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MOBILITY BASED PERFORMANCE OF BELLMAN FORD FOR MANET

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ABSTACT

A mobility pattern has a high relative speed, the nodes might move out of range more quickly. Thus an already existing link may remain stable for a relatively shorter duration. This may lead to more packets being dropped due to link breakage, resulting in lower throughput. Higher control overhead is needed to repair the more frequently broken link. We also note that the worst performance of the protocols. This paper shows the effect of mobility and also effect of End to End Delay on protocol of Bellman Ford.

KEYWORDS: MANET, Bellman Ford Algorithm, MANET Protocols

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Original Article

INTRODUCTION

An ad-hoc wireless network is a collection of two or more devices equipped with wireless communications and networking capability. Such devices can communicate with another node that is immediately within their radio range or one that is outside their radio range. In this, an intermediate node is used to rely or forward the packet from the source toward the destination. An ad-hoc wireless network is self-organizing and adaptive. This means that a formed network can be deformed on the fly without the need of any system administration [11, 12]. The term “ad-hoc’ tends to imply “can be mobile, standalone, or networked.” Ad hoc nodes or devices should be able to detect the presence of other such devices and to perform the necessary handshaking to allow the sharing of information and services.

Routes between two hosts in MANET may consist of hops through other hosts in the network. The task of finding and maintaining routes in MANET is nontrivial since host mobility causes frequent unpredictable topological changes. A number of MANET protocols for achieving efficient routing have been recently proposed. They differ in the approach used for searching a new route and/or modifying a known route, when hosts move. It is assumed that each node is aware of the geographic location of all other nodes in MANET.

Figure 1: Mobile Ad hoc Network

ROUTING PROTOCOLS FOR MANET

Routing protocols can be divided into proactive, reactive and hybrid protocols, depending on the routing topology as shown in figure 2.

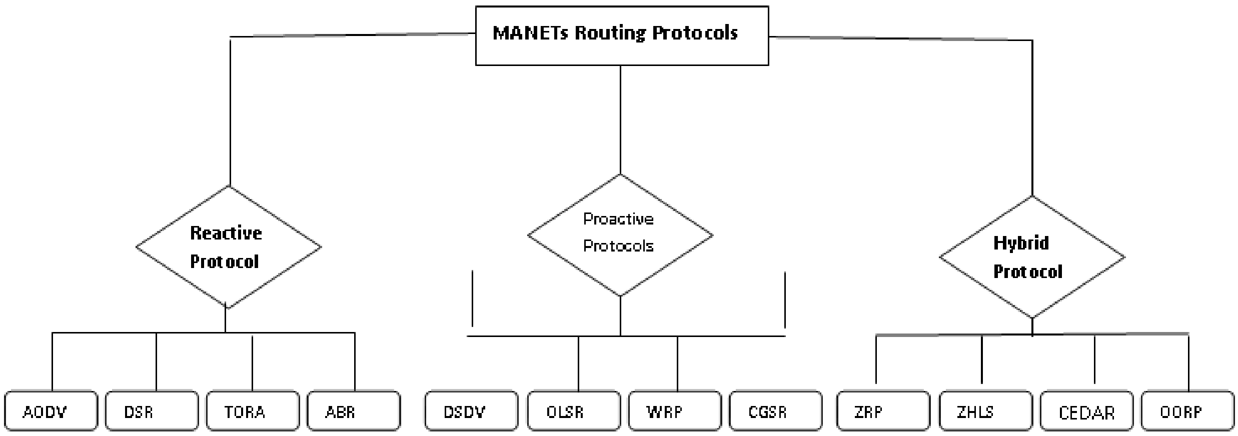


Figure 2: Routing Protocols

Bellman Ford Proactive Protocol: DV is a decentralized routing algorithm, that requires that each router simply inform its neighbors of its routing table. For each network path, the receiving routers pick the neighbor advertising the lowest cost, then add this entry into its routing table for re-advertisement. To find the shortest path, DV is based on one of two basic algorithms: the Bellman-Ford (RIP) and the Dijkstra algorithms (OSPF).

In RIP (The Routing Information Protocol), DV is known as the "Bellman-Ford" algorithm (1957) or Ford-Fulkerson Algorithm (1962), after its inventors. It is used in many routing protocols in practice, including Internet BGP, ISO IDRP, NOVELL IPX, and the original ARPANET. Currently, Apple talk and Cisco are also used this algorithm.

Main Features of DV

DV algorithm is iterative, asynchronous, and distributed.

- **Distribution:** This algorithm enables each node receives some information from one or more of its directly attached neighbors.
- **Iteration:** The process of exchanging information will continue until no more information is exchanged between the neighborhoods.
- **Asynchronous:** This algorithm does not require all of the nodes to operate in lock step with each other.

What is RIP?

RIP is a distance-vector protocol that allows routers to exchange information about destinations for computing routes throughout the network. Destinations may be networks or a special destination used to convey a default route. In RIP, Bellman-Ford algorithms make each router periodically broadcast its routing tables to all its neighbors. Then a router knowing its neighbors' tables can decide to which destination neighbor to forward a packet.

How Bellman-Ford Algorithm works

Routers that use this algorithm have to maintain the distance tables (which is a one-dimension array -- "a vector"), which tell the distances and shortest path to sending packets to each node in the network. The information in the distance table is always updated by exchanging information with the neighboring nodes. The number of data in the table equals to that of all nodes in networks (excluded itself). The columns of table represent the directly attached neighbors whereas the rows represent all destinations in the network. Each data contains the path for sending packets to each destination in the network and distance/or time to transmit on that path (we call this as "cost"). The measurements in this algorithm are the number of hops, latency, the number of outgoing packets, etc.

Formal Algorithm

- The starting assumption for distance-vector routing is each node knows the cost of the link of each of its directly connected neighbors. Next, every node sends a configured message to its directly connected neighbors containing its own distance table. Now, every node can learn and update its distance table with cost and next hops for all nodes network. Repeat exchanging until no more information between the neighbors.
- Consider a node X that is interested in routing to destination Y via a directly attached neighbor Z. Node X's distance table entry, Dx (Y,Z) is the sum of the cost of the direct-one hop link between X and Z, c(X,Z), plus neighboring Z's currently known minimum-cost path (shortest path) from itself(Z) to Y. That is Dx(Y,Z) = c(X,Z) + minw{Dz (Y, w)} The minw is taken over all the Z's This equation suggests that the form of neighbor-to-neighbor communication that will take place in the DV algorithm - each node must know the cost of each of its neighbors' minimum-cost path to each destination. Hence, whenever a node computes a new minimum cost to some destination, it must inform its neighbors of this new minimum cost.

Protocol Property of Bellman Ford

Table 1

Protocol Property	Bellman Ford
Loop Free	Yes
Multiple Routes	No
Distributed	Yes
Reactive	No
Unidirectional Link Support	No
QoS Support	No
Multicast	No
Security	No
Efficiency	No
Periodic Broadcast	Yes

REVIEW OF LITERATURE

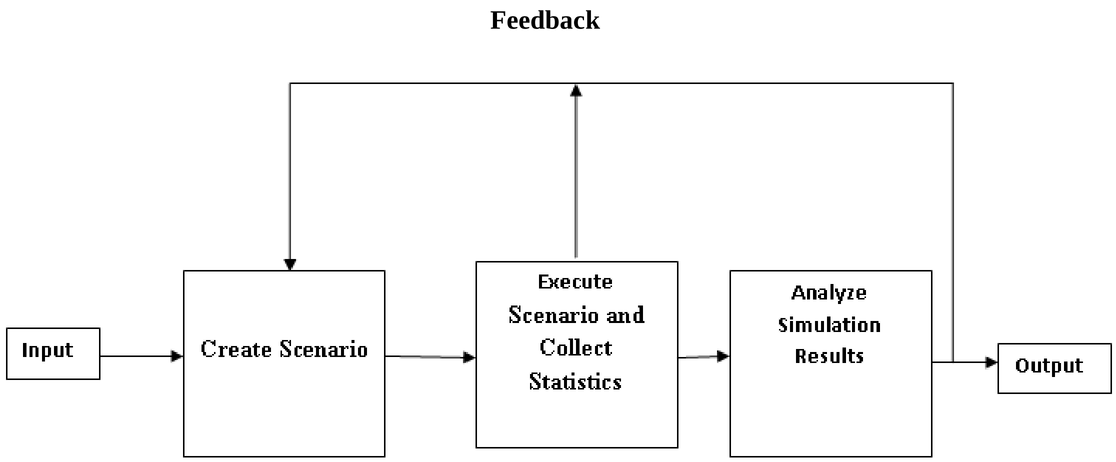
Various routing protocols have been proposed in the past. A number of protocol optimizations are proposed to reduce the route discovery overhead. Bhavyesh Divecha has define the performance of a routing protocol varies widely across different mobility models and hence the study results from one model cannot be applied to other model. G. Santhosh Kumar et al. (2007) observed that node mobility is a very important aspect in the design of effective routing algorithm for mobile wireless networks. It has been observed that Performance metrics such as end-to-end delay, throughput and routing load should be considered in the case of mobility models. Brent Ishibashi et al. (2003) studied a number of characteristics that concern with the links and routes that make up an ad hoc network. Joy Ghosh et al. found that most routing protocols in MANET adopt the popular Random Waypoint model for its simplicity and suitability for theoretical study and analysis. Mona Ghassemian et al. evaluated different routing schemes for mobile ad hoc networks with respect to different mobility metrics. A new mobility metric called link stability metric that can capture the random mobility of mobile nodes in an ad hoc network has been analyzed in an environment with a random waypoint mobility model

N.J. Dearham focuses at various protocols that have been developed to deal with such issues and, through contributions made herein, are now readily available for simulation in *NS-2*. A simulation environment that was used to compare the routing protocols proposed, used various metrics. **Yogesh** Chaba et al. (2009) provide an overview of reactive routing protocols for MANETs. Niroj Kumar Pani (2009) proposed a secure hybrid ad hoc routing protocol, called Secure Zone Routing Protocol (SZRP), which aims at addressing the above limitations by combining the best properties of both proactive and reactive approaches. The proposed protocol is based on the concept zone routing protocol (ZRP). It employs an integrated approach of digital signature and both the symmetric and asymmetric key encryption techniques to achieve the security goals like message integrity, data confidentiality and end to end authentication at IP layer. Vikas Singla (2009) provide the performance comparison of the DSR, DSDV and AODV protocols for CBR traffic in mobile ad hoc networks (MANETs).

SIMULATION

The main objective of this simulation study was to evaluate the performance of different popular MANETs routing protocols Bellman Ford on static IEEE 802.15.4 star topology for varying Mobility Models [13].

Scenario-Based Simulation



PERFORMANCE EVALUATION PARAMETERS

Packet Delivery Ratio (PDR): Packet delivery ratio is calculated by dividing the total number of data packets received at all the nodes, by the total number of data packets sent out by the CBR sources. Packet delivery ratio forms an important Metric for performance evaluation of an ad hoc routing protocol because, given similar scenarios, the number of data packets successfully delivered at the destination depends mainly on path availability, which in turn depends on how effective the underlying routing algorithm is in a mobile scenario[6].

This number represents the effectiveness and the throughput of a protocol in delivering data to the intended receivers within the network. Number of successfully delivered legitimate packets as a ratio of number of generated legitimate packets.

$$PDR = \frac{\text{Total no. of Packets Received}}{\text{Total no. of Packets sent}}$$

Average End-to-End Delay: Average end to end delay is the time a data packet takes in traversing from the time it is sent by the source node till the point it is received at the destination node [14].This metric is a measure of how efficient the underlying routing algorithm is.

Throughput: Throughput is, bits per second delivered to destination, so that unicast network throughput is sum of bits delivered to all destinations over time.

RESULTS

Table 2: Effect of Mobility on Packet Delivery Ratio in Group Mobility

Mobility	BellmanFord
10	0.249068
20	0.277778
30	0.248695
40	0.215511
50	0.206935

Table 3: Effect of Mobility on Packet Delivery Ratio in None Mobility Model

Mobility	Bellman Ford
0	0.30303

Table 4: Effect of Mobility on Packet Delivery Ratio in Random Way Point Model

Mobility	Bellman Ford
10	0.289683
20	0.174603
30	0.126984
40	0.059524
50	0.063492

Table 5: Effect of Mobility on End to End Delay in Group Mobility Model

Mobility	BellmanFord
10	0.015162
20	0.012906
30	0.013786
40	0.010094
50	0.007986

Table 6: Effect of Mobility on End to End Delay in None Mobility Model

Mobility	Bellman ford
0	0.034712

Table 7: Effect of Mobility on End to End Delay in Random Way Point Model

Mobility	Bellman Ford
10	0.28613
20	0.064128
30	0.056836
40	0.045227
50	0.020703

Table 8: Effect of Mobility on Throughput in Group Mobility Model

Mobility	BellmanFord
10	3061
20	3463.667
30	3051
40	2172
50	2589.667

Table 9: Effect of Mobility on Throughput in None Mobility Model

Mobility	Bellman Ford
0	2422

Table 10: Effect of Mobility on Throughput in Random Way Point Model

Mobility	Bellman Ford
10	7513
20	3819
30	1508
40	706
50	2385

OBSERVATION & DISCUSSIONS

In our simulation, we have studied the effect of Mobility using Ad hoc routing protocols under the following conditions:

Effect of Mobility: In the presence of high mobility, link failures can happen very frequently.

Table 2, 3 & 4 shows Bellman Ford is average in PDR. As we increase the Mobility, we found the increase in PDR ratio.

Table 5, 6 & 7 shows effect of Mobility on Average end to end delay. Mobility does not affect Bellman Ford; it is average in this Mobility Model. In None Mobility model, there is delay in Bellman Ford protocol. In Random Way Point Mobility Model again Bellman Ford is good in End to End Delay. When we increase the mobility the protocols shows decrease in End to End Delay Ratio. So we can say that Bellman Ford is better protocol.

CONCLUSIONS

Using Bellman Ford protocol, the effect of mobility on the throughput in Random Way point Mobility model decreases when we increases the mobility as shown in tables 8, 9 & 10. The effect of Bellman ford is also good in throughput in none mobility.

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