Fig 1: RTS/CTS Clearing

Enhanced RTS/CTS scheme for IEEE 802.11Wireless Networks based on Retransmissions

Ch.Swathi

MSIT

Introduction

IEEE 802.11 based wireless networks use the RTS/CTS handshake to combat interference and hidden node problem, both happening frequently in wireless networks leading to frame collisions. As per the RTS/CTS scheme, RTS and CTS frames are exchanged between sender and receiver, respectively before transmission of DATA frame. The RTS/CTS mechanism is controlled by setting the "**RTS threshold**"

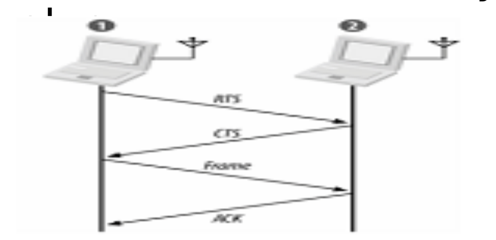


Fig 1: RTS/CTS Clearing

Frames larger than the threshold use the RTS/CTS handshake else frames are directly sent. However, there are some inherent deficiencies in the RTS/CTS mechanism. All the frames irrespective of the network traffic and type of traffic are sent using the RTS/CTS exchange, there is no application dependency. Additionally, the RTS/CTS mechanism doesn't account for any network feedback. For instance, this mechanism may not be necessary for network with less traffic or if number of collisions is less. In nutshell, the default scheme is neither dependent on the application type nor is dependent on the network traffic. It depends only on the data size and … TS/CTS handsha…

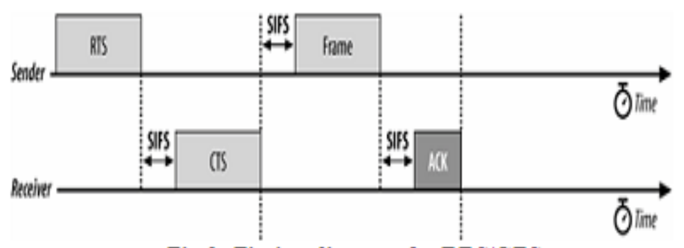


Fig 2: Timing diagram for RTS/CTS

Henceforth, we propose a new enhanced RTS/CTS scheme. As per the proposed scheme, we intend to vary the use of RTS/CTS exchange depending on the traffic type. The first proposed scheme ensures to get a network feedback in order to use the RTS/CTS mechanism.

Every application has a different requirement for QoS delivery and therefore the same scheme might not be effective if it is not application dependent. Therefore the second proposed scheme makes the network application dependent and varies accordingly the RTS threshold for different types of traffic.

The proposed schemes ensure to provide both the network and the application feedback which would improve its performance. Simulation results show that the scheme has a greater improvement.

Methods

Proposed Scheme1:

In the default scheme the RTS threshold remains constant throughout the network operation. In this modified scheme the RTS threshold is varied based on the number of retransmissions for each packet i. e. based on the traffic congestion. This scheme makes use of two parameters whose values when compared to the number of retransmissions made would vary the RTS threshold value

$$\text{RTS Threshold} = \begin{cases} 0 & > \text{retry}_{max} \ \textbf{(real time \& normal data traffic use RTS/CTS)} \\ 250 & < \text{retry}_{max} \ \&\& > \text{retry}_{min} \ \textbf{(only real time traffic use RTS/CTS)} \\ 1000 & < \text{retry}_{min} \ \textbf{(None of the traffic type use RTS/CTS)} \end{cases}$$

If the number of retransmissions is more it means that the network is congested and a dedicated access to the medium is necessary which leads to use of the RTS/CTS handshake. When there are no collisions, no congestion then the use of the RTS/CTS would add an additional capacity to the network therefore the RTS/CTS mechanism needs to be disabled. The retry values consider can be differed based on the network scenario.

Proposed Scheme2:

This scheme honors the applications' varying requirements. In order to provide proper delivery of application traffic a s per their QoS requirements, the scheme is made dependent on the application type. This scheme introduces different RTS Thresholds based on the type of traffic i.e. RTS Threshol… the RTS T…

$$\text{RTS Threshold}_{\text{Real Time}} = \begin{cases} 0 & > \text{retry}_{max} \\ 250 & < \text{retry}_{max} \ \&\& > \text{retry}_{min} \\ 1000 & < \text{retry}_{min} \end{cases}$$

$$\text{RTS Threshold}_{\text{Normal Data}} = 250$$

Normal data traffic needs to be more reliable with maximum throughput and therefore needs to have a consistent RTS Threshold. Real time traffic can have a varied amoun… ensures to be dependent … re… e for

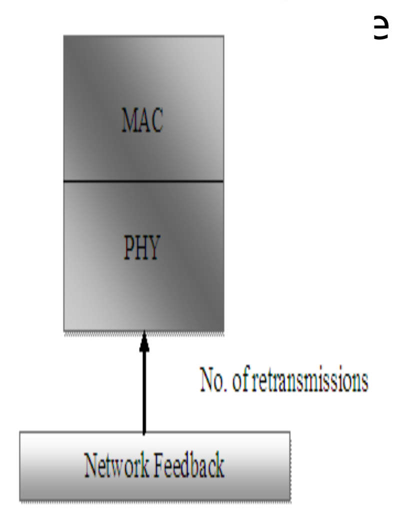


Fig 3: Network Feedback Proposed Scheme

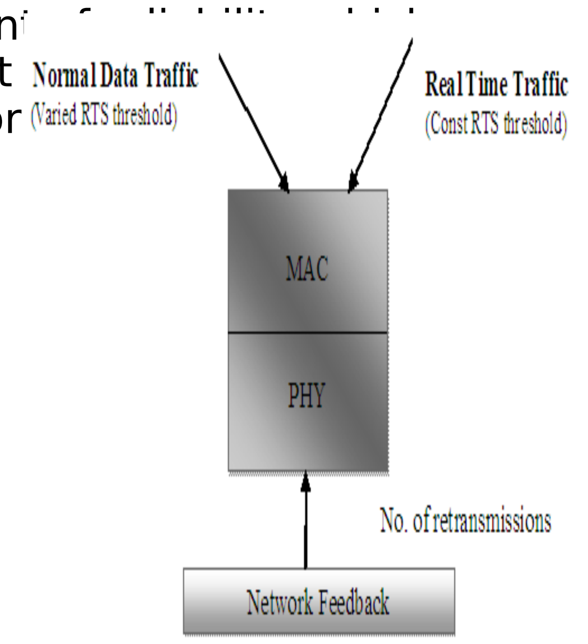


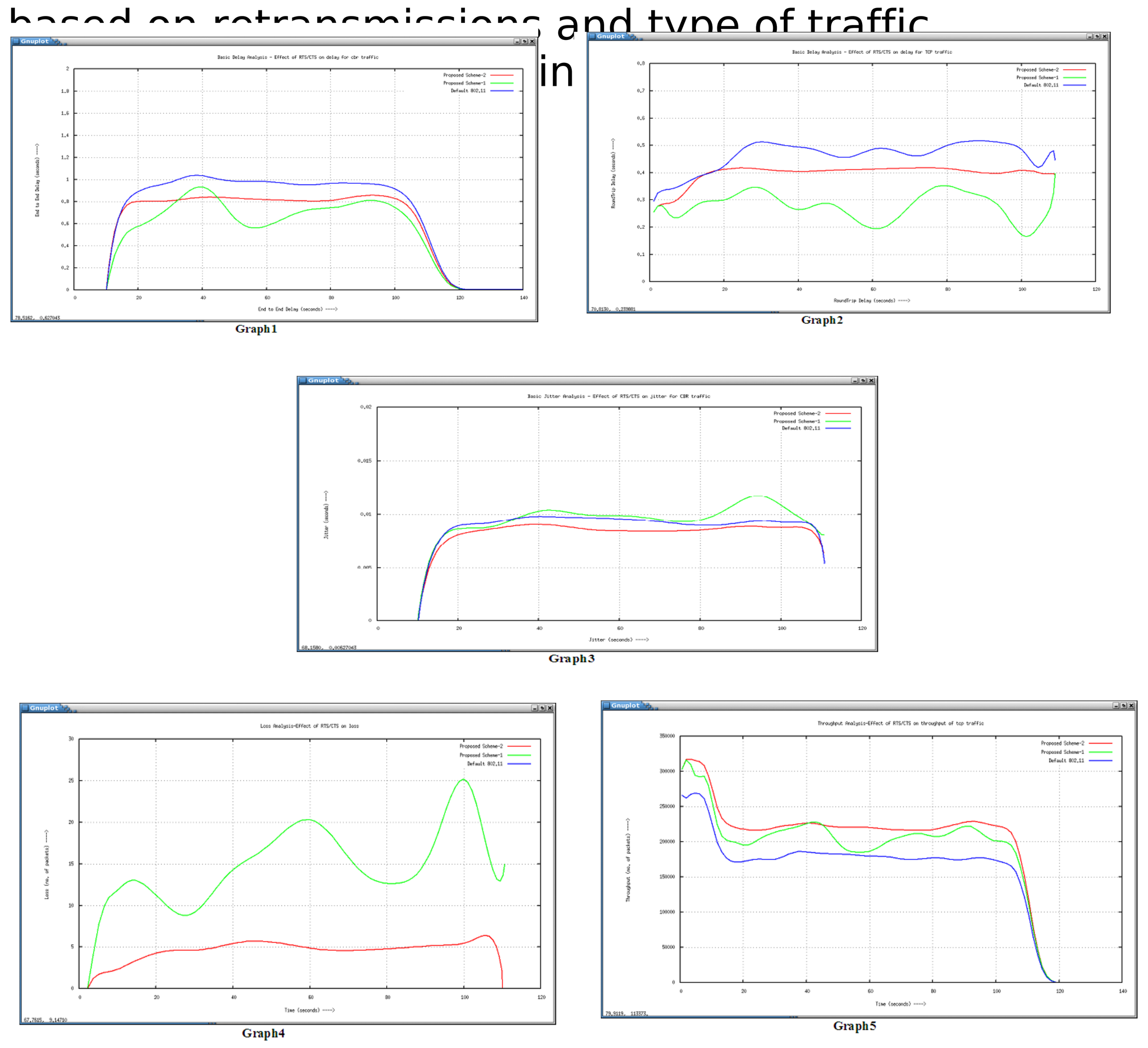
Fig 4: Application Feedback Proposed Scheme

Results

The QoS parameters considered are delay, jitter, loss and throughput. The experiments are carried out for all the QoS parameters by increasing the network traffic i.e. by increasing the number of nodes and the results observed were same.

- Graph1 depicts the delay for the real time traffic, the proposed scheme1 and 2 are less when compared to the default. Proposed scheme2 is more when compared to the proposed scheme1 due to the account of varying the RTS based on traffic type where as it varies the RTS threshold equally for both the type of traffic.
- Graph2 depicts the round trip delay for normal data traffic, here also the effect of schemes is less rather than the default ones. Proposed scheme1 is instead less when compared to the other scheme due varying RTS Threshold constantly for both the type of traffic.
- Graph3 depicts the jitter for real time traffic; the same reason could also be accounted here i.e. Due to the fact that jitter is varied based on the type of traffic in proposed scheme2.
- Graph4 depicts the loss; average loss is almost negligible in the default case whereas the proposed schemes show a probable amount of loss for not enabling RTS/CTS for all the packets.
- Graph5 depicts the throughput for TCP based traffic, we can observe that the maximum throughput is in the proposed scheme2 where the RTS Threshold is varied based on the type of traffic rather to the varying based on only the network feedback as in proposed scheme1 or by remaining it constant (enabled) as in the default scheme for each packet.

The results show that the selection of threshold based on retransmissions and type of traffic … in



Graph1 Graph2 Graph3 Graph4 Graph5

Conclusions

The main idea of enhancing the default RTS/CTS mechanism is to decrease the delay incurred by the additional load of the RTS and CTS packets before the actual transmission of the data packets and in turn increase the performance of the network.

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