

# A Point-to-Multipoint Distribution Mechanism for IPTV Video Network

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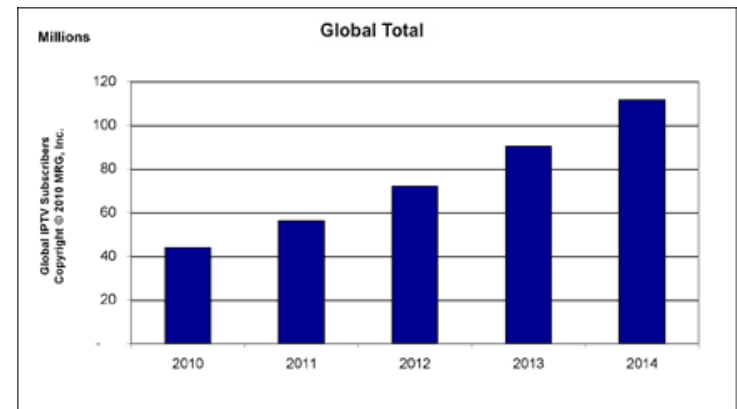
# Outline

- Background
- Motivation
- Labelcast Protocol
- More Discussions
- Performance Analysis
- Summaries & Upcoming work

# Background

- IPTV service
  - the most promising applications
  - delivered over IP networks
  - long-lived connection, high bandwidth consumption and continuity
  - video quality monitoring is important for both ISPs and Clients

Global IPTV Subscriber Forecast



# Why Labelcast is needed?

- Lacking efficient data distribution mechanism, especially between core and access network
  - IP multicast, P2P, CDN, UDP/RTP
- Video monitor is the basis for market success of IPTV
  - QoE of clients
- Why not define a new protocol for IPTV ?

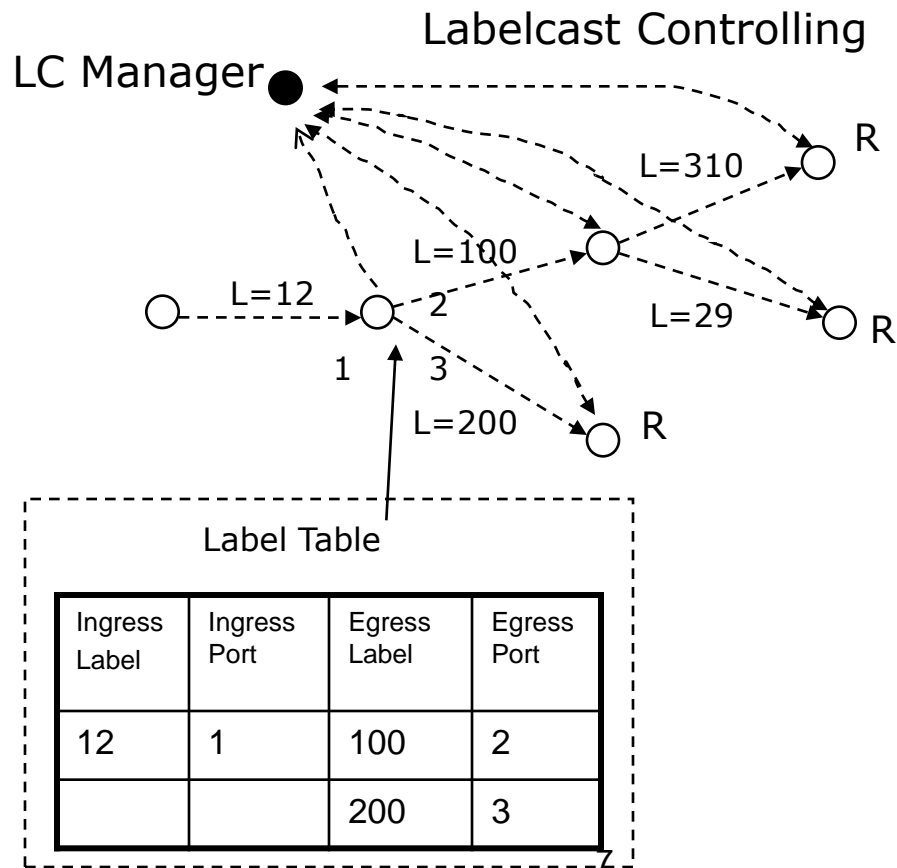
# Why Labelcast is needed? (Cont.)

- Labelcast can provide abundant information
  - Video quality monitor
  - Failure recovery
  - Routing optimization
  - Flow control
  - ...

# Labelcast Protocol

- A protocol especially designed for IPTV
  - Abundant information supporting for quality monitoring
- A transport layer protocol
  - Not depend on IP layer technologies
  - Transparent to applications
- Setup the transmission paths between source and receivers through label switching
  - Special path
  - Point-to-multipoint

- Label based forwarding



- Labelcast packet structure

Source IP: source node IP

Destination IP:

Multicast IP: multi-receivers

Unicast IP: single receiver (VOD or time-shift program watcher)



# Labelcast Header

field	Len	function
Ver	2b	protocol version
Pri	2b	packets priority, encoded by the set by the payload types
Seq	12b	sequence of a packet in data flow source node, unchanged during forwarding
BW	6b	Bandwidth of the flow which equal to $BW * 128Kbps$
Aid	8b	Identify different applications at the receiver
Label	16b	For packets forwarding use
TS	16b	Record packet arrive time in us

set by the source node, unchanged during forwarding

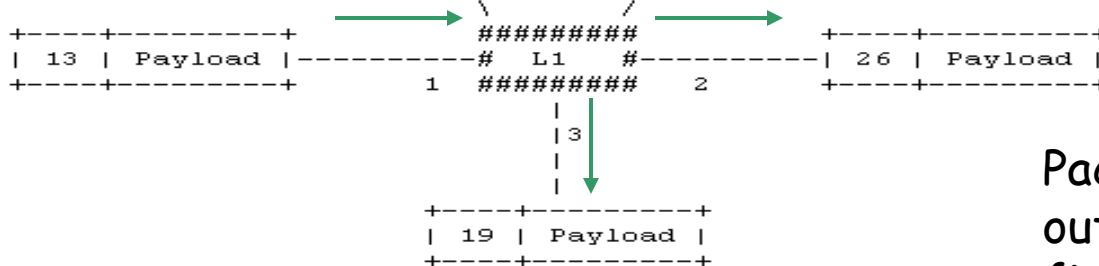
changed hop by hop along the forwarding path

- Application Example
  - Label based forwarding

Ingress port	Ingress label	Egress port	Egress label
1	13	2	26
		3	19

Labelcast switch node (L1) use Ingress port(1) and label(13) to lookup the forwarding table

Get the output port list and their corresponding new label



Packet is replicated and sent to output port 2 and 3, and label field will be replaced with new values

- Video-aware Network Processing
  - Video transmission quality can be monitored through Bw, TS, Seq fields
  - Distribution paths are optimized by the monitoring results
- Detecting Network State
  - Network state can be known by the Labelcast protocol, such as jitter or loss rate

- Impact on protocol stack
  - Source server
    - Labelcast packets are identified by Aid
    - Stream processor can provide RTSP/RTP/UDP/HTTP/Labelcast format
    - Encapsulates the transport layer header with Labelcast protocol form
  - Client
    - Receives Labelcast packets with Raw Socket
    - Resolves Labelcast packets and sends the payload to the applications

- Impact on protocol stack(Cont.)
  - Forwarding Node
    1. Modify the TTL options in the header and recompute the checksum of IP header
    2. Modify the timestamp of the header, and rewrite the local time
    3. Look up the label table, get the next hop, and replace the label

# Performance Analysis

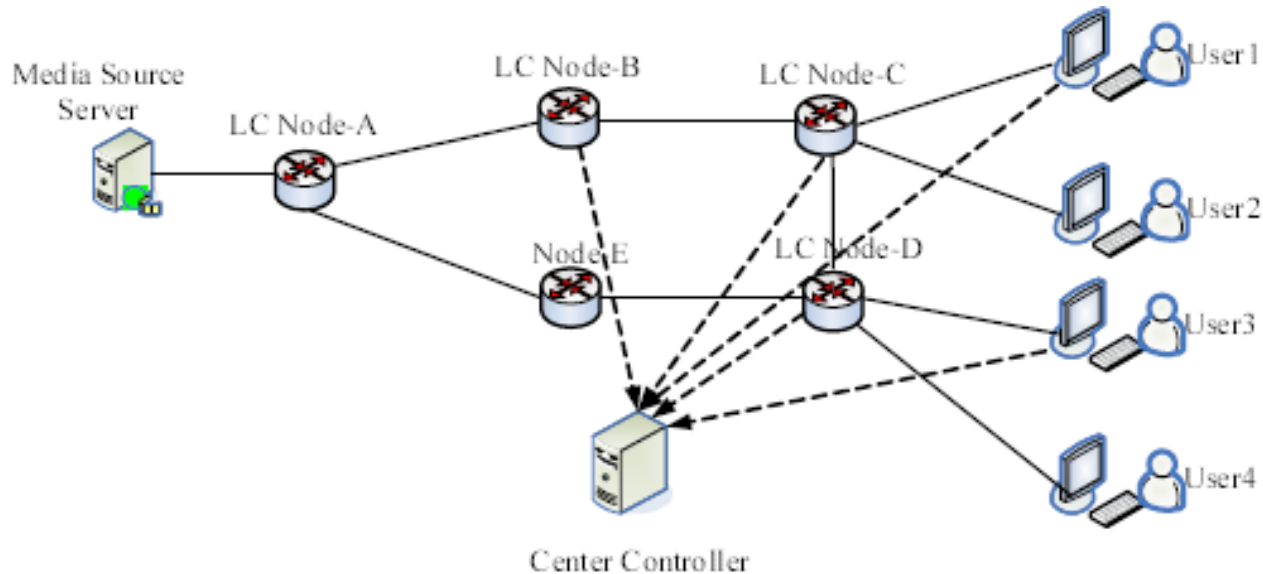


Fig. 4. Experiment topology

- Experiment environment
  - Test period: 100s~350s
    - At 250s, add the background streams to B
  - Video monitor: Monitor the stream passing A、 B、 C、 D
  - Source rate: Average rate is 5524kb/s
- Evaluation standard
  - DF
  - MLR
  - Stream Bandwidth
  - Node average Bandwidth

# Performance Analysis

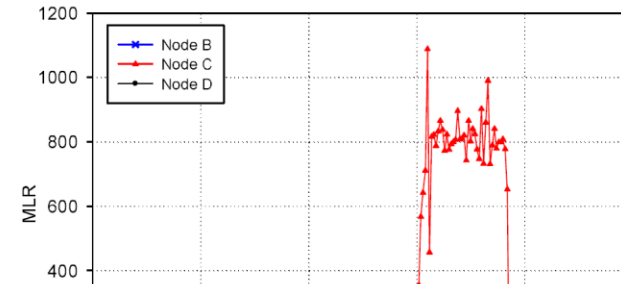
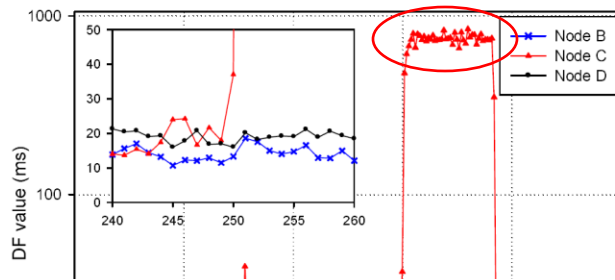


TABLE I

PERFORMANCE ANALYSIS AT EACH NODE

Node	Before Replacing label					After Replacing label				
	VBR	DF (ms)	MLR	StreamBW (kbps)	NodeBW (kbps)	VBR	DF (ms)	MLR	StreamBW (kbps)	NodeBW (kbps)
A	-1244	13.08	0	10694	33184	-1260	12.67	0	10694	33210
B	-8647	14.34	0	10635	104467	-	-	0	0	0
C	-1055216	727.55	784	2262	33.198	-1574	14.30	0	10691	33204
D	-1474	18.63	0	10692	22664	-1371	18.26	0	10693	43003

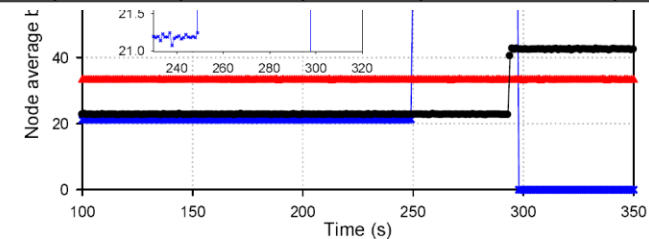
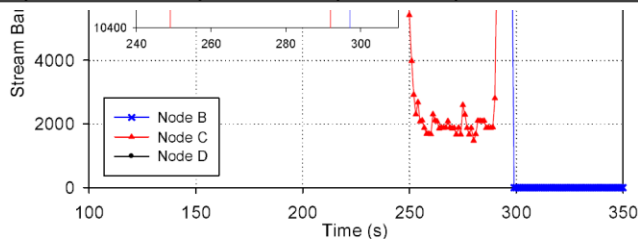


Fig. 5. Performance comparison before and after replacing label



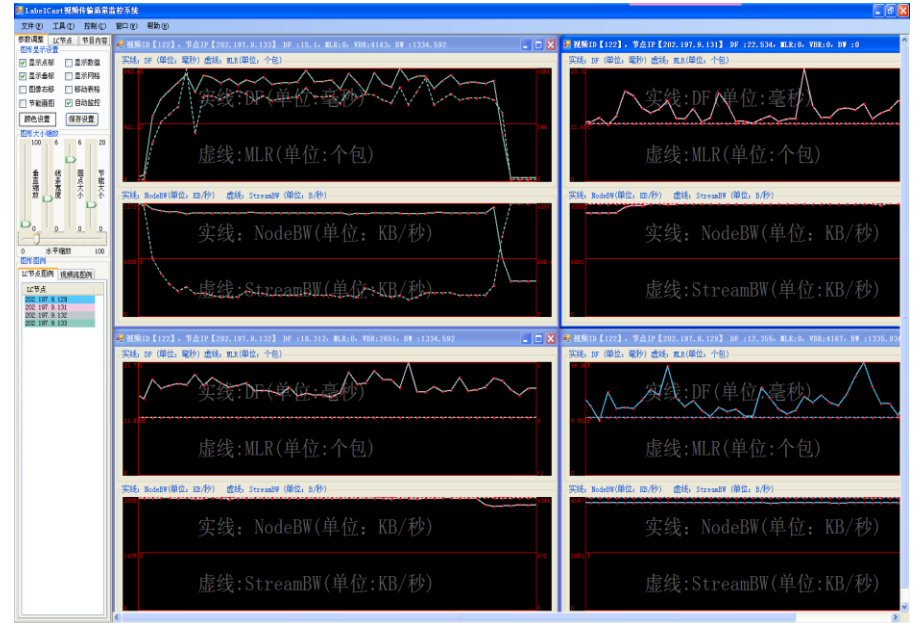
# More Discussions

- The Role of IP Multicast Address
  - Group ID
  - Layer 3 processing
- Labelcast Deployment
  - Changes little to the underlay network
  - Value-added module in router
  - IP tunnel can be used in Labelcast

# Summaries & Upcoming work

- Summaries
  - Labelcast is very suitable for IPTV video data transmission
  - Provide abundant information
  - Video quality monitoring
- Upcoming work
  - Control plan
  - Transmission optimization

# Appendix: Prototype Demo



Any Questions?