Smith College, CSC 249
October 8, 2014

Transport Layer Review

- The transport layer services are:
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Discussion Question 2

- Consider a reliable protocol that uses only NAKs (no unnecessary ACKs, since most often, things work well!). Suppose the sender sends data infrequently. Would a NAK-only protocol be preferable to a protocol that uses ACKs? Why?
Discussion Question 3

- Now suppose the sender has a lot of data to send and the end-to-end connection experiences few losses. In this second case, would a NAK-only protocol be preferable to a protocol that uses ACKs? Why?

Discussion Question 4: Why Wait for 3 Duplicate ACKs before retransmission?

- Why did the TCP designers choose to have TCP wait until it has received three duplicate ACKs before performing a fast retransmit, rather than performing a fast retransmit after the first duplicate ACK for a segment is received?
TCP sender events:

(1) \textbf{data received from application}:
   1. Create a segment and assign a SEQ number
      - SEQ # is byte-stream number of first data byte in segment
   2. Start timer if it is not already running
      - Timer is for the oldest un-acked segment
      - Expiration interval: TimeOutInterval

(2) \textbf{timeout}:
   1. Retransmit segment that caused the timeout
   2. Restart the timer

(3) \textbf{ACK received}:
   - For previously unacked segments
     1. update what is known to be acked
     2. start timer if there are outstanding segments

\textbf{Finite State Machines}
TCP Congestion Control

TCP Congestion Control: FSM

TCP Connection Management

TCP Connection Management

TCP server lifecycle

TCP Connection Management

TCP server lifecycle
**Transport Layer Summary**

- TCP (and UDP) Services
- Defining and implementing a reliable transport service
- Checksum
- Detect loss and retransmit
- Detect out-of-order and retransmit
- Flow Control
- Connection management
- Congestion control

**Transport services and protocols**

- Provide *logical communication, a virtual connection*

  ...between application processes running on different hosts

  *This is not a physical path including routers*

**Network Layer: Routing and Forwarding**

- Create versus use the forwarding table

<table>
<thead>
<tr>
<th>header value</th>
<th>output link</th>
</tr>
</thead>
<tbody>
<tr>
<td>0100</td>
<td>2</td>
</tr>
<tr>
<td>0101</td>
<td>2</td>
</tr>
<tr>
<td>1001</td>
<td>1</td>
</tr>
</tbody>
</table>

Address value in arriving packet’s header