Follow-up Discussion on Switch-controlled Packet-level Load Balancing Solutions

Jieyu Li（China Mobile)

Weiqiang Cheng（China Mobile）

Ruixue Wang (China Mobile)

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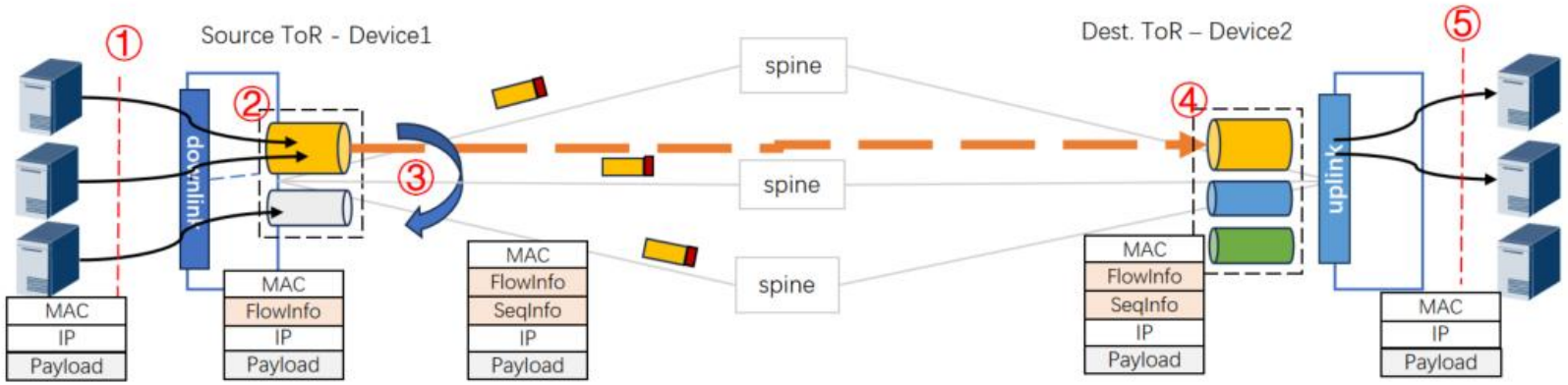
Recap

- In July Plenary Nendica meeting, the contribution ‘1-25-0013-01’ discussed the background and motivation of swith-controlled packet-level load balancing solutions, and called for considerations to their standardization in IEEE 802.1.

- This contribution intend to push foward the discussion based on concerns mentioned in the July plenary meeting, and mainly talk about the relevance with 802.1cb.

Some concerns mentioned in the July Plenary

The simple example of possible end-to-end processing shown in 1-25-0013-01 :



① Send original flows.

② Aggregate into a new spray-then-reorder "flow"

- Aggregated Source: from the certain source ToR
- Aggregated Destination: toward the certain dest. ToR or dest. ToR's output port or priority.

→ New Flow Information (e.g., src. deviceID) should be carried.

③ Spray the new "flow"

- Granularities:
  - One packet
  - A Group of packets
- Strategies:
  - Round-robin
  - Congestion-aware
  - ...

→ Sequence information within the new 'flow' should be carried.

④ Re-order the "flow"

- Identify the flow based on FlowInfo
- Reorder based on SeqInfo
- Remove the extra tag.

⑤ Receive original flows.

Some concerns

Stream Aggregation and Insert Extra tag like Sequence number

- It sounds similar with 802.1cb.

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Spraying Strategies

- How to do congestion-aware, local or global.

Re-ordering issues

- The cost of re-ordering in switches, and the vendor's willingness to do this.

802.1cb vs Packets Spray-and-Reorder (PSR) (1)

802.1cb

- **Purpose:** provides increased reliability (with the cost of bandwith).
- **Key operation:** sequence numbering and **replicating** every packet, in the source end system and/or in relay systems in the network, and **eliminating** those replicates in the destination end system and/or in other relay systems.
- **Main scenarios:** TSN network.

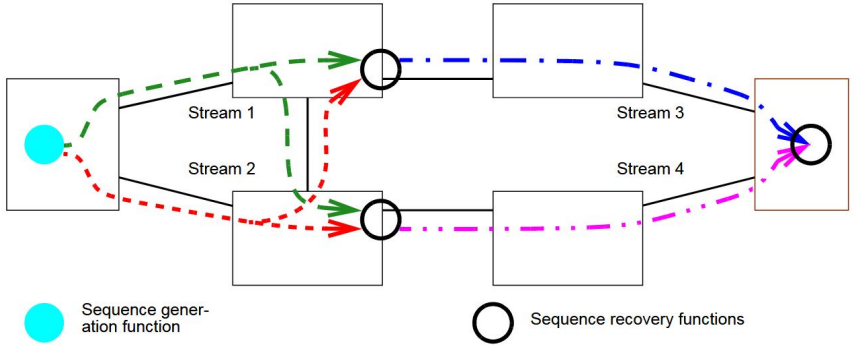
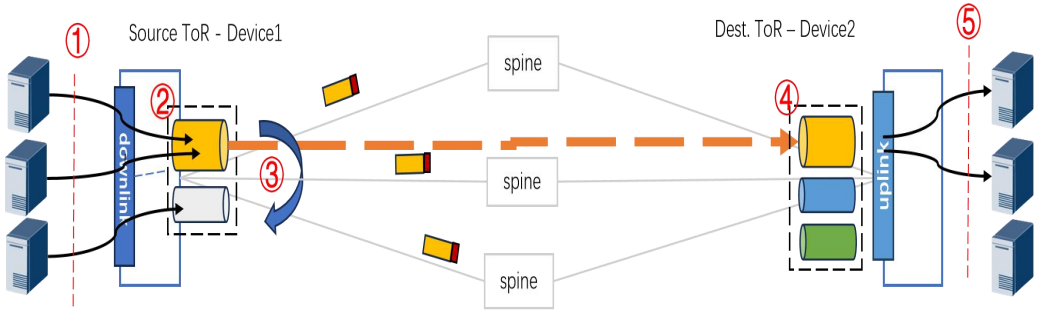


Figure 7-1—Compound Stream built from four Member Streams

from 802.1CB-2017

PSR

- **Purpose:** fully utilizes network multi-paths bandwidth.
- **Key operation:** sequence numbering and **spraying** packets of a compound flow among multiple paths in source ToR, and **reordering** OOO packets in destination ToR.
- **Main scenarios:** the network that need fine grained load balancing, like AI computing network with the taffic pattern consisting of low entropy and high bandiwidth flows.



- **The purpose, key functions, and main applied scenarios of 802.1cb and PSR are distinct.**

802.1cb vs Packets Spray-and-Reorder (PSR) (2)

Some similarities:

1) Stream identification

Both need to identify streams from end station to apply certain opertions.

- **P802.1cb:** define four functions to identify stream, including MAC and IP layer header, and also support MAC header overwrites.
- **PSR:** In source ToR, identify the compound flow to spray; In destination, identify the packets from the same compund flow to reorder. May use the similar identification function to do this.

Table 6-1—Stream identification functions

Stream identification function	Active/passive	Examines	Overwrites	Reference
Null Stream identification	Passive	destination_address, vlan_identifier	None	6.4, 9.1.2
Source MAC and VLAN Stream identification	Passive	source_address, vlan_identifier	None	6.5, 9.1.3
Active Destination MAC and VLAN Stream identification	Active	destination_address, vlan_identifier	destination_address, vlan_identifier, priority	6.6, 9.1.4
IP Stream identification	Passive	destination_address, vlan_identifier, IP source address, IP destination address, DSCP, IP next protocol, source port, destination port	None	6.7, 9.1.5

2) Extra information need to be carried in the MAC header

Both need to carry extra information, like sequence information

- **P802.1cb:** define a new TPID value for R-TAG to carry sequnce informtaion.
- **PSR:** also need sequence number, but more information may be needed. can also define a TPID value for PSR to carry relevant information.

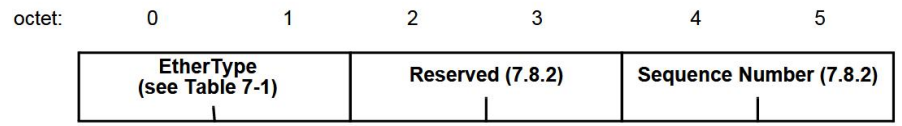


Figure 7-4—R-TAG format

Table 7-1—R-TAG EtherType

Purpose	EtherType
Redundancy tag (R-TAG)	F1-C1

from 802.1CB-2017

Conclusion

- The purpose, basic operaions on flows, and main applied scenarios between 802.1cb and PSR are different, but 802.1 cb can provide PSR reference in stream identification and tag definication.
- Plan to unfold and discuss more detailed solution of spraying and reordering in the network.

Discussion

- If our goal is to initiate a project for PSR, any suggestions for the next step?

Thank You !