2018 Fall Computer Network

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1. Link-layer switch, by the textbooks definition, are forwarding device in the link layer (layer 2) that base their forwarding decision on values in the fields of the link-layer frame. For example, base on MAC addresses. A router are forwarding devices in the network layer (layer 3) that base their forwarding decision on values in the fields of the network layer

2. (a) Data plane determines how datagram arriving on router input port is forwarded to router output port.
   (b) Control plane determines how datagram is routed among routers along end-end path from source host to destination host.

3. The main difference between RR and WFQ is that WFQ services bits at each scheduling turn, and RR handles packet at each scheduling turn. RR is unaware of the size of the packet, but WFQ is aware of the size of the packet. We can make WFQ and RR the same by adjusting the weight of WFQ to be proportional equal considering the packet size of each class. In this way both will be sending per packet of each class each turn and rotates to the next class of packet.

   source: http://what-when-how.com/qos-enabled-networks/queuing-and-scheduling-qos-enabled-networks-part-2/

4. (a)

Prefix Match	Link Interface
11100000 00	0
11100000 01000000	1
11100000	2
11100001 0	3
otherwise	3

   (b)
   `11001000 10010001 01010001 01010101` : matches 5_{th} entry, goes to interface 3.
   `11100001 01000000 11000011 00111100` : matches 3_{rd} entry, goes to interface 2.

`11100001 10000000 00010001 01110111` : matches 4_{th} entry, goes to interface 3.

5. (a)

   128.119.40.128/26 in binary is `10000000.01110111.00101000.10000000` . With the front 26 bits as the subnet part, we have the remaining 6 bits as the host part, which is `10000000.01110111.00101000.10000000` to `10000000.01110111.00101000.10111111` . (128.119.40.128 ~ 128.119.40.191)
   So select 128.119.30.130 is legally inside the subnet.

   (b)

   128.119.40.64/25 in binary is `10000000.01110111.00101000.01000000` . Splitting them into 4 subnets means using 2 bits to distinguish subnets, and the remaining for as the host part.
   So we four subnets are

   - `10000000.01110111.00101000.01000000` = 128.119.40.64
   - `10000000.01110111.00101000.01010000` = 128.119.40.80
   - `10000000.01110111.00101000.01100000` = 128.119.40.96
   - `10000000.01110111.00101000.01110000` = 128.119.40.112

6. MTU is 700 bytes, so per packet we can have $700 - 20 = 680$ bytes, 20 bytes are for the IP headers. So in total we need $\lfloor 2400/680 \rfloor = 4$.

   - packet 1: length=700 (including IP headers), flag=1, offset=0
   - packet 2: length=700 (including IP headers), flag=1, offset=85
   - packet 3: length=700 (including IP headers), flag=1, offset=170
   - packet 4: length=360 (including IP headers), flag=0, offset=255

7. File size=5MB. Assume data is carried in TCP segments, with each TCP segment also having 20 byte header. So each datagram can carry $1500 - 40 = 1460$ bytes. Number of total datagram is $\lfloor 5000000/1460 \rfloor = 3425$. All of the datagrams is 1500 bytes except the last one, which is 1000 bytes.

8. (a)

   Home addresses: 192.168.1.1, 192.168.1.2, 192.168.1.3 with the router interface being 192.168.1.4
   (b)
   NAT Translation Table

WAN	Side LAN Side
24.34.112.235, 4000	192.168.1.1, 3345
24.34.112.235, 4001	192.168.1.1, 3346
24.34.112.235, 4002	192.168.1.2, 3445
24.34.112.235, 4003	192.168.1.2, 3446
24.34.112.235, 4004	192.168.1.3, 3545
24.34.112.235, 4005	192.168.1.3, 3546

9. s2 flow table

match	action
Ingress port=3, Dst=10.1.*.*	Forward(2)
Ingress port=3, Dst=10.3.*.*	Forward(2)
Ingress port=4, Dst=10.1.*.*	Forward(1)
Ingress port=4, Dst=10.3.*.*	Forward(1)