IP address

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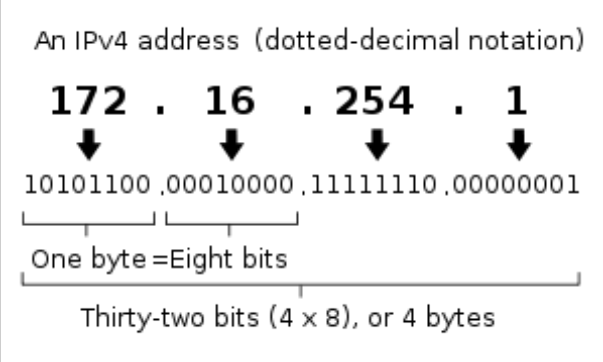
An Internet Protocol address (IP address) is a numerical label assigned to each device (e.g., computer, printer) participating in a computer network that uses the Internet Protocol for communication.[1] An IP address serves two principal functions: host or network interface identification and location addressing. Its role has been characterized as follows: "A name indicates what we seek. An address indicates where it is. A route indicates how to get there."[2]

The designers of the Internet Protocol defined an IP address as a 32-bit number[1] and this system, known as Internet Protocol Version 4 (IPv4), is still in use today. However, because of the growth of the Internet and the predicted depletion of available addresses, a new version of IP (IPv6), using 128 bits for the address, was developed in 1995.[3] IPv6 was standardized as RFC 2460 in 1998,[4] and its deployment has been ongoing since the mid-2000s.

IP addresses are usually written and displayed in human-readable notations, such as 172.16.254.1 (IPv4), and 2001:db8:0:1234:0:567:8:1 (IPv6).

The Internet Assigned Numbers Authority (IANA) manages the IP address space allocations globally and delegates five regional Internet registries (RIRs) to allocate IP address blocks to local Internet registries (Internet service providers) and other entities.

IPv4 addresses



Decomposition of an IPv4 address from dot-decimal notation to its binary value.

Private addresses

Early network design, when global end-to-end connectivity was envisioned for communications with all Internet hosts, intended that IP addresses be uniquely assigned to a particular computer or device. However, it was found that this was not always necessary as private networks developed and public address space needed to be conserved.

Computers not connected to the Internet, such as factory machines that communicate only with each other via TCP/IP, need not have globally unique IP addresses. Three ranges of IPv4 addresses for

private networks were reserved in RFC 1918. These addresses are not routed on the Internet and thus their use need not be coordinated with an IP address registry.

Today, when needed, such private networks typically connect to the Internet through network address translation (NAT).

IPv4 address exhaustion

High levels of demand have decreased the supply of unallocated Internet Protocol Version 4 (IPv4) addresses available for assignment to Internet service providers and end user organizations since the 1980s. This development is referred to as IPv4 address exhaustion. IANA's primary address poolwas exhausted on 3 February 2011, when the last five blocks were allocated to the five RIRs.[5][6] APNIC was the first RIR to exhaust its regional pool on 15 April 2011, except for a small amount of address space reserved for the transition to IPv6, intended to be allocated in a restricted process.[7]

IP address assignment

Internet Protocol addresses are assigned to a host either anew at the time of booting, or permanently by fixed configuration of its hardware or software. Persistent configuration is also known as using a static IP address. In contrast, in situations when the computer's IP address is assigned newly each time, this is known as using a dynamic IP address.

Methods

Static IP addresses are manually assigned to a computer by an administrator. The exact procedure varies according to platform. This contrasts with dynamic IP addresses, which are assigned either by the computer interface or host software itself, as in Zeroconf, or assigned by a server usingDynamic Host Configuration Protocol (DHCP). Even though IP addresses assigned using DHCP may stay the same for long periods of time, they can generally change. In some cases, a network administrator may implement dynamically assigned static IP addresses. In this case, a DHCP server is used, but it is specifically configured to always assign the same IP address to a particular computer. This allows static IP addresses to be configured centrally, without having to specifically configure each computer on the network in a manual procedure.

In the absence or failure of static or stateful (DHCP) address configurations, an operating system may assign an IP address to a network interface using state-less auto-configuration methods, such as Zeroconf.