Access-Based Proactive Hybrid Routing Protocol for Hybrid Wireless Mesh Network

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***Abstract*- Hybrid routing protocol is the most proper routing protocol for Wireless Mesh Networks. Hybrid routing protocol is composed of proactive routing protocol and reactive routing protocol. The proactive routing protocol is adaptive for static mesh routers, and the reactive routing protocol is suitable for mobile mesh clients. In this Paper the existing hybrid routing protocols are all neglect the access process. That is, if the nearest access mesh router knows the way to destination, it will be used to provide service for the mesh clients unconditionally, which will cause congestion of this access mesh router and load of the whole proactive route. This paper proposes an access-based hybrid routing protocol to improve the situation. During the process of access, the condition of the whole proactive path containing the access mesh router will be considered. The mesh router whose proactive path condition is better will reply the request from mesh clients. In this paper, we also discuss about WMN with several access modes.**

***Index Terms*- hybrid wireless mesh network; hybrid routing protocol; access-based.**

I. INTRODUCTION

Wireless mesh network (WMN) has the feature of self-configuring, self-healing, self-organization, low cost, robustness and ease maintenance. WMN has wide application prospect. WMN can be classified into infrastructure WMN, client WMN and hybrid WMN. Hybrid WMN which is shown in Figure 1 is the most generic type, including static mesh routers and mobile mesh clients. Infrastructure WMN is a multi-hop wireless network among mesh routers, and it has strong self-healing and self organization ability. Mesh routers have low mobility, strong computing ability and no energy constraint. As nodes in infrastructure WMN need to access Internet and other networks, some mesh routers have gateway function. Mesh clients here must access mesh routers by one hop to communicate with each other. The data flows in network are mostly to and from the gateway. Infrastructure WMN which is the backbone of hybrid WMN can be the higher layer of hybrid WMN.

Client WMN is similar to the pure ad hoc network. The mesh clients in client WMN have no gateway function. However, they have routing and data forwarding abilities. They do not have to access mesh routers to communicate, and can send data packets to each other directly by multiple hops. Thus, client WMN can help the whole network to build a point-to-point wireless network. And client WMN is the lower layer of hybrid WMN, which makes the whole network more flexible.

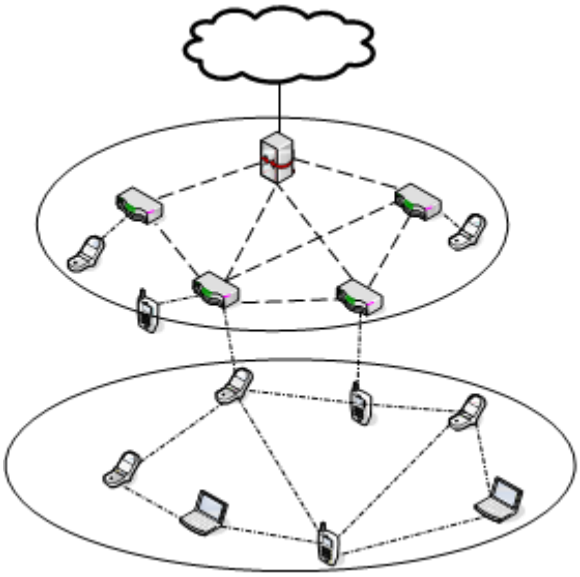

Figure 1. Hybrid wireless mesh network

Hybrid WMN combines infrastructure WMN and client WMN. Mesh routers are always with multiple radio interfaces and low mobility, while mobile mesh clients are usually equipped with only one radio interface. Unlike mesh clients in infrastructure WMN, mesh clients in hybrid WMN can communicate with each other directly. Routing

protocol design can influence network performance greatly. A proper routing protocol is important for the whole network. Routing protocols are classified into proactive, reactive and hybrid routing protocols. Proactive routing protocols are adaptive for static mesh routers, and reactive routing protocols are more proper for mobile mesh clients. Thus, hybrid routing protocols can perform better for hybrid WMN. Nowadays, routing protocols designed for hybrid WMN are quite few. Most of them are only reactive routing protocols. However, only making use of reactive routing protocols in hybrid WMN can bring extra cost during route discovery among mesh routers. Because mesh routers are static, and there is no need to discover new ways again once one mesh router needs to communicate with other mesh routers. Thus, proactive routing protocol should be used among mesh routers, and hybrid routing protocol is quite adaptive in hybrid WMN. However, current hybrid routing protocols designed for hybrid WMN are even fewer than reactive routing protocols. proactive tree-based routing and reactive routing strategy, and concentrates on gateway oriented traffic. HMesh and the routing protocol proposed by Trivi˜no et al combine OLSR and AODV. Proactive and Reactive routing protocols, and considers channel condition, interference and energy. Nevertheless, all these existing hybrid routing protocols overlook the access process. In the gateway oriented traffic, when a mesh client wants to communicate with gateway, the nearest mesh router will be accessed unconditionally. That will cause high congestion and load of the access mesh router and the whole proactive route. The access-enhanced hybrid routing protocol (AB-HRP) proposed in this paper considers the condition of whole proactive path in the access process. The remainder of this paper is organized by access based hybrid routing are as follows. ABHRP is explained in detail in Section II. Section III discusses. Section IV concludes the paper.

II.ACCESS-BASED HYBRID ROUTING PROTOCOL

AB-HRP (Access Based-Hybrid Routing Protocol) based on the access process in hybrid routing protocol. When a mesh client can access more than one mesh routers, it will choose the mesh router with better proactive path condition.

A. Proactive Routing Metric:

The Mesh Clients near a mesh router may influence the condition of this mesh router, because these mesh clients may need to access the mesh router irregularly. In AB-HRP, for a mesh router, the number of mesh clients is used to represent the weight of this mesh router. Then because the proactive path in hybrid routing protocol is only composed of mesh routers, the proactive routing metric of the whole path can be expressed as

$$Metric_{path} = \sum_{i=1}^{m} ni + m$$

Where ni is the number of neighbour mesh clients of the mesh router i, and m is the total number of mesh routers in the proactive path. Less Metric path means less neighbour mesh clients of mesh routers in the path, and less hop count to destination. Thus, the route with less Metric path has better condition

B. Access Mechanism:

The Mesh Clients in AB-HRP are different from mesh clients in traditional hybrid routing protocol, and they no longer access their nearest mesh routers unconditionally. If a mesh client can access more than one mesh routers, it will choose the mesh router with less value of Metric path. That is, the proactive path where the access mesh router is located has the better path condition. Thus, when the mesh client accesses this kind of access mesh router, the whole network performance can be improved greatly. To explain the access mechanism of AB-HRP more clearly, an example is shown in Figure 2.

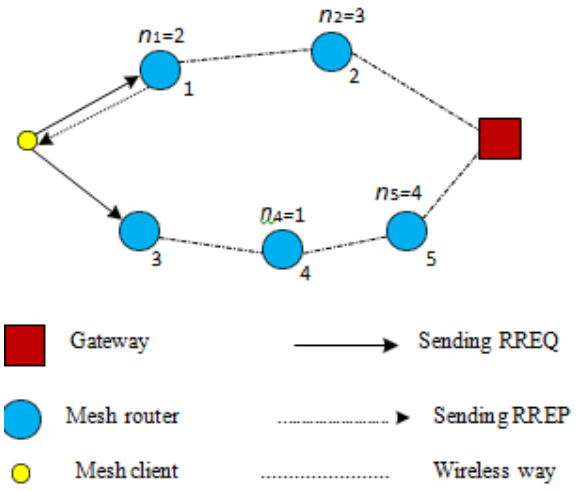

Figure 2. An example of the access mechanism of AE-HRP

In Figure 2, mesh routers have known the way to gateway according to the proactive routing protocol. In access process, when mesh client S wants to send packets to gateway D, it broadcasts route request (RREQ) message, and both mesh router 1 and 3 can receive this message. Then mesh router 1 and 3 will check the Metric path of the proactive path where they are located respectively. Because the Metric path of path 1-2-D is seven and the Metric path of path 3-
4-5-D is ten, mesh router 1 is chosen to be accessed. Finally, Route reply (RREP) message is sent from mesh router 1 to mesh client S. When a mesh router receives a RREQ message, the processing mechanism is shown in Figure 3. Firstly, the mesh router will check whether this RREQ is the first one. If it is, the mesh router will create a reverse route. If not, only the RREQ with better metric can make the mesh router update the reverse route. Then if the mesh router knows the destination in its proactive routing table, it will check whether there is another mesh router with better Metric path. If a mesh router with better Metric path exists, this mesh router just drops the RREQ. If not, the mesh routers will unicast a RREP to the source node.

C.WMN with Several Access Modes:

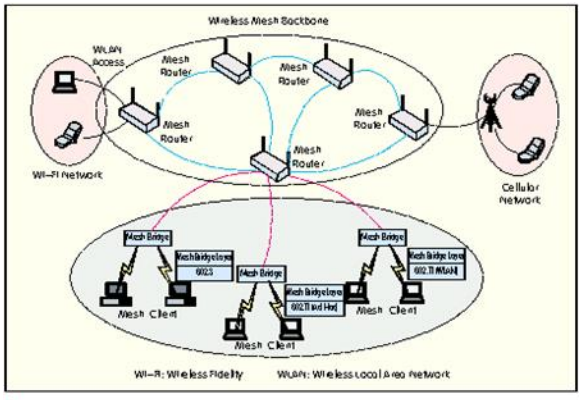

Figure 3. WMN with several access modes.

In the above figure 3 shows Wireless Mesh Backbone contains Mesh Routers. The Mesh Routers are Access with WiFi Networks, Cellular networks, and Wireless Mesh Clients. This total concept is called as Several Access Modes with WMN.

A Wireless Mesh Network (WMN) is a communications network made up of radio nodes organized in a mesh topology. It is also a form of wireless ad hoc network.

A mesh refers to rich interconnection among devices or nodes. Wireless mesh networks often consist of mesh clients, mesh routers and gateways. Mobility of nodes is less frequent. If nodes were to constantly or frequently move, the mesh will spend more time updating routes than delivering data. In a wireless mesh network, topology tends to be more static, so that routes computation can converge and delivery of data to their destinations can occur. Hence, this is a low-mobility centralized form of wireless ad hoc network. Also, because it sometimes relies on static nodes to act as gateways, it is not a truly all-wireless ad hoc network.

The Mesh Clients are like laptops, cell phones and other wireless devices while the mesh routers forward traffic to and from the gateways which may, but need not, be connected to the Internet. The coverage area of the radio nodes working as a single network is sometimes called a mesh cloud. Access to this mesh cloud is dependent on the radio nodes working in harmony with each other to create a radio network. A mesh network is reliable and offers redundancy. When one node can no longer operate, the rest of the nodes can still communicate with each other, directly or through one or more intermediate nodes. Wireless mesh networks can self form and self heal. Wireless mesh networks work with different wireless technologies including 802.11, 802.15, 802.16, cellular technologies and need not be restricted to any one technology or protocol. See also mesh networking.

A Wireless mesh networks is a relatively "stable-topology" network except for the occasional failure of nodes or addition of new nodes. The path of traffic, being aggregated from a large number of end users, changes infrequently. Practically all the traffic in an infrastructure mesh network is either forwarded to or from a gateway, while in wireless ad hoc networks or client mesh networks the traffic flows between arbitrary pairs of nodes.

If rate of mobility among nodes are high, i.e., link breaks happen frequently, wireless mesh networks will start to break down and have low communication performance.

III.CONCLUSION

The Hybrid Routing Protocol including both proactive and reactive routing protocol is an adaptive kind of routing protocol for hybrid WMN. However,

existing hybrid routing protocols are all neglect the access process, and mesh clients simply access their nearest mesh routers unconditionally. Then this situation will cause high congestion in the same access mesh router and proactive path. AB-HRP proposed in this paper considers the access process, and the mesh router with better proactive path condition will be chosen to be accessed. In this paper, we also discuss about WMN with several access modes mechanisms.

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