

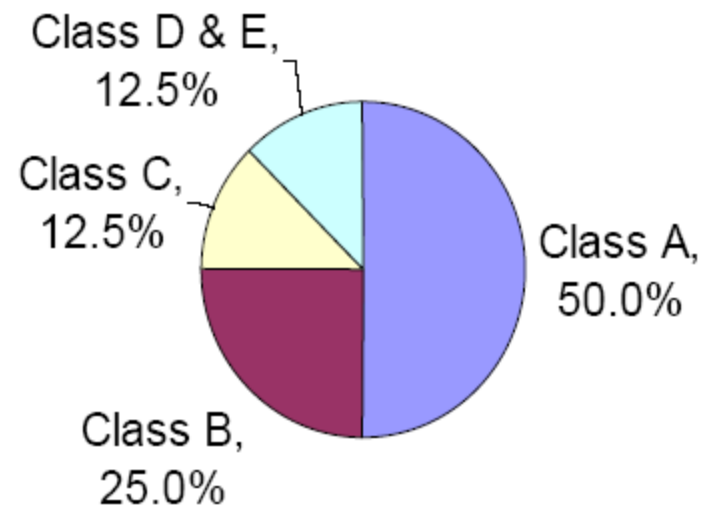
CLASS LESS ADDRESSING AND VLSM

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Classful Addressing

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- Prior to 1981
 - ▣ Only the first 8 bits to specify the network portion
- From 1981
 - ▣ the IPv4 32-bit address allows three different classes

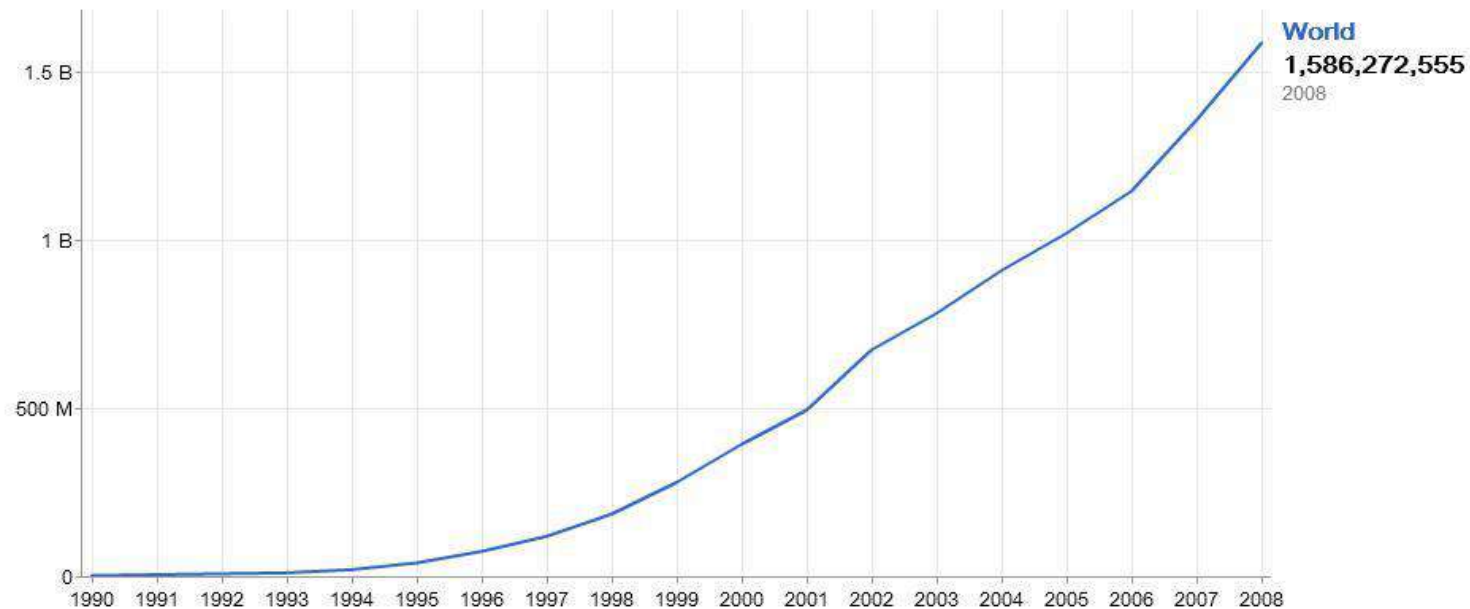


Limited address space and address wastage

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□ 32 bit address

▣ Theoretically $2^{32} = 4294967296$ addresses



Classfull Address and masks

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□ Class A

- 11111111.00000000.00000000.00000000

- 255.0.0.0

□ Class B

- 11111111.11111111.00000000.00000000

- 255.255.0.0

□ Class C

- 11111111.11111111.11111111.00000000

- 255.255.255.0

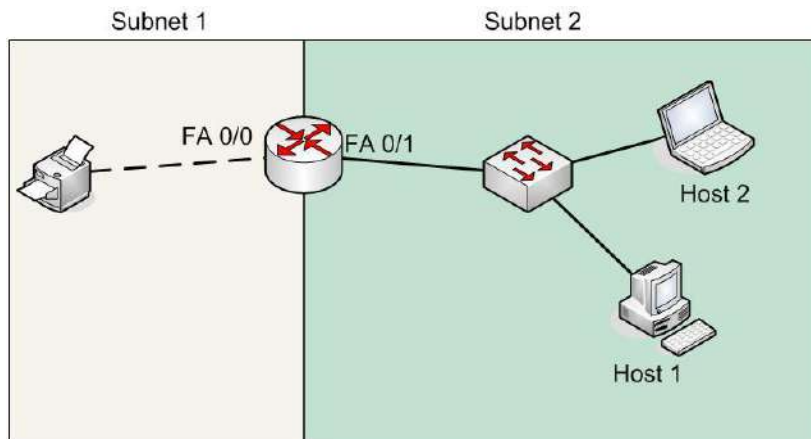
Variable Length Subnet Masking (VLSM)

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- NO concept of class anymore
- Subnet mask can be of variable length
 - ▣ 11111111.11111111.11110000.00000000
 - 255.255.240.0
 - /20
 - ▣ 11111111.11111111.11111111.10000000
 - 255.255.255.128
 - /25
- NO or very less IP address wastage

Problem 1: VLSM calculation

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- Given IP address
 - ▣ 210.168.200.0 / 24
 - Mask 255.255.255.0
- Subnet 1
 - ▣ 2 hosts or interfaces
- Subnet 2
 - ▣ 28 hosts or interfaces
- Use the 0th subnet to reduce IP address wastage

Required Tool – Magic Table

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- Use 1
 - ▣ Decimal to Binary conversion
- Use 2
 - ▣ Binary to Decimal conversion
- Use 3
 - ▣ Number of combinations

128	64	32	16	8	4	2	1

Magic Table Use 1 – Decimal to Binary conversion

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- What is 55_{10} in Binary?
 - ▣ 00110111_2

128	64	32	16	8	4	2	1
0	0	1	1	0	1	1	1

Magic Table Use 2 – Binary to Decimal conversion

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- What is 11110000_2 in Decimal?
 - ▣ 240_{10}

128	64	32	16	8	4	2	1
1	1	1	1	0	0	0	0

Magic Table Use 3 – Number of combinations

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□ 2 bit Binary

- ▣ 00
- ▣ 01
- ▣ 10
- ▣ 11

□ 3 bit Binary

- ▣ 000
- ▣ 001
- ▣ 010
- ▣ 011
- ▣ 100
- ▣ 101
- ▣ 110
- ▣ 111

128	64	32	16	8	4	2	1

VLSM calculation

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- Start with the largest subnet
 - ▣ Subnet 1: 2 hosts
 - ▣ Subnet 2: 28 hosts – start here
- Work out towards the smallest subnet
- If two or more subnets of same size, start with any

Subnet 2 calculation: 28 hosts

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- To generate 28 different IP addresses
 - ▣ Need to have AT LEAST 28 different combinations
 - ▣ 5 bits can generate 32 different combinations

128	64	32	16	8	4	2	1

Subnet 2 calculation: 28 hosts

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	128	64	32	16	8	4	2	1
Subnet address	0	0	0	0	0	0	0	0
1 st host address	0	0	0	0	0	0	0	1
2 nd host address	0	0	0	0	0	0	1	0
Last host address	0	0	0	1	1	1	1	0
Broadcast address	0	0	0	1	1	1	1	1

Subnet 2 calculation: 28 hosts

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- Subnet address (ID)
 - ▣ 210.168.200.0
- 1st host address
 - ▣ 210.168.200.1
- Last host address
 - ▣ 210.168.200.30
- Broadcast address
 - ▣ 210.168.200.31
- Subnet Mask
 - ▣ /27
- Total number of hosts
 - ▣ 30

	128	64	32	16	8	4	2	1
Subnet address	0	0	0	0	0	0	0	0
1 st host address	0	0	0	0	0	0	0	1
2 nd host address	0	0	0	0	0	0	1	0
Last host address	0	0	0	1	1	1	1	0
Broadcast address	0	0	0	1	1	1	1	1

Subnet 1 calculation: 2 hosts

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- ❑ To generate 2 different IP addresses
 - ❑ Need to have 2 different combinations
 - ❑ 1 bit can generate 2 combinations
 - But the first and the last are NOT allowed for a host
 - ❑ 2 bits can generate 4 different combinations
 - 2 different IP host addresses

128	64	32	16	8	4	2	1

Subnet 1 calculation: 2 hosts

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	128	64	32	16	8	4	2	1
Subnet address	0	0	1	0	0	0	0	0
1 st host address	0	0	1	0	0	0	0	1
Last host address	0	0	1	0	0	0	1	0
Broadcast address	0	0	1	0	0	0	1	1

Subnet 1 calculation: 2 hosts

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- Subnet address
 - ▣ 210.168.200.32
- 1st host address
 - ▣ 210.168.200.33
- Last host address
 - ▣ 210.168.200.34
- Broadcast address
 - ▣ 210.168.200.35
- Subnet Mask
 - ▣ /30
- Total number of hosts
 - ▣ 2

	128	64	32	16	8	4	2	1
Subnet address	0	0	1	0	0	0	0	0
1 st host address	0	0	1	0	0	0	0	1
Last host address	0	0	1	0	0	0	1	0
Broadcast address	0	0	1	0	0	0	1	1

Problem 1: Completed solution

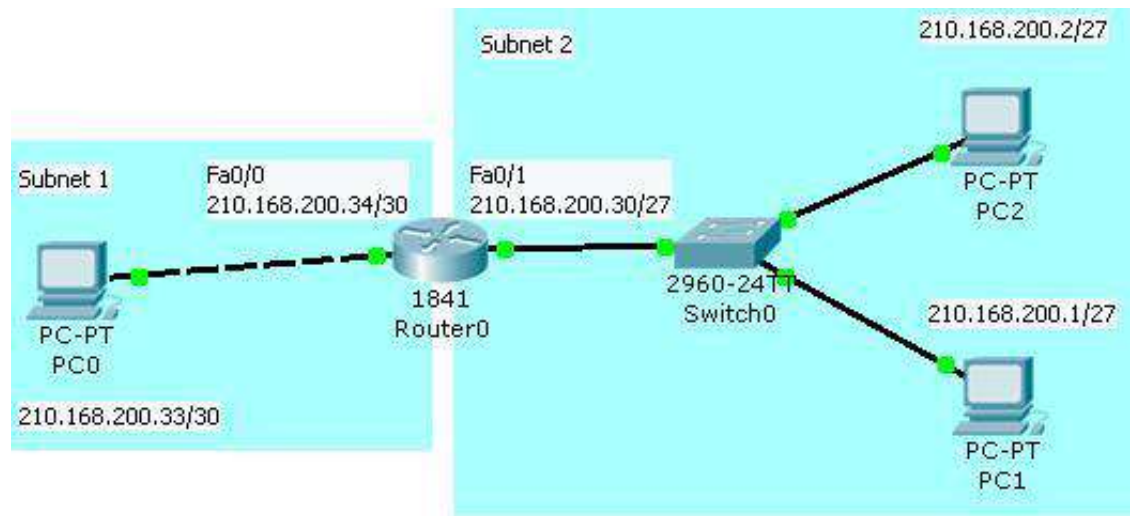
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□ Subnet 1

- ▣ First address
210.168.200.33
- ▣ Last address
210.168.200.34
- ▣ Mask /30

□ Subnet 2

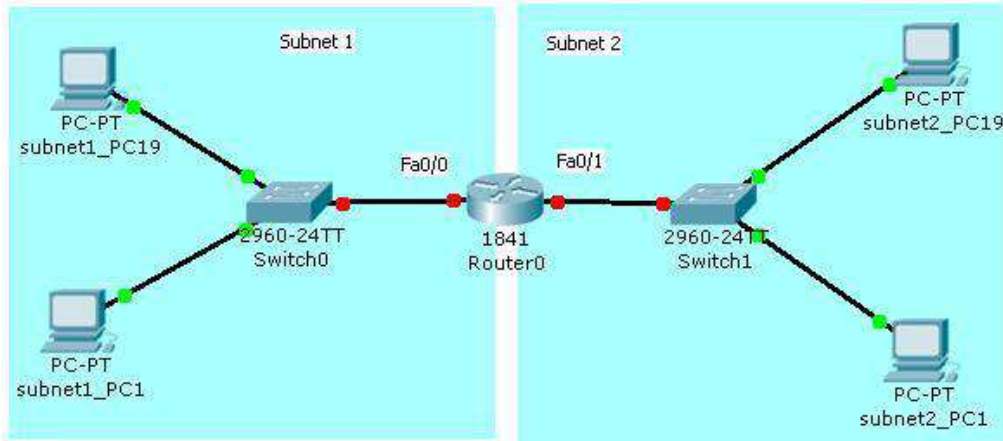
- ▣ First address
210.168.200.1
- ▣ Last address
210.168.200.30
- ▣ Mask /27



The last address of the subnet is assigned to the default Gateway or Router Interfaces

Problem 2: VLSM calculation

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- Given IP address
 - ▣ 210.168.200.0 / 24
 - Mask 255.255.255.0
- Subnet 1
 - ▣ 20 hosts
- Subnet 2
 - ▣ 20 hosts
- Use the 0th subnet to reduce IP address wastage

Subnet 1 calculation: 20 hosts

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		128	64	32	16	8	4	2	1
Subnet address		0	0	0	0	0	0	0	0
1 st host address	PC 1	0	0	0	0	0	0	0	1
2 nd host address	PC 2	0	0	0	0	0	0	1	0
19 th host address	PC 19	0	0	0	1	0	0	1	1
Last host address	Fa0/0	0	0	0	1	1	1	1	0
Broadcast address		0	0	0	1	1	1	1	1

Subnet 2 calculation: 20 hosts

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		128	64	32	16	8	4	2	1
Subnet address		0	0	1	0	0	0	0	0
1 st host address	PC 1	0	0	1	0	0	0	0	1
2 nd host address	PC 2	0	0	1	0	0	0	1	0
19 th host address	PC 19	0	0	1	1	0	0	1	1
Last host address	Fa0/0	0	0	1	1	1	1	1	0
Broadcast address		0	0	1	1	1	1	1	1

Problem 2: Completed solution

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□ Subnet 1

□ Subnet address

■ 210.168.200.0

□ First

■ 210.168.200.1

□ Last

■ 210.168.200.30

□ Broadcast

■ 210.168.200.31

□ Mask

■ 255.255.255.224 or /27

□ Subnet 2

□ Subnet address

■ 210.168.200.32

□ First

■ 210.168.200.33

□ Last

■ 210.168.200.62

□ Broadcast

■ 210.168.200.63

□ Mask

■ 255.255.255.224 or /27