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Comparative Study of AODV, DSDV and DSR Routing Protocols in Wireless Sensor Network Using NS-2 Simulator

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Abstract- Wireless sensor network is an important communication tool used in many applications. There are various routing protocols which can provide significant benefits to wireless sensor networks in terms of both performance and reliability. Many routing protocols have been designed for wireless sensor networks. But the popular ones are DSR, DSDV, AODV.NS-2(Simulator) has used for comparing the performance of these 3 protocols and the simulation results are analyzed for the parameters Throughput, End to End Delay, Packet delivery Ratio.

Keywords-AODV, DSDV, DSR, WSN, NS-2

I. INTRODUCTION

A wireless sensor network is a self configuring network of small sensor nodes communicating among themselves using radio signals, monitor and understand the physical word [1]. A WSN can be generally described as a network of sensor nodes that cooperatively sense and may control the environment enabling interaction between persons or computers and the surrounding environment [2].

Sensor nodes are also known as motes. These motes are highly constrained in terms of size, CPU power, bandwidth and memory. It provides a bridge between the real physical and virtual words. These sensor nodes are autonomous devices using a variety of sensors to monitor the environment in which it is deployed.

Due to the feature of ease of deployment of sensor nodes, wireless sensor networks (WSNs) have a vast range of applications such as monitoring of environment and rescue missions. Wireless sensor network is composed of large number of sensor nodes. The event is sensed by the low power sensor node deployed in neighborhood and the sensed information is transmitted to a remote processing unit or base station [3].

Wireless sensor networks are used in various type of applications like seismic sensing, military applications, health applications, home applications and environmental applications. There are two main applications of wireless sensor networks which can be categorized as: monitoring and tracking and other commercial applications. [4]

In general the two types of wireless sensor networks are: unstructured and structured. The structured wireless sensor networks are those in which the sensor nodes deployment is in a planned manner whereas unstructured wireless sensor networks are the one in which sensor nodes deployment is in an ad-hoc manner. As there is no fixed infrastructure between wireless sensor networks for communication, routing becomes an issue in large number of sensor nodes deployed along with other challenges of manufacturing, design and management of these networks. There are different protocols that have been proposed for these issues.

II. ROUTING PROTOCOLS

There are two types of routing protocols i.e PROACTIVE and REACTIVE Protocols.

In Proactive routing fresh lists of destinations and their routes are maintained by periodically distributing routing tables throughout the network [5]. Here routing information is computed and shared and the path is set prior to the actual transfer of data packets between the source and destination. Example of Proactive routing are- DSDV, CGSR, OLSR.

In reactive routing routes are found on demand by flooding the network with route request packets. Here the source initiates the data transfer process by issuing a route request, the most relevant immediate neighbor issues a route reply to this request and takes forward the data transfer process. This happens till the destination is reached and the data packet received [5].Examples of Reactive routing are AODV, DRR, CBRP.

1)AD HOC ON DEMAND DISTANCE VECTOR ROUTING PROTOCOL(AODV): Being a 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. [6]

AODV makes use of <RREQ, RREP> pair to find the route. The source node broadcast the RREQ i.e. Route Request message to its neighbors to find the route to destination. The RREQ message [7] contains the source and destination address, lifespan of message, sequence numbers of source and destination and request ID as unique identification. Destination Sequence Number is the latest sequence number received in the past by the source for any route towards the destination and Source Sequence Number is the current sequence number to be used in the route entry pointing towards the source of the route request [8].If any node from a list of neighbors is destination or knows the route to destination, it can send RREP message to source.

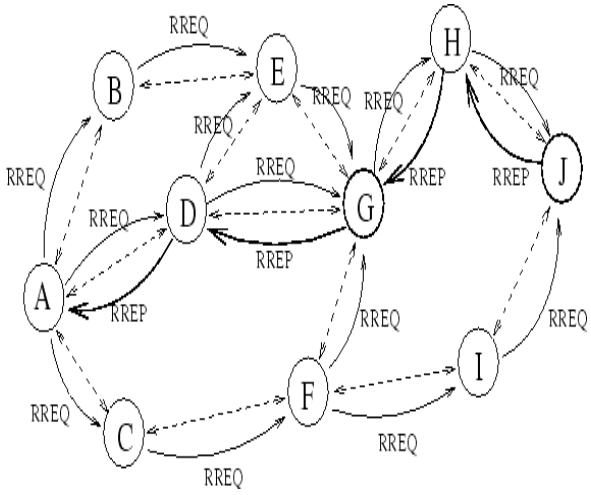


FIG-AODVROUTING

*2) Destination sequenced distance vector(DSDV):*The Destination-Sequenced Distance-Vector (DSDV) Routing Algorithm is based on the idea of the classical Bellman-Ford Routing Algorithm with certain improvements [9]. Every mobile station maintains a routing table that lists all available destinations, the number of hops to reach the destination and the sequence number assigned by the destination node. The sequence number is used to distinguish stale routes from new ones and thus avoid the formation of loops.

The stations periodically transmit their routing tables to their immediate neighbors. A station also transmits its routing table if a significant change has occurred in its table from the last update sent. So, the update is both time-driven and event-driven. The routing table updates can be sent in two ways:- a "full dump" or an incremental update. A full dump sends the full routing table to the neighbors and could span many packets whereas in an incremental update only those entries from the routing table are sent that has a metric change since the last update and it must fit in a packet. If there is space in the incremental update packet then those entries may be included whose sequence number has changed. When the network is relatively stable, incremental updates are sent to avoid extra traffic and full dump are relatively infrequent.

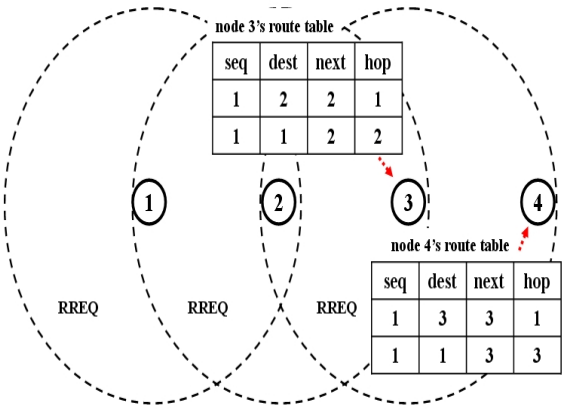


FIG-DSDV ROUTING

III. NS-2 SIMULATOR

It is developed by UC BERKELEY. NS-2 stands for Network Simulator version 2. NS-2 is a discrete event simulator for networking research. It was developed as a part of VINT Project (Virtual Internet Testbed). It was a collaboration of many institutes like UC Berkeley, AT&T, XEROX PARC and ETH. Its first version was developed in 1995 and version 2 was released in 1996. Basically, NS-2 works at packet level. It provides substantial support to simulate bunch of protocols like TCP, UDP, FTP, HTTP and DSR. NS-2 simulates both the wired such as P2P links, LAN etc. and wireless networks like ad-hoc, cellular, GPRS, UMTS, WLAN, Bluetooth. It is primarily UNIX based and use TCL as its scripting language. NS-2 is a standard experiment environment in research community.

c)DYNAMIC SOURCE ROUTING(DSR):

DSR is a reactive routing protocol. It initiates route discovery only on demand like AODV. DSR [10] stores the whole path to destination in its routing table instead of next hop node unlike AODV. The packet header includes the address of all the nodes through which the packet must pass to reach the destination node. This kind of routing is called source routing and that's why the name of protocol is. A pair of <RREQ, RREP> message is used to discover the route similar to AODV. Source node broadcast the RREQ message and the node having route to destination replies with RREP message. If node receiving RREQ message doesn't have information regarding destination node it rebroadcast the RREQ message after adding its address to source address.

1) NS2 ARCHITECTURE:

NS-2 simulator is based on two languages: an object oriented simulator, written in C++ and a OTcl (an object oriented extension of Tcl) interpreter, used to execute user's command script. NS-2 has a rich library of network and protocol objects. There are two class hierarchies: the compiled C++ hierarchy and the interpreted OTcl one, with one-to-one correspondence between them.

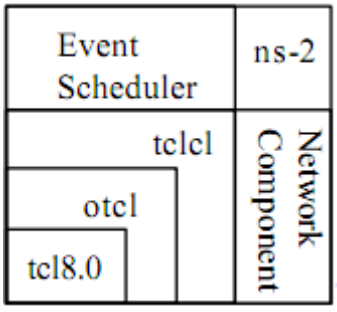


Fig. NS-2 Architecture

The compiled C++ hierarchy allows us to achieve efficiency in the simulation and faster execution times. This is in particular useful for the detailed definition and operation of protocols. This allows us to reduce packet and event processing time.

Then in the OTcl script provided by the user, we can define a particular network topology, the specific protocols and applications that we wish to simulate and the form of the output that we wish to obtain from the simulator.

2) SIMULATION SETUP: The protocols to be implemented and analyzed and the tools to be used for this implementation and analysis have been selected by a thorough study of the reference papers mentioned in the later portions of this text. We have discussed pervasively about the protocols and now we will be discussing the tools in the same way.

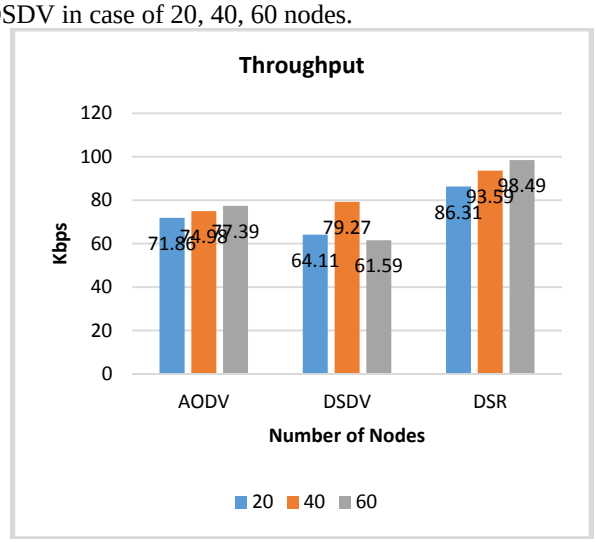
Parameter Type	Parameter Value
Protocols	AODV,DSDV,DSR
Simulation Time	150ms
Number of Nodes	20,40,60
Packet Type	TCP Packet
Queue Type	Priority Queue
Environment size	1000m*500m
Traffic Type	Constant Bit Rate
Platform	Ubuntu
Simulator	NS2

Simulation is followed by a display of the working of the network with the protocols. This is done by using Network Animator (NAM). NAM is a TCL/TK based animation tool for viewing network simulation traces and real world packet traces. It supports topology layout, packet level animation and various other data inspection tools [11]

IV RESULTS

The performance of routing protocols is evaluated on NS2 simulator. We have considered three parameters for evaluation: throughput, end to end delay and packet delivery ratio.

1)*Throughput:* It is described as the total number of received packets at destination out of total transmitted packets [11].In this we have taken three nodes 20,40,60 nodes and we estimate the throughput of three protocols. The overall throughput of DSR is better than AODV and DSDV in case of 20, 40, 60 nodes.

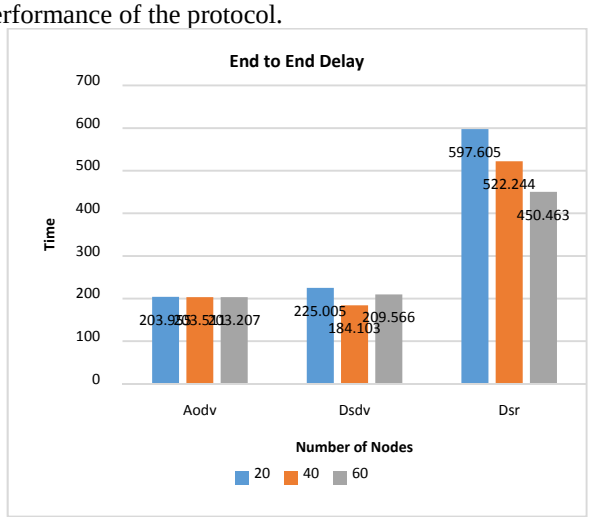


2) End to End Delivery Ratio: It is described as time taken for a packet to be transmitted across a network from source to destination. It also includes the delay caused by route discovery process and the queue in data packet transmission. Only the data packets that successfully delivered to destinations that counted.

We calculate end to end delay of three protocols of three nodes 20,40 and for 60 nodes. And the graph comes out to be. Here we analysed that AODV has less end to end delay than remaining protocols (DSR and DSDV).Basically for different-2 nodes end to end delay is different but we analyzed the overall performance.

∑ (arrive time – send time) / ∑ Number of connections

The lower value of end to end delay means the better performance of the protocol.

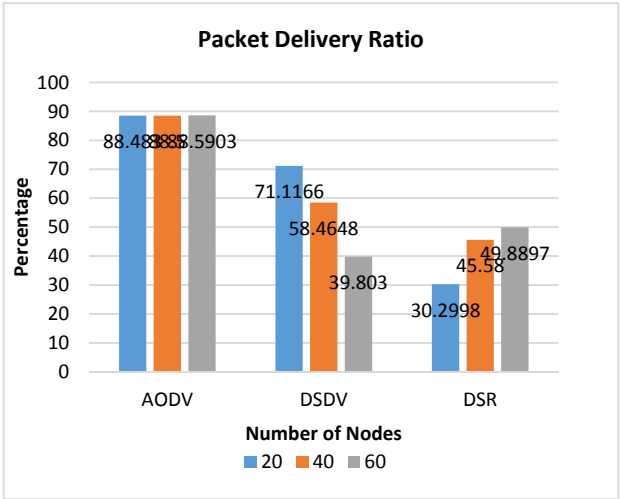


So, in **END TO END DELAY PERFORMANCE of AODaV is best than DSDV and DSR** protocols.

3)Packet Delivery Ratio: Packet delivery ratio : the ratio of the number of delivered data packet to the destination. This illustrates the level of delivered data to the destination. The greater the value of packet delivery ratio means the better performance of protocol

∑ Number of packet receive / ∑ Number of packet send.

Here also overall performance of AODV Protocols is better than DSDV and DSR .For 20, 40 and 60 nodes AODV has the maximum packet delivery ratio than others. So highest the packet delivery ratio greater it has the ability to send packet more to various nodes.



So, overall performance of AODV is better than both protocols. AODV has the ability to send more packets.

V. CONCLUSION

In this paper we have seen the performance analysis of three different protocols AODV, DSDV, DSR on basis of THROUGHPUT, END TO END DELAY AND PACKET DELIVERY RATIO. By the analysis overall performance of AODV is better than DSDV and DSR .In case of THROUGHPUT DSR has better result I i.e performance of DSR is better than both AODV and DSR. The results can vary according to the parameters. In this we have considered fixed number of nodes. Other parameters like energy, jitter can also be calculated .From this we can infer that routing protocols is necessary for better performance.

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