Mitigation of Channel Impairment in Ethernet Wireless Local Area Network in Nigeria

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ABSTRACT: This paper focuses on mitigation of channel impairment in Ethernet wireless local area network. During the data collection procedure, the flowchart for the queuing behaviour of Ethernet was shown, the throughput data presentation as well as the MATLAB CODE were also presented in this paper. The major objective of this paper is to establish the influence of varying the traffic intensity and the network size of Ethernet quality of service (QOS). The network is developed and converted into MATLAB simulation model.

Key words: Throughput, delay Ethernet frame

INTRODUCTION

Wireless network is the major medium of communication between people in today’s tremendous growing world. The demand for this type of communication is increasing every minutes of the day, therefore to handle this great demand, more wireless Ethernet network has been established in order to attain the high speed rate and data rate requirement. Since the local area network also known as LAN concept was defined about 30 years ago, many technologies have been developed to occupy times area of the market. Names such as 100 voice grade (100VG) and local Asynchronous transfer mode (LATM) were once common but however, Ethernet has outlive them all become used in almost all local area network installation [2]. Ethernet therefore refers to a family of protocols and standards that together defined the physical and data link layer of the world most popular type of LAN.

1. ETHERNET FRAME

A frame is the heart of an Ethernet network which the station uses to deliver data between the stations on the network. A frame consists of a set of bits organized into several fields. These fields include includes address fields, a variable size data field that carries from 46 to 15000 byte of data and error checking field that check the integrity of the bits in the frame to make sure that the frame has arrived.

2. DATA COLLECTION

The traffic data used in this paper were been obtained from input generator of the Ethernet network. The input generator module generate input for bandwidth sizes and packet sizes in order to generate request. This input generator were built inside the Ethernet local area network that runs on a mix operation system and formulated special software.

The synchronous (sloshed) operation throughputs can be expressed as shown below.

\[ S = \frac{E[H]}{E[\text{Ls}]} \]  

Where \( E[H] \) is the amount of useful work \( E[Ls] \) is the expected donation of random slot

\[ E[H] = (G \cdot \gamma \cdot \text{E}^{-\gamma} \cdot \text{E}[\text{Ls}] \]  

\[ E[Ls] = G \cdot \gamma \cdot \text{E}^{-\gamma} + (1+G) \cdot \text{E}^{-\gamma} + (b \cdot \gamma) \cdot [1-(1+G) \cdot \text{E}^{-\gamma}] \]

\( G \) = Traffic intensity

\( \gamma \) = Virtual Clock rate

\( a \) = Propagation time

\( b \) = Transmission time foe colliding message under asynchronous operation, the throughput is expressed as
\[ S = \frac{E[H_c]}{E[L_c]} \] \hspace{1cm} -(2) \\

Where \( E[H_c] = [C_e] - \text{ar}a \)  \\
\( E[L_c] = (1+2a + e^{-\text{arg}} / \text{rG}) \)

The standard equilibrium radom access delay mode is used to estimate the mean message delay. \( T \) so that

\[ T = (S-T_0+1) T_R + 1 + G \] \hspace{1cm} -(3) \\

Where \( T_0 \) is the initial delay. \( T_R \) is the retransmission delay. 

The arrivals of data frame are described by general passion processes \( G_i \) with arrival rate \( X_i \), and the variable lengths of frames are reflected by general transmission described by General transmission processes \( G_t \).

\[ T = T_T = T_D (x) + T_{ack} \] \hspace{1cm} -(4) \\

Where 

\( T_T \) Es transmission \( T_D (x) \) Es Radom transmission delay 

\( T_{ack} \) is the acknowledgement time –a

The maximum throughput 

\[ X_{\max} = \frac{1}{E[T_T] + \rho + E[T_{ack}]} \] \hspace{1cm} -(5) \\

Expected mean average time 

\[ X_{\max} = \frac{1+c^2}{2(1-\rho)} E[T] \] \hspace{1cm} -(6) \\

Where \( \rho \) = utilization load factor.

\[ C^2 = \frac{E[T^2]}{E[T]^2} - 1 \] \hspace{1cm} -(7) \\

\( E(T) \) = average service time per transmission 

\[ E[T^2] = E[T_D^2] + E[T_D^2] - E[D] \] \hspace{1cm} -(8) \\

In the simulation model, throughput sis defined as follow

\[ S = \frac{\text{Number of Successful Transmission}}{\text{Total Transmission Time}} \times \frac{\text{Message Length}}{\text{Message Length}} \] \hspace{1cm} -(9) \\

\[ S_{\max} = \frac{\rho}{[PxF]} \] \hspace{1cm} -(10) \\

Where \( \rho \) = time length of a massage 

\( F \) = time length for an interferes

4. DATA PRESENTATION AND ANALYSIS

Table 1: Displays the relationship between throughput and varying packet sizes. The mean throughputs increase as the traffic intensity increased. When \( 5=3 \) throughput increase linearly with offered load for a small number contending stations due to multiplexing of back off times that occurs. However, at higher contention level, when \( 5=6 \) and \( 10 \). The curve of simulated results binging to deniate from theoretical curve.

Packet size (bytes) throughput for press stations

<table>
<thead>
<tr>
<th>Packet size (types)</th>
<th>Throughput for (3) stations</th>
<th>Throughput for six stations</th>
<th>Throughput for Ten station</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>400</td>
<td>1500</td>
<td>2800</td>
</tr>
<tr>
<td>400</td>
<td>1200</td>
<td>2400</td>
<td>3550</td>
</tr>
<tr>
<td>800</td>
<td>1500</td>
<td>2700</td>
<td>3500</td>
</tr>
<tr>
<td>1200</td>
<td>1700</td>
<td>3100</td>
<td>3350</td>
</tr>
<tr>
<td>1600</td>
<td>1900</td>
<td>3250</td>
<td>3230</td>
</tr>
<tr>
<td>2400</td>
<td>2100</td>
<td>3300</td>
<td>3200</td>
</tr>
<tr>
<td>2800</td>
<td>2250</td>
<td>3270</td>
<td>3180</td>
</tr>
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<tr>
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<tr>
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<td>3180</td>
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<tr>
<td>5200</td>
<td>2980</td>
<td>3050</td>
<td>2290</td>
</tr>
<tr>
<td>5600</td>
<td>3000</td>
<td>2980</td>
<td>2250</td>
</tr>
<tr>
<td>6000</td>
<td>2980</td>
<td>2924</td>
<td>2210</td>
</tr>
<tr>
<td>6400</td>
<td>2950</td>
<td>2828</td>
<td>2170</td>
</tr>
</tbody>
</table>
Therefore, in order to maximize throughput in the network, the load must be carefully chosen. The graph below show throughput for collision detected for three station.

![Graph showing collision detected for 3 stations vs varying packet sizes](image)

**Fig. 1: Collision for three stations versus varying packet sizes**

5. CONCLUSION

In this paper, the major findings of this work are summarizes with recommendations given for improvise the traffic performance in Ethernet network scheme. It has also been verified that Ethernet network is influenced by the sizes of the packets transmitted to the network. The result shows that with respect to quality of service parameter like throughput, collision utilization and delay are summarized.

REFERENCES


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