



IEEE P802.1DP Stream Isolation options | Sept Interim 2022

P802.1DP Stream Isolation Options

Continued...

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Objective



- **Continue discussion on aerospace stream isolation requirements**
- **Discuss and work through options for stream isolation at bridges in an aerospace network**
- **Solicit feedback from 802.1 TSN community**

References:

- P802.1DP Stream Isolation, May 2022
<https://www.ieee802.org/1/files/public/docs2022/dp-jabbar-stream-isolation-0522-v01.pdf>
- P802.1DP Stream Isolation Continued
<https://www.ieee802.org/1/files/public/docs2022/dp-jabbar-stream-isolation-continued-0622-v00.pdf>
- Summary of Aerospace Use Cases
<https://www.ieee802.org/1/files/public/docs2021/dp-Jabbar-Aerospace-UseCase-Summary-0521-v01.pdf>
- Introduction to Aerospace Network Certification
<https://www.ieee802.org/1/files/public/docs2021/dp-zaehring-Introduction-to-Aerospace-Network-Certification-JAR25-1309-CS25-0321-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 (PSFP, Qci)
3. Queueing and Forwarding (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



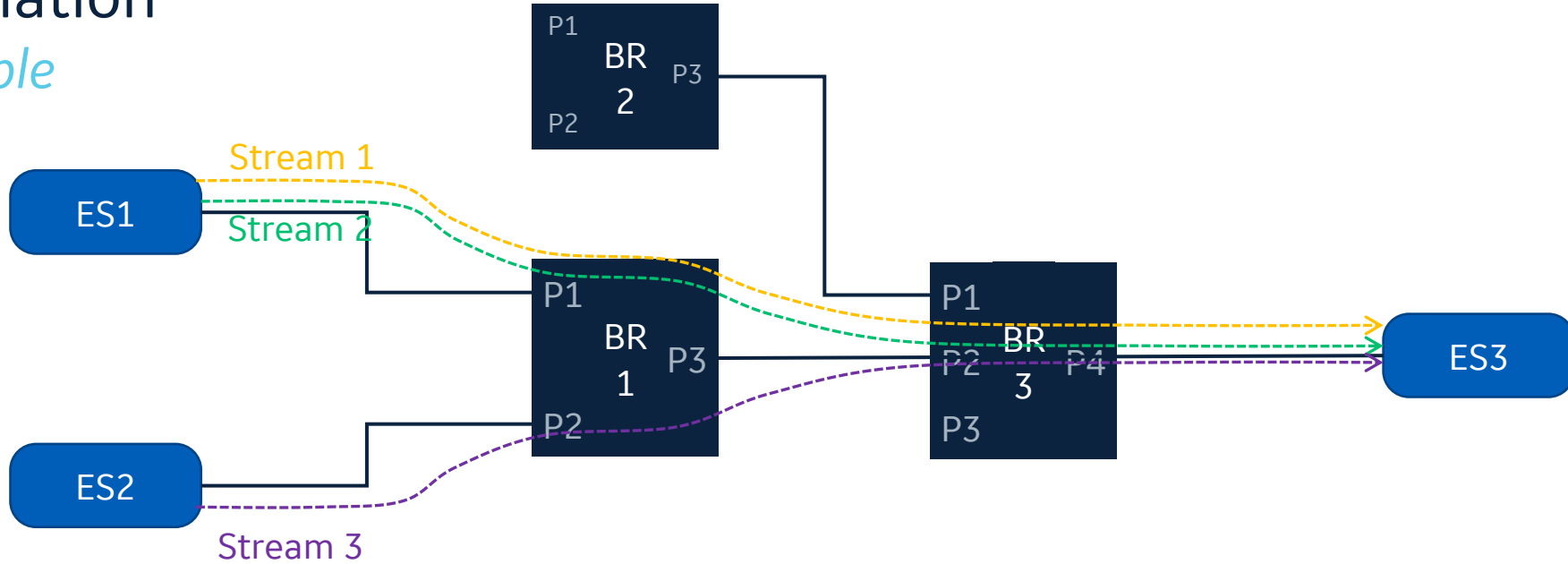
What do we not mean by stream isolation?

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



Option 1: 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) (this leads to a requirement of 2K-4K entries max for a DP compliant bridge)

Option 2: 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

Option 3: Per Stream isolation at the edge bridges and aggregate flow in the “core” network bridges

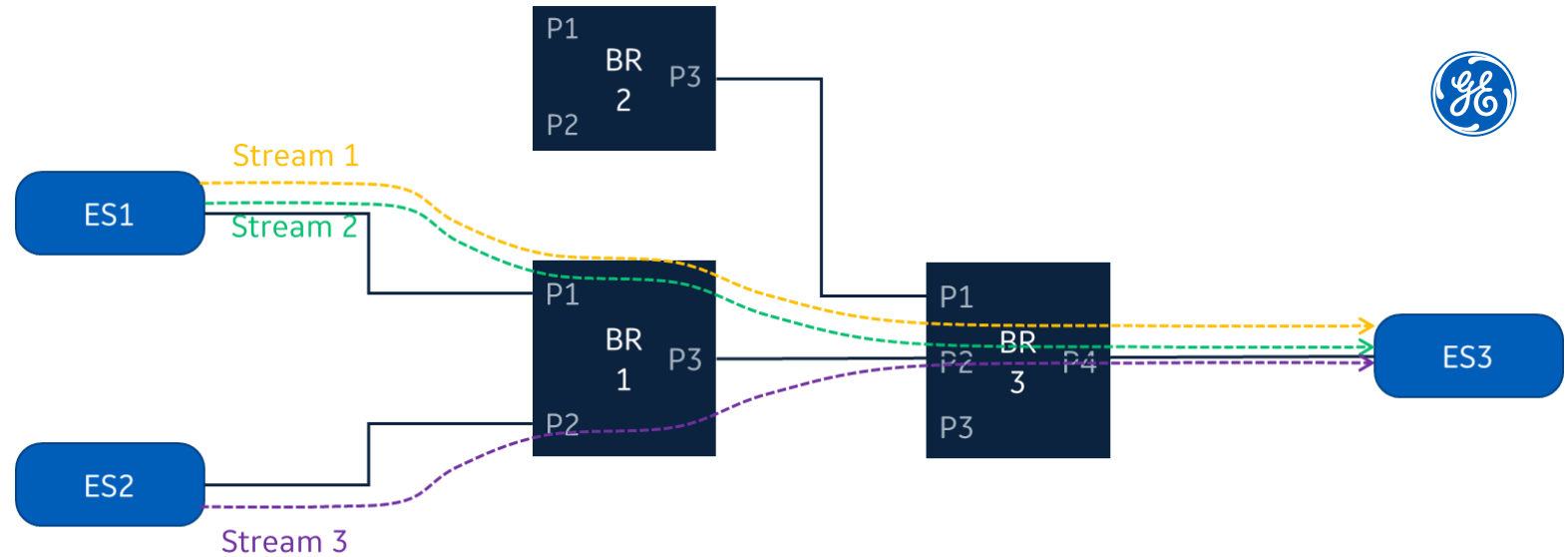
- Appropriate Stream identification right from source (e.g. vlan) or active DMAC VLAN stream identification at the edge bridges

Stream Isolation

Trivial Example



Working out numbers for option 3
Per stream policing at the edge bridges



Per port number of streams to be identified and policed on Edge Bridges (connected to end stations)

On the low end:

- Police all qav streams as one. – one rate filter per port
- Police all qbv streams as one – one stream filter per port

Realistic End: (max num of streams per end station = 20-50)

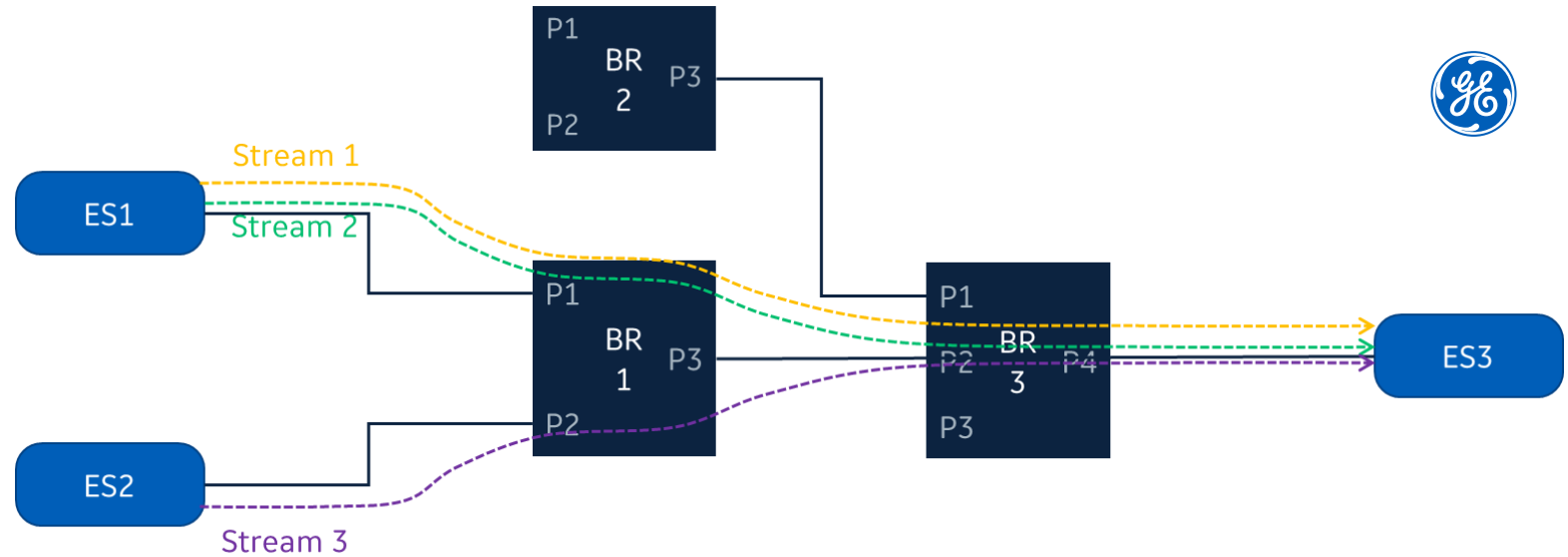
- Police each qbv stream independently – multiple stream filters per port
- Police all qav streams as one – one rate filter per port
- Don't police BE streams at all. Just shape the BE queue at edge bridges only.

High End (max num of streams per end station = 100,)

- Police each qbv stream independently – multiple stream filters per port
- Police each qav stream independently – multiple rate filter per port
- Don't police BE streams at all. Just shape the BE queue at every bridges only

Stream Isolation

Trivial Example

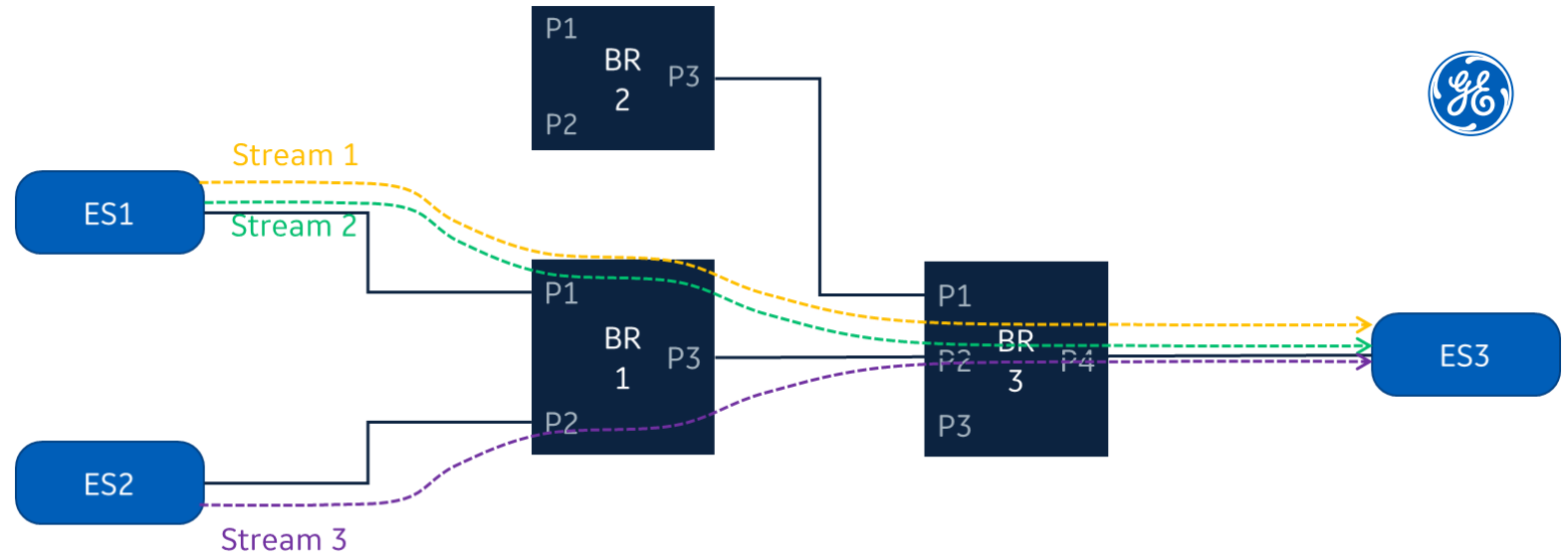


Similar discussion in DG group

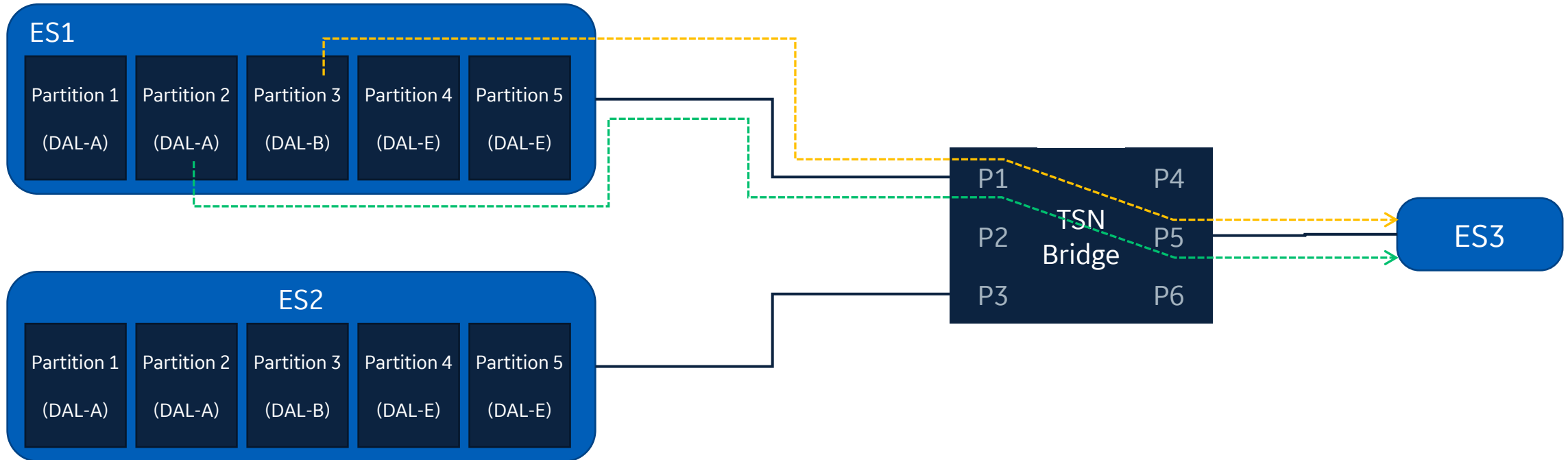
<https://www.ieee802.org/1/files/public/docs2022/dg-turner-ModuleProfiles-0422-v02.pdf>

- Leverages the fact that the HW resources supporting the stream identification and policing are available as a block in the switch and can be unequally allocated to ports.
- From a HW perspective, there is no significant difference when it comes to supporting different stream identification functions? DG is considering Mask and Match as the default.
- Does not include performance considerations of aggregated stream identification in the core network.
- DG has **an absolute limit of 256** for the max number of streams in an automotive network

Stream Performance?



Stream Isolation – Requirements (Reference)



- 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

Discussion



- Stream isolation is stream identification, filtering, policing, and forwarding/queueing. It is required for many of the TSN use cases.
- Safety and certification in aerospace puts a hard limit on minimum capabilities of an aerospace bridge.
- Different approaches exist to address this issue
- Even with more “optimized” approach, stream isolation may require larger number of bridge entries for stream identification and stream filters
- In the most expansive aerospace use case, the desired number of stream-isolation related bridge entries is 4096.