

Two-Port End Stations

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(Self)

Introduction

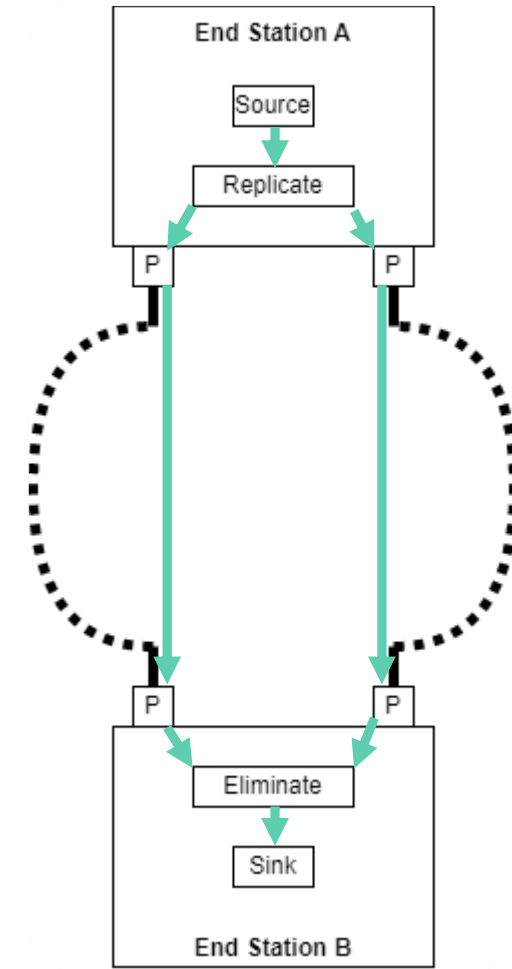
- Individual Contribution
- Background
 - Two-Port end stations appear at least in the context of IEC/IEEE P60802 and IEEE P802.1DP/SAE AS6675:
 - IEC/IEEE P60802 D2.0
<https://www.ieee802.org/1/files/private/60802-drafts/d2/60802-d2-0.pdf>
 - DP Conformant Components
<https://www.ieee802.org/1/files/public/docs2023/dp-jabbar-conformant-components-0623-v01.pdf>
 - The author believes that these end stations **do not** provide the functionality intended in the profiles/their use-case(s).
- The crux
 - Both IEC/IEEE P60802 and IEEE P802.1DP/SAE AS6675 are TSN profile projects. To the author's understanding, a profile project can use functionality found in existing base standards, but cannot specify new functionality.
 - This is an issue in presence of functionality not specified in existing base standards but needed by a profile.

Overview

- Content
 - One use-case
 - The end station reference model (RM)
 - The issues
 - Missing splitting function
 - Missing bridging functionality
 - Potential solutions (some exploration of the solution space)
 - Link Aggregation
 - Higher layers
 - 3 Port Bridge + 1 Port End Station
- Shortcuts to published standards
 - 802.1Q: IEEE Std 802.1Q-2022
 - 802.1CB: IEEE Std 802.1CB-2017+IEEE Std 802.1CBcv-2021+IEEE Std 802.1CBdb-2021
 - 802.1AX: IEEE 802.1AX-2020

One Use-Case

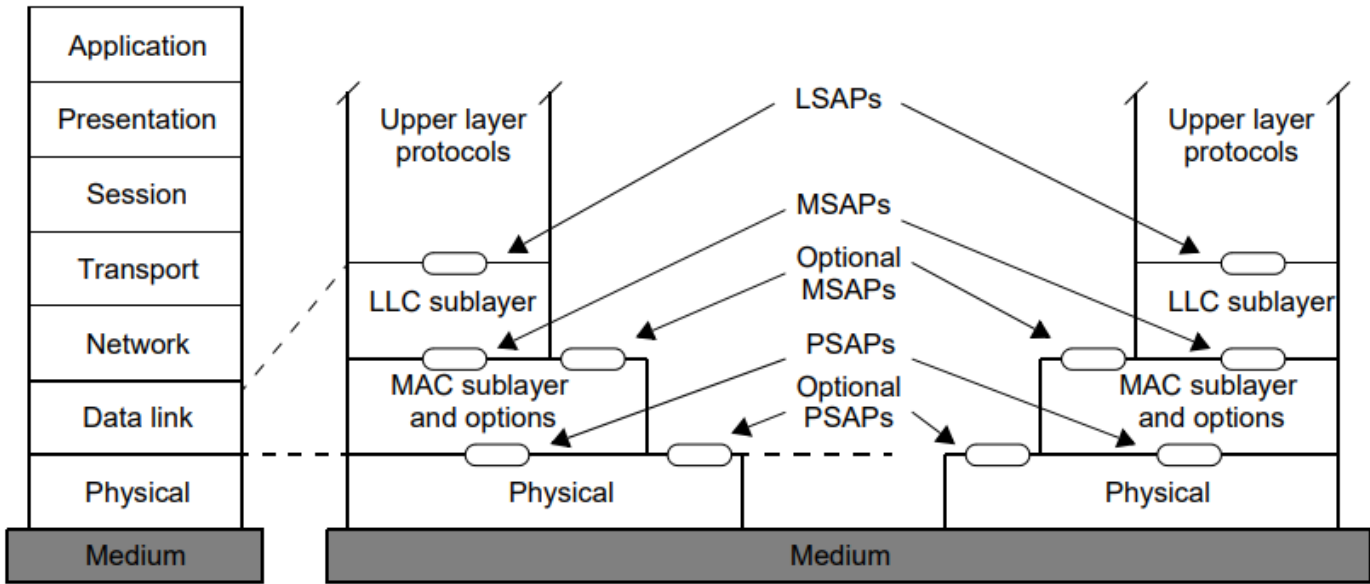
- Sending a stream via redundant paths, clockwise and counterclockwise in a ring.
- Tolerates omission failure (e.g., broken wire or device) on one path.
- Intended to use 802.1CB/FRER for replication/redundant transmission.
- This use-case is, from the author's point of view, very important in various systems, and may be part of the motivation for introducing two port end stations in the ongoing profile projects.



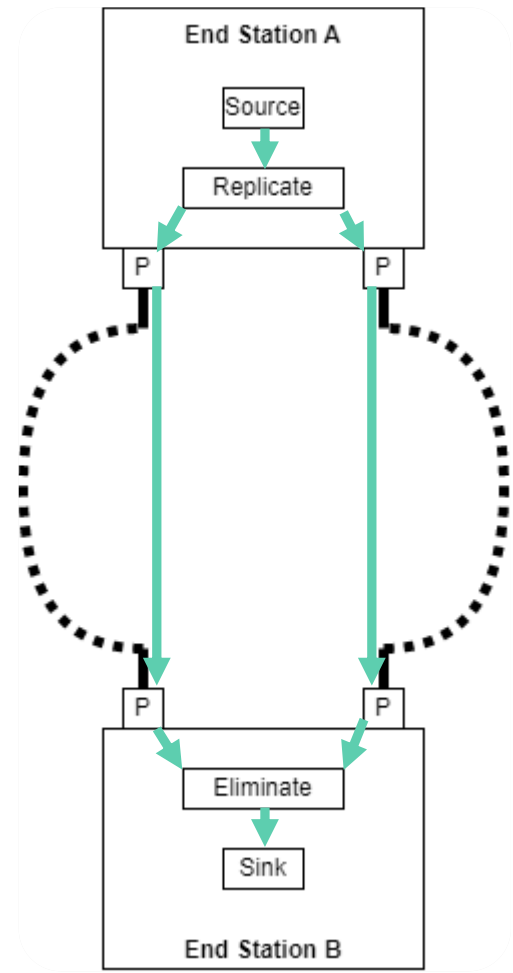
The end station reference model (RM)

MSAP MAC service access point
 LSAP link service access point

PSAP PHY service access point



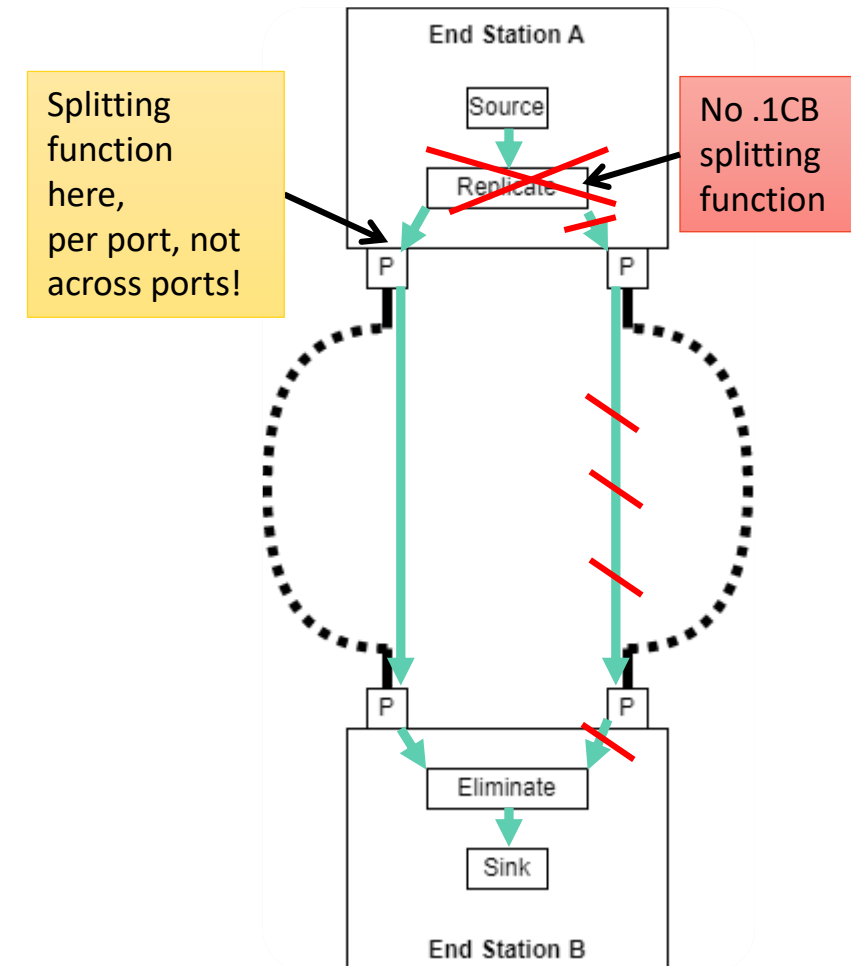
Source: IEEE P802-REVc/D1.0



Issue: Missing splitting function

- From 7.7 of 802.1CB:
The Stream splitting function accepts a packet from the upper layers with a stream_handle subparameter (item a in 6.1), makes zero or more copies of that packet, each with a stream_handle subparameter that can be different from the original stream_handle, and passes those packets to the next-lower layer.
- ...
*A packet passed down from the upper layers is acted upon by a Stream splitting function **on a particular port** (10.6.1.1) and direction (10.6.1.2) only if its stream_handle subparameter is in the frerSplitInputIdList (10.6.1.3) configured for that port and direction in some entry in the Stream split table (10.6).*
- From 10.6.1 of 802.1CB:
*frerSplitPort - **The port** on which the system is to place an instance of the Stream splitting function (7.7)*
- From 12.6.1.2 802.1CB:

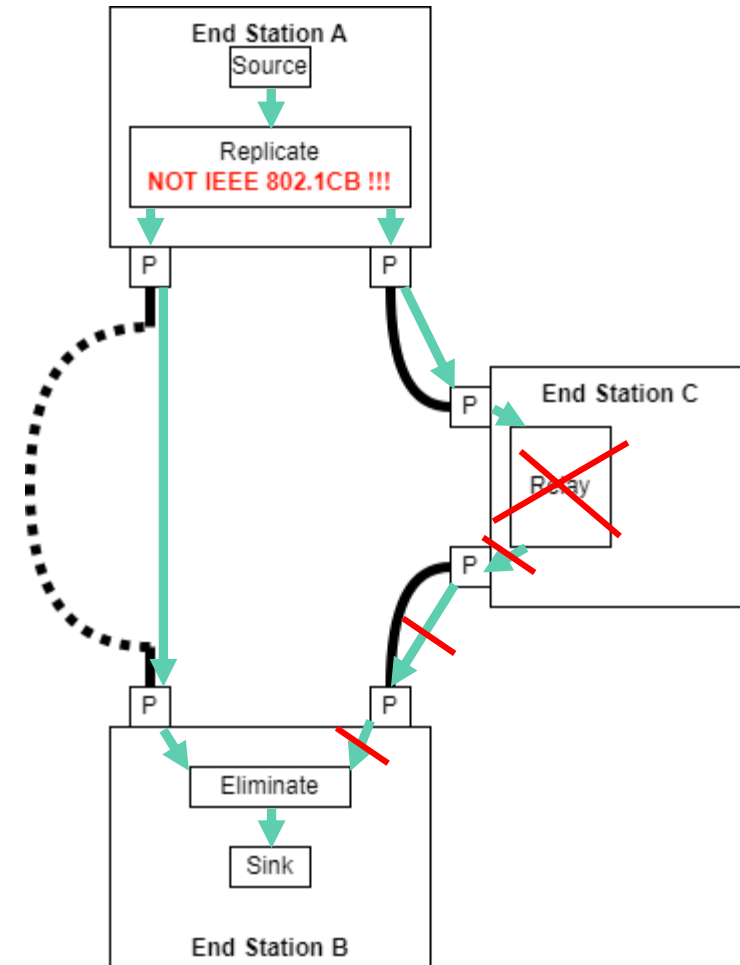
```
+--rw stream-split* [port direction-out-facing]
|  +--rw port                if:interface-ref
|  +--rw direction-out-facing  dot1cb-sid-types:direction
|  +--rw input-id*             -> /dot1cb-sid:stream-identity/handle
|  +--rw output-id*            -> /dot1cb-sid:stream-identity/handle
```



→ 802.1CB/FRER (and its YANG for end stations) not usable for the given use-case!

Issue: Missing bridging functionality

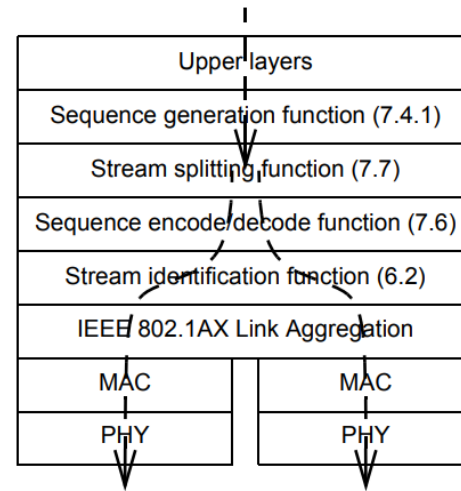
- Most (if not all) two port end stations in a ring would need to relay frames.
- To the author's knowledge, neither IEEE Std 802 nor Stds of IEEE 802.1 specify such a relay for end stations.
- The relay specified by 802.1Q is for bridges, not for end stations.



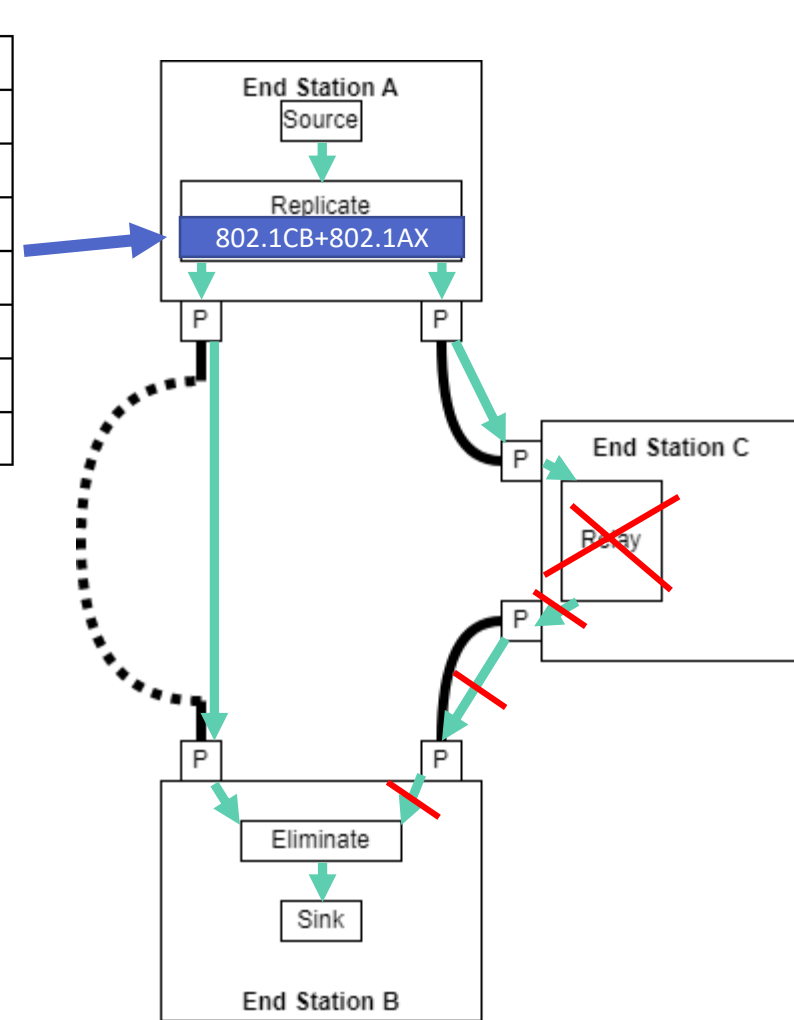
→ A two port end station can't relay frames based on 802[.1] Stds, but it needs to for the given use-case!

Potential solutions: Link aggregation

- IEEE Std 802.1CB provides an informative example for combining 802.1CB with 802.1AX.
- In theory, this combination could provide frame replica transmission on two end station ports:
 - Replicas get different stream_handle values by the splitting function [7.7 of 802.1CB].
 - Active stream identification [6.6 of 802.1CB] overwrites VLAN IDs per stream_handle.
 - C-VID based distribution algorithm [8.2.2. of 802.1AX] with Connection IDs being VLAN IDs (may require excessive use of VLANs).
 - Strict first replica left/second replica right requirement [6.2.4 of 802.1AX] with different Connection IDs for both replicas.
- However:
 - IEEE Std 802.1AX is not required by the given TSN profile projects, at least now.
 - Missing normative content in 802.1CB and 802.1AX, for example the combination of both and missing YANG for 802.1AX.
 - Does not resolve the issue of the missing relay.



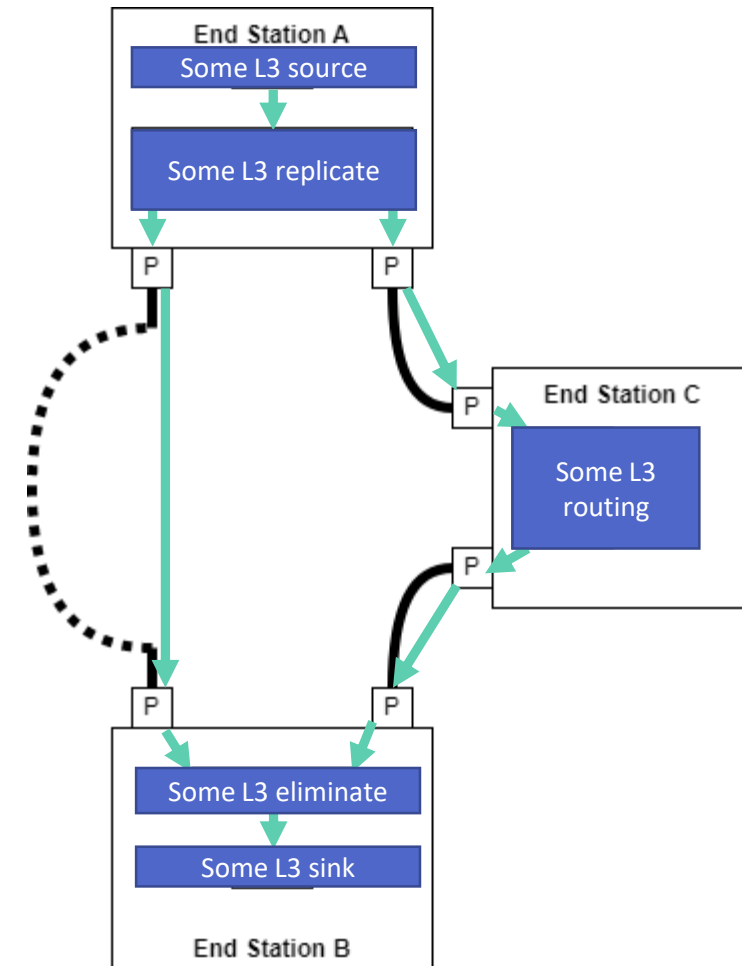
Source: Figure C-2 of 802.1CB



→ Does not do the trick for the given use-case! ☹️

Potential solutions: Higher layers

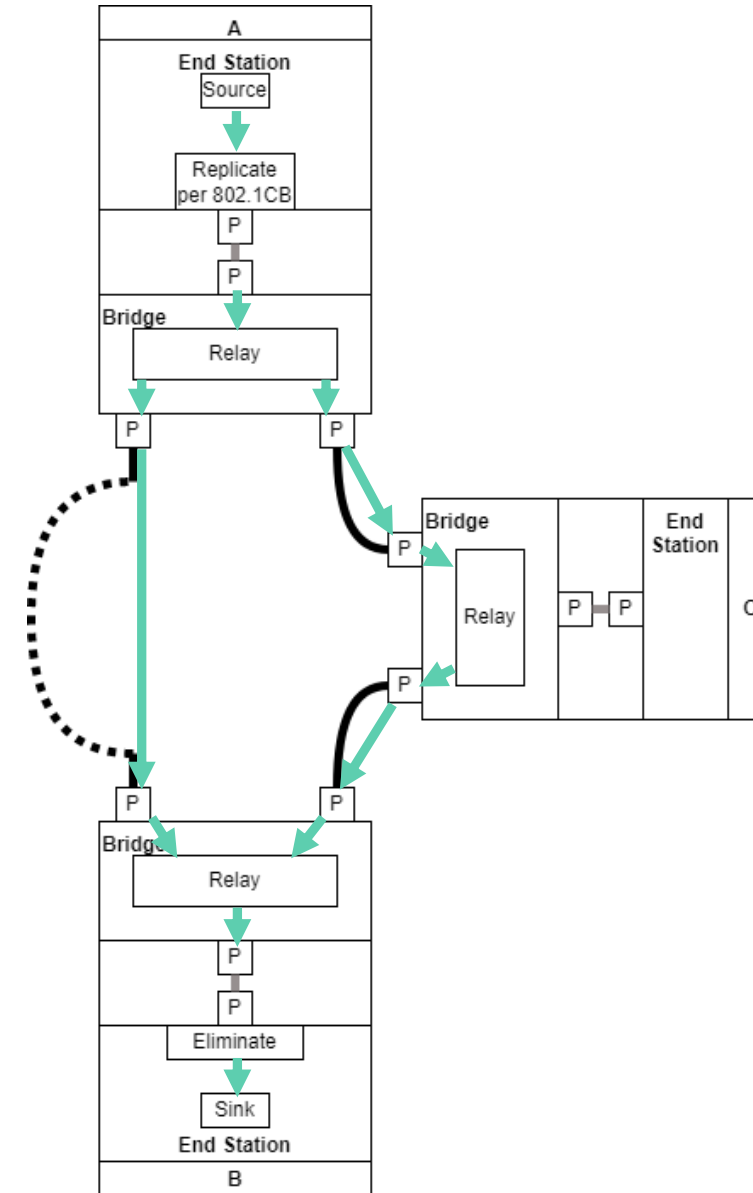
- A L3 router may be seen as multi-port end station, from an IEEE 802.1 perspective.
- It could be investigated whether there are standards providing all necessary functionality on layer 3 or higher (e.g., IETF RFCs).
- However:
 - The author is not aware of L3 standards providing all necessary functionality.
 - This would effectively increase the requirements in the profiles.
 - Shifting some functions to L3 may have a “rippling effect”, moving other functions to higher layers as well.
 - It is unclear whether IEEE 802.1 would be the right venue.



→ *Does not do the trick for the given use-case!* ☹️

Potential solutions: 3 port bridge + 1 port end station

- “Boxes” combining a 3 port bridge with a 1 port end station solve both issues, the missing relay and the missing replicate function.
- It is unclear to the author whether there are concerns on this solution in the profile project groups and if, what these concerns are.
- One potential concern could be that the implementation requirements for “Boxes” are increased significantly. The author does not share this concern.



Thank You for Your Attention!

Questions,
Comments,
Opinions,
Ideas?