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Performance Evaluation of Extended Rate PHY (802.11g) for 1 Mbps and 2 Mbps Using OPNET for AODV Routing Protocol

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ABSTRACT

In this paper performance analysis of Extended Rate PHY (802.11g) is done for 1 and 2 mbps data rate for AODV routing protocol. We used OPNET Simulation tool and created a network containing 25 mobile nodes with data rate 1 Mbps and 2 Mbps with transmission power 0.005 watts and buffer size 1024000 bits each node moves randomly in the network and simulation time was 2000 sec. Extended Rate PHY (802.11g) is compared in terms of 1 Mbps and 2 Mbps for different QOS's using AODV protocol. According to the resulted performance we can say that infrared wireless LAN might do a better job of satisfying requirements for mobile applications in campus networks. The simulation result of the research has practical reference value for further study.

Keywords : AODV, IRLAN, INFRA RED, MANET, QOS, OPNET

I. INTRODUCTION

Mobile ad hoc Network i.e. a dynamic distributed network and due to the dynamic nature the topology of network keep on changing randomly. The nodes in MANET due to mobility give result of frequent changes of network topology that is why making routing in MANETs a challenging task. Routing protocol is most important issue in data communication and performance of MANET. MANET's AODV helps to send and receive packets via nodes and each node performs like a router and a host. Due to which routing protocols are to be effective and accurate for handling mobility of nodes and giving best utilization for technologies. Nodes can be anything they may be laptop; computers and wireless phones but they have a limited transmission range for transmissions it may be direct or indirect. The successes of communication between nodes depend on cooperation of other nodes and distance between them. [5]

The AODV or say Ad hoc On-Demand Distance Vector the algorithm enables dynamic, self-starting, multi-hop routing via participating mobile nodes intended to establish and maintain an ad hoc network. AODV allows mobile nodes to respond over link breakages and changes of network topology in a certain time bound manner. In AODV, a table is maintained by each node that contains information about sending the packets to which neighbor in order to reach the final destination. Bellman-Ford distant vector algorithm is a relative of that, but it is adapted to work in a mobile environment. [1]

In data communication performance Wireless LAN is the major issue in MANET's. Hence, WLAN is required to be effective and accurate for handling mobility of nodes to give best utilization for technology. It is determined by Routing protocol as it is a standard to determine how nodes find the way via which forwarding of packets between devices all over

the network is done. In this paper performance of ***Extended Rate PHY (802.11g)*** is evaluated by using HTTP & FTP application type and Ad hoc On-Demand Distance Vector as Ad hoc Routing Protocol of Wireless LAN Standard. [2]

TABLE I. WLAN CLASSIFICATIONS

WLAN Physical Characteristics	Data Rates
Frequency Hopping	1 , 2 Mbps
Direct Sequence	1 , 2 , 5.5 , 11 Mbps
Infra Red	1 , 2 Mbps
OFDM(802.11a)	6 , 9 , 12 , 18 , 24 , 36 , 48 , 54 Mbps
Extended Rate PHY(802.11g)	1 , 2 , 5.5 , 11 , 6 , 9 , 12 , 18 , 24 , 36 , 48 , 54 Mbps

II. RELATED WORK

Neeraj[1] In this paper Comparative performance of Infra Red WLAN and Extended Rate PHY (802.11g) WLAN standard is done for 1 and 2 mbps data rate for AODV Routing Protocol. We used OPNET Simulation tool we created a network containing 25 mobile nodes with data rate 1 Mbps and 2 Mbps with transmission power 0.005 watts and buffer size 1024000 bits each node moves randomly in the network and simulation time was 2000 sec. Infra Red WLAN and Extended Rate PHY (802.11g) WLAN is compared in terms of 1& 2 Mbps for different QOS's using AODV protocol. According to the resulted performance we can say that Infra Red performed better in our QOS. The simulation result of the research has practical reference value for further study.

Vineet [2] in this paper analysis and performance of Infra Red WLAN is done for 1 and 2 mbps data rate for GRP. We used OPNET Simulation tool we created a network containing 20 mobile nodes with data rate 1 Mbps and 2 Mbps with transmission power 0.005 watts and buffer size 1024000 bits each node moves randomly in the network and simulation time was 1500 sec. Infra Red WLAN is compared in terms of 1 Mbps and 2 Mbps for different QOS's using GRP protocol. According to the resulted performance we can say that infrared wireless LAN might do a better job of satisfying requirements for mobile applications. The simulation result of the research has practical reference value for further study.

Ruchita [3] in this paper analysis and performance of OLSR in OFDM (802.11a) & Extended Rate PHY (802.11g) at 54 Mbps Data Rate. We used OPNET Simulation tool we created a network containing 25 mobile nodes for data rate 54 Mbps with transmission power 0.005 watts and buffer size 256000 bits each node moves randomly in the network and simulation time was 1500 sec. OLSR is compared in terms of OFDM (802.11a) and Extended Rate PHY (802.11g) for different QOS's using OPNET. According to the resulted performance we can say that 802.11g might do a better job of satisfying requirements for mobile applications. The simulation result of the research has practical reference value for further study..

Jonish [4] Mobile Ad-Hoc network (MANET) is a network of mobile nodes that can communicate with each other without using any centralized control or fixed infrastructure .In this paper analysis of the performance of TORA and GRP routing protocol is done with the use of OPNET simulation tool, we created a 50 mobile nodes networks on data rate 1 and 2 Mbps and transmission power 0.005 watts with buffer size 256000 bits the time of simulation was 1500 sec. TORA and GRP routing protocols were compared in terms of Download Response Time, Upload Response Time, Delay, Load and Media Access Delay in scenario for the simulation analysis and performances. The simulation result of the research has practical reference value for further study.

III. EXTENDED RATE PHY (802.11g) WIRELESS LAN

A wireless local area network (WLAN) is a wireless computer network that links two or more devices using a wireless distribution method (often spread-spectrum or OFDM radio) within a limited area such as a home, school, computer laboratory, office building or campus. This gives users the ability to move around within a local coverage area and still be connected to the network, and can provide a connection to the wider Internet. Most modern WLANs are based on IEEE 802.11 standards, marketed under the Wi- Fi brand name. For example Spectrix, once the chair of the 802.11 IR group, offers wireless LAN products that implement diffused optical technologies very similar to 802.11 IR. The primary difference between infrared and radio wireless LANs is the frequency of the transmitted signal. Don't become complacent with radio frequency (RF) technologies, such as 802.11a and 802.11b, as the only option for wireless LANs.

IV. SIMLATION SETUP

OPNET Modeler is a well known research simulator now a days, Which provides tools through the OPNET Technologies in order to undertake the experimental evaluation of matrices; the version used for study is OPNET Modeler 14.5 [12]. GUI interface is the best platform to work on and the OPNET provides GUI interface to work on. And due to GUI interface it is easy to built model of working in Virtual environment. One of the most extensively used commercial simulators based on Microsoft Windows platform is OPNET, which incorporates most of the routing parameters of MANET as compared to other commercial simulators. It simulates the network graphically and gives the graphical structure of actual networks and network components.

TABLE II. SIMULATION PARAMETERS

Simulation Parameter	Value
Simulator	OPNET Modular 14.5
Area	2000*2000
Network Size	25 Nodes
Data Rate	1, 2 Mbps
Mobility Model	Random waypoint
Traffic Type	FTP, HTTP
Simulation Time	2000 sec
Address Mode	IPV4
Standard	Extended Rate PHY(802.11g)
Routing Protocol	AODV

TABLE III. AODV PARAMETERS

Attribute	Value
Active Route Timeout	3.0
Hello Interval(sec)	Uniform(1,1.1)
Allowed Hello Loss	2
Net Diameter	35
Node Traversal Time(sec)	0.04
Route Error Rate Limit (pkts/sec)	10
Timeout Buffer	2
TTL Start	1
TTL Increment	2
TTL Threshold	7
Local Add TTL	2
Packet Queue Size (Packets)	Infinity
Local Repair	Enabled
Addressing Mode	IPV4

TABLE IV. WIRELESS LAN PARAMETERS

Attribute	Value
Physical Characteristics	Extended Rate PHY(802.11g)
Data Rate	1,2 Mbps
Short Retry Limit	7
Long Retry Limit	4
Max Receive Lifetime (sec)	0.5
Buffer Size(bits)	1024000
Roaming Capability	Enabled
Large Packet Processing	Fragment

Fig. 1 shows the simulation environment of scenario containing 25 WLAN mobile nodes, one fixed WLAN Server, Application definition, Profile definition and Mobility config. We configure the nodes in the scenario to work with 1 Mbps and 2 Mbps data rate with EXTENDED RATE PHY (802.11G) standard.

Fig. 1 Network Model for 25 Nodes scenario

V. PERFORMANCE MERICS

A. FTP Download Response Time (sec)

Time elapsed between sending a request and receiving the response packet. Measured from the time a client application sends a request to the server to the time it receives a response packet. Every response packet sent from a server to an FTP application is included in this statistic

B. FTP Upload Response Time (sec)

Time elapsed between sending a file and receiving the response. The response time for responses sent from any server to an FTP application is included in this statistic.

C. HTTP Page Response Time (sec)

Time elapsed between sending a request and receiving the response page. Measured from the time a client application sends a request to the server to the time it receives a response page.

D. WLAN Retransmission Attempts (packets)

It is the total number of retransmission attempts by all WLAN MACs in the network until either packet is successfully transmitted or it is discarded as a result of reaching short or long retry limit.

E. WLAN Media Access Delay (sec)

It 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.

VI. SIMULATION RESULTS AND ANALYSIS

Figure (2 - 6) below shows Email Download Response Time(sec), FTP Upload Response Time (sec), GRP Total No. of Backtracks, WLAN Retransmission Attempts (packets) and WLAN Media Access Delay (sec) in 20 mobile nodes scenario for EXTENDED RATE PHY (802.11G) standard at 1 Mbps and 2 Mbps data rate with AODV. The color scheme is showing the protocols behavior in different graphs which gives the average values. From these average values we will conclude the behavior of the EXTENDED RATE PHY (802.11G).

A. FTP Download Response Time (sec)

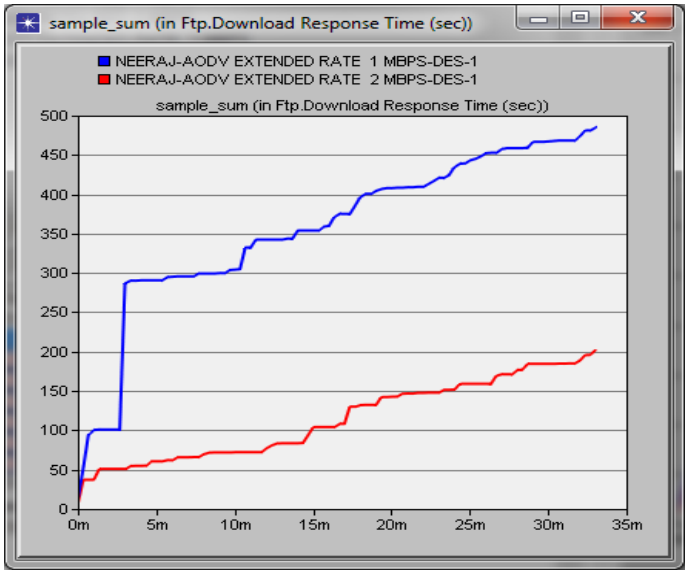

Fig. 2 Sample Sum for *FTP Download Response Time (sec)* in 1 and 2 Mbps for EXTENDED RATE PHY (802.11G)

According to simulation, as we can see in Fig. 2, FTP Download response time in Extended Rate PHY (802.11g) AODV 1 Mbps is more than 2 Mbps. This shows 2 Mbps works well than 1 Mbps in Extended Rate PHY (802.11g) AODV in terms of FTP Download Response time.

B. FTP Upload Response Time (sec)

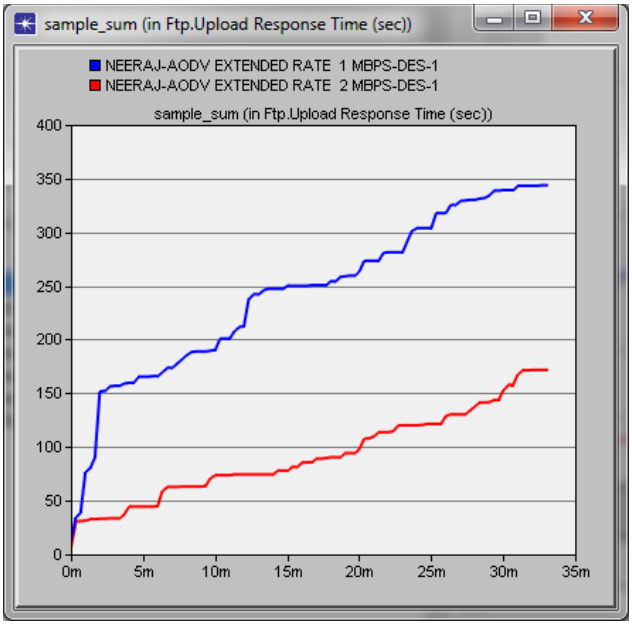

Fig. 3 Sample Sum for *FTP Upload Response Time (sec)* for 1 and 2 Mbps for EXTENDED RATE PHY (802.11G)

According to simulation, as we can see in Fig. 3, FTP Upload Response time in Extended Rate PHY (802.11g) AODV 1 Mbps is higher than in 2 Mbps. This shows 2 Mbps works well than 1 Mbps in Extended Rate PHY (802.11g) AODV in terms of FTP Upload Response time.

C. HTTP Page Response Time (sec)

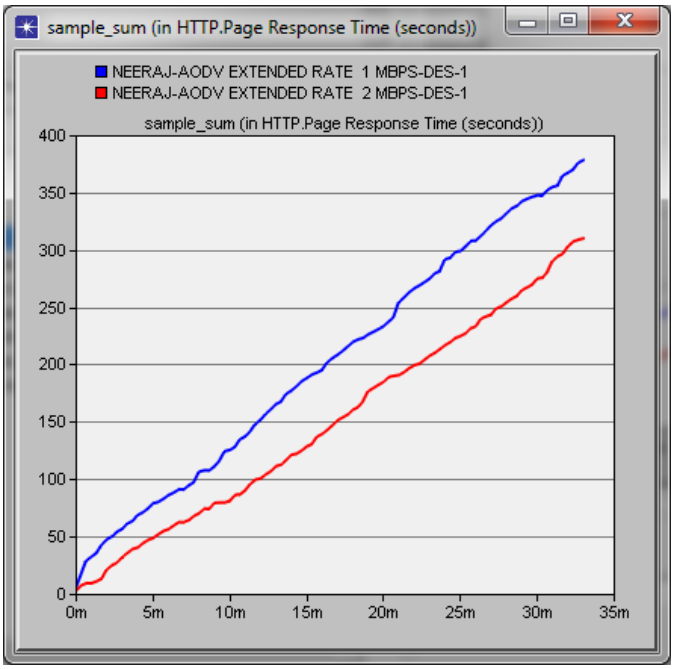

Fig. 4 Sample Sum for *HTTP Page Response Time (sec)* for 1 and 2 Mbps for EXTENDED RATE PHY (802.11G)

According to simulation, as we can see in Fig. 4, *HTTP Page Response Time (sec)* in Extended Rate PHY (802.11g) AODV 1 Mbps is higher than in 2 Mbps. This shows 2 Mbps works well than 1 Mbps in Extended Rate PHY (802.11g) AODV in terms of *HTTP Page Response Time (sec)*.

D. WLAN Retransmission Attempts (packets)

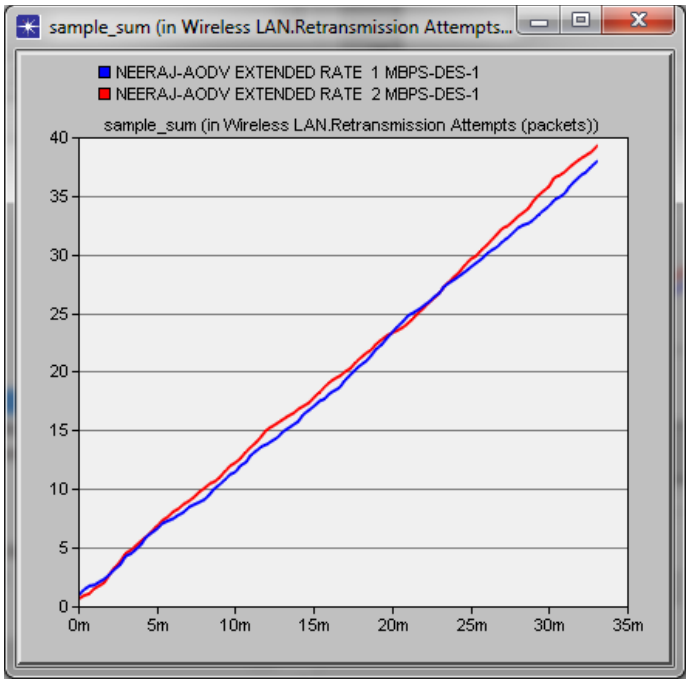

Fig. 5 Sample Sum for Retransmission Attempts in packets for 1 and 2 Mbps for EXTENDED RATE PHY (802.11G)

According to simulation, as we can see in Fig. 5, Wireless LAN Retransmission Attempts in Extended Rate PHY (802.11g) AODV 2 Mbps is higher than in 1 Mbps. This shows 2 Mbps works well than 1 Mbps in Extended Rate PHY (802.11g) AODV in terms of WLAN Retransmission Attempts.

E. WLAN Media Access Delay (sec)

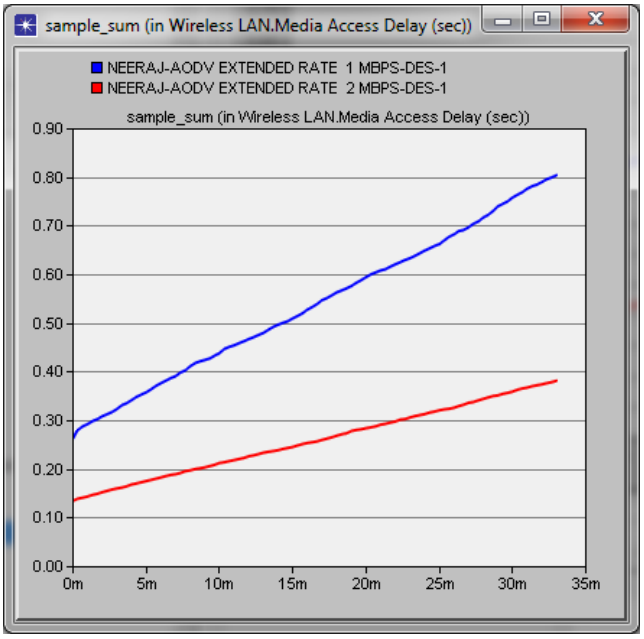

Fig. 6 Sample Sum for Media Access Delay for 1 and 2 Mbps for EXTENDED RATE PHY (802.11G)

According to simulation, as we can see in Fig. 6, Media Access Delay in Extended Rate PHY (802.11g) AODV 1 Mbps is higher than in 2 Mbps. This shows 2 Mbps works well than 1 Mbps in Extended Rate PHY (802.11g) AODV in terms of Media Access Delay.

VII. CONCLUSION

In this paper performance of Extended Rate PHY (802.11g) is evaluated with the use of AODV Protocol for metrics like FTP Download Response Time (sec), FTP Upload Response Time (sec), HTTP Page Response Time (sec), WLAN Retransmission Attempts (packets) and WLAN Media Access Delay (sec) by using 25 nodes scenario with IEEE 802.11 Extended Rate PHY (802.11g) Standard in 1 Mbps and 2 Mbps. From the above discussion we find out that Infra Red 2 Mbps performs better in terms of FTP Download Response Time (sec), FTP Upload Response Time (sec), HTTP Page Response Time (sec), WLAN Retransmission Attempts (packets) and WLAN Media Access Delay (sec).

TABLE IV. RESULTING VALUES

S. No.	Performance Metrics	EXTENDED RATE PHY (802.11G) (1 Mbps)	EXTENDED RATE PHY (802.11G) (2 Mbps)
1	FTP Download Response Time (sec)	-	BETTER
2	FTP Upload Response Time	-	BETTER
3	HTTP Page Response Time (sec)	-	BETTER
4	Retransmission Attempts	-	BETTER
5	WLAN Media Access Delay	-	BETTER

Extended Rate PHY (802.11g) have large no of possibilities to be worked on. An Extended Rate PHY (802.11g) might do a better job of satisfying requirements for mobile applications. The simulation result of the research has practical reference value for further study in the campus networks.

VIII. REFERENCES

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