

Reading Report #13
Paper: A Case for End System Multicast
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Narada protocol is suitable only for multicast application with a small group size (a few hundred nodes), for example, video conference. Beyond all the well-known benefits of implementing multicast functionality on a overlay network, the major problem of Narada is scalability. This is because:

1. Each node in the group needs to carry out the duplicating and forwarding operation, manage group membership, as well as performing application specific functionalities. The first two are usually implemented by multicast router in IP multicast.
2. Each node in the overlay network has to maintain a list of all the nodes that are currently in the network. This is too much overhead for a end host when the size of the overlay network scales up.
3. The size of routing table for each node is linear to the size of the group. Therefore the state maintained by a node is in the order of $O(N)$ where N is the size of group.
4. Since each node manages both data plane and control plane, the control overhead is big because each control message contains the state of all nodes in the group, thus the control overhead is in the order of $O(N^2)$ where N is the size of group.

Another potential problem of Narada is that it takes a long time to converge and the overlay network tends to be instable because simulation results show that it is difficult to form a stable mesh, even after a very long time.

I think in order to make the idea of end-system-multicast scale to large size, we need to let the network layer and end system cooperate, each sharing some workload. For example, one of the most challenging tasks in overlay networks is the management of node dynamics, that is, let nodes join and leave the group at their will. In traditional IP multicast network, node dynamics is not a major concern as the network infrastructure is considered to be stable and only the leaf nodes join and leave the network. But for overlay network, this is not the case any more, node dynamics is completely managed by end system. This may affect application performance, especially, those real time network application may suffer from managing node dynamics.

The combination of the two different multicast schemes can be adopted for general-purpose scalable multicast network. Though we need to carefully evaluate the division of functionalities and try to put as less function to network as possible. But still, network itself needs to play a role here.