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Categorization and Selection of Routing Protocols for Wireless Mesh Network

Rahul R. Dhulekar[1], Pornima Niranjane[2]
[1]M.E. 1st Year (Computer Science and Engineering) Babasaheb Naik College of Engineering Pusad, District-Yavatmal, Maharashtra, India
[2]M.Tech. (Computer Science and Engineering) Asst. Professor (Dept. of CSE & IT), Babasaheb Naik College of Engineering, Pusad, District-Yavatmal, Maharashtra, India

Abstract:- The fundamental characteristic of Wireless Mesh Network (WMN) is routing. Routing protocols directly enables many of the advantages of WMNs over competing technologies. WMNs requires a routing protocols that provide flexibility to work with different topologies, low control traffic overhead, low latency for route (re-) discovery, mobile user support, scalability with respect to mobility and network dimension, efficient handover, multicast which is important for emergency response cases and more desirable one – multipath. Here in this paper, some of the appropriate and relevant routing protocols for WMNs, their behavior, and comparison is presented.

Keywords:- Protocols, Wireless Mesh Networks, WMNs, Routing

I. INTRODUCTION

Wireless Mesh Network (WMN) can be seen as a special type of wireless ad-hoc network. A wireless mesh network often has a more planned configuration, and may be deployed to provide dynamic and cost effective connectivity over a certain geographic area. An ad-hoc network, on the other hand, is formed ad hoc when wireless devices come within communication range of each other. The mesh routers may be mobile, and be moved according to specific demands arising in the network. Often the mesh routers are not limited in terms of resources compared to other nodes in the network and thus can be exploited to perform more resource intensive functions. In this way, since these nodes are often constrained by resources, the WMNs differs from an ad-hoc network.

II. CATEGORIZATION

Routing protocols for WMNs are mostly based on protocols designed for mobile adhoc networks. These can be classified in the three categories as;

1.1 Proactive Routing Protocols

A proactive routing protocol is also called "table driven" routing protocol and is based on the traditional Link State and Distance Vector algorithms, which were originally designed for wired networks. Using proactive routing algorithms, mobile nodes continuously evaluate routes to all reachable nodes and attempt to maintain consistent, up-to-date routing information regardless of whether data traffic exists or not. So the overhead to maintain up-to-date network topology information is high. Thus, a source node can get a routing path immediately if it needs one. Proactive routing protocols maintain a table for each node representing the entire network topology which is regularly updated in order to maintain the freshness of routing information. At any given time, any node knows how to reach another node of the network. This approach minimizes the route discovery delay at the cost of exchanging data periodically, which consumes network bandwidth. Proactive protocols are preferred for small networks because of low routing, table lookups. Destination Sequenced Distance Vector (DSDV), Optimized Link State Routing (OLSR), Topology dissemination Based on Reverse-Path Forwarding (TBRPF), Open Shortest Path First – MANET (OSPF-MANET), Fish-eye State Routing (FSR) are some of proactive routing protocols.

1.2 Reactive Routing Protocols

Reactive routing protocols for WMNs are also called "on-demand" routing protocols. In a reactive routing protocol, routing paths are searched only when needed. A route discovery operation invokes a route-determination procedure. The discovery procedure terminates either when a route has been found or no route available after examination for all route permutations.

In reactive routing protocols, nodes are not aware of the net-work topology. Routing table is constructed on-demand. They find routes by flooding network with route requests. This leads to higher latency due to the fact that the route has to be discovered, however it minimizes control traffic overhead. Usually, reactive routing protocols are better suited in net-works with low node density and static traffic patterns. Since the traffic patterns are static, the first request encompasses the route discovery, while the subsequent use the previous discovery to route the traffic. On the other hand, proactive proto-cols are more efficient in dense networks with bursty traffic due to the continuous exchange of topology information, reducing route discovery delay. Reactive protocols are preferred for high mobility networks. Dynamic Source Routing (DSR), Ad hoc On-Demand Vector (AODV) and some other extensions derived from AODV are reactive routing protocols.

1.3 Hybrid Routing Protocols

Hybrid Wireless Mesh Networks (HWMN) is wireless multi-hop networks consisting of two types of nodes, mesh-router and mesh-client. Mesh-routers are more static and less resource constrained than mobile mesh-clients and forms the wireless backhaul of the network. Hybrid routing protocols are mixed design of two approaches mentioned above. The protocols typically use a proactive approach to keep routes to neighborhood nodes (nodes within the vicinity of the source). But for the nodes beyond the vicinity area the protocol behaves like a reactive one. Alternatively, multiple algorithms can be used simultaneously, if WMN is segmented into clusters. Within each cluster a proactive algorithm is used, whereas between clusters a reactive algorithm is used. The challenge is to choose a point, a point from which the protocol should change from proactive to reactive.

III. ARCHITECTURE

Wireless mesh architecture design is a first step towards providing high-bandwidth Internet access over a specific coverage area. WMNs consist of Mesh Clients (MCs) and Wireless Mesh Routers (WMRs), which relaying each other's packets in a multi-hop fashion, where mesh routers have minimal mobility and form the Backbone of WMNs (BWMNs). To illustrate more, it is made up of wireless communication nodes, each of which can communicate with other nodes. Mesh architecture breaks the long distance into a series of shorter hops to boost the signal by intermediate nodes. Intermediate nodes not only sustain signal strength, but also forward packages on behalf of other nodes based on their knowledge of the network. Such architecture allows continuous connections and reconfiguration around broken or blocked. A typical WMN is illustrated in following Figure.

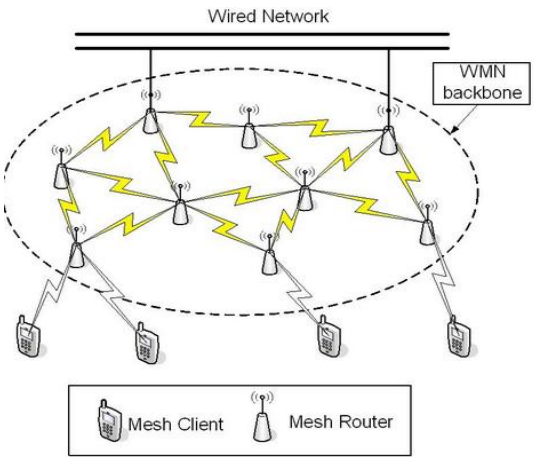

Fig.4.WMN Architecture

IV. WNS COMPONENTS

There are three types of node in a WMN: WMN client, WMN router, and WMN gateway

4.1 WMN clients

These are the end-user devices such as: laptops, PDAs, smart phones, etc that can access the network for using applications like email, VoIP, game, location detection, etc. These devices are assumed to be mobile; they have limited power, they may have routing capability, and may or may not be always connected to the network.

4.2 WMN routers

These are in the network to route the network traffic. They cannot terminate nor originate the traffic. The routers have limitation in mobility and they have reliable characteristics. Transmission power consumption in mesh routers is low, for multi-hop communications strategy. Additionally, the Medium Access Control (MAC)

protocol in a mesh router supports multiple-channels and multiple interfaces to enable scalability in a multi-hop mesh environment.

4.3 WMN gateways

These are routers with direct access to the wired infrastructure/Internet. Since the gateways in WMNs have multiple interfaces to connect to both wired and wireless networks, they are expensive. Therefore, there are a few number of WMN gateways in the network. Moreover, their placement has a significant impact on the performance of the network.

V. APPLICATIONS OF WMNS

There are some applications cannot be directed and fully support by other wireless technologies rather than WMNs. It was a motivation to develop WMNs.

5.1 Broadband Wireless Access:

Currently, Broadband access has an important role in information economy. It provides services for real time applications such as: video telephony, online-gaming, video on demand, and telecommunications. Each new application has a significant impact on quality of life. For example, Telecommuting can reduce daily travelling of individuals. It leads to increased productivity for the time saving. It also reduces traffic on the streets, thus it has a positive impact on the environment.

5.2 Industrial Applications:

Building automation: In a building, there are many devices need to be monitored and controlled like electrical devices including power, light, air conditioner, elevator etc. Today, the wired networks are taking care of such environment. This is very expensive due to the complexity in deployment and maintenance of a wired network. Currently, Wi-Fi networks are another option to reduce the cost of such networks. But, this solution has not achieved satisfactory performance yet for expensive wiring of Ethernet which is needed for Wi-Fi Access Points (APs).

5.3 Hospitality:

In hotels and resorts, one of their services is high-speed Internet connectivity which is free. Wireless mesh networks are easy to set-up, lower in cost, and without having to change the existing structures or disrupt business for both indoor and outdoor.

VI. CONCLUSION

The analytical study of this thesis demonstrates that WMN technology proved to be a revolutionary and modern technology which has remarkable impacts in the field of Telecommunications and Internet Systems. Routing protocols play vital role to increase the credibility of WMNs. The selection of appropriate routing protocol with respect to network improves the efficiency and reliability of network. There are some suggestions regarding analytical study, routing protocols should not be centralized. These should be distributed in nature. Routing protocols used in ad-hoc networks should develop loop free routes; due to loop free environment bandwidth consumption becomes low. Routing protocols should have capability to maintain QOS in terms of different parameters such as delay, load, jitter and throughput etc. Mainly there are two categories of protocols used in WMNs or MANETs i.e. reactive and proactive. Both types of protocols have different utilization in MANETs; both categories have advantages and disadvantages discussed in this thesis. Thus to achieve good results and efficiency in communication according to scenarios and parameters, selection of suitable category of protocol is very important.

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