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Comparative Analysis of Routing Protocols In Wireless Sensor Network

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Abstract – Wireless sensor network (WSN) is one of the important network technologies. They consist of thousands of sensor nodes, which are responsible for communication. WSN have limited resources, transmission range and storage capabilities. Due to these drawbacks routing is a challenging issue in WSN. Routing protocols in wireless sensor networks are responsible for maintaining the routes in the network and ensure reliable multi-hop communication under these conditions. In this paper a comparative analysis on the protocols are discussed.

I Introduction

Wireless Sensor Networks are groups of nodes that are dispersed spatially and can monitor environmental conditions.WSN can be used to measure the temperature, humidity and many more**.**

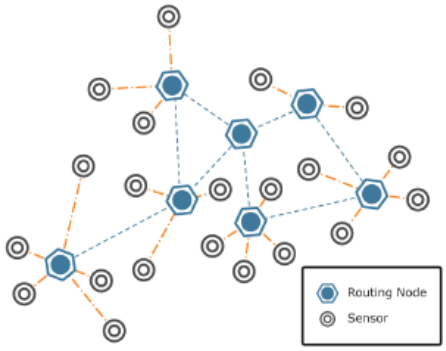

Figure 1: A typical WSN

A typical representation of a sensor node is showed in Figure 1,whenever an event is detected in sensor fields, the information will be routed to base stations, the base station in turn forwards that information to user. A Sensor node usually consists of a Sensing Unit, Processing Unit, Transceiver, and Power Unit.

II Types of Routing Protocols

The routing protocols are broadly classified into 3 types. They are Reactive, Proactive and Hybrid routing protocols.

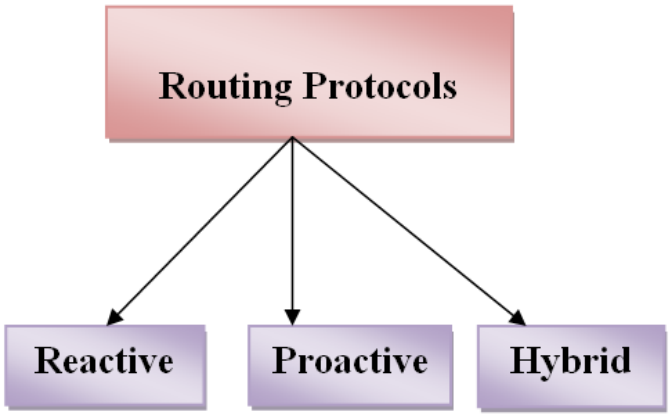

Figure 2: Types of Routing Protocols

A. Reactive protocols

The reactive protocols are also called as On-Demand Routing Protocols. In these protocols communication happens only when the source node request to communicate with other node.

Example: AODV, DSR etc.

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

AODV is a type of reactive routing protocol. AODV uses traditional routing tables, one entry per destination and sequence numbers are used to determine whether routing information is up-to-date and to prevent routing loops. It helps in both multicasting and unicasting.AODV has two phases, namely: route discovery route maintance and data forwarding. Route discovery is done by broadcasting the RREQ to its neighbors by specifying destination and sequence numbers. If the neighbors have route to destination it reply with RREP otherwise forwards the RREQ to other neighbors. It sends HELLO messages periodically to its neighbors to check whether the link is working correctly.

B. Proactive protocols

The proactive protocols are also called as Table Driven Routing Protocols. In these protocols a routing table can be maintained at every node so that a route can be detected to every other node with a lesser delay. They provide good

reliability and less latency.

Example: OLSR, DSDV etc.

Destination-Sequenced Distance-Vector Routing (DSDV):

DSDV is proactive routing protocol. It is based on bellman-ford routing algorithm to give shortest path to nodes. Sequence numbers are used in routing table entry in order to avoid loops in the network. Here the routing tables are updated periodically. The tables are exchanged regularly to maintain the network up to date. It has two message types one is full dump and incremental dump. In this protocol the updates lead to high control overhead during high mobility due to broken links.

C. Hybrid protocol

The combination of proactive and reactive protocols is called as hybrid routing protocol.

Example: ZRP.

Zone Routing Protocol (ZRP):

ZRP is hybrid routing protocol. It uses the concept of both proactive and reactive routing protocol in order to send information over the network. Here if the packet destination in the same origin it uses proactive protocol. If the packet is out of the origin it uses reactive protocol. Thus ZRP reduces the control overhead.

The comparative overview of each protocol mentioned above is given in Table 1.

Table 1: Summary of protocols

Feature	AODV	DSDV	ZRP
Protocol Type	Table driven and Source routing	Distance vector	Both table driven and distance vector
Route discovery	On demand	Via control message	Via control message and on demand
Route maintained in	Routing Table	Routing Table	Routing Table
Multiple route	No	No	No
discovery			
Multicast	Yes	Yes	Yes
Broadcast	Yes	Yes	Yes
Reuse of routing information	No	Yes	Yes

III Simulation tool:

Network simulator-NS2

• NS2is an open-source simulation tool.

• It supports wired and wireless network.

• It uses TCL as its scripting language.

Figure 3, Figure 4 and Figure 5 represents routing network using AODV, DSDV and ZRP.

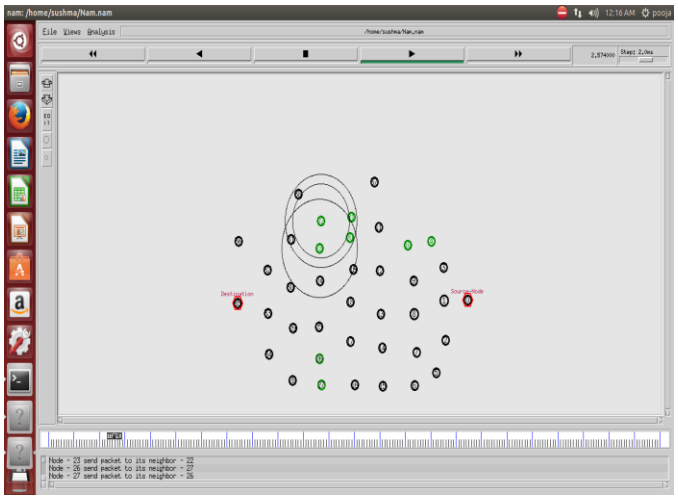

Figure 3: Routing network using AODV protocol

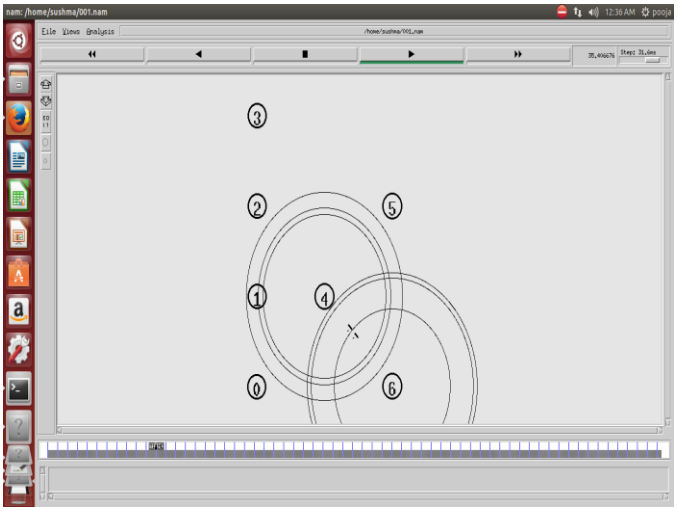

Figure 4: Routing network using DSDV protocol

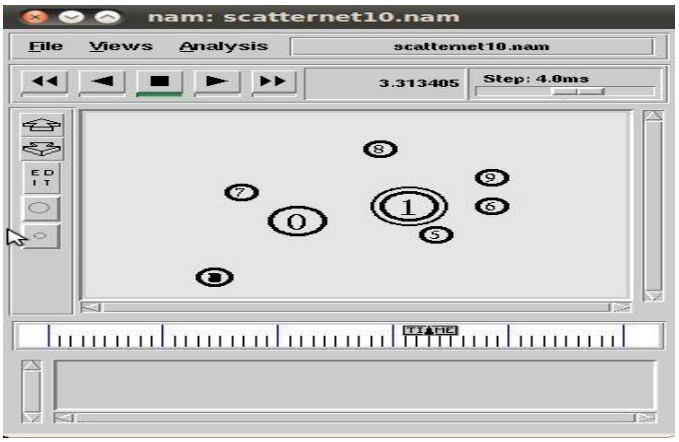

Figure 5: Routing network using ZRP protocol

IV Performance metrics

The main parameters used to evaluate the performance and network lifetime in wireless sensor network are throughput, delay, packet delivery ratio, overhead and energy.

A. Throughput:

It is measure to calculate how the data is reached the destination.

B. Delay:

An average time interval that the data take from source to destination.

C. Packet delivery ratio:

It is a ratio of number of data reached at the destination to number of data sent.

D. Jitter

It describes standard deviation of packet delay between all nodes.

V. Performance Comparison Analysis

Comparative analysis on the above mentioned metrics are discussed in this section.

1. Packet Delivery Ratio

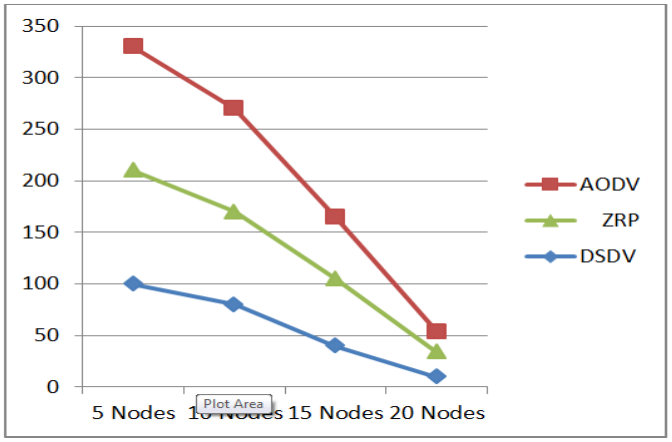

Figure 6: Packet delivery ratio v/s Number of nodes

Here as a nodes increases packet delivery ratio also increases. Here AODV has highest performance of the network and DSDV has the least.

2. Throughput

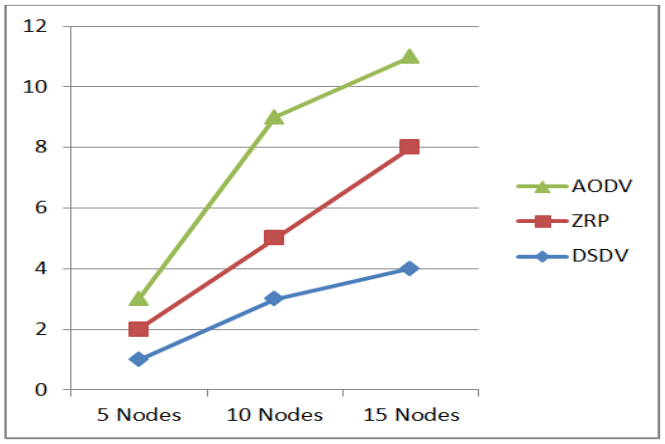

Figure 7: Throughput v/s Number of nodes

Throughput for AODV protocol is better while comparing it with DSDV and ZRP protocols as shown in figure 7.

VI. Conclusion

This paper includes the comparisons of three protocols with respect to the features mentioned in table 1. AODV is certainly superior to the DSDV and ZRP protocol in terms of throughput and delay parameters.

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