



Clarifying hold and forward buffering mechanism

Source: Ericsson

Document for: Discussion/Agreement

Agenda Item: 7.7.2

Work Item / Release: Vertical_LAN/Rel-16



Problem Statement

Scenario:

- 5GS and TSN use case: to provide deterministic delay for frames belonging to TSN Streams
- How to ensure that time spent inside the 5GS is deterministic/constant?
 - Hold and Forward buffering based on timestamps (i.e., timestamping at ingress of 5GS and control egress traffic based on timestamp value to deliver it at right time)

Issue:

- Wire speed timestamping is a very challenging task
- How to add timestamp value to ingress frames (what header fields to use ...)?

Solution components:

- Virtual time slots created based on the clock of the 5GS
- Instead of timestamp a virtual time slot specific number are added to ingress frames
 - Ethernet R-Tag defined to carry Seq.Num information
 - Using a Seq.Num as a form of “Relative Timestamp”



Background information: R-Tag defined in 802.1CB

- 802.1CB defines an R-Tag to carry 16 bit sequence number in Ethernet frames (note: .1CB lists other options to carry sequence number information)
- Nothing prohibits the use of multiple R-Tags in an Ethernet frame.**

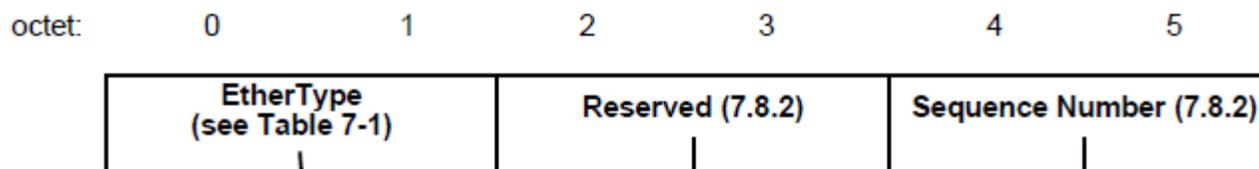


Figure 7-4—R-TAG format

- R-Tag can be used for several purposes
 - 802.1CB shows how R-Tag can be used for a FRER function (Frame Replication and Elimination for Redundancy)
 - Nothing prohibits to use R-Tag for other purposes as well
- In this presentation the **additional R-Tag is used only within the 5GS. It is added at ingress and removed at egress of 5GS. R-Tag used inside the 5GS is not visible for the outside world.** Ethernet frames may use other R-Tag(s) for which the 5GS is transparent.

How it works ...Technical details



Creating virtual time slots (raster) in 5GS

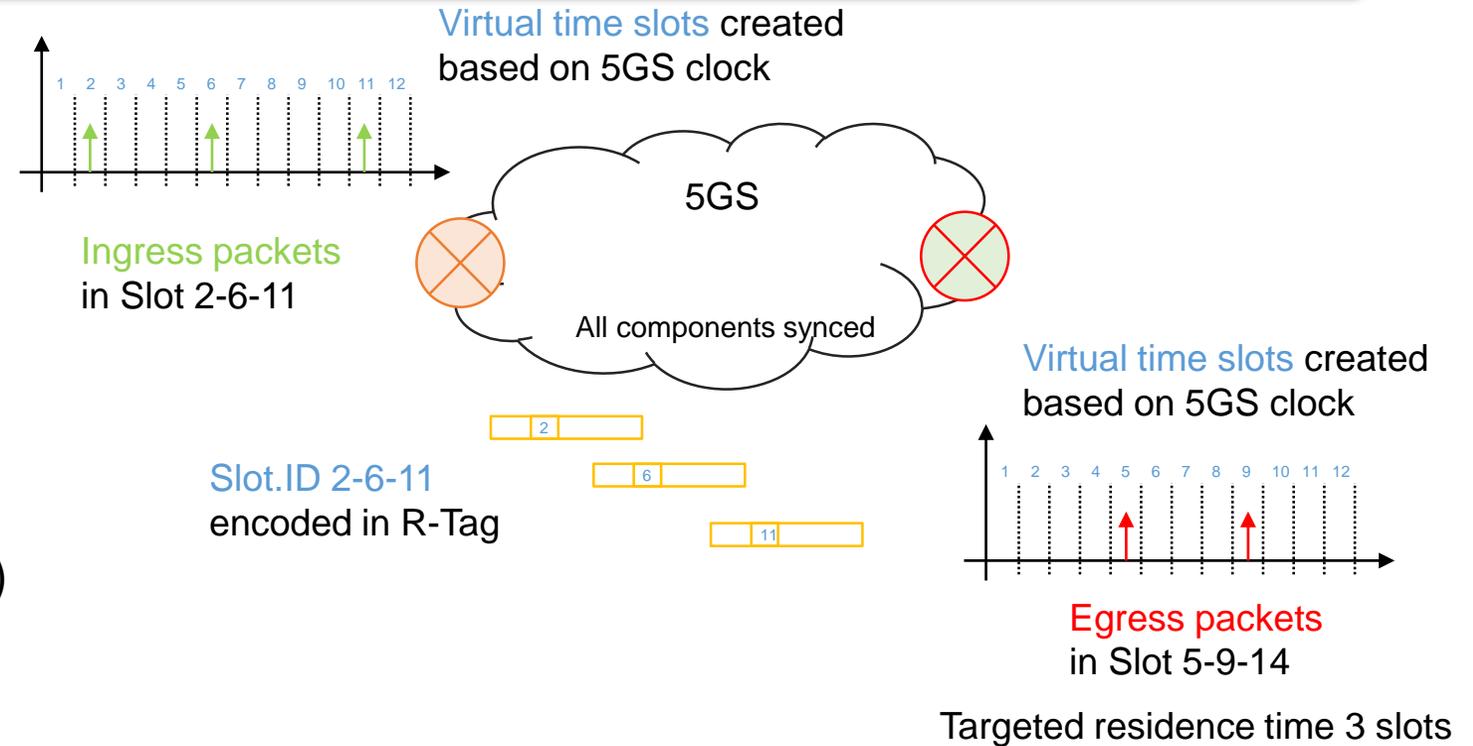
- Virtual slots are same on all 5GS components as they are all in-sync with 5GS clock
- Slot.ID refers to arrival slot and encoded in R-Tag

Ingress tasks

- Add time slot specific Slot.ID
- Encode Slot.ID in added R-Tag (as Seq.Num)

Egress tasks

- Calculate egress Slot.ID based on R-Tag and Stream specific targeted residence time within the 5GS (i.e., targeted delay)
- Remove R-Tag





Further technical details (not for 3GPP specification but illustration/example of how it would be designed in an implementation)

Stream delay (5GS residence time of the Stream)

- this solution allows to define different delay values per Stream

Slot.ID increased for each ingress virtual time slot

- Slot.ID is encoded in added R-Tag as Seq.Num
- Seq.Num format as per 802.1CB (16 bit)
- Seq.Num is cyclic, mod 2^{16} (e.g., every 10ms)
- Seq.Num cycle must be bigger than targeted residence time (e.g., 1ms target delay → 10 ms cycle)
- Egress Slot.ID calculated mod 2^{16}

Virtual time slots raster

- Slot duration determines accuracy (e.g., 65.536 slot in 10 ms → 0.15 usec accuracy)
- Time slots raster can be Stream specific if required ...



Summary

- Propose to take solution defined as S2-2002055 as the way forward for specification update.