Soal Praktikum *Practicum Case* COMP6372 Computer Networks	BINUS UNIVERSITY
Teknik Informatika *Computer Science*	CS- COMP6372 -Var01
Periode Berlaku Mulai Semester Ganjil 2018/2019 ***Valid on*** *Odd Semester Year* 2018/2019	**Revisi 00** *Revision 00*

Learning Outcomes
- Describe basic structures of network

Topic
- Session 02 - Basic Subnetting

Sub Topics
- IP Addressing
- Classful Subnetting (FLSM)
- Classless Subnetting (VLSM)
- Exercises

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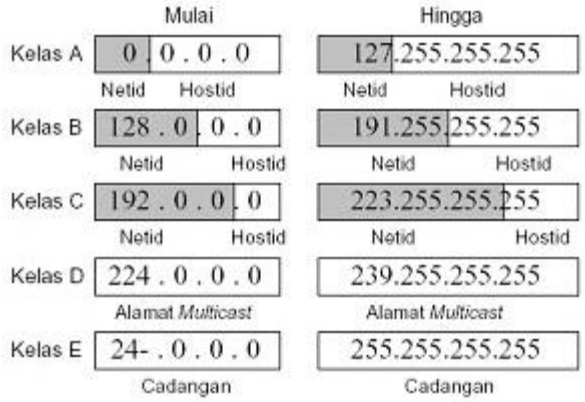
A. IP Addressing

IP Address Class:



- Class A

  When in binary format, first bit (at the leftmost) from Class A IP Address always 0. First octet (8 bit) signed as a network number that given by ARIN. Internal Network Administrator can be assigned the next 24 bit. To make it easier identifying Class A address, Class A first octet value always assigned between 0 – 126 (127 was started at 0 bit, but it's already provided for special purposes i.e. loopback addressing), all Class A IP Address only used first 8 bit for network identification, next 24 bit can be used to host address. Each network that used Class A IP Address can have 2 to the power of 24 minus 2 $(2^{24}-2)$ or 16,777,214 IP Address that can be used for connected devices at this network.

- Class B

  First 2 bit from Class B address always 10 (from 1 and 0). For the example of Class B is 143.234.23.8. First 2 octet was indentifying as a network number that given by ARIN. Then Internal Network Administrator can be assigned next 16 bit. First octet value from Class B always assigned between 128 – 191. Class B IP Address used the first 16 bit for identifying a network number and next 16 bit can be used for host. Each network that used Class B can be had 2 to the power of 16 minus 2 or 65,534 IP Address that can be used for connected devices at this network.

- Class C

  First 3 bit from Class C IP Address always 110 (read in binary format i.e. 1 1 0). Example of Class C IP Address is 194.23.23.4. First 3 octet was identifying a network number that given by ARIN. Then Internal Network Administrator can be assigned next 8 bit. First octet value of Class C IP Adress always between 192 – 223. Each network that used Class C IP Address can be had 2 to the power of 8 minus 2 or 254 IP address for connected devices at this network.

- Class D

  Class D IP address is be used for multicasting purposes. First 4 bit of Class D IP address always set to 1110, so that first byte can be between 224 – 247, otherwise next bit were arranged that appropriate with multicast group requirement that using this IP address. In multicasting, there are no network ID and host ID.

- Class E

Class E IP address is not used for public purposes. First 4 bit IP address from Class E will be set to 1111, so that first byte only between 248 – 255. In additional can be called as Network Prefix, that can be used for IP address that pointing at network.

B. Classful Subnetting (FLSM)

Subnetting is an IP address grouping which becomes some other network ID into smaller network member count, that's called subnet (subnetwork).

Steps to do subnetting:

1. **Determine the new Subnet Mask**
2. **Determine each network IP Host**

Example:

Case:

NA (Network Address) = 192.168.1.0

SM (Subnet Mask) = 24 = 11111111.11111111.11111111.00000000

= 255.255.255.0 -> class C

Requirements:

- Admin section need **15** hosts
- Operational section need **33** hosts

Do the **classful subnetting** to gives IP for every hosts in each section!

1. **Find the highest hosts**

   The highest hosts in Operational section need **33 hosts**

2. **Determine the new Subnet Mask**

   Use this formula: 2^h – 2 >= total the highest host

   Example:

   2^h – 2 >= 33

   2^6 - 2 >= 33

   64 – 2 >= 33

   62 >= 33

h=6

n = 32 – b – h

b = total bit **1** from old subnet mask

n = 32 – 24 – 6

= 2 (add with 1 bit number as much as 2 from old subnet mask)

new Subnet Mask = 11111111.11111111.11111111.**11**000000

= 255.255.255.192

Determine each network IP Host

Use this formula: 2^total zero bit that remaining in new Subnet Mask

2^6 = 64

Result for IP Host partition in each network as follows:

No.	IP Host	Network Address	Broadcast Address
1	192.168.1.0 – 192.168.1.63	192.168.1.0	192.168.1.63
2	192.168.1.64 – 192.168.1.127	192.168.1.64	192.168.1.127
3	192.168.1.128 – 192.168.1.191	192.168.1.128	192.168.1.191
4	192.168.1.192 – 192.168.1.255	192.168.1.192	192.168.1.255

1. The first IP address on each network is used for **Network Address**
2. The last IP address on each network is used for **Broadcast Address**
3. Network No. 1 for **Admin** section with usable IP range 192.168.1.1 – 192.168.1.62 with **Network Address** 192.168.1.0 and **Broadcast Address** 192.168.1.63
4. Network No. 2 for **Operational** section with usable IP range 192.168.1.65 – 192.168.1.126 with **Network Address** 192.168.1.64 and **Broadcast Address** 192.168.1.127
5. Network No. 3 and 4 were free because the requirement at the case only need 2 networks.

C. Variable Length Subnet Mask (VLSM)

Variable Length Subnet Mask is a subnetting technique that allows network engineers to divide an IP address space into subnets of different sizes.

Example:

Case:

The given Network Address = **200.199.1.0/24**

- Operational Division have **20** hosts
- Academic Division have **50** hosts
- Registration Division **15** hosts

Subnet Mask = /24 = 11111111.11111111.11111111.00000000

= 255.255.255.0 -> class C

1. **Sort the network by hosts requirement from highest to lowest**
   - Academic Division have **50** hosts
   - Operational Division have **20** hosts
   - Registration Division **15** hosts

2. **Determine the new Subnet Mask**, **new Network Prefix**, and **Total Host for each network**

   Use this formula: **2^h – 2 >= total host each division**

   Example:

   - Academic Division

     2^h – 2 >= 50

     2^6 – 2 >= 50

     64 – 2 >= 50

     62 >= 50

     h = 6

n = 32 – b – h

b = total bit **1** from old subnet mask

n = 32 – 24 – 6

= 2 (add with 1 bit number as much as 2 from old subnet mask)

New Subnet Mask = 11111111.11111111.11111111.**11**000000

= **255.255.255.192**

New network prefix = **/26**

Total host = 2^h

= 2^6

= **64 hosts**

- Operational Division

2^h – 2 >= 20

2^5 – 2 >= 20

32 – 2 >= 20

30 >= 20

h = 5 (add with 1 bit number as much as 5 from old subnet mask)

n = 32 – b – h

b = total bit **1** from old subnet mask

n = 32 – 24– 5

= 3 (add with 1 bit number as much as 3 from old subnet mask)

New Subnet Mask = 11111111.11111111.11111111.**111**00000

= **255.255.255.224**

New network prefix = **/27**

Total host = 2^h

= 2^5

= **32 hosts**

- Registration Division

  2^h – 2 >= 15

  2^5 – 2 >= 15

  32 – 2 >= 15

  30 >= 15

  n = 5 (add with 1 bit number as much as 5 from old subnet mask)

  n = 32 – b – h

  b = total bit **1** from old subnet mask

  n = 32 – 24 – 5

  = 3 (add with 1 bit number as much as 3 from old subnet mask)

  New Subnet Mask = 11111111.11111111.11111111.**111**00000

  = **255.255.255.224**

  New network prefix = **/27**

  Total host = 2^h

  = 2^5

  = **32 hosts**

2. Determine each network IP Host

- IP address range for Academic Division:
  - 200.199.1.1/26 -> Network Address
  - 200.199.1.2/26 – 200.199.1.62/26 -> Usable IP Address
  - 200.199.1.63/26 -> Broadcast Address

- IP address range for Operational Division:
  - 200.199.1.64/27 -> Network Address
  - 200.199.1.65/27 – 200.199.1.94/27 -> Usable IP Address
  - 200.199.1.95/27 -> Broadcast Address

- IP address range for Registration Division:
  - 200.199.1.96/27 -> Network Address
  - 200.199.1.97/27 – 200.199.1.126/27 -> Usable IP Address
  - 200.199.1.127/27 -> Broadcast Address

Study case

Right now you work as network engineer for PT Kadit Osi, PT Kadit Osi plan to open their new branch in Batam. Make a network plan with requirement as below:

- Marketing division : Need **4** host
- Research division : Need **19** host
- Programer division : Need **7** host

Please provide IP table using VLSM with network base **103.49.221.0/24**
Design network cabling use https://www.draw.io/ with these scenario

- Marketing division : bus topology
- Research division : ring topology
- Programer division : star topology

All three division connected with Router before through internet.
You can add network diagram with, select more shape, and search CISCO or Network
Draw each PC using your nick name (3 character) followed with host number

If you don't understand, please ask your assistant!