



To Studying the Various Scenarios Characteristics of a Cluster in WSN

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Abstract—Wireless Sensor Network have been increasing dramatically in the recent years as they are used more & more in daily life. Medical, Environmental and Military sectors are some important areas that the recent developments have been applied in. In some cases, sensor networks are expected to be able to operate for a long period of time in standby and transmit the gathered data when required, as soon as possible. In this paper, we propose a cluster network. We design using Star topology. Because it is easy to implement & as compared to others it gives efficient result. Also in this growth of network can be easily done by increasing the number of nodes. We make three scenarios in it. And then study the various characteristics of them. E.g. CPU utilization, Ethernet Delay, Ethernet load, and so on.

Keywords— WSN, RIVERBED, OPNET, Clustering, CPU Utilization, simulation, view result.

I. INTRODUCTION

A Wireless Sensor Network (WSN) is a system of wireless mobile nodes that dynamically self-organize in arbitrary and temporary network topologies. In the mobile ad hoc network, nodes can directly communicate with all the other nodes within their radio ranges; whereas nodes that not in the direct communication range use intermediate node(s) to communicate with each other. In these two situations, all the nodes that have participated in the communication automatically form a wireless network, therefore this kind of wireless network can be viewed as mobile ad hoc network.

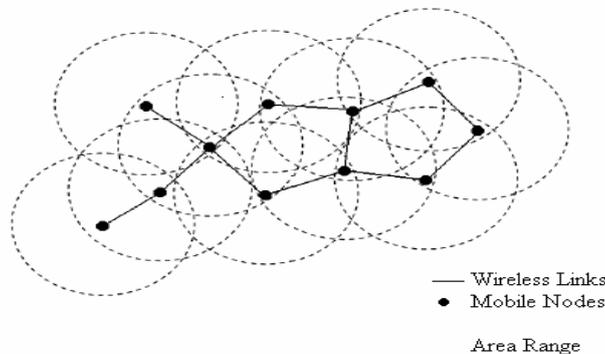


Figure 1 A Schematic Diagram of WSN

When a host tries to communicate with other host(s), the host(s) in between the source and the destination(s) should be involved to make the connection. A Wireless Sensor Network (WSN) consists of spatially distributed autonomous sensors to monitor physical or environmental conditions such as temperature, sound, vibrations, pressure, humidity, motion or pollutants. The WSN is built of nodes from a few to several hundred or even thousands where each node is connected to one sensor. Each sensor network node has typically several parts: a Radio transceiver with an internal antenna or connection to external antenna, a microcontroller, an electronic circuit for interfacing with the sensors and an energy source, usually a battery or an embedded form of energy harvesting.

A collection of mobile nodes are comprised into the Mobile Ad-hoc Networks (MANETs). The mobile nodes creates a wireless networks among themselves without using any infrastructure or administrative support dynamically. Ad-hoc wireless networks are self-creating, self-organizing, and self-administering. By communicating among their component mobile nodes they inherit from being exclusive. Therefore, in order to provide the necessary control and administration function, such communications are used for supporting such network. In earlier days due to such apparent advantages, military, police, and rescue agencies particularly under disorganized or hostile environments, as well as isolated scenes of natural disaster and armed conflict, utilize Ad-hoc networks. The potential applications which are used in other major areas are home, small office networking, in a small area, collaborative computing with laptop computers. Moreover, in all the conventional areas of interest for mobile computing, Ad-hoc networking has clear potential applications. .

A sensor node might vary in size from that of a shoebox down to the size of a grain of dust, although functioning “motes” of genuine microscopic dimensions have yet to be created. The topology of the WSNs can vary from a simple star network to an advanced multi-hop wireless mesh network. In a WSN, a sensor node is free to move around and may communicate with other hosts at any time. When a communicating partner is within a host’s radio coverage, they can communicate directly in a single-hop fashion. Otherwise, a route consisting of several relaying hosts is needed to forward messages from the source to the destination in a multihop fashion. To support multihop communication in a WSN, a mobile host has to work as a router and co-operate with other hosts to find routes and relay messages. WSN/MANETs are increasingly important because wireless communication is rapidly becoming ubiquitous. Potential applications range from military and disaster response applications to more traditional urban problems such as finding desired products or services in a city. The devices themselves are diverse, including PDAs, cell phones, sensors, laptops, etc.

In this paper, we use Star topology. A wireless Sensor Network is made up of three components: Sensor nodes, Task Manager node and Interconnect Backbone as shown in fig.2

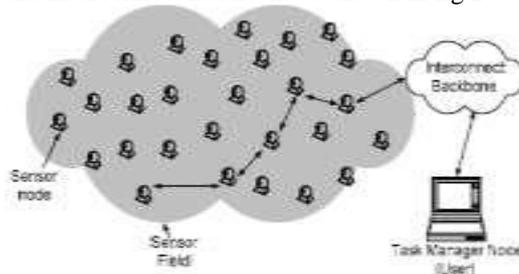


Fig. 2 Wireless sensor network

II. WIRELESS SENSOR NETWORK

Applications:

WSN applications can be divided into two categories.

1. The first category is environmental monitoring. It monitors environmental data (e.g. temperature, humidity) over a long period of time.
2. The second category of WSN applications consists of applications that require an identification of a mechanical system through a measured system response. This category requires highly sensitive sensors, high frequency sampling, and highly correlated sampling. The requirements can be characterized as High Fidelity Sampling (HFS). Health Monitoring of mechanical machines, condition-based monitoring, earthquake monitoring and structural health monitoring belong to this category.
3. With the increase of portable devices as well as progress in wireless communication, ad-hoc networking is gaining importance with the increasing number of widespread applications. Ad-hoc networking can be applied anywhere where there is little or no communication infrastructure or the existing infrastructure is expensive or inconvenient to use. Typical applications include
 - Military Battlefield:
 - Commercial Sector:
 - Local Level:
 - Personal Area Network
 - MANET-VoVoN

III. WIRELESS SENSOR NETWORKING REQUIREMENTS AND CHALLENGES

For a wireless sensor network to deliver real-world benefits, it must support the following requirements in deployment: scalability, reliability, responsiveness, mobility, and power efficiency. Each of requirements is described in Table

Table 1 Essential Requirements of WSN

Requirements	Description
Reliability	The ability of the network to ensure reliable data transmission in a state of continuous change of network structure
Scalability	The ability of the network to grow, in terms of the number of nodes, without excessive overhead.
Responsiveness	The ability of the network to quickly adapt itself to changes in topology.
Mobility	The ability of the network to handle mobile nodes and changeable data paths.
Power efficiency	The ability of the network to operate at extremely low power levels.
Routing	topology of the network is constantly changing, the issue of routing packets between any pair of nodes becomes a challenging task
Quality of Service (QoS):	An adaptive QoS must be implemented over the traditional resource reservation to support the multimedia services.
Multicast	Multicast is desirable to support multiparty wireless communications.

The complex inter-relationships between these characteristics are a balance; if they are not managed well, the network can suffer from overhead that negates its applicability in the real world. In order to ensure that network supports the application's requirements.

IV. DESIGN OF WSN MODEL

In designing of WSN model, we set the parameter of WSN with help of simulator. When we set the parameter of WSN, then architecture of WSN is formed. The parameters are:

1. Configuration topology like Star topology.
2. No. of sensor nodes.
3. Central node is 3C_SSII_1100_3300_4s_ae52_e48_ge3.
5. Periphery node model (Sensor node) is Sm_Int_wkstn.
6. Link model is 10BaseT.
7. Workstation of WSN is 1(ethernet_wkstn).
8. Configuration is Application config, Profile config.
9. Server of WSN is Sm_int_server.
10. Radius of sensor node from center node model.

In these parameters we change radial distance for the number of new small WSN cluster in clustering and no. of sensor nodes in the aggregation.

Above design parameters are of single wireless sensor network. We make 3 scenario of this and compare the results.

V. CLUSTERING

A sensor network can be made scalable by assembling the sensor nodes into groups i.e. clusters. Every cluster has a leader, often referred to as the cluster head (CH) A CH may be elected by the sensors in a cluster or pre assigned by the network designer. The cluster membership may be fixed or variable.

A number of clustering techniques have been specifically designed for WSNs for scalability and efficient communication. The concept of cluster based routing is also utilized to perform energy efficient routing in WSNs. In a hierarchical architecture, higher energy nodes (cluster heads) can be used to process and send the information while low energy nodes can be used to perform the sensing.

5.1 Advantages of Clustering:-

1. Clustering reduces the size of the routing table stored at the individual nodes by localizing the route set up within Cluster.
2. Clustering can conserve communication bandwidth since it limits the scope of Inter cluster interactions to CHs and avoids redundant exchange of messages among sensor nodes.
3. Clustering cuts on topology maintenance overhead. Sensors would care only for connecting with their CHs.

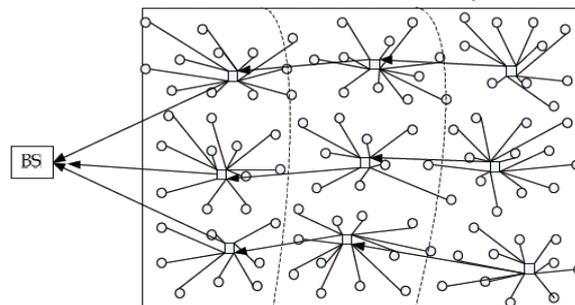


Figure 3 Cluster hierarchies in sensing field

4. The CH can prolong the battery life of the individual sensors and the network lifetime as well by implementing optimized management strategies.
5. A CH can perform data aggregation in its cluster and decrease the number of redundant packets.
6. A CH can reduce the rate of energy consumption by scheduling activities in the cluster.

5.2 Performance Measures

Some performance measures that are used to evaluate the performance of clustering protocols are listed below.

- Network lifetime:** It is the time interval from the start of operation (of the sensor network) until the death of the first alive node.
- Number of cluster heads per round:** Instantaneous measure reflects the number of nodes which would send directly to the sink, information aggregated from their cluster members.
- Number of nodes per round:** This instantaneous measure reflects the total number of nodes and that of each type that has not yet expended all of their energy.
- Throughput:** This includes the total rate of data sent over the network, the rate of data sent from cluster heads to the sink as well as the rate of data sent from the nodes to their cluster heads.

VI. SIMULATION OF DESIGNED ARCHITECTURE OF WSN

For wireless sensor network simulation, the Measure of Performance (MOP) such as latency, delay, queue size, and throughput should be consistent with the overall combined network of dynamic platform and terrestrial systems. From the modeling and simulation perspective, the best effort is to integrate different modeling tools so as to exam the interoperability of the proposed model

The **simulation time** is the time taken during the process of simulations. We observed that if we run the simulation for a long time, millions of simulations evens need to consider for measuring the average QoS parameters of HTTP and voice traffics, as nodes are considered as in random motions with random directions. Therefore, to get correct simulation results from our designed IMANET scenarios, we run the scenarios for 0.5 seconds only. we use riverbed simulator for this purpose. Riverbed Simulator is advanced version of OPNET software which was powerful tool in designing wireless sensor network.

6.1 Collecting Statistics

Three types of statistics are collecting in a wireless sensor network. These are-

1. Global Statistics
2. Individual Statistics
3. Node Statistics/ Server Statistics

Some of them are described below-

6.1.1. Global Statistics-

Ethernet delay(sec)-this statistics represent the end delay of all packets received by all the stations.

6.1.2. Individual Statistics-

Ethernet delay-this statistics represent the end delay of all packets received by all the stations.

CPU Utilization (%)-This statistics represents the end to end Delay of all packets received by all the stations. It is expressed in percentage (%).

6.1.3. SERVER Statics-

Load (in Bits)-load submitted to Ethernet layer by all other Higher layer in this node.

Load (Bit/Second)- Load submitted to Ethernet layer by all other higher layer in this node.

Traffic Received (bits)- Number of bits forwarded by Ethernet Layer to the Higher layers in this node.

Traffic Received (bits/seconds)- Throughput (in bit/sec) of the data forwarded by the Ethernet layer to the higher layer in this node.

Transmission Attempts- Number of transmission attempts by this station before the packets in successfully received at its destination.

Collision Count- total number of collision encountered by this station during packet transmission.

CPU Utilization (%)-This statistics reports the utilization in percentage of the simple CPU. The Simple CPU is used to model the IP packets forwarding delay and application processing delay. It is expressed in percentage (%).

6.2 View result of 2 & 3 cluster network

In Ethernet Delay graph when we increased no. of small clusters so that coverage area increased. The effect on Ethernet load of WSN. In graph, blue line show that when single cluster, Blue line show that two clusters network area and Red for three cluster network area. A given below fig. 4, show that when two cluster used then data transmission is increased suddenly, after that data transmission decreased but greater than single cluster.

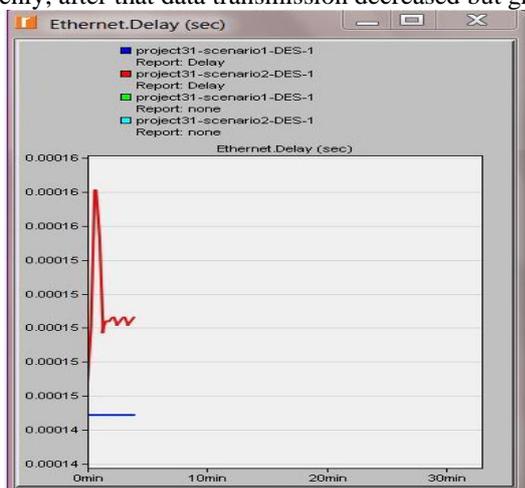


Fig-4 Comparison of Ethernet Delay scenario 1 & 2

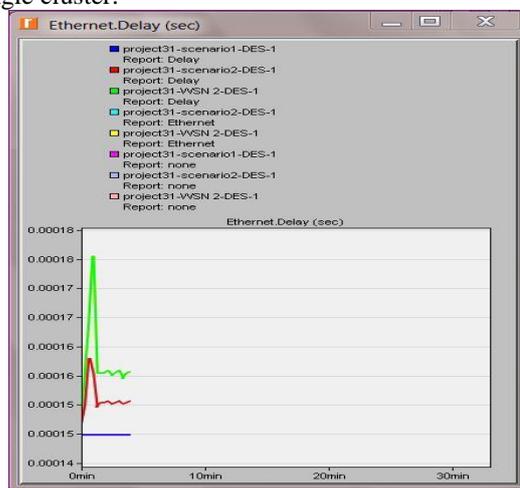


Fig-5 Comparison of Ethernet Delay scenario 1 , 2 & 3

In three cluster WSN data transmission more greater than single WSN and 2 clusters WSN. Ethernet delay graph delay is almost same and fluctuated.

6.2.1 Server Characteristics-

Ethernet Load for two cluster network is shown in fig 6. below. The Blue line shows the Ethernet load (bit/sec) of server for scenario 1 & whereas the Red line shows the Ethernet load (bit/sec) of cluster network scenario 2. It is clear from fig.6 that as cluster increases

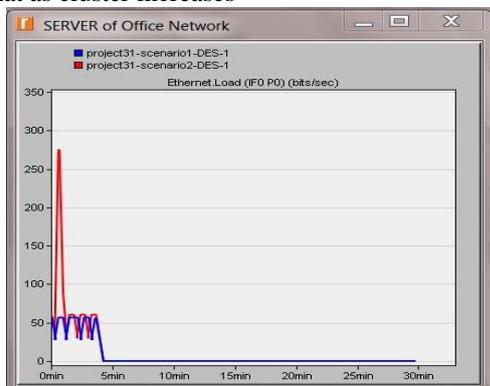


Fig-6 Comparison of Ethernet Delay scenario 1 & 2

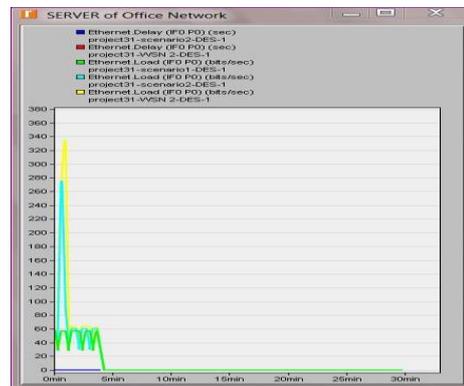


Fig-7 Comparison of Ethernet Delay scenario 1, 2 & 3 at server

The Ethernet load at the server also increases. Now we see the graph of three cluster wireless sensor network load. The figure no. 7 shows the three cluster with three different colors. The green line shows the Ethernet load at the server for the scenario 1, whereas the Sky Blue or Indigo line shows the Ethernet load (bit/sec) at the server for the scenario 2 while the yellow line shows the Ethernet load at the server for scenario 3 of WSN.

It is clear from the fig.7 that as the scenario or cluster of wireless sensor network increases, the Ethernet load will increase. It is also surprisingly from the fig that the Ethernet load of scenario 3 is four times of scenario 1. It means load carrying capacity is increase.

VII. CONCLUSION

As the number of scenario or Cluster of a wireless sensor network increases the elapsed time, total events, speed average & Memory usage is also increase. But total Ethernet delay is less. In wireless communication or in mobile ad-hoc network we want Ethernet delay is minimum so that the information reaches at the server node in minimum time.

In the clustering technique, we perform experiment All the information all around the sensors are collected at the central point, then these information send to WSN server, At last this information reach at the workstation, where it we use.

as compare to first experiment of clustering Technique, then we observe, as we increase the cluster of WSN the capacity of the data transmission increase with high rate and ending with linear transmission.

Ethernet delay of clustering technique experiments, we observe that as we increase the cluster, at starting time increase but after some time it become similar previous experiments.

7.2 Suggestions for future work

The scope of this research paper is, we are easily implement the experiment for MANET/ WSN and easily observe the result of experiment by using the RIVERBED simulator. We can study the different parameters CPU Utilization by connecting nodes in topology other than STAR topology. In the future we are easily various experiment of the reliability, load, delay, node failure, traffic received, transmission attempts, end to end point delay, processing time, peak to peak time. And observe their effect on transmission.

REFERENCE

- [1] Lalit Kumar, Manoj Ahlawat UIET, MDU, Rohtak, India, *Evolution Techniques for Reliability of Wireless Sensor Network*, International Journal of Advances in Engineering & Sciences Vol.2, Issue 4, Oct. 2012.
- [2] Kalpana, Govindaswamy, and Muthusamy Punithavalli. "Reliable Broadcasting Using Efficient Forward Node Selection for Mobile Ad-Hoc Networks." International Arab Journal of Information Technology (IAJIT) 9, no. 4 (2012).
- [3] Wenyu CAI, Xinyu JIN, Yu ZHANG, *Research on Reliability Model of Large-Scale Wireless Sensor Networks*, IEEE International Conference, Zhejiang University, Hangzhou, China, 310027, 2006, Page 1-3.
- [4] Dimitrios J. Vergados, Dimitrios. D. Vergados and Nikolaos Pantazis "An Energy Efficiency Scheme for Wireless Sensor Networks" PENED 2003.
- [5] Frodigh, Magnus, Per Johansson, and Peter Larsson. "Wireless Ad Hoc Networking-The Art Of Networking Without A Network." Ericsson Review 4, no. 4 (2000): 249.
- [6] Deepak Sharma, Kapil Sachdeva, Dr. Shelly Garg and Lalit Kumar, "Deployment of WSN/MANET using Clustering Technique" JRPS July-Sept 2014.