UNIVERSITY OF STIRLING

DEPARTMENT OF COMPUTING SCIENCE AND MATHEMATICS

Hybrid Overlay Multicast Simulation and Evaluation

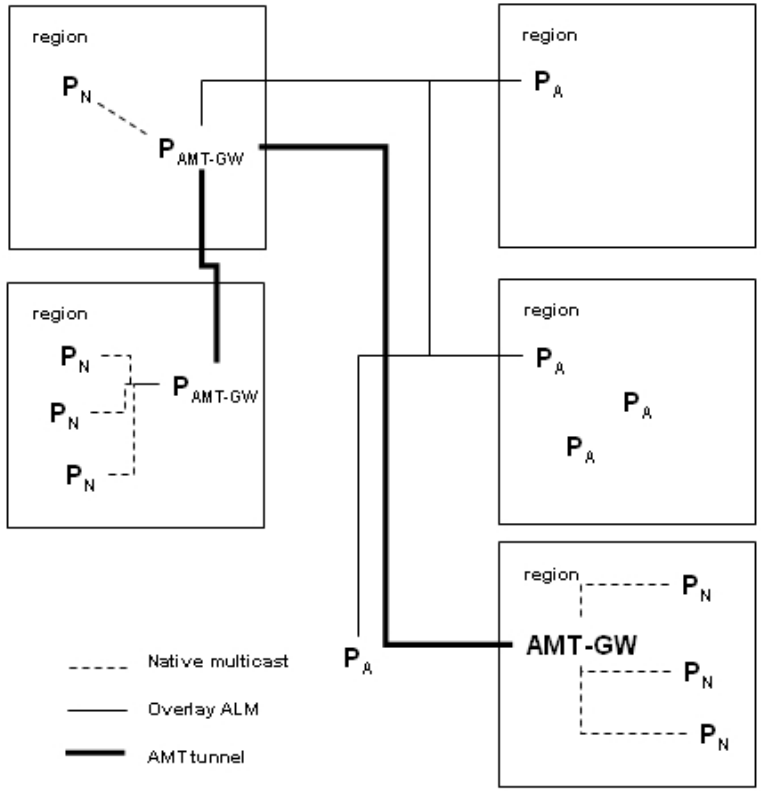
John Buford, Avaya Labs Research, USA
Mario Kolberg, University of Stirling, UK

Multicast

- Widely considered important for consumer communications applications
  - Small group video conferencing
  - IPTV
- Native multicast deployment is rather slow
- Alternatives:
  - Application Layer Multicast
  - Native Multicast with tunnelling between regions
- SAM RG within IRTF investigates a third option:
  - Hybrid protocols which use overlay multicast with native multicast where it is available

Hybrid Overlay Multicast

- Select between OM subtree and NM subtree opportunistically
- Expect improved network efficiency, increase throughput and reduce latency
- Design based on AMT tunnelling mechanism
- Protocol uses structured P2P overlay to connect peers in different types of multicast regions



Simulation Environment

- SSF-NET

Function	Availability
Overlay Protocols	Chord, EpiChord
Max Overlay Size	10,000 nodes
Overlay Multicast	No
Native Layer Topology	transit-stub generated by GT-ITM
Max Native Layer Size	10,000 nodes
Native Multicast	No
AMT Support	No

- OverSim

Function	Availability
Overlay Protocols	Chord, Pastry, Koorde, Broose, Kademlia, Bamboo
Max Overlay Size	100,000 nodes
Overlay Multicast	Yes: Scribe, CommonALM-API
Native Layer Topology	*INET:* configurable topology including bandwidths, packet delays, and losses *SimpleUnderlay:* simple underlay for high Performance Simulation
Max Native Layer Size	100.000 nodes
Native Multicast	No
AMT Support	No

Simulation Model

```
Simulate
    Initialize
        Load underlay topology
        Divide underlay topology into NM and OM regions
        Assign an AMT-GW to each NM region
        Initialize peers and overlay
    Run
        Repeat K iterations
            Select peers to form an OM tree
            Select OM tree root
            Form hybrid tree
            Collect tree quality measures
            Destroy tree
        End
```

Evaluation Metrics

- Link Stress
  - Number of identical packets send over a link
  - Hybrid multicast should reduce link stress
- Stretch
  - Ratio of path lengths between packets sent over the overlay to that sent over the unicast path.
- Control Overhead
  - Overhead for control messages, both in terms of number of messages and bandwidth consumed
- Join latency
- Startup latency