

# **SUBNETTING**

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# INTRODUCTION

- In sub netting, a **network is divided into smaller subnets** with each subnet having its own subnet address.

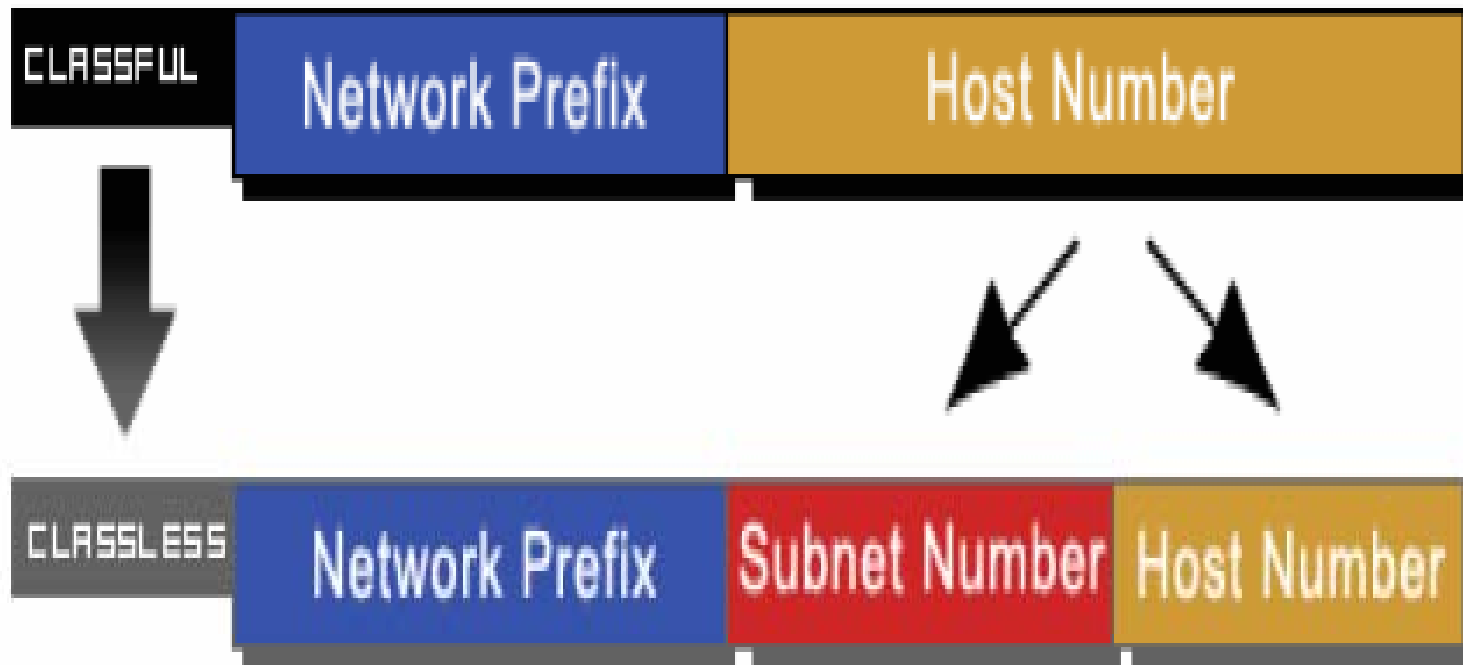
## **Reasons for Sub netting**

- Most IP address assignments were not used very efficiently.
- Broadcast problem.
- Many sites were requesting multiple network numbers due to variable amounts of networks at their sites.

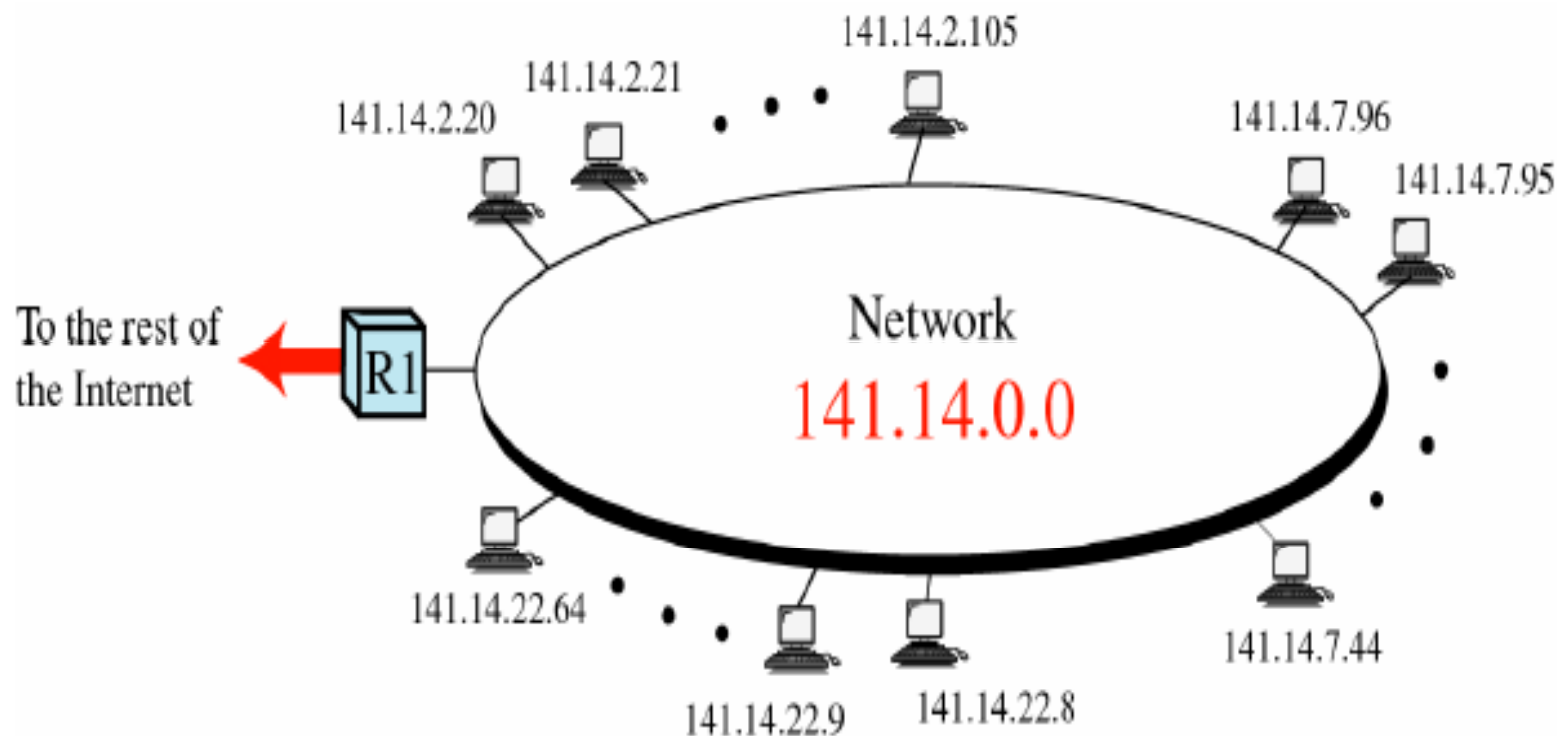
# Benefits of subnetting

- Reduced network traffic
- Simplified management
- Smaller broadcast domains

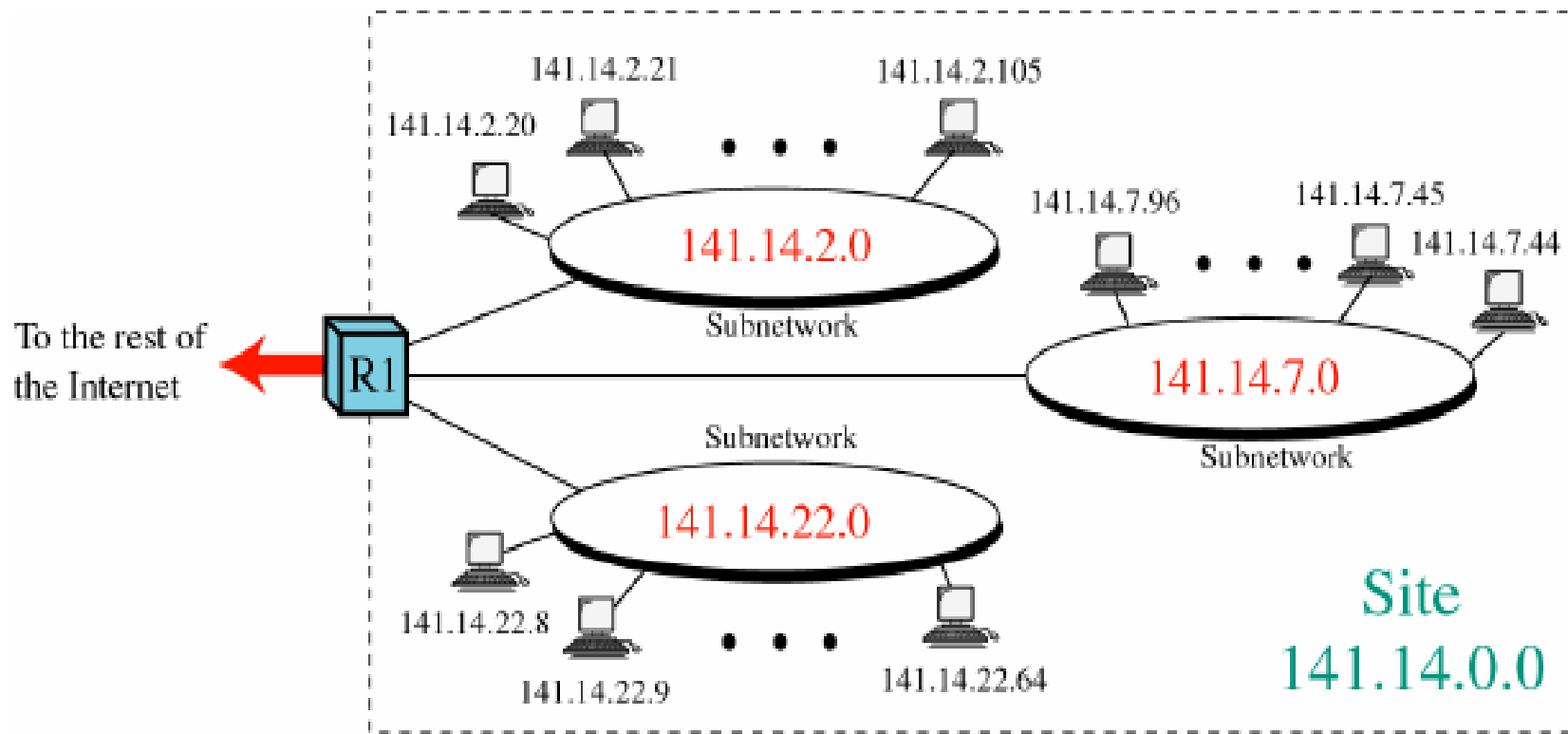
# Subnetting



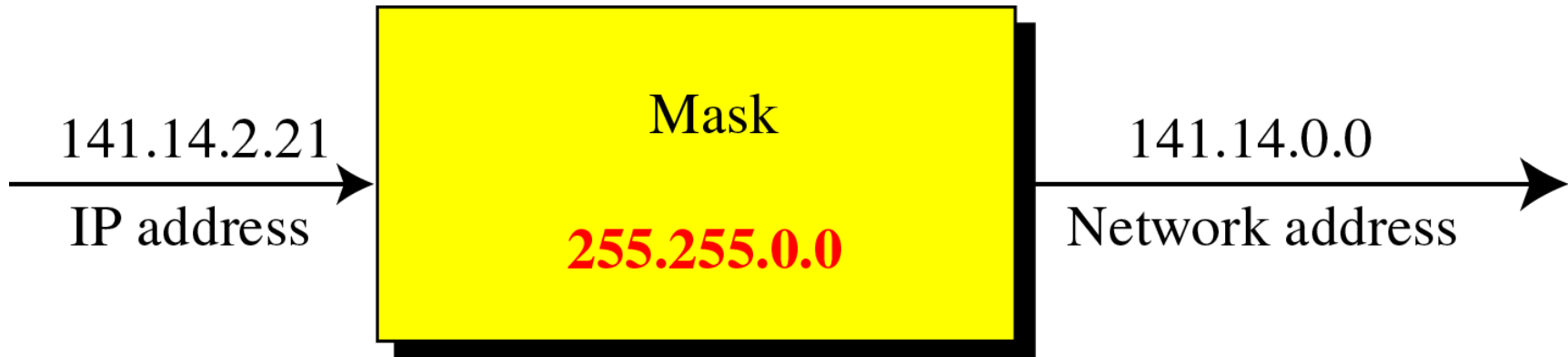
# Network Before Subnetting



# Network After Subnetting



# Masking



a. Without subnetting



b. With subnetting

# Subnet Mask

How do we determine the entire subnets inside our network?

**Subnet mask is used to distinguish the network ID from the host ID**

## Example

	Dot-decimal Address	Binary
Full Network Address	192.168.5.10	11000000.10101000.00000101.00001010
Subnet Mask	255.255.255.0	11111111.11111111.11111111.00000000
Network Portion	192.168.5.0	11000000.10101000.00000101.00000000
Host Portion	0.0.0.10	00000000.00000000.00000000.00001010



# How to know network is sub netted

Address Class	Bits for Subnet Mask	Network Prefix
Class A	11111111 00000000 00000000 00000000	/8
Class B	11111111 11111111 00000000 00000000	/16
Class C	11111111 11111111 11111111 00000000	/24

IP Address: 192.168.2.1

Subnet Mask: 255.255.255.0

With Prefix Notation: 192.168.2.1/24

## **Prefix Notation**

IP Address: 132.168.64.3/18

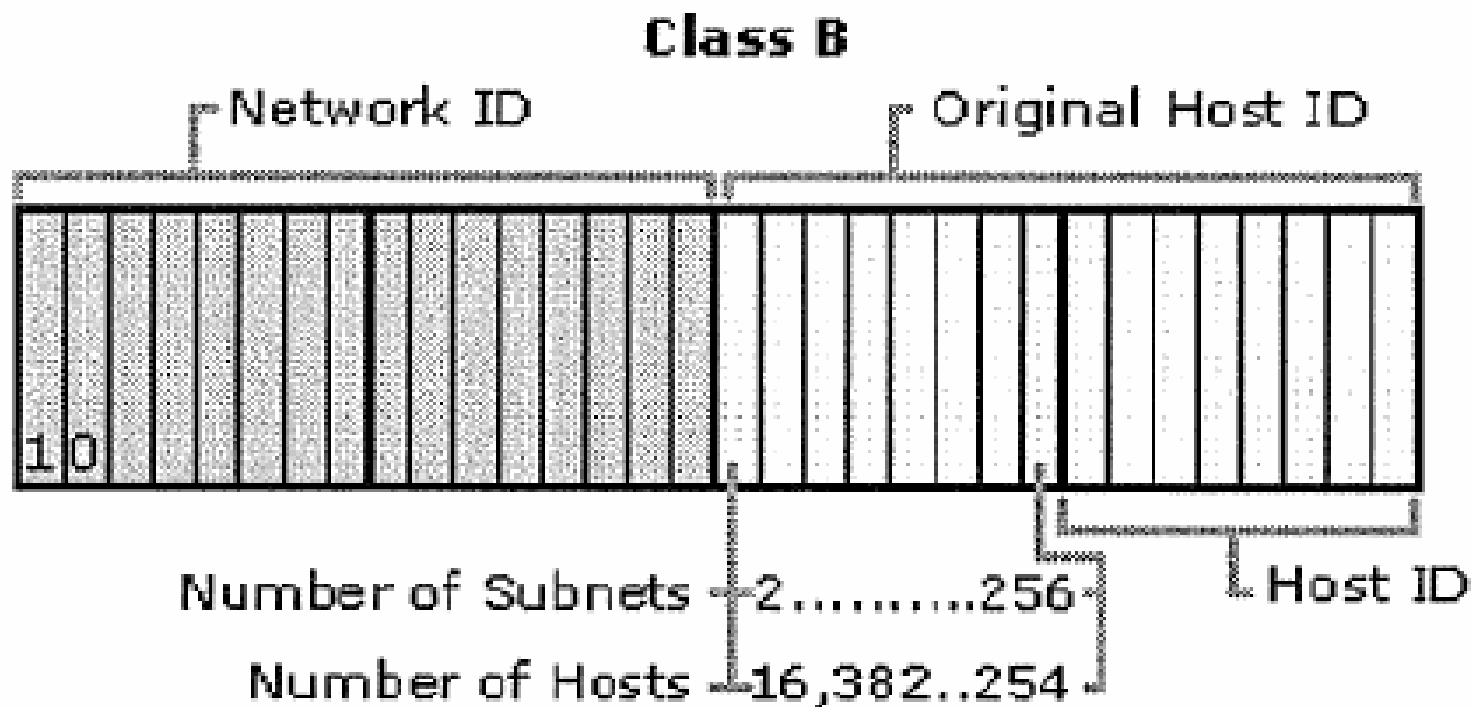
Subnet Mask: 255.255.192.0

# Subnetting: how to?

- Number of host bits used for subnetting
- What are the sub netted Network IDs
- What are the IP Addresses for each new subnet?

# Number of host bits used for subnetting

- How many subnets I will have in the future
- Use more bits to overcome the change overhead.



# Example

Network	Network (binary)	Broadcast address
192.168.5.0/26	11000000.10101000.00000101.00000000	192.168.5.63
192.168.5.64/26	11000000.10101000.00000101.01000000	192.168.5.127
192.168.5.128/26	11000000.10101000.00000101.10000000	192.168.5.191
192.168.5.192/26	11000000.10101000.00000101.11000000	192.168.5.255

## Possible subnets for a /24 prefix (traditional Class C)

<b>CIDR notation</b>	<b>Network Mask</b>	<b>Available Networks</b>	<b>Available Hosts per network</b>	<b>Total usable hosts</b>
/24	255.255.255.0	1	254	254
/25	255.255.255.128	2	126	252
/26	255.255.255.192	4	62	248
/27	255.255.255.224	8	30	240
/28	255.255.255.240	16	14	224
/29	255.255.255.248	32	6	192
/30	255.255.255.252	64	2	128
/31	255.255.255.254	128	2 *	256

# Another Example

Network ID: 191.168.0.0

Use 3 bits

Subnet Mask: 255.255.224.0

## Subnets of the example

	<b>Subnet Binary Representation</b>	<b>Subnetted Network ID</b>
1	10111111.10101000. <u>000</u> 00000.00000000	191.168.0.0/19
2	10111111.10101000. <u>001</u> 00000.00000000	191.168.32.0/19
3	10111111.10101000. <u>010</u> 00000.00000000	191.168.64.0/19
4	10111111.10101000. <u>011</u> 00000.00000000	191.168.96.0/19
5	10111111.10101000. <u>100</u> 00000.00000000	191.168.128.0/19
6	10111111.10101000. <u>101</u> 00000.00000000	191.168.160.0/19
7	10111111.10101000. <u>110</u> 00000.00000000	191.168.192.0/19
8	10111111.10101000. <u>111</u> 00000.00000000	191.168.224.0/19

**How many hosts allowed for each subnet of the previous example?**

	<b>Subnet Binary Representation</b>	<b>Range of IP Addresses</b>
1	10111111.10101000. <u>0000</u> 0000.00000001 10111111.10101000. <u>000</u> 11111.11111110	191.168.0.1 - 191.168.31.254
2	10111111.10101000. <u>0010</u> 0000.00000001 10111111.10101000. <u>001</u> 11111.11111110	191.168.32.1 - 191.168.63.254
3	10111111.10101000. <u>0100</u> 0000.00000001 10111111.10101000. <u>010</u> 11111.11111110	191.168.64.1 - 191.168.95.254
4	10111111.10101000. <u>0110</u> 0000.00000001 10111111.10101000. <u>011</u> 11111.11111110	191.168.96.1 - 191.168.127.254
5	10111111.10101000. <u>1000</u> 0000.00000001 10111111.10101000. <u>100</u> 11111.11111110	191.168.128.1 - 191.168.159.254
6	10111111.10101000. <u>1010</u> 0000.00000001 10111111.10101000. <u>101</u> 11111.11111110	191.168.160.1 - 191.168.191.254
7	10111111.10101000. <u>1100</u> 0000.00000001 10111111.10101000. <u>110</u> 11111.11111110	191.168.192.1 - 191.168.223.254
8	10111111.10101000. <u>1110</u> 0000.00000001 10111111.10101000. <u>111</u> 11111.11111110	191.168.224.1 - 191.168.255.254



## **Static Subnetting**

- All subnets in the subnetted network use the same subnet mask
- Easy to implement
- Waste IP Addresses

## **Variable Subnetting**

- Subnets use different subnet masks
- Real world environments
- No wasting of IP addresses

## **Variable Subnetting Example**

Network ID: 135.41.0.0/16

24 subnets are required as follows:

- One subnet with up to 32000 hosts
- 15 subnets with up to 2000 hosts
- 8 subnets with up to 250 hosts

## One subnet with up to 32000 hosts

- I need one bit only to subnet
- Subnet ID options:

Subnet ID (Decimal)	Subnet ID (Binary)	Subnet Mask
135.41.0.0/17	10000111.00101001.00000000.00000000	255.255.128.0
135.41.128.0/17	10000111.00101001.10000000.00000000	255.255.128.0

# 15 subnets with up to 2000 hosts

I need 4 bits to subnet

Subnet ID options:

Subnet ID (Decimal)	Subnet ID (Binary)	Subnet Mask
135.41.128.0/21	10000111.00101001.10000000.00000000	255.255.248.0
135.41.136.0/21	10000111.00101001.10001000.00000000	255.255.248.0
135.41.144.0/21	10000111.00101001.10010000.00000000	255.255.248.0
-	-	-
-	-	-
-	-	-
135.41.240.0/21	10000111.00101001.11110000.00000000	255.255.248.0

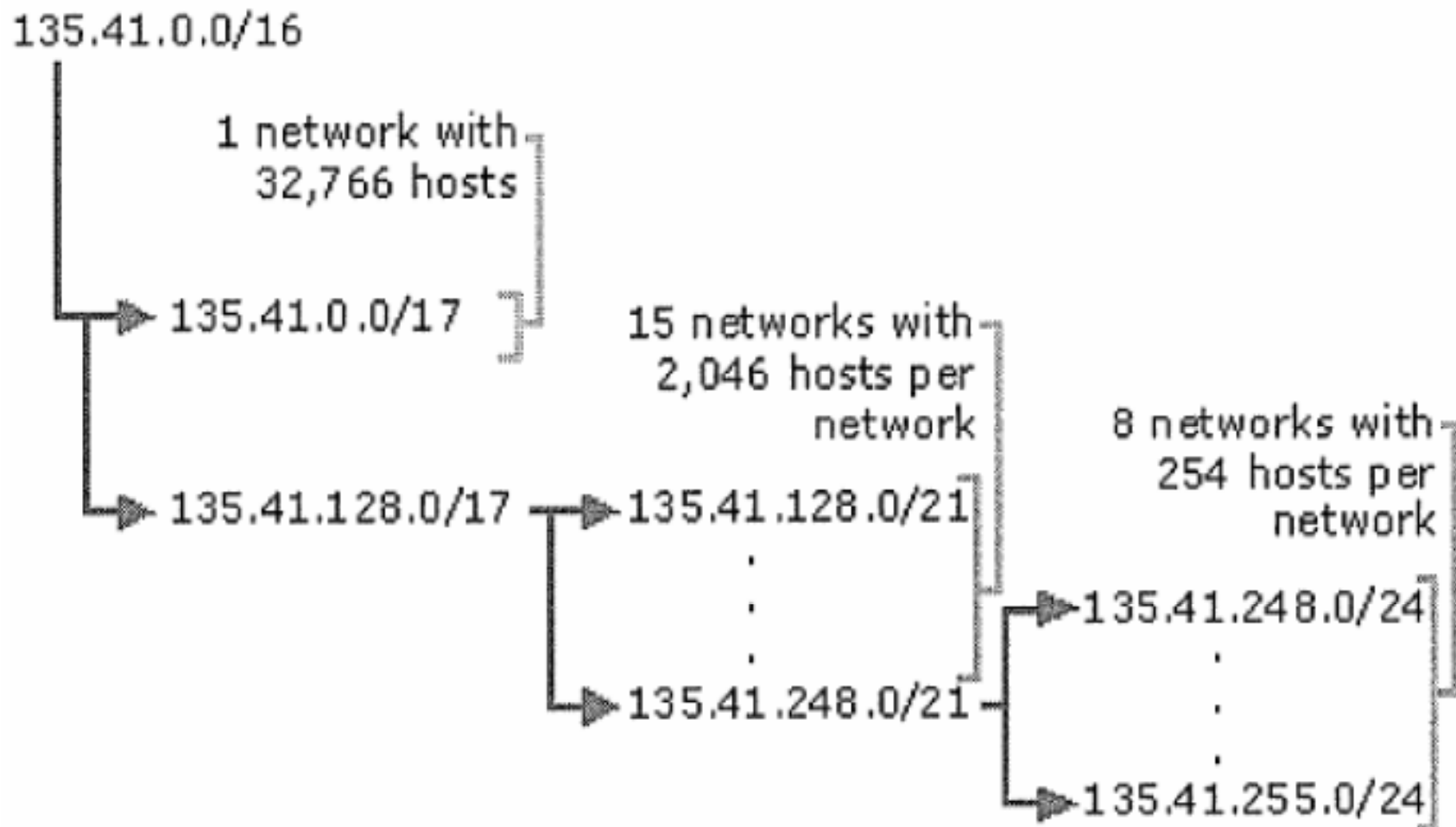
# 8 subnets with up to 250 hosts

I need 3 bits to subnet

Subnet ID options:

Subnet ID (Decimal)	Subnet ID (Binary)	Subnet Mask
135.41.248.0/24	10000111.00101001.11111000.00000000	255.255.255.0
135.41.249.0/24	10000111.00101001.11111001.00000000	255.255.255.0
135.41.250.0/24	10000111.00101001.11111010.00000000	255.255.255.0
135.41.251.0/24	10000111.00101001.11111011.00000000	255.255.255.0
-	-	-
-	-	-
-	-	-
135.41.255.0/24	10000111.00101001.11111111.00000000	255.255.255.0

# Variable Subnetting of 135.41.0.0/16



# APPLICATIONS

- NETWORK MANAGEMENT
- BROADCASTING MESSAGES

# SCOPE OF RESEARCH

- SUBNET ADDRESSING IN IPv10 and further versions of IP Protocol



# Assignment 12

- Why subnetting is required?

Thank you