

Internet Protocol

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The Internet Protocol (IP) is the network layer communications protocol in the Internet protocol suite for relaying datagrams across network boundaries. Its routing function enables internetworking, and essentially establishes the Internet.

IP has the task of delivering packets from the source host to the destination host solely based on the IP addresses in the packet headers. For this purpose, IP defines packet structures that encapsulate the data to be delivered. It also defines addressing methods that are used to label the datagram with source and destination information.

IP was the connectionless datagram service in the original Transmission Control Program introduced by Vint Cerf and Bob Kahn in 1974, which was complemented by a connection-oriented service that became the basis for the Transmission Control Protocol (TCP). The Internet protocol suite is therefore often referred to as TCP/IP.

The first major version of IP, Internet Protocol version 4 (IPv4), is the dominant protocol of the Internet. Its successor is Internet Protocol version 6 (IPv6), which has been in increasing deployment on the public Internet since around 2006.

Internet protocol suite

foundational protocols in the suite are the Transmission Control Protocol (TCP), the User Datagram Protocol (UDP), and the Internet Protocol (IP). Early

The Internet protocol suite, commonly known as TCP/IP, is a framework for organizing the communication protocols used in the Internet and similar computer networks according to functional criteria. The foundational protocols in the suite are the Transmission Control Protocol (TCP), the User Datagram Protocol (UDP), and the Internet Protocol (IP). Early versions of this networking model were known as the Department of Defense (DoD) Internet Architecture Model because the research and development were funded by the Defense Advanced Research Projects Agency (DARPA) of the United States Department of Defense.

The Internet protocol suite provides end-to-end data communication specifying how data should be packetized, addressed, transmitted, routed, and received. This functionality is organized into four abstraction layers, which classify all related protocols according to each protocol's scope of networking. An implementation of the layers for a particular application forms a protocol stack. From lowest to highest, the layers are the link layer, containing communication methods for data that remains within a single network segment (link); the internet layer, providing internetworking between independent networks; the transport layer, handling host-to-host communication; and the application layer, providing process-to-process data exchange for applications.

The technical standards underlying the Internet protocol suite and its constituent protocols are maintained by the Internet Engineering Task Force (IETF). The Internet protocol suite predates the OSI model, a more comprehensive reference framework for general networking systems.

Internet Control Message Protocol

The Internet Control Message Protocol (ICMP) is a supporting protocol in the Internet protocol suite. It is used by network devices, including routers

The Internet Control Message Protocol (ICMP) is a supporting protocol in the Internet protocol suite. It is used by network devices, including routers, to send error messages and operational information indicating success or failure when communicating with another IP address. For example, an error is indicated when a requested service is not available or that a host or router could not be reached. ICMP differs from transport protocols such as TCP and UDP in that it is not typically used to exchange data between systems, nor is it regularly employed by end-user network applications (with the exception of some diagnostic tools like ping and traceroute).

A separate Internet Control Message Protocol (called ICMPv6) is used with IPv6.

IPv6

Internet Protocol version 6 (IPv6) is the most recent version of the Internet Protocol (IP), the communications protocol that provides an identification

Internet Protocol version 6 (IPv6) is the most recent version of the Internet Protocol (IP), the communications protocol that provides an identification and location system for computers on networks and routes traffic across the Internet. IPv6 was developed by the Internet Engineering Task Force (IETF) to deal with the long-anticipated problem of IPv4 address exhaustion, and was intended to replace IPv4. In December 1998, IPv6 became a Draft Standard for the IETF, which subsequently ratified it as an Internet Standard on 14 July 2017.

Devices on the Internet are assigned a unique IP address for identification and location definition. With the rapid growth of the Internet after commercialization in the 1990s, it became evident that far more addresses would be needed to connect devices than the 4,294,967,296 (2³²) IPv4 address space had available. By 1998, the IETF had formalized the successor protocol, IPv6 which uses 128-bit addresses, theoretically allowing 2¹²⁸, or 340,282,366,920,938,463,463,374,607,431,768,211,456 total addresses. The actual number is slightly smaller, as multiple ranges are reserved for special usage or completely excluded from general use. The two protocols are not designed to be interoperable, and thus direct communication between them is impossible, complicating the move to IPv6. However, several transition mechanisms have been devised to rectify this.

IPv6 provides other technical benefits in addition to a larger addressing space. In particular, it permits hierarchical address allocation methods that facilitate route aggregation across the Internet, and thus limit the expansion of routing tables. The use of multicast addressing is expanded and simplified, and provides additional optimization for the delivery of services. Device mobility, security, and configuration aspects have been considered in the design of the protocol.

IPv6 addresses are represented as eight groups of four hexadecimal digits each, separated by colons. The full representation may be shortened; for example, 2001:0db8:0000:0000:8a2e:0370:7334 becomes 2001:db8::8a2e:370:7334.

Internet Protocol television

Internet Protocol television (IPTV), also called TV over broadband, is the service delivery of television over Internet Protocol (IP) networks. Usually

Internet Protocol television (IPTV), also called TV over broadband, is the service delivery of television over Internet Protocol (IP) networks. Usually sold and run by a telecom provider, it consists of broadcast live television that is streamed over the Internet (multicast) — in contrast to delivery through traditional terrestrial, satellite, and cable transmission formats — as well as video on demand services for watching or replaying content (unicast).

IPTV broadcasts started gaining usage during the 2000s alongside the rising use of broadband-based internet connections. It is often provided bundled with internet access services by ISPs to subscribers and runs in a closed network. IPTV normally requires the use of a set-top box, which receives the encoded television content in the MPEG transport stream via IP multicast, and converts the packets to be watched on a TV set or other kind of display. It is distinct from over-the-top (OTT) services, which are based on a direct one-to-one transmission mechanism.

IPTV methods have been standardised by organisations such as ETSI. IPTV has found success in some regions: for example in Western Europe in 2015, pay IPTV users overtook pay satellite TV users. IPTV is also used for media delivery around corporate and private networks.

Internet Message Access Protocol

In computing, the Internet Message Access Protocol (IMAP) is an Internet standard protocol used by email clients to retrieve email messages from a mail

In computing, the Internet Message Access Protocol (IMAP) is an Internet standard protocol used by email clients to retrieve email messages from a mail server over a TCP/IP connection. IMAP is defined by RFC 9051.

IMAP was designed with the goal of permitting complete management of an email box by multiple email clients, therefore clients generally leave messages on the server until the user explicitly deletes them. An IMAP server typically listens on port number 143. IMAP over SSL/TLS (IMAPS) is assigned the port number 993.

Virtually all modern e-mail clients and servers support IMAP, which along with the earlier POP3 (Post Office Protocol) are the two most prevalent standard protocols for email retrieval. Many webmail service providers such as Gmail and Outlook.com also support for both IMAP and POP3.

IPv4

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Internet Protocol version 4 (IPv4) is the first version of the Internet Protocol (IP) as a standalone specification. It is one of the core protocols of standards-based internetworking methods in the Internet and other packet-switched networks. IPv4 was the first version deployed for production on SATNET in 1982 and on the ARPANET in January 1983. It is still used to route most Internet traffic today, even with the ongoing deployment of Internet Protocol version 6 (IPv6), its successor.

IPv4 uses a 32-bit address space which provides 4,294,967,296 (2³²) unique addresses, but large blocks are reserved for special networking purposes. This quantity of unique addresses is not large enough to meet the needs of the global Internet, which has caused a significant issue known as IPv4 address exhaustion during the ongoing transition to IPv6.

IP address

An Internet Protocol address (IP address) is a numerical label such as 192.0.2.1 that is assigned to a device connected to a computer network that uses

An Internet Protocol address (IP address) is a numerical label such as 192.0.2.1 that is assigned to a device connected to a computer network that uses the Internet Protocol for communication. IP addresses serve two main functions: network interface identification, and location addressing.

Internet Protocol version 4 (IPv4) was the first standalone specification for the IP address, and has been in use since 1983. IPv4 addresses are defined as a 32-bit number, which became too small to provide enough addresses as the internet grew, leading to IPv4 address exhaustion over the 2010s. Its designated successor, IPv6, uses 128 bits for the IP address, giving it a larger address space. Although IPv6 deployment has been ongoing since the mid-2000s, both IPv4 and IPv6 are still used side-by-side as of 2025.

IP addresses are usually displayed in a human-readable notation, but systems may use them in various different computer number formats. CIDR notation can also be used to designate how much of the address should be treated as a routing prefix. For example, 192.0.2.1/24 indicates that 24 significant bits of the address are the prefix, with the remaining 8 bits used for host addressing. This is equivalent to the historically used subnet mask (in this case, 255.255.255.0).

The IP address space is managed globally by the Internet Assigned Numbers Authority (IANA) and the five regional Internet registries (RIRs). IANA assigns blocks of IP addresses to the RIRs, which are responsible for distributing them to local Internet registries in their region such as internet service providers (ISPs) and large institutions. Some addresses are reserved for private networks and are not globally unique.

Within a network, the network administrator assigns an IP address to each device. Such assignments may be on a static (fixed or permanent) or dynamic basis, depending on network practices and software features. Some jurisdictions consider IP addresses to be personal data.

Internet Printing Protocol

The Internet Printing Protocol (IPP) is a specialized communication protocol used between client devices (computers, mobile phones, tablets, etc.) and

The Internet Printing Protocol (IPP) is a specialized communication protocol used between client devices (computers, mobile phones, tablets, etc.) and printers (or print servers). The protocol allows clients to submit one or more print jobs to the network-attached printer or print server, and perform tasks such as querying the status of a printer, obtaining the status of print jobs, or cancelling individual print jobs.

Like all IP-based protocols, IPP can run locally or over the Internet. Unlike other printing protocols, IPP also supports access control, authentication, and encryption, making it a much more capable and secure printing mechanism than older ones.

IPP is the basis of several printer logo certification programs including AirPrint, IPP Everywhere, and Mopria Alliance, and is supported by over 98% of printers sold today.

Communication protocol

group of protocols designed to work together is known as a protocol suite; when implemented in software they are a protocol stack. Internet communication

A communication protocol is a system of rules that allows two or more entities of a communications system to transmit information via any variation of a physical quantity. The protocol defines the rules, syntax, semantics, and synchronization of communication and possible error recovery methods. Protocols may be implemented by hardware, software, or a combination of both.

Communicating systems use well-defined formats for exchanging various messages. Each message has an exact meaning intended to elicit a response from a range of possible responses predetermined for that particular situation. The specified behavior is typically independent of how it is to be implemented. Communication protocols have to be agreed upon by the parties involved. To reach an agreement, a protocol may be developed into a technical standard. A programming language describes the same for computations, so there is a close analogy between protocols and programming languages: protocols are to communication

what programming languages are to computations. An alternate formulation states that protocols are to communication what algorithms are to computation.

Multiple protocols often describe different aspects of a single communication. A group of protocols designed to work together is known as a protocol suite; when implemented in software they are a protocol stack.

Internet communication protocols are published by the Internet Engineering Task Force (IETF). The IEEE (Institute of Electrical and Electronics Engineers) handles wired and wireless networking and the International Organization for Standardization (ISO) handles other types. The ITU-T handles telecommunications protocols and formats for the public switched telephone network (PSTN). As the PSTN and Internet converge, the standards are also being driven towards convergence.

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