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Paper 24

A SURVEY ON VARIOUS MULTICAST ROUTING PROTOCOLS WITH ANDWITHOUT CROSS LAYER TECHNIQUES IN MANET

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Abstract:
MANET is the wireless, infrastructure-less, continuously self-configuring network which plays an important role in the point-to-point communication and multipoint communication. Since unicast routing suffers from certain drawbacks, the Multicast Routing is introduced for the efficient and secured communication but it does not guarantee QoS. The Cross-Layer Multicast Routing is later introduced to increase the Quality of Services and for the effective communication. By using the CLMR Protocols, we can elite the information from multiple layers and these can also be used to increase the performance of overall network. The CLMR uses several protocols which will increase QoS and increase the signal strength when compared to the nCLMR. This paper presents the survey based on various multicast routing protocols with cross layer and without cross layer techniques in MANET.

Keywords: MANET, communication, multicast, QoS, Cross- Layer

1 Introduction

Mobile Ad hoc Network (MANET) is a collection of wireless mobile nodes that form a network dynamically without any support of central administration. It is self- organized network as it does not depends upon any infrastructure. Each device connected must forward traffic unrelated to its own use, and therefore be a router. If the network topology is changed, then their routing tables will also change. The mobile nodes can directly communicate with each other. And also some intermediate nodes are used to route the packets. The mobile ad-hoc networks are fully distributed and robust. Wireless applications, where sharing of information is mandatory, like Personal area networking, Military environments, Civilian environments and Emergency operations require rapid deployable and quick adoptable routing protocols, due to these reasons there are needs for mobile ad hoc network. MANETs are very flexible and can be established quickly and easily using low cost equipments.

MANET nodes are free to move in bidirectional and they move with the unpredictable time. In general two types of communications can be considered in classical MANETs, broadcast communications and multi-hop communications via routing protocols. Mobile Ad Hoc Networks are further

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classified into three types. Vehicular Ad hoc Network (VANET), a subclass of mobile *Ad Hoc* network is a technology that uses moving cars as nodes in a network to create a mobile network. VANET enables effective communication with another vehicle or roadside equipments and responsible for smooth and secure vehicle behaviour across the roads.SPANs which stands for Smartphone Based Mobile Ad-Hoc Network which is the type MANET used across mobile phone devices by creating peer-to-peer network through the help of Wi-Fi and Bluetooth Technology.

2 Literature Review

Alaa Azmi Allahham and Muamer N. Mohammed, their study based on "Multipath Routing Protocol Based on Cross-Layer Approach for MANET". Their work shows that the results show that the enhanced algorithm gives results better than the standard algorithm in terms of the routing traffic, delay. The constant motion of the nodes is one of the key challenges faced by MANET networks. The negative effects of not dealing with this challenge, such as: High consumption of bandwidth, overhead, delay and latency.

Qilin Wu, Xianzhong Zhou, Fangzhen Ge their study based on "A cross-layer protocol for exploiting cooperative diversity in multi-hop wireless ad hoc networks". Their work shows that the Medium access control (MAC) and routing enabled cross-layer cooperative transmission (MACR-CCT) scheme uses the MAC and routing layer data for interference management. On the basis of intermediate distance and gain, relays are selected to forward the packets to multiple receivers. As compared to IEEE-802.11, CoopMAC, Reco-MAC, it supports delayed transmission with less error over a given range.

Deepika Vodnala, Dr. S. Phani Kumar, Srinivas Aluvala, their study based on "Analysis study on various Multicast Routing Protocols in MANET". Their work shows that all multicast routing protocol tries to solve some problems, all of these routing protocols has their own advantage and disadvantages too. There is no any protocol founded yet that
can be solving all ad-hoc network problems. Therefore, there are many issues in multicast routing protocol that can be discussed to develop the protocols to perform better multicasting in the future.

Lin Zhang, Zhao Wang,Ming Xiao, Gang Wu Shaoqian Li, their study based on C"entralized caching in two-layer networks: Algorithms and limits". Their work shows that Cross-layer caching is a hybrid method which offers variable storage buffer for multiple receivers. The joint coaching method is used to determine the cache data over multiple layers. Acceptable level of cache gain rate is maintained for multiple users.

3. Review on Existing Protocol

3.1 PIM

Protocol Independent Multicast (PIM) distributes the multicast data using routes gathered by other protocols. PIM, which is a multicast routing protocol can use two information bases that are underlying unicast routing information base or a separate multicast-capable routing information base. It builds unidirectional shared trees rooted at a Rendezvous Point (RP) per group, and it will optionally creates shortest path trees per source. A PIM implementation is free to hold whatever internal state it requires and will still be conformant with this specification so long as it results in the same externally visible protocol behavior as an

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abstract router. PIM has two tasks: To ensure that traffic from sources outside the PIM domain reaches receivers inside the domain. To ensure that traffic from sources inside the PIM domain reaches receivers outside the domain.

3.2 AMRIS

AMRIS is an on-demand protocol. To support multiple senders and receivers within a multicast session AMRIS construct a shared delivery tree. AMRIS is different compared to other protocols because each participant in the multicast session has a session-specific multicast session member id**.** AMRIS maintains *a* Neighbour-Status table which stores the list of existing neighbours and their multicast session member ids. Each node sends a periodic beacon to signal their presence to neighbouring nodes. AMRIS is designed to operate independently of underlying unicast protocols. AMRIS does not depends on the unicast routing protocol to provide routing information to other nodes.

3.3 ODMRP

On- Demand Multicast routing protocol (ODMRP) is a mesh based source-initiated protocol. It uses forwarding group concept and multiple paths exist between sender and receiver. It applies on-demand procedures to build route and maintain multicast group membership dynamically. By maintaining a mesh, instead of a tree, the drawbacks of multicast trees in ad hoc networks like frequent tree reconfiguration and non-shortest path in a shared tree are avoided. In ODMRP, group membership and multicast routes are established by the source on-demand. When a multicast source has packets to send but no route to the multicast group, it broadcasts a Join-Query control packet to the entire network. This control packet is periodically broadcast to refresh the membership information and updates routes.

3.4 PUMA

Puma is a receiver initiated routing protocol in which receivers join a multicast group using special address.The flooding of data or control packets is reduced using special address by all sources. Distributed algorithm is used to elect core among receivers of a multicast group. Multicast announcement acts as a single control message to perform all tasks in PUMA. In PUMA, core is responsible for creation and maintenance of mesh and forwarding the data packets. If the core node fails, core election takes place among the receivers. During the core election, energy of the receiver node is not considered.

3.5 MAODV

Multicast Ad-hoc On-Demand Distance Vector protocol is the extension to the Ad -hoc On-Demand Distance vector protocol. It has the capability of unicasting and as well as broadcasting. It can route the information using multicast routing. When a node wishes to join a multicast group then it originates a route request (RREQ) message and also if the node has some data to send to the group but it does not have a route to that group then also it does the same thing. Only the members of the multicast group respond to join RREQ.

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Comparison of Existing Protocol:

PROTOCOL	MULTICAST TOPOLOGY	LOOP FREE	DEPENDENCE OF UNICAST	QOS	PERIODIC MESSAGE
MAODV	Tree	Y	Yes	No	Yes
PIM	Tree	Y	No	No	Yes
AMRIS	Tree	Y	No	No	Yes
ODMRP	Tree	Y	No	No	Yes
PUMA	Mesh	Y	Yes	No	Yes

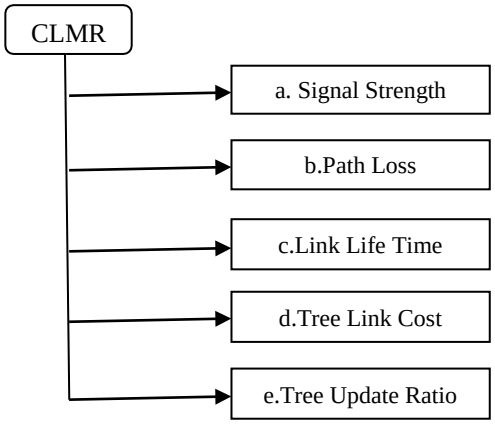
4. Cross Layer

The Cross Layer is the technique where information sharing takes place between nonadjacent layers to optimize the overall performance of the network. By using the cross- layer interaction between layers many QoS parameters like energy, security, tree management cost and various control overhead can be optimized for improved performance. Cross-layer can be used to optimize the power for wireless links in such a way that maximum transmission range can be ensured.

Multicasting can reduce the communication cost. Cost of Tree-based routing operations is more expensive as compared to mesh- based operations due to complex multicast tree management iterations which consume multiple resources at the same time. Cross-layer multicast which can support the optimal tree operations w.r.t network resources as well as performance to meet QoSThe Cross Layer design is used to improve the QoS by reducing tree management cost and optimizing tree operations.

4.1 Cross-layer Multicast aware Routing (CLMR)

Cross-layer Multicast Link aware Routing (CLMR) exploits the information from PHY layer, Application, and Routing layer, to form a multicast group with the consideration of the following parameters:



a) Signal strength: If a non-member node wants to join the group, then it should have a better quality of signal strength which can be derived as:

Ss = (St *G)/dn * Pl, Where Ss : Signal Strength, St : Packet transmitted with t signal strength, dn : Distance between receiver node and the sender node.

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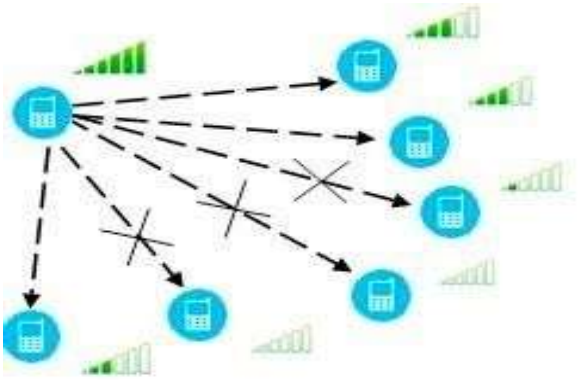
b) Path loss: Path loss (PL) in wireless communication is a reduction in the power of a link. It is derived as:
PL = 20Log10(d) + 20Log10(f) + 32.44 -
G(Tx,Rx), Where G: Gain, d : Distance from the transmitter, f: Signal Frequency, Tx: Gain by transmitter antenna, Rx: Gain by receiver antenna.

c) Link Life Time: It is defined as the maximum lifetime of the wireless link until a link breaks for a particular node.
Link Stability Factor (LSF) can be defined as: LSF = ∑Link - failure /∑Ti, Where Ti is time interval.
d) Tree Link cost (TLC): Tree Link cost (TLC) is the cost which is required to maintain a tree link and it can be derived as,
TLC = (rB + rq B) / LC, Where rB : the amount of bandwidth currently in use by existing connections, rq B : the amount of bandwidth requested by the newly arriving group of participants, Link Capacity (LC): total bandwidth of the link.

e) Tree Update Ratio (Tur): It can be defined as the number of tree updates over a specific interval due to the Tree management Operations. It is derived as
∑ Tur = ∑ Ntu / ∑Ti, Where Tur: tree updates ratio, Ntu: no. of tree updates, Ti: time interval .



Comparison of Non-Cross Layer with Cross Layer:

PROPERTIES	**nCLMR**	**CLMR**
Throughput analysis	Less Efficient	More Efficient
Packet Delivery Ratio	Very Less	More
Routing Load	More	Less
End-To-End Delay	High	Low
Energy Consumption	High	Low
Tree Management Cost	More	Less
Mean Data Delay	High	Low

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6. Conclusion

In this paper we can see that MAODV performed well using CLMR scheme which can be extended for other multicast routing protocols. CLMR builds the group using member nodes which have higher signal strength and energy level. MAODV without CLMR is less efficient in terms of throughput and Packet Delivery Ratio while with CLMR scheme its throughput and has increased up to a significant level. The Mean Data Delay, Energy Consumption, Tree Update Ratio, End To End Delay of MAODV, in case of nCLMR, it is higher as compared to CLMR. Without using CLMR, MAODV could not perform well and it has a less throughput and PDR due to extra control overhead. CLMR reduces the extra control overhead as well as the tree management cost thus results in improved QoS. Finally, it can be concluded that MAODV performed well using CLMR scheme which can be extended for other multicast routing protocols.

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