Internet info

What is Internet?

The **Internet** (or **internet**)[a] is the global system of interconnected computer networks that uses the Internet protocol suite (TCP/IP)[b] to communicate between networks and devices. It is a network of networks that consists 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 Internet carries a vast range of information resources and services, such as the inter-linked hypertext documents and applications of the World Wide Web (WWW), electronic mail, telephony, and file sharing.

The origins of the Internet date back to the development of packet switching and research commissioned by the United States Department of Defense in the 1960s to enable time-sharing of computers.[2] The primary precursor network, the ARPANET, initially served as a backbone for interconnection of regional academic and military networks in the 1970s. The funding of the National Science Foundation Network as a new backbone in the 1980s, as well as private funding for other commercial extensions, led to worldwide participation in the development of new networking technologies, and the merger of many networks.[3] The linking of commercial networks and enterprises by the early 1990s marked the beginning of the transition to the modern Internet,[4] and generated a sustained exponential growth as generations of institutional, personal, and mobile computers were connected to the network. Although the Internet was widely used by academia in the 1980s, commercialization incorporated its services and technologies into virtually every aspect of modern life.

Most traditional communication media, including telephony, radio, television, paper mail and newspapers are reshaped, redefined, or even bypassed by the Internet, giving birth to new services such as email, Internet telephony, Internet television, online music, digital newspapers, and video streaming websites. Newspaper, book, and other print publishing are adapting to website technology, or are reshaped into blogging, web feeds and online news aggregators. The Internet has enabled and accelerated new forms of personal interactions through instant messaging, Internet forums, and social networking services. Online shopping has grown exponentially for major retailers, small businesses, and entrepreneurs, as it enables firms to extend their "brick and mortar" presence to serve a larger market or even sell goods and services entirely online. Business-to-business and financial services on the Internet affect supply chains across entire industries.

The Internet has no single centralized governance in either technological implementation or policies for access and usage; each constituent network sets its own policies.[5] The overreaching definitions of the two principal name spaces in the Internet, the Internet Protocol address (IP 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.[6] In November 2006, the Internet was included on USA Today's list of New Seven Wonders.[7]

Terminology

Further information: Capitalization of "Internet"

The Internet Messenger by Buky Schwartz, located in Holon, Israel

The word internetted was used as early as 1849, meaning interconnected or interwoven.[8] The word Internet was used in 1974 as the shorthand form of Internetwork.[9] Today, the term Internet most commonly refers to the global system of interconnected computer networks, though it may also refer to any group of smaller networks.[10]

When it came into common use, most publications treated the word Internet as a capitalized proper noun; this has become less common.[10] This reflects the tendency in English to capitalize new terms and move to lowercase as they become familiar.[10][11] The word is sometimes still capitalized to distinguish the global internet from smaller networks, though many publications, including the AP Stylebook since 2016, recommend the lowercase form in every case.[10][11] In 2016, the Oxford English Dictionary found that, based on a study of around 2.5 billion printed and online sources, "Internet" was capitalized in 54% of cases.[12]

The terms Internet and World Wide Web are often used interchangeably; it is common to speak of "going on the Internet" when using 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,[13] a collection of documents (web pages) and other web resources, linked by hyperlinks and URLs.[14]

## History

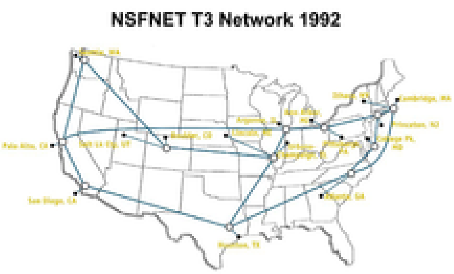
Main articles: History of the Internet and History of the World Wide Web

In the 1960s, the Advanced Research Projects Agency (ARPA) of the United States Department of Defense funded research into time-sharing of computers.[15][16][17] Research into packet switching, one of the fundamental Internet technologies, started in the work of Paul Baran in the early 1960s and, independently, Donald Davies in 1965.[2][18] After the Symposium on Operating Systems Principles in 1967, packet switching from the proposed NPL network was incorporated into the design for the ARPANET and other resource sharing networks such as the Merit Network and CYCLADES, which were developed in the late 1960s and early 1970s.[19]

ARPANET development began with two network nodes which were interconnected between the Network Measurement Center at the University of California, Los Angeles (UCLA) Henry Samueli School of Engineering and Applied Science directed by Leonard Kleinrock, and the NLS system at SRI International (SRI) by Douglas Engelbart in Menlo Park, California, on 29 October 1969.[20] The third site was the Culler-Fried Interactive Mathematics Center at the University of California, Santa Barbara, followed by the University of Utah Graphics Department. In a sign of future growth, 15 sites were connected to the young ARPANET by the end of 1971.[21][22] These early years were documented in the 1972 film Computer Networks: The Heralds of Resource Sharing.[23]

Early international collaborations for the ARPANET were rare. Connections were made in 1973 to the Norwegian Seismic Array (NORSAR) via a satellite station in Tanum, Sweden, and to Peter Kirstein's research group at University College London which provided a gateway to British academic networks.[24][25] The ARPA projects and international working groups led to the development of various protocols and standards by which multiple separate networks could become a single network or "a network of networks".[26] In 1974, Vint Cerf and Bob Kahn used the term internet as a shorthand for internetwork in RFC 675,[9] and later RFCs repeated this use.[27] Cerf and Kahn credit Louis Pouzin with important influences on TCP/IP design.[28] Commercial PTT providers were concerned with developing X.25 public data networks.[29]

Access to the ARPANET was expanded in 1981 when the National Science Foundation (NSF) funded the Computer Science Network (CSNET). In 1982, the Internet Protocol Suite (TCP/IP) was standardized, which permitted worldwide proliferation of interconnected networks. TCP/IP network access expanded again in 1986 when the National Science Foundation Network (NSFNet) provided access to supercomputer sites in the United States for researchers, first at speeds of 56 kbit/s and later at 1.5 Mbit/s and 45 Mbit/s.[30] The NSFNet expanded into academic and research organizations in Europe, Australia, New Zealand and Japan in 1988–89.[31][32][33][34] Although other network protocols such as UUCP had global reach well before this time, this marked the beginning of the Internet as an intercontinental network. Commercial Internet service providers (ISPs) emerged in 1989 in the United States and Australia.[35] The ARPANET was decommissioned in 1990.[36]




T3 NSFNET Backbone, c. 1992.

Steady advances in semiconductor technology and optical networking created new economic opportunities for commercial involvement in the expansion of the network in its core and for delivering services to the public. In mid-1989, MCI Mail and Compuserve established connections to the Internet, delivering email and public access products to the half million users of the Internet.[37] Just months later, on 1 January 1990, PSInet launched an alternate Internet backbone for commercial use; one of the networks that added to the core of the commercial Internet of later years. In March 1990, the first high-speed T1 (1.5 Mbit/s) link between the NSFNET and Europe was installed between Cornell University and CERN, allowing much more robust communications than were capable with satellites.[38] Six months later Tim Berners-Lee would begin writing WorldWideWeb, the first web browser, after two years of lobbying CERN management. By Christmas 1990, Berners-Lee had built all the tools necessary for a working Web: the HyperText Transfer Protocol (HTTP) 0.9,[39] the HyperText Markup Language (HTML), the first Web browser (which was also a HTML editor and could access Usenet newsgroups and FTP files), the first HTTP server software (later known as CERN httpd), the first web server,[40] and the first Web pages that described the project itself. In 1991 the Commercial Internet eXchange was founded, allowing PSInet to communicate with the other commercial networks CERFnet and Alternet. Stanford Federal Credit Union was the first financial institution to offer online Internet banking services to all of its members in October 1994.[41] In 1996, OP Financial Group, also a cooperative bank, became the second online bank in the world and the first in Europe.[42] By 1995, the Internet was fully commercialized in the U.S. when the NSFNet was decommissioned, removing the last restrictions on use of the Internet to carry commercial traffic.[43]

Worldwide Internet users[44]Users2005201020172019[45]World population[46]6.5 billion6.9 billion7.4 billion7.75 billionWorldwide16%30%48%53.6%In developing world8%21%41.3%47%In developed world51%67%81%86.6%

As technology advanced and commercial opportunities fueled reciprocal growth, the volume of Internet traffic started experiencing similar characteristics as that of the scaling of MOS transistors, exemplified by Moore's law, doubling every 18 months. This growth, formalized as Edholm's law, was catalyzed by advances in MOS technology, laser light wave systems, and noise performance.[47]

Since 1995, the Internet has tremendously impacted culture and commerce, including the rise of near instant communication by email, instant messaging, telephony (Voice over Internet Protocol or VoIP), two-way interactive video calls, and the World Wide Web[48] with its discussion forums, blogs,

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 services.[49] 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%.[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 nature of the Internet protocols, which encourages vendor interoperability and prevents any one company from exerting too much control over the network.[51] As of 31 March 2011, the estimated total number of Internet users was 2.095 billion (30.2% of world population).[52] 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.[53]

Governance

Main article: Internet governance

ICANN headquarters in the Playa Vista neighborhood of Los Angeles, California, United States.

The Internet is a global network that comprises 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 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). ICANN is governed by an international board of directors drawn from across the Internet technical, business, academic, and other non-commercial communities. ICANN coordinates the assignment of unique identifiers for use on the Internet, including domain names, IP addresses, application port numbers in the transport protocols, and many other parameters. Globally unified name spaces are essential for maintaining the global reach of the Internet. This role of ICANN distinguishes it as perhaps the only central coordinating body for the global Internet.[54]

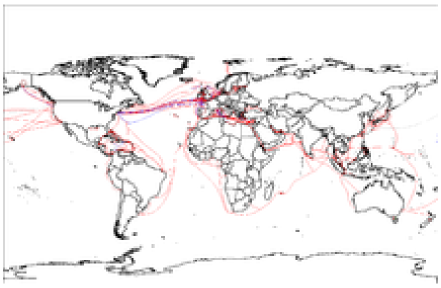
Regional Internet registries (RIRs) were established for five regions of the world. The African Network Information Center (AfriNIC) for Africa, the American Registry for Internet Numbers (ARIN) for North America, the Asia-Pacific Network Information Centre (APNIC) for Asia and the Pacific region, the Latin American and Caribbean Internet Addresses Registry (LACNIC) for Latin America and the Caribbean region, and the Réseaux IP Européens – Network Coordination Centre (RIPE NCC) for Europe, the Middle East, and Central Asia were delegated to assign IP address blocks and other Internet parameters to local registries, such as Internet service providers, from a designated pool of addresses set aside for each region.

The National Telecommunications and Information Administration, an agency of the United States Department of Commerce, had final approval over changes to the DNS root zone until the IANA stewardship transition on 1 October 2016.[55][56][57][58] 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".[59] 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 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 in Tunis established the Internet

Governance Forum (IGF) to discuss Internet-related issues.

Infrastructure

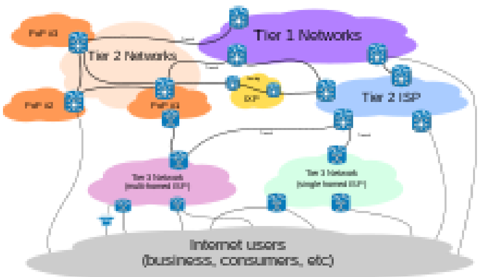
See also: List of countries by number of Internet users and List of countries by Internet connection speeds



2007 map showing submarine fiberoptic telecommunication cables around the world.

The communications infrastructure of the Internet consists of its hardware components and a system of software layers that control various aspects of the architecture. As with any computer network, the Internet physically consists of routers, media (such as cabling and radio links), repeaters, modems etc. However, as an example of internetworking, many of the network nodes are not necessarily internet equipment per se, the internet packets are carried by other full-fledged networking protocols with the Internet acting as a homogeneous networking standard, running across heterogeneous hardware, with the packets guided to their destinations by IP routers.

## Service tiers




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

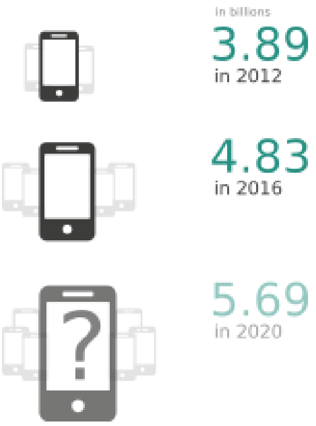
Internet service providers (ISPs) establish the worldwide connectivity between individual networks at various levels of scope. End-users who only access the Internet when needed to perform a function or obtain information, represent the bottom of the routing hierarchy. At the top of the routing hierarchy are the tier 1 networks, large telecommunication companies that exchange traffic directly with each other via very high speed fibre optic cables and governed by 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.

## Access

Common methods of Internet access by users include dial-up with a computer modem via telephone circuits, broadband over coaxial cable, fiber optics or copper wires, Wi-Fi, satellite, and cellular telephone technology (e.g. 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 that are usually fee-based. These terminals are widely accessed for various usages, 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 devices such as a laptop or PDA. These services may be free to all, free to customers only, or fee-based.

Grassroots efforts have led to wireless community networks. Commercial Wi-Fi services that cover large areas are available in many cities, such as New York, London, Vienna, Toronto, San Francisco, Philadelphia, Chicago and Pittsburgh, where the Internet can then be accessed from places such as a park bench.[60] Experiments have also been conducted with proprietary mobile wireless networks like Ricochet, various high-speed data services over cellular networks, and fixed wireless services. Modern smartphones can also access the Internet through the cellular carrier network. For Web browsing, these devices provide applications such as Google Chrome, Safari, and Firefox and a wide variety of other Internet software may be installed from app-stores. Internet usage by mobile and tablet devices exceeded desktop worldwide for the first time in October 2016.[61]

## Mobile communication




Number of mobile cellular subscriptions 2012–2016

The International Telecommunication Union (ITU) estimated that, by the end of 2017, 48% of individual users regularly connect to the Internet, up from 34% in 2012.[62] Mobile Internet connectivity has played an important role in expanding access in recent years especially in Asia and the Pacific and in Africa.[63] The number of unique mobile cellular subscriptions increased from 3.89 billion in 2012 to 4.83 billion in 2016, two-thirds of the world's population, with more than half of subscriptions located in Asia and the Pacific. The number of subscriptions is predicted to rise to 5.69 billion users in 2020.[64] As of 2016, almost 60% of the world's population had access to a 4G broadband cellular network, up from almost 50% in 2015 and 11% in 2012.[disputed – discuss][64] The limits that users face on accessing information via mobile applications coincide with a broader process of fragmentation of the Internet. Fragmentation restricts access to media content and tends to affect poorest users the most.[63]

Zero-rating, the practice of Internet service providers allowing users free connectivity to access specific content or applications without cost, has offered opportunities to surmount economic hurdles, but has also been accused by its critics as creating a two-tiered Internet. To address the issues with zero-rating, an alternative model has emerged in the concept of 'equal rating' and is being tested in experiments by Mozilla and Orange in Africa. Equal rating prevents prioritization of one type of content and zero-rates all content up to a specified data cap. A study published by Chatham House, 15 out of 19 countries researched in Latin America had some kind of hybrid or zero-rated product offered. Some countries in the region had a handful of plans to choose from (across all mobile network operators) while others, such as Colombia, offered as many as 30 pre-paid and 34 post-paid plans.[65]

A study of eight countries in the Global South found that zero-rated data plans exist in every country, although there is a great range in the frequency with which they are offered and actually used in each.[66] The study looked at the top three to five carriers by market share in Bangladesh, Colombia, Ghana, India, Kenya, Nigeria, Peru and Philippines. Across the 181 plans examined, 13 per cent were offering zero-rated services. Another study, covering Ghana, Kenya, Nigeria and South Africa, found Facebook's Free Basics and Wikipedia Zero to be the most commonly zero-rated content.[67]

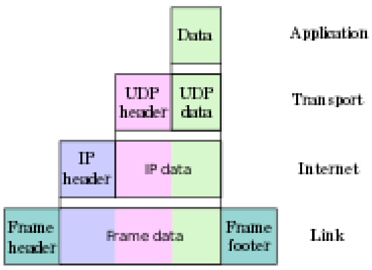
## Internet Protocol Suite

The Internet standards describe a framework known as the Internet protocol suite (also called TCP/IP, based on the first two components.) This is a suite of protocols that are ordered into a set of four conceptional layers by the scope of their operation, originally documented in RFC 1122 and RFC 1123. At the top is the application layer, where communication is described in terms of the objects or data structures most appropriate for each application. For example, a web browser operates in a client–server application model and exchanges information with the Hypertext Transfer Protocol (HTTP) and an application-germane data structure, such as the Hypertext Markup Language (HTML).

Below this top layer, the transport layer connects applications on different hosts with a logical channel through the network. It provides this service with a variety of possible characteristics, such as ordered, reliable delivery (TCP), and an unreliable datagram service (UDP).

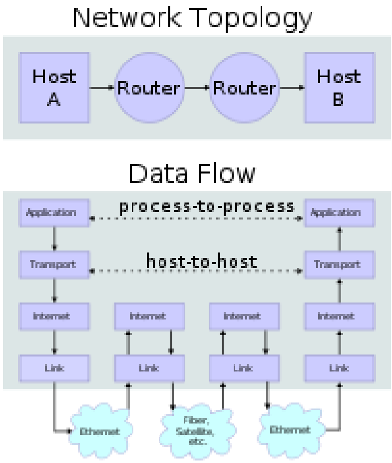
Underlying these layers are the networking technologies that interconnect networks at their borders and exchange traffic across them. The Internet layer implements the Internet Protocol (IP) which enables computers to identify and locate each other by IP address, and route their traffic via intermediate (transit) networks.[68] The internet protocol layer code is independent of the type of network that it is physically running over.

At the bottom of the architecture is the link layer, which connects nodes on the same physical link, and contains protocols that do not require routers for traversal to other links. The protocol suite does not explicitly specify hardware methods to transfer bits, or protocols to manage such hardware, but assumes that appropriate technology is available. Examples of that technology include Wi-Fi, Ethernet, and DSL.




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.

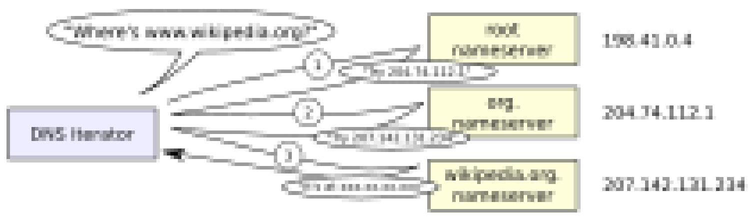
## Internet protocol




Conceptual data flow in a simple network topology of two hosts (A and B) connected by a link between their respective routers. The application on each host executes read and write operations as if the processes were directly connected to each other by some kind of data pipe. After the establishment of this pipe, most details of the communication are hidden from each process, as the underlying principles of communication are implemented in the lower protocol layers. In analogy, at the transport layer the communication appears as host-to-host, without knowledge of the application data structures and the connecting routers, while at the internetworking layer, individual network boundaries are traversed at each router.

The most prominent component of the Internet model is the Internet Protocol (IP). IP enables internetworking and, in essence, establishes the Internet itself. Two versions of the Internet Protocol exist, IPV4 and IPV6.

### IP Addresses




A DNS resolver consults three name servers to resolve the domain name user-visible "www.wikipedia.org" to determine the IPV4 Address 207.142.131.234

For locating individual computers on the network, the Internet provides IP addresses. IP addresses are used by the Internet infrastructure to direct internet packets to their destinations. They consist of fixed-length numbers, which are found within the packet. IP addresses are generally assigned to equipment either automatically via DHCP, or are configured.

However, the network also supports other addressing systems. Users generally enter domain names (e.g. "en.wikipedia.org") instead of IP addresses because they are easier to remember, they are converted by the Domain Name System (DNS) into IP addresses which are more efficient for routing purposes.

## IPv4

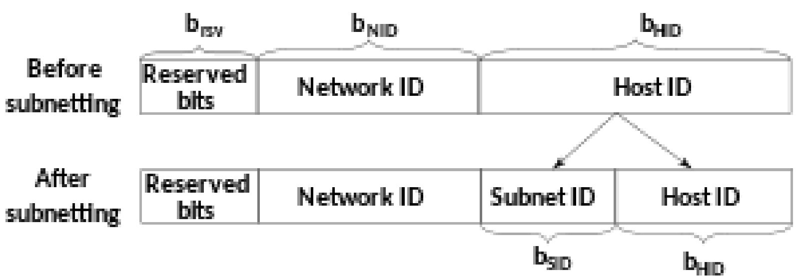
Internet Protocol version 4 (IPv4) defines an IP address as a 32-bit number.[68] IPv4 is the initial version used on the first generation of the Internet and is still in dominant use. It was designed to address up to ≈4.3 billion (109) hosts. However, the explosive growth of the Internet has led to IPv4 address exhaustion, which entered its final stage in 2011,[69] when the global IPv4 address allocation pool was exhausted.

## IPv6

Because of the growth of the Internet and the depletion of available IPv4 addresses, a new version of IP IPv6, was developed in the mid-1990s, which provides vastly larger addressing capabilities and more efficient routing of Internet traffic. IPv6 uses 128 bits for the IP address and was standardized in 1998.[70][71][72] IPv6 deployment has been ongoing since the mid-2000s and 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.[73]

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. Thus, translation facilities must exist for internetworking or nodes must have duplicate networking software for both networks. Essentially all modern computer operating systems support both versions of the Internet Protocol. Network infrastructure, however, has been 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 the exchange of data over the network. Indeed, the Internet is defined by its interconnections and routing policies.

## Subnetwork




Creating a subnet by dividing the host identifier

A subnetwork or subnet is a logical subdivision of an IP network.[74]: 1,16 The practice of dividing a network into two or more networks is called subnetting.

Computers that belong to a subnet are addressed with an identical most-significant bit-group in their IP addresses. This results in the logical division of an IP address into two fields, the network number or routing prefix and the rest field or host identifier. The rest field is an identifier for a specific host or network interface.

The routing prefix may be expressed in Classless Inter-Domain Routing (CIDR) notation written as the first address of a network, followed by a slash character (/), and ending with the bit-length of the prefix. For example, 198.51.100.0/24 is the prefix of the Internet Protocol version 4 network starting at the given address, having 24 bits allocated for the network prefix, and the remaining 8 bits reserved for host addressing. Addresses in the range 198.51.100.0 to 198.51.100.255 belong to this network. The IPv6 address specification 2001:db8::/32 is a large address block with 296 addresses, having a 32-bit routing prefix.

For IPv4, a network may also be characterized by its subnet mask or netmask, which is the bitmask that when applied by a bitwise AND operation to any IP address in the network, yields the routing prefix. Subnet masks are also expressed in dot-decimal notation like an address. For example, 255.255.255.0 is the subnet mask for the prefix 198.51.100.0/24.

Traffic is exchanged between subnetworks through routers when the routing prefixes of the source address and the destination address differ. A router serves as a logical or physical boundary between the subnets.

The benefits of subnetting an existing network vary with each deployment scenario. In the address allocation architecture of the Internet using CIDR and in large organizations, it is necessary to allocate address space efficiently. Subnetting may also enhance routing efficiency, or have advantages in network management when subnetworks are administratively controll