Abstract

This thesis presents a new Application Layer Multicast protocol. To reduce the load on servers and increase the network efficiency, Application Layer Multicast protocols construct overlay networks and distribute data efficiently. E-mail distribution and USENET news distribution are early Internet applications that fall into the broad general category of Application Layer Multicast. Application Layer Multicast protocols do not change the network infrastructure. These protocols implement multicast forwarding mechanism at the end hosts. Many researchers are finding ways to push the multicast routing capabilities onto hosts than onto routers. The idea here is to construct an overlay network of hosts, on top of routers. Routers do normal unicast routing, while the hosts attached to them will take care of multicast group management and routing among themselves. While IP Multicast protocol works at network layer, that requires applications to be aware of multicast and programs be written specifically using IP Multicast API [76]; protocols like End-system Multicast [1-2], Scattercast [3-4] and Overcast [5] require an application-layer overlay infrastructure to be laid of. All these protocols, share the common goal of providing the benefits of multicast without requiring direct router support or the presence of a physical broadcast medium [4].

The main contribution of this thesis is to give a DNS kind of infrastructure based solution for multicast services. We emphasize that multicast can better be provided at application level rather than at router level. To provide multicast at application level we present four major contributions named 1. Construction of Appcast Overlay. 2. Exploiting Broadcast Media Property. 3. Exploiting Query Redundancy and 4. A Generic Multicast Application Development Framework.

1. Construction of Appcast Overlay: We propose a new application layer multicast that exploits the topology information. Any application layer multicast protocol that does not exploit topology may in fact decrease the efficiency in terms of bandwidth and increase delay. We develop new algorithm 'Appcast' that creates a multicast overlay topology, which we further optimize by two more extensions to it taking delay and processing power as parameters.
2. Exploiting Broadcast Media Property: The application developers are not able to take advantage of the media nature like broadcast for satellite networks. We show ways of how the broadcast nature can best utilized by developers.

3. Exploiting Query Redundancy: Hosts are organized as an overlay in application layer multicast. Overlays disseminate information in a hierarchical and incremental fashion. Also, not all members in an overlay or multicast group need exactly same information. In this case, if we can filter the information at different levels of overlay, while the information is distributed, we can minimize the bandwidth and processing requirement. Each member's interests are represented by Xpath [78] query and the information to be distributed is in the form of XML [80] document as XML is gaining importance as the standard for information exchange. We look at the XML document-processing problem particularly in the context of application layer multicast and propose a new Xpath processing algorithm called YALXP - Yet Another Light weight Xpath [78] processor. YALXP algorithm processes multiple Xpath queries over a XML document in single document traversal i.e. in one pass it can answer multiple queries.

4. A Generic Multicast Application Development Framework: We design generic application architecture and develop three different kinds of applications. We take 'scheduled file pushing' application as one-way multicast application, 'database replication' as event and rule based one-way multicast application and 'auctions' as interactive multicast application and implement all three.