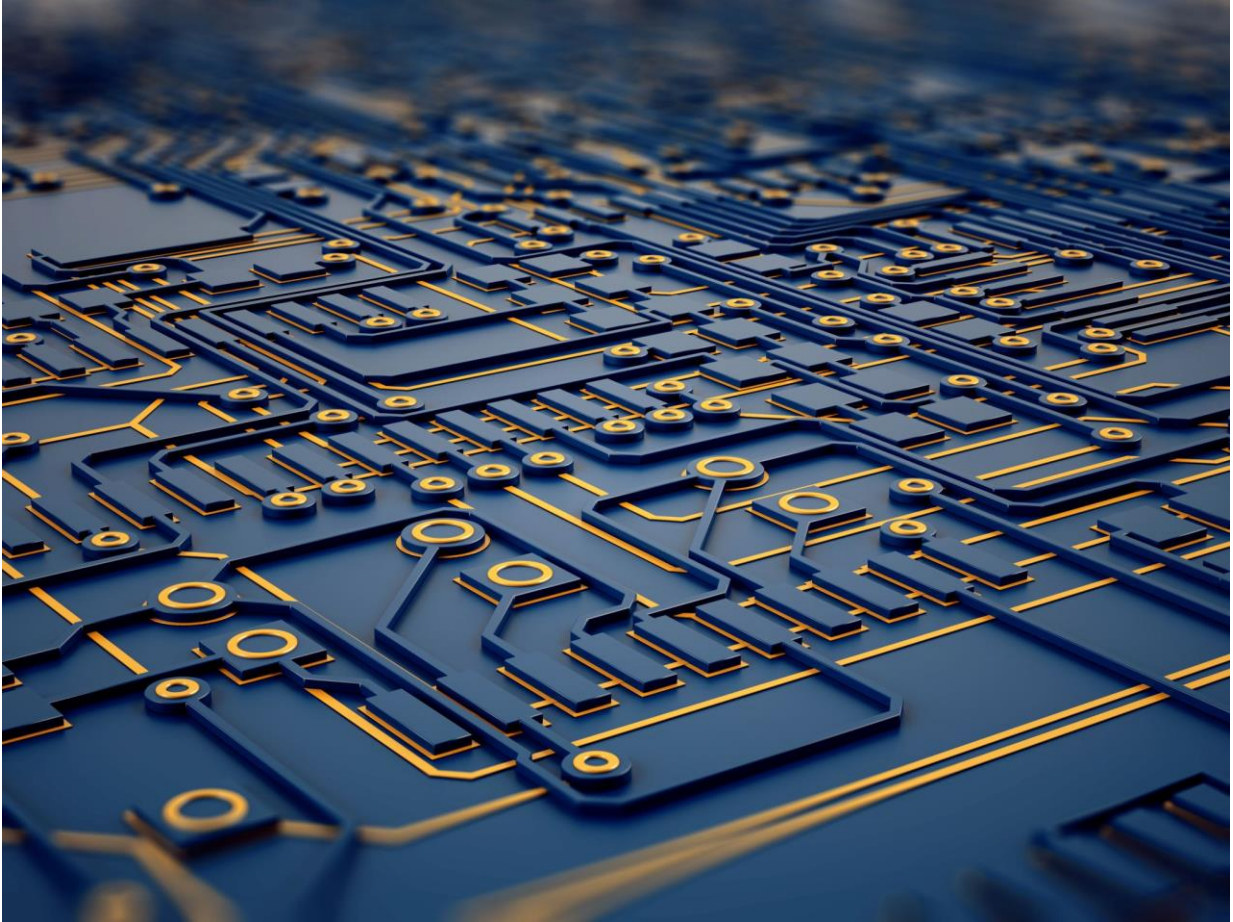


IPv6 Research



Course: Cloud Computing

Student: Plamen Manov

Teacher: Renuga Jayakumar

Table of Contents

I. Introduction.	3
- Dual Stack.....	3
- Tunneling	3
- Translation	3
1.Unicast addresses	4
2.Multicast addresses.	5
3. Anycast addresses.....	6
References	7
PART 2 – ADDRESSING TABLE	8

IPV6 Research

I. Introduction.

We already know that there is not enough IPV4 addresses. That is why the world networks impact ipv6 in our connections. IPV6 is larger than IPV4 – has 128-bit address space and provides over 340 undecillion addresses, meanwhile IPV4 has 4.3 billion addresses. With the IPV6, IETF is trying to fix the limitations of IPV4. For example is Internet Control Message Protocol version 6(ICMPv6) where address resolution and address autoconfiguration are included, but unable to founded in ICMP for IPV4. The motivating factor for moving to IPV6 from IPV4 is the depletion of IPV4 addresses. The moving from IPV4 to IPV6 is not strictly dated. It is getting slowly and step by step, it will take several years and both of them will coexist together. To convert their addresses, the network administrator are using some tools and protocol, which has been created by ITF. Those conversion techniques can be divided in three types:

- **Dual Stack** – allows to IPV4 and IPV6 to work together and they are run on the device simultaneously. It is known like native IPV6 and that means the customer has an IPV6 on his network
- **Tunneling** – transports IPV6 packet on the IPV4 network and that packet is encapsulated inside of the IPV4 packet
- **Translation** -allowing the communications between IPV6 and IPV4 devices by Network Address Translator 64(NAT64) using the translation techniques.

IPV6 is formatted and written in different way than IPV4. The length of IPV6 is 128 bits and is written in a series of hexadecimal values. A single hexadecimal digit representing four bits and IPV6 are not case sensitive and can be written in uppercase or lowercase.

The format for writing IPV6 is X:X:X:X:X:X:X, where each “X” consisting of 4 hexadecimal values, or each “X” is a single hextet, equvalere to 16 bits. If we are using the preferred format that is mean we will type every 32 digits, but does not necessary because there is two rules, which will help to reduce to typing all of 32 digits for IPV6:

- Rule 1 – Omit leading 0 – omitting any leading zeroes in every hextet .
Examples: 02ba can be represented as 2ba
09d9 can be represented as 9d9
00da can be represented as da
Preferred - 5002:02bd:0007:52da:0a56:0026:cad0:90fe which Is equivalent to -
No leading 0s - 5002:2bd:7:52da:a56:26:cad0:90fe
Preferred – fe09:0000:0000:0000:0546:5648:79db:cfde
No leading 0s - fe09:0:0:0:546:5648:79db:cfde
- Rule 2 – Double colon – (::) – replacing any single, contiguous string of 1 or more 16 bit hextet, which consist of all zeroes. For example 3201:db91:9:0:0:0:54a is represented as

3201:db91:9::54a, where the double colon is used to replace 0:0:0 or all three 0 hextets. Double colon can be used just once in an IP address, otherwise there will be more than one possible address. The notation of IPV6 can be reduced when is using the omitting leading zeroes technique. This is known like a compressed format.

Example : 90fe:db06::9309::ab16 – used incorrect compressed format

The double colon is used twice and now we will see the possible IP addresses :

90fe:db06:0000:0000:9309::ab16

90fe:db06::9309:0000:0000:0000:ab16

90fe:db06:0000:9309::ab16

90fe:db06::9309:0000:0000:ab16

The practice says to be used double colon on the longest string or in the first string should be used double colon in case if they are equal.

IPV6 has a three types of addresses – unicast, multicast and anycast.

- Unicast - IPV6 addresses exceptionally identifies the interface on the enabled IPV6 device.
- Multicast – where single IPV6 packets are sent to multiple destination
- Anycast - in that situation any unicast IPV6 address will be able to be assigned into many devices.

1.Unicast addresses

The portion of network (prefix) of IPV4 address is possible to be recognized from dotted-decimal subnet mask or from the prefix length. To IPV6 addresses it is just named with prefix length and there is no used dotted-decimal subnet mask. That prefix length exists in range from 0 to 128 and is represented in slash notation and used to indicate IPv6 addresses network portion. It is preferred to be used /64 prefix length for LANs and other types of networks.

IPv6 has different types of unicast addresses – Global Unicast, Link-local, Loopback, Unspecified Address, Unique Local, Embedded IPv4. Usually IPv6 use two unicast addresses – Global Unicast Address (GUA) and Link-Local Address (LLA).

- GUA – it is similar to IPv4 public address – globally unique addresses, which are internet-routable and can be configured statically or dynamically.
- LLA – it is required to be assigned for all IPv6 enable device and are used to have communication between the devices on the same network (Local link). They are not and can not be routable and need to be enclosed in a single link, where will get confirmation.

The range of Unique Local Addresses is fc00::/7 to fdff::/7 and still unusable. Probably these addresses will be usable for devices with no access outside like internal servers and printers. Unique Local IPv6 addresses have similarity with RFC 1918 private IPv4 addresses. The differences is that they are used for local addressing, for devices which will never have access to another network and are not translated and routed to global address of IPv6.

Global routing prefix, Subnet ID and Interface ID is the GUA's structure.

- Global routing prefix – the network (portion) of the address assigned from the provider (ISP) to site or customer. Example: ipv6 address 2001:db8:acad::/48 - the first part is the global routing prefix(2001:db8:acad) which are 48 bits or 3 hextets known by the ISP. The next double colon (::) and /48 prefix length are the rest of address which means the address contains just 0s. The size of the subnet ID can be determined from the size of the global routing prefix.
- Subnet ID is located between Global prefix and the interface ID. Organization is using the subnet ID to identify subnets within its site. More subnets are available when the subnet ID is larger. For the subnetting the benefit is a 128-bit address is able to support enough subnets and hosts per subnet in every network. For 16-bit subnet id can be created up to 65.536 subnets, for 64-bit it can be supported up to 18 quintillion IPv6 address per subnet
- Interface ID –One single host can have multiple interfaces and every one can have one or more IPv6 addresses. Ipv6 interface ID is equivalent to the host portion to IPv4.

LLA enables to devices to communicate with different device which is IPv6 enabled and it is located on the same link and nowhere else. Each device which is assigned in IPv6 network need to have an LLA. If is not manually configured, it will automatically create LLA. Ipv6 devices communicate each other on the same network, because they are able to create IPv6 LLA even they are not assigned with global unicast IPv6 address.

To create IPv6 network we can do statically configurations to IPv6 GUAs and LLAs on the routers and devices. As we said just with LLAs the IPv6-enabled device can communicate each other(only on the same subnet). The most of IPv6 verification and configuration are similar with IPv4. Sometimes the difference is to use ipv6 instead of ip for the commands. The static configuration of IPv6 host is similar like IPv4 and it does not scale to bigger environments, that is why the assigning is preferred to be done dynamically. Two ways are available for devices to obtain automatically IPv6 GUA – Stateless address autoconfiguration(SLAAC) and Stateful DHCPv6. If they are used the default gateway address will be automatically assigned and be the like the LLA of the router.

Static configuration of a Link-Local Unicast Address enable to recognize and easy remembered address. Typically for IPv6 just need to assign easy LLAs on the routers. LLA is easy to be configured manually with using the IPv6 link local command.

2.Multicast addresses.

They are similar to IPv4 multicast addresses. Usable to send single packet to just one or more destinations. The multicast addresses of IPv6 have the prefix ff00::/8. The multicast addresses are usable just to be destination address. IPv6 multicast addresses has two types:

- well-known multicast addresses
- solicited node multicast addresses
- Well-known Multicast addresses – they are assigned and are reserved for a group of devices. A single assigned multicast address is used to contact with a group of devices running with the same service or protocol. There are 2 groups of IPv6 assigned multicasts addresses

- ff02::1(ALL-nodes multicast group) – all IPv6 enabled devices can join. All devices will processed and receive a packet which is sent in the group.
- ff02::2(ALL-routers multicast group)-in this group all IPv6 router are able to join. With the routing command ipv6 unicast-routing, the router becomes a member. All routers on the network will processed and receive the packet which is sent in the group.
- Solicited-node IPv6 multicasting Addresses – similar to all-nodes multicast address. They are mapped to Ethernet multicast address, which is special and that allowing to the Ethernet NIC to do filtering on the frame and examining the MAC address of the destination without sending it to the Ipv6 process.

3. Anycast addresses.

The ability every IPv6 unicast address to be assigned to multiple devices. Every packet sent to an anycast address will take the route to the nearest device with that address. (Anon., 2020)

References

Anon., 2020. *NetAcad*. [Online]
Available at: <https://www.netacad.com/>
[Accessed august 2020].

PART 2 – ADDRESSING TABLE

Lab no	Network address	First IP address	Last IP address	Broadcast add	Subnet mask
School of applied computer s+ growth					
Open access lab -240pcs	172.17.0.0/24	172.17.0.1	172.17.1.254	172.17.1.255	255.255.255.0
Lab 308 - 120pcs	172.17.2.0/24	172.17.2.1	172.17.2.254	172.17.2.255	255.255.255.0
Lab 410- 50pcs	172.17.3.0/22	172.17.3.1	172.17.3.126	172.17.3.127	255.255.252.0
Lab 301- 45pcs	172.17.3.128/22	172.17.3.129	172.17.3.190	172.17.3.191	255.255.252.0
Lab 412- 36pcs	172.17.3.192/22	172.17.3.193	172.17.3.254	172.17.3.255	255.255.252.0
Lab 306 - 35pcs	172.17.4.0/22	172.17.4.1	172.17.4.62	172.17.4.63	255.255.252.0
Lab 411 – 30pcs	172.17.4.64/22	172.17.4.65	172.17.4.126	172.17.4.127	255.255.252.0
Lab 303 – 30pcs	172.17.4.128/22	172.17.4.129	172.17.4.190	172.17.4.191	255.255.252.0
Lab302 – 30pcs	172.17.4.192/22	172.17.4.193	172.17.4.254	172.17.4.255	255.255.252.0
Staff – 25	172.17.5.0/21	172.17.5.1	172.17.5.30	172.17.5.31	255.255.248.0
Test centre - 25pcs	172.17.5.32/21	172.17.5.33	172.17.5.63	172.17.5.63	255.255.248.0
Lab 302 – 20pcs	172.17.5.64/21	172.17.5.65	172.17.5.90	172.17.5.91	255.255.248.0
Printers – 5	172.17.5.92/20	172.17.5.93	172.17.5.106	172.17.5.107	255.255.240.0
Printers – 2	172.17.5.108/18	172.17.5.109	172.17.5.114	172.17.5.115	255.255.192.0
Video cam – 1	172.17.5.116/18	172.17.5.117	172.17.5.122	172.17.5.123	255.255.192.0
Ip phone - 1	172.17.5.124/18	172.17.5.125	172.17.5.130	172.17.5.131	255.255.192.0
DNS server	2002:36:1c6::90				
Email server	2002:34:45d0::8:1				
Finance server	2002:61b4::7a0:7				

Registry server	2002:64a::52:85				
File server	200:94ad:45::9				
Print	2002:460b::46:14				
MP&ISP link	Fe80::2006				
School of automotive engineering					
Lab 301 – 85pcs	172.17.6.0/23	172.17.6.1	172.17.6.126	172.17.6.127	255.255.254.0
Lab 206 – 55pcs	172.17.6.128/22	172.17.6.129	172.17.6.190	172.17.6.191	255.255.252.0
Lab102 – 35pcs	172.17.6.192/22	172.17.6.193	172.17.6.254	172.17.6.255	255.255.252.0
Lab 103 – 30pcs	172.17.7.0/21	172.17.7.1	172.17.7.30	172.17.7.31	255.255.248.0
Lab 101 – 25pcs	172.17.7.32/21	172.17.7.33	172.17.7.62	172.17.7.63	255.255.248.0
Lab 205 – 20pcs	172.17.7.64/21	172.17.7.65	172.17.7.94	172.17.7.95	255.255.248.0
Staff – 20	172.17.7.96/21	172.17.7.97	172.17.7.126	172.17.7.127	255.255.248.0
CAD lab – 10pcs	172.17.7.128/21	172.17.7.129	172.17.7.142	172.17.7.143	255.255.248.0
School of Architecture, built and Nat. Environment					
Lab 409 – 60pcs	172.17.8.0/23	172.17.8.1	172.17.8.126	172.17.8.127	255.255.254.0
Lab 201 – 54 pcs	172.17.8.128/23	172.17.8.129	172.17.8.254	172.17.8.255	255.255.254.0
Lab 410 – 45 pcs	172.17.9.0/22	172.17.9.1	172.17.9.62	172.17.9.63	255.255.252.0
Lab 404 – 35pcs	172.17.9.64/22	172.17.9.65	172.17.9.126	172.17.9.127	255.255.252.0
Lab 203 – 30 pcs	172.17.9.128/22	172.17.9.129	172.17.9.254	172.17.9.255	255.255.252.0
Lab 408 – 28 pcs	172.17.10.0/22	172.17.10.1	172.17.10.62	172.17.10.63	255.255.252.0

Lab 205 – 28 pcs	172.17.10.64/22	172.17.10.65	172.17.10.126	172.17.10.127	255.255.252.0
Lab 202 – 25 pcs	172.17.10.128/21	172.17.10.129	172.17.10.158	172.17.10.159	255.255.240.0
Staff – 4	172.17.10.160/19	172.17.10.161	172.17.10.166	172.17.10.167	255.255.224.0