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A Critical Review on Routing Protocols and Metrics in WMN

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Abstract*— Now days the use of wireless devices is increases tremendously all over the world which leads researchers to frequently work over the new improvements in ad hoc network communication protocols, which we can called as mesh network routing protocols. The main aim behind these researches is to outperform the existing routing protocols by extending them with new algorithms or methods in order to present the unique communication protocol. In the review we have studied many routing protocols which are basically categorized into three main types such as reactive, proactive and hybrid routing protocols. In this paper we are discussing all routing protocols for mesh network those are comes under these three types. Apart from the main routing protocols, there are many improved routing protocols presented by different researchers and still research is going on day by day. In mesh network, it is very tough task to predict the performance of routing protocol under varying network conditions and scenarios. During this paper we are discussing about all existing routing protocols with main focus on their features, functionalities and characteristics.

Keywords*— Routing, Mesh Network, Reactive, Proactive, Hybrid Protocols.

I. INTRODUCTION

Wireless networks are becoming increasingly popular as they provide flexibility, mobility support, and are easy to deploy. Besides, the reduced wired infrastructure and large-scale commercialization, notably of IEEE 802.11, result in plummeting costs. Thus, more and more ISPs offer wireless access, which will in the long term result in ubiquitous Internet. Infrastructure-based wireless networks, such as IEEE 802.11 wireless distribution systems, limit the coverage to users within the transmission range 2 of access points. In this case, access points are connected to a wired network, which incurs in high infrastructure costs. Ad hoc networks [1] otherwise have no infrastructure costs because they do not require wires. Nevertheless, ad hoc networks cannot supply backhaul access and may become a collection of isolated networks due to user mobility. Choosing the position of access points in wireless distribution systems or predicting user location to avoid isolated areas is challenging.

Wireless mesh networks (WMNs) [2] aim at guaranteeing connectivity. WMNs build a multihop wireless backbone to interconnect isolated LANs and to extend backhaul access to users not within range of typical access points. Backbone routers are usually stationary and mobile users roam among them. Consequently, they can permanently be power supplied. As mobility and energy saving are no longer issues, WMN routing considers link quality metrics, such as capacity or error probability [3, 4].

Currently, much effort is made on IEEE 802.11 MAC to fully exploit novel PHY techniques. Nonetheless, in multihop scenarios, performance depends on the routing protocol to properly choose routes given the current network conditions. Different metrics and protocols are proposed to improve wireless mesh routing [5, 6].

So this paper has proposed various algorithms measuring parameters and routing protocols comparison.

II. CERTAIN ISSUES THAT LEADS TO ROUTING IN MESH NETWORKS

There are certain issues in mesh network:

i. Energy efficiency: To consume nodes efficiently and wisely is one of the important features of mesh networks. As mesh nodes are prepared with non-chargeable batteries with inadequate energy supply, a mesh network cannot works well after a fraction of nodes run out of energy.
ii. Network Scalability: The number of mesh nodes in a mesh network may be in the arrange of thousands and even millions in many wireless network applications. Therefore, scalability is a critical factor so that the network feedback does not appreciably damage as the network size increases [7].
iii. Fault Tolerance: Node failure can be occur if some responsive situation occurred and that should be incorporated in designing and implementation.
iv. Data Accuracy: Mesh network's main task is to obtain exact information that can be enhanced via joint signal processing.
v. Network Autonomy: The nodes of mesh can either be deterministic or can be scattered randomly and the untended nodes should be self-sufficient in a particular situation following the topologies of the network.

vi. Information Security: It is a common necessity in about all networks so that mesh data can be executed, transmitted firmly.

III. ROUTING PROTOCOLS IN MESH NETWORKS

Routing protocols determine a few policies which often governs the particular destination of communication packets by supply in order to destination spot in the network. Within SN, you can find several types of routing protocols every one of them is employed based on the network situation. Figure 1 demonstrate principle classification from the routing protocols in SN [8].

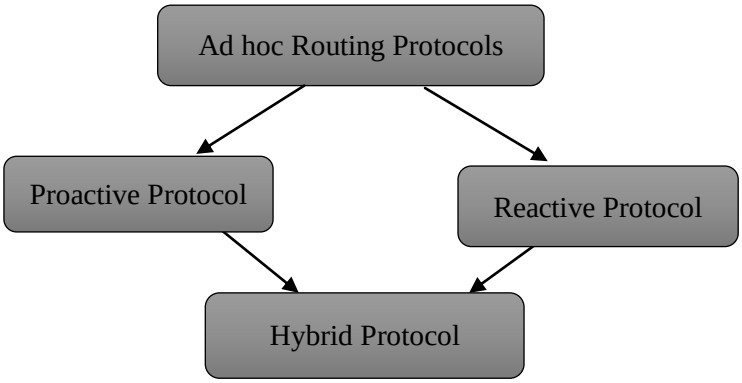

Fig. 1 Routing Protocols in Mesh Network

A. Proactive Routing Protocol

Proactive routing protocols will also be termed while table motivated routing protocols. On this every node preserve routing table which often is made up of specifics of the particular network topology also devoid of needing it. This characteristic while a good choice for datagram targeted traffic, incurs substantial signaling targeted traffic and energy usage [9]. Your routing furniture are updated regularly every time the particular network topology improvements. Proactive protocols are certainly not made for huge networks while they must preserve node records for each and every node from the routing table of each and every node. These protocols preserve diverse quantity of routing furniture various by protocol in order to protocol. There are numerous well-known proactive routing protocols. Illustration: DSDV, OLSR, WRP etc.

B. Reactive routing protocol

Reactive routing protocol is also known as on demand routing protocol. On this protocol route is identified every time it can be desired Nodes start route breakthrough upon requirement foundation [10]. Supply node recognizes its route cache for that accessible route by supply in order to destination spot in the event the route is not accessible subsequently that initiates route breakthrough process. The on- requirement routing protocols possess two important ingredients:

C. Hybrid routing protocol

There is a trade-off among proactive and reactive protocols. Proactive protocols possess huge overhead and a smaller amount latency whilst reactive protocols possess a smaller amount overhead and much more latency. So some sort of Hybrid protocol is introduced in order to get over the particular weak points of both proactive and reactive routing protocols. Hybrid routing protocol is mix off both proactive and reactive routing protocol. This makes use of the particular route breakthrough system of reactive protocol and also the table maintenance system of proactive protocol to be able to stay clear of latency and overhead issues from the network. Hybrid car protocol would work for huge network where large numbers of nodes exist. On this huge network is divided straight into number of specific zones where routing in the sector is performed by utilizing reactive tactic and outside the sector routing is done utilizing reactive tactic. There are numerous well-known hybrid routing protocols for MANET similar to ZRP, SHARP [11].

IV. PERFORMANCE ANALYSIS METRICS IN MESH NETWORKS

A. Throughput

Throughput is the rate of invention or the rate on which a bit can be processed. When used in the framework of communication networks [12].

B. Packet Delivery ratio

Packet delivery ratio is defined as the ratio of data packets expected by destinations to those generated through sources. It can be taken as:

$$PDR = S1 \div S2$$

Where, S1 is the sum of data packets received by the each destination and S2 is the sum of data packets generated by the each source [13]

C. End to end delay

The average time taken by data packet to reach the destination and includes all delays caused by buffering during route discovery latency, queuing at the interface queue. Mathematically, it can be defined as:

$$Avg.EED = S/N$$

S is the amount of the time spends to bring packet for each destination, and N is the number of packets received by the all destination nodes.

D. Routing overhead

It is the ratio between the numbers of sent routing packets over the number of received data packets.

E. Bit Error rate

The bit error rate (BER) is the numeral of bit errors per unit time. BER is a unit less calculation, frequently taken as percentage.

F. Congestion

It occurs when a link or node having much data that its quality of service suffers. Typical effects include loss of packet, new connection blocking etc. [14].

V. ANALYSIS OF THREE ROUTING PROTOCOLS

The hybrid routing protocols employ both reactive and proactive properties by maintaining intra-zone information proactively and inter-zone information reactively. Another way to reduce routing overheads is by using conditional updates rather than periodic ones. In on demand routing protocols, the flooding-based routing protocols such as DSR and AODV will also have scalability problems [15]. In order to increase scalability, the route discovery and route maintenance must be controlled. Hybrid routing protocols such as the ZHLS may also perform well in large networks. ZRP is another hybrid routing protocol which is designed to increase the scalability of Mesh networks. It maintains strong network connectivity (proactively) within the routing zones while determining remote route (outside the routing zone) quicker than flooding. Also it can incorporate other protocols to improve its performance. Although newer protocols have built upon the earlier ones, we cannot identify a single best protocol. Also other protocols can be utilize w.r.t hybrid protocols but all depends on the applicability [16].

VI. CONCLUSION AND FUTURE SCOPE

In this paper, we have presented and discussed the taxonomy of routing protocols in wireless mesh networks and provided comparisons between them. The protocols are divided into three main categories: (i) source-initiated (reactive or on-demand), (ii) table-driven (pro-active), (iii) hybrid protocols. For each of these classes, we reviewed and compared several representative protocols. While there are still many challenges facing mesh network related to routing and security. Each routing protocol has unique features. Based on network environments, we have to choose the suitable routing protocol. In future various protocols like DSR, AODV etc. can be compared with each other in order to know which works well with which metrics and can be optimized using various optimization techniques.

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