Networking

Link Layer
Network Layer
End to End Layer

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Link Layer

- Reliable communication between the hosts in the network
- Link Layer
- Frame packets
- Checksums

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Link Layer

- Physical/logical link layer
- Multiplexing between different network protocols
- frame mark + network protocol + data + checksum…
- MTU
- Example: 802.11b, Ethernet

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Network Layer

- We need to route the packets between these hosts
- Network layer
- Routing: design project
- A method for addressing: IP protocol

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End to End Layer

- Still we need a protocol that will control how the two end hosts will communicate
- We did do error detection at the link layer but…
- So we need end to end error control
- And checksums
- End to End argument

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End to End Layer

- What do we want form our protocol?
- At least once delivery:
- Nonce (unique ID)
- Acknowledgement
- Timers

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End to End Layer

- At most once delivery:
- Make use of nonce
- Cache the nonces at the receiver

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End to End Layer

- In order delivery
- Make the nonce monotonically increasing,
- Sequence numbers

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End to End Layer

- Different MTUs for different links along the path
- Divide up Datagrams and reassmble

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End to End Layer

- Efficiency
  - Utilize the available bandwidth
  - Don't send too much

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End to End Layer

- The lock-step
  - One packet per round trip time
- Fixed window
  - N packets per
    (N transmission time + 1 roundtrip time)

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End to End Layer

- Sliding window
  - For continuous flow:
  - Window size >= round-trip time * bottleneck data rate
- Don't send faster than the receiver can accept

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End to End Layer

- Shared resources
- Congestion collapse
- Congestion flag
- Random Early Drop

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TCP

- Slow start
- Duplicate Acknowledgement
- Equilibrium: Additive increase, multiplicative decrease
- Restart when Retransmission timer expires

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End to End Layer

- Multiplexing/ Demultiplexing between applications
- The Presentation layer
- Ports

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End to End Layer

- Also Session Layer
- And Application Layer

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Papers

- Ethernet
- Mobile IP
- End to End argument
- Click modular router
- Hands on: trace route, ping

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