Balancing Network Traffic Load in Geographic Hash Table (GHT)

R. Asha, V.Manju, Meka Sindhu & T. Subha

Department of Information Technology, Sri Sai Ram Engineering College, Chennai.
E-mail : ashaniteesh@gmail.com, manjupadma1991@gmail.com, mekasindhu91@gmail.com
subharajan1979@yahoo.co.in

***Abstract* – Balancing the network traffic load is a serious problem in wireless sensor network. The data generated in a wireless sensor network is stored on the sensor node and accessed through geographic hash table(GHT). GHT is used to retrieve the data from nodes. The previous approaches allow balancing network load by changing the georouting protocol[1] . In our paper we have designed two new approaches called analytical and heuristic. In analytical approach the destination density function yielding quasiperfect load balancing under uniformity assumption. Heuristic approach is used whenever uniformity assumptions are not fulfilled. This approach attempts to prevent multiple request being sent to a single node. We have used hash algorithm for security purpose.**

Keywords – analytical, georouting protocol , heuristic, Load balancing, Wireless sensor network.

I. INTRODUCTION

Balancing storage resources is important in wireless sensor networks, because the memory size of sensor nodes is limited. Imbalance in network traffic load has a negative effect on network lifetime since transmit and receive operations are not evenly spread among network nodes. In order to extend the lifetime of a network we use load balancing in GHTs. This Geographic Hash Table (GHT) **[**10**]** is used to retrieve and store data from sensor nodes. Each node is assigned a value of certain range. For Example: 2D real interval $[0,1]^2$. Each data is appended with metadata. This metadata is hashed to a key value. Keys are stored at nodes.

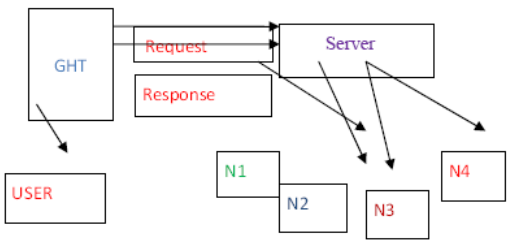

Fig. 1 : GHT Data Retrieval

As shown in Figure **[**1**]**, GHT maintains all the information about nodes. GHT is an approach for effectively retrieving data from a wireless sensor network.

II. RELATED WORK

2.1 Georouting

It is also called as geographic routing **[**7**]** or position-based routing.In georouting, instead of a specific destination node, a message is routed toward a specific geographic location and it is delivered to the node whose key is closest to destination. Load imbalance problem is reduced when modifying the underlying georouting protocol. Changing the georouting protocol comes at a price and it might impact on upper layers and existing applications.

2.2 Load Balancing in Networks

Load balancing might split incoming transactions evenly to all servers, or it may redirect transactions to next available server as needed. The load balancing service **[**9**]** is usually provided by dedicated software or hardware, such as multilayer switch.

TABLE 1: Literature Survey

Title	Description
Tradeoffs between Stretch Factor and Load Balancing Ratio in Routing on Growth Restricted Graphs (2004)	This paper discussed the tradeoff between two quality measures for routing in growth restricted graphs. The two measures considered stretch factor, which measures the lengths of the routing paths, and the load balancing ratio, which measures how

	evenly the traffic is distributed.
Balancing Traffic Load in Wireless Networks with Curveball Routing (2007)	The problem is addressed to balancing the traffic load in multi-hop wireless networks, which considers a point-to-point communicating network with a uniform distribution of source-sink pairs.
Routing in Outerspace: Fair Traffic Load in Multihop Wireless Networks (2008)	This paper consider security-related and energy-efficiency issues in multi-hop wireless networks
Covering Space for In Network Sensor Data Storage (2010)	This paper proposed to map data to a *covering space*, which is a tiling of the plane with copies of the sensor network, such that the sensors receive uniform storage load and traffic. Distributed algorithms proposed to construct the covering space with Ricci flow and Mobius transforms

III. Model Of A Network

Source Node(s): The node which initiates the query process for a key k.

Destination Node (d): The node responsible for key k.

In Geographic routing protocol such as GPSR**[**10**]** a packet may encounter a dead end (i.e. target separated by a wall or obstruction).The packet is then diverted until a path to the target is available .They do not take path length into account when routing around local obstructions such that the packet moves from source to destination.

Probability density functions:

- The source density s(x, y), denoting the probability density of having the source node s of a random query located at (x, y).

- The destination density d(x, y), denoting the probability density of having the destination node d of a random query located at (x, y).

- The traffic density t(x, y), denoting the probability density that a random query traverses location (x, y) on its route from node s to node d.

Source density s depends on parameters such as node locations and data query patterns and the destination density d depends on factors such as the number of keys managed by a node located at (x, y), and/or their popularity.

IV. Design Of Hash Function

4.1 Hash function

It is any algorithm or subroutine that maps large data sets of variable length to smaller data sets of a fixed length. Hash function example as shown in figure**[**2**]**.

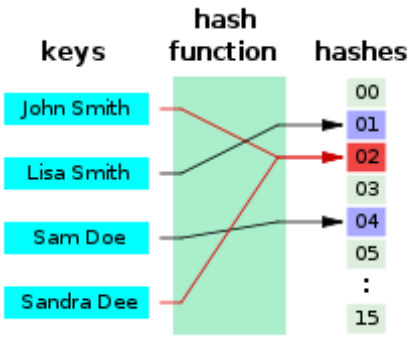

Fig. 2 : Hash Function

In particular, we want to specify that the hash function can be computed in a fully distributed and localized way, thus according to typical wireless sensor network design guidelines.

4.2 Hash tables

Hash functions are primarily used in hash tables, to quickly locate a data record (e.g., a dictionary definition) given its search key (the headword).

V. Modules

5.1 Analytical Approach

First, we have to decide how many number of server going to be used and nodes being connected to it. Here we are considering nodes n1,n2,n3,n4 etc. and servers s1,s2 etc. are constructed.

In this Analytical approach, a new node would be added to the server in two conditions.

1. When the number of data exceed the permissible limit in each node.
2. When we want to create a new node.

We have used simulation coding so that the data moves from highly loaded node to newly created node. Hence load over a particular node could be reduced and it could be balanced easily.

Implementation

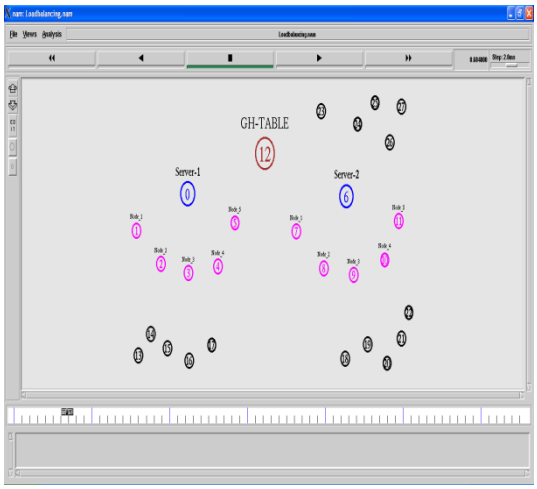

Fig. 3 : Server and Nodes Network

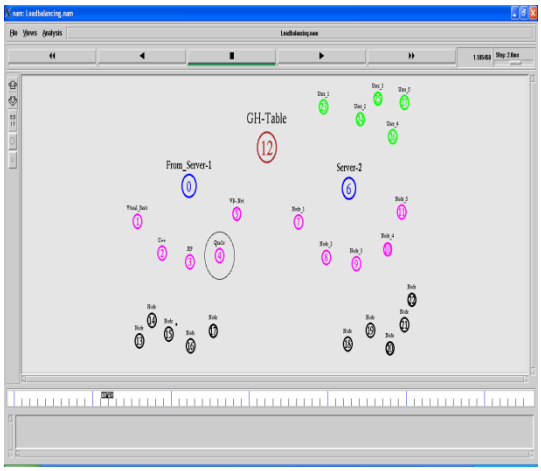

Fig. 4 : Data assigning to nodes.

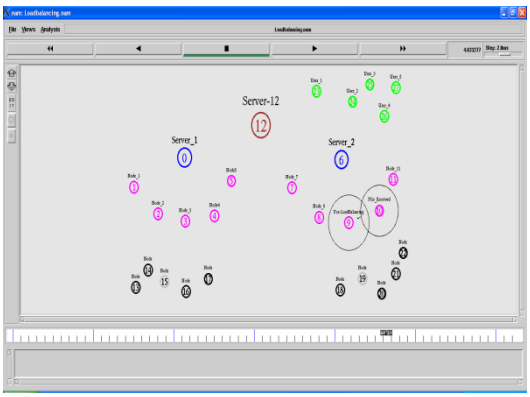

Fig. 5 : File transfer from one node to another node for load balancing

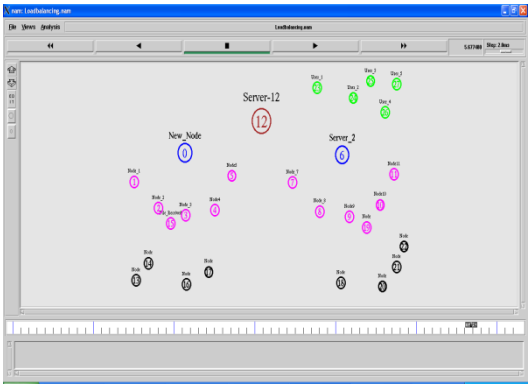

Fig. 6 : Assigning data to newly created node.

5.2 *Heuristic Approach*

Heuristic approach attempts to prevent multiple request being sent to a single node. It does this by moving data from highly loaded node to some other nodes having lesser load. The analytical approach is based on uniformity assumptions for what concerns node and source density. When these assumptions are not met, we propose to use a different load balancing approach, based on (an iterative) heuristic that repeatedly changes key ranges assigned to nodes as long as a load balancing metric is improved. When there is a request for data from the source, the data would be parsed through the geographic hash table(GHT) which will map the requested data through its associated key value. These key values are actually stored in the geographic hash table(GHT). Hence mapping would be made to the node, which requested data could be retrieved.

Implementation

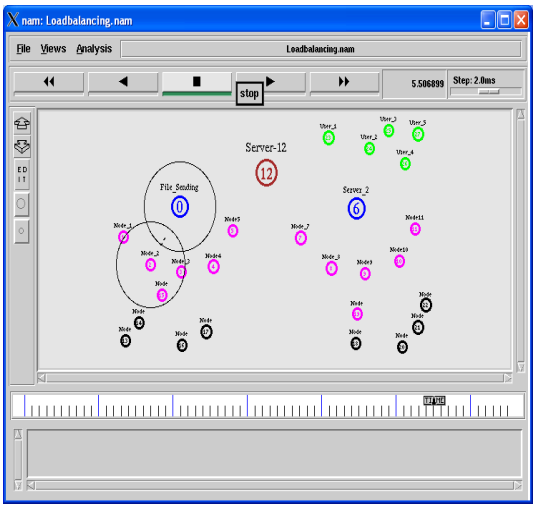

Fig. 7 : Multiple request sending to one node.

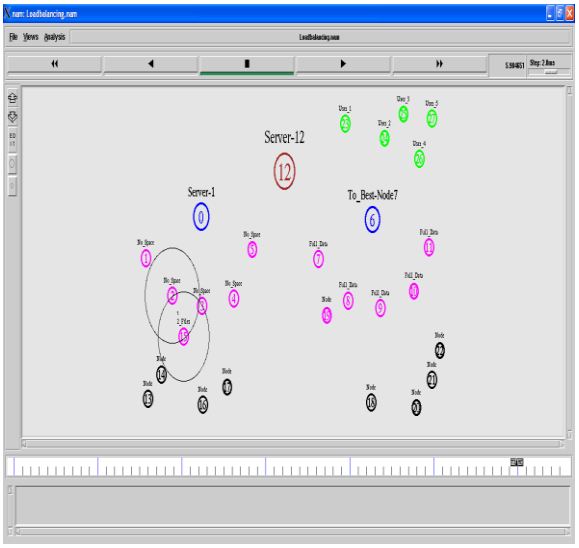

Fig. 8 : File transfer to newly created node.

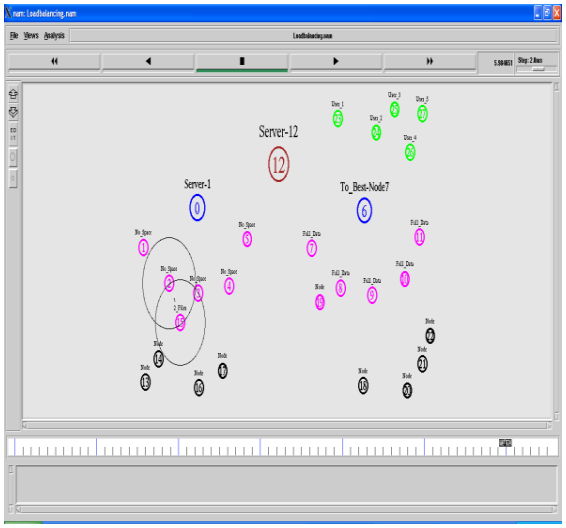

Fig. 9 : File received from highly loaded node.

VI. CONCLUSION

The proposed analytical and a heuristic approach, has been shown to provide very good load balancing in ideal conditions, and to provide load balancing improvements comparable or even superior to those provided by existing schemes in practical scenarios, even when uniformity assumptions are not valid. The major advantage of the presented load balancing methodology over existing ones lies in its practicality and versatility. Imbalance in network traffic load instead has a negative effect on network lifetime, since energy-consuming transmit/receive operations are not evenly spread among network nodes. This explains why researchers have recently proposed techniques to improve storage and load balancing in GHT. In this paper, we are concerned with the load balancing problem in GHT, and we do not consider storage balancing. We left this storage balancing for future work.

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