

P802.1Qdv contribution – Leftover Frames Catchup

dv-yizhou-leftover-frames-catchup-0723-v01

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Network control frames may use the highest priority

- Network admin gets used to multiple traffic classes with SP (strict priority)
- Some network control frames use the highest priority
 - IEEE 1588

A.5.3.3 Network component delay fluctuation

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Most bridges and routers support traffic prioritization. High-priority traffic suffers less fluctuation in propagation time. PTP event messages preferably are sent with high priority compared with other data whenever possible. See Annex D through Annex I for specific priority recommendations for each transport protocol.

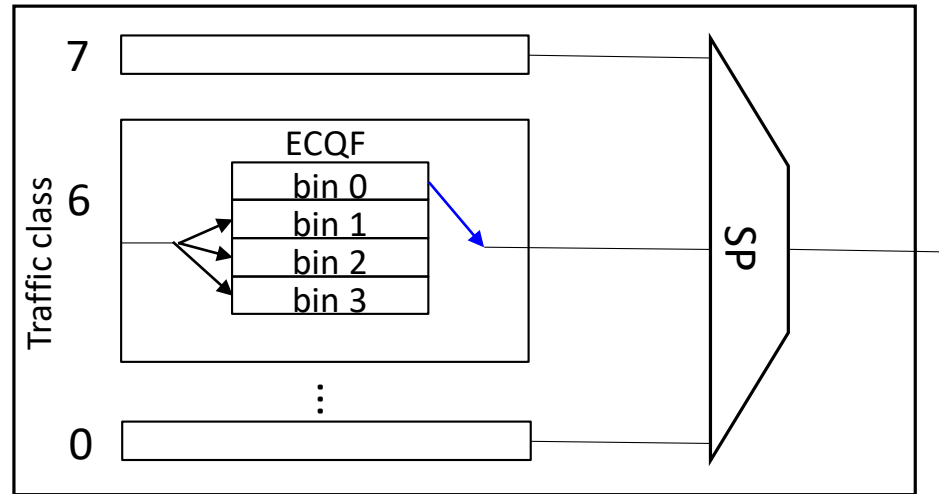
D.4 Optional values

For PTP event messages, the value of the Differentiated Service (DS) field in the Traffic Class (TC) field should be set to the highest traffic class selector codepoint available.

NOTE 1— When the layer 2 transport mechanism allows for multiple priorities, the highest priority preferably is used for PTP event messages.

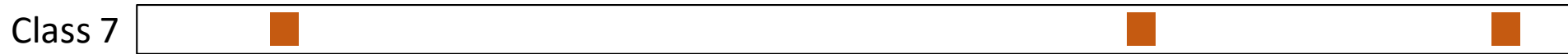
A provisioning with ECQF + SP (strict priority)

An output port with 8 traffic class

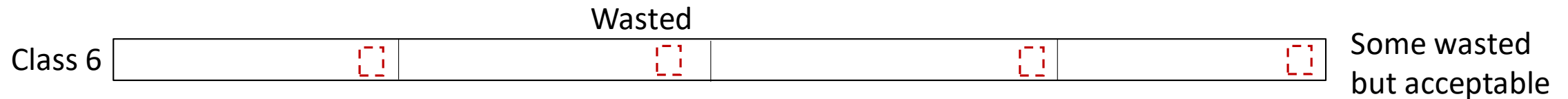


- Class 7: Network control frames, like time sync, STP TCN, protection switching event msg, etc
 - Generated by network node, the highest priority, transmit ASAP
 - Simple provisioning is preferred, no dependency with other user traffic class configuration
 - Loosely scheduled or sporadic (e.g. TCN (topology change notification), Protection Switching event message)
 - Limited use, low frame frequency, sparse
- Class 6: user traffic
 - ECQF is used to provide the bounded latency and jitter

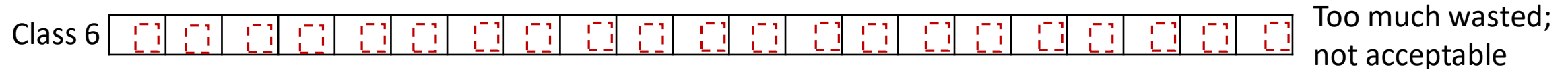
Sparse frames in class 7 bring difficulties to class 6 reservation when cycle time is small



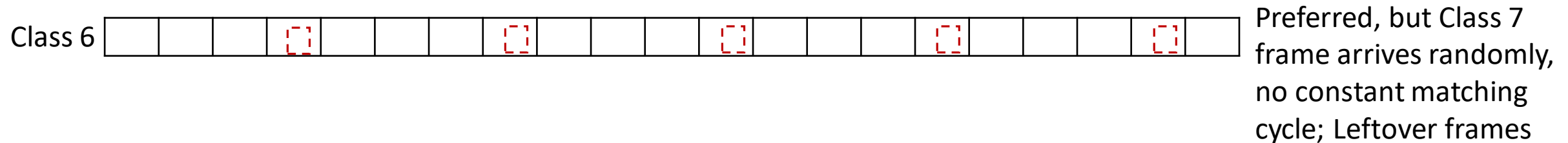
Case 1: large cycle interval



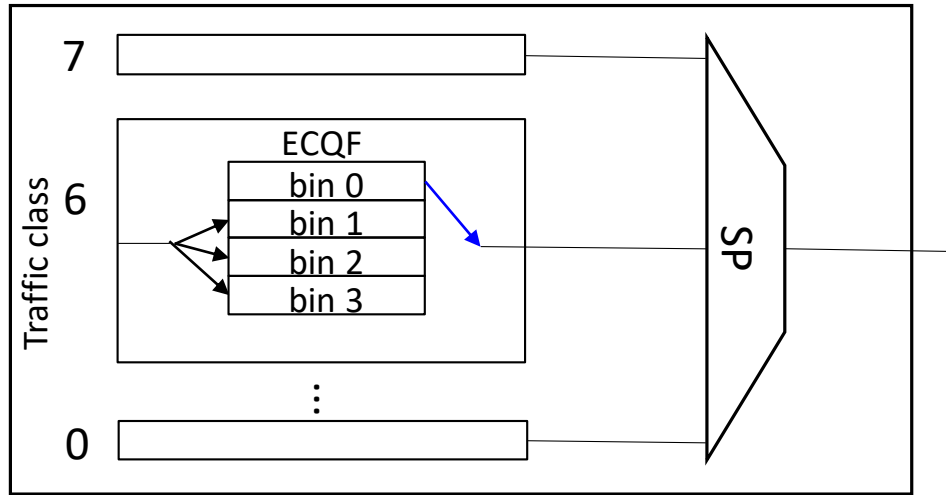
Case 2: small cycle interval



or

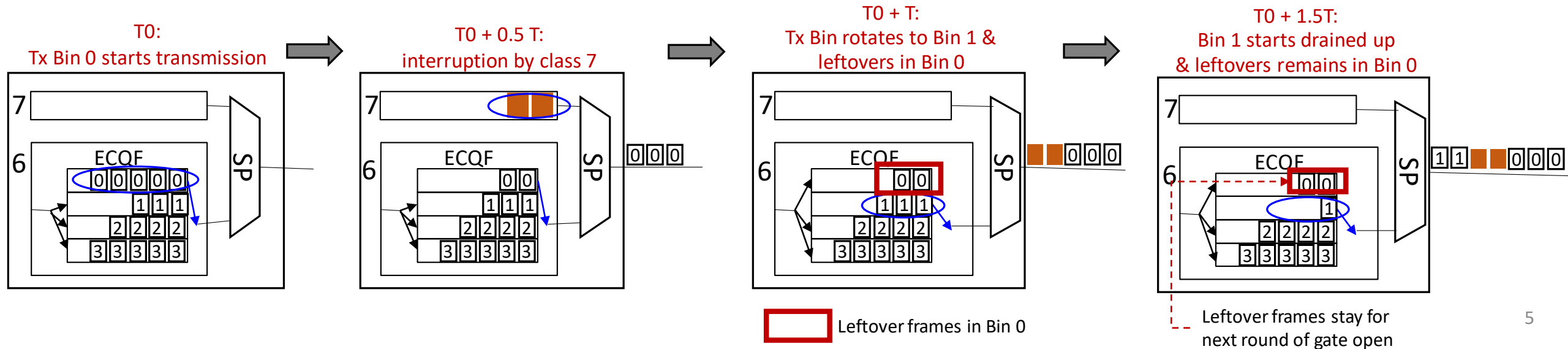


Leftover frames issue



An output port with 8 traffic class

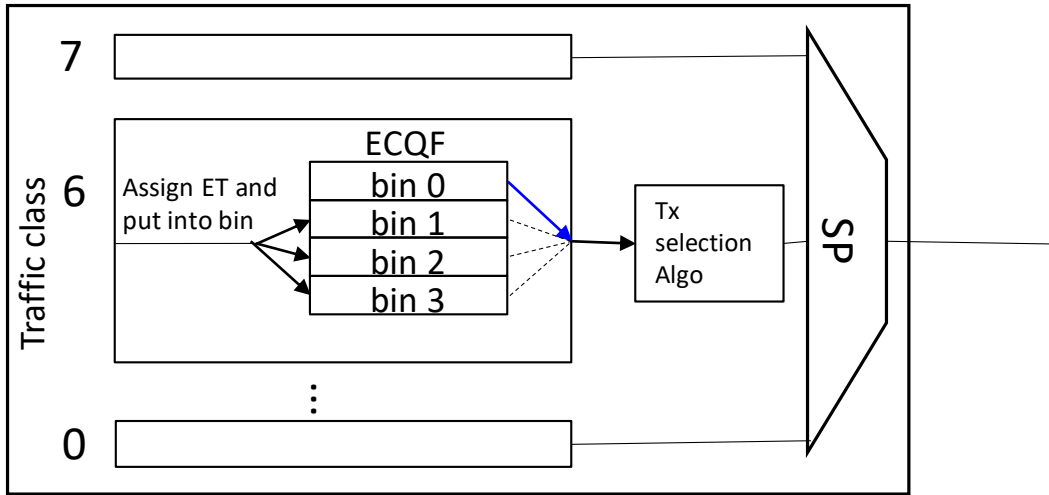
- Following the conventional CQF way for bin rotation, frame draining from a bin is controlled by a time based gate control list. Tx bin rotates every cycle interval T .
- When a cycle in class 6 in transmission is interrupted by class 7 frames, the bin in class 6 may not be emptied up before its tx gate closes.
- The leftover frames in a bin will be drained when the bin rotates for open again. It takes extra $(n-1)*T$.



Using ET (eligibility time) based tx instead of time based gate control can help? - background

- It was briefly mentioned that (E)CQF can use eligibility time (ET) concept for bin-based CQF transmission rather than use conventional Qbv like time based transmission gate control
- How ET works roughly (follow some logic from ATS algo):
 - Reception:
 - Compute frame output timing called ET and assign it to the frame
 - Transmission:
 - uses the assigned ET to regulate the traffic for transmission
 - Only frames with ET earlier than NOW, eligible for transmission selection
 - Automatically in non-decreasing order per scheduler
- Key if using ET concept in CQF: ET for the frames in the same transmission cycle assigned the identical value.

ET based tx help drain leftover frames sooner



An output port with 8 traffic class

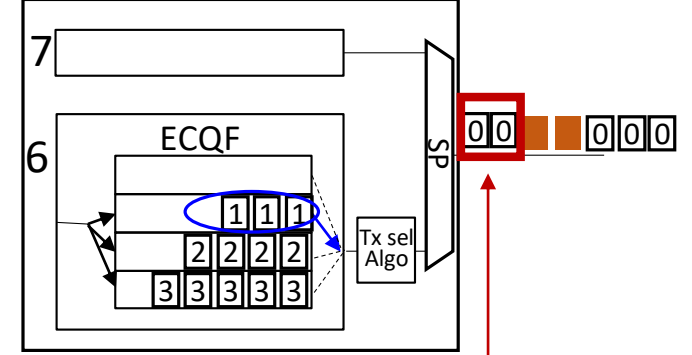
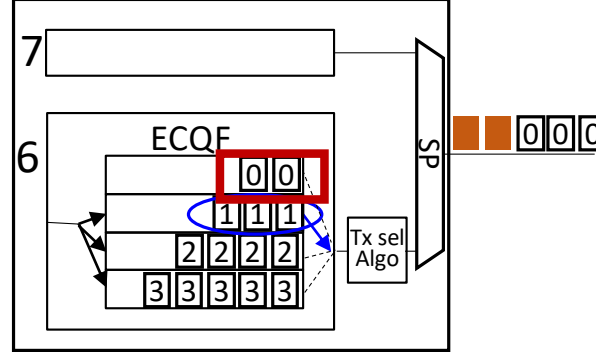
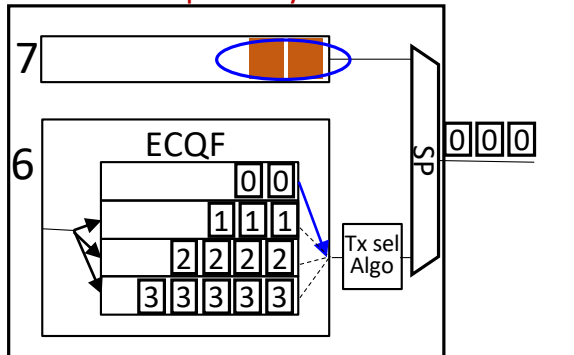
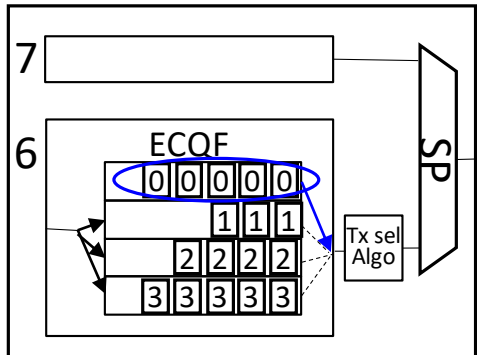
- ETx is the starting time of a frame's scheduled transmission cycle x. ET0 for cycle 0/bin 0, ET1 for cycle 1/bin 1 and so on in the example left.
- Frames have the identical ET when being put into the same bin in the same cycle.
- Leftover frames issue alleviated:
 - They have earlier ET than NOW and are still eligible for Tx.
 - They are roughly delayed by T instead of $(n-1)*T$

T0:
Tx Bin 0 starts transmission

T0 + 0.5 T:
interruption by class 7

T0 + T:
Tx Bin rotates to Bin 1 & leftovers in Bin 0

T0 + 1.5T:
ET of leftovers in Bin 0 is earlier than NOW.
So Bin 0 can be emptied sooner.

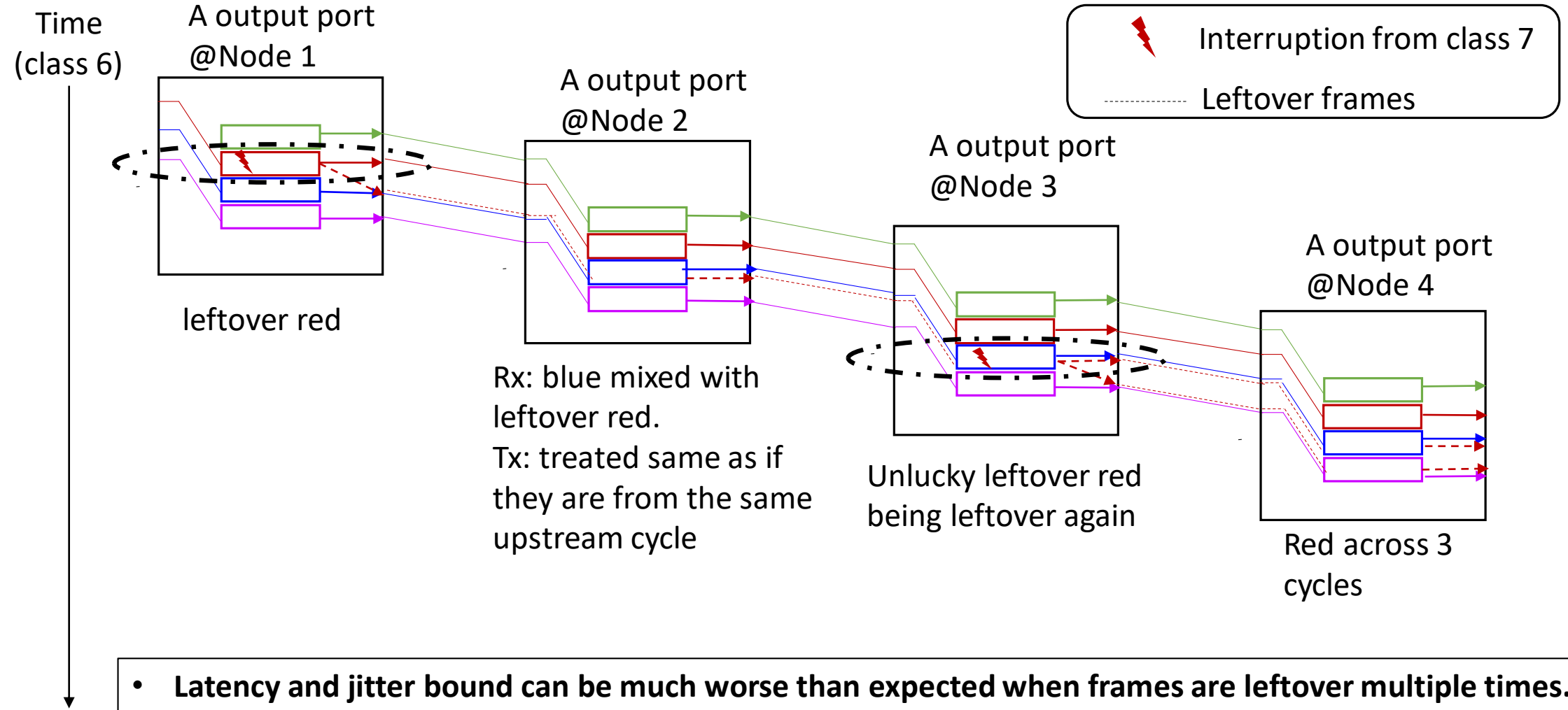


Note: number 0-3 indicates ET for frames.

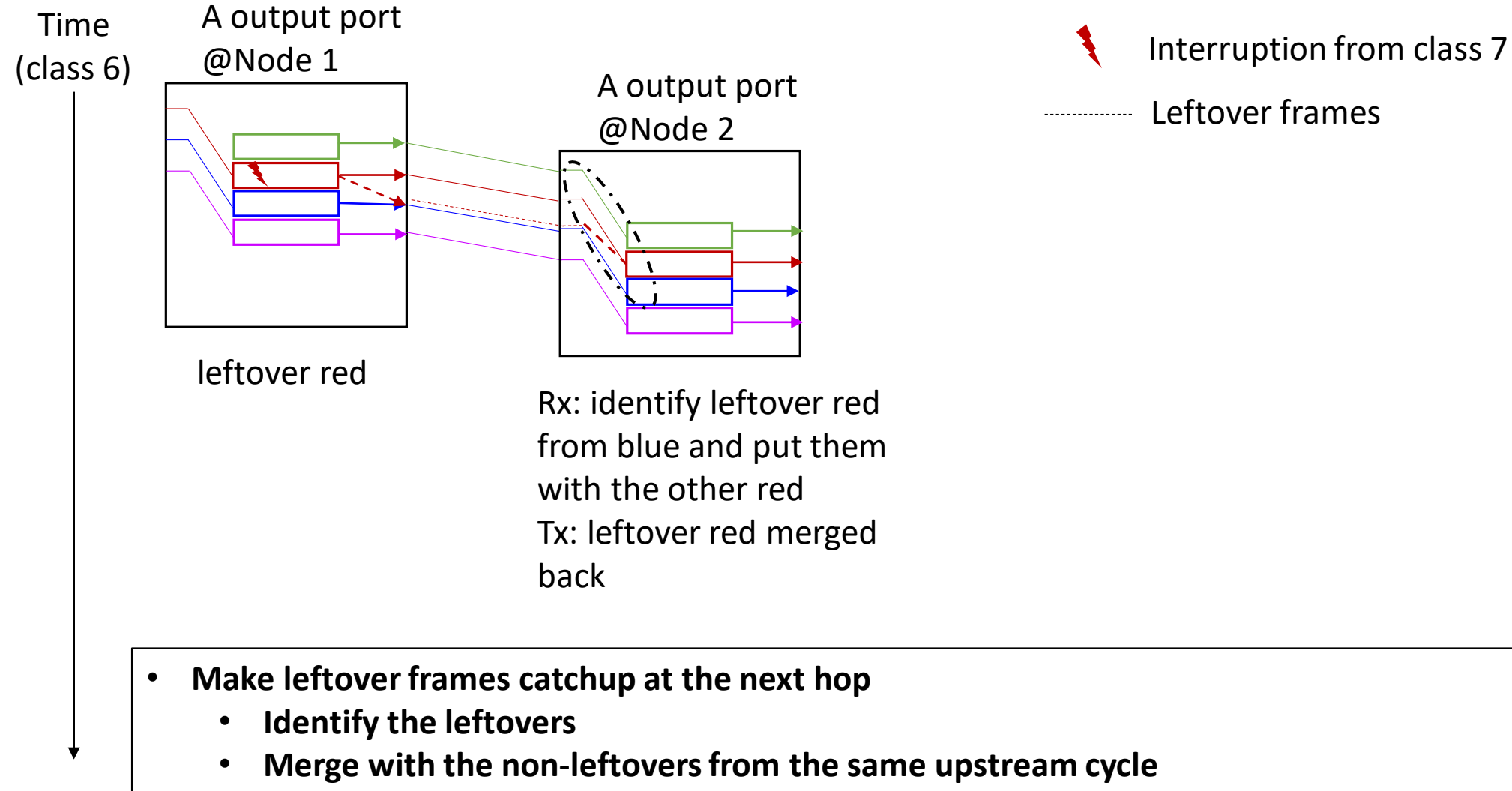
Leftover frames in Bin 0

ET0 Leftover frames being drained.
Not sure about the order with ET1

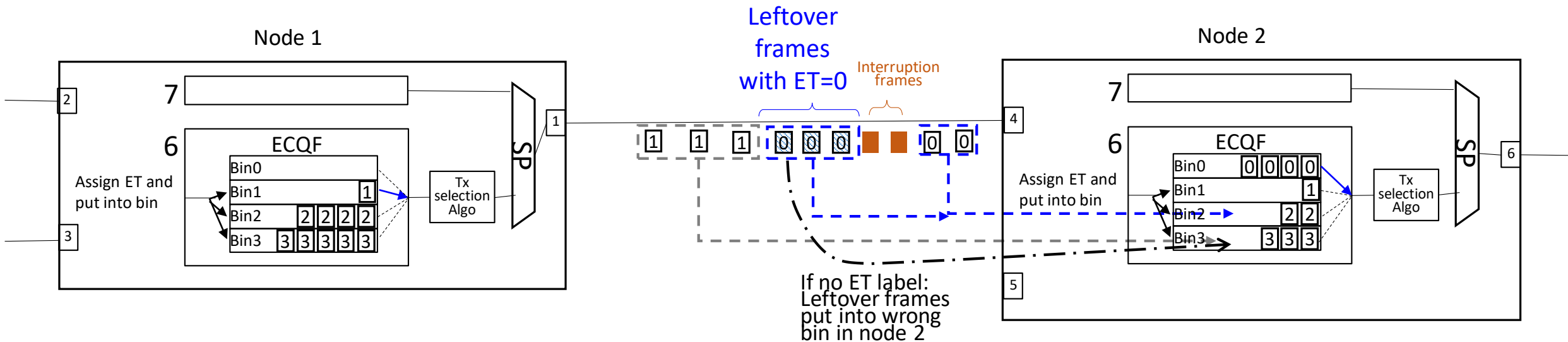
Cascading effect of leftover frames



Can we make leftover frames catchup?



Carrying ET label in data frames make the leftover frames catch up at the next hop



Summary

- Using ET (eligibility time) concept to model bin-rotation in ECQF seems bring some advantages to alleviate the leftover frame issue.
- ET label carried in data frame makes the downstream node ensure from which upstream node cycle a frame was sent. It may make leftover frames to catchup at next node.
- Cycle ID⁽¹⁾ carried in data frames was proposed earlier and it can be considered as the ET label and it has the smaller ID space comparing to the absolute time.
- The general purpose is to unambiguously identify a frame's sending cycle from upstream node to overcome the time variation caused by various reasons including leftover.
- **How the group feel about adding a data plane label design to Qdv scope?**

(1) [dv-yizhou-cycle-id-and-PAR-modification-discussion-0123-v01](#)