ISSN: 2278 – 909X
International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE)
Volume 5, Issue 5, May 2016

Comparative Study of Flooded and Directed Diffusion Protocol in WSN

Shreya Kaushal, Nishu Gupta, Rajbir Sandhu

ABSTRACT: Wireless sensor network consists of individual nodes that can interact with their environment by sensing or controlling various physical parameters. These are powerful because they are amenable to support a lot of different real world applications. In this paper study of various routing protocols for WSN has been presents which can be used for various approaches. The three main categories explored are data-centric, hierarchical and location based. The common objective of these approaches is to get better throughput and increased lifetime of the sensor network. A comparison has been shown between two routing protocols- Flooding and directed diffusion.

Keywords: WSN, NS2, TCL, UPD, MATLAB

Introduction

In the present scenario, the emergence of WSN is essential towards the miniaturization of computing device. Sensor networks are composed of thousands of resource sensor nodes and resourced base stations are there[1]. All nodes in a given network communicate with each other via wireless communication. In a multihop network, intermediate nodes have to relay packets from the source to the destination node. Such an intermediate node has to decide to which neighbor to forward an incoming packet not destined for itself. Typically, routing tables that list the most appropriate neighbor for any given packet destination are used.

Unlike their ancestor ad-hoc networks, WSNs are resource limited, these are prone to failures. The number of nodes in WSNs is several orders higher than that of ad hoc networks. The major components of a typical sensor network are:

Sensor Field: A sensor field can be considered as the area in which the nodes are placed.

Sensor Nodes: Sensors nodes are the heart of the network. They are in charge of collecting data and routing this information back to a sink.

Sink: A sink is a sensor node with the specific task of receiving, processing and storing data from the other sensor nodes. They serve to reduce the total number of messages that need to be sent, hence reducing the overall energy requirements of the network. Sinks are also known as data aggregation points.

Task Manager: The task manager which is also known as base station is a centralized point of control within the network, which extracts information from the network and disseminates control information back into the network. It also serves as a gateway to other networks, a powerful data processing and storage centre and an access point for a human interface. The base station is either a laptop or a workstation.

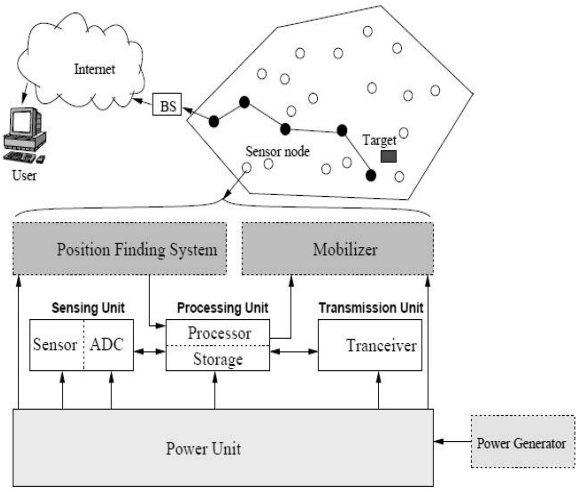

Fig 1. Components of Wireless Sensor Networks

Routing in Wireless Sensor Networks

Routing is a process of determining a path between source and destination upon request of data transmission. In WSNs the network layer is mostly used to implement the routing of the incoming data. It is known that generally in multi-hop networks the source node cannot reach the sink directly. So, intermediate sensor nodes have to relay their packets. The implementation of routing tables gives the solution. These contain the lists of node option for any given packet destination. Routing table is the task of the routing algorithm along with the help of the routing protocol for their construction and maintenance.

The Flooding Protocol In flooding [1], the source node floods all events to every node in the network. Whenever a sensor receives a data message, it keeps a copy of the message and forwards the message to every one of its neighboring sensors and the cycle repeats.

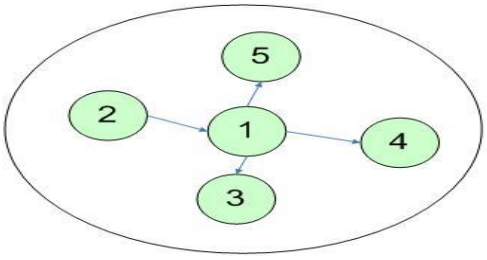

Fig 2. Flooding

It is an easy-to-implement routing scheme, and it is suitable for various network types, node distributions and environments. The main advantage of flooding is the increased reliability provided by this routing method. Since the message will be sent to at least once to every host it is almost guaranteed to reach its destination. But the unlimited broadcasting the packets in the flooding scheme will cause the broadcast storm.

The Directed Diffusion Protocol Direct Diffusion [2] is the data centric protocol. It is the first proposed protocol for the wireless sensor network scenarios. If directed diffusion does not perform better than flooding, it cannot be considered viable for sensor networks. It consists of several elements, interests, data messages, gradients, and reinforcements. First, sink node requests data by sending interests. An interest message is a query or an interrogation, which specifies what a user wants to its neighbors for named data. The data is named using attribute-value pairs and it is the collected or processed information of a phenomenon that matches an interest of a user [3]. The interests are flooded over the whole network by the sink. Such data can be an *event*, *which* is a short description of the sensed phenomenon. Whenever a node receives an interest, it will check whether the interest exists or new one. If it is a new interest, the sensor node will set up a gradient toward the sender to "draw" down data that matches the interest. Each pair of neighboring nodes will establish a gradient to each other. After the gradient establishment stage, the source node begins to send the related data that matches the interest to the sink. The data are generally broadcasted to all its gradient neighbors. Events are propagated toward the interest originators along multiple gradient paths. The sensor network reinforces one or a small number of these paths. The reinforcement scheme in directed diffusion is generally designed for minimum delay or

maximum number of packets received during a certain period of time as shown in Fig 3.

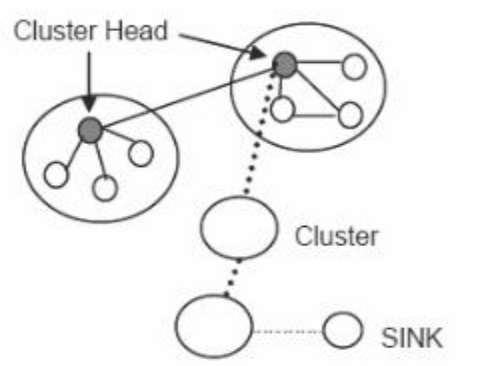

Fig 3. Maximum number of packets received

INSTALLATION, SIMULATION and DESIGN

The Network Simulator (NS2)

Simulation can be defined as "Imitating or estimating how events might occur in the aid of technology, or combinations. The value lies in the pacing you under realistic conditions that change as a result of behavior of others involved, so you cannot anticipate the sequence of events or the final outcome.

NS is a discrete event network simulator where the timing of events is maintained by a scheduler and able to simulate various types of network such as LAN and WPAN according to the programming scripts written by the user. Besides that, it also implements variety of applications, protocols such as TCP and UDP, network elements such as signal strength, traffic models such as FTP and CBR, router queue management mechanisms such as Drop Tail and many more.[4]

Tool Command Language (Tcl)

Short for Tool Command Language, TCL [4] is a powerful interpreted programming language developed by John Ouster out at the University of California, Berkeley. Tcl is a very powerful and dynamic programming language[4]. It has a wide range of usage, NS2 is an event driven network simulator, which can be implemented in Linux-based including web and desktop applications, networking, administration, testing etc. TCL is a truly cross platform, easily deployed and highly extensible. The most significant advantage of Tcl language is that it is fully compatible with the C programming language and Tcl libraries can be interoperated directly into C programs.

The Network Animation (NAM)

The network animator began in 1990 as a simple tool for animating packet trace data. This trace data is typically derived as output from a network simulator like ns or from real network measurements, e.g., using tcp dump.

The Tracegraph

It is a data presentation system for Network Simulator NS2. The simulator doesn't have any options implemented to analyze simulations results so it's hard to use it. Trace graph [2] system provides many options for analysis, including 250 graphs and statistical reports. It is implemented in MATLAB 9.0 and can be compiled to run without MATLAB.

Simulation of Routing Protocols

Simulation of different routing protocols (Flooding and Directed Diffusion) has been carried over to evaluate the performance. Various parameters that are considered for simulation are listed in table 1.

Table 1. Network parameter

Parameter name	Flooding	Directed Diffusion
Channel type	Wireless	Wireless
topology	Random	random
Packet size	64	64
Initial energy	7 Joules	7 Joules
Source Node	7	7
Destination Node	5	5

Simulation of flooding protocol

Simulation of flooding protocol is performed over 30 nodes having energy 7 joules. Nodes in the network are

in random position. In this scenario there is a source node that will broadcast the data and all the neighboring nodes will do the same after receiving it. Node 7 is the source node and node 5 is the sink node. In figure 4 source node 7 is flooding the data to its neighboring nodes. The flooding of packets is shown by red color.

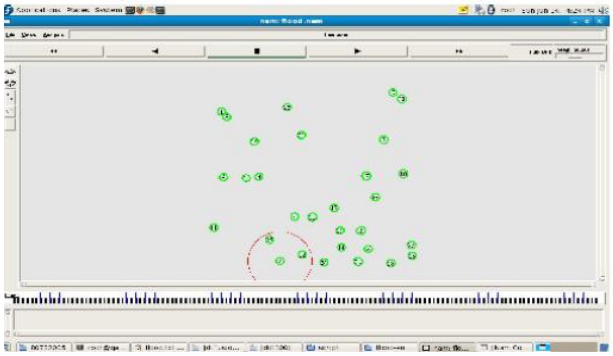

Fig. 4 Source Node 7 is flooding the data

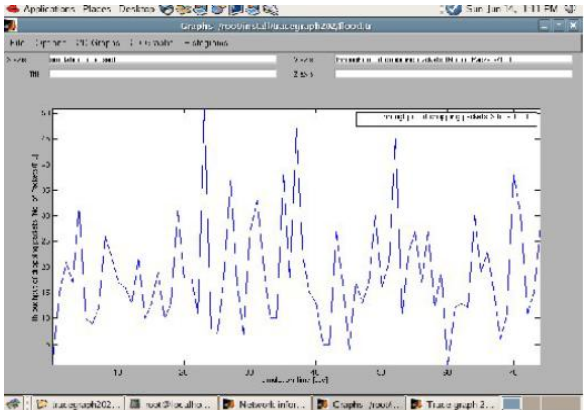

Fig. 5 Simulation graph of Flooded protocol

Simulation of Directed Diffusion Protocol

The same topology has been implemented for directed diffusion with same source node and same sink node. The difference between the simulation of flooding and directed diffusion is that in directed diffusion, the communication starts from sink itself[6]. When the sink sends the interest about what it needs, source node sends a gradient in reply and then data is being delivered to the sink. In this simulation scenario, node 7 is the source node and node 5 is the sink node. Sink node 5 sends the interest Source node 7 is sending. In figure 6, sink node 5 is sending interest to all the neighboring nodes. All the nodes in the network have a cache to store the different interests.

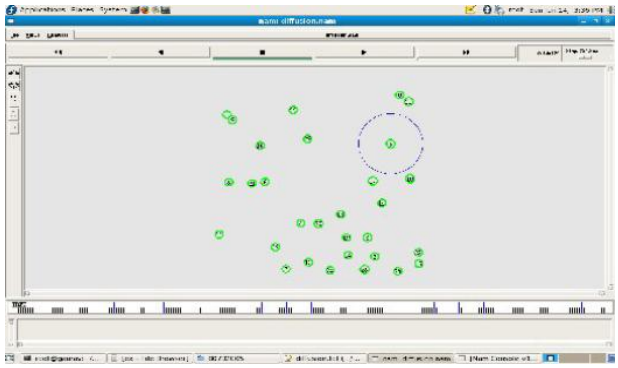

Fig. 6 Sink Node 5 is sending interest to all the neighboring nodes

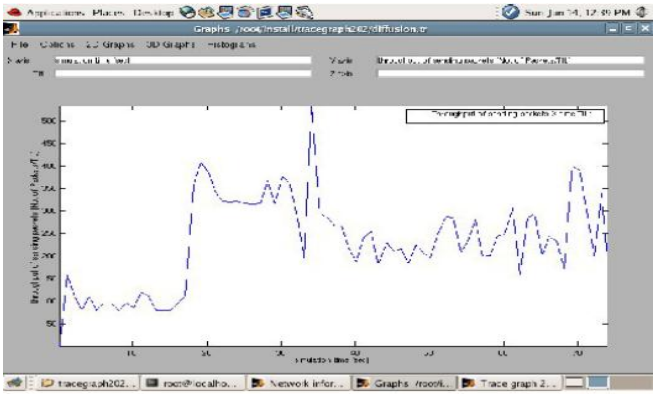

Fig.7 Simulation graph of Directed Diffusion Protocol

Comparison in Flooding and Directed diffusion

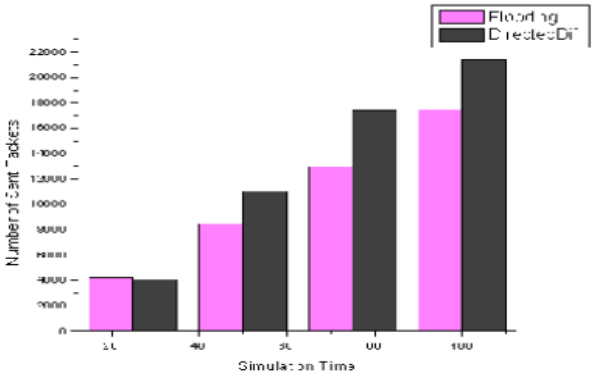

Table 2: Comparison Parameters for both protocols

Protocol	Initial Energy	Remaining energy	Network Lifetime
Flooding	7 J	2.6 J	82 s
Directed Diffusion	7 J	2.9 J	90 s

Conclusion:

With the results of tracegraph, we can conclude that in the case of flooding, throughput of delivered packets is quite less than the throughput in the case of directed diffusion. Also end-to-end delay is also better in the case of directed diffusion. Since energy of the nodes is a constraint in wireless sensor network, so a fix amount of energy is given to the network in both the cases[7]. As the simulation time increases, nodes in the network continuously lose its energy and after a fix simulation time network collapse. In the case of flooding protocol, network lifetime is 82 seconds and for directed diffusion it is almost 91 seconds. Since Directed Diffusion is data centric so there is no need for a node addressing mechanism. Directed diffusion can reduce the bandwidth needed for sensor networks[8]. Each node is assumed to do aggregation, caching and sensing. Directed diffusion is energy efficient since it is on demand and no need to maintain global network topology.

References:

[1] Shio Kumar Singh, M p Singh and DK Singh "Routing Protocols in Wireless Sensor Networks-A Survey" International Journal of Computer Science &Engineering Survey(IJCSES)Vol.1,No.2,November2010. Parul et al., International Journal of Advanced Research in Computer Scie

[2] Rafe Alasem, Ahmed Reda and Mahmud Mansour "Location based energy efficient reliable routing protocol for wireless sensor network "World Scientific and Engineering Academy ANDC Society(WSEAS) Stevens Point, Wisconsin, USA,2011.

[3] Mohammad S. Al Fares, Zhili Sun and Haitham Cruickshank, "A Hierarchical Routing Protocols for Survivability in Wireless Sensor Network" Proceedings of the International Multi Conference of Engineers and Computer Scientists 2009Vol 1, March 18-20, 2009, Hong Kong.

[4] Howitt and J.A. Gutierrez, "IEEE 802.15.4 low rate wireless personal area network coexistence issues", Wireless Communications and Networking 2003 pp 1481- 1486 [5] Jun Yang, Deyon Zhang, Yunyi Zhang, "An Energy Efficient Data Gathering Protocol for wireless Sensor Networks", Eighth IEEE/ACIS International conference on computer and information science, Shanghai, June- 2009 [7] S. [6] Tilak et al., "A Taxonomy of Wireless Microsensor Network Models," in ACM Mobile Computing and Communications Review (MC2R), June 2002.

[7] Sha chao, Wang ru-chan, "Energy efficient clustering algorithm for data aggregation in wireless sensor networks", The Journal of china Universities of posts and Telecommunications, volume 17, December 2010, pp 104-109

[8] Avokh, A. Mirjalily, G., "Dynamic Balanced Spanning Tree (DBST) for data aggregation in wireless Sensor Networks", 5th International Symposium on Telecommunications (IST, 2010), Tehron, Iran, Dec 2010, pp 391-396

Authors Profile-

Shreya Kaushal received the M.E degree in Electronics and Communication from Thapar University(PB) in 2013 and B.Tech degree in Electronics and Communication

Engineering from Lovely Professional University in 2011, respectively. She has qualified her GATE in 2011. During 2013-2014 she was teaching as Assistant Professor in Gurukul Vidyapeeth Engineering College. Now, She is Working with IET Bhaddal Technical Campus as an Assistant Professsor in ECE Department.

Nishu Gupta, have done her Master's from GNDEC Ludhiana in the field of Power Systems. Currently she is working as an Assistant Professor. Her specialization is Electricity Price Optimization. She have done research in the areas of electricity markets, reducing the prices for generation end. She have 4 International and 6 National Publications. Currently She is working on saving energy and wireless energy transmission.

RAJBIR SINGH SANDHU received the M-Tech degree in Information Technology with 71% from KSOU in 2011 and B.Tech in Information Technology from SVIET (PTU) in 2008, AND He has over 7 years of experience in the field of Information Technology. He presently works for IET BHADDAL, as assistant professor in computer science engineering department.