Internet Protocol Version 6

Course Code: COE 3206   Course Title: Computer Networks

Dept. of Computer Science
Faculty of Science and Technology

Lecturer No:	10	Week No:	12	Semester:	Fall 23-24
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Lecture Outline

❑ To introduce the IPv6 addressing scheme and different notations used to represent an address in this version.

❑ To explain the three types of addressing used in IPv6: unicast, anycast, and multicast.

❑ To show the address space in this version and how it is divided into several blocks.

❑ To discuss some reserved blocks in the address space and their applications.

❑ To define the global unicast address block and how it is used for unicast communication.

❑ To discuss how three levels of hierarchy in addressing are used in IPv6 deploying the global unicast block.

❑ To discuss auto configuration and renumbering of IPv6 addresses.

Measurement of 128 bit

Examples:

            2001:0211:00AB:0000:0000:0000:0000:0001
  Working in the 1st Hexted we can see
  2 = 0010   (4-bit)
  0 = 0000   (4-bit)
  0 = 0000   (4-bit)
  1 = 0001   (4-bit)

= Total 16 bit in One Hexted.

In total :- 16 bit * 8 Hexted = 128 bit.

How to Shorten IPv6 Address

1. Leading Zero Can be Omitted.
2. Consecutive Hexted of Zeros can be represented/replaced by double colon (::).
3. Double colon can only be used once in an IPv6 Address.

2001:0211:00AB:0000:0000:0000:0000:0001

=According to the rules, we can write

i.   2001:211:AB:0:0:0:0:1   -Leading 0's are omitted
ii. 2001:211:AB::1   - Consecutive 0 means (::)
iii. Already Used one double colon.

Final Shorten IP address:-

2001:211:AB::1

Problem set

Show the unabbreviated colon hex notation for the following IPv6 addresses:

a. An address with 64 0s followed by 64 1s.
b. An address with 128 0s.
c. An address with 128 1s.
d. An address with 128 alternative 1s and 0s.

Solution:-

a. 0000:0000:0000:0000:FFFF:FFFF:FFFF:FFFF
b. 0000:0000:0000:0000:0000:0000:0000:0000
c. FFFF:FFFF:FFFF:FFFF:FFFF:FFFF:FFFF:FFFF
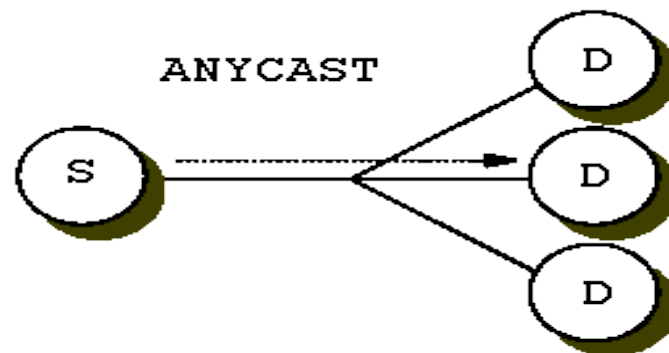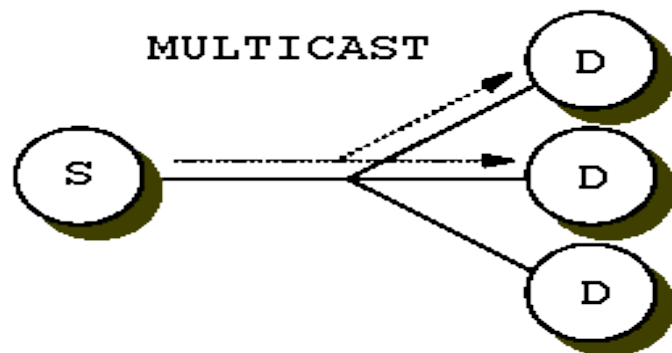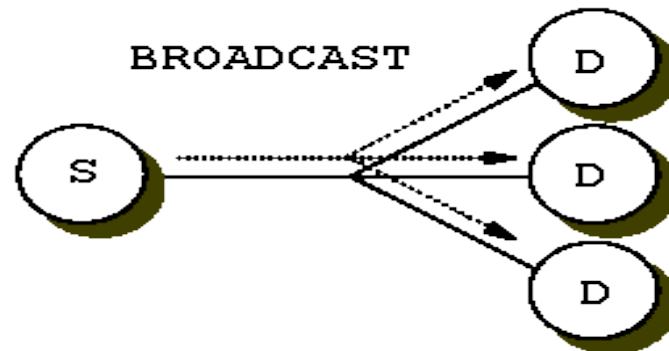d. AAAA:AAAA:AAAA:AAAA:AAAA:AAAA:AAAA:AAAA

Problem set (cont...)

Show abbreviations for the following addresses:
- ❖a. 0000:0000:FFFF:0000:0000:0000:0000:0000
- ❖b. 1234:2346:0000:0000:0000:0000:0000:1111
- ❖c. 0000:0001:0000:0000:0000:0000:1200:1000
- ❖d. 0000:0000:0000:0000:0000:FFFF:24.123.12.6

Solution
- ✓a. 0:0:FFFF::
- ✓b. 1234:2346::1111
- ✓c. 0:1::1200:1000
- ✓d. ::FFFF:24.123.12.6

Types of ipv6 Address

Types of ipv6 Address (cont...)

- Like IPv4...
  - Unicast
    - An identifier for a single interface. A packet sent to a unicast address is delivered to the interface identified by that address.
  - Multicast
    - An identifier for a set of interfaces (typically belonging to different nodes). A packet sent to a multicast address is delivered to all interfaces joined to that group address.
  - Anycast
    - An identifier for a set of interfaces (typically belonging to different nodes). A packet sent to an anycast address is delivered to one of the interfaces identified by that address (the "nearest" one, according to the routing protocols' measure of distance).
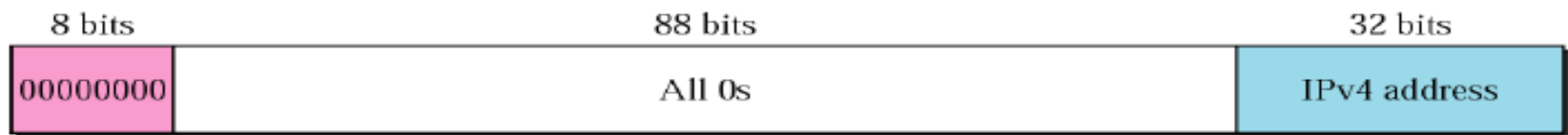
What is removed in ipv6

What is not in IPv6

- **Broadcast**
    - There is no broadcast in IPv6.
    - This functionality is taken over by multicast.
    - Helps mitigate some DDoS attacks.

Convert IPv4 to IPv6

8 bits	88 bits	32 bits
00000000	All 0s	IPv4 address

First 8 bits 0, following 88 bits will also be zero, last 32 bits will be the IPv4 address.

IPv4 address: 192.168.10.62

Convert it into IPv6

Representing each octet with 8 bits binary:

192 = 1100 0000 = C0

168 = 1001 0100 = 94

10 = 0000 1010 = 0A

62 = 0011 1110 = 3E

IPv6 address will be→ 0:0:0:0:0:0:C094:0A3E → ::C094:A3E

❖ All the link local address starts with FE80

❖ It is used for retrieving MAC address

FE80::5D39:84FF:FE29:3064

5D39:84FF:FE29:3064

↗ Rules to convert link local into MAC Address:

↗ i) Drop the First four Hextets

↗ ii) Flip the 7th bit of 5th Hextet

↗ iii) Drop the 2nd Octet of 6th Hextet

↗ iv) Drop the 1st Octet of 7th Hextet

FE80::5D39:84FF:FE29:3064

drop   flip   drop

↗ 5D39=0101110100111001

↗ 7th bit flip   **5F39**

↗ MAC address: 5F39:8429:3064

References

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Books

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2. **Computer Networking: A Top-Down Approach**, *J. F., Kurose, K. W. Ross*, Pearson Education, Inc., Sixth Edition, USA.

3. **Official Cert Guide CCNA 200-301 , vol. 1**, *W. Odom*, Cisco Press, First Edition, 2019, USA.

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