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1 Problem description

We are planning to study a problem of high-bandwidth multicast in cooperative environments. A tree-based multicast works well in systems with high availability of interior nodes. However, the latter is a problem for the application level mulicast in peer-to-peer systems. SplitStream [2] solves the problem by redistributing the content among interior-node-disjoint multicast trees providing a uniform loading among the peers. Authors [2] show that it is possible to construct an efficient SplitStream forest provided that participants of the multicast at least have equal inbound and outbound bandwidth. Furthermore, the SplitSream is resistant to failures, provided that the content is encoded, since peers lost on average one stripe due to nodes malfunction.

2 Problem importance

The application level multicast using only unicast translation is an alternative to multicast at the network layer which has to be supported by the network infrastructure. In cooperative networks users get access to a service in exchange to provided resources. Unfortunately, usage of multicast trees is not an option in cooperative networks, as majority of users are leaves and do not provide necessary resources for the transmission of messages. This problem is particularly evident in a distribution of audio and video resources. SlipStream allows the distribution of such content, providing a uniform load on the network participants.

The main idea behind the SplitStream is to divide the content on k stipes and to distribute them among the trees which forms one multicast group. Participants specifying an upper bound to resources they are willing to transmit can subscribe to multicast in those groups that ditsribute stripes they need. However, the problem with the forest construction is that if a node is internal in some tree it should be a leaf in all others and, at the same time, the forest shall meet the requirements imposed on the bandwidth.

SplitStream is resilient against failures and sudden nodes departures. The system is construced so that any node is interior in only one tree. So the node failure causes loss of one stripe on average. Appropriate methods of content encoding help to hide information loss in the system.

The main problem in design of SplitStream is efficient construction of distribution trees forest that satisfy bandwidth constraints in decentralized, scalable and efficient manner.

3 Related work

So far we have found several articles related to the topic. Castro et al. [2], [1] describe the SplitStream design and give a theoretical justification for the effiecient forest construction. They also implemented the SplitStream and tested it in the Planetlab [6]. Rowstron and Druschel [7] describe Pastry "a scalable, distributed object location and routing substrate for wide-area peer-to-peer applications" [7]. Castro et al. also present Scribe in their paper [3]. Scribe is an application level anycast for highly dynamic groups. The SplitSream is built on top of the Scribe. We have also found java implementation of Pastry, Scribe and the SplitStream at FreePastry [5] which could a good starting point of our C implementation.

4 Milestones

Our plan of the SplitSream implementaion:

1. Gnunet [4] build. Studying of the API. (9th May)
2. Studying of the article [2]. Formalization of the SplitSream algorithms. (16th May)
3. Studying java implementation of Pastry, Scribe and SplitSream [5]. (23th May)
4. Building interior-node-disjoint trees. (30th May)

   This could be done on top of the implementation of DHT in GNUnet.
5. Implementation of mechanism for limitation of a node's outdegree. (6th June)
6. Implementation of parents location.(13th June)
7. Implementation of Spare Capacity group.(20th June)
8. Experimental evaluation and testing.(4th July)

References

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[3] M. Castro, P. Druschel, A-M. Kermarrec, and A. Rowstron. Scalable application-level anycast for highly dynamic groups. In *NGC*, Munich, Germany, 2003.

[4] GNUnet. https://gnunet.org/.

[5] FreePastry. http://www.freepastry.org.

[6] Planetlab. http://www.planet lab.org.

[7] A. Rowstron and P. Druschel. Pastry: Scalable, distributed object location and routing for large-scale peer-to-peer systems. In *IFIP/ACM International Conference on Distributed Systems Platforms (Middleware)*, pages 329–350, Heidelberg, Germany, 2001.