1. IT and the UK Higher Education system

1.1. The Higher Education system

There are some 150 institutions of higher education (HEIs) in the UK. Most of these are universities but some are special purpose schools (e.g. in art or in music) or are established as colleges which present their students for degrees awarded by other institutions. All save one are state-supported through one of the three Higher Education Funding Councils for England, Wales or Scotland, or through the Department of Education for Northern Ireland. There may be some disadvantages in this financial dependency. The common base, however, does lend itself to cooperative action nationally and to coordinated collaboration internationally.

1.2. Coordination of IT developments

The Joint Information Systems Committee (JISC) acts for all four national funding bodies and also, in network provision, for the six government-funded Research Councils. Its remit is "to stimulate and enable the cost effective exploitation of information systems and to provide a high quality national network infrastructure for the UK higher education and Research Councils community". The JISC, and its ancestor the Computer Board for Universities and Research Councils, have broadly the following history:

- in the 1960s: the financing of mainframes within each university
- in the 1970s: the provision of national supercomputing centres
- in the 1980s: the development of networking (initially, to access the supercomputing centres)
- in the 1990s: the provision of networked resources and promotion of innovation in information services

The same period has also seen a trend in provision from supplier-led in the 1960s to user-driven in the 1990s.

1.3. The JISC method of working

The annual budget is $50M. Its purpose is to motivate focused initiatives which deliver UK-wide benefits. This sum has to be seen in the context of the UK higher education sector's total spend on computing and information services, estimated at $1600M p.a., most of this being met from individual university budgets. Half of the JISC's $50M is devoted to network provision; half to the promotion of networked services and other IT innovations.

The JISC itself consists of academics and academic administrators (chief information officers, university presidents/vice-presidents) and works through various subcommittees and working groups These advise an executive of civil servants.

The basis of the programmes is pre-competitive collaboration. Pooling of expertise across the sector is both a prerequisite of success and a benefit in itself. Most of the work is contracted out to teams of faculty or to external suppliers. The in-house network operations team has recently been floated as private not-for-profit company.

Maintenance of the network is a long term commitment. The aim with most other initiatives is to co-fund and to move continuing activities to a self-funding basis.

2. The UK academic network

2.1. The infrastructure

The UK's Joint Academic NETwork (JANET) is planned and, to date, centrally funded. The typical access capacities at successive dates give a summary of the growth in this facility.

- 1988: most at 64Kbit/sec (JANET)
- 1992: most at 2Mbit/sec (JANET Mk II)
- 1994: most at 34Mbit/sec (SuperJANET)
- 1997: some at 155Mbit/sec

The fastest increasing demand is for international connectivity, especially to the USA. The cost of cross-frontier lines within Europe is ten to twenty times that of within-state lines of the same capacity. Transatlantic lines are slightly cheaper(!) but still very expensive. Expansion of national backbone capacity has lately been constrained by the need to increase the international budget substantially.

2.2. Changes over time in network functions

In recent years the following changes have been accelerating:

- from data exchange to multi-service networking
- from text to image
- from one-to-one communication to many-to-many
- or to one-to-many ('multi-casting')
- from store-and-forward to real-time interaction
- from research use to research +teaching +administration
- from inter-institution to inter-institution +intra-institution
- from elective use to mission-critical status
- from natural sciences to all disciplines

3. Services

3.1. Information services

As already indicated, the JISC has moved in the 1990s from funding only infrastructure to stimulating and co-ordinating networked applications and services. At present the range of activities includes:

- centrally available bibliographic resources (e.g. the ISI citation indices, Compendex, BIOSIS Previews)
- government statistical series
- varied datasets (e.g. archive of social science research results and an Arts and Humanities Data Service)
- the On-line Public Access Catalogue (OPAC) of the Consortium of University and Research Libraries
- Subject gateways to global networked resources

3.2. *General support services*

These include:
- National bulletin boards (e.g. BUBL: the British Universities' Bulletin Board for Libraries)
- Subject gateways (e.g. SOSIG (the Social Sciences Information Gateway), OMNI (for health studies and medicine), ADAM (for arts, architecture, media and design)
- Mailbase (which sets up and manages a huge number of mail lists, moderated and unmoderated)
- Shareware servers (for UNIX, Windows and Macintosh systems)
- Mirrors of major holdings in other parts of the world
- National World-Wide Web caches, for effective exploitation of international bandwidth.
- The Combined Higher Education Software Team, which negotiates bulk purchase of software and datasets, delivering UK-wide annual savings of $50M on purchases

3.3. *Standards Working Group*

This is a small-scale activity to achieve coordination of relevant standards activities within the UK higher education and research community. For the most part funding, is limited to meeting the travel and other out-of-pocket expenses in return for coordinated action and reporting by those who are supported in such work by their own institutions.

4. Development programmes

4.1. *eLib: the Electronic Libraries Programme*

The eLib Programme funds 60 projects at a cost of $24M over three years in the following areas:
- access to network resources
- digitisation
- digital preservation
- electronic document delivery
- electronic journals
- hybrid libraries
- on-demand publishing

4.2. *JTAP: The JISC Technology Application Programme*

At a cost of $10M over three years, this funds 59 small projects exploring the application of new technologies to all parts of the higher education sector. The areas currently supported are:
- Visualisation, virtual environments, convergence of audio-visual and multi-media
- Co-operative and distance working, computer-based learning, computer-assisted assessment
- Technologies for network accessibility, nomadic and wireless systems
- Video-conferencing and video services
- Administration of higher education institutions (e.g. estate management, security)
- Technologies to support staff and students with disabilities

Each cluster of projects maintains a 'club' which enables sharing of experience, monitoring of technological developments of common interest, avoidance of wasteful project overlap, and maximisation of dissemination.

The general aims are to reduce duplication and the cost of innovation and to support the achievement of a well informed community, able to develop and deploy innovative applications.

4.3. TLTP, CTI and UMI

Outside the framework of the JISC several smaller programmes are also supported by some or all of the Funding Councils.

The Teaching Learning and Technology Programme (supported by all four HE funders)

This programme has run since early 1992 in successive phases, each reviewed as successful and leading to renewal. The emphasis is on the creation of courseware or of tools for building courseware. Projects (very few of them network based) have been selected from a very large number of competitive applications. About three-quarters are based on consortia, each with participation by from two to forty-four institutions. Total funding over the five years 1992-97 was $30M and the range of disciplines served is wide. The TLTP has established a Support Network to respond to enquiries about integrating technology into teaching and learning. Centres at nine universities, acting cooperatively, specialise in different topics (e.g. video, use of WWW, students with special needs, hypermedia). The Support Network focuses on issues of particular interest to senior decision makers and support staff, but is open to approaches from all members of the supported institutions.

The Computers in Teaching Initiative (all four HE funders; took its current form in 1989)

The Initiative, which has run at the level of about $1.5M per annum, comprises 24 subject-based centres, each working within its discipline community to provide a tailored support and information service to encourage the use of learning technologies in UK higher education. The function is not to produce new teaching materials. The centres proceed by collating information and evaluating software and courseware of special interest to particular disciplines, by providing advice and training, and generally by raising awareness through newsletters, resource guides, demonstrations, workshops and conferences. The 24 fields served range from Art and Design to Statistics.

The Use of MANs Initiative (UMI, supported by Scottish Higher Education Funding Council)

All of the 21 Universities and Higher Education Colleges in Scotland are linked to one of four Metropolitan Area Networks based on 155 Mbit/s ATM. These are inter-connected also at 155Mbit/second the ATM backbone extends throughout the campuses. In 1995 SHEFC established the Use of MANs Initiative to speed the productive exploitation of this excellent connectivity. The Initiative has funded many distinct projects, producing high quality teaching materials, exploiting distributed computing power, and in several cases focusing on staff development and training. Projects utilising animations, video clips, audio, and powerful indexing and search engines have delivered results in medicine, biology, language and computing and in teaching in these and other fields.

5. Examples of UK projects

5.1. The SuperJournal Project (eLib)

The eLib programme has funded several electronic journal projects which bring together universities, learned societies and commercial publishers in the promotion of new concepts of the journal, exploitation of advanced technology, opportunities for parallel publishing in electronic and paper form, and exploration of the economics of electronic publishing.

The SuperJournal Project, based on established publications, seeks to create a significant body of multimedia content. The subjects covered include political science, protein genetics, computing, physical chemistry and communication and cultural studies. The publishers will make journal content available and encourage authors to submit multimedia elements to be put on a server by a team of programmers and database managers. Readers from nine universities, initially, will access the material. Search tools and interfaces have been chosen by open invitation. A systematic exploration modes of usage is being undertaken as part of the project.

5.2. Project PATRON (Performing Arts Teaching Resources ONline)

Some of the problems generally associated with short loan or reserve collections in academic libraries are specially pertinent to the performing arts, where there are specific media-related problems.

Students and staff require special audio-visual facilities for the many of the course materials. These facilities are frequently over-subscribed and prone to damage or malfunction. To gain maximum benefit the student needs simultaneous access to the musical score or dance notation, the recorded performance, and the explanatory text. Students and faculty often wish to borrow audio-visual materials for preparation or for use in class. There are also security and preservation issues: videotapes and CDs are attractive items to thieves and a little damage renders a videotape completely useless.

The overall aim is the digital encoding of audio and video material on a server and on-demand delivery of high quality audio, video, scores and text across a high-speed digital network to the desktop.

The work plan includes an evaluation of the novel learning environment for music and dance students created by Project PATRON; and the exploration of copyright and licensing issues associated with digital libraries in the Performing Arts.

5.3. Interactive Teaching Project in Surgery (TLTP with SuperJANET)

This is a collaboration among six major medical schools which provide 30% of all UK training in surgery. The project, a practical extension of one of the initial SuperJANET demonstrator projects, harnesses advanced telecommunications technology to teaching and learning in surgery, where visual information observation of a skilled practitioner are critical to the learning process.

A major objective is to give the students access to a larger pool of patients and of clinical specialists, with something akin to one-to-one teaching and with better sight of the operations than can be achieved with traditional techniques. The consequent reduction in student numbers in

operating theatres reduces infection risk. By collaboration between centres of excellence throughout UK the students have the opportunity to hear and see at first hand the opinions and skills of the best teachers in UK.

The 40-week course embraces both interactive teaching and personal study by the student. Live teaching enables real-time interaction between surgeon and remote students. In addition a steadily growing body of case studies and demonstration material is stored on a multimedia server, to which access can be gained from any site on the network at any time. One aim is to achieve a 50% increase in productive learning time by providing both supervised and unsupervised access to important visual information and case studies.

In addition, the collaboration has stimulated an examination of teaching content by the participating surgeons. Organisational and technical problems of sharing teaching among different centres over SuperJANET have had to be addressed and the solutions to these are of general applicability.

5.4. ReLaTe: Remote Language Teaching over SuperJANET

The ReLaTe project originated in a one year study to develop and test video-conferencing techniques for use in language teaching funded by BT (British Telecom) as part of the joint JISC/BT SuperJANET initiative. Given the subject matter, the sound quality attainable over a high-speed network is particularly significant. By further developing the software and using it in real foreign language classes, the project has demonstrated the feasibility of sharing language teaching resources within UK universities.

As is common in multimedia conferencing systems, the ReLaTe project's software provides participants with a screen which includes both video images and a whiteboard area on which text and diagrams can be placed and manipulated by all participants.

An important element of the ReLaTe project is the investigation of the pedagogical implications of multimedia tools provided. Studies of four courses have been conducted: French for Business; Advanced French; Beginner's Portuguese; and Latin for Academic Purposes. The system has been found particularly useful for practising several language skills at the same time: listening, speaking, reading and writing. In many respects participants found the experience more useful than traditional face-to-face methods. For instance, it provided a rapid way of resurrecting the lost skills of speaking and listening in a second language which are the first to be eroded by lack of use.

The shared workspace tool (the whiteboard) plays a major role. Tutors use the whiteboard extensively to import both text and images. Moreover, while in the traditional face-to-face situation the blackboard is usually the exclusive province of the tutor, students can and do interact directly with the material on the whiteboard, using it freely to convey organise and convey information. (The whiteboard also proved to be very useful when network conditions caused a decline in audio quality.)

5.5. Clyde Virtual University (CVU): a project exploiting a Metropolitan Area Network (MAN)

The JISC and the Funding Councils have strongly promoted the establishment of Metropolitan Area Networks, both to achieve economies in the national topology and to encourage regional collaboration. ClydeNET embraces the multiple sites of the four universities and two specialised colleges (of Art and of Music and Drama) in the Glasgow area.

Clyde Virtual University course materials, supported by the SHEFC, is available on a high-speed server directly connected to the CyldeNET MAN. The primary objective is conversion of existing courseware for on-line delivery to students who have access to the World Wide Web. Most computer assisted learning (CAL) materials are complicated to install on networks and do not necessarily work on the various PCs, Macs and UNIX machines in the member institutions. Converting courseware for delivery using Internet technologies allows more students to have access to CAL at a lower cost.

- The CVU Virtual Lecture Theatre provides access to the on-line courseware. Initial material is concentrated in Computing Science, Library Studies, and Study Skills. Areas under development include Clinical Biochemistry, Social Work, Library Studies, Modern Languages, and Statistics.
- The CVU Assessment Hall houses an assessment engine, enabling students to take on-line tests, either as part of an interactive courseware module or as stand-alone summative assessments. On-line assessment not only reduces the faculty work-load but provides students with detailed feedback on their performance.
- The CVU Virtual Café hosts conversations of interest to students and staff across ClydeNET, both on general issues relating to the virtual university and in specific subject areas.

5.6. ROADS: Resource Organisation and Discovery in Subject-based services

This project, funded by JISC under the eLib Programme, is a collaboration among three institutions, building on the particularly successful social science subject-based gateway SOSIG. The consortium is producing easy to use, highly configurable, software for setting up indices of selected Internet resources which can be both searched and browsed.

Provision is made for interoperability among gateways, with cross-searching according to user-defined criteria, based on condensed indexing which informs each gateway of the resources available via others in the set. The overall function of ROADS is to assist librarians and information scientists to produce catalogued access to Internet resources in delimited fields.

The development team have a track record in the field of network-based resource identification, indexing and cataloguing, seeking compatibility with current and probable future indexing and cataloguing requirements. The project is active in the collaborative development of standards for metadata (especially the Dublin Core), cataloguing, indexing and searching.

6. Wider application

6.1. Human Factors

The provision of technology is in danger of outstripping the community's capacity to use it effectively and the JISC therefore pursues the following actions:

- identifying and promulgating information on costs and benefits
- raising awareness of the social human impact of developments in information systems
- improving understanding of the resources, human as well as financial, required to support the new environments

Until recently, specific actions in these areas have depended mainly on the busy Co-ordinators appointed to support the general work of each JISC programme. Now, a distinct central function has been established under a Head of JISC Programmes, with a small core team and a budget for the contract employment of consultants, technical writers and software developers.

The aim is to accelerate awareness and understanding within the academic community, to ensure the dissemination of innovation, and to provide training —mainly for potential trainers.

6.2. Information Strategies

In addition, guidelines for the preparation of institutional information strategies have been issued, following comprehensive consultation and investigation of the needs of the UK higher education community. Six institutions were chosen by competitive applications procedure to act as pilot sites for evaluating the framework. A requirement of the receipt of pilot funds is that these sites share their experiences with the rest of the HE community. Open workshops have been held and a link has been established with Institution-Wide Information Strategies programme of the (US) Coalition for Networked Information.

7. Progress and problems

7.1. Progress

Central initiatives have stimulated the adoption of new methods across the entire spectrum of academic disciplines, including the social sciences and the humanities. Collaborations involve industry partners (e.g. publishers) and new HE institutions as well as large, long established universities. Usage of networked tools and resources is well developed in teaching as well as in research. Systematic steps have advanced practical international collaboration.

7.2. Obstacles to progress

The cost of the end-user systems remains high, partly because ever more powerful desk-top boxes are required in order to run ever more feature-packed new versions of market-leading software. Nor is it certain that the much-hyped, stripped down 'network computer' will be an acceptable alternative for knowledge workers and students, as distinct from business users. The institutions least able to fund large-scale provision are, on the whole, those which attract the students least

able to afford their own equipment. In any case, networked seats —whether equipped with PCs/NCs or merely with connection points for personally owned portables— require precious space.

The use of computer-mediated communication in distance learning requires a widely pervasive commodity infrastructure. This, whether delivered by wire, by terrestrial radio or by satellite, is in place at present in only a very small number of countries.

The key resource for teaching and learning is effective courseware. Good courseware is even more difficult to create than a successful textbook. The large-scale establishment of excellent, affordable courseware and of electronic publications depends on the emergence of an active competitive market in these products. This depends, in turn, on the general adoption of suitable standards. However, most public investment to date has been in content-specific, and even device-specific packages. There are exceptions to this in the UK portfolio of activities.

Notable exceptions in the USA include the Department of Defence's *Advanced Instructional Development* programme, the *Instructional Management Systems* programme led by EDUCOM (part of the National Learning Infrastructure), and the work of the Institute of Academic Technology at University of North Carolina, which has provided tools enabling teachers to develop Web-based, and therefore ubiquitously available, multi-media courses without having to learn HTML. All of these aim to stimulate a market in courseware by providing effective tools and standards. All deploy real dollars and committed people.

7.3. Copyright and IPR: a special problem

Although many universities claim rights in patents arising from work done in the course of employment, few have sought to claim copyright ownership. There is now good reason for them to do so, not as a means of earning money but as a means of reducing expenditure by strengthening their position vis-a-vis the publishers, whose products consume a large share of higher education budgets. The JISC has recommended that UK academics give publishers only limited rights to publication in specific printed media, retaining rights for further exploitation such as use for teaching and for electronic publication. It also recommends that material be offered where possible to university presses or other non-commercial publishers.

This approach leaves three issues still to be resolved:

- clarification of the law on copyright ownership of the different types of material created by academics: lecture notes and other material for students; research publications; multimedia materials; software
- consistency among institutions in their IPR policies and the contracts of employment under which they engage faculty
- co-ordination of policies towards commercial publishers when copyright is assigned or licensed

8. International collaboration

8.1. The potential

The scope for international collaboration is great and UK teachers and researchers already benefit from the sharing of expensive facilities (e.g. radio telescopes), dissemination of widely useful data

(e.g. satellite images), specialisation in the maintenance of databases (e.g. the STN partnership of Karlsruhe, Tokyo and Ohio), and real-time collaboration among researchers.

There are now moves to collaboration in the adoption of tools and standards with, for example:

- the Council of Australian University Libraries
  (shared subject gateways)
- the US InterNIC and Scout programmes
  (implementing the UK 'ROADS' software to create a cross-search capability)
- the JISC/EU international project DESIRE
  (27 partners across Europe working on metadata standards for cataloguing and access)

8.2. The difficulties

Full collaboration and information exchange is severely handicapped by the high charges for international traffic which are levied by most public network operators (PNOs). The majority of these have been state-owned monopolies until within the last year or so. Privatisation is now proceeding rapidly, but in such a way as to maximise the cash returns to the national treasuries. The effects of deregulation are expected by most observers to be slow and limited in effect, given imperfect markets and the dominant position occupied by the former monopolists.

In any case, whether monopolists or not, de jure or de facto, the owners of major telecoms infrastructure see value-added services as the future cash cow, not the provision of raw bandwidth to the research and education community (nor to anyone else). Much depends on the emergence of new suppliers and on the adoption of a more proactive approach by the national regulators. Meanwhile, reciprocal arrangements are expensive and no cost-sharing mechanisms are in place.

8.3. The special role of the USA

The USA is the home base of the Internet, historically, topologically and organisationally. It is also the location of the richest networked information resources. Around the world, the demand for access to the US is probably greater than that for access to any other country. Furthermore, because of the priority assigned to North American connections by most countries, this is the place where world-wide international traffic can most easily be exchanged.

The entrepreneurial American culture combined with the creative regulatory framework established by the Federal Communications Commission has generated an excellent network infrastructure, advanced services, and a lively market in low-cost Internet service provision. Although US citizens may not share the perception, the FCC is seen from abroad as having played a particularly enlightened role in enabling Internet development. These achievements, however, rest on administrative structures and government policies which diverge so markedly from those elsewhere that it is difficult for other countries to interact fruitfully.

This is especially the case when liberalisation and privatisation, and the imposition on NSF of a requirement to promote policy driven projects at the expense of curiosity research and general support of science, have removed from the oversight of commodity networking the NSF Network Division: the only body which bore some similarity to the government network-funding bodies on which other countries still rely.. The basis for forward planning and efficient collaboration has disappeared. Nor will it return: American universities can obtain adequate national and international service at reasonable price from the public network operators. The problem is one-

sided: it affects the non-American countries, who find themselves at the mercy of the commercial providers. The problem, it should be said, is one not of deliberate exploitation but of a mis-match of practices. Nevertheless, it is not easy to solve.

9.   Some personal remarks

The above account, which is intended to be balanced and informative, is offered from the point of view of a national body whose function is to promote innovation in the use of information technology and information services in teaching and research within universities and colleges. Perhaps some rather more idiosyncratic remarks may be allowed in closing.

(a) There is a widespread hope that innovations in IT will help educate more students for less money. Although this may be proved possible it has not yet happened. So far, spending on IT has delivered more enrichment than economy.

(b) Where economies can be delivered, they will surely be associated with a change in the distribution of expenditure from faculty posts to infrastructure. The new technology is more about doing new things than about doing the old things in new ways.

(c) New technology and distance learning are often spoken of in the same breath; and not a few universities are hoping to solve their financial problems by offering distance learning. They will face substantial challenges. First, the technologies introduced on-campus cannot be extended to the community at large in a simple manner. Second, distance learning is more about authoring skills and publishing than about technology: the availability of the means of dissemination is only a first small step.

(d) Computing and information technology in support of research can be funded selectively using the usual processes of review. Computer assisted learning, however, depends on mass provision and requires much more substantial investment.

(e) Once provided, CAL lends itself much more readily to the acquisition of skills than to the exploration of concepts and theories. (The wonders of hypertext documents are often circumscribed quite narrowly by the boundaries of the material incorporated.) The skills acquired may be significant —a new language, or manipulative proficiency in a field of applied mathematics. These, however, do not constitute the whole of a higher education; and skills training may be offered much more cheaply by organisations which do not attempt to maintain the craft skills and the faculty research of a university.

The end point of the current line of technological innovation will not be universities like the present ones doing more efficiently or more effectively pretty much what they do now. It may not even be universities in their present number with many of them performing new functions. Rather, it may be a severely reduced number of universities with much of the new activity being undertaken by radically different kinds of organisations.

IT in UK Higher Education
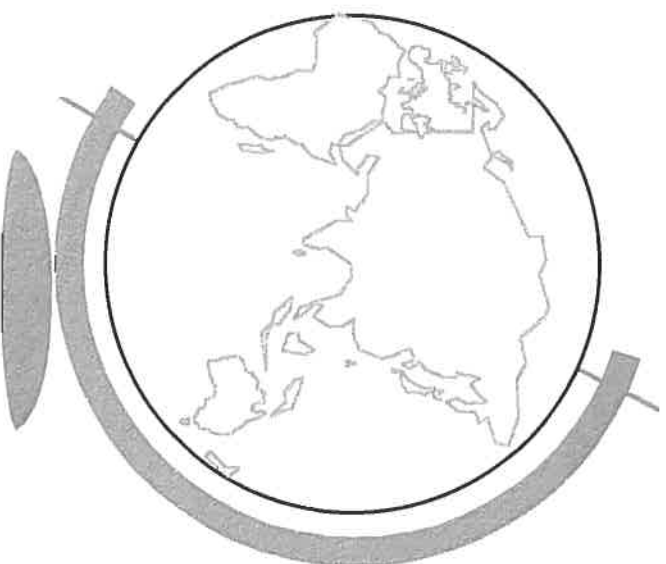
ICUS, Washington 25 November 1997

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Summary

❑ IT in UK Higher Education

- ➤ structure
- ➤ programmes
- ➤ trends

❑ Discussion

- ➤ obstacles to progress
- ➤ need for a market
- ➤ international dimension
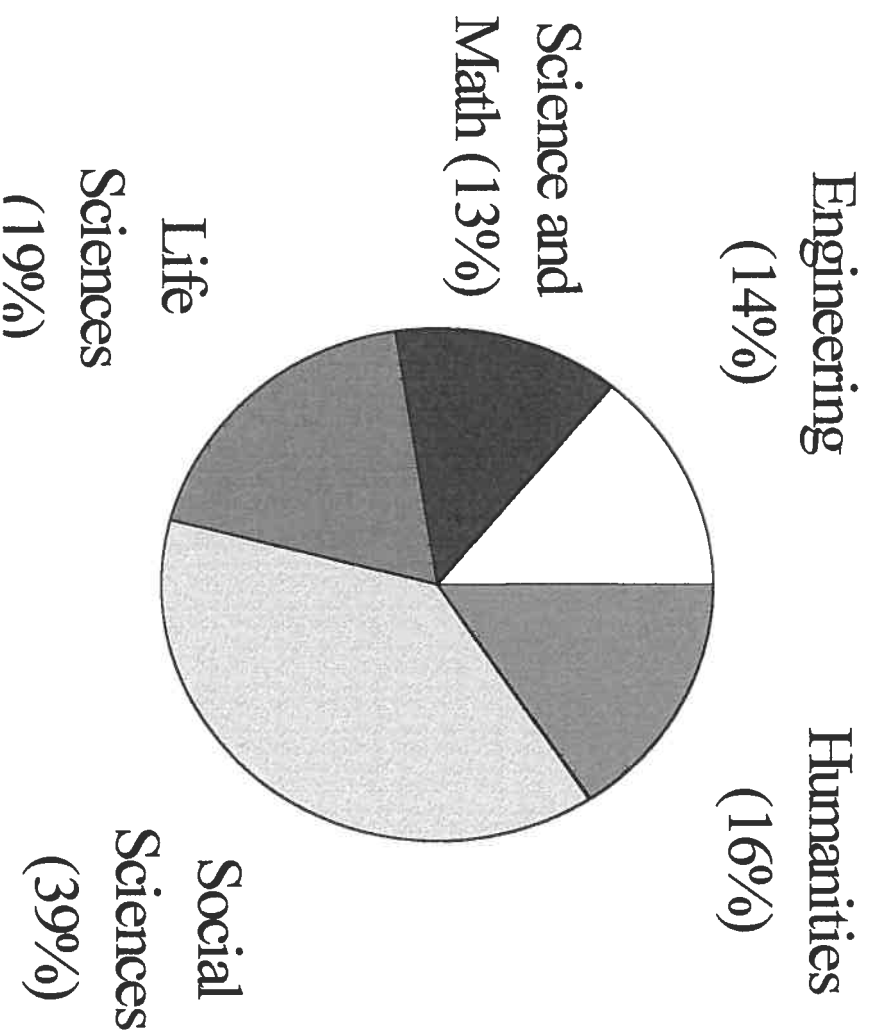- ➤ the role of the USA
- ➤ concluding questions

IT and UK Higher Education

- ❑ HE in the UK is largely state-financed
- ❑ With coordinated central funding of IT initiatives (Joint Information Systems Committee and other bodies)
  - ➤ pre-competitive collaboration
  - ➤ full range of disciplines: teaching and research
  - ➤ network +information services +development programs
- ❑ Moving from
  - ➤ data exchange *to* multi-service networking
  - ➤ store-and-forward *to* real-time interaction
  - ➤ one-to-one *to* one-(or many-)to-many
  - ➤ natural science *to* all disciplines

Alistair Chalmers   IT in UK HIgher Education   ICUS, Washington, 25Nov97

Users of JISC information services

Engineering
(14%)

Science and
Math (13%)

Life
Sciences
(19%)

Social
Sciences
(39%)

Humanities
(16%)

Alistair Chalmers   IT in UK HIgher Education   ICUS, Washington, 25Nov97

Examples of funded programs

❑ Datasets, on-line catalogues and subject gateways

❑ Bulletin boards and list servers

❑ Mirrors, caches and shareware servers

❑ Digitisation, document delivery, electronic journals

❑ Courseware and teaching tools

❑ Applications technology development:—

➤ virtual environments, cooperative working

➤ network accessibility, distance learning

➤ estate management (e.g. security)

An example of usage: BIDS ISI

Number of users per day
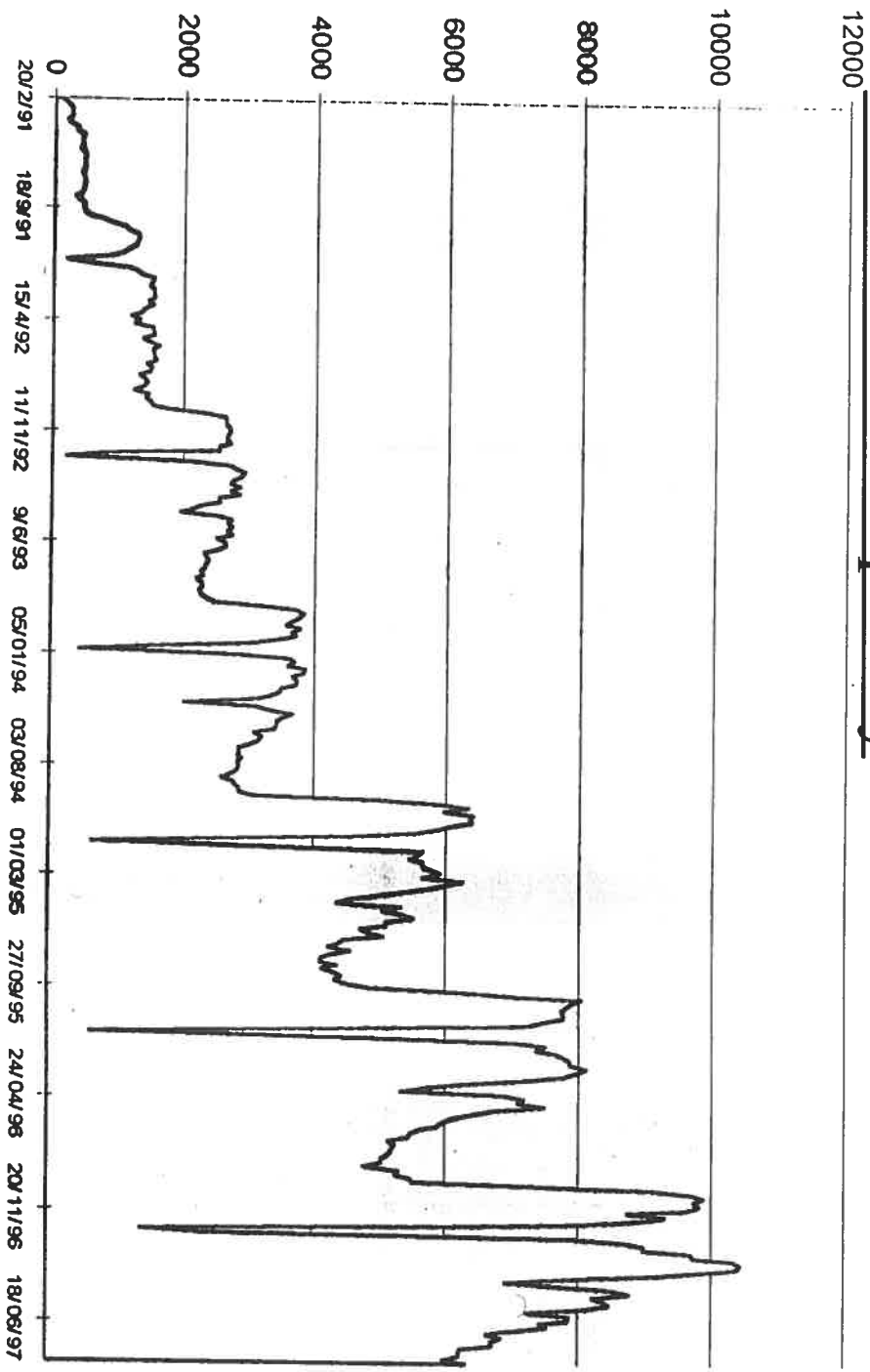
Alistair Chalmers   IT in UK HIgher Education   ICUS, Washington, 25Nov97

Human factors

□ Resistance to new technology
  ➤ now declining?

□ IT skills shortage
  ➤ being tackled, but still a significant factor

□ Need for many talents
  ➤ IT merely a vehicle for creativity

□ Poor awareness of potential
  ➤ beyond the attraction of bells and whistles

□ Need for institutional strategies
  ➤ not just for individual efforts

Obstacles to progress

❑ High cost of end-user equipment
- ➤ continuing escalation of configurations
- ➤ 'Network Computers' limited in applicability

❑ Resistance to ready-made courseware
- ➤ on the basis of 'not invented here'

❑ Enthusiasm for tailor-made packages
- ➤ rather than for generic tools

❑ Infrastructure required for distance learning
- ➤ and need to adapt materials to dial-up speeds
- ➤ or even to asynchronous learning

A necessary condition: a market

❑ Excellent, affordable software requires a market
  ➤ in the USA, this is facilitated by the work of the FCC

❑ Emergence of this depends on adoption of standards
  ➤ in the USA, these are promoted by major agencies

❑ Elsewhere — rarely the same creative approach

❑ Big problem: copyright and intellectual property rights
  ➤ law needs to be clarified
  ➤ academics need to strengthen their position
  ➤ in consistent ways

International collaboration

❑ Collaboration is already extensive, but is . . . .

  ➤ handicapped by *very* high network charges which . . . .

  ➤ will be affected only slowly by privatisation of . . . .

  ➤ state-owned monopolies, which will be . . . .

  ➤ de facto continuing monopolies for some time . . . .

  ➤ in pursuit of new cash cows in the form of . . . .

  ➤ value-added services (yet to be identified!)

❑ Raw bandwidth for education has *low* priority

  ➤ those who seem to offer it are usually seeking
    a captive audience for additional services

The special role of the USA

❑ The USA is the home base of the Internet

➤ historically, topologically, and organisationally

❑ Access is sought to US more than to any other country

➤ also, the USA is the natural point for international exchange

❑ Provision within the USA is extremely well developed

➤ based on a unique combination of entrepeneurial culture and creative regulatory framework

❑ Other HE systems depend on central planning

❑ The withdrawal of NSF leaves no US partner

Concluding questions

❑ Is distance learning a *simple extension* from the campus?

❑ *Can* CAL educate more students for less money?

❑ By doing the *old* things in new ways?

❑ How is CAL to be *funded*?

❑ What can CAL contribute to *higher* education?

❑ What *structures* best support skills acquisition?

Some UK information sources

□ <http://www.jisc.ac.uk/>
  ➤ Joint Information Systems Committee (including SuperJANET, eLib, JTAP, etc.)

□ <http://www.tltp.ac.uk/>
  ➤ Teaching, Learning & Technology Programme

□ <http://www.cti.ac.uk/>
  ➤ Computers in Teaching Initiative

□ <http://www.talisman.hw.ac.uk/>
  ➤ Teaching and Learning in Scottish MANs

□ <http://ukoln.ac.uk/services/>
  ➤ United Kingdom Office of Library Networking