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PERFORMANCE EVALUATION OF TWO ROUTING PROTOCOLS FOR MANET USING OPNET MODELER

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ABSTRACT
MANET is called mobile Ad-hoc network which included the mobile wireless devices or named node in the network. The way that the communication in the MANET works is to uses the other nodes in the middle of the path called inter-node. A mobile Ad hoc network does not use any wireless devices that can be located in the centre of network which makes the network as a centralized network. MANET is the kind of networks which could configure or organize it.
In this paper routing protocol DSR and GRP for mobile ad hoc network are compared on the basis of delay load and throughput.

Keywords: MANET, Routing protocol DSR and GRP OPNET Modeler, Delay, Load, Throughput.

1. INTRODUCTION:

Mobile Ad hoc Network (MANET) is a group of mobile nodes which work independently and use radio waves to communicate with each other. Nodes which are nearer to each other and come in the radio range of each other can directly communicate with clear communication & low noise or other disturbing factors, whereas if nodes are far apart from each other then intermediate nodes perform routing to pass the packets to adjacent nodes and deliver to the other end. These infrastructures less networks are distributed in nature and can work at any place making them extensible and robust in working [1]. MANET is the kind of networks which could configure or organize it. In another word each mobile node can receive and then it can forward data packets which this makes the mobile device works as a router. Therefore routing is one of the critical parts of the MANET system. Our problem is to discuss and simulate two different routing protocols and comes to know about their performance in the different scenarios. We use OPNET modeler for some simulation and get results using different prospects.

2. MANET Routing Protocol

As it was mentioned in the previous chapter there is no use of the regular routing Protocols like RIP, EIGRPA and OSPF v2 in the MANET. Therefore, a few numbers of the protocols have been introduced for using in the MANET. They are divided to three categories:

1. REACTIVE
2. PROACTIVE
3. HYBRID.

A.DSR Routing: the Dynamic Source Routing protocol (DSR) is an on demand routing protocol used in ad hoc wireless networks to allow communication over multiple hops among nodes. As other on demand routing protocols, the path-finding process is launched only when a path is required by a node to communicate with a destination DSR was designed to restrict the bandwidth consumed by control packets in ad hoc wireless networks, by eliminating the periodic table-update messages used in proactive protocols. DSR protocol is based on two Mechanisms: Route discovery and route maintenance [10].

B.GRP Routing: This schema collects network information at a source node with a small amount of control overheads. According to the collected information, source node can finds routes and continuously transmit data even if the current route is disconnected. The result of this approach is achieving fast transfer with less overhead of control massages [11]. This approach is widely known as hybrid routing protocol, because it can

simultaneously use the strengths of reactive routing and proactive routing protocols. A packet that named DQ is used continuously to forward to each node's neighbors until the destination is reached. When it reaches the destination, the destination node broadcasts a network information gathering (NIG) packet to its neighbors. The source node computes the best route according to collected information and then immediately starts to transmit data packets. [12].

Proposed Design and Simulation

A mobile Ad hoc network does not use any wireless devices that can be located in the centre of network which makes the network as a centralized network. MANET is the kind of networks which could configure or organize it. In another word each mobile node can receive and then it can forward data packets which this makes the mobile device works as a router. Therefore routing is one of the critical parts of the MANET system. Our problem is to discuss and simulate two different routing protocols and comes to know about their performance in the different scenarios. We use OPNET modeler for some simulation and get results using different prospects.

3. Simulation Environment and considerations

The goal of this study is to determine how DSR and GRP routing protocols work along with using some application in MANET systems. The simulator used in this study is OPNET Modeler, version 15.0.A PL3. The protocols are studied in different scenarios with considering the three metrics like Load, Delay and Throughput to compare the results in the design.

The scenarios are based on the FTP application (Medium Load) with the following configuration

Table 3-1: OPNET FTP application Attributes Value

:

Attribute	Value
Command Mix (Get / Total)	50%
Inter-Request Time(seconds)	Constant(1)
File Size(bytes)	Constant(5000)

Here is the Summary of design and the parameters value which were chosen for the study:

Table 3-2: OPNET Design parameters Values

Simulation Parameter	Value
Number of Nodes	29+1
Simulation Time	30 min
Area	1000(m) x 1000(m)
Mobility Model, Speed	Random Way Point, 5m/s
Operational Mode	802.11g
Data Rate	11 Mbps
BSS Identifier	Auto Assigned
Fragmentation Threshold(bytes)	None
Buffer Size(bits)	256000
Large Packet processing	Drop

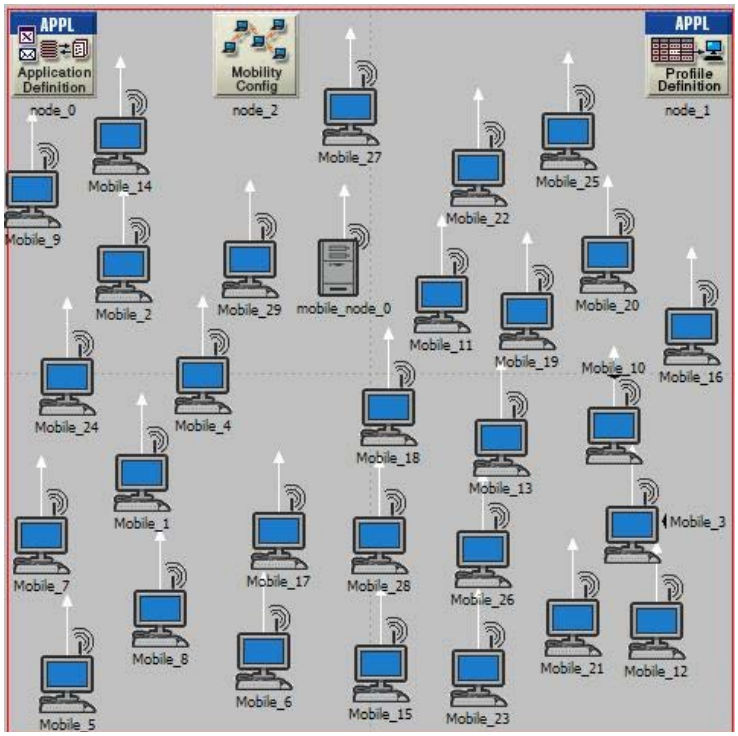

Figure 3-1: OPNET Design

Every other parameter or attribute is used in default value. Also, some other applications, either single or combination with FTP, were chosen in some scenarios to observe the differences and compare the metrics values with the main scenario.

In all scenarios, one pattern of randomly placed nodes has been used in the simulation area and only in one scenario nodes were arranged in a circle shape to compare the results with the main scenario. There are 29 mobile client nodes and one mobile server node in the design.

In the next sections, Metrics which are going to be used for performance of DSR and GRP as ad-hoc routing protocol are introduced first, and then scenarios with having DSR and GRP separately in the simulation along with the metric value results will be discussed.

Figure 3-1 is the main design of our MANET where the nodes and server are located and Figure 3-2 & 3-3 shows the main parameters configuration table in the OPNET simulator.

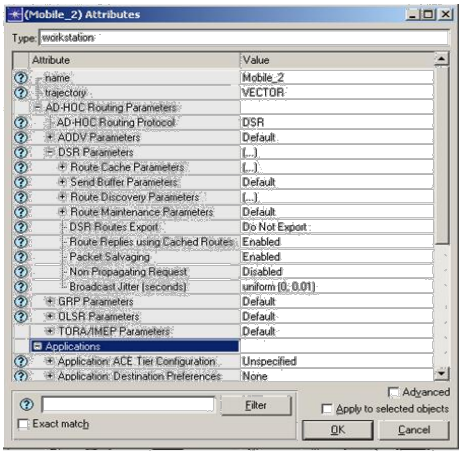

Figure 3-2 OPNET Design

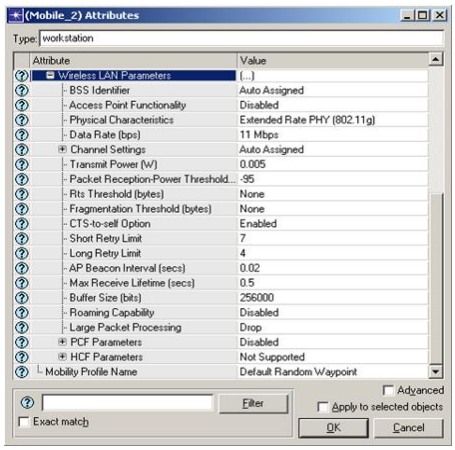

Figure 3-3 OPNET Design

Performance metrics: While comparing three protocols we focus on four performance measures Delay, Load and Throughput.

1. Delay: It is the time taken by a packet from the movement it is transmitted on the network by source node to reach the destination node.

2. Load: It is the amount of traffic being carried by the network.

3. Throughput: It is the no. of packets received by all the destinations over the duration of simulation.

3.1 First-Second Scenarios, FTP application and Simulation Results:

With considering of the attributes values for the FTP application in the medium load (refer to table 3-2) and simulation parameters values (refer to table 3-1) after running the simulation for 30 minutes, here are the result for 3 metrics for assigning DSR and GRP as ad-hoc routing protocol separately in the design.

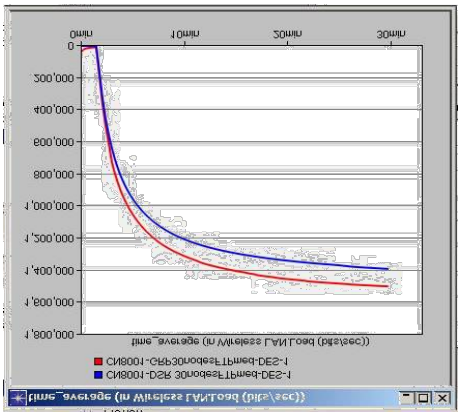

Figure 3-4: DSR and GRP, FTP, Throughput

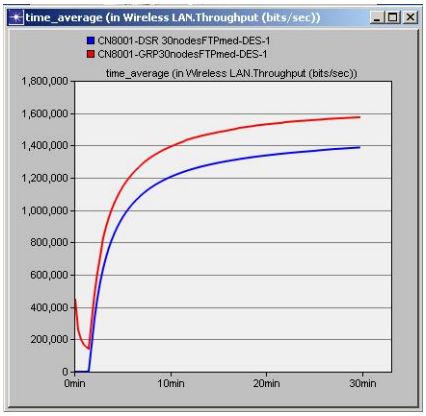

Figure 3-5: DSR and GRP, FTP, Load

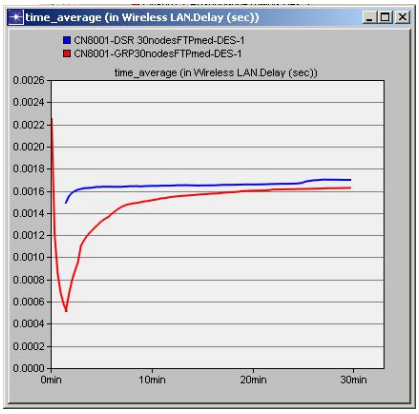

Figure 3-6: DSR and GRP, FTP, Delay

Results of simulation represent that the mobile ad-hoc network while GRP is set to the nodes will have higher throughput, load and lower delay than the network when DSR is used in that network. This shows that when FTP application runs in this design GRP would have better performance than DSR.

3.2 Third-Forth Scenarios, FTP-Fragmentation and Simulation Results:

In these scenarios the fragmentation effect on the considered metrics is verified. Here are the Parameters that have been set up in the OPNET design:

Table 3-3: Fragmentation Parameters

Simulation Parameter	Value
Fragmentation Threshold (bytes)	512
Buffer Size (bits)	1024000
Large Packet Processing	Fragmentation

After running the simulation, there is not seen any big difference or change on the rough put and load metrics results compared to the first scenario but in terms of the delay metric there is a difference. Here are the results:

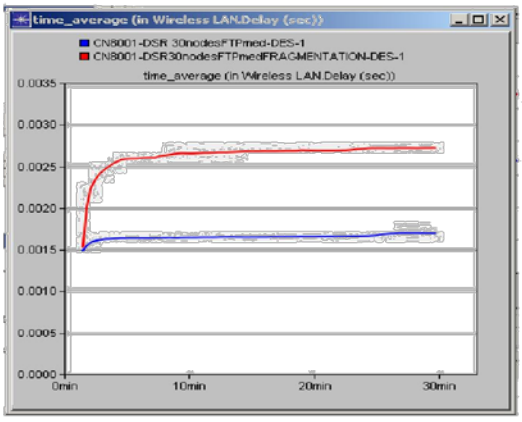

Figure 3-7: DSR with Fragmentation, Delay

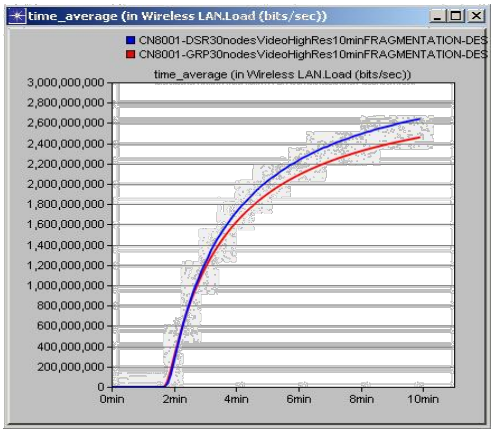

Figure 3-8: GRP with Fragmentation, Delay

Figure 3-7 and 3-8, it can be seen the delay in the fragmentation mode is more while there is used no fragmentation in the simulation. This is explained just because of the extra delay for building the fragmented byte and also transmitting this kind of byte to the destination

3.3 Fifth-Sixth Scenarios, Video application and Simulation Results

In these scenarios, the video high resolution has been applied to the simulation as application. Here are the attribute values for the application:

Table 3-4 Video high resolution Parameter

Simulation Parameter	Value
Frame Inter-arrival Time Information	30 frames/sec
Frame Size information (bytes)	352X240 pixels

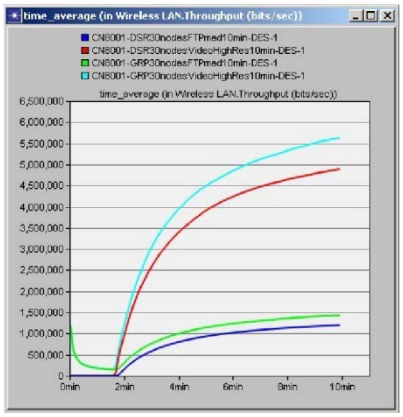

Figure 3-9 DSR-GRP-FTP-Video, Throughput

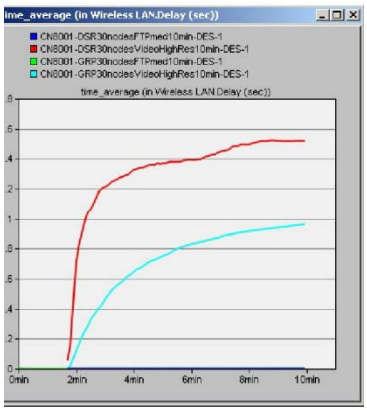

Figure 3-10 DSR-GRP-FTP-Videos, Delay

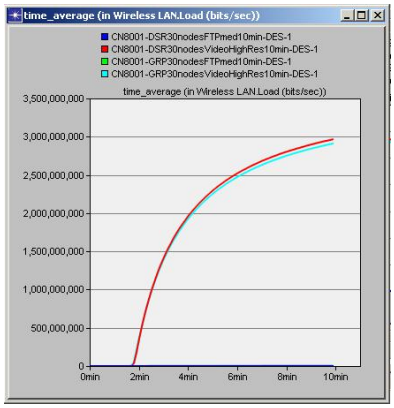

Figure 3-11 DSR-GRP-FTP-Video, Load

More throughput while GRP is used in compare to DSR, this is justified with the same reason that it was explained in the previous section which indicated GRP builds all the routes between all the nodes for maintaining the topology at all the time.

3.4 Seventh-Eight Scenarios, Video-Fragmentation and Simulation Results

In these scenarios, everything was considered the same as previous section (using Video High resolution) plus fragmentation factors were also added to the network to evaluate how it could affect the network behavior. Here are the results

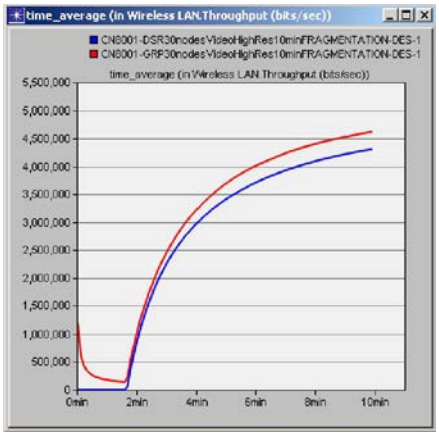

Figure 3-12: DSR-GRP-Video-Frag, Throughput

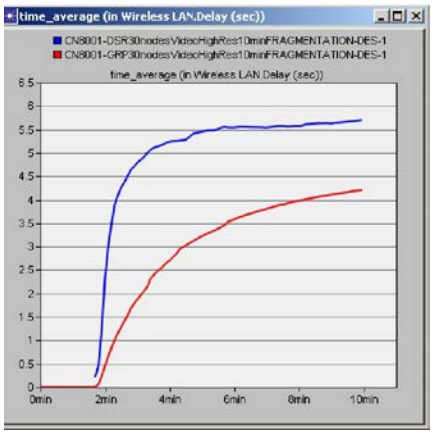

Figure 3-13: DSR-GRP-Video-Frag, Delay

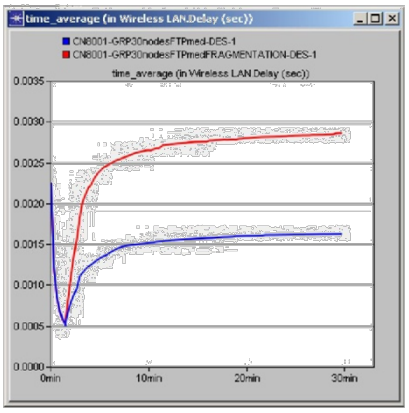

Figure 3-14: DSR-GRP-Video-Frag, Load

As the results show, there is no difference on the behavior of the routing protocols in the network between applying the fragmentation and not applying that.

3.5 Ninth-Tenth Scenarios, Email application and Simulation Results

In these scenarios, the type of application of the main scenario was changed to Email (High load) with the default values to evaluate the network behavior and simulation results. Here they are the results:

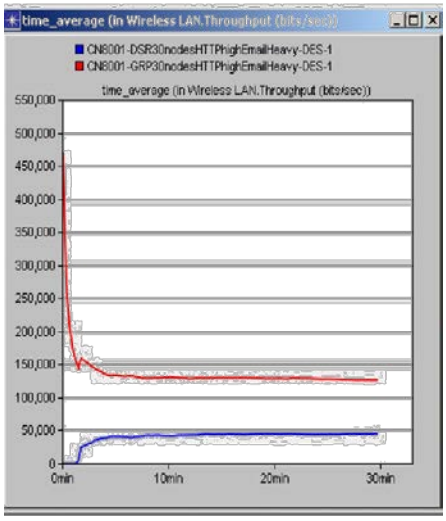

Figure 3-15 DSR-GRP-Email, Throughput

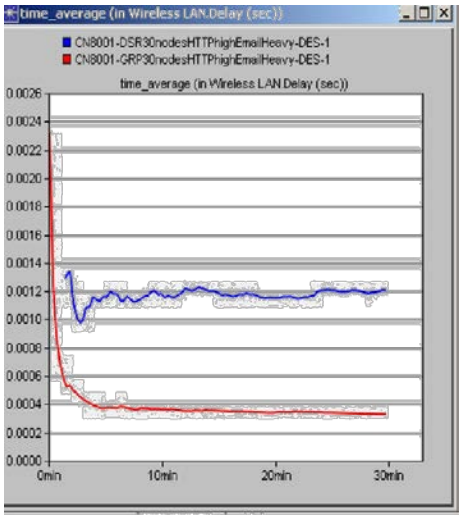

Figure 3-16 DSR-GRP-Email, Delay

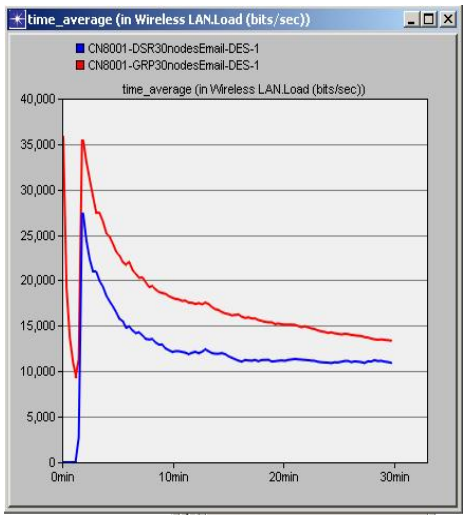

Figure 3-17 DSR-GRP-Email, Load

As the results show, the network with the GRP has higher throughput and Load but less delay in compare with the network where the DSR used as ad-hoc routing protocol

3.6 Eleventh-Twelfth Scenarios, HTTP-Email and Simulation Results

In this scenario, the combination of the two applications HTTP and Email were applied to the network to evaluate the behavior of the metrics in the network.

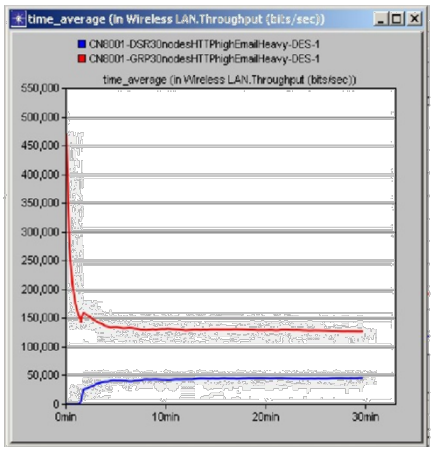

Figure 3-18 DSR-GRP-HTTP-Email, Throughput

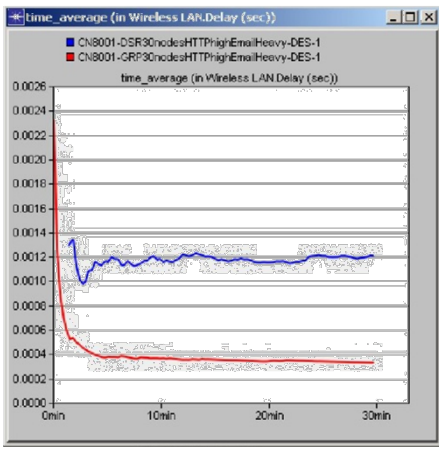

Figure 3-19 DSR-GRP-HTTP-Emails, Delay

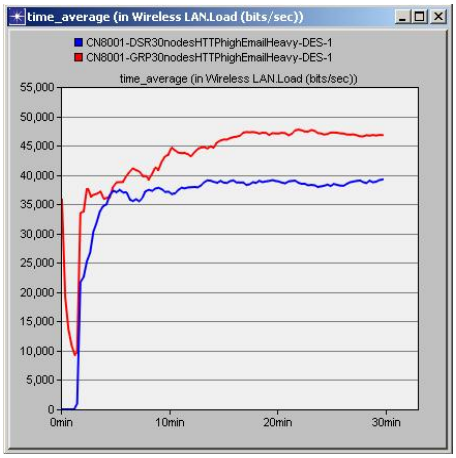

Figure 3-20 DSR-GRP-HTTP-Email, Load

As it is seen, even with having and running two HTTP and Email application at the same time the network with GRP protocol still has the higher throughout and load and less delay in compare with the network running through DSR protocol

CONCLUSION AND FUTURE WORK

In this Case Study we worked on the performance evaluation for the two MANET routing protocols (DSR and GRP) for a mobile Ad-hoc network with running different scenarios in OPNET modeler to simulate the results. With considering to look at three metrics values such as throughput, load and delay and analysis of the results it was observed that GRP creates more traffic volume, less delay than the network with using DSR. In terms of the throughput GRP is higher because all the routes available between any source and destination at all the time and they are maintained and this makes the bandwidth is always in use which this could be small disadvantage of the GRP however in terms of the delay GRP could be considered as a better routing protocol. In future, this work can also be enhanced to test on other protocols like hybrid routing protocols (ZRP). It is preferred that the network with the light traffic or if there is not always Routes to be needed between source and destination DSR would be the better choice, and for the network with the high volume of traffic or requiring routes between many sources and destinations like teleconferencing GRP would be the better routing protocol in the MANET system.

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