

2011 International Conference on Power Electronics and Engineering Application
(PEEA 2011)

A Mobile Ad Hoc Networks Algorithm Improved AODV Protocol

Zhu Qiankun, Xu Tingxue, Zhou Hongqing, Yang Chunying, Li Tingjun

Naval Aeronautical and Astronautical University, Yantai 26400, China

Abstract

AODV protocol is based on the minimum delay path as the route selection criteria, regardless of the size of the load path nodes, routing has a large selection of blindness in real-time requirements in the network transmission higher than the amount of information large, the occupancy of the route longer the case, often a bottleneck node problem, leading to some of the routing node congestion and delays or even data loss and a series of problems; This paper presents a web-based time-delay In AODV routing protocol, based on adding random selection algorithm, the traffic in accordance with the principles of ADM allocated to different paths, thereby reducing the network congestion and reduce network latency and improve the network QOS.

© 2011 Published by Elsevier Ltd. Selection and/or peer-review under responsibility of [name organizer]

Key words: Mobile; Ad Hoc Networks; Delay; Routing Path

1. Introduction

Ad Hoc Mobile Ad Hoc network is a group of mobile devices with a wireless transceiver nodes, the communication between wired base stations do not rely on traditional, but by wireless mobile nodes with their neighbors to exchange information, support for dynamic reconfigurable Multi-hop ad hoc networks, in the case of no central infrastructure, the number of mobile users by the formation of self-organizing multi-hop wireless mobile network, the system is fully distributed, without using constraints, each node not only receives And to send information terminals, but also can act as a router for communication between other nodes, nodes via multi-hop wireless link to communicate [1]. Because of its great flexibility, it can be widely used in military preparedness, economic development, and personnel can not reach high-risk areas and other occasions, has broad application prospects.

Ad Hoc AODV protocol is the most commonly used mobile ad hoc networks of a classic on-demand routing protocol (on-demand routing protocol), also known as reactive routing protocol, the node does not save the timely and accurate routing information, the purpose when the source node needs to Node to send packets, the source node in the network initiated the process of route lookup, find the route before starting to send packets, the topology and the routing table on demand content is created, its advantage is not periodically broadcast routing Information only when needed, before opening the routing process, issue the control signal to establish and maintain paths, which could reduce the cost of establishing and maintaining the path, saving a certain amount of network resources, the drawback is to send data packets, if no go Destination routing, the packets need to wait for the time required to establish the route [1], while the agreement in the path of choice to select only the shortest path routing, without considering the load path on the node size, the result is to increase The routing of blindness, resulting in some of the routing congestion and delays may occur and even data loss and other issues. To address these issues we propose a routing protocol based on probability distribution.

2. AODV Routing Protocol Analysis

2.1. The Route Discovery Process

Path Discovery: The Ad Hoc network, when a source node must send data packets to a destination node, the source node first check whether its own routing table to the destination node of the routing information, if the route exists, the source node will Data packets to the destination node to the next hop node; if there is no valid routing table information, the source node will start the path of the request process, broad casting RREQ (Route Request) control packets. Every node sends a RREQ, the serial number will be increased by 1, with the serial number and the source node to node unique combination of IP identified RREQ, to avoid double handling. After sending the RREQ, the source node will set the value of a good time to wait for the path response. Sends a RREQ important task is to establish a reverse path, so that the destination node of the RREP (Route Reply) can return to the source node to follow this path. RREQ transmission, will update the routing tables of intermediate nodes. If the current node is the destination node, or intermediate nodes, and presence in the routing table, a feasible path to the destination node, then returns the RREP; otherwise, to the neighbors and then broadcasts the RREQ. When the node receives a RREP, it is to send RREP to the node and the destination node sends RREP path routing table, so to ensure that data packets are leading to the destination node of the path is available. The hop is after another hop until the source node to complete the path discovery [2].

2.2. Route Maintenance

In the maintenance of the routing process, in order to detect node mobility or other reasons due to interrupted routing, each routing node contains adjacent nodes periodically broadcast HELLO messages, HELLO message generation time of the TTL value of 1. Node receives a HELLO can create a new entry or know of a neighbor, his neighbor and remains connected. If not received within a certain period of time a neighbor's HELLO message, that the neighbors and he is no longer connected to the node for the next hop of the route can no longer be used to transmit data, so these routes is set to an invalid state. AODV routing protocol with the local service function, the node will start the route discovery process, in order to build a new route broadcast RREQ, if given time to re-establish an effective route to send data and then, if the established route is unsuccessful, then the upstream Send RRER. After the failure of the first partial route maintenance can reduce the data transmission delay, reduce the upper control and network load.

Whether in the route discovery or maintenance in the local, AODV routing protocol in the source node receives RREP from different paths, the destination node through a series of numbers to determine the route, in the same serial number, select the number of hops than Small routing [2]. This ignores whether the node on the path for the hot spots, will form a hot zone, an increase of routing blindness, even though there are some roads not to take advantage of lighter loads, so that the uneven load distribution across the network, local busy roads lead to decreased transmission efficiency [4].

3. AODV Protocol Analysis Algorithm

Fig.1 shows a simple mobile self-organizing network structure [5], dotted line represents the reception range of each node. Shown in Figure 1 from the source nodes to destination node d, a total of M paths, for the first i paths, so that it is the average packet delay D_i , defined on F cost function for routing path selection, which was expressed as [3]:

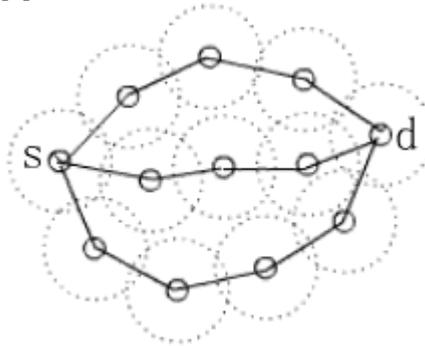


Fig.1 Ad hoc Basic Structure

$$F = \sum_i D_i \tag{1}$$

In mobile ad hoc networks, a single node queuing delay, processing delay and transmission delay is the main source of delay [6]. For a single packet, the processing delay and transmission delay is more constant, while the queuing delay affected by the degree of network congestion, changed greatly. In queuing theory, the node can send and receive Markov M / M / 1 service model [7]. According to Little formula indicates, the average delay of data packets conform to the following relationship:

$$D = \frac{\lambda}{\mu(\mu - \lambda)} \tag{2}$$

Where, λ is the packet arrival rate, μ is the packet transmission rate, and $\mu \geq \lambda$.

In wired networks, routing nodes receive and transmit fixed capacity, and affect each other. In the Adhoc network, sending and receiving nodes share the same wireless channels influence each other. Let node processing capacity of B (receives and send share), then $\mu = B - \lambda$. so the average delay of data packets into a relationship [6]:

$$D = \frac{\lambda}{(B - \lambda)(B - 2\lambda)} \quad \lambda < B/2 \tag{3}$$

Network from the above equation, the average delay of data packets through the node arrival rate and processing power to get it.

In the AODV protocol, the routing delay is a minimum standard, it is likely because the data takes too long routing, data transmission and other factors caused a large quantity of data on the minimum delay path congestion, the other path will be as little delay Long idle without waste of resources to the network overall performance is low.

In summary, to improve network performance we can follow the path of flow of the transmission capacity allocation, so that the path to better network performance can also be assigned certain tasks and to avoid the bottleneck node to improve network performance. We expect that in the path delay distribution of many small tasks, while the path delay distribution of the larger task less, or do not assign tasks. From this we can create the following model:

set D_i is the total i -path delay, $p(i)$ the probability of the path is chosen, it is clear that when the delay is 0 (ideal) path is selected as the 100% probability When the path of failure that is selected when the delay is infinite with probability 0, its distribution with normal distribution, normal distribution obtained by the following formula:

$$p(i) = \frac{1}{\sqrt{2\pi}} e^{-\frac{(D_i)^2}{2}} \quad (4)$$

As can be seen from the above algorithm, we can delay the path of the situation, in accordance with (4) the calculation of the probability of the path can be selected so that the load in accordance with the principles of ADM allocated to each path, which can effectively avoid the bottleneck node, reducing Network congestion and improve network performance.

4. Simulation

Use NS-2 simulation experiments [9], a total of 40 simulation nodes, the node range of motion for the 1000m X 1000m, nodes in the network model with random motion, velocity in the 0 ~ 20m / s, when the node reaches the target point, Residence time, and then randomly select a new target point and a new speed, movement to the new target point, and so on [8]; MAC layer uses the 802.11 protocol, the node transmission radius of 100m, the link bandwidth 2Mbps, packet size is 512 bytes, simulation time is 500s.

Test two sets of data collection protocols AODV and AODV to improve throughput, AODV, and AODV protocol to improve the time delay, by comparing two sets of simulation data.

Fig.2 shows the improved AODV protocol and AODV protocol throughput comparison chart of simulation results, we can clearly see that the first 260 seconds the throughput of roughly two protocols, this is because, during this time is the path discovery process, the node is the initial establishment of the routing topology, so roughly the same throughput in two ways; after the initial establishment of the topology, the node to start data exchange, the amount of information increases, AODV's throughput is significantly improved agreement than the original AODV protocol, and both The 400 seconds are relatively stable, indicating that the throughput, the improved protocol is better than the original AODV protocol.

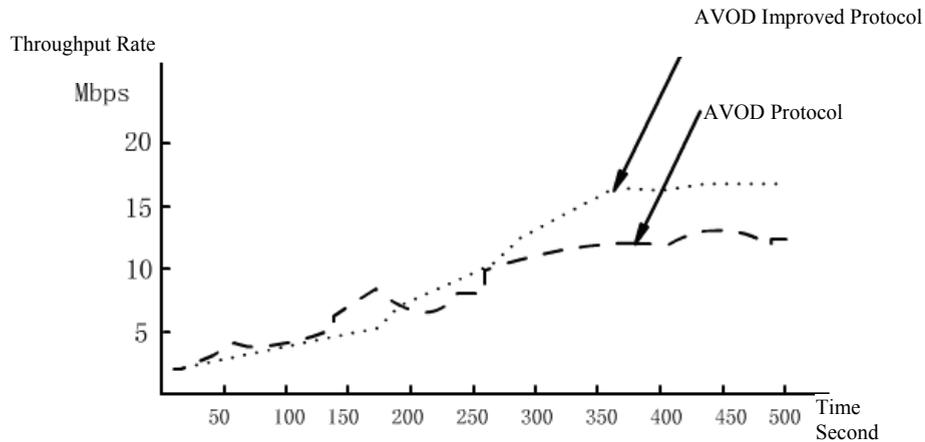


Fig.2 Throughput Rate Comparison

In the beginning of 130 seconds, the data delay was relatively large, it is because, this time is the path discovery process, the network has not established the routing topology, the nodes There is no route available, so a larger delay, when the routing topology is complete, the delay is relatively stable, and improved significantly better than the delay routing protocol AODV protocol in the source.

5. Conclusion

In this paper, the standard AODV routing protocol to improve the existing problems will be neglected in the past the path to take advantage of better performance, assign tasks according to the size of the amount of path delay, the full use of network resources and improve the overall performance of the network, especially in Higher network load, real-time circumstances require a higher energy than efficient, lower-end latency, reduce packet loss rate. Simulation results show that the improved AODV protocol in terms of throughput and network delay has a distinct advantage.

Acknowledgements

This work was supported in part by a grant from NSFC (Natural Science Foundation of China): 60874112

References

- [1] David M. QoS and Traffic Management in IP and ATM Networks [M]. California: The McGraw-Hill Companies, Inc., 2000. 203-226.
- [2] RFC 2501-1999, Mobile Ad hoc Networking (MANET): Routing Protocol Performance Issues and Evaluation Considerations [S]
- [3] NS-2 [EB/OL]. <http://www.isi.edu/nsnam/ns>.
- [4] Li Tingjun, Lin Xueyuan, Research on intergrated navigation system by rubidium clock [J], Journal on Communication 2006, Vols 27(8): pp144-147

- [5] Li Tingjun, Research on TDOA Passive Tracking Algorithm Using Three Satellites[J]. Journal of Naval Aeronautical and Astronautical University 2009, Vols 24(4):pp376-378
- [6] Li Tingjun, Lin Xueyuan, GPS/SINS Integrated Navigation System Based on Multi-scale Preprocessing [J], Journal of Wuhan University, 2011, Vols 36(1):pp6-9
- [7] Li Tingjun The Phonetic Complex Data Based on FPGA Key Engineering Materials. Vol s 475 (2011) pp1156-1160
- [8] Li Tingjun Study On Airborne Single passive location Technology[J] Applied Mechanics and Materials Vols.58 (2011) pp2006-2009
- [9] Li Tingjun Design and Implement of a TACAN Simulation Cabinet Turns on/off[J] Applied Mechanics and Materials Vols.58 (2011) pp2002-2005.