



IEEE P802.1DP Stream Isolation | May 2022

P802.1DP Stream Isolation

Per-Stream Identification, Policing, and forwarding at the Bridges

Abdul Jabbar
GE Research

Objective



- **Review and further develop aerospace stream isolation requirements**
- **Discuss hard vs. soft requirements with respect to design choices and certification**
- **Socialize the requirements with the larger 802.1 TSN community**
- **Get feedback from the community**

References:

- **Considerations for TSN configuration for avionic network**
<https://www.ieee802.org/1/files/public/docs2022/dp-kretzschmar-considerations-for-configuration-0422-v01.pdf>
- **P802.1DP Configuration Model**
<https://www.ieee802.org/1/files/public/docs2022/dp-jabbar-configuration-0322-v01.pdf>

Stream Isolation



What is meant by stream isolation?

When multiple streams traverse a bridge, one stream's behavior should have no (provable) impact on other streams. This includes both normal operation and failure modes.

A single failed end-station/transmitter/port/application, shall not disrupt any other streams on a bridge...definitely not all other streams

From TSN Toolset perspective, this implies that bridges primarily support **per-stream** :

1. Identification
2. Filtering and Policing (PSPF, Qci)
3. Forwarding/ Queueing (this is supported in Pre-TSN Ethernet)

Stream isolation could, potentially, be required other profiles addressing machine and mission critical operations – industrial automation, automotive, etc.

Stream Isolation

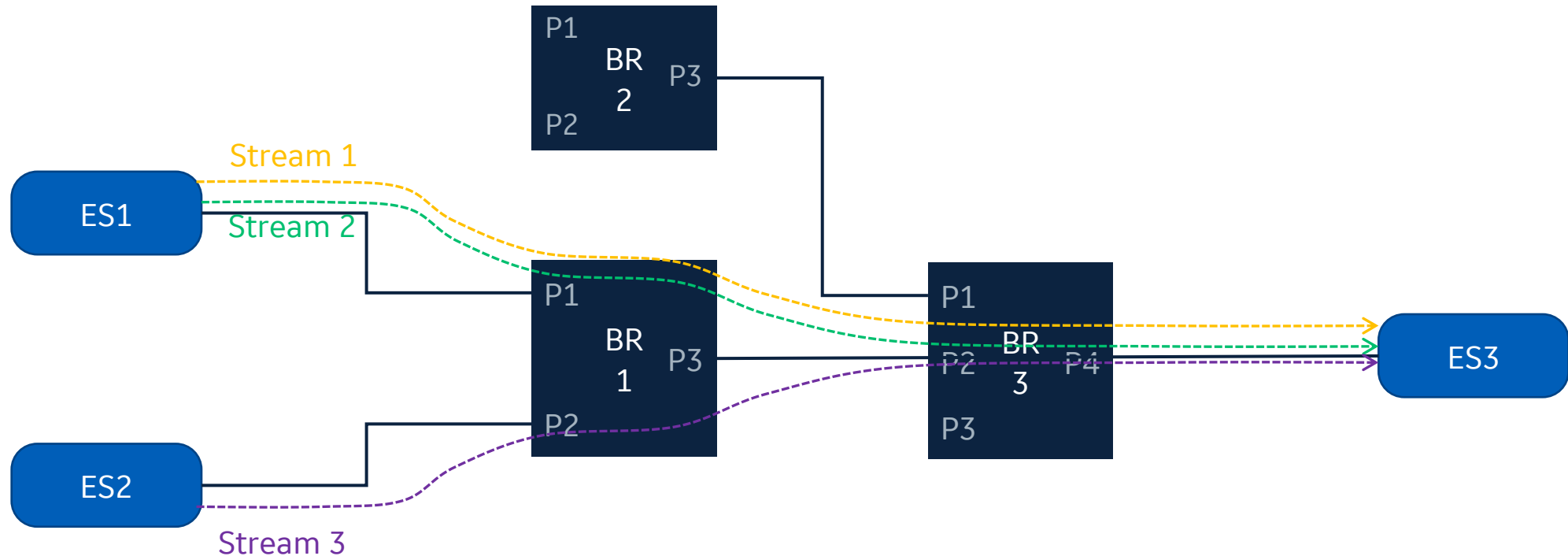


What do we not mean by stream isolation?

Performance...although the requirements to achieve certain latency and PDV bounds may also impose similar requirements on per-stream identification, filtering, and shaping.

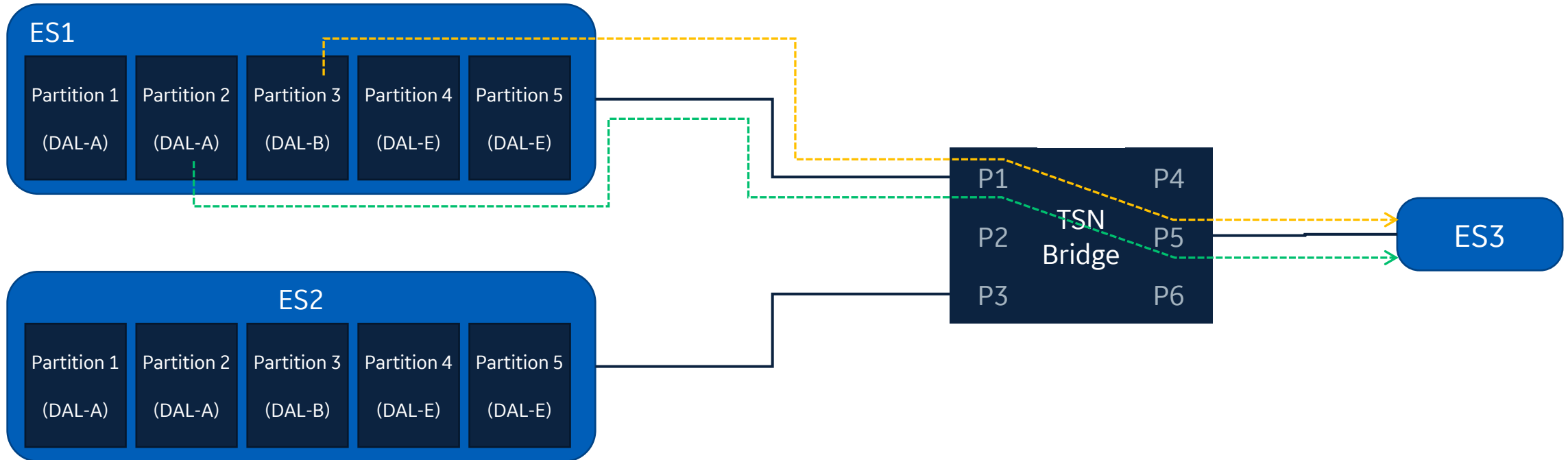
The achieved performance depends on network design, traffic shaping at end stations and bridges, amongst other things. There is more than one way to achieve desired performance.

Stream Isolation – Trivial Example



- Isolating failure (misbehaving) of streams, end-stations, and bridges requires policing of all streams at each hop.
 - Num of bridge entries = num streams in the network (limit case)
- Isolating at the device level (police aggregated streams.. failure in one stream is failure of all streams)
 - Num of bridge entries = num of nodes (100 to 500)
 - Easier with rate-constrained (Qav) streams, difficult with time-aware (Qbv) streams
 - Does not address partitioning issue (on next page)

Stream Isolation - Requirements



- ARINC 653 Partitions allow for multiple DAL levels to run on the same device
- Cannot police the two streams from an ES as an aggregate...one partition cannot impact another partition.
- Even with a single partition end station, there are multiple priority transmission queues. Stream isolation between traffic classes?
- Number of streams to be isolation may scale with $n \times \text{num-of-nodes}$, where n could be between 2 and 10

Stream Isolation

A653 Partitions -

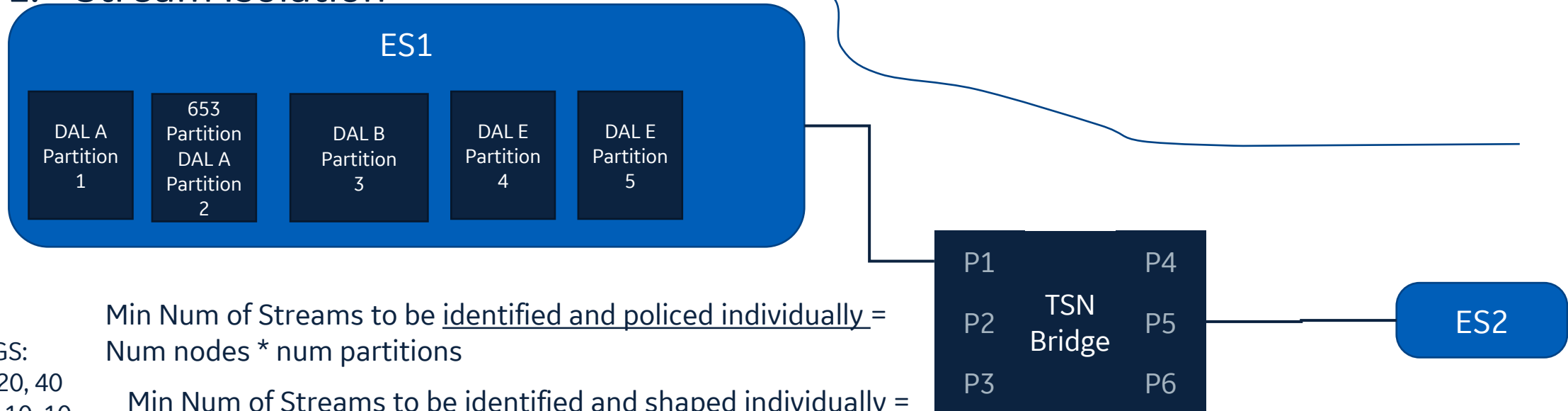
1. Stream/VL Identification
2. Corresponding Stream Policing



Realistically Target:
 : 100 * 8 = 800 (400 to 1000 Streams)
 75 nodes, only 16 has 8 partitions,

1. Stream Isolation

DAL E partition traffic could be policed together



Min Num of Streams to be identified and policed individually =
 Num nodes * num partitions

Min Num of Streams to be identified and shaped individually =
 Num nodes * num partitions * **unique performance buckets**

VL BAGS:
 2, 10, 20, 40
 10, 10, 10, 10

For partition 1:
 For certification/failure mode analysis, I don't need to distinguish and police each VL separately.

 I might still want to keep them separate for shaping and performance

For partition 2:
 Do not recommend combining VLs between two same DAL partitions.

 Unless they are from same company and same DAL....blame goes to one entity

Total Num of Streams:
 Today - 1000; Total 4096
 Num of Nodes:

Max Num of Partitions = 32

Discussion



- Stream isolation is stream identification, filtering, policing, and forwarding/queueing. It is required for many of the TSN use cases.
- Is this an aerospace specific issue or applicable to other profiles as well?
- As a bare minimum, the stream isolation at the bridges must scale with the total number of end stations in the network – hundreds in case of aerospace. Is this in line with TSN community expectations for implementations?
- More likely, the per-stream isolation requirements at the bridges must scale with n^* *number_of_end_stations*, where n could range from 2 to 10. That puts the number of entries at ~1000
- In the most expansive aerospace use case, the desired number of stream-isolation related bridge entries is 4096.
- Better network design and traffic engineering could lessen the requirements of bridges, but safety and certification puts a hard limit on minimum capabilities of an aerospace bridge.