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Performance Evaluation of Routing Protocols for WCDMA Network

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Abstract: Evaluating the performance of WCDMA wireless networks is important because it allows determining the types of applications that can be supported on such networks. BER of an average multi-hop route directly affects the ability of wireless network to support applications requiring a specific BER, for a given node transmission power and node spatial density. Given this feature, destination node can estimate stability of routes and can select the best and more stable route. Therefore we can reduce the delay and jitter of sending data packets. In this work, an attempt has been made to compare the performance of two prominent on demand reactive routing protocols and one proactive routing protocol for WCDMA scheme & these protocols are DSR, DSDV & AODV protocols. DSR and AODV is a reactive gateway discovery algorithm whereas DSDV comes under proactive category. A WCDMA scheme connects by gateway only when it is needed. our simulation results for all the three protocols based on metrics such as packet delivery rate, throughput, routing overhead and average end to end delay by using NS-2 simulator.

Keywords: WCDMA, DSDV, AODV, DSR, Throughput & Packet Delivery Ratio

I. INTRODUCTION

WCDMA Network is an important air interface technology for wireless network .In such networks reliability comes at a high price[1]. So for maintaining this reliability during congestion period we are using A number of routing protocols such as Dynamic Source Routing(DSR),Ad Hoc on-Demand Distance Vector Routing(AODV) and Destination-sequenced Distance- Vector(DSDV) have been implemented[2]. In this paper, an attempt has been made to compare the performance of two prominent on-demand reactive routing protocols for WCDMA networks: DSR and AODV along with the traditional proactive DSDV protocol. A simulation model with Mediam Access Control(MAC) and physical layer models are used to study interlayer interactions and their performance implications. The On-demand protocols, AODV and DSR perform better than table-driven DSDV protocol. Although DSR and AODV share similar on demand behavior, the differences in the protocol mechanism can lead to measurable amount of variation in performance. A variety of workload are characterized by mobility, load and size for wcdma network in a given scenario were simulated which helped to analyze the performance. Section II discusses about the related work. Section III concern with proposed work along with simulation result followed by performance evaluation of routing protocol in section IV. Finally section V gives the conclusion.

II. RELATED WORK

A number of routing protocols have been proposed and implemented for wireless network in order to enhance the bandwidth utilization, higher throughputs, lesser overheads per packet, minimum consumption of energy and others. All these protocols have their own advantages and disadvantages under certain circumstances. The major requirements of a routing protocol was proposed by Zuraida Banta et al.[4] that includes minimum route acquisition delay, quick routing reconfiguration, loop-free routing, distributed routing approach, minimum control overhead and scalability. Protocols for wcdma scheme possess two properties such as Qualitative properties (distributed operation, loop freedom, demand based routing & security) and Quantitative properties (end-to-end throughput, delay, route discovery time, memory byte requirement & network recovery time). Obviously, most of the routing protocols are qualitatively enabled. A lot of simulation studies were carried out in the paper [3] to review the quantitative properties of routing protocols.

A number of extensive simulation studies on various wireless routing protocols have been performed in terms of control overhead, memory overhead, time complexity, communication complexity, route discovery and route maintenance[5]. However, there is a severe lacking in implementation and operational experiences with existing wireless routing protocols. The various types of mobility models were identified and evaluated by Tracy Camp et al. [6] because the mobility of a node will also affect the overall performance of the routing protocols. A framework for the ad hoc routing protocols was proposed by Tao Lin et al. [7] using Relay Node Set which would be helpful for comparing the various routing protocols like AODV, OLSR & TBRPF [8].

The performance of the routing protocols OLSR, AODV and DSR was examined by considering the metrics of packet delivery ratio, control traffic overhead and route length by using NS-2 simulator [9][10][11]. The performance of the routing protocols OLSR, AODV, DSR and TORA was also evaluated with the metrics of packet delivery ratio, end-to-end delay, media access delay and throughput by also using OPNET simulator[12][13].We quantify the effect of node mobility and message length on the Bit Error Rate (BER) of an average multi-hop route using a recently developed communication-theoretic framework for wcdma wireless network. We study the network performance such as throughput, delivery ratio, and end-to end delay when position-based routing is used. Also node mobility and position error affect the performance. The variation in performance differentials are analyzed by use of varying simulation time. These simulations are carried out using NS-2 simulator. The results presented in this work illustrate the importance in carefully evaluating and implementing routing protocols in an wireless environment.

III. PROPOSED WORK

A. Routing Protocols For Wcdma Scheme:

We have presented a detailed performance comparison of important routing protocols for WCDMA wireless networks. AODV and DSR are reactive protocol while DSDV is proactive protocols. 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. Both proactive protocols fail to respond fast enough to changing topology. Routing overhead in proactive protocols remains almost constant 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. DSR has performed well compared to all other protocols in terms of delivery ratio while AODV outperformed in terms of average delay. DSR generates lower overhead than AODV while DSDV generates almost constant overhead due to proactive nature. Poor performance of DSR in respect of average delay can be accounted to aggressive use of caching and inability to delete state route. But it seems that caching helps DSR to maintain low overhead.

IV. SIMULATION RESULTS

In this section, we present our simulation efforts to evaluate and observations that compare the performance of the protocols that we described previously.

A. Packet Delivery Fraction (PDF) or Throughput as a Function of Pause Time:

PDF is the ratio between the numbers of packets originated by the application layer sources and the number of packets received by the sinks at the final destination. It describes the loss rate that will be seen by the transport protocols, which in turn affects the maximum throughput that the network can support. In terms of packet delivery ratio, DSR performs well when the number of nodes is less as the load will be less. However its performance declines with increased number of nodes due to more traffic in the network. The performance of DSDV is better with more number of nodes than in comparison with the other two protocols. The performance of AODV is consistently uniform.

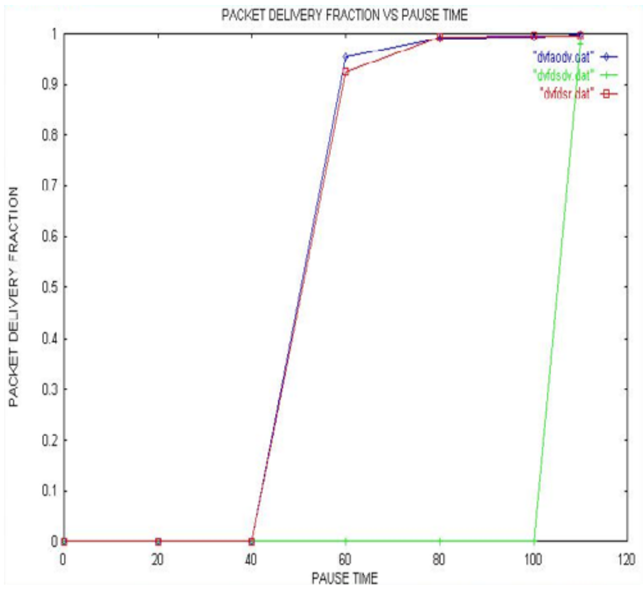

Figure-3.1 Packet Delivery Fraction Vs. Pause Time

B. Average End to End Delay:

The delay is affected by high rate of CBR packets as well. The buffers become full much quicker, so the packets have to stay in the buffers a much longer period of time before they are sent. For average end-to-end delay, the performance of DSR and AODV are almost uniform. However, the performance of DSDV is degrading due to increase in the number of nodes. Also the load of exchange of routing tables becomes high and the frequency of exchange also increases due to the mobility of nodes.

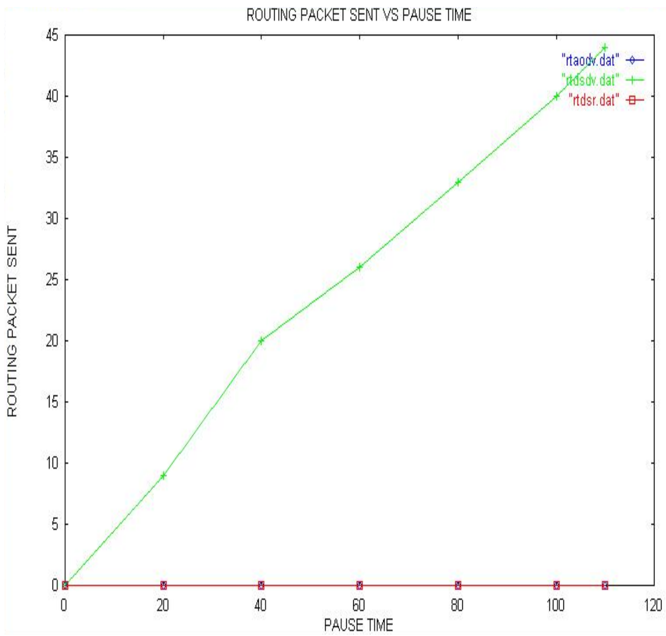

Figure 3.2 Routing Packet Sent Vs. Pause Time

C. Routing Overhead:

An important measure of the scalability of the protocol, and thus the network, is its routing overhead. It is defined as the total number of routing packets transmitted over the network, expressed in bits per second or packets per second. We evaluated that the highest amount of routing traffic is sent by AODV is followed by DSR and lastly by DSDV. The reason for incurring less overhead is that it sends the routing traffic only when it has data to transmit. This in turn eliminates the need to send unnecessary routing traffic. AODV has routing overhead slightly higher than DSR because of multiple route replies to a single route request.

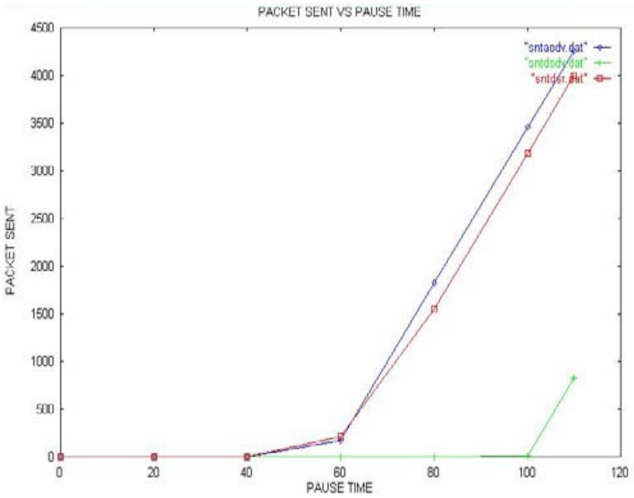

Figure 3.3 Packet Sent Vs. Pause Time

D. Packet Loss as a Function of Pause Time:

We observe that when the pause time is less, the packet loss in DSR is more as compared to AODV. But at higher pause time the packet loss in AODV increases. Since the route discovery process of AODV causes very long delays due to the amount of control packet transmitted, causes large number of packets to wait in the queue. As a result of which packets in the queue get dropped which causes more packet loss in AODV.

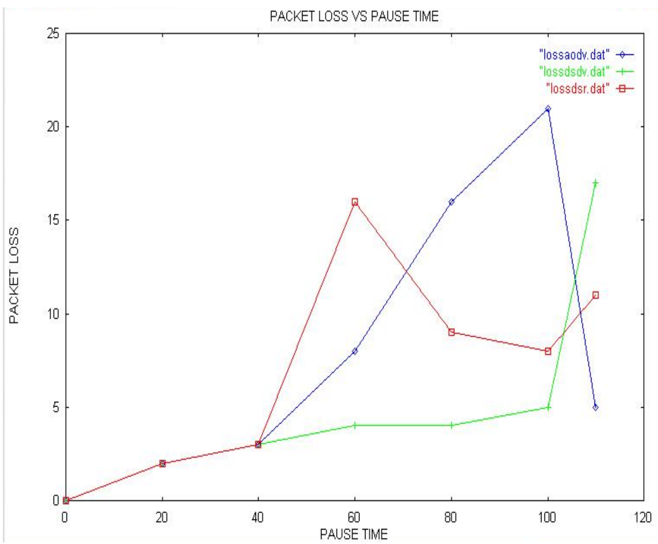

Figure 3.4 Packet Loss Vs. Pause Time

V. CONCLUSION

We have presented a detailed performance comparison of important routing protocols for WCDMA wireless networks. AODV and DSR are reactive protocol while DSDV is proactive protocols. 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. Proactive protocols fail to respond fast enough to changing topology. Routing overhead in proactive protocols remains almost constant 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.DSR has performed well compared to all other protocols in terms of delivery ratio while AODV outperformed in terms of average delay. DSR generates lower overhead than AODV while DSDV generates almost constant overhead due to proactive nature. Poor performance of DSR in respect of average delay can be accounted to aggressive use of caching and inability to delete state route. But it seems that caching helps DSR to maintain low overhead.

In DSDV, high mobility results in frequent link failures and the overhead involved in updating all the nodes with new routing information compared to AODV and DSR, where the routes are created as and when required. In application oriented metrics such as packet delivery fraction and delay, AODV outperforms DSR in more “stressful” situations (i.e., small number of nodes and lower load or mobility), with widening performance gaps with increasing stress (e.g., more load, higher mobility). However, DSR consistently generates less routing load than AODV.

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Short Bio Data for the Authors

Dr.Y.Madhavee Latha, presently working as a Principal at MRECW, Secunderabad. She received Ph.D (Signal Processing) from JNTU Hyderabad . She has more than 10 years of experience in the field of teaching. She contributed various research papers in journals & Conferences of national/international repute. Her area of intrest includes multimedia systems, communication & signal processing. She is senior member of ISTE,IETE & IEEE, Technical societies.

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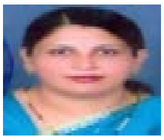

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