5.3: Reading- The Internet

Introduction

The Internet is a global system of interconnected computer networks that use the standard Internet protocol suite (TCP/IP) to link several billion devices worldwide. It is a network of networks that consists of millions of private, public, academic, business, and government networks of local to global scope, linked by a broad array of electronic, wireless, and optical networking technologies.

The origins of the Internet date back to research commissioned by the United States government in the 1960s to build...
robust, fault-tolerant communication via computer networks. This work, combined with efforts in the United Kingdom and France, led to the primary precursor network, the ARPANET, in the United States. The interconnection of regional academic networks in the 1980s marks the beginning of the transition to the modern Internet. From the early 1990s, the network experienced sustained exponential growth as generations of institutional, personal, and mobile computers were connected to it.

The funding of a new U.S. backbone by the National Science Foundation in the 1980s, as well as private funding for other commercial backbones, led to worldwide participation in the development of new networking technologies, and the merger of many networks. Though the Internet has been widely used by academia since the 1980s, the commercialization of what was by the 1990s an international network resulted in its popularization and incorporation into virtually every aspect of modern human life. As of 2014, 38 percent of the world’s human population has used the services of the Internet within the past year—over 100 times more people than were using it in 1995. Internet use grew rapidly in the West from the mid-1990s to early 2000s and from the late 1990s to present in the developing world.

Contents

- 1 History
- 2 Function
  - 2.1 Linking
  - 2.2 Dynamic updates of web pages
  - 2.3 WWW prefix
  - 2.4 Scheme specifiers
- 3 Web security
- 4 Privacy
- 5 Standards
- 6 Accessibility
- 7 Internationalization
- 8 Statistics
- 9 Speed issues
- 10 Web caching

Most traditional communications media, including telephony and television, are being reshaped or redefined by the Internet, giving birth to new services such as voice over Internet Protocol (VoIP) and Internet Protocol television (IPTV). Newspaper, book, and other print publishing are adapting to website technology, or are reshaped into blogging and web feeds. The entertainment industry, including music, film, and gaming, was initially the fastest growing online segment. The Internet has enabled and accelerated new forms of human interactions through instant messaging, Internet forums, and social networking. Online shopping has grown exponentially both for major retailers and small artisans and traders. Business-to-business and financial services on the Internet affect supply chains across entire industries.

The Internet has no centralized governance in either technological implementation or policies for access and usage; each constituent network sets its own policies. Only the overreaching definitions of the two principal name spaces in the
Internet, the Internet Protocol address space and the Domain Name System (DNS), are directed by a maintainer organization, the Internet Corporation for Assigned Names and Numbers (ICANN). The technical underpinning and standardization of the core protocols is an activity of the Internet Engineering Task Force (IETF), a non-profit organization of loosely affiliated international participants that anyone may associate with by contributing technical expertise.

---

**Terminology**

The *Internet*, referring to the specific global system of interconnected IP networks, is a proper noun and may be written with an initial capital letter. In the media and common use it is often not capitalized, viz. *the internet*. Some guides specify that the word should be capitalized when used as a noun, but not capitalized when used as an adjective. The Internet is also often referred to as *the Net*.

Historically the word *internetted* was used, uncapitalized, as early as 1849 as an adjective meaning "Interconnected; interwoven". The designers of early computer networks used *internet* both as a noun and as a verb in shorthand form of internetwork or internetworking, meaning interconnecting computer networks.

The terms *Internet* and *World Wide Web* are often used interchangeably in everyday speech; it is common to speak of "going on the Internet" when invoking a web browser to view web pages. However, the World Wide Web or *the Web* is only one of a large number of Internet services. The Web is a collection of interconnected documents (web pages) and other web resources, linked by hyperlinks and URLs. As another point of comparison, Hypertext Transfer Protocol, or HTTP, is the language used on the Web for information transfer, yet it is just one of many languages or protocols that can be used for communication on the Internet.

The term *Interweb* is a portmanteau of *Internet* and *World Wide Web* typically used sarcastically to parody a technically unsavvy user.

---

**History**

Text from the very first message ever sent via the ARPANET.

Research into packet switching started in the early 1960s and packet switched networks such as Mark I at NPL in the UK, ARPANET, CYCLADES, Merit Network, Tymnet, and Telenet, were developed in the late 1960s and early 1970s using a variety of protocols. The ARPANET in particular led to the development of protocols for internet working, where multiple separate networks could be joined together into a network of networks.
The first two nodes of what would become the ARPANET were interconnected between Leonard Kleinrock’s Network Measurement Center at the UCLA’s School of Engineering and Applied Science and Douglas Engelbart’s NLS system at SRI International (SRI) in Menlo Park, California, on 29 October 1969. The third site on the ARPANET was the Culler-Fried Interactive Mathematics center at the University of California at Santa Barbara, and the fourth was the University of Utah Graphics Department. In an early sign of future growth, there were already fifteen sites connected to the young ARPANET by the end of 1971. These early years were documented in the 1972 film Computer Networks: The Heralds of Resource Sharing.

Early international collaborations on the ARPANET were rare. European developers were concerned with developing the X.25 networks. Notable exceptions were the Norwegian Seismic Array (NORSAR) in June 1973, followed in 1973 by Sweden with satellite links to the Tanum Earth Station and Peter T. Kirstein’s research group in the UK, initially at the Institute of Computer Science, University of London and later at University College London.

In December 1974, RFC 675 – Specification of Internet Transmission Control Program, by Vinton Cerf, Yogen Dalal, and Carl Sunshine, used the term internet as a shorthand for internet working and later RFCs repeat this use. Access to the ARPANET was expanded in 1981 when the National Science Foundation (NSF) developed the Computer Science Network (CSNET). In 1982, the Internet Protocol Suite (TCP/IP) was standardized and the concept of a world-wide network of fully interconnected TCP/IP networks called the Internet was introduced.

TCP/IP network access expanded again in 1986 when the National Science Foundation Network (NSFNET) provided access to supercomputer sites in the United States from research and education organizations, first at 56 kbit/s and later at 1.5 Mbit/s and 45 Mbit/s. Commercial Internet service providers (ISPs) began to emerge in the late 1980s and early 1990s. The ARPANET was decommissioned in 1990. The Internet was fully commercialized in the U.S. by 1995 when NSFNET was decommissioned, removing the last restrictions on the use of the Internet to carry commercial traffic. The Internet started a rapid expansion to Europe and Australia in the mid to late 1980s and to Asia in the late 1980s and early 1990s.

Since the mid-1990s the Internet has had a tremendous impact on culture and commerce, including the rise of near instant communication by email, instant messaging, Voice over Internet Protocol (VoIP) “phone calls”, two-way interactive video calls, and the World Wide Web with its discussion forums, blogs, social networking, and online shopping sites. Increasing amounts of data are transmitted at higher and higher speeds over fiber optic networks operating at 1-Gbit/s, 10-Gbit/s, or more.
The Internet continues to grow, driven by ever greater amounts of online information and knowledge, commerce, entertainment and social networking. During the late 1990s, it was estimated that traffic on the public Internet grew by 100 percent per year, while the mean annual growth in the number of Internet users was thought to be between 20% and 50%. This growth is often attributed to the lack of central administration, which allows organic growth of the network, as well as the non-proprietary open nature of the Internet protocols, which encourages vendor interoperability and prevents any one company from exerting too much control over the network. As of 31 March 2011, the estimated total number of Internet users was 2.095 billion (30.2% of world population). It is estimated that in 1993 the Internet carried only 1% of the information flowing through two-way telecommunication, by 2000 this figure had grown to 51%, and by 2007 more than 97% of all telecommunicated information was carried over the Internet.

**Governance**

The Internet is a globally distributed network comprising many voluntarily interconnected autonomous networks. It operates without a central governing body.

The technical underpinning and standardization of the core protocols (IPv4 and IPv6) is an activity of the Internet.

---

**Worldwide Internet users**

<table>
<thead>
<tr>
<th></th>
<th>2005</th>
<th>2010</th>
<th>2014&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>World population</td>
<td>6.5 billion</td>
<td>6.9 billion</td>
<td>7.2 billion</td>
</tr>
<tr>
<td>Not using the Internet</td>
<td>84%</td>
<td>70%</td>
<td>60%</td>
</tr>
<tr>
<td>Using the Internet</td>
<td>16%</td>
<td>30%</td>
<td>40%</td>
</tr>
<tr>
<td>Users in the developing world</td>
<td>8%</td>
<td>21%</td>
<td>32%</td>
</tr>
<tr>
<td>Users in the developed world</td>
<td>51%</td>
<td>67%</td>
<td>78%</td>
</tr>
</tbody>
</table>

<sup>a</sup>Estimate. Source: International Telecommunications Union.
Engineering Task Force (IETF), a non-profit organization of loosely affiliated international participants that anyone may associate with by contributing technical expertise.

To maintain interoperability, the principal name spaces of the Internet are administered by the Internet Corporation for Assigned Names and Numbers (ICANN), headquartered in the neighborhood of Playa Vista in the city of Los Angeles, California. ICANN is the authority that coordinates the assignment of unique identifiers for use on the Internet, including domain names, Internet Protocol (IP) addresses, application port numbers in the transport protocols, and many other parameters. Globally unified name spaces, in which names and numbers are uniquely assigned, are essential for maintaining the global reach of the Internet. ICANN is governed by an international board of directors drawn from across the Internet technical, business, academic, and other non-commercial communities. ICANN’s role in coordinating the assignment of unique identifiers distinguishes it as perhaps the only central coordinating body for the global Internet.

Regional Internet Registries (RIRs) allocate IP addresses:

- African Network Information Center (AfriNIC) for Africa
- American Registry for Internet Numbers (ARIN) for North America
- Asia-Pacific Network Information Centre (APNIC) for Asia and the Pacific region
- Latin American and Caribbean Internet Addresses Registry (LACNIC) for Latin America and the Caribbean region
- Réseaux IP Européens – Network Coordination Centre (RIPE NCC) for Europe, the Middle East, and Central Asia

The National Telecommunications and Information Administration, an agency of the United States Department of Commerce, continues to have final approval over changes to the DNS root zone.

The Internet Society (ISOC) was founded in 1992 with a mission to “assure the open development, evolution and use of the Internet for the benefit of all people throughout the world”. Its members include individuals (anyone may join) as well as corporations, organizations, governments, and universities. Among other activities ISOC provides an administrative home for a number of less formally organized groups that are involved in developing and managing the Internet, including: the Internet Engineering Task Force (IETF), Internet Architecture Board (IAB), Internet Engineering Steering Group (IESG), Internet Research Task Force (IRTF), and Internet Research Steering Group (IRSG).

On 16 November 2005, the United Nations-sponsored World Summit on the Information Society, held in Tunis, established the Internet Governance Forum (IGF) to discuss Internet-related issues.

Infrastructure

The communications infrastructure of the Internet consists of its hardware components and a system of software layers that control various aspects of the architecture.
Routing and service tiers

Packet routing across the Internet involves several tiers of Internet service providers.

Internet service providers establish the world-wide connectivity between individual networks at various levels of scope. End-users who only access the Internet when needed to perform a function or obtain information, represent the bottom of the routing hierarchy. At the top of the routing hierarchy are the tier 1 networks, large telecommunication companies that exchange traffic directly with each other via peering agreements. Tier 2 and lower level networks buy Internet transit from other providers to reach at least some parties on the global Internet, though they may also engage in peering. An ISP may use a single upstream provider for connectivity, or implement multihoming to achieve redundancy and load balancing. Internet exchange points are major traffic exchanges with physical connections to multiple ISPs.

Large organizations, such as academic institutions, large enterprises, and governments, may perform the same function as ISPs, engaging in peering and purchasing transit on behalf of their internal networks. Research networks tend to interconnect with large subnetworks such as GEANT, GLORIAD, Internet2, and the UK's national research and education network, JANET.

It has been determined that both the Internet IP routing structure and hypertext links of the World Wide Web are examples of scale-free networks.

Computers and routers use routing tables in their operating system to direct IP packets to the next-hop router or destination. Routing tables are maintained by manual configuration or automatically by routing protocols. End-nodes typically use a default route that points toward an ISP providing transit, while ISP routers use the Border Gateway Protocol to establish the most efficient routing across the complex connections of the global Internet.

Access

Common methods of Internet access by users include dial-up with a computer modem via telephone circuits, broadband over coaxial cable, fiber optic or copper wires, Wi-Fi, satellite and cellular telephone technology (3G, 4G). The Internet may often be accessed from computers in libraries and Internet cafes. Internet access points exist in many public places such as airport halls and coffee shops. Various terms are used, such as public Internet kiosk, public access terminal, and Web payphone. Many hotels also have public terminals, though these are usually fee-based. These terminals are widely accessed for various usage, such as ticket booking, bank deposit, or online payment. Wi-Fi provides wireless access to the Internet via local computer networks. Hotspots providing such access include Wi-Fi cafes, where users need to bring their own wireless-enabled devices such as a laptop or PDA. These services may be free to all, free to
Grassroots efforts have led to wireless community networks. Commercial Wi-Fi services covering large city areas are in place in London, Vienna, Toronto, San Francisco, Philadelphia, Chicago and Pittsburgh. The Internet can then be accessed from such places as a park bench. Apart from Wi-Fi, there have been experiments with proprietary mobile wireless networks like Ricochet, various high-speed data services over cellular phone networks, and fixed wireless services. High-end mobile phones such as smartphones in general come with Internet access through the phone network. Web browsers such as Opera are available on these advanced handsets, which can also run a wide variety of other Internet software. More mobile phones have Internet access than PCs, though this is not as widely used. An Internet access provider and protocol matrix differentiates the methods used to get online.

Protocols

While the hardware components in the Internet infrastructure can often be used to support other software systems, it is the design and the standardization process of the software that characterizes the Internet and provides the foundation for its scalability and success. The responsibility for the architectural design of the Internet software systems has been assumed by the Internet Engineering Task Force (IETF). The IETF conducts standard-setting work groups, open to any individual, about the various aspects of Internet architecture. Resulting contributions and standards are published as Request for Comments (RFC) documents on the IETF web site.

The principal methods of networking that enable the Internet are contained in specially designated RFCs that constitute the Internet Standards. Other less rigorous documents are simply informative, experimental, or historical, or document the best current practices (BCP) when implementing Internet technologies.

The Internet standards describe a framework known as the Internet protocol suite. This is a model architecture that divides methods into a layered system of protocols, originally documented in RFC 1122 and RFC 1123. The layers correspond to the environment or scope in which their services operate. At the top is the application layer, the space for the application-specific networking methods used in software applications. For example, a web browser program uses the client-server application model and a specific protocol of interaction between servers and clients, while many file-sharing systems use a peer-to-peer paradigm. Below this top layer, the transport layer connects applications on different hosts with a logical channel through the network with appropriate data exchange methods.

Underlying these layers are the networking technologies that interconnect networks at their borders and hosts via the physical connections. The internet layer enables computers to identify and locate each other via Internet Protocol (IP) addresses, and routes their traffic via intermediate (transit) networks. Last, at the bottom of the architecture is the link layer, which provides connectivity between hosts on the same network link, such as a physical connection in form of a local area network (LAN) or a dial-up connection. The model, also known as TCP/IP, is designed to be independent of the underlying hardware, which the model therefore does not concern itself with in any detail. Other models have been developed, such as the OSI model, that attempt to be comprehensive in every aspect of communications. While many similarities exist between the models, they are not compatible in the details of description or implementation; indeed, TCP/IP protocols are usually included in the discussion of OSI networking.
As user data is processed through the protocol stack, each abstraction layer adds encapsulation information at the sending host. Data is transmitted over the wire at the link level between hosts and routers. Encapsulation is removed by the receiving host. Intermediate relays update link encapsulation at each hop, and inspect the IP layer for routing purposes.

The most prominent component of the Internet model is the Internet Protocol (IP), which provides addressing systems (IP addresses) for computers on the Internet. IP enables internet working and in essence establishes the Internet itself. Internet Protocol Version 4 (IPv4) is the initial version used on the first generation of the Internet and is still in dominant use. It was designed to address up to ~4.3 billion ($10^9$) Internet hosts. However, the explosive growth of the Internet has led to IPv4 address exhaustion, which entered its final stage in 2011, when the global address allocation pool was exhausted. A new protocol version, IPv6, was developed in the mid-1990s, which provides vastly larger addressing capabilities and more efficient routing of Internet traffic. IPv6 is currently in growing deployment around the world, since Internet address registries (RIRs) began to urge all resource managers to plan rapid adoption and conversion.

IPv6 is not directly interoperable by design with IPv4. In essence, it establishes a parallel version of the Internet not directly accessible with IPv4 software. This means software upgrades or translator facilities are necessary for networking devices that need to communicate on both networks. Essentially all modern computer operating systems support both versions of the Internet Protocol. Network infrastructure, however, is still lagging in this development. Aside from the complex array of physical connections that make up its infrastructure, the Internet is facilitated by bi- or multi-lateral commercial contracts, e.g., peering agreements, and by technical specifications or protocols that describe how to exchange data over the network. Indeed, the Internet is defined by its interconnections and routing policies.

**Services**

The Internet carries many network services, most prominently the World Wide Web, electronic mail, Internet telephony, and File sharing services.
World Wide Web

This NeXT Computer was used by Tim Berners-Lee at CERN and became the world's first Web server.

Many people use the terms Internet and World Wide Web, or just the Web, interchangeably, but the two terms are not synonymous. The World Wide Web is only one of hundreds of services used on the Internet. The Web is a global set of documents, images and other resources, logically interrelated by hyperlinks and referenced with Uniform Resource Identifiers (URIs). URIs symbolically identify services, servers, and other databases, and the documents and resources that they can provide. Hypertext Transfer Protocol (HTTP) is the main access protocol of the World Wide Web. Web services also use HTTP to allow software systems to communicate in order to share and exchange business logic and data.

World Wide Web browser software, such as Microsoft’s Internet Explorer, Mozilla Firefox, Opera, Apple’s Safari, and Google Chrome, lets users navigate from one web page to another via hyperlinks embedded in the documents. These documents may also contain any combination of computer data, including graphics, sounds, text, video, multimedia and interactive content that runs while the user is interacting with the page. Client-side software can include animations, games, office applications and scientific demonstrations. Through keyword-driven Internet research using search engines like Yahoo! and Google, users worldwide have easy, instant access to a vast and diverse amount of online information. Compared to printed media, books, encyclopedias and traditional libraries, the World Wide Web has enabled the decentralization of information on a large scale.

The Web has also enabled individuals and organizations to publish ideas and information to a potentially large audience online at greatly reduced expense and time delay. Publishing a web page, a blog, or building a website involves little initial cost and many cost-free services are available. However, publishing and maintaining large, professional web sites with attractive, diverse and up-to-date information is still a difficult and expensive proposition. Many individuals and some companies and groups use web logs or blogs, which are largely used as easily updatable online diaries. Some commercial organizations encourage staff to communicate advice in their areas of specialization in the hope that visitors will be impressed by the expert knowledge and free information, and be attracted to the corporation as a result.

One example of this practice is Microsoft, whose product developers publish their personal blogs in order to pique the public’s interest in their work. Collections of personal web pages published by large service providers remain popular, and have become increasingly sophisticated. Whereas operations such as Angelfire and GeoCities have existed since the early days of the Web, newer offerings from, for example, Facebook and Twitter currently have large followings.
These operations often brand themselves as social network services rather than simply as web page hosts.

Advertising on popular web pages can be lucrative, and e-commerce or the sale of products and services directly via the Web continues to grow.

When the Web developed in the 1990s, a typical web page was stored in completed form on a web server, formatted in HTML, complete for transmission to a web browser in response to a request. Over time, the process of creating and serving web pages has become dynamic, creating flexible design, layout, and content. Websites are often created using content management software with, initially, very little content. Contributors to these systems, who may be paid staff, members of an organization or the public, fill underlying databases with content using editing pages designed for that purpose, while casual visitors view and read this content in HTML form. There may or may not be editorial, approval and security systems built into the process of taking newly entered content and making it available to the target visitors.

**Communication**

Email is an important communications service available on the Internet. The concept of sending electronic text messages between parties in a way analogous to mailing letters or memos predates the creation of the Internet. Pictures, documents and other files are sent as email attachments. Emails can be cc-ed to multiple email addresses.

Internet telephony is another common communications service made possible by the creation of the Internet. VoIP stands for Voice-over-Internet Protocol, referring to the protocol that underlies all Internet communication. The idea began in the early 1990s with walkie-talkie-like voice applications for personal computers. In recent years many VoIP systems have become as easy to use and as convenient as a normal telephone. The benefit is that, as the Internet carries the voice traffic, VoIP can be free or cost much less than a traditional telephone call, especially over long distances and especially for those with always-on Internet connections such as cable or ADSL. VoIP is maturing into a competitive alternative to traditional telephone service. Interoperability between different providers has improved and the ability to call or receive a call from a traditional telephone is available. Simple, inexpensive VoIP network adapters are available that eliminate the need for a personal computer.

Voice quality can still vary from call to call, but is often equal to and can even exceed that of traditional calls. Remaining problems for VoIP include emergency telephone number dialing and reliability. Currently, a few VoIP providers provide an emergency service, but it is not universally available. Older traditional phones with no “extra features” may be line-powered only and operate during a power failure; VoIP can never do so without a backup power source for the phone equipment and the Internet access devices. VoIP has also become increasingly popular for gaming applications, as a form of communication between players. Popular VoIP clients for gaming include Ventrilo and Teamspeak. Modern video game consoles also offer VoIP chat features.

**Data transfer**

File sharing is an example of transferring large amounts of data across the Internet. A computer file can be emailed to customers, colleagues and friends as an attachment. It can be uploaded to a website 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 networks. 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 for access to the file. The price can be paid by the remote charging of funds from, for example, a credit card whose details are also passed – usually fully encrypted – across the Internet. The origin and authenticity of the file received may be checked by digital signatures or by MD5 or other message digests. These simple features of the Internet, over a worldwide basis, are changing the production, sale, and distribution of anything that can be reduced to a computer file for transmission. This includes all manner of print publications, software products, news, music, film, video, photography, graphics and the other arts. This in turn has caused seismic shifts in each of the existing industries that previously controlled the production and distribution of these products.

Streaming media is the real-time delivery of digital media for the immediate consumption or enjoyment by end users. Many radio and television broadcasters provide Internet feeds of their live audio and video productions. They may also allow time-shift viewing or listening such as Preview, Classic Clips and Listen Again features. These providers 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 television or radio receiver. The range of available types of content is much wider, from specialized technical webcasts to on-demand popular multimedia services. Podcasting is a variation on this theme, where – usually audio – material is downloaded and played back on a computer or shifted to a portable media player to be listened to on the move. These techniques using simple equipment allow anybody, with little censorship or licensing control, to broadcast audio-visual material worldwide.

Digital media streaming increases the demand for network bandwidth. For example, standard image quality needs 1 Mbit/s link speed for SD 480p, HD 720p quality requires 2.5 Mbit/s, and the top-of-the-line HDX quality needs 4.5 Mbit/s for 1080p.

Webcams are a low-cost extension of this phenomenon. While some webcams can give full-frame-rate video, the picture either is usually small or updates slowly. Internet users can watch animals around an African waterhole, ships in the Panama Canal, traffic at a local roundabout or monitor their own premises, live and in real time. Video chat rooms and video conferencing are also popular with many uses being found for personal webcams, with and without two-way sound. YouTube was founded on 15 February 2005 and is now the leading website for free streaming video with a vast number of users. It uses a flash-based web player to stream and show video files. Registered users may upload an unlimited amount of video and build their own personal profile. YouTube claims that its users watch hundreds of millions, and upload hundreds of thousands of videos daily. Currently, YouTube also uses an HTML5 player.

Social impact

The Internet has enabled new forms of social interaction, activities, and social associations.
Overall Internet usage has seen tremendous growth. From 2000 to 2009, the number of Internet users globally rose.
from 394 million to 1.858 billion. By 2010, 22 percent of the world’s population had access to computers with 1 billion Google searches every day, 300 million Internet users reading blogs, and 2 billion videos viewed daily on YouTube. In 2014 the world’s Internet users surpassed 3 billion or 43.6 percent of world population, but two-thirds of the users came from richest countries, with 78.0 percent of Europe countries population using the Internet, followed by 57.4 percent of the Americas.

The prevalent language for communication on the Internet has been English. This may be a result of the origin of the Internet, as well as the language’s role as a lingua franca. Early computer systems were limited to the characters in the American Standard Code for Information Interchange (ASCII), a subset of the Latin alphabet.

After English (27%), the most requested languages on the World Wide Web are Chinese (25%), Spanish (8%), Japanese (5%), Portuguese and German (4% each), Arabic, French and Russian (3% each), and Korean (2%). By region, 42% of the world’s Internet users are based in Asia, 24% in Europe, 14% in North America, 10% in Latin America and the Caribbean taken together, 6% in Africa, 3% in the Middle East and 1% in Australia/Oceania. The Internet’s technologies have developed enough in recent years, especially in the use of Unicode, that good facilities are available for development and communication in the world’s widely used languages. However, some glitches such as mojibake (incorrect display of some languages’ characters) still remain.

In an American study in 2005, the percentage of men using the Internet was very slightly ahead of the percentage of women, although this difference reversed in those under 30. Men logged on more often, spent more time online, and were more likely to be broadband users, whereas women tended to make more use of opportunities to communicate (such as email). Men were more likely to use the Internet to pay bills, participate in auctions, and for recreation such as downloading music and videos. Men and women were equally likely to use the Internet for shopping and banking. More recent studies indicate that in 2008, women significantly outnumbered men on most social networking sites, such as Facebook and Myspace, although the ratios varied with age. In addition, women watched more streaming content, whereas men downloaded more. In terms of blogs, men were more likely to blog in the first place; among those who blog, men were more likely to have a professional blog, whereas women were more likely to have a personal blog.

According to forecasts by Euromonitor International, 44% of the world’s population will be users of the Internet by 2020. Splitting by country, in 2012 Iceland, Norway, Sweden, the Netherlands, and Denmark had the highest Internet penetration by the number of users, with 93% or more of the population with access.

Several neologisms exist that refer to Internet users: Netizen (as in as in “citizen of the net”) refers to those actively involved in improving online communities, the Internet in general or surrounding political affairs and rights such as free speech, Internaut refers to operators or technically highly capable users of the Internet, digital citizen refers to a person using the Internet in order to engage in society, politics, and government participation.

**Usage**

The Internet allows greater flexibility in working hours and location, especially with the spread of unmetered high-speed connections. The Internet can be accessed almost anywhere by numerous means, including through mobile Internet devices. Mobile phones, data cards, handheld game consoles and cellular routers allow users to connect to the Internet wirelessly. Within the limitations imposed by small screens and other limited facilities of such pocket-sized devices, the
services of the Internet, including email and the web, may be available. Service providers may restrict the services offered and mobile data charges may be significantly higher than other access methods.

Educational material at all levels from pre-school to post-doctoral is available from websites. Examples range from CBeebies, through school and high-school revision guides and virtual universities, to access to top-end scholarly literature through the likes of Google Scholar. For distance education, help with homework and other assignments, self-guided learning, whiling away spare time, or just looking up more detail on an interesting fact, it has never been easier for people to access educational information at any level from anywhere. The Internet in general and the World Wide Web in particular are important enablers of both formal and informal education. Further, the Internet allows universities, in particular researchers from the social and behavioral sciences, to conduct research remotely via virtual laboratories, with profound changes in reach and generalizability of findings as well as in communication between scientists and in the publication of results.

The low cost and nearly instantaneous sharing of ideas, knowledge, and skills has made collaborative work dramatically easier, with the help of collaborative software. Not only can a group cheaply communicate and share ideas but the wide reach of the Internet allows such groups more easily to form. An example of this is the free software movement, which has produced, among other things, Linux, Mozilla Firefox, and OpenOffice.org. Internet chat, whether using an IRC chat room, an instant messaging system, or a social networking website, allows colleagues to stay in touch in a very convenient way while working at their computers during the day. Messages can be exchanged even more quickly and conveniently than via email. These systems may allow files to be exchanged, drawings and images to be shared, or voice and video contact between team members.

Content management systems allow collaborating teams to work on shared sets of documents simultaneously without accidentally destroying each other’s work. Business and project teams can share calendars as well as documents and other information. Such collaboration occurs in a wide variety of areas including scientific research, software development, conference planning, political activism and creative writing. Social and political collaboration is also becoming more widespread as both Internet access and computer literacy spread.

The Internet allows computer users to remotely access other computers and information stores easily, wherever they may be. They may do this with or without computer security, i.e. authentication and encryption technologies, depending on the requirements. This is encouraging new ways of working from home, 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 bookkeepers, in other remote locations, based on information emailed 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 their desk, perhaps on the other side of the world on a business trip or a holiday, can access their emails, access their data using cloud computing, or open a remote desktop session into their office PC using a secure Virtual Private Network (VPN) connection on the Internet. This can give the worker complete access to all of their normal files and data, including email and other applications, while away from the office. It has been referred to among system administrators as the Virtual Private Nightmare, because it extends the secure perimeter of a corporate network into remote locations and its employees’ homes.
Social networking and entertainment

Many people use the World Wide Web to access news, weather and sports reports, to plan and book vacations and to pursue their personal interests. People use chat, messaging and email to make and stay in touch with friends worldwide, sometimes in the same way as some previously had pen pals.

Social networking websites such as Facebook, Twitter, and Myspace have created new ways to socialize and interact. Users of these sites are able to add a wide variety of information to pages, to pursue common interests, and to connect with others. It is also possible to find existing acquaintances, to allow communication among existing groups of people. Sites like LinkedIn foster commercial and business connections. YouTube and Flickr specialize in users' videos and photographs.

While social networking sites were initially for individuals only, today they are widely used by businesses and other organizations to promote their brands, to market to their customers and to encourage posts to "go viral". "Black hat" social media techniques are also employed by some organizations, such as spam accounts and astroturfing.

A risk for both individuals and organizations writing posts (especially public posts) on social networking websites, is that especially foolish or controversial posts occasionally lead to an unexpected and possibly large-scale backlash on social media from other internet users. This is also a risk in relation to controversial offline behavior, if it is widely made known. The nature of this backlash can range widely from counter-arguments and public mockery, through insults and hate speech, to, in extreme cases, rape and death threats. The online disinhibition effect describes the tendency of many individuals to behave more stridently or offensively online than they would in person. A significant number of feminist women have been the target of various forms of harassment in response to posts they have made on social media, and Twitter in particular has been criticised in the past for not doing enough to aid victims of online abuse.

For organizations, such a backlash can cause overall brand damage, especially if reported by the media. However, this is not always the case, as any brand damage in the eyes of people with an opposing opinion to that presented by the organization could sometimes be outweighed by strengthening the brand in the eyes of others. Furthermore, if an organization or individual gives in to demands that others perceive as wrong-headed, that can then provoke a counter-backlash.

Some websites, such as Reddit, have rules forbidding the posting of personal information of individuals (also known as doxxing), due to concerns about such postings leading to mobs of large numbers of Internet users directing harassment at the specific individuals thereby identified. In particular, the Reddit rule forbidding the posting of personal information is widely understood to imply that all identifying photos and names must be censored in Facebook screenshots posted to Reddit. However, the interpretation of this rule in relation to public Twitter posts is less clear, and in any case like-minded people online have many other ways they can use to direct each other's attention to public social media posts they disagree with.

Children also face dangers online such as cyberbullying and approaches by sexual predators, who sometimes pose as children themselves. Children may also encounter material which they may find upsetting, or material which their parents consider to be not age-appropriate. Due to naivety, they may also post personal information about themselves online, which could put them or their families at risk, unless warned not to do so. Many parents choose to enable internet filtering, and/or supervise their children's online activities, in an attempt to protect their children from inappropriate
material on the internet. The most popular social networking websites, such as Facebook and Twitter, commonly forbid users under the age of 13. However, these policies are typically trivial to circumvent by registering an account with a false birth date, and a significant number of children aged under 13 join such sites anyway. Social networking sites for younger children, which claim to provide better levels of protection for children, also exist.

The Internet has been a major outlet for leisure activity since its inception, with entertaining social experiments such as MUDs and MOOs being conducted on university servers, and humor-related Usenet groups receiving much traffic. Today, many Internet forums have sections devoted to games and funny videos. Over 6 million people use blogs or message boards as a means of communication and for the sharing of ideas. The Internet pornography and online gambling industries have taken advantage of the World Wide Web, and often provide a significant source of advertising revenue for other websites. Although many governments have attempted to restrict both industries' use of the Internet, in general this has failed to stop their widespread popularity.

Another area of leisure activity on the Internet is multiplayer gaming. This form of recreation creates communities, where people of all ages and origins enjoy the fast-paced world of multiplayer games. These range from MMORPG to first-person shooters, from role-playing video games to online gambling. While online gaming has been around since the 1970s, modern modes of online gaming began with subscription services such as GameSpy and MPlayer. Non-subscribers were limited to certain types of game play or certain games. Many people use the Internet to access and download music, movies and other works for their enjoyment and relaxation. Free and fee-based services exist for all of these activities, using centralized servers and distributed peer-to-peer technologies. Some of these sources exercise more care with respect to the original artists' copyrights than others.

Internet usage has been correlated to users' loneliness. Lonely people tend to use the Internet as an outlet for their feelings and to share their stories with others, such as in the "I am lonely will anyone speak to me" thread.

Cybersectarianism is a new organizational form which involves: "highly dispersed small groups of practitioners that may remain largely anonymous within the larger social context and operate in relative secrecy, while still linked remotely to a larger network of believers who share a set of practices and texts, and often a common devotion to a particular leader. Overseas supporters provide funding and support; domestic practitioners distribute tracts, participate in acts of resistance, and share information on the internal situation with outsiders. Collectively, members and practitioners of such sects construct viable virtual communities of faith, exchanging personal testimonies and engaging in collective study via email, on-line chat rooms and web-based message boards." In particular, the British government has raised
concerns about the prospect of young British Muslims being indoctrinated into Islamic extremism by material on the Internet, being persuaded to join terrorist groups such as the so-called “Islamic State”, and then potentially committing acts of terrorism on returning to Britain after fighting in Syria or Iraq.

Cyberslacking can become a drain on corporate resources; the average UK employee spent 57 minutes a day surfing the Web while at work, according to a 2003 study by Peninsula Business Services. Internet addiction disorder is excessive computer use that interferes with daily life. Psychologist Nicolas Carr believe that Internet use has other effects on individuals, for instance improving skills of scan-reading and interfering with the deep thinking that leads to true creativity.

Electronic business

Electronic business (e-business) encompasses business processes spanning the entire value chain: purchasing, supply chain management, marketing, sales, customer service, and business relationship. E-commerce seeks to add revenue streams using the Internet to build and enhance relationships with clients and partners.

According to International Data Corporation, the size of worldwide e-commerce, when global business-to-business and -consumer transactions are combined, equate to $16 trillion for 2013. A report by Oxford Economics adds those two together to estimate the total size of the digital economy at $20.4 trillion, equivalent to roughly 13.8% of global sales.

Drawbacks

While much has been written of the economic advantages of Internet-enabled commerce, there is also evidence that some aspects of the Internet such as maps and location-aware services may serve to reinforce economic inequality and the digital divide. Electronic commerce may be responsible for consolidation and the decline of mom-and-pop, brick and mortar businesses resulting in increases in income inequality.

Author Andrew Keen, a long-time critic of the social transformations caused by the Internet, has recently focused on the economic effects of consolidation from Internet businesses. Keen cites a 2013 Institute for Local Self-Reliance report saying brick-and-mortar retailers employ 47 people for every $10 million in sales, while Amazon employs only 14. Similarly, the 700-employee room rental start-up Airbnb was valued at $10 billion in 2014, about half as much as Hilton Hotels, which employs 152,000 people. And car-sharing Internet startup Uber employs 1,000 full-time employees and is valued at $18.2 billion, about the same valuation as Avis and Hertz combined, which together employ almost 60,000 people.

Telecommuting

Remote work is facilitated by tools such as groupware, virtual private networks, conference calling, videoconferencing, and Voice over IP (VOIP). It can be efficient and useful for companies as it allows workers to communicate over long distances, saving significant amounts of travel time and cost. As broadband Internet connections become more commonplace, more and more workers have adequate bandwidth at home to use these tools to link their home to their corporate intranet and internal phone networks.
Crowdsourcing

Internet provides a particularly good venue for crowdsourcing (outsourcing tasks to a distributed group of people) since individuals tend to be more open in web-based projects where they are not being physically judged or scrutinized and thus can feel more comfortable sharing.

Crowdsourcing systems are used to accomplish a variety of tasks. For example, the crowd may be invited to develop a new technology, carry out a design task, refine or carry out the steps of an algorithm (see human-based computation), or help capture, systematize, or analyze large amounts of data (see also citizen science).

Wikis have also been used in the academic community for sharing and dissemination of information across institutional and international boundaries. In those settings, they have been found useful for collaboration on grant writing, strategic planning, departmental documentation, and committee work. The United States Patent and Trademark Office uses a wiki to allow the public to collaborate on finding prior art relevant to examination of pending patent applications. Queens, New York has used a wiki to allow citizens to collaborate on the design and planning of a local park.

The English Wikipedia has the largest user base among wikis on the World Wide Web and ranks in the top 10 among all Web sites in terms of traffic.

Politics and political revolutions

Banner in Bangkok during the 2014 Thai coup d'état, informing the Thai public that 'like' or 'share' activities on social media could result in imprisonment (observed June 30, 2014).

The Internet has achieved new relevance as a political tool. The presidential campaign of Howard Dean in 2004 in the United States was notable for its success in soliciting donation via the Internet. Many political groups use the Internet to achieve a new method of organizing for carrying out their mission, having given rise to Internet activism, most notably practiced by rebels in the Arab Spring.

The New York Times suggested that social media websites, such as Facebook and Twitter, helped people organize the political revolutions in Egypt, by helping activists organize protests, communicate grievances, and disseminate information.
The potential of the Internet as a civic tool of communicative power was explored by Simon R. B. Berdal in his 2004 thesis:

As the globally evolving Internet provides ever new access points to virtual discourse forums, it also promotes new civic relations and associations within which communicative power may flow and accumulate. Thus, traditionally ... national-embedded peripheries get entangled into greater, international peripheries, with stronger combined powers... The Internet, as a consequence, changes the topology of the “centre-periphery” model, by stimulating conventional peripheries to interlink into “super-periphery” structures, which enclose and “besiege” several centers at once.

Berdal, therefore, extends the Habermasian notion of the Public sphere to the Internet, and underlines the inherent global and civic nature that interwoven Internet technologies provide. To limit the growing civic potential of the Internet, Berdal also notes how “self-protective measures” are put in place by those threatened by it:

If we consider China’s attempts to filter “unsuitable material” from the Internet, most of us would agree that this resembles a self-protective measure by the system against the growing civic potentials of the Internet. Nevertheless, both types represent limitations to “peripheral capacities”. Thus, the Chinese government tries to prevent communicative power to build up and unleash (as the 1989 Tiananmen Square uprising suggests, the government may find it wise to install “upstream measures”). Even though limited, the Internet is proving to be an empowering tool also to the Chinese periphery: Analysts believe that Internet petitions have influenced policy implementation in favor of the public's online-articulated will …

Incidents of politically motivated Internet censorship have now been recorded in many countries, including western democracies.

---

**Philanthropy**

The spread of low-cost Internet access in developing countries has opened up new possibilities for peer-to-peer charities, which allow individuals to contribute small amounts to charitable projects for other individuals. Websites, such as DonorsChoose and GlobalGiving, allow small-scale donors to direct funds to individual projects of their choice.

A popular twist on Internet-based philanthropy is the use of peer-to-peer lending for charitable purposes. Kiva pioneered this concept in 2005, offering the first web-based service to publish individual loan profiles for funding. Kiva raises funds for local intermediary microfinance organizations which post stories and updates on behalf of the borrowers. Lenders can contribute as little as $25 to loans of their choice, and receive their money back as borrowers repay. Kiva falls short of being a pure peer-to-peer charity, in that loans are disbursed before being funded by lenders and borrowers do not communicate with lenders themselves.

However, the recent spread of low cost Internet access in developing countries has made genuine international person-to-person philanthropy increasingly feasible. In 2009 the US-based nonprofit Zidisha tapped into this trend to offer the first person-to-person microfinance platform to link lenders and borrowers across international borders without intermediaries. Members can fund loans for as little as a dollar, which the borrowers then use to develop business activities that improve their families’ incomes while repaying loans to the members with interest. Borrowers access the Internet via public cybercafes, donated laptops in village schools, and even smart phones, then create their own profile pages through which they share photos and information about themselves and their businesses. As they repay their
loans, borrowers continue to share updates and dialogue with lenders via their profile pages. This direct web-based connection allows members themselves to take on many of the communication and recording tasks traditionally performed by local organizations, bypassing geographic barriers and dramatically reducing the cost of microfinance services to the entrepreneurs.

Security

Many computer scientists describe the Internet as a “prime example of a large-scale, highly engineered, yet highly complex system”. The structure was found to be highly robust to random failures, yet, very vulnerable to intentional attacks.

The Internet structure and its usage characteristics have been studied extensively and the possibility of developing alternative structures has been investigated.

Internet resources, hardware and software components, are the target of malicious attempts to gain unauthorized control to cause interruptions, or access private information. Such attempts include computer viruses which copy with the help of humans, computer worms which copy themselves automatically, denial of service attacks, ransomware, botnets, and spyware that reports on the activity and typing of users. Usually these activities constitute cybercrime. Defense theorists have also speculated about the possibilities of cyber warfare using similar methods on a large scale.

Surveillance

The vast majority of computer surveillance involves the monitoring of data and traffic on the Internet. In the United States for example, under the Communications Assistance For Law Enforcement Act, all phone calls and broadband Internet traffic (emails, web traffic, instant messaging, etc.) are required to be available for unimpeded real-time monitoring by Federal law enforcement agencies.

Packet capture (also sometimes referred to as “packet sniffing”) is the monitoring of data traffic on a computer network. Computers communicate over the Internet by breaking up messages (emails, images, videos, web pages, files, etc.) into small chunks called “packets”, which are routed through a network of computers, until they reach their destination, where they are assembled back into a complete “message” again. Packet Capture Appliance intercepts these packets as they are traveling through the network, in order to examine their contents using other programs. A packet capture is an information gathering tool, but not an analysis tool. That is it gathers “messages” but it does not analyze them and figure out what they mean. Other programs are needed to perform traffic analysis and sift through intercepted data looking for important/useful information. Under the Communications Assistance For Law Enforcement Act all U.S. telecommunications providers are required to install packet sniffing technology to allow Federal law enforcement and intelligence agencies to intercept all of their customers’ broadband Internet and voice over Internet protocol (VoIP) traffic.

There is far too much data gathered by these packet sniffers for human investigators to manually search through all of it. So automated Internet surveillance computers sift through the vast amount of intercepted Internet traffic, and filter out and report to human investigators those bits of information which are “interesting”—such as the use of certain words or phrases, visiting certain types of web sites, or communicating via email or chat with a certain individual or group. Billions
of dollars per year are spent, by agencies such as the Information Awareness Office, NSA, GCHQ and the FBI, to
develop, purchase, implement, and operate systems which intercept and analyze all of this data, and extract only the
information which is useful to law enforcement and intelligence agencies.

Similar systems are now operated by Iranian secret police to identify and suppress dissidents. All required hardware and
software has been allegedly installed by German Siemens AG and Finnish Nokia.

Censorship

![Internet censorship and surveillance by country](https://workforce.libretexts.org/Bookshelves/Information_Technology/Introduction_to_Computer_Applications_and_Concepts/…)

Some governments, such as those of Burma, Iran, North Korea, the Mainland China, Saudi Arabia and the United Arab
Emirates restrict access to content on the Internet within their territories, especially to political and religious content, with
domain name and keyword filters.

In Norway, Denmark, Finland, and Sweden, major Internet service providers have voluntarily agreed to restrict access to
sites listed by authorities. While this list of forbidden resources is supposed to contain only known child pornography
sites, the content of the list is secret. Many countries, including the United States, have enacted laws against the
possession or distribution of certain material, such as child pornography, via the Internet, but do not mandate filter
software. Many free or commercially available software programs, called content-control software are available to users
to block offensive websites on individual computers or networks, in order to limit access by children to pornographic
material or depiction of violence.

Performance

As the Internet is a heterogeneous network, the physical characteristics, including for example the data transfer rates of
connections, vary widely. It exhibits emergent phenomena that depend on its large-scale organization.
Outages

An Internet blackout or outage can be caused by local signaling interruptions. Disruptions of submarine communications cables may cause blackouts or slowdowns to large areas, such as in the 2008 submarine cable disruption. Less-developed countries are more vulnerable due to a small number of high-capacity links. Land cables are also vulnerable, as in 2011 when a woman digging for scrap metal severed most connectivity for the nation of Armenia. Internet blackouts affecting almost entire countries can be achieved by governments as a form of Internet censorship, as in the blockage of the Internet in Egypt, whereby approximately 93% of networks were without access in 2011 in an attempt to stop mobilization for anti-government protests.

Energy use

In 2011 researchers estimated the energy used by the Internet to be between 170 and 307 GW, less than two percent of the energy used by humanity. This estimate included the energy needed to build, operate, and periodically replace the estimated 750 million laptops, a billion smart phones and 100 million servers worldwide as well as the energy that routers, cell towers, optical switches, Wi-Fi transmitters and cloud storage devices use when transmitting Internet traffic.

CC licensed content, Shared previously