California State University, Monterey Bay

Week 1 - Homework 2

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CST331

Introduction to Computer Networks

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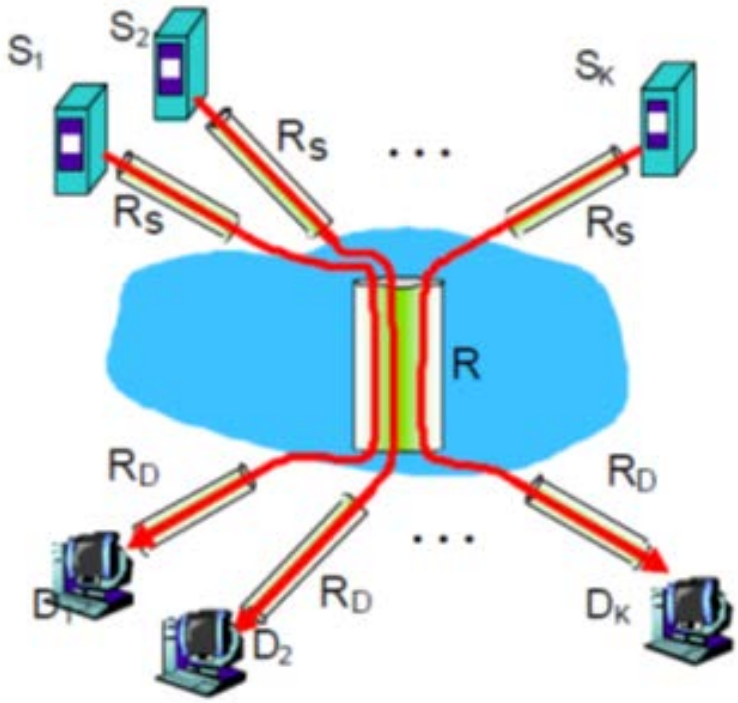
Problem

Consider the network scenario in the figure below. K sources are connected to the Internet via links of capacity R_S, and within the network fairly share a common link of capacity R, to K destinations. Each destination is connected to the network by a link of capacity R_D. You can assume that there are no other links or source-destination pairs in the network. Suppose that source S_i has an infinitely large file it wants to send to destination D_i (i.e., each sources sends to a different destination).



1. Suppose that K=10, R_S = 100 Mbps, R_D= 54 Mbps, and R = 50 Gbps. What is the throughput between each source-destination pair? Where are the bottleneck links?
    a. Since R is a common link for the 10 destinations, then each link would be R / 10 or 50 Gbps / 10 = 5 Gbps .

       The throughput would be the min (R_S, R_D, (R/K)) or

       Min (100 Mbps, 54 Mbps, 5 Gbps) … or 54 Mbps

    b. R_D

2. Suppose now that K=10, R_S = 100 Mbps, R_D= 1 Mbps, and R = 0.75 Gbps. What are the throughputs between each source-destination pair? Where are the bottleneck links?

    a. Since R is a common link for the 10 destinations, then each link would be R / 10 or 0.75 Gbps / 10 = 0.075 Gbps .

    1 gigabit / second = 1000 megabits / second So .075 x 1000 = 75 Mbps

    The throughput would be min (R_S, R_D, (R/K)) or

    Min (100 Mbps, 1 Mbps, 75 Mbps) … or 1 Mbps

    b. R_D

3. In the scenario above, suppose we increase the capacity of the destination links to 100 Mbps. Will this increase the throughput between sources and destinations? Explain you answer.

    a. Yes, the throughput would increase. Given that the bottleneck is the min (R_S, R_D, (R/K)), which yields R or 75 Mbps, then the throughput would increase to 75 Mbps.