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# A Survey of Quality of Service (QOS) In Wireless Ad-hoc Networks

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***Abstract*** *- Quality of Service (QoS) is the recital level of a service accessible by the network to the user. Provision of quality of service assurance in wireless adhoc networks is very difficult due to some inherent difficulties like node mobility, multi-hop communications, disagreement for channel access and lack of central coordination. Due to bandwidth constraint and dynamic topology Quality of service (QoS) is a challenge task. In this paper we present the Comprehensive review related to Quality of service support in wireless adhoc networks, challenges and frame works involved in Quality of service.*

***Key Words— Wireless Adhoc Network, Quality of Service, Topology.***

## I. INTRODUCTION

A Wireless Ad hoc Network is a collection of wireless nodes dynamically forming a momentary network. These networks can be formed on the fly, without requiring any fixed infrastructure. This type of dynamic network is useful for battlefield tactical operation or emergency search-and-rescue operations where an infrastructure is beyond imagination. The formation simplicity of Wireless Adhoc Networks also inspired its deployment in civilian forums such as ah hoc conferences, campus recreation and electronic classrooms. With the tremendous growth of applications available over wireless networks, it is envisioned that wireless access will be considered as another hop of the communication path. Since many applications have Quality of Service (QoS) requirements such as delay and throughput, it is imperative that the wireless part of the communication should be able to support Quality of Service (QoS) similar to wired networks. To achieve such goals, the medium access control protocol should provide an efficient mechanism to share the limited spectrum among all mobile nodes, together with simplicity of operation, high system throughput, and good service differentiation for flows with different priorities. The IEEE 802.11 for wireless local area networks is one of the most widely deployed wireless techniques. It allows people to implement a wireless network in one of two possible configurations either in the infrastructure mode or the adhoc mode. Under the infrastructure mode, all nodes reside in a particular region where all communication must go through the access point. If the connection between a node and the access point is lost, the node cannot transmit any packets where as in adhoc node all nodes can form an adhoc network spontaneously without any centralized control. Even if a node loses direct connections with some nodes, it is still possible for the node to communicate with others through multi hop connections. This feature allows ad hoc networks to be flexibly deployed in scenarios such as battlefields, emergencies, etc., where no pre-established infrastructure exists. The basic access mechanism for ad hoc networks is the distributed coordination function. As the bandwidth of the wireless channel increased, variety of services can be provided in the wireless network, such as the video conference, network phone, and online video games. Some of these services require the guarantee of a certain bandwidth or a bounded delay, probability of packet loss, delay variance otherwise, the quality of these services will be unacceptable. Power usage is one of the QoS attribute which is more specific to Wireless adhoc networks. Conventional Internet QoS protocols like Resource Reservation Protocol cannot be simply move around to the wireless environment due to the error-prone nature of wireless links and the high mobility. This is true for Wireless adhoc networks because every node will move randomly, because of multihop network topology which alter randomly and at changeable times. Therefore, quality of service (QoS) becomes an important issue in Wireless Adhoc Networks.

## II. QUALITY OF SERVICE IN DIFFERENT NETWORK LAYERS

*1) Application layer:*
A particular Class of Service and adaptively change will depend on the network state, so that its packets are not rejected if the network fails to keep up with the desired Class of Service.
*2) Session or presentation layers:*
These are used as classifiers to distinguish between the different Class of Service and data belonging to different module to separate wait in lines for the transport layer.

*3) Transport layer:*

Services the higher Class of Service queue more often using some negotiation, and maps the three classes of service to different network-layer controls.

*4) Network layer:*

Considering each Class of Service data differently, it uses dissimilar routing mechanisms for each of them and sends the data into three different queues for the data-link layer.

*5) Data-link layer:*

Uses different protocols again for different Class of Service to get faster, better, and assured service can be delivered.

*6) Physical layer:*

This again may used for better error-correction schemes and may give more time for transmission to higher Class of Service. It possibly adaptively tries to change the modulation scheme with respect to the state of channel and hence try to provide a service even when the channel Bit Error Rate is high.

## III. CHALLENGES INVOLVED IN PROVIDING QUALITY OF SERVICE

Quality of Service can be calculated in terms of data rate, delay variation (jitter), and packet loss. Providing Quality of Service has its own challenges and problems.

*1) Unstable Substantial link properties*

Because the wireless link is random and time unreliable, it becomes complicated to ensure that a least amount level of service is satisfied.

*2) Medium access issues*

Because the wireless channel is shared by many devices, running them in such a way that the Quality of Service guarantees is not easy.

*3) Direction-finding*

Because the nodes have mobility, the network topology changes arbitrarily with time, and the routing protocol needs to modernize the routes and links.

*4) Power consumption*

Nodes, being mobile, have incomplete power capacity.

*5) Categorization of the link state*

Because the network state alters with time, one needs to have some means in place which can continue to modernize the network state and, based on it, predict whether it will be able to achieve a particular quality of service requirement or not.

*6) Self-motivated topologies*

Nodes are free to move arbitrarily thus the network topology which is typically multihop may change randomly and rapidly at unpredictable times, and may consist of both bidirectional and unidirectional links.

*7) Lack of Central Coordination*

Like wireless LAN, Wireless Adhoc Networks does not have central organizers to coordinate the activity of the nodes. A Wireless Adhoc Networks may be set up spontaneously without planning and its members can change dynamically, thus making it difficult to provide any form of centralized control. As a result communications protocols in Wireless Adhoc networks utilize only locally available state and operate in a distributed manner.

*8) Imprecise state information*

The nodes in Wireless Adhoc Network maintain link specific as well as flow-specific state information. The link-specific state information comprises bandwidth, delay, delay jitter, loss rate, error rate, stability, cost and distance values for each link. The flow-specific information includes session ID, source address, destination address and QoS requirements of the flow. Due to dynamic changes in network topology and channel characteristics, these state information are inherently imprecise.

## IV. FACTORS AFFECTING QUALITY OF SERVICE PROTOCOL PERFORMANCE

Even after overcoming the challenges a number of factors have major impacts while evaluating the performance of Quality of Service protocols. Some of these parameters are can be summarized as follows:

*1) Node mobility*

This factor generally encompasses several parameters: the nodes maximum and minimum speed, speed pattern and pause time. The speed of the pattern determines whether the node moves at uniform speed at all times or whether it is constantly varying, and also how it accelerates, for example, uniformly or exponentially with time. The break time determines the span of time nodes remain motionless between each period of movement. Together with maximum and minimum speed, this constraint determines how frequently the network topology changes and thus how regularly network state information must be efficient.

*2) Network size*

Quality of Service state has to be gathered in some way for routing decisions to be made, the larger the network, the more difficult this becomes in terms of modernize latency and message overhead. This acts as the same with all network status information.

*3) Number, type and data rate of traffic sources*

Intuitively, a smaller number of traffic foundations fallout in fewer routes being required and vice versa. Traffic sources can be constant bit rate or may generate bits or packets at a rate that varies with time according to the Poisson

distribution, or any other mathematical model. The maximum data rate affects the number of packets in the network and hence the network load. All of these factors affect performance significantly.
*4) Node transmission power*
Some nodes may have the capability to vary their broadcast power. This is important, since at a higher power, nodes have more direct neighbors and hence connectivity increases, but the interference

## V. CLASSIFICATION OF QUALITY OF SERVICE SOLUTIONS AND MODELS

Quality of Service solutions is basically classified into Quality of Service approach and the layers at which they operate. Quality of Service approaches can be classified into the following types.
*1) Coupled*
Here, there will be close interaction between the routing algorithm and the QoS mechanism for providing QoS guarantees. Examples are Ticket-Based Probing (TBP), Predictive Location-Based QoS Routing Protocol (PLBQR), Time Domain Reflectometry (TDR), Quality of Service AdHoc On-Demand Distance Vector (QoS-AODV), BR, OQR, OLMOR, Active Query Router (AQR), Core-Extraction Distributed Ad Hoc Routing (CEDAR), and Intelligent Optimization Self-Regulated Adjustment (INORA)
*2) Decoupled*
There will not be any routing protocol on which the QoS mechanism is dependent. Examples are INSIGNIA, stateless wireless ad hoc network (SWAN), and PRTMAC
*3) Independent*
The network-layer protocols are not dependent on MAC. Examples are TBP, PLBQR, QoS-AODV, INSIGNIA, INORA, and SWAN
*4) Dependent*
The network-layer protocols are dependent on the MAC layer. Examples are TDR, BR, OQR, OLMQR, AQR, CEDAR, and PRTMAC
*5) Table driven*
There will be the routing table in each node which helps in transmitting the packets. Examples are PLBQR
*6) On demand*
The source node will find the route. No routing tables are provided. Examples are TBP, TDR, QoS-AODV, OQR, OLMQR, AQR, INORA, and PRTMAC
*7) Hybrid*
This includes the features of both the table-driven and on-demand approaches. Examples are BR and CEDAR
*8) Quality of Service Models*
Qualities of Service Models identify the architecture in which certain services could be provided in the network. The QoS Model for wireless adhoc networks should consider the existing QoS architectures in the Internet. The IntServ and DiffServ are the two basic models in the Internet.

- Integrated Service(IntServ)and Resource Reservation Protocol (RSVP)
- Differentiated Service(DiffServ)

The basic idea of the Integrated Service model is flow specific states are kept in Integrated Service Enables Router. A flow is an request session between a pair of end users. Flow specific state should include band width requirement, delay bound. Integrated Service proposes Guaranteed Service and Control Load Service. The Integrated Service has some resource limitations like the amount of state information increases proportionally with the number of flows and due to every host must perform the processing of admission control, classification, and scheduling is heavy burden for resource limited hosts. Differentiated Service is designed to overcome the difficulty of implementing and deploying Integrated Service and Resource Reservation Protocol in the Internet. This is designed for fixed networks and may be possible solution for the QoS model.

## VI. QUALITY OF SERVICE MECHANISMS

The Quality of Service mechanisms are selected and configured according to the user specification, resource availability, and supply management policy. In supply management mechanism are categorized into either the static or dynamic. Static resource management deals with flow establishment and dynamic resource management deals with media transfer.
*1) Quality of Service Provision Mechanisms*
*A) Quality of Service mapping*
Performs the function of automatic translation between representations of Quality of Service at different system levels like operating system, transport layer etc.
*B) Admission Testing*
Responsible for comparing the supply requirement arising from the requested Quality of Service against the available resources in the system. Once admission testing has been successfully completed on a particular resource module local resources are reserved immediately.
*C) Resource Reservation Protocols*
Arranges for allocation of suitable end system and network possessions according to user Quality of Service specification.

 

*2) Quality of Service Control Mechanisms*

Quality of Service mechanisms operates on time balance. These include flow shaping, flow scheduling, flow policing, flow control and synchronization. In flow shaping based in the user supplied information the regulation follows. The flow scheduling manages the forwarding flows and these flows are scheduled independently in the network. The flow policing can be treated as the dual monitoring and flow control includes open loop and closed loop schemes. The flow synchronization is required to control the event ordering and timings of media applications.

*3) Quality of Service Management Mechanisms*

Basically the Management Mechanisms include Monitoring, Maintenance, Degradation, Availability and Scalability. The monitoring allows each level of the system to track the ongoing Quality of Service met in each layer. The maintenance compares the expected performance with the monitored Quality of service. In degradation the Quality of Service indication to the user in the lower layers if failed it cannot be done any thing further by the mechanisms. In availability it specifies the interval over the jitter, delay loss, synchronization can be monitored. The scalability comprises and manipulates flows as they progress through communication system which scales the flow to the end systems only.

## VII. QUALITY OF SERVICE FRAME WORKS

The frame work is a complete system which responsible to provide the required Quality of Service. The frameworks are INSIGNIA, Intelligent Optimization Self Regulated Adjustment (INORA) and Class Based Fine Feed Back Scheme. The INSIGNIA frame work allows audio, video and real time applications to specify maximum and minimum band width, plays vital role in allocation, control between nodes. Basing on the availability of bandwidth the mechanisms attempt to provide guarantee in the services. The Intelligent Optimization Self Regulated Adjustment is mechanism (INORA) makes use of INSIGNIA. The INORA represents a signaling approach. In Class Based Fine Feedback Scheme the interval is divided into Maximum and Minimum of N classes where the Minimum and maximum bandwidth are required by the Quality of Service flow.

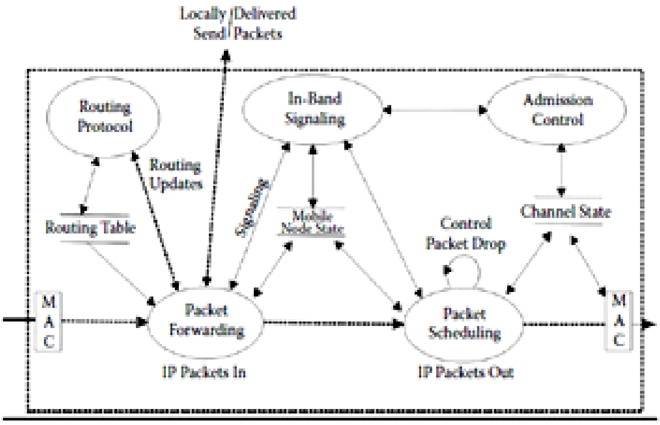


Fig -1: INSIGNIA Quality of Service Frame Work.

## VIII. CONCLUSION

In this paper we have summarized a comprehensive review on Quality of Service Support in Wireless Adhoc Networks. We have presented the issues and challenges, factor affecting the Quality of Service. We also summarized the Quality of Service models and mechanisms. The importance of quality of Service is really felt in the Wireless Adhoc Networks. Continued growth is expected in this area to provide efficient communications in Wireless Adhoc Networks.

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