Internet Protocol v4

Arief Prasetyo

IP v4

- Pengalamatan Logic
- Lapisan Network
- 32 bit biner
  - 11000000 10101000 00001010 00000011
- Decimal dotted
  - 192.168.10.3
- Bagian Host dan bagian Network
  - 192.168.10.3

Binary To Decimal Conversion

Exponent	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
Position	128	64	32	16	8	4	2	1
Bits	1	1	1	1	0	1	0	1
				1 BYTE / 1 Octet				
Add these numbers together	128 +	64 +	32 +	16 +	0 +	4 +	0 +	1
Decimal				245				

A 1 in this position means 64 is added to the total.

A 0 in any position means that 0 is added to the total.
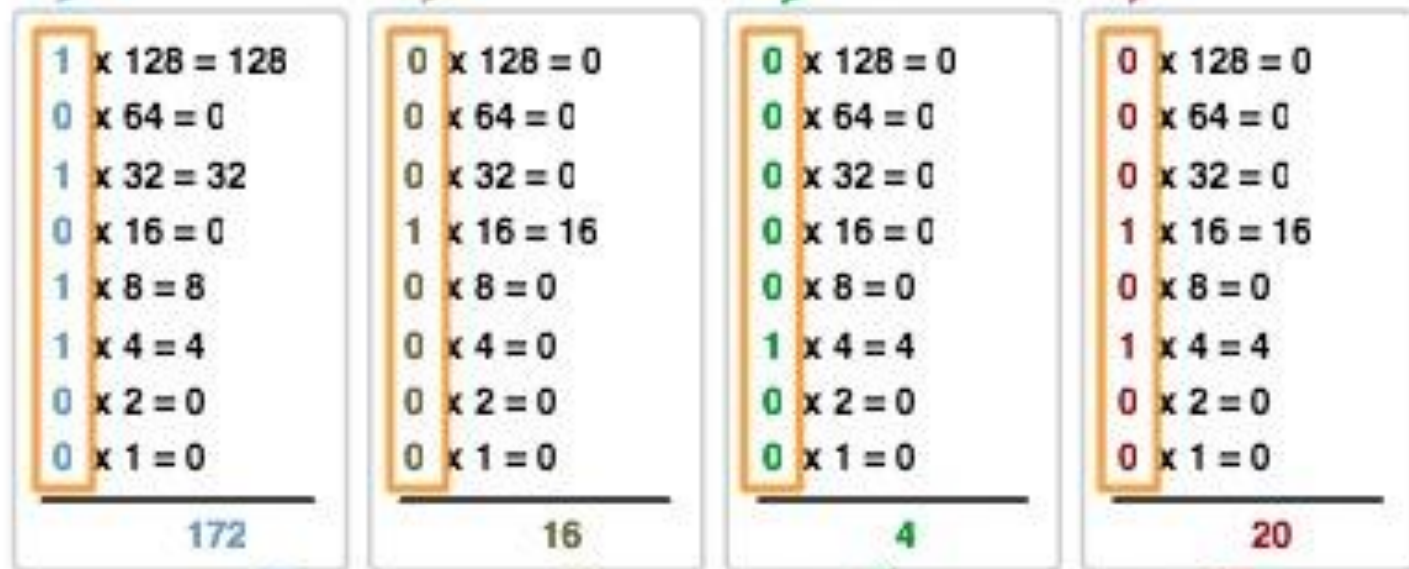
11110101 in Binary = Decimal Number 245

Converting an IPv4 from Binary to Dotted Decimal Notation

Binary IPv4 address 10101100000100000000010000010100

Divide the 32 bits into 4 octets

10101100000100000000010000010100

| 10101100 | 00010000 | 00000100 | 00010100 |

Convert each octet to decimal

Each octet decimal value is separated by a "."

1 x 128 = 128	0 x 128 = 0	0 x 128 = 0	0 x 128 = 0
0 x 64 = 0	0 x 64 = 0	0 x 64 = 0	0 x 64 = 0
1 x 32 = 32	0 x 32 = 0	0 x 32 = 0	0 x 32 = 0
0 x 16 = 0	1 x 16 = 16	0 x 16 = 0	1 x 16 = 16
1 x 8 = 8	0 x 8 = 0	0 x 8 = 0	0 x 8 = 0
1 x 4 = 4	0 x 4 = 0	1 x 4 = 4	1 x 4 = 4
0 x 2 = 0	0 x 2 = 0	0 x 2 = 0	0 x 2 = 0
0 x 1 = 0	0 x 1 = 0	0 x 1 = 0	0 x 1 = 0
172	**16**	**4**	**20**

Decimal IPv4 address

172.16.4.20

Decimal to Binary Conversion Steps

Position

128	64	32	16	8	4	2	1
x	x	x	x	x	x	x	x

172>=128 — No

Yes — 10000000   put 1 in position 128

172-128=44

44>=64? — No — 44>=32? — No

Yes

10100000   put 1 in position 32

44-32=12

12>=16 — No — 12>=8? — No

Yes   Yes

10101000   put 1 in position 8

12-8=4

4>=4? — No

Yes — 10101100   put 1 in position 4

4-4=0

STOP

Convert decimal 172 to binary 10101100
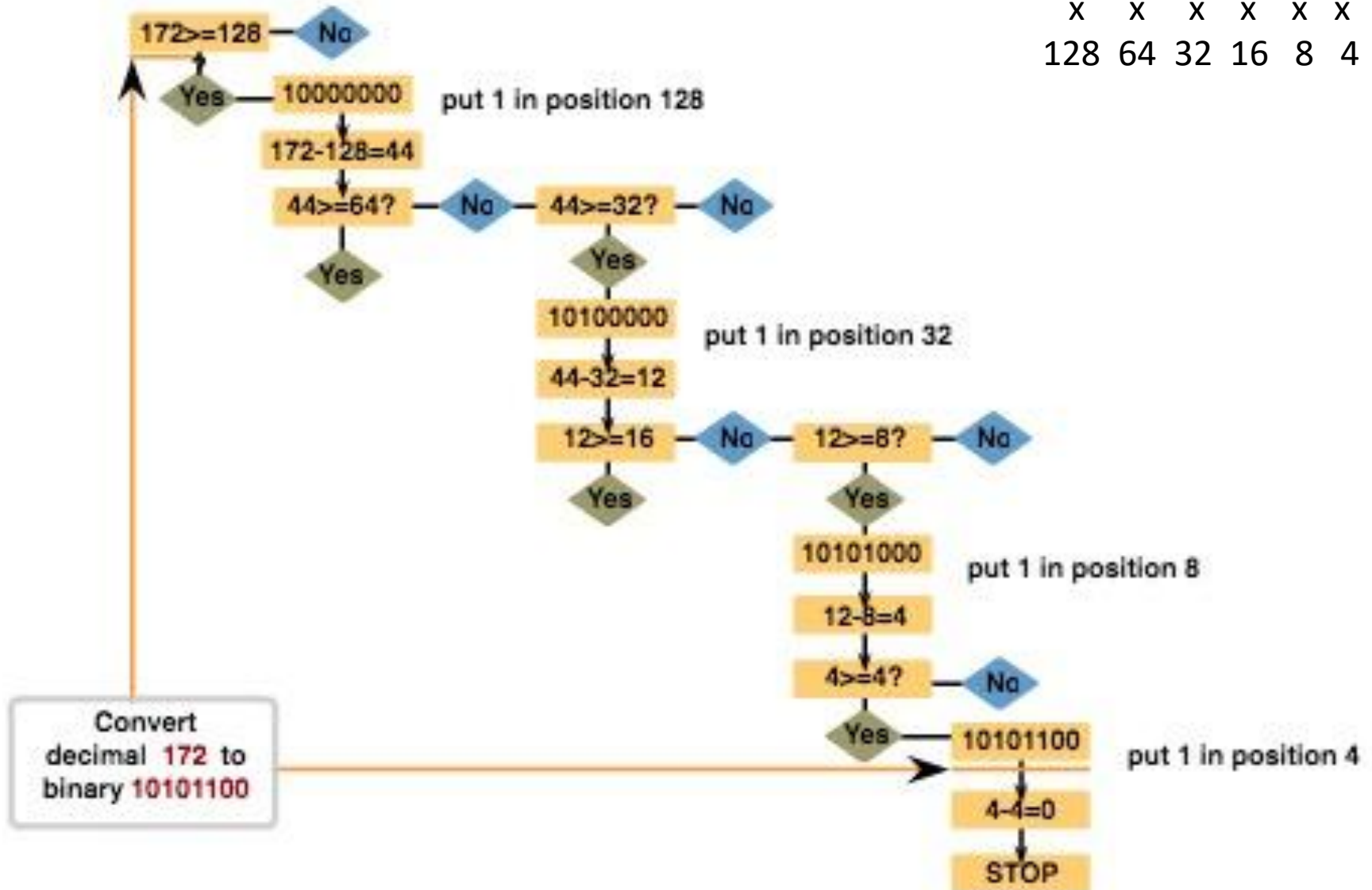
Tipe Alamat dalam IPv4

- Network Address → digunakan untuk mengacu / menamai sebuah network
- Broadcast Address → alamat yg digunakan untuk mengirim paket ke seluruh anggota network
  - Alamat tertinggi dalam sebuah network
- Host Address → digunakan untuk end device dalam jaringan

Tipe Komunikasi antar Host

- Unicast → 1 host ke 1 host lain
- Broadcast → 1 host ke semua host dalam sebuah jaringan
  - Directed broadcast : 192.168.10.255
  - Limited broadcast : 255.255.255.255
- Multicast → 1 host ke beberapa host

Reserved Addresses

- IP Address range : 0.0.0.0 – 255.255.255.255
- Experimental Addresses
  - 240.0.0.0 – 255.255.255.254 (RFC 3330)
- Multicast Addresses
  - 224.0.0.0 – 239.255.255.255
- Host Addresses
  - 0.0.0.0 – 223.255.255.255

Private Addresses

Blok alamat yang digunakan dalam lingkungan terbatas (tanpa akses internet)

- 10.0.0.0 -10.255.255.255 (10.0.0.0/8)

- 172.16.0.0 – 172.31.255.255 (172.16.0.0/12)

- 192.168.0.0 – 192.168.255.255 (192.168.0.0 / 16)

Special Addresses

- Tidak bisa digunakan untuk alamat host
- Network address & Broadcast Address → alamat pertama dan terakhir dr network
- Loopback → 127.0.0.1
  – 127.0.0.0 – 127.255.255.255
- Default route → 0.0.0.0
  – 0.0.0.0 – 0.255.255.255
- Link Local Addresses
  – 169.254.0.0 – 169.254.255.255
- Testnet Addresses
  – 192.0.2.0 – 192.0.2.255

Historic Network Classes

IP Address Classes

Address Class	1st octet range (decimal)	1st octet bits (green bits do not change)	Network(N) and Host(H) parts of address	Default subnet mask (decimal and binary)	Number of possible networks and hosts per network
A	1-127**	00000000-01111111	N.H.H.H	255.0.0.0	128 nets (2^7) 16,777,214 hosts per net (2^24-2)
B	128-191	10000000-10111111	N.N.H.H	255.255.0.0	16,384 nets (2^14) 65,534 hosts per net (2^16-2)
C	192-223	11000000-11011111	N.N.N.H	255.255.255.0	2,097,150 nets (2^21) 254 hosts per net (2^8-2)
D	224-239	11100000-11101111	NA (multicast)		
E	240-255	11110000-11111111	NA (experimental)		

** All zeros (0) and all ones (1) are invalid hosts addresses.

Subnet Mask

- untuk membedakan bagian network dan host dari alamat IP
- 32 bit
- Bisa ditulis sebagai prefix dari network
  - 10.20.30.4 /8
  - 172.16.10.100 /16
  - 192.168.100.4 /24
  - merupakan jumlah bit 1 dari subnet mask

Subnet Mask (2)

Network and Host Portions of an IP Address

These values are in the network portion of the address. They can be "0" or "1".

IP Address	172	.	16	.	4	.	1
	10101100		00010000		00000100		00000001

Subnet Mask	255	.	255	.	255	.	0
	111111111		1111111111		111111111		00000000

Prefix /24 (24 high order bits)

A "1" in these positions indicates that these positions are part of the network portion of the address.

NETWORK   HOST

Subnet Mask (3)

- Subnet mask AND IP address → network address

Applying the Subnet Mask

A device with address 192.0.0.1 belongs to network 192.0.0.0

	High order bits Prefix /16		Low order bits	
	192 .	0 .	0 .	1
Host Address	11000000	00000000	00000000	00000001
Subnet Mask	255	255	0	0
	11111111	11111111	00000000	00000000
Network Address	11000000	00000000	00000000	00000000
Network	192 .	0 .	0 .	0

Subnetting

- menggunakan VLSM (Variable Length Subnet Mask) sebagai prefix untuk memaksimalkan efisiensi penggunakan alamat IP

- /24 = 254 host (256 – 2 alamat utk network dan broadcast)
- /25 = 126 host
- /26 = 62 host
- /27 = 30 host
- /28 = 14 host
- /29 = 6 host
- /30 = 2 host

- 192.168.10.100
- 11000000.10101000.00001010.01100100

- Prefix /26
- Subnet masknya : 26 bit angka 1
- 11111111.11111111.11111111.11000000

HOST : 192.168.10.100 /26

	Octet 1	Octet 2	Octet 3	Octet 4
IP address	192	168	10	100
	1 1 0 0 0 0 0 0	1 0 1 0 1 0 0 0	0 0 0 0 1 0 1 0	0 1 1 0 0 1 0 0
Subnet mask	1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1	1 1 0 0 0 0 0 0
	255	255	255	192
Network ID	1 1 0 0 0 0 0 0	1 0 1 0 1 0 0 0	0 0 0 0 1 0 1 0	0 1 0 0 0 0 0 0
	192	168	10	64
Broadcast Addr	1 1 0 0 0 0 0 0	1 0 1 0 1 0 0 0	0 0 0 0 1 0 1 0	0 1 1 1 1 1 1 1
	192	168	10	127

IP address host   : 192.168.10.100 /26

Subnet mask   : 255.255.255.192
Network ID   : 192.168.10.64 /26
Broadcast addr : 192.168.10.127

IP address host   : 192.168.10.100 /26

- Subnet mask   : 255.255.255.192
- Network ID   : 192.168.10.64 /26
- Broadcast addr   : 192.168.10.127

- Range host dari Network 192.168.10.64 :
  192.168.10.65 - 192.168.10.126

HOST : 192.168.10.100 /26

	Octet 1	Octet 2	Octet 3	Octet 4
IP address	192	168	10	100
Subnet mask	255	255	255	192
Network ID	192	168	10	64

IP address host : 192.168.10.100 /26
Subnet mask   : 255.255.255.192
Network ID   : 192.168.10.64 /26

Practice

- Host IP Address : 10.20.30.40 / 24

Network ID   :

Subnet mask :

First Host   :

Last Host   :

Broadcast   :

Practice

- Host IP Address : 192.168.1.100 / 24

Network ID   :

Subnet mask :

First Host   :

Last Host   :

Broadcast   :

Practice

- Host IP Address : 172.16.0.114 / 26

Network ID   : 172.16.0.64

Subnet mask : 255.255.255.192

First Host   : 172.16.0.65

Last Host   : 172.16.0.126

Broadcast   : 172.16.0.127

Practice

- Host IP Address : 172.16.114.2 / 18 (Kelas B)

Network ID   : 172.16.64.0

Subnet mask : 255.255.192.0

First Host   : 172.16. 64.1

Last Host   : 172.16.127.254

Broadcast   : 172.16. 127.255

Practice

- Host IP Address : 222.100.2.100 / 27

Network ID   : 222.100.2.96

Subnet mask : 255.255.255.224

First Host   : 222.100.2.95

Last Host   : 222.100.2.126

Broadcast   : 222.100.2.127

Practice

- Host IP Address : 104.10.2.100 / 21

Network ID   :104.102.X.0

Subnet mask : 255.255.248.0

First Host   : 104.102.X.1

Last Host   : 104.102.Y.254

Broadcast   : 104.102.Y.255

Home WorK

Host IP Address :

a) 204.10.10.100 / 29

b) 104.25.100.56/ 21

c) 77.100.104.204/ 13

Network ID   :

Subnet mask :

First Host   :

Last Host   :

Broadcast   :

Practice

- Host IP Address : 104.10.2.100 / 23

Network ID   :

Subnet mask :

First Host   :

Last Host   :

Broadcast   :

Practice

- Host IP Address : 10.1.2.100 / 14
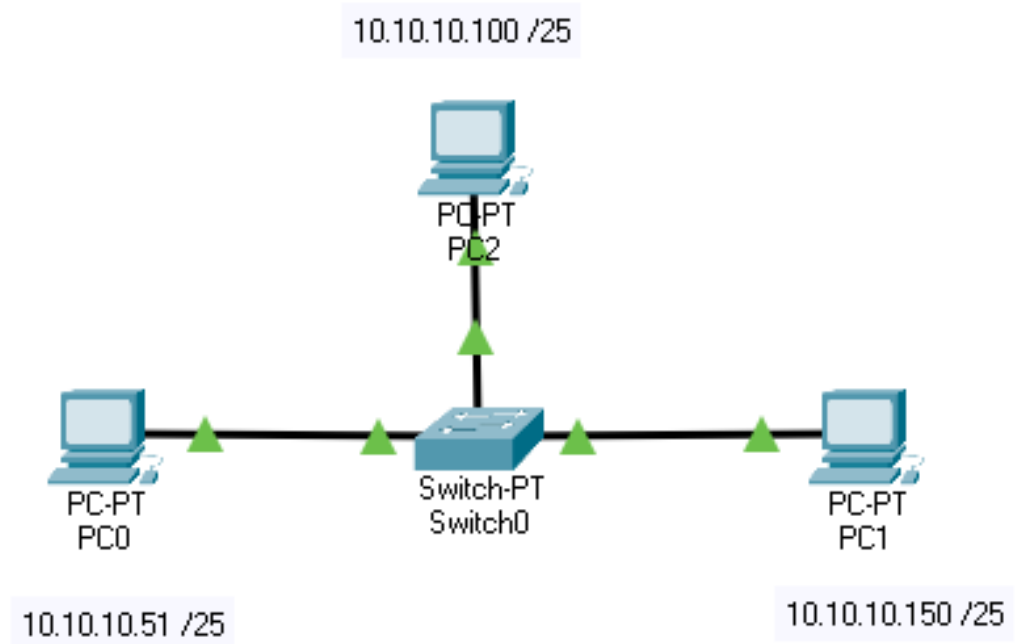
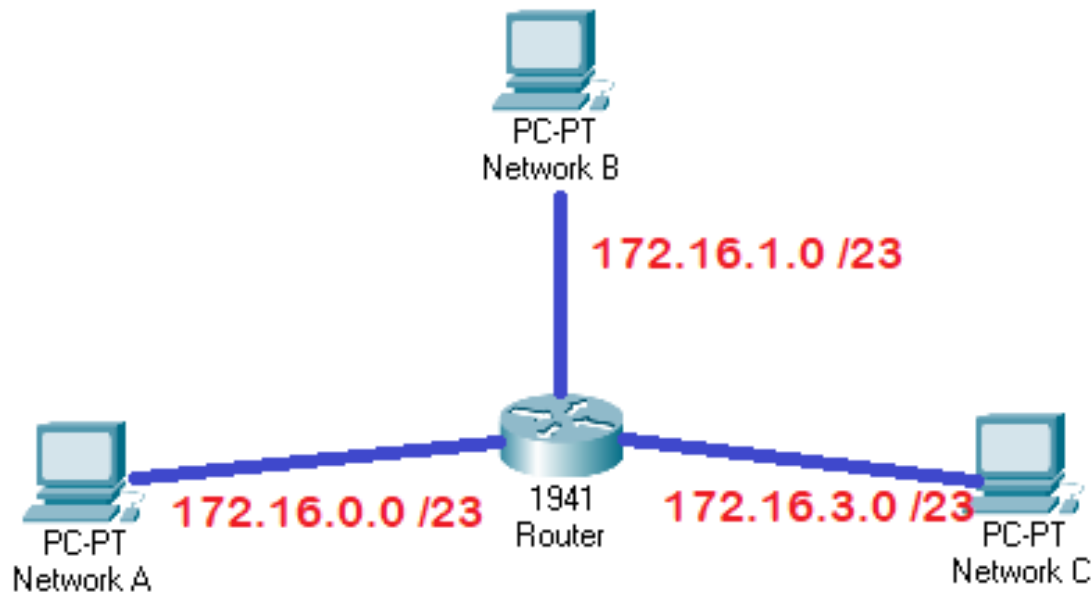Network ID   :

Subnet mask :

First Host   :

Last Host   :

Broadcast   :

Practice

PC0 can connect to PC2, but neither PC0 nor PC2 can connect PC1. Why ?

Practice

PC-PT
Network B

172.16.1.0 /23

172.16.0.0 /23

1941
Router

172.16.3.0 /23

PC-PT
Network A

PC-PT
Network C

Router is used to connect 3 network. Error message turned up when Router configuration is set as in the figure. What is the problem ?

Practice

- From **10.10.20.0 /24** address pool, how many subnet can we make if we use :

/25 network :

/27 network :

/28 network :

Practice

- From **192.168.100.5 /23** address, how many subnet can we make if we use :

/25 network :

/27 network :

/28 network :

Practice

- From 172.16.5.0 /24 address pool, create the most efficient network addressing for 3 subnets :
  - Network A : 100 host
  - Network B : 54 host
  - Network C : 21 host

Practice

- From 192.168.1.0 /24 address pool, create the most efficient network addressing for 4 subnets :
  - Network A : 20 host
  - Network B : 100 host
  - Network C : 54 host
  - Network D : 10 host

Practice

- From 10.10.1.0 /24 address pool, create the most efficient network addressing for 4 subnets :
  - Network A : 60 host
  - Network B : 105 host
  - Network C : 16 host
  - Network D : 36 host