A Transport-Level Protocol Suite for Multimedia Multicast Communication over an SSM-enabled Internet

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To overcome some of the limitations of the traditional multicast service model, the SSM Working Group of the IETF has proposed a new IP multicast service, named Single-Source Multicast (SSM), which relies on the concept of channel. When SSM is adopted, end-systems only receive datagrams originating at a specified end-system (a.k.a. the source of the channel). Adopting such a model results in simpler and more scalable routing mechanisms. However, the adoption of the SSM model poses new problems when deploying some of the traditional transport protocols. For instance, these protocols usually rely on the possibility of multicasting control messages from receivers to all other group members (e.g. RTCP is based on the periodic transmission of control packets to all participants in the session, using the same distribution mechanism as the data packets; Reliable Multicast protocols usually use the multicast mechanism to issue ACK/NACK messages, combined with some form of message aggregation/suppression to avoid source implosion).

In this poster we describe the overall architecture of a transport-layer protocol suite that supports multimedia multicast applications and is particularly suited to be supported by an SSM-enabled Internet. Design and implementation of this protocol suite are two of the goals of GCAP, a research project funded by the European Commission under the Framework V IST Programme. Work presented in this poster is carried out by the authors in conjunction with the LIP6 Laboratory of the University “Pierre et Marie Curie” of Paris.

GCAP protocols can be grouped in two families: data-plane protocols and control-plane protocols. GCAP data-plane protocols implement the basic mechanisms to deliver synchronised media quanta belonging to one or more mono-media multicast connections. The service model provided by these protocols conforms to a Fully Programmable Transport Protocol model, which provides a Partial Order and Partial Reliability service.

This poster mainly describes the control-plane protocols, which create an end-to-end transport infrastructure supporting multicast communication over an SSM-enabled IP network. The basic idea is to use end-system multicast in the control plane, to let all the members of a multicast channel exchange control messages (so to build transport level functionality like group integrity checks, counting, ack/nack aggregation, local repair, and so on). To do so, a spanning tree is created. This tree, rooted at the channel source, is made of bi-directional point-to-point (i.e. unicast) connections among channel receivers, and can be used to deliver messages both upstream and downstream. To create and maintain this tree, end-systems use the Control Tree Building protocol, which also works as an underlying protocol for specific protocols, used to address end-to-end issues like group management, counting, QoS monitoring, reliability. The poster presents the algorithm used to build this control tree, assuming only a minimal knowledge of the network topology and partial knowledge of group membership. In particular, starting from the observations that receivers are usually clustered, it is required that end-systems know their own “domain” identifier. For the tree building mechanism to be efficient, it is required that receivers with the same domain ID are close to each other (in terms of delay). The poster presents simulation results showing how the resulting control tree is affected by the group size and other specific parameters.