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Comparative study of DSR, AODV Routing Protocol for WPAN Using NetSim Simulator

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***Abstract*:** Zigbee is a recent wireless standard based on IEEE 802.15.4 for personal area networking. Recently, it has created a lot of interest among the research community for Wireless Sensor Network (WSN). Zigbee is an open specification and designed to achieve very low power consumption. Specifically, it has been built up on the top of the Physical layer& MAC layer and defines the Network and Application layer which has been normalized in IEEE 802.15.4.In this paper, attempt has been made to measure the performance parameters of Zigbee routing protocol such as AODV and DSR using Net Sim simulator. The performance parameters such as End to End delay, Throughput,& Packet Delivery Ratio (PDR) have been analyzed. Even though many studies related to AODV & DSR have been presented in the current literature, it has not been analyzed through Net Sim simulator. So, we made an attempt to investigate the performance of AODV & DSR routing protocols and compare it for personal area network (PAN) using Net Sim Simulator as it is a Professional Simulator in the area of computer networks.

Keywords: Zigbee, AODV, DSR, Net Sim Simulator.

I. INTRODUCTION

The Zigbee is an IEEE 802.15.4standard used for low data rate.IEEE 802.15.4protocol is a standard which is recently adopted as communication standard forlow cost and low power consumption for Wireless Personal Area Network. Which can be used in many different wireless sensor network applications such as home/building automation, consumer electronics, industrial controls, medical sensor applications**[**3**]**The advantages of Zigbeeis the Reliable and self configuration, it supports huge number of nodes, Easy to organize, big amount of battery life, protected, cheap, Can be used globally. The low rate WPAN task group (802.15.4) deals with low data rate, large amount of battery life (months or even years) and very low complexity. The IEEE 802.15.4 defines the physical (PHY) layer and the Medium Access (MAC) layer. The specification for the Physical defines a low-power spread spectrum radio operating at frequency ranges are 2.4 GHz, 915 MHz and 868MHz.The MAC layer shows the many 802.15.4 radios operating in the same area can allocate the airwaves. The MAC layer specifications also mention different network topologies [4].

The architecture of a Zigbee device is illustrated in Figure 1.

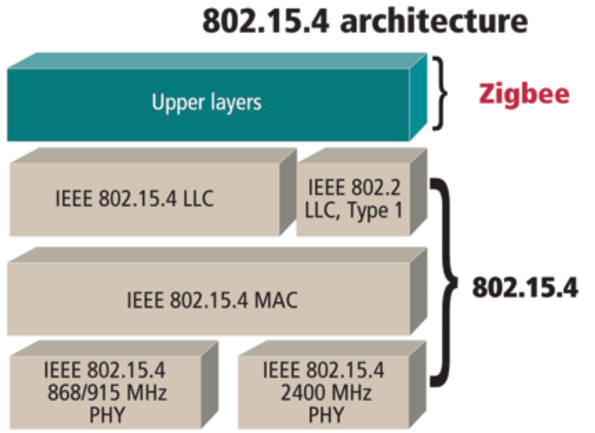

Figure1. Zigbee Device Architecture [3]

The PHY contains the RF (Radio Frequency) transceiver and its low-level control mechanism. The PHY also contains a MAC sub layer that provides access to the physical channel for all transfer types. The upper layers consist of a network layer and an application layer. The network layer provides network configuration, manipulation, and message routing and the application layer provides the intended function of a Zigbee device. The LLC (Logical Link Control) is responsible for the logical link functions of one or more logical links. Command packets generated by the LLC are called PDUs (Protocol Data Units). The LLC accesses the MAC sub layer through the Service Specific Convergence Sub layer (SSCS) [7].

Rest of the paper is organized as follows. Section II presents the existing routing protocols. Section III presents the experimental setup for NetSim Simulator. Section IV discusses the simulation results followed by a conclusive remark in Section V.

II. EXISTING ROUTING PROTOCOL

There are several kinds of routing protocols for WPAN. Basically, it can be classified as Proactive and Reactive routing protocols. Proactive protocol is also called as table-driven protocol. A reactive routing protocol is also called On-Demand Routing Protocol. The combination of both (proactive and reactive) the protocols are called as Hybrid routing protocols. Here, particularly, we have dealt with reactive routing protocols.

A. Pro-Active Routing Protocol:

Table-driven routing protocol [2] attempt to maintain consistency, updated routing information from each node to every other node in the network. These protocols require each node to maintain one or more tables to store routing information, and they respond to changes in network topology by broadcasting updates routes throughout the network in order to maintain a consistent network view. Different types of table driven routing protocols are present in the literature. Few of these are discussed below.

a) Destination- Sequenced Distance- Vector Routing (DSDV).
b) Optimized Link State Routing (OLSR).

B. Reactive Routing Protocol:

This type of routing creates routes only when anticipated by the source node. When a node requires a route to a destination, it has to initiate a route discovery process within the network. This process is completed once a route is found and all possible route permutations have been examined. Once a route has been established, it is maintained by a route maintenance procedure until either the destination becomes inaccessible along every path from the source or the route is no longer desired [2].Different types of on-Demand routing protocols are available in the existing literature. The protocols which are taken into our consideration are discussed below.

a)Ad-Hoc on demand Distance Vector (AODV). b) Dynamic Source Routing (DSR). c)Temporally ordered routing algorithm (TORA). d) Associativity Based routing (ABR). e) Signal Stability-Based Adaptive Routing (SSA). f) Location-Aided Routing Protocol (LAR)

a. Dynamic Source routing (DSR):

Dynamic Source Routing Protocol uses source routing and caching [8] where the sender node includes the complete hop-by-hop route to the destination node in the packet header and routes are stored in a route cache. When a node wants to communicate with another node to which it does not know the route, it recruits a route discovery process with a flooding request of route request (RREQ) packets. Each node receiving the RREQ retransmits packets unless it is the target node or it knows the route to the destination from its cache. Such a node replies to the RREQ packet with a route reply (RREP) packet.

The RREP packet takes the navigated path back to the source node established by the RREQ packet. This route is stored in the source node cache for future communication. If any link of this route goes down, the source node is informed by a route error (RERR) packet and this route is discarded from cache. An intermediate node stores the source route in their cache for future use [9][10].

b. Ad-hoc On-Demand Distance Vector Routing (AODV):

Ad-hoc On-Demand Distance Vector routing protocol is a destination based reactive protocol. This protocol inherits the attributes of route discovery from DSR. Nevertheless, AODV resolves the problem of large headers found in DSR. This problem can cause substantial performance degradation particularly when the actual data contents are small. AODV maintains routing tables on the nodes in place of including a header in the data packet. The source node initiates the route discovery process in the same way as the DSR discovers. An intermediate node may reply with a route reply (RREP) packet only if it knows a more recent path than the one known by the sender node to the destination node.

A destination sequence number is used to indicate how recent the path has been followed. A new route request generated by the sender node is labeled with a higher sequence number and an intermediate node that knows the route to the destination is labeled with a smaller sequence number cannot send the RREP message. Forward links are setup when a RREP travels back along the same path taken by RREQ. So the routing table entries are used to forward the data packet and the route is not included in the packet header. If an intermediate node is unable to forward the packet to the next hop or destination due to link failures, it generates the route error (RERR) message by labeling it with a higher destination sequence number. When the sender node receives the RERR message, it initiates a new route discovery process for the destination node [2][10].

III. EXPERIMENTAL SETUP

To verify the performance of AODV and DSR protocols through NetSim simulator, a grid area of 100*100m is chosen for the simulation. In simulation window, user can see the number of different nodes; one can drag the nodes and drop on the simulation area. The Figure 2 shows the simulation window with PAN coordinator and wireless nodes. Then the properties button can be selected. A pause time is used to simulate a mobility model. There are two types of mobility model such as Random Walk and Random Way Point mobility model are used. Through this mobility model, nodes are continuously moving in the simulation area.

The properties option can be selected as per the experimental set up requirements and then the simulation time is set.

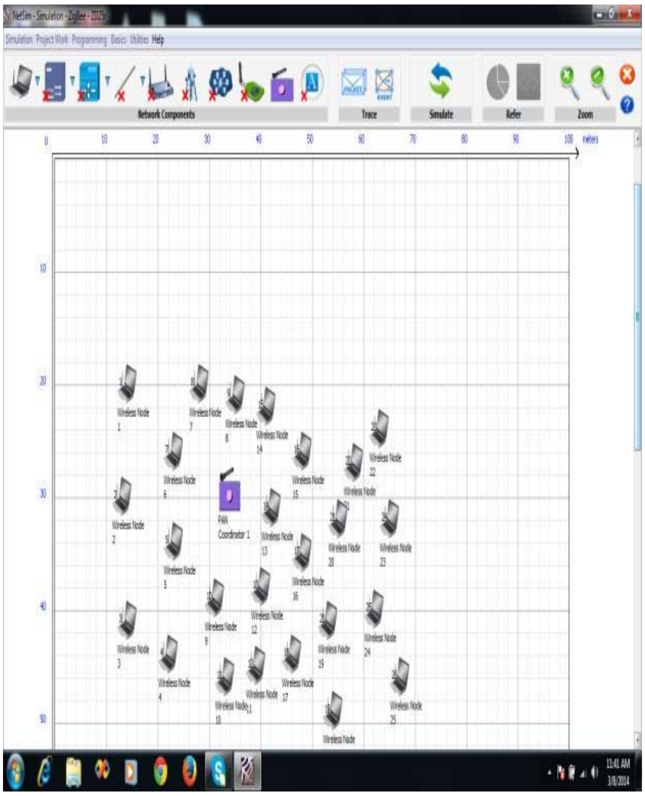

Figure 2.Simulation Window for 25 Nodes.

Figure 3.Nodes Properties.

IV. SIMULATION RESULTSAND ANALYSIS

The first analysis is based on varying the number of nodes from 10 to 25 in an area of 100x100m. We have considered both the random walk and random way point models. After extensive simulations, it is observed from Figure 4 that the End-to-End delay is less in case of DSR compared to AODV in both the random walk and random way point mobility model cases.

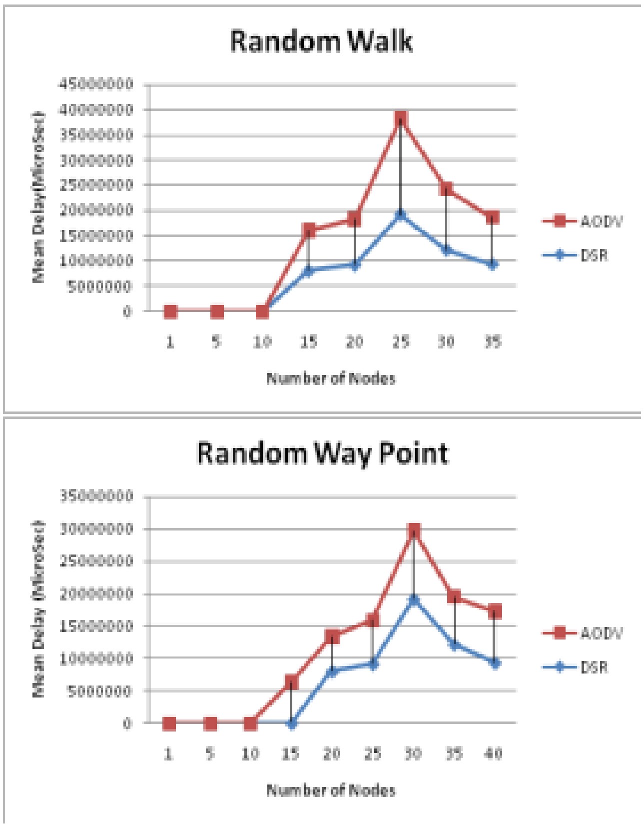

Figure 4. Delay Comparison for DSR & AODV with Random Walk & Random Way Point.

Second, we tried to analyze throughput as it is one of the major performance measure.We varied number of nodes from 10 to 25 in an area of 100x100m. It is evident from Figure 5 that the throughput of AODV is better than DSR.

The key simulation parameters which are considered for AODV and DSR protocol simulations are given in Table 1.

Table 1. Simulation Parameters WithVarying Node Density

Parameter	Value
Protocol	AODV,DSR,WPAN(ZIGBEE)
No. Of Nodes	5,10,15,20,25.
Area Size	100m x 100m
Transmission Type	Point To Point
Packet Size	1472 Bytes
Simulation Time	50sec
Pause Time	10
Traffic Type	Custom
Mobility Model	Random Walk,
Device Name	PAN Coordinator
Beacon Order	Enable
Channel Characteristics	No Path Loss

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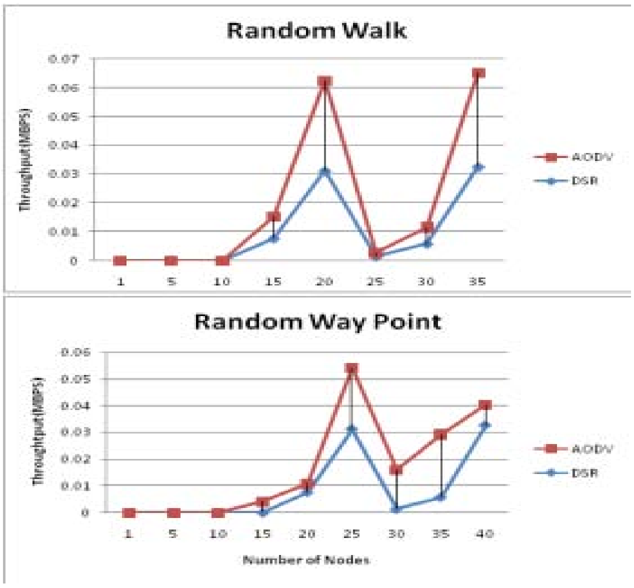

Figure 5.Throughput Comparison for DSR & AODV with Random Walk & Random Way Point.

Third, we have analyzed packet delivery ratio (PDR) in both the protocols by varying the same number of nodes in the same area. Figure 6 shows that the DSRperforms better than AODV in case of packet delivery ratio.

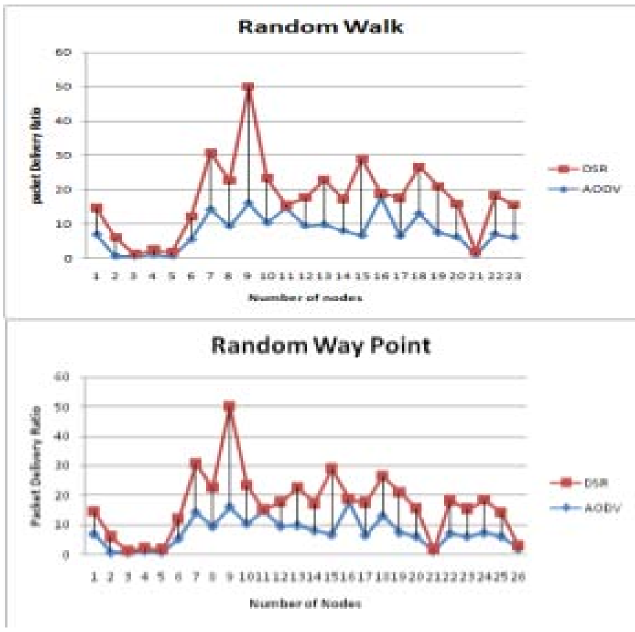

Figure 6.Packet Delivery Ratio Comparison for DSR & AODV with Random Walk & Random Way Point.

V. CONCLUSION

This paper provides simulation results for on demand routing protocols like AODV and DSR for WPAN using NetSim simulator. It has also presented a comparison of these on-demands routing protocol under varying number of nodes & Pause Time, simultaneously measure performances under various performance metrics including end to end delay, throughput, Packet Delivery Ratio. From the simulation results it is concluded that that AODV performs better than DSR while measuring the throughput and PDR whereas DSR protocol produces better results in measuring end to end delay compared to AODV.

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