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Analytical Study of Different Parameters of Antenna for Wireless Networks

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ABSTRACT

In this paper, we studied about Wireless networks which is a relatively new and promising key technology for next generation wireless networking that have recently attracted both the academic and industrial interest. Their popularity comes from the fact that they are self-organized, self-configurable and easily adaptable to different traffic requirements and network changes. The high-capacity needs of the access nodes which have to forward the accumulated traffic of their underling users. They have to cope with the delay and other strict quality-of-service (QoS) requirements of the end user applications. They must provide a large enough effective communication range to ensure that no APs (or groups of APs) are isolated from the Internet gateways. In order to satisfy the above requirements, a range of novel techniques has to be exploited. Such technology enablers include but not limited to multi-hopping, various multiple antennas techniques and novel medium access control (MAC) and routing algorithms.

Keywords: RFID, WSN, Radio Waves, Sensor.

I. INTRODUCTION

Prior to looking at the security aspects of WMNs we will compare these WMNs with other wireless technologies, pointing out the differences and judging from our current position the security issues of WMNs. The following figure represent the infrastructures of (a)WiFi network (b) WMN network used to provide internet connectivity.

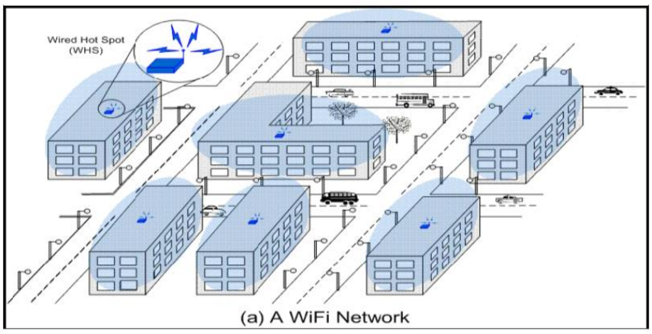
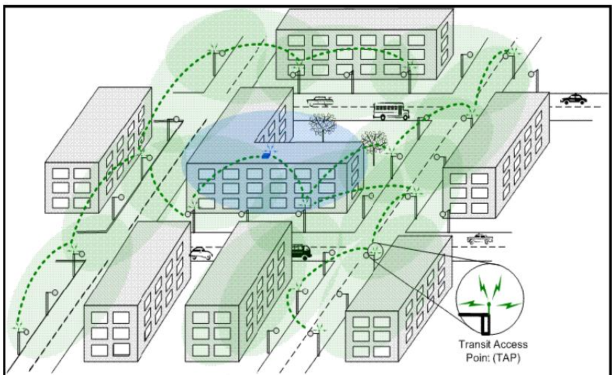


Fig 1: A Wi-Fi Network

From the figure 1 we can see that a Wi-Fi network consists of several wired hot spots (WHS). On the other hand the WMNs consist of just a single WHS, and several Transit Access Points (TAPs). This is what brings about the advantages of WMNs. WHSs cost much more than TAPs and are much more delicate. Extending the Wi-Fi network will require additional WHSs to be installed. While extending the WMN will require additional TAPs, these devices are cheaper and much easier to deploy. This brings forth further advantages e.g. being able to setup temporary wireless networks, and being able to setup wireless networks in areas where cabling for WHSs cost is not possible. Therefore WMNs have the capability of extending to geographic locations that Wi-Fi/WLANs are unable to [1-5]. The diagram of a wireless mesh network is shown in Fig 2.



(b) A Mesh Network

Fig 2: Mesh Network

The structure of a WMN has opened doors to further improvements of existing wireless networks in terms of (a) resolving limitations (b) improving performances.

Despite being very effective (cheap deployment & wider connectivity) they unfortunately bring security hazards into the picture. A reasonable suggestion to address this issue would be to adopt successful security measures taken up by other wireless technologies. But doing so would be deemed ineffective. This is because the concept used in WMNs is new. This fact is mainly due to new security challenges and the requirement for new security mechanisms [6-8].

II. MATERIALS AND METHOD

MAC techniques

The CSMA/CA is under wireless mode and CSMA/CD is under wired mode main technique of MAC for the channel access in shared environment. The MAC independently responsible for the access of channel under shared medium either in wired mode or wireless mode. Most of the MAC protocols use additional techniques to improve the performance of CSMA/CA.

MAC retransmissions

The main problem of the CSMA/CA protocol is that the transmitter can't detect collisions on the medium. There is also a higher error rate on the air than on a wire. There is a higher chance of packets being corrupted due to higher error rate by wireless properties. TCP does not allow very much packet losses at the MAC layer. The protocols also implement positive acknowledgement and MAC level retransmissions to avoid losing packets on the air. The principle of positive acknowledgement and retransmission are very simple such as each time a node or station receives a packet, it sends back immediately a short message like an ack to the transmitter to indicate that it has successfully received the packet without errors. If after sending a packet the transmitter does not receive an ack, it knows that the packet was lost. Therefore, it will retransmit the packet after contending again for the shared medium, like in Ethernet. At most all MAC protocols use a stop and go mechanism to perform their duty of transmission. They transmit the next frame from the queue only if the current frame has been properly acknowledged. There is no sliding window mechanism taken like as in TCP. The rationale is that it makes the protocol quite simpler and minimize latency and also, avoid de sequencing frames. The systematic MAC retransmission under the CSMA/CA mode of operation is presented in figure 3.

The ack frames are embedded in the MAC protocol, so these frame are guaranteed to not collide. This systematic approach and contention to access the channel in shared mode and non collision is indicated in figure 4. These ack frames are very different from the TCP ack packets, which work at a different level and on a different time frame. Actually, broadcast and multicast packets are not acknowledged, so they are more likely to fail during the transmission [9-12]

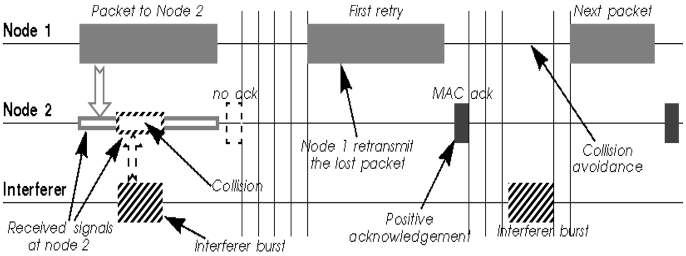


Figure 3.MAC Retransmission Strategy Under CSMA/CA

Suppose, if all modern wireless LAN protocols implement this essential feature then some old products may lack it. Wireless WAN protocols like satellite links don't implement that either. This is so because the round trip delay in their case is so long that by the time they would receive the ack frame. They could have to sent another frame. If wireless LAN doesn't implement MAC level retransmissions the all is not lost. To prove this students of Berkeley have created a protocol called snoop which filters the TCP ack frames and retransmits the lost packets before TCP even notices that they are lost. This is still a link level retransmission, but done just over the MAC.

Fragmentation

The radio mode of transmission of data and information has a higher error rate than that of the wired mode of any categories like Unshielded Twisted Pair(UTP), Coaxial Cable (Coax) and Optical Fiber. The transmission error from source node or station to receiver node or station requires a strategy to detect and then retransmit the negative ack frame to the specified sender station or node through the same radio mode. An another problem is that the negative ack frame may lost during the transmission. Hence, it requires another strategy under the wireless or radio mode of transmission.

MAC level retransmissions solve this problem, but this does not really perform well. If the packet to transmit is long and contains only one error, the node needs to retransmit it entirely. If the error rate is significantly high, we could come to some situation where the probability of error in large packet is dangerously close to. We can't fit a packet between the bursts of errors due to fading or interferers, so we can't get packet through.

This is the reason that to use fragmentation at one end and reassembly at another end. Fragmentation is sending the big packets in small pieces over the medium. Of course, this adds some overhead, because it duplicates packet headers in every fragments. Each fragment is individually checked and retransmitted if necessary. The first advantage is that in case of error, the node needs only to retransmit one small fragment, so it is faster. The second advantage is that if the medium is very noisy, a small packet has a higher probability to get through without errors, so the node increases its chance of success in bad conditions.

III.RESULTS AND DISCUSSION

Wireless mode either in radio frequency based or microwave-based transmission through the open air faces an another problem which is called attenuation. The attenuation is basically loss of the strength of the signal in open air. This loss of strength of the signal may produce the bit error of the data and information. Another problem of this loss of strength of signal is hidden terminal problem. Here, in wireless mode the problem is associated with hidden node or hidden station. The hidden node or station problem comes from the fact that all nodes may not hear each other because the attenuation is too strong between them. This is due to fact that transmissions are based on the carrier sense mechanism, those nodes ignore each other and may transmit at the same time. Usually, this is a good thing because it allows frequency reuse.But, for a node placed in between, these simultaneous transmissions have a comparable strength and so collide. This node could be impossible to reach because of these collisions. The fundamental problem with carrier sense only is that the transmitter tries to estimate if the channel is free at the receiver with only local information. The situation might be quite different between those two locations.A simple and elegant solution to this problem by Phil Karn in his MACA protocol for AX.25. MACA uses Request to Send/Clear to Send (RTS/CTS). RTS/CTS is a handshaking mechanism. By this RTS/CTS mechanism, before sending a frame, the transmitter sends a RTS and wait for a CTS from the receiver. The scenario of RTS and CTS is represented in figure 4. The reception of a CTS indicates that the receiver is able to receive the RTS.

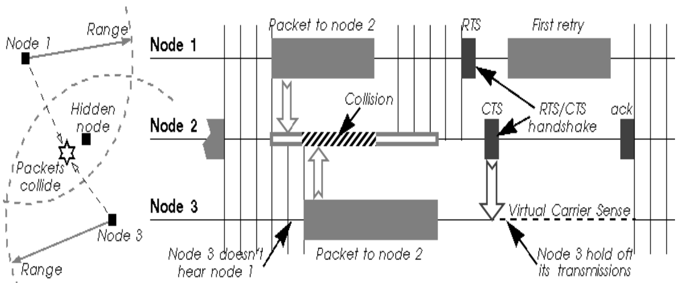


Figure 4. RTS/CTS and Hidden Node in CSMA/CA

At the same time, every node in the range of the receiver hears the CTS even if it doesn't hear the RTS. So, they understand that a transmission is going on. The nodes hearing the CTS are the nodes that could potentially create collisions in the receiver assuming a symmetric channel. Because, these nodes may not hear the data transmission, the RTS and CTS messages contain the size of the expected transmission to know how long the transmission will last. This is the collision avoidance feature of the RTS/CTS mechanism and also called virtual carrier sense where all nodes avoid accessing the channel after hearing the CTS even if their carrier sense indicate that the medium is free.

RTS/CTS has another advantage like lowers the overhead of a collision on the medium. If two nodes attempt to transmit in the same slot of the contention window, their RTS collide and they don't receive any CTS, so they lose only a RTS, whereas in the normal scenario they would have lost a whole packet. Because the RTS/CTS handshaking adds a significant overhead, usually it is not used for small packets or lightly loaded networks.

IV. CONCLUSION

One of the main problems of TDMA and Polling protocol is for the base station to know when the nodes want to transmit. In CSMA/CA, each node simply waits to win a contention, so this problem doesn't exist. However, TDMA and Polling usually require a service slot or reservation slot mechanism. The idea is to offer a period where nodes can contend such as compete and send to the base station some information about their traffic requirements like a reservation request packet. This period coming at regular interval and the remaining of the time, nodes just obey the base station normally. The base station feeds the reservation requests to its scheduling algorithm and decides the main frame structure when each node will transmit. This period of time for sending reservation requests is either called service slot, if it is use for more purpose like cell location and roaming or reservation slot if it is use only to request a transmission or connection. If the MAC is connection oriented, the rate of new connection is low, so usually a single service slot is enough. A simple Aloha protocol uses a fair policy such as if a node or station has to send a frame then it transmits, and if it fails by collision with other requests or medium errors then it back offs a random number of slots before retrying. Protocols which use many different channels, such as cellular phone, can even have a dedicated service channel separate from other transmissions, instead of multiplexing service requests with the data traffic [13]

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