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A Survey on Infrastructure less Multicasting Routing Protocols in Mobile Adhoc Networks

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Abstract

A Mobile Ad hoc Networks (MANET) is a collection of wireless mobile nodes forming a temporary network without using any existing infrastructure. Mobile Ad-hoc Network (MANET) routing protocols facilitate the creation of such networks without centralized infrastructure. Hence, routing paths in mobile ad hoc networks potentially contain multiple hops, and every node in mobile ad hoc networks has the responsibility to act as a router. This paper is a survey of infrastructure less multicasting routing protocols in mobile adhoc networks. Ad-hoc On-Demand Distance Vector Routing (AODV) protocol is capable of unicast, broadcast, and multicast communication. Unicast and multicast routes are discovered on- demand and use a broadcast route discovery mechanism. The core assisted mesh protocol is introduced for internet multicasting. CAMP use cores only to limit the traffic needed for a router to join a multicast group. ODMRP is a mesh-based, rather than a conventional tree-based, multicast scheme and uses a forwarding group concept; only a subset of nodes forwards the multicast packets via scoped flooding. It applies on-demand procedures to dynamically build routes and maintain multicast group membership. PUMA-Protocol for Unified Multicasting through Announcements is another mesh-based multicast protocol. The protocol uses a single control message, a multicast announcement that is exchanged periodically by each network node. One of the purposes of multicast announcements is to elect a core member for the group and to ensure that all nodes in the network have a path to the core.

Keywords: MANET, MAODV, CAMP, AMRIS, PUMA..

Introduction

In ad hoc wireless network nodes often changes with in the network locations. But some routes generates unnecessary routes in network, this may cause the network routing load. Most of wired network links rely on the symmetric are always fixed. But in ad-hoc wireless network nodes are changes there positions frequently with in network. Means when sources want to send a packet to destination, mediator will not checks for any quality signals, it just forwards packets. Interference is one the major problem in ad-hoc network. When links comes and go depends on the transmission characteristics, one transmission can over here to another and so this may be correct the total transmission. Another major problem of ad-hoc network is dynamic topology. In ad-hoc network topology is not constant. Mobile node characteristics changes when they movies in network location.

Infrastructure Less Multicasting Routing Protocols

A mobile ad hoc network lacks a fixed infrastructure and has a dynamically changing topology. The nodes move freely and independently of one another. Ad hoc networks are heavily used in emergency situations where no infrastructure is available, for eg. battlefields, disaster mitigation etc.

(Corson et al., 1999) Design of multicast routing protocol is difficult due to the inherent uncertainty and unpredictable dynamism. Several multicast protocols have been proposed for mobile ad hoc networks. Based on the network structure along which multicast packets are delivered to multiple receivers, multicast protocols can be broadly categorized into two types, namely tree-based multicast and mesh based multicast. The tree structure is known for its efficiency in utilizing the network resource optimally, while tree based protocols are generally more efficient in terms of data transmission. Mesh based protocols are more robust against topology changes due to availability of many

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redundant paths between mobile nodes and result in high packet delivery ratio. On the other hand, multicast mesh does not perform well in terms of energy efficiency because mesh-based protocols depend on broadcast flooding within the mesh and therefore, involving many more forwarding nodes than multicast trees.

A multicast packet is delivered to all the receivers belong to a group along a network structure such as tree or mesh, which is constructed once a multicast group is formed. However, due to node mobility the network structure is fragile and thus, the multicast packet may not be delivered to some members. To compensate this problem and to improve the packet delivery ratio, multicast protocols for ad hoc networks usually employ control packets to periodically refresh the network structure.

Following are the protocols to cope with multicast in ad-hoc networks

1. Multicast Ad hoc On-demand Distance vector protocol (MAODV)
2. Ad-hoc Multicast Routing (AMRoute)
3. Ad hoc Multicast Routing protocol (AMRIS)
4. Core Assisted Mesh Protocol (CAMP)
5. On Demand multicast routing protocol (ODMRP)
6. Protocol for Unified multicasting through Announcements (PUMA)

Multicast Ad hoc On-demand Distance vector protocol (MAODV)

MAODV is an extension of AODV (Ad-hoc On-demand Distance Vector) and maintains a multicast tree structure. In MAODV, if a new node wants to be a member of a multicast group, it sends Join Request packet to the network. The multicast member that is nearest to the new node replies with the Join Reply packet and adds its entry in the routing table. Group Hello messages are broadcasted on periodic basis to check for connectivity of the tree structure which increases the control overhead due to route query flooding packets to maintain routes. If there is any link breakage, then it is repaired by the downstream node that broadcast a route request message.

The Multicast operation of Ad-hoc On-demand Distance Vector (Royer et al., 1999) is a reactive tree-based multicast routing protocol. Using MAODV, all nodes in the network maintain local connectivity by broadcasting “Hello” messages with TTL set to one. Every node maintains three tables, a Routing Table (RT), a Multicast Routing Table (MRT) and a Request Table. RT stores routing information and has the same function as in AODV. Each entry in MRT contains the multicast group IP address, the multicast group leader’s IP address, the multicast group sequence number, the hop count to multicast group leader, the hop count to next multicast group member, and the next hops. The next hops field comprises interface and IP address of next hop, the link direction and the activated flag indicating whether the link is added into the multicast tree. Each entry of the Request Table stores the IP addresses of a node, which has sent a request, and the IP address of the requested multicast group.

Ad-hoc Multicast Routing (AMRoute)

The Ad-hoc Multicast Routing (Liu,2000) is a tree based multicast routing protocol for mobile ad hoc networks. AMRoute relies on the existence of an underlying unicast routing protocol. AMRoute has two key phases: mesh creation and tree creation. This protocol can be used for networks in which only a set of nodes supports AMRoute routing function. Using AMRoute, bi- directional unicast tunnels are continuously created between pairs of group numbers that are close together. In contrast to the multicast group members, some nodes for tunnel construction don’t support AMRoute. When send a packet to a logically adjacent member, the packet will be physically sent on a unicast tunnel and may pass through many routers. The unicast tunnels form a mesh for each multicast group. AMRoute constructs a multicast distribution tree periodically for each multicast group based on the mesh links available. The group members forward and replicate multicast traffic along the branches of the virtual tree.

Ad hoc Multicast Routing protocol(AMRIS)

The AMRIS (Wu et al., 1999) is a proactive shared tree based multicast routing protocol, which is independent of the underlying unicast routing protocol. The unique feature of AMRIS is that to each node in the multicast session a session specific multicast session member id (msm-id) is assigned. The msm-id provides a heuristic height to a node and the ranking order of msm-id numbers directs the flow of datagrams in the multicast delivery tree. Every node calculates its msm-id during the initialization phase, which is initiated by a special node called Sid. Normally, the Sid is the source node if there is only one source for the session. Otherwise, the Sid is the source node that has the minimum msm-id. The sid broadcasts a NEW_SESSION message to its neighbors. The NEW_SESSION message comprises the Sid’s msm-id, the multicast session id, and the routing metrics. After receiving the NEW_SESSION

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message, a node calculates its own msm-id, which is larger than the one specified in the NEW_SESSION message, but the msm-ids are not consecutive. Before re-broadcast the NEW_SESSION message again, a receiver replace the msm-id field with its own msm-id and the routing metrics of the message. A random jitter is introduced between the reception and rebroadcast of a NEW_SESSION message to prevent broadcast storms.

Core Assisted Mesh Protocol (CAMP)

The Core-Assisted Mesh protocol (Garcia et al.,1999) is a proactive multicast routing protocol based on shared meshes. The mesh structure provides at least one path from each source to each receiver in the multicast group. CAMP relies on an underlying unicast protocol which can provide correct distances to all destinations within finite time. Every node maintains a Routing Table (RT) that is created by the underlying unicast routing protocol. CAMP modifies this table when a multicast group joins or leaves the network. A Multicast Routing Table (MRT) is based on the Routing Table that contains the set of known groups. Moreover, all member nodes maintain a set of caches that contain previously seen data packet information and unacknowledged membership requests.

CAMP classifies nodes in the network as duplex or simplex members, or non-members. Duplex members are full members of the multicast mesh, while simplex members are used to create one-way connections between senders only nodes and the rest of the multicast mesh. Unlike CBT, in which all traffic flows through core nodes, the core nodes in CAMP are used to limit the control traffic when receivers are joining multicast groups.

The creation and maintenance of meshes are main parts of CAMP. A receiver-initiated method is used in the mesh creation procedure. When a node wants to join a multicast mesh, firstly it consults a table to determine whether it has neighbors that are already members of the mesh. If so, the node announces its membership via a CAMP UPDATE. If it does not have such a neighbor, it either propagates a JOIN REQUEST towards one of the multicast group "cores", or attempts to reach a group member by broadcasting requests using an expanding ring search algorithm. Any duplex member of the multicast group can respond to the request with a JOIN ACK, which is propagated back to the request sender.

Protocol for Unified multicasting through Announcements (PUMA)

The objective of a multicast routing protocol for ad hoc environment is to support the transportation of information from a sender to multiple receivers in a group while trying to use the available bandwidth efficiently in the presence of frequent topology changes. The Protocol for Unified Multicasting through Accouchements (PUMA) establishes and maintains a shared mesh for each multicast group without depending upon a unicast routing protocol (Ravindra et al.,2004).

In PUMA, any source can send multicast data to a multicast group without having to knowing the constituent members of the group. Moreover source does not require joining the group to dispatch the data. PUMA is a receiver initiative approach where receivers join the multicast group using the address of a special core node without the need for flooding of control packets from the source of the group. It makes the use of dynamic cores (not pre assigned).

When a receiver wishes to join a multicast group, it first determines whether it has received a multicast announcement for that group before. If the node knows the core, it starts transmitting multicast announcements and specifies the same core for the group. Otherwise it considers itself the core of the group and starts transmitting multicast announcements periodically to its neighbors stating itself as the core of the group. Node propagates multicast announcements based on the best multicast announcements it receives from its neighbors. A multicast announcement with higher core ID nullifies the announcement of a lower core ID. So, each connected component has only one core. If more than one receiver joins the group simultaneously, then the one with the highest ID becomes the core of the group.

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	ODMRP	MAODV	CAMP	AMRIS	PUMA
N/w topology	Mesh	Tree	Mesh	Tree	Mesh
Initialization Approach by	source	source	source & receiver	source	Receiver
Maintenance Approach	Soft State	Hard State	Hard State	Soft State	Soft State
Dependency	No	Yes	Yes	No	No
Loop Free	Yes	Yes	Yes	Yes	Yes
Flooding of control packets	Yes	Yes	No	No	No
Independent Routing Prot.	Yes	Yes	No	No	Yes
Periodic Control Msgs	Yes	Yes	No	Yes	Yes

Comparision of Infrastructure Less Based Protocols

Conclusion

This paper, presents a general view of infrastructure less multicasting routing protocols in mobile ad-hoc networks. Any multicast routing protocol in MANETs tries to overcome some difficult problems which can be categorized under basic issues or considerations. In this paper a number of infrastructures less routing protocols are categorized. All protocols have their own advantages and disadvantages. Multicast tree-based routing protocols are efficient and satisfy scalability issue, they have several drawbacks in ad hoc wireless networks due to mobile nature of nodes that participate during multicast session. At last we have find out the comparison of infrastructure less multicasting routing protocols.

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