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OPTIMIZE THE ROUTING PROTOCOL AODV, OLSR AND DSR ROUTING PROTOCOLS WITH ITS PERFORMANCE

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Abstract— Wireless and mobile communication has experienced an unprecedented growth during the past days. Recently, an increasing number of wireless local area network hot spots are emerging, allowing travelers with portable computers to surf the internet from airports, railway, hotel and other public locations. Furthermore, an increasing number of devices such as laptops, personal digital assistants, tablets PC, smart phones etc are provided with short range wireless interfaces. These are user friendly and more powerful. In this paper we have presented routing protocols in Mobile Ad hoc Network and their functionality in MANET with the performance through FTP service of AODV, OLSR and DSR routing protocol by using OPNET simulator 14.5. The performance is evaluated under different parameters like Delay, Load, Media access delay, Network Load, Retransmission and Throughput for Database load.

Keywords— MANET, Routing Protocol, Physical characteristics, Direct sequence, Data rates

1. INTRODUCTION

This evolution is diving a new alternative way for mobile communication in which mobile devices form a self-creating, self-organizing and self-administering wireless network called mobile ad hoc networks. In MANET nodes are communicate with each other by using without an infrastructure. Each nodes work as a router. MANET is a fast growing area of research [1].

In MANET, protocols are classification into three categories: (1) Proactive protocols provide fast response to topology changes by continuously monitoring topology changes and disseminating the related information as needed over the network [2]. (2) Reactive routing protocols, find the route only when there is data to be transmitted as a result, generate low control traffic and routing overhead. (3) Hybrid protocol could be derived from the two previous ones, containing the advantages of both the protocols. In this paper, we perform the concentrate AODV, DSR and OLSR routing protocols and functionality in MANET with physical characteristic and data rate in FTP service. This paper is organised as follows. In sec. 2, we describe the routing protocols in MANET. Sec 3, gives various parameters traffic loads in MANET. In sec 4, Wireless operative mode. In sec 5, simulation environment in OPNET SIMULATOR 14.5 is given. Sec 6 shows the results and discussion about the performance of various parameters of AODV, DSR & OLSR protocols. Conclusion is given in Sec 7.

2. ROUTING PROTOCOLS IN MANET

The most popular protocols are AODV, OLSR and DSR. This section describes the main features of three protocols Ad Hoc On-Demand Distance Vector Protocol, Dynamic source routing and Optimized Link State Routing deeply studied using OPNET 14.5. An ad-hoc routing protocol is a convention, or standard, that it improves the scalability of wireless networks compared to infrastructure based wireless networks because of its decentralized nature.

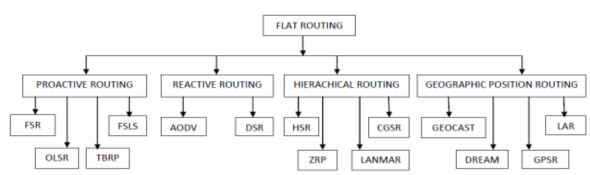

Figure 1: Classification of Protocols

2.1 AD-HOC ON DEMAND DISTANCE VECTOR (AODV): AODV is reactive routing protocol. In this route is discovered or maintain according to node request. AODV uses destination sequence number. It is capable for both unicast and multicast routing. Mobile nodes respond to the any change in network topology and link failures in necessary times. In case of the link failures the respective defective nodes are notified with the message, and then the affected nodes will revoke the routes using the lost link [3]. AODV uses the message types Route Request (RREQ), Route Replies (RREP) and Route Error (RERR) in finding the route from source to destination. AODV performs two

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operations: (1) route discovery and (2) route maintenance (3) Route Caching.

2.2 OPTIMIZED LINK STATE ROUTING (OLSR): OLSR is a proactive routing protocol. Every node of network maintaining information about all routes in route table. When a route is needed, the route table is immediately available. OLSR uses the concept of Multipoint Relays (MPR) to reduce the overhead in the network. OLSR uses two control messages: (1) Hello and (2) Topology Control (TC). Hello message are used to find the link state and neighbouring nodes. In OLSR, nodes send HELLO messages to their neighbours at a predetermined interval. These messages are periodically sent to determine the status of the links [3]. TC message is used for broadcasting information for neighbours which includes at least the MPR selector list. It also handles the calculation of outing tables.

2.3 DYNAMIC SOURCE ROUTING (DSR): DSR is also a reactive routing protocol. It uses the concept of source routing [4]. In source routing the sender knows all hop-by-hop routes to the destination. All the routes are stored in the route cache. When a node attempts to send a data packet to a destination it does not know the route. In DSR each node maintains a route cache with route entries which are continuously updated. The advantage of DRS is that no periodic routing packets are required. It is used to updates its route caches by finding new routes [5]. DSR has capability to handle unidirectional links. The sender of the packets selects and controls the route used for its own packets, which also supports features such as load balancing. All routes used are guaranteed to be free of loops as the sender can avoid duplicate hops in the selected routes.

3. VARIOUS PARAMETERS IN TRAFFIC LOADS

SR. NO.	PARAMETERS	DESCRIPTION
1	**Delay(Sec)**	Represents the end to end delay of all the packets received by the wireless LAN MACs of all WLAN nodes in the network and forwarded to the higher layer.
2	**Load (Bits/Sec)**	Represents the total load submitted to wireless LAN layers by all higher layers in all WLAN nodes of the network.(Global)
3	**Media Access Delay (Sec)**	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.
4	**Throughput (Bits/Sec)**	Represents the total number of bits (in bit/sec) forwarded from wireless LAN layers to higher layers in all WLAN nodes of the network.
5	**Network load (Bits/sec)**	Network load represents the total load in bit/sec submitted to wireless LAN layers by all higher layers in all WLAN nodes of the network. When there is more traffic coming on the network, and it is difficult for the network to handle all this traffic so it is called the network load. The efficient network can easily cope with large traffic coming in, and to make a best network, many techniques have been introduced.(node network).
6	**Retransmission (Packets)**	The number of times data has to be retransmitting i.e called Retransmission Attempts. How many no of times data has to be retransmit by the Source node.

Table 1: Simulation parameters

All these parameters help us to evaluate the best routing protocol between them. All the parameters that have taken play a very vital role to judge or evaluate the performance of the wireless network.

4. WIRELESS OPERATIVE MODE

In 1997, the Institute of Electrical and Electronics Engineers (IEEE) created the first WLAN standard. They called it 802.11 after the name of the group formed to oversee its development. 802.11 only supported a maximum network bandwidth of 2 mbps that is too slow for most applications. For this reason, ordinary 802.11 wireless products are no longer manufactured. In our research work 802.11a/b/g standard with release year, bandwidth, frequency, data rate, modulation technique is used to simulate our network.

STANDARD	802.11a	802.11b	802.11g
Release	Sep 1999	Sep 1999	Jun 2003
Bandwidth (MHz)	20	20	20
Frequency (GHz)	5	2.4	2.4
Data Rate (Mbit/s)	2,4,6,9,12,18,36,48,54	5.5,11	2,4,6,9,12,18,36,48,54
Modulation	OFDM	DSSS	OFDM, DSSS

Table 2: Standard Detail

DSSS: Direct sequence spread spectrum (DSSS) PHY in 802.11 had data rates of 1 Mbps and 2 Mbps. It quickly became clear that direct sequence technologies had the potential for higher speeds. Direct sequence became the PHY of choice. In 1999, a PHY with data rates of 5.5 Mbps and 11 Mbps was specified in 802.11b.

EXTENDED RATE PHY (802.11g): As 802.11a emerged from the laboratory into commercially-available chipsets, users had a desire to obtain higher speeds than 802.11b, while retaining backwards compatibility with the installed base of 802.11b hardware. The result is 802.11g, which offers a headline bit rate comparable to 802.11a while still operating in the microwave band. By working at slightly less than half the frequency, 802.11g devices have better range than the 5 GHz 802.11a devices.

5. SIMULATION ENVIROMENT

Several researchers have done the qualitative and quantative analysis of ad hoc routing protocol by means of different performance metrics. They have used different simulators for this purpose which is one of several tools provided from the OPNET Technologies suite. For undertake the experimental evaluation, the most recently available version, namely OPNET MODELER 14.5 has been adopted in our study OPNET is one of the most extensively used commercial simulators based on Microsoft Windows Platform, which incorporates most of the MANET routing parameters compared to other commercial simulators available [6].

The network entities used during the design of the network model are wireless server, application configuration, profile configuration, mobility configuration and workstations. Table 1 shows the various simulation parameters.

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SIMULATION PARAMETER	VALUE
Simulator	OPNET MODELER 14.5
Area	800x800 (m)
Network Size	20 nodes
Protocol	DSR,OLSR,AODV
Mobility Model	Random Way Point
Traffic Type	FTP
Simulation Time	900 (Sec)
Address Mode	IPv4
Physical Characteristics	Direct Sequence
Data Rate	2 mbps
Seed	128

Table 3: Simulation parameters Value

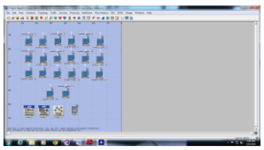

Figure 2: Environment Scenario of 20 Nodes

6. RESULTS AND DISCUSSION

6.1 FTP SERVICE IN DSR PROTOCOL (Direct Sequence vs Extended Rate PHY (802.11g)

a) Delay (Sec)

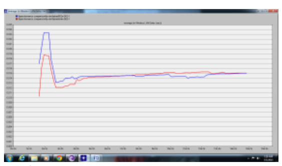

Figure 3: Comparison of Delay in DSR Protocol with FTP Service through Direct Sequence and Extended Rate PHY 802.11g

In figure 14, X-axis denotes time in minutes and Y-axis is denotes time in seconds. It shows that the average peak value of delay is almost 0.0233 seconds for DSR in Direct Sequence and 0.0187 Seconds for DSR in Extended Rate PHY (802.11g). After 15 minutes, it gradually drops 0.0131 seconds for DSR in Direct Sequence and 0.0102 seconds for DSR in Extended Rate PHY (802.11g).

b) Load (Bits/Sec)

Figure 4: Comparison of Load in DSR Protocol with FTP Service through Direct Sequence and Extended Rate PHY 802.11g

In figure 15, X-axis denotes time in minutes and Y-axis is denotes data rate which is in bits/sec. It shows that the average peak value of load is almost 69714.79 bits/sec for DSR in Direct Sequence and 69712.25 bits/sec for DSR in Extended Rate PHY (802.11g). After 15 minutes, It gradually drops 7749.33 bits/sec for DSR in Direct Sequence and 7749.33 bits/sec for DSR in Extended Rate PHY (802.11g).

c) Media Access Delay (Sec)

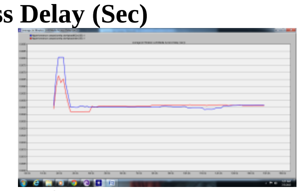

Figure 5: Comparison of Media Access Delay in DSR Protocol with FTP Service through Direct Sequence and Extended Rate PHY 802.11g

In figure 14, X-axis denotes time in minutes and Y-axis is denotes time in seconds. It shows that the average peak value of Media Access delay is almost 0.0080 seconds for DSR in Direct Sequence and 0.0067 Seconds for DSR in Extended Rate PHY (802.11g). After 15 minutes, it gradually drops 0.0043 seconds for DSR in Direct Sequence and 0.0041 seconds for DSR in Extended Rate PHY (802.11g).

d) Network Load (Bits/Sec)

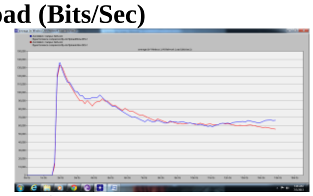

Figure 6: Comparison of Network Load in DSR Protocol with FTP Service through Direct Sequence and Extended Rate PHY 802.11g

In figure 15, X-axis denotes time in minutes and Y-axis is denotes data rate which is in bits/sec. It shows that the average peak value of Network Load is almost 136114.79 bits/sec for DSR in Direct Sequence and 132789.84 bits/sec for DSR in Extended Rate PHY (802.11g). After 15 minutes, It gradually drops 15498.66 bits/sec for DSR in Direct Sequence and 11625.48 bits/sec for DSR in Extended Rate PHY (802.11g).

e) Retransmission Attempts (Packets)

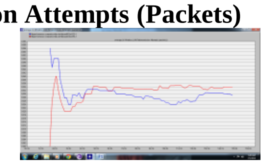

Figure 7: Comparison of Retransmission Attempts in DSR Protocol with FTP Service through Direct Sequence and Extended Rate PHY 802.11g

In figure 14, X-axis denotes time in minutes and Y-axis is denotes time in seconds. It shows that the average peak value of Retransmission Attempts is almost 0.0561 Packets for DSR in Direct Sequence and 0.0401 Packets for DSR in Extended Rate PHY (802.11g). After 15 minutes, It gradually drops 0.0237 Packets for DSR in Direct Sequence and 0.0200 Packets for DSR in Extended Rate PHY (802.11g).

f) Throughput (Bits/Sec)

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Figure 8: Comparison of Throughput in DSR Protocol with FTP Service through Direct Sequence and Extended Rate PHY 802.11g

In figure 15, X-axis denotes time in minutes and Y-axis is denotes data rate which is in bits/sec. It shows that the average peak value of Throughput is almost 69714.79 bits/sec for DSR in Direct Sequence and 69712.25 bits/sec for DSR in Extended Rate PHY (802.11g). After 15 minutes, It gradually drops 7749.33 bits/sec for DSR in Direct Sequence and 7749.33 bits/sec for DSR in Extended Rate PHY (802.11g).

STANDARD PARAMETERS	DIRECT SEQUENCE DSR		EXTENDED RATE PHY (802.11G) DSR	
	Peak Value	Drop Value	Peak Value	Drop Value
DELAY	0.023331649	0.013118531	0.018777726	0.010274207
LOAD	69714.79365	7749.333333	69712.25397	7749.333333
MEDIA ACCESS DELAY	0.00807304	0.004346669	0.006744743	0.004171707
NETWORK LOAD	136114.7937	15498.66667	132789.8413	11625.48148
RETRANSMISSION ATTEMPTS	0.056179775	0.023768176	0.040182135	0.020091068
THROUGHPUT	69714.79365	7749.333333	69712.25397	7749.333333

Table 4: Comparison of DSR Protocol

6.2 FTP SERVICE IN OLSR PROTOCOL (Direct Sequence vs Extended Rate PHY (802.11g)

a) Delay (Sec)

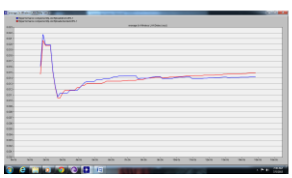

Figure 9: Comparison of Delay in OLSR Protocol with FTP Service through Direct Sequence and Extended Rate PHY 802.11g

In figure 14, X-axis denotes time in minutes and Y-axis is denotes time in seconds. It shows that the average peak value of delay is almost 0.0217 seconds for OLSR in Direct Sequence and 0.0206 Seconds for OLSR in Extended Rate PHY (802.11g). After 15 minutes, It gradually drops 0.0106 seconds for OLSR in Direct Sequence and 0.0104 seconds for OLSR in Extended Rate PHY (802.11g).

b) Load (Bits/Sec)

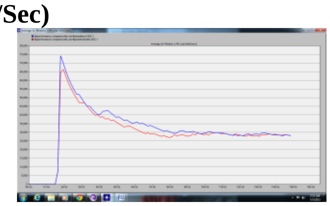

Figure 10: Comparison of Load in OLSR Protocol with FTP Service through Direct Sequence and Extended Rate PHY 802.11g

In figure 15, X-axis denotes time in minutes and Y-axis is denotes data rate which is in bits/sec. It shows that the average peak value of load is almost 74113.09 bits/sec for OLSR in Direct Sequence and 66405.07 bits/sec for OLSR in Extended Rate PHY (802.11g). After 15 minutes, It gradually drops 7373.03 bits/sec for OLSR in Direct Sequence and 7584.59 bits/sec for OLSR in Extended Rate PHY (802.11g).

c) Media Access Delay (Sec)

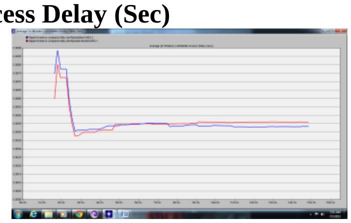

Figure 11: Comparison of Media Access Delay in OLSR Protocol with FTP Service through Direct Sequence and Extended Rate PHY 802.11g

In figure 14, X-axis denotes time in minutes and Y-axis is denotes time in seconds. It shows that the average peak value of Media Access delay is almost 0.0088 seconds for OLSR in Direct Sequence and 0.0079 Seconds for OLSR in Extended Rate PHY (802.11g). After 15 minutes, It gradually drops 0.0040 seconds for OLSR in Direct Sequence and 0.0037 seconds for OLSR in Extended Rate PHY (802.11g).

d) Networl Load (Bits/Sec)

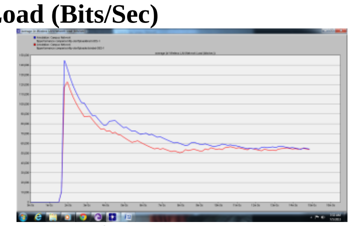

Figure 12: Comparison of Network Load in OLSR Protocol with FTP Service through Direct Sequence and Extended Rate PHY 802.11g

In figure 15, X-axis denotes time in minutes and Y-axis is denotes data rate which is in bits/sec. It shows that the average peak value of Network Load is almost 144648.20 bits/sec for OLSR in Direct Sequence and 122845.46 bits/sec for OLSR in Extended Rate PHY (802.11g). After 15 minutes, It gradually drops 10869.92 bits/sec for OLSR in Direct Sequence and 10951.70 bits/sec for OLSR in Extended Rate PHY (802.11g).

e) Retransmission Attempts (Packets)

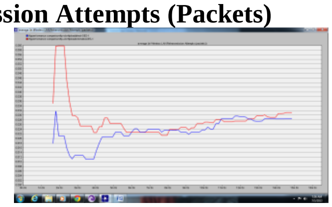

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Figure 13: Comparison of Retransmission Attempts in OLSR Protocol with FTP Service through Direct Sequence and Extended Rate PHY 802.11g

In figure 14, X-axis denotes time in minutes and Y-axis is denotes time in seconds. It shows that the average peak value of Retransmission Attempts is almost 0.0316 Packets for OLSR in Direct Sequence and 0.0597 Packets for OLSR in Extended Rate PHY (802.11g). After 15 minutes, It gradually drops 0.0111 Packets for OLSR in Direct Sequence and 0.0212 Packets for OLSR in Extended Rate PHY (802.11g).

f) Throughtput (Bits/Sec)

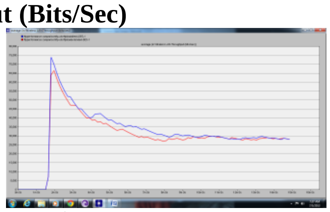

Figure 14: Comparison of Throughput in OLSR Protocol with FTP Service through Direct Sequence and Extended Rate PHY 802.11g

In figure 15, X-axis denotes time in minutes and Y-axis is denotes data rate which is in bits/sec. It shows that the average peak value of Throughput is almost 73798.01 bits/sec for OLSR in Direct Sequence and 66405.07 bits/sec for OLSR in Extended Rate PHY (802.11g). After 15 minutes, It gradually drops 7028.74 bits/sec for OLSR in Direct Sequence and 7072.59 bits/sec for OLSR in Extended Rate PHY (802.11g).

STANDARD PARAMETERS	DIRECT SEQUENCE OLSR		EXTENDED RATE PHY (802.11G) OLSR	
	Peak Value	Drop Value	Peak Value	Drop Value
DELAY	0.021737238	0.010643427	0.020656374	0.010482528
LOAD	74113.09402	7373.037037	66405.07937	7584.592593
MEDIA ACCESS DELAY	0.008841127	0.004065477	0.007995314	0.00376632
NETWORK LOAD	144648.2051	10869.92593	122845.4603	10951.7037
RETRANSMISSION ATTEMPTS	0.031669445	0.011144779	0.059768744	0.021282191
THROUGHPUT	73798.01709	7028.740741	66405.07937	7072.592593

Table 5: Comparison of OLSR Protocol

6.3 FTP SERVICE IN AODV PROTOCOL(Direct Sequence vs Extended Rate PHY (802.11g)

a) Delay (Sec)

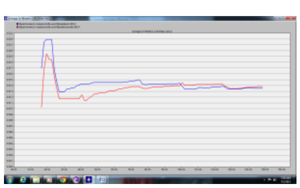

Figure 15: Comparison of Delay in AODV Protocol with FTP Service through Direct Sequence and Extended Rate PHY 802.11g

In figure 14, X-axis denotes time in minutes and Y-axis is denotes time in seconds. It shows that the average peak value of delay is almost 0.0219 seconds for AODV in Direct Sequence and 0.0194 Seconds for AODV in Extended Rate PHY (802.11g). After 15 minutes, It gradually drops 0.0128 seconds for AODV in Direct Sequence and 0.0102 seconds for AODV in Extended Rate PHY (802.11g).

b) Load (Bits/Sec)

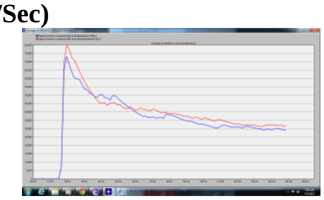

Figure 16: Comparison of Load in AODV Protocol with FTP Service through Direct Sequence and Extended Rate PHY 802.11g

In figure 15, X-axis denotes time in minutes and Y-axis is denotes data rate which is in bits/sec. It shows that the average peak value of load is almost 73034.66 bits/sec for AODV in Direct Sequence and 79682.03 bits/sec for AODV in Extended Rate PHY (802.11g). After 15 minutes, It gradually drops 7749.33 bits/sec for AODV in Direct Sequence and 7749.33 bits/sec for AODV in Extended Rate PHY (802.11g).

c) Media Access Delay (Sec)

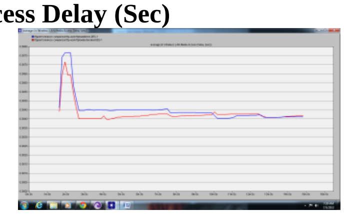

Figure 17: Comparison of Media Access Delay in AODV Protocol with FTP Service through Direct Sequence and Extended Rate PHY 802.11g

In figure 14, X-axis denotes time in minutes and Y-axis is denotes time in seconds. It shows that the average peak value of Media Access delay is almost 0.0076 seconds for AODV in Direct Sequence and 0.0071 Seconds for AODV in Extended Rate PHY (802.11g). After 15 minutes, It gradually drops 0.0040 seconds for AODV in Direct Sequence and 0.0039 seconds for AODV in Extended Rate PHY (802.11g).

d) Network Load (Bits/Sec)

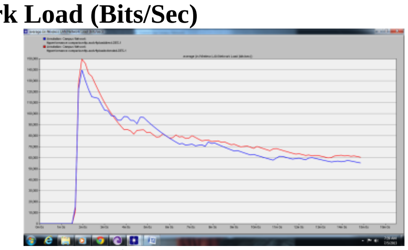

Figure 18: Comparison of Network Load in AODV Protocol with FTP Service through Direct Sequence and Extended Rate PHY 802.11g

In figure 15, X-axis denotes time in minutes and Y-axis is denotes data rate which is in bits/sec. It shows that the

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average peak value of Network Load is almost 139437.20 bits/sec for AODV in Direct Sequence and 149409.52 bits/sec for AODV in Extended Rate PHY (802.11g). After 15 minutes, It gradually drops 15498.66 bits/sec for AODV in Direct Sequence and 11625.48 bits/sec for AODV in Extended Rate PHY (802.11g).

e) Retransmission Attempts (Packets)

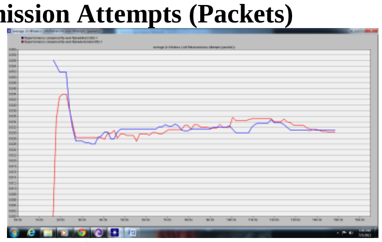

Figure 19: Comparison of Retransmission Attempts in AODV Protocol with FTP Service through Direct Sequence and Extended Rate PHY 802.11g

In figure 14, X-axis denotes time in minutes and Y-axis is denotes time in seconds. It shows that the average peak value of Retransmission Attempts is almost 0.0561 Packets for AODV in Direct Sequence and 0.0438 Packets for AODV in Extended Rate PHY (802.11g). After 15 minutes, It gradually drops 0.0259 Packets for AODV in Direct Sequence and 0.0270 Packets for AODV in Extended Rate PHY (802.11g).

f) Throughtput (Bits/Sec)

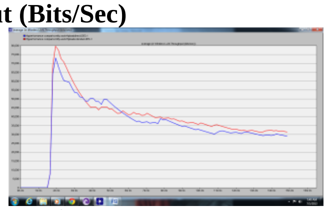

Figure 20: Comparison of Throughput in AODV Protocol with FTP Service through Direct Sequence and Extended Rate PHY 802.11g

In figure 15, X-axis denotes time in minutes and Y-axis is denotes data rate which is in bits/sec. It shows that the average peak value of Throughput is almost 73034.66 bits/sec for AODV in Direct Sequence and 79682.03 bits/sec for AODV in Extended Rate PHY (802.11g). After 15 minutes, It gradually drops 7749.33 bits/sec for AODV in Direct Sequence and 7749.33 bits/sec for AODV in Extended Rate PHY (802.11g).

STANDARD PARAMETERS	DIRECT SEQUENCE AODV		EXTENDED RATE PHY (802.11G) AODV	
	Peak Value	Drop Value	Peak Value	Drop Value
DELAY	0.021921724	0.012863018	0.019424408	0.010275034
LOAD	73034.66667	7749.333333	79682.03175	7749.333333
MEDIA ACCESS DELAY	0.007650094	0.004035977	0.007146502	0.0039811
NETWORK LOAD	139437.2063	15498.66667	149409.5238	11625.48148
RETRANSMISSION ATTEMPTS	0.056179775	0.025986589	0.043875476	0.027008756
THROUGHPUT	73034.66667	7749.33333	79682.03175	7749.333333

Table 6: Comparison of AODV Protocol

6.4 FTP SERVICE IN DSR, AODV AND OLSR (DIRECT SEQUENCE)

a) Delay (Sec)

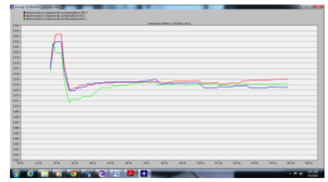

Figure 21: Comparison of DSR, AODV and OLSR Protocol for Delay in FTP Service through Direct Sequence

In figure 14, X-axis denotes time in minutes and Y-axis is denotes time in seconds. It shows that the average peak value of delay is almost 0.0219 seconds for AODV, 0.0233 seconds for DSR and 0.0217 seconds for OLSR. After 15 minutes, it gradually drops and attains a constant value of approximately 0.0128 seconds for AODV, 0.0131 seconds for DSR and 0.0106 seconds for OLSR.

b) Load (Bits/sec)

Figure 22: Comparison of DSR, AODV and OLSR Protocol for Load in FTP Service through Direct Sequence

In figure 15, X-axis denotes time in minutes and Y-axis is denotes data rate which is in bits/sec. It shows that the average peak value of load is almost 73034.66 bits/sec for AODV, 69714.79 bits/sec for DSR and 74113.09 bits/sec for OLSR. After 15 minutes, it gradually drops to almost 7749.33 bits/sec for AODV, 7749.33 bits/sec for DSR and 7373.03 bits/sec for OLSR.

c) Media Access Delay (Sec)

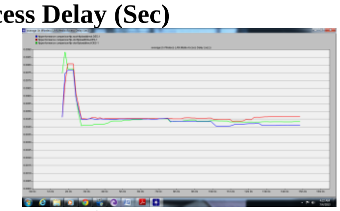

Figure 23: Comparison of DSR, AODV and OLSR Protocol for Media Access Delay in FTP Service through Direct Sequence

In figure 16, X-axis denotes time in minutes and Y-axis is denotes time in seconds. It shows that the average peak value of Media access delay is almost 0.0076 seconds for AODV, 0.0080 seconds for DSR and 0.0088 seconds for OLSR. After 15 minutes, it gradually drops and attains a constant value of approximately 0.0040 seconds for AODV, 0.0043 seconds for DSR and 0.0040 seconds for OLSR.

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d) Network Load (Bits/Sec)

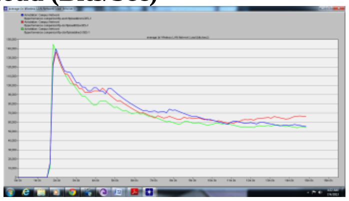

Figure 24: Comparison of DSR, AODV and OLSR Protocol for Network Load in FTP Service through Direct Sequence

In figure 17, X-axis denotes time in minutes and Y-axis is denotes data rate which is in bits/sec. It shows that the average peak value of network load is almost 139437.20 bits/sec for AODV, 136114.79 bits/sec for DSR and 144648.20 bits/sec for OLSR. After 15 minutes, it gradually drops to almost 15498.66 bits/sec for AODV, 15498.66 bits/sec for DSR and 10869.92 bits/sec for OLSR.

e) Retransmission Attempts (Packets)

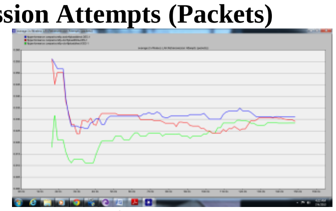

Figure 25: Comparison of DSR, AODV and OLSR Protocol for Retransmission Attempts in FTP Service through Direct Sequence

In figure 18, X-axis denotes time in minutes and Y-axis is denotes data rate which is in Packets/sec. It shows that the average peak value of retransmission is almost 0.0561 packets for AODV, 0.0561 packets for DSR and 0.0316 packets for OLSR. After 15 minutes, it gradually drops as time progress and reaches to almost 0.0259 packets for AODV, 0.0237 packets for DSR and 0.0111 packets for OLSR.

f) Throughput (bits/sec)

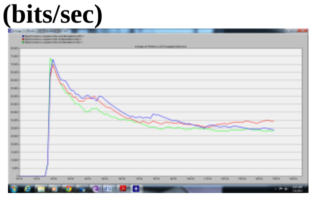

Figure 26: Comparison of DSR, AODV and OLSR Protocol for Throughput in FTP Service through Direct Sequence

In figure 19, X-axis denotes time in minutes and Y-axis is denotes data rate which is in bits/sec. It shows that the average peak value of throughput is almost 73034.66 bits/sec for AODV, 69714.79 bits/sec for DSR and 73798.01 bits/sec for OLSR. After 15 minutes, it gradually drops to almost 7749.33 bits/sec for AODV, 7749.33 bits/sec for DSR and 7028.74 bits/sec for OLSR.

6.5 FTP SERVICE IN DSR, AODV AND OLSR (EXTENDED RATE PHY (802.11g))

a) Delay (Sec)

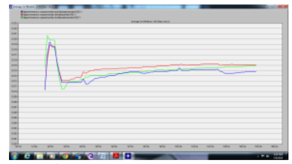

Figure 27: Comparison of DSR, AODV and OLSR Protocol for Delay in FTP Service through Extended Rate PHY 802.11g

In figure 14, X-axis denotes time in minutes and Y-axis is denotes time in seconds. It shows that the average peak value of delay is almost 0.0194 seconds for AODV, 0.0187 seconds for DSR and 0.0206 seconds for OLSR. After 15 minutes, it gradually drops and attains a constant value of approximately 0.0102 seconds for AODV, 0.0102 seconds for DSR and 0.0104 seconds for OLSR.

b) Load (bits/Sec)

Figure 28: Comparison of DSR, AODV and OLSR Protocol for Load in FTP Service through Extended Rate PHY 802.11g

In figure 15, X-axis denotes time in minutes and Y-axis is denotes data rate which is in bits/sec. It shows that the average peak value of load is almost 79682.03 bits/sec for AODV, 69712.25 bits/sec for DSR and 66405.07 bits/sec for OLSR. After 15 minutes, it gradually drops to almost 7749.33 bits/sec for AODV, 7749.33 bits/sec for DSR and 7584.59 bits/sec for OLSR.

c) Media Access Delay (Sec)

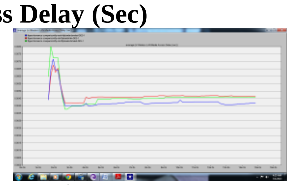

Figure 29: Comparison of DSR, AODV and OLSR Protocol for Media Access Delay in FTP Service through Extended Rate PHY 802.11g

In figure 16, X-axis denotes time in minutes and Y-axis is denotes time in seconds. It shows that the average peak value of Media access delay is almost 0.0071 seconds for AODV, 0.0067 seconds for DSR and 0.0079 seconds for OLSR. After 15 minutes, it gradually drops and attains a constant value of approximately 0.0039 seconds for AODV, 0.0041 seconds for DSR and 0.0037 seconds for OLSR.

d) Network Load (Bits/Sec)

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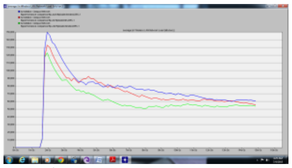

Figure 30: Comparison of DSR, AODV and OLSR Protocol for Network Load in FTP Service through Extended Rate PHY 802.11g

In figure 17, X-axis denotes time in minutes and Y-axis is denotes data rate which is in bits/sec. It shows that the average peak value of network load is almost 149409.52 bits/sec for AODV, 132789.84 bits/sec for DSR and 122845.46 bits/sec for OLSR. After 15 minutes, it gradually drops to almost 11625.48 bits/sec for AODV, 11625.48 bits/sec for DSR and 10951.70 bits/sec for OLSR.

e) Retransmission Attempts (Packets)

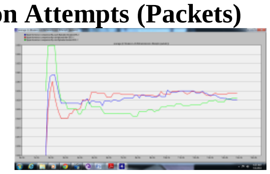

Figure 31: Comparison of DSR, AODV and OLSR Protocol for Retransmission Attempts in FTP Service through Extended Rate PHY 802.11g

In figure 18, X-axis denotes time in minutes and Y-axis is denotes data rate which is in Packets/sec. It shows that the average peak value of retransmission is almost 0.043875476 packets for AODV, 0.040182135 packets for DSR and 0.059768744 packets for OLSR. After 15 minutes, it gradually drops as time progress and reaches to almost 0.027008756 packets for AODV, 0.020091068 packets for DSR and 0.021282191 packets for OLSR.

f) Throughput (Bits/sec)

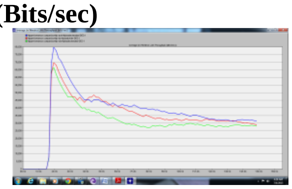

Figure 32: Comparison of DSR, AODV and OLSR Protocol for Throughput in FTP Service through Extended Rate PHY 802.11g

In figure 19, X-axis denotes time in minutes and Y-axis is denotes data rate which is in bits/sec. It shows that the average peak value of throughput is almost 79682.03 bits/sec for AODV, 69712.25 bits/sec for DSR and 66405.07 bits/sec for OLSR. After 15 minutes, it gradually drops to almost 7749.33 bits/sec for AODV, 7749.33 bits/sec for DSR and 7072.59 bits/sec for OLSR.

Table 3 shows numeric values of various parameters taken into consideration for FTP Service in AODV, DSR and OLSR protocols. It gives the performance comparison of 3 protocols in terms of delay, load, media access, network load, retransmission attempts and throughput for FTP Service.

STANDARD PARAMETERS	DIRECT SEQUENCE			EXTENDED RATE PHY (802.11G)		
	DSR	OLSR	AODV	DSR	OLSR	AODV
DELAY	0.023331649	0.021737238	0.021921724	0.018777726	0.020656374	0.019424408
LOAD	69714.79365	74113.09402	73034.66667	69712.25397	66405.07937	79682.03175
MEDIA ACCESS DELAY	0.00807304	0.008841127	0.007650094	0.006744743	0.007995314	0.007146502
NETWORK LOAD	136114.7937	144648.2051	139437.2063	132789.8413	122845.4603	149409.5238
RETRANSMISSION ATTEMPTS	0.056179775	0.031669445	0.056179775	0.040182135	0.059768744	0.043875476
THROUGHPUT	69714.79365	73798.01709	73034.66667	69712.25397	66405.25397	79682.03175

Table 7: Values of various parameters corresponding to 3 protocols for FTP Service.

As shown in Table 7, DSR performs better than OLSR and AODV in Direct Sequence and OLSR performs better than DSR and AODV in Extended Rate PHY 802.11g in Delay parameter for FTP Service. OLSR performs better than DSR and AODV in Direct Sequence and AODV perform better than DSR and OLSR in Extended Rate PHY 802.11g in load parameter for FTP Service. OLSR performs better than DSR and AODV in Direct Sequence and OLSR performs better than DSR and AODV in Extended Rate PHY 802.11g in Media Access Delay for FTP Service. OLSR performs better than DSR and AODV in Direct Sequence and AODV perform better than DSR and OLSR in Extended Rate PHY 802.11g in Network Load for FTP Service. DSR & AODV perform better than OLSR in Direct Sequence and OLSR performs better than DSR and AODV in Extended Rate PHY 802.11g in Retransmission Attempts for FTP Service. OLSR performs better than AODV & DSR in Direct Sequence & AODV performs better than DSR and OLSR in Extended Rate PHY 802.11g in Throughput for FTP Service.

7. CONCLUSION

In this paper, we performed the comparison between three protocols AODV, DSR and OLSR with Direct Sequence and Extended Rate PHY 802.11g in FTP Service through Delay, Load, Media access delay, Network Load, Retransmission and Throughput parameters. The results are taken in tabular form as well as graphical form by using OPNET Simulator 14.5. The results show that which protocol performs better than another by using Operative Mode (Direct Sequence and Extended Rate PHY 802.11g) in FTP Service.

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