A survey on quality of services of DSDV, AODV and DSR routing protocols in Ad hoc Networks

Pankaj Kumar Varshney

Institute of Computer Applications, Mangalayatan University, Beswan, Aligarh-U.P. (India)

G.S.Agrawal

Institute of Computer Applications, Mangalayatan University, Beswan, Aligarh-U.P. (India)

Sudhir Kumar Sharma

School of Engineering of Technology, Jaipur National University, Jaipur-Raj. (India)

Abstract- The sustainability of Quality of Services (QoS) is difficult in Ad hoc Networks due to frequently changing network topology. In general, QoS is realized by the users on the overall performance of a network. To measure the quality of services, we have considered several factors such as, packet dropped, bandwidth, throughput, transmission delay, jitter, and security in our study. We have shown that the transmission delay, bandwidth, packet dropped, and security are more responsible for improving QoS in Ad hoc networks. We also found that in the presence of these factors the DSR is better performed as compared to AODV and DSDV.

Keywords: Ad hoc Networks, Routing Protocols, Quality of Services.

I. INTRODUCTION

Ad-hoc networks are a collection of mobile nodes that can be deployed without the need for any centralized infrastructure. Ad hoc network is very flexible and can configure itself automatically [1]. Ad hoc networks are the voice/data networks that are established temporarily without requirement of an infrastructure, in which some of the network devices are a part of the network only for the duration of a communication session. A routing protocol specifies the method used and sequences deployed for maintaining and updating the routing table at the nodes in the network. A central challenge in the design of Ad hoc networks is the development of dynamic routing protocols that can efficiently find routes between two communication nodes. Due to the dynamic nature of Ad hoc, designing communications and networking protocols for these networks is a challenging process. A considerable amount of research has been done in this area, and routing protocols have been developed [2]. Most of these protocols such as the DSR, AODV and DSDV maintain routes on a best-effort basis. While this might be sufficient for a certain class of Ad hoc applications, it is not adequate for the support of more

demanding applications such as multimedia audio and video. Such applications require the network to provide guarantees on the Quality of Service (QoS).

II. ROUTING PROTOCOLS

The process of sending messages or packets of data requires a special method called routing. Routing refers to sending the data from the source node to the destination node through the intermediate nodes. A routing protocol specifies how routes communicate with each other. The routing protocols have two primary functions: Selection of an appropriate route and delivery of packets to its correct destination. Generally, current routing protocols for ad hoc networks can be categorized as: proactive and reactive.

PROACTIVE ROUTING PROTOCOL (TABLE DRIVEN):
 All the mobile nodes or stations are required to have complete knowledge of the network. Or keep track of routes of all destination in the Ad hoc network are called proactive protocols [5]. Advantage: Minimal initial delay. Disadvantage: Additional control traffic. The proactive protocols maintain routing information about each

node in the network. The information is updated throughout the network periodically or when topology changes. Each node requires storing their routing information. The existing proactive routing protocol is: DSDV (Destination Sequences Distance Vector).

A. DESTINATION-SEQUENCED DISTANCE-VECTOR ROUTING PROTOCOL (DSDV):

DSDV [17] is developed on the basis of Bellman–Ford routing [8] algorithm with some modifications. In this routing protocol, each mobile node in the network keeps a routing table. Each of the routing table contains the list of all available destinations and the number of hops to each. Each table entry is tagged with a sequence number, which is originated by the destination node. Periodic transmissions of updates of the routing tables help maintaining the topology information of the network. If there is any new significant change for the routing information, the updates are transmitted immediately. So the routing information updates might either be periodic or event driven. DSDV protocol requires each mobile node in the network to advertise its own routing table to its current neighbors. The advertisement is done either by broadcasting or by multicasting. By the advertisements, the neighboring nodes can know about any change that has occurred in the network due to the movements of nodes. The routing updates could be sent in two ways: one is called a „„full dump‟‟‟ and another is „„incremental.‟‟‟ In case of full dump, the entire routing table is sent to the neighbors, where as in case of incremental update, only the entries that require changes are sent[10].

B. REACTIVE ROUTING PROTOCOL (SOURCE-INITIATED ON-DEMAND DRIVEN):

The reactive routing protocols look for the routes and are created as and when required. Or acquire information only when it is actually needed. These protocols try to eliminate the conventional routing tables and consequently reduce the need for updating these tables to track changes in the network topology [8]. In contrast to pro-active routing protocols which maintain all up-to-date at every node, routes are created only when desired by the source node in re-active protocols. When a source requires to a destination, it has to establish a route by route discovery procedure, maintain it by some form of route maintenance procedure until either the route is no longer desired or it becomes inaccessible, and finally tear down it by route deletion procedure. Some of the existing re-active routing protocols are: DSR (Dynamic Source Routing), AODV (ad hoc On-Demand Distance Vector Routing). In pro-active routing protocols, routes are always available (regardless of need), with the consumption of signaling traffic and power. On the other hand, being more efficient at signaling and power consumption, re-active protocols suffer longer delay while route discovery. Both categories of routing protocols have been improving to be more scalable, secure, and to support higher QoS[13].Advantages: High uncertainly in the position of the nodes. Disadvantage: High latency time in route finding.

C. AD HOC ON-DEMAND DISTANCE VECTOR ROUTING (AODV):

AODV [10] is basically an improvement of DSDV. But, AODV is a reactive routing protocol instead of proactive. It minimizes the number of broadcasts by creating routes based on demand, which is not the case for DSDV. When any source node wants to send a packet to a destination, it broadcasts a route request (RREQ) packet. The neighboring nodes in turn broadcast the packet to their neighbors and the process continues until the packet reaches the destination. During the process of forwarding the route request, intermediate nodes record the address of the neighbor from which the first copy of the broadcast packet is received. This record is stored in their route tables, which helps for establishing a reverse path. If additional copies of the same RREQ are later received, these packets are discarded. The reply is sent using the reverse path. For route maintenance, when a source node moves, it can reinitiate a route discovery process. If any intermediate node moves within a particular route, the neighbor of the drifted node can detect the link failure and sends a link failure notification to its upstream neighbor. This process continues until the failure notification reaches the source node. Based on the received information, the source might decide to re-initiate the route discovery phase [8].

D. DYNAMIC SOURCE ROUTING (DSR):

DSR is a reactive protocol based on the source route approach   [11]. In Dynamic Source Routing (DSR), the protocol is based on the link state algorithm in which source initiates route discovery on demand basis. The sender determines the route from source to destination and it includes the address of intermediate nodes to the route record in the packet. DSR was designed for multi hop networks for small Diameters. It is a beaconless

protocol in which no HELLO messages are exchanged between nodes to notify them of their neighbors in the network [8].

III. QoS REQUIREMENT TO THE ROUTING PROTOCOLS:

QoS routing requires not only finding a route from a source to a destination, but a route that satisfies the end-to-end QoS requirement, often given in terms of packet dropped, bandwidth, throughput, transmission delay, jitter, and security [3]. According to [4], QoS is a set of service requirements to be met by the network while transporting a flow. A flow is a packet stream from a source to a destination with an associated QoS. A fundamental requirement of any QoS mechanism is a measurable performance metric. Typical QoS metrics include packet dropped, bandwidth, throughput, transmission delay, jitter, and security.

Quality of Service (QoS) is being developed to meet the emerging requirements of heterogeneous applications in the Internet which is able to provide only best effort service. QoS of fixed wireless networks is still an open problem. Moreover, ad hoc networks make the QoS appear an even more challenging problem than ever before, despite some of re-active routing protocols can be configured to return only paths that comply with certain desired QoS parameters [13]. Due to the nature of ad hoc networks, QoS cannot be guaranteed for a long time because of the link quality variation. Methods to detect and report changes in the connection quality should be investigated in the future.

IV. RELATED WORK

During last few years, lot of research work and advancements are taking place for assuring Quality of service for different types of data flows offered by Ad hoc to different end users. Some of the major constraints or parameters, which are required by user as QoS guarantee are Bandwidth, End to End Delay, Jitter (delay variance), Probability of packet loss, Battery Power etc.[18]. Lot of attention has been given by researchers for improving the quality of services of Ad hoc network through performance measure of routing protocols. Many of the researchers have evaluated the performance of the popular routing protocols such as DSDV, AODV and DSR on the basis of different parametric matrices like throughput, end-to-end delay, packet dropping rate, Packet delivery ratio etc. [1] In that study, they have observed that the packet dropping rate for DSR is very less than DSDV and AODV but under the high mobility AODV and DSR perform better than DSDV. [2] Evaluated the different routing protocols behavior in 802.16. It was seen that the DSDV protocol has best performance in terms of the packet delivery fraction which outperforms both DSR and AODV. In another study [3] have analyzed the DSDV, DSR and AODV protocols. Their result revels that the DSR and DSDV have low and stable routing overhead as compared to AODV, and indicated that the overall performance of DSR is better than AODV and DSDV routing protocols. [5] Conducted a comparative study for DSDV, DSR, and AODV and indicated that the packet dropping rate for DSR is very less than DSDV and AODV. Both AODV and DSR perform better under high mobility than DSDV. DSR performs higher than the DSDV and AODV. DSR consistently generates less routing load than AODV. [6] Analyzed the performance of DSDV and AODV. They were observed that DSDV is better than AODV in terms of packet delivery fraction and lower than AODV in term of end to end delay and routing overhead. [7]Conducted a comparative study for DSDV and AODV, and indicated that the DSDV routing protocol consumes more bandwidth, because of the frequent broadcasting of routing updates. While the AODV is better than DSDV as it doesn't maintain any routing tables at nodes which results in less overhead and more bandwidth. Study suggested that the AODV perform better under high mobility scenario than DSDV. [10] analyzed the performance of AODV, DSDV and ZRP. It has been found that the performance of DSR is good in terms of routing overhead and number of packets dropped due to route cache. It can also be concluded from the simulation results that the reliability of AODV and DSR protocols is better than other.

V. PERFORMANCE MATRICES AND ANALYSIS

PACKET DROPPED: The ratio of the data packets lost at destinations to those, generated by the CBR (Constant Bit Rate) sources. It occurs due to the route failure or the overloading of the buffers.[1], [4], [9] Mainly Packet drop occurs due to the end of TTL (Time to Live). If a protocol takes much time to decide destination path, then the packets having short life time, fall into victim to drop. Efficient protocols can wisely find out routing direction

thus packets dropping rate reduces for them. The dropped packet for DSR is less than that of DSDV; AODV has no periodic updates exist in DSR.

BANDWIDTH: The data capacity of a link, which is typically defined in bps (bit per second). [2] The DSDV performs poorly as the bandwidth is less as compare to DSR and AODV.

THROUGHPUT: Throughput is the number of packet that is passing through the channel in a particular unit of time. [2]-[10] DSR shows higher throughput than the DSDV and AODV since its routing overhead is less than others and the rate of packet received for AODV is better than the DSDV When the pause time increases (10, 20, 30, 40 and 90 secs). Moreover, the change in the pause value does not have any effect on AODV performance.

TRANSMISSION DELAY: A specific packet is transmitting from source to destination node and calculates the difference between send times and received times. [2]-[10] the transmission delay of packets is less in DSR as compare of AODV and DSDV, due to the caching of routes. However, as the number of nodes increases, DSR exhibits significantly higher delay then other two protocols. This may be due to the increasing node density because of which the number of data sessions increases which leads to increased transmission delay.

JITTER: It is the variation in the time between packets arriving. Jitter is commonly used as an indicator of consistency and stability of a network. [18] AODV initially shows high jitter and after a certain time interval low jitter value appears. And in the beginning DSDV has very low jitter rate approx zero within the time interval of 0-45 second and after 45 second the situation remained unstable. AODV shows high jitter in between 50 to 95 second but later on the performance is quite good. And DSDV gives better jitter performance because of low node mobility and free channel.

SECURITY: Security is a critical issue of ad hoc networks that is still a largely unexplored area. Since nodes use the open, shared radio medium in a potentially insecure environment, they are particularly prone to malicious attacks, such as denial of service. Lack of any centralized network management or certification authority makes the dynamically changing wireless structure very vulnerable to infiltration, eavesdropping, interference etc. Security is often considered to be the major "roadblock" in commercial application of ad hoc network technology. The common approach is secure routing, which has an appealing idea of dividing the data on N pieces which are sent along separate routes and, at the destination, the original message is reconstructed out of any (M – out – of - N) pieces of the message [13]. We found that source-routing facilitates securing ad hoc network routing protocols. Source routing empowers the sender to circumvent potentially malicious nodes, and enables the sender to authenticate every node in a ROUTE REPLY. Such fine-grained path control is absent in most distance vector routing protocols, which makes such protocols more challenging to fully secure [19].

VI. CONCLUSION

The numbers of authors have conducted simulation studies to evaluate the performance of DSDV, AODV and DSR protocols in Ad hoc network and presented their results. In the work presented here, the authors have used large simulation area, maximum speed, large simulation duration, and chain topology. It is found that the results of DSR protocol is superior as compare to DSDV, AODV protocols for parameters such as packet dropped ratio, bandwidth, throughput, transmission delay, and jitter rate.

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