Internet Access, Control and Growth

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The Internet, or simply the Net, is the publicly available worldwide system of interconnected computer networks that transmit data by packet switching using a standardized Internet Protocol (IP) and many other protocols. It is made up of thousands of smaller commercial, academic, and government networks. It carries various information and services, such as electronic mail, online chat and the interlinked web pages and other documents of the World Wide Web. Because this is by far the largest, most extensive internet (with a small i) in the world, it is simply called the Internet (with a capital I).
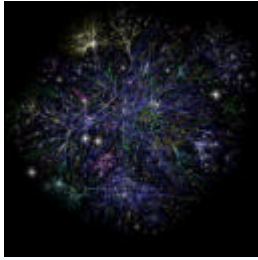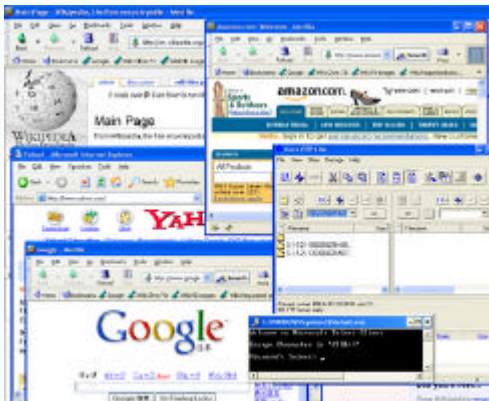

The Internet as mapped by The Opte Project (*http://opte.prolexic.com/*) on 15. January 2005

Growth of Internet

Creation of the Internet
Covered in the History of Internet <Refer Lecture 1>

Today's Internet

Different Internet applications, such as Web browsers, FTP, and Telnet apart from the incredibly complex physical connections that make up its infrastructure, the Internet is held together by bi- or multi-lateral commercial contracts (for example peering agreements) and by technical specifications or protocols that describe how to exchange data over the network.

Unlike older communications systems, the Internet protocol suite was deliberately designed to be agnostic with regard to the underlying physical medium. Any communications network, wired or wireless, that can carry two-way digital data can carry Internet traffic. Thus, Internet packets flow through wired networks like copper wire, coaxial cable, and fiber optic; and through wireless networks like Wi-Fi. Together, all these networks, sharing the same high-level protocols, form the Internet.

The Internet protocols originate from discussions within the Internet Engineering Task Force (IETF) and its working groups, which are open to public participation and review. These committees produce documents that are known as Request for Comments documents (RFCs). Some RFCs are raised to the status of Internet Standard by the Internet Architecture Board (IAB).

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Some of the most used protocols in the Internet protocol suite are IP, TCP, UDP, DNS, PPP, SLIP, ICMP, POP3, IMAP, SMTP, HTTP, HTTPS, SSH, Telnet, FTP, LDAP, SSL, and TLS.
There have been many analyses of the Internet and its structure. For example, it has been determined that the Internet IP routing structure and hypertext links of the World Wide Web are examples of scale-free networks.

Similar to how the commercial Internet providers connect via Internet exchange points, research networks tend to interconnect into large sub networks such as:
•GEANT
•Internet2
•Little GLORIAD
These in turn are built around relatively smaller networks. See also the list of academic computer network organizations

Internet Access

Remote access
The Internet allows computer users easily to connect to other computers and information stores wherever they may be across the world. They may do this with or without the use of security, authentication and encryption technologies, depending on the requirements.

This is encouraging new ways of home-working, collaboration and information sharing in many industries. An accountant sitting at home can audit the books of a company based in another country, on a server situated in a third country that is remotely maintained by IT specialists in a fourth. These accounts could have been created by home-working book-keepers, in other remote locations, based on information e-mailed to them from offices all over the world. Some of these things were possible before the widespread use of the Internet, but the cost of private, leased lines would have made many of them infeasible in practice.
An office worker away from his or her desk, perhaps the other side of the world on a business trip or a holiday, can open a remote desktop session into his or her normal office PC using a secure Virtual Private Network (VPN) connection via the Internet. This gives him or her completely normally access to all their normal files and data, including e-mail and other applications, while they are away.

File-sharing

A computer file can be e-mailed to customers, colleagues and friends as an attachment. It can be uploaded to a web site or FTP server for easy download by others. It can be put into a "shared location" or onto a file server for instant use by colleagues. The load of bulk downloads to many users can be eased by the use of "mirror" servers or peer-to-peer networking.

In any of these cases, access to the file may be controlled by user authentication; the transit of the file over the Internet may be obscured by encryption and money may change hands before or after access to the file is given. The price can be paid by the remote charging of funds from, for example a credit card whose details are also passed - hopefully fully encrypted - across the Internet. The origin and authenticity of the file received may be checked by digital signatures or by MD5 message digests.

These simple features of the Internet, over a world-wide basis, are changing the basis for the production, sale and distribution of many types of product, wherever they can be reduced to a computer file for transmission. This includes all manner of office documents, publications, software products, music, photography, video, animations, graphics and the other arts. This in turn is causing seismic shifts in each of the existing industries that previously controlled the production and distribution of these products. See RIAA - the Recording Industry Association of America has been particularly vocal about the problems this is causing them.

Streaming media and VoIP

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Many existing radio and television broadcasters have provided Internet 'feeds' of their live audio and video streams (for example, the BBC (http://www.bbc.co.uk)). They have been joined by a range of pure Internet 'broadcasters' who never had on-air licenses. This means that an Internet-connected device, such as a computer or something more specific, can be used to access on-line media in much the same way as was previously possible only with a TV or radio receiver. The range of material is much wider, from pornography to highly specialized technical web-casts. The simplest equipment can allow anybody, with little censorship or licensing control, to broadcast on a worldwide basis. Time-shift viewing or listening is not a problem as the BBC have shown with their Preview, Classic Clips and Listen Again features.

Web-cams can be seen as an even lower-budget extension of this phenomenon. In this case the picture may update only slowly - perhaps once every few seconds or slower, but Internet users can watch animals around an African waterhole, ships in the Panama Canal or the traffic at a local roundabout live and in real time. Some sex-workers commercially allow web-cam access into their bedrooms-cum-studios, with or without two-way sound, to those who want to pay on line.

VoIP stands for Voice over IP, where IP refers to the Internet Protocol that underlies all Internet communication. This phenomenon began as an optional two-way voice extension to some of the Instant Messaging systems that took off around the turn of the millenium. In recent years many people and organizations have been working hard to make VoIP systems as easy to use and as convenient as a normal telephone. The benefit is that, as the actual voice traffic is carried by the Internet, VoIP costs much less than an actual telephone call, especially over long distances and especially for those with always-on ADSL or DSL Internet connections anyway.

The disadvantages are that it is still difficult to initiate a call with someone, unless they are at their keyboard and expecting to hear from you, and that there are still a number of competing standards that are mitigating against universal acceptance.

In all of these cases, existing large organizations, that have grown accustomed to regular incomes for their services, are finding increased competition in their service areas, coming directly from the Internet. While newcomers strive to make these inroads, the traditional industries are having to adapt, adopt, complain or suffer. Meanwhile the consumer in each case most probably benefits from the increased range of services and possible price reductions. Some worry about the lack of censorship and control while others see a continuing globalization of culture and norms.

Impact of Internet

Internet culture

The Internet is also having a profound impact on work, knowledge and worldviews. In addition to the creation of electronic commerce and communication with clients by email and related means, the Internet is transforming other aspects of the workplace. Certain companies have adopted the use of blogs, which are largely used as online diaries, for promotional purposes. Since most people search the Web looking for information, these easily-updatable websites can be filled with advice on the company's area of specialization. The company's hope is that, when the visitor finds this free information, they will note the appearance of expert knowledge and may be drawn to the business' site as a result. An example of this practice is Microsoft, which has allowed its developers to publish their own personal blogs in order to pique the public's interest in their work.

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Graphic representation of the WWW, a service running over the Internet, as represented by hyperlinks
The World Wide Web

Through keyword-driven Internet research using search engines like Google, millions worldwide have easy, instant access to a vast and diverse amount of online information. Compared to encyclopedias and traditional libraries, the Internet has enabled a sudden and extreme decentralization of information and data.

Cultural awareness

From a cultural awareness perspective, the Internet has both an advantage and a liability. For people who are interested in other cultures and the worldviews of those cultures it provides a significant amount of information and an interactivity that would be unavailable otherwise. However, for people who are not interested in other cultures and worldviews there is some evidence indicating that the Internet enables them to avoid contact to a greater degree than ever before.

Current and potential problems

The Internet, along with its benefits, has a lot of negative publicity associated with it ranging from genuine concerns to tabloid scaremongering.

Child abuse
According to children's charities, the number of annual convictions for child pornography offences have increased by over 1000% since the Internet was first available to the public in the late 1980s. With the recent growth in Chat rooms and instant messaging services in the late 1990s, the potential for a new form of child abuse has emerged: so-called grooming. This involves a pedophile pretending to be a child in a chat room/instant message conversation, to gain the trust of a child before arranging to meet up.

Copyright infringement

Copyright infringement has also been the focus of much media attention, mainly through peer-to-peer file sharing software, but also through private members-only chat rooms, so-called warez sites (which openly offer illegal copies of software or the means to crack copy protection), or even the sale of counterfeit CDs, DVDs and software masquerading as legitimate product. Many ordinary Internet users are less concerned about the actual infringement itself but more about the effect on the Internet as a whole if tighter controls result from the infringement.

Viruses

In the 1980s and early 1990s, when very few people had access to the Internet, viruses were not a huge problem. They did exist and did cause just as much damage to computers as modern viruses can today, but there was no fast-moving epidemic because there was no means for a virus to directly infect other computers. Before the Internet, the only way for a computer to be infected was through use of a removable disc that was itself infected. As a result, virus infections were mercifully rare.

All that changed with the widespread growth of the Internet. With near-universal Internet access among computer users in developed countries, and the proliferation of high-speed broadband Internet connections, a virus on one person's computer can infect thousands of other computers. In fact, much of the disruption from virus outbreaks is caused not by the payload of the virus (e.g. deleting hard drive, shutting down computer every five minutes), but by the Internet congestion caused by the virus spreading itself.

Security cracking
When computers were stand alone machines (or at most connected to a company's internal network), to steal data from a system an intruder had to physically steal it. The Internet means that data from an insecure site could be stolen by someone working two blocks from the site, or just as easily from another country. Some of the recent high-profile examples of this were when a working version of the source code for Half Life 2 was copied from the developer's computer systems by security crackers and when portions of the

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Windows NT code base were copied from one of the companies that had access to it via the Microsoft Shared Source initiative. In both cases the Internet was used for dissemination of the leaked code, in particular using P2P networks.

Dated technology

Very few people outside the technical community are aware of the future problems posed by the Internet's archaic technology. It was originally designed for a small number of research institutions to share research data, and was never intended for the multi-billion user behemoth the modern Internet has become.

One serious problem is that the IP address (a unique number assigned to each Internet computer, functioning much like a street address in the real world) will run out eventually. Despite an estimated world population of over six billion, there are only a little over four billion different IP address combinations possible under the current system (see IPv4 address exhaustion for more information.) This also doesn't take into account the fact that there is not a 1:1 person to computer ratio in current computerized countries, where many people will have a desktop machine at home, a laptop machine for on the go, another desktop machine at work, and an e-mail mobile phone, all requiring their own IP address.

This could pose serious problems in the future as more and more nations expand their computer infrastructure (the vast majority of the world's population does not currently use the Internet, that's the so-called digital divide) and even now efforts are proceeding to find new ways of running the Internet. The new version of the Internet Protocol, IPv6, which expands the address space of the Internet, is one proposal for how to deal with some of the technical problems caused by the growth of the Internet.

Self-destructive subcultures

The neutrality of this section is disputed. Since the early 1990s, it has been widely recognized that the Internet enables broader distribution of all ideas, including those considered distasteful by any portion of the population. The most widely condemned of these ideas are those that promote, condone, or justify the infliction of violence upon innocent, non-consenting people. Examples include racism, sexism, and fascism.

Around 2000, The Atlantic Monthly and other publications revealed a similar but distinct issue: The Internet also allows people who exhibit or wish to practice abnormal behavior to find one another easily, due to anonymous search engines and online forums or services. As sparse subpopulations, it was often unlikely or difficult to find willing partners or like-minded individuals prior to the Internet.

A small number of these subcultures promote self-destructive or mutually destructive behavior. Websites and mailing lists exist that explicitly promote anorexia, apotemnophilia, necrophilia, and suicide. While these activities are easily recognized as abnormal and self-destructive by most adults, many people fear that children or mentally ill persons visiting such sites would lack the maturity necessary to make that discrimination.

In rare cases, people have used the Internet to find willing partners for abnormal activities, but with disastrous or fatal results. In one case, a German named Armin Meiwes (the "German cannibal") made an online arrangement with Bernd Jürgen Armando Brandes to kill and eat him. Meiwes was later convicted of manslaughter. (This is sensitive and a serious impact of internet).

Censorship

Some countries such as Iran and the People's Republic of China restrict what people in their countries can see on the internet. The BBC is proposing to offer its entire range of terrestrial television broadcasting as free downloads, but only to people within the UK. At the moment most internet content is available regardless of where one is in the world, so long as one has the means of connecting to it.

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Internet access

Internet public access point.

Common methods of home access include dial-up, which is the slowest, landline broadband (over coaxial cable, fiber optic or copper wires) and satellite.

Public places to use the Internet include libraries and Internet cafes, where computers with Internet connections are available. There are also Internet access points in public places like airport halls, sometimes just for brief use while standing. Various terms are used, such as "public Internet kiosk", "public access terminal", and "Web payphone".

Wi-Fi provides wireless access to computer networks, and therefore can do so to the Internet itself. Hotspots providing such access include Wifi-cafes, where a would-be user needs to bring their own wireless-enabled devices such as a notebook or PDA. These services may be free to all, free to customers only, or fee-based. A hotspot need not be limited to a confined location. Whole campuses and parks have been enabled, even an entire downtown area. Grassroots efforts have led to wireless community networks.

Apart from Wi-Fi, there have been experiments with proprietary mobile wireless networks like Ricochet, various high-speed data services over cellular or mobile phone networks, and fixed wireless services. These services have not enjoyed widespread success due to their high cost of deployment, which is passed on to users in high usage fees. New wireless technologies such as WiMAX have the potential to alleviate these concerns and enable simple and cost effective deployment of metropolitan area networks covering large, urban areas.

Broadband access over power lines was approved in 2004 in the United States in the face of stiff resistance from the amateur radio community. The problem with modulating a carrier signal over power lines is that an above-ground power line can act as a giant antenna and completely jam long-distance radio frequencies used by amateurs, seafarers and others.

Countries where Internet access is a commodity used by a majority of the population include Iceland, Sweden, Australia, Denmark, the United States, Canada, the UK, The Netherlands, Japan, Singapore, Taiwan, South Korea and Norway. The use of the Internet around the world has been growing rapidly over the last decade, although the growth rate seems to have slowed somewhat after 2000. The phase of rapid growth is ending in industrialized countries, as usage becomes ubiquitous there, but the spread continues in Africa, Latin America, the Caribbean and the Middle East.

However, Internet access is unequally split between low-speed and high-speed accesses. ADSL or other broadband access is rare or nonexistent in most developing countries; even in developed countries, high prices and average performances may limit its penetration (most countries in Eastern Europe, the United States), while low prices and high performances may attract a large number of consumers (Scandinavia, France). Even within the same country, wide differences may exist between larger cities (often having multiple providers of broadband access) and rural areas (where often no broadband access is available). The expansion of the availability of Internet access is a way to bridge the so-called digital divide.

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