

Exercises

- 6-15) In Figure 6-20, suppose that a new flow E is added that takes a path from R1 to R2 to R6. How does the max-min bandwidth allocation change for the five flows?

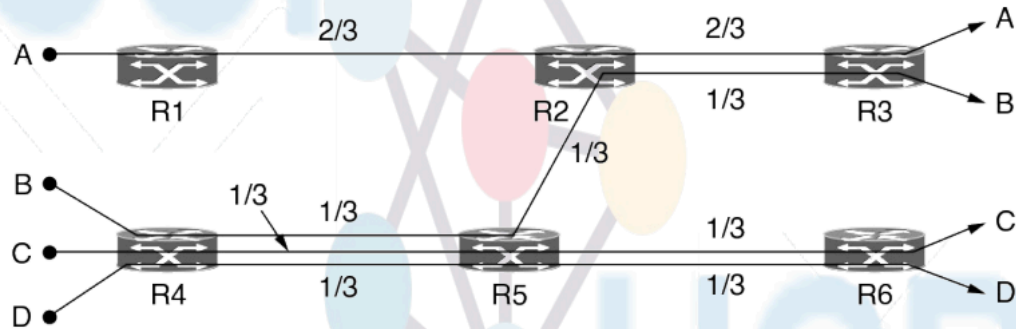
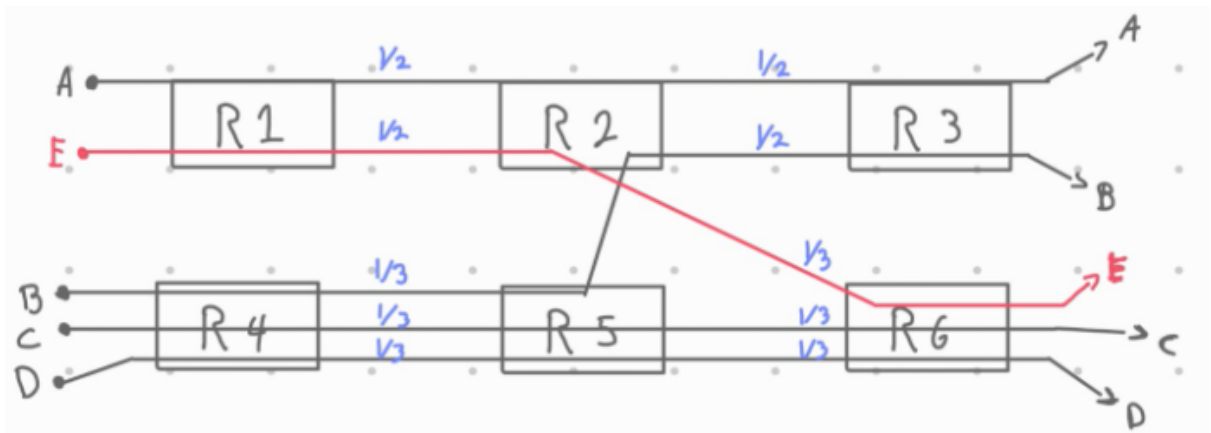


Figure 6-20. Max-min bandwidth allocation for four flows.



Exercises

- 6-20) Two hosts simultaneously send data through a network with a capacity of 1 Mbps. Host A uses UDP and transmits a 100 bytes packet every 1 msec. Host B generates data with a rate of 600 kbps and uses TCP. Which host will obtain higher throughput?
- 6-23) Both UDP and TCP use port numbers to identify the destination entity when delivering a message. Give two reasons why these protocols invented a new abstract ID (port numbers), instead of using process IDs, which already existed when these protocols were designed.

6-20)

- Since TCP includes mechanisms for flow control and congestion control, Host B can dynamically adjust its transmission rate to maximize bandwidth usage while adapting to network conditions. In contrast, UDP used by Host A lacks such controls, sending packets steadily at its predefined rate, without adjusting for network congestion.

Host A's data rate translates to 100 kbps (100 bytes * 8 bits = 800 bits per millisecond), significantly lower than Host B's potential 600 kbps throughput. TCP's adaptive nature thus allows Host B to utilize a larger portion of the available bandwidth.

6-23)

- **Port numbers provide a stable, service-oriented addressing method:** Port numbers create a clear separation from process IDs, enabling data to be routed to services consistently without needing specific information about process IDs. This abstraction allows for a more straightforward mapping to applications and services, such as routing web traffic to port 80 for HTTP, regardless of the particular process managing the service.
- **Consistency and interoperability across systems:** Process IDs are temporary and may change with each session or reboot, making them unreliable for identifying services over time or across different systems. Port numbers, however, are standardized across devices (e.g., port 443 for HTTPS), ensuring that applications can connect to the correct services on any system. This consistency improves compatibility and enables smooth communication between hosts on diverse networks.