CprE 489
Lecture 12

Fall Semester 1997

Alternating Bit Protocol (ABP)

- Sender

```
seq_no := 0
repeat forever
   get data from network layer
   create frame with seq_no field
   done := false
   repeat
      send frame to physical layer
      set timer
      wait for event {ackarrival, frameerror, timeout}
      if event = ackarrival and ack's seq_no = 1-seq_no
             then done := true  endif
   until done
   seq_no := 1 - seq_no
endrepeat
```

Note: It is often best to think of the ack's seq_no as a request for data with that sequence number.

APB Receiver

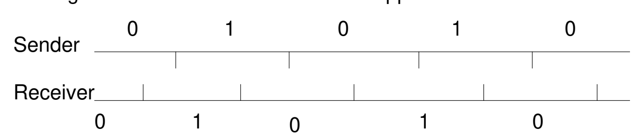
- Receiver

```
expected_seq_no = 0
repeat forever
   wait for event {framearrival, frameerror}
      if event = framearrival then
         if expected_seq_no = seq_no in frame  then
             remove data from frame and put to network layer
             expected_seq_no := 1 - expected_seq_no
         endif
      send ack with expected_seq_no included to physical layer
      endif
endrepeat
```

Note: the ack with expected_seq_no can be thought of as a request for data with that sequence number.

Properties of ABP

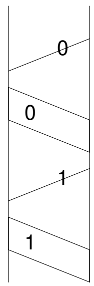
- Stages of ABP are interlocked like a zipper



- ABP can fail if the initial sequence number are set improperly. For example, Sender starts out with sequence number = 0 and Receiver starts out with expected sequence number = 1.
- If ABP times out too early too often then unnecessary frames are sent.
- ABP may have a utilization problem - we'll fix this with sliding windows.
- ABP as written is "sender driven", that is the sender is in control and the receiver just reacts.
- ABP is a simplex protocol in that data flows only in one direction - to make a duplex protocol use "piggybacking."

Receiver Driven Protocol

- The receiver instead of the sender has timeouts.
- Instead of acknowledgements, the receiver sends "requests" to the sender for data.



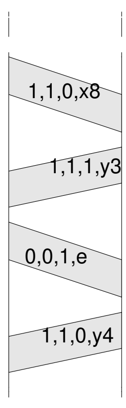
Duplex Protocol - Using Piggybacking

req number	data bit	seq number	data	CRC, etc

Typical Frame

- req number tells other party what data is expected next by me.
- data bit tells other party if there is data from me on board.
- seq. number tells other party the sequence number of the data on board.
- data, if any, is data for the other party from me.
- CRC, etc. is other stuff.
- The protocol can be symmetric with both side employing timeouts.

Duplex Example



(req no , data bit, seq no, data)

- The duplex protocol carries on two simplex protocols simultaneously.
- The state of the sender1 and sender2 can be thought of as constisting to two bits.

  - request number for data being sent to me

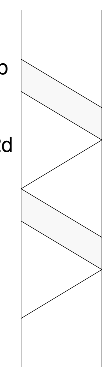
  - sequence number of data data being sent from me.

Underutilization of Stop-and-Wait

- All stop-and-wait protocols suffer from underutilization if propogation delay is high.

packet time = p/b

round-trip delay =2d



Utilization can be very small.

$$U = \frac{\frac{p}{b}}{\frac{p}{b} + 2d} = \frac{1}{1 + \frac{2db}{p}}$$