Multicast in a CineGrid testbed

Igor Idziejczak

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‘Investigate the possibility of sending high quality video to multiple destinations using multicast for a reliable, scalable high bandwidth CineGrid testbed without loss of performance’
Why multicast?

- For a single 4K (~4 x 1080p) stream: 7,6 Gbit/s is needed
- With unicast: every destination -> factor X more bandwidth
- $X = \text{number of receivers}$
- $7.6 \text{ Gbit/s times } X = \text{impossible for current hardware of the CineGrid testbed}$
Research scope

- Traditional multicasting
- Network layer multicasting (NLM)
  - Provider Link State Bridging (PLSB)
- Application layer multicasting (ALM)
  - SAGE bridge
Traditional multicasting
Traditional multicasting

- Multicast addresses: IPv4 (class D), MAC addresses (01-00-5E-00-00-00 to 01-00-5E-FF-FF-FF)
- Internet Group Management Protocol (IGMP): Router sends Host Membership Query, host responds w/ Host Membership Report
- IGMP snooping: switch -> on what port to send the multicast
- Multicast routing protocols (Sparse-Mode, Dense-Mode): SM is pull model, DM is push model
Different multicast solutions

Network layer multicast (NLM)  Application layer multicast (ALM)
Provider Backbone Transport

- PBT = Provider Backbone Bridges - Traffic Engineering (PBB-TE) and defined in 802.1Qay®
- Build upon Provider Backbone Bridges (MAC-in-MAC)
- No Spanning Tree Protocol (STP) or MAC-learning
- Primary & backup path (not forced): fail-over in <50 ms
- Important for the CineGrid: scalability, reliability & QoS
PLSB = Shortest Path Bridging is defined in 802.1aq®

Each B-VLAN: flooding & learning -> disabled

Link state protocol Intermediate System to Intermediate System (IS-IS)

IS-IS, flexible routing protocol: easily adapted. Remove IP w/ layer 2 functionality (B-MAC addresses & I-SID)

All nodes inform neighbors (LSA) -> Share view network. PLSB applies Shortest Path First (SPF), Forwarding Information Base (FIB) -> every node
Source: Nortel Networks. *Introduction to Provider Link State Bridging*. 2007
Scalable Adaptive Graphics Environment (SAGE) is a specialized middleware for streaming high quality video and high resolution graphics in real-time from remote locations to multiple displays over very fast networks.

Test: try to send a stream from a SAGE bridge to multiple destinations

Installation: SAGE & SAGE bridge on the central node, on display nodes SAGE & fsManager w/ two displays attached

Results: sending to both the nodes, stream successful initialized, tcpdump captured packets from both the nodes

Problem: the second screen stays black
Placing end nodes
Chain reaction
Create VLANs

source

cloud

broadcast

cloud

broadcast

receiver

receiver

receiver
## Conclusion and future work

- SAGE bridge is a possibility for multicasting
- APM is a possibility for multicasting
- PLSB ‘cutting-edge’ and no experience
- Advantages and disadvantages NLM/ALM

| More research on the black screen of the 2nd display |
| More investigation on different APM applications |
| PLSB should be tested in conjunction with PBT |
| Performance test comparing NLM/ALM |