Animations

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Stop and Wait Protocol

Figure 1: Stop and Wait Protocol
Stop and Wait Protocol

- Protocol for sending (or receiving) data reliably.
- Needed for lossy communication channels.
- Data is sent in form of packets.
- Send one packet and wait for it’s acknowledgment (ack).
- Once ack is received send another packet.
$$U = \frac{T_f}{2T_p + T_f}$$

*Tf*: Time to Transmit one frame (packet)

*Tp*: One way propagation Delay

$$T_f = \frac{\text{Frame Size in bits}}{\text{Link Capacity (bps)}}$$

**Figure 2: Stop and Wait Protocol**
Our Example

- Packet Size = 500 B
- Link Capacity = 0.2 Mbps
- One Way Propagation Delay = 200ms = 0.2 seconds

\[ T_f = \frac{500 \times 8}{0.2 \times 10^6} = 0.02 \text{seconds} \]

\[ Efficiency = U = \frac{0.02}{2 \times 0.2 + 0.02} = 4.76\% \]

- Stop and Wait can be in-efficient!

Pipelining

- Stop and Wait can be inefficient, especially on big pipes.
- Possible Remedy: *Give the source a credit of packets that can be sent without having to wait for acknowledgments.*
\[ U = \frac{N \cdot T_f}{2T_p + T_f} \]

- \( T_f \): Time to Transmit one frame (packet)
- \( T_p \): One way propagation Delay

\[ T_f = \frac{\text{Frame Size in bits}}{\text{Link Capacity (bps)}} \]

**Figure 3: Pipelining in Stop and Wait Protocol**
Exercise

- Download the following files:

- Packet Size: 500 B,

- Link Capacity: 10 Mbps

- One way propagation delay: 4ms

- Calculate the value $N$ when the link will be 50% and 100% utilized.

- Verify that pipe2.nam and pipe4.nam actually do this.

- Comment on the other two nam files.

- To run a nam file, say pipe1.nam, type nam pipe1.nam
Question

- Why is the pipe not full with $N = 20$?

Answer: Why? For our efficiency calculations we assumed the first ACK was sent exactly when the reception of the first packet begins. That is not true; the first ACK is sent when the reception of the first packet finishes and the packet is processed (you may need to slow down a bit the animation to see this fact).
Summary

• What is animation good for?

• It illustrates the details and dynamics of protocols.

• Along with graphs (of performance metrics) it can be used to validate analysis.

• Simulation also has to be validated against experiments (Future).