

# Edge Device Multi-unicasting for Video Streaming

T. Lavian, P. Wang, R. Durairaj, F. Travostino

Advanced Technology Lab, Nortel Networks

D. B. Hoang

University of Technology, Sydney

Presented By

Ramesh Durairaj

radurai@nortelnetworks.com

# Outline

- **Introduction**
- **Application Layer Multicast and related work**
- **Application Layer Multi-Unicast**
- **ALMuti-Unicast Testbed**
- **Performance Measurement**
- **Conclusion**

# Problems with IP multicast

- **After a decade of research and development IP Multicast still has not been deployed widely in the global Internet due to:**
  - Lack of feasible admission control
  - Small multicast address space
  - Difficulty in estimating group size for billing
  - best-effort multi-point delivery service

# IP multicast for Video Streaming

- **Business model does not adequately cover the cost of replication of data at each intermediate routers.**
- **Multicast adds software complexity and requires support inside the networks in terms of elaborate control support from IP routes, membership managements and multicast routing protocols.**
- **Enterprises do not want to run multicast for fear of degrading the performance of other critical applications.**
- **Enterprises are not willing to pay the additional charges incurred from content streaming.**

# Application Level Multicast

- **Multicast data stream from a server to multiple clients at the application level.**
- **Overlay network structure must be constructed at the application layer to connect participating end systems**
- **Mechanisms for adapting the overlay structure are necessary to provide and maintain adequate level of QoS of the application**
  - Yoid – generic structure for overaly networks for content distribution
  - Overcast – single-source multicast
  - End System Multicast – small-scale multicast for teleconference
  - ALMI – an ALM infrastructure for multi-sender multicast that scales to a large number of groups with small number of members

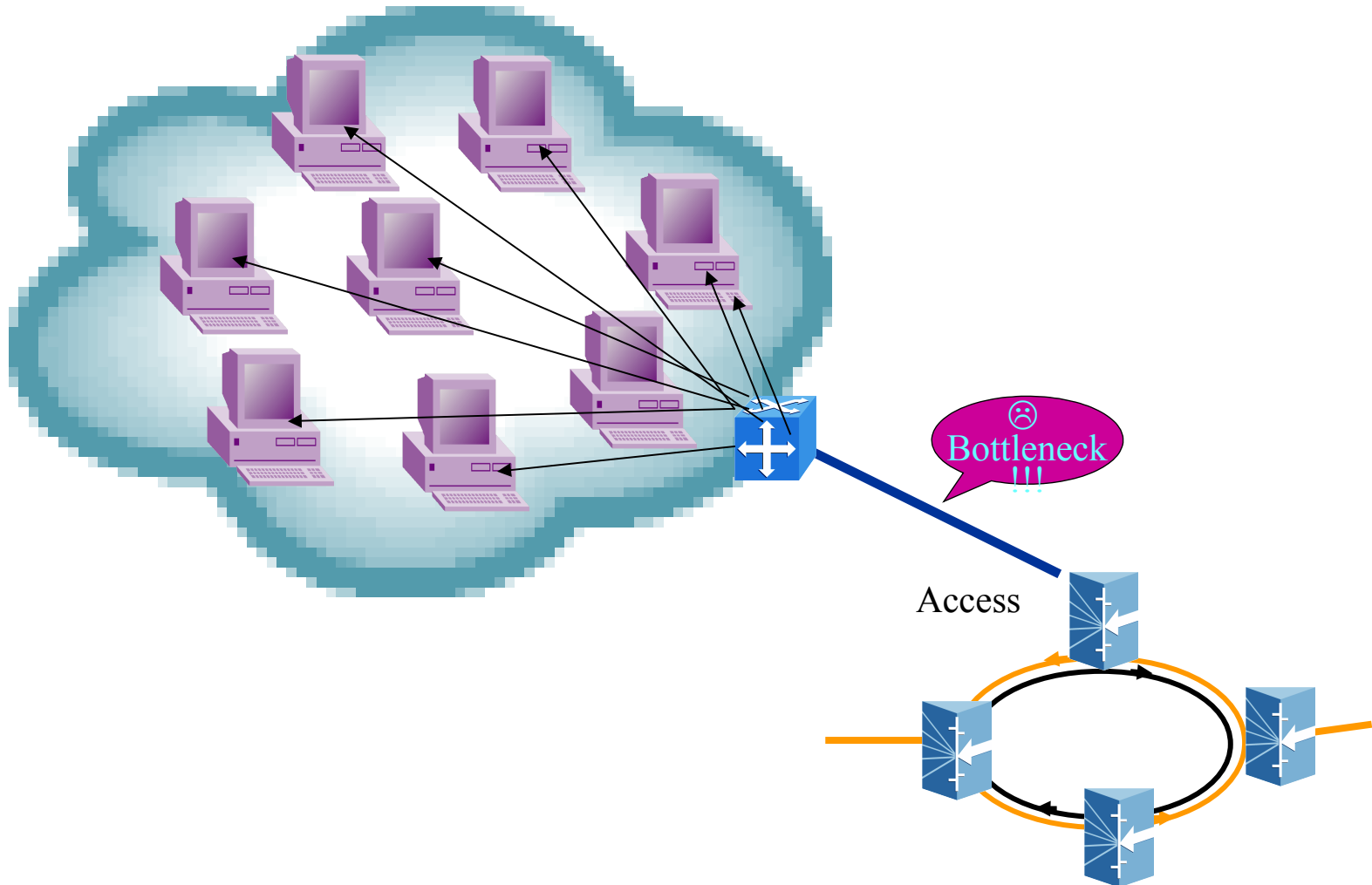
# Application Level Multicast

- Offer multipoint delivery as an application level service
- All multicast state in end systems
- Quick deployment, Remove many of IP multicast deployment barriers
- Maintain the simplicity of the underlying IP layer
- Delay and bandwidth penalty are low.

# Problems with ALM

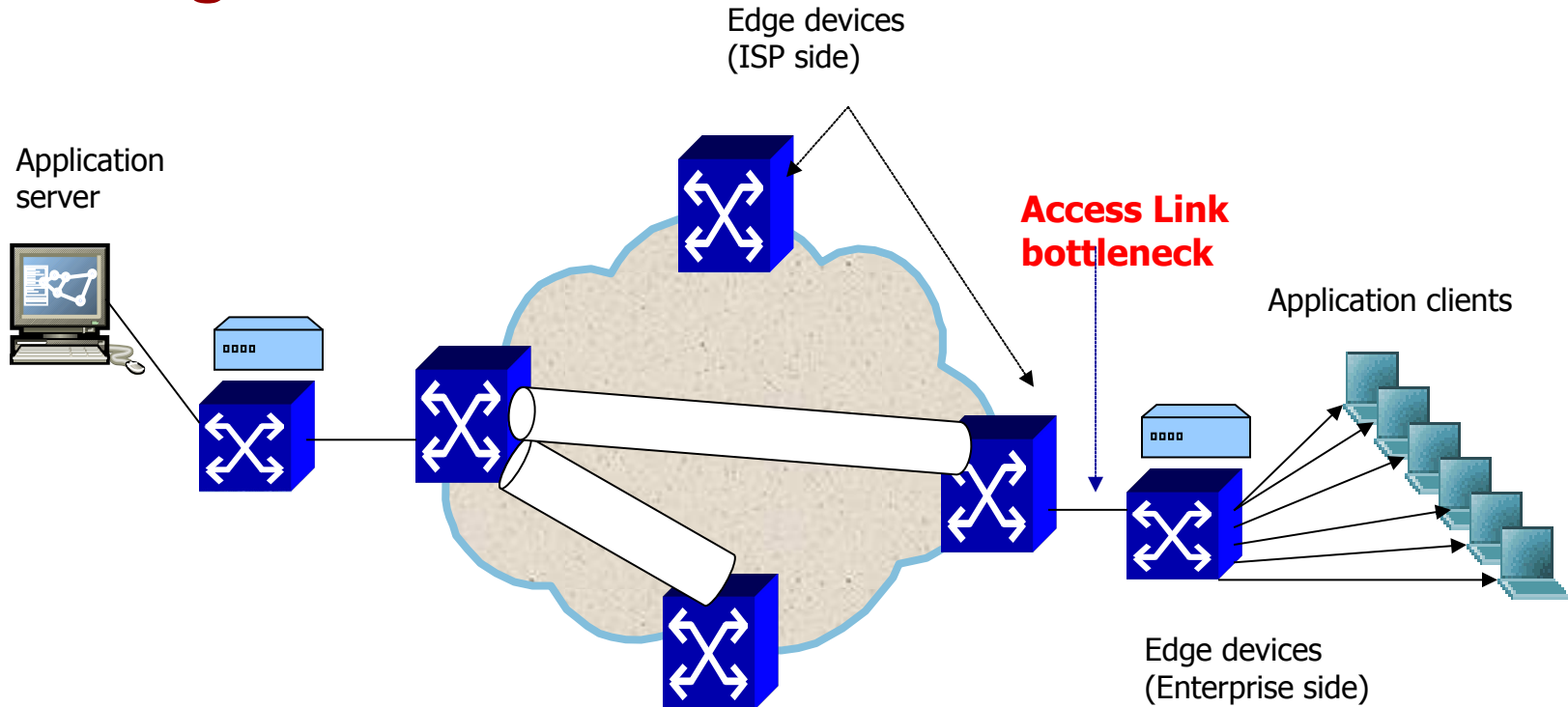
- **The application has to integrate itself with a particular ALM scheme**
- **ALM applications encounter a bottleneck at network access links**
- **Considerable processing power is required to support ALM mechanisms.**

# Stream Duplication





# General Application Layer Multi-Unicast from Edge Device Architecture

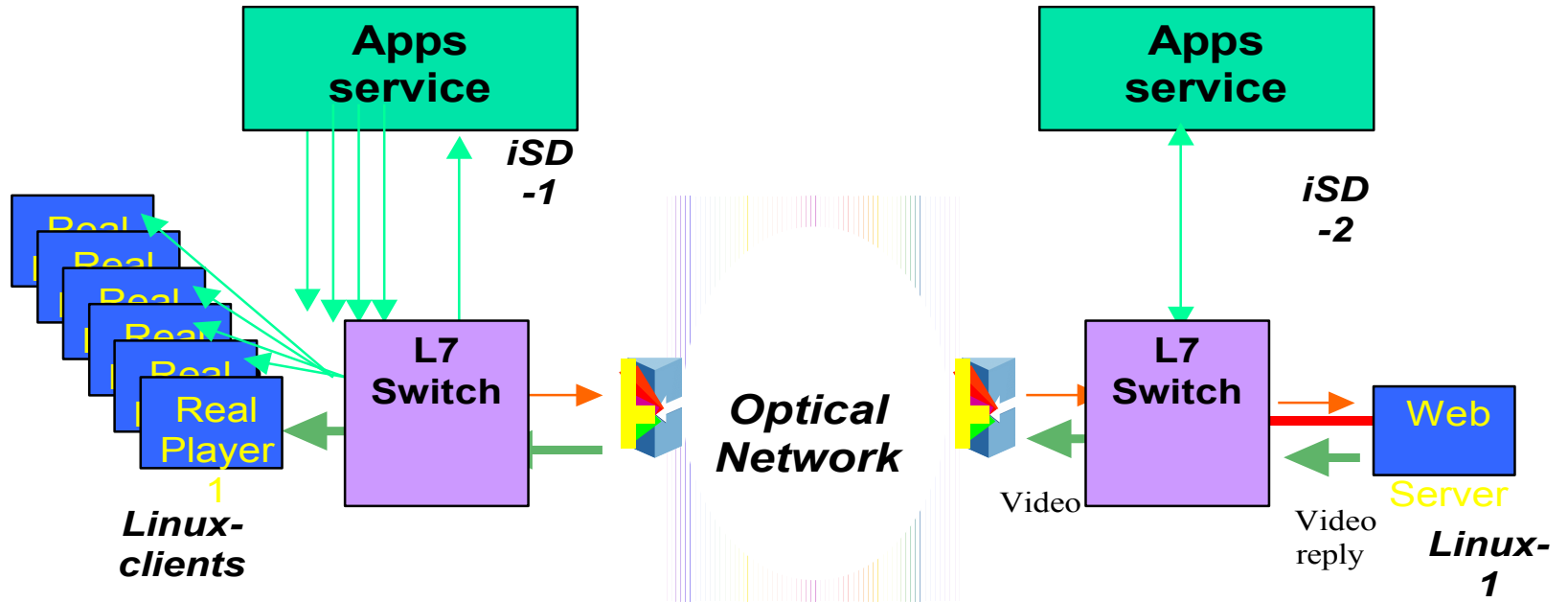


Edge devices form overlay structure

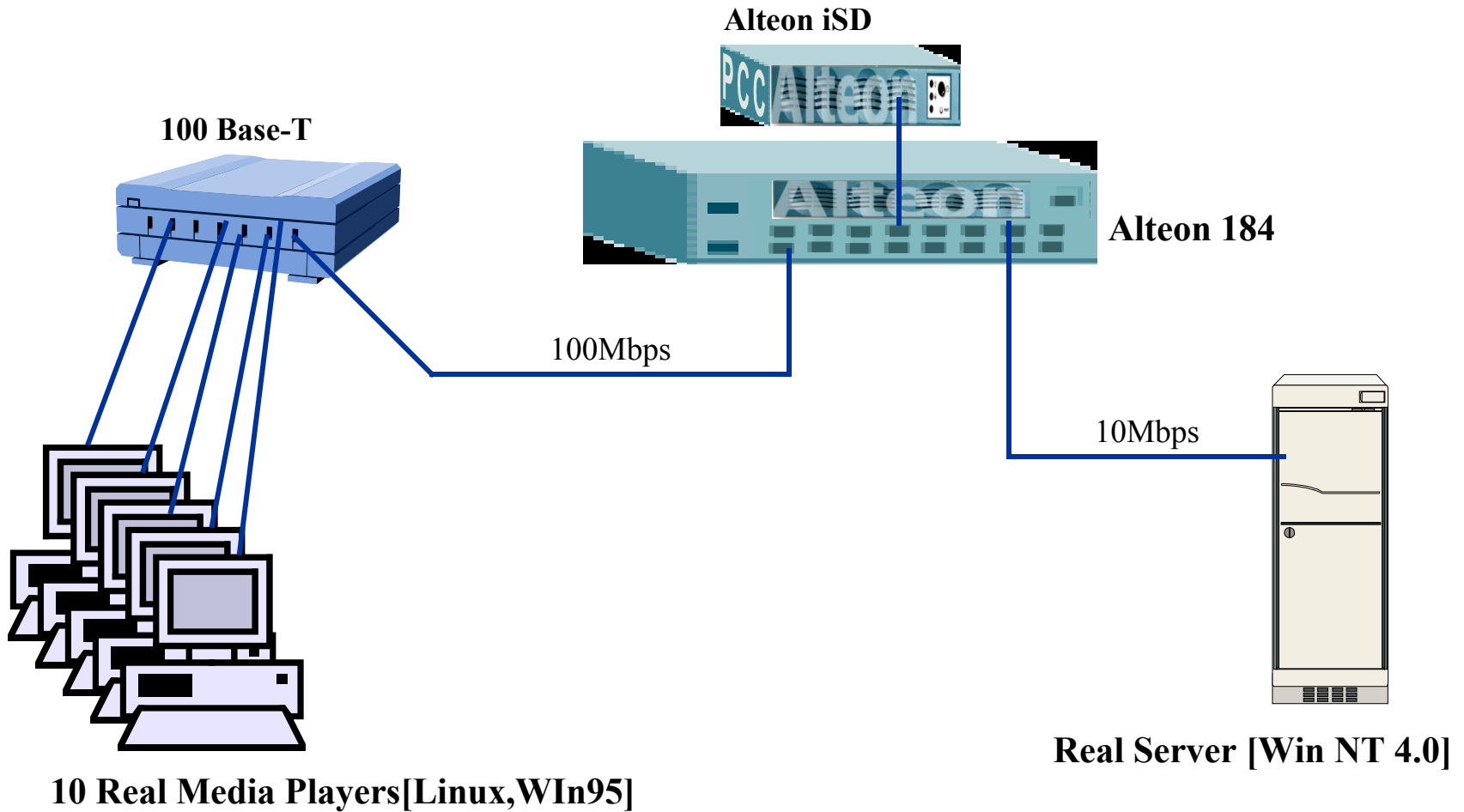
Edge devices can replicate and multi-unicast to multiple clients

Overcome bottleneck problem over access link

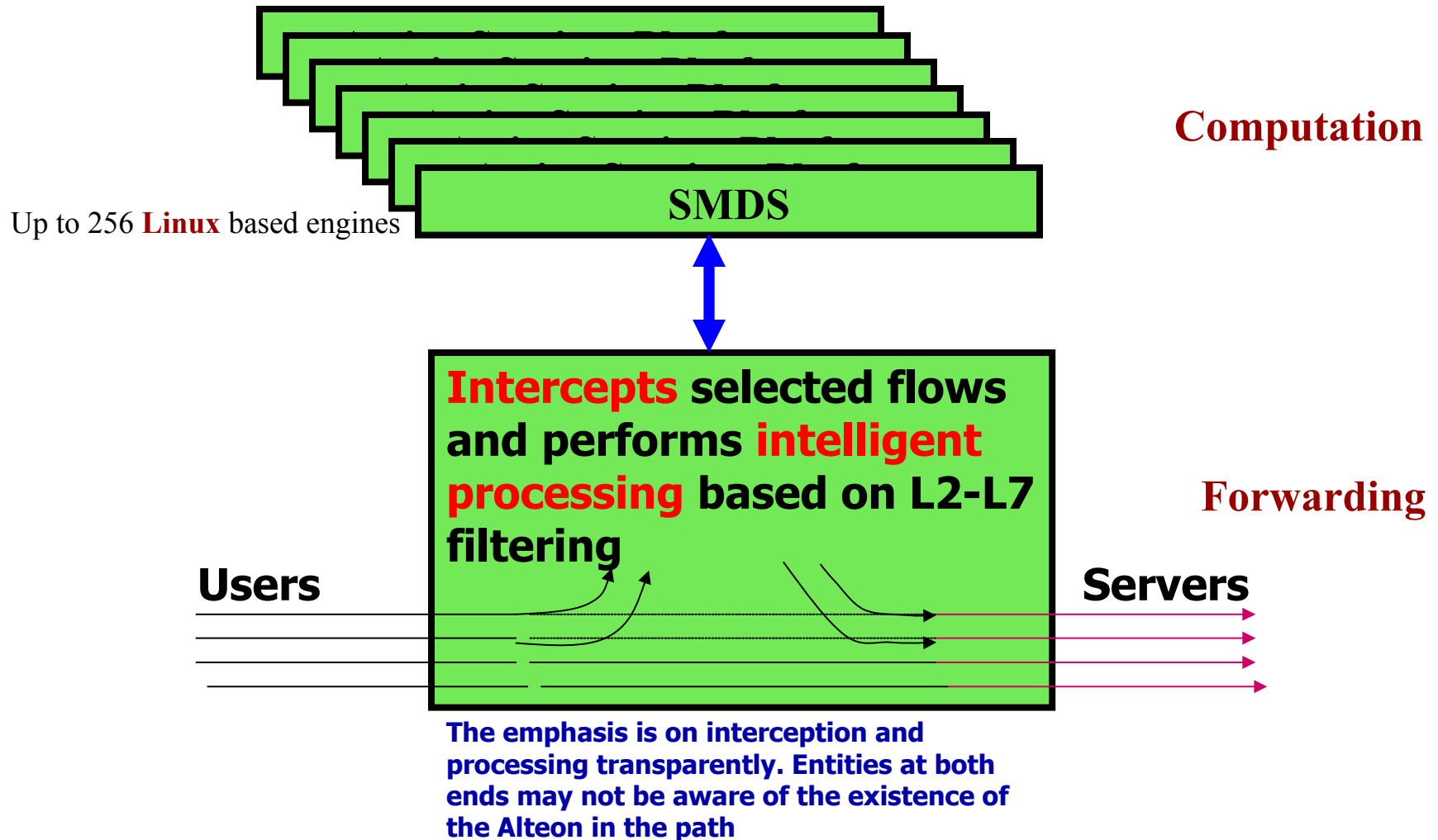
# Example - Video Streaming across an Optical Domain



# ALMunicast Test Setup



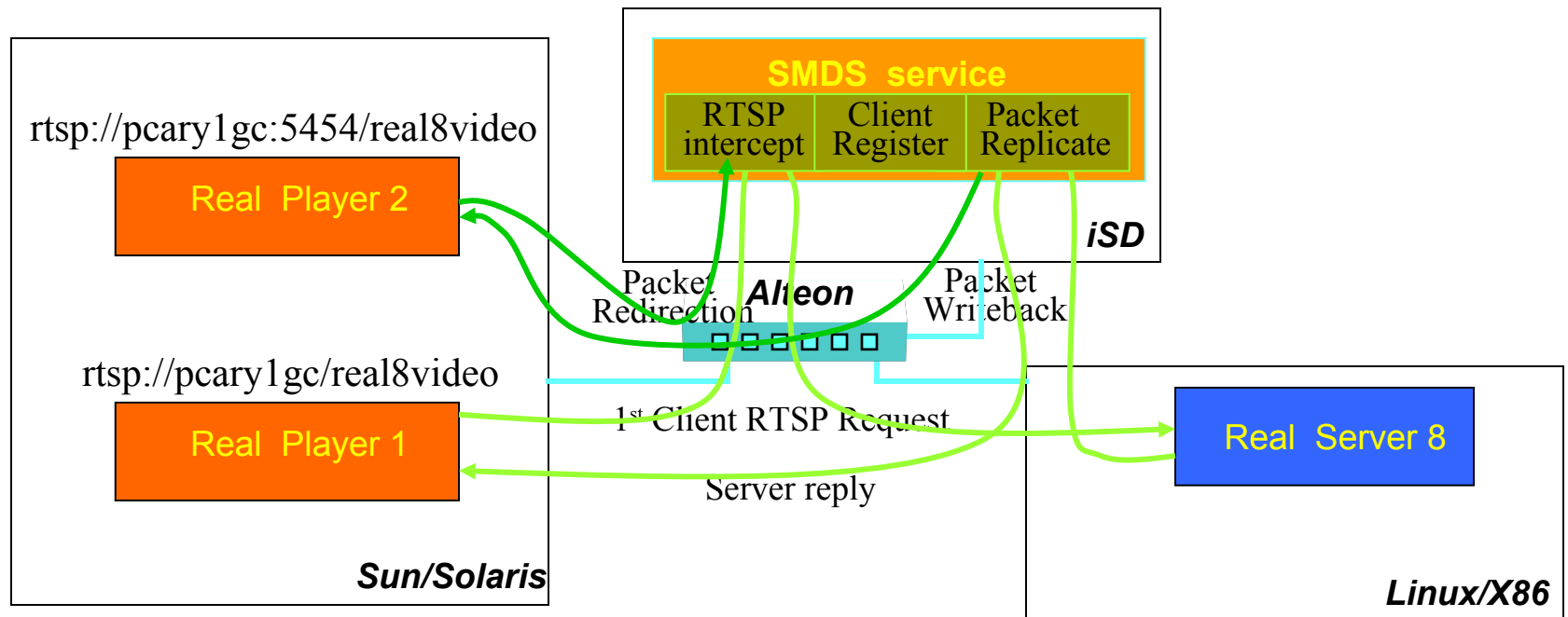
# Alteon/iSD Platform



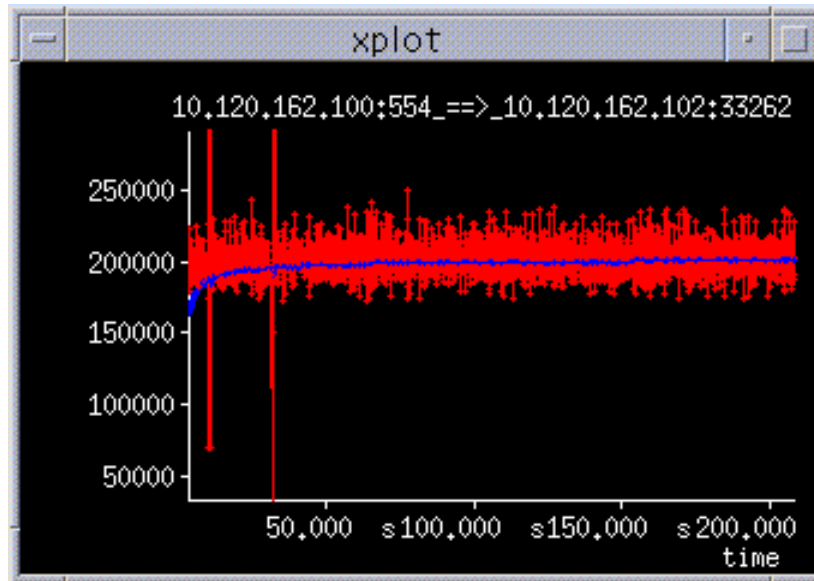
# Setup/Operation

## The setup with Alteon/iSD

- 1 Real server on Linux or NT, 2~8 Real Players on Solaris Streaming Media Distribution Service (SMDS) on iSD
- Real Player RTSP request filter and interception
- Real Server reply real-time stream filter and replication
- RTSP session setup by replicating first 16 packets cached



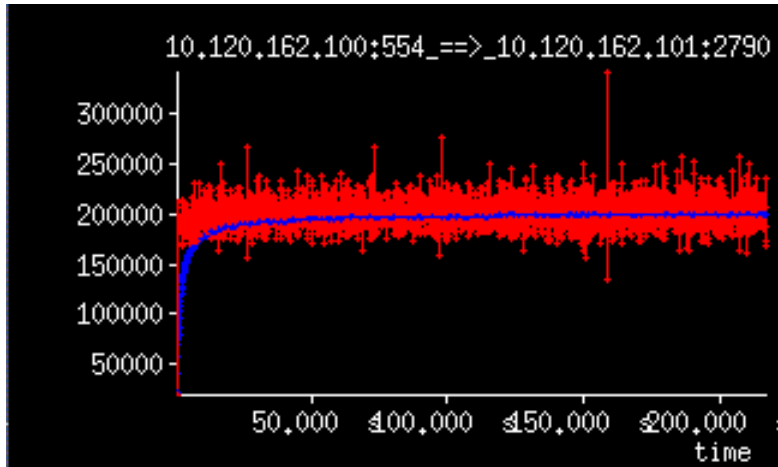
# Streaming with one client



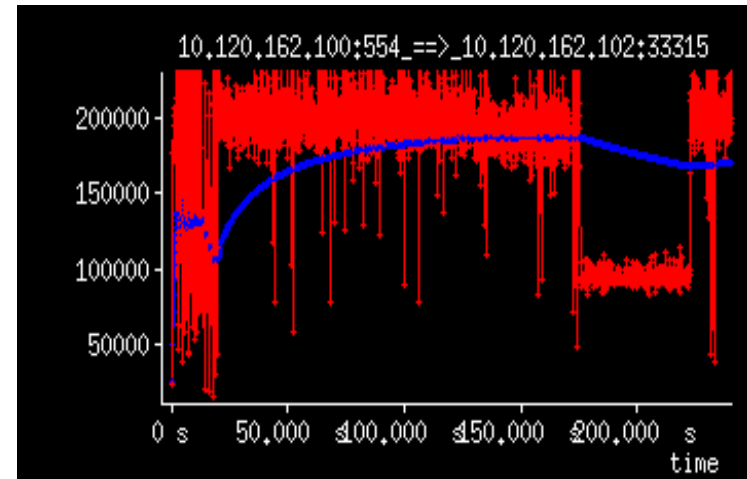
One stream, one client – 200KBps = 1.6Mbps

# Streaming with 4 clients-without Multi-Unicast

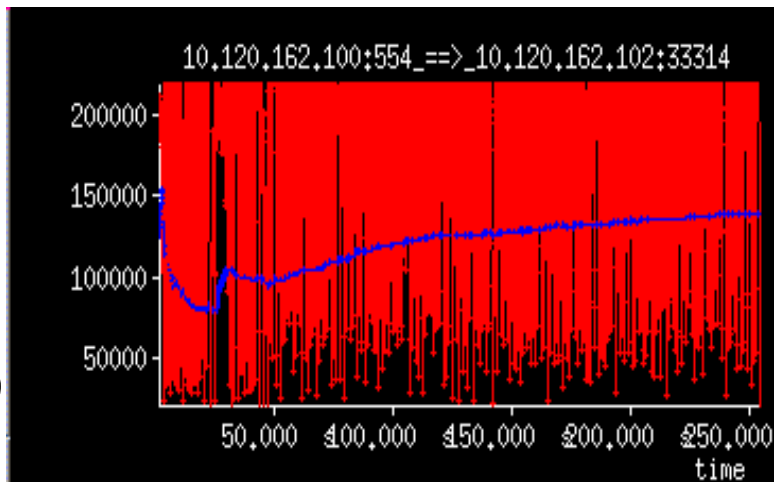
(1)



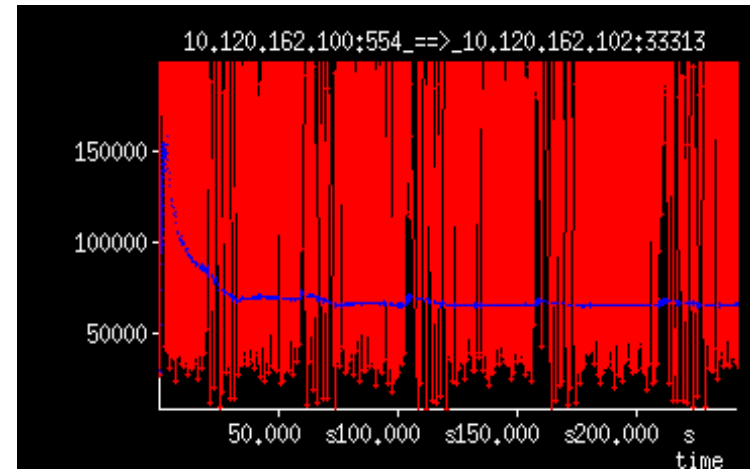
(2)



(3)



(4)

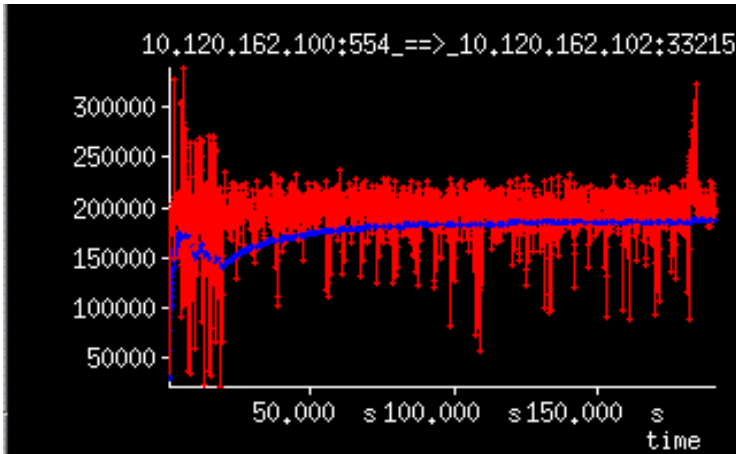


Simultaneous 4 streams.

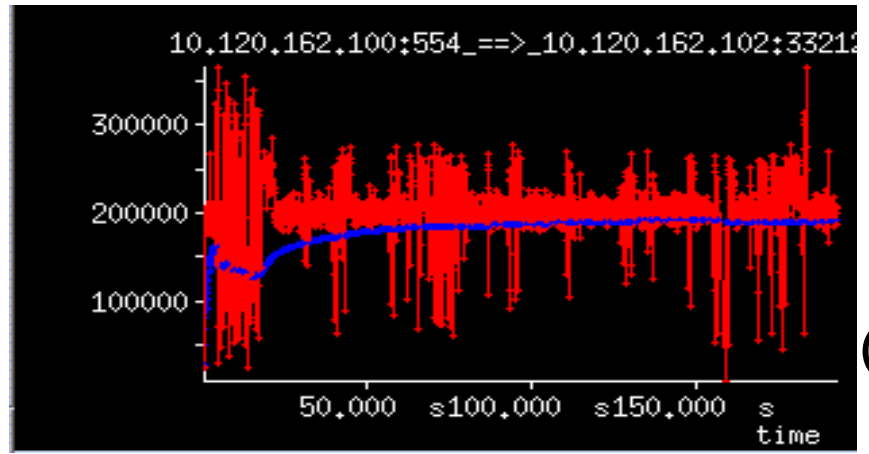
Degradation of throughput for each additional client

# Streaming with 4 clients-with Multi-Unicast

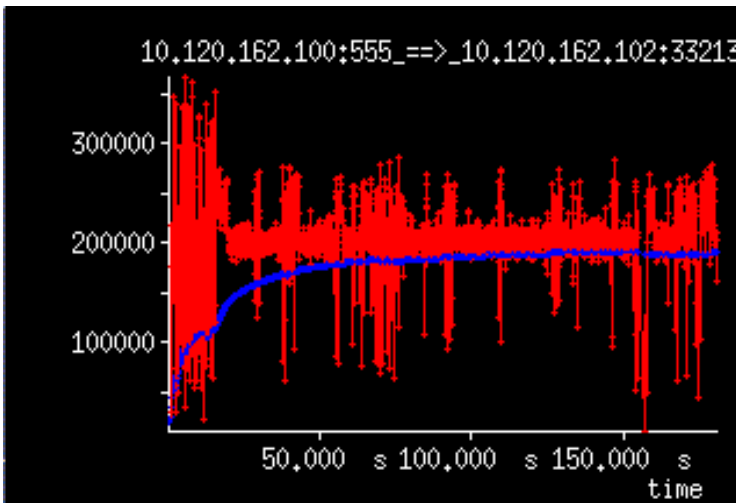
(1)



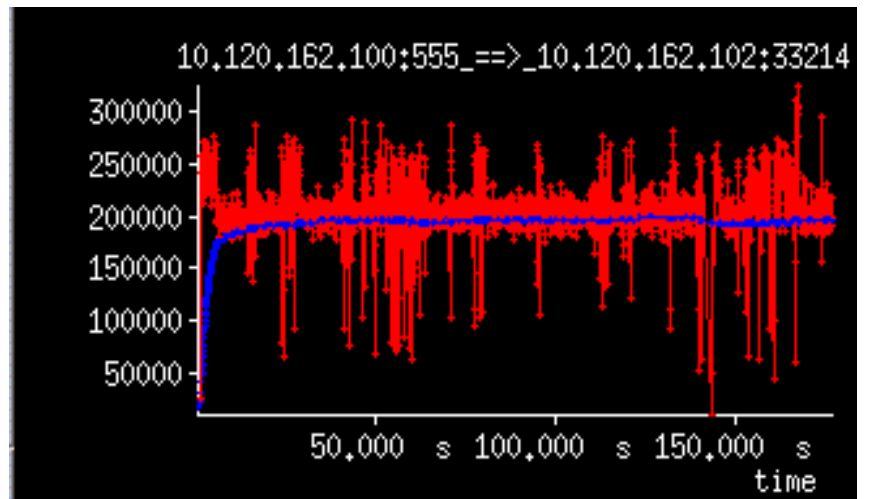
(2)



(3)



(4)



Sustained throughput with Multi-Unicast  
Provides QoS [BW] for each client



# Conclusion and Future Work

- **Streaming Media is just one service on this architecture.**
- **Programmable Intelligent Edge devices in this architecture can support**
  - Self Organizing Overlays
  - Data Replication for any ALM scheme.
  - Content-Aware services into the Network
- **Future Work**
  - Software API toolkit
  - Scalability and performance enhancement via FPGA based hardware Acceleration
  - For more Information - [www.openetlab.org](http://www.openetlab.org)

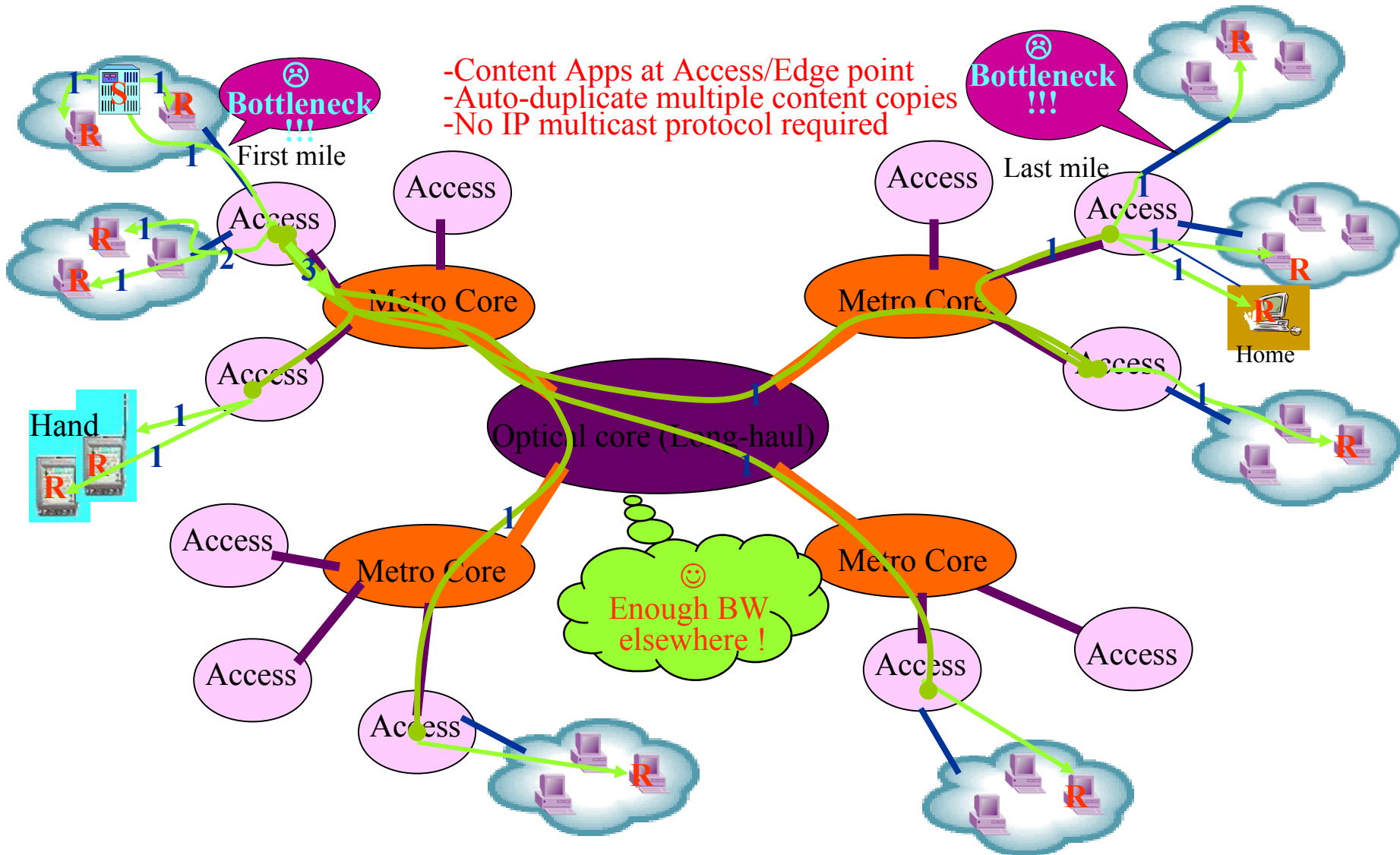
***Thank you!***

***Q&A***

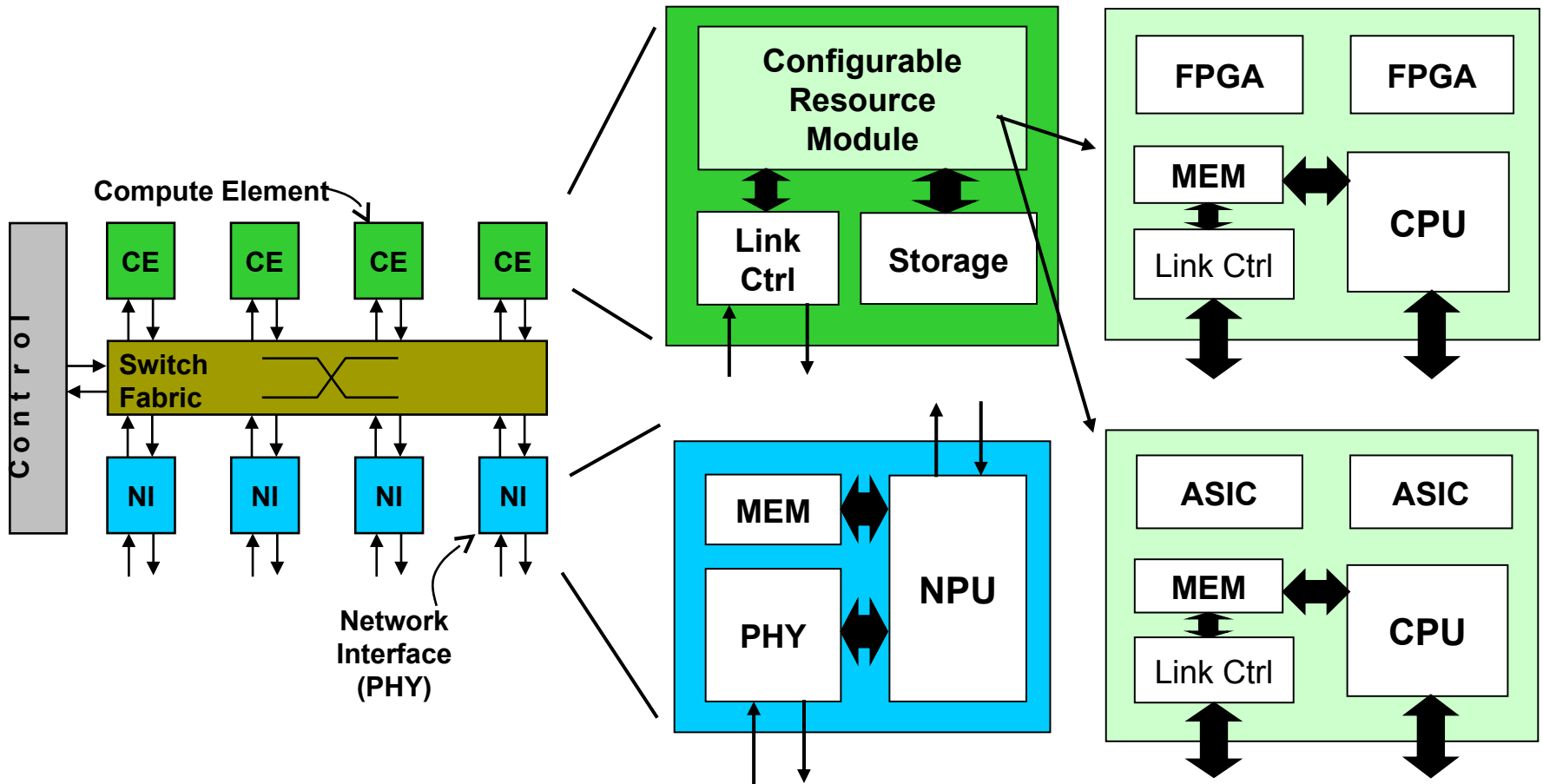
# *Backup Slides*

# Tunnel Multicast

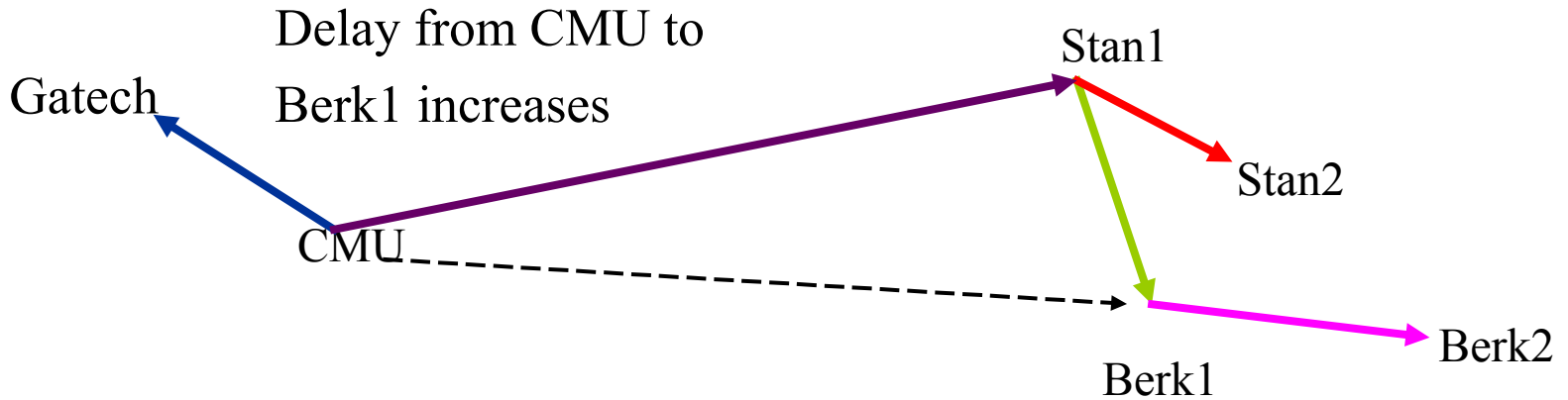
- Content Apps at Access/Edge point
- Auto-duplicate multiple content copies
- No IP multicast protocol required



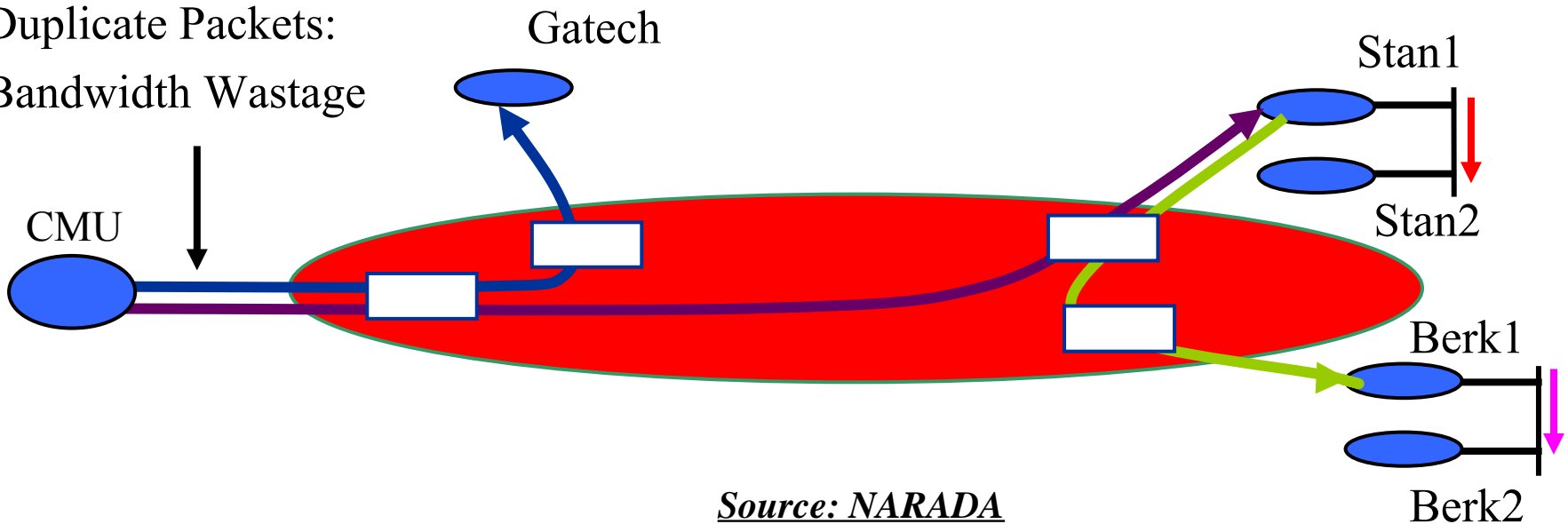
# Content-aware Service Gateway Hardware Architecture



# Performance Concerns



Duplicate Packets:  
Bandwidth Wastage



*Source: NARADA*