



The Internet and the story of Communication

Price
30p

Some history

Development of the internet is the story of how great strides in communications and computer technology came together.

At a time when we can talk to relatives in a different continent using a mobile phone via a satellite in space, it is salutary to imagine what life was like before the telephone. Yet even until 100 years ago word of mouth, or letter conveyed by a runner or rider, were the usual modes of communication.

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

Then in 1876 Alexander Graham Bell developed a microphone that could convert sound waves to electrical signals and a loudspeaker that could convert them back again. For the first time people could speak to each other beyond the range of a human voice. In 1896 Marconi patented a radio transmission system capable of being used for commercial exploitation of radio waves. His first transatlantic transmission succeeded in 1901. These 2 inventions, which enabled man to communicate along a *wire* and then across *space* underpin modern communications.

In 1966 it was proposed that glass fibres could be made through which light could travel great distances. Such fibres were produced during the early 1970s. The development of fibre optics massively increased the *capacity* of lines. A single fibre optic cable can carry 1000 TV channels simultaneously and is capable of being developed to carry 10,000 times as much.

The accumulation of knowledge

Early man could neither read nor write. 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 moveable type to Europe (developed in China some 400 years earlier) by Gutenberg between 1446 and 1448, allowed 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. By 1702 London had its first daily newspaper.

Handwriting only became general in Britain in the 18th and 19th centuries. With the spread of literacy and development of low cost papermaking came an increase in letter writing and the introduction of the postal service.

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. The transistor has allowed the manufacture of cheap radio receivers, televisions, mobile phones, fax machines as well as computers. The significance of the computer however is that it can *store, and process, knowledge*.

Computers

Since 1976 the cost of personal computers has fallen rapidly relative to their power. In 1990 computer memory cost £30/Megabyte (MB). 10 years later it was less than £1. A typical PC would have had a clock speed of 16MHz, less than 640kB of memory, a hard disc with around 20MB capacity, and a price around £1000. 10 years later, for the same price (despite inflation), the machine had 200 times the hard disc capacity, 50 times more memory, and 20 times the clock speed - all in a lap top computer the size of a large book, complete with a CD-ROM!

Since 1950 computing power has increased by a factor of *10 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 18 months. So far it shows no sign of flattening off.

There have in fact been 3 phases of computing development. First came the mainframe - large, powerful and expensive, *shared* by up to 100 scientists and engineers at a time. Second came the personal computer or PC. It arrived in the 1970s when American engineers, in particular at the Xerox Palo Alto Research Centre realised that computer power was exploding and saw that the ratio of computers to workers could reach one-to-one. This was the first PC.

The third phase is known as ubiquitous computing, where instead of being used *individually*, computers start being *connected together*. Bearing in mind that computers include monitoring and other devices, not just standard desk models or lap tops, the ratio of computers to people is increasing beyond parity, and may even reach 100 to 1, the

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opposite of phase 1. As late as 1995 even Bill Gates, founder of Microsoft, had not recognised the significant consequences of this 3rd phase. He did, and the rest, in particular the expansion of the internet, is history.

The invisible computer

One, almost invisible, use of the internet is that of monitoring. As prices continue to fall, the numbers of computer backed sensors and controls in our environment, will increase. They will sense our presence and anticipate our needs. This already happens. Devices in buildings can sense if rooms are in use and adjust heating and lighting accordingly. CCTV is becoming more and more common in shopping centres. The technology allows individuals to be identified and tracked. Because the information can be transmitted quickly and cheaply, monitoring can be carried out centrally and problems reacted to efficiently. It is already possible, if one wishes, to draw the lounge curtains closed from the office or even switch the oven on remotely from the car.

The internet

What most people think of as the internet is the merger of the incredible sophistication of *communications* with *global* accessibility to *information*. Not for nothing is the internet referred to as the 'information super-highway'.

Its beginning can be traced back *40 years* to 1961 and the American government, when ARPANET created a *network* of 4 computers. In 1844, when Samuel Morse telegraphed "What hath God wrought?" from Washington to Baltimore, he helped usher in the age of electronic communications. In November 1961, when computer scientists connected their computer at UCLA to one at Stamford Research Institute there were no photographers present and no one can even remember what message was passed between the two devices. It was an inauspicious beginning. By 1971 there were still only 24 sites, though by 1981 the number was over 200. In 1990, with the end of the Cold War, the US government passed the network to the National Science Foundation. It was Tim Berners-Lee, a British mathematician working at CERN, who in 1991 created the World Wide Web. His contribution was simple but earth shattering. He wrote programs which allowed every kind of computer to talk to each other. The obstacles of different operating systems, protocols, and software were overcome. By 1994 45,000 smaller networks were connected. Now more than *half* of all households in the UK are connected, an even higher percentage in the USA, and varying percentages all round the world.

The implications of the internet

The internet provides unprecedented access to *knowledge* and unprecedented ability to *communicate*. In America, the number of messages sent by email is already 30 times as numerous as those sent by post. In consequence it is dramatically easier to keep in touch with family or business anywhere in the world. Digital wedding photographs and even video clips can be sent 'Down Under' within minutes of being taken. Email messages can be left in 'boxes in the sky' and collected at the next internet café. It is possible to scan drawings between offices saving the need to meet. Groups of people all round the globe can share common interests, for example genealogy. It is possible to find out about one's illness and the options *before* visiting one's

GP. One can read government and council reports, so citizens can be better informed and better educated. For businesses, information can be at one's fingertips. The consequence is to save time (and hence costs) and to accelerate research and development.

The internet is also re-shaping employment patterns in 4 main directions. First, if shoppers can find out the price of goods, perhaps 'see' them on display, and even compare prices store by store, they can order direct. Currently this is happening predominantly for groceries, books, holidays, cars, and despite the implosion of the 'dot.com' bubble, the market grows. The consequence is that the number of retail outlets with high overheads will decline, whereas the number of delivery services will increase. The same effect on retail premises will happen with banks and estate agents. Though there are worries about security, most banks now offer internet accounts paying higher rates of interest than standard ones.

The second impact will be on location. Utilities for example can group their staff in call centres remote from their customer, even abroad in English speaking countries like India, where wage costs are so much lower. The information needed can be brought up on a computer anywhere. This presents an opportunity to government: it is possible to take advantage of the technology to re-locate some of its offices to areas of high unemployment.

The third impact also relates to location. There are now computer programs called 'Agents' or 'Bots' which can be 'sent out' to scout the world wide web for the best price on, for example, a book or CD, order it by credit card, and have it delivered within days. Increasingly the internet user will be able to 'shop', not in a national, but an international market. This poses 2 problems for government. How does it collect sales related taxes, especially on small items sent by post, and how does it legislate for fraud and provide consumer protection? Once again, governments are struggling to catch up with technology.

The fourth impact is in learning. Computers have already entered schools but it seems inevitable they will be increasingly used to 'pass on knowledge', to provide and mark exams, and even give 'coaching'. The notion of 'whole class' teaching could go. Teachers could become researchers selecting the best material, organisers of teaching programs, tutors on an individual basis, and pastoral carers. Such teaching modes could just as easily be used for adult learning, especially 'second time around' courses in the privacy of the home, at a time convenient to the learner.

There is another impact which could be even more profound. The creation of communities depends on the ability to communicate. Historically the limiting factor has been distance. Initially it was the parish. It is widely thought that Hitler and Mussolini only achieved their dominance because they could project their ideas through the new fangled radio. The internet removes the limitation caused by distance. It makes the creation of trans-national 'communities' with common interests including religion, much more likely. It would undermine the nation state but encourage the growth of global communities. We live in exciting times.
