
Government policies toward information and communication technologies: a historical perspective

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Abstract.

The development of what one might call ‘modern’ systems of information and communication began with the Gutenberg printing press in the fifteenth century, and progressed through the pre-paid postal system, electric telegraph and telephone in the nineteenth century, radio and television broadcasting in the twentieth century, and most recently the internet. This essay focuses on the response of governments to these innovations, beginning with the printing press.

1. Introduction

The internet is the latest stage in the search for technologies to record information and transmit it at ever-increasing speeds and lower cost. Early humans began this process by inventing first oral, then written languages, and by solving the problem of communication across space using such primitive techniques as signal fires, drums and runners. The development of what one might call ‘modern’ systems of information and communication began with the Gutenberg printing press in the fifteenth century, and progressed through the pre-paid postal system, electric telegraph and telephone in the nineteenth century, radio and television

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broadcasting in the twentieth century, and the internet in the late twentieth and early twenty-first centuries.

In this brief essay, I discuss the reaction of governments to these innovations, beginning with the printing press. It is not my purpose to describe the history or even the nature of these inventions in any detail. That task would require a book or, more likely, a number of books, and knowledge of the subject far more thorough than I possess. My purpose is more limited, and is driven by knowledge that governments around the world, at this very moment, are attempting to decide how to – indeed, whether to – tax, regulate and control access to the internet. The past may contain some lessons for the present.

To anticipate the findings, governments in the past did little to encourage innovation in information and communication technologies (ICT). In fact, they frequently resorted to state ownership or regulation to control the use and restrict dissemination of new technologies developed by private citizens. At first glance, it may seem strange that governments are content to leave the sale and manufacture of military weapons to free markets, yet invariably retain control of information and communication technologies. After all, the vast majority of messages sent each day across town or around the world have little effect on anyone, whereas all arms have the potential to kill or to maim. But messages sometimes contain information or misinformation of vital importance, and control of such information or misinformation is power. For this reason governments insist that there is need to control communications, and usually codify this into law. The French Parliament, for example, in the year 1837 passed a very explicit and forward-looking piece of legislation:

Anyone who transmits without authorization any signals from one point to another one whether with the aid of mechanical telegraphs or by any other means will be subject to imprisonment for a duration of between one month and one year. [1]

The law predates not only the telephone, but also the electric telegraph, and was not repealed until the 1980s.

2. Printing press (moveable type)

Books were produced long before the fifteenth century, but in very small quantities. They were either copied laboriously by hand, or printed using techniques of wood-block printing begun in the eighth century in Japan and no doubt much earlier in China, but not until the end of the fourteenth century in Europe. This process was revolutionized, most likely in the year 1450, by the printing press, the invention of which is attributed to Johannes Gutenberg, a silversmith in Mainz, Germany. Unknown to the Europeans, moveable metal type had been used successfully five decades earlier in Korea. This was the result of efforts of the Korean government, through a Department of Books established in 1392. The Koreans made little use of this innovation, however, as wood blocks were less expensive and more practical for Chinese characters [2].

With moveable type and alphabets containing relatively few letters, it became possible to reproduce writings of all kinds in great volume. Printing presses sprang up in the large commercial towns of Europe, with 150 presses in Venice alone by the end of the fifteenth century. Before the printing press, manuscript books in Europe could be numbered in the thousands. In the first 50 years of industrial printing, these increased to more than nine million books. The availability of books and pamphlets in large numbers provided an impetus for a rapid rise in rates of literacy among the middle classes.

Well into the sixteenth century, governments and the established Church in Europe came to realize that the printing press could be used to reproduce seditious literature as well as Latin Bibles and letters of indulgence. The Catholic Church in Rome decreed in 1543 that no book could be printed or sold without permission, published in 1559 the first *Index Librorum Prohibitorum* (index of banned works), and restored the Inquisition to punish authors of such works. Governments cooperated fully with the Church, but these early efforts at censorship were often not successful. It is said, in fact, that listing a book in the *Index* guaranteed that it would attain 'best seller' status, despite the fact that printers of such works faced a very real threat of being burnt at the stake. It is possible that a Protestant Reformation would have occurred in any event, but there is no doubt that the printing press facilitated it. Martin Luther's theses, for example,

were translated from Latin into local languages, printed and circulated throughout Europe. Later, the power of the printed word was demonstrated by seditious pamphlets that circulated prior to the American revolution of 1776 and the French revolution of 1789, despite the best efforts of the respective governments to censor them.

Delivery systems were slow and costly, so the printing of news was at first restricted to occasional pamphlets on foreign wars or other major events of interest. When rudimentary newspapers began to appear in Europe in the seventeenth century, government censorship stifled their development. Formal censorship persisted in many countries of Europe well into the nineteenth century, and informal censorship continues everywhere to this day. Typical of frustrated European writers of the nineteenth century, a young German journalist, who would later become famous, called for an end to censorship:

The essence of a free press is the principled, reasonable, moral essence of freedom. The character of a censored press is the unprincipled aberration of unfreedom, it is a civilised abomination, a perfumed monster . . . A censored press has a demoralising effect . . . The government only hears its own voice, it knows that it only hears its own voice, yet it persists in the delusion that it hears the voice of the people and in turn demands of the people that they should persist in this delusion. [3]

Eventually, technology weakened the ability of governments to control access to literature and news, for the industrial revolution caused a further explosion in printing. Hand-driven presses gave way to presses driven by steam, and then by electricity. Books, pamphlets and newspapers reached the masses in abundance, despite attempts by government to tax, license, censor or otherwise restrict their sale. In Britain alone, by the end of the nineteenth century more than 6000 new titles of books were published each year, in addition to daily newspapers, many of them tabloids, some of which had press runs that numbered in the hundred thousand. Information of all kinds reached all levels of society.

3. The postal system

Modern postal systems make it possible for any person to send a letter or a parcel to any addressee at a low price, paid for by the sender rather than the addressee. Many in the world today take this service for granted, so it is surprising how long it took for such a system to be implemented. Postal systems existed in antiquity,

the most famous being perhaps the *cursus publicus* of the Roman Empire, but these systems were not designed to serve the public. They transported for the most part official mail, and the high fees charged for carrying private mail were collected from the recipient, not the sender. Prior to the nineteenth century, in the words of one historian [4], governments maintained postal systems 'more for the purposes of censorship, espionage, and revenue than for service.'

Increased literacy that followed the invention of the printing press led to increased demand for mail services, a demand that government postal systems, for the most part, ignored. In 1680, the merchant William Dockwra created a Penny Post that served only greater London, but can nonetheless be described as the first modern postal system. Dockwra offered deliveries almost hourly in London, and daily deliveries to places up to 10 miles (16 km) outside of London. His main innovation was that several hundred receiving stations accepted letters prepaid at a low rate (one penny for delivery within London, two pennies for delivery outside London) rather than charge the addressee at a high rate. The Penny Post was a commercial success, but short-lived. The government took over the company in 1683 and forced Dockwra to pay damages for infringement of the state monopoly of mail service established by royal proclamation in 1635. Nearly a century later, in 1759, Claude-Humbert Piarron de Chamousset introduced a similar system in Paris. It too was quickly taken over by the state monopoly, but the French government paid the owner compensation rather than charging him for damages.

Modern, nationwide postal systems finally emerged in the nineteenth century following increasing demands for reform of the state monopolies. Curiously, few disputed the right of the state to protect its monopoly from private competition. Rowland Hill, a British administrator and educator, published in 1837 an influential report that advocated transformation of the government postal system into the modern system that we know today. His principal innovation was the introduction of a uniform and low rate of postage (one penny for each half ounce) for delivery anywhere in the country, regardless of distance. Moreover, he proposed a return to Dockwra's system of pre-payment, accomplished this time by affixing adhesive stamps on each envelope or parcel. The government initially rejected Hill's proposals, but popular agitation in favour of the 'penny post' caused politicians to reconsider their positions. In 1840, the government of Britain implemented all of Hill's proposals, including a uniform rate system of pre-payment by stamps.

The reforms proposed by Hill spread gradually to the rest of the world, beginning with Switzerland and Brazil in 1843. Governments of 22 countries with reformed postal systems agreed to establish a General Postal Union (renamed the Universal Postal Union, or UPU) in 1875. The UPU grew rapidly and by 1914 included almost all independent countries. It continues to function today as a specialized agency of the United Nations. The primary purpose of the UPU is to assure that letters and parcels posted in any member country are delivered to any addressee located in another member country, i.e. that postal systems function as a truly international system of information exchange, much like the internet today.

Despite these useful reforms, postal systems remained a monopoly of government, and postal inspectors retained the right to open suspicious letters or parcels. In recent years, private couriers and parcel delivery companies have begun to operate in direct competition with official postal systems for both domestic and international deliveries. Nonetheless, nowhere has this opening of the market been complete. Governments insist on retaining a monopoly for delivery of ordinary letters, even when they permit private competition for delivery of parcels and for special delivery of letters.

Why have governments through the centuries insisted so strongly on control of postal systems, to the extent of preserving them as a state monopoly? After all, government control of printing for the most part has been restricted to licensing, censorship and taxation. State monopoly of printing is rare whereas state monopoly of the postal service is the norm.

One reason, already mentioned, is the desire for state security, for protection against subversive or unpopular ideas. Local printing presses can reproduce subversive ideas, but books, pamphlets and newspapers can be printed outside the country, and then mailed to citizens within the country. For this reason it is far more important to control the distribution of information than the reproduction of information. A second reason is that governments often like to subsidize some users of the postal system at the expense of others. Remote, rural communities, for example, may benefit from a uniform flat rate for postage that exceeds the cost of delivery in urban areas, but is far below the true economic cost of delivery to rural areas. Politicians, or religious and other groups favoured by the government, might benefit from a reduced rate of postage, or even free postage. Approved magazines or commercial catalogues might also be favoured by a 'second class' bulk rate that is much lower than the 'first class' rate charged other

customers. Finally, a postal system, unlike a printing press, can be subject to considerable economies of scale. Once an infrastructure is in place to move the mail, the marginal cost of delivery of an additional letter or parcel is much less than average cost until volumes of mail become very large.

4. Telegraph and telephone

Postal systems were able to deliver the mail progressively faster in the nineteenth century, thanks to advances in transportation, namely railways and steamships. The large gains in speed of communication came, however, with the arrival of the electric telegraph. William Cooke and Charles Wheatstone in Britain are credited with invention of the first working electric telegraph in the year 1836. Samuel Morse in the USA was developing his own version at almost the same time, and by 1838 had perfected his code.

Telegraph systems require large investments in wire (overland) or cable (underwater and underground). For this reason they are natural monopolies. It is simply not economic to have two or more competing companies connecting point A to point B. The USA at first had as many as 51 telegraph companies, but Western Union was formed in 1856 and quickly began an acquisition spree. In Britain, government accomplished the same task in 1868 by nationalizing the telegraph companies and passing control to the Post Office, but only for domestic lines, as international lines were left in private hands [5].

The world rapidly became connected by cable and wire. In 1851, a submarine cable was laid between Britain and France. By 1861, the Atlantic coast of North America was connected with the Pacific and 2250 telegraph offices were in operation in the USA alone. In 1866, after repeated failures, the USA and Britain were successfully connected by submarine cable. (An earlier transatlantic cable failed in 1858 after only 3 weeks of operation.) The telegraph reduced the time it took to send a message between New York and London from more than a week to a few minutes. The demand for rapid communication between the two continents was such that by 1892 there were 10 cables spanning the Atlantic. A total of 2527 distinct submarine cables, measuring 489 311 nautical miles, had been laid by 1910, up from a reported 569 cables and 64 000 nautical miles 33 years earlier [6]. By 1930, a global web existed that spanned both the Pacific and the Atlantic oceans, and linked Europe and North America with India, Australasia, Asia, Africa and South America. These

international connections impacted positively on print media: newspapers were able to publish fresh news taken from a telegraph feed, rather than report events that happened days or weeks ago. Although no-one knew it at the time, decades later a global web of cables and wires would serve as the infrastructure for another revolutionary development in communication technology: the internet.

The telephone, which was first built and tested in 1876 by Scottish inventor Alexander Graham Bell in North America, added a new dimension – voice – to long distance communication. American Bell was founded in 1880, obtained a controlling interest in Western Union and Western Electric (the telegraph equipment manufacturing firm) two years later, and eventually became American Telephone and Telegraph (AT&T). This communications giant was eventually regulated by the American states and by the federal government. In the rest of the world (with the notable exception of Canada, which followed the US model), the telephone and telegraph service was run as a monopoly service of government, often as a branch of the postal monopoly. The telephone was slow to displace the telegraph for long distance communication. This was in part because of cost (copper wires for telephone lines cost more than iron wires for telegraphy) and in part for technical reasons (poor quality of transmission and need for sender and receiver to speak the same language). Nonetheless, the slow transition from telegraph to telephone also reflects the fact that national telegraph monopolies were under no pressure to offer the option of voice to their consumers. New York and Chicago were not connected by telephone until 1892, New York and San Francisco in 1915 and New York and London in 1927 [6, 7].

The rationale for strict regulation or government ownership of telephone and telegraph companies is clear: they were natural monopolies. In addition, as in the case of postal services, tight control allows governments to provide classes of consumers with cross-subsidies. Examples of these cross-subsidies are policies such as uniform rates even though calls between rural, isolated communities are more costly for a company than calls between densely populated cities, or high rates for long-distance calls to keep the price of local phone calls lower than would otherwise be possible.

Technological change, in the form of microwave links, has ended the natural monopoly of long distance telephone and telegraph service. With microwave technology, any two telephone exchanges can be linked with only a modest investment in towers and

equipment. This, indeed, was the strategy of a small company in the USA called MCI (Microwave Communications Inc.) that requested permission from the Federal Communications Commission to operate such links between major urban centres. AT&T opposed the application and the case went to the courts. Following a lengthy legal battle, the courts in 1975 banned MCI from selling telephone services, and then reversed this judgement two years later. MCI emerged victorious and long-distance telephony in the USA was deregulated in 1984. With competition, the price of long distance calls plummeted while, deprived of cross-subsidies, the price of local telephone service increased.

In Britain, the government of Mrs Thatcher wanted to deregulate telecommunications, but was faced with the problem that the industry was not a regulated monopoly but an integral part of the government's Post Office monopoly. Therefore, the government first established British Telecom (BT) in 1981 as a public corporation separate from the Post Office, then privatized it in 1984 by selling just over half of its stock to the general public. BT was then regulated as a private monopoly (actually a duopoly since another, smaller company, Mercury plc, had also been formed) in much the same way as AT&T had been regulated in the USA prior to deregulation. The UK is now moving gradually away from regulation to a competitive market.

Governments in the rest of Europe and all over the world are in the process of privatizing their state monopolies of long distance telephony and permitting competition, even the entry of foreign firms. With the advent of wireless mobile communications, not even local telephone exchanges are regarded as natural monopolies and some countries, notably the USA, are opening up local exchanges to competition.

5. Broadcasting

Surprisingly, the first public broadcast of news and entertainment was not by radio, but by telephone, in 1893. Tivador Puskás set up a telephone exchange in Budapest, and then began a daily broadcast service independent of the telephone system. Subscribers could listen between the hours of 10:30 a.m. and 10:30 p.m. to a programme of news, music and theatre, interspersed with advertising. Puskás thought that telephone broadcasting would spread around the world. It never did, but it remained popular in Budapest, and had more than 10 000 subscribers at its peak, in the 1920s.

Equally surprising is the fact that the first use of radio, or wireless telegraphy, was not for broadcasting, but rather for two-way communication, especially for ship to shore, but also (from the year 1927, until a suitable cable was laid in 1956) for transatlantic telephone calls. In recent years, telephone has begun to migrate back to wireless while radio (via the internet) and television broadcasts increasingly go by cable!

The main use of radio, however, is as a mass medium surpassing even the newspaper in coverage, since transmission costs are low and literacy is not required of the audience. The first commercial radio broadcasts in 1919 were much less ambitious than the telephone broadcasts of Puskás. A 6 kW transmitter at Chelmsford, Essex (Britain) sent two half-hour programmes of speech and music over the airwaves each day. After about a year of operation, the Post Office banned the broadcasts on grounds that they infringed its monopoly of communication. The British Post Office agreed to issue a number of experimental amateur licenses, but sought to prevent what it regarded as the 'commercialization' of radio. In 1922, the British Broadcasting Company was formed as a private, but non-commercial, monopoly owned by manufacturers of radio receiving sets and financed by licenses and royalties on the sale of radio receivers and equipment. In 1927, the company was liquidated and replaced by a government entity, the British Broadcasting Corporation (BBC). The BBC retained its monopoly of broadcasting until the creation of the Independent Television Authority in 1954. The BBC model of public service broadcasting has influenced broadcasting in many countries around the world.

The growth of broadcasting in the USA took a very different turn from that in Britain. The first commercial radio station (KDKA in Pittsburgh) began broadcasts in November of 1920. There were eight commercial stations in the country by the end of 1921, and 564 by the end of 1922. Advertising from the beginning was the principal source of revenue for these commercial stations. In response to what it viewed as chaotic and unregulated growth, the United States Congress in 1927 created an agency that is now known as the Federal Communications Commission (FCC) to allocate wavelengths to broadcasters. The result of this system was four regulated radio networks (National Broadcasting Company, Columbia Broadcasting Company, Mutual Broadcasting Company and American Broadcasting Company) that operated alongside a number of educational (non-commercial) radio stations.

In the 1920s, wherever governments allowed, there was a boom in new radio broadcast companies that

rivalled the recent boom in internet start-up companies. It was a simple matter to control this growth, since in every country some government agency had to allocate wavelengths to broadcasters. Few countries followed the USA in licensing commercial stations and abstaining from government ownership. Most, drawing on a tradition of government-owned postal, telegraph and telephone services, followed the BBC model of state broadcasting, without advertising. In some countries, such as France and Canada, government and commercial stations operated side by side.

Television broadcasting was feasible in 1931, but did not become important until after World War II, beginning in the USA and Britain. When wartime restrictions on manufacture were removed in the USA in 1946, there were an estimated 10 000 television sets in use. This number grew to a million by 1949, 10 million by 1951 and 50 million in 1959. British consumers owned proportionately as many television receivers, and consumers in other countries followed in the 1950s and 1960s. The first transatlantic television broadcast (via AT&T's Telstar satellite) was in 1962, and the first transpacific transmission was in 1964. Beginning in the early 1970s, space satellites have provided connections for virtually all areas of the earth and are capable of carrying multiple television channels simultaneously with telephone and other communications.

6. Internet

The internet, unlike the other technologies examined in this essay, actually began as a government project, more specifically as a project of the Advanced Research Projects Agency (ARPA) of the United States Department of Defence. The Pentagon asked ARPA to design a computer network that would be secure and resist attack in the event of war. Researchers at ARPA developed the concept of packet-switching, in which data is split into tiny packets that may take different routes to arrive at a final destination, where they are re-assembled. From a military point of view, such a network is secure for two reasons. First, it is difficult for an enemy to make sense of intercepted, unassembled packets. Second, since there is more than one route to a destination, if one node is destroyed by enemy action, the packets can travel by an alternative route.

ARPANET, precursor of today's internet, linked four research centres in 1969, and 15 by the year 1971. In 1973 ARPANET went international, with links to University College of London and the Royal Radar Establishment in Norway. The developers of ARPANET

had in mind communication between *machines* (long distance computing and file transfers) rather than communication between *persons* (electronic mail and discussion groups). It turned out that, contrary to expectations, communication between people became much more popular than communication between machines. In 1971, Ray Tomlinson of ARPANET invented e-mail, and it was an instant success. Various discussion groups sprang up, where a person asks to receive all posts on a particular topic, and the volume of e-mail in ARPANET accelerated. To the dismay of the Pentagon, which was financing the network, the most popular discussion group was one on science fiction.

The first step toward extending this new tool of communication beyond the small group of ARPA subcontractors occurred in 1974, with the creation of Telnet, a public version of ARPANET. In 1979, two graduate students made use of Telnet to establish USENET 'newsgroups' that exist to this day, and continue to grow. Newsgroups differ from the discussion groups of ARPA in that, instead of signing up for receipt of all posted messages, a member accesses an electronic bulletin board where the messages are temporarily stored. Various other networks, such as BITNET and CSNET, were established to provide services (especially e-mail) to university researchers with no access to ARPANET.

On 1 January 1983 ARPANET adopted Transmission Control Protocol/Internet Protocol (TCP/IP), a date that, for many, marks the birth of the internet. The internet is the global interconnection of millions of otherwise independent computers and information systems. TCP/IP makes this interconnection possible. The IP provides an address for each tiny packet of data, which can then be transmitted by any of a number of routes, using otherwise incompatible computers of different makes and models. The next higher layer of protocol, the TCP, handles the re-sending of any packets that might have been lost, and reassembles the packets at their destination. The authors of TCP/IP use the analogy of 'electronic postcards' to explain how the internet is able to transmit packets [8].

After TCP/IP, the most important development to date for the internet was the release in 1991 of the world wide web (WWW), which was developed by Tim Berners-Lee at CERN (Switzerland). The WWW 'browser/editor' gave anyone with a modem and a computer, access to documents throughout the world. Users of the browser do not have to know this, but it functions thanks to a special protocol known as hyper-text transfer protocol (HTTP), and, for fast retrieval,

documents can be written in hypertext markup language (HTML). The first browser did not support graphics, but this changed in 1993 with the release of Mosaic (which developed into Netscape) and the WWW revolution truly began. Business and media began for the first time to take notice of the internet, and the number of web sites mushroomed from 623 in December 1993 to 100 000 in January 1996, one million in April 1997, 3.7 million by year-end 1998 and 9.5 million by year-end 1999.

The internet uses standards or protocols such as TCP/IP, HTML and HTTP that are 'open' in the sense that they are not the intellectual property of anyone, and can be freely used without charge. Access to the internet, however, is not free. Full access normally requires a personal computer (PC), and computers will not run without an operating system. One company – Microsoft – dominates the market for PC operating systems. In August 1995 this software giant attempted to transform its monopoly of operating systems into a monopoly of access to the web by 'bundling' its own browser (Internet Explorer) with the Windows 95 operating system. By using proprietary rather than open standards, it is easy for Microsoft to support, for example, the posting of web pages that can be read only by its browser. In October of 2001, Microsoft released Windows XP and extended its practice of 'bundling' to Microsoft Media Player, instant messaging and digital photography software. This anticompetitive behaviour has provoked a strong outcry from competing software firms and from antitrust authorities in the USA and in the European Union.

In November 2000, an estimated 407 million persons worldwide were accessing the internet, more than twice the 201 million of September 1999, and more than 15 times the 26 million estimated to have been online in 1995 [9]. As impressive as such growth is, it implies that the internet still reaches fewer than 7% of the world's population. Moreover, it tends to reach the wealthiest and most educated of this population, for the internet, like earlier ICT, has spread unevenly. (It is said that half the inhabitants of our planet have never used a telephone and, more than five centuries after Gutenberg, illiteracy continues to block the access of many to both books and the internet.) There are more users of the internet in affluent Sweden than in the entire continent of Africa, more in Britain than in Latin America and the Caribbean. The number of unique documents on the world wide web, as of January 2000, is estimated at more than one billion, posted on 4.2 million unique servers, and additional documents are being posted at a rate of more than 20 million a month.

Not surprisingly, English is the language of preference on the web, for 86.55% of all pages are written in this language, and an additional 2.36% in French [10].

Governments for the most part have supported development of the internet, but would now like to regulate various aspects of it, much as they regulate other forms of communication. Some of the more radical internet thinkers, such as John Perry Barlow [11], argue that such efforts will fail because the internet is 'borderless and unregulatable' and 'too widespread to be easily dominated by any single government'. In an allusion to the origin of the internet as a network designed to withstand military attack, writers such as Barlow claim that the internet 'interprets censorship as damage and routes around it.'

These philosophers of cyberspace may yet be proven wrong. Governments are not helpless when it comes to regulation of the internet, and it is very possible that they will be more successful in this endeavour than they were in the past in regulating the printing of books, pamphlets and newspapers, and their distribution through the postal systems. In fact, the internet provides new tools for governments that are willing to use them, tools that can increase the cost of access to certain types of information and tools that make it difficult for citizens to hide their activities from government.

Government can raise the cost of access to sites on the internet that it regards as dangerous, subversive or immoral in at least three different ways. Software filters are one commonly used method. Filters are not perfect – sometimes material gets through that should be blocked, and innocent sites may be inadvertently blocked – but they do make it much more difficult to access selected sites. A second method is to require designated sites to track the 'IP address' of the internet service provider (ISP), and refuse access if the ISP is located in a specified country. This method can be used, for example, to block European access to neo-Nazi sites located in the USA, but it requires international co-operation. A third way to discourage visits to inappropriate sites is to facilitate peer pressure by allowing internet access only in libraries, cybercafes or other public places.

Technology to monitor the internet activities of citizens is evolving very rapidly. It is now possible to access computers remotely and obtain a record of sites visited and of electronic messages sent and received. Government agencies can also 'tap' the flow of information that is routed through an ISP. This is much more efficient than tapping a telephone or reading the ordinary ('snail') mail of a suspect, for programs exist that can quickly search a large number of digital documents

for useful information. In July of 2000 it became known that the FBI of the USA has been using such a surveillance system, which was code-named 'Carnivore', for some time now. Public revelation of this fact came about only because an ISP (EarthLink Inc.) objected to the placement of Carnivore on its server.

In statements prepared for Congress, the FBI [12] provides an excellent description of how Carnivore works:

Because many internet Service Providers lacked the ability to discriminate communications to identify a particular subject's messages to the exclusion of all others, the FBI designed and developed a diagnostic tool, called Carnivore. The Carnivore device provides the FBI with a 'surgical' ability to intercept and collect the communications which are the subject of the lawful order while ignoring those communications which they are not authorised to intercept.'

The FBI adds that misuse of the tool is avoided due to the existence of 'intense oversight from internal FBI controls, the US Department of Justice . . . , and by the Court.'

The government of USA no doubt has appropriate controls in place to protect the privacy of its citizens. This does not detract, though, from the fact that technology does exist that can intercept electronic communication on a scale unimaginable for communication with ordinary letters or by telephone. Each government must decide where to strike the balance between privacy and law enforcement. For government, the challenge of the internet is much the same as the challenges of earlier innovations in ICT, beginning with the printing press in the fifteenth century. Nonetheless, because of its very digitized nature, regulation and surveillance of the internet may well prove easier than regulation and surveillance of earlier forms of communication.

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