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Multiple Accesses Sharing of Channel Resources

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Abstract: ***Media Access Control sub layer's primary function is to manage the allocation of one broadcast channel among N competing users. For the same, many methods are available such as static and dynamic allocation method. In the static channel allocation method, allocating a single channel among N competing users can be either Frequency division multiplexing (FDM) or Time division multiplexing (TDM). In FDM the total bandwidth will be divided into N equal parts for N users. This way, every user will have their own frequency band so no conflict or collision will occur among user in the network. But, this is feasible only when the numbers of users are small and traffic is also limited. If, the number of users becomes large this system has face many problems like either one user is gets one frequency band that is not used at all or the other user does not get a frequency band for transmission. Hence, it is simple and efficient for a small number of users. Similarly, in TDM (Time Division Multiplexing), discussed with first Block every user will get a fixed Nth time slot.***

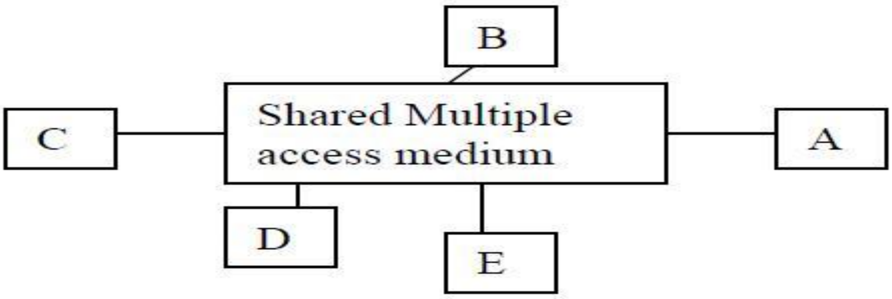
In the dynamic channel allocation the important issues to be considered are whether, time is continuous or discrete or whether the station is carrier sensing large number of stations each with small and bursty traffic.

Keywords: Static and Dynamic Channel, Pure ALOHA, Slotted ALOHA.

I. INTRODUCTION

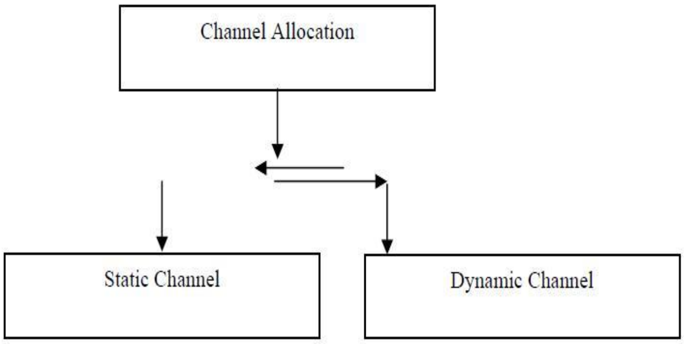
The Data Link Layer (DLL) is divided into two sub layers i.e., the Media Access Control (MAC) layer and the Logical Link Control (LLC) layer. In a network nodes are connected to or use a common transmission media. Based on the connection of nodes, a network can be divided into two categories, that is, point-to-point link and broadcast link. Here, I have study, broadcast link and their protocols then a control process for solving the problem of accessing a multi access channel is required.

Many protocols are available for solving the problem of multi-access channel. These protocols can control an access on shared link as in broadcast network. It is an important issue to be taken into consideration that is, how to who gets access to the channel while, many nodes are in competition as shown in below *Figure.*



Shared media

The protocol which decides who will get access to the channel and who will go next on the channel belongs to MAC sub-layer of DLL. Channel allocation is categorized into two, based on the allocation of broadcast among competeting users that is Static channel allocation problem and Dynamic Channel allocation problem as shown in below *Figure.*



Channel allocation technique

II. OBJECTIVE

The need for accessing multi-access channel;

Common methods for accessing multi-access channel like FDM, TDM;

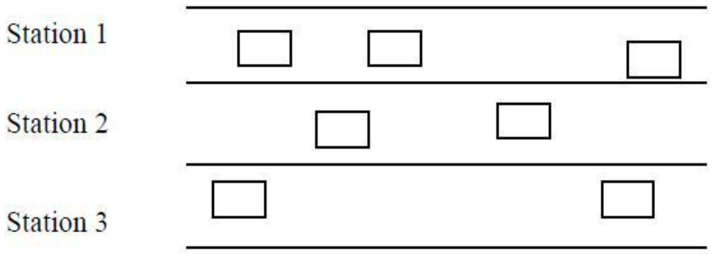
The need for Dynamic channel allocation method;

Pure ALOHA method for channel allocation;

Slotted ALOHA method for channel allocation;

III. PURE ALOHA

If, one node sends a frame to another node, there can be some error in the frame. For the same we discussed some retransmission strategies to deal with the error. But, in case of allocating a single channel among N uncoordinated competing users, then the probability of collision will be high. Station accesses the channel and when their frames are ready. This is called random access. In an ALOHA network one station will work as the central controller and the other station will be connected to the central station. If, any of stations want to transmit data among themselves, then, the station sends the data first to the central station, which broadcast it to all the stations.

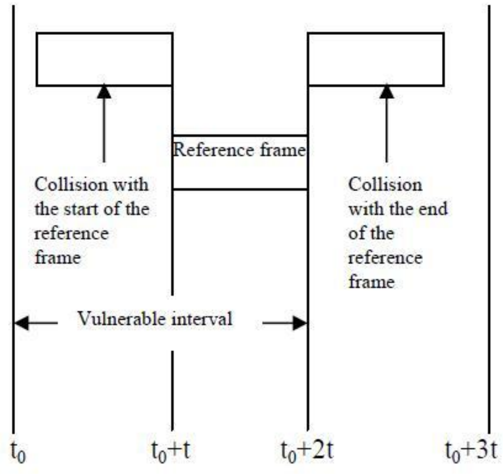


ALOHA

Here, the medium is shared between the stations. So, if two stations transmit a frame at overlapping time then, collision will occur in the system. Here, no station is constrained; any station that has data /frame to transmit can transmit at any time. Once one station sends a frame after 2 times the maximum propagation time. If the sender station does not receive its own frame during this time limit then, it retransmits this frame by using backoff algorithm. And if, after a number of repeats if it does receive own pocket then the station gives up and stops retransmitting the same frame.

Let R be the bit rate of the transmission channel and L be the length of the frame. Here, we are assuming that the size of frame will be constant and hence, it will take constant time t= L/R for transmission of each packet.

As in the case of Pure ALOHA protocol frames can be sent any time so, the probability of collision will be very high. Hence, to present a frame from colliding, no other frame should be sent within its transmission time. We will explain this with the help of the concept of vulnerable period as shown in below Figure.



Vulnerable Period

Let a frame is that transmitted at time t0 and t be the time required for its transmission. If, any other station sends a frame between t0 and t0+t then the end of the frame will collide with that earlier sent frame. Similarly, if any other station transmits a frame between the time interval t0+t and t0+2t again, it will result in a garbage frame due to collision with the reference frame. Hence, 2t is the vulnerable interval for the frame. In case a frame meets with collision that frame is retransmitted after a random delay.

Hence, for the probability of successful transmission, no additional frame should be transmitted in the vulnerable interval 2t.

To find the probability of no collision with a reference a frame, we assume that a number of users are generating new frames according to Poisons distribution. Let S be the arrival rate of new frames per frame time. As we find probability of no collision, S will represent the throughput of the system. Let G be the total arrival rate of frames including retransmission frames (also called load of the system). For finding the probability of transmission from the new and retransmitted frame. It is assumed that frames arrival is Poisson distributed with an average number of arrivals of G frames/ frame time. The probability of k frames transmission in 2t seconds is given by the Poisson distribution as follows:

The throughput of the system S is equal to total arrival rate G times the probability of successful transmission with no collision,

That is S = G * P

S=G * P (zero frame transmission in the vulnerable interval i.e.,2t seconds)

Since

P [K frame in vulnerable interval 2t] = (2G) e–2G , K = 0, 1, 2,3

Thus

P [K = 0 in 2t] = – 2G

Hence, S = G * P = G . e–2G

Note that the averages load is G. Hence it is 2G in 2t

S=G * e-2G

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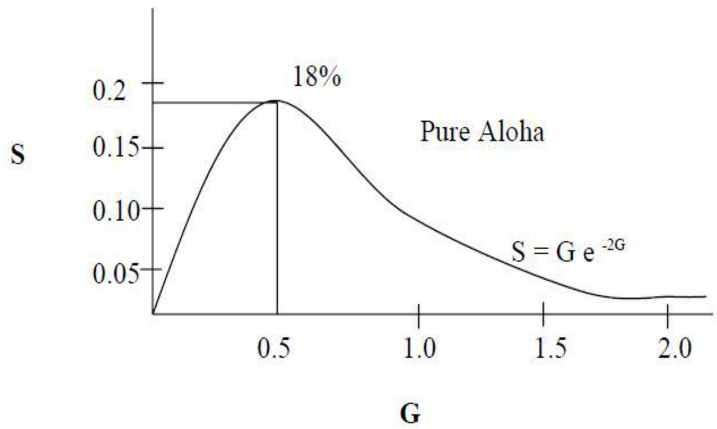
The relationship between S vs. G can be shown in below *Figure.*



Throughput vs. load graph of pure ALOHA

As G is increasing, S is also increasing for small values of G. At G=1/2, S attains its peak value i.e., S=1/2e i.e., 0.18(approx). After that, it starts decreasing for increasing values of G. Here, the average number of successful transmission attempts/frames can be given as G/S = e2G. An average number of unsuccessful transmission attempts/frame is G/S – 1 = e2G − 1.

IV. SLOTTED ALOHA

In this, we can improve the performance by reducing the probability of collision. In the slotted ALOHA stations are allowed to transmit frames in slots only. If more than one station transmit in the same slot, it will lead to collision this reduces the occurrence of collision in the network system. Here, every station has to maintain the record of time slot. The process of transmission will be initiated by any station at the beginning of the time slot only. Here also, frames are assumed to be of constant length and with the same transmission time. Here the frame will collide with the reference frame only if, it arrives in the interval t0-t to t0. Hence, here the vulnerable period is reduced that is to t seconds long.

The throughput of the system S is equal to the total arrival rate G times the probability of successful transmission with no collision

That is S = G * P

S=G * P (zero frame transmission in t seconds)

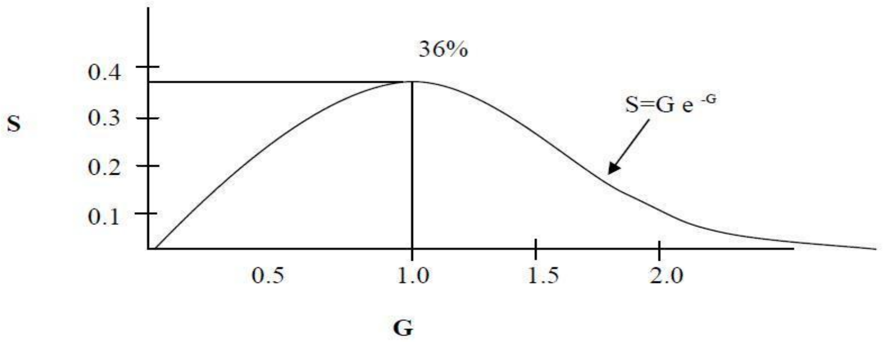
The probability of k frames transmission in t seconds and is given by the Poisson distribution as follows:

P[k]= (G)k * e-G/k!, k=0,1,2,3……

Here average load in the vulnerable interval is G (one frame time) Hence, the probability of zero frames in t seconds = e-G

S= G * e-G

The relationship between S vs G can be shown in below *Figure.*



Throughput vs. load graph of slotted ALOHA

From the figure we can see that the system is exhibiting its performance. Maximum throughput that can be achieved with Slotted ALOHA S=1/e= 36 % (Approx.)

V. CONCLUSION

In some networks, if a single channel and many users use that channel, then, allocation strategy is required for the channel. We have study in this paper, FDM and TDM allocation method. They are the simplest methods for allocation. They work efficiently for a small number of users. For a large number of users the ALOHA protocol is considered. There are two versions of ALOHA that is Pure ALOHA and Slotted ALOHA. In Pure ALOHA no slotting was done but the efficiency was poor. In Slotted ALOHA, slots have been made, so that every frame transmission starts at the beginning of the slot and throughput is increased by a factor of 2. However, with this performance also we are not able to utilize the medium in an efficient manner. Due to the high rate of collision systems the bandwidth is which was designed to implement random access in LANs. So, for avoiding collision and to increase efficiency in sensing the channel, CSMA is used. IEEE 802.3 Ethernet uses 1 persistent CSMA/CD access method.

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Kalyani Raval has received B.com (Accountancy), M.sc I.T. degree and pursuing M.Com from Maharaja Krishnakumarsinhji Bhavnagar University. She has more than 3 years of experience in teaching. Currently working as a Teaching Assistant at M. J. College of Commerce, Vidyanagar, Bhavnagar. She is member of International Association of Engineers (IAENG). In her academic career up till now 9 Research articles have been published. Also, she has presented papers at different seminars at national and an international level. An experienced faculty and mentor with an extensive knowledge of Research, Literature and Communication Skill.