

## Multicast Review

“The Evolution of Multicast: From the MBone to Interdomain Multicast to Internet2 Deployment” was published in IEEE's Network Special Issue on Multicasting, January/February 2000 by Kevin Almeroth.

The paper opens with the history of multicast and the evolution of intradomain multicast, then gives a functional overview of the current deployed multicast options and areas of research in multicast.

Multicast was first achieved in March 1992 by MBone, which transmitted an audio conference call from an IETF meeting to 20 remote sites. The routing decisions were made by the Distance Vector Multicast Routing Protocol (DVMRP), which using broadcast-and-prune technique to build multicast trees.

The original MBone multicast network was running as a virtual service above the Internet. Routers now can now natively handle multicast packets, which integrates multicast into the Internet itself. Two additional protocols are been developed, Multicast Extensions to OSPF (MOSPF), Protocol Independent Multicast (PIM), Core Based Trees (CBT).

As MBone grew, problems arose. It's flat topology caused scalability problems, mainly that large, flat networks are inherently unstable. The solution is though the use of route aggregation and hierarchical interdomain routing, but there are no protocol mechanisms to manage the virtual topology or interdomain policy. While the problems of MBone are clearly explained, they could have been supplemented by factual data. For example, a graph of the network stability as it grew over time could have been a good visual aid.

The paper layed out short-term steps for solving the current multicast problems. First is by extending the interdomain unicast route exchange protocol Border Gateway Protocol (BGP). Second a protocol to build trees and one to interconnect them across domains must be developed.

BGP provides hop-by-hop policy routing through unicast. The extension, Multiprotocol Extensions to BGP4 (MBGP) provides the ability to carry multiprotocol routes, and more specifically, a field to specify unicast, multicast, or unicast/multicast. This gives the ability of determining the next hop to a host, but does not provide multicast tree construction functions. Figure 3 shows a inter-domain multicast topology running BGP/MBGP. The smaller clusters of interdomain clouds are formed with links between them. Figure 4 shows the problem that nodes inside of the domains can not always communicate to the other domain due to nontree multicast links.

Multicast Source Discovery Protocol (MSDP) is a new protocol used for Rps to communicate with each other when one receives a source register message. Figure 5 shows the steps in MSDP operation. The limitation of MSDP is that it has large overhead with it's message flooding. The number of SA messages (plus data) will become very large.

The paper then describes multiple long-term solutions to the multicast that are currently being researched: Border Gateway Multicast Protocol (BGMP), Multicast Address-Set Claim (MASC) protocol, GLOP, Root Addressed Multicast Architecture, Express Multicast, Simple Multicast. The paper also brings to light additional problems if a new protocol is standardized. It must be determined if

these newly standardized protocols will be replacements, or will they work in parallel with existing multicast?

Finally, the paper goes over the current efforts to deploy interdomain multicast. The current problem for the MBone infrastructure is that its virtual network on top of the Internet is no longer needed as multicast routers become integrated with the Internet. MBone is transitioning to using the native multicasting routers and will slowly dissolve, forcing sites to migrate. Internet2 has attempted to do multicast “right from the start”, all nodes must be multicast enabled and no tunneling allowed. The two Internet2 backbones in the United States is vBNS and Abilene, with Figures 6 and Figure 7 showing the topology of each network.

The paper was written in a very standard format. Because the paper was published in a special topic paper, it assumed an audience with knowledge of networking and multicast and did not spend time unnecessary time going over its usage. The paper could have benefited by included data or references to experimentation done on the different possible long-term solutions. This could also be used to compare and contrast the the long-term solutions.