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Study and Analysis of AODV and DSDV Routing Protocols Over Zigbee Network for Different Topologies under FTP Traffic Pattern

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***Abstract*—Wired technology is replaced by wireless technology in almost all the fields, because wireless technology is more efficient and reliable as compared to wired networks .There are various wireless standards defined under IEEE 802 family and for WPAN it defines IEEE802.15 standard series. Zigbee is an open specification developed by Zigbee Alliance build on the top of IEEE802.15.4 Physical and Media Access Control layer standard which is one of the global wireless standards of communication protocol for Low-Rate Wireless Personal Area Networks (LR-WPAN). There are different topologies and traffic patterns under which Zigbee can be analyzed and whose knowledge is essential for optimizing the performance and enhancing the QoS of the network. It supports Star, Peer to Peer (Mesh) and Cluster tree topologies and FTP, CBR and POISSON Traffic patterns. This paper presents overview of IEEE 802.15.4/Zigbee and analyzes the performance of AODV and DSDV routing protocol over Zigbee network for different topologies under FTP data traffic pattern using Drop tail queue in Beacon enabled mode by varying Number of nodes, Number of sources and Range. Performance analysis is carried out using various parameters like Average End-to-End delay, Average Throughput and Packet delivery ratio, it determine the Quality of Services (QoS) of the network under different scenarios using NS2 simulator (Version 2.35).**

Keywords—IEEE 802.15.4, Zigbee, AODV, DSDV, FTP

I. Introduction

With the rapid growth of mobile computing devices the demand for short range wireless standards for portable and flexible connectivity are increasing day by day. Therefore, IEEE802.15 working group was formed to create Wireless Personal Area Network (WPAN) standard, intended to focus on low-cost, low power and short range. Zigbee is an open specification for Lower rate wireless personal area network build on the top of IEEE802.15.4 standard where IEEE802.15.4 standard focuses on the specification of the lower two layers (physical and data link layer) and ZigBee provides upper layers of the protocol stack (from network to the application layer). It supports small, cheap, energy-efficient devices operating on battery power. It aims at low power consumption, low data rate, low cost, short range and flexible, reliable, scalable wireless communication. Therefore, it is anticipated to enable various short range applications in the fields of home networking, home/office automation, automotive networks, industrial networks, hotels, hospitals, interactive toys and remote metering and many more [12].Before the implementation of real time applications, extensive performance evaluation of the standard is necessary especially when critical issue like QoS is of concern. The knowledge of traffic pattern is also essential for optimizing the performance. Because the uneven distribution make traffic heterogeneous in nature and it will affects the QoS. So it's a challenge to choose the optimal routing protocol that can be used with most usable data traffic pattern to enhance the QoS of network. In this paper an attempt is made to analyze the performance of AODV and DSDV routing protocols over IEEE 802.15.4/Zigbee network different topologies under FTP traffic pattern with respect to the related work done by various researchers.

The rest of the paper is organized as follows: section II covers related work in this area. Section III provides a brief overview of the IEEE 802.15.4/ Zigbee standard. Section IV describes various routing protocols and traffic patterns, in section V simulation environment is discussed, simulation result is analyzed in section VI and finally section VII gives conclusion of the paper.

II. Related Work

Several efforts on performance evaluations were conducted since the inception of IEEE802.15.4. The literature comprehensively defines the IEEE802.15.4 protocol as well as simulations on various traffic patterns.

J.Zheng and M.J.Lee [1] developed the IEEE 802.15.4 standard on the ns2 simulator and carry out several sets of experiments to study its various features.

Prathamesh Ajgaonkar et al. [2] conduct AODV simulation with different traffic scenarios like FTP, CBR and Poisson, having different network topologies (Star and Peer to Peer on various types of queue such as Drop Tail, Stochastic Fair Queue (SFQ), and Random Early Detection (RED) is carried out to analyze QoS parameters like end-to-end packet delay and jitter.

Elmustafa Sayed Ali Ahmed et al. [3] identify the performance of data traffic patterns (CBR, FTP and POISSON) in Zigbee personal area networks (PAN) using MANET routing protocols (AODV, DSR and

INTANTSENSE).Simulation and computations of throughput, data loss, PDR, overhead and delay done using NS2 simulator (Version 2.34) with parameter of quality of data and pause time.

Arpitha et al. [4] analyze the performance of IEEE 802.15.4 topologies such as star, mesh and cluster tree of WPAN using different performance metrics like goodput, throughput, end-to-end delay with respect to routing protocol AODV and DSDV using NS2.

Deepali Ramesh et al. [5] provides a brief description of Zigbee standards focusing on developing different topology models using AODV protocol and using different traffics to analyze using various metrics like packet delivery ratio, jitter, end to end delay and load factor using NS2.

Chavan et al. [6] evaluate ZigBee based WPAN by considering PDR, Throughput, Jitter and Delay, for Star and mesh topologies and generate various scenarios by varying number of node on mobility, range, routing and simulation time.

Veerendra et al. [7] perform simulation for three network topology (scatternet, piconet and peer to peer) with varying network density using both beacon and non-beacon enabled mode on different traffic type.

Gowrishankar.S et al. [8] evaluate IEEE 802.15.4 over AODV with sink mobility through variations in traffic load, number of source nodes and packet size. Various metrics like PDR, Network Throughput, Average Network Delay and Normalized Routing Load is considered for evaluation.

Sangeetha et al. [9] analyze IEEE 802.15.4/ZigBee network for AODV and DSDV protocols by using throughput and energy remaining per node as the performance metrics using NS2 simulator.

Haithem et al. [10] analyze AODV and DSR performance for IEEE 802.15.4/ZigBee using network simulator Ns2 based on packet loss, network throughput packet delivery ratio, energy consumption and average delay. Various simulation scenarios by varying network and traffic densities is investigated.

III. Overview of Zigbee/IEEE 802.15.4

We shall now give a brief overview of the IEEE 802.15.4/Zigbee standard, focusing on the details relevant to our performance study. IEEE and ZigBee alliance have joined hands to develop a complete specification of protocol stack for IEEE802.15.4.The IEEE 802.15.4/Zigbee protocol architecture is shown in Fig. 1 .The IEEE 802.15.4 forms the basis for the ZigBee specification which was firstly published by the ZigBee alliance in 2003. IEEE focuses on the specification of the lower two layers of the protocol (physical and Mac layer) that supports for low data rate, low power consumption, and low cost whereas ZigBee works on upper layers of the protocol stack (network, transport, and application layer) that enables interoperable data networking, security services. The basic framework conceives a 10-meter communications range with a transfer rate of 250kbit/s. It operates in the 2.4GHz ISM band, which makes this technology easily applicable and worldwide available.

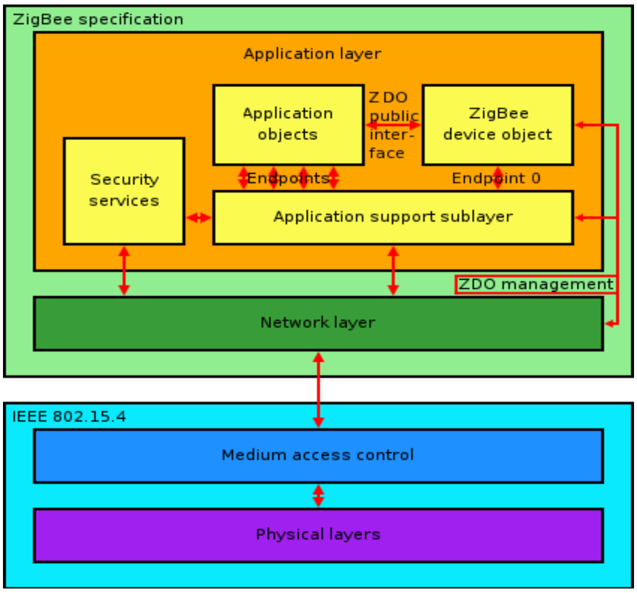

Fig. 1. Layered Protocol Stack of IEEE 802.15.4

The Physical layer defined by IEEE 802.15.4 controls activation and deactivation of the radio transceiver, energy detection (ED), link quality indication (LQI), channel selection, clear channel assessment (CCA), and transmitting as well as receiving packets across the physical medium. At the physical layer, Zigbee operates in the ISM band within three different frequency bands. The supported data rate is 250 kbps at 2.4GHz with offset quadrature phase shift keying (OQPSK) modulation, 40 kbps at 915 MHz and 20 kbps at 868 MHz with binary phase shift keying (BPSK) modulation. Total of 27 channels including single channel between 868 and 868.6 MHz, 10 channels between 902.0 and 928.04 MHz and 16 channels between 2.4 and 2.4835 GHz are allocated in 802.15.4. Having several channels in different frequency bands makes it possible to relocate within the available spectrum [15].

The MAC layer defined by IEEE 802.15.4 controls the access to the communication channel and provides flow control through acknowledgements and retransmissions. It also controls frame validation, Beacon management, Device synchronization, Guarantees time slot management and handles nodes association and disassociation.

The MAC layer defines two types of devices a full-function device (FFD) and a reduced-function device (RFD). The FFD can operate in three modes a PAN coordinator, a coordinator, or a device. An FFD can communicate with RFDs or other FFDs, while an RFD can communicate only with FFD. RFD is intended for very simple applications that do not require the transfer of large amounts of data and need minimal resources.

The MAC layer supports two operational modes beacon-enabled mode and non-beacon-enabled mode. We are considering beacon enabled mode for our analysis, it is used when the coordinator runs on batteries and thus offers maximum power savings, whereas the non-beacon mode is used when the coordinator is mains-powered.

In beacon enabled mode, PAN coordinator broadcasts beacons periodically to synchronize the attached devices for effective communication. In this mode superframe structure is used for communication over network in a beacon enabled mode shown in Fig. 2 which has a beacon on either side of the structure. Each superframe structure consists of active and inactive period. In active period, communication takes place; nodes send packets using slotted CSMA-CA mechanism .It consist of a beacon, a contention access period (CAP) and a contention free period (CFP). In the CAP, the device must compete with other devices. In the CFP, the PAN coordinator assigns guaranteed time slots (GTS) to a single device, which together forms the CFP. In inactive period node is tuned off to save battery power the coordinator enters a low power mode and doesn't interact with its PAN. The structure of superframe is characterized by two parameters Superframe Order SO and Beacon Order BO. SO is the variable which is used to determine the length of the superframe duration. BO establishes the Beacon Interval (BI) which is the length of superframe. The BI and SD can be defined as follows:

$BI = B \times 2BO$
$SD = B \times 2SO$

Constant B can be defined as a base superframe duration which is a minimum duration of superframe when the value of BO is equal to 0. The relation between SO and BO that must be satisfied:

$0 \leq SO \leq 14$
$0 \leq BO \leq 14$

When BO=14 then there are no beacon transmissions. An inactive portion is denoted, when the beacon interval is same as that of the superframe duration (SO = BO) and when beacon order is greater than superframe order [16, 19].

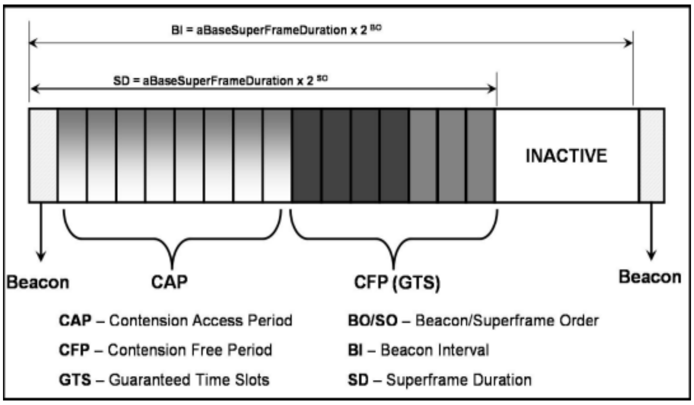

Fig. 2. Superframe Structure of IEEE 802.15.4 in an Beacon Enabled mode

In nonbeacon-enabled mode, PAN coordinator does not broadcast beacons periodically and communication is carried out using unslotted CSMA. It is useful whenever there is light traffic in between nodes. The power consumption is more in this mode as compared to beacon enabled mode as the node keeps on listening channel until it is found idle and transmission starts when channel is idle so various nodes compete to access the channel.

Different topologies supported in IEEE 802.15.4 are star topology or peer to peer network (Mesh) or a cluster tree network [18, 19] which is shown in Fig. 3.

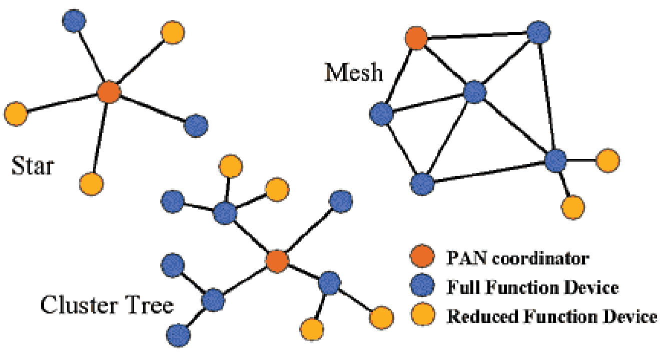

Fig. 3. Zigbee Topology Models

Peer-to-peer (Mesh) networks capable of performing self-management and organization form arbitrary patterns of connections. In a star network all the end devices, directly communicate with the coordinator. Cluster-tree network is a special case of a peer-to-peer network in which most devices are FFDs and an RFD .It consists of a number of clusters connected whose central nodes are also in direct communications with the single PAN Coordinator.

Network layer is the lowest layer of ZigBee and acts as an
interface between application layer and MAC Layer. It is responsible for Starting a network, joining and leaving a network, configuring a new device, addressing, topology specific routing, neighbor discovery and routing discovery.

Application Layer is the highest layer of the ZigBee stack. ZigBee specification divides the layer into three different sub-layers: Application support sub layer, ZigBee device objects, and manufacturer defined Application objects. It is responsible for grouping address definitions, fragmentation and reassembly of packets, reliable data transport, management of cryptographic keys for security and table maintenance for binding and forwarding messages between devices.

IV. OVERVIEW OF ROUTING PROTOCOL AND TRAFFIC PATTERN

A. Routing Protocols

There are three types of routing protocols mentioned below which are defined according to the routing path established for wireless network.

1) Table-driven or Proactive protocols

It actively determines the layout of the network and maintain consistent and up-to date routing information by periodically distributing routing information among each other. This is especially important for time-critical traffic. The well-known proactive routing protocol is DSDV.

Destination Sequenced Distance Vector (DSDV) is a loop free routing protocol in which the shortest path is calculated based on the Bellman-Ford algorithm. Data packets are transmitted between the nodes using routing tables stored at each node. Each routing table contains all the possible destinations from a node to any other node in the network and also the number of hops to each destination. The protocol has three main attributes: to avoid loops, to resolve the "count to infinity" problem, and to reduce high routing overhead. Each node issues a sequence number that is attached to every new routing-table update message and uses two different types of routing-table updates, named "full" and "incremental dumps", respectively, to minimize the number of control messages disseminated in the network. Each node keeps statistical data concerning the average setting time of a message that the node receives from any neighboring node. The data is used to reduce the number of rebroadcasts of possible routing entries that may arrive at a node from different paths but with the same sequence number. DSDV takes into account only bidirectional links between nodes [14].

2) On demand or Reactive protocols

In this protocol routes are created as and when required by using route discovery mechanism to reduce traffic overhead . As a result, they help consume less energy comparing to proactive protocols. It maintains active routes only. The well-known reactive routing protocols are DSR and AODV.

Adhoc On Demand Distance Vector Routing Algorithm (AODV) uses routing tables which stores, one entry per destination. It is capable of both unicast and multicast routing .To find a route to the destination, the source node floods the network with RouteRequest packets (RREQ), and the packets carry the destination address and sequence number. The RouteRequest packets create temporary route entries for the reverse path through every node it passes in the network. When it reaches the destination a RouteReply (RREP) is sent back through the same path the RouteRequest was transmitted. Every node maintains a route table entry which updates the route expiry time. A route is valid for the given expiry time, after which the route entry is deleted from the routing table. Whenever a route is used to forward the data packet the route expiry time is updated to the current time plus the Active Route Timeout. An active neighbor node list is used by AODV at each node as a route entry to keep track of the neighboring nodes that are using the entry to route data packets. These nodes are notified with RouteError packets when the link to the next hop node is broken. Each such neighbor node, in turn, forwards the RouteError to its own list of active neighbors, thus invalidating all the routes using the broken link. AODV is designed to support communication between mobile nodes with lowest possible routing path.

3) Hybrid protocols

These classes of routing protocols are reported that choosing best among them is very difficult as one may be performing well in one type of scenario while the other may work in other type of scenario. So Hybrid protocols are proposed to combine the merits of both proactive and reactive routing protocols and overcome their shortcomings. It was proposed to reduce the control overhead of proactive routing protocols and also decrease the latency caused by route discovery in reactive routing protocols. It includes protocols like ZRP, TORA etc.

B. Traffic Patterns

Data source of any network can be modeled using various traffic patterns. Traffic models are mainly used for prediction of performance of network and congestion of network .Traffic model should be such that it resembles real world network traffic. It should satisfy specific applications of a network and enhance capacity of a network. The knowledge of communication pattern and traffic characteristics is essential for designing and optimizing its performance. In this work we are analyzing FTP data traffic pattern.
There are three data traffic patterns CBR, FTP and Poisson which are mostly used in the networks [3, 13].

1) Constant Bit Rate (CBR)

The Constant Bit Rate (CBR) Traffic is a real time traffic that consume and constant the sending rate, where the traffic sending rate is specified at the Peak Cell Rate (PCR) parameter. CBR traffic model provides the best guarantee of delivery of traffic. It uses UDP as its transport agent.

2) File Transfer Protocol (FTP)

File Transfer Protocol (FTP) Traffic is a standard mechanism provided by the Internet for transferring files from one host to another. File transfer protocol is the application protocol based on client server model and is used for transfer of web pages, to download programs and other file from one computer to another computer. It uses TCP/IP protocol for data transfer. In FTP traffic model data is transferred using TCP transport agent and is used for bulk data transfer.

3) Poisson

Poisson Traffic generates traffic when bit rate is variable and this traffic model is suitable when data traffic is not bursty. It generates traffic according to Poisson distribution. Packets are sent at very high rate during on period and no packets are sent during off period. Packets are constant size.

V. SIMULATION ENVIRONMENT

We consider Zigbee using operating frequency of 2.4GHz with maximum data rate250kbps and simulation is carried out using network simulator tool. Network Simulator (Version 2), widely known as NS2 is an open source event driven simulation tool designed specifically for research in communication networks that simulates the behavior of network without an actual network is being present. It is an object oriented simulator written in OTcl and C++ languages. C++ is for backend used to run simulation and OTcl is for frontend used to create and configure the network. After simulation, NS2 outputs either text based or animation-based simulation results. To interpret these results graphically and interactively, tools such as NAM (Network AniMator) and XGraph are used.

A. Performance metrics

Performance of Zigbee protocol is evaluated using the following metrics:

1) Packet Delivery Ratio(PDR): It is the ratio of data packets successfully delivered to the destination to the data packets generated by the source. A high value of Packet Delivery Fraction indicates that most of the packets are being delivered to the higher layers and is a good indicator of the protocol performance.

2) Average End-to-End Delay: This is the average timedelay for data packets from the source node to the destination node. Ideally the value of endto-end delay should be as low as possible.

3) Average Throughput: The successful transmission of data packets in a unit time is known as throughput. It is usually measured in kbps .It should be high.

B. Experimental Setup

The various simulation parameters which we have used in our analysis are depicted in Table 1.

TABLE I. SIMULATION PARAMETERS

Parameter	**Parameter Value**
Channel Type	Wireless Channel
MAC Protocol	IEEE 802.15.4
Routing Protocol	AODV,DSDV
Network Topology	Random, Star, Peer to Peer (Mesh)
Terrain Size	80 X80 m^2
Mode	Beacon Enabled
Traffic Type	FTP
Simulation Time(s)	100
Number of Nodes	10,20,30,40,50
Traffic Density (No. of sources)	1, 3, 5, 7
Range(m)	10, 15, 20, 25
Queue Type	Drop Tail
Radio propagation models	Two ray ground
Antenna Model	Omni-Directional Antenna
Beacon order, Super frame order	3

Three set of simulation is carried using FTP Traffic pattern and NAM window for simulated ZigBee network with 20 nodes for Random , Star and Peer to Peer (Mesh) topology is shown in Fig. 4, Fig. 5 and Fig. 6 respectively. In the First set a ZigBee network with Random topology, in the second set a Zigbee network with Star topology and in third set a Zigbee network with Peer to Peer (Mesh) topology has been set up and analyzed by varying Number of nodes, Number of sources and Range between nodes. When Number of nodes are varied Number of source 3 and Range 10m is kept constant , when Number of source is varied Number of nodes 20 and Range 20m is kept constant and when Range is varied Number of nodes 20 and Number of source 3 is kept contant in all the scenarios. The network is simulated using both AODV and DSDV protocols. The combinations of the nodes are
chosen randomly and user can make the selection of any source and destination.

1) AODV / DSDV simulation for Random Topology

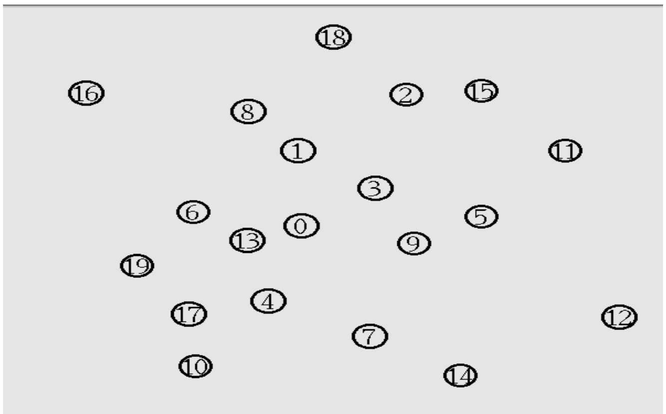

Fig. 4. Random Topology

2) AODV / DSDV simulation for Star Topology

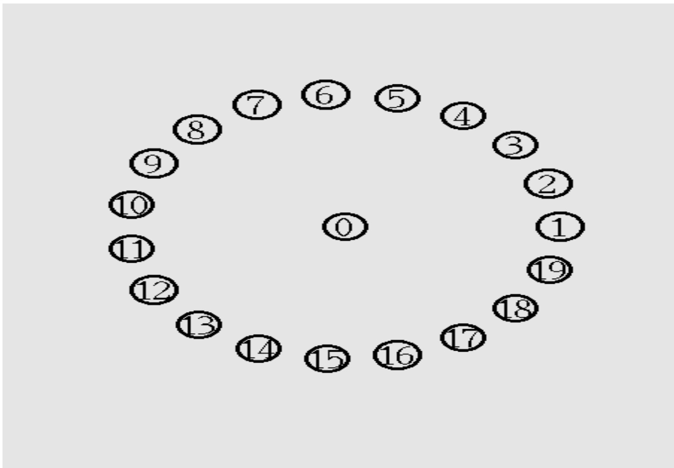

Fig. 5. Star Topology

3) AODV / DSDV simulation for Peer to Peer (Mesh) Topology

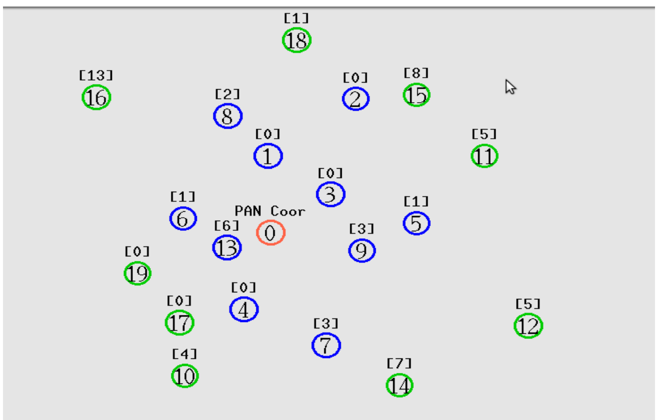

Fig. 6. Peer to Peer (Mesh) Topology

The trace file generated after simulation is shown in Fig. 7 for FTP traffic Pattern.

```
r 3.079205884 _11_ MAC  --- 9 ACK 5 [0 b 9 0]
r 3.079845821 _9_ MAC  --- 9 tcp 100 [0 9 b 800] ------- [11:0 9:0 30 9] [4 0] 1 0
r 3.079870821 _9_ AGT  --- 9 tcp 100 [0 9 b 800] ------- [11:0 9:0 30 9] [4 0] 1 0
s 3.079870821 _9_ AGT  --- 11 ack 40 [0 0 0 0] ------- [9:0 11:0 32 0] [4 0] 0 0
r 3.079870821 _9_ RTR  --- 11 ack 40 [0 0 0 0] ------- [9:0 11:0 32 0] [4 0] 0 0
s 3.079870821 _9_ RTR  --- 11 ack 40 [0 0 0 0] ------- [9:0 11:0 30 11] [4 0] 0 0
s 3.080535821 _9_ MAC  --- 11 ack 47 [0 b 9 800] ------- [9:0 11:0 30 11] [4 0] 0 0
s 3.082423884 _11_ MAC  --- 11 ACK 5 [0 9 b 0]
r 3.082775947 _9_ MAC  --- 11 ACK 5 [0 9 b 0]
r 3.083415884 _11_ MAC  --- 11 ack 40 [0 b 9 800] ------- [9:0 11:0 30 11] [4 0] 1 0
s 3.083415884 _11_ MAC  --- 10 tcp 107 [0 9 b 800] ------- [11:0 9:0 30 9] [5 0] 0 0
r 3.083440884 _11_ AGT  --- 11 ack 40 [0 b 9 800] ------- [9:0 11:0 30 11] [4 0] 1 0
s 3.083440884 _11_ AGT  --- 12 tcp 100 [0 0 0 0] ------- [11:0 9:0 32 0] [6 0] 0 0
r 3.083440884 _11_ RTR  --- 12 tcp 100 [0 0 0 0] ------- [11:0 9:0 32 0] [6 0] 0 0
s 3.083440884 _11_ AGT  --- 13 tcp 100 [0 0 0 0] ------- [11:0 9:0 32 0] [7 0] 0 0
r 3.083440884 _11_ RTR  --- 13 tcp 100 [0 0 0 0] ------- [11:0 9:0 32 0] [7 0] 0 0
s 3.083440884 _11_ RTR  --- 12 tcp 100 [0 0 0 0] ------- [11:0 9:0 30 9] [6 0] 0 0
s 3.083440884 _11_ RTR  --- 13 tcp 100 [0 0 0 0] ------- [11:0 9:0 30 9] [7 0] 0 0
```

Fig. 7. Traffic after Simulation for FTP traffic pattern

VI. SIMULATION RESULT ANALYSIS

In this section the performance of IEEE 802.15.4/Zigbee for different topologies using AODV and DSDV routing protocols over FTP Traffic Pattern by varying Number of nodes, Number of sources and Range has been studied through extensive simulation.

A. Packet Delivery Ratio

Fig. 8, Fig. 9, Fig. 10 shows the performance of Packet Delivery Ratio for Random, Star and Peer to Peer (Mesh) topology over AODV and DSDV Protocol by varying Number of nodes, Number of sources and Range respectively.

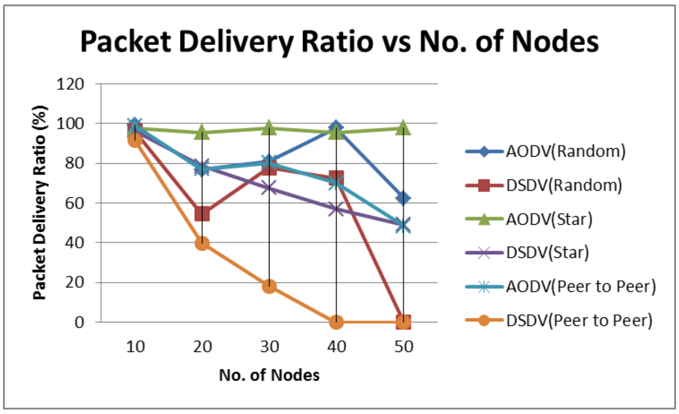

Fig. 8. Packet Delivery Ratio vs No. of Nodes

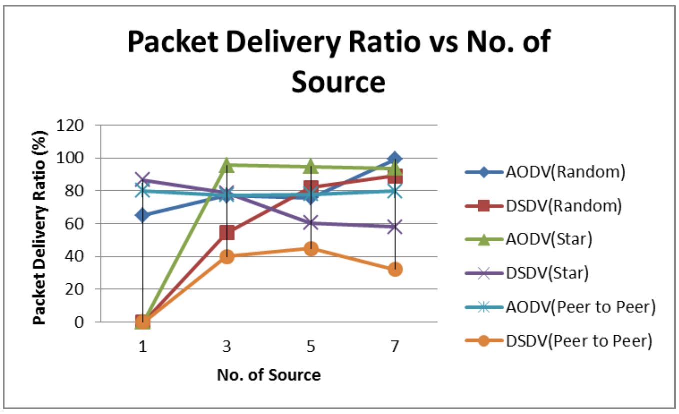

Fig. 9. Packet Delivery Ratio vs No. of Source

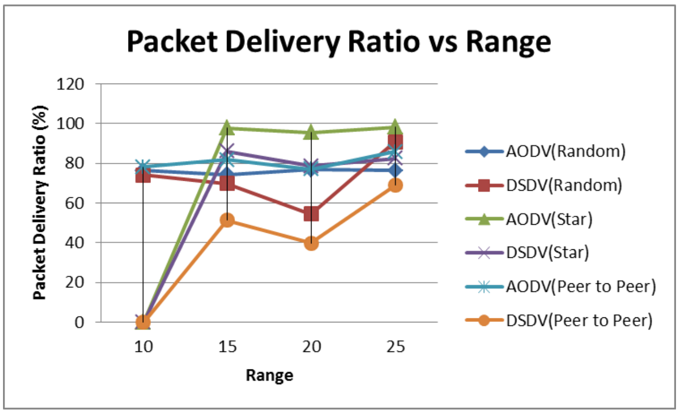

Fig. 10. Packet Delivery Ratio vs Range

Overall, Packet delivery ratio of AODV is better than DSDV for all topologies. The reason for DSDV's low packet delivery ratio is that it is a table-driven protocol and updates its table periodically which leads to an increase in the routing load in the network and less packet delivery ratio. On the other hand, AODV is an on demand routing protocol and adapts faster than DSDV to the change of the routing caused by nodes. AODV can find an alternate route if the current link has broken whereas DSDV is rendered useless at that point.

As the Number of nodes increases in the network Packet delivery ratio decreases, as the Number of source increases Packet delivery ratio increases and as the Range increases Packet delivery ratio increases for both protocols.

B. Average End to End Delay

Fig. 11, Fig. 12, Fig. 13 shows the performance of Average End to End Delay for Random, Star and Peer to Peer (Mesh) topology over AODV and DSDV Protocol by varying Number of nodes, Number of sources and Range respectively.

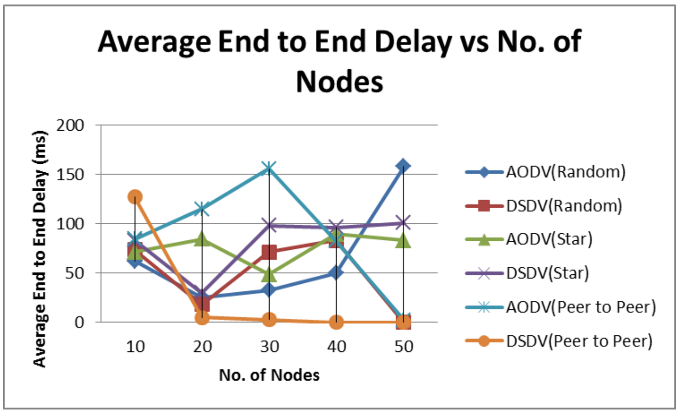

Fig. 11. Average End to End Delay vs No. of Nodes

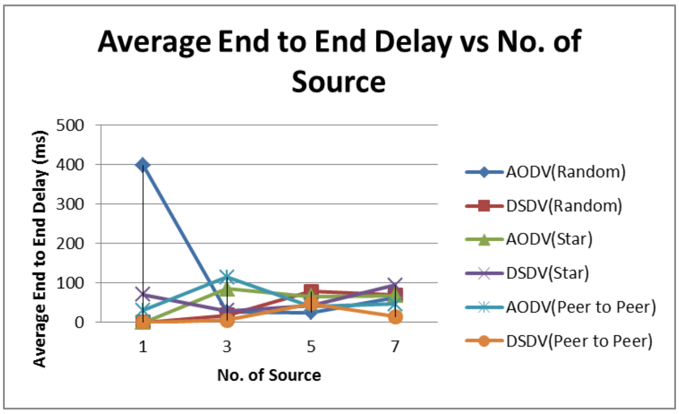

Fig. 12. Average End to End Delay vs No. of Source

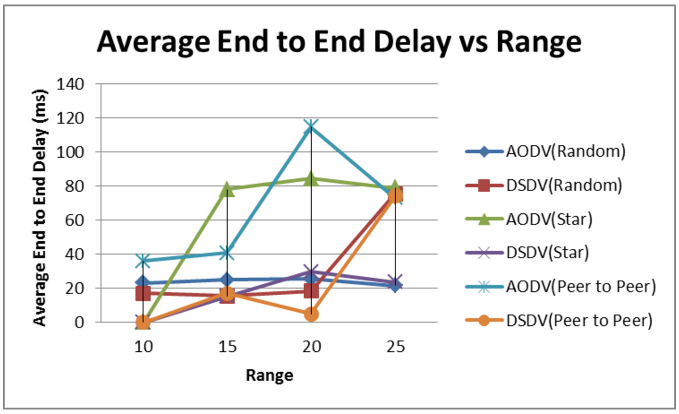

Fig. 13. Average End to End Delay vs Range

Overall, Average End to End delay of AODV is more than DSDV for all topologies. So DSDV performs much better because it is a proactive routing protocol and in these types of protocols the path to a destination is immediately available. In other words, there is no delay caused by routing discovery. End-to-end delay includes the delay in the send buffer, the delay in the interface queue, the bandwidth contention delay at the MAC, and the propagation delay. Furthermore, DSDV routing protocol tries to drop the packets, if it is not possible to deliver them which means less delay. On the other hand, in AODV packets stay in the send buffer till the route is discovered in order to be sent to the destination on that route. The presence of more number of nodes between source and destination affects the increase in hop count thus resulting in increased average end-to-end delay. If a link break occurs in the current topology, AODV would try to find an alternate path from among the backup routes between the source and the destination node pairs resulting in additional delay to the packet delivery time. In comparison, if a link break occurs in DSDV, the packet would not reach the destination due to unavailability of another path from source to destination.

As the Number of nodes, Number of Source and Range increases in the network both Protocols shows a considerable performance.

C. Average Throughput

Fig. 14, Fig. 15, Fig. 16 shows the performance of Average Throughput for Random, Star and Peer to Peer (Mesh) topology over AODV and DSDV Protocol by varying Number of nodes, Number of sources and Range respectively.

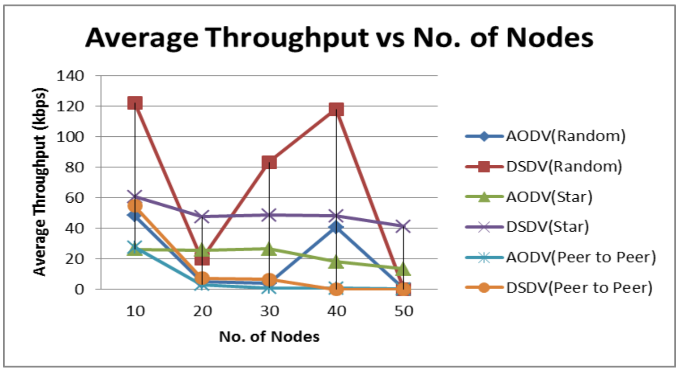

Fig. 14. Average Throughput vs No. of Nodes

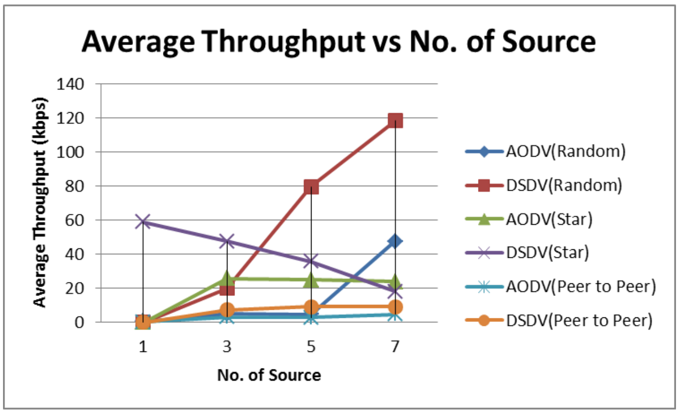

Fig. 15. Average Throughput vs No. of Source

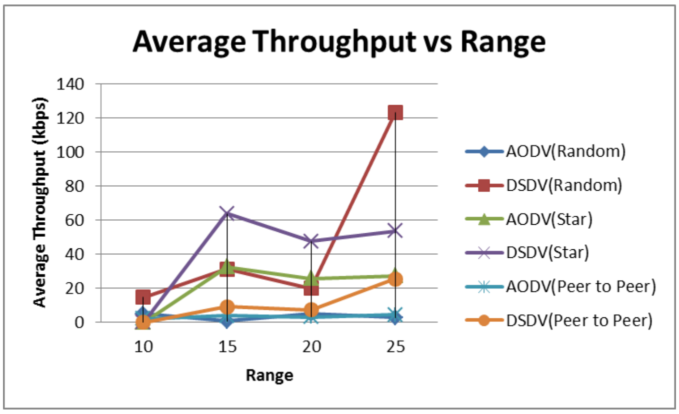

Fig. 16. Average Throughput vs Range

Overall, throughput of AODV is better than DSDV for all topologies. The reason for AODV's better performance is that maximum amount of TCP packets are sent and receive from source to destination because of its reactive nature. It drops a considerable number of packets during the route discovery phase and is more reliable. DSDV routing table update mechanism is not fast enough to update the routing tables when topology changes occur and network congestion occurs due to high traffic in the network because of increase in overhead and control messages for routing updations.

As the Number of nodes increases in the network average throughput decreases, as the Number of source increases average throughput increases and as the Range increases average throughput increases for both protocols.

VII. CONCLUTION

This work is carried out with different parameters using NS2 simulator. To study and analyze AODV and DSDV performance on different Topologies of Zigbee Network under FTP Traffic patterns several set of simulations are carried out by varying Number of nodes, Number of sources and Range and performance is analyzed in terms of packet delivery ratio, average end-to-end delay and average throughput. Based on the results obtained from simulations, it is inferred that:

(i) Packet delivery ratio of AODV protocol is better than DSDV in all scenarios.
(ii) Average End to End delay of DSDV protocol is better than AODV in all scenarios.
(iii) Average Throughput of AODV protocol is better than DSDV in all scenarios.

If we consider the topology performance Peer to Peer (Mesh) topology gives overall better performance than Star topology as the Number of Nodes, Number of Sources and Range increases due to the multihop transmissions and routing options availability. As the Nodes, Source and Range increases , PDR decreases rapidly for Zigbee network and end to end delay will increase, this in turn affects throughput.

Thus, we can conclude that the ZigBee network performs better with AODV than DSDV protocol in terms of both Throughput and Packet Delivery Ratio but not in terms of Average End to End Delay. AODV for small network with less number of nodes, low range and less number of sources might not perform well in that case DSDV performs better.

REFERENCES

[1] Jianliang Zheng and Myung J. Lee "A Comprehensive Performance Study of IEEE 802.15.4 " IEEE Press Book, 2004

[2] Prathamesh Ajgaonkar, Lingfeng Wang, and Mansoor Alam, "Simulation Studies on ZigBee Communications for Home Automation and Networking", 2010 IEEE.

[3] Elmustafa Sayed Ali Ahmed1, Ibrahim Khider Altahir2, A. Alrhman Mohammed3 and Amani Dawod Salih" Performance Analysis of Traffic Patterns over MANET Routing Protocols in Zigbee Personal Area Network" International Journal of Computer Science and Telecommunications Volume 6, Issue 1 , January 2015

[4] Arpitha E M, Ramesh T M "Performance Analysis of Low Rate WPAN Topologies "International Journal of Innovative Research in Computer and Communication Engineering, 2014

[5] Deepali Ramesh Borade, Shaikh.Mohd. Laeeq , "Performance and Evaluation of IEEE 802.15.4 under Different Topologies with AODV Protocol", 2012 IEEE Students' Conference on Electrical, Electronics and Computer Science .

[6] Chavan S.G., Shirsat S.A. , "Performance Comparison of Network Topologies in ZigBee Based WPAN", International Journal of Scientific & Engineering Research, Volume 4, Issue 10, October-2013 ISSN 2229-5518

[7] G R Veerendra, Nandini Prasad K S, Babu N V and Puttamadappa C, "Topology Based Performance Analysis of IEEE 802.15.4 for Wireless Sensor Networks", IJCSNS International Journal of Computer Science and Network Security, VOL.10 No.8, August 2010

[8] Gowrishankar.S, T.G.Basavaraju, Subir Kumar Sarkar, "Simulation Based Analysis of Mobile Sink Speed in Wireless Sensor Networks", Proceedings of the World Congress on Engineering and Computer Science 2010 Vol I WCECS 2010, October 20-22, 2010, San Francisco, USA

[9] Sangeetha C P, Dr. C.D. Suriyakala, "Performance Analysis of IEEE802.15.4/ZigBee Wireless Sensor Networks" International Journal of Engineering Sciences & Research Technology, April -2014

[10] Haithem Ben Chikha, Amira Makhlouf and Wiem Ghazel, "Performance Analysis of AODV and DSR Routing Protocols for IEEE 802.15.4/ZigBee"

[11] Rajesh kumar dubey and Anamika pathak ,"Performance of Routing Protocols for ZigBee Wireless Sensor Network",J. of Comp. and I.T. Vol. 3,4(3&1), 99-103 (2013).

[12] Ms. Swati V. Birje, Mr. Mahesh Kumbhar, Mr. Raviraj S. Patkar, "Performance Analysis of IEEE802.15.4" International Journal of Advanced Research in Computer Science and Software Engineering, 2013

[13] Pooja Sahu, Mr. Anshul Shrotriya" Performance Evaluation of IEEE 802.15.4 under Different Traffic Conditions" International Journal of Scientific & Engineering Research, Volume 4, Issue 12, December-2013 1824 ISSN 2229-5518

[14] Patil v.p." Impact of mobility and network load on the performance of reactive and proactive routing protocol in Manet" International Journal of Computer Engineering & Science, Sept 2012.

[15] M. M. Chandane, S. G. Bhirud, S.V. Bonde," Performance Analysis of IEEE 802.15.4", International Journal of Computer Applications (0975 – 8887) Volume 40– No.5, February 2012

[16] Vaddina Prakash Rao," The simulative Investigation of Zigbee/IEEE 802.15.4", http://www.vaddina.com/pages/01_01_00_00_Zigbee/00 _content/zigbee.pdf

[17] Harleen Kaur Sahota, Sandeep Singh Kang "ZigBee : A Promising Wireless Technology" International Journal of Computer Science and Network (IJCSN) Volume 1, Issue 6, December 2012

[18] Dusan Stevanovic,"Zigbee / IEEE 802.15.4 Standard talk" June 20, 2007

[19] Sinem Coleri Ergen,"ZigBee/IEEE 802.15.4 Summary" September 10, 2004

[20] Information Sciences Institute, "The Network Simulator Ns-2", Http://www.isi.edu/nanam/ns/"

[21] Zigbee Simulations "http://www.ifn.et.tudresden.de/~marandin/ZigBee/ ZigBeeSimulation.html"

[22] ZigBee Alliance, "ZigBee Specification", Janvier 2008.