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Maximize the System Throughput in Wireless Mesh Network Using Enhanced Gateway Selection Method

KEYWORDS: WMN, Network topology, Routing, wireless communication, Throughput optimization.

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ABSTRACT *Studying the challenging problem of optimizing gateway placement for throughput in Wireless Mesh Networks. Wireless Mesh Networks can be easily deployed without wirelines. A wireless mesh network consists of wireless mesh routers and a base station directly connected to external networks. At the centre of the wireless mesh network the base station is located and it chooses a certain number of wireless mesh routers as gateways. Finding the candidate gateways that maximize the system throughput without solving a complex optimization problem which includes a large number of parameters and involves heavy computation load easily and quickly. The gateway performance is evaluated by numerical analysis, and also demonstrated through computer simulations. It can also be determined the appropriate candidate gateway with high accuracy when there is a certain variance in the amount of traffic generated by users at each wireless mesh router and also find the minimum number of gateways to maximize the throughput of WMN.*

I. INTRODUCTION

Wireless mesh networks is an emerging technology for last mile broadband Internet access in recent years. Nodes in wireless mesh network consist of wireless mesh routers and mesh clients. Each and every node acts not only as an end user but also as forwarding packets, router on behalf of other nodes whose destinations are not within its wireless transmission range directly.

The network is divided into three hierarchies. The top hierarchy is deploying a base station, the wireless mesh network located at the centre to take charge of the whole area, choosing a certain number of wireless mesh routers as gateways, and establishing a connection point-to-point with 25GHz band with each of them. WMN is comprised of a set of wireless mesh routers and clients. The middle hierarchy consists of wireless mesh routers with the network backbone which is directly connected to the base station as the gateway, in which widely used standard, 802.11a with (5 GHz)high frequency band, is used in the backbone of the network . The bottom consists of mesh clients that are deployed at the edge with 2.4 GHz to communicate with the mesh routers by using standard, 802.11b .

II. A GATEWAY SELECTION METHOD

A novel method is proposed to choose the gateway for deploying a WMN for disaster recovery, it is used to achieve the maximum system throughput. The base station can select a number of wireless mesh routers as gateways, and establish a connection with each of them.

Particularly, due to the base station supports one channel, Assume that mesh routers connect to each other by the single channel. Moreover, note that we consider only one gateway in a certain area. If there are multi-gateways, the problem can be solved by separating the nodes related to one gateway from nodes associated to other gateways, which is beyond the research scope of this paper. Here, we design a network topology to analyze the system throughput. We randomly deploy the wireless mesh router nodes within a certain area, and they contact with adjacent nodes when the distance between two of them is less than the transmission range. The Minimum Spanning Tree (MST) algorithm to delete the redundant paths and maintain the unique routing path for our network topology.

III. MULTIHOP TRAFFIC-FLOW WEIGHT GATEWAY PLACEMENT

Increasing throughput in backbone communication by adding new gateways is effectively reducing the average number of hops each packet needs to access gateways and by existing gateways it reduces the traffic load. The benefits can be diminishing due to inappropriate gateway placement, the new gateways will also result in more interference to existing gateways. Therefore the gateway placement algorithm is not only relieving traffic load in the network but also introduced minimal interference.

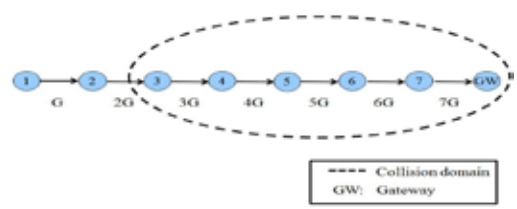

Figure 1 Gateway Placement

IV. WI-FI PROTECTED ACCESS (NOVEL GATEWAY SYSTEM)

The security issues of the original 802.11 standard addresses 802.1X. The issues still exist with regard to weaknesses in the WEP encryption and data integrity methods. The solution to these problems is the i standard, a new standard that specifies improvements to wireless LAN networking security. The wireless vendors agreed on an interoperable interim standard known as Wi-Fi Protected Access™ (novel gateway system™). The goals of novel gateway system were the following:

A. To require secure Wireless Mesh Networking A Novel gateway system requires secure Wireless Mesh Networking authentication, encryption, unicast and global encryption key management by requiring 802.1X.
B. To address the issues with WEP through a software upgrade.

The stream cipher within WEP is vulnerable to known the plaintext attacks. In addition, the data integrity provided with

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WEP is relatively weak. A novel gateway system with WEP solves most of the remaining security issues, yet only requires firmware updates in wireless equipment and an update for wireless clients.

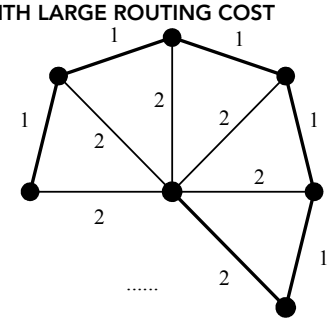
C. To be forward-compatible with the i standard
   A subset of the security features in the i standard is a novel gateway system.
D. To be available before 802.11i standard ratification

The wireless equipment and wireless clients are upgrade using novel gateway system.

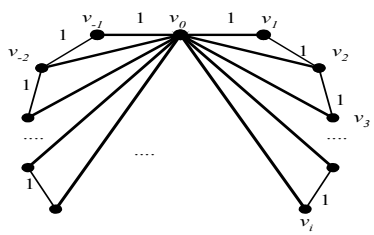
V. MINIMUM SPANNING TREE ALGORITHM

Let G=(V,E) be a connected graph where for all (u,v) in E and there is a cost vector C[u,v]. A graph is connected if every pair of vertices is connected by a path. A spanning tree for G is a free tree that connects all vertices in G. A connected acyclic graph is also called a free tree. The cost of the spanning tree is the sum of the cost of all edges in the tree. To find a spanning tree of minimum cost.

AN MST WITH LARGE ROUTING COST



TREE WITH LARGE WEIGHT USING SMALL ROUTING COST



VI. CONCLUSION

A major issue is addressed, which is quickly selecting a wireless mesh router as the gateway in the wireless mesh network, in order to provide the maximum system throughput. In the existing algorithms, we consider the realistic environment for disaster area, in which each mesh router has different traffic loads. Here a novel method that easily assigns a few nodes as candidate gateways that are on the routing path between the selected basic nodes. Calculating the system throughput for each candidate node and then select the node with maximizing the system throughput as the gateway, without the need for solving a complex optimization problem which includes a large number of parameters and involves heavy computation load. In addition, the performance of the proposed method is demonstrated through computer simulations and evaluated by numerical analysis. It can be effective and efficient in determining the appropriate candidate of the gateway with high accuracy when there is a certain variance in the amount of traffic generated by users at each wireless mesh router, reducing the computing complexity, and maximizing the system throughput of the wireless mesh network. A gateway placement algorithm based on multi-hop traffic weight was proposed and a non-asymptotic analytical model was also derived to determine the achieved throughput by a gateway placement algorithm and also MTWP algorithm is used for the cross-optimization did not consider between gateway placement and throughput of WMNs. Therefore, gateway method would be very useful for quickly deploying wireless mesh networks for disaster recovery.

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