Labelcast Protocol

draft-sunzhigang-sam-labelcast-01

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Outline

- Diff 01 vs 00
- Background
- Labelcast Protocol
- More Discussions
- Summaries & Upcoming work
- Appendix: Prototype Demo

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Diff 01 vs 00

- Added in section 2 Why Labelcast is needed?
- Described Impact on protocol stack in section 4.2
  - Source
  - Client
  - Forwarding Node
- Added Application Example in section 5
- Modified More discussion in section 6

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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

Millions	Global Total

Source: Copyright © 2010 MRG, Inc.
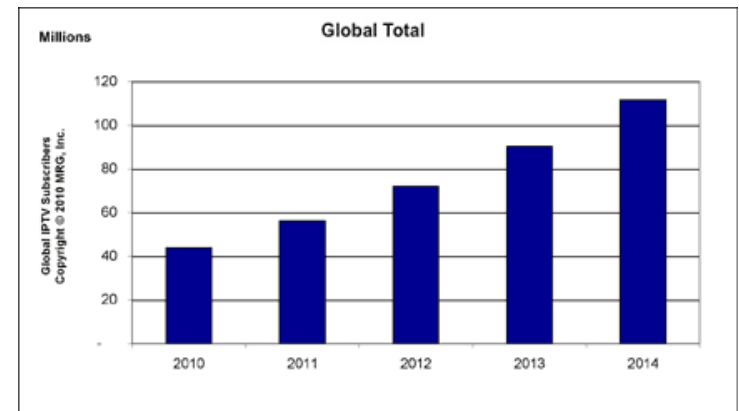
Why Labelcast is needed?

- 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 ?
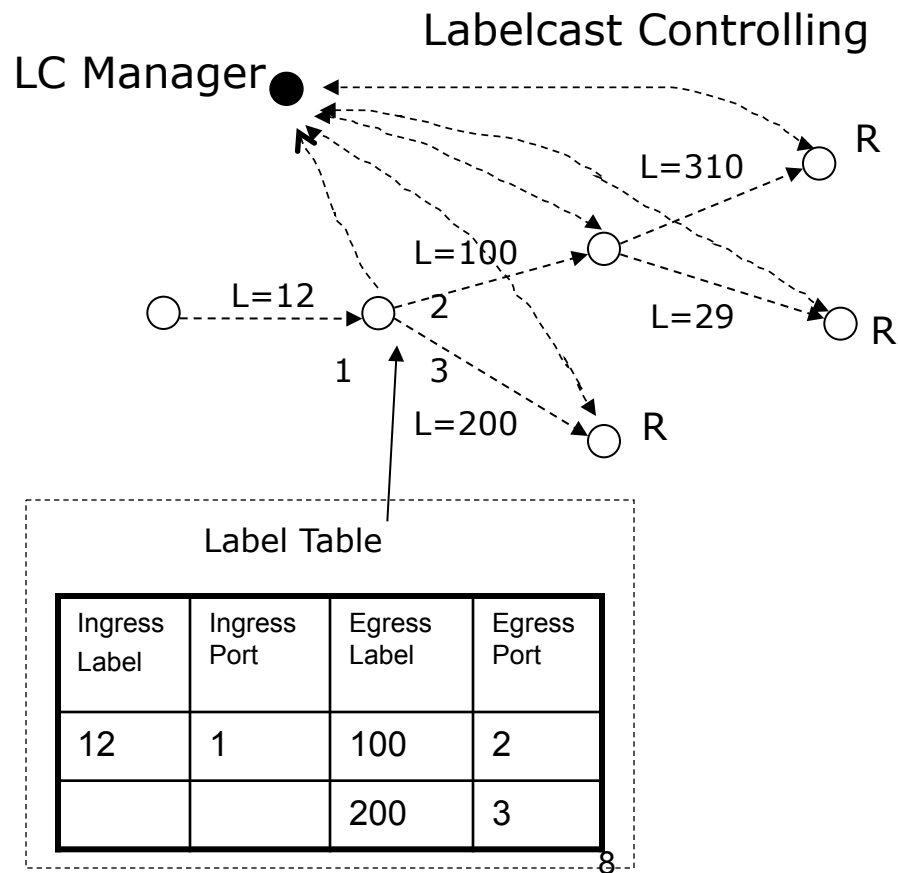
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Why Labelcast is needed? (Cont.)

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

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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

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- # Label based forwarding

Labelcast Controlling

LC Manager

L=310

L=100

L=12   2

L=29   R

1   3

L=200   R

Label Table

Ingress Label	Ingress Port	Egress Label	Egress Port
12	1	100	2
		200	3

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- Labelcast packet structure

```
+-----------+-----------+-----------------------------+
|    IP     | Labelcast |                             |
|  Header   |  Header   |          Payload            |
+-----------+-----------+-----------------------------+

 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|Ver|Pri|        Seq        |     BW      |       Aid         |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|           Label           |              TS                 |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
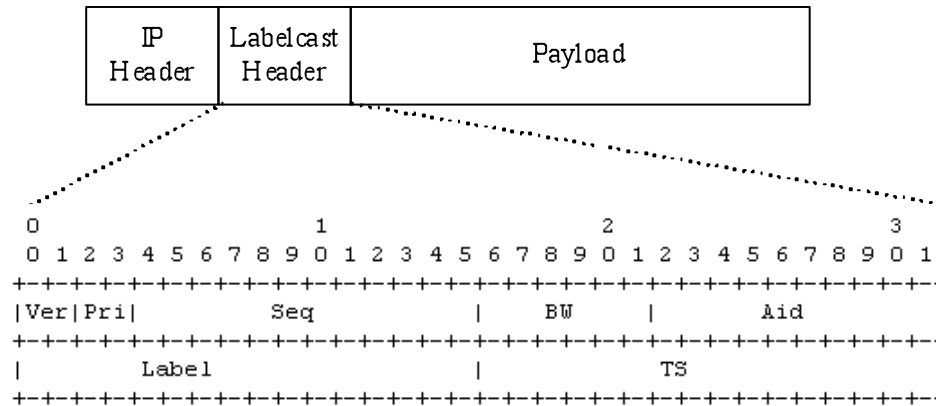
Source IP: source node IP
Destination IP:
Multicast IP: multi-receivers
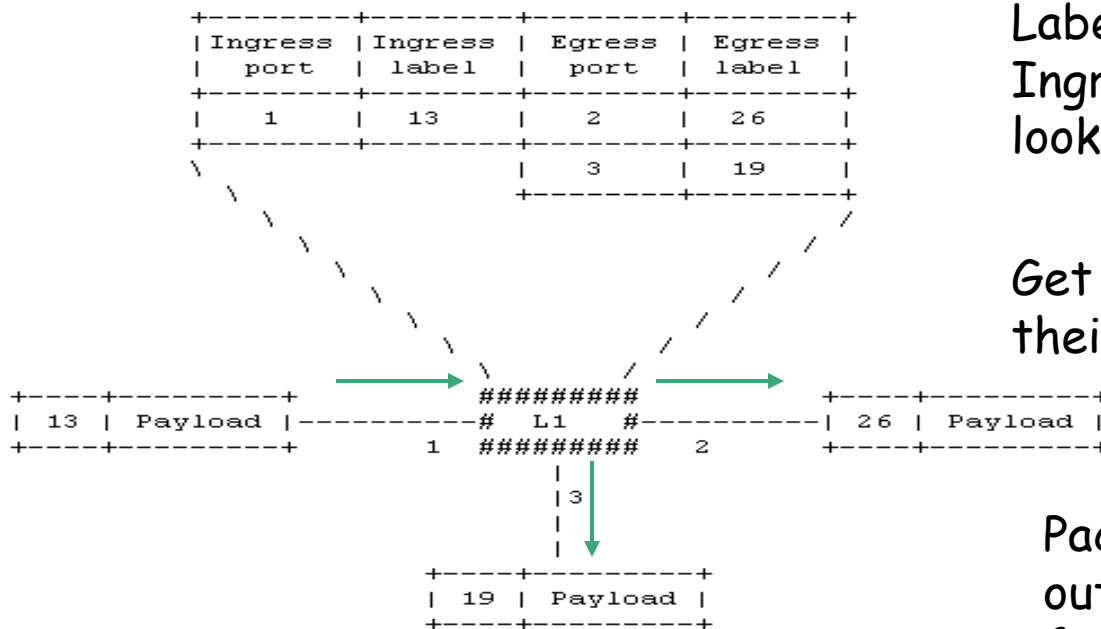Unicast IP: single receiver (VOD or time-shift program watcher)

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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

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• Application Example
– Label based forwarding

```
+--------+--------+--------+--------+
|Ingress |Ingress | Egress | Egress |
| port   | label  | port   | label  |
+--------+--------+--------+--------+
|   1    |   13   |   2    |   26   |
+--------+--------+--------+--------+
\                |   3    |   19   |
  \              +--------+--------+
    \                          /
      \                      /
        \                  /
          \              /
            \          /
              \      /
                \  /
+----+---------+   #########   +----+---------+
| 13 | Payload |---------# L1 #---------| 26 | Payload |
+----+---------+  1 #########  2 +----+---------+
                         |
                        |3
                         |
                         |
              +----+---------+
              | 19 | Payload |
              +----+---------+
```

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

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- 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

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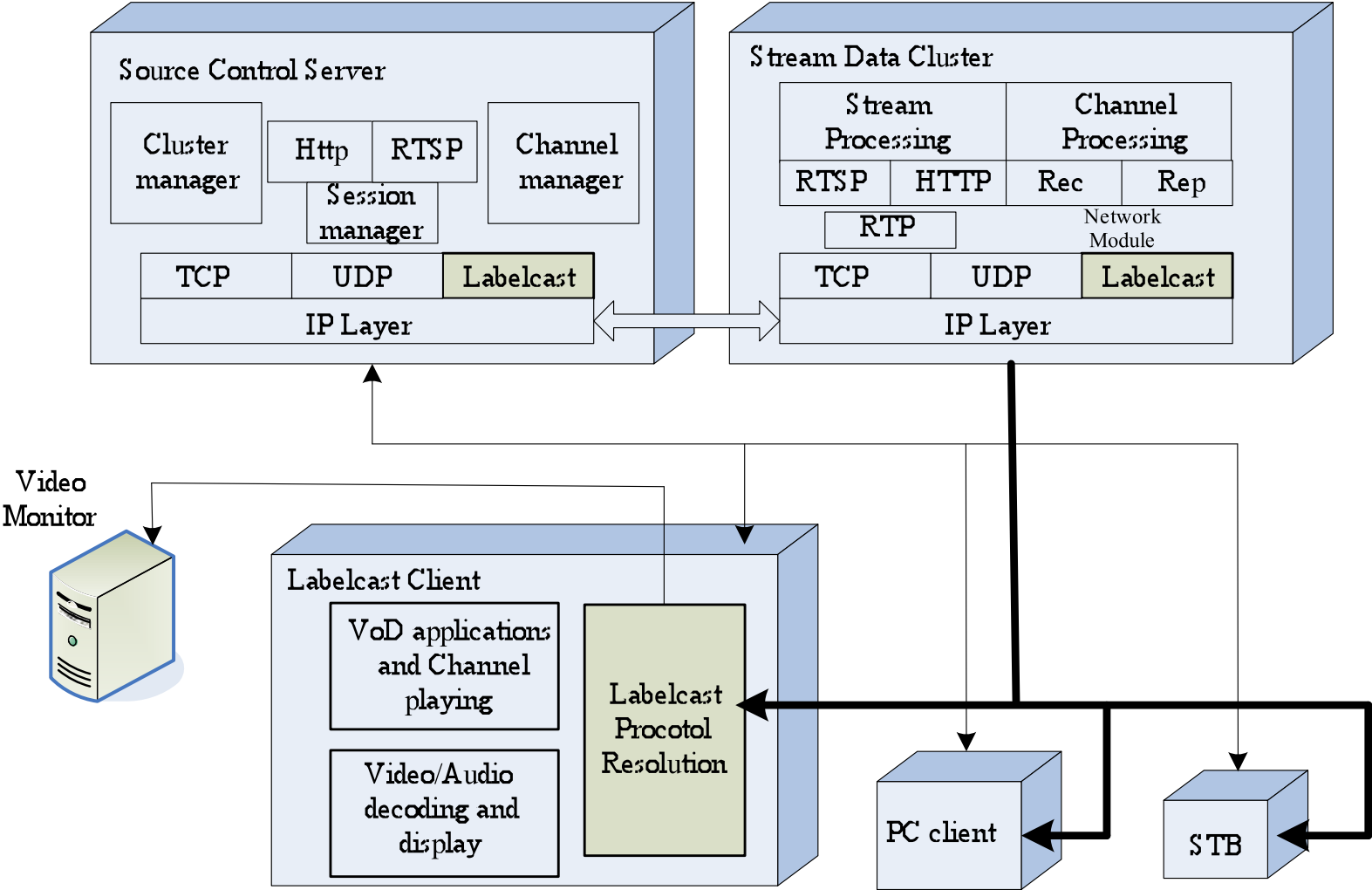 - Source server
    - Labelcast packets are identified by Aid
    - Stream processor can provide RTSP/RTP/UDP/ HTTP/Labelcast format
    - Encapsulates the transport layer header with Labelcast protocol form
  - Client
    - Receives Labelcast packets with Raw Socket
    - Resolves Labelcast packets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

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- **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 rewirte the local time
    3. Look up the label table, get the next hop, and replace the label

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Labelcast Prototype system

Source Control Server

| Cluster manager | Http | RTSP | Channel manager |
| | Session manager | | |

| TCP | UDP | Labelcast |
| IP Layer | | |

Stream Data Cluster

Stream Processing	Channel Processing
RTSP	HTTP	Rec	Rep
RTP	Network Module
TCP	UDP	Labelcast
IP Layer		

Video Monitor

Labelcast Client

| VoD applications and Channel playing |
| Video/Audio decoding and display |

Labelcast Procotol Resolution

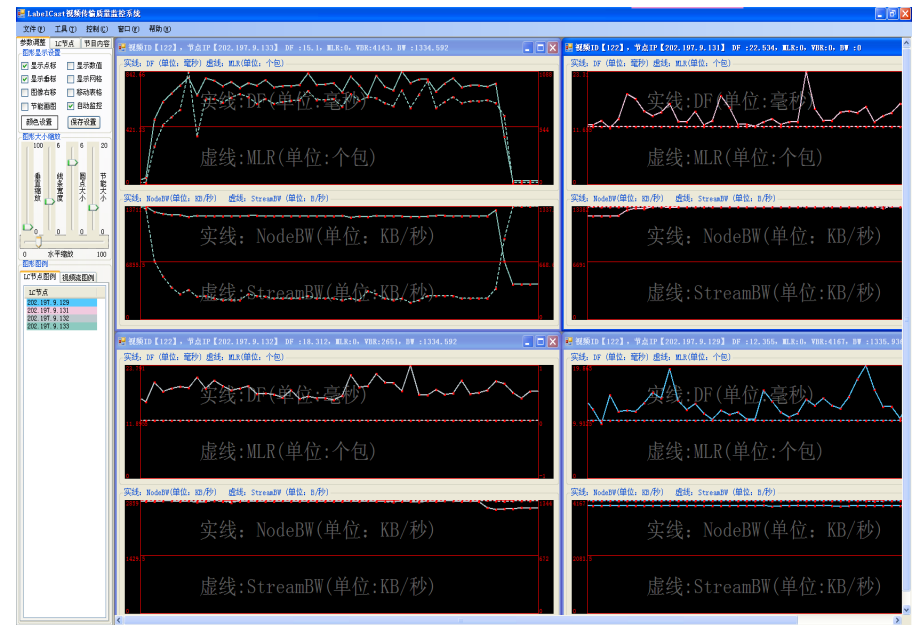PC client

STB

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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

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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

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Appendix: Prototype Demo

Any Questions?

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