Research Paper Computer Science

A Study on Multicast Routing Protocols for Manets MRMP, ERAMOBILE, TSMP, LAM, PUMA

* Dr.R.Periasamy** C.Ranjithkumar*** P.Panimalar

* Department of Computer Science, Nehru Memorial College, Tiruchirapplli, Tamilnadu, South India

** Department of Computer Science, Vivekanandha College of Arts and Sciences for Women, Tamilnadu

*** Department of Computer Science, AVC College, Mayeladuthurai, Tamilnadu, South India.

ABSTRACT

In this paper, we focus on fundamentals of multicast routing protocols for mobile ad-hoc networks (MANETs). MANET is based on infrastructure less network of wireless devices connected by wireless links. In the past surveys are lot Tree or Mesh based multicast routing protocols, this article presents overview of multicast routing protocols such as, Maximum Residual Multicast Protocol(MRMP), Epidemic-Based Reliable and Adaptive Multicast(Era-mobile), Tim Synchronized Multiple Access (TSMP), Light Adaptive Multicast (LAM).This study is useful information for many researches in Mobile ad-hoc Networks.

Keywords : Mobile ad-hoc network, Multicast Routing, MRMP, Era-mobile, TSMP, LAM

Introduction

Multicasting plays an important role in the typical application of ad hoc wireless networks namely, emergency search and rescue operations, military applications etc. nodes form groups to carry out certain tasks that require point-to-point and multi-point-to-multipoint voice and data communications. The arbitrary moment of nodes, with the constraints of power source and bandwidth makes multicast routing very challenging.

An ad-hoc routing protocol is a convention, that controls how nodes decide which way to route packets between more than one devices in a mobile ad-hoc network. Multicasting is intended for group communication that supports dissemination of information from a sender to all receivers in a group. It's the ability of communication network to accept a single message from an application and to deliver copies of the same message to multiple recipients, at different location. One of the challenges is to minimize the amount of network resources employable by multicasting.

There are two types of multicasting Ad-hoc routing structure, first one Tree based structure it delivers data from source to destination in the form of tree structure. It provides high mobility efficiency, with low packet delivery ration due to the frequent tree breaks; the second mesh based structure is a connected component of the network containing all receivers of group. Multiple links among the nodes in an ad-hoc wireless network results in a mesh-shaped structure. The mesh based multicast routing structure may work on high mobility environment. There are several multicast routing protocols plays important role in mobile ad-hoc networks (MANETs). It is represented in the classification of multicast routing protocols based on the topologies like, tree, mesh and hybrid.

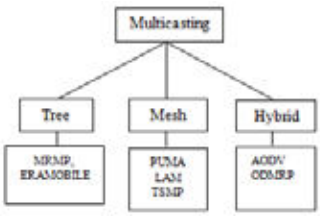

Fig 1: Classification of multicasting

Ad-hoc network having some characteristics, as follows: Mobility: The fact that nodes can be rapidly repositioned and move in raison of ad-hoc networks. The mobility model can have major impact on the selection of a routing scheme and can thus influence performance. Multi-hopping: A multi-hop network is a network, where the path from source to destination traverses several other nodes. Self-organization: The ad-hoc network must autonomously determine its own configuring parameters including: addressing, routing, clustering, position identification, power control, etc. Energy conservation: Most ah-hoc nodes have limited power supply and no capacity to generate their own power supply. Energy efficient protocol design is critical for longevity of mission. Scalability: In some applications, the ad-hoc network can grow to several thousand nodes. For wireless "infrastructure" network, scalability is simply handled by hierarchical construction. Security: The challenges of wireless security are well known ability of the intruders to jam. The ad-hoc networks, however, are even more vulnerable to attacks than the infrastructure counterparts.

There has been a lot of research in the area of multicasting communication. Although existing lot of surveys and books which examine various aspects of multicasting is a self-organizing collection of wireless communication nodes. That from a temporary and dynamic wireless network established by group of mobile nodes on a standard wireless channel for infrastructure less administration. We discuss about the multicast routing protocols such as, MRMP in the chapter2, TSMP in chapter 3, ERAMOBILE in chapter 4, LAM in chapter 5, and PUMA in chapter 6.

2. Maximum Residual Multicast Protocol (MRMP)

Each device in MANET is free to move independently in any destination and will therefore changes its link to other devices frequently. The primary challenges in building management are equipping each device to continuously maintain the information. It is prove that the deriver tree is loop-free and theoretically optimal in the maximization of minimized residual energy.

Routing over mobile Ad-hoc network is complicated by the consideration of energy efficiency. While the shortest paths are not favored in routing, maximum residual routing where

the minimum residual energy of nodes is maximized for each multicast, MRMP is adaptable to network topologies and resources that may change in MRMP, there is no periodic control message is employed to collect routing information, from intermediate nodes of a loop-free multicasting tree.

Routing problems have become highly challenging because of the popularity of mobile devices. MRMP taught power aware routing, when network topologies and data traffic may change quickly. In which nodes may be with high mobility. In the past decades, many excellent power aware routing protocols/algorithm has been proposal for mobile Ad-hoc networks. However, most of the existing results rely on the knowledge of certain global information such as, the remaining any of all nodes and minimum transmission power used between every pair of nodes. The maintain problem of similar global information is highly challenging in protocol designs, because of the difficultly and cost in the maintenance of up-to-date information. MRMP is designed for application with a huge population of mobile device such that, global information can be efficiently maintained at any node.

3. Time Synchronized Multiple Accesses (TSMP)

TSMP is a networking protocol that forms the foundation of reliable, ultra-low power secure communication in a wireless sensor network. It was developed by dust networks as a communication protocol for self organizing networks of wireless devices called motes. As a growing commercial and industrial application it needs reliable, timely, secure delivery of packets at low power. TSMP stay synchronized to each other and communicate in time slots, similar to other Time Division Multiple access (TDM) system such deterministic communication allows. The devices to stay extremely low power, as the radios only turn on of the periods of scheduled communication.

TSMP is a media access and networking protocol that design specifically for low power low bandwidth reliable networking. TSMP operate on the 2.4 GHz, ISM band on IEEE 802.15.4 radios and in the 900 MHz ISM band on proprietary radios. TSMP provides a packet band protocol where each transmission contains a single packets and acknowledged (AUKS) when a packet has been received without any alteration. These mechanism are in plane to transport packets across a multi-hop networks as efficiently as reliable as possible.

3.1 TSMP Packets

MAC Header	NET Header	Payload	APP MIC	MNC MIC	FCS

Fig 2: TSMP Packets

TSMP packets consist of a header a payload and a trailer. Packets contain fields that identity the sending node, define the destination, ensure secure message transfer and provide reliability and quality of server information (QOS).

3.2TSMP-Components

There are few components of TSMP that contribute to end-to-end networks reliability, simple installation and power efficiency.

- ★ Time Synchronized communication.
- ★ Frequency hopping
- ★ Automatic node joining and node for return
- ★ Fully redundant mesh routing.
- ★ Secure message transfer.

3.3 Time Synchronized Communication

TSMP network is translated in a specific time for end-to-end communication. It is referred to as Time Division Multiple Access (TDMA) Synchronized communication. It is a technique that provides reliable and efficient transport of wireless data. In the wireless communication several other Medium Access Control (MAC) mechanism are available such as TDMA, CSMA, CDMA, TSMP is band on TDMA.

3.3.1 Time Slots and Frames

In TSMP each communication window is called timeslot. A serious of the slots makers up a frame which repeats for the entire network. The frame length increase in slots. A shorter frame length increase refresh rate, increasing effective band width and increase power consumption.

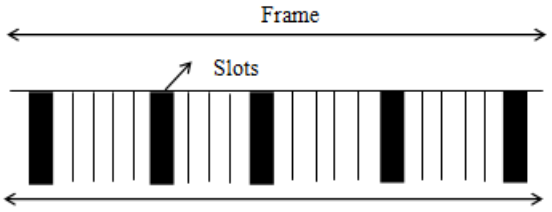

Fig 3: Time slots and frames

3.3.2 Synchronization

TDMA system has time synchronization. All nodes must share common sense of time. TSMP nodes maintain a precise secure of time and exchange information with neighbors. A . common sense of time enables,(i)Band width can be pre located to ensure, reliable transmission.(ii)Transmitting nodes can effectively change frequencies.

3.4 Frequency hopping

To shining the wireless media access time, TSMP also slices it across frequency. It provides fault tolerance as well as effective bandwidth. It is commonly referred to as FHSS (Frequency Hopping Spectral Spectrum).

3.5 Automatic node joining and network formulation

The self-organizing is one of the resources for mesh networking in first place. TSMP nodes are fully capable of mesh networking nodes. In TSMP set of nodes are shared in a network id and password and are synchronized with each other.

3.6 Redundant Mesh Routing

In a redundant mesh topology network devices are connected with many redundant interconnections between network nodes. In a true mesh topology every node has a connection to every other node in the network. A mesh network with redundant connections is an example of a redundant topology. The level of redundancy can be measured by network connectivity. Redundant mesh routing must have in real world RF environments. A full mesh topology with automatic node joining the network long-term reliability.

Redundant routing requires:

- ★ Spatial Diversity(try a different roots)
- ★ Temporal Diversity(try again later)

This is the redundant mesh routing and advanced over Star-Mesh routing architecture.

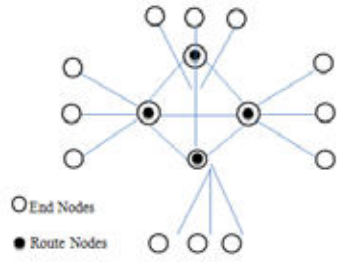

Fig 4: Star-Mesh Architecture

3.7 Secure Message Transfer

There are three pillars of secure message transfer;

- ★ Encryption: The information is carried by the message from being read by other parties.
- ★ Authentication: Ensure sender is actually the sender.
- ★ Integrity: Ensure the message was delivered unaltered.

4. Epidemic-Based Reliable and Adaptive Multicasting for Mobile Ad-hoc Networks (ERAMOBILE)
In mobile Ad-hoc networks have enormous potential in several fields of applications. Lack of information, self-organizing and mobility are the reason behind the popularity of MANETS. Multicasting is an ideal communication paradigm for several application areas that require efficient support of group communication. Era-mobile's target is group applications requiring high-level of reliability and the protocol aims to provide reliable multicasting data delivery with minimal overhead even in the adverse network conditions.

Era-mobile utilizes an Epidemic-based method in multicast operation to cope with dynamic and unpredictable topology changes arising from the mobility. This mechanism does not do multicasting. It also needs neither having global or partial view of the network. Besides, it substantially minimizes the overhead by eliminating redundant data transmission. Era-mobile is its capability of adapting to varying densities in order to provide reliable data delivery. It handles three types of functional units and its operation.

Data dissemination unit: It disseminates data and recovers missing data packets.

Adaptive unit: Responsible for setting nodes.

Buffer management unit: It provides ordered data delivery.

4.1 Work Load:
To investigate the impact of data rate, the number of packets generated per second by the traffic source is varied from 1 to 16 unit payload size. The single multicast group consists of 20 nodes while the traffic rate of 1 packet symbolizes the light traffic. The rate of 16 packets represents heavy traffic. All protocols react similar to increasing traffic. Era-mobile achieves fully reliable delivery for all traffic rates except heavy fully scenarios. In heavy traffic scenario, the delivery ratio of the protocols tends to decrease due to the highly congested network environments.

The highly traffic rate increase the number of data packets delivered by the nodes, in all protocols also increase the duplicate data packets in flooding, this receive overhead to remain constant, in that situation Era-mobile increase as well as a node request propagates more data with the rising packets. So Era-mobile achieves fully reliable data delivery in dynamic environment of MANET'S. Applications that may no delay-sensitive can use Era-mobile to deliver multicast data reliably with minimal overhead.

5. Light Adaptive Multicast (LAM)
Adaptive routing describes the capability of a system, through which routes are characterized by their destination, to alter the path of the system in response to change the conditions. The adoption is indented to allow as many routes as possible to remain valid in response to the change. The term commonly used in data networking, is to describe the capability of a network to 'route around' damage, occurs due to loss of a node in connection between nodes. So other path choices are available in the LAM.

To provide lightweight adaptive and scalable datagram multicasting Service in large Mobile Ad-hoc Networks (MANETs), we used in different environments multicasting in a broadcast media of highly dynamic, bandwidth constrained topology. IP multicast adopted a simple, best-effort delivery model with many-to-many semantics. The lightweight services which enhance the IP multicast forwarding services to facilitate scalable and efficient as reliable multicast.

The Lightweight Adaptive Multicast (LAM) works at the network layer. It contains both TCP and UDP that represented in the architecture of Light Adaptive Multicast. LAM is a group shared tree algorithm for efficiency. For scalability reason no timers are needed for LAM.

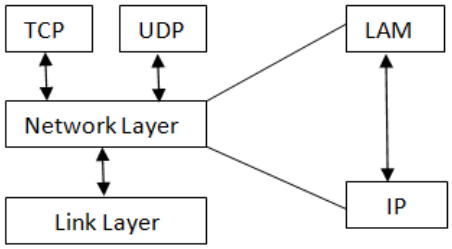

Fig 5: LAM Architecture

6. Protocol for Unified Multicasting through Announcement (PUMA):
PUMA is distributed receiver initiated mesh based multicast routing protocol. PUMA uses simple and efficient control message, in multicast announcement, to maintain the mesh. Besides that multicast meshes can be compiled into a single announcement bucket. It doesn't require any unicast protocol and all transmission are broadcasts. Even through broadcast transmission are unreliable, the mesh itself introduces some redundancy that includes only group members and the nodes interconnecting them.

Each multicast announcement specifies the sequence number, the address of the group(group ID), the address of the core(core ID), the distance to the core, a mesh members as that is set when the sending node belongs to the mesh, and a parent that states the preferred neighbor to reach the core. With the information contained in such announcements nodes elect cores, determine the routes for source outside a multicast group to forward data packets towards the group, notify others about joining or leaving the mesh of a group, and maintain the mesh of the group.

Multicast announcement propagates throughout the mesh nodes learn the shortest path. This way packets can be quickly tranfer to the core on its way towards the core 2 things can happen;

1. **The packet goes all the way until it reaches the core.**
2. **A mesh packets list before reaching the core.**

Anyway, once the data packets reach the mesh. The packet propagates only inside the mesh. PUMA's uses the shared mesh based multicast topology for constructing routes to the members of multicast group without depending upon any unicast routing protocol. Multicast group maintenance of PUMA is achieved by using the soft state approach where in which the multicast group membership and its associated routes are refreshed periodically by flooding its Multicast Announcement (MA) packets.

6.1Control packets:
PUMA uses single control packets called Multicast Announcement (MA) to create and maintain its multicast topologies in MANET.

Mesh Membership Code	Distance to Core
Group ID	
Code ID	
Sequence Number	
Parent	

6.2 Multicast Announcement
Mesh membership code: This field is set to 1 when a node wants to join into the group; else it is unset.

Distance to core: Hop count from the current node to core node.

Group ID: Address of the group.

Core ID: Sequence number of the group.

Parent ID: Address of the neighbor to reach to reach the core.

6.3 Uses of Multicast Announcement:

Multicast Announcements are used

- To elect the core.
- Find out the sources outside a multicast group to unicast data packets towards the group.
- Join and leave the mesh of a group.
- Maintain the mesh of the group.

7. Conclusion

This paper presents number of multicast routing protocols for Mobile ad-hoc networks. Multicast routing is extremely important component of communication protocols in mobile ad-hoc networks. This study review typical tree or mesh based multicast routing protocols and their characteristics. It is basically used for IP-based networking technology for self-organizing wireless networks.

REFERENCES

1. Anuratha Banerjee,Paramartha Dutta, "A Survey of Multicast Routing Protocols for MANETS", International Journal of Engineering Science And Technology, Volume:1,2(10)/2010. | 2. Fawad Alikhan, Muhammad Atif, "An Overview about Standards, Protocols, Architecture and Applications of MANETs", International Journal of Computer Science and Telecommunications. Volume: 3, Issue: 6, June/ 2012. | 3. Ranjeet, Ankur Mishra, "Survey of Energy efficient Multicast Routing Protocolsin MANETs", International Journal of Computer Science and Electronics Engineering, Volume:1, Issue:5/ 2012. | 4. G.Viyaya Kumar, Dr.M.N.Nagendra, "Current Research on Routing Protocols for MANETS", International Journal of Computer Science and Engineering, Volume: 2, No:3/2010. | 5. Kristofer S.J.Pister, Lance "TSMP: Time Synchronized Mesh Protocol" Proceedings of the IASTED International Symposium Distributed Sensor Networks. Number 16-18, 2008. | 6. Oznur Ozkasap, Emre Atsan"Epidemic-based reliable and adaptive multicast for mobile ad-hoc networks", Journal homepage:www.elsevier.com/locate/comnet, February 2009. | 7. Technical overview of TSMP by Dust Networks, 26 June 2006. | 8. C.S .Siva Ram Murthy, B.S. Manoj, Ad-hoc wireless Networks: Architecture and Protocols, Pearson Education. | 9. Dewan Tanvir Ahamed, "Multicasting in Ad-hoc Networks", Wireless Ad Hoc Networking, CSI15140F-2005 | 10. Pravin Ghosekar, Grish Katkar, Dr. Pradip, "Mobile Ad-hoc Networking: Imperatives and Challenges", IJCA Special Issue on "Mobile Ad-hoc Networks" MANETs, 2010. | 11. Sudip Mishra, Issac, Subhas "Guide to Wireless Ad Hoc Networks" Springer, 2009. | 12. Luo Junhai, Xue Liu, Ye Danxia "Research on multicast routing protocols for mobilr ad-hoc networks", WWW.sciencedirect.com/Computer Networks-2008. | 13.A.Ibrahim, MHashem, F Amer "An Enhanced Reliable Ad-Hoc Multing Protocol", | 14. Aaron striegel, G.Manimaran, "A Survey of Qos Multicasting Issues". | 15. "List if Ad-Hoc Routing Protocols", Wikipedia.