

Networking for Multimedia

Tech Topic #03: Advanced Routing

K. Almeroth, "The Evolution of Multicast: From the Mbone to Inter-Domain Multicast to Internet2 Deployment," IEEE Network Special Issue on Multicasting, January/February 2000.

The present article covers a good width and breadth of introductory layer-3 multicasting topics. The paper was appropriately published in a special edition of IEEE Network on multicasting. This work, along with equally well-written papers on layer 2 and application layer multicasting, could probably be considered sufficient as a complete contemporary overview on the topic. This also points out, however, that the latter two topics are generally ignored in the article. A more accurate title may have been "The Evolution of Multicast *Routing*".

On the other hand, it could also be argued that these last two techniques are, to a certain extent, cheating: layer 2 networks often have a native mechanism to support 1-to-many communication and application layer concepts ignore the problem of multicast routing entirely.

Expounding on the history of intradomain multicasting techniques and deployment comprises a good half of the paper. The Standard IP multicast model points of IP-style semantics and open and dynamic groups are important even today; these are aspects of the concept that have become so ingrained in our thinking that they are often overlooked.

On first read the depth of detail with which the Mbone was covered seemed excessive, but the reviewer was later impressed with its use of introducing the distance vector multicast routing protocol (DVMRP), as well as tying it back in to illustrate issues with current multicast and in the commodity Internet deployment section.

The sparse and dense mode protocol descriptions are clear and effective. A mere ten years later the reviewer was surprised to have never heard of core based trees (CBT). The paper simply mentions that CBT is technically comparable to PIM-SM but not deployed by vendors; it suggests the question of why this is the case.

Similarly, the author states that the described intradomain protocols have been deployed (or are popular) but does not comment whether or not there were others considered which did not get deployed. The reader is left to guess, whereas an explicit statement may have added some additional insight into the reasons why some were chosen over others, or clarified that there were no more.

The concepts of rendezvous points, shared trees, broadcast-and-prune and explicit join are all summarized as multicast terminology. The term 'source-specific' is not mentioned even as the problems with rendezvous points—single point of failure, excessive network load, non-optimal paths—were enumerated and discussed. It may just be the case that this paper came before this term was widely used or known.

The “problems with multicast” section was perhaps overly focused only on problems specific to the Mbone. The example of the Mbone network as non-optimal was representative and effective but it may not have been required to concentrate on it so much. The scalability and manageability reasons why the community needs an interdomain multicast solution could potentially have stood out more on their own rather than merely as a fix for an existing infrastructure.

The second half of the paper covers interdomain multicasting and its deployment. This ends up constituting much of the content of the paper. MBGP's plain-language functional example is illustrative and gives a clear mental picture of the problem being solved, which in turn provides a nice way to segue into thinking about the issues with connecting sparse mode domains that MBGP does not solve.

MBGP and the MDSP are the only protocols in the paper that achieve coveted figure status. MDSP, in fact, gets two; one for the problem and one for the protocol's solution. These are appropriate, though, given that the operation of MDSP is described in a numeric list. Problems associated with MDSP such as join latency, bursting sources and scalability are well-stated. So much so, in fact, that the reviewer recently came upon similar statements regarding MDSP in a much more recent RFC (4608).

The paper goes on to discuss six current possible long-term solutions: the border gateway multicast protocol (BGMP, not to be confused with MBGP), the multicast address-set claim (MASC), GLOP (as in, statically allocate a Glop of multicast addresses), the root addressed multicast architecture, express multicast, and simple multicast. There really can be very little critique of this section given that the solutions are not stringently compared, only introduced and described briefly. A similar comment to the one given about the intradomain protocols above may apply however: it is not explicitly mentioned whether these systems are representative and/or if others are being or should be developed.

The paper concludes with brief commentary on how multicast routing currently exists in both the Internet and what is called the Internet2. The figures here were more “nice to haves” rather than “contributed significantly to the content” given that most of the paper was spent explaining the state of the multicast union protocol-wise. The article states itself that evaluating usage is tricky. However, from an organizational perspective it was good to have such a section at the end to wrap up the vehicle of the Mbone network which had served a useful purpose throughout. The main theme of defining and expanding a hierarchical suite of multicast routing protocols is well-emphasized; an impressive accomplishment for a tutorial-type work.