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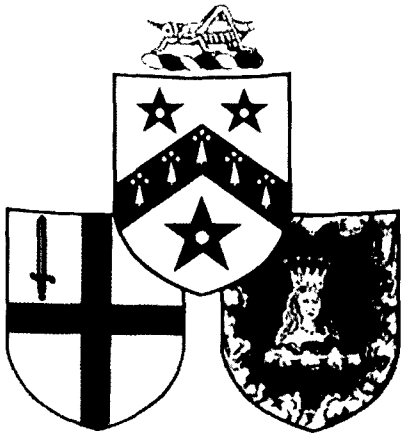

THE INTERNET AND ELECTRONIC COMMERCE

Lecture 1

THE NEW TECHNOLOGY

by

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GRESHAM COLLEGE

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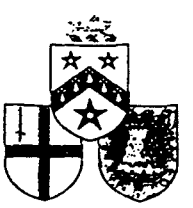

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"The human brain contains some 100 trillion (10 to the power of 12) neurones capable of interconnecting in a quadrillion (10 to the power of 15) ways, a scale which could not be replicated synthetically in the foreseeable future." – Michael Connors, the Race to the Intelligent State, 1997.

"All the neurones in the brain that make up perceptions and emotions operate in a binary fashion. We can some day replicate this on a machine." – Bill Gates, quoted in Time Magazine, 13th January 1997.

Wired: *"So is there a Clarke Test for computer consciousness?"*

Arthur C. Clarke: *"If it showed a really genuine sense of humour, then I decide it was conscious. That could be a really good test. It would have to be able to make jokes – and make jokes at it's own expense."* - Wired Magazine, January 1997.

Introduction

The emphasis on my lectures will be to raise questions for public discussion on legislative regulatory and policy changes being brought about by the social, economic and political challenges of the new communications technology.

If we look at the history of communications we find that the present communication convergence is the fourth in such series of revolutions in human history.

The first communication revolution began when human beings acquired language, giving birth to an oral culture.

The second occurred when writing was invented, giving birth to a literary culture.

The third communication revolution began when mass printing and mass publication technologies were invented, facilitating the spread of mass education.

The fourth is the present digital electronic revolution the so called convergence between telecommunications, broadcasting and computer technology between telecom/broadcast/computer technology allowing the development of an instantaneous global culture.

These revolutions were precursors to social and economic revolutions, for they influenced radically the way societies organised the production and distribution of wealth, and the way they govern. Each revolution generated it's own characteristic culture and related social ecological relationships.

Information Rich and Information Poor

It is common knowledge that effects of the communication revolution are not uniform across all countries. Also, the revolution means different things to different countries. While many of us speak of the phenomenon called globalisation created as a result of the impact of new communication technologies, we also realise that many countries in the world are yet to be touched by this phenomenon. Many of the poorer countries of the world have been left behind by the information revolution. We should not be unduly dazzled by developments in electronic wizardry or developments in communication technologies which have brought immense wealth to some countries, particularly those in the industrial part of the world, it has also created a great divide in the world amongst the information rich and the information poor.

Despite the uneven levels of development, political leaders of most countries have recognised the need to keep in step with the technological developments in communications if their countries are ever to develop. Leaders of even the poorest countries aspire to benefit by linking up with the economic grind of the developed world. I have personal experience in Vietnam where I advised the government on legislation and regulations to allow the reception and development of the new communications technology. Before commencing I needed to thoroughly absorb the vocabulary differences, history and culture of the country. In fact, most of these countries are rushing to link up with the electronic super highway, opening up hitherto totally controlled sectors of their economies, inviting multi-national companies to invest in their countries and making substantial investments themselves in the communication sector with little regard to social cohesion.

What are some effects of these technological developments on the global economy?

1. Regardless of the present problems the new developing nations particularly from the Pacific area together with Israel and the subset of the Indian population challenge and outstrip the older Anglo-US and European societies so that those that began the race to the intelligent state, may not be the first to get there or be the fittest competitors. For example, Singapore. This may cause a power shift of historic dimensions equal to the shift of economic power created by the huge displacement of oil revenues in the Middle East states some 25 years ago.

2. The IT revolution may begin to feed on itself. Having been the source of new jobs, soaking up the unemployment created by the declining manufacturing industry in the West, it may turn in on itself and start to eliminate jobs within it's own sector, thus creating rather then alleviating unemployment. This new unemployment will be of educated white collar professionals, with greater political power than the old working class jobless.

3. States which rely too much on information society employment may be inherently unstable. People in such jobs tend to earn significant incomes and expect a high lifestyle. So they tend to consume imports. If there is no export trade in goods to offset this, there will be an endemic balance of trade deficit. So perhaps paradoxically, it is the states that retain a large manufacturing base which may do best in the information revolution.

4. Politically, it is not clear whether the information society will create, as US Vice President A Gore likes to say, a new populace democracy the world over: or whether the new information technologies are essentially about control, more specifically about ability of small numbers of people to exercise greater degrees of control over large areas of activity and people. The effect of the information society via the controlled devices and systems that it creates, may be to empower the elite still further.

5. Nor is it clear that the information society will benefit all members of society. In the case of India for example, there is prediction that higher urban literacy may co-exist with a continuing high level of rural illiteracy, as a pragmatic response to the nations needs.

All these points have great political implications, and should destroy once and for all, the notion that technology is politically neutral, and that government should simply stand aside and let the market get on with it. Rather, the task of governments is to get rid of obsolete and unproductive barriers to development, but at the same time to take action to minimise the deleterious effects of change according to social, economic, moral and political ideals that are influenced by, but are independent of, technological change. These issues will be explained and discussed in the lectures.

New Technology

The present communication revolution is a result of the confluence of technological advances in three fields: computing, telecommunications and broadcasting. Historically, these three sectors evolved independently and separately, but today, due to technological developments such as digitalisation these three sectors are converging.

The technical convergence of computing and telecommunications has created the sector of information technology (IT). This sector has developed and is developing exponentially. The

IT sector, comprising telecommunications software development, computing and electronic networking, is supported by substantial investment in research and development.

However the related process of convergence in the broadcasting sector, that is, between computing and broadcasting, has not progressed at the same level. Different policy regimes govern these two areas and these have implications for international trade in communication and cultural products and in the growth of international markets in these products.

The state policies in the IT sector emphasis liberalisation and regulation, providing private corporations with freedom to invest in IT related technology such as telecommunications networks. We will be looking at these developments.

Speed of Development

Statistics in this industry are very significant and emphasis the cultural differences appearing in the communications super highway.

Approximately 100 countries now enjoy Internet access. Recent surveys report that there are around 20 million Internet hosts world wide, and the number of actual Internet users is currently estimated to be in the region of 100 million. It is forecast that this figure will increase to a quarter of a billion users by the year 2000.

In the UK: virtually every blue chip company has now established a presence on the world-wide-web, a new business site appears on the world-wide-web every 50 minutes and there are over 250,000 commercial sites up and running. KPMG predict that by January 1999, 50% of UK homes will have home computers and domestic Internet connections.

With so many people so optimistic about the future of electronic commerce, the NET has become a "must-have" scramble for much of corporate Britain.

Many of the issues raised by the Internet and electronic commerce will be determined by large organisations and businesses that are pouring millions of pounds into research and development and governments will have a limited effect. Some of the issues that will be determined are for example, international and local payment systems, intellectual property, defamation, private international law, contracts at a distance and the strengthening of international co-ordination. These private sector organisations pushing development forward include the banks, financial industry, telecommunications industry, broadcasting and computing industry. These industries have their own bias.

However there are many issues raised in which the individual can have and influence through canvassing through their respective members of parliament. For example, in pornography, fraud, criminal law, data protection and privacy, security, freedom of information and censorship. These are live human rights issues that have been debated both informally and in the press. All of these issues will be thoroughly explored in the lectures.

The need to co-operate – the business prospective

Regional organisations and inter-governmental and private sector bodies have been mobilised into working towards solutions within a variety of formal and co-operative frameworks. A host of conferences and events involving governments, private sector and international organisations have been held. Much work has already been achieved within the WTO, notably the GATT, GATS and TRIPS Agreements.

As regards the new information services, the business and commercial community faces the difficult challenge of ensuring free access to the global electronic market place.

Since electronic commerce is adding rapidly a new dimension to the global economy, international community should define an appropriate mechanism, which can help the different actors to respond more quickly and in a co-ordinated manner to new requirements as they arise. In this context they need to answer three questions:

1. What are the most urgent obstacles?

2. What are the most effective means to remove them?

3. What method of co-ordination is best suited to respond rapidly and effectively to new challenges.

The changes now taking place are unstoppable. Therefore all participants should examine how they will work together in the future

From the point of view of business, what is not required is to establish a supervisory authority or a set of binding rules. They should, however, reach a forward looking understanding on how best to develop common practices to problems and their solutions. An international charter would not therefore define the key issues to be solved as such, but contain an understanding on how to process a strengthening of international co-ordination which should be organised with as wide as possible participation in the international community.

From the point of view of the government and the individual, however, there is a need to regulate, for example, data protection, encryption for security, child pornography to mention just a few. The interest of government and private enterprise will often conflict.

<u>The Convergent Picture:</u>

AN OVERALL PERSPECTIVE OF THE COMMUNICATIONS ENVIRONMENT

A Venn diagram illustrates the present level of convergence from the once very separate technologies. The arrows on the diagram show the movement of the technology.

Let us initially look at each of the separate sections from the legal and regulatory aspect and give examples of the technology in each, and then followed by a look at the convergence technologies which are a mix of the various technologies merged to give multimedia.

1 Telecommunications

The telecommunications infrastructures in most countries, with the notable exceptions of the United States and the Philippines, were, and in many jurisdictions still are, a government owned monopoly.

The legislation governing the monopoly was, and still is in many cases from the user's point of view, draconian, which gave the monopoly significant rights to do virtually what it liked in its own jurisdiction.

For instance, most of the monopolies had the right to enter property, lay cables through property and dig up roads or pavements to lay cables, install unsightly telephone poles, etc. Neither the local authorities nor the individual had rights to stop them. The monopoly also had the rights to set domestic and international tariffs and to decide on the type of equipment that would be marketed and used in their particular jurisdiction. In other words, they were the judge and jury for all matters relating to telephonic communication.

With the exceptions noted earlier this situation continued until the early 1980s. Beginning with the UK, Australia and New Zealand, due to pressure from business through their User Organisations, the situation started to change.

In the UK in 1984 a duopoly was established and British Telecom was privatised.

An industry-specific regulator (OFTEL) was set up by the Telecommunications Act 1984 to regulate the industry. This was felt necessary in order to ensure that the new entity, Mercury, would be given a level playing field against the incumbent monopolist BT.

Similarly, in 1991 the Australian Government passed the Telecommunications Act 1991, which established a duopoly with a similar regulatory structure to the UK but gave the regulator (AUSTEL) more powers than OFTEL had been given by the British Government.

New Zealand chose a different route. The New Zealand Government, after much consideration, decided to de-regulate the market by licensing any firm that applied for a cellular or fixed network licence, in other words, legislated for full competition. It also decided that an industry-specific regulator was not

necessary. The market sector would be controlled by the existing competition regulator.

As more countries began the process of de-regulation, or liberalisation (which is perhaps a better word), of their telecommunications sectors, several regulatory models emerged. Such models have a significant impact on the rate of development of the market and need to be taken into consideration in any due diligence of the market.

With the establishment of these more liberalised conditions, significant changes commenced in these jurisdictions. Competition started to have an effect on equipment suppliers, tariffing, access to phones etc. Prices began to fall and a much larger equipment choice and network opportunities occurred.

With international pressure (mainly from the US and the WTO) being brought to bear on many countries and the realisation by governments that communications is the life blood of the 21st century without which they will be left behind, there is now a general move within most countries in the world to expand their telecommunications sectors by increasing competition and privatisation of the monopoly carrier.

This has been helped by the recent WTO deliberations whereby 71 member states agreed to a timetable to create full competitions sector within 10 years.

In most cases the way from monopoly to full competition is through the establishment of a regulator with industry's-specific powers to enforce issues such as interconnect, licensing, tariffing, numbering and other industry-specific parameters.

It should be emphasised that the regulatory framework for telecommunications refers to the regulation of the carriage of information and to the allocation of the electromagnetic radio frequency spectrum.

2 Broadcasting

Broadcasting in nearly all countries has developed along a different path from telecommunications. Again, in many countries the national broadcaster is a government-owned entity and, in many countries, the only authorised broadcaster. However, in other countries the national broadcaster is a separate entity from government and again in many countries competition has been possible through commercial licensing. The US is one example of a country which has taken a different path in that there is no government-owned national broadcaster. Broadcasting has always been on a commercial basis although the number of licences has been restricted. Licences will always be restricted (perhaps not always, but in the foreseeable future) because of the need to allocate band width from the available electromagnetic spectrum. A scarce commodity.

In order to control the content of broadcasting, most countries have established a set of rules and many have established regulators. There have also been specific rules about ownership of broadcasting in many countries, both with

regard to overseas ownership and also cross-ownership within the media environment.

It was also necessary to establish broadcast frequency allocation rules relating to frequency, power and geographical location. In the UK jurisdiction, the Broadcasting Act 1984 sets out the rules.

It may also be useful at this stage to draw a line between broadcasting and radio communications. Essentially, broadcasting is point to multi-point communications whereas radio communications is point to point and two-way communication.

3 Computers

Computers and computer technology have grown from within the private second without any government control or ownership. There have been no government sponsored rules for the development of computers, and as a result of open competition, computer technology has advanced in significant leaps and bounds and is now advancing exponentially with a generation being as little as six months for both software and hardware.

The convergence of these three initially separate industries commenced with the computer-telecommunications technology followed in the computer-broadcasting spheres. However, with the birth of the Internet all three technologies are used to disseminate information, video, data and voice, on a world-wide basis.

A significant, if not THE legal question that arises as a result of this convergence is what set of laws is to govern the Internet, and we will talk about these in a later lecture.

4 Modes of Transmission

Within the three sectors listed above there are four broad categories of transmission. These are:

4.1 Wireline (twisted pair or copper wire)

4.2 Cable (coaxial or fibre)

4.3 Terrestrial (short/medium/long wireless; microwave)

4.4 Satellite (GEO; MEO; LEO)

4.1 Wireline

The twin pair copper cable was the first method of transmitting information from one point to another. The telegraph was invented by Samuel Morse in 1832 in the US and developed initially by the US railway systems for sending information regarding trains, freight, passengers, etc., in order to gain a competitive edge. But, but 1866, the telegraph connected the nations of the world with the laying of the Trans-Atlantic Cable between the US and France.

The problem with a Morse code is that transmission can only go one way at a time and therefore its use was limited. However, the importance of the Morse telegraph is not just historical; it illustrates the simplicity of the complete data communications system. Much of the terminology that developed around the Morse system is still in use today.

The wire (telegraph channel) between the operators, is in one or two states; either current is flowing or it is not. This illustrates a simple idea which has been repeated over and over again in the development of data communications systems. A two-state communications system is the simplest, and easiest to build, and the most reliable. The two states can be On and Off, Plus and Minus (with current flowing in opposite directions) or 1 and 0 (the concept used in computers). A two-state system is referred to as a binary system.

In order to make the telegraph more economical, a way had to be found to put more than one single into a channel. The invention of the telephone arose out of Alexander Bell's experiment on a "harmonic telegraph", by which he tried to put more than one telegraph signal on a channel.

Once voice was able to be transmitted then voice signals which were converted to an analogue electrical signal could be transmitted along the line in both directions simultaneously. However, only one pair of sender/receiver could operate at one time otherwise everyone could hear what everyone else was saying.

The next development was coaxial cable, and later multiplex technology, which presented the possibilities of allowing more than one conversation at a time without interference when the conversations were spaced at different frequencies for transmission along the co-ax cable. Also music and other forms of analogue audio entertainment could be transmitted without significant loss of frequency response, which was of course the problem with telephone lines. Hence it was possible to transmit radio along the coaxial cable without losing too much energy and frequency degradation in the transmission. In both cases it was possible to place amplifiers in the lines in order to amplify the signals if they had to go any large distance.

Initially all of the signals were analogue. Now of course many of these signals are converted to digital signals allowing more information to be sent with greater accuracy and reproducible frequency response.

4.2 Cable

Advance forms of co-ax cable were laid in the United States, particularly for the transmission of television in the 1970s and 1980s. The co-ax cable technology has now largely been replaced by fibre optic technology, which enables a greater number of television channels to be transmitted on any one cable together with multiplexed telephone calls. Technology for fibre optic cables is of course digital, which allows much greater use of the cable capacity than using analogue signals.

In addition to cables connecting cities on the continents, submarine cable has been used for the transmission of telephone calls between the continents. The first Trans-Atlantic Cable (TAT 1) was commission in 1956. It was able to carry

90 calls at any one time. The fourth generation of fibre optic cables to be laid commencing in the year 2000 will operate at 80 Gbts/sec and transmit 3.5 million simultaneous calls. Submarine cable now connect most of the work through the Trans-Atlantic, Pacific and Indian Ocean cables.

TABLE 1

History of Transatlantic Cable Systems

Year in Service	Cable Systems	Cost (US$) per voice path	Capacity (voice paths)
1956	TAT-1*	557,000	89
1965	TAT-4*	365,000	137
1970	TAT-5*	49,000	1,440
1983	TAT-7*	23,000	8,400
1988	TAT-8	9,000	37,800
1993	TAT-10	2,700	113,400
1996	TAT-12/13	1,000	604,000
1998	AC-1	<125	2,457,600
*No longer in service			
Source: Telegeography Inc.			

TABLE 2

History of Transatlantic Cable Systems

Year in Service	Cable Systems	Cost (US$) per voice path	Capacity (voice paths)
1957	Hawaii 1*	378,000	91
1964	TPC-1*	406,000	167
1974	Hawaii 2*	41,000	1,690
1975	TPC-2*	73,000	1,690
1988	TPC-3	16,000	37,800
1992	TPC-4	5,500	75,600
1996	TPC-5	2,200	604,000
1999	China-US	<200	4,916,200
*No longer in service			
Source: Telegeography Inc.			

5 Broadcasting

Broadcasting developed rapidly after the initial experiments by Marconi in 1895 using Morse Code to transmit a signal from Nova Scotia to Ireland. In 1902 the first radio transmissions of the human voice were accomplished.

Short wave for worldwide cover, medium and long wave for local and regional cover developed. It was soon shown however that radio frequencies had to be regulated by the governments concerned in order to make sure that interference and "jamming" did not occur. This frequency allocation was carried out by the

ITU, which had been founded as the International Telegraph Union in 1865 by twenty states. The initial signals were analogue but with digital technology it is now possible to reduce the band width required by radios and hence more radios transmitting stations can be put on air. In addition, digital technology allows much greater quality and allows FM stereo broadcasts from one transmitter.

6 Satellite

With the development of satellite technology significant advances were made in the transmission of information around the world. The first satellites were in GEO stationary orbits some 23,000 miles above the earth in an orbit that allowed the satellite to rotate at the same speed as the point of the earth above which the satellite was based. All GEO-stationary satellites are based above the equator. The GEO-stationary satellite enabled both point to point communications, in other words large antennas sending signals from one point in the earth and connected by the satellite to another large antennae on the other side of the world. It also enabled point to multipoint transmission whereby one powerful transmitter could transmit to the satellite which would then beam a signal in a footprint over a specifically allocated part of the globe. It is possible to point the satellite signal at specific areas, however, there is a large "fuzz" factor at present which means that the satellite signal does stray to other places. A satellite may have a very large footprint covering almost a third of the earth's surface or it can be a spot beam which is aimed at say a particular country or even city.

As will be explained later, the orbits of GEO-stationary satellites, at this stage of the technology, need to be spaced at 1.5 degrees apart. This means a maximum of 240 satellites spaced around the equator. However, there are techniques now for placing two satellites in any one particular orbital slot, providing they do not interfere electronically with each other, and therefore effectively doubling the number of satellites in use.

The second type of satellite we need to discuss is the LEO or low each orbiting satellite. This is a fairly recent development and indeed the first systems are not as yet operating although it is expected that they will be by the year 2000. The idea of a low each orbiting satellite is that it will enable two-way communications from the earth using a handset similar to a cellular telephone. You will appreciate that because the GEO-stationary satellites are 23,000 miles away it is not possible to transmit from the surface of the earth using a small cellular radio-sized antenna. It needs a large dish with significant power to transmit the signal. However, with a low earth orbiting satellite orbiting at about 400 miles above the earth, it is possible to use a smaller hand portable transceiver. It is proposed that the LEOs will orbit between 400 and 1600 miles above the earth. The drawback of course is that the footprint of one low earth orbiting satellite can only cover one relatively small area of the earth at any particular time; It is therefore proposed that the LEO system should contain at least 60 and up to 100 satellites in order to cover the whole earth at any particular time. As well as giving two way communications directly to earth-based transceivers, the satellite networks will allow satellite-to-satellite communication, which means that a user in say the UK could transmit and talk to another user in say Singapore without the signal ever entering the local wireline network. This obviously creates many problems for the local jurisdiction, which is losing control of the telecommunications transmission and reception and hence valuable international finance.

A further development is the medium earth orbiting satellite, which is known as a MEO. This satellite is designed to orbit between about 1000 and 5000 miles above the earth and will communicate from the earth on a two-way basis with a geo-stationary satellite to give worldwide coverage. The advantage of the MEO is that fewer satellites to cover the earth are needed as they are higher in the sky. At present, 5 US and one European organisations are building and launching satellites either of the LEO or MEO type to cover the earth.

In the overall plan however we need to discuss the other issues involved in the distribution of information both within countries and internationally. If we start with radio, electric magnetic radiation was first transmitted from aerials and was able to penetrate right around the world on short wave and to regional centres on medium and long wave bands. This situation continued until the early 1970s. International traffic was able to be carried by cables laid at the bottom of the ocean, which although effective in carrying traffic were expensive to lay and their capacity was extremely low. However, once the technology for fibre optics was developed and fibre optic amplifiers were available then an increase in capacity was available. This increase in capacity enabled television and radio programmes to be transmitted via the cable system rather than physically carrying the film from one country to another. This also enabled events in one corner of the world to be seen simultaneously as they occurred in another in another corner of the world. The major development which went along concurrently with this was the technology developed for satellite. To give a complete coverage of the world it is necessary to have three satellites spaced with one over each of the Atlantic, the Indian and the Pacific Oceans. As stated earlier, satellites have to be in the order of 1-1.5 degrees apart so that interference does not occur between the satellites. As there are 36- degrees in a circle, this limits the number of satellites to approximately 240. It is possible to fudge these figures as two or more satellites can be put into a single orbital slot and we will discuss the says of doing this in a later lecture. The development of GEO-stationary satellites enabled much better quality television, radio and telecommunications links to be established between countries – telecommunications links from ground station to satellite to ground station, broadcasting links from ground station to satellite to footprint. There are also a great many variations of this basic configuration including v-sats which allow links to remote areas for telecommunications and television.

Geo-stationary satellites do have an important role in the global information infrastructure. Such satellites will play an increasing role, particularly for broadcast applications where their wide coverage is advantageous. The digital direct broadcast satellite services introduced in recent years had been among the most successful consumer electronic products introduced in history and provide a first glimpse of the potential of digital satellite communication.

While there are various proposals for geo-stationary satellites in the Ka band, with different and changing service models, when the dust settles, geo-stationary satellites will end up serving distinctly different markets. Geo stationary satellites will continue to be used for the applications for which they are used today, largely broadcast-type applications, whilst low-earth orbit satellites will be used for two-way, interactive applications.

The evolution from GEO-stationary to low earth orbit (LEO) satellites has resulted in a number of proposed global satellite systems, which can be grouped in three

general types. The best way of distinguishing between the LEO systems is by comparison with their terrestrial counterpart services. The so-called little LEOs will provide the satellite equivalent of paging. The big LEOs (like Iridium and Glibalstar) provide the satellite equivalent of cellular-hand held mobile voice service.

7 Computers

Computer technology has, a I said earlier, developed in the private sector. Governments have had no hand in its development other than specific requests by the US Government in their tendering process which promoted the use of high level languages which speeded up the use and development of computers for the home. Prior to this request by the US Government, computers were programmed using machine language which was difficult to use to control the operating systems of the computers. As a result of the lack of a regulatory regime, the computer industry has been able to expand without limit with R&D playing a major role in the industry expansion.