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HBH Multicast Distribution through Recursive Unicast Trees

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Abstract -- **IP Multicasting has been, and still is, an interesting research topic. The Internet is likely been organized with both unicast and multicast enabled networks. Thus utmost importance is given to design protocols that allow the progressive deployment of the multicast service by supporting unicast clouds. This paper gives HBH (hop-by-hop multicast routing protocol) through Recursive Unicast Tree (REUNITE). HBH adopts the source-specific channel abstraction to simplify address allocation and implements data distribution using recursive unicast trees, which allow the transparent support of unicast- only routers. An important original feature of HBH is its tree construction algorithm that takes into account the unicast routing asymmetries. Since most multicast routing protocols rely on the unicast infrastructure, the unicast asymmetries impact the structure of the multicast trees. This paper shows that HBH can be recursively deployed and that with a small fraction of HBH-enabled routers in the network HBH outperforms application-layer multicast. The main motivation of the Hop-By-Hop multicast routing protocol (HBH) is to transparently support unicast routers.**

Keywords - REUNITE, Multicast, Routing, Multicast, Forward Table (MFT), Multicast Control Table (MCT).

I. INTRODUCTION

A computer network is a collection of hardware components and computers interconnected by communication channels that allow sharing of resources and information. Multicast is the delivery of a message or information to a group of destination computers simultaneously in a single transmission from the source. Copies are automatically created in other network elements, such as routers, but only when the topology of the network requires it. IP Multicast is a technique for one-to-many communication over an Internet Protocol (IP) infrastructure in a network. It scales to a larger receiver population by not requiring prior knowledge of whom or how many receivers there are. Multicast uses network infrastructure efficiently by requiring the source to send a packet only once, even if it needs to be delivered to a large number of receivers. The nodes in the network take care of replicating the packet to reach multiple receivers only when necessary. The IP Multicast architecture is completed by group addressing and routing protocols. A multicast group is identified by a class-D IP address which is not related to any topological Information, as interface, because only a few routers are branching nodes.The key idea of REUNITE is to separate multicast routing information in two tables: a Multicast Control Table (MCT), which is stored in the control plane, and a Multicast Forwarding Table (MFT), which is installed in the data plane. Nonbranching routers simply keep group information in their MCT; whereas branching nodes keep MFT entries which are used to recursively create packet copies to reach all group members. REUNITE identifies a conversation by a <S, P> pair, where S is the unicast address of the source and P is a port number. Class-D IP addresses are not used. As receivers join the group REUNITE populates its tables to construct the distribution tree, using two control messages join and tree. Join messages travel upstream from the receivers to the source, whereas messages are periodically multicast by the source to refresh the soft-state of the tree. Only the branching nodes for the group <S1, P1> keep entries in their MFTs. The control table, MCT, is exclusively used for tree construction, not for packet forwarding. Nonbranching routers in the<S1, P1> tree have MCT entries for <S1, P1> but no MFT entry. state is difficult to aggregate. opposed to the hierarchical unicast addressing model. Therefore, multicast address allocation is complex, and multicast forwarding. As a consequence, the Internet is likely to be organized with both unicast- and multicast-enabled networks. Therefore, it is of utmost importance to design protocols that allows the progressive deployment of the multicast service by supporting unicast clouds. This paper is organized as follows. Section II presents the related work, motivations, and basic ideas of HBH, Section III describes the REUNITE, and Section IV presents the HBH Multicast Distribution through REUNITE, Section V describes the implementation and results, Section VI concludes the paper.

II. RECURSIVE UNICAST TREES (REUNITE)

REUNITE[2] implements multicast distribution based on the unicast routing infrastructure. The basic motivation of REUNITE is that, in typical multicast trees, the majority of routers simply forward packets from one incoming interface to only one outgoing

Currently, there is no scalable solution to inter-domain multicast routing. ISPs (Internet Service Providers) have interest in multicast to face the increasing demand for network resources and content distribution

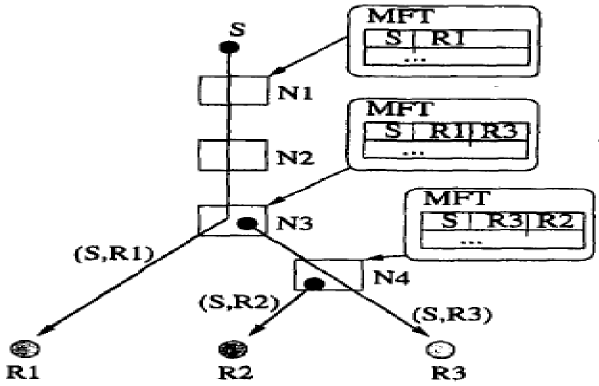


Fig. 1. Packet forwarding in REUNITE.

(Packets are sent via unicast and replicated at branching points) The key idea of the REUNITE protocol is to use *recursive unicast* to implement multicast service. For each group, REUNITE" builds a delivery tree rooted at a specially designated node called *root.*

Every branching node of the tree maintains a list of receivers' addresses. A receiver *R* is said to have joined the multicast tree at node *N* if *R's* address is maintained at *N*. In REUNITE, a receiver's address is maintained at exactly one node in the group's delivery tree. To multicast a packet, the root sends a copy of the packet to each receiver in its list. Similarly, when a branching node forwards such a packet, it sends a copy of the packet to each receiver in its own list. This procedure continues recursively until packets reach all leaf nodes of the tree, i.e., all receivers. Consider the example in Figure 1, which shows a multicast group with three receivers. Assume S is the source and the root, *R1* joins at S, *R3* at N3, and *R2* at N4. Note that only *N3* and N4 are branching nodes; N1 and N2 are not. The list of receivers maintained by each node is shown in the *last* entry of the corresponding tables. When S multicasts a packet, it simply sends the packet to all receivers in its list, which in this case consists only *of* RI. When *N3* forwards this packet it also sends a copy to *R3*, which is the only receiver in its list. Finally, when the copy traverses N4, N4 makes another copy and sends it to *R2*. Using unicast addresses instead of class D addresses for data delivery is a key difference between REUNITE and all existing IP multicast protocols. One of the key distinctive features of REUNITE is that it uses only unicast IP addresses for both data forwarding and group identification purposes. In contrast, all existing IP multicast protocols use class D IP addresses. In REUNITE, there is a special root node associated with each group. While any node can serve as the root, the source may be a more desirable choice in the case of *single-source* or *almost single-source* applications.

A. Operation with REUNITE

Enhanced scalability by reduction of forwarding state: With REUNITE, only routers that are acting as multicast tree branching points for a group need to keep multicast forwarding state of the group. Non-branching-point routers simply forward packets by unicast routing. *No need for class D IP address:* With REUNITE, a multicast group is identified by a two tuple (unicast_IP_address, port_number) and there is no need for a separate block of class D IP addresses. In this case, the allocation of unique group identification becomes trivial. In addition, the maximum number of simultaneously active multicast groups increases dramatically.

Native support for incremental deployment: Since unicast addresses are used as destination addresses in REUNITE, a router that does not implement REUNITE will simply forward the packets onto the next hop based on the unicast destination address, without any adverse effect on the protocol other than the potential loss of efficiency. This allows REUNITE to be incrementally deployed with a subset of network nodes, without the need of tunneling.

Load balancing and graceful degradation: With REUNITE, when a router does not have resources (forwarding table entry, buffer space, processing power) to support additional multicast groups, it can simply ignore further protocol messages and the branching point will be automatically migrated to other routers.

Support for access control: Access control can be implemented by authenticating senders at the root node. Problem with the operation of REUNITE :

REUNITE may fail to construct shortest-path branches in the presence of unicast routing asymmetries with undesirable behavior of REUNITE that is the route for one receiver may change after the departure of another receiver. This is undesirable if some Quality of Service (QOS) mechanism is to be implemented.

III. HOP-BY HOP (HBH)

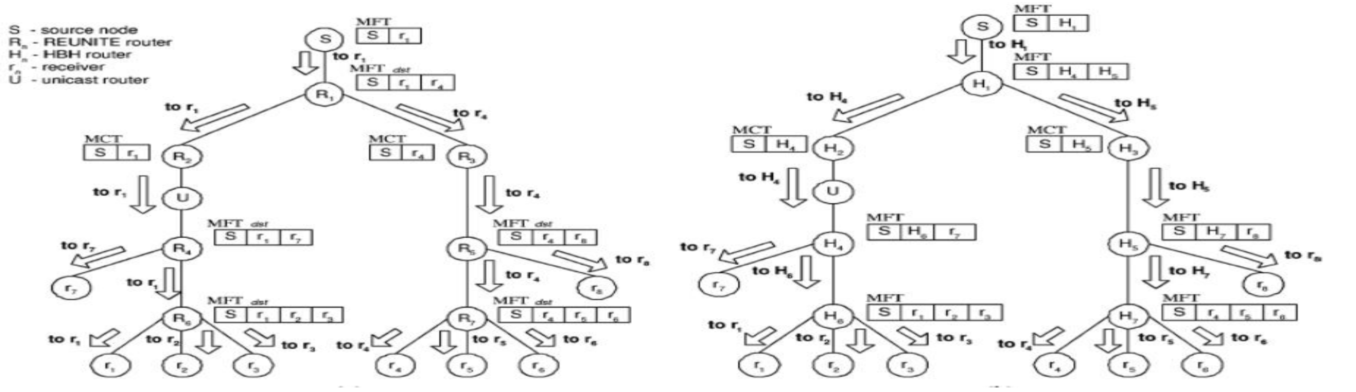
The HBH multicast protocol has a tree construction algorithm that is able to better deal with the pathological cases due to asymmetric unicast routes. HBH uses two tables, an MCT and an MFT, that have nearly the same function as in REUNITE. The difference is that one entry table in HBH stores the address of a *next branching node* instead of the address of a *receiver,* except the branching router nearest the receiver. HBH adopts the source-specific channel abstraction to simplify address allocation and implements data distribution using recursive unicast trees, which allow the transparent support of unicast- only routers. HBH uses the unicast infrastructure to do packet forwarding with smaller routing tables, similarly to REUNITE, but uses the channel abstraction to identify the group. Thus, HBH preserves compatibility with IP Multicast as it uses class-D IP addresses for group identification.HBH constructs shortest-path trees (SPTs) instead of reverse SPTs as most routing protocols do. Consequently, HBH has the potential to provide better routes in asymmetric networks. Additionally, the tree management algorithm of HBH provides enhanced tree stability in the presence of group dynamics and reduces tree bandwidth consumption in asymmetric networks.

IV. MULTICAST DISTRIBUTION USING REUNITE

The Proposed system called the HBH Multicast Distribution using Recursive Unicast has a tree construction algorithm that is able to better deal with the pathological cases due to asymmetric unicast routes. The basic idea of recursive unicast is that packets have *unicast* destination addresses. The routers that act as branching nodes for a specific multicast group are responsible for the creation of packet copies with *modified* destination address in such a way that all group members receive the information. Fig. 2(a) gives an example of the recursive unicast data distribution in REUNITE. In this figure, the source is S, r_A is a receiver, and is a REUNITE The source sends data in unicast to the first receiver that joined the group. At a branching node, Rʙ, incoming packets are addressed to the first receiver r_A, that joined the group in the sub tree below Rʙ. The receiver r_A is stored in a special MFT entry, MFT(S).dst. The router Rʙ creates one packet copy for each receiver in its MFT. The destination address of each packet copy is set to the unicast address of the receiver. The original packet is also forwarded to r_A . In the example of Fig. 2(a), S produces data packets addressed to r1, and these packets reach r1unchanged. The router R1 creates one packet copy and sends it to r4. Since R3 is a nonbranching node, it simply forwards the packets without consulting its MFT. The router R5 creates one packet copy to r8, and finally R7 creates copies to r5 and r6. Fig. 2(b) shows how the recursive unicast data distribution works for our protocol, HBH.

In this figure, Hj is an HBH router. The source S sends data addressed to H1. The router H1 creates two packet copies and sends them to H4 and H5 (the next downstream branching nodes). The router H3 simply forwards the packets in unicast. H5 receives the data and sends a modified packet copy to H7 and r8. Finally, H7 creates one packet copy to r4, r5, and r6. Data distribution is symmetric on the other side of the tree. The recursive unicast technique allows the progressive deployment of the multicast service because data forwarding is based on unicast addresses.

Unicast-only routers in the distribution tree are transparently supported. These routers are unable to be branching nodes of the tree, but can still forward data since unicast destination addresses are used. Interchangeably use (S) and (S, P) to refer to REUNITE's multicast group and (S) and (S, G) to refer to HBH's multicast Channel. Advantages/Operation of Proposed system: A multicast channel in HBH is identified by<S, G>, where S is the unicast address of the source and G is a class-D IP address allocated by the source. This definition solves the address allocation problem while being compatible with SSM's channel definition. Therefore, HBH can support IP Multicast clouds as leaves of the distribution tree. The tree structure of HBH has the advantage of an enhanced stability of the table entries when compared with REUNITE. The tree management scheme of HBH minimizes the impact of member departures in the tree structure. There are no route changes for other members when a member leaves the group because the unicast routes are symmetric. Tree reconfiguration in REUNITE may cause route changes to the remaining receivers. This is avoided in HBH.



(a) (b)

Fig. 2. Data distribution in the Recursive Unicast approach. (a) REUNITE tree. (b) HBH tree.

V. IMPLEMENTATION

The HBH Multicast Distribution Through REUNITE is implemented using JAVA Networking. JAVA SWING is used to provide the user interface. The following four major operations are done in the proposed system: (1) Group Generation (2) Path Discovery (3) Recursive UniCast Trees and (4) Hop by Hop Transmission. In group generation, all the nodes that are attached to the particular node will be displayed in the list and the left and the right node to which the message has to be sent are selected from the list. When we want to send a message the data will be sent to those nodes which are selected from the list. Under path discovery, the shortest path from the source node i.e. the root to the left and the right is found out and the request is sent from the left and right nodes to the root node by which the shortest path is found and the message is sent along the shortest path found through the found shortest path.The key idea of REUNITE is to separate multicast routing information in two tables: a multicast control table (MCT), which is stored in the control plane, and a multicast forwarding table (MFT), which is installed in the data plane. Initially in Recursive Uncast tree, the MFT has no destination (dst) entry. Data received by a branching router HB, has unicast destination address set to HB (in REUNITE, data are addressed to MFT(s).dst. This choice makes the tree structure more stable than in REUNITE. Non branching routers simply keep group information in their MCT; whereas branching nodes keep MFT entries which are used to recursively create packet copies to reach all group members. Multicasting the data from the source node to the REUNITE server. The HBH multicast protocol has a tree construction algorithm which finds the end-host in the specified subnet by checking node by node. This is achieved by checking the every node IP address against destination IP. The sample results are shown below.

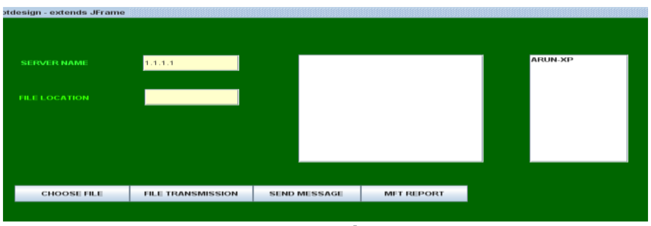


Fig. 3 Root Node Design

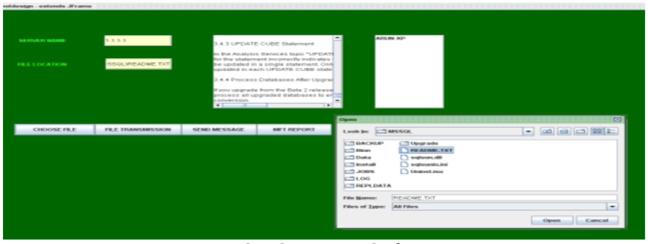


Fig. 4 Root Node Choosing File for Transmission

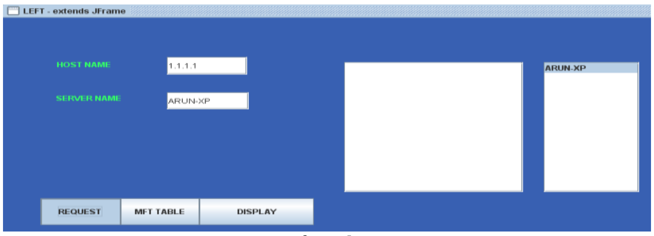


Fig. 5 Left Node Request

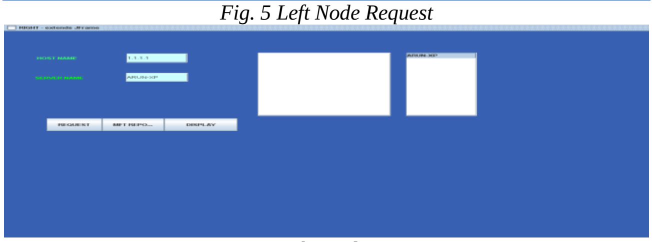


Fig. 6 Right Node Request

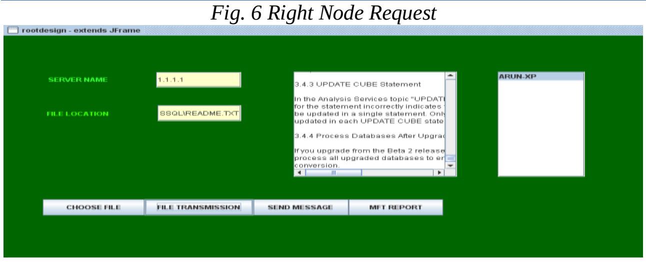
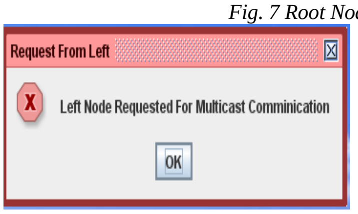
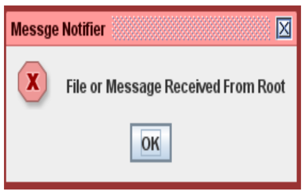


Fig. 7 Root Node File Transmission





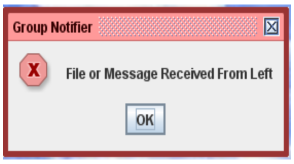


Fig. 8 Message Boxes

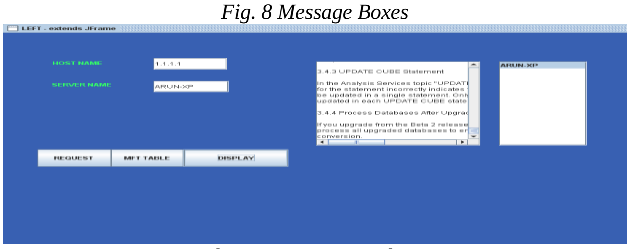


Fig. 9 File/Message Received From Root

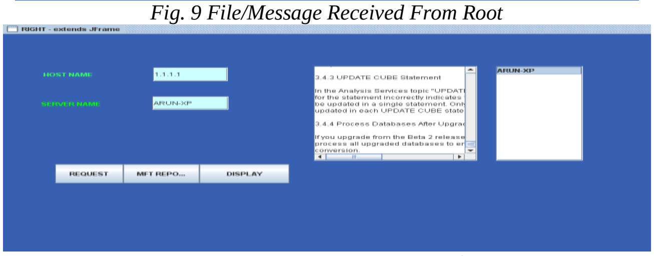


Fig. 10 File/Messege Received From Left to Right

Fig. 11 Root Node MFT Report

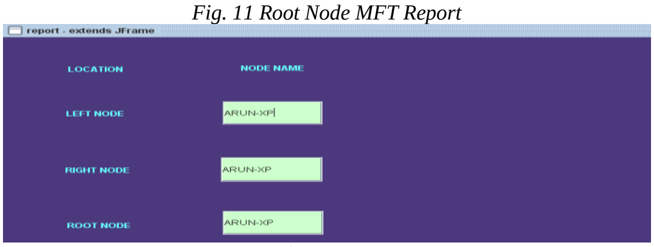


Fig. 12 Left Node MFT Report

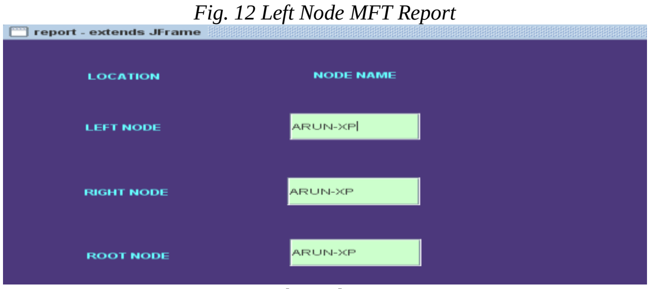


Fig. 13 Right Node MFT Report

VI. CONCLUSION AND FUTURE ENHANCEMENT

A multicast routing protocol that implements multicast distribution through recursive unicast trees.HBH allows the incremental deployment of the multicast service because unicast routers inside the network are transparently supported. The main goals of HBH are: to support unicast clouds, allowing incremental deployment; to have a stable tree structure, by minimizing the impact of receiver departures; and to construct low-cost trees.Its tree construction algorithm outperformed REUNITE in terms of the tree cost and the delay experienced by the receivers. The advantage of HBH grows with larger and more connected networks. The tree management algorithm of HBH uses three control messages to construct SPT. messages are periodically sent to the source by the receivers. The source periodically produces messages that are multicast to the receivers. As the messages travels in the tree, the intermediate nodes may generate messages that are responsible of refining the tree structure. In Future the proposed system may be extended to implement in wireless Network. Recursive Unicast Tree algorithm also be extended to support large network. Hop by Hop node finding is well supported by the wireless environment to avoid the resource-dependent Problem.

REFERENCES

[1] Luís Henrique M. K. Costa, *Member, IEEE*, Serge Fdida, *Senior Member, IEEE*, and Otto Carlos M. B. Duarte. "Incremental Service Deployment Using the Hop-By-Hop Multicast Routing Protocol" IEEE/ACM TRANSACTIONS ON NETWORKING, VOL. 14, NO. 3, JUNE 2006

[2] I. Stoica, T. S. E. Ng, and H. Zhang, "REUNITE: A recursive unicast approach to multicast," in *Proc. IEEE INFOCOM*, Mar. 2000, vol. 3, pp. 1644–1653.

[3] S. Deering, "Host Extensions for IP Multicasting," RFC 1112, Aug. 1989.

[4] T. Bates, R. Chandra, D. Katz, and Y. Rekhter, "Multiprotocol Extensions for BGP-4," RFC 2283, Feb. 1998.

[5] D. Meyer and B. Fenner, "Multicast Source Discovery Protocol (MSDP)," RFC 3618, Oct. 2003.

[6] C. Diot, B. N. Levine, B. Liles, H. Kassem, and D. Balensiefen, "Deployment issues for the IP multicast service and architecture," *IEEE Network*, vol. 14, no. 1, pp. 78–88, Jan. 2000.

[7] S. Bhattacharyya, C. Diot, L. Giuliano, R. Rockell, J. Meylor, D. Meyer, G. Shepherd, and B. Haberman, "An Overview of Source-Specific Multicast (SSM)," RFC 3569, July 2003.

[8] R. Finlayson, "The UDP Multicast Tunneling Protocol," Work in progress, <draft-finlayson-umtp-09.txt>, Nov. 2003.

[9] P. Liefooghe and M. Goossens, "An architecture for seamless access to multicast content," in *Proc. IEEE Conf. Local Computer Networks*, Nov. 2000, pp. 488–494.

[10] L. H. M. K. Costa, S. Fdida, and O. C. M. B. Duarte, "Hop by hop multicast routing protocol," in *Proc. ACM SIGCOMM*, Aug. 2001, pp.249–259.

[11] S. Deering, D. L. Estrin, D. Farinacci, V. Jacobson, C.-G. Liu, and L. Mei, "The PIM architecture for wide-area multicast routing," *IEEE/ACM Trans. Netw.*, vol. 4, no. 2, pp. 153–162, Apr. 1996.

[12] D. Estrin, D. Farinacci, A. Helmy, D. Thaler, S. Deering, M. Handley, V. Jacobson, C. Liu, P. Sharma, and L. Wei, "Protocol Independent Multicast-Sparse Mode (PIM-SM): Protocol Specification," RFC 2362, Jun. 1998.

[13] D.Waitzman, C. Partridge, and S. Deering, "Distance Vector Multicast Routing Protocol," RFC 1075, Nov. 1988.

[14] R. C. Chalmers and K. C. Almeroth, "On the topology of multicast trees," *IEEE/ACM Trans. Netw.*, vol. 11, no. 1, pp. 153–165, Feb. 2003.

[15] V. Paxson, "End-to-end routing behavior in the Internet," *IEEE/ACM Trans. Netw.*, vol. 5, no. 5, pp. 601–615, Oct. 1997.

[16] J. Moy, "Multicast Extensions to OSPF," RFC 1584, Mar. 1994.

[17] K. Fall and K. Varadhan, "The ns Manual," UC Berkeley, LBL, USC/ ISI, and Xerox PARC, Dec. 2003 [Online] Available: http://www.isi.edu/nsnam/ns/ns-documentation.html

[18] D. Magoni and J.-J. Pansiot, "Internet topology modeler based on map sampling," in *Proc. IEEE Int. Symp. Comput. Commun.*, Jul. 2002, pp. 1021–1027.

[19] A. El-Sayed, V. Roca, and L. Mathy, "A survey of proposals for an alternative group communication service," *IEEE Network*, vol. 17, no. 1, pp. 46–51, Jan. 2003.

[20] P. Radoslavov, C. Papadopoulos, R. Govindan, and D. Estrin, "A comparison of application-level and router-assisted

hierarchical schemes for reliable multicast," *IEEE/ACM Trans. Netw.*, vol. 12, no. 3, pp.469–482, Jun. 2004.

