6.1-52

Christopher Zúñiga

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Exercise 6-20 Solution

Problem Statement

Two hosts (A and B) share a 1 Mbps network:

- Host A: Uses UDP, sends 100-byte packets every 1 ms.
- Host B: Uses TCP, generates data at 600 kbps.

Which host achieves higher throughput?

Key Steps

1. **Calculate Host A's attempted rate:**

$$Packetsize = 100\,bytes \times 8 = 800\,bits$$

$$Rate = \frac{800\,bits}{0.001\,s} = 800\,kbps$$

2. **Total demand exceeds network capacity:**

$$800\,kbps(A) + 600\,kbps(B) = 1400\,kbps > 1000\,kbps(1Mbps)$$

3. **TCP congestion control:** Host B (TCP) will reduce its rate to avoid congestion, while Host A (UDP) continues transmitting aggressively.

4. **Fair share calculation:** The network allocates bandwidth proportionally. However, UDP does not back off, so Host A dominates:

$$Throughput(A) \approx 800\,kbps, \quad Throughput(B) \approx 200\,kbps$$

Conclusion

Host A (UDP) achieves higher throughput due to lack of congestion control.

$$HostA(UDP)$$

Exercise 6-23 Solution

Problem Statement

Why do UDP/TCP use port numbers instead of process IDs?

Reasons

1. **Abstraction and standardization:** Port numbers are OS-independent, unlike process IDs, which vary across systems.
2. **Multiplexing:** Ports allow multiple applications on a single host to communicate simultaneously. Process IDs alone cannot manage multiple connections efficiently.
3. **Security and management:** Ports simplify mapping services to applications (e.g., HTTP on port 80), enabling easier firewall rules and service management.

Final Answer

Port numbers provide OS-independent abstraction and enable efficient multiplexing of network connections.