

A Study on Issues and Behavior of MAC Protocol for Mobile Networks

Ritu^{1*}, Mamta^{2**}, Monika Rani^{3**}

(1*,2**) *Department of Electronics and Communication Engineering,*

(3**) *Lecturer, Department of Electronics and Communication Engineering
 N.C college Israna (Panipat), Haryana*

Abstract— Mobile network have number of associated challenges which are required to control by forming the layered control over the network. MAC is having significance to provide the channel level and communication level control. This protocol is associated with physical layer and provides the signal form transmission. The data framing, encoding and information transition are the key features provided by the protocol. In this paper, an exploration to the MAC protocol is provided under architectural view and also identified the associated issues. The paper has explored the MAC protocol categorization based on the feature adaptation. The paper also explored the working and structure of MAC protocol 802.11

Keywords: MAC, 802.11, Contention Control, Mobile Network, Spectrum Sensing.

I. INTRODUCTION

Mobile network is infrastructure less dynamic protocol in which devices are connected through wireless links. Each mobile in network operators freely as a system and also act as router for other nodes in the network. Because of this nature, the cooperative communicating is performed without any controller device. It is able to generate a long distance multi hop path between node pair along with heterogeneous characteristics of network. This network does not have any base station which makes the routing more complex. The mobile adhoc network is completely different from cellular network in which base station is present. Mobility is main properties of such type of network. The difference between these network forms is shown in table 1.

A) MAC in Mobile Network

As the mobile network is defined to provide the sharing on broadcast channel. The bandwidth available for communication is limited so that the shared communication is required to perform in controlled form. This protocol is responsible for providing the shared medium access over the network along with issue relative derivation such as mobility observation, bandwidth analysis and resolving the expose terminal problem. MAC protocol is responsible to provide

the answers to these all problems and challenges. Some of the common issues associated with MAC protocol are discussed in this section

Table 1: Feature Difference between Cellular and Mobile Adhoc Network

| Feature | Cellular Network | Mobile Adhoc Network |
|-----------------------------|---------------------------------|---|
| Infrastructure Existence | Base station work as controller | Node itself taken intelligent routing decision |
| Hop Count | Single Hop Communication | Multi Hop Communication |
| Bandwidth | Guaranteed | Shared Bandwidth |
| Synchronization | Time Synchronization is Easy | Time Synchronization is difficult and consume bandwidth |
| Cost | High Cost | Low Cost |
| Deployment | Time Consuming | Easy |
| Reuse of Frequency Spectrum | Geographical Channel Reuse | Dynamic Frequency Reuse via Carrier Sense Multiple access |

B) MAC Protocol Issues

MAC protocol is adaptive to the channel sharing and provided the low level signal based communication over the network. The issues resolved by this protocol are listed here under

a) Bandwidth Efficiency

MAC protocol must be design to provide the effective utilization of available bandwidth. Different MAC forms are defined to provide the ratio adaptive bandwidth estimation based on actual communication analysis. This protocol is responsible to obtain the control overhead involved to

provide the minimum bandwidth adaptive communication using MAC protocol.

b) Quality of service

This protocol is defined to provide the QoS support to resolve the complexities in data sessions. This protocol provided the improved communication under critical traffic sessions. MAC protocol is responsible for resource reservation and provides the consideration to the complexities of mobile network.

c) Synchronization

The synchronization is required to provide balanced communication while performing the packet exchange. MAC is responsible for time adaptive synchronization so that the overhead over the bandwidth access get reduced. Synchronization also reduces the communication conflicts so that the reliability of data transmission also improves.

d) Mobility Tracking

As the nodes change the location frequently, to perform the cooperative communication it is the responsibility of MAC protocol to track these nodes significantly. The MAC protocol does not affect the mobility but is required to track the position to provide the cooperative communication. Some MAC protocols are also defined based on the predictive positional estimation.

e) Error Prone Shared Communication

As the communication is performed through shared medium, some communication fault or conflicts or collisions can occur. The carrier sense adaptive communication is provided by MAC protocol. MAC protocol must grant channel access in such way that can reduce the collisions.

In this paper, an exploration to the MAC protocol for mobile network is explored. The paper has discussed different type of MAC along with evolution characteristics is explored. In this section, the basic characteristics of mobile network and MAC protocol are defined.

The section also identified the issues required to resolve by MAC protocol for mobile network. In section II, the work defined by earlier researchers on different MAC protocols is discussed. In section III, the MAC protocol types are discussed along with categorization. In section IV, the conclusion of this work is defined and explored.

II. RELATED WORK

Lot of work is provided by earlier researchers on optimization of mobile network applied on different layers of network. Some of such work is discussed in this section.

Nermin Makhoul[1] has provided a work on MAC protocol optimization using cooperative link analysis without forming the central control. Author observed the associated communication issues along with Collision Detection on multiple nodes. Author observed the directional analysis on nodes so that mobility at node level will be identified and the predictive location based communication is formed to optimize the communication.

Shivani Rao[2] has presented a comparative analysis on different MAC protocol based on cooperative communication and provided the analysis on dynamic behaviour of nodes. Author defined the comparison for CSMA and MACA technologies in terms of packet communication and delay parameters. Author observed that CSMA provided the more effective results as compared to MACA.

Hongqiang Zhai[3] provided a study on associated challenges and relative solution for MAC protocol observation. Author provided the functionality specification based work to analyze the various challenges for different communicating features such as mobility, power and vulnerability analysis. Author provided the study on the associated design issues and provided the criticality observation based communication in the network.

Patheja[4] also provided a work on improved MAC protocol with integration of exponential algorithm for bandwidth optimization. Author provided the analysis on the rapid growth of communication system with service level observation and sub layer derivation so that the wireless channel adaptive communication will be formed. Author provided the collision analysis and provided the secure communication under resolution analysis so that the successful transmission will be formed in the network. Author observed the real time problem in the network and provided the wait time adaptive communication in the network. Author provided the performance derivation based communication under different associated parameters. Author provided the algorithmic formation using back-off algorithm so that the observation to the network under different constraints is done. Author also provided the parameters specific analysis so that the observation to the communication vector is obtained from the work. Author

provided the parameter specific communication in network and provided the improved communication over the network.

Jagruti Sahoo[5] has provided a partition adaptive message dissemination for MAC optimization. Author provided the service range based road safe communication to identify the emergency messages. Author control the density, accident adaptive communication in network.

III. MAC CLASSIFICATION

There are different types of MAC protocols available. These protocols are different in terms of protocol initiation stage, time synchronization and the reservation methods. The protocol is here defined in three main categories given here under

A) Contention Based Protocols

The main feature or the requirement of MAC protocol is to improve the channel access policy under contention. The node communication control is here defined under resource reservation so that the shared channel access can be optimized. As the communication performed, the neighbor node analysis is performed. These Contention based protocols can be divided in two sub stages called single channel sender initiated and multi channel sender initiated. In case of sender initiated single channel protocol, the node gains the contention to use the complete bandwidth. But in case of multiple channels, the bandwidth is divided into sub channels and provided the simultaneous access to multiple nodes. Each node gets a separate sub channel with bandwidth specification on separate channel.

B) Contention Based Protocol with Reservation Mechanism

The real time traffic analysis is defined to achieve the periodic access over the communication channel. The communication traffic observation with reserve bandwidth analysis is achieved to provide the active traffic and communication support. The protocols in this category divided in two sub categories called Synchronous Protocol and Asynchronous Protocols. Synchronous protocol are adaptive time shared mechanism and provides the time synchronization. Asynchronous protocol does not requires such global synchronization among the communicating nodes.

C) Contention Based Protocol with Scheduling Mechanism

These protocols provide the packet scheduling at the nodes and provides channel access optimization. The node level scheduling is here achieved so that the bandwidth starvation can be avoided. The scheduling scheme is here defined to optimize the battery characteristics and provide the scheduling over the channel in optimized form.

IV. IEEE 802.11

IEEE 802.11 provides the medium access control mechanism under the PCF and DCF. PCF is here defined as the centralized communication scheme whereas DCF protocols the distributed communication mechanism. DCF is based on the concept of CSMA/CA (Carrier Sense Multiple Access with Collision Avoidance). In these communication characteristics, the packet is transmitted and sense under physical characteristics of channel. These characteristics are defined as Physical Carrier Sense(PCS) and Virtual Carrier Sense(VCS) methods. PCS where represents the MAC layer notification based communication to provide the exploration to the communication. The carrier sensing is here provided to control the data frame communication under header inclusion with RTS, CTS and data frames. The communication duration is also analyzed based on the frame time analysis so that the source driven communication is performed and its ACK access is observed. The RTS frame duration analysis is provided for RTS, Data and ACK transmission based communication control. The duration of data also tracked with ACK transmission.

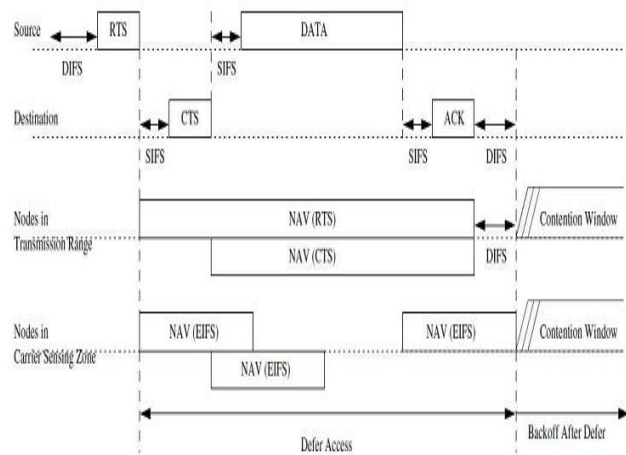


Figure 1: IEEE 802.11 Communication Process

Each node of IEEE802.11 is defined to control the online transmission session. The communication update is also provided with duration information in RTS, CTS and Data packets as the receive packet is generated. The channel is

considered busy if PCS and VCS indication is achieved during the communication. The time frame interval analysis is also provided to obtain the frame space analysis and provides the IEEE 802.11 specific analysis so that the transmission control will be achieved. The transmission range and sensing range based formation of communication process by the protocol is shown in figure 1.

IEEE 802.11 is used to improve the throughput and delay performance of the IEEE 802.11 DCF Improve network.

The node transmission range is correctly defined in protocol itself specific to the RTS and RTS. The carrier sensing zone is also defined to provide the packet decoding and perform the time based communication. The ACK adaptive communication is performed to avoid the collision during the communication. The EIFS obtained the packet length based communication and provides the time length formation to control the communication in an integrated form. The communication constraints are defined to control the communication and to improve the reliability.

DCF is defined in an integrated way to provide the improvement to CSMA/CA method and provide the polling scheme to enable the communication. The protocol is defined under the point coordinator vector so that the communication and control will be obtained in constraints defined for Adhoc protocol. The frame adaptive constraints are also defined to generate the communication frame and to provide the sensing setup.

The channel adaptive communication is provided by DCF. The analysis to the communication is provided under the interval and transformation formation. If the transmission is busy and communication is running, the back off time analysis provided. The timer also provides the reduction to the communication delay so that the channel adaptive communication will be formed. The transmission is activated under the time frame specification with slotted interval based on this contention window size is decided. Based on this optimum size, the optimization to communication is also achieved.

V. CONCLUSION

In this paper, an exploration to the MAC protocol is provided for mobile network. The paper has discussed the various issues associated with mobile network. The paper also explored the structural components of MAC protocol. Later on the categorization of MAC protocol is discussed.

The main stress of this paper is given to IEEE 802.11 protocol and its structural significance in communication architecture.

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AUTHOR'S PROFILE



Ritu, student M. Tech., department of electronics and communication, N.C college of engineering, Israna, Panipat, Haryana.