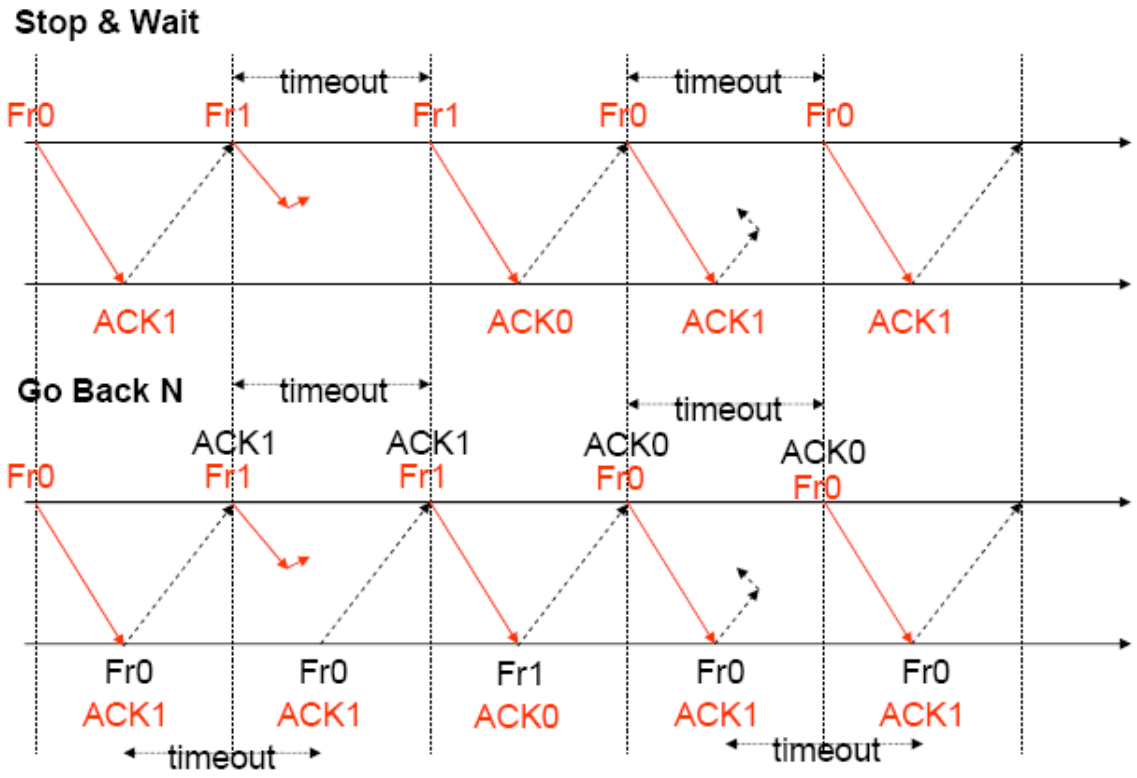
Chapter 5

Q 21. Compare the operation of Stop-and-Wait ARQ with bidirectional Go-Back-N ARQ with a window size of 1. Sketch out a sequence of frame exchanges using each of these protocols and observe how the protocols react to the loss of an information frame and to the loss of an acknowledgment frame.

Solution

The figure below shows that the bidirectional Go-Back-N ARQ recovers from errors in the same time that Stop-and-Wait:



Q 33. A telephone modem is used to connect a personal computer to a host computer. The speed of the modem is 56 kbps and the one-way propagation delay is 100 ms.
Q.2 A scanner has a resolution of 600 x 600 pixels/square inch. How many bits are produced by an 8-inch x 10-inch image if scanning uses 8 bits/pixel? 24 bits/pixel?

a. Find the efficiency for Stop-and-Wait ARQ if the frame size is 256 bytes; 512 bytes. Assume a bit error rate of 10^{-4}.

Solution

$P_f = 1 - (1 - 10^{-4})^{n_f}$
$n_f = 256 \times 8 = 2048$ or $n_f = 512 \times 8 = 4096$
$t_{prop} = 100$ ms

$n_o = 0$
$n_a = 64$ bits
$t_{proc} = 0$

Using the results in Equation 5.4,

$$\eta = (1 - P_f)\frac{1 - \frac{n_o}{n_f}}{1 + \frac{n_a}{n_f} + \frac{2(t_{prop} + t_{proc})}{n_f}R}$$

= 0.125 (n_f = 2048)
= 0.177 (n_f = 4096)

b. Find the efficiency of Go-Back-N if three-bit sequence numbering is used with frame sizes of 256 bytes; 512 bytes. Assume a bit error rate of 10^{-4}.

Solution

Given that $W_S = 2^3 - 1 = 7$, we can calculate that the window size is:

$$\frac{n_f \times W_S}{R} = 256ms$$

Since this is greater than the round trip propagation delay, we can calculate the efficiency by using the results in Equation 5.8.

$$\eta = (1 - P_f)\frac{1 - \frac{n_o}{n_f}}{1 + (W_S - 1)P_f}$$

= 0.385 (n_f = 2048)

= 0.220 (n_f = 4096)

Q 34. A communications link provides 1 Mbps for communications between the earth and the moon. The link is used to send color images from the moon. Each image consists of 10,000 x 10,000 pixels, and 16 bits are used for each of the three-color components of each pixel.

a. How many images per second can be transmitted over the link?

Solution

The number of images that can be transmitted per second is:

$$1\times10^{6}\frac{bits}{\sec}\Big/(10000^{2}\times16\times3\frac{bits}{image})=2.1\times10^{-4}images/\sec ond$$

b. If each image is transmitted as a single block, how long does it take to get an acknowledgment back from earth? The distance between earth and the moon is approximately 375,000 km.

Solution

$$t_O=t_f+2t_{prop}=\frac{(10000^{2}\times16\times3\frac{bits}{image})}{1\times10^{6}\frac{bits}{\sec}}+2\frac{375000\times10^{3}m}{3\times10^{8}\frac{m}{\sec}}$$

$$=4800+2.50=4802.5\sec/image$$

Note that if each image is transmitted in a single block, t_{prop} becomes insignificant compared to t_f.