Load Balancing on Multi Channels Through Gateways

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Abstract

We propose an adaptive online load-balancing protocol for Multi-Gateway Wireless Mesh Networks (WMNs) which, based on the current network conditions, balances load between gateways. Our protocol (GWLB) achieves two goals: (i) alleviating congestion in affected domains and (ii) balancing load to improve flow fairness across domains. As a result of applying GWLB the throughput and fairness of flows improves. So, the proposed scheme effectively takes into account the elastic nature of TCP traffic, and intra-flow and inter-flow interference when switching flows between domains. .The existing scheme contains maximizing network throughput while providing fairness is one of the key challenges in wireless LANs (WLANs). This is typically achieved when the load of access points (APs) is balanced and imbalance of load, several load balancing schemes have been proposed. These schemes commonly require proprietary software or hardware at the user side for controlling the user-AP association by controlling the size of WLAN cells. The existing scheme does not support to the users neither the IEEE 802.11 standards. It only requires the ability of dynamically changing the transmission power of the AP beacon messages. But we failed to set polynomial time algorithms which minimize the load of the most congested AP. We also consider the problem of network-wide min-max load balancing. Unable to show Simulation results the performance of the proposed method is comparable with or superior to the best existing association-based method.

Keywords

GWLB, WLAN, TCP, WMNS, ISP, MIPMANET, RREQ

I. Introduction

In this Agents running in each access point broadcast periodically the local load level via the Ethernet backbone and determine whether the access point is overloaded, balanced or under-loaded by comparing it with received reports. The load metric is the access point throughput. Overloaded access points force the handoff of some stations to balance the load. Only under-loaded access points accept roaming stations to minimize the number of handoffs. Here they designed a two-step process to transfer station. Firstly, the overloaded AP disassociates the station and then only under-loaded APs accept it. There experimental evaluation that our balancing scheme increases the total network throughput and decreases the cell delay [1].

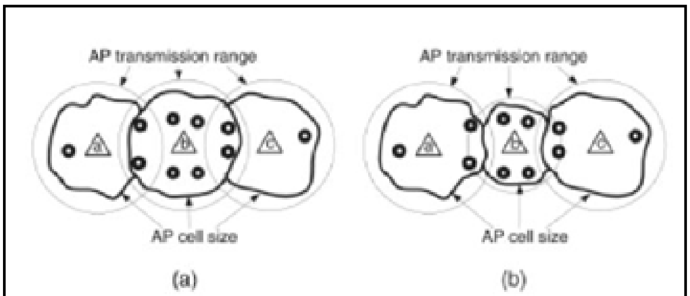

Fig. 1(a)-(b): Transmission of Cell

This paper is to provide an assessment of the advantages that cell breathing may give in optimal management of CDMA network capacity. The capabilities of cell breathing and is primarily intended to determine whether there are any deployment and/or traffic scenarios where the breathing algorithm can be used to improve capacity in high traffic cells by redirecting mobiles to surrounding cells. Analysis of the problem and presented two algorithms that find network-wide deterministic optimal solutions. The first algorithm minimizes the load of most congested AP(s) in the network, and the second algorithm produces an optimal min-max (priority) load balanced solution. These optimal solutions are obtained only with the minimal information which is readily available without any special assistance from the users or modification of the standard. The control on the transmission power of the AP beacon messages, which should be possible with simple software update of APs. Here even a small number of power levels. Our cell breathing scheme can be deployed in network management tool of WLANs and activated each time the APs experience unbalanced load.[2] This paper investigates a new Load balancing scheme for mobile networks that changes cellular coverage according to the geographic traffic distribution in real time.

A novel bubble oscillation algorithm is proposed to address a multidimensional optimization problem. Any un-served traffic in the network is absorbed by the geographic load balancing in a similar way that a vacuum between bubbles is filled by bubble oscillation. The bubble oscillation algorithm described has the potential of being used in other similar multidimensional resource allocating problems. Keywords System design. The geographic load balancing is performed by emulating the bubble oscillations, as the process of base stations re-allocating un-served traffic units is very similar to that of bubbles' filling the vacuums between them. [3]

In this CDMA cellular networks equipped with conventional matched filter receivers. For this types of cellular networks, both of the cell-breathing effect and near-far unfair access problem exist. Cell-breathing effect is an effect that the cell coverage will shrink when supporting more users. The near-far unfair access problem means that the near users will have a lower blocking probability than far users. To solve these two problems, a bandwidth-space partitioning technique is adopted. Several admission control / sub band assignment schemes, based on the bandwidth-space partitioning technique, schemes such as

- Scheme 1 CSW - Complete Sharing without Bandwidth Partitioning
- Scheme 2 CSP(N) - Complete Sharing with N sub bands Partitioning
- Scheme 3 GP(N) - Grouping Policy with N sub bands Partitioning
- Scheme 4 CRS(N) - Circular Sharing with N sub- bands Partitioning
- Scheme 5 BTS(N) -Balanced Threshold Sharing with N sub bands Partitioning [4]

A mobile user has the option of connecting to one of several IEEE 802.11 Access Points (APs),each using an independent channel. User throughput in each AP is determined by the number of other users as well as the frame size and physical rate being used. where users could multi home, We convert the problem into a fluid model and show that under a pricing scheme, which we call the cost price mechanism, the total system throughput is maximized, If the Internet Service Provider (ISP) could charge prices greater than that of the cost price mechanism. We show that even in this case multi roaming out performs unit roaming, both in terms of throughput as well as profit to the ISP [5].

In this paper, the problem of association of wireless stations (STAs) with an access network served by a wireless local area network (WLAN) and a 3G cellular network. There is a set of WLAN Access Points (APs) and a set of 3G Base Stations (BSs) and a number of STAs each of which needs to be associated with one of the APs or one of the BSs. Each association provides each STA with a certain transfer rate. We evaluate an association on the basis of the sum log utility of the transfer rates and seek the utility maximizing association. We also obtain the optimal time scheduling of service from a 3G BS to the Associated STAs. They propose a fast iterative heuristic algorithm. A Numerical results show that Algorithm converges in a few steps yielding an association that is Within 1% (in objective value) of the optimal (obtained through Exhaustive search); in most cases the algorithm yields an optimal solution [6].

II. Model

With minimum hop gateway selection policy like MIPMANET, imbalance of generated traffic may cause traffic load imbalance at gateway nodes. A gateway node has a tendency of traffic concentration because all external traffic goes through it, so traffic load imbalance may bring serious performance degradation. In this section, we propose a new cost function which takes account of traffic load and wireless channel contention and a new gateway selection method.

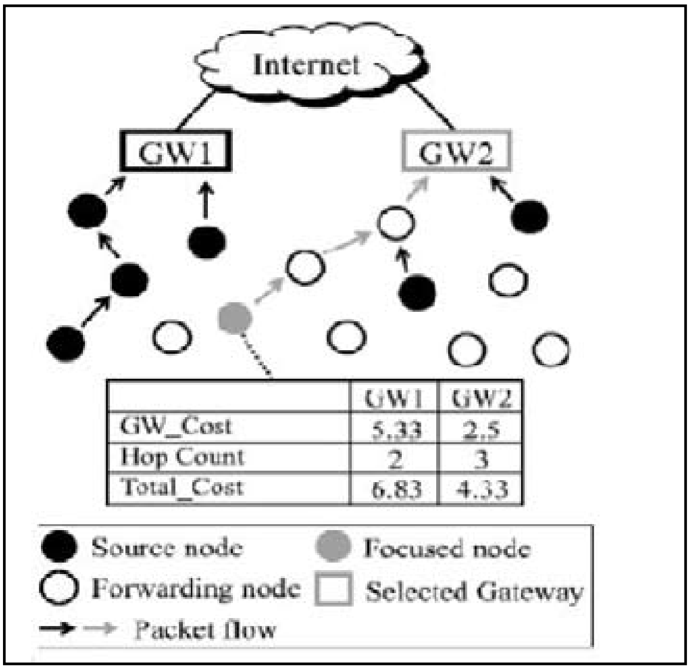

Fig. 2: Load Balancing Gateway

1. Cost Function

Minimum-hop gateway selection policy may cause traffic condition or heterogeneous geographic node distribution, load balancing mechanism will improve Load" affecting throughput throughput performance. "Performance has many aspects in wireless multi-hop networks. Traffic intention (traffic load) is simply affects throughput performance a lot. However, the same traffic intention has different impact on throughput performance. We would like to explain this phenomenon with the following example. When a host transmits a packet through n-1 nodes to its default gateway (n hops to default gateway), this packet transmission affects more than the case of single hop transmission even though their traffic intention are the same. Single hop transmission only affects once to wireless channel around a gateway. hop transmission affects more times to wireless channel around a gateway. For example, the second last hop transmission causes pause of other transmission around the gateway because of soft carrier sense.

The third last hop and further hop transmission may have affection to wireless channel around the gateway. This affection to wireless channel around the gateway gets the smaller with the further hop transmission from the gateway first, we define cost function of gateway node i affected by host k, ki, as where hkiis the number of hops between host k and gateway nodei. When there exist ni wireless hosts connected to gateway node i, we define total cost of gateway node i, Ci, as Each gateway node can obtain the number of hops, hki, by receiving RREQ packet from active hosts. It calculates gateway total cost Ci and distributes this calculated cost to all hosts by broadcasting periodically an advertizing massage use h-1. In wireless multihopnetworks, nodes distributes 2-dimenshional field, so h-2 is also a candidate for cost function. We will evaluate the case of cost function using h-2 in our further research.

B. Gateway Selection Method

When each host receives advertising massage from multiple gateways, it calculates its own cost for these gateways. there are two gateways, GW1 and GW2, and these two gateways have 4 and 2 connected hosts, respectively. When a focused host(gray colored one) would like to send data to an external host, it should select an adequate gateway. here, total gateway cost of GW1 and GW2 is 5.33 (=1/3+2*(1/2)+3*(1/1)+1/1) and 2.5 (=1/2+1/1+1/1), respectively. Focused host's hop count to GW1 and GW2 is 2 and 3, respectively. So, when this host is connected to GW1, total cost of GW1 is 6.83 (=5.33+1/2+1/1).

When this host is connected to GW2, total cost of GW2 is 4.33 (=2.5+1/3+1/2+1/1). So, this focused host selects GW2 which gives smaller cost as its own default gateway. Each host selects gateway node which gives minimum total cost. This cost function takes account of not only traffic load but wireless channel contention around the gateway node. So, with this minimum cost gateway selection, throughput performance of communications through gateway node can be improved.

III. Performance Evaluvation

our proposed load-balancing gateway selection method is comparatively evaluated with the minimum-hop gateway selection.

A. Simulation Model

In order to evaluate basic performance of our proposed method, we use a static model where no mobility of hosts are considered. Semi automated node placement model where square field is divided into cells and one host is located randomly in each cell. When we use pure random model, there may be some heterogeneity of connectivity among wireless hosts. We would like to avoid evaluating our proposed method in this extremely heterogeneous situation, so semi-automated node placement which avoids extremely heterogeneous host location is used.

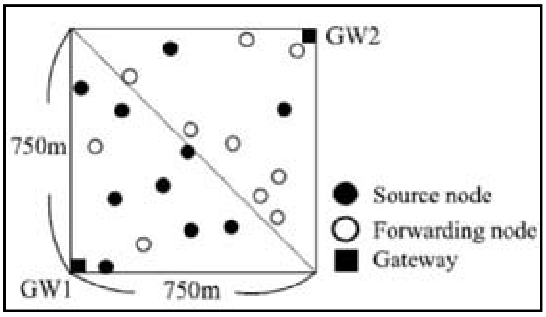

Fig. 3: Simulation Model

There are two gateway nodes and 20 wireless hosts in the simulation field. Randomly selected host starts its session. Each session has exponentially distributed life time of average 10 second. When a session ends its lifetime, another session is assumed to be generated from a randomly selected host. In order to evaluate gateway throughput performance, only external sessions which have external destination host are generated. Connected gateway is selected at session generated time and gateway is not switched during session lifetime. 8 sessions and 2 sessions are located randomly inside GW1 side and GW2 side. AODV is used for routing protocol and IEEE 802.11 DCF is used for MAC protocol.

B. Total Gateway Throughput

Horizontal axis shows threshold and vertical axis shows total throughput of GW1 and GW2 (summation of GW1 and GW2 throughput). The dotted line shows total throughput of the minimum-hop gateway selection. The, total throughput is improved with threshold smaller than 2. And, with increase of threshold, total throughput decreases. GW1 throughput decreases monotonically with increase of threshold.

C. Normalized Throughput of Each Host

Vertical axis shows throughput which is normalized with generated traffic volume. Horizontal axis shows node number. Nodes are numbered as the most left-side and right side node of horizontal axis is the closest host to GW1 and GW2, respectively. So, node 1 is the closest host to GW1 and node 20 is the closest host to GW2.

The number in parenthesis is hop count difference between GW1 and GW2. For example, for node 3, difference between hop counts to GW1 and GW2 is 4. For each host, normalized throughput of minimum-hop gateway selection and our proposed load-balancing gateway selection of threshold 1, 2 and 4 are depicted.

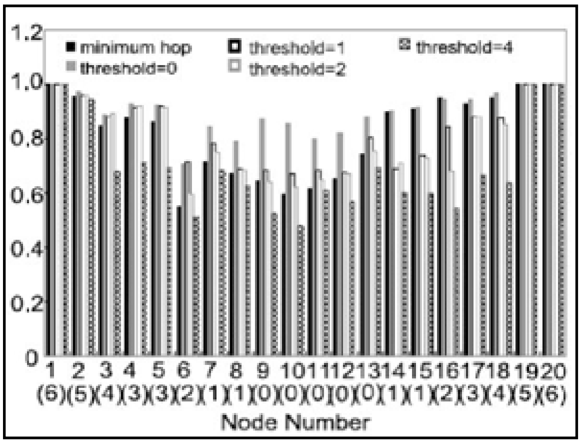

Fig. 4: Normalization Throughput

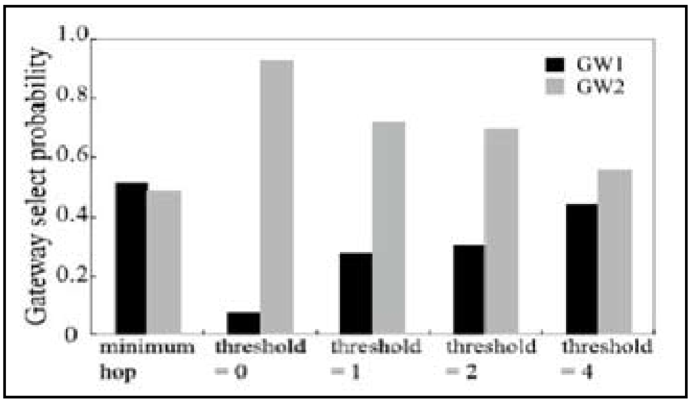

Fig. 5: Selection Probability

This load balancing situation with large threshold has another bad effect. In this situation, few difference between hop counts of GW1 and GW2, selects GW1 and GW2 almost equally. There is no performance penalty of selecting GW2. So, large portion of these hosts are preferably to select GW2. However, load balance situation obtained by hosts with performance penalty of selecting GW2 prevents preferable select of GW2 for these hosts without performance penalty. From these deep insights, we find that load-balancing gateway selection policy should be applied only to hosts whose hop count to GW1 andGW2 is not so large. So, small threshold, say 0 or 1.

IV. Conclusion

In this paper, we propose a new gateway selection method which takes account of traffic intensity channel contention around the gateway node. The further from the gateway a wireless channel usage is, impact on channel around the gateway decreases the more. A host only applies our load balancing gateway selection policy only to the gateways whose hop count is within threshold from the shortest gateway. We evaluate our proposed load-balancing gateway selection method with comparing with the minimum-hop gateway selection policy. Simulation results show that our proposed method obtains performance improvement with small threshold values.

References

[1] Y. Bejerano, S.-J.Han,“Cell Breathing Techniques for Load Balancing in Wireless LANs”, Proc. IEEE INFOCOM, 2006.
[2] A. Jalali,"On cell breathing in CDMA networks", In Proc. IEEE ICC'98, Vol. 2, pp. 985 - 988, Atlanta, Georgia, USA, June 1998.
[3] H. Velayos, V. Aleo, G. Karlsson,"Load balancing in overlapping wireless LAN cells", In Proc. IEEE ICC'04, Vol. 7, pp. 3833-3836, June 1998.
[4] L. Du, J. Bigham, L. Cuthbert,“A Bubble Oscillation Algorithm for Distributed Geographic Load Balancing in Mobile Networks”, Proc. IEEE INFOCOM, 2004.
[5] I. Tinnirello, G. Bianchi,“A Simulation Study of Load Balancing Algorithms in Cellular Packet Networks”, Proc. ACM/ IEEE Int’l Workshop Modeling, Analysis and Simulation of Wireless and Mobile Systems (MSWiM ’01), pp. 73-78, 2001.
[6] P. Bahl, M.T. Hajiaghayi, K. Jain, V.S. Mirrokni, L. Qiu, A. Saberi,“Cell Breathing in Wireless LANs: Algorithms and Evaluation”, IEEE Trans. Mobile Computing, Vol. 6, No. 2, pp. 164-178, Feb. 2007.

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[7] I. Papanikos, M. Logothetis,"A Study on Dynamic Load Balance for IEEE 802.11b Wireless LAN", Proc. Int'l Conf. Comm. Control (COMCON '01), 2001
[8] A. Jalali,"On Cell Breathing in CDMA Networks", Proc. IEEE Int'lConf. Comm. (ICC ' 98), pp. 985-988, 1998.

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