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Performance Analysis of Routing Algorithms: AODV, DSDV, OLSR, DSR in WPAN

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ABSTRACT:

The main aim of this project is to establish the communication in short-range by using wireless technology and using Zigbee/IEEE 802.15.4 protocol. It is designed to meet the needs for low cost, low power, simple and short range wireless networking. In this project we analyze performance of IEEE 802.15.4 topologies are mesh, star, cluster tree of WPAN using different performance metrics like throughput, good put, end-to-end delay with respect to routing protocol Ad hoc On demand Distance Vector(AODV), Optimized Link State Routing Protocol(OLSR), Dynamic Source Routing(DSR), Destination Sequenced Distance Vector(DSDV), using Network Simulator2(NS-2). Simulation results verify that DSR gives the better performance in mesh topology and DSDV gives better performance in cluster tree and star topology.

KEYWORDS:

WPAN, Star, Cluster tree, Mesh, AODV, DSR, OLSR, DSDV.

I.INTRODUCTION:

Wireless personal area networks (WPANs) are used to convey information over short distances among a private, intimate group of participant devices [1]. Here we are using IEEE 802.15.4/Zigbee is a short range wireless technology in WPAN and Zigbee technology is simpler (and less expensive) than Bluetooth. Zigbee features are low complexity, low power consumption and low cost. Zigbee developed by Zigbee Alliance, it one of the newest technologies and its plays very important roles in networking. The main objectives of an LR-WPAN like Zigbee are ease of installation, short-range operation, reliable data transfer, extremely low cost, and a reasonable battery life, while maintaining a simple and flexible protocol.

Zigbee offers three types of unlicensed frequency bands are 2.4 GHz, 915MHz and 866MHz [2]. Here using data rate 250kbps and 16 channels at 2.4GHz bands. IEEE 802.15.4 has three types of topologies like mesh, cluster and star. The main aim of our project to analyze performance of Zigbee topologies based network by measuring goodput, throughput and end-to-end delay with respect to routing protocol AODV, DSR, OLSR and DSDV using NS2.

II.RELATED WORK:

The IEEE 802.15.4/Zigbee is a new standard defined for Low Rate-WPAN which provides a low cost and very less complicated solution. The applications are targeted in wireless sensors networks (WSN), interactive toys, home automation and remote controls [2].Now a day's healthcare/hospital environments using wireless technology is important role, because it's provides the low rate features [1].

Low-rate wireless technology as specified IEEE 802.15.4 standards and it is most useful to medial environments. WPAN support to tens of communicating devices in patient's details and updating reading of patient's conditions in the hospital room. To improve the overall performance of the network which is measured in terms of goodput, access delay and packet loss is done by N. Golmie [6].

Here they analyzes different multiple topologies like Cluster-Tree, Mesh and Star with various scenarios to compare the different performance metrics such as traffic sent, throughput, traffic received, delay etc. In this analysis it was found that Cluster-Tree topology was best as compared to Star and Mesh topologies because it take 45% and 20% load greater as compared to Star and Mesh Topology respectively. Similarly its delay, throughput, traffic sent and traffic received were better than the other two topologies [1] [9].

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III.PROPOSED WORK:

IEEE 802.15.4/Zigbee is a newly developed wireless protocol which build's the higher layers of communication stack known as OSI (Open Systems Interconnection), using the lower layers of IEEE 802.15.4 as a basis which are designed considering the factors low-cost and low-power. These lower layers are termed as Medium Access Control sub layer (MAC) and the Physical layer (PHY). The following figure1 shows the architecture of IEEE 802.15.4[1].

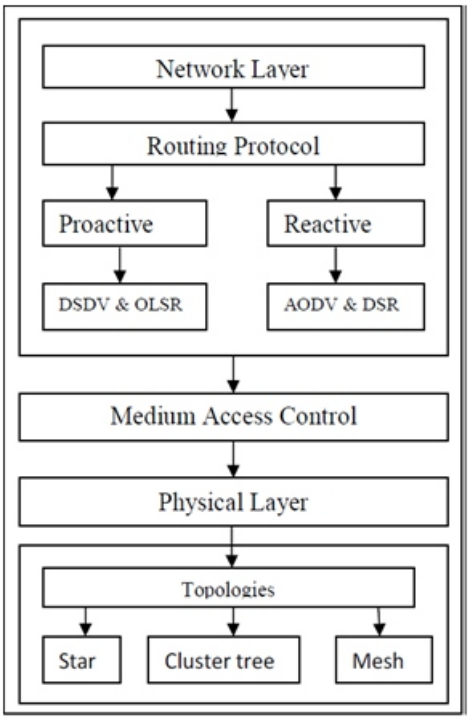

Figure 1 IEEE 802.15.4 Architecture

In above architecture, the physical layer is responsible for data transmission and reception using a certain radio channel according to a specific modulation and spreading techniques. This layer supports the three types of topologies are cluster tree, mesh, star topology and IEEE 802.15.4 having three nodes are PAN coordinator, Router and EndDevice. PAN coordinator is a network master and it's controlled by network communication. Routers are mediator to two nodes and communication directly to PANC and EndDevices. EndDevices are cannot communicate directly, but they communication through PANC. Mesh topology is robust and flexible; it is decentralized network all devices can communicate directly with each other within its range. Cluster tree is formed by parent-child relationship, each coordinator as a cluster head and multiple devices as leaf nodes. In star topology, communication controlled by PANC in the network [1] [2].

Mac Layer forwarding of MAC frames through physical channel and manages accessing of physical channel and network beaconing. MAC layer provides time synchronization and frame validation. The MAC protocol supports two operational modes that can be selected by a central controller of the Person Area Network (PAN), called PAN Coordinator and two modes are Beacon-enabled mode and Non Beacon-enabled mode. It controls frame validation, guarantees time slots and handle node associations.

Here we are using network layer for packet forwarding and routing. Here using two types of routing protocols are proactive and reactive, AODV and DSR are reactive routing protocols, on the other hand invoke a route determination procedure on demand only. Thus when a route is needed, some sort of global search procedure is employed. DSDV and OLSR are proactive routing protocol attempts to continuously the route within the network, so that when a packet needs to be forward the route is already known and can be immediately used [1][2].

IV.PERFORMANCE EVALUATION:

Network Simulator (NS2) is an open-source event-driven simulator designed specifically for research areas in computer communication networks. Network Simulator (NS2) now contains modules for numerous network components such as transport layer protocol, routing, application, etc. Researchers can simply use an easy-to-use scripting language to configure a network environment; to investigate network performance and observe results generated by NS2. It is simply an event driven simulation tool that has proved useful in studying the dynamic nature of communication networks.

Simulation of wireless as well as wired network functions and protocols (e.g., routing algorithms, TCP, UDP) can be done using NS2. The main aim of our project using network simulator to analyse performance of IEEE 802.15.4 topologies are mesh, star, cluster tree of WPAN using different performance metrics like good put, throughput, end-to-end delay with respect to routing protocol AODV, DSR, OLSR and DSDV. Figure 2 show the design of the simulation.

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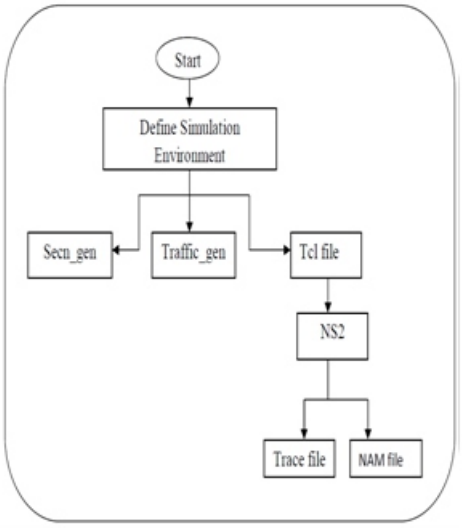

Figure 2: Simulation Design.

In this project consider IEEE 802.15.4 topologies of WPAN using maximum data rate 250kbps in operating frequency of 2.4GHz. Here using Omni directional antenna for communication, two-ray ground propagation model and the queuing model used is drop tail queue. The routing is based on AODV, DSR, OLSR and DSDV. In this project consider the following three parameters metrics to compare IEEE 802.15.4 topologies with four routing protocol.

1.Throughput: It is the rate of data packets successfully transmitted in a unit of time in the network during the simulation.

2.Goodput: It is a ratio between total delivery time and the delivered amount of information.

3.End-to-end delay: It is defined as propagate from source to destination the average time taken by the data packets.

Simulation parameters are Simulator is NS2.35, Simulation area is 50X50, MAC model is IEEE 802.15.4, Simulation time 100 milliseconds, Channel frequency is 2.4Ghz, Traffic type is FTP, and Packet size is 50 bytes, Propagation model is Two-Ray model.

V.SIMULATION RESULTS:

We consider the results by using Network Simulator (Ns2.35) software simulation.

We calculate the Performance metrics by using "trace file", with help of AWK program. The simulation results are shown figures in the form of bar graphs. Graph show the comparison between routing protocols with IEEE 802.15.4 topologies of WPAN.

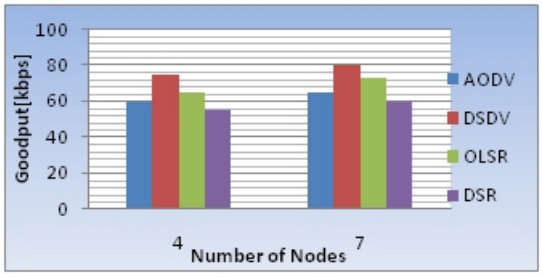

Figure: 3 Goodput of Star topology

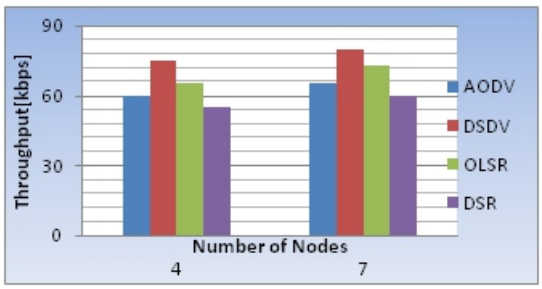

Figure: 4 Throughput of Star topology

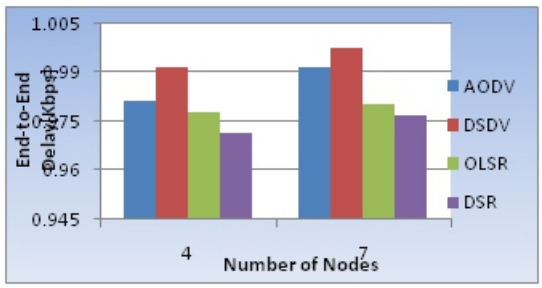

Figure: 5 End-to-End Delay of Star topology

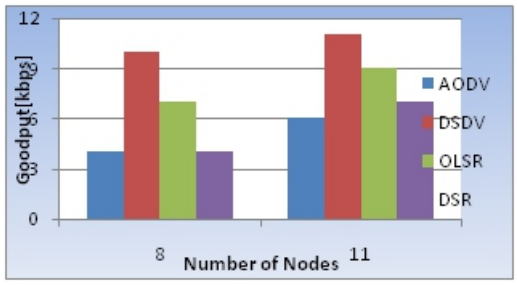

Figure 6 Goodput of Cluster tree topology

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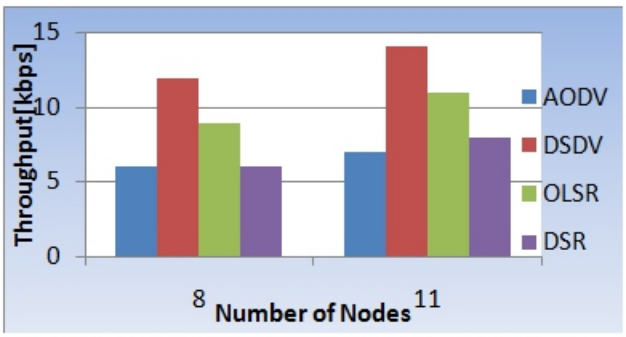

Figure: 7 Throughput of Cluster tree topology

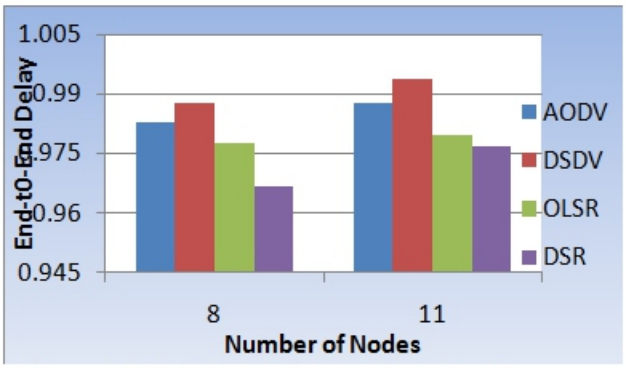

Figure: 8 End-to-End Delay of Cluster tree topology

The figure3, figure4 and figure5 show the Star topology of performance metrics, and the figure6, figure7- and figure8 show the Cluster topology of performance metrics respectively, throughput, goodput and end-to-end delay with the values of AODV, DSR, OLSR and DSDV routing protocols compared. Here throughput and goodput was maximum amount of TCP packets are sent and receive from source to destination in terms of DSDV routing protocol. The advantage of these protocols is that a path to a destination is immediately available, because it is a proactive protocol, so here no delay for route discovery. Here DSDV gives the better performance than other protocols.

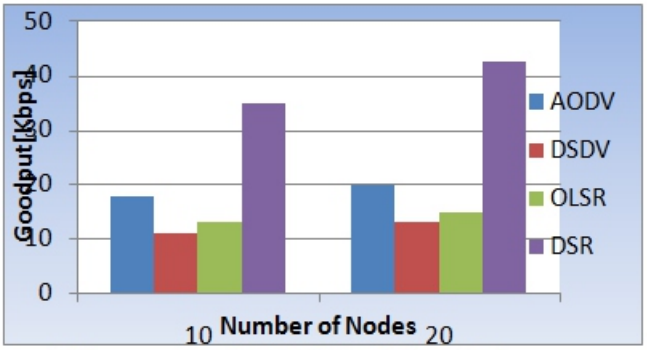

Figure: 9 Good put of Mesh topology

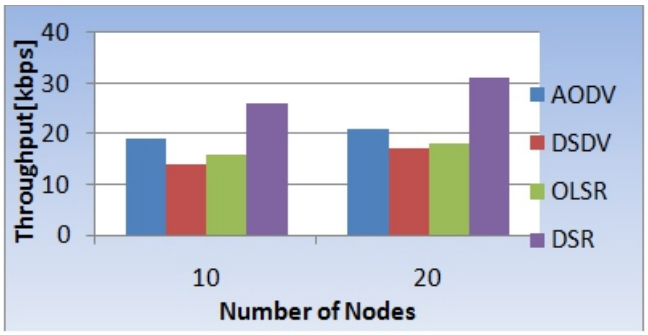

Figure: 10 Throughput of Mesh topology

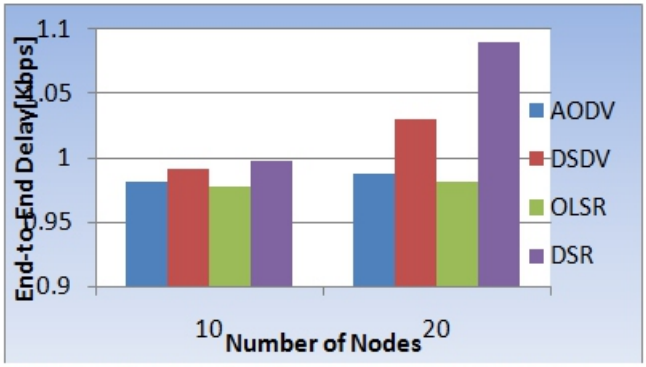

Figure: 11 End- to- End Delay of Mesh topology

The figure9, figure10 and figure11 show the mesh topology of performance metrics respectively goodput, throughput and end-to-end delay with values of AODV, DSR, OLSR, and DSDV routing protocols compared. Here goodput and throughput was maximum amount of TCP packets are sent and receive from source to destination in terms of DSR routing protocol, because of less traffic, node density and free of channel. Here DSR gives better performance than other protocols.

VI.CONCLUSION:

We have analyzed and simulated using different performance metrics and using AODV, DSR, OLSR and DSDV routing protocol with IEEE 802.15.4 topologies of WPAN. Finally we conclude that we got good performance in cluster tree and star topology with DSDV routing protocol and mesh topology with DSR routing protocol.

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