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Stability and Achieving Maximum Throughput Using Slotted Aloha and Csma with Multipacket Reception

A. Sangeetha, K. Parthiban** and R. Gopi****

ABSTRACT

The random access protocols with multi packet reception (MPR), which include both slotted-Aloha and slotted τ-persistent CSMA protocols. For both protocols, each node makes a transmission attempt in a slot with a given probability. The transmission channel is divided into equal slot using slotted-Aloha, then CSMA is used to check whether the channel is idle or not. CSMA is used to avoid collision that is occurred during transmission. Toward receive the optimal transmission probability maximizing a system throughput for both protocols and to develop a simple random access protocol with MPR, this achieves a system throughput close to the maximum value. Optimal transmission probability in the slotted-Aloha protocol is a good approximation for the τ-persistent CSMA protocol. A simple τ-persistent CSMA protocol with MPR is proposed which dynamically adjusts the transmission probability τ depending on the estimated number of active nodes, and thus can achieve a system throughput close to the maximum value.

Keywords: *Slotted Aloha;Multi Packet Reception; Slotted τ-Persistent CSMA Protocols; Maximum Throughput.*

1.0 Introduction

Mobile computing is a technology that allows transmission of data between the communication device without having to be connected to be fixed physical link. Communication is the process of establishing connection or link between two points for information exchange. For any communication to take place, Figure 1.1 shows the Transmitter, Receiver, Channel or Transmission medium. The source generates the message to be transmitted. The transmitter sends the message over the transmission channel. The transmission link can be the medium such as electric conductors, air or light. The receiver receives the message from transmission channel & then given to the destination by the receiver. During the transmission over the channel, the message is distorted.

Digital communications refers to the field of study concerned with the transmission of digital data. This is in contrast with analog communications. While analog communications use a continuously varying signal, a digital transmission can be broken down into discrete messages. Transmitting data in discrete messages allows for greater signal processing capability. The ability to process a communications signal means that errors caused by random processes can be detected and corrected.

Digital signals can also be sampled instead of continuously monitored and multiple signals can be multiplexed together to form one signal. Because of all these advantages, and because recent advances in wideband communication channels and solid-state electronics have allowed scientists to fully realize these advantages, digital communications has grown quickly. Digital communications is quickly edging out analog communication because of the vast demand to transmit computer data and the ability of digital communications to do so.

Wireless communication is the transfer of information over a distance without the use of electrical conductors or “wires”. The distances involved may be short (a few meters as in television remote control) or long (thousands or millions of kilometers for radio communications). When the

**Corresponding Author: Department of Computer Science Engineering, Dhanalakshmi Srinivasan Engineering College, Perambalur, Tamil Nadu, India (E-mail: sangeetha53a@gmail.com)*
***Department of Computer Science Engineering, Dhanalakshmi Srinivasan Engineering College, Perambalur, Tamil Nadu, India*
****Department of Computer Science Engineering, Dhanalakshmi Srinivasan Engineering College, Perambalur, Tamil Nadu, India*

context is clear, the term is often shortened to "wireless". Wireless communication is generally considered to be a branch of telecommunications.

It encompasses various types of fixed, mobile, and portable two-way radios, cellular telephones, personal digital assistants (PDAs), and wireless networking. Other examples of wireless technology include GPS units, garage door openers and or garage doors, wireless computer mice, keyboards and headsets, satellite television and cordless telephones.

Wireless technology may supplement or replace hard wired implementations in security systems for homes or office buildings. Perhaps the best known example of wireless technology is the cellular telephone and modems.

These instruments use radio waves to enable the operator to make phone calls from many locations worldwide. The devices can be used anywhere that there is a cellular telephone site to house the equipment that is required to transmit and receive the signal that is used to transfer both voice and data to and from these instruments.

Optimal transmission probability is obtained using slotted aloha and τ-persistent CSMA station senses the carrier or channel before transmitting a frame. It means the station checks the state of channel, whether it is idle or busy.

The numbers of active nodes are calculated and thus can achieve a throughput close to the maximum value. Second one is the τ-persistent CSMA.

Based on transmission probability it not secure because trusted third party an attack is any attempt to destroy, expose, alter, disable, steal or gain unauthorized access to or make unauthorized use of an gain.

2.0 Related Work

A random access protocol, a transmitting node always transmits at the full rate of the channel, namely, R bps.

When there is a collision, each node involved in the collision repeatedly retransmits its frame until the frame gets through without a collision. But when a node experiences a collision, it doesn't necessarily retransmit the frame right away.

Because after a collision the random delays are independently chosen, it is possible that one of the nodes will pick a delay that is sufficiently less than the delays of the other colliding nodes, and will therefore be able to "sneak" its frame into the channel without a collision. Examples of random access MAC protocols slotted ALOHA, ALOHA, CSMA and CSMA/CD

2.1 Slotted-aloha protocol

Random access protocols with one of the most simple random access protocols, the so-called slotted ALOHA protocol. In slotted ALOHA, the following assumptions are considered All frames consist of exactly L bits, Time is divided into slots of s (i.e., a slot equals the time to transmit one frame), Nodes start to transmit frames only at the beginnings of slots and the nodes are synchronized so that each node knows when the slots begin.

Let p be a probability, that is, a number between 0 and 1. The operation of slotted ALOHA in each node is simple, When the node has a fresh frame to send, it waits until the beginning of the next slot and transmits the entire frame in the slot, If there isn't a collision, the node won't consider retransmitting the frame. If there is a collision, the node detects the collision before the end of the slot. The node retransmits its frame in each subsequent slot with probability p until the frame is transmitted without a collision.

2.2 CSMA protocol

In both slotted and pure ALOHA, a node's decision to transmit is made independently of the activity of the other nodes attached to the broadcast channel. CSMA: listen before transmit. In the networking world, this is termed carrier sensing - a node listens to the channel before transmitting. If a frame from another node is currently being transmitted into the channel, a node then waits ("backs off") a random amount of time and then again senses the channel.

If the channel is sensed to be idle, the node then begins frame transmission. Otherwise, the node waits another random amount of time and repeats this process. If channel sensed idle, transmit entire packet.

If channel sensed busy, defer transmission for Persistent CSMA, retry immediately with probability p when channel becomes idle (may cause instability). For Non-persistent CSMA, retry after random interval.

Collision detection - a transmitting node listens to the channel while it is transmitting. If it detects that another node is transmitting an interfering frame, it stops transmitting and uses some protocol to determine when it should next attempt to transmit.

2.3 Multipacket reception

In networking, multi packet reception refers to the capability of networking nodes for decoding/demodulating signals from a number of source nodes concurrently. In wireless communications, Multi packet reception is achieved using physical layer technologies like orthogonal CDMA, MIMO and space–time codes.

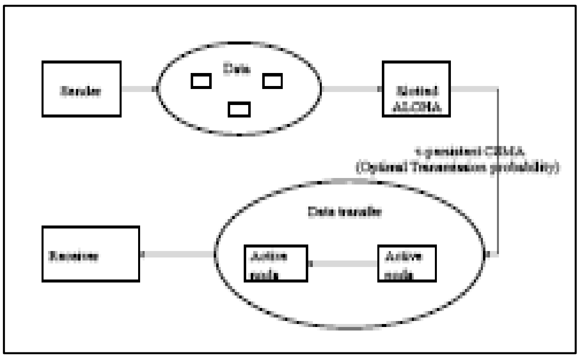
3.0 System Design

In the ALOHA system, a node transmits whenever data is available to send and it requires a method of handling collisions that occur when two or more systems attempt to transmit on the channel at the same time. Node first sends when it has traffic if there was a Collision (no acknowledgement received) then waits a random time and resend. If another node transmits at the same time, a collision occurs, and the frames that were transmitted are lost. Slotted ALOHA divides time into discrete intervals and each interval corresponds to a frame of data. It requires users to agree on slot boundaries. It does not allow a system to transmit any time.

The system has to wait for the beginning if the next slot. The Random access protocols with multi packet reception (MPR), which include both slotted-ALOHA and τ-persistent CSMA protocols. CSMA protocol was developed to overcome the problem found in ALOHA i.e. to minimize the chances of collision, so as to improve the performance. The station senses the carrier or channel before transmitting a frame. It means the station checks the state of channel, whether it is idle or busy.

Existing System ALOHA does not guarantee that the frame of data will actually reach the remote recipient without corruption. Retransmit any data which is corrupted. Existing method taking high load, so collisions are very frequent and take long time to deliver and frame lost is possible. CSMA protocol was developed to overcome the problem found in ALOHA i.e. to minimize the chances of collision, so as to improve the performance. The station senses the carrier or channel before transmitting a frame. It means the station checks the state of channel, whether it is idle or busy. Optimal transmission probability is obtained using slotted aloha and τ-persistent CSMA .Based on transmission probability; the numbers of active nodes are calculated and thus can achieve a throughput close to the maximum value.

Fig 1: System Architecture



3.1 Node Establishment

In this phase, the nodes and node details such as node name, IP address, port number and status are collected and registered. After registration process the nodes are activated by entering node name and port number.

In the multi hop wireless network a topology for every node can be created. The details of each node are collected by server node. A server has its own login and password. The node details and path details are stored and maintained in database.

3.2 Slot Splitting and Scheduling

Optimal transmission probability in the slotted-Aloha leads to an optimal slotted-Aloha protocol, which dynamically and optimally tunes the transmission probability of node depending on the estimated number of active nodes.

After creating links from each and every node in the topology creation, the virtual rates for links are computed. Each source node needs to collect the sum of the dual variables from all the links that interfere with at least one link along its route. Then, each link can check the packet from all the flows that pass through it and update the total virtual rate.

If a link is scheduled to transmit, the other links interfere with the scheduled links can also overhear the dual variable information and acknowledgement sent by the destination node.

3.3 Active Node Detection

Optimal transmission probability in the slotted-Aloha protocol with MPR, a simple distributed algorithm is used for estimating the number of active nodes (i.e., nodes that have packets ready for transmission) at runtime.

By observing the number of successful transmissions in a slot, each node can get an estimate of the number of active nodes and use this estimate to tune its transmission probability.

Then using optimal transmission probability in the τ-persistent CSMA protocol with MPR under the general settings $T_i < T_s$ and $T_i < T_c$, where T_i, T_s, and T_c is the length of an idle slot, a successful transmission slot, and a collision slot, respectively. Under certain conditions the optimal transmission probability in the slotted- Aloha protocol with MPR is a good approximation of the one in the τ-persistent CSMA protocol with MPR.

This finding is very useful because it allows us to directly apply the proposed algorithm for estimating the number of active nodes in the slotted-Aloha protocol to the case of the τ-persistent CSMA protocol with MPR.

3.4 MPR analysis

In this phase the process of controlling congestion and scheduling each and every work done in mini time slots for example link scheduling, transmit process, acknowledgement etc. Suppose that every node has infinitely many packets waiting to be transmitted. The access point can schedule at will. Finale to improve the system throughput in the MPR case, where the transmission probability τ of a node is dynamically and optimally tuned based on the estimated number of active nodes in the network. The proposed protocol can achieve a system.

4.0 Conclusion

The impact of MPR on the MAC layer behavior where the study is carried out by considering both slotted-Aloha and τ-persistent CSMA protocols.

Based on the result, a simple τ-persistent protocol with MPR is developed which can achieve a system throughput close to the maximum value. This finding is useful in that it provides a new guideline when designing a MAC protocol with MPR.

In future work, the τ-persistent CSMA based on transmission probability is not secure because a third party can attack the network and may attempt to destroy, expose, alter, disable, steal or gain unauthorized access. To avoid security problem Cryptography Encryption is used for making a communication private.

A sender can send a private message to another user encrypts (enciphers) the message before transmitting it. Only the intended recipient knows how to correctly decrypt (decipher) the message.

The eavesdropper would only see the encrypted message and the hacker would not know how to decrypt it successfully, the message would make no sense to them.

As such, privacy can be ensured in electronic communication.

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