Load Balancing for Wireless network by using Min-Max algorithm

Rishikesh Balkrishna Pansare
Department of Computer Engineering
SND COE & RC, Babhulgoan.
Dist-Nashik India
Rishi4646@gmail.com

Prof. Imran R. shaikh
Department of Computer Engineering
SND COE & RC, Babhulgoan.
Dist-Nashik India
Imran.shaikh22@gmail.com

Abstract**—**Network overload is one of the key challenges in wireless LANs. This goal is typically achieved when the load of access points is balanced. Recent studies on operational WLANs, shown that access point's load is often uneven distribution i.e.it will be a crucial task to handle the load of overloaded server. To identify such overloaded server many kind of techniques like load balancing have been proposed already. These methods are commonly required proprietary software or hardware at the user side for controlling the user-access point association. In this proposed system we are presenting a new load balancing method by controlling the size of WLAN cells, which is conceptually similar to cell breathing in cellular networks. This method does not require any modification to the users neither the IEEE 802.11 standard. It only requires the ability of dynamically changing the transmission power of the AP beacon messages. We have develop a set of polynomial time algorithms which find the optimal beacon power settings which minimizes the load of the congested access point. We have also considered the problem of network-wide min-max load balancing. Simulation results show that the performance of the proposed method is comparable with or superior to the best existing association-based method.

Keywords- *Load balance in wireless LAN, Power reduction, access point , Wireless LAN, RMI,RPC.*

*****

I. Introduction *(Heading 1)*

A wireless LAN connects two or more devices using some wireless distribution method and usually provides a connection through an access point to the wider Internet. This gives users the mobility to move around within a local coverage area and so that user will remained connected to the network. Most modern WLANs are based on IEEE 802.11 standards, marketed under the Wi-Fi brand name.

Wireless LANs have become popular in the home due to ease of installation, and in commercial complexes offering wireless access to their customers; Large wireless network projects are being put up in many major cities.

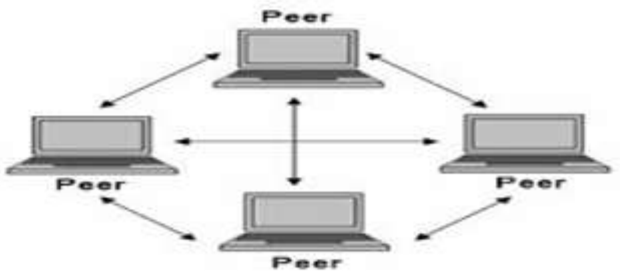

Figure 1.1: Peer to peer connection

1.1 Types of LAN (WLAN):

A) Peer-to-peer:

An ad-hoc system which is also known as Wi-Fi Direct network is a system where stations communicate only peer to peer. There is no base and no one gives permission to talk. This is accomplished using the self-governing Basic Service Set (IBSS). A peer-to-peer (P2P) network allows. Wireless devices to directly communicate with each other.

Wireless devices within range of each other can discover and communicate directly without relating central access points. This method is typically used by two computers so that they can connect to each other to form a network. If a signal strength meter is used in this situation, it may not examine the strength accurately and can be confusing, because it registers the strength of the strongest signal, which may be the closest computer.

B) Bridge Network:

A bridge can be used to connect networks, typically of different types. A wireless Ethernet connection allows the connection of devices on a wired Ethernet network to a wireless network. The connection acts as the connection point to the Wireless LAN.

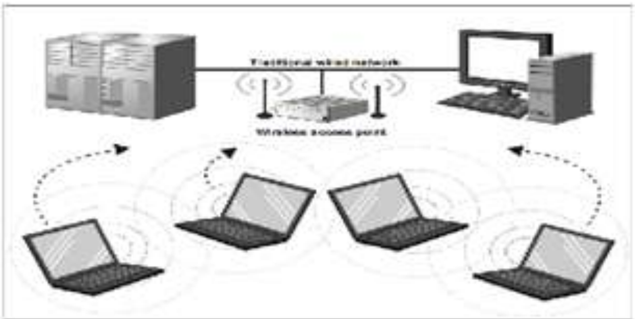

Figure 1.2 Bridge network

C) A Wireless allocation System:

A Wireless allocation System enables the wireless interconnection of access points in an IEEE 802.11 network. It allows a wireless network to be extended using multiple access points without the need for a wired backbone to link them, as is conventionally required. The famous advantage of WDS over other solutions is that it preserves the MAC addresses of client packets across links between access points.

Wireless technologies opened the way to seamless and ubiquitous service delivery. In recent years, network bandwidth and quality has been extremely improved in a speed even much faster than the enhancement of computer performance. Numerous communication and computing tasks in the fields can be integrated and applied in a distributed system in now a days. However, those resources are heterogeneous and dynamic in distributed systems connecting a broad range of resources. This method has proposed a hybrid load balancing policy to maintain performance and stability of Distributed system. Load balancing is found to reduce significantly the mean and standard deviation of job response times, especially under heavy and/or unbalanced workload.

Network overload is one of the main challenges in wireless LANs (WLANs). This goal is classically achieved when the load of access points (APs) is balanced. Modern studies on operational WLAN have shown that AP load is often uneven allocation. To rectify such overload, more than a few load balancing schemes have been proposed.

Figure 1.3: Wireless Network

These methods are commonly required proprietary software or hardware at the end side for calculating the user-AP association. In this study we present a new load balancing method by controlling the size of WLAN cells (i.e., AP's coverage range), which is abstractly similar to cell breathing in cellular networks. This method does not require any modification to the users neither the wireless standard. It only requires the ability of dynamically changing the transmission power of the AP beacon messages. We have formeda set of polynomial time algorithms that locate the optimal beacon power settings which minimize the load of the most congested AP. We also judge the problem of network-wide min-max load balancing.

Figure 1.4: Devices connected with access point

This study proposed a hybrid load balancing policy to maintain performance and stability of distributed system. Load balancing is found to reduce significantly the mean and standard deviation of job response times, especially under heavy and/or unbalanced workload. Network overload is one of the key challenges in wireless LANs (WLANs).

This goal is classically achieved when the load of access points (APs) is balanced. Recent studies on operational WLAN have shown that AP load is often uneven allocation. To rectify such overload, more than a few load balancing schemes have been proposed. These methods are commonly required proprietary software or hardware at the end side for calculating the user-AP association. In this study we present a new load balancing method by controlling the size of WLAN cells (i.e., AP's coverage range), which is conceptually similar to cell breathing in cellular networks.

Load balancing is a computer networking method to distribute workload across multiple computers or a computer cluster, network links, central processing units, disk drives, or other resources, to achieve optimal resource utilization, maximize throughput, minimize response time, and avoid overload. Using multiple components with load balancing, instead of a single component, may increase consistency through redundancy.

This method does not require any modification to the users neither the wireless standard. It only requires the ability of dynamically changing the transmission power of the AP beacon messages. We build up a set of polynomial time algorithms that locate the optimal beacon power settings which minimize the load of the most congested AP. We also consider the problem of network-wide min-max load balancing.

II. RELATED WORK

Load balancing is a computer networking method to distribute workload across multiple computers or a computer cluster, network links, central processing units, disk drives, or other resources, to achieve optimal resource utilization, maximize throughput, minimize response time, and avoid overload. Using multiple components with load balancing, instead of a single component, may increase reliability through redundancy.

Recent studies [2], [3] on operational IEEE 802.11 wireless LANs (WLANs) have shown that traffic load is often unevenly distributed among the access points (APs). In WLANs, by default, a user scans all existing channels and associates itself with an AP that has the strongest received signal strength indicator (RSSI), while being oblivious to the load of APs. As users are, typically, not evenly distributed, some APs tend to suffer from heavy load, while their adjacent APs may carry only light load. Such load imbalance among APs is undesirable as it hampers the network from fully utilizing its capacity and providing fair services to users.

Cell breathing is a mechanism which allows overloaded cells to offload subscriber traffic to neighboring cells by changing the geographic size of their service area. Heavily loaded cells decrease in size while neighboring cells increase their service area to compensate. Thus, some traffic is handed off from the overloaded cell to neighboring cells, resulting in load balancing.

Cell breathing is the constant change of the range of the geographical area covered by a cellular telephone transmitter based on the amount of traffic currently using that transmitter. When a cell becomes heavily loaded, it shrinks. Subscriber traffic is then redirected to a neighboring cell that is more lightly loaded, which is called load balancing.

The load in a WLAN is rarely evenly divided among all access points. Most mobile nodes may be associated with one access point while neighboring access points could be lightly loaded or idle. Terminals associated with the overloaded AP will experience high rates of collision and large delays when contending for medium access. By redistributing some of the mobile nodes to neighboring AP's, the load on the network becomes more evenly distributed, allowing an increase in overall network throughput and a decrease in MAC delay. Load balancing can be a useful means of improving the network performance during congestion periods.

In this proposed system, optimal load allocation strategies are proposed for a wireless sensor network which is connected in a star topology. The load considered here is of arbitrarily divisible kind, such that each fraction of the job can be distributed and assigned to any processor for computation purpose. Divisible Load Theory emphasizes on how to partition the load among a number of processors and links, such that the load is distributed optimally. Its objective is to partition the load in such a way so that the load can be distributed and processed in the shortest possible time.

The load contribution may be as simple as the number of users associated with an AP or can be more sophisticated to consider factors like transmission bit rates and traffic demands. Consequently, various load balancing and max-min fairness objectives can be achieved, such as bandwidth fairness, time fairness, and weighted fairness.

Our scheme does neither require any special assistance from users nor any change in the 802.11 standard. It only requires the ability of dynamically changing the transmission power of the AP beacons. Today, commercial AP products already support multiple transmission power levels, so we believe that this requirement can be relatively easily achieved. Depending on the extent of available information, we consider two knowledge models. The first model assumes complete knowledge, in which user-AP association and AP load are known a priori for all possible beacon power settings. Since such information may not be readily available, we also consider the limited knowledge model, in which only information on the user-AP association and AP load for the current beacon power setting is available.

Proposed system uses following algorithm:

1. Limited Knowledge Algorithm.
2. Min-Max Algorithm

Limited Knowledge Algorithm

In limited knowledge algorithm, unlike the complete knowledge case, in this model, the algorithm cannot calculate bottleneck set in advance. According to it, as long as a network state is suboptimal and it dominates an optimal solution, a sequence of set power reduction operations of congested APs converges to the optimal state. Thus after each iteration, the algorithm updates the APs beacon power settings and evaluates the AP loads. This process raises the problem of determining a "termination condition" when an optimal solution is found. Without the termination condition, we may end up with a suboptimal solution. To this end, we use an optimal state recording approach that keeps record of the network state with the lowest congestion load found so far. We define two variables for recording. The first is S that keeps the recorded state and the second is Y that keeps the congestion load value of state S, termed the recorded congestion load.

The algorithm works as follows. It starts with the maximal power state and it initializes the recorded state S and the recorded congestion load Y accordingly. Then, the algorithm, iteratively, calculates the set D of congested APs and as long as the set D does not contain any AP with minimal power level, it performs a set D power reduction operation. After each iteration the algorithm evaluates the congestion load of the new state and if that load is lower than the recorded congestion load, then the algorithm updates its variables S and Y correspondingly. At the end, the algorithm sets the AP power levels according to the recorded network state.

Min-Max Algorithm

The algorithm iteratively finds a min max priority-load-balanced state that yields the optimal load vector Y. At any iteration m, m ε [1…|A|], we call a routine to calculate a network state that minimizes the priority load of the m^{th} coordinate of the load vector. The routine needs to satisfy two requirements:

Requirement 1. The initial state of each iteration, m, must dominate the optimal state.

Requirement 2. The calculated network state at the m^{th} iteration should not affect (increase) the load of the APs that their load have already been determined by the previous iterations.

To meet Requirement 1, the algorithm starts with the maximal power state in the first iteration and we need to ensure that each iteration ends with dominating state of the optimal solution. Moreover, to meet Requirement 2, we define a set of fixed APs, F, whose load have already been determined by previous iterations. Initially, the set F is empty and at each iteration, a new AP is added to it, until F contains all the APs. We refine the definition of the congestion load Y as the maximal load on any no fixed AP.

III. IMPLEMENTATION AND PERFORMANCE MEASURE

Dynamic Power Assignment

We inspect how to control power to optimize throughput based on given client demands. When clients' demands are usually changing, it is often desirable to find an assignment without requiring many clients to handoff to different APs, since the overhead of hand-off is non-negligible.

Cell breathing in CDMA

Cell breathing is a term used to reflect the fact that the coverage area of a base station in a CDMA system will become smaller if there are more subscribers**.**

If, for example, a total power of 20 watts is available, the network can provide for 10 watts to both of two subscribers, or, 2 watts to all of 10 subscribers. The utmost output power existing for an individual subscriber depends on the number of active subscribers in every radio cell. The further subscribers logged on to the cell, the lesser the power offered for an individual subscriber and hence the lower its range.

IV. RESULTS

As a security measure we have provided the authentication method in which admin will enter the username and password.

If that username and password both the fields are correct then only authentication will be successful. Else authentication will not be successful. Once this process successfully completes all other menus will be activated till then all those menus will be kept hidden.

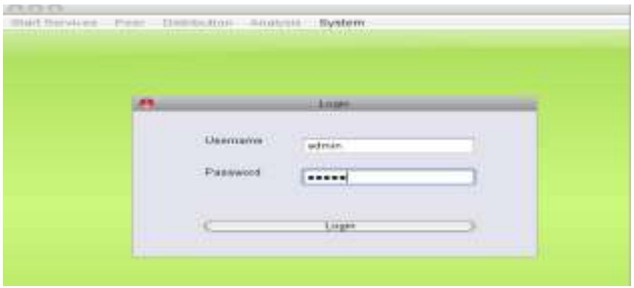

Fig. 1.5 : GUI for Admin Username and Password

In this authentication process we have provided the text fields to enter the user name and password of authenticate user i.e. Admin only. Hence in this way we have implemented the security concerns with our project.

Fig. 1.6 : GUI for Peer Addition

As our project is based on the client server system therefore need arises to add client (s) with our server. In above figure 1.7 we have added a peer i.e. client by adding its IP address.

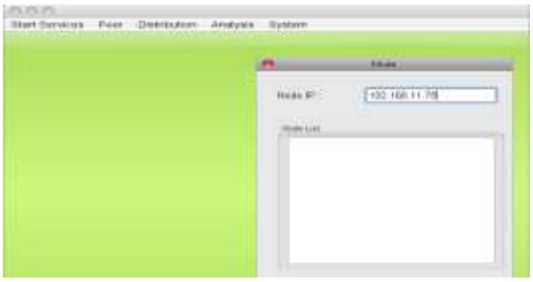

Fig. 1.7 : GUI of node (peer) addition

We can add a client which is in LAN by providing it's IP address and then after clicking on the Add button we will add that system into the list of clients associated with our server.

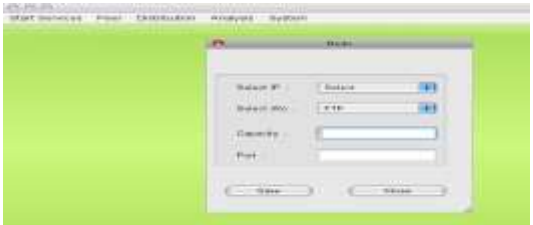

Fig. 1.8: GUI for Setting Request Handling (Load) Capacity

In above figure after selecting IP address and protocol such as FTP we can initialize that system with capacity. Capacity is nothing but the request handling capacity of that system. Therefore that system / server will handle at most these many requests arising towards it but afterwards if server becomes overloaded then all those requests will handle by secondary server which is under loaded.

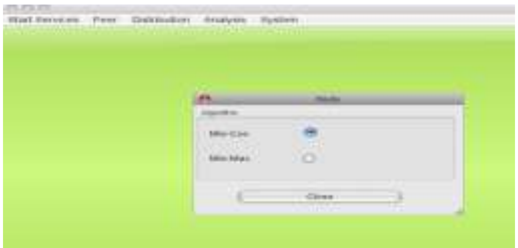

Fig. 1.9 : GUI for Selection of Algorithm

Load balancing which is nothing but handling of overloaded requests by backup server / secondary server. Actually all those requests will be handled by secondary server once primary server becomes overloaded.

We have introduced two algorithms Min-Con and Min-Max. The first algorithm Min-Con which reduces congestion to a optimum level of congested AP's (access points). So over loaded server will transfer that entire load to the backup server i.e. secondary server.

Second algorithm produces an optimum min-max load balanced solution. This happens because of after some time server which is overloaded will transfer that load optimally on available access points.

Suppose if client who is associated with AP1 then the time and bandwidth is high as compared to AP2 and AP3. So whenever new request arises from client 1 it gives to AP1 because of high bandwidth and same for AP2 and AP3 for client 2 and client 3. But if AP1 is overloaded then request will diverted towards the AP2 or AP3 …. APn.

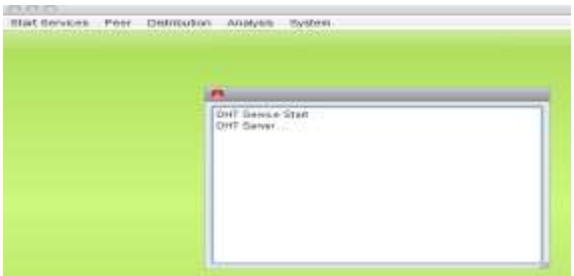

Fig. 2.0 : GUI for DHT Server Start

A distributed hash table (DHT) is a class of a decentralized distributed system that provides a lookup service similar to a

ISSN: 2321-8169
5530 - 5535

hash table; (key, value) pairs are stored in a DHT, and any participating node can efficiently retrieve the value associated with a given key. Responsibility for maintaining the mapping from keys to values is distributed among the nodes, in such a way that a change in the set of participants causes a minimal amount of disruption. This allows a DHT to scale to extremely large numbers of nodes and to handle continual node arrivals, departures, and failures.

Fig. 2.1: GUI for FTP Server Start

A FTP server is used to transfer the files. FTP, also known as File Transfer Protocol, is a protocol for the rapid, simple transmission of files across a network supporting the TCP/IP protocol. This network is generally the Internet, or a local network. FTP is a way of accessing files on another computer. FTP uses the Client-Server architecture, meaning that there is a server that holds the files, and does the authentication, and a client, or the end-user, who is accessing the files. The server listens on the network for connection requests from other computers. When we click on the button of start this window is hided and new window appears, that window is used to stop the ftp server

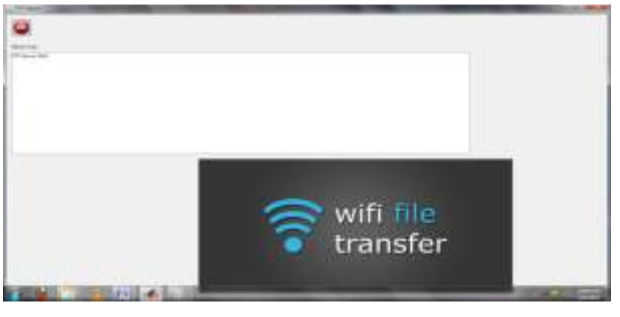

Fig. 2.2: GUI of FTP Server Stop

This window appears when the FTP server is started and for ending the FTP server we have to click on red button.

Fig. 2.3: GUI for FTP Client Start

The client can make a connection to the FTP server by using FTP client software. Once connected and authenticated (via rsh or SFTP) the client can do things such as uploading files, to the server, downloading files (taking the server's files and putting them on his own computer) from the server, and renaming, deleting files on the server, changing file permissions, etc. When we start the client demands the IP address of main server so we have o enter the correct IP address of server.

Fig. 2.4 : GUI for File Download

Figure shows the file download window. When we have to give load to the server we have to click on the download file button on each IP at the same time.

Result Analysis

In results its shows the comparative results between traditional load balancing and the min-max algorithm shows the balanced the server with client.

Fig. 2.5 Pie Chart for Min-Congestion Algorithm

Fig. 2.6 : Pie Chart for Min-Max Algorithm

ISSN: 2321-8169
5530 - 5535

Fig. 2.7 : Bar Chart for Min-Congestion Algorithm

Fig. 2.8 bar Chart for Min-Max Algorithm

V. CONCLUSION

I have developed power control algorithms that maximize system throughput. I have studied how to simultaneously maximize system throughput and minimize APs power. Power minimization is helpful to reduce interference among different APs. I have provided a rigorous formulation of the association control problem that considers bandwidth constraints of both the wireless links. The algorithms minimizes the load of the congested access points because it is not having any previous history so, it diverts all load towards the access points which are having list loads and produces an optimal Min-Max (priority) load balanced solution. The load is now balanced because after some time server having history of scattered load on available access points like whenever access points are get congested and new requests arises from clients then my cell breathing server calculate the load on available bandwidth and power basis and transfers that load to list congested access points.

ACKNOWLEDGMENT

I thank to my project guide and PG Coordinator **Prof. Imran R. Shaikh**, And Our Head of Computer Department **Prof. S.R. Durugkar** and our faculty member of Computer Engineering, **S.N.D.College of Engineering, Babhulgoan**. Without their importance this development could not be Completed.

REFERENCES

[1] Manish M. and Cheema R.K.,"A Min-Max approach to perform load balancing in distributed network", 978-1-4673-0471-9 IEEE,2012.

[2] Y. Bejerano and S.-J. Han, "Cell Breathing Techniques for Load Balancing in Wireless LANs," Proc. IEEE INFOCOM, 2006.

[3] M. Balazinska and P. Castro, "Characterizing Mobility and Network Usage in a Corporate Wireless Local-Area Network,"Proc. USENIX Int'l Conf. Mobile Systems, Applications, and Services (MobiSys '03), 2003.

[4] T. Henderson, D. Kotz, and I. Abyzov, "The Changing Usage of a Mature Campus-Wide Wireless Network," Proc. ACM MobiCom, pp. 187-201, 2004.

[5] T. Togo, I. Yoshii, and R. Kohno, "Dynamic Cell-Size Control According to Geographical Mobile Distribution in a DS/CDMA Cellular System," Proc. IEEE Personal, Indoor, and Mobile Radio Comm. Symp. (PIMRC '98), pp. 677-681, 1998.

[6] A. Jalali, "On Cell Breathing in CDMA Networks," Proc. IEEE Int'l Conf. Comm. (ICC '98), pp. 985-988, 1998.

[7] I. Papanikos and M. Logothetis, "A Study on Dynamic Load Balance for IEEE 802.11b Wireless LAN," Proc. Int'l Conf. Comm.Control (COMCON '01), 2001.

[8] I. Tinnirello and G. Bianchi, "A Simulation Study of Load Balancing Algorithms in Cellular Packet Networks,"

[9] Proc. ACM/ IEEE Int'l Workshop Modeling, Analysis and Simulation of Wireless and Mobile Systems (MSWiM '01), pp. 73-78, 2001.

[10] A. Balachandran, P. Bahl, and G.M. Voelker, "Hot-Spot Congestion Relief and Service Guarantees in Public-Area Wireless Networks," SIGCOMM Computing Comm. Rev., vol. 32, no. 1, pp. 59-59, 2002.

[11] H. Velayos, V. Aleo, and G. Karlsson, "Load Balancing in Overlapping Wireless LAN Cells," Proc. IEEE Int'l Conf. Comm. (ICC '98), 1998.