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ANALYSIS OF CHALLENGES IN THE AREA OF QUALITY OF SERVICE (QOS) SUPPORT IN MOBILE AD-HOC NETWORK (MANETS)

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Abstract - Mobile ad hoc networks are the collection of wireless nodes which communicate with each other either in single or multihop without the support of centralized infrastructure. Each device in a MANET changes its link to other devices all the time, as they are free to move in all direction. It is important to be cautious while transferring data over MANETs and it is not secure, because of its dynamic nature. In MANTEs real time and Multimedia applications required Quality of Service (QoS) like bandwidth, energy, end-to-end delayand jitter. In MANETs Quality of Service (QoS) is much more difficult and challenging task, usually defined as a set of service requirements that needs to be met by the network while transporting packets from a source to its destination[3]. This paper presents analysis of challenges and issues in providing QoS support to MANETs. There are many challenges in Quality of Service provisioning for MANETs like automatically changing topology, wireless capacity limitations, limited battery power, and Network Configuration, Limited physical security[3].

Keywords - Mobile ad hoc Network, Quality of service, Wireless Network, Packets

I. INTRODUCTION

A mobile ad hoc network (MANET) is a collection of randomly moving wireless devices which communicate with each other either in single or multihop without centralized infrastructure within an area. Unlike in cellular networks, there is not any fixed base-stations to support routing and mobility management. The wireless mobile devices communicate with each other without the help of wired base-stations. The wireless mobile devices are made with transmitter and receiver for communication purpose. Since each transmitter has a limited effective range, distant nodes communicate through multihop paths with other nodes in the middle as routers[10]. These networks are particularly suitable for emergency situations like floods and other disasters where wired networks are unable to operate[11].

A Quality of Service (QoS) is required in network while transporting packets from its source to its destination. The actual form of QoS and its parameter depends upon the requirement of the specific application. The main goals of QoS are: -

- More Determined network behavior is to be achieved
- Better initialization of the resources of network
- Better network for delivery of information
- Maintenance of end-to-end QoS with user mobility etc.

QoS metrics is also introduced which includes packet loss rate, bandwidth, estimated delay, packet jitter, path reliability and hop count[3]. QoS framework is a structural collection of concept and its relationship between related topics of QoSsupportive system which have common disciplines[3].

QoS routing is not sufficient to find a route from one node to other nodes in the network This route is also check the other QoS parameters like bandwidth delay packet loss. To guarantee these constraints after a route was found, resource reservations on the participating nodes are made. QoS is more difficult to find the perfect solution in ad hoc network than in most other type of networks because of sharing bandwidth and changing topologies as devices in the network are moving.

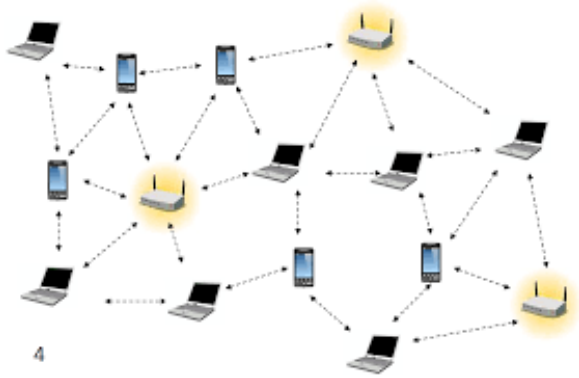

Figure 1.Mobile Ad-hoc Network

II. QOS PROVISIONING CHALLENGES IN MANET

1. Performance of MANETs

QoS is the set of service provided by the network to the user The primary goal of QoS is utilization of network resources for data transmission The service provider offers different types of services to the user based on a set of service requirements such as

minimum bandwidth maximum delay maximum variance in delay and maximum rate of packet loss After accepting a service request from the user the network is expected to ensure the committed service requirements of the users throughout the communication. QoS provisioning is challenging due to the key characteristics of MANETs i.e. decentralized network, mobility of hosts and limited availability of resources.

QoS architecture is divided in to following modules to play supporting role of QoS in MANETs.

Admission Control: Admission control policies are generally with service level agreements SLA with user. They may be additionally based on the availability of network resources to meet the performance objectives of a service request.

Traffic Classification & Scheduling: Scheduling is based on a service rate allocation to classes of traffic that share a common buffer. It is the mechanism that selects a packet for transmission from queue. Packet scheduling thus controls bandwidth allocation to different nodes in the network. The desired service guarantees are realized independently at each router via proper scheduling.

QoS – Hard vs Soft State: Maintaining the set of requirements for data flows in MANETs is one of the most challenging aspects of the QoS framework. Typically, wired networks have little quality of service where the route and the reservation between source-destination pairs remain fixed for the duration of a session. Whereas, in the wireless network route discovery and path reservation between source-destination is not fixed because of changing topology in the network. Wired networks are working on **hard-state**connection-oriented communications and wireless networks are **soft-state** approach management of reservations in MANETs. It relies on the fact that a source sends data packets along an existing path. If a data packet arrives at intermediate node working as a router and no reservation exists, then admission control and resource reservations attempt to establish soft state. Received data packets at router are used to refresh the existing soft-state reservation. When an intermediate node receives a data packet that has an existing reservation, it reconfirms the reservation over the next interval of data transmission.

Buffer Management: Buffer management is the task of storing or dropping a packet waiting in a transmission queue. Buffer management is often associated with congestion control.Packet loss will happen when data is not transmitted from sender to receiver via a selected route because of data transmission queue is full, is the buffer management.

Resource Reservation: Resource reservation is known as the reserving resources for desired network for better performance and the support of authentication, authorization, accounting and agreement between ISPs and users. **End-to-End Delay:** End-to-End delay refers to the time taken by a packet to be transmitted from source node to destination node. Lesser end-to-end delay implies better performance.

2. Quality of Service

QoS is a challenging task, because constantly changing the topology of an ad hoc network, reserving resources in the network sustains quality of service. Quality of Service indicates the performance of a network. Packet Delivery Rate (PDR), Packet Loss Rate (PLR) and delay are the most important factors to measure in the QoS. Packet delivery ratio is the ratio of the number of packets delivered to the destination. Packet loss ratio is the ratio of the number of packets lost to the number of packets sent.Delay is the time taken bypacket received and packet sent.

3. QoS Provisioning Challenges in MANETs

Providing QoS support in MANETs is more challenging than conventional wireless networks. A summary of the major challenges in providing QoS support in MANETs are as follows:

1. Dynamically varying network topology: In MANETs network topology changes dynamically because of no restrictions on mobility. Thus, paths may get breaks, therefore re-establishment of new paths are required, QoS session may suffer due to frequent path breaks. QoS session may cause some of the packets belonging to that session to miss their delay targets, which is not acceptable for applications in QoS requirements for re-establishment of paths.

2. Error-prone shared radio channel: QoS requirements like hard packet delivery radio or stable link are difficult to maintain because of multi-path fading effects through the wireless medium.

3. Lack of central coordination:MANET is not a centralized network to control activity of nodes like wireless LAN and cellular network Because of this lack of central co- ordination in MANETs it increases overhead and complexity of QoS state information.

4. Imprecise state information: In MANETs there is lack of accuracy related to node and link specific information due to dynamic changing network topology this may result in inaccurate routing decisions.

5. Limited availability of resources: Mobile devices have less computational power, less memory, limited battery power supply as compared to other devices results into limits the amount of QoS requirements.

6. Hidden Terminal Problem: In MANETs devices frequently facing hidden terminal problem when packets are sent by two or more nodes, collides at receiver. While retransmitting packets, some packets gets exchanged and does not fulfil QoS requirement.

7. Node mobility: The nodes in a MANET are moves randomly in the network which changes node mobility of nodes. Because of mobility link may get breaks and data transmission may not possible in the network. Topology of network will change and not met the QoS requirement in MANET.

III. IDENTIFYING PROBLEMS AND SOLUTIONS

Quality of Service in mobile ad-hoc networks has become an area of interest, because of various requirements of different applications, the services required and the QoS parameters will change for each application. Therefore, for transmitting packets from source to destination pre- specified service requirements needs to be available in the network. Real time applications need mechanisms that guarantee restricted delay and delay jitter. The most important delays that affect the end to end delay in packet delivery from one node to another node are: the queuing delay at the source and intermediate nodes, the processing time at the intermediate nodes, the transmission delay, and the propagation duration over multiple hops from the source node to the destination node[12].

Generally, in wired networks, QoS parameters are characterized by the requirements of multimedia traffic. But in ad-hoc networks QoS requires new constraints due to highly dynamic network topology and traffic load conditions, time-variant QoS parameters like throughput, latency, low communication bandwidth, limited processing and power capacity than wire-based network[12].

Moreover, QoS in ad-hoc networks relates not only to the available resources in the network but also to the mobility speed of these resources. This is because mobility of nodes in ad-hoc networks may cause link failures and broken paths[12]. To continue a communication therefore, it requires finding a new path. However, delay will occur for establishing a new path, also some of the packets may get lost.

In mobile ad-hoc networks, mobile computation devices are working on battery powered having limited capacity of communication of each device.

The battery Life, bandwidth, and buffer space are the important resources in each network. Usually, the transmitter power consumes the most energy in the node and it is essential to conserve the available energy in MANETs either by low-power design of hardware or special power control mechanisms.

Security issue is an important factor in providing QoS in mobile ad-hoc networks. Communications in wireless environment are not secure due to the broadcasting behaviour of this type of network. Generally, MANETs have very less resourcesavailable than fixed networks and they are more influenced by the resource constraints of the nodes. Therefore, it is hard for these networks to support different applications with appropriate QoS requirements.

The four main goals of cryptography for any networks are Confidentiality, Integrity, Availability, and Non-repudiation, as demonstrated in Figure 2. The major issues to provide security are as follows: shared radio broadcast channel, unsecured operational environment, lack of central authority, lack of association, limited resource availability, and physical vulnerability.

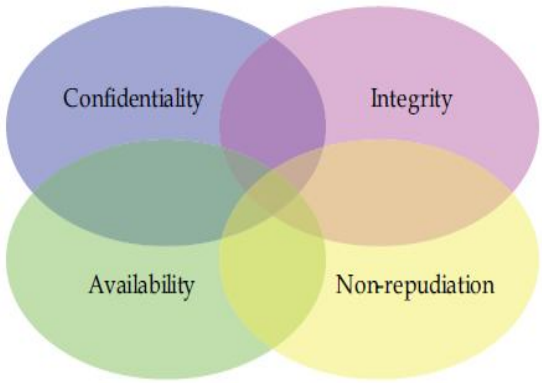

Figure 2. The four fundamental requirements for a secure network

The requirements of a secure routing protocol for MANETs are: detection of malicious nodes, guarantee of correct route discovery, confidentiality of network topology, and stability against attacks. Fig.3 displays the security issues in each TCP/IP layer

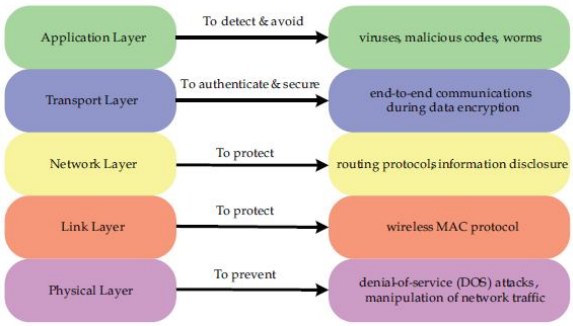

Figure 3. The security issues: challenges and corresponding layers

CONCLUSION

Mobile ad-hoc network is collection of wireless nodes on a shared wireless channel. This network is having highly dynamic topology resulted from the mobility of network nodes. MANETs are expected to have a significant place in the development of wireless communication systems. Such networks are attractive because they can be user friendly and deployed anywhere and anytime. Hence, mobile ad-hoc networks are capable to provide the required quality of service for the delivery of real-time communications such as audio and video.

Many ideas regarding QoS parameters considered in wire-based networks can be used for MANETs if we consider various constraints due to the dynamic nature, bandwidth restriction, the limited processing, and capabilities of mobile nodes.The routing protocols in this type of networks must be developed to consider power aware as a primary objective. The support of QoS requirements in terms of delay and

bandwidth becomes a challenge due to the dynamic nature of ad hoc networks.

Thus, for providing efficient quality of service in mobile ad-hoc networks, there is a solid need to create new architectures and services for routine network controls.

FUTURE WORKS

In the Mobile ad-hoc Network, there are many areas that provides opportunity for development like academic, defense, disaster recovery, industrial environments, and healthcare. There are many challenges that require to be addressed as well. These challenges need to develop efficient routing procedures, mechanisms for reducing power consumption and extending the battery life, mechanisms for efficient use of limited bandwidth and communication capacity, new algorithms for information security, and making smaller but more powerful mobile devices.

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