CSC361

Computer Networking

Mantis Cheng

Dept of Computer Science

Unit 5

Sliding Windows Protocols

Important Concepts

- FSM & Stop-and-Wait
- Reliable Data Communication (ABP)
- Round-Trip Time (RTT)
- Sliding Windows Protocols

What We Learned So Far

- Routers and swithces are responsible to route packets across the Internet; they use **network id** to determine how to route packets from one network to the next.
- Routers typically use **longest prefix match** (or the **most specific** route) to determine the final destination network.
- NATs allow IP addresses to be reused; they thus help slow down the exhaustion of IP addresses. Port numbers play an important role in NATs.

Protocol Specification and FSM (7:51)

Stop and Wait(8:10)

(a simplified Alternating Bit Protocol)

Summary

- To prevent the receiver being overrun by too many sent packets, the sender **stops and waits** until the receiver **acknowledges** the reception of a packet.
- With a 1-bit counter, an out-of-sync **delayed** ACK and **retransmitted** DATA can be avoided.
- However, it only works if packets are **not** duplicated by the network and the packets are **not** delivered out of order.

Alternating Bit Protocol

[Sliding Windows Protocol (19:25)]

(watch the first 6 minutes)

Summary

- Throughput of **stop-and-wait** protocol = l/RTT bps (e.g., l = 12K bits, and RTT=$50 * 10^{-3} sec$, throughput = 240K bits/sec).
- Sliding Windows Protocols allow **multiple** un-ACK'ed packets in transit.
- **Bandwidth-delay** product = 1Mbps * 50 msec = 50K bits, implies 4 (12K bits) packets can be sent.
- **Bandwidth-delay** product = 10Mbps * 50 msec = 500K bits, implies 40 (12K bits) packets.

Summary (continued)

- Sliding Windows Protocols improve the performance of **stop-end-wait** by taking advantage of the **pipelining** effect of bandwidth-delay product.
- A sender maintains a **sliding window** of unACK'ed packets.
- A receiver ACKs those packets that have been received successfully.
- The sender may retransmit **all** or **one** unACK'ed packets.

Go-Back-N Simulation I (5:04)

(a sender DATA packet is lost)

(Go-Back-N similator)

Go-Back-N Simulation II (2:03)

(a receiver ACK packet is lost)

Summary

- **Go-Back-N**:
  - the sender uses a **single timer** for all unACK'ed packets;
  - it retransmits **all** unACK'ed packet upon timeout.
  - the receiver maintains a window of **size 1**;
  - it always ACKs the **last** successfully recevied packet, called **accumlative acks**.

Selective-Repeat Simulation I (4:30)

(a sender DATA packet is lost)

(Selective-Repeat similator)

Selective-Repeat II (2:52)

(a receiver ACK packet is lost)

Summary

- **Selective-Repeat**:
  - the sender maintains **multiple timers**, one per unACK'ed packet;
  - it retransmits **only** the timeout unACK'ed packet.
  - the receiver maintains a window of **size** m **> 1**;
  - it only ACKs **successfully received** packets.
  - Packets are delivered only if they are **contiguous**, buffered otherwise.

The End