ABSTRACT

Wireless mesh network (WMN) operates both in infrastructure and ad-hoc mode. It provides extended network coverage based on heterogeneous wireless technologies through multi-hop communications. In WMNs, the routing mechanisms and network organization need to be improved so that optimal path discovery or different protocols adaptability can be achieved. Hybrid routing is a demanding issue to be discussed these days as need of higher mobility management in the diverse situations and environments. It’s required to improve the older schemes for higher data rate and minimum energy consumptions. The proposed work presents a design of a novel routing algorithm for optimal route discovery, congestion reduction, dynamic route selection and scalability in hybrid mesh networks. The authors have focused on Hybrid Routing Protocols to originate a novel routing scheme based on AODV (Ad-hoc On-Demand Distance Vector routing protocol) in Ad-Hoc level with clustering scheme and DSDV (Destination Sequence Distance Vector) as proactive routing protocol in Backbone Mesh Router Level to form a new hybrid routing protocol. In this work a Novel Hybrid Distance Vector (NHDV) routing protocol algorithm has been introduced, which is the combination of DSDV (Destination Sequence Distance Vector) and AODV routing protocols. A clustering scheme with the combination of two efficient clustering schemes for Ad-hoc mesh client levels is discussed in detail and a performance metric for DSDV is also discussed which ETX (Expected Transmission Count) is for measuring packet loss ratio at each link for higher throughput. A new performance metric introduced in AODV as Mesh Router Count is used to improve the performance of communication to the Mesh Routers. The proposed work is the design of new algorithm that presents an optimal solution in bringing out a revolutionary change to Hybrid Routing.

Keywords: AODV, DSDV, Expected Transmission Count, Mesh Router, Wireless Mesh Network, WMN

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1. INTRODUCTION

Wireless Mesh Networks (WMNs) or Mobile Ad hoc Networks (MANETs) are widely used networks in disaster management, security surveillance and emergency situations, since they have capability to manage and configure themselves without any external support. Generally WMNs are deployed using IEEE 802.11 standard devices and hardware infrastructures. In WMNs mesh nodes are connected wirelessly in multi-hop connectivity. Some of these are Mesh Routers that provide backbone infrastructure while Mesh Clients communicate in mobile ad-hoc mode having diverse node positions. Recently WMNs became very cost effective as there is no need of wired medium and can easily be deployed in longer distance without too much ground support. Most WMNs are applicable in emergency situations, intelligent transportation, military and community networks. For more mobility with optimal communication having minimal resource utilization and better QoS, many routing protocols are developed and deployed. Some of these are reactive (demand driven) and some are proactive (table driven).

MANETs have issues in routing and optimal solutions for minimizing delays and packet loss, which is a challenging task because of high mobility. Ad-hoc nodes can cause more link breakages and delay the transmission. In earlier schemes these issues were partially addressed, some of these were eliminated but few of them still are creating problems. In this research work we have strongly focused on hybrid WMN in which both infrastructure and mobile ad-hoc modes are involved. There are few protocols that are capable to operate in both modes simultaneously while most of these still have performance issues related to routing overheads.

The most widely used protocols in WMNs are AODV, which is reactive in nature, and DSDV, which is proactive. WMNs are divided into three basic types: infrastructure, client mesh and hybrid mesh. In this paper we will discuss the hybrid mesh networks. Hybrid Wireless Mesh Network (HWMN) is the combination of two modes of communications (Akyildiz, 2005): infrastructure (backbone) and ad-hoc (Client). In infrastructure mode Mesh Routers are involved in routing, however mesh clients are not directly involved in forwarding and routing packets as they get access to other nodes through mesh routers. In ad-hoc (Client Mesh) mode client nodes are independent. Hybrid mesh is the combination of both infrastructure and ad-hoc modes.

Normally, in reactive AODV routing protocol, a RREQ (Route Request) packet is generated from the source node for route discovery to destination. Source node broadcasts RREQ to all the neighbor nodes until the destination is found or an intermediate node knows the route to destination. Then a RREP (Route Reply) packet is generated and unicast back to the source, otherwise RREQ is rebroadcast and forwarded to next nodes. A TTL (Time To Live) parameter is incremented each time a RREQ is broadcast. If this timer gets expired and destination not found or link breakage occurs, RERR (Route Error) message is sent back to source node and AODV performs a local route repair. This process is explained in Figure 1.

2. PROBLEM IDENTIFICATION

WMNs are self-organized and self-configured capable of handling wide range of applications (Asad, 2007). As they work in flat or hierarchy mode there are some problems with WMNs as the same as MANETs (Martin, 2010). The challenge is to overcome scalability and handle mobility when number of nodes becomes large. Another problem with WMN in hybrid scenarios is to manage both backbone networks and ad-hoc mode at the same time with minimum energy consumption, higher throughput and less routing overhead. As hybrid wireless mesh networks are a combination of both infrastructure mode and ad-hoc mode but making them truly hybrid is a still problem as we can either use a reactive or proactive routing protocols for static mesh routers and for mobile mesh clients. Both types of protocols have particular
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