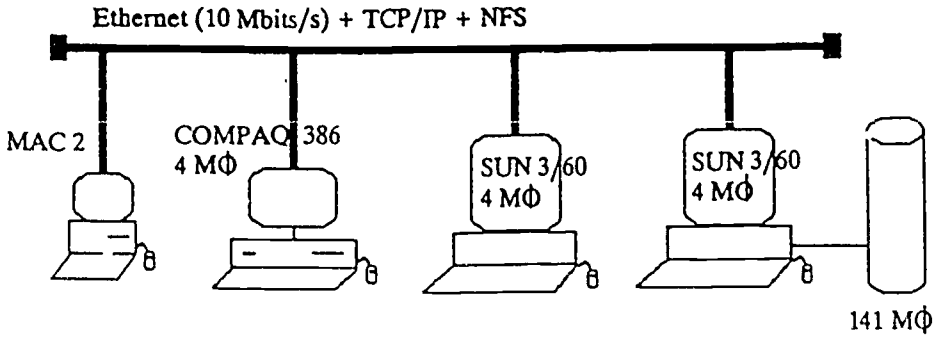
This system would be able to provide for small-group interaction as well as student - tutor contact. It would combine the ability to 'take over' a distant terminal, including mouse input and screen displays. It would also include simultaneous voice communication. A specific area of each participant's screen would be used as a a common workspace, and each user would have their own private areas and files. The system would operate on the WYSIWIS (What You See Is What I See) principle. Current trials of a prototype aim to test out how the users react to the system, how best to start up a conference, how turn-taking is controlled, whether the tutor needs or should have particular privileges, and how private one-to-one exchanges can be integrated within the conference structure. At the moment, the objects that can be created and exchanged on the system include text and graphics; however, it is intended to analyse the possibilties of creating and exchanging digitised sounds and pictures. Software development will be compatible with ultimate transfer to connection via an ISDN network (the current prototyping is on an Ethernet network - see diagram)

(b) Multi-media Asynchronous Computer Conferencing System

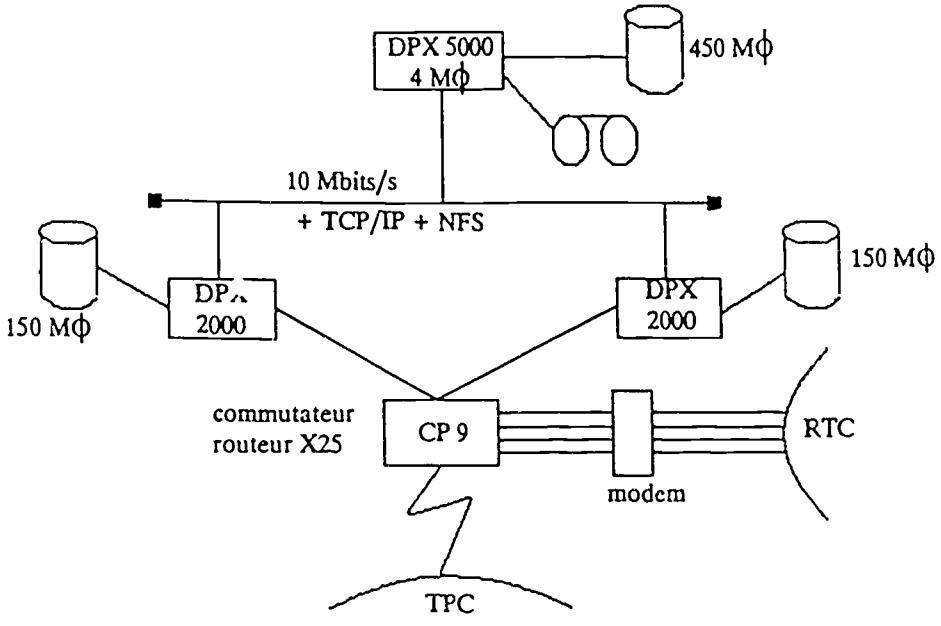
This project, at the moment, involves the development of specifications for a system which will include an intelligent, videotex-based interface, with automatic logon features and the possbility of individualised filtering and storage of messages, on the user's workstation. The software is designed in SMALLTALK on a PC/AT (see diagram).

At the same time, two related reasearch studies are being carried out:

- experimentation and evaluation of the way an existing conferencing system is used, particularly from the cognitive, pedagogical, and technical aspects
- a bibliographic study of the relevance of research in the fields of conversation theory and cognitive science.



(a) Plate-forme de prototypage pour la communication synchrone



(b) Plate-forme de prototypage pour la communication asynchrone

Figure 8: CUEPP, Lille - Prototyping environments for (a) synchronous and (b) asynchronous conferencing

ACKNOWLEDGEMENTS

This report does not pretend to give a comprehensive picture of the totality of uses of computer networking for education and training in France. Rather, it is an eclectic selection of a range of different applications, intended to illustrate the diversity of uses and the influence of cultural and technological factors in their origin and development.

Understandably, the selection of particular case studies is based as much on my own pre-occupations and contacts as on any structured framework for selection.

I would particularly like to acknowledge the time and help that the following people gave me, as well as their courtesy and generosity, during the time when I was compiling information for this report:

- Roger Balcon and Françoise Leclerc, COMETT-Ouest, Nantes
- Alain Derycke, CUEEP, Université de Lille
- Robert Descargues and Guy Gouardères, Université Paul Sabatier, Toulouse III
- Jean-Paul Desbruères, Délégation à la Formation Professionelle, Paris
- Jean-Pierre Descendre, DIDAO, Paris
- Mme Guille and M. Pénisson, UAP, Bouray-sur-Juine
- André Huon, CNED, Rennes
- Bertrand Lebret, Double Hélice, Paris
- Alain Meyer, CNAM Pays de la Loire, Nantes
- Nicole Mercier, Université Paul Valéry, Montpellier
- Françoise Quelen, Direction du Programme *Télétel*, Paris
- Marie-France Reinbold, IFCAM, Crédit Agricole, Paris

It goes without saying that any errors, misinterpretations, or omissions in either of the two parts of this report are entirely my responsibility, and not that of the people who helped me in answering my questions and providing me with relevant information.

Tony Kaye

Milton Keynes, September 30th 1989

APPENDIX FOUR: CONFERENCING SYSTEMS

Prepared for the Training Agency
by
John Coll
X-ON Software Ltd

AKCS

Distributor	Karl S Denninger Macro Computer Solutions Inc 520 N Seymour Avenue, Suite 11 Mundelein, IL 60060 USA
Telephone	+1 312 566 8910
Fax	+1 312 566 9324
Online demo	+1 312 566 8911
UK distributor	Graham Adams DataDrive 30 Hobday Street LONDON E14 6AQ UK
Telephone	+44 1 515 0053
General	AKCS was designed to be used in a networked environment of AKCS sites particularly over Usenet but also over email and direct UUCP connections. The product can be easily and extensively customised. All control files are simple ASCII files and numerous different configurations can co-exist and be selected easily by the user. A full screen context sensitive editor is included. Users need not see any UNIX activity - including the UNIX login, whilst a 15 bit privilege mask can finely control exactly what parts of the conferencing system a user can access. AKCS claim a very high degree of security for their product.
Operating Systems	UNIX System V release 3 et. sec. XENIX 2.2 et. sec.
Current Version	6
Pricing	Version 6 (current release) 3B1 & 80286 - US$149; £95 3B2/300 & 80386 - US$249; £159 3B2/400 & Sun 4 etc. - US$499; £318 Version 7 - see below - October 1989 3B1 & 80286 - US$199; £127 3B2/300 & 80386 - US$299; £190

	No educational or other discounts apply.
Source code	US$2499; £1592 plus a non-disclosure agreement of course.
Maintenance fee	6 months free then $60 to $149, £38 to £95, per year depending on configuration. They claim to fix reported bugs as soon as practical (normally within a few days) as long as the customer is under software maintenance.
Support	Email, telephone and linked conferences are available. AKCS sites are all eligible to receive the 'sysadm' conference.
Documentation	User Manual - $9.50, £6, plus shipping.
Significant customers	Includes AT&T and Harris Computers.
Future priorities	Version 7 is due out on 1st October 1989 and will support up to 1024 conferences. Conferences will be grouped in related areas with related names and these can be presented to users as a group. Enhanced scanning of conferences. Version 7 can scan over 50 conferences per second. Enhanced full screen maintenance facilities, and link mode transfer protocols.

CAUCUS

Distributor	Metasystems Design Group Inc Arlington Plaza, Suite 103 2000 North 15th Street Arlington, VA 22201 USA
Telephone	+1 703 243 6622
Fax	+1 703 841 9798
UK distributor	X-ON Software Ltd 65 Victoria Road London N22 4XA UK
Telephone	+44 1 881 3659
Fax	+44 1 889 3127
Telex	931210251 XS G

General

The Caucus system is structured in a similar way to Confer and has many similar commands. Unlike Confer, however, it is available for a wide range of operating systems which makes it attractive to organisations who wish to start small and move to larger systems as they grow. Caucus is a commercially supported system.

Caucus is very easily extended and customised: all the textual prompts are held in a plain ASCII file. As a result several foreign language versions are available including French and Dutch.

The ease with which external routines can be linked into Caucus without access to source code, has resulted in a strong line of Third Party products including a range of menu systems, accounting and management packages and multi-site support facilities.

Operating Systems: MS-DOS, UNIX, XENIX, Novell LAN, Data General AOS/VS and DG/UX, DEC VMS including clusters, Primos.

Current Version: 2.1

Pricing

Typical prices are	US$	UK£
UNIX or XENIX on 80286	1000	675
UNIX or XENIX on 80386	1800	1200
MicroVAX III	7500	5000
Prime 9000	10000	6700

	DEV VAX 8800, IBM VM/CMS 15000 12500 A 50% discount is available for members of EDUCOM.
Source code	is not normally available.
Maintenance fee	20% of current licence fee per year.
Support	full online support is available as well as access to an international users conference. A wide range of tailored support packages is available in the USA, UK and Japan.
Documentation	User Guide, 50pp A4. Installation Manual 20pp A5. Dictionary and Macro Writers Guide 21pp A4.
Customer base	over 250
Significant customers	Boeing, British Telecom, City of Santa Monica, US Army, Queens Overall Economic Development Corporation, Inet of America, University of Virginia, Eastern Michigan University, Bell South, National Library of Medicine.
Future priorities	Version 2.2 will be released during October 1989 and it includes full support for user-customised menus, enhanced mail and editing capabilities as well as yet further extensions to the user macro capability. Muti-site Caucus, enabling users around the world to participate in the same conference, has been beta-testing for 6 months and will be released during October 1989. A windows-based front end for Caucus with batch login and update to a host is under development and has been demonstrated.

COM AND SUPERCOM

Distributor	Prof. Jacob Palme QZ UniversitetsData AB QZ University Computer Centre Linnegatan 89 Box 27322 S-102 54 STOCKHOLM Sweden
Telephone	+46 8 665 45 00
Fax	+46 8 665 40 88
Telex	10366 FOA S
Online demo	

General

COM was originally developed by the Swedish National Defense Research Institute in 1977. It has passed through many revisions and spawned PortaCOM (q.v.) which runs on a wide range of hosts.

Above all else COM is a distributed system. Not only does it easily support multiple sites running the same conference but it also helps the user to deal with the influx of messages in a unique way. If a user receives the same message three times - for example once as mail and then in two different conferences - then the user need only read the message once. All three messages are linked and a reply to any one of the messages will result in replies being sent to out via all the appropriate return routes. Personal mail and conference items are exceptionally well integrated. COM also supports gateways, networks and protocols like UUCP, JNT-MAIL, BITNET and X.400.

Internally COM consists of a database of text messages and a database of users. Conferences consist of links to users and to text messages.

Prof. Jacob Palme is particularly concerned to bring conferencing within the international standards arena thus ensuring that users of any one system can communicate with users of other systems. Whilst he has little time for those who just talk about inter-networking, he does seem to be prepared, even anxious, to work with those who have a genuine desire to establish inter-working.

Features of COM include commands that can be given at any time, both menu and command drive, and usage statistics (both global and individual) of users, conferences, and lists of conference members. It also allows text interchange using RFC822 - Arpanet,

CSNET, MAILNET etc., retrieval by conference, author, recipient, item number or range, date and time of message, and finally, it provides an automatic facility for removing old text items when space is short.

SuperCOM will be Beta testing early in 1990 with delivery expected late 1990. SuperCOM is an extension of COM incorporating the following new features:

Retrieval of old text items by keyword. Items of lasting interest can be given keywords and kept permanently, turning SuperCOM into a text database system combined with a conferencing system.

Two user interfaces will be produced: one line oriented and the other screen oriented in the style of the Macintosh and MS–Windows.

SuperCOM will support the X.400 messaging standard, distributed operation on several small and large computers, and even better handling of conversations as a user can withdraw or join any branch of a conversational tree structure.

The User process part of the system should execute on the user's own PC, and UNIX and MS-DOS versions - not DEC system 10 & 20 will be provided.

Operating Systems

COM: DECsystem 10 and system 20.
SuperCOM: UNIX and MS-DOS

Pricing

COM:	US$	UK£
minimum	17400	11000
maximum	43500	27700

depending on the number of users.
A 60% educational discount is offered.

Source code

is available at no extra charge.

Support

No maintenance is provided for older versions of COM but SuperCOM will be fully supported.

Documentation	Basic User Manual. COM Teleconferencing System - Advanced Manual by Jacob Palme and Eva Albertson. September 1983. Installation Management Guide The COM Teleconferencing System Functional Specification by Jacob Palme et al. November 1980. Restricted availability. All in English and Swedish and also available in machine readable format.

CONFER

Distributor	Ann E Edwards Vice President Advertel Communication Systems Inc 2067 Ascot Road Ann Arbor, MI 48103 USA
Telephone	+1 313 665 2612
Fax	none
Online demo	may be available on request
UK distributor	None
General	Confer is an IBM 370 based system that has been in use at Wayne State University since the early 1970s. It only operates under a proprietary Operating System called MTS which has made it unsuitable for adoption at many other sites. Confer was conceived by Dr. Robert Parnes who heads Advertel Communication Systems Inc. Advertel offer Confer II as a timeshare system and their customers include The US Army, The US Environmental Protection Agency, The Department of Commerce of the State of Michigan and the Kellogg Foundation. Confer is a simple 'two-dimensional' system where each conference contains a number of items and each item contains a number of responses. Caucus has been very closely modeled on Confer and is strikingly similar. However Confer contains many additional facilities such as the concept of an Auditor who can read but not write, Bulletins which are seen by conference members only once and a much more extensive set of message facilities.
Operating Systems	MTS on IBM 370. DEC VMS soon.
Pricing	Confer II is available on three University host computer systems: one at Wayne State University, Detroit; and the other two at The University of Michigan, Ann Arbor. One license has been sold to Hewlett Packard. Confer V (as opposed to Confer II) has been written for the VMS operating System. The VM version is currently in Beta-test and is expected to be released in early 1990. No pricing is currently available for this product.

Source code	is not available
Support	not yet announced - but the University of Michigan has extensive experience of the system and the needs of users. It remains to be seen how this experience will be brought to outside customers.
Documentation	The Beginner's Guide to Confer II. 1988. 48pp A4. The Quick Reference Guide for Confer II. June 1989. 20pp, A5 Pocket reference card CRLT:Organizer. Aug 25 1989. A printout of a Conference Organizer Conference. 270pp A4.
Future priorities	1. VMS version mentioned above 2. UNIX version

CoSy

Distributor	Blair Newhouse Director, Sales and Marketing Softwords 4252 Commerce Circle Victoria British Columbia V8Z 4M2 Canada
Telephone	+1 604 727 6522
Fax	+1 604 727 6418
UK distributor	None

General

Softwords have reached an agreement with The University of Guelph to market, maintain and develop CoSy from October 1st 1989.

CoSy has been widely used in the Academic community and some sales have been made in the business community. Its low price and availability of source code has been seen as a major plus. Some users (including BIX and the Open University) have reported that extensive customisation was required before the product was put into general use but Softwords confirm that many customers have found CoSy well engineered, easy to install, robust and reliable in operation. CoSy has a user interface that encourages and supports non-technical users.

Pricing

Softwords does not plan to increase Guelph's prices for the existing product line and hopes to introduce a simplified pricing structure which will result in some savings to future customers. The latest available prices from Guelph were:

CoSy VM 1.0 version	US$	UK£
IBM VM 9375/20, 370/148, 4361/3	6800	3310
IBM VM 9375/60, 370.165, 4381/11	8200	5222
IBM VM 370/168, 4381/14, 3083	12900	8219
IBM VM 3081, 3084, 3090	16700	10636
IBM VM source code	3000	1910

CoSy VMS release 2.03		
DEC 730, 750	5100	3248
DEC 780, 785	6200	3949
DEC 8200, 8300	8200	5222
DEC 8800	9800	6242
Source code	3000	1910
CoSy UNIX release 3.2		
NCR tower	6600	4203
DEC VAX 780, 785	7700	4904
DEC 8600, 8650	11200	7133
Source code included		
CoSy XENIX	1995	1270

Source code — Softwords will continue to make the source code available to those customers that require it.

Current Version — various - see above

Maintenance fee — Under review. Guelph's fee was 15% of the license fee - minimum $1000

Support — Support was provided directly from Guelph. It has been suggested that CoSy was presented as a user-developed and user supported system where individual sites were encouraged to customise the source code to meet their individual needs. This inevitably made installation and on-going support difficult.

Softwords will take over the maintenance of CoSy and their initial emphasis will be to provide professional support for a proven product. Softwords will also develop strategic international partnerships to provide an on-going commitment to CoSy's world-wide community of users. This is most encouraging.

Documentation — Original documentation was A4 new docs will be standard 3 ring A5 format.
CoSy System Managers Guide.
System Administrators Guide and Installation Notes, April 1988, 20pp A4.
CoSy User Reference Manual, May 1988, 76pp, A4. This is a factual and technical guide.
Pocket reference card.
Documentation is specific to the operating system in use.

Customer base — 151

Major Sites include — Byte's BIX, The Open University

Future priorities	1. Improvement of documentation and packaging. Softwords wish to simplify the set-up process so that most users can complete installation without further support. 2. The UNIX and VMS distributed versions are being Beta tested and will be made available as soon as they meet Softwords' quality assurance procedures. 3. Other distributed versions 4. Availability of CoSy in other spoken languages

EIES 2

Distributor	Mr. Jim Whitescarver New Jersey Institute of Technology Newark, NJ 07102 USA
Telephone	+1 201 596 2937
Fax	+1 201 596 1630
Danish distributor	Mette Ringsted, Consulate (also Jens Ambrosius, Conferencing System Consultant) The Jutland Technological Institute Teknologiparken DK-8000 Arhus C Denmark
Telephone	+45 86 14 24 00
Fax	+45 86 14 77 22
Telex	68722 jytek dk
General	Initially it proved difficult to obtain information about EIES2. However the following information has been furnished by Jens Ambrosius. EIES 2 presents a Smalltalk User Interface. It is written in C for the UNIX operating system. All EIES 2 programming is based on ASN.1 (X.408 and X.409). This makes the system in accordance with the ISO application layer programming and potentially conferment with standards such as X.400 Electronic Mail, FTAM File Transfer and Access Management and the X.500 directory structure. The system benefits from more than 12 years of experience with conferencing systems gathered for example by the New ' rsey Institute of Technology and the Jutland Institute of Technology.
Operating Systems	UNIX System V release 3.
Pricing	US$ 10000 per system with a 50% educational discount
Source code	is not available
Mainten. nce fee	The distributors can offer education to employees or, on a license basis will take care of maintenance.
Support	A subscription can be taken for the 'Help Desk' which provides telephone support during normal office hours.

Documentation	One set of manuals is delivered with each system. Both manuals are in English: Instructional manual Technical manual.
Future priorities	Facilities to enable configuration of the user interface. Common document creation - enables several users to work on the same document/report which is especially useful for project oriented work. Decision Support. This is an improvement of the conferencing facilities. The keywords in this feature are decisions, requirements, proposals, dependencies and resources. Project Management Support. The EIES 2 project management Support is modelled on The Coordinator and is Task-centered. Actions include: assign, commit, commit-to-commit, reject, complete and close. Integration of CASE tools into the group communication environment.

PARTICIPATE (PARTI)

Distributor	Harry Stevens Participate Technologies 132 Southwick Court Ann Arbor, MI 48105-1409 USA
Telephone	+1 313 994 6470
Fax	+1 313 665 8695
Telex	
Online demo	Compuserve. GO PARTI
UK distributor	John Wilkie 14 Meadow Way Blackwater Camberley Surrey GU17 0PT
Telephone	0276 31922
Fax	01 839 2875

General

Parti was written in 1981 for Prime computers and has since then been ported to DEC and IBM host systems. It was aggressively marketed and was for several years the de-facto conferencing system with a large installed base.

Its most obvious feature is its branching structure where a linear sequence of notes can branch off in several directions. Many, perhaps particularly those in an academic environment, find this of great benefit as it encourages serendipity and free thought. Others find that it results in a system where it is difficult to find a particular thread of discussion unless you know where to look. Topics can be moved from one place to another or attached to multiple points if appropriate.

Parti provides a simple and effective command system where any command can be issued at any point.

Version 4 is a released product which will be sold until the end of 1989 and supported during 1990. Version 5 is beta testing at present.

Operating Systems	Version 4: DEC VMS, Primos and IBM VM Version 5: UNIX system V. MS-DOS is being considered.		
Current Version	4		
Pricing	Version 4 - revision 4.6	US$	UK£
	VAX and Prime micros	3750	2390
	VAX and Prime minis	7500	4780
	IBM VM and DEC mainframes	12500	7960
Source code	Version 4 is available at	25000	15900
	plus 20% for each object code copy resold		
	or with no additional royalties	150000	95000
Pricing	Version 5 is priced by the number of user accounts on the system. Sample figures are given below but they will quote for other numbers of users. The UK prices are quoted from the UK distributor rather than being direct US$-UK£ conversions.		
		US$	UK£
	100 users	1000	700
	500 users	7500	5000
	unlimited	10000	6750
Source code	Version 5 is available for $26300; £16750		
	20% discount to non-profit educational institutions		
Maintenance fee	12% of current pre discount license fee		
Support	Phone support for the Maintenance fee. Additional fee payable for online support.		
Documentation	User Manual Installation Instructions System Administrators Guide		
Significant customers	Compuserve, Harvard Law School		

PORTACOM

Distributor	Bengt Olsen KOMunity Software AB Sveavagen 114 S-113 50 STOCKHOLM Sweden
Telephone	+46 8 34 20 40
Fax	+46 8 31 61 39
Telex	19271 KSAB S
Online demo	
UK distributor	none
General	PortaCOM has grown out of the need to make the COM system available on a wide variety of host systems. PortaCOM is being developed separately from, but in close cooperation with, the COM team. An advanced security system has been implemented and can be purchased for use with PortaCOM. It consists of two modules; one for the host and one for the terminal. PortaCOM has a well integrated mail and conferencing system (see COM). KOMunity pride themselves both on their customer support and on the lack of bugs in the code! Please read the section on COM for relevant background to this product.
Operating Systems	MVS/TSO, VM/CMS, BS2000, OS1100, VMS UNIX - DS90, Pyramid, DDE and Sun. Other UNIX systems soon.
Pricing	Dependent on the number of simultaneous users rather than the hardware platform or operating system. Prices vary between minimum 120000 SEK $18000 £11500 maximum 300000 SEK $45300 £28800; A 60% educational discount is offered with a further 20% discount to members of Educom.
Source code	is not normally available.
Maintenance fee	16% of list price per year for 1 to 2 new versions per year plus bug fixes and updates. If users are connected through a network then help and advice is available through that network at no extra charge.

Support	A wide range of services is available, some free and some for a fee. These include installation training of administrators, user training, distance education and management consulting.
Documentation	User Manual Installation Manual Administrators Manual Self study documentation.

VAX NOTES

Distributor	Digital Equipment Corporation DECdirect PO Box 85 Reading Berkshire RG2 0TU
Telephone	0734 393200 (pre-sales, sales & technical support)
Fax	0734 315191
Telex	847227 DECDIR G
Online demo	none
General	VAX Notes is bundled in with many DEC sales and is therefore, far and away, the system with the largest installed based. The product is fully integrated with DEC's mail system and can operate under DECwindows. VAX Notes can operate over DECnet to permit users at any location to access a conference on another host. VAX Notes is not a fully distributed system - it uses DECnet to provide the real-time communications link to a particular host system. VAX Notes supports Digital's Compound Document Architecture (CDA) allowing the inclusion of text, data, graphics and images in a conference. VAX Notes is well established but is felt by some to be technically oriented and simpler user interfaces are available on other systems.
Operating Systems	VMS 5.x
Current Version	2
Pricing	DEC charge separate fees for a licence to use the software and for the software and documentation. Three licence options are available: 1: A full function Server which permits Clients access to all features. 2: A reduced functionality Client which prevents the creation of conferences. To use the Client a Server must be available. 3: A User-based option which supports a specified number of Notes users.

It will often be most economical to purchase an unlimited, clusterwide, licence for VAX Notes and the following costings are given on that basis.

MicroVAX 3100, able to support 30+ users	£ 1353
Media	475
Support and maintenance	924
Total for MicroVAX 3100	£ 2752
8600 able to support 100+ users	£ 9862
Media	475
Support and maintenance	924
Total for 8600	£ 11261

As mentioned above substantial discounts, up to 100%, are available in certain circumstances.

Source code — is not available.

Maintenance fee — £ 240 per annum

Support — £ 684
Note that the exact figure will vary between different DEC agents.

Documentation — Product manual for Client, Server and User-based options.

Customer base — Several hundred

APPENDIX FIVE:

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ADDENDUM

REPORT ON THE TRAINING AGENCY WORKSHOPS

Sheffield, June 1990

Robin Mason

This addendum is based on a series of workshops sponsored by the Training Agency to discuss the main issues of this report and to make recommendations for the way forward in educational and training uses of networking.

REPORT ON THE TRAINING AGENCY WORKSHOPS

FORWARD

Just as the first 500 copies of this report had been distributed to interested inquirers, a series of workshops based on its findings were held, at the request and sponsorship of the Training Agency. The aim of these workshops was to gather together representative users of computer networks in the United Kingdom, to look at the future requirements of the networking fraternity. The workshops were held over four days in Sheffield, and were attended each day by about 20 different participants who are currently involved in educational and training applications of networking in the United Kingdom.

Participants were invited to give an overview of the critical issues from their perspective for the development of the educational potential of computer networking. The first workshop centred on the use of networking in the community, and focussed on the themes of access to facilities, information technology and the disabled, and the growth of telecottages. On the second day, participants from the higher education sector discussed the themes of integration of various teaching media, of extending the use of computer networking into more areas of the curriculum and into the infrastructure of a whole campus. The use of electronic networks for professional and vocational training was the focus of the third day, with special emphasis on factors affecting acceptibility, on extending skills training and the impact on organisational culture. The final day consisted of developing strategies for the furtherance of computer networking - its markets, the standards required and its contribution to education and training.

The following additional section is a direct outcome of these workshops. It tries to address a number of the shortcomings identified in the report, as well as providing a summary of the arguments and ideas generated during the four days of discussion. Despite the different agendas for each day, a number of common concerns emerged in all the workshops, and these will form the basic outline for presenting the various discussions. By not only defining the problems but also distilling the benefits, this section aims to set the agenda for education and training uses of networking in the 2000s.

DEFINING THE TERMINOLOGY

One of the gaps identified in the report was the use of the term 'computer networking' in the title of a work which was largely about computer conferencing, and not the whole range of networking possibilities: access to remote databases, the use of electronic mail, remote computer-aided or technology-based training, shared access to files, bulletin board systems,

computer-supported cooperative learning tools, as well as the software known as computer conferencing. Although many of the issues, difficulties, advantages and drawbacks discussed in the first part of the report apply to all these uses of networking, the case studies and list of applications in later parts are almost completely drawn from uses of computer conferencing. This 'evolution' of the project from an investigation into the educational uses of all forms of networking, into the incomplete compilation of information on one small part of the field took place for a number of reasons:

- The reporting of this small but emerging aspect of the whole field was the least well documented in the available literature.

- The educational value of this particular medium was seen as the most potentially important.

- The range of its uses and the understanding of its capabilities were the least known and exploited.

- To try to cover the whole field of networking use was simply impossible with the time and resources available.

Nevertheless, some readers may find this blurring of distinctions and lack of clarity in terminology a major oversight. Those who use a range of these electronic facilities will be aware of the overlap not only in their terminology but even in their actual application: conferencing systems invariably include email; group email facilities can almost resemble conferencing; conferencing can be seen and used as a form of database; bulletin boards are simply poor relations of conferencing systems; shared file spaces are one component of cooperative work systems, and so on. The following solution to this question of terminology has been adopted throughout this additional section: the term networking is used when the notion of general computer-mediated use of an electronic network is implied and the term computer conferencing is used where the specific attributes of conferencing software are intended.

WHAT IS COMPUTER CONFERENCING?

It was estimated by one participant that less than 1% of the present use of computers was in a networked situation. Of this tiny 1%, the majority consisted of email and online databases. Computer conferencing, therefore, may be a growing application, but it is hardly dominating the field. In fact, it was variously described during the workshops as "just a gimmick", "the icing on the cake" and "not really necessary". One participant asked whether it should be regarded as a technology or an activity. Others questioned what was the real product being marketed. In educational terms, the answer was "added value". Conferencing does not replace teachers or other resources; it

provides a new environment, unique ways of interacting, different time and space for learning, wider contacts and expertise.

LITTLE OR LARGE NETWORKS?

During the data collection stage for the major part of this report, a considerable lack of awareness was noted of what other applications, products or people were available in the same field. At the time this seemed to point to the need for a central resource, a national networked facility offering access to software, resources, information and expertise. Indeed, discussion of this notion was one of the original conceptions behind the workshops. Participants from all sectors were almost unanimous in arguing that centralisation of all networking facilities was not the way forward. Diversity of programmes, networks and research projects was seen as a positive feature of the current state of work in the area. The feeling of ownership was stressed, particularly by community-action representatives: it was important for initiatives directed at the disadvantaged, remote or specialised interests that the network be seen as belonging to the group. Likewise, distance learners found that access to their institution's network contributed largely to their sense of an educational community. This advantage of networking might be lost with a large network organised and serviced by staff unconnected with the individual group concerns.

Nevertheless, any institution or group which becomes involved in networking needs to build up expertise in a range of skills: technical support, moderating ability and contact with the user population. Using the services of a large host system, such as Campus 2000, may for some institutions be not only the most economical but also the most advantageous choice. For those who choose to 'go it alone', the actual experience of setting up a networking facility and tackling the problems of that particular context, may be the best teacher.

The disadvantages of the proliferation of different networks were also discussed: the variety of protocols used and the lack of communication and hardward standards, which increased the difficulties of providing gateways from one system to another. Access to people on other systems and to the international electronic community was an important facility for most workshop participants. A second disadvantage was reported by those participants involved in the use of several systems: remembering the different commands for each system and switching between systems for different information had negative effects and inhibited use.

STANDARDS AND INTERFACES

Perhaps the most frequently repeated condition for the development of networking in the future was the need for access and use of electronic systems to be made easier:

> "Access must be as easy as turning on a TV."
>
> "Just as the Queen's Coronation sold TV in the UK and the postal strike in '88 sold the FAX machine, we need a rallying event for computer networking."
>
> "Moving from one system to another is like an electronic chess game."

Nothing so inhibited the growth of use as the present awkwardness of logging on and moving around within and between systems. In this respect, computer networking is like a lumbering dinosaur in the age of the elegant micro-chip. As long as access remains a punishing initiatory rite, networks will be dominated by 'techies' talking in computer-ese and by courses about the technology itself.

The overwhelming consensus of the workshops was that standards must be developed for the communication protocols, but that diversity of hardware, software and network systems was a positive strength. The example of the JANET network in the UK was cited as support of the value of standards, although its effectiveness in linking all its members had created a situation of the 'haves and have nots' amongst those ineligible for membership. The lack of such a standardised and user-free facility for those in the public, voluntary and community sectors was noted with concern and regret.

EDUCATIONAL VALUE

Despite the inhibitory situation created by the lack of standards and of friendly front-ends and the difficulties of access, the technology involved in networking was generally regarded as a secondary concern. Although the workshop participants were in one way or another committed network users, a very strong message emerged from each day's discussions: that the educational value of networking needs to be addressed directly. "What are we using networks for", was the question which was raised over and over. The variety of answers offered shows the wide range of educational applications already in practice, and the potential of this medium to meet a range of contexts. The following analysis is intended for use by anyone who wishes to extract or 're-package' the list for their own purposes.

Inherent attibutes of computer networks

1) Independent of Location

The ability to connect people in any location, nationally or internationally, opens the doors of education in unprecedented ways. Interaction and exchange can be based on common interests and desire for exchange, not on accident of location or physical availability of expertise.

2) Interactive

The fundamental element of email and conferencing is the interactions between users. The computer is merely a tool or vehicle for facilitating human contact. Communication between people lends itself not only to expression of a personal point of view and but also to exposure to other viewpoints.

3) Asynchronous

Spreading discussion out over time provides a reflective element which is particularly beneficial to the learning process. Before replying or inputting new items, reference can be made to other material, discussions and other work can be carried out, or time to reflect on an appropriate response can all take place.

4) Text-based

The fact that these facilities are, at present, based on the written word lends their use to an educational system which is so dependent on written examinations, essays, and assignments in all the major curriculum areas. Reading and preparing email and conferencing messages provides practice in the language of the particular discipline.

5) Group Orientation

Conferencing systems to a greater extent than email systems alone, provide the opportunity for setting up group working situations - for exchange of information, for discussion and exploration of a particular theme or issue, or for the preparation of a joint piece of written work. Group discussion is an ideal context for developing critical analysis and ability to integrate and synthesise ideas and perspectives.

6) Serendipity

To the extent that networking involves interactions between people, there will always be an element of surprise and unforeseeable

outcomes. This contributes not only to the enjoyment and fun of networking, but also to the learner-centred approach to education.

7) Access to information

Databases, and to a lesser extent conferencing and email, provide access to up-to-date information in ways impossible with printing technology alone. The new 'storage' media have now made available vastly increased amounts of data.

Educational contexts for their use

Distributed groups of people with little opportunity to meet face-to-face benefit from the facility to interact, exchanging information, opinions and perspectives. They may be isolated geographically, distributed over many offices of a large company or simply connected only through a particular interest in common.

Organisations benefit from the coordinating power of networking: to enhance the efficiency of face-to-face meetings, to bring together different areas of staff who otherwise are isolated, or to make connections outside the organisation with consultants, experts or peers in similar contexts.

Schools can use networks to bring together children across Europe and the world, thereby providing access to experiences outside the usual classroom provision.

Distance learners benefit from the interactive nature of networking which encourages active learning rather than passive acceptance of printed course material. Connectivity with other learners also creates a social environment for learning which is more conducive to understanding than working in isolation.

The equalising nature of networking provides a passport for the disabled to enter the mainstream of education and training. In fact, they can pass unnoticed amongst the other users of the system, if they choose not to mention their disability.

Libraries, both public and institutional, can, through networking, open their doors to a wider user base in a more convenient way: information can be accessed online, references checked and book orders placed for subsequent collection. Public libraries can act as a community resource centre with gateways to the rest of the electronic world.

Networks within schools or school districts offer children a new resource for developing collaborative projects outside the four walls of the classroom.

Access to shared files - either on campus or amongst collaborators distributed across the globe - creates new possiblities in tutoring and research. Assignments can be submitted and marked online, joint papers can be written online and teachers can update printed information with more recent additions online.

In most learning situations, there is great value in mutual self-help. Electronic communication facilitates the giving and receiving of support amongst users, often creating a lateral network of help lines which is beneficial to all involved.

Computer networking can be used to facilitate social change by empowering dispersed people to form pressure groups and support their particular cause.

Rationale for further exploitation

- The emphasis placed on communication and technology in the National Curriculum makes computer networking an ideal medium for meeting the needs of the primary and secondary education sectors.

- The phenomenal growth in the use of distance education will increasingly demand interactive technologies to support isolated learners.

- The present era of rapid technological change has transformed education and training from a classroom activity of the young to a life-long process. Computer networking meets the need for working adults to train, re-train and keep up-to-date with developments in their field.

- Computer networking opens new education markets in Europe and the Pacific Rim, and contributes substantially to the "redrawing of institutional walls".

- The demand for choice and flexibility in work patterns as well as in learning requirements points to the use of networking as a facility for time and work management. Teletraining can be intimately linked with teleworking, and both pass more control over to the user.

- Organisations which are flexible and responsive to changing pressures are those which will survive. Computer networking is associated with and appropiate for lateral and open-ended responsiveness.

- Networking is ideal for creating a cohesive group amongst those who work in the same location. The stored resource of past messages allows new members to join the group at a later date.

- Although the 'pay-back' of networking is often hard to see amongst the pioneering applications today, the need for networked educational systems will be greater in 15 years time. The basic work of laying the foundations for the future need must be tackled now.

INTEGRATION WITH OTHER MEDIA

Just as computer conferencing can be usefully combined with other networked facilities, for example, use of databases, gateways to other systems, use of shared files, so educational networking needs to be integrated with other media generally. New products or technologies either being piloted or actually on the market are leading the way in this regard: satellite broadcasting or cable television for delivery of course material or training packages, voice and even video mail for tutorial support, networked campuses and communities for use by students, the general public and commercial and industrial organisations.

Conferencing is often combined with more common media as the 'glue' to sustain group dynamics between face-to-face meetings or to add human interaction to the use of online training packages.

The developing field of computer-supported cooperative learning is an example of the combination of computer tools with the facilities required to work collaboratively. Although there are many aspects to the research in this field - some to support synchronous and co-located groups, others to help distributed or asynchronous groupings, most uses involve a network, whether local, wide area or broadband. It is in these developments that the future shape of networking can be seen. Group creativity may be the catch-phrase of the next generation and tools which enhance co-creativity will be the desired educational media.

INTERNATIONAL DEVELOPMENTS

The potential offered by electronic networking to expand the scope of contacts to Europe and the rest of the world, is perhaps the single most significant issue raised by use of this medium. At one level, this potential opens new markets for educational providers, new dimensions for educational projects and new scope for collaborative training programmes. There is no doubt that many schemes are planned or in progress which capitalise on this facility.

One of the factors involved in European developments particularly is the question of language and the use of the 8 bit character set. In order to

transmit the non-ascii code symbols of European languages, the 7 bit set still in use by many English speaking countries must be abandoned. It would be counter-productive to the spirit and potential of networking if European languages are not accommodated. In fact, learning foreign languages through computer conferencing interactions is a new use of networking now being exploited.

The European Commission has a number of programmes such as DELTA and COMETT to advance the use of computer networking in education and training. Ideas for a European electronic university have been floated and various projects using satellite broadcasting for widely dispersed specialist groups, such as high technology and medical training, combined with computer conferencing support are already in progress. Computer conferencing is also being used as an administrative and communications tool for the coordination of the various programmes.

The availability of international electronic information systems has had a major impact on libraries and their users. For some time it has been possible to search remote library catalogues through networking, and commercial database searches have also been possible from libraries. A new development is the plan to make some of these databases available on the JANET network, at a set cost to the participating institution, so that individual users can access database information from their own offices or terminals.

The proliferation of national and international 'mailing lists' which act to a some extent like large scale conferencing systems, is another major example of the potential of networking to vastly extend the scope of an individual's contacts in particular areas. Groups are formed based on a common interest or topic, and mail messages from one user go to everyone on the list. Sometimes the messages pass through a moderator; sometimes not. International lists already exist in most fields and thrive on the interest and use of the participants.

TRAINING

The difficulties of training naive computer users and the need to convince teachers and to develop the skills of moderating online conferences were constant themes of the workshops. For purposes of rural and community use, a system as simple as the French Minitel was regarded as essential. Given the difficulties of the present provision, face-to-face training as well as follow-up support was needed to be successful with most naive users. The development of front-ends and seamless interfaces was highly desirable to cope with the present tortuous procedures for access.

Various methods for training larger groups were also discussed: the vanguard approach where one department is highly trained to act as a leader for the

others to follow later; the cascade method, where some are trained to go off and train others and finally the approach of training a lot of the people a little. It was generally acknowledged that 'telematеurs' seemed to emerge naturally, regardless of the nature or degree of training. These people, who invariably have good interpersonal skills, are the most effective ones to encourage interaction, support those in difficulty and moderate conferences. Although some moderating skills can undoubtedly be taught, many are independent of the medium and are identical with effective communication and human interaction.

The need for reward and recognition of networking use amongst teachers and trainers was a matter for concern amongst those most directly involved in the education sector.

> "There has to be something in it for them to be worth their taking on this new responsibility".
>
> "Networks must enrich the environment in which people work".
>
> "We have to show teachers that the networking environment can provide sustained improvements in learning".

Finally, training was seen as most effective when directly linked with the purpose or context for using the network. Learning the procedures and commands for access and control should be presented as a means to achieving a particular end.

COSTS

The headlong rush into distance and open learning as a cheaper option than traditional methods for retraining and up-dating the workforce was regarded with suspicion by many educators. Without due regard for planning and preparation of course materials, these programmes often resulted in 'cheap', rather than merely cheaper options. Adding networking to the educational provision will generally add to costs, as it should rarely be used to replace other facilities or staff. Nevertheless, acceptance of the cost of any educational provision is often a matter of justification and of presentation.

As the cost of developing and running an in-house system drop, more and more institutions will undoubtedly look to this option. Nevertheless, it was considered inefficient and unnecessary for academic institutions to spend time and resources maintaining private networks. These should be part of the country's basic infrastructure.

In the voluntary sector, hosting and updating databases requires funding, as commercial access charges would be prohibitive to the target users. Setting up

systems where the business use of facilities subsidises the voluntary and community uses is becoming more common.

Provision of local call access to PSS from all parts of the country was certainly seen as a priority amongst those who had experienced the way in which the present deficiencies in this provision hampered the natural growth of networking applications.

RECOMMENDATIONS AND SUGGESTIONS

1 The need for standards in communication protocols should be vigorously supported at a European-wide level. Major lobbying should be undertaken during the current review of the duopoly situation in UK telecommmunications. The use of X.400 and X.500, and an 8 bit rather than 7 bit alphabet should be recommended, and only projects based on these standards should be funded.

2 The development of gateways between systems should be actively promoted, and access to JANET broadened.

3 To meet the growing demand for moderators and online teaching skills, courses should be offered and material prepared to train new users in these techniques. By holding the courses online, participants could learn by doing.

4 There is a pressing need for material which specifies and collects examples of good practice in the educational applications of networking. Much of the present literature is over-enthusiastic, and is difficult to distinguish the successful from the mediocre.

5 Although a central network is not recommended, a resource centre or person could usefully act as a clearing house for information and advice about where to go for expertise.

6 Face-to-face meetings such as the workshops sponsored by the Training Agency are an essential means for the loosely knit community to exchange ideas and keep in touch with new developments.

7 Public libraries should be promoted as access points to networking facilities. In this way, voluntary and community based networking initiatives can provide the basic equipment and gateways for their users.

8 Every opportunity should be taken to bring together the service providers with those who add value to networks by teaching on them or developing software for them.

9 The restriction on service providers against allowing preferential costs for educational use of networks should be reviewed.

10 Research into the problem of information overload should be conducted with a view to understanding the problem and investigating design solutions.

APPLICATIONS

With the addition of a new section to this report, there is an opportunity to describe a number of applications not mentioned earlier. No systematic attempt has been made to present a comprehensive up-date, and only UK additions are made here.

Gaeltel

GAELTEL is an email and conferencing system serving primarily the West of Ireland. It uses both the CoSy and VAX Notes systems and is a bilingual service in English and/or Irish. Binary File Transfer is also supported on the system. Main users are secondary schools, community development groups and the Irish PETRA projects. The host organisation, GCOM, provides gateways to other networks and has excellent training facilities for IT&T staff.

Contact: Sean O'Drisceoil, Galetel System Manager, GCOM Teo., Na Forbacha, Galway, Ireland. tel. 091-92533/92425

Greenspace

Greenspace Networking Resources Project is a three year research project looking at the development of self-sustaining networks for community action in conservation. The emphasis is on the needs of communities, rather than authorities. The project investigates communications for information exchange (between voluntary groups, local people, and voluntary and public bodies), resources (meeting and making the most of the practical needs of conservation) and skills development (formal training and informal sharing).

The project is helping to develop HANTSNET (Hampshire County Council's computer system providing a comprehensive information system throughout the county) as a major network communications tool. HANTSNET is to be opened up to public use via community centres, libraries, and schools, allowing members of local communities access to networks to enter and obtain information.

Contact: Kay Wagland, Greenspace Networking Resources Project, BTCV, North Hill Close, Winchester SO22 6AQ. tel. 0962 846172

GreenNet

GreenNet is a computer communications and information exchange service specifically for peace, environmental and human rights movements. GreenNet is part of the Association for Progressive Communications along with sister networks in the US, Canada, Brazil, Nicaragua, Australia and Sweden. It provides a support service for other campaigning and progressive groups and individuals, allowing them to work together more readily across organisational, national and issue boundaries.

Contact: GreenNet, 25 Downham Road, London N1 5AA. tel 071 923 2624.

Poptel

Poptel is the international electronic communications and online information service for non-commercial and non-governmental organisations. Poptel operates on GeoNet, continental Europe's largest email community with 25 host systems across Europe and in the USA. Poptel has users in over 45 countries, including trade unions, development and human rights organisations, peace groups and documentation centres.

Poptel is run by Soft Solution - a computer software co-operative based in London. Working closely with like-minded organisations such as Interdoc and Antenna, Soft Solution is committed to spreading the use of computer communications technology as a tool for the non-commercial sector in Britain and throughout the world.

Contact: Poptel/GeoNet, 25 Downham Road, London N1 5AA. tel 071 249 2948.

Elnet

CECOMM (see European Application 5), with financial support from the Training Agency, has established an electronic network of educational establishments in the UK, France and Germany. Participating centres (tertiary educational establishments) will link together with partners within the other two countries, and use the computer conferencing methodologies developed at CECOMM to carry out group activities within two principal curriculum areas: Business and Language Studies.

Participating centres will link together using personal computers via their local public data network to host computers in their own countries. In turn,

these host computers will be linked to allow all centres to work within a common environment. Students and their teachers will be able to participate in task-oriented activites with similar groups in the other countries. These centres will be the first in Europe to have the opportunity to use computer conferencing technology to support cross-cultural learning.

Contact: Dick Davies, Institute of Higher Education, Southampton, Hampshire SO9 4WW. tel 0703 229381

PICT

The Programme on Information and Communication Technologies is the UK's first concentrated examination of the complex economic, social, managerial and policy issues raised by developments in the new information and communication technologies. PICT's network of multidisciplinary research teams is gathering and interpreting data to help inform policy debate. PICT's activities can be divided into three broad categories: research, dissemination and training. It's network includes six interlinked research centres. The multi-disciplinary nature of the research teams has become its hallmark.

Contact: Nigel Gardner, PICT Director, Social Studies Faculty Centre, University of Oxford, George Street, Oxford OX1 2RL. tel 0865 278721.

HICOM

HICOM is a computer conferencing system for people interested in Human Computer Interaction. The service is provided by a computer conferencing system, email and database facilities. It aims to bring together all parts of the HCI community - academics, industrialists, professional bodies, committees, project teams, and funding organisations. It is a free service owned by the community, managed by volunteers and actively supported by organisations such as Digital Equipment Company, Computer Sciences Company and the HCI Service at Loughborough University of Technology.

Contact: Paul Wilson, HICOM Executive Manager, Computer Sciences Co. Ltd., Computer Sciences House, Brunel Way, Slough SL1 1XL. tel. 0753 73232.

Community Computer Network

The aims of CCN are to encourage the community-based use of computers, the socially-responsible use of computers, as well as communication and cooperation between groups throughout the country. Despite minimal organisational structure, CCN runs regular national conferences, produces a

newsletter and a monthly membership bulletin, and manages a user group on the email and bulletin board system GeoNet.

Contact: CCN, 35 Pink Lane, Newcastle NE1 5DW.

The Manchester Host

Manchester City Council is set to be at the European forefront of the development of 'networked cities'. By establishing a computer information and communications service, Manchester offers local businesses and community organisations cheap, easy access to a powerful computer, the Manchester Host Computer. The Host will subscribe to online services, which users can access on a "pay as you use" basis. By spreading the costs over thousands of users, facilities previously reserved for large companies can be provided to even the smallest groups. The Host will also provide a valuable new service for non-commercial organisations in the city, for example by equipping "electronic village halls" for access by individual users and voluntary groups.

The services to be available on the Host computer include communications services such as email, bulletin boards, computer conferencing, file transfer, FAX transmission and Telex. The Host will also provide Information Services, the core of which will be a database/document retrieval system. This information can be made available free or at low cost to the end-user (for public service databases) or at a price set by the information provider. In addition, the Host will provide access to external information sources via gateways.

The Host should also be seen in the wider context of providing an important component of the developing telecommunications structure of the region which includes the forthcoming Cable TV franchises, the City Council's Telematics training programme involving over a dozen European partners and the proposal to the European Community's COMETT programme for an advanced telecommunications project.

Contact: Dave Spooner, Manchester City Council, St James' Buildings, Oxford Street, Manchester M1 6FL. tel. 061 234 1259.

ITL, Blackburn College

Blackburn is one of the first British colleges or universities to have implemented a broadband network on a campus-wide scale. Unlike Ethernet, broadband offers a major bonus in educational terms, namely video, as channels for video co-exist happily with data channels. The network is also permanently linked through dedicated modem lines into wider comms networks, such as JANET, Prestel and Campus 2000.

As the College has always worked closely with local industry and community projects, the network will also be used for educational and training applications outside the College.

Contact: Len Adam, Blackburn College, Feilden Street, Blackburn, Lancashire BB2 1LH. tel 0254 55144

Dudley LEA and Interspan

Schools in the Dudley LEA have chosen to use Interspan, an electronic mail system which offers a very cost effective method of delivery. Children and teachers prepare their messages during the day and leave it in their outtrays. Overnight the central Interspan computer phones in to the school, picks up the mail and delivers it to its various destinations. Messages can consist of simple text or data files. It can also be used for updating software on the school file servers.

Interspan has, in addition, proved to be a most valuable curriculum tool within schools with local area networks. Every child can have their own exclusive mailbox and can send messages to anyone on the system in any class. These messages are picked up and delivered within minutes allowing immediate debate and exchange of ideas.

Because Interspan conforms to the X.400 international standard for electronic mail systems, it can communicate with any other X.400 mail system. A gateway is now being set up between Interspan and the Luxembourg central X.400 system, which has a mailbox in every school in Luxembourg. Already schools in Dudley LEA have been communicating with France, Germany and Luxembourg as part of their European Awareness Project funded by the Central Bureau.

Experience has shown that personal links between teachers are vital to the success of any networking project. Dudley hosted an International Conference of participating staff which fostered relationships between teachers and ironed out a number of problems - such as taking great care that curriculum topics are chosen which fit into foreign schools with strict timetables, a more rigid curriculum and limited computer time.

Contact: Dudley LEA - Rob Cowell, Computer Centre, Bowling Green Road, Netherton, Dudley, DY2 9LY. tel 0384 634155

Interspan - SJ Research, Intercell, 1 Coldhams Lane, Cambridge, CB1 3EP. tel. 0223 461406

ENB Computer Assisted Learning Project

The overall aim of the three year project is to enable educators in the field of nursing, midwifery and health visiting to use computers competently and creatively. Using the cascade system of dissemination, a number of Centre Leaders attend a three day induction meeting which is followed up and supported afterwards by communication and CAL facilities on Campus 2000.

The success and scope of this project is apparent in the fact that, at present, these users represent the largest group on Campus 2000.

Contact: Paula Procter, Director, ENB CAL Project, Woodseats House, 764a Chesterfield Road, Sheffield S8 0SE. tel 0742 553231

Campus 2000

Since the applications in the earlier part of the report were compiled, Campus 2000 has emerged as the major provider of online systems to education in the UK. For this reason, it is important to discuss this network in more detail, and to correct a number of statements made previously.

Campus 2000 was formed in January 1989 with the integration of two well-established services, PRESTEL Education and The Times Network Systems (TTNS). However, Campus 2000 is not synonymous with PRESTEL, which is a commercial service run by British Telecom for the benefit of business and home users. It contains some elements of the PRESTEL database, but it provides a vastly different range of features and services specially tailored for educational use. Nevertheless, neither are subsidised services.

The vast range of primary and secondary school applications of Campus 2000 has only been touched upon in the earlier part of the report. It can be accessed from anywhere in the UK at local telephone charge rates, and yet provides a vehicle for many local, national and worldwide cross-curricular projects. For teachers, it provides specialist subject and project information as well as a flexible and dynamic resource for contacting other educationalists.

In addition Campus 2000 presently has about 450 accounts in Further and Higher Education establishments, as well as in many establishments throughout Europe and across the world. Much of the development work on distance education and computer supported cooperative services in these sectors has been carried out on the Campus 2000 service. Furthermore, it provides links to thousands of other users with compatible mail systems worldwide.

Contact: Richard Gray, Campus 2000, 214 Grays Inn Road, London WC1X 8EZ. tel. 071 782 7104.