Date: ...../...../.....

CSE421 – Computer Networks – SFQ

Lecture 11 – Subnetting

(I) FLSM – Fixed Length Subnet Masking

(II) VLSM – Variable " " "

Subnet – Network Address

↳ 192.168.0.0/13

IPv4 addresses are all used up – (I) IPv6 ↗ Long term

(II) Plenty addresses of different scheme.

Short term – (I) Subnetting to avoid addresses

(II) Use private addresses locally + NAT for internet access

↳ many hosts can share a few public addresses.

(III) DHCP

192.168.0.0/13

13 Network bits + 19 Host bits = 32

↓

13 + 2 bits (borrowed from host) + 17 = 32

Subnet ID

↳ 192.168.0.0/15

FLSM – How many networks?

VLSM – How many hosts?

Classful Addressing is a method but is very wasteful.

A → 8 C → 24

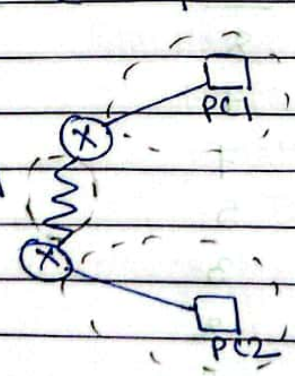
B → 16

Soln – VLSM

→ Need to make 3 subnets / 3 networks. All subnets of a main network must have the same subnet mask.

$2^{②} = 4$ [can hold 3 networks]

↓ no. of bits



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192.168.0.0/13

192.10101000.00000000.00000000

← N → ← H →

2 bits borrowed

00 ✓	192.168.0.0/15 → LAN1
01 ✓	192.170.0.0/15 → LAN2
10 ✓	192.172.0.0/15 → WAN
11 (unused)	Number of usable IPs = $2^{17}-2$

(counted ↓↓ controlled)

VLSM — always satisfy the requirements of your biggest LAN & work your down to the smallest LAN

* assign a block of IP satisfying only the particular LAN.

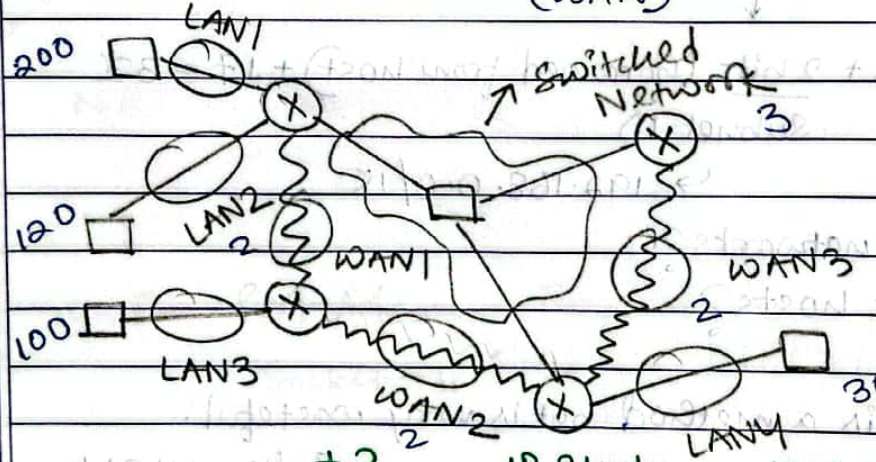
200 hosts → 256 IPs

1000 " → 1024 IPs

* Switched Networks (connection of router via switch) ↳ MAN

* Point-to-Point connection → Hosts = 2 (WAN)

N.A. = 10.13.0.0/16



4 LANs
3 WANs
1 Switched Network / MAN (3 routers)

		+2	IP Block	Host bits	Network bits
					$\rightarrow 2^n$
LAN1	200	202	256	8	24
LAN2	120	122	128	7	25
LAN3	100	102	128	7	25
LAN4	30	32	32	5	27
MAN	3	5	8	3	29
WAN1	2	4	4	2	30
WAN2	2	4	4	2	30
WAN3	2	4	4	2	30

subnet

10.13.00000000.00000000

N H

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Hosts → H1 → 120 BA+NA → 120+2 = 122

H2 → 5

(*) Waste Comparison —

classful → /8, /16, /24.

H1 → 122

/24 → Host bits = 8

Hosts = 2^8 = 256

Waste = 134

/24 → Req. Hosts = 5+2 = 7

Waste = 256 − 7 = 249

∴ Total = 383

Classless — FLSM + VLSM

FLSM → Req. Hosts = 122

↙ calculates based on no. of networks; ignores host requirement.

Hosts = 2^7 = 128

Waste = 6

Req. Hosts = 7

Hosts = 2^7 = 128

Waste = 121

∴ Total = 127

VLSM → Req. Hosts = 122

↙ based on requirement

Hosts = 2^7 = 128

Waste = 6

Req. Hosts = 7

Hosts = 2^3 = 8

Waste = 1

∴ Total = 7 → improves but not wastes.

Why do we arrange from ascending to descending order?

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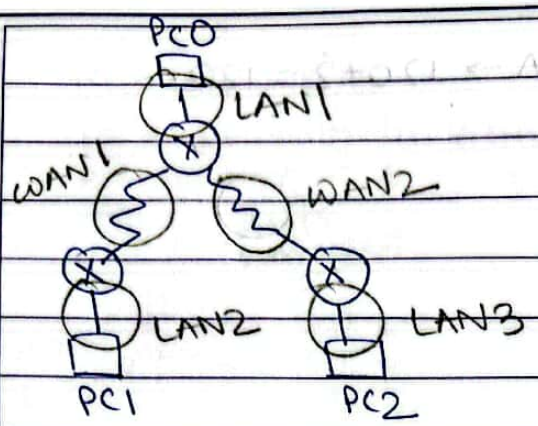

N.Address — 192.168.16.0/24

Host Requirements —

LAN1 → 120

LAN2 → 60

LAN3 → 20

WAN1 → 2

WAN2 → 2

		+2	IP Block	Host bits	Network bits
LAN1	120	122	128	7	25
LAN2	60	62	64	6	26
LAN3	20	22	32	5	27
WAN1	2	4	4	2	30
WAN2	2	4	4	2	30

one level will have same subnet mask.

192.168.16.0/24

192.168.16.0/25 (120)

192.168.16.128/25

192.168.16.128/26 (60)

192.168.16.192/26

192.168.16.192/27 (20)

192.168.16.224/27

192.168.16.224/30 (2)

192.168.16.228/30 (2)

VLSM (from the table from before) —

10.13.|00000000|0|00|00|00 (Right to left)

N — subnet ID — H — 11

10.13.0.0/16

10.13.0.0/24 — 200

10.13.1.0/24

10.13.2.0/24

Network Address for 200 Hosts for this Network

10.13.1.0/25 — 120

10.13.1.128/25 — 100

10.13.X.128/27

No /25 combinations left

10.13.2.0/27 — 30

10.13.2.32/27

10.13.2.48/29

10.13.2.48/30 — 2

10.13.2.40/29 — 5

10.13.2.40/30 — 2

10.13.2.44/30 — 2