Comparative Study of Reactive and Proactive Routing Protocols

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Abstract - In MANET Wireless mobile nodes which dynamically forms an ad-hoc network without the help of substantiate infrastructure or centrally managed. Routing protocols in mobile ad hoc network helps node to send and receive packets. We will study about AODV, DSR (Reactive), and OLSR, DSDV, TORA (Proactive) protocols based on various mobility models [3] such as RPGM, CMM and RWP. This paper will reflect the study of reactive and proactive routing protocols for further analysis interpretation of 5 types of routing protocols they are (AODV, DSR, OLSR, DSDV and TORA) which will rely on packet delivery ratio, average end to end delay, throughput and routing overhead.

Keywords- AODV, DTN, DSR, OLSR, DSDV, TORA

I. BACKGROUND

The ad-hoc networks are collection of wireless mobile nodes which forms a temporary network without the help of any stand-alone infrastructure or a centrally managed infrastructure. Mobile Ad-hoc networks are self-organizing and self-configuring multi-hop networks where, the structure of a network can change dynamically. This is mainly due to the mobility of the nodes. Hosts in the network will utilize the randomly accessed wireless channel, cooperating in a friendly manner to engaging themselves in multi-hop forwarding. The nodes in the network not only act as hosts but also as routers that route data to/from other nodes in network.

In mobile ad-hoc networks where there is no infrastructure support as is the case with wireless networks, and a destination node is always or may be not in range of a source node transmitting packets; a routing procedure is required for finding the path so as to forward the packets appropriately between the source and the destination. Within a cluster, base station can reach all mobile nodes without routing via broadcast in common wireless networks. In the case of ad-hoc networks, each node must be able to forward data for other nodes. This creates additional problems along with the problems of dynamic topology which is unpredictable connectivity changes [1, 2, 3, 4, 5].

II. COMPARISON OF PROACTIVE AND REACTIVE PROTOCOLS

There are several attempts has been made by the researchers to compare the performance of two prominent on-demand reactive routing protocols for mobile ad hoc networks: DSR and AODV, taking in consideration to the traditional proactive DSDV protocol. On-demand protocols, AODV and DSR perform better under high mobility simulations than the table-driven DSDV protocol. DSDV performs fair with respect to all performance matrices of comparison if it has no constraints of bandwidth. The performance differentials were analyzed using varying network load, mobility, and network size. Once the route is established, the performance of the AODV protocol for different load condition shows better results throughout the simulation time except the beginning and ending time. The average end-to-end delay of packet delivery was higher in both DSR and AODV as compared to DSDV, when number of nodes increased. Routing overhead of DSDV is approximately constant at varying pause time from beginning and end of the simulation as compared to the AODV and DSR. As number of sources increases at certain limit and no big constraint of bandwidth, it results that the DSDV perform well with respect to all included performance matrices as compared to AODV and DSR. Both AODV and DSR perform better under high mobility simulations than DSDV. In lower mobility scenario generally DSR perform better than AODV due to caching strategy used by DSR but it could be possible only at low offered load. Although AODV, outperforms DSR in more "intense" in case of increasing more load and higher mobility. High mobility results in frequent link failures and the overhead involved in updating all the nodes with the new routing information as in DSDV is much more than that involved AODV and DSR, where the routes are created as and when required [6,7,8,9,10]. The impact of mobility models in performance of multicast routing protocols in MANET. Three widely used mobility models such as Random Way Point, Reference Point Group and Manhattan mobility models and three popular multicast routing protocols such as On-Demand Multicast Routing Protocol, Multicast Ad hoc On-demand Distance Vector Routing protocol and Adaptive Demand driven

Multicast Routing protocols are already implemented in NS2. Several experiments have been carried out to study the relative strengths, weakness and applicability of multicast protocols to these mobility models. The authors analyzed the impact of mobility pattern on multicast routing performance of mobile ad hoc networks and conclude that in addition to the strengths and weaknesses of the individual multicast routing protocols, the mobility patterns does also have influence on the performance of the routing protocols. The connectivity of the mobile nodes, route setup and repair time are the major factors that affect protocol performance. There is no clear winner among the protocols in our case, since different mobility patterns seem to give different performance rankings of the protocols.

The performance of different routing protocols under different mobility models. Two mobility models with high mobility and low mobility constraints have been considered, which mirror the realistic mobility patterns of the mobility nodes with high mobility and low mobility [11, 12, 13, 14, 15]. The two reactive protocols AODV and DSR are examined based on the traces derived in each of the mobility model for various speed of the mobile nodes, traffic and node density in the network. An analysis of the results obtained from the simulations shows that the AODV protocol in Boundless simulation area model is performing well than DSR. Based on the observations, it is to suggest that AODV routing protocol can be used in case of heavy node mobility its performance is better than DSR protocols and conclude that in the probabilistic Random walk model the mobility pattern does not show any edged turn and abrupt stops. The number of neighbors becomes average and hop distance is minimum. The result came in lower delay and increased packet delivery ratio. AODV yields good performance when nodes mobility might be high/low, when traffic might be high/low and when network might be sparse/dense. But the performance of DSR is good for low traffic and low mobility. When simulation area is boundless the node travels unobstructed throughout the entire simulation area and it also avoids the sharp efforts caused in all the remaining models. The traveling pattern of the mobile nodes is smoother and speed and the path to travel in next step depends on the previous speed of the node and direction of the node. Few documents provides an overview of the three protocols DSR, AODV and TORA by presenting their characteristics, functionality, benefits and limitations. The objective is to make a decision about the observations that how the performance of the protocols can be improved. It can be concluded that due to the dynamically changing topology and ad-hoc environment which is not centralized, and no security and power awareness is hard to achieve in mobile ad hoc networks. The security and power awareness mechanisms should be built-in features for all class of applications based on ad hoc network. The focus of the study is on these issues in our future research work and effort will be made to propose a solution for routing in Ad Hoc networks by tackling these core issues of secure and power aware/energy efficient routing. The evaluation and impact of different mobility models on the performance of MANET routing protocols [16, 17, 18, 19, 20]. They have proposed various protocol independent metrics to capture interesting mobility characteristics, including spatial and temporal dependence and geographic restrictions. In addition, a rich set of parameterized mobility models is introduced including Random Waypoint, Group Mobility, Freeway and Manhattan models. Based on these models several 'test-suite' scenarios are chosen carefully to span the metric space. They demonstrated the utility of test suite by evaluating various MANET routing protocols, including DSR, AODV and DSDV. Results show that the protocol performance may vary drastically across mobility models and performance rankings of protocols may vary with the mobility models used. This effect can be explained by the interaction of the mobility characteristics with the connectivity graph properties.

Finally, there attempt to decompose the routing protocols into mechanistic "building blocks" to gain a deeper insight into the performance variations across protocols in the face of mobility conclude there is no clear winner among the protocols in this case, since different mobility patterns seem to give different performance rankings of the protocols. The authors hope that "test-suite" of mobility models can be incorporated into the current scenarios used to test the MANET routing protocols. A Few literature compares the performances of three routing protocols: Destination Sequenced Distance Vector (DSDV), Ad Hoc On demand Distance Vector (AODV) and Dynamic Source Routing (DSR), based on results analysis obtained using simulations with different load and mobility scenarios performed with Network Simulator version 2 (NS-2) [21,22,23,24]. In low load and low mobility scenarios routing protocols perform in a similar manner. However, with mobility and load increasing DSR outperforms AODV and DSDV protocols. This concludes that in low mobility and low load scenarios, all three protocols react in a similar way, while with mobility or load increasing DSR outperforms AODV and DSDV routing protocols. Poor performances of DSR routing protocol, when mobility or load are increased, are the consequence of aggressive use of caching and lack of any mechanism to expire stale routes or determine the freshness of routes when multiple choices are available .and also suggest that in order to analyze and improve existing or new MANET routing protocols, it is desirable to examine other metrics like power consumption, fault tolerance, number of hops, jitter, etc. in various mobility and traffic models.

Sr. No.	Name	Load	Mobility	Remarks
1	DSR	Increasing	Increasing	It outperforms AODV and DSDV
2	AODV	Increasing	Increasing	Poor Performance as compared to DSR
3	DSDV	Increasing	Increasing	Poor performance as compared to DSR

Table 1 Represents the increasing load and mobility

Sr. No.	Name	Load	Mobility	Remarks
1	DSR	Low	Low	Act in similar way as AODV and DSDV
2	AODV	Low	Low	Act in similar way as DSR and DSDV
3	DSDV	Low	Low	Act in similar way as AODV and DSR

Table 2 Represents the similar load and mobility when values are kept low

[5] The performance evaluation of four different routing protocols i.e. Dynamic Source Routing Protocol (DSR), Ad hoc On-demand Distance Vector (AODV), Fisheye State Routing (FSR) and Zone Routing Protocol (ZRP) with respect to variable pause times. Performance of DSR, FSR and ZRP is evaluated based on Average end-to-end delay, Packet delivery ratio, Throughput and Average Jitter. And give the conclusion according to their simulation results, and found that DSR shows best performance than AODV, FSR and ZRP in terms of packet delivery ratio and throughput as a function of pause time. FSR show lowest end-to-end delay and ZRP has less average jittering than DSR, AODV and FSR. DSR and AODV performed the worst in case of average jitter and ZRP performed the worst in case of throughput.[6] It is also stated that a single routing protocol can't perform best in all situations. So, the choice of routing protocol should be done carefully according to the requirements of the specific application. [7] Now if we focus on the Reactive (AODV), Pro active (OLSR), and Hybrid (ZRP) protocols based on random waypoint mobility model. The performance evaluation of three types of routing protocols (AODV, OLSR, and ZRP) based on packet delivery ratio and average end to end to end delay. What they found out is that Reactive protocols better in terms of packet delivery ratio and throughput. [8] The author present a logical survey on routing protocols and compare the performance of AODV, OLSR and TORA and conclude that that OLSR is more competent in high density networks with highly sporadic traffic. OLSR requires that it continuously have some bandwidth in order to receive the topology updates messages.

Sr. No.	Name	Sparse	Moderate	Dense
1	AODV	Poor as compared to OLSR	Better	Poor as compared to TORA
2	OLSR	Performs Well	Poor as compared to AODV	Poor as compared to TORA
3	TORA	Poor as compared to OLSR	Poor as compared to AODV	Better

Table 3. Performance Evaluation for AODV,OLSR and TORA in different kinds of Networks

AODV keeps on improving in packet delivery ratio with dense networks. The Performance of all protocols was almost stable in sparse medium with low traffic. TORA performs much better in packet delivery owing to selection of better routes using acyclic graph. [2] The Dynamic Source Routing (DSR) protocol is a simple and robust routing protocol designed for use in multi-hop wireless ad-hoc networks of mobile nodes. Several of the optimizations proposed in the protocol tend to hamper the performance, especially in the case of high node mobility and low traffic load.

This issue has been studied extensively, and DSR shows to perform better with certain optimizations turned off. They show that DSR's performance is unsatisfactory even with these modifications. Several previous studies indicate that some of the route gathering techniques and optimizations proposed in the original protocol actually hurt the performance in many situations and make DSR underperform another commonly used routing protocol––ad hoc on demand distance vector (AODV). Because of source routing, however, DSR is considered to be desirable from security aspect. Several previous studies indicate the benefit of turning off some of the "optimization" features of DSR to improve its performance, they have shown that even with these modifications, DSR's performance is unsatisfactory (nearly 40% of the injected packets are dropped), especially at low traffic loads. (Unlike several previous studies, we investigate the protocol performance at low traffic loads.) We propose three simple and intuitive changes to the routing protocol: (a) limiting the replies sent by destinations in response to route requests from sources, (b) sorting the routes based on freshness rather than hop count, and (c) limiting the number of routes kept per destination to one. Using simulations, we show that these features improve DSR's performance.[9] The aim of this paper is to compare the Performance Metric Aodv And Dsdv Routing Protocols In MANET's Using NS-2 with different parameter of QoS metrics and analyze two types of data packet TCP and UDP . DSDV and AODV routing protocol, packet delivery ratio is independent of offered traffic load. The authors conclude that as a reactive protocol AODV transmits network information only on-demand and DSDV maintains table driven routing mechanism as proactive routing protocol.

Sr. No.	Name	TCP	UDP	Percentage of Packets Transfer	Delay	Jitter
1	AODV	No effect	No effect	70%-90%	Initially High after some time it gets low	Value remains high due to high node mobility
2	DSDV	No effect	Delay increases	50%-75%	Initially low increases gradually	Better due to low node mobility

Table 4. Performance of AODV and DSDV in case of TCP and UDP

AODV protocols delivering 70% to 90% of the packets in all cases, while DSDV delivering 50% to 75%. Delay is high initially in AODV but after some time it is very low. But in the case of DSDV, it is very low at starting and increased gradually specially for UDP packets. DSDV gives better jitter performance due to low node mobility and free channel, but variation of the packets arrival time or jitter is little bit high in case of AODV because of high node mobility and unavailability of free channel. So we can conclude that AODV indicating its highest efficiency and performance under high mobility than DSDV. Simulation results show the performance of TCP and UDP packets with respect to the average end to end delay, throughput, and jitter. Finally, it is concluded that the performance of AODV is better than DSDV routing protocol for real time applications.[10] AODV is better and efficient to deal with high congestion and it scaled better by successfully delivering packets over heavy trafficked network compared to OLSR and DSR.[11] The FSR and AODV outperform ZRP in general for all the scenarios due to its low overheads and multilevel scope technique. The reduced routing traffic overhead and only periodical propagation of link state information makes FSR suitable for the high mobile dynamic changing network topology and thus the throughput is good with the high mobility of nodes, similarly for the AODV also. The poor performance of ZRP is also because it doesn't have suitable mechanism to expire the expired routes. ZRP is suitable for the low mobility scenarios and therefore the average end-to-end delay is also very high with high mobility.

III. CONCLUSION

When we are discussing about proactive and reactive routing protocols than the actual thing which hampers the routing protocols performance is node movement if node moves less or it may not move at all than all the routing protocols performs well, but at the time of movement several other loads associated with the node that is traffic, jitter etc. are also included and then performance is compared. After reading the literature we find that FSR performs well in high mobile dynamic changing network topology and AODV shares the same.

REFERENCES

[1] R. Kumar et al., SPF: Segmented Processor Framework for Energy Efficient Proactive Routing Based Applications in MANET, Proceedings of IEEE Conference RAECS, pp. 1-6.
[2] Rohit K. Bhullar et al., Cross-Platform Application Development for Smartphones: Approaches and Implications, Proceedings of IEEE Conference, pp. 2571-2577.
[3] Rohit Kumar et. al., Specialized hardware Architecture for Smartphones, Intl. Journal of Engineering Research and Applications, ISSN: 2248-9622, pp.76-80.
[4] Rohit Kumar et al., Smartphones hardware Architectures and Their Issues, International Journal of Engineering Research and Applications, ISSN: 2248-9622, pp.76-80.
[5] Deepinder Kaur. et al., Energy Named Entity Recognition, Extraction and Classification using Conditional Random Field with Kernel Approach, IJEAR, ISSN: 0973-4562,Vol. 10, Issue:15, pp. 38193-38198.
[6] S.K. et al., Comparing Routing Protocols, IJEMER, ISSN: 2249-6645, Vol. 4, Issue: 2, pp. 36-42.
[7] K. Taneja et. al., EEGRP: Grid Based and Caching Equipped Energy Efficient Routing Protocol for MANET with Restricted Movement, Far East Journal of Electronics and Communications, ISSN: 0973-6999, pp- 1-16.
[8] R.K. et. al., Smartphone's hardware and software development Issues, IJES, ISSN: 2320-0332, pp. 69-75.
[9] Wen-Hwa Liao et al., GRID: A fully Location Aware Routing Protocols for MANET, Telecommunications Systems, pp. 1548-1557 (2001).
[10] Y.-C. Tseng et al., Power Saving Protocol for IEEE 802.11 based Multi-hop MANET, IEEE , pp. 37-60, (2001).
[11] Shiv K. Verma et al., Hybrid Image Fusion Algorithm using Laplace pyramid and PCA Method" ACM Conference March, pp. 1-6.
[12] T.-Y. Hsieh et al., An Architecture for Power-saving Communication in Wireless Mobile Ad-hoc Network Based on Location and Position Information, Micro-processors and Micro-systems, pp. 457-465, (2004).
[13] Elizabeth M. Belding-Royer et al., Distance Vector (AODV) Routing, IETF Internet draft, draft perkinsmanet aodvbis-OO.txt.,   pp. 225-234, (2003).
[14] Jean-Pierre Ebert et al., Power Saving Mechanisms in Emerging Standards for Wireless LANs: MAC Layer Perspective, IEEE Personal Communications volume 4, pp.40-48, (1998).
[15] M.E. Steenstrup et al., Distance-Vector Routing, Routing in Comm. Networks, Prentice-Hall, pp. 83-98 (1995).
[16] S. Sisodia et al., Performance Evaluation of a Table Driven and On Demand Routing protocol in Energy Constrained MANETs, Proceedings of IEEE Conference ICCCI, pp. 76-80.
[17] K. Prabhu et. al., Performance Analysis of Modified OLSR Protocol for MANET using ESPR Algorithm, Proceedings of IEEE Conference ICICES, pp.1-5.
[18] L. pawar et. al., Optimized Route Selection On The Basis Of Discontinuity And Energy Consumption In Delay Tolerant Networks, Springer : Advances in Intelligent Systems and Computing, ISSN: 2194-5357, In Press.
[19] Rohit kumar Bhullar et al. Novel Stress Calculation in Parallel Processor Systems Using Buddy Approach with Enhanced Short Term CPU Scheduling, Tailor and Fransis, CRC press, In Press.
[20] M. Kaur et al Stochastic Approach for Energy-Efficient Clustering in WSN", Global Journal of Computer Science and Technology, Vol. 14, Issue 7, pp. 1-8.
[21] Rohit K. Bhullar et al., "Novel Stress Calculation in Segmented Processor Systems Using Buddy Approach", Journal of intelligent and fuzzy systems" IOS press, ISSN: 1064-1246, In Press.
[22] Rohit kumar Bhullar et al, "Test Your Programming Quotient for C", Param Hans Publisher New Delhi, ISBN: 978-1-329-80946-8, Book.
[23] Rohit Kumar et. al, "Pen Drive With OS Controlled Inbuilt Permanent Data Storage Partition", Patent 2111/DEL/2015.
[24] Rohit Kumar et. al, "REAL TIME CLEANLINESS STATUS MONITORING SYSTEM FOR PUBLIC TOILETS", Indian Patent 1957/DEL/2015.