

INTERNET PROTOCOLS

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Table of contents

Introduction.....	2 ; 3 ; 4
Types of IPv6.....	5 ; 6
References.....	7
Scheme for School of	
Management and Engineering.....	8; 9; 10

Introduction

The Internet Protocol (IP) is a protocol or set of rules to route and address data packets so they can travel across networks and reach the right destination. Data passing through the Internet is split into smaller pieces, called packets.

An IP address is assigned to each device or domain that connects to the Internet, and as packets are directed to the IP address attached to them, data arrives where it is needed.

The IP address is used in the network processing programs. In contrast, at the level of the users with Internet access, the identification of computers is done through a host name managed by the DNS system.

"Internet Protocol version 6" (IPv6) is the latest version of "Internet Protocol" (IP). IPv6 was developed by the IETF (Internet Engineering Task Force) to solve the problem of IPv4 address depletion. IPv6 will fully replace IPv4 in the future.

IPv4 notation is obtained by writing each octet in decimal form, separated by points, and IPv6 addresses are written mostly in the form of 8 groups of 4 hexadecimal digits, each group being separated by two points (:))

IPv4 coverage is much higher than IPv6 globally.

There are a lot of technical differences between the two protocols, which cannot be covered in this article, but the main purpose of both versions is to identify the location of a device on a network.

IPv4, the widely used version until 2011, can no longer scale, the number of stations connected to such a network being limited to 4.3 billion. The last IPv4 addresses were allocated by IANA at the beginning of 2011. IPv6 first involves the radical enlargement of the address space from 232 to 2128, but also the self-configuration of the address through a stateless mechanism, the standardization of the size of a subnet and the security integration of the protocol IPSec.

IPv6 has been designed to give each network around the globe more addresses that can be routed throughout the Internet; addresses can be used for a wide variety of devices, including

cell phones, PDAs, vehicles with IP support, appliances and more. In addition to providing greater address space, IPv6 has the following advantages over IPv4:

- Address management and delegation becomes easier;
- Easy self-configuration of addresses;
- Built-in IPsec;
- Optimized routing;
- Finding double addresses.

It is likely that the Internet will use IPv4 and IPv6 in parallel for quite some time. The two protocols cannot communicate directly, needing a dedicated gateway or one of the transition mechanisms implemented.

An IPv6 address is expressed in Hexa (base 16 with values from 0 - 9 and A - F) can look like this:

2003:4581:A7C1:EFDB:0000:0000:1327:0001

IPv6 addresses have two lifetimes: preferred and valid, the preferred lifetime being always <= valid.

After the preferred lifetime expires, the address cannot be used as a source IP address for new connections if a similar good preferred address is available. After the lifetime expires, the address is not used (recognized) as a valid destination IP address for the packets, nor used as the source IP address.

IPv6 encapsulates these functions in IP as part of algorithms for stateless automatic configuration and neighbor discovery using ICMPv6 (Internet Control Message Protocol version 6). As a result, there is no such thing as ARP6.

In IPv6, the address domain is part of the architecture. Unicast addresses defined two domains, including local and global connection; multicast addresses have 14 domains. The default address selection for source and destination takes into account the domain.

The configuration is optional, depending on the required functions. IPv6 can be used for any Ethernet adapter and can be run through the loopback interface. IPv6 interfaces are self-configurable, using stateless IPv6 automatic configuration. You can also manually configure the IPv6 interface. Therefore, the system will be able to communicate with other IPv6 systems that are local or remote, depending on the type of network and the existence of an IPv6 router.

In its activity, the IETF has made improvements to IPv6 compared to IPv4. IPv6 protocol can manage packets more efficiently, improve performance and increase security. This allows internet service providers to reduce the size of routing tables, making them more hierarchical.

With all these benefits, it seems that the industry needs a long time to move from IPv4 to IPv6. One of the reasons is that the translation of network addresses (NAT) helped to delay the transition. NAT allows traffic to be routed to thousands and thousands of individual IP addresses on private networks through NAT gateways that use a single public IP address each.

Types of IPv6

- **Global unicast:**

The IPv6 addresses of global unicast are identical to public addresses in IPv4. It is possible to use these addresses on the Internet. Nevertheless, the big difference with IPv4 is that IPv6 has so much address space that on any computer in the network we can use global unicast addresses.

- **Link-local:** Link-local addresses in IPv6 are new. Such addresses operate only on the local connexion, as the terminology implies, we never route such addresses. Using these addresses, IPv6 packets are sent and received on a single subnet.

- **Loopback:** An address not assigned to any physical interface that can be used for a host to send an IPv6 packet to itself.

- **Unspecified address:** Used only as a source address and indicates the absence of an IPv6 address.

- **Unique local:** Unique local addresses function as private IPv4 addresses. If you don't want to connect to the Internet or if you want to use IPv6 NAT, you can use these addresses on your own network. The benefit of unique local addresses is that you don't need to register with an agency to obtain any space for your address.

- **IPv4 embedded:** An IPv6 address that carries an IPv4 address in the low-order 32 bits of the address.

UNSPECIFIED - An initialising host can only use this address as a source address before it has learned its own address.

Prefix: `::/128`

LOOPBACK - When a host talks to itself over IPv6, this address is used. This often occurs if sending data to another system.

Prefix: `::1/128`

IPv4-MAPPED - These addresses are used to embed IPv4 addresses in an IPv6 address. One use for this is in a dual stack transition scenario where IPv4 addresses can be mapped into an IPv6 address. See RFC 4038 for more details.

Prefix: `::ffff/96`

Example: `::ffff:192.0.2.47`

Unique Local Addresses (ULAs)-

These addresses are reserved for local use in home and business environments and are not space for public addresses.

Such addresses may not be identical, and there is no registry of formal addresses. Packets with these addresses are not intended to be routed on the public Internet in the source or destination regions, but are intended to be routed within the company or organisation.

Prefix: fc00::/7

Example: fdf8:f53b:82e4::53

Link-Local Addresses - Link-

local addresses in IPv6 are new. These addresses work only on the local link, as the wording implies, we never route these addresses. Using these addresses, IPv6 packets are sent and received on a single subnet.

Prefix: fe80::/10

Example: fe80::200:5aee:feaa:20a2

Global Unicast

The IPv6 addresses of global unicast are identical to public addresses in IPv4. It is possible to use these addresses on the Internet. Nevertheless, the big difference with IPv4 is that IPv6 has so much address space that on any computer in the network we can use global unicast addresses.

Prefix: 2000::/3

Multicast

A multicast IPv6 address is used to send a single IPv6 packet to multiple destinations.

Prefix: ff00::/8

Example: ff01:0:0:0:0:0:0:2

References

<https://en.wikipedia.org/wiki/IPv6>

<http://www.ciscopress.com/articles/article.asp?p=2803866&seqNum=4>

https://www.ripe.net/participate/member-support/lir-basics/ipv6_reference_card.pdf

<https://networklessons.com/ipv6/ipv6-address-types>

<https://www.cloudflare.com/learning/ddos/glossary/internet-protocol/>

School of Applied Computing - Network Address: 188.82.1.0/22					
	Column1	Column2	Column3	Column4	Column5
Room	Subnet mask	Network Address	Min Host	Max Host	Broadcast
OA - 250 devices	255.255.255.0	188.82.0.0/24	188.82.0.1	188.82.0.254	188.82.0.255
TC - 22 devices	255.255.255.224	188.82.0.32/27	188.82.0.33	188.82.0.62	188.82.0.63
lab301 – 60 pcs	255.255.255.192	188.82.0.128/26	188.82.0.129	188.82.0.190	188.82.0.191
Lab302 – 30 pcs	255.255.255.224	188.82.0.64/27	188.82.0.65	188.82.0.94	188.82.0.95
Lab303 – 36 pcs	255.255.255.192	188.82.0.0/26	188.82.0.1	188.82.0.62	188.82.0.63
Lab304 – 45 pcs	255.255.255.192	188.82.0.192/26	188.82.0.193	188.82.0.254	188.82.0.255
Lab306 – 40 pcs	255.255.255.192	188.82.0.64/26	188.82.0.65	188.82.0.126	188.82.0.127
Lab308 – 140 pcs	255.255.255.0	188.82.1.0/24	188.82.1.1	188.82.1.254	188.82.1.255
Lab309 – 50 pcs	255.255.255.192	188.82.2.0/26	188.82.2.1	188.82.2.62	188.82.2.63
Lab310 – 18 pcs	255.255.255.224	188.82.0.96/27	188.82.0.97	188.82.0.126	188.82.0.127
Staff - 20 pcs	255.255.255.224	188.82.0.128/27	188.82.0.129	188.82.0.158	188.82.0.159

School of Automotive Engineering - Network Address: 188.82.2.0/23						
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Room	Subnet mask	Network Address	Min Host	Max Host	Broadcast
Lab101 – 40 pcs	255.255.255.192	188.82.2.0/26	188.82.2.1	188.82.2.62	188.82.2.63
Lab102 – 25 pcs	255.255.255.224	188.82.2.32/27	188.82.2.33	188.82.2.62	188.82.2.63
Lab103 – 35 pcs	255.255.255.192	188.82.2.64/26	188.82.2.65	188.82.2.126	188.82.2.127
Lab205 – 40 pcs	255.255.255.192	188.82.2.128/26	188.82.2.129	188.82.2.190	188.82.2.191
Lab206 – 48 pcs	255.255.255.192	188.82.2.192/26	188.82.2.193	188.82.2.254	188.82.2.255
Lab301 – 50 pcs	255.255.255.192	188.82.3.0/26	188.82.3.1	188.82.3.62	188.82.3.63
CADlab – 20 pcs	255.255.255.224	188.82.2.64/27	188.82.2.65	188.82.2.94	188.82.2.95
Staff – 25 pcs	255.255.255.224	188.82.2.96/27	188.82.2.97	188.82.2.126	188.82.2.127

School of Engineering - Network Address: 188.82.4.0/23						
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Room	Subnet mask	Network Address	Min Host	Max Host	Broadcast
Lab201 – 20 pcs	255.255.255.224	188.82.4.0/27	188.82.4.1	188.82.4.30	188.82.4.31
Lab202 – 80 pcs	255.255.255.128	188.82.4.0/25	188.82.4.1	188.82.4.126	188.82.4.127
Lab203 – 65 pcs	255.255.255.128	188.82.4.128/25	188.82.4.129	188.82.4.254	188.82.4.255
Lab205 – 25 pcs	255.255.255.224	188.82.4.32/27	188.82.4.33	188.82.4.62	188.82.4.63
Lab404 – 45 pcs	255.255.255.192	188.82.4.0/26	188.82.4.1	188.82.4.62	188.82.4.63
Lab408 – 28 pcs	255.255.255.224	188.82.4.64/27	188.82.4.65	188.82.4.94	188.82.4.95
Lab409 – 80 pcs	255.255.255.128	188.82.5.0/25	188.82.5.1	188.82.5.126	188.82.5.127
Lab410 – 45 pcs	255.255.255.192	188.82.4.64/26	188.82.4.65	188.82.4.126	188.82.4.127
Staff – 18 pcs	255.255.255.224	188.82.4.96/27	188.82.4.97	188.82.4.126	188.82.4.127

Server	0:0:0:0:FFFF:BC52:0300
MP	0:0:0:0:FFFF:BC52:0500
DNS	0:0:0:0:FFFF:BC52:0600
Email	0:0:0:0:FFFF:BC52:0700
Finance	0:0:0:0:FFFF:BC52:0800
Registry	0:0:0:0:FFFF:BC52:0900
File	0:0:0:0:FFFF:BC52:0A00
Print	0:0:0:0:FFFF:BC52:0B00