COMPARATIVE PERFORMANCE STUDY OF HYBRID ROUTING PROTOCOL OVER REAL TIME DATA IN MANET

Shashank Awasthi, Dr. A. L. N. Rao

ABSTRACT: MANET is a collection of wireless nodes that can dynamically form a network to exchange information without using any pre-existing fixed network infrastructure with or without centralized network controller. MANETs are becoming useful due to the existing wireless infrastructure is costly and not convenient now a days. MANET is becoming important part of next generation mobile services. Due to the frequent changes [1] in network topology and the lack of the network resources both in the wireless medium and in the mobile nodes, mobile ad hoc networking becomes a challenging task. As a result, routing in such networks experiences link failure more often than infrastructure based network. Hence, a routing protocol that supports ad hoc networks requires considering the reasons for link failure to improve its performance. Link failure results from node mobility and lack of the network resources. Therefore it is essential to analyze the characteristics to identify the quality of links. Furthermore, the routing protocols must be adaptive to cope with the time-varying low-capacity resources. For instance, it is possible that a route that was earlier found to meet certain requirements no [2] longer does so due to the dynamic nature of the topology. In such a case, it is important that the network intelligently adapts the session to its new and changed conditions. The mobile nodes must co-operate at the routing level in order to forward packets to moderate the behavior in MANET. It is required to build the relationship between the mobile nodes in the MANET and select routes based on the trust. A hybrid routing protocol should be designed in which communication path between sender node and receiver node is made up through strong metrics. In this work an attempt has been made to compare the performance of hybrid routing [3] protocol and prominent routing protocols such as AODV, DSR and DSDV. The performance differentials are analyzed using varying simulation time These simulations are carried out using the ns-2 network simulator. The results presented in this work illustrate the importance in carefully evaluating and implementing routing protocols in an ad hoc environment.

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I. INTRODUCTION.

Mobile Ad Hoc Networks are wireless networks which do not require any infrastructure support for transferring data packets between two nodes. Wireless network is a computer network that is wireless and it is commonly associated with a telecommunications network whose interconnections between nodes are implemented without the use of wires. In mobile ad-hoc networks nodes are free to move randomly. Thus the network's wireless topology may be unpredictable and may change rapidly. MANETs employ the traditional TCP/IP structure to provide end to end communication between nodes. However due [2] to their mobility and the limited resource in wireless networks, each layer in the TCP/IP model require redefinition or modifications to function efficiently in MANETs. In these networks nodes also work as routers that are they also route packet for [1] other nodes also. Nodes that are involved in MANETs organize themselves arbitrarily store and forward for other nodes. In mobile ad hoc networks, routes are basically multi hop because of this limited radio propagation range, topology changes frequently and unpredictably since each network host moves randomly.

Availability of small, inexpensive wireless communicating devices has played an important role in moving mobile [4] ad hoc network close to reality. Consequently mobile ad hoc networks are attracting a lot of attention from the research community. MANETs are advantageous because of their readily deployable nature as they do not need any centralized infrastructure. Minimal configuration, quick deployment and absence of a central governing authority make ad hoc networks suitable for emergency situations like natural disasters, military conflicts, emergency medical situations etc. Recent advancements such as Bluetooth introduced a fresh type of wireless systems which is frequently known as mobile ad-hoc networks.

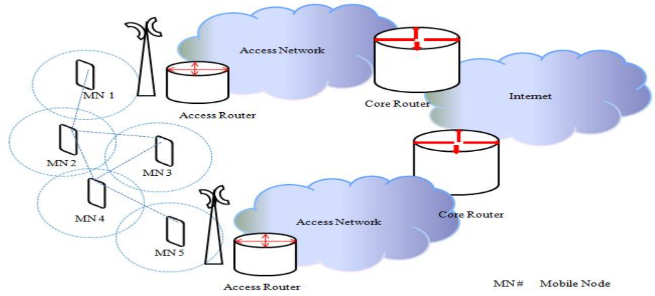

Figure 1: Mobile Ad-hoc Network

Mobile ad-hoc networks or "short live" networks control in the nonexistence of permanent infrastructure. As shown in figure 1. Describe mobile Ad-hoc network. Mobile nodes coordinate to each other to access the outside network such as internet. Mobile nodes are connected with access router, these access routers connected with core routers through access network.

Mobile ad hoc network offers quick and horizontal network deployment in conditions where it is not possible otherwise. Ad-hoc is a Latin word, which means "for this or for this Wireless networks can be classified in two types: - infrastructure network and infrastructure less (ad hoc) networks. Infrastructure network consists of a network with fixed and wired gateways. A mobile host interacts with a [1] [2] bridge in the network (called base station) within its communication radius. The mobile unit can move geographically while it is communicating. When it goes out of range of one base station, it connects with new base station and starts communicating through it. This is called handoff. In this approach the base stations are fixed.

A Mobile ad hoc network is a group of wireless mobile computers (or nodes); in which nodes collaborate by forwarding packets for each other to allow them to communicate outside range of direct wireless transmission. Ad hoc networks require no centralized administration or fixed network infrastructure such as base stations or access points, and can be quickly and inexpensively set up as needed. An Ad Hoc network is a collection of wireless mobile nodes dynamically forming a temporary network without the use of any existing network infrastructure or centralized administration. Nodes in mobile and ad hoc network communicate with one another via packet [5] radios on wireless multihop links. Because of node mobility and power limitations, the network topology changes frequently. Routing protocols therefore plays an important role in mobile multihop network communications. Routing protocols used inside ad hoc must be prepared to automatically adjust to an environment that can vary between the extremes of high mobility with low bandwidth and low mobility with high bandwidth.

The hybrid routing protocol combines the advantages of proactive routing protocol and reactive routing protocol. The routing is initially [6] established with some proactively prospected routes and then serves the demand from additionally activated nodes through reactive flooding.

Nodes in mobile and ad hoc networks communicate with one another via packet radios on wireless multihop links. While exchanging the information, the nodes may continue to move, so the network must be prepared to adapt continually. Because of node mobility and power limitations, the network topology changes frequently. Routing protocols therefore play an important role in mobile multihop network communications. Most of the protocols in this category, however, use single route and do not utilize multiple alternate paths.

A central challenge in ad hoc networks is the design of routing protocols that can adapt their behavior to frequent and rapid changes in the network. The [4] performance of proactive and reactive routing protocols varies with network characteristics, and one protocol may outperform the other in different network conditions. The optimal routing strategy depends on the underlying network topology, rate of chane, and traffic pattern, and varies dynamically. Hybrid Routing Protocol automatically finds the balance point between proactive and reactive routing by adjusting the degree to which route information is propagated proactively versus the degree to which it needs to be discovered reactively.

Hybrid protocols seek to combine the proactive and reactive approaches. An example of such a protocol is the *Zone Routing Protocol* (ZRP) ZRP divides [2] the topology into zones and seek to utilize different routing protocols within and between the zones based on the weaknesses and strengths of these protocols.

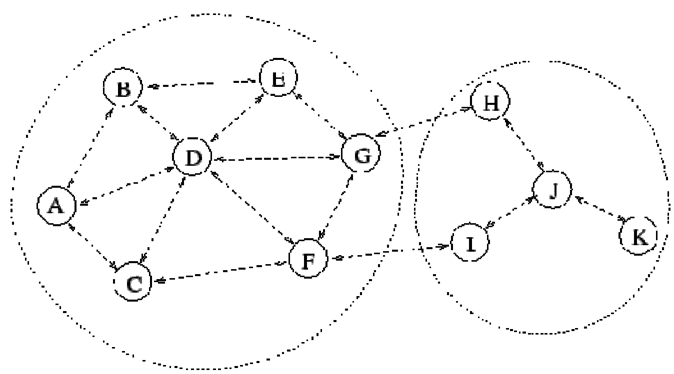

Figure 2: Zone Routing Protocol Network Scenario

ZRP is totally modular, meaning that any routing protocol can be used within and between zones. The size of the zones is defined by a parameter *r* describing the radius in hops. Figure 2 illustrates a ZRP scenario with r set to 1. Intra-zone routing is done by a proactive protocol since these protocols keep an up to date view of the zone topology, which results in no initial delay when communicating with nodes within the zone. Inter-zone routing is done by a reactive protocol. This eliminates [6] the need for nodes to keep a proactive fresh state of the entire network. ZRP defines a technique called the *Bordercast Resolution Protocol* (BRP) to control traffic between zones. If a node has no route to a destination provided by the proactive inter-zone routing, BRP is used to spread the reactive route request.

There is a fundamental trade-off between proactive dissemination and reactive discovery of routing information. While proactive protocols can provide good reliability and low latency through frequent dissemination of routing information, they entail high overhead and scale poorly with increasing numbers of participating nodes. In contrast, reactive protocols, can achieve low routing overhead, but may suffer from increased latency due to on-demand route discovery and route maintenance. Since the characteristics of a practical network vary dynamically with time, choosing an appropriate routing protocol is an important design and implementation decision. A protocol suited for a given network size, density, and mobility may behave inefficiently as the network characteristics and application behavior change.

An adaptive hybrid routing protocol requires the following three properties for successful deployment.

- **Adaptive:** The protocol should be applicable to a wide range of network characteristics. It should automatically adjust its behavior to achieve target goals in the face of changes in traffic patterns, node mobility and other network characteristics.

- **Flexible:** The protocol should enable applications to optimize for different application-specific metrics at the routing layer. These optimization goals should not be set by the network designer, but be placed under the control of the network participants.

Efficient and Practical: The protocol should achieve better performance than pure, non-hybrid, strategies without invoking costly low-level primitives such as those for distributed agreement or reliable broadcast.

II. LITERATURE REVIEW.

A performance comparison of Adhoc on-Demand Distance Vector (AODV), Destination- Sequenced Distance-Vector Routing protocol (DSDV), Dynamic Source Routing Protocol (DSR), and Optimum Link State Routing (OLSR) protocols on variable bit rate (VBR). In this paper, Author was categorized routing protocols in two categories, Table-driven and on-demand routing protocols. In table-driven protocols, each node maintain up-to-date routing information to all the nodes in the network where in on-demand protocols a node finds the route to a destination when it desires to send packets to the destination. Several table-driven protocols were discussed as ZRP and FSR are table-driven protocols that use destination sequence numbers to keep routes loop-free and up-to-date. FSR reduces the size of tables to be exchanged by maintaining less accurate information about nodes farther away. Author has presented a detailed performance comparison of important routing protocols for mobile ad hoc wireless networks. Both reactive protocols performed well in high mobility scenarios than proactive protocol. High mobility result in highly dynamic topology i.e. frequent route failures and changes. Irrespective of mobility while in AODV it increases with increase in mobility. Both AODV and DSR use reactive approach to route discovery, but with different mechanism. DSR uses source routing and route cache and does not depend on their timer base activity. On other hand AODV uses routing tables, one route per destination, sequence number to maintain route. Author analyzed the observation from simulation is that DSR has performed well compared to AODV, ZRP protocols in terms of Delivery ratio while AODV outperformed in terms of Average delay. DSR, FSR generates lower of less number of nodes all protocols performed poorer in terms of delivery ratio as nodes breakage may be more and no route may be available, again DSR ,FSR outperformed all with respect to Delivery Ratio. In case of average delay, AODV [2] [3] [5] was better than DSR. Poor performance of DSR, FSR in respect of average delay can be accounted to aggressive use of caching and inability to delete stale route. But it seems that caching helps DSR to maintain low overhead. In paper [1] we studied a replacement hybrid multipath routing protocol for MANET known as Hybrid Multipath Progressive Routing Protocol for MANET (HMPRP), in this paper author improved the performance of accepted MANET routing protocols, namely, the Ad-hoc On-demand Distance Vector routing protocol and use of their most popular properties to formulate a replacement Hybrid routing protocol using the received signal strength.

The Hybrid Multipath Progressive Routing Protocol additionally extends the battery lifetime of the mobile devices by reducing the specified variety of operations for Route determination and for packet forwarding. We studied that better performance are achieved with regard to AODV, OLSR, and ZRP routing algorithm in terms of packet delivery ratio, throughput, energy consumed and end-to-end packet delay. HMPRP achieved better performance by the elimination unwanted message exchanges and route requests and route replies. In other [2] research work, the main objective is to compare the quality of service performance parameters such as average throughput, average jitter and average delay of NOAH (No-Adhoc Routing Agent) and DSDV (Destination-Sequenced Distance-Vector routing). The NOAH protocol performed better than DSDV in term of average jitter and delay when the number of nodes increases. In term of throughput the two protocols under consideration still similar. This performance study can be enhanced by taking into account other mobility models by adding maybe other parameters like pause time.

III. PROBLEM OVERVIEW.

We described the identified problems in reactive and proactive routing protocols. Proactive routing protocols periodically up-to dates the routing tables, this increases lots of overhead, even very few data packets has forwarded in the communication while in reactive protocols, they react only when route desired by the communicated nodes. Hybrid routing protocols are a new [4] advanced protocol, which are having both feature proactive and reactive in nature. The motive to design these protocols is to increase scalability and reliability. Even reactive and proactive routing protocols have some advantageous features, those can be included in the proposed hybrid protocol.

Disadvantage: proactive Vs reactive: The proactive routing protocols maintain the complete network graph in current state, where it is not required to send packets to all those nodes. Consumes lots of network resources to maintain up-to-date status of network graph. “A frequent system-wide broadcast limits the size of ad-hoc network that can effectively use DSDV because the control message overhead grows as O (n^2). Let assume a mobile Ad-hoc network scenario that contains 100 nodes. Only few very nodes are active in communication pattern, but all nodes exchange their routing table after each beacon time (2ms - 20ms). This increases lots of [7] communication overhead in the network. After a certain number of mobile nodes, controls message/routing messages overhead grow in a exponential figure.

On the other hand, The reactive routing protocol have very high response time as route is needed to be discovered on demand, when there is some packet to be sent to new destination which does not lie on active path. Let assume a mobile Ad-hoc network scenario that contains 100 nodes. In a wireless communication, reverse communication is not same as forward direction communication. This may take very high response time to investigate a path between sender node and destination node. As well as reactive protocol, identify a new route, whenever it detects some causes/problems found in the current path. This increases packet loss percentage in an unacceptable manner.

Both these approaches have some substantial disadvantage and to overcome hybrid routing protocols designed. Hybrid routing protocols, takes advantage of proactive approach by providing reliability within the scalable zone, and for beyond the scalable zone it looks for the reactive approach. MANET is a collection of mobile nodes that can dynamically form a network to exchange information [3] without using any pre-existing fixed network infrastructure with or without centralized network controller. MANETs are becoming useful due to the existing wireless infrastructure is costly and not convenient now a days. MANET is becoming important part of next generation mobile services acceptable for voice over internet protocol, video conferencing, mobile bank transaction etc.

Due to the frequent changes in network topology and the lack of the network resources both in the wireless medium and in the mobile nodes, mobile ad hoc networking becomes a challenging task. As a result, routing in such networks experiences link failure more often than infrastructure based network. Hence, a routing protocol that supports ad hoc networks requires considering the reasons for link failure to improve its performance. Link failure results from node mobility and lack of the network resources. Therefore it is essential to analyze the characteristics to identify the quality of links. Furthermore, the routing protocols must be adaptive to cope with the time-varying low-capacity resources. For instance, it is possible that a route that was earlier found to meet certain requirements no longer does so due to the dynamic [11] nature of the topology. In such a case, it is important that the network intelligently adapts the session to its new and changed conditions. The mobile nodes must co-operate at the routing level in order to forward packets to moderate the behavior in MANET. Let assume a network scenario, a company setups a mobile ad-hoc network in a rural area to communicate through a video conferencing. As frequent changes in network topology and the lack of network resources such as power, as a result it degrades the performance of the network. In proactive routing protocol, very huge exchanges of routing messages in a very short span of time interrupt the service performance of network. While in case of reactive routing protocol, it takes too much time establish a communication path between sender and receiver that discards the IP packet, until it does not get a communication path. Due to these issues, the variation of packet transmission time is increased in exponential characteristics, which is not suitable for IP level services such as voice over internet protocol, video conferencing etc.

To overcome these deficiencies, hybrid routing protocol is introduced. It is suitable for highly versatile networks, characterized by large range of nodal mobilities and large network diameters. The protocol is a hybrid of proactive and reactive schemes, allowing adjustment of its operation to the current network operational conditions. One of the major challenges in designing a routing protocol for the ad hoc networks stems from [2] the fact that, on one hand, to determine a packet route, at least the reachability information of the source neighbors needs to be known to the source node. On the other hand, in an ad hoc network, the network topology can change quite often. Furthermore, as the number of network nodes can be large, the potential number of destinations is also large, requiring large and frequent exchange of data (e.g., routes, routes updates, or routing tables) among the network nodes. Thus, the [4] amount of update traffic can be quite high. This is in contradiction with the fact that all updates in a wirelessly interconnected ad hoc network travel over the air and, thus, are costly in resources.

IV. PERFORMANCE EVALUATION AND DESIGN

We present the design parameters of our system and the various metrics considered in the performance evaluation of the routing protocols. We begin by presenting an overview of the performance metrics considered in the comparisons. We evaluate the performance of proposed hybrid routing based on some metrics. On the basis of these metrics, we evaluated the result in favor of our proposed protocol.

Performance Metrics: Different performance metrics are used in the evaluation of hybrid routing protocol. They represent different characteristics of the overall network performance. In this report, we evaluate four metrics used in our comparisons to study their effect on the overall network performance. These metrics are packet delivery ratio, average delay, normalized routing load and network throughput. Basically a metric is a standard measurement used in a routing algorithm to determine the best possible, effective and efficient route to a destination.

(A) **Packet Delivery Ratio (PDR*)*** is defined as the ratio of data packets delivered successfully to destination nodes and the total number of data packets generated for those destinations. PDR characterizes the packet loss rate, which limits the throughput of the network. The higher the delivery ratio better is the performance of the routing protocol. PDR is determined as:

$$PDR = (Pr/Ps) \times 100$$

Where Pr is the total packets received and Ps is the total packets sent.

(B) **Average Delay (Davg)** indicates the time taken for a packet to travel from the source node to application layer of the destination node. It also includes the route discovery wait time that may be experienced by a node when a route is initially not available. The average delay is computed as:

$$Davg = (tr - ts) / Pr$$

Where *ts* is the packet send time and *tr* is the packet receive time for the same packet at destination.

(C) **Normalized Routing Load (NRL)** is the ratio of control packets to data packets in the network. It gives a measure of the protocol routing overhead; i.e. how many control packets were required (for route discovery/maintenance) to successfully transport data packets to their destinations. It characterizes the protocol routing performance under congestion. NRL is determined as:

$$NRL = Pc/Pd$$

Where *Pc* is the total control packets sent and *Pd* is the total data packets sent.

(D) Throughput A network's end-to-end throughput is a measure of the network's successful transmission rate, and is usually defined as the number of data packets successfully delivered to their final destination per unit of time. However, to convert this metric to a measure of data throughput or to compare it to other networks, the network's packet size and the network's number of nodes also has to be known.

Throughput = number of bits contained in accepted packet / simulation time.

Network Performance Affecting Factors: Throughput, error rate, delay are network performance parameters and there are some factors that affect these parameters.

(A) Throughput Performance Factors Throughput of the most networks whether local area or wide area varies with time. Sometimes there is a sudden throughput change because of the failures on the network nodes, lines or traffic congestion in the network. Throughput performance affecting factors are-

1) Node or link failures
2) Congestion
3) Bottleneck
4) Buffer Capacity

(B) **Node or link failures-** Sometimes because of some reason there is a link failure and this causes congestion in other nodes, links. Such failures can lead to also packet loss, packet delay and file transfer errors.

(C) **Network Congestion-** When a network is heavily loaded the congestion occurs due to the heavy traffic or bottlenecks. Most of the networks are designed to accommodate the average [6] [7] traffic demands. However in some cases demands increase and exceed the average network capacity. In that time, throughput of the network decreases and network load increases.

(D) **Bottlenecks-** Bottlenecks are another raeson for declining throughput in the network. It occurs due to the node failures or inadequate node and link failures.

(E) **Buffer capacity-** For each end to end connection there is a limited amount of buffer memory at the end systems and of the network interfaces. Data is temporarily stored in these buffers when sending from source to destination. In the transmission of large files, such as video frames, buffer capacity is very often inadequate.

Network Error Performance Issues: For the network performance, the errors should be as low as possible. Network errors arise-

- Individual bits in packets are inverted or lost.
- Packets are dropped.
- Packets arrive out of order.

(A) Bit Errors- Bit errors sometimes occur**.** When that happens error- detecting codes are employed and detect bit error in the packet. Then this code request retransmission of the faulty packet.

(B) Packet loss- In a connection oriented network, when packets are dropped the receiving end-system is usually able to detect such situation and informing sending side of the problem. The receiving end-system does not have precise information about which packet is dropped. A standard approach is retransmission of most packets to the receiving system. However, in connectionless networks, detection of packet loss is difficult. Reason for dropped packets is congestion in the network.

(C) Out of order packets- When long streams transferred, packets are numbered in sequence. And then receiving system arranges the received packets in a numerical order. If the receiving end system cannot be able to arrange the packet, then there is an error. Sometimes one packet might be lost, dropped that in situation the receiving end cannot rearrange the original sequence. Then receiving end requests to retransmission of either portion of the packet sequence on entire packet sequence.

V. RESULT AND ANALYSIS.

We discuss and analyze the results of our simulations. We begin our discussion by analyzing the jitter of the network. We then analyze the packet delivery ratio, packet end-to-end delay, normalized routing load and lastly the throughput of the network. We defined these parameters in section 6.1 of this report. We collected global statistics for the entire network and present average values in this report.

Average Jitter Analysis: Packet delivery ratio metric is calculated by Application layer dividing the number of

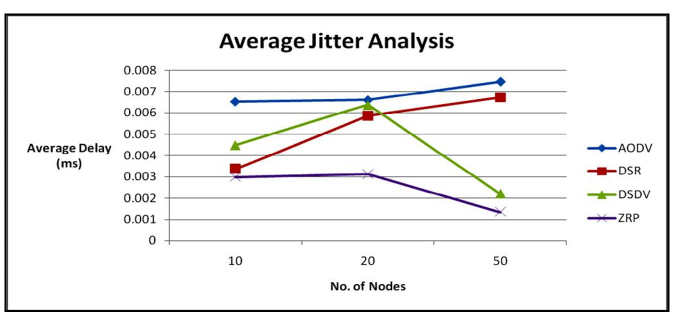

Figure 3- Average jitter vs. No. of nodes

In the above shown figure 3, we simulate the network in three defferent traffic pattern. In the first traffic pattern ten mobile nodes are used to analaze the average packet transmission delay in four defferent routing protocols. In second and third traffic pattern, we consider 20 and 50 mobile nodes respectively. From the result, we analaze that hybrid routing protocol (zone routing protocol) performs better in a heavy traffic scenario compareratively to AODV, DSR and DSDV routing protocols. AODV routing protocol perform worst in any condition. From the result, no. of nodes and average packet transmission delay are directly propotinal to each other.

In zrp protocol, when the traffic is low or no. of nodes are very few, the average delay is around 3ms, but when the traffic slightly increase zrp performs better in that situation, and the average delay of packet transmission comes down to 3ms to 1.7 ms. Moreover DSDV is good choice for real time application in heavy traffic pattern. Overall reactive protocols are not suitable for real time applications, as it takes too much time to identify a path.

Packet Delivery Ratio: Packet delivery ratio metric is calculated by Application layer dividing the number of packets received by the destination through the number of packets originated. The ratio of the data packets delivered to the destinations to those generated by the CBR sources is known as packet delivery fraction. Total number of delivered data packets divided by total number of data packets transmitted by all nodes. This performance metric will give us an idea of how well the protocol is performing in terms of packet delivery at different speeds using different traffic models.

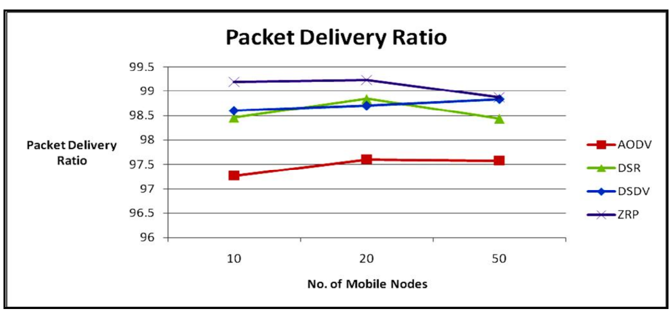

Figure 4- Packet Delivery Ratio vs. No. of nodes

In the above shown figure 4, we simulate the network in three defferent traffic pattern. In the first traffic pattern ten mobile nodes are used to analaze the packet delivery ratio in four defferent routing protocols. In second and third traffic pattern, we consider 20 and 50 mobile nodes respectively. From the result, we analaze that hybrid routing protocol (zone routing protocol) performs better in a heavy traffic scenario compareratively to AODV, DSR and DSDV routing protocols. AODV routing protocol perform worst in any condition. From the result, no. of nodes and packet delivery ratio are directly propotinal to each other.

Average End-to-End Delay

The End-to End delay metric is calculated by a packet from the time it was transmitted by a source node at the time it was received at the destination node. Network delay is the total latency experienced by a packet to traverse the network from the source to the destination. At the network layer, the end-to-end packet latency is the sum of processing delay, packet, transmission delay, queuing delay and propagation delay. The end-to-end delay of a path is the sum of the node delay at each node plus the link delay at each link on the path. This metric is calculated by subtracting "time at which first packet was transmitted by source" from "time at which first data packet arrived to destination". This includes all possible delays caused by buffering during route discovery latency, queuing at the interface queue, retransmission delays at the MAC, propagation and transfer times. This metric is crucial in understanding the delay introduced by path discovery.

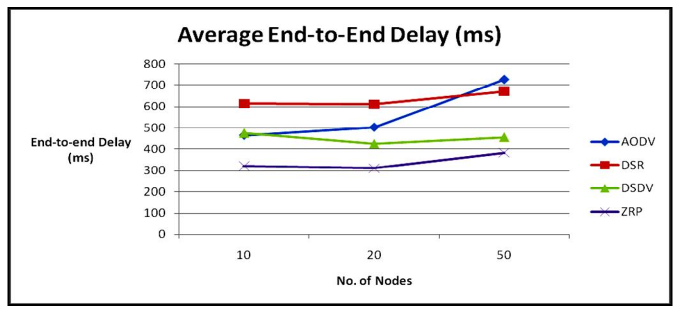

Figure 5- Average End to end delay vs. No. of nodes

In the above shown figure 5, we simulate the network in three defferent traffic pattern. In the first traffic pattern ten mobile nodes are used to analaze the average end-to-end delay (which is total taken by node delay and link delay) in four defferent routing protocols. In second and third traffic pattern, we consider 20 and 50 mobile nodes respectively. From the result, we analaze that hybrid routing protocol (zone routing protocol) performs better in a low traffic scenario compareratively to AODV, DSR and DSDV routing protocols. AODV routing protocol performs good in low traffic, but as traffic increases performance decreases on the otherhand. From the result, no. of nodes and average end-to-end delay are maintained upto a berrable level by the ZRP routing protocol, which suitable for real time application such as voice over internet protocol, video conferencing, weather forecasting etc.

In zrp protocol, when the traffic is low or no. of nodes are very few, the average end-to-end delay is around 300ms, but when the traffic slightly increase zrp performance decreases but very slow comparatively to other reactive and proactive routing protocols, and the average end-to-end delay increases from 300ms to 390ms. Moreover DSDV is good choice for real time application in heavy traffic pattern. Overall reactive protocols are not suitable for real time applications, as it takes too much time to identify a path.

In zrp protocol, when the traffic is low or no. of nodes are very few, the average packet delivery ratio is around 99.3%, but when the traffic slightly increase zrp performance decreases but very slow, and the average packet delivery ratio comes down to 99.3% to 98.7%. Moreover DSDV is good choice for real time application in heavy traffic pattern. Overall reactive protocols are not suitable for real time applications, as it takes too much time to identify a path.

Packet Loss (%): Packet loss is defined as the difference between the number of packets sent by the source and received by the sink. Packet loss is the failure of one or more transmitted packets to arrive at destination. This metric is very useful to predict the suitability of routing protocol for real time applications.

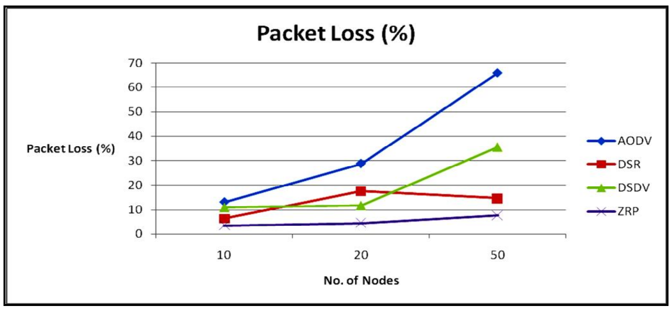

Figure 6- Packet loss vs. No. of nodes

In the above shown figure 6, we simulate the network in three defferent traffic pattern. In the first traffic pattern ten mobile nodes are used to analaze the average packet loss percentage compare with four defferent routing protocols. In second and third traffic pattern, we consider 20 and 50 mobile nodes respectively. From the result, we analaze that hybrid routing protocol (zone routing protocol) performs better in a low traffic scenario compareratively to AODV, DSR and DSDV routing protocols. AODV routing protocol performs average in low traffic, but as traffic increases performance degrads in a angel of 45 degree. From the result, no. of nodes and average packet loss% are maintained by the ZRP routing protocol, which suitable for real time application such as voice over internet protocol, video conferencing, weather forecasting etc.

In zrp protocol, when the traffic is low or no. of nodes are very few, the average packet loss% is below 5%, but when the traffic slightly increase zrp performs in a stable manner, and the average packet loss% increases from 5% to 8%. Moreover DSR is good choice for real time application in heavy traffic pattern.

Average Throughput (kbps): The throughput metric is defined as the total amount of data a receiver receives from the sender divided by the time it takes for the receiver to get the last packet. The throughput is measured in the bits per second (bit/s or bps). We analyze the throughput of the protocol in terms of number of messages delivered per one second.

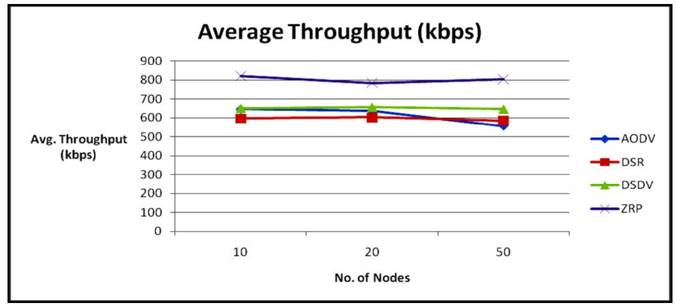

Figure 7- Average Throughput vs. No. of nodes

In the above shown figure 7, we simulate the network in three defferent traffic pattern. In the first traffic pattern ten mobile nodes are used to analaze the average throughput. In second and third traffic pattern, we consider 20 and 50 mobile nodes respectively to increase the traffic load in network in smooth manner. From the result, we analaze that hybrid routing protocol (zone routing protocol) performs better in a low traffic scenario compareratively to AODV, DSR and DSDV routing protocols. AODV routing protocol performs average in low traffic compare to DSR and other proactive routing protocol such as DSDV based on our scenario, but as traffic increases performance degrads downward fastly. From the result, no. of nodes and average throughput performance are maintained by the ZRP routing protocol, which suitable for real time application such as voice over internet protocol, video conferencing, weather forecasting etc.

In zrp protocol, when the traffic is low or no. of nodes are very few, the average throughput is above 800kbps but when the traffic slightly increase zrp performs in a zigzag manner, and the average throughput changes from 800kbps to 790kbps then again increases upto 810kbps. Moreover DSDV performs good in that situation, but comparatively slow to ZRP.

Normalized Routing Load: This metric is defined as the number of control packets created per mobile node. Control packets comprise route requests, route replies and error messages. The number of routing packets transmitted per data packet delivered at the destination. Each hop wise transmission of a routing packet is counted as one transmission. Total number of routing packets (in bytes) divided by total number of delivered data packets. Here, we analyze the average number of routing packets in bytes needed to deliver a single data packet. This is needed because the size of routing packets may vary.

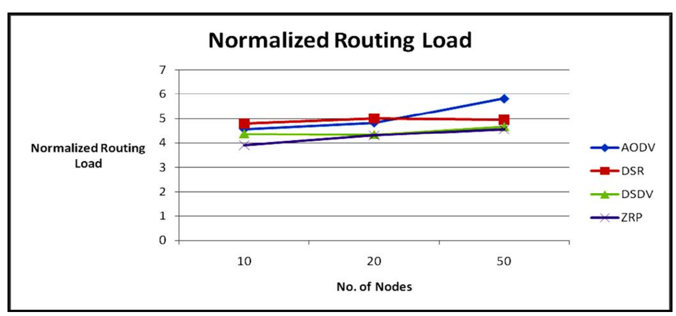

Figure 8- Normalized routing load vs. No. of nodes

In the above shown figure 8, we simulate the network in three defferent traffic pattern. In the first traffic pattern ten mobile nodes are used to analaze the total normalized routing load. In second and third traffic pattern, we consider 20 and 50 mobile nodes respectively to increase the traffic load in network in smooth manner. From the result, we analaze that hybrid routing protocol (zone routing protocol) performs better in a low traffic scenario compareratively to AODV and DSR routing protocols. AODV routing protocol performs average in low traffic compare to DSR and other proactive routing protocol such as DSDV based on our scenario, but as traffic increases performance degrads upward fastly. From the result, no. of nodes and normalized routing load performance are maintained by the ZRP routing protocol, which suitable for real time application such as voice over internet protocol, video conferencing, weather forecasting etc.

In zrp protocol, when the traffic is low or no. of nodes are very few, the average throughput is below 4 but when the traffic slightly increase zrp performs in a incremental manner, and the normalized routing load changes from 4 to 4.5or 4.7.

VI. CONCLUSION AND FUTURE WORK:

Wireless mobile ad-hoc network has very enterprising applications in today's world. With fast growing technology mobile laptop computers and wireless hardware costs are becoming very affordable. There is increasing use of wireless devices. In coming years, mobile computing will keep flourishing, and an eventual seamless integration of MANET with other wireless networks, and the fixed Internet infrastructure, appears inevitable. Ad hoc networking is at the center of the evolution towards the 4th generation wireless technology.

In this work we have provided descriptions of several routing schemes proposed for ad-hoc mobile networks. We have also provided a classification of these schemes according the routing strategy i.e., table driven and on demand. We have presented a comparison of these two main categories of routing protocols, highlighting their features, differences and characteristics. Finally we have identified possible applications and challenges facing ad-hoc wireless networks. The evaluation considers the impact of scalability, mobility and video conferencing heavy traffic load on different types of routing protocols. The simulation using ns2 consider different scenarios that attempt to cover all the aspects required for network evaluation. In this paper, analysis and investigations are carried out on the acquired simulation results of three prominent categories of routing protocols, reactive, proactive and hybrid routing protocol. All the simulations are performed over Mobile Ad-hoc networks. We consider DSDV, DSR, AODV and ZRP representative of proactive, reactive and hybrid type of Routing Protocols respectively.

From the investigation, it can be easily determined that the performance of ZRP which is a hybrid protocol is best when we compare on the basis of jitter and other metrics as packet delivery ratio, average end-to-end delay, packet loss%, average throughput and normalized routing load. AODV has the poorest performance amongst the four protocols examined. ZRP which is a hybrid protocol has moderate performance which is suitable for real time application services. We consider the network in three defferent traffic pattern 10, 20 and 50 mobile nodes respectively. In the first traffic pattern 10 mobile nodes are used to analaze the average packet transmission delay in four defferent routing protocols. From the investigation, we simulate that hybrid routing protocol (zone routing protocol) performs better in a heavy traffic scenario compareratively to AODV, DSR and DSDV routing protocols. AODV routing protocol perform worst in any condition. From the result, no. of nodes and average packet transmission delay are directly propotinal to each other. In zrp protocol, when the traffic is low or no. of nodes are very few, the average delay is around 3ms, but when the traffic slightly increase zrp performs better in that situation, and the average delay of packet transmission comes down to 3ms to 1.7 ms. Moreover DSDV is good choice for real time application in heavy traffic pattern. Overall reactive protocols are not suitable for real time applications, as it takes too much time to identify a path. AODV routing protocol performs good in low traffic, but as traffic increases performance decreases on the other hand. From the result, no. of nodes and average end-to-end delay are maintained upto a berrable level by the ZRP routing protocol, which suitable for real time application such as voice over internet protocol, video conferencing, weather forecasting etc. In ZRP protocol, when the traffic is low or no. of nodes are very few, the average end-to-end delay is around 300ms, but when the traffic slightly increase zrp performance decreases but very slow comparatively to other reactive and proactive routing protocols, and the average end-to-end delay increases from 300ms to 390ms. Moreover DSDV is good choice for real time application in heavy traffic pattern. Overall reactive protocols are not suitable for real time applications, as it takes too much time to identify a path.

In ZRP protocol, when the traffic is low or no. of nodes are very few, the average throughput is above 800kbps but when the traffic slightly increase ZRP performs in a zigzag manner, and the average throughput changes from 800kbps to 790kbps then again increases upto 810kbps.

Overall the performance of zone routing protocol is very impressive in a heavy network traffic load. Finally, ZRP is comparatively better to providing quality in video streaming over proactive and reactive routing protocols on Mobile Ad-hoc network.

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