Labelcast Protocol

(draft-sunzhigang-sam-labelcast-02)

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Main changes from version -01

- Revised motivations
- Clarified relationship between labelcast and IP multicast
- Distinguished roles of labelcast and RTP/RTCP in network status detection
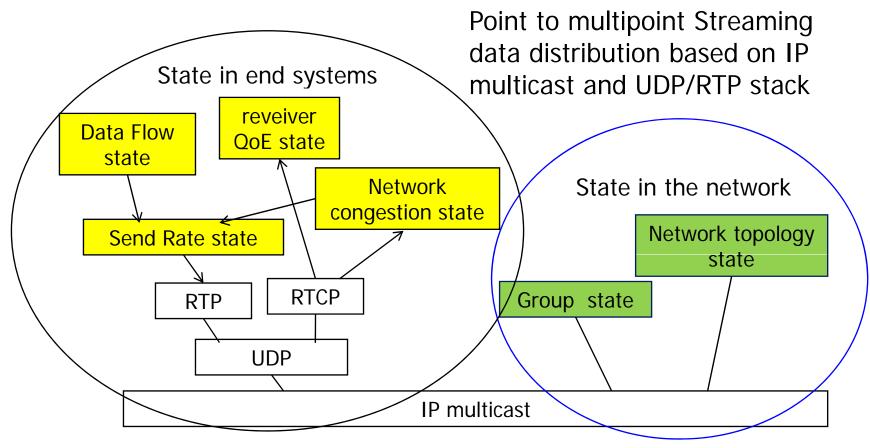- Add some thoughts about labelcast deployment

In Charter of SAMRG

- SAMRG is chartered to improve multicast performance with respect to several dimensions
  - Number of groups
  - dynamics of group membership
  - dynamics of network topology
  - dynamics of network resource constrains

- A key design consideration is the placement of multicast state information along the multicast path......

Motivations(1)

- **What is the multicast state information?**
    - group information
    - group member distribution
    - network topology
    - network congestion status
    - QoS requirement of the multicast data flow

- **What is the location of these states in the current ip multicast network?**

Motivations(2)

Point to multipoint Streaming data distribution based on IP multicast and UDP/RTP stack

State in end systems

Data Flow state

reveiver QoE state

Network congestion state

Send Rate state

RTP

RTCP

UDP

State in the network
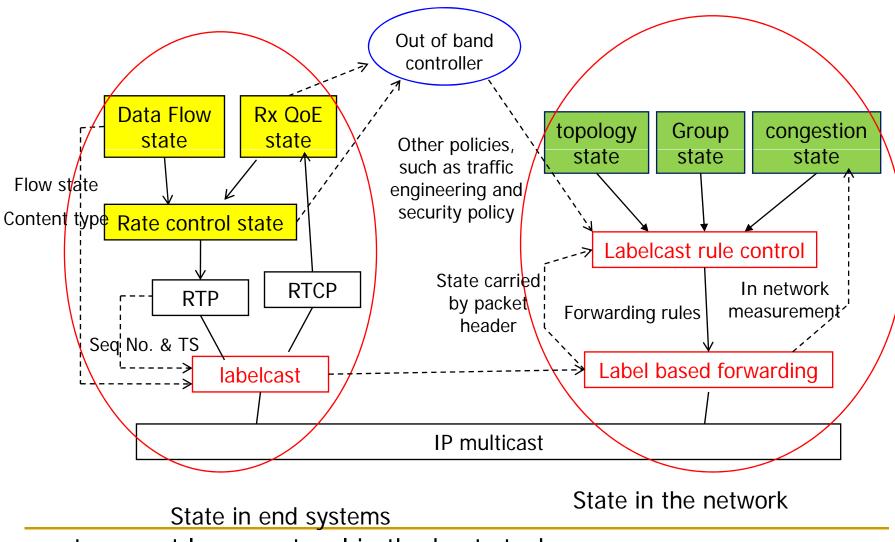
Network topology state

Group state

IP multicast

1.states located in end systems are hardly to be spread into the network

2.IP multicast infrastructure is a close system, policies based on states other than topology can not be easily cut in

Basic idea of labelcast(1)

- Label based forwarding: Separation of forwarding rules and multicast routing protocols
  - Out of band Policies can be easily cut in
  - Unicast/multicast packets can be processed in the same way

- In band state spreading: more state information is carried in packet header
  - Flow state, payload state (content type)
  - States for in-network measurement

Basic idea of labelcast(2)

Out of band controller

Data Flow state

Rx QoE state

topology state

Group state

congestion state

Flow state

Content type

Rate control state

Other policies, such as traffic engineering and security policy

Labelcast rule control

RTP

RTCP

State carried by packet header

In network measurement

Forwarding rules

Seq No. & TS

labelcast

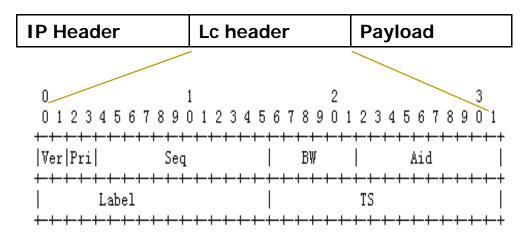Label based forwarding

IP multicast

State in the network

State in end systems

transport layer protocol in the host stack

7

Labelcast header format (1)

Labelcast header is identified by protocol field in IP header

IP Header	Lc header	Payload

Labelcast header is 8 bytes long with 7 fields

```
 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                   |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Figure 1: Head Format

Labelcast is a light weight protocol, data integrity and control feedback problem are left to application layer, checksum and source port number are not used
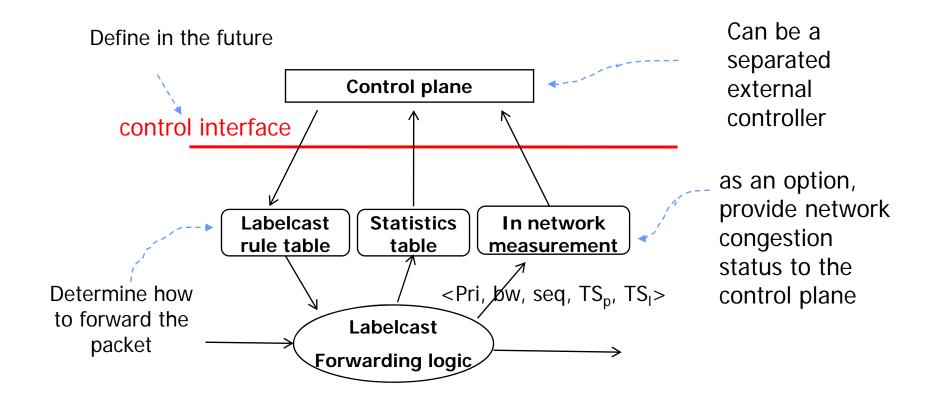
Labelcast header format (2)

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

set by the source node, unchanged during forwarding

Modified hop by hop along the forwarding path

Labelcast packet processing(1)

Labelcast forwarding processing model

Define in the future

Can be a separated external controller

control interface

Control plane

Labelcast rule table

Statistics table

In network measurement

as an option, provide network congestion status to the control plane

Determine how to forward the packet

Labelcast Forwarding logic

$<Pri, bw, seq, TS_p, TS_l>$

Labelcast packet processing(2)

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 |
                  +----+--------+

        Figure 2: Label Processing
```

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

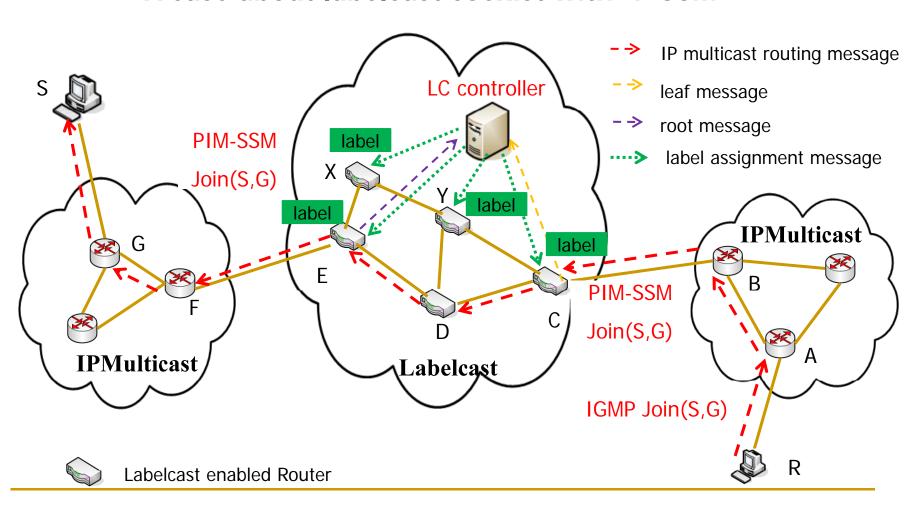Get the output port list and their corresponding new label.

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

Relationship to IP multicast(1)

- Labelcast is a supplement to current IP multicast infrastructure
  - Just like MPLS and IP
- Labelcast enabled switch nodes have two forwarding planes
  - Labelcast plane & IP plane
  - labelcast is the first choice, IP forwarding plane can work instead, if
    - Not labelcast packet
    - No corresponding rules in labelcast rule table, maybe labelcast control plane is failure

Relationship to IP multicast(2)

A case about labelcast coexist with IP SSM

Relationship to RTP/RTCP

- RTP/RTCP is used for applications while labelcast is used for the network
    - RTP packets can not be identified easily in the network
    - RTCP based tomography can not deduce network status in real time
        - To restrict rtcp traffic, receivers may feedback their status in every several minutes

- If in-network measurement is not enabled, result of RTCP tomography can also be used to generate out-of-band policies to effect label forwarding rules

14

Other discussions

- **Labelcast based Application development**
  - End systems can use labelcast directly for streaming data distribution
  - Common API and associate middleware can be used to mask the difference
- **Labelcast deployment**
  - **Gateway based**
    - Building labelcast cloud in IP multicast networks
  - **IP tunnel based**
    - Tunnel setup between two disjunct labelcast nodes

Any questions?