
The Evolution of Multicast: From the MBone to Interdomain Multicast to Internet2 Deployment
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This paper essentially provides a history of multicast and describes the strengths and weaknesses of the various multicast protocols up to year 2000. As such this paper contains no analysis however does provide enough information in most cases to explain at a high level how the protocols work. The paper seems to require a decent amount of background knowledge on unicast routing and the basics of multicast, and as such I see the target audience of this paper as network administrators, new researchers in the networking / multicast field and incredibly technology savvy people who are interested in this sort of thing. As a summary of multicast up to year 2000, the paper brought up some interesting points about multicast going forward and had a few direct mentions that a lot of work is yet to be researched in the area of multicast.

The paper started by mentioning that there was a problem with multicast and then contrasted the evolution of multicast with that of the more recent HTTP protocol which by year 2000 had much more widespread use. The paper attributed this difference in adoption to the fact the multicast is not only end-to-end as the client/server based HTTP protocol is. Additionally in the introduction it brought up the problem of cost v. efficiency gains through the use of multicast. The paper was quick to mention that short term functional solutions to problems which may introduce their own issues are still meaningful as the demand for multicast grows.

The first section talks about intradomain or flat level multicast in which all multicast routers pretty much must be aware of all sources. The parallelism between the evolution of intradomain unicast routing protocols immediately jumps to mind and is directly mentioned in the paper. In fact, I think the author deliberately wanted to show this parallelism to aid in the explanation of multicast's evolution which I think significantly adds to the strength of the paper. The evolution in this first section is pretty straight forward from a Multicast Backbone (MBone) via mrouted to DVMRP that utilized broadcast-and-prune and was a dense mode protocol. It was quickly mentioned the drawback to these dense mode protocols was that each router had to keep state for each source.

The next section (with the same title, "The Evolution of Intradomain Multicast") talks about two additional dense level protocols MOSPF and PIM-DM. Detail about MOSPF was slightly lacking but as pointed out in the last sentence the key part is that is uses link-state to pass information around about receivers further supporting my argument that this paper parallels the history of unicast routing protocols. PIM-DMs advantage is utilizing existing routing tables created by whatever unicast routing protocol thus removing a dependency on a particular algorithm to generate routes.

Then the evolution goes on to talk about sparse mode protocols which is beneficial when there are only a few members of a multicast group. The primary idea here is the shared tree located in â€œthe coreâ€ , also known as a rendezvous point (RP). The RP keeps state about receivers in the multicast group which it acquires when they join. The paper did a great job to mention that RPs can be a single point of failure but quickly also mentioned the bootstrap portion for recovery.

Then comes the important transition in the paper which mentions how

these protocols were great at a moderately small scale, but don't work well when you have competing ISPs each serving hundreds of thousands of users who may behave towards each other as immature children would. Just as the evolution of unicast routing protocols led to the development of interdomain protocols such as BGP, multicast protocols went the same way with the combination of MBGP, MSDP and PIM-SM.

After briefly describing how the three can be used in tandem the paper discusses two problems. The first being join latency combined with bursty sources in which destination nodes may not receive information if only a small amount is sent in intervals longer than the timeout value. The second being issues of scale as there apparently is a great deal of overhead in MSDP. These problems are used in the paper to remind the reader that MBGP/PIM-SM/MSDP is just a â€œnear-term solutionâ€ but more work is yet to be done.

The next section of the paper discusses ongoing research with BGMP, MASC, GLOP, and RAMA. The paper seems to suggest that RAMA has the best potential as there are two subsections detailing Express Multicast and Simple Multicast in which the root of the multicast tree is placed at the source thus eliminating core placement.

Finally the paper finishes by mentioning the deployment of protocols in the Internet. The paper is careful to mention that backwards compatibility is needed and describes how the MBone having it's own AS supports backwards compatibility. On the Internet2 side of things the paper states they are trying to do the things â€œthe right wayâ€ and indicates that this is a positive step forward for multicast.

Overall the paper was written in a logical manor, save for one portion (mentioned later) and was quite well written with only one noticeable mistake in a semi-close read: "However if RP does not have forwarding state for this group, it sends a register-stop message to the RP." I'm pretty sure that should read "register-stop message to the source." With respect to the figures I think there placements were a little off with respect to where they were mentioned in the text, and the figure commentaries were a little weak. Furthermore I think the latter figures in the paper don't really add much to the content and really are just taking up more space than they should, though on the plus side I like how the font-size in the figures is about the same as the paper's text.

The one portion of the paper that was not written in a logical manor was with respect to PIM-SM. It was first briefly mentioned when introducing PIM-DM which I question if was necessary there. Nonetheless the more confusing part is in the CBT section where it says "There are two differences between CBT and PIM-SM." It's kind of hard to describe differences between 'A' and 'B' when A hasn't been explained yet, which in this case PIM-SM is explained after CBT thus leading to the confusion.

After reading this paper I can't help but compare it with the difficulty to push out IP6. Multicast just like IP6 requires upgrades on pretty much every router in the Internet and though eventually they may all support it it's not something we can reliably depend on happening in the near future. After all, what incentive does an ISP have to add IP6 routers, or routers that support newer multicast protocols? It seems like doing so will just drive more traffic through the ISP which may or may not mean more revenue depending on where the traffic is going to and coming from. From what I can tell it seems CDNs that utilize adhoc or P2P like multicast systems to efficiently disseminate information to all the end nodes is a great alternative.