COMPUTER NETWORKS : Notes

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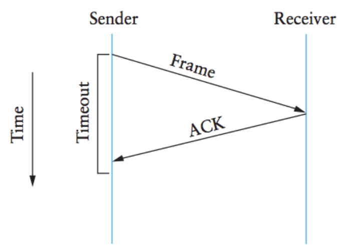
Reliable Communication: If an error is detected in communication then the course of action to be taken is :
a. re-transmission
b. error correction

However, error correction can often be costly and is reserved for specific channels.
Hence, the more frequently used method is re-transmission, that is, if an erroneous frame is detected then the entire frame is re-transmitted.
This procedure is called **Automatic Repeat Request** or ARQ protocol.

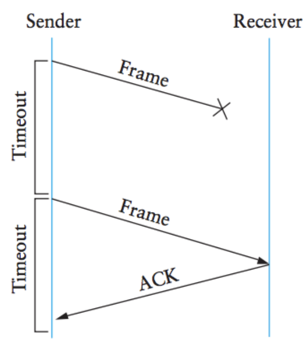
Challenges of ARQ:
a. The repeat request made upon receiving an erroneous frame by the receiver might not reach the sender. This needs to be tackled.
b. We need to detect which frame is erranous if the same connection has multiple frames associated with it.

Concept of ARQ:
After transmitting one frame, the sender waits for an acknowledgment before transmitting the next frame. If the acknowledgment does not arrive from the receiver after a certain period of time, the sender makes a decision.
The sender expects a '1' if the frame received is not erranous, ie, it expects 1 if acknowledgement is positive and does not receive anything when the acknowledgement is negative.
Four different scenarios result from this basic algorithm

a.

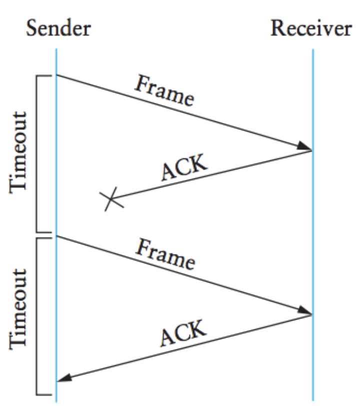


Exhibits the situation in which the acknowledgement is received before the wait time expires and thus the sender knows that the frame sent is not erroneous.
b.

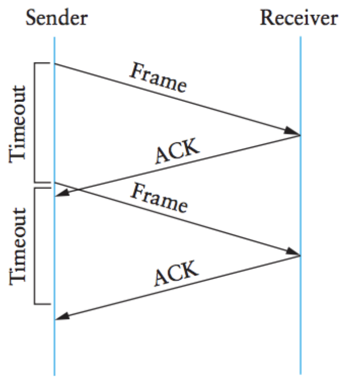


(b)

c.



(b) and (c) show the situation in which the original frame and the ACK, respectively, are lost and therefore the frame is re-transmitted
d.



(d)

shows the situation in which the acknowledgement comes after the wait time is over so the acknowledgement essentially carries no meaning.

Let us extend this to when the sender has multiple frames to send to the receiver

In the case of (c), our current system will fail since the receiver will expect $frame_2$, however the sender will resend $frame_1$ since it did not receive the acknowledgement of $frame_1$.
This protocol is also called **the stop and wait protocol**.

Bandwidth is defined as the number of bits one can transmit into the media per second
Speed of propagation can be defined as the distance/velocity in a direct link communication
Queueing Delay can be defined as the delay in processing in transmission
transmission Delay can be defined as the time taken to transmit from the sender to the receiver
That is,

$\frac{framesize}{bandwidth} + \frac{distance}{velocity}$

Latency of a Frame for a single frame can be defined as : transmission delay + propogation delay + queueing delay

Let us say, we represent the following:
Bandwidth : M Mbps
Propogation Delay : D Secs
Frame Size : L Bits

Therefore, T = $\frac{L}{M} + 2D$

Multiplying both sides by M

T*M = $(\frac{L}{M} + 2D)$*M

T*M = $L + 2DM$

We know, we can represent efficiency as follows :

Efficiency = number of bits sent/ number of bits that could have been ideally sent

Efficiency = $\frac{L}{L+2DM}$

Efficiency = $\frac{1}{1+2DM/L}$

Efficiency = $\frac{1}{1+(RTT)M/L}$