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ASSESSMENT AND EVALUATION OF ENHANCED MULTICAST ROUTING MECHANISM FOR EVOLVING NETWORK TOPOLOGIES

M. Rakesh Chowdary*, N. Abhishek & A. Yashwanth Reddy*****
Assistant Professor, Department of Computer Science and Engineering, Sree Dattha Group of Institutions, Hyderabad, Telangana

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Abstract:

Routing protocols of mobile ad-hoc network tend to need different approaches from existing Internet protocols, since most of the existing Internet protocols were designed to support routing in a network with fixed structure. In the academic and industrial world, those who think about such things have written quite a few papers proposing various routing solutions for mobile ad-hoc networks. In most wireless networking environments in productive use today the users devices communicate either via some networking infrastructure in the form of base stations and a backbone network, or directly with their intended communication partner, e.g. using 802.11 in ad hoc networks. In the proposed work, the evaluation of the distributed island multicast Protocol with AODV for news broadcasting and software distribution often has a large number of users is to be simulated and compared with CIM. It requires scalable and distributed solutions for data delivery. In DIM, hosts in the same island elect a unique leader. All leaders form an overlay tree. Based on the leader tree, leaders select bridge-nodes for their islands and construct a delivery overlay in distributed manner.

Key Words: Networks, Broadcasting & Software Distribution.

1. Introduction

Early works on combining IP multicast and unicast focus on setting up tunnels to MBone and uses dedicated servers (e.g., gateways and relays) to set up tunnels (Sivajothi, E., et al., 2015). But these tunneling mechanisms focus on the connection between a pair of hosts and do not consider data distribution among a set of session hosts. Subset multicast (SM) also makes use of local multicast capability (Buvana, M., et al., 2015). In SM, the source sends a copy of data to each of the multicast islands. The host in an island that receives data from the source then multicasts data within the island. Clearly, each island is connected to the source via unicast. This is not scalable to large sessions with many islands.

In HMTP, each island has a unique leader (called a designated member) (Vijayakumaran, C. and T. Adiline Macriga, 2015). Designated members form an overlay tree for data distribution. Each designated member also IP multicasts data within its island. While this approach imposes the responsibilities of data receiving, data forwarding and island management on a single leader in each island, a leader has high nodal stress and heavy workload. Furthermore, when islands are large (e.g., the whole MBone can be a single island), it is not efficient to represent each island by a single leader, where end-to-end delay depends on leader locations and selection of appropriate leaders is not easy. Also noticing the limitations of HMTP, the authors of HMTP further propose universal multicast (UM) to allow multiple designated members in one island (Upendran and R. Dhanapal, 2015). In the approach, a designated member multicast its Heart-Beat messages with a certain time-to-live value so that the messages reach only a subset of the island members. Island members that do not receive Heart-Beat messages then assume that their designated member has left and automatically elect a new designated member. In this way, an island can have multiple designated members. Most recently, the scalable island multicast (SIM) protocol (Xing Jin, et al., 2009; Vaishnavi, R., et al., 2015), as a distributed protocol, allow distributed host joining and island management. It use two multicast groups (i.e., DATA and CONTROL groups) for a session. In SIM, hosts first form an overlay tree. Based on the tree, each island identifies its egress and further elects an ingress. A network application may select a proper protocol according to its system requirement. Preliminary works on CIM and DIM have been partially about basic concepts and performance issues of CIM and DIM, respectively [1-7].

2. Methodology:

In the proposed work, the evaluation of the distributed island multicast Protocol with AODV for news broadcasting and software distribution often has a large number of users is to be simulated and compared with CIM (SRB Prabhu, S. Sophia, 2013; Heinzelman, W.B., et al., 2002). It requires scalable and distributed solutions for data delivery. In DIM, hosts in the same island elect a unique leader.

All leaders form an overlay tree. Based on the leader tree, leaders select bridge-nodes for their islands in distributed manner and construct a delivery overlay (Saravanan, S., RM. Chandrasekaran, 2015). Applications such as multiparty conferencing often involve a small number of users and consume much network bandwidth. As the session size is not large, we can use a central server to collect all host information. With global information at hand, the server can build a bandwidth-efficient tree. As each user may be the source of data flows, we consider building a shared tree for all users. Therefore, CIM relies on a central server to compute a delivery tree spanning all users. When the tree is computed, the tree structure is distributed to all users. Note that in the tree, an edge between two members within the same island represents the logical relationship for fault recovery and tree maintenance, not the actual data flow. Each tree has a unique version number, which avoids clashing and routing loops with previous trees (Thaler, D., et al., 2004). Each session has a unique class-D IP address for IP multicast. A joining host first detects the existence of the island by sending an Island Detection message to the class-D address. An island member receiving the message, if any, replies with an Island Detection Reply message consisting of its host ID to the same multicast address (using IP-multicast). The joining host then knows members of its island. If no reply is received after a few trials, the joining host concludes that there are members in its island. Afterwards, the joining host sends a Join Session message consisting of the IDs of its island members (if any) to the server.

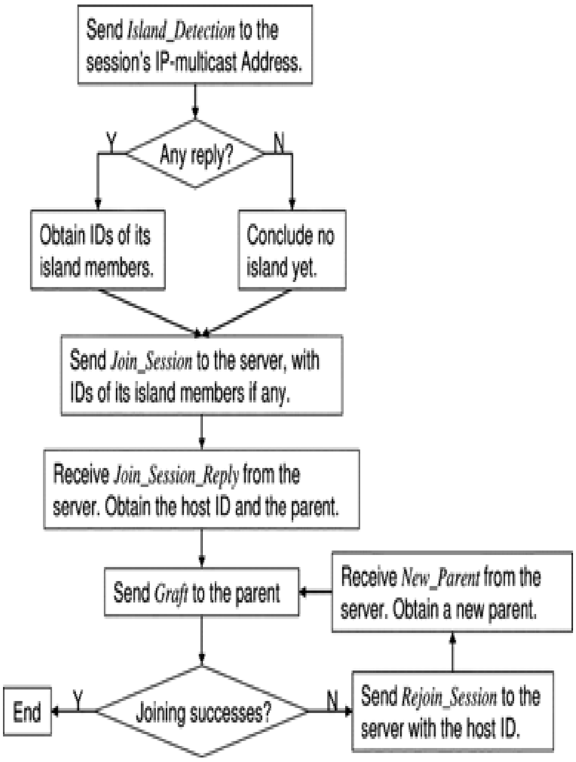

Figure 1: Host joining in CIM

The server then replies with a Join Session Reply message which consists of a unique ID for the joining host and the designated parent. The joining host then sends a Graft message to the designated parent. The parent may reject the request if it is overloaded. If this occurs, the joining host sends a Rejoin Session message consisting of its host ID to the server. Upon receiving the message, the server designates a new parent for it by a New Parent message. In order to continuously improve tree performance, the controller, based on round-trip time (RTT) measurements reported by members, periodically runs a minimum spanning tree algorithm (Modified MST-Prim algorithm). To avoid overloading of some nodes, we impose an adjustable application-dependent degree limit on all nodes during the tree construction. If the application requires high bandwidth, the degree limit should be set low (so that link bandwidth is shared with fewer members). The consequent spanning tree then would be sub-optimal in cost but more load-balanced. The edge between nodes of different islands is assigned a weight equal to their estimated RTT (infinity if unknown). All other edges (i.e. within the same island) are assigned weight -1. In this way, nodes within the same island are joined together as a tree. Note that within the same island, an edge between two nodes does not indicate the forwarding path of data packets; data packets are forwarded according to IP multicast. These edges only imply parent-child logical relationship, which are for tree maintenance and fault recovery purposes only. The edges spanning across islands, however, do indicate packet forwarding paths (Sivaranjini, T., et al., 2015; SRB Prabhu, S. Sophia, 2011). The example of a tree with four islands in Figure 4.2 The intra-island tree edges, as indicated by the dashed lines, are not used for data delivery. Instead, data are multicast within islands. Between different islands, packets are forwarded along tree edges via unicast, as indicated by the solid lines [8-11]. A leaving host sends a Leave Session message to the server, which accordingly fixes tree partition by assigning a new parent to each of the leaving host's tree neighbors. That is, the server sends a New Parent message to each of the host's tree neighbors, which then sends a Graft message to the new parent. After reconstructing the tree, the server sends a Leave Session Reply message to the leaving host. The leaving host then stops forwarding data packets and leaves the session (Park, J., et al., 2001).

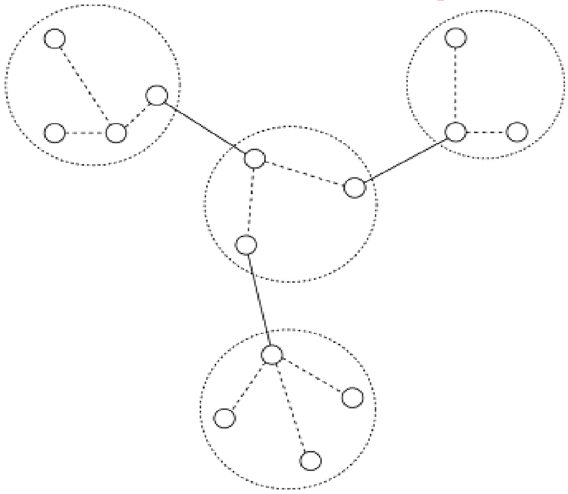

Figure 2: Example of a tree

The controller computes a new tree periodically (e.g., every 30 seconds). If its total RTT as compared to the old tree reduces to a certain threshold, the new tree is adopted; otherwise, the newly computed tree is rejected. If the new tree is adopted, the controller informs each of the nodes of its new parent and children via a NEW PARENT message. The use of the threshold reduces tree instability and the associated overhead caused by frequent tree re-configurations (Figure 1).

Neighbor Monitoring: In order to obtain updated RTT between hosts, the server periodically generates a neighbor list for each host. Upon receiving the list, a host pings peers in the list to either obtain the RTT between them or identify some failed hosts. Hosts then report the measurement results to the server. Each host also periodically pings its parent and children. Upon detecting the failure of its parent, a host requests a new parent from the server by a Rejoin Session message. To reduce overhead, the server limits the length of the neighbor list. The frequency of sending lists from the server is set inversely proportional to the session size in order to achieve high scalability. When generating the neighbor list, the server prefers those with unknown or old RTT values (Figure 2). The server also removes unresponsive hosts from its tree computation.

Parent Selection: In choosing the new parent for a node, the controller favors nodes with the following properties: 1) In the same island - the controller would try to choose a node that is in the same island. Choosing a new parent in another island means a separate unicast stream. Furthermore, a node in another island is often farther. 2) High responsiveness to ping messages - this is because a node not responsive to ping messages suggests that it is busy or overloaded. 3) Low nodal degree - a node with a low nodal degree is preferable as forwarding load would be more evenly distributed among all nodes.

3. Distributed Island Multicast with AODV:

3.1 Distributed Island Multicast: While CIM can quickly build a delivery tree with low overhead, it relies on a central server for tree construction and maintenance. The server becomes the system bottleneck and forms a single point of failure. When the session size is large, the server is easily overloaded. On the other hand, applications such as news broadcasting, software distribution and media streaming often involve more than thousands of end users. We need to develop a scalable protocol for these applications. DIM is a fully distributed protocol for such purpose. It organizes hosts into a two-level hierarchy. The upper level contains inter-island connections, where a unicast-based overlay tree connects all islands. The lower level contains intra-island connections, where packets are delivered via IP multicast within islands. This two-level architecture guarantees that the whole delivery flow is loop-free. In order to set up inter-island connections, each island elects a unique leader. A pure overlay protocol runs on top of leaders. Given a pair of neighboring islands (i.e., their leaders are directly connected in the inter-island tree), one host is selected from each island and the two hosts form a pair of bridge-nodes. The connection between bridge-nodes, instead of the connection between leaders, is the actual data delivery path between islands. In this way, each island has only one ingress and may have no or some egresses. We require two class-D multicast addresses for each DIM session. One is used for multicasting data packets and the other is used for multicasting control messages. We call the groups corresponding to these two IP addresses a DATA group and a CONTROL group, respectively. Each host joins both groups. Packet forwarding rule at a host depends on the host role. The source or an ingress multicasts data packet to its DATA group. An egress forwards packets along its inter-island connection to the downstream island. The other hosts receive packets without forwarding. Note that a host may have multiple roles. For example, the source may also be an egress. In that case, it also forwards packets as an egress. A leader periodically multicasts Heart Beat messages to the CONTROL group. A leader also runs a bridge-node selection algorithm to select ingress and egress. A leader will play the roles of ingress and egress for its island if there is no ingress or egress in the island. For a host not in any multicast island, we consider that it forms an island only consisting of itself. It plays the roles of leader, ingress and egress for the island.

3.2 Host Joining and Leaving: When a host joins the session, it first joins the DATA and CONTROL groups. If there exists an island, the host will receive the island leader's Heart Beat messages from the CONTROL group. The joining process then ends, and the host can receive data from its leader. If the host does not receive any Heart Beat message, it forms an island only consisting of itself and becomes the island leader. The host then needs to further join the inter-island tree formed by leaders. This tree joining process depends on the used overlay protocol, which can be any existing overlay protocol. Afterwards, the host receives packets and forwards them according to the forwarding rules. Regarding host leaving, if the host is not a leader, it unicasts a Leave Session message to the leader and informs its leaving The leader then plays the roles of the leaving host, if any, for the time being. On the other hand, if a leader leaves, it multicasts a Leader Leave message to the CONTROL group and triggers the leader election process.

3.3 Leader Election: If the current leader fails (detected through the absence of its Heart Beat messages) or leaves the system (detected through the Leader Leave message), a new leader needs to be elected. The leader election process works as follows. When a host discovers that its leader is absent, it waits for a random time and sends a Leader Elect message with its local timestamp to the CONTROL group. On the other hand, if a host receives Leader Elect messages before sending its own Leader Elect message, the host does not send any message. If a host receives multiple Leader Elect messages, it selects the sender with the smallest timestamp as the leader. In this way, the host sending message with the smallest timestamp finally becomes the new leader.
In case of contention, the host with the lexically lowest IP address is selected as the leader. The new leader then advertises itself to the whole group. Note that we do not need to synchronize time at different hosts.

3.4 Bridge-Node Selection: Bridge-node selection is a periodical and distributed process for tree improvement. Individual Bridge-Node Selection: In individual selection, a bridge-node is selected independent of the other bridge-node in its neighboring island. An island leader periodically multicasts the list of current bridge-nodes to its island members through Heart Beat messages. Upon receiving the message, if a host finds that itself is a better bridge-node (based on the metrics discussed below) for some neighboring island, it sends a Candidate message to the CONTROL group after a random delay. The Candidate message contains a list of numerical values, each representing the cost (e.g., delay) of connecting to one neighboring island. Based on the received Heart Beat and Candidate messages, a host in the island can maintain a list of the best bridge-nodes to the neighboring islands. A host suppresses its Candidate message if it cannot improve any of the costs. Whenever a better bridge-node is found, the leader informs the corresponding neighboring island's leader about the new bridge-node.

3.5 Closest to Neighbor's Centroid (CNC): Suppose that hosts can obtain their network coordinates using tools like GNP or Vivaldi. In CNC method, an island selects, for each neighboring island, a bridge-node that is the closest to the centroid of the neighboring island. In detail, each host reports its network coordinates to the leader when joining the island. The leader can then compute the island centroid and periodically advertise it to the neighboring leaders. The hosts closest to the centroids of the neighboring islands are selected as bridge-nodes.

4. Conclusion:

The Internet today consists of multicast-capable "islands" interconnected by multicast-incapable routers. In order to enable global multicast and to achieve network efficiency, these islands should be interconnected by unicast connections while multicast capability should be used within an island. In this project, I have presented the design and simulation of a Distributed version of IM. In DIM where hosts can join islands in distributed fashion and form a delivery tree. The Simulation study is performed by using NS-2.27 simulator. The simulation results show that DIM protocol is efficient in terms of packet Delivery Ratio, end-to-end delay, energy consumed and Routing overhead for news broadcasting and software distribution applications compared with CIM.

5. References:

1. Mary Judith, A., V. Parthasarathy, L. Naga Durgaprasad Reddy and K. Devakumar, 2015. "Simulation of a Hexagonal Cluster for Energy Efficiency and Effective Data Transmission", Journal of Applied Sciences Research, 11(10): 48-54.
2. Thiagarajan, K., R. Satheesh Babu, K. Saranya, 2015."Construction of Network and (i, j) – Distance Graph", Journal of Applied Sciences Research, 11(14): 01-05.
3. Sivajothi, E., N. Vijayalakshmi, A. Swaminathan and P.Vivekanandan, 2015. "Low Energy Adaptive Clustering Hierarchy – Redundancy Aware protocol (LEACH-RA)", Advances in Natural and Applied Sciences, 9(13): 1-6.
4. Buvana, M., M. Suganthi, K. Muthumayil, 2015. "A Markov process Model for Load Requester in Mobile Ad hoc Networks", Advances in Natural and Applied Sciences, 9(13): 39-49.
5. Vijayakumaran, C. and T. Adiline Macriga, 2015. "An Integrated Intrusion Detection and Adaptive False Localization Techniques for MANETs", Advances in Natural and Applied Sciences, 9(8): 15-21.

6. Upendran and R. Dhanapal, 2015. “Firefly Algorithm based Secure and Energy Efficient Routing (FASER)”, Advances in Natural and Applied Sciences, 9(8): 29-35.
7. Radhika, P. and B. Babu, 2015. “Certain Investigations on Performance Parameters for A Multiple Access Channel In Communication Systems”, Journal of Applied Sciences Research, 11(23): 37-42.
8. Thamizhmaran, K. and A. Akshayadevi, 2015. “Survey on Cluster Head with Cluster Head Selection Techniques and algorithm for MANET”, Journal of Applied Sciences Research, 11(23): 43-46.
9. Sathish kumar, N. and C.G. Ravichandran, 2015. “Dynamic Priority Based Congestion Aware Routing for Wireless Sensor Networks”, Journal of Applied Sciences Research, 11(22): 50-55.
10. Xing Jin, Kan-Leung Cheng, and S.-H. Gary Chan, 2009. “Island Multicast: Combining IP Multicast With Overlay Data Distribution” IEEE transactions on multimedia, 11(5).
11. Vaishnavi, R., S. Mary Praveena, Ila Vennila, 2015. “Investigation of Passive Optical Network Based Fiber to the Home Architecture for Downstream Traffic”, Advances in Natural and Applied Sciences, 9(7): 13-20.