



Impact of Caching the Performance of Dynamic Source Routing Protocol for Mobile Ad Hoc Network

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Abstract- In recent years mobile ad hoc networks have become very popular and lots of research is being done on different aspects of MANET. Mobile Ad Hoc Networks a system of mobile nodes communicate with each other over wireless links and behave as a distributed manner. There are different aspects are taken in research like cache size, no. of nodes, traffic overhead, average route discovery time, route expiry time to analyse the performance for Dynamic Source routing Protocol. In this paper we discuss if the number of nodes increase in the network what effect occurs on the performance of DSR protocol.

Keywords- MANET, DSR (Dynamic source routing), Routing, Caching, OPNET.

I. INTRODUCTION

Mobile Ad hoc Networks (MANET) are wireless networks without any fixed infrastructure. A mobile ad hoc network is a collection of mobile devices that communicate with each other through a wireless links. Mobile ad hoc network is collections of wireless nodes that can allow people and devices to communicate with each other without help of an existing infrastructure. Each device in a MANET is free to move independently in any direction.

So many routing protocols have been designed for MANET. We discovered that the Dynamic Source Routing (DSR) protocol has got some special characteristics for improving the efficiency of routing in MANET. Our work is on the caching mechanism of the DSR protocol. We analyze the effects of cache size and cache expiry time on the performance of DSR protocol. Normally, we put a theory increase in the cache size and its timeout would improve the performance of the dynamic source routing protocol for MANET. This theory might not completely be correct due to some factors such as the availability of appropriate routes in the cache. To prove our theory we simulated some mobile ad hoc networks operated upon the DSR protocol in order to find out the effects of the cache capacity and the cache timeout on the performance of the DSR protocol. The simulations were carried out on OPNET modeler 14.5 and results collected were carefully analyzed.

1.1 Homogenous Mobile Device Network

Two or more mobile devices (MD) that have networking capabilities and wireless communications are said to establish a MANET. The MD should be within their radio ranges. A destination MD that is out of radio range from the source MD, an intermediate MD that is within radio range with the destination MD can forward the packets from the source MD to the destination MD. An ad hoc wireless network should be self-organizing and adaptive. The MANET that has two or more mobile devices that is of the same type is said to set up homogeneous mobile device.

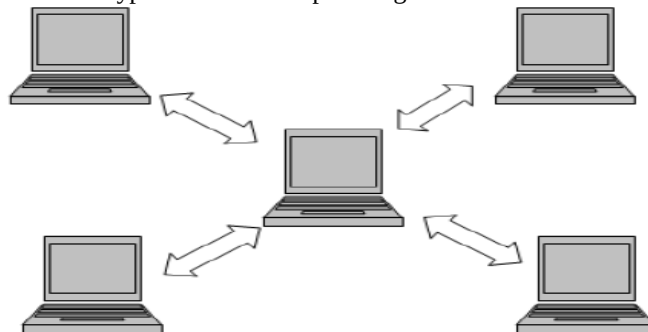


Fig. 1 Homogeneous Mobile Device Network

1.2 Heterogenous Mobile Device Network

These MDs have differences in terms of their size, memory, computational power, and battery capacity. MDs features allow some MDs to act as a server while others can work as a client. Examples of different types of MDs are pocket PC, laptop, cellular phones etc. MANET that is set up by different types of mobile devices is said to be heterogeneous mobile device network.

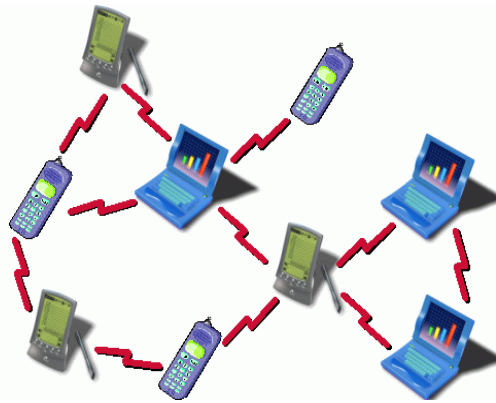


Fig. 2 Heterogenous Mobile Device Network

1.3 Dynamic Source Routing Protocol

Dynamic Source Routing (DSR) is a reactive, flexible and simple protocol. DSR is on demand routing protocol and uses the concept of source routing instead of routing tables like other protocols. When source node send packets to the destination node, the different packets may follow the different routes, even they have same source and destination. DSR allow the packets to be travel loop-free and avoid the need for updating routing information in the routing tables periodically that is required in table-driven approach. Therefore DSR routing protocol reduce the bandwidth consumption by the control packets in ad hoc mobile networks. The major difference between this and the other on-demand routing protocols is that it is beacon-less and hence does not require periodic hello packet transmissions, which are used by a node to inform its neighbors of its presence. The DSR protocols composed of two main mechanisms Route Discovery and Route Maintenance.

II. IMPLEMENTATION & RESULT

The performance depends upon which the evaluation of the dynamic source routing protocol caching mechanism was based and the design concepts of the simulation part. OPNET modeller 14.5 was used as the simulation tool.

Two network metrics and one cache metric were evaluated in our simulation work and they are average packet end-to-end delay, routing overhead and route discovery time.

The simulation was set up with the view of investigating the performance of DSR protocol caching mechanism. Our emphasis were on the effects of the route cache size and route cache expiry time. Every other parameter was fairly kept constant for all the simulated scenarios. The simulations were divided into twelve different scenarios with the following network parameters.

OPNET Modeler 14.5 simulator was used in our simulation. OPNET modeller 14.5 executes four phases in order to complete a simulation process. These phases consist of modeling of the network; choosing the required parameters; running the simulation of the created model; and viewing and analysis of results. The simulation setup on OPNET is shown in the fig. 3.

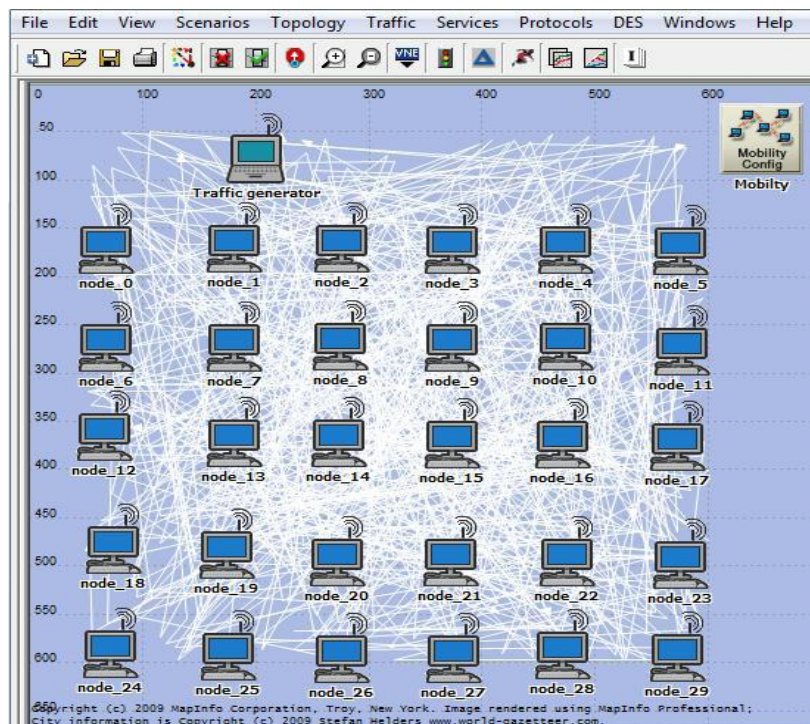


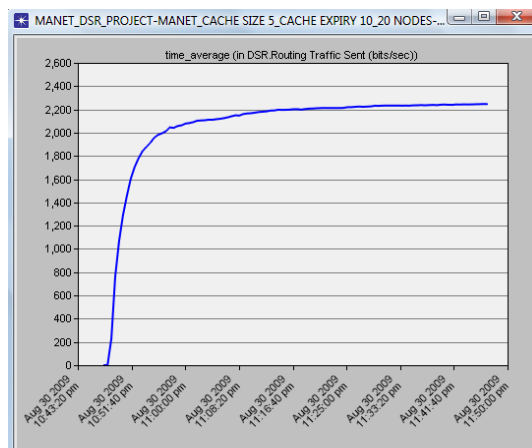
Fig 3- Example of 30 Nodes Simulated Network Model in OPNET

From the graphs extracted and the tabular results, it can be observed that as the cache size increases when the cache expiry time keeping constant, the routing overhead traffic increases exponentially and later stabilized to a maximum value. Then we steadily increased the cache expiry time while keeping the cache size constant. For this case, we also observed that when the cache size was kept constant at 10 bits while increasing the cache expiry time, the routing overhead traffic were approximately the same irrespective of the amount of the cache expiry time. The 30 nodes scenarios which has a large amount of broadcast enquiry packets, route discovery packet, route error packet due to link failures as the mobile nodes are moving from one place to another were found to acquire more overhead routing traffic than the networks made up of 20 nodes.

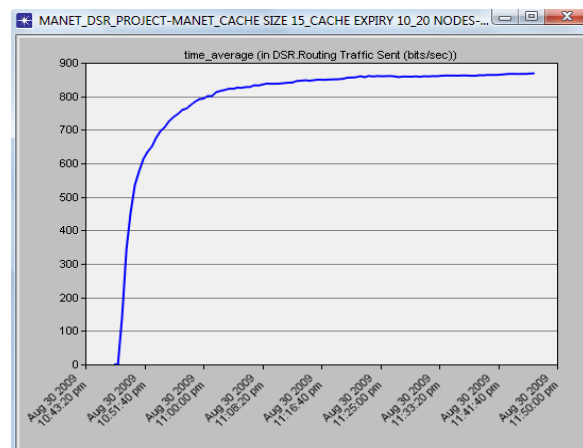
Results from the simulations are presented in the table 1

Table-1

Scenario	No. of Nodes	Cache Size (Bits)	Route Expiry Time (Seconds)	Routing Overhead Traffic (Bits)	Av. End-To-End Delay (Seconds)	Av. Route Discovery Time (Seconds)
Setup 1	20	5	10	2460.0	0.00370	0.10100
Setup 2	20	10	10	1597.8	0.00450	0.12440
Setup 3	20	15	10	0868.4	0.00627	0.17050
Setup 4	20	10	5	1600.5	0.00491	0.12410
Setup 5	20	10	10	1596.7	0.00455	0.12480
Setup 6	20	10	15	1580.2	0.00434	0.12710
Setup 7	30	5	10	3716.0	0.00760	0.07785
Setup 8	30	10	10	3117.0	0.00763	0.08522
Setup 9	30	15	10	2347.0	0.00840	0.10280
Setup 10	30	10	5	3127.0	0.00761	0.08415
Setup 11	30	10	10	3119.0	0.00768	0.08527
Setup 12	30	10	5	3115.0	0.00761	0.08562

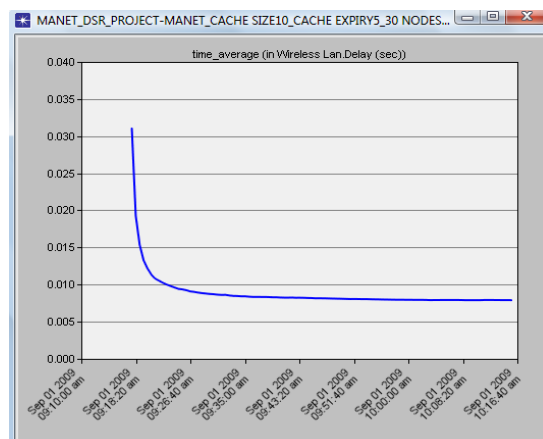


(A)

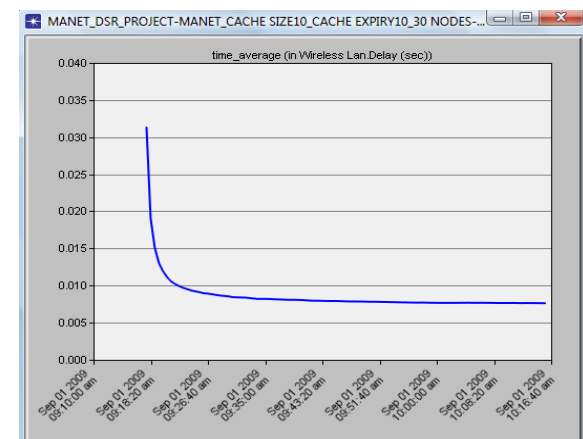


(B)

Routing Overhead Traffic for cache expiry time 10, and 20 nodes; A) cache size 5, and B) cache size 15.



(A)



(B)

Average End-To-End delay for cache size 10, and 30 nodes; A) cache expiry time 5, B) cache expiry time 15.

It can be analysed from our simulation results that the higher the number of nodes in a network, the higher the routing traffic and the average end-to-end delay but the lower the route discovery time. In order to reduce the incurrence of high routing overhead traffic and average end-to-end delay, a high capacity cache should be used when the number of nodes in a MANET is high. This increases the performance of the protocol.

III. FUTURE WORK

We are suggesting that further research work should be carried out on the evaluation of the performance of the DSR caching mechanism. Our work was limited to the path cache organization of the dynamic source routing protocol as provided by the simulator (OPNET) working in our simulations. We therefore suggest the study of the link cache organization of the same protocol in order to validate our findings with regards to the effects of cache capacity and cache expiry time on the performance of the DSR protocol. To achieve this, a different simulator should be adopted.

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