CN-Basic
L11

IP Addressing

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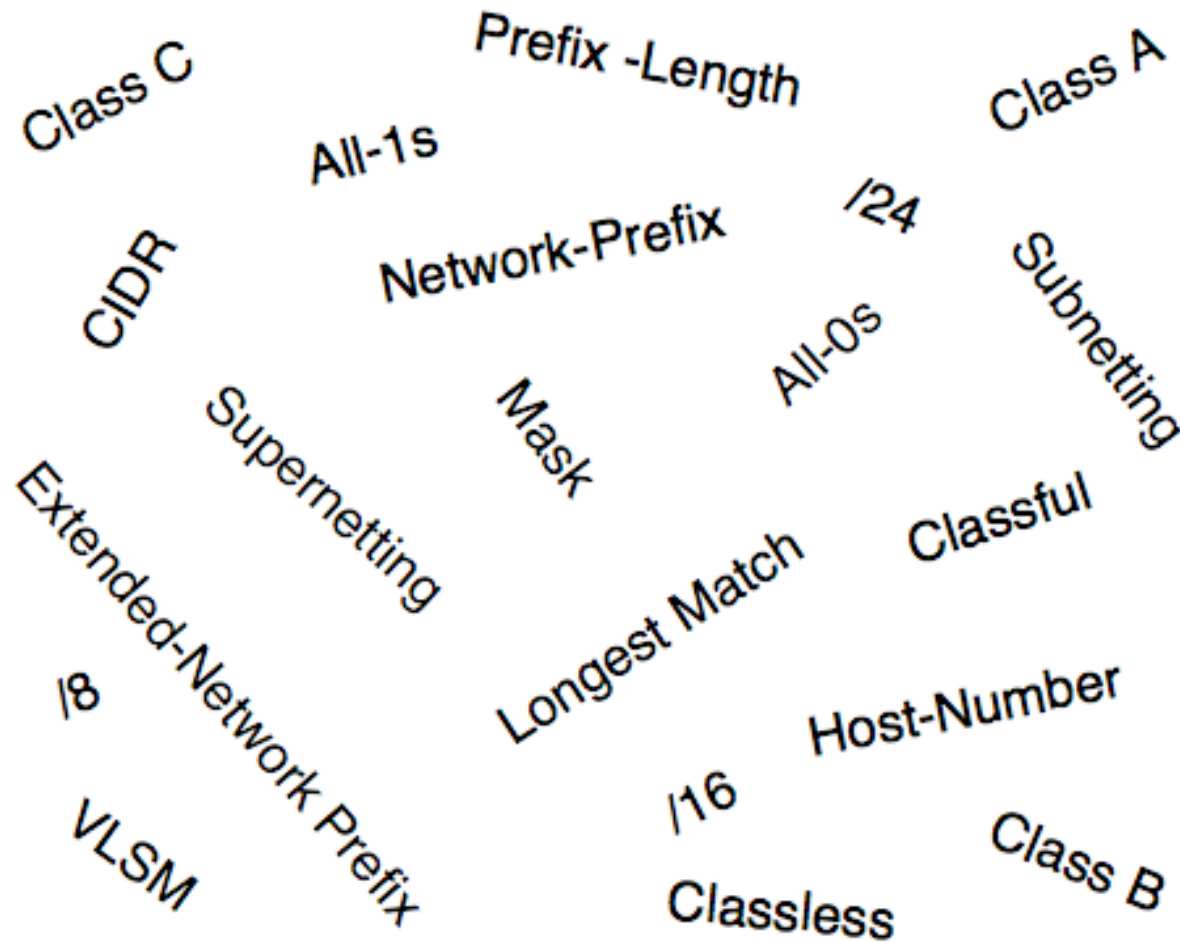https://www.youtube.com/watch?v=H4lrvTCDu4M

IP Addressing

- Understanding terms to use
  - Naming
    - Identifies what it is
  - Addressing
    - Identifies where it is
  - Routing
    - Identifies how to reach it
- Examples:
  - Name: KS Institute of Technology
  - Address: Raghuvanhalli, Kankapura Road
  - Routing: Need to map to find directions from starting point.

Understanding IP Addressing:
Everything You Ever Wanted To Know

Class C Prefix -Length Class A
All-1s
CIDR Network-Prefix /24 Subnetting
Supernetting Mask All-0s
Extended-Network Prefix Longest Match Classful
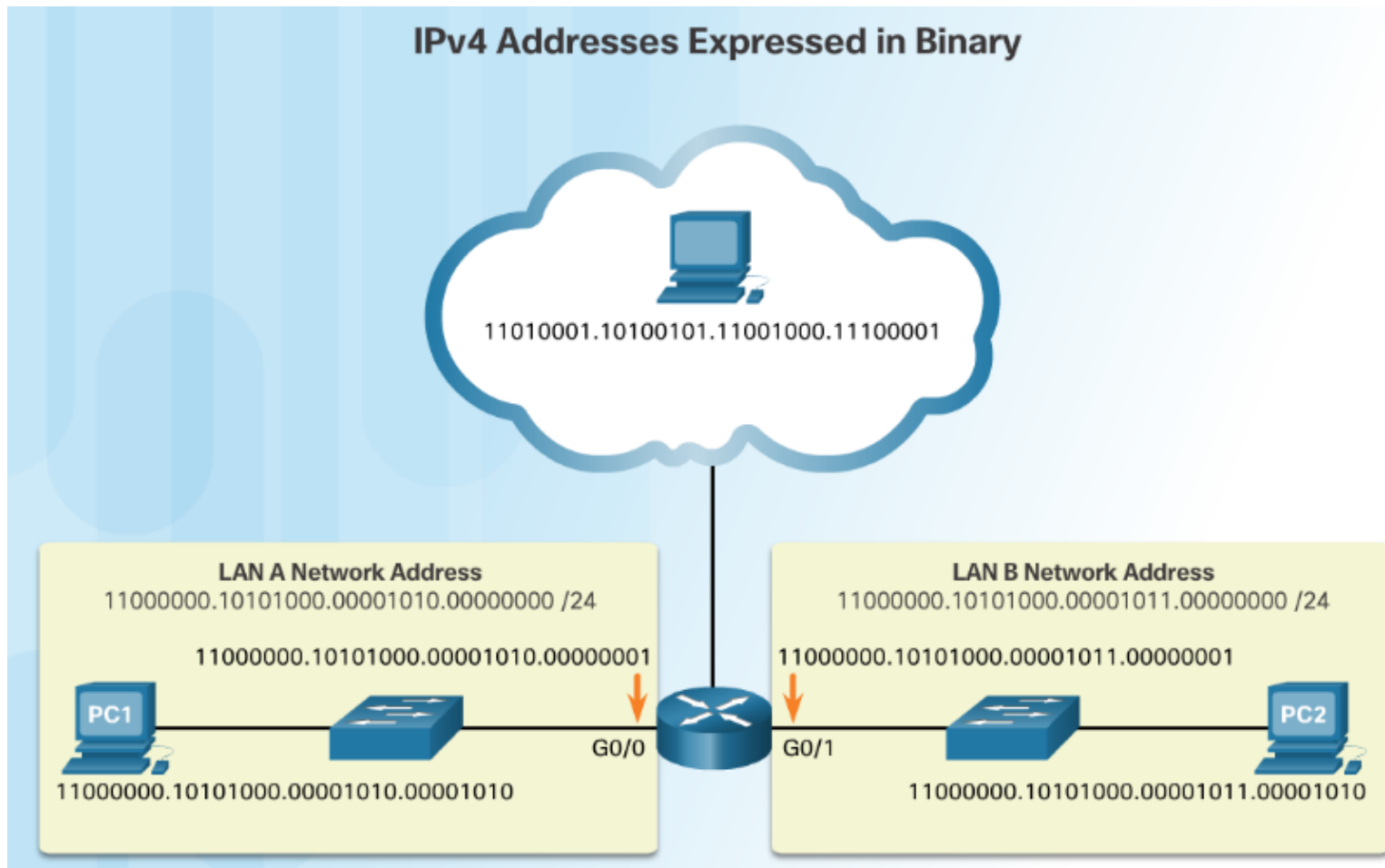/8 Host-Number
VLSM /16 Class B
Classless

src: Chuck Semeria, NSD Marketing, 3Com Corp, 1996

Example

- Consider the website: <u>www.rprustagi.com</u>
- Name:
  - Identifies the website <u>`rprustagi.com`</u>
- Address (IP Address)
  - `69.161.146.196`
- Route: Use **`traceroute`** to find the route
  - `192.168.1.1`
  - abts-kk-dynamic-001.4.179.122.<u>airtelbroadband.in</u>
  - abts-kk-static-017.33.166.122.<u>airtelbroadband.in</u>
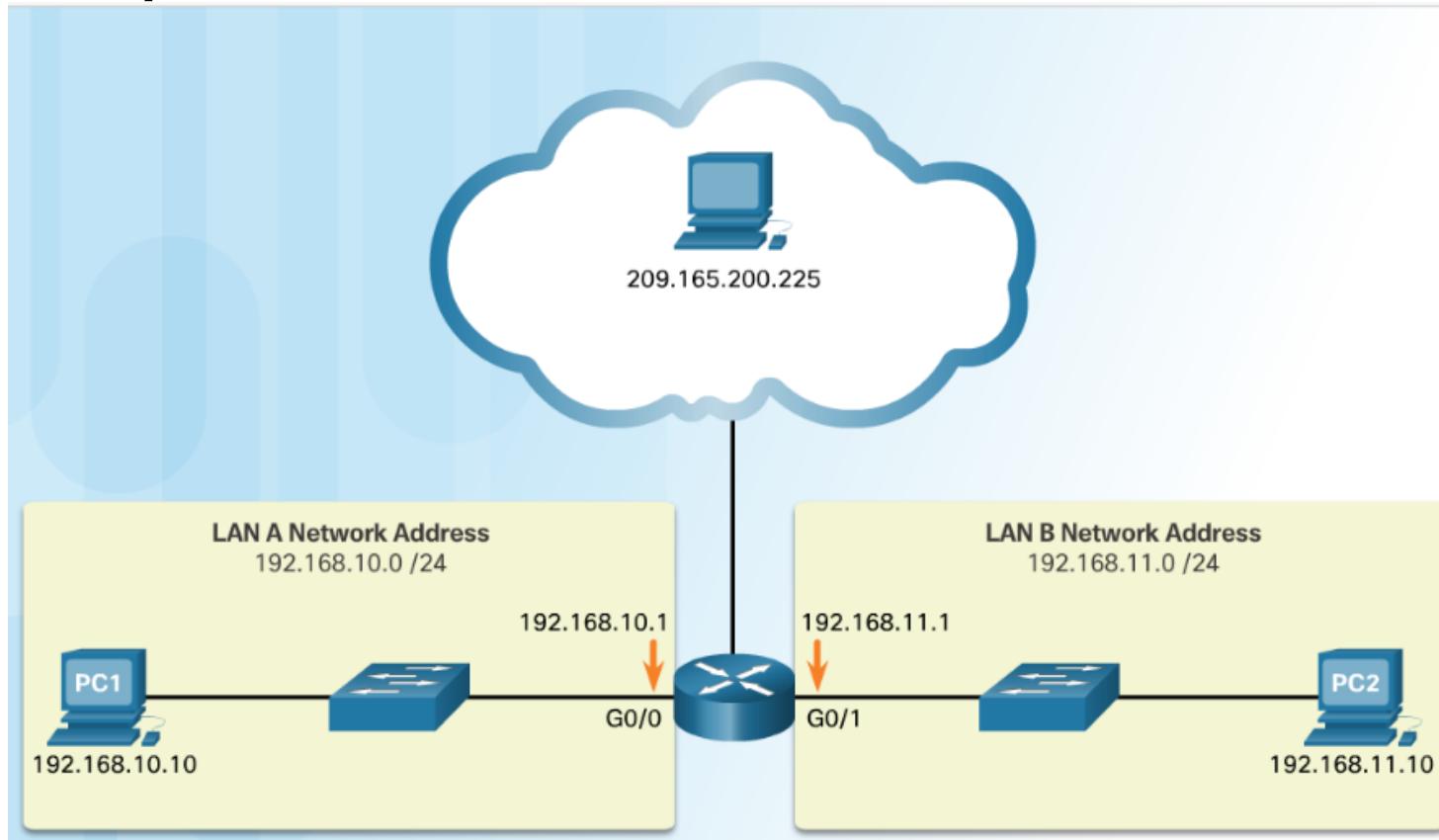 - `125.62.180.9`
  - `182.79.146.194`
  - ...

IP Address

- IPv4 addresses are expressed in 32 binary bits divided into 4 octets (8 bits)

IPv4 Addresses Expressed in Binary

11010001.10100101.11001000.11100001

LAN A Network Address
11000000.10101000.00001010.00000000 /24

11000000.10101000.00001010.00000001

PC1

G0/0

11000000.10101000.00001010.00001010

LAN B Network Address
11000000.10101000.00001011.00000000 /24

11000000.10101000.00001011.00000001

G0/1

PC2

11000000.10101000.00001011.00001010

src: CCNA R&S M1: Intro to Networking

IP Address

- IPv4 addresses are commonly expressed in dotted decimal notation i.e. `a.b.c.d/n`
- Example: `192.168.10.1`

209.165.200.225

LAN A Network Address
192.168.10.0 /24

LAN B Network Address
192.168.11.0 /24

192.168.10.1

192.168.11.1

PC1

PC2

G0/0   G0/1

192.168.10.10

192.168.11.10

IP addressing: introduction

- Analogy: A house has mulitple doors opening on different streets. What is its address?
  - Do all doors have same number?
- **IP address:** A 32-bit identifier for interface of an host, router *etc.*
- **interface**: A connection between host/router and physical link
  - A router typically has multiple interfaces
  - A host typically has one or two interfaces (e.g., wired Ethernet, wireless 802.11)
  - A host also has a loopback address (127.0.0.1)
- *Note: IP addresses associated with each interface*

IP addressing: introduction

223.1.1.1

223.1.1.2

223.1.1.3

223.1.1.4

223.1.2.1

223.1.2.9

223.1.2.2

223.1.3.27
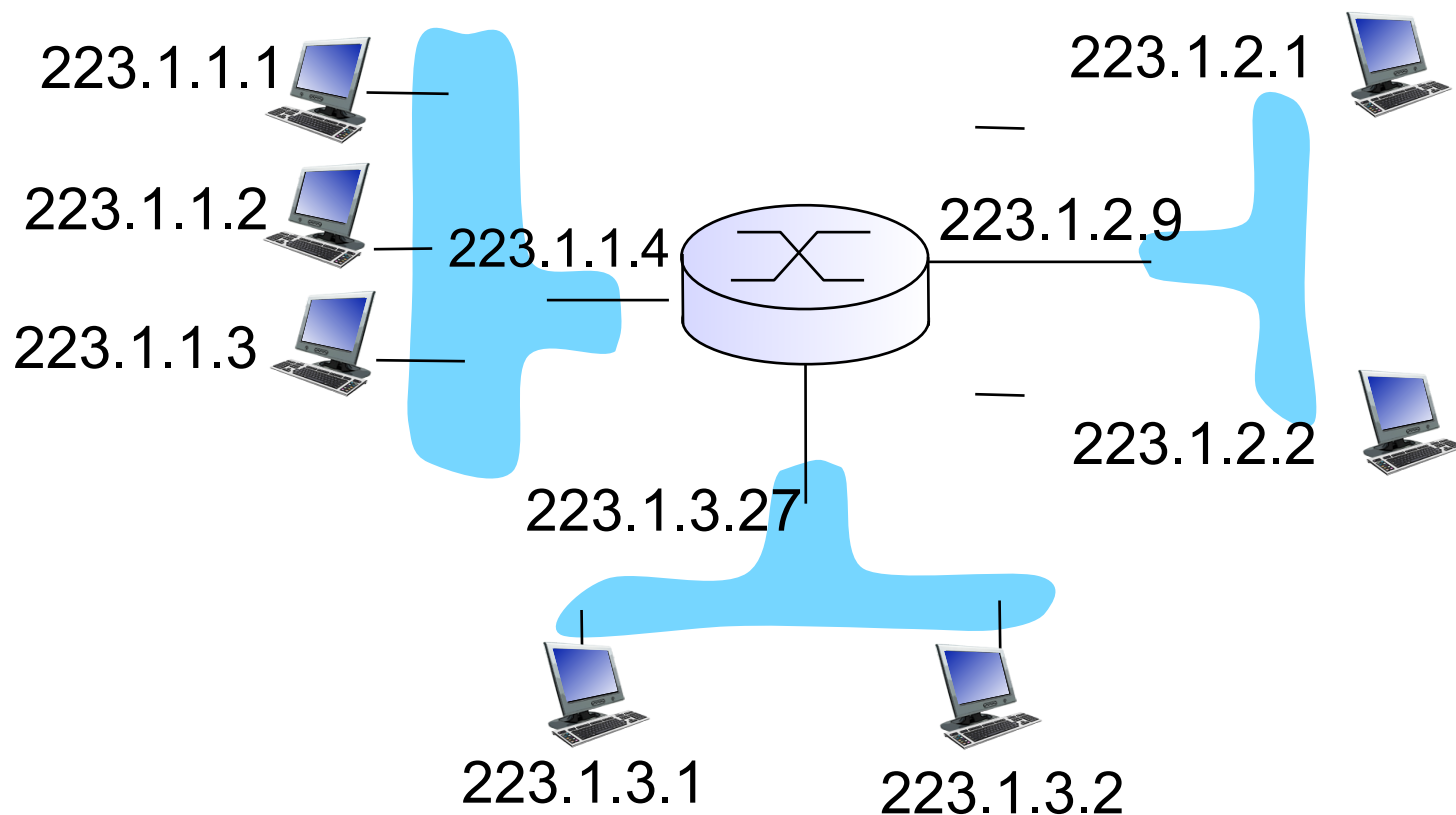
223.1.3.1

223.1.3.2

223.1.3.27 = 11011111 00000001 00000011 00011011
                 223   1   3   27

IP Address: Decimal to Binary Conversion

- Consider `192.168.10.11`
  - Convert 1st octet

Example: 192.168.10.11

128	64	32	16	8	4	2	1

IP Address: Decimal to Binary Conversion

- Consider `192.168.10.11`
  - Convert 2nd octet

Example: 192.168.10.11

Positional Value	128	64	32	16	8	4	2	1

IP Address: Decimal to Binary Conversion

- Consider `192.168.10.11`
  - Convert 3rd octet

Example: 192.168.**10**.11

Positional Value	128	64	32	16	8	4	2	1

IP Address: Decimal to Binary Conversion

- Consider `192.168.10.11`
  - Convert 4th octet

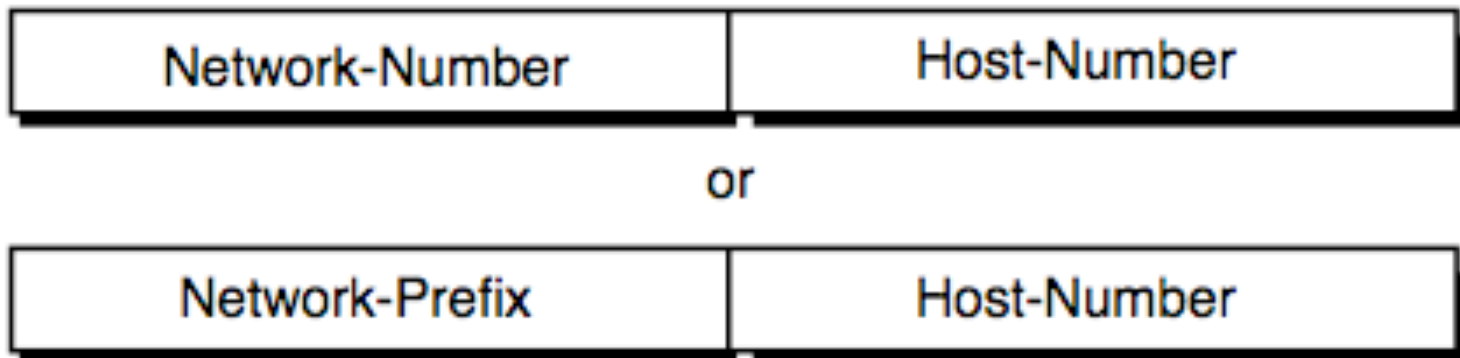Example: 192.168.10.**11**

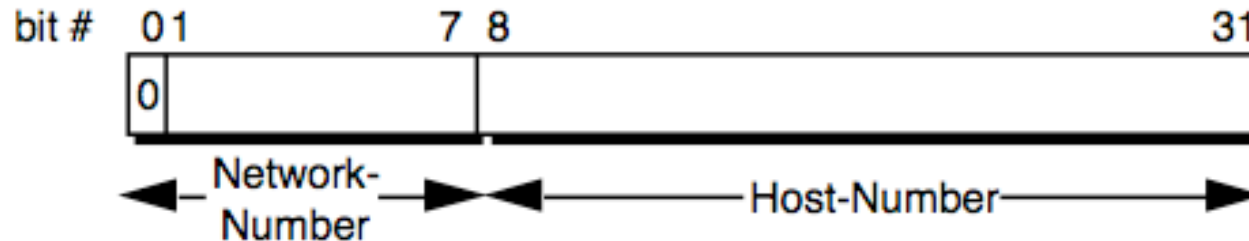| Positional Value	128	64	32	16	8	4	2	1

IP Address and Network

- An IPv4 address is hierarchical.
  - Composed of a Network portion and Host portion.
- All devices on the same network must have the identical network portion.
- The Subnet Mask helps devices identify the network portion and host portion.
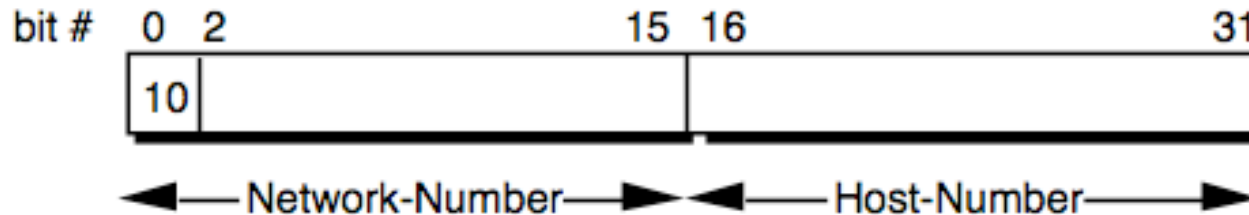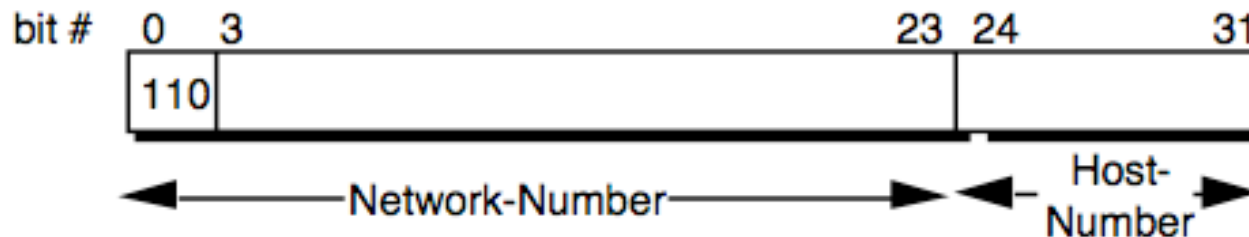
Network-Number	Host-Number

or

Network-Prefix	Host-Number

Initial IP Addressing (Classful)

Class A

bit # 0 1   7 8   31

| 0 | | |

← Network-Number → ← Host-Number →

Class B

bit # 0 2   15 16   31

| 10 | | |

← Network-Number → ← Host-Number →

Class C

bit # 0 3   23 24   31

| 110 | | |

← Network-Number → ← Host-Number →

Dotted Decimal Notation

bit #   0   31

| **10** 010001 . 00001010 . 00100010 . 00000011 |

145   10   34   3

145.10.34.3
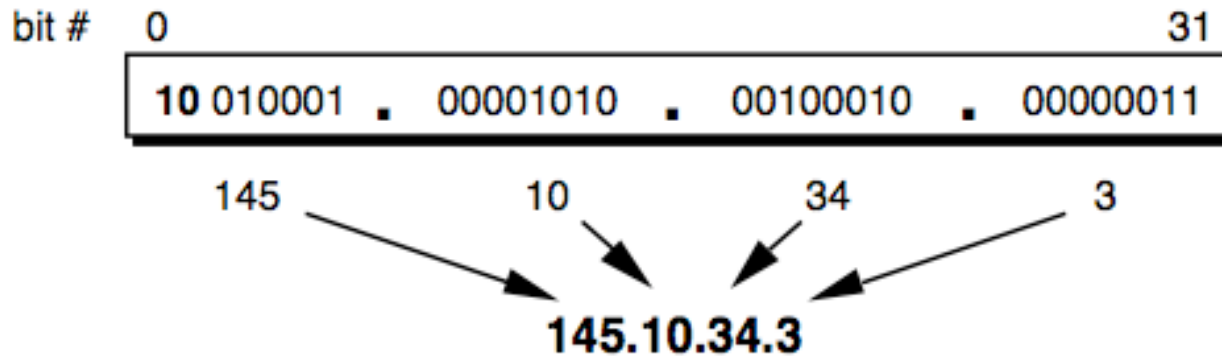
Address Class	Dotted-Decimal Notation Ranges
A (/8 prefixes)	1.xxx.xxx.xxx through 126.xxx.xxx.xxx
B (/16 prefixes)	128.0.xxx.xxx through 191.255.xxx.xxx
C (/24 prefixes)	192.0.0.xxx through 223.255.255.xxx

Case Study 01

- A: Take your laptop/desktop and connect to internet on wifi. Identify IP addresses of all interfaces (e.g. loopback and Wifi interface)

- B: Take your smartphone and connect to internet. Identify the IP address assigned to your wifi interface of the phone.

- C: Convert your phone into wifi hotspot and connect your laptop to this hotspot. Note down the IP address of your laptop.

Case Study 02

- A: List the 5 websites you use regularly, e.g.
  - google.com, facebook.com, instagram.com, twitter.com, linkedin.com
  - Find the IP addresses of these websites. E.g example to find IP address of rprustagi.com, use `ping` to find the latency and IP Address
    - (Linux/Mac): `ping -c 2` www.rprustagi.com
    - (Windows): `ping -n 2` www.rprustagi.com
- B: Use `traceroute` (Linux) / `tracert`(Window) to find all the routers in the path from your machine to these websites.

Summary

- IP Address
- 32 bits (4 octets)
- Decimal dotted notation (DDN)