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Performance Analysis of Various Application Protocols for MANET

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***Abstract*—**A mobile ad hoc network (MANET) consists of mobile wireless nodes. The communication between these mobile nodes is carried without any centralized control. The ease of deployment and the infrastructure less nature of Mobile Ad Hoc Networks (MANET) make them highly desirable for present day multi media communications. In this paper we analyze the performance of TCP/IP based application protocol (HTTP, FTP) via increasing number of nodes and observing its effect on parameters like throughput, network load, media access delay and traffic received. Network simulation tool is OPNET Modeler (Ver. 14.5).

Keywords—Ad-hoc,MANET,FTP,HTTP,OPNET.

I. INTRODUCTION

Ad-hoc, namely,Ad Hoc mode is a short-term wireless network fremework which locates two or more wireless net adapters without using any acess point.One of good features of such networks is the flexibility and can be deployed very easily. Thus it is suitable for the emergency situation. But on the other side it is also very difficult to handle the operation of ad hoc networks. Each node is responsible to handle its operation[5].

MANET stands for Mobile Ad hoc Network. It is a robust infrastructureless wireless network. A MANET can be formed either by mobile nodes or by both fixed and mobile nodes. Nodes randomly associate with each other forming arbitrary topologies. They act as both routers and hosts. The ability of mobile routers to self-configure makes this technology suitable for provisioning communication to, for instance, disaster-hit areas where there is no communication infrastructure, conferences, or in emergency search and rescue operations where a network connection is urgently required.

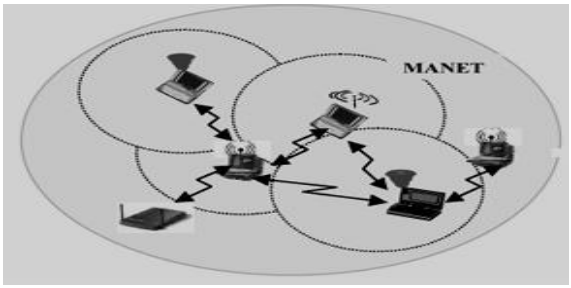

Figure-1 Mobile Ad-Hoc Network

The need for mobility in wireless networks necessitated the formation of the MANET working group within The Internet Engineering Task Force (IETF) for developing consistent IP routing protocols for both static and dynamic topologies. [6]

For any communication network it must be able to tranposrt user traffic twards its targeted destination.the communiaction performance of a network can effect the satsfaction level of the users.The ability to send information at high level speeds demanda low end-to-end delay. In addition user would like to trasmit a variety of information, such as data audio and video.An ad hoc network is not useful if it cannot offer acceptable communication services. Given the dynamics of the network topology, the underlying protocols must be able to cope with these dynamics efficientrly while at the same time yeilding good communication peformance**.**

II. APPLICATIONS

Applications are the predominant sources of traffic in the network. It is the traffic generated by applications that loads the network, makes demands on the bandwidth and the underlying network technology, and creates load on the servers. For the optimum performance of an application, you must ensure that the network and server infrastructure are designed to meet the requirements of the application. Likewise, it is necessary to design applications so that they minimize their impact on network and server resources. To do this, it is necessary to first create an accurate model of the application.

To be an accurate representation of the application, an application model should have the same traffic characteristics in terms of the size of the packets generated, the rate at which they are generated, the transport protocol over which it runs (e.g., TCP, UDP, fiber channel, etc.), the number of simultaneous connections, timeouts, retransmissions, failure and recovery and so on. Together these characteristics create a run time traffic pattern of the application.

Each application has its unique traffic pattern, or signature, and therefore creates its characteristic load on the network and servers. Thus, the concept of application modeling is to capture the traffic pattern of the applications of interest.[1]

III. STANDERD APPLICATIONS

Depending on their underlying networks, application architectures may differ. Standard network applications are implemented in a two-tier architecture in which the client issues a request and a server or client receives the request and

returns a response. This request-response exchange typically happens within one "conversation" between the client and the server, or between a client and another client. In this chapter, we use the term "conversation" to represent a sequence of activity between a client and a server within the context of a given application. A conversation includes a pattern of data exchanges, typically defined in a statistical manner that repeats over time. [1]

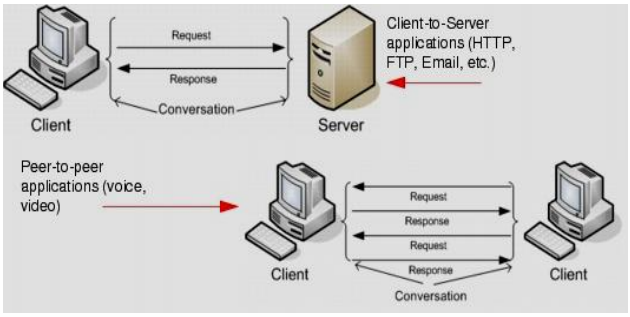

Figure-2 Application Architecture

IV.FTP

File transfer and access in a computer network is viewed to be an important function .In a distributed network environment, there are diskless machine that have little or no file storage ability. Such device can create, store, and update files to a remotely connected file sever, which is another machine but equipped with large storage and processing capability .There are also cases where remote storage is used to archive data. FTP is one of the earliest versions of file transfer software.

FTP uses TCP to ensure reliable transfer of file data. Although this sounds simple, in actuality it is complex. Not only will a TCP connection be established prior to data transfer but also the need for authorization checks, naming and representation among heterogeneous machines. FTP client need to apply a valid login name and password to perform file transfer /access operation.

FTP is interactive in that the user can enter specific commands to store and retrieve files, large file transfer are supported by FTP and timer is used to close a session if the connection is inactive after some time prior's be able to support FTP over an ad hoc wireless network is attractive and desirable. There is no need for transfer of floppy disk from one host to another. The transfer of bits can be done over the-air, in a mutihop fashion [4].

V.HTTP

Web access is getting more and more popular these days with the arrival of the internet. The web server allows one to advertise information to other User can download information (video and audio clips, text files etc) into there local machines.

To ensure that web access and services can be supported in ad hoc networks, an ad hoc mobile host is configured to be a web server. The client then access a specific web page stored at the web server, which is several wireless hops away. The client is running a web browser and by specifying the HTTP address of the specific web site, an underlying connection is established from the client to the server [4].

VI. SIMULATION SCENARIO.

The research is carried out using direct event simulation software known as OPNET (Optimized Network Engineering Tool) Modeler version 14.5. It is one off the most widely used commercial simulator based on Microsoft Windows platform .the simulation focus on the performance of application protocol in mobile ad hoc network therefore six simulation scenario with no of node combination are considered. The nodes are randomly placed within certain gap from each other in 1000x1000m campus environment. The constant ftp, http traffic was generated in the network i.e. user define via Application and Profile Configuration. Every node in the network was configured to execute AODV. The simulation time was set to 120s [8].

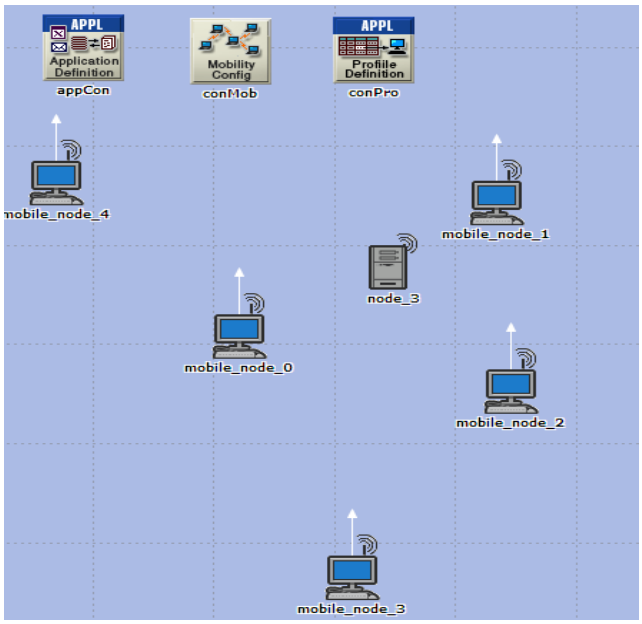

Figure-3 MANET Topology

A) Traffic Flow Parameters

Traffic was generated in the network explicitly by configuring user defined application and profile definition

1) Application Configuration

A heavier application traffic flow in the topology was generated which each node will be processing from the respective application traffic generated was as FTP-high load, HTTP-Heavy browsing.

2) Profile Configuration

The Profile configuration for each application was defined as Operation Mode: Serial (Ordered) and Start Time: application start time was set to constant 5 seconds of time period.

3) Mobility Configuration

The Mobility configuration for whole network is set to random way point with a constant speed of 10 meter/second.

4) DES Configuration Parameter

The DES simulation criterion was run for total time of 120 seconds. The overall simulation monitored within the following criteria:

- Duration: 2 minutes (120 seconds)
- Seed: 128
- Update Interval: 500000 events(This specifies how often simulation calculates event/second data)
- Simulation kernel: Optimized ('optimized' kernel was chosen because it run faster than the remaining other two simulation kernels).[9]

TABLE 1 SIMULATION PARAMETER

PARAMETER	VALUE
Number of nodes	3,5,10
Simulation time	10 second
Campus network size	1000m*1000m
Application	FTP, HTTP
Start time offset	5 second
Duration	120 second
Mobility model	Random way point
Speed	10 meter/second
Start time	5 second

VII. PERFORMANCE METRICS

This work focuses on three performance metrics which are quantitatively measured. The performance metrics are important to measure the performance and activities that are running on Opnet simulation. These metrics are

Traffic Received (bytes/sec): Average bytes per second forwarded to the HTTP/FTP applications by the transport layers in the network.

Load (bits/sec): Represents the total load (in bits/sec) submitted to wireless LAN layers by all higher layers in all WLAN nodes of the network.

Media Access Delay (sec): Represents the global statistic for the total of queuing and contention delays of the data, management, delayed Block-ACK and Block-ACK Request frames transmitted by all WLAN MACs in the network. For each frame, this delay is calculated as the duration from the time when it is inserted into the transmission queue, which is arrival time for higher layer data packets and creation time for all other frames types, until the time when the frame is sent to the physical layer for the first time. Hence, it also includes the period for the successful RTS/CTS exchange, if this exchange is used prior to the transmission of that frame. Similarly, it may also include multiple numbers of backoff periods, if the MAC is 802.11e-capable and the initial transmission of the frame is delayed due to one or more internal collisions [1].

VIII. RESULTS AND ANALYSIS

The simulation results are shown below in the form of graphs. Graphs show each parameter variation when number of node varies.

Results for File Transfer Protocol

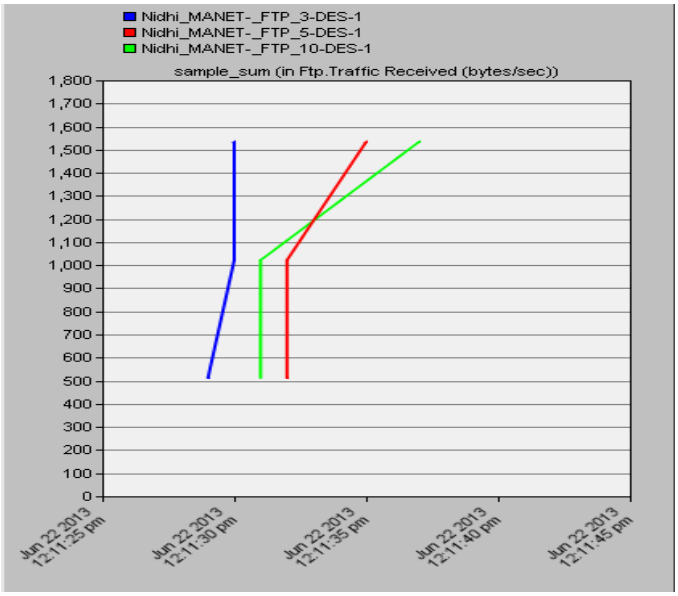

Figure-4 Traffic Received (bytes/sec)

Figure-4 Represents average bytes per second forwarded to the FTP applications by the transport layers in the network. As the number of node for the network is increases the Traffic Received (bytes/sec) decreases.

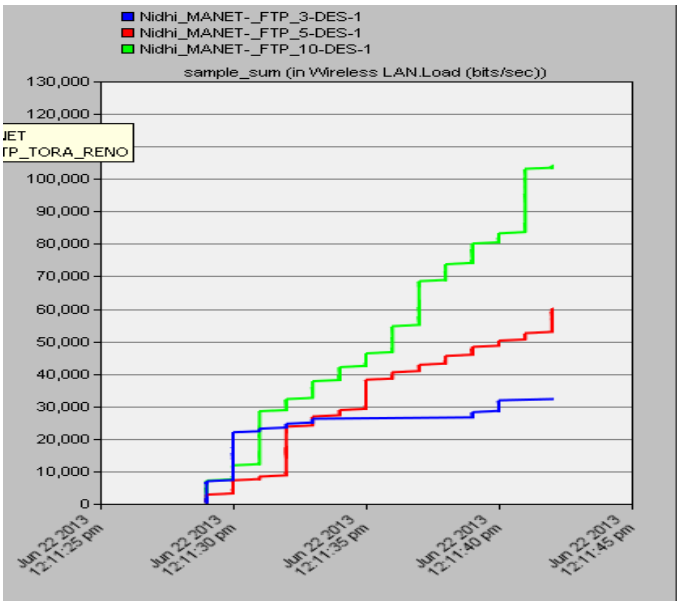

Figure-5 Loads (bits/sec)

Figure-5 Represents the total load (in bits/sec) submitted to wireless LAN layers by all higher layers in all WLAN nodes of the network. As the number of node for the network is increases the Load (bits/sec) for the network increases.

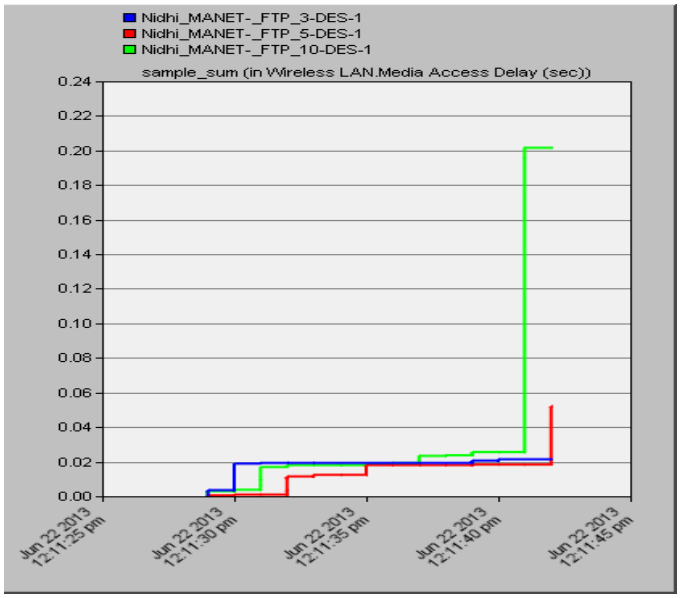

Figure-6 Media Access Delay

Figure-6 Represents the global statistic for the total of queuing and contention delays of the data, management, delayed Block-ACK and Block-ACK Request frames transmitted by all WLAN MACs in the network. As the number of node for the network increases the Media Access delay (sec) for the network increases.

Results for Hypertext Transfer Protocol

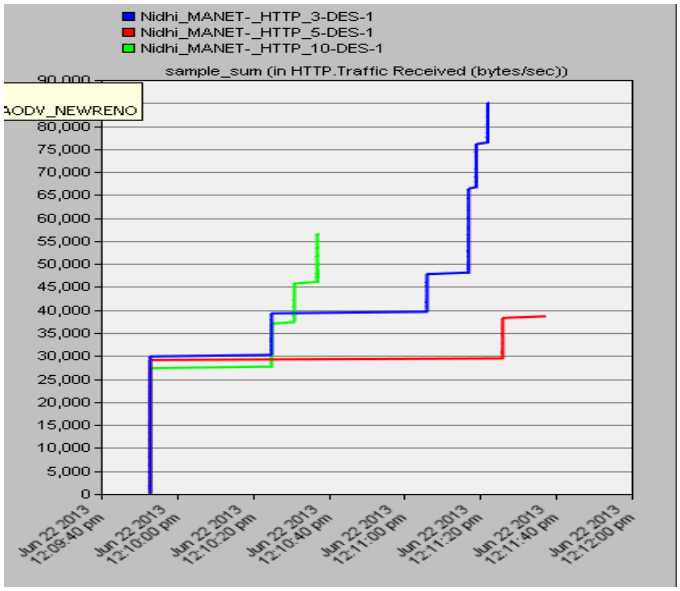

Figure-7 Traffic Received (bytes/sec)

Figure-7 Represents average bytes per second forwarded to the HTTP applications by the transport layers in the network. As the number of node for the network is increases there is not any linear variation of Traffic Received (bytes/sec).

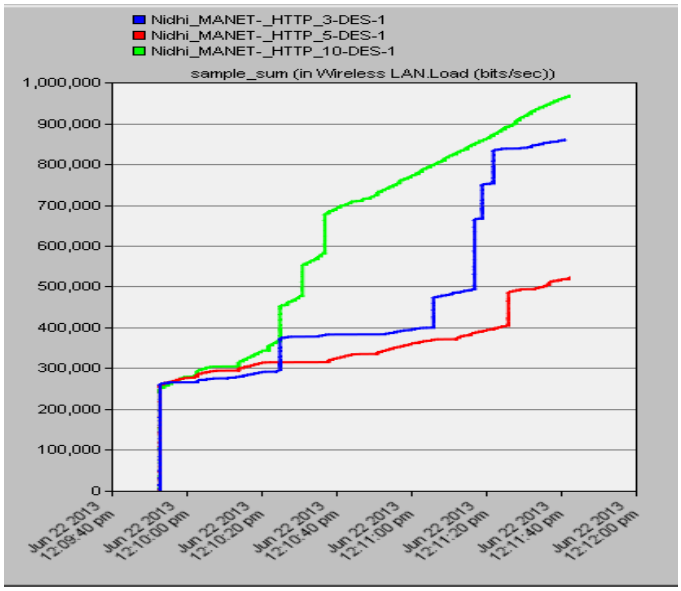

Figure-8 Loads (bits/sec)

Figure-8 Represents the total load (in bits/sec) submitted to wireless LAN layers by all higher layers in all WLAN nodes of the network. As the number of node for the network is increases the Load (bits/sec) increases.

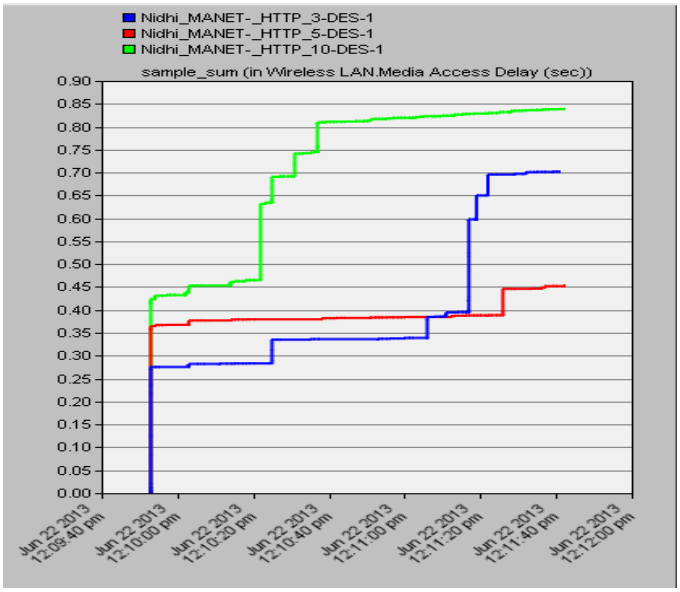

Figure -9 Media Access Delay

Figure-9 Represents the global statistic for the total of queuing and contention delays of the data, management, delayed Block-ACK and Block-ACK Request frames transmitted by all WLAN MACs in the network. As the number of node for the network increases the Media Access delay (sec) for the network increases

IX. CONCLUSION

This paper we analyze the slandered application protocol. The considerable observation is, simulation results agree with expected results based on theoretical analysis. Mobile ad-hoc networks are wireless networks that use multi-hop instead of static networks infrastructure to provide network connectivity.

From the experimental results we conclude that increase in the number of nodes will cause increase in media access delay and network load. Same way we can also analyze other application such as Voice, Video, Email and remote login.

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