ASSESSMENT OF RECESS TIME DEVIATIONS ON THE MANET EFFICIENCY METRICS

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ABSTRACT: *Adhoc network refers to cluster of nodes vigorously establishing a short persisted set-up that lacks integrated infrastructure. In this scenario, nodes trust on each other for path information to update respective routing tables in dynamic environment. Due to continuous movement of nodes effective & robust protocols are required to ensure fast propagation of network topology scheme. In recent years frequent designs have been proposed for replicating the routing information among network participating nodes but very less have been instigated so far due to associated limitations and computational cost. Practically used protocols for ad-hoc routing includes AoDV, DSR, DSDV & TORA. It is extremely important to set up an appropriate routing protocol as the adaptations in routing mechanism often leads to measurable amount of disparity in network performance.This study examines influence of the recess time variations on ad-hoc network throughput by simulating diverse statuses of wireless ad-hoc cluster. Based on open source software NS-2, simulation-based experimentation was performed employing different connection patterns and mobility models of ad-hoc network. The foremost reason for degradation in performance appears the traffic control overhead necessary for maintaining precise routing tables of continually traveling nodes. The network performance has been assessed on the basis of control-overhead data associated with routing, delivery rate of network in terms of packets and end-wise average delay time. Obtained results can be set reference presenting appropriateness of routing techniques in definite circumstances.*

List of keywords. MANET, TCP, AODV, DSR, DSDV, TORA, NS2

1 INTRODUCTION

Computing devices are often interconnected to form “Network” that allows users to take optimal advantage of available resources. Wireless network is solution for data portability & “any-where” accessibility with minimal required infrastructure. Wireless network helps minimizing the down-time in comparison with bounded wired environment that relies of cables. Irrespective of the location, users can establish communication with reasonable security protection in wireless network. Two different practical implementation of wireless network as shown in fig. 1 include:

- Infrastructure- based Networks
- Infrastructure-less Networks

1.1 Infrastructure based Networks

Infra-structured network refers to cluster of nodes using stationary and bounded gateways. A portable node links a fixed gateway station inside its communication scope that helps moving node to establish connection with anticipated destinations. Moving beyond the range of a particular access point leads to dissociation with current gateway. Generally moving node remains disconnected before associating with new gateway & this swing is called as Handoff that raises problems in smooth communication.

1.2 Infrastructure-Less Networks

Ad-hoc network represents a novel paradigm of wireless communication of portable hosts [1]. Adhoc network lacks the fundamental notion of wireless network i.e. fixed access point which is conventionally responsible for centralized route management. As an alternative all moving nodes that are inside each other’s radio[2] scope interconnect with each other directly via wireless links, while those that are positioned outside range, rely on neighbor nodes to pass on messages as intermediate routers [2]. The motion of nodes inside network changes the topology frequently resulting in communication problem as route changes time and again [3]. For resolving the problem every node in adhoc network has to serve as router simultaneously by identifying paths to other operational nodes in range [4]. Ad-hoc networks have proved to be very valuable in disasters, search & rescue procedures or settlements in which users intend to propagate information rapidly.

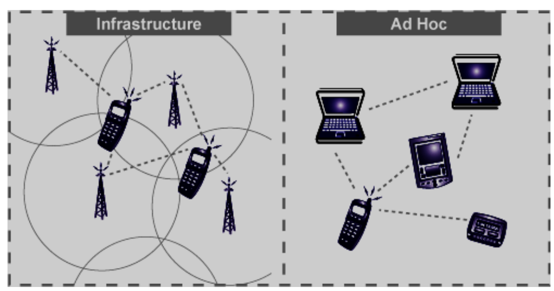

Fig.1. Infrastructure versus adhoc networks

1.3 Adhoc Network Challenges

Adhoc networks have remained emphasis of research community in recent years due to developing wireless network standards [3]. Different issues relating to adhoc networks are being explored but instead of establishing an eventual standard more questions are being raised up. Some of the important issues demanding research include the effective routing of data, energy use optimization of participating nodes and quality of service in network. Inherently routing [5] has become more complex due to the fast moving nature of participating devices [6] that demands multi hop behavior from all devices. Academically, projected routing techniques for ad-hoc networks can be categorized in two sets [8, 9]. Table driven techniques are based on pro-active mechanism but it costs extra computation whereas On-demand protocols rely on re-active nature mechanism & offers fast convergence. fig. 2 shows taxonomy of MANET protocols accordingly

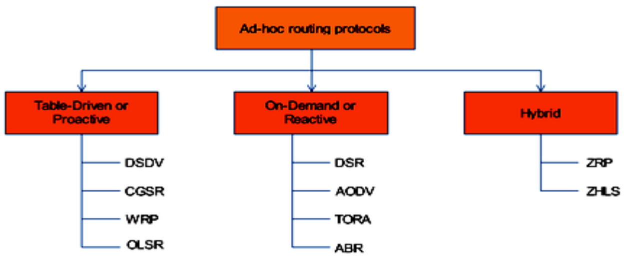

Fig.2. Routing Protocols for MANET

In case of pro-active nature, every participant retains update information of all nodes it recognizes in the network [10]. After a specific interval of time this route information is updated periodically for incorporating the changes in network state. This auto update feature costs devices in terms of energy & computational resources & in turn it offers immediate path to destination node in network. It also increases the control overhead in the network limiting the available bandwidth for effective transmission. In contrast, reactive protocols establishes the route only at the time of need that ensures to conserve node energy but it generally takes longer to accomplish complete transmission from source to destination. Research community is aiming to find an appropriate balance in terms of weighted pro& reactive protocols.

1.4 Wireless Internet

Innovative challenges have been posed for research community by the idea of "wireless-internet". An imperative issue is to handle the wireless mobility that stresses robust routing of data among different networks or even inside a single network. Inter-network routing issue has been resolved in terms of Mobile IP protocol however routing inside wireless network is being focused by research community.

1.5 Domain Mobility

Internet embraces of dissimilar set-ups commissioning diverse technologies [11] where every independent network is treated as "Administrative Domain". Irrespective of their geographic location all networks are interlinked together using dedicated protocols. IP is most prevailing internet protocol that hides the physical differences of networks & offers a global addressing scheme on top. For internet connectivity a legal IP based address is pre-requisite but this also restricts mobility of nodes. Depending upon the type of transition, a node may require IP based updated route or even new logical address for proper identification in new network. Accordingly device mobility can be placed in one of following categories.

1.5.1 Macro Mobility.

Displacement of an internet node between different administrative authorities is demarcated as Macro mobility. Macro-mobility often demands a change in Internet protocol (IP) address & dedicated procedures are defined for handling Macro-mobility..

1.5.2 Micro Mobility.

Transition inside a single administrative domain where there is no need of IP address alteration is termed as micro mobility. Micro mobility often requires adjustment in route due to the change in position and neighbors. Routing becomes core important for handling micro mobility and a robust mechanism should minimize the impact of mobility in network. Impact on routing protocol performance can be examined by changing the mobility constraints including pause time of node & moving speed in network.

2 EXPERIMENTS & ANALYSIS

2.1 Experimentation Setup

Our experimentation consists of open source based simulations employing Red-Hat Linux & discrete event network simulator NS-2. NS2 allows simulating various network scenarios for evaluating network performance as it provides inherent support for TCP, unicast and several multicast protocols. This investigation is focused on four prominent MANET routing protocols including DSR (DistanceSourceRouting), DSDV(DestinationSequence DistanceVector), AoDV(AdhocOn-demandDistance Vector) & TORA (TemporallyOrderedRoutingAlgorithm).

2.2 Measures of Interest

The impact of micro mobility on ad-hoc network has been surveyed in this study by evaluating three important network parameters that define the network performance. It is important that chosen evaluation metrics should be considerate to all aspects of network performance therefore we have chosen:

- Packet delivery fraction (PDF)
- End-wise Delay time (EED)
- Routing-Control-Overhead(RO)

2.2.1 Packet Delivery Fraction:

Packet delivery Ratio represents the proportion of packets acknowledged at the destination to total number of engendered by traffic generators in adhoc network. For this we have considered the quantity of "sent" and "received" packets in the trace file and then quotient is obtained.

2.2.2 End-wise Delay Time:

This measure metric accounts all conceivable delay(s) occurred due to the transitional buffering or route discovery at intermediate nodes of network[13]. It also counts MAC layers associated delays and this total delay has been calculated by inspecting trace files of simulation that records sent & received time packet-wise in the network.

2.2.3 Routing Overhead.

Network topology is to be established within every node of MANET before transmission of data from source to any destination as every device simultaneously behaves as router. Dynamic nature of MANET requires continuous updating of routing tables within nodes of MANET. So this topology information is often interchanged among nodes for a smooth MANET behavior but this result in increased network traffic. This exchange of routing paths is termed as control overhead as it does not contains data from source to destination but the topology information only. Trace file has been examined for packets having associated tags of routing for calculation of total overhead.

2.3 Testing Environment

It is important to mention that this study has been performed for certain scenarios of MANET and adaptations in input conditions can reflect deviations in resultant metrics. For example for a wider area there is potential possibility of packet drop resulting in reduced PD ratio whereas a reasonable range ensures optimal PD ratio. Conversely, control overhead is inherently associated with the protocol being employed & ranks the protocol in terms of other parameters.

2.4 Traffic Pattern for MANET

It is necessary to establish wireless network based traffic model in NS-2 for running a MANET simulation. Provided utility namely "cbrgen.tcl" was used to generate different traffic-patterns for our experimentation. This utility can be located according to the path provided in [11,12,13] i.e. ".\ns2\indep-utils\cmu-scen-gen\". Different traffic models are created with the help of cbrgen as shown in fig.3.

2.5 Mobility Pattern for MANET

Once appropriate traffic model has been generated for adhoc network, pause time based mobility model is defined for nodes that represents the dynamic behavior of network. A short pause time refers to highly dynamic network whereas longer delays represent stable and static networks with less dependency on routing updates. Utility mentioned in [13] is used from "\ns2\indep-utils/cmu-scen-gen/setdest" as shown in fig. 4.

```
ns cbrgen.tcl [-type cbr] [-nn nodes] [-seed seed] [-mc connec-
tions] [-rate rate]
```

Parameter	Values
Type of Traffic	CBR
Number of Node	60
Number of connection	10,20,30,40
Seed	10
Rate	8Kbps

```
ns cbrgen.tcl -type cbr -nn 60 -seed 0.1 -mc 10 -rate
0.000125 >cp1
```

Fig.3. Traffic generation model for MANET

3 RESULTS & CONCLUSIONS

3.1 Analysis of results

The section beneath reveals results obtained after experimentation on different set-ups of ad-hoc networks. Recess-time or Pause time intimates the amount of time a node remains static before starting motion in new direction in MANET range. Different values for pause time have been tested to examine the impact on the network throughput, measured in terms of three selected metrics.

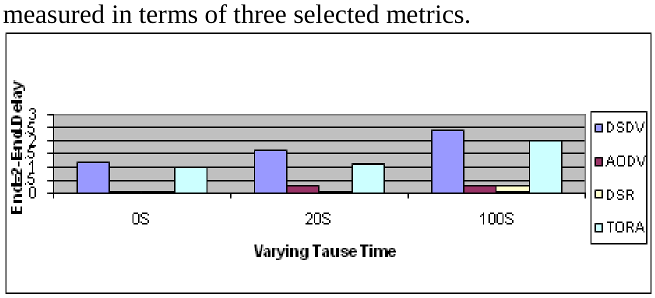

Fig 3.1.1.End-wise delay(10 data-sources w.r.t recess time)

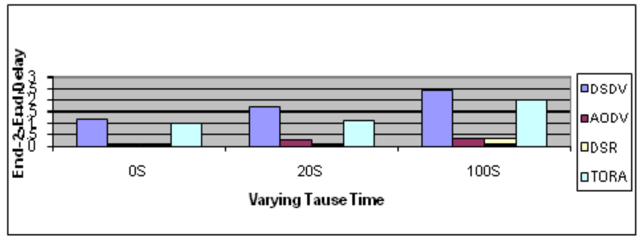

Fig 3.1.2 End-wise delay(20 data-sources w.r.t recess time)

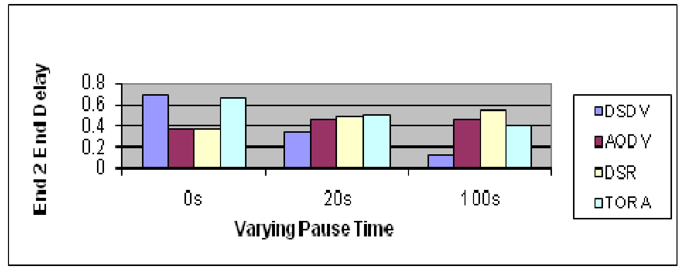

Fig 3.1.3 End-wise delay(30 data- sources w.r.t reces time)

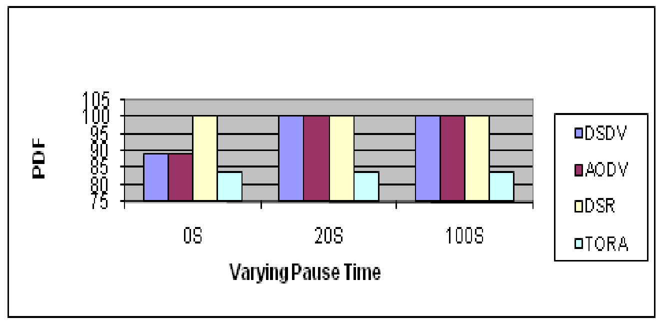

Fig 3.1.4 End-wise delay(40 data- sources w.r.t reces time)

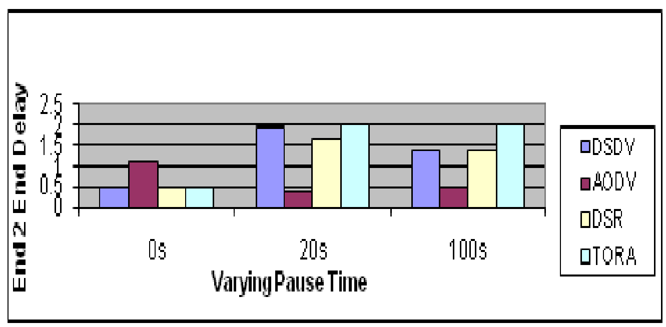

Fig 3.2.1. PDF for 10 data-sources w.r.t recess time.

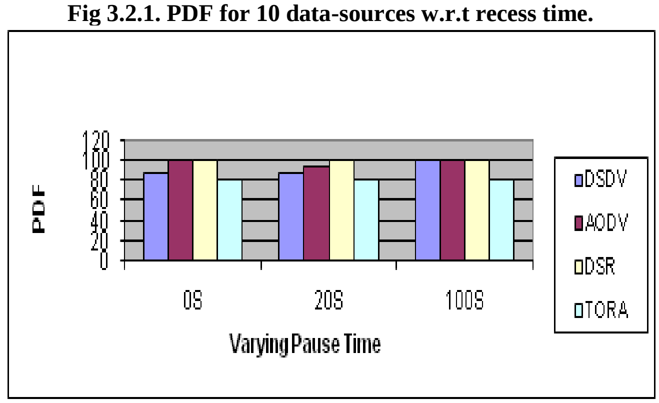

Fig 3.2.2. PDF for 20 data-sources w.r.t recess time.

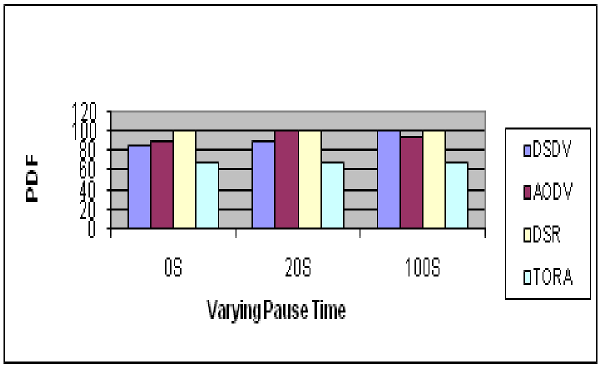

Fig 3.2.3. PDF for 30 data sources w.r.t recess time.

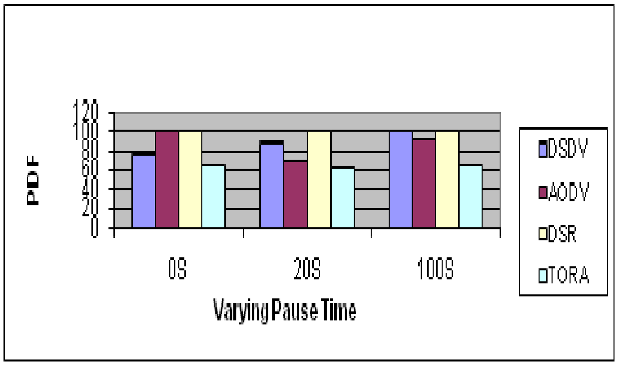

Fig 3.2.4. PDF for 40 data-sources w.r.t recess time.

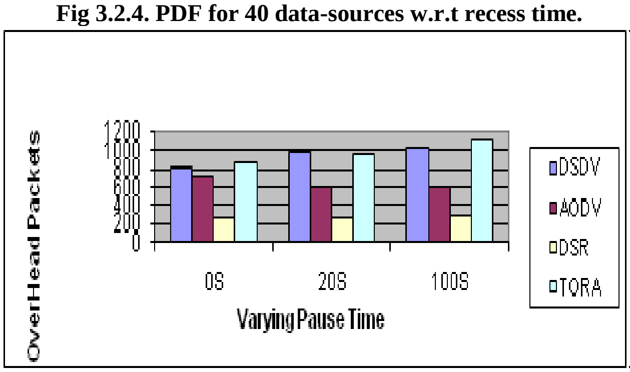

Fig 3.3.1 Routing-overhead generated w.r.t recess time in 10 nodes

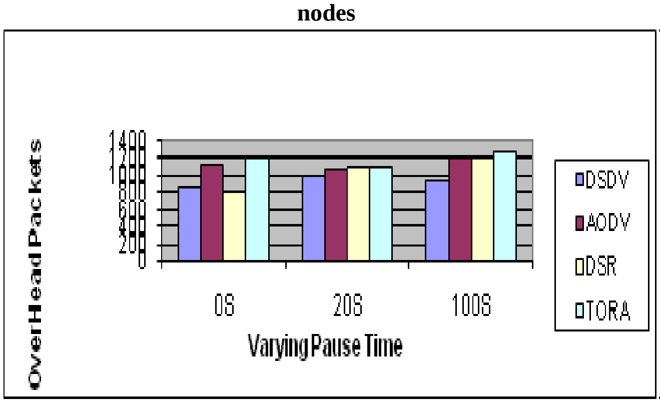

Fig 3.3.2 Routing-overhead generated w.r.t recess time in 20 nodes

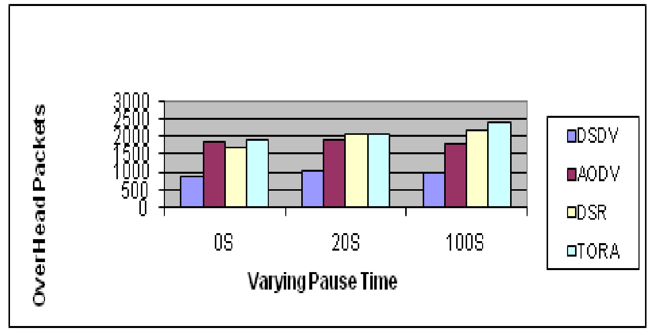

Fig 3.3.3 Routing-overhead generated w.r.t recess time in 30 nodes

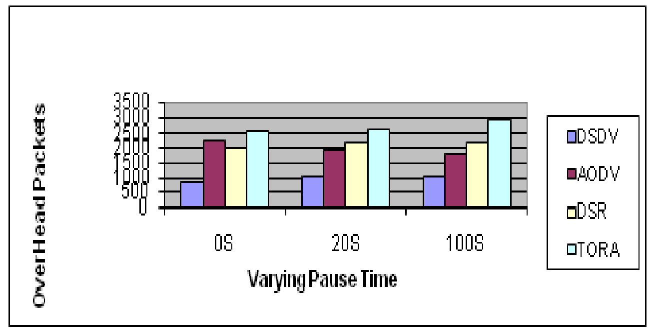

Fig 3.3.4 Routing-overhead generated w.r.t.recess time in 40 nodes.

```
./setdest -n <num_of_nodes> -p <pause time> -s
<max speed> -t <sim time> -x <maxx> -y <maxy> > fi-
lename
```

Parameter	Values
Number of Nodes	60
Pause Time	0,10,20,40,100 seconds
Maximum Speed	10 m/s
Simulation Time	100 seconds
Maximum X-axis	500
Maximum Y-axis	500

```
./setdest -n 60 -p 0  -M 10 -t 100 -x 500 -y
500 > scl
```

Fig.4. Mobility definition model for MANAT

3.2 CONCLUSION

After recess time variation based experimentation it is clear that routing techniques are greatly pretentious to network mobility & highly dynamic networks (ad-hoc networks) should be equipped with exceptional routing mechanism. However it can be visualized from obtained results that DSR & AoDV performs better even at high mobility that makes them suitable choice for dynamic networks. Due to the fact that DSR rely on source routing technique, the controls overhead starts increasing exponentially when the network proliferates. In contrast AoDV offers modest control information & reasonable endwise delay time. These results can be used for further developments in the field.

REFERENCES:

[01] Lidong Zhou & Zygmunt J. Haas, *“Securing, Adhoc Networks”*, Department of Computer Science, School of Eectrical Engineering, Cornell University, Ithaca, NY.

[02] Atul Yadav, Parag Joshi, *“Performance of Flat Routing Protocols in MANET”*, International Journal of Electronics and Computer Science Engineering. http://www.ijecse. org/wp-content/uploads/2012/09/**Volume-1Number-4**PP-2035-2041.pdf.

[03] Wenjia Li and Anupam Joshi, *“Security Issues in Mobile Ad Hoc Networks - A Survey”,* http://www.csee.umbc.edu/~wenjia1/699_report.pdf.

[4] Amutha, S. Balasubramanian, *"Secure implementation of routing protocols for wireless Ad hoc networks,"* Information Communication and Embedded Systems (ICICES), 2013 International Conference on 21-22 Feb. 2013, pp.960-965.

[5] Chenna Reddy P, ChandraSekhar Reddy P, *"Performance Analysis of Adhoc Network Routing Protocols", Adhoc and Ubiquitous Computing 2006, ISAUHC '06*, International Symposium on 20-23 Dec. 2006,pp.186-187.

[06] B. Ahlgren, J. Arkko, L. Eggert and J. Rajahalme, *"A Node Identity Internetworking Architecture,"* INFOCOM 2006. 25th IEEE International Conference on Computer Communications. Proceedings, Barcelona, 2006, pp. 1-6.

[07] Gurpinder Singh, Jaswinder Singh, *“MANET:Issues and Behavior Analysis of Routing Protocols”,* International Journal of Advanced Research in Computer Science and Software Engineering **Volume 2, Issue 4**, April 2012.

[08] Narendra Singh Yadav, R.P.Yadav, *“Performance Comparison and Analysis of Table- Driven and On-Demand Routing Protocols for Mobile Ad-hoc Networks”* http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.110.13&rep=rep1&type=pdf.

[[9] “*Mobile Adhoc Networks Challanges, Applications & Their Routing Protocols”,* http://gnindia.dronacharya.info/download/Research/ DEC_Research_Journal_Book_1905 2011 .pdf

[10] Ping Zhang, Barolli L, *"A Survey of Internet Mobility"*, Network-Based Information Systems, 2009.NBIS '09. International Conference on 19-21 Aug. 2009, pp.147,154,

[11] Mrs. Saba Siraj, Mr. Ajay Kumar Gupta, Mrs Rinku Badgujar, *“Network Simulation Tools Survey”,* International Journal of Advanced Research in Computer and Communication Engineering, *Vol. 1*, *Issue 4*, June 2012.

[12]www.isi.edu/nsnam. Network Simulator for Wireless Networks

[13] Ruoshan Kong, "The Simulation for Network Mobility Based on NS2", Computer Science and Software Engineering, 2008 International Conference on 12-14 Dec. 2008, pp.1070-1074.