

Date: ...27.02.2024.....

C&F421 - Computer Networks - SFG

Lecture 08 - Network Layer: IPv4 Addressing

IP Address/Logical Addressing

IPv4 \rightarrow 32 bits IPv6 \rightarrow 128 bits

$x \cdot x \cdot x \cdot x \rightarrow$ octets (4)

$\frac{192}{8} \cdot \frac{168}{8} \cdot \frac{10}{8} \cdot \frac{1}{8} \rightarrow 8 \times 4 = 32 \text{ bits}$

$2^7 \ 2^6 \ 2^5 \ 2^4 \ 2^3 \ 2^2 \ 2^1 \ 2^0$

128 64 32 16 8 4 2 1

1 1 0 0 0 0 0 0 $\rightarrow 192 = 128 + 64$

1 0 1 0 1 0 0 0 $\rightarrow 168 = 128 + 32 + 8$

0 0 0 0 1 0 1 0 $\rightarrow 10 = 8 + 2$

0 0 0 0 0 0 0 1 $\rightarrow 1$

IP Address \rightarrow Network bits + Host bits

Prefix Mask $\rightarrow /16$ [First 16 bits for Network; remaining for the host]

Subnet Mask

Subnet Mask \rightarrow IP Address [for routers]

Suppose, prefix mask $\rightarrow /20$

255.255.240.0

11000000.10101000.00001010.00000001 \leftarrow IP

11111111.11111111.11110000.00000000 \leftarrow Subnet Mask

11000000.10101000.00001010.00000000 \leftarrow AND operation

Router only needs the network bits, it will not lead you to host device.

192.168.0.0 \rightarrow Network Address

/16 \rightarrow 255.255.0.0 \hookrightarrow first binary combination / unusable

First usable IP \rightarrow 192.168.0.1

Last usable IP \rightarrow 192.168.15.254

Broadcast Address \rightarrow 192.168.15.255

\hookrightarrow last binary combination / unusable

Total IP = $2^{12} \rightarrow$ Host bits

Total usable IP = $2^{12} - 2$

\hookrightarrow exclude network and broadcast addresses.

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Lecture 10 - IPv4 Addressing [Theory]

* Each device on a network - uniquely identified at Network Layer

* To identify a path/route \rightarrow using IP Address

via a network, the

address must have two parts:

(I) Network part

(II) Host part

IPv4

(32 bits)

IPv6

(128 bits)

- source & destⁿ address is contained in his packet.

(I) Network Portion -

* a network can be defined as a set of hosts that have identical bit patterns in the network address part of their addresses.

Ex. 192.168.10.1
192.168.10.67
192.168.10.204

(II) Host Portion -

* variable number of least significant bits - host part

* no. of bits used in this host portion determines the number of hosts that we can have w/in the network.

Prefix Mask - identify the network part of the address.

Ex. 192.68.1.24/16

\rightarrow First 16 bits are in the Network Portion & the remaining are in the Host part

Subnet Mask - another form of Prefix Mask; used for routers

16 \rightarrow Subnet mask of 255.255.0.0

24 \rightarrow " " " 255.255.255.0

- has the same IP Address format (32 bits divided into

Prefix Mask of /24 \rightarrow first 24 bits of subnet octets)
 mask would be 1 \rightarrow 11111111.11111111.11111111.00000000

\swarrow
 represent
 same information
 differently
 \nwarrow

Why is the logic "AND" used?

- * Routers use AND to determine the route a packet will take.
- * The network number in the destⁿ address is used to find the network in the routing table.
- * Router then determines the best path for the frame.

Types of Addresses -

cannot be assigned to a device.

(I) Network Address - first IP (all hosts have same network bits)

(II) Broadcast Address - last IP (each host bit = 1)

(III) Host Address - in between (unique address assigned to each device on a network)

Ex. 192.168.10.0/24

↳ Host Address:

192.168.10.1 ~ 192.168.10.254

* Complicated Examples -

172.16.4.0 → IP Address

Prefix Mask → /25

Network Address - 172.16.4.0

Broadcast Address - 172.16.4.127 ($2^6 + 2^5 + 2^4 + \dots + 2^0$)

Host Address - 172.16.4.1 ~ 172.16.4.126

Prefix Mask → /27

Network Address - 172.16.4.0

Broadcast Address - 172.16.4.31

Host Address - 172.16.4.1 ~ 172.16.4.30

Special Addresses - (I) Unicast (message sent to one host; web surfing + file transfer)

(II) Broadcast

(a) limited Broadcast

(b) Directed "

* message addressed to all hosts on a network

* uses network's broadcast address or 255.255.255.255 locally

(III) Multicast

* message addressed to a group of hosts

* uses an IP address → 224 ~ 239

Ex. video/audio broadcast;
news feed; distribution of software

Date:/...../.....

Classful Addressing—

→ Memorize

Class	First Octet Range	High Order Bits
A	0 ~ 127	0
B	128 ~ 191	10
C	192 ~ 223	110
Multicast	224 ~ 239	1110
Experimental	240 ~ 255	1111

	01	02	03	04	Subnet Mask
Class A	Network	Host	Host	Host	/8
B	Network	Network	Host	Host	/16
C	Network	"	Network	"	/24

→ 224rbba host

→ 224rbba host

224rbba 91 ← 0.0.0.0

281 ← 128

0.0.0.0 → 224rbba host

(8 + ... + 256) 15.15.15.15 → 224rbba host

15.15.15.15 → 224rbba host

15.15.15.15 → 224rbba host

0.0.0.0 → 224rbba host

15.15.15.15 → 224rbba host

15.15.15.15 → 224rbba host

Special Address - (1) Unicast (message sent to one host only)

(2) Broadcast

(3) Limited Broadcast

(4) Multicast

(5) Reserved

(6) Private