CS 471/571

Transport Layer 1
Network Architecture

- Application
- Transport
- Network
- Frame/Link
- Physical
<table>
<thead>
<tr>
<th>Frame Header</th>
<th>IP Header</th>
<th>TCP Header</th>
<th>HTTP Header</th>
<th>HTTP Data</th>
<th>Frame Trailer</th>
</tr>
</thead>
</table>

Transport Layer

• Provide services that allow application processes to communicate
• Segment is the common term for the messages exchanged by transport layers
Transport Layer Terminology

• Flow control
• Congestion control
• Acknowledgements
• Sliding Window Protocol
  – Also used by Frame layer
  – Go-Back-N
  – Selective Repeat
Transport Layer Terminology

• Error detection
  – Bit errors
  – Lost Segments
  – Acknowledgements (ACKS), Negative ACKS

• Multiplexing
  – Encapsulate a data chunk sent via a socket into a segment

• Demultiplexing
  – Deliver a data chunk found in a segment to the proper socket
UDP: segment header

UDP segment format

<table>
<thead>
<tr>
<th>source port #</th>
<th>dest port #</th>
</tr>
</thead>
<tbody>
<tr>
<td>length</td>
<td>checksum</td>
</tr>
</tbody>
</table>

32 bits

length, in bytes of UDP segment, including header

application data (payload)

why is there a UDP?

• no connection establishment (which can add delay)
• simple: no connection state at sender, receiver
• small header size
• no congestion control: UDP can blast away as fast as desired
TCP segment structure

- **URG**: urgent data (generally not used)
- **ACK**: ACK # valid
- **PSH**: push data now (generally not used)
- **RST, SYN, FIN**: connection estab (setup, teardown commands)
- **Internet checksum** (as in UDP)

### TCP Segment Fields

- **source port #**
- **dest port #**
- **sequence number**
- **acknowledgement number**
- **receive window**
- **checksum**
- **Urg data pointer**
- **options** (variable length)
- **application data** (variable length)

**Network Layer**

- **F**: not used
- **S**: not used
- **R**: not used
- **P**: not used
- **A**: not used

**32 bits**

- **not used**

**Internet checksum**

- **rcvr willing to accept**
- **# bytes of data** (not segments!)