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REVIEW ARTICLE

A COMPARATIVE STUDY ON DIFFERENT ROUTING PROTOCOL FOR WPAN NETWORK: REVIEW

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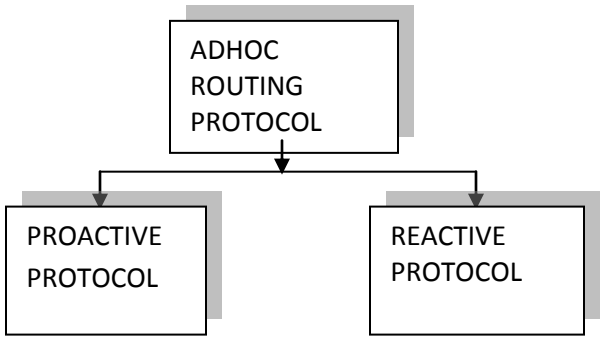
Abstract: WPAN provides the mobile network formation for indoor scenario. This network form is defined with certain restrictions and constraints. As the network is having the capabilities of MANET, It can work on different Mobile Protocols such as AODV, DSR, Zigbee etc. In this paper, a study on these protocols is presented in WPAN environment. The analytical results shows that Zigbee is most appropriate protocol under restricted environment and constraints.

Introduction

A standard set of regulations and requirements that allow two electronic items to connect to and exchange information with one another. Protocols regulate data transmission among devices as well as within a network of linked devices through both error control and specifying which data compression method to use. In particular, protocols decide: the method of error checking, how to compact data (if required), how the transmitting device signals that it has concluded sending data, and how the receiving device signals that it has completed receiving data.



In this section, we present a brief description of two widely used reactive and proactive protocols. A detailed description of these protocols is presented.

1. REACTIVE PROTOCOL

In reactive protocol, the time taken by the data to reach the destination from source varies. Ad Hoc On-Demand Distance Vector (AODV) routing protocol, Dynamic MANET On demand(DYMO) routing protocol, Dynamic Source Routing (DSR), Zigbee protocol, 6LoWPAN are some examples of reactive protocols.

2. PROACTIVE PROTOCOL

In Proactive protocol, the average end to end delay time remains constant. Destination Sequence Distance Vector is an example of proactive protocol.

Reactive protocols are much more efficient, faster and more adaptive than the proactive protocols. So we discuss some reactive protocols.

- **AODV**

Ad Hoc On-Demand Distance Vector (AODV) routing protocol is widely used in the Zigbee standard. AODV does not maintain routing information for each path and only creates routes when necessary. When data is transmitted from source to destination, it broadcasts a route request (RREQ) packet to the neighbouring nodes. A RREQ packet contains source and destination address, source and destination sequence number, a broadcast id, and a hop count. In this protocol, there are two main operations which are the route discovery and the route maintenance. Also, AODV has four types of messages; Route Request (RREQ), Route Reply (RREP), Route Error (RERR) and HELLO (to monitor the link status). AODV uses symmetric links between neighboring nodes.[1][2]. In AODV, broadcasts are not necessary. If a link breakage does not affect on going transmission. No global broadcast occurs if a link breakage does not affect on going transmission. Only affected nodes are informed. Local movements of nodes have local effects AODV reduces the network wide broadcasts to the extent possible. Significant reduction in control overhead as compared

- **DYMO**

A Dynamic MANET On-demand(DYMO) is a reactive adhoc routing protocol. It has two main operations; one is route discovery and the other one is route maintenance. The node only discovers the route to the destination when it has packets to send. In this case it updates its table RREP with the source node as destination and unicasts that message in the network It enables dynamic, reactive, multihop routing between participating nodes wishing to communicate. Route discovery and management are basic operations of the protocol. To react quickly to the changes in the network topology nodes should maintain their routes and monitor their links. A Route Error (RERR) is sent to the packet source to indicate the current route is broken. Once the source receives the RERR, it will re-initiate route discovery if it still has packets to deliver. To enable extension of the base specification, DYMO defines the handling of unsupported extensions. By default handling, future extensions are handled in a predetermined

understood fashion. DYMO uses sequence numbers to ensure loop freedom. All DYMO packets are transmitted via UDP on port TBD.

- **Dynamic Source Routing**

A Dynamic Source Routing (DSR) is a reactive ad-hoc routing protocol and has two main operations; one is route discovery and the other one is route maintenance. [2].It is a simple and efficient routing protocol designed specifically for use in multi-hop wireless ad hoc networks of mobile nodes. The network is completely self-organizing and self-configuring, requiring no existing network infrastructure or administration. Network nodes cooperate to forward packets for each other to allow communication over multiple "hops" between nodes not directly within wireless transmission range of one another. The DSR protocol has two main mechanisms that work together. First, the discovery and second maintenance of source routes in the ad hoc network.

Route Discovery is the mechanism through which a node S wishing to send a packet to a destination node D obtains a source route to D. Also, Route Discovery is used only when S attempts to send a packet to D and does not already know a route to D.

Route Maintenance is the mechanism through which node S is able to detect, while using a source route to D, if the network topology has changed such that it can no longer use its route to D because a link along the route no longer works. When Route Maintenance indicates a source route is broken, S use any other route it happens to know to D, or it can invoke Route Discovery again to find a new route for subsequent packets to D. Route Maintenance for this route is used when S is actually sending packets to D.[4]

Dynamic Source Routing is reactive or On Demand protocol. It is Developed at CMU in 1996. Route discovery cycle used for finding route – on Demand. In Dynamic Source Routing, there is maintenance of active routes. In DSR, there is no periodic activity of any kind – Hello Messages in AODV. It also utilizes source routing (entire route is part of the header). Dynamic Source Routing uses caches to store routes. It also Supports unidirectional links. In Dynamic Source Routing, Asymmetric routes are supported.

- When node A wants to send a packet to node B, but does not know a route to B, node A initiates a route discovery
- Source node A floods Route Request (RREQ)
- Each RREQ, has sender's address, destination's address, and a unique Request ID determined by the sender
- Each node appends own identifier when forwarding RREQ.[4][5]

- **ZigBee Protocol**

ZigBee originated from the domestic honeybee which uses a zig-zag type of dance to communicate important information to other hive members. This communication dance is what engineers are trying to emulate to tackle complex tasks. Zigbee Protocol focused on relatively Simple Devices. First, Low cost (open standard, multi-vendor availability),Second is Low data rate and Third Low power (years on a AA battery / batteryless).The Zigbee Protocol is robust, reliable, simple deployment and maintenance (mesh, self-org g, anizing, self-healing).Zigbee is able to Sense and Control. These are True Wireless Networks that Scale (not simply wireless links)

The goal of the ZigBee is to provide the consumer with ultimate flexibility, mobility and ease of use by building wireless intelligence and capabilities into everyday devices. ZigBee technology is a low data rate, low power consumption, low-cost, wireless networking protocol targeted towards automation and remote control applications. IEEE 802.15.4 committee started working on a low data rate standard a short while later. Then the ZigBee Alliance and the IEEE decided to join forces and ZigBee is the commercial name for this technology. ZigBee is expected to provide low cost and low power connectivity for equipment that needs battery life as long as several months to several years but does not require data transfer rates as high as those enabled by Bluetooth.

There are three categories of nodes in a ZigBee system. They are Coordinator, Router and End devices.

- Coordinator

Forms the root of the network tree and might bridge to other networks. There is exactly one coordinator in each network. This is responsible for initiating the network and selecting the network parameters such as radio

frequency channel, unique network identifier and setting other operational parameters. It can also store the information about network, security keys.

- Router

Router acts as intermediate nodes, relaying data from other devices. Router can connect to an already existent network, also able to accept connections from other devices and be some kind of re-transmitters to the network. Network may be extended through the use of ZigBee routers.

- End Devices

End Device can be low-power /battery-powered devices. They can collect various information from sensors and switches. They have sufficient functionality to talk to their parents (either the coordinator or a router) and cannot relay data from other devices. This reduced functionality allows for the potential to reduce their cost. They support better low power models. These devices do not have to stay awake the whole time, while the devices belonging to the other two categories have to. Each end device can have up to 240 end nodes which are separate applications sharing the same radio. 3.2 ZigBee physical device types.[6][7]

PERFORMANCE METRICS AND EVALUATION

- **End to End delays**

The average end-to-end delay of a data packet is the interval when one packet formed from Constant Bit Rate source completely received to the application layer of the destination. Average delay for packet transmission between client and server shows the performance of end to end delay at variable pause time 50s, 75s, 100s and 125s with varying nodes random placement. Routing protocols Zigbee has largest end to end delay as compared to other protocol AODV, DSR and DYMO routing. AODV, DSR, DYMO, Zigbee Routing Protocols has Comparative Performance using Varying Pause Time protocols. AODV have smallest end to end delay but DSR have more end to end delay.

- **Average Jitter:-**

Average Jitter (s) The difference between the expected arrival time of a packet and the actual arrival time is known as jitter. Jitter is caused by delays and congestion in the network. It causes discontinuity in the real-time voice stream. A jitter buffer is implemented which temporarily stores arriving packets to minimize the delay variations. The performance of average jitter (s) is different ay at different pause time. Zigbee routing protocol gives largest average jitter as compared to other routing protocols DYMO, DSR and AODV. AODV gives smallest average jitter as compared to

- **Throughput of receiving packets**

The throughput of receiving packets increases till around TIL (Time Interval Length) then it stays stable then it starts to drop. The DSR throughput of receiving packets increases to TIL then it starts to drop and increases again due to the change in the network and because of the nodes' movement. At around the simulation time, the throughput drops again. Then, it gets better in the range from then it starts to drop till the end of the simulation. DYMO throughput of receiving packets increases to TIL and it stays stable for a while until it gets changed in the middle of the simulation. Then, it increases again to TIL.

- **Dropped Packets**

At the beginning of the simulation, there was high dropped packet and after that it stays stable for a while and after that it goes up again and ends up to cumulative dropped packets from the sent packets. In DSR protocol, it doesn't face any dropping at the beginning then it starts to drop a little bit and after that it stables.

CONCLUSION

In this paper, comparative anlaysis is presented on different reactive protocols for WPAN environment. The analysis is here done in terms of throughput, jitter and delay parameters. The results shows that Zigbee has provided the highest communication throughput and communication delay.

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