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# ALDES Briefing Paper

## Telecommunications

### And the Future

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## 1 A Short History

### 1.1 Communications

At a time when communications is instant, when we can talk to relatives in a different continent using a mobile phone via a satellite in space it is hard to imagine what life would be like without the telephone. Yet until 100 years ago word of mouth or letter conveyed by a runner was the usual mode of communication.

The first real breakthrough came in 1833 with the invention of the electromagnetic telegraph. Cooke and Wheatstone improved the system in 1837 allowing near instantaneous communication along a wire. This was followed in 1838 by the invention of Morse code, which greatly improved the efficiency of the telegraph and led to his first telegraph line in 1843. The first undersea cable between the UK and Europe was built in 1850, with the first transatlantic cable in 1866.

In 1876 Alexander Graham Bell developed a microphone and speaker that could convert sound waves to electrical signals and back again. In 1896 Marconi patented a radio transmission system capable of being used for commercial exploitation of radiowaves, and succeeded in his first transatlantic transmission in 1901.

In 1966 it was proposed that glass fibres could be made through which light could travel for great distances. Such fibres were produced during the early 1970s. A single fibre optic cable can carry 1000 TV channels simultaneously and is capable of carrying 10,000 times as much.

### 1.2 Information and Computers

Early man could neither read nor write word of mouth passed information. Without writing the sum total of knowledge of each isolated tribe was

limited to the memories of its oldest members and by what each generation could discover anew for itself. The oldest known writing in the world is a 5500-year-old Mesopotamian tax account. The introduction of movable type to Europe between 1446 and 1448 (developed in China some four centuries earlier) by Gutenberg allowed for the rapid development of printed books. Before Gutenberg there were only around 30,000 books in all of Europe, literacy and books were the tool of a tiny educated elite that guarded this precious resource. By 1500 Europe was flooded with more than 9 million books, paving the way for the Renaissance.

Handwriting only became general in Britain in the 18<sup>th</sup> and 19<sup>th</sup> centuries with the spread of literacy, the development of low cost papermaking techniques and the increase in letter writing following the introduction of the postal service. By 1702 London had its first daily newspaper.

In 1947 the transistor was born, this small solid-state device enabled another step change in technology. Electronic equipment could be reduced in size and power consumption. The first microcomputer was developed in 1971 with the first personal computer following in 1976. It has allowed the manufacture of cheap radio receivers, televisions, telephones, mobile phones, fax machines and computers.

### 1.3 The Birth of the Internet

In 1844, when Samuel Morse telegraphed "What hath God wrought?" from Washington to Baltimore he helped to usher in the age of electronic communications. In November 1961, when computer scientists connected their computer at UCLA to one at Stamford

The purpose of this briefing note is to present our vision on the future of the internet. It has been prepared for ALDES by Chris Shepherd, but the opinions expressed are his own. If you see errors or have comments, please e-mail [chris.shepherd@iee.org](mailto:chris.shepherd@iee.org)

Research Institute there were no photographers present and no one can even remember what the message was that passed between the two. This was the inauspicious beginning of the Internet.

## 2 Computers

The cost of personal computers are falling at unprecedented rates whilst their power is increasing. Just ten years ago computer memory cost £30/megabyte (MB), this has now fallen to less than £1/MB. A typical PC would have a clock speed of 16MHz, less than 640KB of memory, a hard disk with around 20MB capacity, and a price of around £1000. Today, for the same price, the machine will have 200X the hard disk capacity, 50X more memory and 20X the clock speed. And all in a lap top computer the size of a large book with a CD-ROM!

Since 1950 computing power has increased by a factor of ten billion. Underlying this explosive growth of computing power is Moore's Law (first stated in 1965 by George Moore) which showed that computer power doubles every eighteen months, and shows no signs of flattening off yet.

### 2.1 Three Phases of Computing

Kaku refers to the three phases of computing used by many computer analysts to divide the history of computing. The mainframe computer defined the first phase. These were large, powerful and expensive computers shared by up to 100 scientists and engineers.

The second phase of computing began in the 1970's when engineers in America (in particular Xerox Palo Alto Research Centre - Xerox PARC) realised that computer power was exploding. They envisaged that the ratio of computers to workers would get to one-to-one, to test the idea they created the world's first personal computer.

The third phase of computers is known as ubiquitous computing, which refers to a time when computers are all connected to each other and the ratio of computers to

people increases beyond parity, perhaps even getting to 100:1 - the opposite of the situation in the first phase. Even Bill Gates had not realised the consequences of this phase of computer development. As recently as 1995, in the first edition of his book *The Road Ahead*, he had not acknowledged the importance of the Internet. He subsequently re-wrote large sections of the book for the second edition and turned his company - Microsoft - around to address the rapid expansion of the internet.

Some computer analysts believe this will lead to a fourth phase with the introduction of artificial intelligence into computing systems maybe even leading on to self-awareness and consciousness. This is a longer-term vision, maybe taking us past the first century of the new millennium but the signs are out there now.

### 2.2 The Invisible Computer

As the price of microprocessors continues to plunge many predict that economics will drive the computer industry into the next phase. Chip manufacturers predict that the price of microchips will drop to 10-50 cents by the year 2000 and a couple of cents by the year 2010. Eventually microprocessors will be as cheap as scrap paper and just as plentiful. With microprocessors that cheap they really will be everywhere.

Large numbers of computers will be present in the environment sensing our presence and anticipating our needs. This is happening in a limited way today with buildings sensing if rooms are in use and adjusting heating and lighting accordingly, or the presence of closed circuit TV (CCTV) in our shopping centres. The technology that will allow individuals to be identified and tracked from images like those generated by CCTV cameras is here. It will presumably only be a matter of time before the CCTV cameras are networked and used in this way for tracking vandals or burglars - or anyone else.

All of these computers will want to communicate with each other. They will be connected together in a network that will span the globe connecting together the smallest and largest computers.

### 3 The Internet

The Internet began in 1961 as ARPANET, a network of four computers. By 1971 there were two dozen sites on the ARPANET, and by 1981 this had risen to more than 200. In 1990, with the end of the Cold War and having completed its mission, the American government passed the network to the National Science Foundation. In 1991 Tim Berners-Lee, a mathematician working at CERN, created the World Wide Web which made multimedia accessible to the Internet. By 1994 there were 45,000 smaller networks connected to the Internet, today the figure is more like 10 million and growing at a rate of 20% per quarter.

Vinton Cerf, an Internet pioneer predicts that, at the present rate of growth, there will be 160 million people on the Internet by the year 2000, Nicholas Negropont of MIT predicts up to a billion people by that time. By 2005 Cerf predicts that the Internet will be as big as the telephone network of today (there are 600 million telephone lines installed world-wide). Even the smaller of these predictions is a very large network indeed!

#### 3.1 The Internet Today

The Internet is still growing rapidly and beginning to affect ever larger numbers of people in their everyday lives. Many businesses would be hard pressed to manage without the internet today with its ready access to information and data. Many engineers and scientists rely on the Internet to provide them with the information they require to carry out their jobs effectively and efficiently. Many people in their own homes use the Internet to find out what is happening in their neighbourhood and even to order their groceries from the local supermarket.

#### 3.2 How the Internet will Shape Our Lives

The services available on the Internet are developing rapidly. Better encryption technology has meant that banks are willing to offer their services over the Net (for example the Co-operative Bank will now offer this service).

Electronic commerce over the net is being studied by think tanks such as Demos where local communities will be able to offer services over the Net using Guaranteed Electronic Markets (GEMs). Whilst the Internet can offer many opportunities for local economies to develop it must also be remembered that the Internet is global. This is already affecting the way some people buy commodities such as books and CD's. Computer programs (called Agents or Bots) can be sent out to scour the world wide web for the best price on a book or CD, order it on your credit card and have it delivered within days.

### 4 The Internet and Party Policy

Over the coming years the Internet is going to have a profound influence on the way we do things. It should make access to information easier (assuming there is a political will to make it available).

The effect on local government and the provision of services will be substantial. Different visions are promoted on the role of technology and, in particular, the Internet in service provision and government accessibility ranging from the provision of existing services on the net to complete changes in the structure of local government based around the provision of electronic services.

These changes are happening at an increasing rate. They are already affecting our lives in significant ways whether we notice it or not. These changes should be reflected throughout our party policy so we are not caught by surprise.

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