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Proposal for Modified Routing Algorithms for Multipath on Demand MANET Topology

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Abstract:
Multipath Variation of the standard Ad Hoc Distance Vector routing protocol severely affected by on demand state variations of the nodes. Therefore it becomes obvious to design a routing mechanism based on the AODV protocol stack with node as metric consideration. The resulting AOMDV protocol we obtain improves its performance efficiency as the rule updating mechanism is modified and now takes into account through a descending value and takes the final value as the one with largest metric of weight. The result is then simulated in a simulator like NS-2 and simulation results are compared against existing AODV protocol system.

Key words : *Routing, Ad-hoc, on demand routing, MANET, AODV, AOMDV, NS2*

1. Introduction

Ad hoc networks of a mobile environment are characterized by presence of a distributed protocols and their complex working in a flexible and bandwidth restricted environment[2]. One point to keep in mind is that a node is capable of acting as both a host as well as a simultaneous passive router in this kind of topology. Communication in a mobile ad hoc environment is through multiple hops and/or a beehive based arrangement where resources like bandwidth are pooled and shared. For special communication requirements such as warzone and medical applications, encryption of this data is also supported. And this communication has been possible due to the advances in the field of routing[3]. The paper presents the architecture of the standard AODV protocol architecture and highlights it shortcomings. As an effort to minimize these shortcomings we present a system which is based on certain assumptions, some of which are obvious. Related Work

In AODV algorithm a function arranges the routing paths in best orders of preference and if the first path is down the next best alternative path is taken[6]. The approach is redesigned in AOMDV as it discovers multiple paths simultaneously. A large number of studies have mathematically proved that this is not always the best approach and discussion of that topic is beyond the scope of this paper. Take for example a mobile network where the shortest path computed by AODV may not be the best one as its energy may not be sufficient for transmission[1]. Therefore it becomes necessary to introduce node status as a metric during routing. Moreover, both AODV and AOMDV are based on RREQ packet broadcasting techniques and this may lead to network congestion. The amount of packets transmitted during broadcast storms can be limited by various flow control techniques[5].

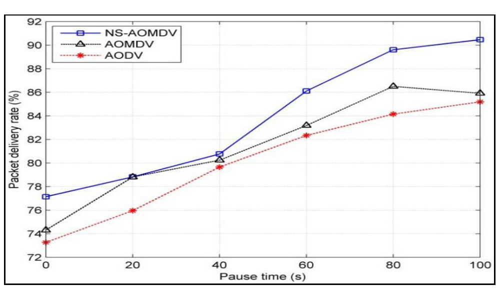

Figure 1

The above figure shows the comparison the efficiency in packet delivery of the standard algorithms against time in a standard simulation of existing protocol and a new protocol named NS-AOMDV

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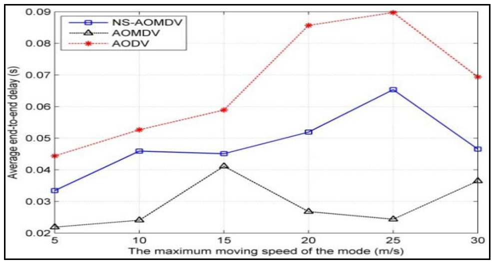

Figure 2

The above figure shows the standard simulation output of node end to end delay against time in a standard simulator. We can see that AODV has highest delay due to broadcast storm based choking.

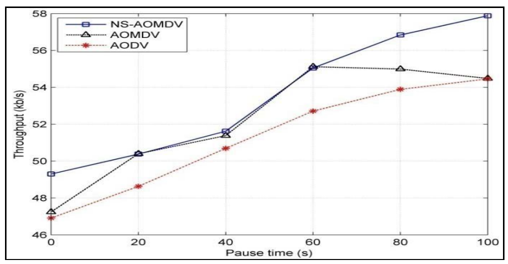

Figure 3

The above figure shows the comparison of thoroughput to pause time in seconds AODV and the new redesigned node metric based AODV compare equally well but the advantage becomes obvious when the pause time exceeds a critical value.

2. Assumptions for Network Modelling

The modelling of the system of this kind requires certain assumptions due the complexity of the protocol design involved.

- The network topology is assumed to be an undirected graph of a sense in which algorithms like Kruskal's and Dijikstra's are applicable. In this architecture T represents number of nodes and S are links in the topology.
- Every node contains a MAC address, associated NIC and an interface buffer queue for processing.
- The ad hoc is generalized as P2P and follows 802.11 architecture.

3. Parameters of A Node

The chief characteristic of a node under consideration is rate of residual energy. Each node absorbs and releases energy in respect to other nodes, a phenomenon called sensing. To appreciate the choice of this metric we must first understand what residual energy is. The formula for residual energy of a system is:

$$\omega(t) - \frac{E(t)}{E}$$

Where

- ω (t)=Residual power
- E (t) = Power at time t
- E= original power

We can easily find that the above computed metric can also reveal the position of a node in a network topology in a indirect fashion. When there is a indication of a excessive power consumption we can assume that the system is in a region of heavy congestion.

4. The Idle Rate of Buffer Queue

The buffer queue is length of buffer expressed in unit X at a time t.The idle rate of the same buffer queue is expressed by the formula:

$$l(t) = \frac{L_{max} - L(t)_i}{L_{max}}$$

In this formula, L max is the maximum length of the buffer queue we allow. The physical significance of such an expression is to express the network congestion in a mathematical form which can later be utilized as an analysis expression for the protocol designed comparison.In an ad hoc network a host is defined as a physical entity with an associated MAC address and an available interface queue for parsing and modules for data transfer and reception. Smaller length of buffer queue means greater processing time worse network performance. However, too large a queue can lead to de utilization a suboptimum results.

5. Node Health

The above two metrics represent the current state of a mobile ad-hoc terminology. However both these metrics are not use independently. Therefore we combine the above two metrics into a single metric called node health.

$$NH_i(t) = \alpha e_i(t) + \beta q_i(t)$$

Where α+β<1 and both are also less than 1. If α<β buffer queue is main factor to take into account else energy of the node is the dominating factor.

6. Route Selection Mechanism and Efficiency

Node based path computation is on the familiar properties of the spanning tree. Each path has an associated weight and so does a node. Let the node weight be defined by X and least of it be defined as S.

$$S_i = \{\min(X_i(t)) | i \in TOPOLOGY\}$$

Where

- S t is the path weight at time t, and
- TOPOLOGY is the set of nodes on the current path.

The algorithm updates and recomputed the node path at the time of route update, which is considerable difference from standard AODV. Whereas AOMDV creates multiple paths, the modified approach creates a unified path capable of real-time updating at the routing phase.In other words, the path which first reaches the destination node is chosen for the primary path and the other paths will become alternate ones. In this way, we can quickly create a path for data transmission.In vague definition the first available path is defined in the topology as the primary and the remaining paths are defined as the secondary path.
When multiple RREP packets are received, we utilize the path which owns the largest X. The X is in the descending order and the best path are calculated.

$$routepath_{list} = \max\{PW_i | p \in PATHGRP\}$$

Where, l

- routepath represents is shortest path for data transmission.
- And PATHGRP group of active paths in the routing table.

7. Conclusion

The paper presented a novel architecture for modifying the approach for routing using the AODV and AOMDV protocols. We showed how the metric for routing was modified and presented the new results.

8. Acknowledgement

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9. References

1. Bernard Fortz, Jennifer Rexford, and Mikkel Thorup, "Traffic Engineering With Traditional IP Routing Protocols," Princeton Education Publication.
2. M. Ericsson, M. Resende, and P. Pardalos, A genetic algorithm for the weight setting problem in D. O. Awduche, MPLS and trafc engineering in IP networks, IEEE Communication Magazine,pp. 4247, December 1999.
3. O. Awduche, A. Chiu, A. Elwalid, I. Widjaja, and X. Xiao, Overview and principles of Internet traffic engineering. Request for Comments 3272, May 2002.
4. Prasum Sinha, Raghupathy Sivakumar, and Vaduvur Bharghavan. CEDAR: A core-extraction distributed ad hoc routing algorithm. In Proc. IEEE Infocom, March 1999.
5. Charles E. Perkins and Pravin Bhagwat. Highly dynamic Destination-Sequenced Distance-Vector routing (DSDV) for mobile computers. In Proc. ACM SIGCOMM Conference (SIGCOMM '94), pages 234–244, August 1993.
6. Brahim Bensaou, Yu Wang, and Chi Chung Ko. Fair medium access in 802.11 based wireless ad-hoc networks. In First Annual IEEE and ACM International Workshop on Mobile Ad Hoc Networking and Computing (MobiHoc), August2000

7. Jinyang Li, Charles Blake, Douglas S. J. De Couto, Hu Imm Lee, and Robert Morris. Capacity of ad hoc wireless networks. In Proceedings of the 7th ACM International Conference on Mobile Computing and Networking, pages 61–69, Rome, Italy, July 2001.
8. Anastassios Michail and Anthony Ephremides. Algorithms for routing session traffic in wireless ad-hoc networks with energy and bandwidth limitations. In Proceedings of 12th IEEE International Symposium on Personal, Indoor and Mobile Radio Communications, 2001.
9. Kwan-Wu Chin, John Judge, Aidan Williams, and Roger Kermode. Implementation experience with MANET routing protocol