Simulating AODV and DSDV For Adynamic Wireless Sensor Networks

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Summary
Sensor networks help find ways where schematic networks that is where wired media won't exist or won't work. Sensor Networks are de facto Standards for communication over distances depending up on the need and requirements. The anticipated outcome that is intended of sensor networks embodies monitoring and evaluation. In this paper we acquaint the execution evaluation of two routing protocols i.e. AODV and DSDV in the context of sensor networks with an assumption that all the node are static. Such a case demonstrates its implication in the fields similar to combat. Where the node may or may not locomote. As an example case, sensor nodes put-upon for land mines detection remain static. The protocols simulation is performed utilizing NS2. The results brought forth understandably distinguish the performance issues of both the routing protocols in the discourse addressed.

Key words:
Sensor Networks, Routing Protocols, NS2

1. Introduction

Sensor networks are the paramount technologies, amidst various radio communication technologies due to their better accuracy. A sensor is a device that has the capability of sensing, to receive a signal and respond to that signal in an autonomous manner.
Sensor network comprises multiple signal detection nodes titled as sensor nodes. Sensor devices are small in size having short communication range, high-energy intake, low storage capacity, light weight and man-portable.
Sensor node consists of four main components as "Sensing unit, Processing unit, Transceiver and Power unit", shown in figure 1[1].

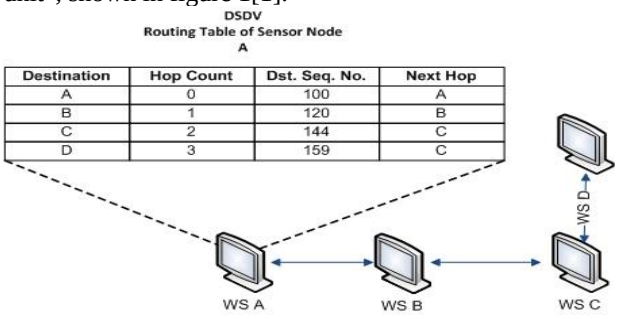

Figure 1. Sensor Node Architecture [1]

Sensing unit has further subunits i.e. Sensor and ADC (Analog to Digital Converter) units.The analog unit (ADC) produces analog signal which is based on sensor observations and converts the observed information into digital signal for further processing. The processing unit has also two units named as Processor and Storage. This processor is just like a computer processor for various computational and decision making purposes. The storage unit is used for storing of sensed information for future use. Transceiver is another component of sensor node which has the capability to send and receive different input and output data. The last component is power unit, which is vital for sensor nodes and sensor network. Power unit is used to maintain the voltage of sensor nodes. Some other optional components, rectangular in shape, are shown in dotted format in figure 1[1].
Sensor node also requires some knowledge from other node(s) and accurate routing path, to achieve this target the location finding system is used. Mobilizer is another feature of the sensor node. Sometimes, a sensor node requires moving to different directions to find out the assigned tasks and this assigned task can sorted out through Mobilizer. The optional unit is power generator which will work as a backup power generator in case of any failure of power unit. The whole scenario is shown in figure 1[1].
Sensor networks are used for monitoring and record conditions at various diverse locations, which include: engineering mechanization, vigil and record the activities, supervising communications, health observation, sensing weather updates and Robotics.
Sensor technology is one of the cheapest technologies to provide security measures in very inhibitory surroundings. These sorts of technologies are attaining popularity day to day, due to best efficiency required in security and affordable cost. So far, most of the
researchers have thought to physically implement the sensor nodes and sensor networks but their thoughts were not enough to create any valuable security difference using sensor networks.
The rest of the paper is organized as follows: Section 2 describes the motivation of this paper, Section 3 describes the similar approaches and related work to the mobile adhoc routing protocols, section 4 is about the routing protocols that we have simulated, section 5 describe the parameters used for simulation and comparison purposes

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and the section next to that discusses the results, in the last the conclusion of the paper is presented.

2. Motivation

The primary aim of this study is to analyze the behavior of the routing protocols in infrastructure-less environment and distinctly the Sensor Networks. The reason why these protocols are selected is their simplicity of design and implementation and to gain the better understanding on how these protocols perform under certain scenarios. The one we aim to study is, where sensor nodes are mostly adynamic. Our case study scenario may resemble a battle field equipped with sensors for land mines detection. Since any inefficient movement of nodes, in this scenario, may have the devastating results.

The DSDV is one of the early protocols in MANETS, and is optimum for the networks with limited nodes and activity. Although its difficult to find widespread implementations of DSDV its Successors may have produced far reaching effects. The most eminent of them is AODV.

3. Related Work

Networks whether wired or ad hoc without the routing protocols are useless, like a blind man without eyes can't get out of the building. Routing protocols play decisive role for the packets as how they will reach the destination. To study the behavior of these protocols,

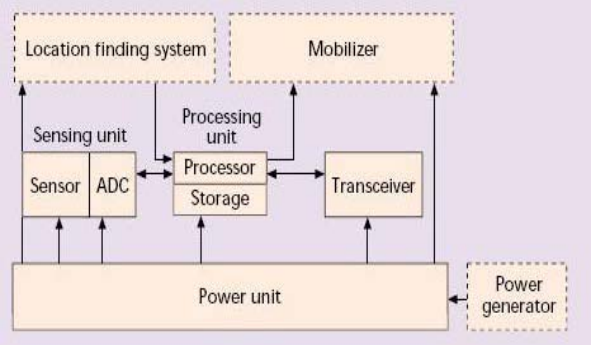

Figure 2. DSDV Routing Table

several attempts have been made in deploying and evaluating protocols in different network environments. Routing protocols naming AODV, DSR, and OLSR, TORA, DSDV and many others have been simulated to judge their performance in various different situations. One of the examples is [2], where the authors have evaluated the performance of routing protocols in a grid environment. Similarly, in a recent work [3], authors have analyzed a routing protocol for sensor networks. In another work [4] mobile adhoc network is simulated to review its performance with reference to QoS. In [5], authors review the routing protocols in the domain of wimax based networks. Another case is of [6], where parameters like speed and tract are considered for simulation.

4. Routing Protocols

4.1. AODV

AODV [7], [8] stands for Ad Hoc on demand distance vector protocol. It is a routing protocol designed for Ad hoc networks. These ad hoc networks can be defined as the computers those converse over the wireless means without any interference from a wired network. Information transmittance in such type of network is done by routing protocols. AODV is a routing protocol which has ability to create a route to destination only on demand. AODV avoids problems similar to Count-to- Infinity. For this AODV uses a technique of assigning sequence numbers to all the updates. AODV is also appropriate for working in restrictive environments. It has ability to intercommunicate with the end points which cannot be accessed directly. AODV has the ability to find the route through which message can be forwarded. It also checks that the path or the route doesn't have loops and also try to find the shortest route to the end point. It has the ability to maintain itself against new route declarations or the errors in the route. It keeps tracks of its neighbors by listening for a HELLO message that each end points broadcasts after fix interval of time. AODV has ability of Route Error message (REER) which allows it to adjust the route when node moves around. Whenever an end point receives REER message it removes all the routes information of bad end point from it routing table. AODV only keeps the records of next hop instead of the whole route. AODV can send and receive the unicasts and multi casts without any hassle. AODV is available in the installer form for platforms like Linux and windows. AODV can be help for information exchange not only locally but to the nodes those are across the internet. The project of AODV@IETF [9] is pursuing this goal actively.

Table 1. Simulation Parameters

Parameter	***Value***
Simulation time	60 Seconds
Routing Protocol	AODV & DSDV
Propagation Model	TwoRayGround
Mac Type	802.11

Link Layer Type	LL
Interface Type	Queue/Droptail/Priq
Number of Nodes	3
Traffic Type	CBR
Packet Size	512 Bytes
Time Interval	0.1s ,0.2s ,0.3s
Area	500m2

4.2. DSDV

DSDV [10] is one of the protocols for ad hoc mobile networks and its inception contributed to the evolution of numerous additional routing protocols. DSDV is an elementary and moderately less complex protocol which is suited fit for less dense network i.e. its targeted to function exquisitely on small node density. DSDV does work, essentially, by sharing routing information with neighboring nodes, which is stacked away by each node in the form of tables. DSDV, though simple

Table 2. Average and Total Delay between AODV & DSDV

Name of Protocol	*Average Delay*	*Total Delay*
AODV	0.003071	0.872216
DSDV	0.004552	2.960383

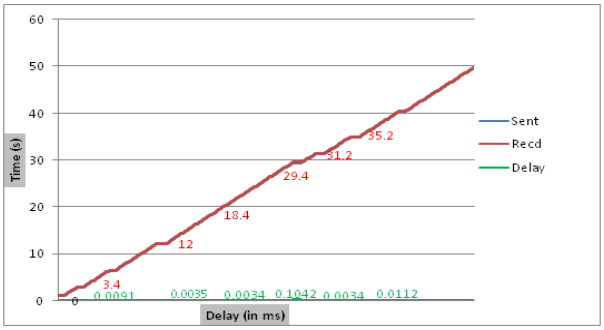

Figure 3. AODV Delay

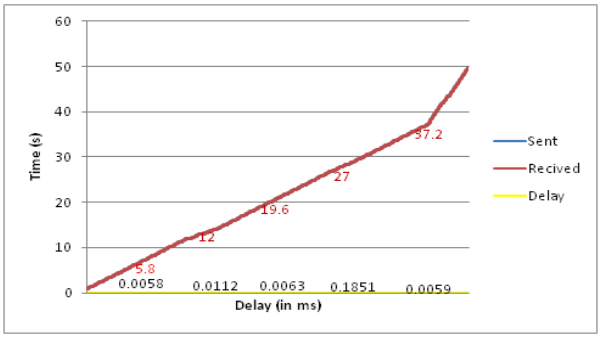

Figure 4. DSDV Delay

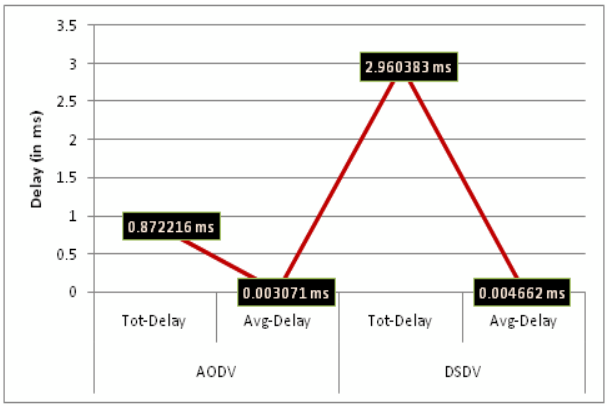

Figure 5. Comparison of Delay between AODV & DSDV Routing Protocols

posses a few shortcomings, since the routing updates are sudden and sporadic, even a minor change in network topology whether logical or physical drives the protocol to exchange the full routing table across the complete network. This holds the network busy in continuation. Which is a heavy processing overhead time for sending even small amounts of data. The bandwidth is constantly eaten up. Figure 2 demonstrates, how DSDV maintains the routing information.

5. Simulation of AODV and DSDV

Network Simulator (NS2) [11] is C++ based discrete event simulator equally good for simulating both the wired and wireless networks. NS2 is one the favorites of the researchers for analyzing protocols since its support for wide variety of domains and its accuracy of results between the real and simulated environment. Our selected protocols AODV and DSDV can be best simulated using NS2. Two parameters are considered for routing protocols, which are Delay and Packet loss. A simulation topology has been created as shown in table I of simulation parameters. The following parameters are considered for simulation:

5.1. Delay

“Delay can be defined as the difference between the packet generation time at the source, to the packet arrival time at the destination”.

5.2. Packet Loss

“Packet Loss can be defined as the packets sent by the source and the packets dropped (loss) before receiving by the base station (sink)”.

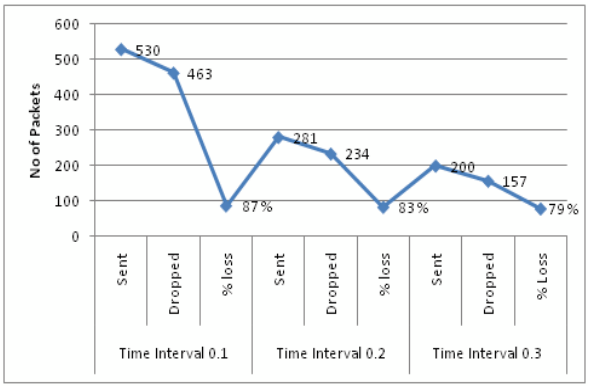

Figure 6. Packet Loss of AODV Routing Protocol

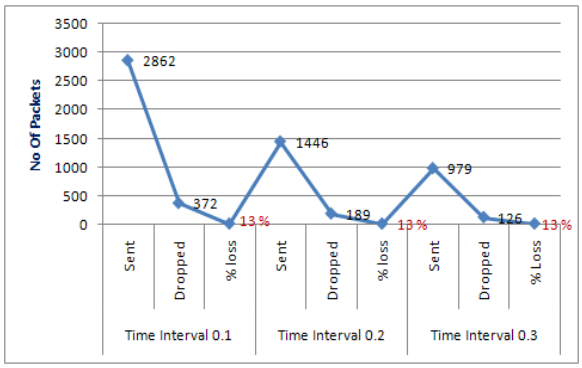

Figure 7. Packet Loss of DSDV Routing Protocol

6. Results and Discussion

Our simulation has compared DSDV protocol which is a Proactive protocol with AODV protocol which belongs to Reactive protocols family. Figure 3 and 4 shows the delay of AODV and DSDV respectively. It's evident that DSDV manifests higher delay and poor performance than that of AODV. Figure 5 depicts comparison of total and average delay between AODV and DSDV. Here AODV has less delay in either case compared to DSDV. Figure 6 and 7 shows the packet loss of AODV and DSDV. Thus, AODV demonstrates better results by exhibiting less packet loss. Table 2 and 3 presents brief comparison of both the protocols.

7. Conclusion

In this paper, we have presented the simulation analysis of two ad hoc network routing protocols, which has contributed in twofold manner. Firstly, a short brief comparison the protocols is presented which may help in the better understanding of these protocols. Secondly, these protocols are simulated in the context of sensor networks where all sensor nodes exhibit no movement. Their performance results are generated graphically and discussed accordingly. It can be concluded from our study that AODY may be well or be more suited to restrictive sensor network scenarios.

Table 3. A Brief Comparison of AODV & DSDV

Parameter	***AODV***	***DSDV***
Flooding	Yes	Yes
Routing loop Avoidance	Yes	Yes
Power Consumption	Medium	High
Link State	-	-
Distance Vector	Yes	Yes
Throughput	High	Medium
Unicast	Yes	-
Multicast	Yes	-
End-to-End Delay	Medium	High

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