Animations

September 5, 2002

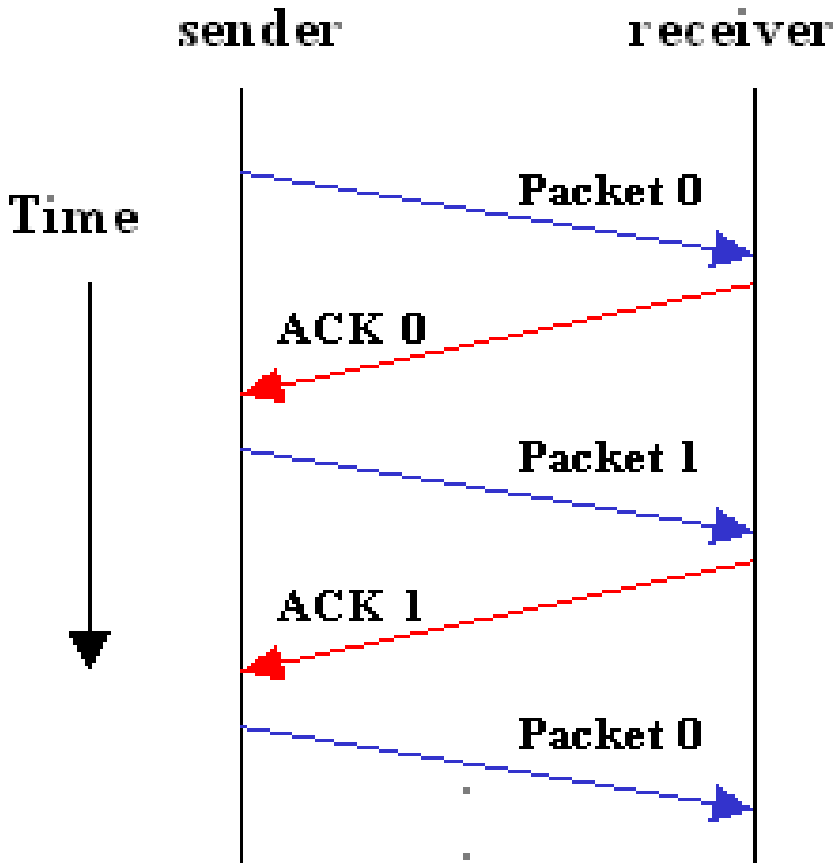
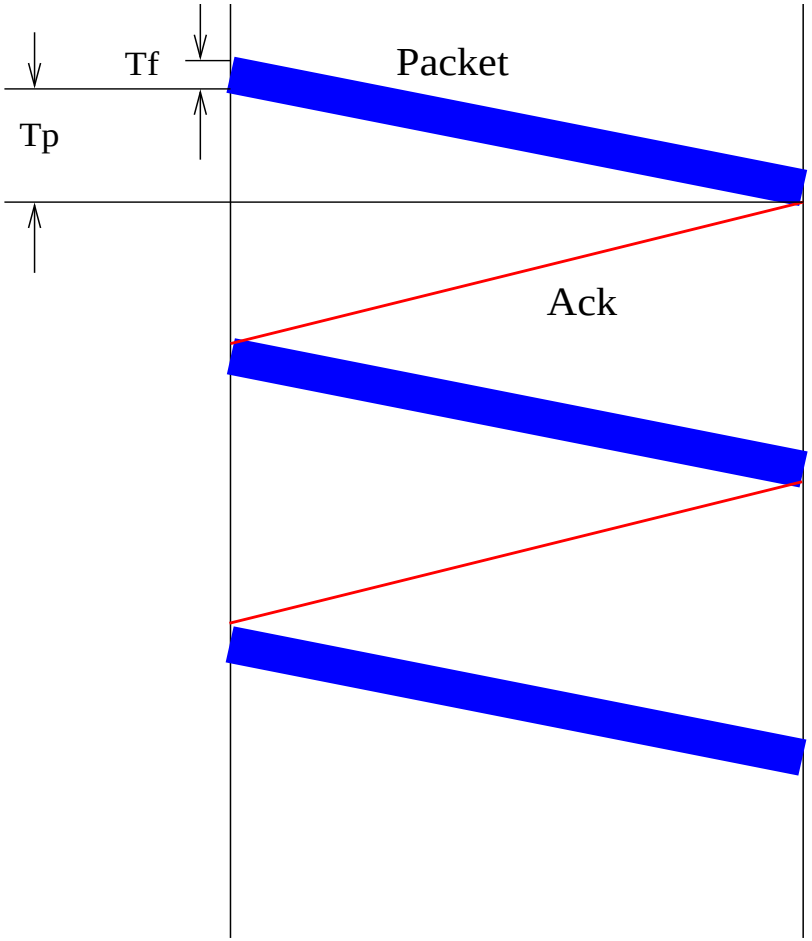


Figure 1: Stop and Wait Protocol

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.

Efficiency of Stop and Wait Protocol



$$U = \frac{Tf}{2Tp + Tf}$$

Tf: Time to Transmit one frame (packet)

Tp: One way propagation Delay

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

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

$$Tf = \frac{500 * 8}{0.2 * 10^6} = 0.02 seconds$$

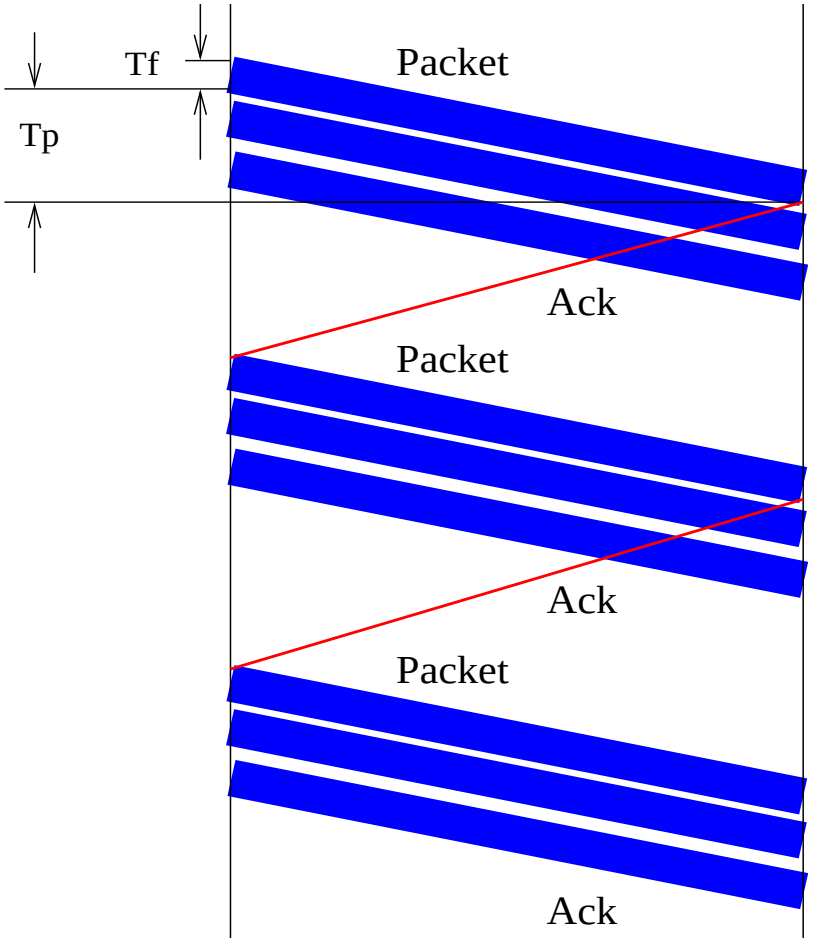
$$Efficiency = U = \frac{0.02}{2 * 0.2 + 0.02} = 4.76\%$$

- *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.*

Efficiency of Pipelining in Stop and Wait Protocol



$$U = \frac{N\ Tf}{2Tp + Tf}$$

Tf: Time to Transmit one frame (packet)

Tp: One way propagation Delay

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

Figure 3: Pipelining in Stop and Wait Protocol

Exercise

- Download the following files:
  pipe1.nam, pipe2.nam, pipe3.nam and pipe4.nam from
  http://networks.ecse.rpi.edu/kartikc/ITL/
- 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).