IP Addressing & Subnetting

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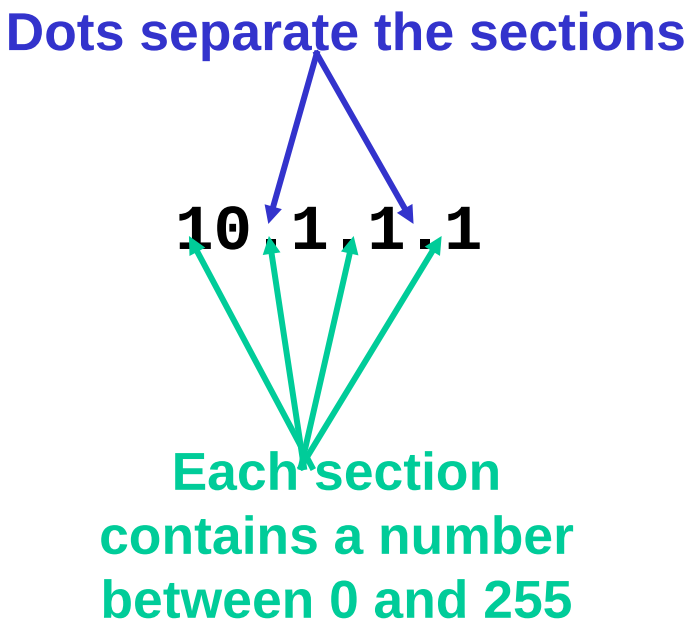
What Is an IP Address?

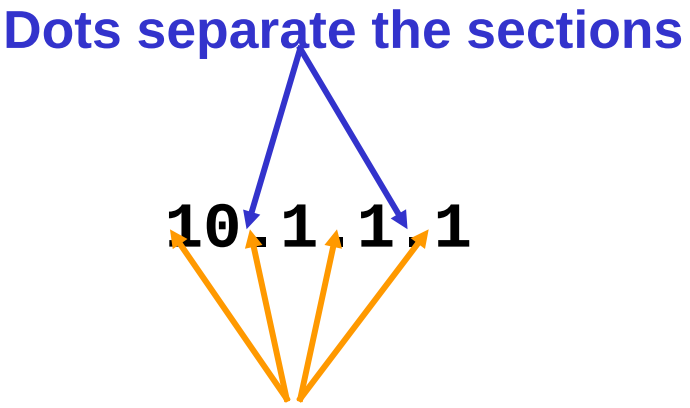
- An IP address is 32 bit combination.
- An IP addresses are written in *dotted decimal* format.
- Four sections are separated by dots.
- Each section contains a number between 0 and 255.



What Is an IP Address?

Why is each section a number between 0 and 255?

- Computers operate in binary, humans operate in decimal.
- Computers treat IP addresses as a single large 32 digit binary number, but this is hard for people to do.
- So, we split them up into four smaller sections so we can remember and work with them better!

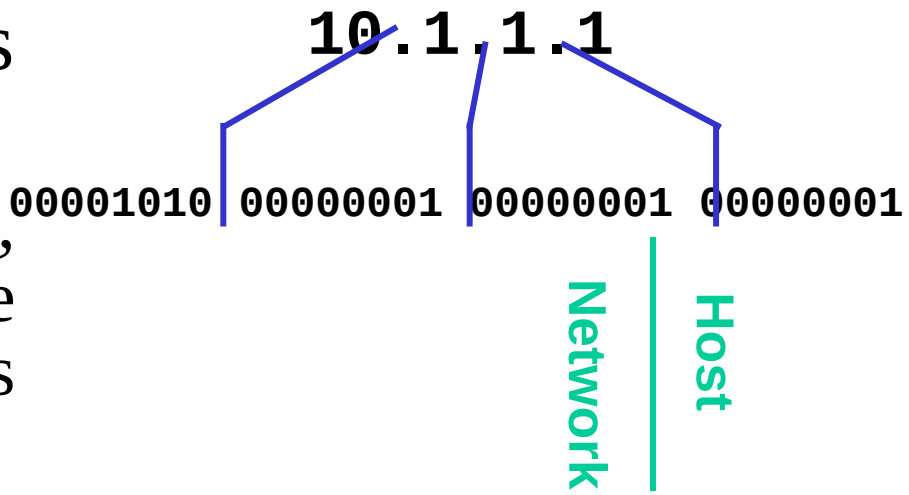


Each section contains a number between 0 and 255

Why????

What Is an IP Address?

- Each device on a network is assigned an IP address.
- Each IP address has two fundamental parts:
  - ✓ The *network* portion, which describes the physical wire the device is attached to.
  - ✓ The *host* portion, which identifies the host on that wire.
  - ✓ How can we tell the difference between the two sections?

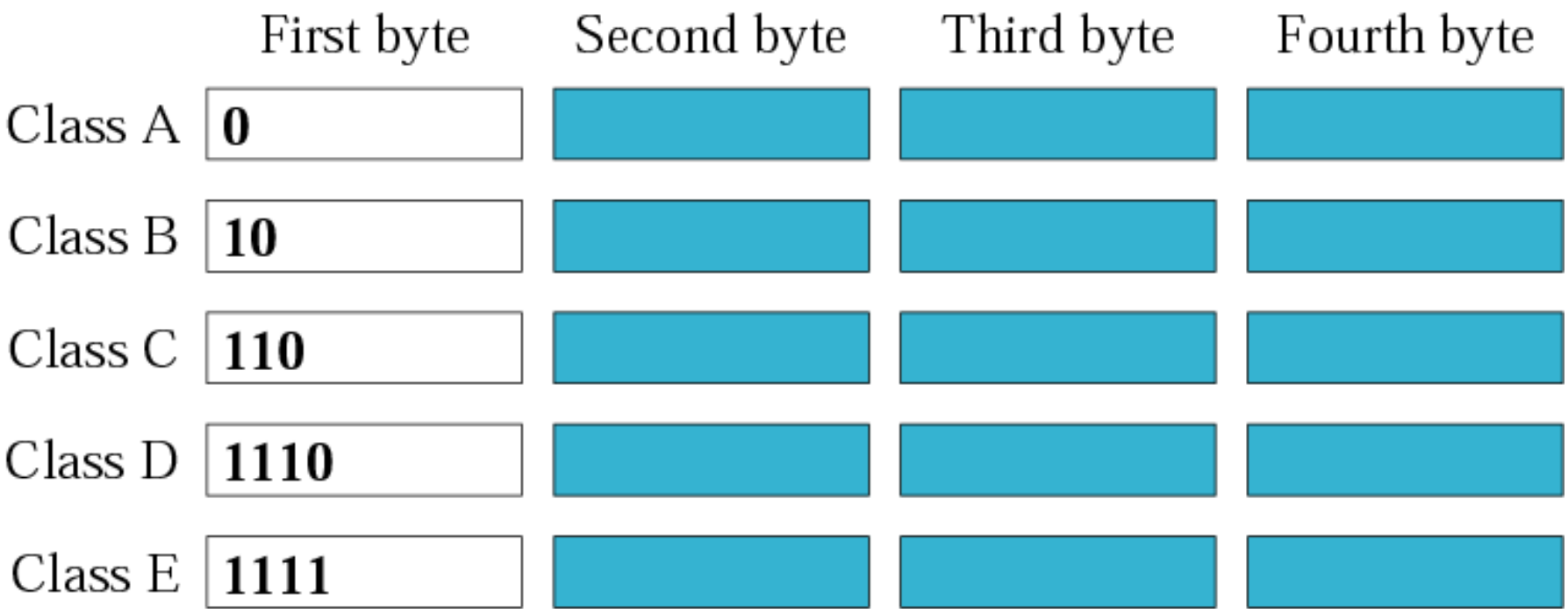


IP Address Classes

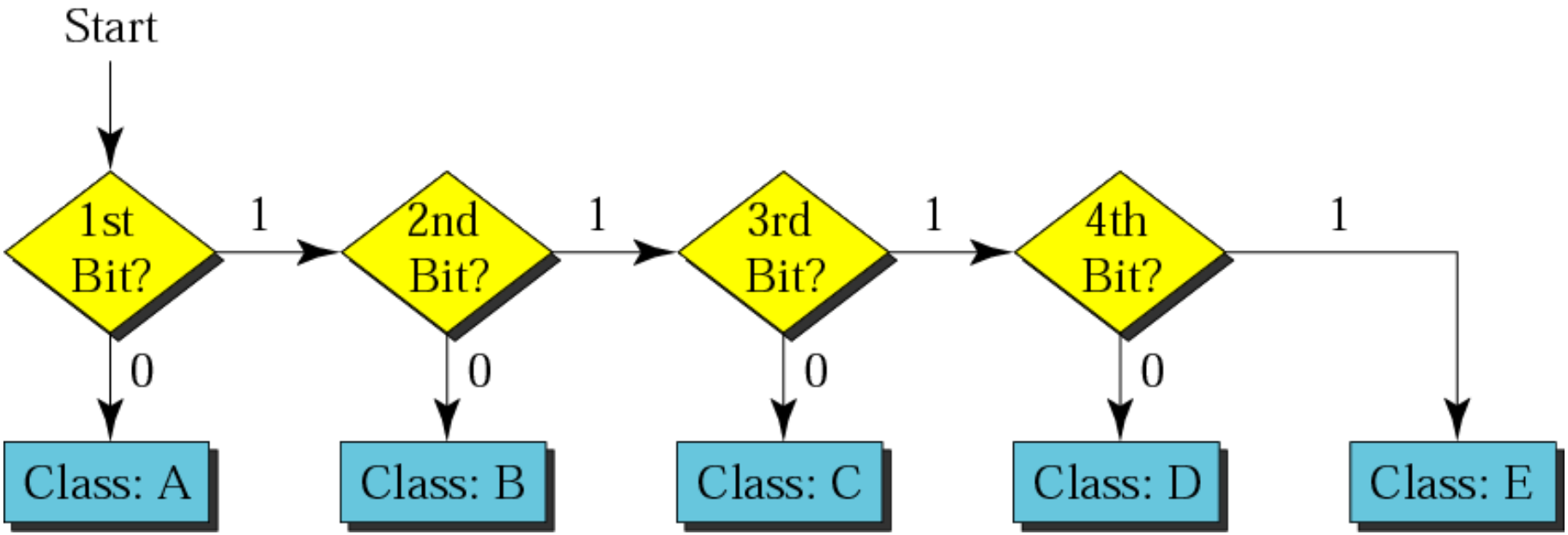
In classful addressing the address space is divided into 5 classes:

1. ***Class A***
2. ***Class B***
3. ***Class C***
4. ***Class D***
5. ***And Class E.***

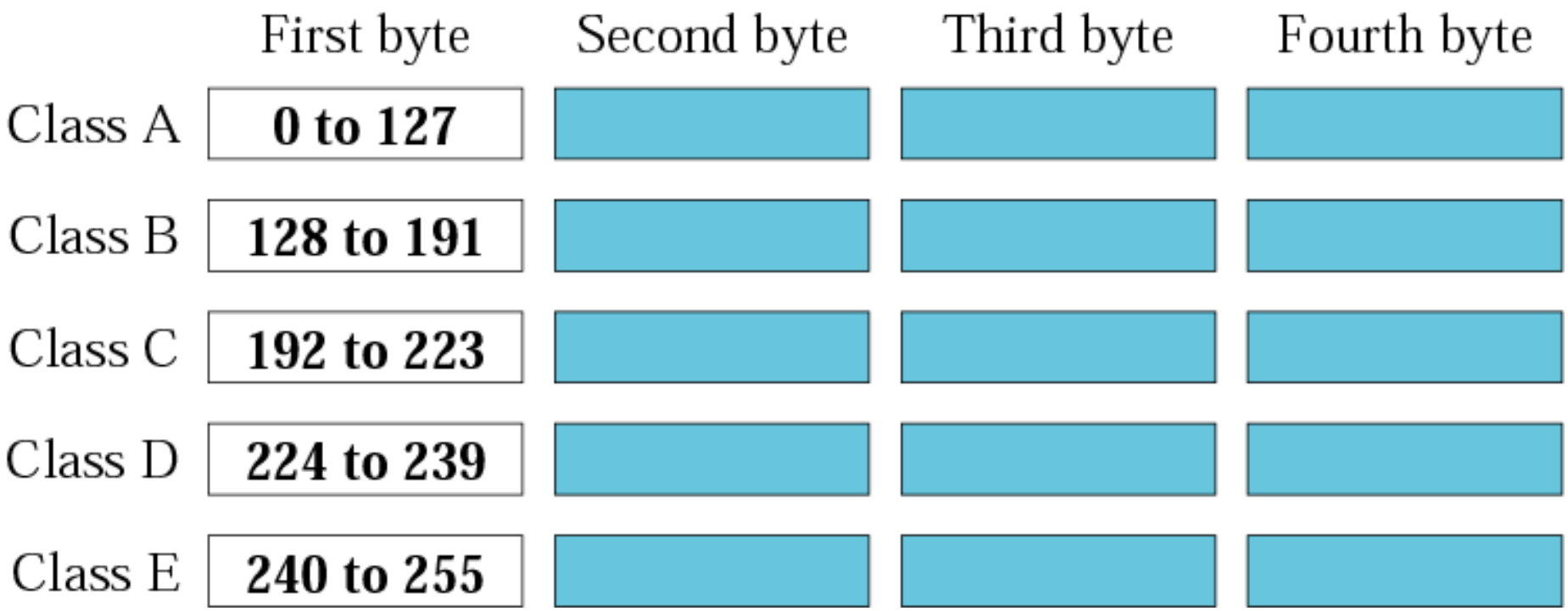
Finding the class in binary notation



Finding the class in binary notation



Finding the class in decimal notation



Wake Up Please

Find the class of the following addresses

158.223.1.108

227.13.14.88

Wake Up Please

Find the class of the following addresses

158.223.1.108

227.13.14.88

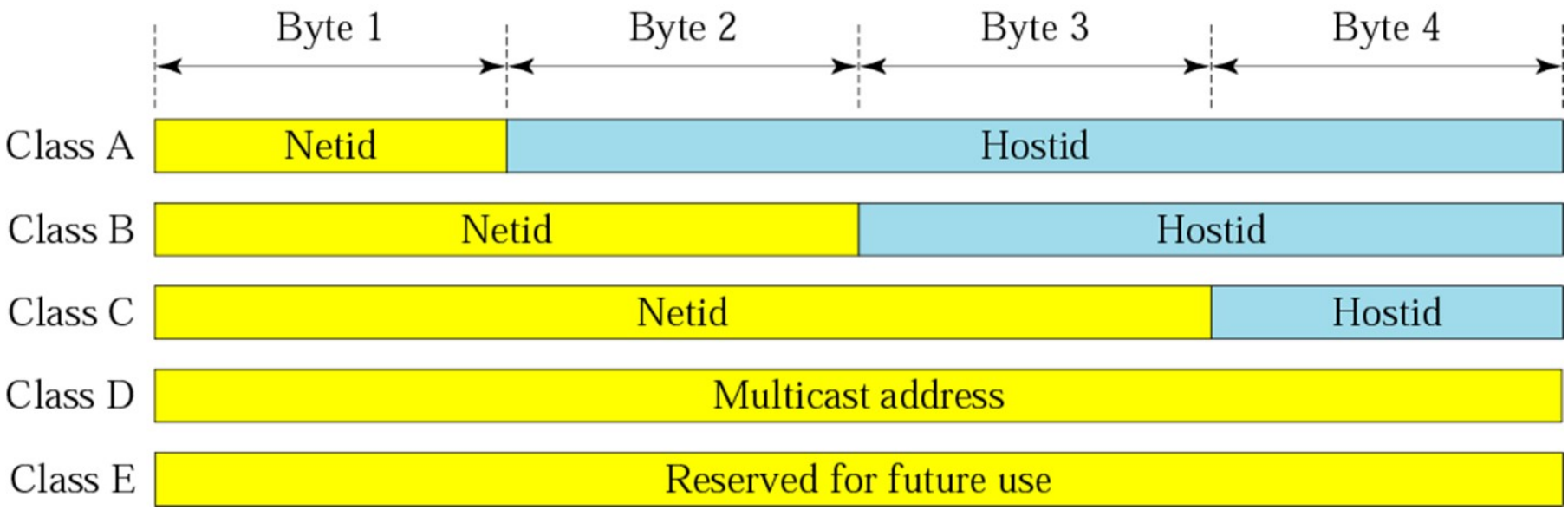
- 158.223.1.108

1st byte = 158 (128<158<191) class B

- 227.13.14.88

1st byte = 227 (224<227<239) class D

Netid and hostid



IP Class	Default Subnet	Network bits	Host bits	Total hosts	Valid hosts
A	255.0.0.0	First 8 bits	Last 24 bits	16, 777, 216	16, 777, 214
B	255.255.0.0	First 16 bits	Last 16 bits	65,536	65,534
C	255.255.255.0	First 24 bits	Last 8 bits	256	254

Network Addresses

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The network address is the first address.

The network address defines the network to the rest of the Internet.

Given the network address, we can find the class of the address, the block, and the range of the addresses in the block

Response Please

Given the network address 132.21.0.0, find the class, the netid, and the range of the addresses

Response Please

Given the network address 132.21.0.0, find the class, the netid, and the range of the addresses

The 1st byte is between 128 and 191.
Hence, Class B,
netid of 132.21.
The addresses range from
132.21.0.0 to 132.21.255.255.

Mask

- Class A default mask is 255.0.0.0
- Class B default mask is 255.255.0.0
- Class C Default mask 255.255.255.0

Subnetting

Subnetting is done by borrowing bits from the host part and add them the network part.

192.168.10.0/24

192.168.10._ _ _ _ _ _ _ _/24

Net ID Host ID

Borrow 1 bit:

192.168.10.X_ _ _ _ _ _ _/25

Network Address: 192.168.10.0 255.255.255.128

Boardcast Address: 192.168.10.127 255.255.255.128

Subnetting

N=1 (No of subnet=2^N=2^1=2)

H=7 (No of host=2^H-2=2^7-2=126) [-2 due to 1 for network address and another for broadcast address]

Subnets	Subnet 1	Subnet 2
Network ID	0	128
First host	1	129
Last host	126	254
Broadcast ID	127	255

Subnetting

N=2 (No of subnet=2^N=2^2=4)
H=6 (No of host=2^H-2=2^6-2=62)

Subnets	Subnet 1	Subnet 2	Subnet 3	Subnet 4
Network ID	0	64	128	192
First host	1	65	129	193
Last host	62	126	190	254
Broadcast ID	63	127	191	255

Please Help ME ☺

If N=3 and H=5

- How many subnet is possible?
- How many valid host per subnet?
- What is the subnet mask?
- CIDR value=?
- Make a subnet table like previous.

Please Help ME ☺

If N=3 and H=5

- How many subnet is possible?
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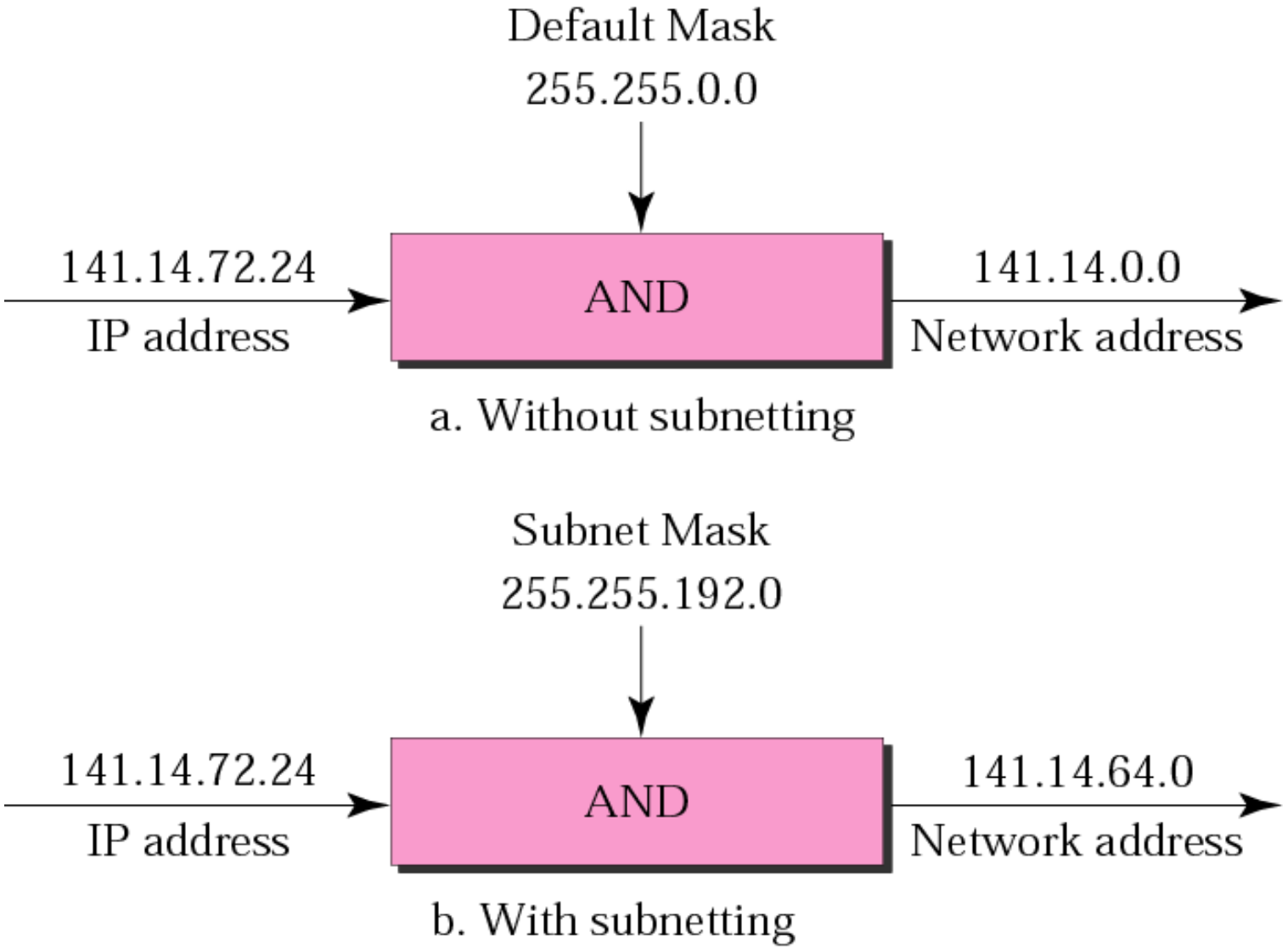
Subnets	Sub 1	Sub 2	Sub 3	Sub 4	Sub 5	Sub 6	Sub 7	Sub 8
Network ID	0	32	64	96	128	160	192	224
First host	1	33	65	97	129	161	193	225
Last host	30	62	94	126	158	190	222	254
Broadcast ID	31	63	95	127	159	191	223	255

Default mask and subnet mask



Learn Yourself

What is the subnetwork address if the destination address is 200.45.34.56 and the subnet mask is 255.255.240.0?

Learn Yourself

What is the subnetwork address if the destination address is 200.45.34.56 and the subnet mask is 255.255.240.0?

11001000 00101101 00100010 00111000

11111111 11111111 1111**0000** **00000000**

11001000 00101101 0010**0000** **00000000**

The subnetwork address is **200.45.32.0**.

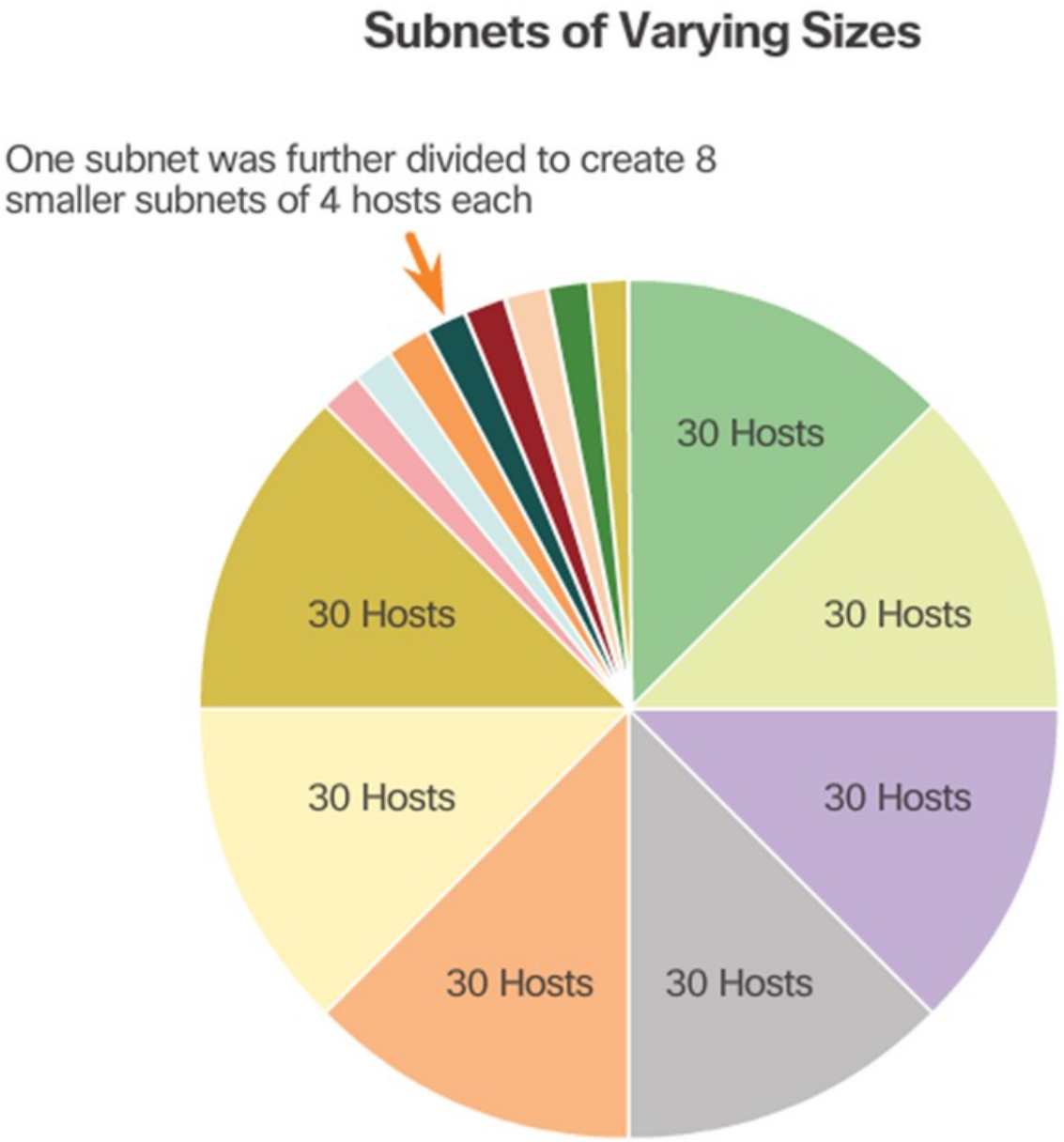
VLSM (Variable Length Subnet masks)

- VLSM Subnets a subnet
  - ✓VLSM divides a network into subnets of various sizes to prevent wasting IP addresses
- Uses up wasted addresses
- Conserves address space on WAN links
  - ✓Point-to-point link only needs 2 addresses
  - ✓With VLSM point-to-point links can use a /30 mask

VLSM (Variable Length Subnet masks)

- Variable Length Subnet Masking allows division of address space based on the size of networks
  - ✓ Start with network requiring the most addresses
  - ✓ Create a subnet mask
    - ➢ (use CIDR – Classless Inter Domain Routing)
  - ✓ Subnet the subnet as needed to provide address space required for other subnets
    - ➢ Be logical – start at beginning or end or address space
    - ➢ Addresses must be contiguous to enable route summarization

VLSM (Variable Length Subnet masks)



VLSM (Variable Length Subnet masks)

- You are required to connect two networks in Brisbane to those in Perth, having the following requirements:
- Brisbane needs to support 25 hosts each on the two networks
- Perth office needs to support 5 and 10 hosts in its two offices
- You may use only 128.186.1.0 /24

VLSM (Variable Length Subnet masks)

Office	#hosts	#host bits	#usable hosts	subnet
Brisbane	25	5	30	/27
Brisbane	25	5	30	/27
Perth	10	4	14	/28
Perth	5	3	6	/29
WAN	2	2	2	/30