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Survey on Multicast Routing Protocols

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ABSTRACT

Multicasting is the newest wireless networking method that communicates with network groups. Multicast routing is essential to point-to-point or multipoint communications. Wireless networks can communicate more effectively, reliably, and securely with multicasting than with unicast routing. There are numerous multicast routing systems; some of them deal with both wired and wireless networks, while others only function with wireless networks. This study analyzes multicasting protocols for ad-hoc networks, explains how they operate, and demonstrates the rationale behind their creation Comparisons of the protocols are made in parallel to show both their advantages and disadvantages.

I. Introduction

Multicast Routing Protocols are a set of rules and procedures that enable efficient and reliable distribution of multicast traffic in a network. Multicast is a communication technique that enables data to be transmitted from a single source to multiple recipients simultaneously, and it is used in a wide range of applications such as video streaming, online gaming, and stock market data distribution. Multicast Routing Protocols are responsible for managing the distribution of multicast traffic in the network and ensuring that it is delivered to all intended recipients efficiently and reliably. There are several multicast routing protocols in use today, including PIM, DVMRP, and Multicast Open Shortest Path First (MOSPF). Every protocol has benefits and drawbacks, and network managers must select the best protocol depending on the unique needs of their network. The efficient distribution of multicast traffic is critical for the success of applications that rely on multicast, and Multicast Routing Protocols play a crucial role in achieving this goal. In this context, the purpose of this paper is to provide an overview of Multicast Routing Protocols, their types, their characteristics, and their use in different network environments. We will discuss the key features of each protocol, their strengths and weaknesses, and provide insights into the factors that affect their performance.

II. Types of Multicast Routing Protocols

Multiple categories can be found in multicast routing protocols; some classified depending on the functionality, while others depend on the structure. The multicast routing protocols are divided into the following types as illustrated in the following diagram based on the topology of the network.

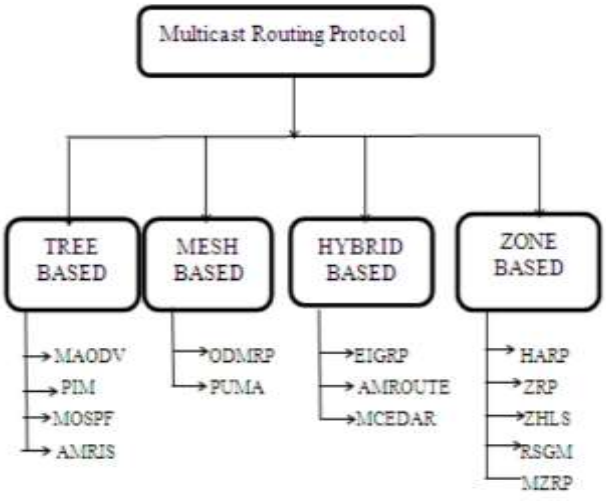

Fig 1: Types of Multicast Routing Protocols

III. Tree Based Multicast Routing Protocols

A tree-based multicast routing system builds and maintains a shared routing tree to transmit data from a source to a destination..

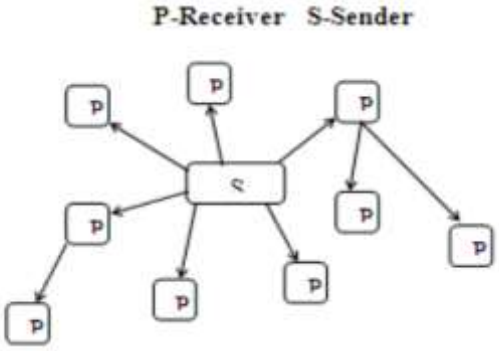

Fig 2: Tree Based Topology

a) Multicast Ad-hoc On demand Distance Vector (MAODV)

MAODV (Multicast Ad hoc On demand Distance Vector) is a multicast protocol designed for ad hoc wireless networks. It is a variant of the Ad-hoc On-demand Distance Vector (AODV) routing protocol, which is used in unicast routing in ad hoc networks. MAODV extends the AODV protocol to support efficient multicast communication in ad-hoc networks. Because MAODV is a reactive protocol, it only creates routes when multicast traffic needs to be transmitted. To determine the shortest way from the source to the destination group, it employs a method known as route discovery. When a node receives a multicast packet and does not have a route to the destination group, it initiates a route discovery process by broadcasting the Route Request (RREQ) packet. The RREQ packet contains information about the source and destination group addresses, as well as a sequence number to prevent loops. The intermediate nodes that receive the RREQ packet check their routing table to see if they have a route to the destination group. If they don't, they continue broadcasting the RREQ packet. The Route Reply (RREP) packet, which provides the route information, is sent back to the source when the RREQ packet reaches a node that has a route to the target group. The source can then use this information to transmit multicast packets to the destination group.MAODV has been shown to perform well in ad-hoc wireless networks with low mobility and moderate multicast traffic. However, its performance may degrade in networks with high mobility and high multicast traffic due to the increased overhead of route discovery and tree maintenance.

b) Protocol Independent Multicast(PIM)

PIM (Protocol Independent Multicast) is a family of multicast routing protocols that operate at the network layer of the OSI model. PIM is called "protocol independent" because it can work with various unicast routing protocols, such as OSPF (Open Shortest Path First) and BGP (Border Gateway Protocol), to provide multicast routing in IP networks. PIM was developed the Internet Engineering Task Force to provide efficiency and scalable multicast routing in IP networks. PIM has many advantages over other multicast routing protocols. It is scalable and can handle large multicast groups with many sources and receivers. It is also flexible and can work with different unicast routing protocols. However, PIM can be complex to configure and manage, and it may not be suitable for networks with high multicast traffic or high mobility.

c) Multicast Open Shortest Path First Protocol (MOSPF)

Due to the fact that MOSPF is a link-state protocol, each router keeps a database of the network topology and uses that data to determine the shortest path to the multicast group.. MOSPF uses a mechanism called flooding to distribute the link-state information throughout the network. A router floods a Link-State Advertisement (LSA) packet to every other router in the network when it notices a change in the network topology. Information about the router's neighbor's, the cost of the links, and the multicast groups it is interested in are all included in the LSA packet. Compared to other multicast routing methods, MOSPF provides a number of benefits. It can manage sizable multicast groups with numerous sources and recipients and is scalable. It is also OSPF compatible, making it simple to integrate into current networks. MOSPF, however, can be difficult to set up and maintain, and it might not be appropriate for networks with a lot of multicast traffic or high mobility. Additionally, MOSPF is not as popular as other multicast routing technologies like PIM.

d) Ad hoc Multicast Routing protocol (AMRIS)

Wireless mobile ad hoc networks (MANETs) without any fixed infrastructure are intended for use with ad hoc multicast routing technologies. These protocols are employed to set up distributed multicast group communication between mobile nodes. Protocols face various challenges such as mobility, dynamic topology, limited bandwidth, and battery power. Researchers continue to work on developing efficient and reliable AMR protocols that can overcome these challenges and provide scalable and robust multicast communication in MANETs.Overall, AMR protocols are essential in enabling multicast communication in MANETs, which have various applications such as military communication, emergency response, and mobile conferencing.

IV. Mesh based routing protocols

Mesh based protocols provide multiple paths between sender and receivers

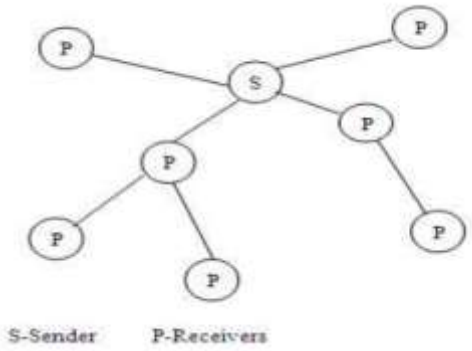

Fig 3: Mesh Based Topology

a) On-Demand Multicast Routing Protocol(ODMRP)

For wireless mobile ad hoc networks (MANETs), which include mobile nodes and no fixed infrastructure, the On-Demand Multicast Routing Protocol (ODMRP) was created. Other multicast routing protocols including Protocol Independent Multicast (PIM) and Distance Vector Multicast Routing Protocol (DVMRP) have scalability and bandwidth issues, which led to the development of ODMRP.In comparison to other multicast routing protocols, ODMRP has several benefits, including less control overhead, better scalability, and faster packet delivery. However, due to the mesh-based forwarding method, it also has certain drawbacks, including greater packet duplication and higher end-to-end delay.ODMRP, which is frequently used in applications like mobile conferencing, is an effective and scalable multicast routing protocol ideal for mobile ad hoc networks.

b) Priority Unavoidable Multiple Access Protocol (PUMA)

For wireless ad hoc networks, the Priority Unavoidable Multiple Access Protocol (PUMA) was developed. The protocol strives to give all nodes, especially those with high-priority traffic, efficient and dependable access to the network.In comparison to other multiple access protocols, PUMA has a number of benefits, including the capacity to accommodate various traffic types with variable priority, fair channel access, and effective channel bandwidth utilisation. However, PUMA has several drawbacks as well, including the requirement for nodes to have a method for figuring out their priority levels and the potential for packet collisions when two nodes trying to transmit at the same time share the same priority level.PUMA is an overall promising multiple access protocol for wireless ad hoc networks that can offer effective and equitable channel access for all nodes, including those with high-priority traffic.

V. Hybrid based multicast routing protocols

The hybrid based multicast routing protocols inherits the traits of both mesh and tree based multicast routing protocols.

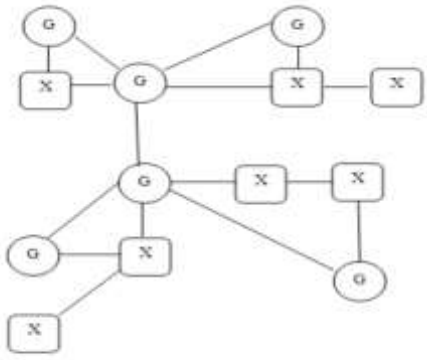

Fig 4: Mesh Based Topology

a) Enhanced Interior Gateway Routing Protocol (EIGRP)

EIGRP, which has several benefits over conventional distance-vector protocols, combines distance-vector and link-state routing protocols. To determine the shortest path between the source and destination nodes, EIGRP employs the Diffusing Update Algorithm (DUAL). By enabling EIGRP to quickly recover from link failures and adapt to changes in network topology, DUAL promotes quick convergence. Compared to other routing protocols, EIGRP has a number of benefits, including quick convergence, support for large networks, and effective utilization of network resources. EIGRP also provides support for multiple network layer protocols, such as IP, IPX, and AppleTalk. Overall, EIGRP is a reliable and efficient routing protocol suitable for large, complex networks that require fast convergence and support for multiple network layer protocols.

b)Ad-hoc Multicast Routing Protocol (AMRoute)

For wireless ad hoc networks, the Ad-hoc Multicast Routing system (AMRoute) was created as a multicast routing system. The multicast distribution tree created by AM Route is a tree-based protocol that spans all multicast receivers and has its root at the source node.AMRoute is superior to conventional multicast routing protocols in a number of ways, including in terms of simplicity, scalability, and bandwidth and energy efficiency. AMRoute can adapt to changes in network architecture and offers support for mobile nodes.AMRoute has certain drawbacks, though, including the absence of QoS support and the potential for packet losses due to node failures or congestion.For wireless ad hoc networks, AMRoute is a promising multicast routing protocol that offers scalable and effective multicast transmission.

VI. Zone based routing protocol

a) Zone Routing Protocol(ZRP)

For wireless ad hoc networks, the Zone Routing Protocol (ZRP) is a hybrid routing protocol. ZRP, which combines proactive and reactive routing techniques, divides the network into zones and assigns a proactive routing protocol to each zone. A reactive routing protocol controls the inter-zone routing.ZRP is superior to traditional routing protocols in a number of ways, including decreased control overhead, quick convergence, and increased scalability. ZRP can adjust to changes in network topology and supports mobile nodes.ZRP does, however, have significant drawbacks, such as the complexity and overhead that come from combining proactive and reactive routing protocols.Overall, ZRP is a promising hybrid routing technology that offers effective and scalable routing for wireless ad hoc networks.

b) Zone based hierarchical link state routing protocol

A hierarchical routing technique created for wireless ad hoc networks is called Zone Based Hierarchical Link State Routing (ZHLS). By separating the network into various zones and managing each zone using a different instance of the link-state routing protocol, ZHLS is an enhancement over the conventional link-state routing protocols such as Open Shortest Path First (OSPF) and Intermediate System-to-Intermediate System (IS-IS).ZHLS is superior to traditional routing protocols in a number of ways, including decreased control overhead, quick convergence, and increased scalability. ZHLS can adapt to changes in network topology and also supports mobile nodes.However, ZHLS has certain drawbacks, including the potential for less-than-optimal pathways and the extra complexity brought on by the hierarchical organisation.

c) Dense multicast zone routing protocol(DMZ)

A multicast routing protocol created for wireless ad hoc networks is called the Dense Multicast Zone Routing Protocol (DMZRP). In order to provide effective and scalable multicast routing in dense networks, DMZRP is a hybrid routing protocol that combines the advantages of proactive and reactive routing systems.Compared to existing multicast routing protocols, DMZRP has a number of benefits, including less control overhead, quick convergence, and enhanced scalability. Additionally supporting mobile nodes, DMZRP is able to adjust to changes in network topology.However, DMZRP has significant drawbacks, including the complexity increase brought on by combining proactive and reactive routing protocols and the potential for taking less-than-optimal routes..

VII. Conclusion

This paper provides an overview of the multicast routing protocols in ad-hoc networks and identifies the key challenges in creating an effective multicast routing protocol. The purpose for creating these protocols is then explained, and the extremely clear operational methods are explored. Finally, while each multicast routing protocol attempts to address a different issue, they all have advantages and disadvantages of their own. There hasn't been developed a protocol yet that can address every issue with ad-hoc networks. As a result, there are numerous difficulties with the multicast routing protocol that can be studied in order to create new protocols for multicasting that will work better in the future.

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