Point to Multipoint Streaming Media Delivery

Problem Statement

Draft-litao-p2mpsmd-sam-problem-statement-01.txt

Tao Li  Zhigang Sun  Hui Wang  Chunbo Jia
Taoli.nudt@gmail.com
National University of Defense Technology, P.R China

SAMRG @ IRTF
Quebec City, July. 28, 2011
Recall

• Challenges Facing P2MP Streaming Media Delivery
  - High QoE (end-users)
  - Optimized resource utilization (ISPs)
  - Efficient and low-cost deployment, maintenance and management (ISPs/ICPs)

• Major Problems
  - Network state information (NSI) acquisition
  - Policy-based control (Separation between mechanism and policy)
Changes from last version

• Several editorial improvements

• More discussion on the existing technologies

• *Ongoing work and preliminary experimental results (in this presentation)*
Existing Technologies for P2MP Streaming Media Delivery

- IP multicast (SSM)
- RTP/RTCP extensions + SSM
- Application-level overlay (P2P, CDN)
IP Multicast (SSM)

- Network resource (Bandwidth) efficiency
- Complete Standard protocol architecture

Problems:
- Scalability for maintaining state information
- Commercial implementation support (Accounting, group management, Security)
RTP/RTCP extensions + SSM

- Error resilience
- Monitor and fault isolation
- More delicate control

Problems:
- Real-time
- Accuracy
P2P

- Robustness and resilience
- Scalability
- Easy Deployment

Problems:

- Profit of ISP
- Management and resource optimization
CDN

- Reliability
- Manageability
- Safety

Problems:
- Cost
- Scalability
Experiments

• **Exp-1**: Network state information (NSI) acquisition
  – Real-time monitoring
  – Accuracy locating

• **Exp-2**: Policy-based Control
  – Flexibility
  – Adaptive
Experimental Setup (Exp-1)
Experimental Results (Exp-1)

DF Value: Delay factor (Normally 5~20)

- Real-time and accurate information of network impairments
- Labelcast provides data-plane NSI
- Independent of control plane or upper layer protocol

(a) R3: DF and MLR

(b) R3: DF and VBR (Virtual Buffer Rate)
EXP-2: Parameterized Gradient Based Multicast Routing (PGBMR)

• **Objective**
  - An *adaptive* multicast routing mechanism supporting *parameterized policy-based* p2mp streaming media delivery

• **Motivated by**
  - PGBR [“An Evaluation of Parameterized Gradient Based Routing With QoE Monitoring for Multiple IPTV Providers”, ITOB 2010]
EXP-2: Parameterized Gradient Based Multicast Routing (PGBMR)

PGBR [“An Evaluation of Parameterized Gradient Based Routing With QoE Monitoring for Multiple IPTV Providers”, ITOB 2010]
EXP-2: PGBMR Experimental Setup

\[ G_{u \rightarrow v, s, d_i} (t) = \alpha \varphi_v (t) + \beta l_{u \rightarrow v} (t) + \gamma h_{v, s, d_i} \]

- \( \varphi_v (t) \): Whether node \( v \) is in the multicast tree or not
- \( l_{u \rightarrow v} (t) \): The residual capacity of the link \( e_{u, v} \) at time \( t \)
- \( h_{v, s, d_i} \): The normalized total hop counts.

Different parameters allow for the different polices

(a) n=100

(a) n=200
EXP-2: PGBMR Experimental Results

Comparison of Request blocking probability

Comparison of total cost of multicast tree

From “Greedy Gradient Based Multicast Routing Policy for Dynamic Network, ICMT2011”
Remarks

• NSI is essential for **real-time** monitoring and **accurately** locating the impairment of the network.

• Policy-based control for flexibility is feasible to be implemented by separating the **policies** from the **mechanism**.
Comments or questions?