CANADIAN COLLEGE OF MODERN TECHNOLOGY

1 SILICON HILL

MILE 91

ASSIGNMENT ONE

NAME: HENRY MARRAH

ID NO: 19290308

DEPARTMENT: COMPUTER SCIENCE

LEVEL: YEAR THREE, SEMESTER ONE

MODULE: DATA COMMUNICATION AND NETWORKING

LECTURER: MR HAMID MILTON MANSARAY

DATE OF SUBMISSION: 26TH FEBRUARY, 2021.

Q1. At the low end, the telephone system is star shaped, with all the local loops in a neighborhood converging on an end office. In contrast, cable television consists of a single long cable snaking its way past all the houses in the same neighborhood. Suppose that a future TV cable were 10-Gbps fiber instead of copper. Could it be used to simulate the telephone model of everybody having their own private line to the end office? If so, how many one-telephone houses could be hooked up to a single fiber?

Answer

According to the question it is possible to use the 10Gbps TV cable to run a private line to the end office of every one. Usually, to ignore the speech compression, the digital pulse code modulation (PCM) telephone requires 64kpbs.

Possible number of telephone houses hooked up in a single fiber:

• If the future TV cable fiber bandwidth is 10Gbps then dividing it by 64 kbps will provide how many numbers of houses can connect in fiber per cable.

Consider the following formula to find the number of possible connections in a single fiber cable:

Consider the following formula to find the number of possible connections in a single fiber cable:

$$\left.\begin{array}{l}\text{Number of connections}\\ \text{per cable}\end{array}\right\} = \frac{\text{Cable bandwidth}}{\left(\begin{array}{l}\text{Required bandwidth to}\\ \text{ignore speech compression}\end{array}\right)} \quad \ldots\ldots (1)$$

Substitute the "Cable bandwidth" value as "10Gbps" and "Required bandwidth to ignore the speech compression" value as "64 kbps" in Equation (1).

$$\left.\begin{array}{l}\text{Number of connections}\\ \text{per cable}\end{array}\right\} = \frac{10 \text{ Gbps}}{64 \text{ kbps}}$$

One "Gbps" is equal to "1,000,000 kbps" to convert the "Gbps" value into "Kbps", multiply the value with "1,000,000".

$$\left.\begin{array}{l}\text{Number of connections}\\ \text{per cable}\end{array}\right\} = \frac{10 \times 1{,}000{,}000 \text{ kbps}}{64 \text{ kbps}}$$

$$= \frac{10{,}000{,}000 \text{ kbps}}{64 \text{ kbps}}$$

$$= 156{,}250$$

Therefore, **156,250** houses can be connected with single 10 Gbps cable and the current system connects with hundreds of houses per cable.

Q2. When a file is transferred between two computers, two acknowledgement strategies are possible. In the first one, the file is chopped up into packets, which are individually acknowledged by the receiver, but the file transfer as a whole is not acknowledged. In the second one, the packets are not acknowledged individually, but the entire file is acknowledged when it arrives. Discuss these two approaches.

Answer

The TCP/IP stack is responsible for the "chopping up" into packets of the data for transmission and for their acknowledgment. Depending on the transport protocol that is used (TCP or UDP) each packet will be acknowledged or not, respectively.

The strategy when the file is chopped up into packets, which are individually acknowledged by the receiver, but the file transfer as a whole is not acknowledged is OK in situations (Applications) that do not need the whole file to be sent, Web site for example: different parts of the web site can arrive in different times.

The TCP/IP stack is responsible for the "chopping up" into packets of the data for transmission and for their acknowledgment. Depending on the transport protocol that is used (TCP or UDP) each packet will be acknowledged or not, respectively. The strategy when the file is chopped up into packets, which are individually acknowledged by the receiver, but the file transfer as a whole is not acknowledged is OK in situations (Applications) that do not need the whole file to be sent, Web site for example: different parts of the web site can arrive in different times.

The other strategy, in which the packets are not acknowledged individually, but the entire file is acknowledged when it arrives is suitable for FTP (mail transfer), we need whole mail, not parts of it.

Q3. Compute the fraction of the bandwidth that is wasted on overhead (headers and retransmissions) for protocol 6 on a heavily loaded 50-kbps satellite channel with data frames consisting of 40 header and 3960 data bits. Assume that the signal propagation time from the earth to the satellite is 270 msec. ACK frames never occur. NAK frames are 40 bits. The error rate for data frames is 1%, and the error rate for NAK frames is negligible. The sequence numbers are 8 bits.

Answer

With a 50-kbps channel and 8-bit sequence numbers, the pipe is always full. The number of retransmissions per frame is about 0.01. Each good frame wastes 40 header bits, plus 1% of 4000bits (retransmission), plus a 40-bit NAK once every 100 frames. The total overhead is 80.4 bits per 3960 data bits, giving 80.4/(3960 + 80.4) = 1.99%.

To proof this; we solve it by determine the total wastage overhead in protocol 6 (Selective Repeat) and Calculate the frame size:

Data bit is 3,960 bits and a header bit is 40 bits. Then, add the data bit to header bit to calculate the frame size.

$$3,960 + 40 = 4,000 \text{ bits}$$

Calculate the NAK and retransmitted frame:

• For 1 percentage of error rates for 4,000 bits of frame.

$$\frac{4,000}{100} = 40$$

• Then, 40 bits of frame is Negative acknowledgement (NAK) and then retransmit 40 frames of data to receiver.

Here, one frame is lost out of 100 frames. Then, 40 frames lost out of 4,000 frames.

• Total header size is $40 \times 100 = 4,000$ bits.

• Total frame size (header and data bits) is $4,000 \times 100 = 400,000$.

Formula to determine the total wastage for header bits is given below:

$$\text{Wastage (header bits)} = \begin{pmatrix} \text{Total header bits} \\ + \text{retransmitted frame} \\ + \text{NAK} \end{pmatrix} \quad \text{...... (1)}$$

Where,

"NAK" denotes the negative acknowledgement.

Substitute the value of "Total header bits" as "$4,000$ bits", "retransmitted frame" bits as "4,000 bits", and "NAK" bit as "40 bits" in Equation (1). Then,

$$\begin{aligned} \text{Wastage (header bits)} &= 4,000 + 4,000 + 40 \\ &= 8,040 \end{aligned}$$

Formula to determine the total wastage for frame (both data and header bits) is given below:

$$\text{Wastage (data + header bits)} = \begin{pmatrix} \text{Total frame bits} \\ + \text{retransmitted frame} \\ + \text{NAK} \end{pmatrix} \quad \text{...... (2)}$$

Where,

"NAK" denotes the negative acknowledgement.

Substitute the value of "Total frame bits" as "$400,000$", "retransmitted frame" bits as "4,000 bits", and "NAK" bit as "40 bits" in Equation (2). Then,

$$\text{Wastage (data and header bits)} = 400,000 + 4,000 + 40$$
$$= 404,040$$

Then, formula to determine the total wastage of overhead is given below:

$$\text{Percentage of total wastage} = \frac{\text{Header wastage}}{\text{Frame wastage}} \quad \text{...... (3)}$$

Substitute the values of "Header wastage" as "8,040" and "Frame wastage" as "404,040" in Equation (3). Then,

$$\text{Percentage of total wastage} = \frac{8,040}{404,040} \times 100$$
$$= 0.01989 \times 100$$
$$= 1.989$$

Therefore, the total wastage percentage using protocol 6 (selective repeat) is 1.99%.

Q4. Ethernet frames must be at least 64 bytes long to ensure that the transmitter is still going in the event of a collision at the far end of the cable. Fast Ethernet has the same 64-byte minimum frame size but can get the bits out ten times faster. How is it possible to maintain the same minimum frame size?

Answer

The Fast Ethernet is the simpler and it remains with the same frame formats, interfaces and procedural rules followed by the Ethernet. The only difference in the fast Ethernet is that it reduces the bit time from "100" nanoseconds to "10" nanoseconds; because, the fast Ethernet can exhibit the output ten times faster than the Ethernet and it reduces the maximum length of the cable by a factor of "10".Thus, it meets the maximum wire delay as "$\frac{1}{10}$" (one-tenth) in fast Ethernet which is as long as in Ethernet.

This advantage makes possible for the fast Ethernet to copy "10Mbps" classic Ethernet with maximum wire delay by a factor of "10".

Hence, the fast Ethernet also uses the same "64 byte" minimum frame size during the transmission.

References:

1. https://www.chegg.com/homework-help/low-end-telephone-system-star-shaped-local-loops-neighborhoo-chapter-2-problem-48p-solution-9780133072624-exc
2. https://www.chegg.com/homework-help/compute-fraction-bandwidth-wasted-overhead-headers-retransmi-chapter-3-problem-33p-solution-9780133072624-exc
3. Andrew S. Tanenbaum Edition 5th Exercise 4 Question 20 (Page No. 352)