Recitation 11

Internet Technology (Section 01)

Token Bucket

- Assume that we have a token bucket that has a fill rate of 10 KBps, a bucket size of 50 KB, and the bucket starts off full. There is a host that sends 15KB-packets every 0.5 seconds in a periodic manner, starting at t=0.5 seconds. Data transmission can occur only when there are available tokens in the bucket, otherwise they are queued until there are tokens available and the queue can be of unlimited size.
  - How many tokens are left in the bucket after 1.5 seconds?

Token Bucket (answer)

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t = 0.5s, (50 - 15) = 35
t = 1s, (35 - 15) + (10 * 0.5) = 25
t = 1.5s, (25 - 15) + (10*0.5) = 15 KB

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$t = 2.5$ sec

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  - Now, suppose the host can send data as much as it wants, whenever it wants. If the token bucket has a fill rate of 20 KBps, what would be the maximum possible burst size?

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    (50*20)/(20-10) = 100 KB

Leaky Bucket

- Suppose there is a leaky bucket at the host network interface. Network data rate is 2 MBps and the data rate on the link from the host to the bucket is 2.5 MBps.
  - Assume the host wants to send 250 MB over the network in bursts. Calculate the minimum capacity of the bucket considering no data loss. You can leave your answer in unreduced form.

Leaky Bucket (answer)

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Time for host to transmit data = 250MB / 2.5MBps = 100sec

Data sent on Network in 100sec = 100 * 2MBps = 200MB

Bucket size = 250MB – 200MB = 50MB

Leaky Bucket

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Leaky Bucket (answer)

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  - Assume the capacity of the bucket is 100 MB. What is the longest burst time in order for no data to be lost?

Data sent on Network = 250MB – 100MB = 150MB

Time for host to send this data = 75sec

Rate = 250MB / 75sec = 3.33MB/sec

Subnets

You have been assigned the IP address range 192.168.0.0/24, and you need to create several subnets to accommodate different departments in your organization. You have the following requirements:

- Subnet A should support up to 30 hosts.
- Subnet B should support up to 20 hosts.
- Subnet C should support up to 10 hosts.

Calculate the subnet mask, network address, usable host addresses range, and the broadcast address for each subnets (A, B, and C).

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Calculate the subnet mask, network address, usable host addresses range, and the broadcast address for each subnets (A, B, and C).

Subnet A) Mask: 255.255.255.224, Network: 192.168.0.0, Range: 192.168.0.1 – 192.168.0.30, Broadcast: 192.168.0.31
Subnet B) Mask: 255.255.255.224, Network: 192.168.0.32, Range: 192.168.0.33 – 192.168.0.62, Broadcast: 192.168.0.63
Subnet C) Mask: 255.255.255.240, Network: 192.168.0.64, Range: 192.168.0.65 – 192.168.0.78, Broadcast: 192.168.0.79

Weighted Fair Queueing

- Suppose a router has three input flows and one output. It receives the packets listed in the following table all at the same time in the router's WFQ computation, in the order listed (i.e., a very slight difference in real time). Assume the current virtual time is zero, and ties are broken by having packets which arrive first get priority. Assume the link rate is 1 Bps. For the Weighted Fair Queueing schedule fill in the table, and specify the order in which packets are transmitted.
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Packet	Packet size (Byte)	Flow	Weight	Weighted Finish #
1	100	1	1	
2	100	1	1	
3	100	1	1	
4	100	1	1	
5	190	2	4	
6	200	2	4	
7	110	3	1	
8	50	3	1	

Weighted Fair Queueing (Answer)

Packet	Packet size (Byte)	Flow	Weight	Weighted Finish #
1	100	1	1	100
2	100	1	1	200
3	100	1	1	300
4	100	1	1	400
5	190	2	4	47.5
6	200	2	4	97.5
7	110	3	1	110
8	50	3	1	160

Little's Law

- In a network, you have an average of 200 data packets queued for transmission, and the network's transmission rate is 400 packets per second. What would the average waiting time be if all the packets exited the queue, but now we observe an average packet interarrival time of 0.0005 seconds per packet?

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$$L = 200$$

$$\lambda = 400$$

$$\text{Little's Law: } L = \lambda * W \rightarrow W = 0.5$$