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A Study on: Wireless Routing Protocols

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***Abstract*— In recent trends Wireless Sensor Network is used in large number of applications. WSN is used to monitor and collect environmental information through variety of sensors nodes. The collections of sensor nodes are fixed in different places and these nodes are sending the monitored information to the centralized node called as a sink. Where the data is analyzed and initiate the action according the value of monitored information. The monitored information can be shared between the various sensor nodes by using the routing protocols. The WSN uses many kinds of routing protocols. In this paper, we have discussed various types of protocols functions and also discussed the energy efficient of the protocols. Finally we have discussed the NS2 simulator to simulate the function of routing protocols with the Network Animator.**

***Keywords*— sensor, routing, protocols**

I. INTRODUCTION

Recent advances in micro-electro-mechanical systems (MEMS) technology, wireless communications, and digital electronics have enabled the development of low-cost, low-power, multifunctional sensor nodes that are small in size and communicate unmetered in short distances. These tiny sensor nodes, which consist of sensing, data processing, and communicating components, leverage the idea of sensor networks based on collaborative effort of a large number of nodes. Sensor networks represent a significant improvement over traditional sensors, which are deployed in the following two ways: • Sensors can be positioned far from the actual phenomenon, i.e., something known by sense perception. In this approach, large sensors that use some complex techniques to distinguish the targets from environmental noise are required. • Several sensors that perform only sensing can be deployed. The positions of the sensors and communications topology are carefully engineered. They transmit time series of the sensed phenomenon to the central nodes where computations are performed and data are fused. A sensor network is composed of a large number of sensor nodes, which are densely deployed either inside the phenomenon or very close to it. The position of sensor nodes need not be engineered or pre-determined. This allows random deployment in inaccessible terrains or disaster relief operations. On the other hand, this also means that sensor network protocols and algorithms must possess self-organizing capabilities. Another unique feature of sensor networks is the cooperative effort of sensor nodes. Sensor nodes are fitted with an on-board processor. Instead of sending the raw data to the nodes responsible for the fusion, sensor nodes use their processing abilities to locally carry out simple computations and transmit only the required and partially processed data. The above described features ensure a wide range of applications for sensor networks. Some of the application areas are health, military, and security. For example, the physiological data about a patient can be monitored remotely by a doctor. While this is more convenient for the patient, it also allows the doctor to better understand the patient's current condition. Sensor networks can also be used to detect foreign chemical agents in the air and the water. They can help to identify the type, concentration, and location of pollutants. In essence, sensor networks will provide the end user with intelligence and a better understanding of the environment. We envision that, in future, wireless sensor networks will be an integral part of our lives, more so than the present-day personal computers.

II. CLASSIFICATION OF ROUTING PROTOCOLS

Routing techniques are required for sending data between sensor nodes and the base stations for communication. Different routing protocols are proposed for wireless sensor network. These protocols can be classified according to different parameters. Routing Protocols can be classified as Proactive, Reactive and Hybrid, based on their Mode of Functioning and Type of Target Applications. Routing protocols can be classified as Direct Communication, Flat and Clustering Protocols, according to the Participation style of the Nodes. Routing Protocols can be classified as Hierarchical, Data Centric and location based, depending on the Network Structure. These protocols require each node to maintain one or more tables to store routing information, and they respond to changes in network topology by propagating updates throughout the network in order to maintain a consistent network view. The areas in which they differ are

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the number of necessary routing-related tables and the methods by which changes in network structure are broadcast. Every mobile node in the network maintains a routing table in which all of the possible destinations within the network and the number of hops to each destination are recorded. Each entry is marked with a sequence number assigned by the destination node. The sequence numbers enable the mobile nodes to distinguish stale routes from new ones, thereby avoiding the formation of routing loops. Routing table updates are periodically transmitted throughout the network in order to maintain table consistency. To help alleviate the potentially large amount of network traffic that such updates can generate, route updates can employ two possible types of packets. The first is known as a full Dump. This type of packet carries all available routing Information and can require multiple network protocol data units (NPDUs). During periods of occasional Movement, these packets are transmitted infrequently. Smaller incremental packets are used to relay only that Information which has changed since the last full dump [6].Each of these broadcasts should fit into a standard-size NPDU, thereby decreasing the amount of traffic generated. The mobile nodes maintain an additional table where they store the data sent in the incremental routing information packets.

2.1 Based on Mode of Functioning and Type of Target Applications

Proactive protocols:

In this type of routing protocol, each node in a network maintains one or more routing tables which are updated regularly. Each node sends a broadcast message to the entire network if there is a change in the network topology. However, it incurs additional overhead cost due to maintaining up-to-date information and as a result; throughput of the network may be affected but it provides the actual information to the availability of the network. Distance vector (DV) protocol, Destination Sequenced Distance Vector (DSDV) protocol, Wireless Routing protocol Fisheye State Routing (FSR) protocol are the examples of Proactive protocols.

Distance Vector (DV) Protocol:

It is a proactive protocol that works on the principles of distance vector where each node in a network maintains a distance table that contains the shortest distance and the address of the next hop router. Initially, each node knows only the distance with the nodes that are directly connected and a distance vector is initialized with that distance. Initially, distance to all others nodes that are not directly connected are initialized to infinity. When a change occurs in the network, each node updates its directly connected neighbors to the least cost distance vector. This process continues until convergence. The advantages of distant vector protocol are 1) No need for global broadcasting and 2) Short route acquisition delay since all information for each node are available in the routing table. The disadvantages are 1) Long convergence time which may cause counting to infinity problem for large networks, 2) Non-availability of alternative paths.

Reactive Protocols:

In this type of routing protocol, each node in a network discovers or maintains a route based on-demand. It floods a control message by global broadcast during discovering a route and when route is discovered then bandwidth is used for data transmission. The main advantage is that this protocol needs less touting information but the disadvantages are that it produces huge control packets due to route discovery during topology changes which occurs frequently in MANETs and it incurs higher latency. The examples of this type of protocol are Dynamic Source Routing (DSR), Ad-hoc On Demand Routing (AODV) and Associativity Based Routing (ABR) protocols.

Dynamic Source Routing (DSR) Protocol:

It is a reactive protocol that creates a route on demand using source routing protocol i.e. it requires a full series of paths to be established between source and destination nodes to transmit packets and each packet follows the same path. The major motivations of this protocol are to limit the bandwidth by avoiding the periodic table updates and long convergence time. The underline fact to this protocol is that it floods a route request message in the network to establish a route and it consists of two procedures: Route Discovery and Route Maintenance.

Hybrid Protocols:

It is a combination of proactive and reactive protocols taking the best features from both worlds.

***Zone Routing Protocol* (ZRP):**

Hybrid protocols seek to combine the proactive and reactive approaches. An example of such a protocol is the *Zone Routing Protocol* (ZRP). ZRP divides the topology into zones and seek to utilize different routing protocols within and between the zones based on the weaknesses and strengths of these protocols. ZRP is totally modular, meaning that any routing protocol can be used within and between zones. The size of the zones is defined by a parameter *r* describing the radius in hops.ZRP defines a technique called the *Bordercast Resolution Protocol* (BRP) to control traffic between zones. If a node has no route to a destination provided by the proactive inter-zone routing, BRP is used to spread the reactive route request.

Cluster Based Protocols:

The cluster based routing is energy efficient method in which nodes those having high energies are arbitrarily selected for processing and sending data while nodes those having low energies are used for sensing and sending information to the cluster heads(CHs). This property of cluster based routing contributes to the scalability, lifetime maximization, and energy minimization. The cluster based routing protocols plays a pivotal role in achieving application

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specific goals. The cluster based routing protocols are classified into three broad categories: block cluster based,grid cluster based,and chain cluster based routing protocols.The popular block cluster based routing protocols are: LEACH,HEED,UCS,EECS,CCM,TEEN,LEACH-VF.

Location Based

In location-based protocols [1], sensor nodes are simply addressed by their means of locations. In sensor networks, location information for nodes is necessary. To estimate energy consumption, all the routing protocols should calculate the distance between two particular nodes. We present a brief about location-aware routing protocols in WSNs. Geographic Adaptive Fidelity (GAF): Geographic adaptive fidelity is an energy aware routing protocol. GAF is a type of protocol which was proposed primarily for MANETS and later it was used for wireless sensor networks as well. The outline of GAF is focused around the energy model that contains energy consumption during the transmission and reception of packets as well as during idle time. In GAF the sensor field will be separated into grid squares, each sensor uses its location information to associate with other grids. This location information will be provided by GPS or by other location systems.

Geographic and Energy-Aware Routing (GEAR):

GEAR is an energy efficient routing protocol proposed for routing queries to target the regions in the sensor field. The sensors will be equipped with localization hardware like GPS, localization system. With the help of this the sensors can know about their current positions. The sensors can know about its location, their residual energy as well as neighbours too. In order to select the sensors to route the packet towards destination it uses energy aware methods using geographical information. At that point GEAR uses recursive geographic forwarding to spread the packets inside the target region.

Coordination of Power Saving with Routing:

SPAN is a type of protocol which is also proposed primarily for MANETs and later it can also be applicable to WSNs as its aim is to reduce energy consumption. The design of SPAN is motivated from the fact that wireless networks are the most power consumable devices. In order to reduce power consumption it is better to turn off the antenna in idle state. Even though span doesn't require the sensors to know their location information it runs well with the geographic forwarding protocol. When the geographic forwarding protocol is used the Span selection rule requires every sensor to display its status to the neighbours and also to its coordinators. Additionally, when it receives a packet, a coordinator forwards the packet to a neighbouring coordinator if any, which is the closest to the destination or to a non-coordinator that is closer to the destination.

NS2:

Ns-2 is an open source discrete event simulator used by the research community for research in networking [1]. It has support for both wired and wireless networks and can simulate several network protocols such as TCP, UDP, multicast routing, etc. More recently, support has been added for simulation of large satellite and ad hoc wireless networks. The ns-2 simulation software was developed at the University of Berkeley. It is constantly under development by an active community of researchers.

Downloading/Installing NS:

NS should configure and build on Unix systems. To install NS-2 in your own system, you can download the package from http://www.isi.edu/nsnam/ns/ns-build.html (To install NS in windows systems, please also refer this page). There are two ways to build ns: from the various packages or 'all-in-one' package. For simplicity, it is recommended to start with the 'all-in-one' package.

Build NS:

Entering NS2 directory and execute:

./gunzip ns-allinone-***.tar.gz

/* *** is the version number *//*unzip the file*/./tar xvf ns-allinone-***.tar/* untar the file */./install

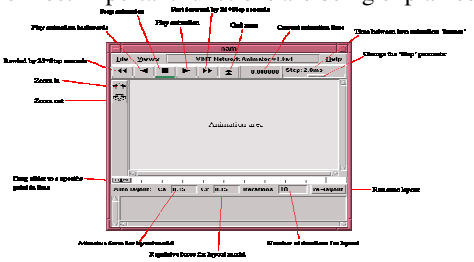
./validate

Starting NS :

You start ns with the command 'ns <tclscript>' (assuming that you are in the directory with the ns executable, or that your path points to that directory), where '<tclscript>' is the name of a Tcl script file which defines the simulation scenario (i.e. the topology and the events). You could also just start ns without any arguments and enter the Tcl commands in the Tcl shell, but that is definitely less comfortable. For information on how to write your own Tcl scripts for ns.Everything else depends on the Tcl script. The script might create some output on stdout, it might write a trace file or it might start nam to visualize the simulation. Or all of the above. These possibilities will all be discussed in later sections.

Starting nam :

You can either start nam with the command 'nam <nam-file>' where '<nam-file>' is the name of a nam trace file that was generated by ns, or you can execute it directly out of the Tcl simulation script for the simulation which you want to visualize. Below you can see a screenshot of a nam window where the most important functions are being explained.



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III. CONCLUSIONS

In this paper, we have discussed some of the important routing protocols in WSN network and also discussed the simulation tool NS2 for animate the routing protocols. In future we will implement the new protocol to provide efficient routing and energy efficient WSN network.

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