

Introducing Guard Frames to Ensure Schedulability of All TSN Traffic Classes

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I- Introduction

- ✓ Offline scheduling of Scheduled Traffic (ST) in Time-Sensitive Networks (TSN) without considering the requirements of non-ST traffic, e.g., Audio-Video Bridging (AVB) traffic, can potentially cause deadline misses for non-ST traffic.
- ✓ This proposed solution can ensure meeting timing requirements for non-ST traffic regardless of the ST scheduling algorithm being used.
- ✓ A Guard Frame (GF) is scheduled together with all ST frames and then removed from the schedule to leave the necessary porosity in the ST schedule to meet the time requirements of non-ST traffic.

II- Guard Frame

- 5 ST frames of size 1 time unit (tu) and period 12 tu, 1 AVB frame of size 1 tu and period 6 tu and 1 low priority frame of size 1 tu and period 6 tu are sent through a TSN link.



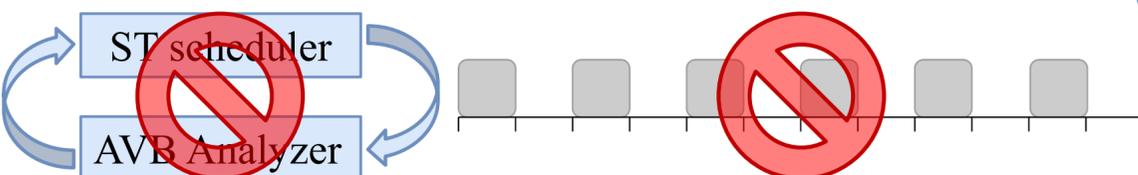
- In most cases both non-ST frames meet their deadlines. However, under certain circumstances, a non-ST frame may miss its deadline.
- And this can happen for both the middle priority and low priority frame.
- To solve this issue, first, we calculate the maximum ST interference that each Non-ST frame can experience without missing its deadline.
- Secondly, we design a GF to prevent the maximum ST interference in all frames. In this case, a GF of period 6 tu and size 2 tu.
- If the ST scheduler provides a valid schedule for ST with the GF, it will also be suitable for non-ST traffic.
- However, this only works for fixed offsets scheduling since, if the offsets are variable, the GF instances could be scheduled in such a way that the ST frame packing would be inadequate for non-ST traffic.



- When scheduling with variable offsets, we must increase utilization to ensure that the maximum ST interference is never exceeded. In this case, a GF of period 2 tu and size 1 tu.
- In this way, non-ST traffic meets again its deadlines.
- Although scheduling with variable offsets is more flexible, it involves an increase in GF utilization.

III- Conclusions and Future Work

- ✓ The GF prevents unnecessary reconfiguration and sparsity of the ST that reduces its QoS.



- ✓ In future work, we will develop the calculation of the maximum allowed ST interference by modifying an existing AVB Analyzer.

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