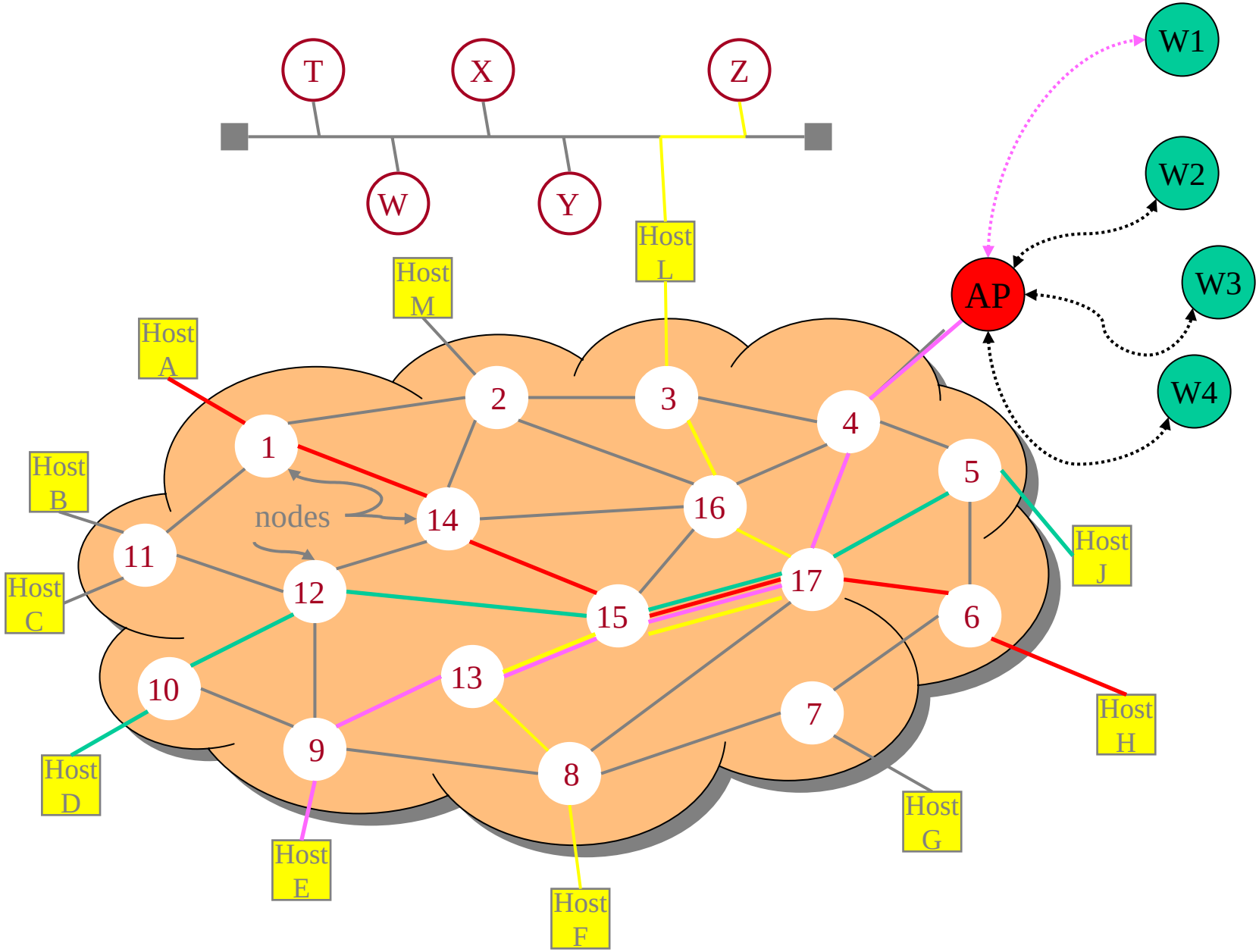
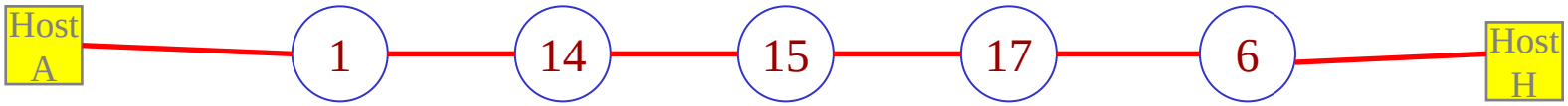
Sample Network Performance Problems


T
X
Z
W
Y
Host L
Host M
Host A
Host B
Host C
Host D
Host E
Host F
Host G
Host H
Host J
W1
W2
W3
W4
AP
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
nodes



1. What is the end-to-end packet latency in this store-and-forward subnet from router 1 to router 6 ?

Assume: All links: 2.5 km; C = 100Mbps; propagation speed = 200m/microsec.

queuing delay = processing delay =0; packet size = 1000 bytes

Solution:

end-to-end packet delay = 4 (equal hops) x link delay

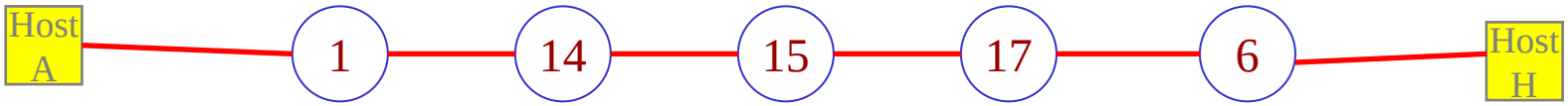
link delay = PROC +QD + TRANS + PROP = 0 + 0 + transmission time + propagation delay

$$\text{transmission time} = \frac{1000 \text{ bytes}}{100 \text{ Mbps}} = \frac{8 \times 10^3 \text{ bits}}{10^8 \text{ bps}} = 8 \times 10^{-5} = 80 \text{ microseconds.}$$

$$\text{prop delay} = \frac{2500 \text{ m}}{200 \text{ m/ microsec}} = 12.5 \text{ microseconds}$$

link delay = 92.5 microseconds

end-to-end subnet delay = 4 x 92.5 = 370 microseconds



2. What is the end-to-end packet delay in this store-and-forward subnet from router 1 to router 6 under the scenario that when a packet from router 1 arrives at router 15 there are three packets enqueued for the link to router 17?

Assume: All links: 2.5 km; C = 100Mbps; propagation speed = 200m/microsec.

processing delay =0; all packet sizes = 1000 bytes

Implied Assumption: queues at 1, 14, and 17 are empty when the packet arrives at node 15.

Required Insight: there will be no queuing delay at 17 even if all three queued packets are going to 6.

Solution:

end-to-end packet delay = 4 (equal hops) x link delay + queuing delay at node 15.

link delay = PROC +QD + TRANS + PROP = 0 + 0 + transmission time + propagation delay

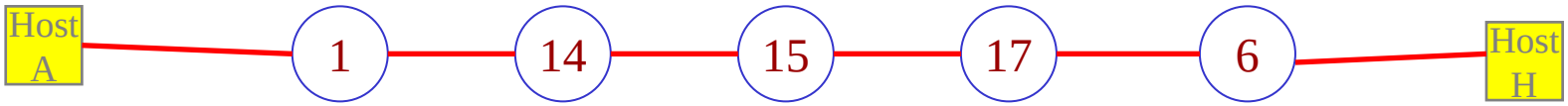
$$\text{transmission time} = \frac{1000 \text{ bytes}}{100 \text{ Mbps}} = \frac{8 \times 10^3 \text{ bits}}{10^8 \text{ bps}} = 8 \times 10^{-5} = 80 \text{ microseconds.}$$

$$\text{prop delay} = \frac{2500 \text{ m}}{200 \text{ m/ microsec}} = 12.5 \text{ microseconds}$$

link delay = 92.5 microseconds

queueing delay at node 15 = 3 packets * transmission time = 3* 80 microseconds = 240 microseconds

end-to-end subnet delay = 4 x 92.5 + 240 = 610 microseconds



What is the end-to-end packet delay in this store-and-forward subnet from router 1 to router 6 under the scenario that when a packet from router 1 arrives at router 15 there are three packets enqueued for the link to router 17?

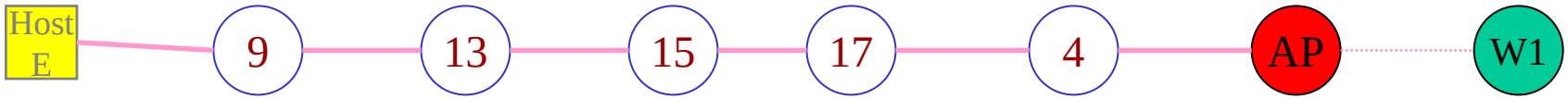
3.a **Assume Now** All links: 2.5 km; **C = 10Mbps**;
propagation speed 200m/microsec.
processing delay = 0; all packet sizes = 1000 bytes

3.b **Assume Now** All links: **25 km;** C = 100 Mbps;
propagation speed 200m/microsec.
processing delay = 0; all packet sizes = 1000 bytes

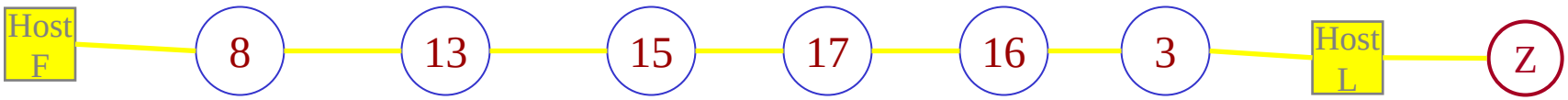
4.a **Assume Now** All links: 2.5 km; C = 100Mbps;
propagation speed 200m/microsec.
processing delay = **10 microsecs;** all packet sizes = 1000 bytes

4.B **Assume Now** All links: 2.5 km; C = 100Mbps;
propagation speed 200m/microsec.
processing delay = **10 microsecs;** all packet sizes = **3000 bytes**

Food for Thought



5. How does the end-to-end packet delay determination change when we send a packet from Host E to wireless Host W1?



6. How does the end-to-end packet delay determination change when we send a packet from Host F to Host Z that is on the Ethernet LAN?