Review on MACA and CSMA with DSR Routing Protocol for MANET

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ABSTRACT

Mobile Ad-Hoc Network is an autonomous group of mobile users that communicate using wireless links with no support from any pre-existing infrastructure network and used as a highly reliable end-to-end protocol for transporting applications. Due to the presence of Ad-Hoc Network in the MANETs, the interconnections between nodes or stations are likely to change on a continual basis, resulting frequent changes in network topology, but wireless networks suffers from significant throughput degradation and delays; it uses Congestion Control and Avoidance algorithms which degrade end-to-end performance in wireless system. The aim of this review is to compare the standardized MAC protocols on MANETs and thereby analyzing performance with different MAC protocols. The routing protocols that are considered in the analysis is Dynamic Source Routing.

Keywords: MANET, DSR, MACA, CSMA and IEEE 802_11.

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INTRODUCTION:

A Mobile ad-hoc wireless network (MANET) is a system of wireless mobile nodes that dynamically self-organize in arbitrary and temporary network topologies [1]. Ad-hoc wireless networks can be located in networks that use multi-hop radio relaying and may operate without any support of fixed infrastructure. As multi-hop, we refer to routes between nodes that may contain multiple hops. In mobile ad hoc networks, the system may operate in isolation, or may include gateways to interfaces with wired networks, such as internet [2].

MANET CLASSIFICATION

We may classify mobile ad-hoc wireless networks into three sub-types [1]: Body, Personal, and Local area networks.

Body area network:- A body area network (BAN) provides connectivity between wearable devices, such as mobile phones, earphones, microphones or mp3 players. The main requirements of a BAN are:

- Interconnection between heterogeneous devices. E.g. mobile phones with microphone.
- Auto configuration. It should be easy add or remove devices in a BAN
- Services integration. Data transfer of audio and video should be compatible with nonreal time data, such as internet traffic.
- Interconnection with other BAN's or personal area computers (PAN's) to exchange information.

The radio covered for BAN may be 2-3 meters, because usually they are devices to use close to the body.

Personal area network:- Personal area networks (PAN) connect mobile devices one to each other, usually in a range of 10 meters around a person. It is possible to connect a PAN with a BAN dealing to the possibility to make ad hoc networks with any electronic device, such as laptops, PDA's or mobile phones.

Wireless local area network:- Wireless Local Area Networks (WLAN) have a range about 100-500 meters; therefore, they achieve more flexibility than wired LAN. It is a good solution for home and office networks. On the implementation of a WLAN, we can target two different approaches: an infrastructure based approach or an ad-hoc approach. An infrastructure-based approach is based on the existence of an access point that provides access for the mobile devices towards a fixed network, such as internet. On the other hand, in ad-hoc wireless networks a centralized infrastructure is not required.

LITERATURE REVIEW

Literature review presented here for the media access control protocol. A MAC layer protocol is the protocol that controls access to the physical transmission medium on a network. It tries to ensure that no two nodes are interfering with each other's transmission and deals with any possible interference [3]. CSMA was the MAC layer used in the first generation packet radio networks. CSMA prevents collision by sensing the carrier before transmission. A terminal however, can sense the medium only within its transmitting range. Transmissions from terminals out of range cannot be identifying.

This in spite of carrier sensing a transmission could still collide at the receiver with another transmission from an out of range node. It is often referred to as the hidden terminal problem [4].

Kleinrock et.al. [5] identified the hidden terminal problem of carrier sensing, which makes carrier sense multiple access (CSMA) performs as poorly as the pure ALOHA protocol when the senders of packets cannot hear one another and the vulnerable period of packets becomes twice a packet length. The BTMA (busy tone multiple access) protocol was a first attempt to solve the hidden-terminal problem by introducing a isolated busy tone channel [5]. The same author proposed SRMA (split channel reservation multiple access) which try to avert collisions by introducing a control packets handshake between the sender node and receiver node [5]. A station that needs to transmit data to a receiver first sends a request-to-send (RTS) packet to the receiver, who responds with a clear-to-send (CTS) if it receives the RTS correctly. A sender transmits a data packet only after receiving CTS successfully. ALOHA or CSMA can be used by the senders to transmit RTS [6].

Several variations of this scheme have been developed since SRMA was first proposed, including MACA, MACAW, IEEE 802.11 and FAMA. The Multiple Access with Collision Avoidance protocol (MACA), proposed by Karn [7] solves the hidden terminal problem and exceed CSMA in a wireless multi hop network.

Fullmer et.al. [8] Extend MACA by carrier sensing. The resulting FAMA-NTR protocol execute almost as well as CSMA in a single-hop wireless network. The same authors propose future improvements achieving even better performance at high loads. In the FAMA-PJ evaluation, a correct radio model is benefit to account for the Tx-Rx turnabout time. Their study reveals the impact of the turnaround time on performance [8]. Several modifications of MACA have been proposed which suppress RTS, mostly to transmit multi packet messages or to support real time streams. For example to increase the channel utilization for multi packet transmissions, Fullmer et.al. [8] Proposed in to replace all RTS packets, but the first with a more symbol in the header of the data packet. The same authors propose to use FAMA-NTR in bulk mode to exaggerate the throughput, for a multimedia application, Lin et.al. Propose to use RTS/CTS only for the first packet of a real time stream. Subsequent packets are transmitted with a reservation pattern that relies on the periodic nature of the multimedia traffic.

AD HOC NETWORK OPERATION

The main issues in an ad hoc network design are as follows [2]: medium access scheme, routing, multicasting, transport layer protocol, quality of service provisioning, self organization, security,

energy management, addressing and service discovery, energy management and deployment considerations.

Medium access control:- The main responsibility of a medium access control (MAC) protocol in ad hoc wireless networks is the distributed arbitration for the shared channel for transmission of packets.

- **Routing:-** The main objective of the routing protocols is exchanging route information finding a feasible path to a destination based on different criteria, such as hop length, minimum power required, or lifetime of the wireless link.

The medium access control sub-layer:- Networks can be divided into two categories: those using point-to-point connections and those using broadcast channels. Broadcast networks have a single communication channel that is shared by all the nodes in the network, and point-to-point networks include many connections between individual pairs of nodes. In every network, there is a channel where data is transmitted. In a broadcast network, the protocols that determine who gets to use the channel are called Medium Access Control (MAC) protocols, which belong to a sub layer of the data link layer. The data link layer is responsible of providing service interface to the network layer, dealing with transmission errors and regulating the flow of data [9].

MAC PROTOCOLS IN WIRELESS NETWORKS

A common radio channel is shared in ad-hoc wireless networks. Over this radio channel, access channel protocols used in wired networks become obsolete and new challenges must be managed, such as mobility of nodes, limited bandwidth availability, quality of service support, and hidden/exposed station problems.

MACA:- Since CSMA protocol sense the channel only at the transmitter, the interference may still take place in the receiver, therefore the hidden station problem does not occur. MACA protocol uses request-to-send (RTS) and clear-to-send (CTS) dialog. Each node upon receiving a RTS or CTS packet, avoids using the channel. Let us now consider A sending a frame to B. A sends a RTS packet to B. This packet contains the length of the data, and its size is only 30 bytes. Then, B replies with a CTS packet, which also contains the data length, copied from the RTS packet. Afterwards, when A receives the CTS packet, the transmission starts. Since there is no carrier sense in MACA, each station waits a random amount of time before trying to get the channel when it has heard a RTS or CTS packet. A binary exponential back off (BEB) algorithm

performs the amount of time to wait. BEB has not always the same value: a node increases it each time a collision is detected [10]. In MACA, most of collisions occur among RTS packets. Since RTS packet size is so much smaller than data packet, there are fewer overloads compared to CSMA. However, data collision is not guaranteed.

As RTS and CTS packets carry the expected duration of data transmission, each node hearing them will defer its transmission until data delivers to the destination. Based on this approach, MACA will solve hidden station problem [2].

MACAW:- The binary exponential backoff mechanism used in MACA performs several disadvantages.

For example, consider figure 2, where S1 is transmitting packets. In this case, the packets transmitted by S2 are collided, and its backoff window is incremented. Afterwards, the probability of S2 to obtain the channel decreases, becoming blocked after a period. To rectify this, in the packet header is attached the current value of the backoff counter. When a node receives the packet, it copies this value into its own backoff counter. A fairest mechanism to allocate bandwidth is obtained with this modification.

Another improvement at MACAW from MACA is a control packet called acknowledgment (ACK). In MACA, transport layer deals with transmission errors, but the typical implementations of the transport layer have a timeout period of about 0.5 seconds; hence, it is slow recovering errors. In MACAW, the data link layers manage that responsibility. Its performance starts when the sender receives an ACK packet once data has successfully delivered. If ACK packet is lost in transmission, the sender retransmits a RTS for the same packet. In this case, the receiver does not send back a CTS packet; instead, it sends an ACK for the packet received.

PROPERTIES OF AD-HOC ROUTING PROTOCOLS

Ad-hoc routing protocols are desired to accomplish the following issues [2].

- Distributed operations: A distributed routing is more fault-tolerant than centralized routing, since the stability of the network is not supported by just one single point.
- Minimum setup: Quick access to routes by nodes is required 20.
- Loop-free: Stale routes should be avoided, which it usually happens when paths are stored in the cache of each node.

- Packet collision: The number of broadcasts made by each node to discover routes should be minimized.
- Mobility: Routing protocols should be adaptive to topology changes. However, the changes in a part of the network that not affects the node should be avoided. Additionally, it should be able to cover optimal routes once the network becomes stable.
- Best uses of resources: It should achieve an optimal use of resources, such as bandwidth, computing power, memory, and battery power.
- Quality of service: It should be able to provide a certain level of quality of service (QoS).

Dynamic source routing (DSR):- The Dynamic Source Routing protocol (DSR) is an on demand routing protocol used in ad hoc wireless networks to allow communication over multiple hops among nodes. As other on demand routing protocols, the path-finding process is launched only when a path is required by a node to communicate with a destination [2].

DSR was designed to restrict the bandwidth consumed by control packets in ad hoc wireless networks, by eliminating the periodic table-update messages used in proactive protocols. DSR protocol is based on two mechanisms: Route discovery and route maintenance.

PROBLEM STATEMENT

MAC protocol was mainly developed to be implemented within wired networks where the main cause for packet loss in network congestion. In this review the aim is to make a clear study between the MACA and CSMA. This evaluation study takes place under different error loss situations. We take into consideration, wireless channel effects and link failure cases. The aim of this evaluation study is to help understanding the impact of the different MAC loss recovery mechanisms on MAC protocol in Ad-Hoc environments. Thus, obtained results can be used as a guideline for efficient design of new specific MAC enhancements for Ad-Hoc Networks.

CONCLUSION

We present a review work of Performance Analysis of Random Access Channel in Wireless Communication Network. In our work, we will study and analyze the theoretical and mathematical model of random access channel using 802.11 MAC protocol and varies standard of 802.11 PHY layer protocol. We will study the possible use of the IEEE 802.11 standards.

REFERENCES

1. Ilyas, M. (2003). The Handbook of Ad Hoc Wireless Networks.
2. Siva Ram, C. & Murthy, B.S. Manoj (2004). Ad Hoc Wireless Networks, Architectures and Protocols.
3. F.A. Tobagi and L. Kleinrock, "Packet Switching in Radio Channels: Part I-The Hidden Terminal Problem in Carrier Sense Multiple Access and the Busy Tone Solution", IEEE Trans. Comm., vol. 23, pp. 1417-1433, 1975.
4. L Kleinrock and F Tobagi, "Packet Switching in Radio Channels: Part II-Carrier Sense Multiple-Access Modes and Their Throughput-Delay Characteristics", IEEE Transactions on Communications, vol.23, pp.1400-1416, 1975.
5. Y.B. Ko and N. H. Vaidya, "Medium access control protocols using directional antennas in ad hoc networks", in IEEE INFOCOM, Vol. 1, pp. 13-21, 2000.
6. L Kleinrock and F Tobagi, "Packet Switching in Radio Channels: Part III-Polling and (Dynamic) Split Channel Reservation Multiple Access", IEEE Transactions on Communications, vol.24, pp.832-845 1976,
7. Shivani Rao, Sanjeev Khambra, "A Comparative Analysis of MAC Protocols in MANET", International journal of Emerging Technology and Advanced Engineering, vol. 3, issue 9, September 2012.
8. Channel L. Fullmer, J.J. Garcia Luna Aceves, "Floor acquisition multiple access for packet radio network", Process of the conference on application technologies, architectures and protocol for computer communications, Newyork, vol.25, no.4,pp.262-273,1995 .
9. Tanenbaum, A. (2003). Computer Networks 4th edition.
10. Karn, P. MACA, a new channel access method for packet ratio.
11. Ibrahim Amadou, Nathalie Mitton, "Revisiting Back off algorithms in CSMA/CA based MAC for channel Reservation in RFID reader Networks through broadcasting", Wimob-9th International Conference on Wireless and Mobile Computing, Networking and Communications, Oct 2013.