

Operating Systems and Networks

Assignment 12

Assigned on: **22th May 2014**Due by: **29th May 2014**

1 Congestion Control

- a) Consider the arrangement of hosts H1 to H8 and routers R1 to R7 in figure below. Show that the links of R1 cannot become a bottleneck of the network and that for all other links, there is a traffic pattern that congests that link. Assume that all the traffic is generated exclusively by messages between two hosts; that is, routers only forward messages and are never the source nor the destination of a message.

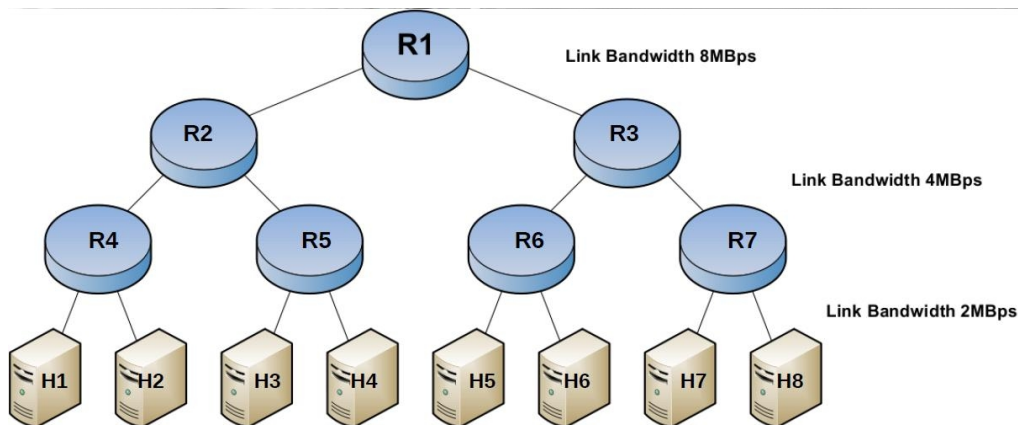


Figure 1: Network Topology for Exercise

- b) Assume that TCP implements an extension that allows window sizes much larger than 64 KB. Suppose that you are using this extended TCP over a 1-Gbps link with a latency of 100 ms to transfer a 10-MB file, and the TCP receive window is 1 MB. If TCP sends 1-KB packets (assuming no congestion and no lost packets):
- How many RTTs occur until the first transmission with a window size of 1MB is done?
 - How many RTTs does it take to send the file?
 - If the time to send the file is given by the number of required RTTs multiplied by the link latency, what is the effective throughput for the transfer? What percentage of the link bandwidth is utilized?

2 TCP congestion control

In the lectures we saw two types of congestion control techniques: *Additive Increase/Multiplicative Decrease* and *Slow Start*. In this question, we are concerned with Slow Start. A TCP connection uses a threshold of 8KB for congestion control. The maximum segment size should be 1KB and the receiver's window is 16KB. After the 8th, the 11th, and the 17th transmission, timeouts are occurring, which are interpreted as network overload.

Sketch the size of congestion window and the threshold into the following diagram.

