IEEE 802.1DG

END STATION REQUIREMENTS
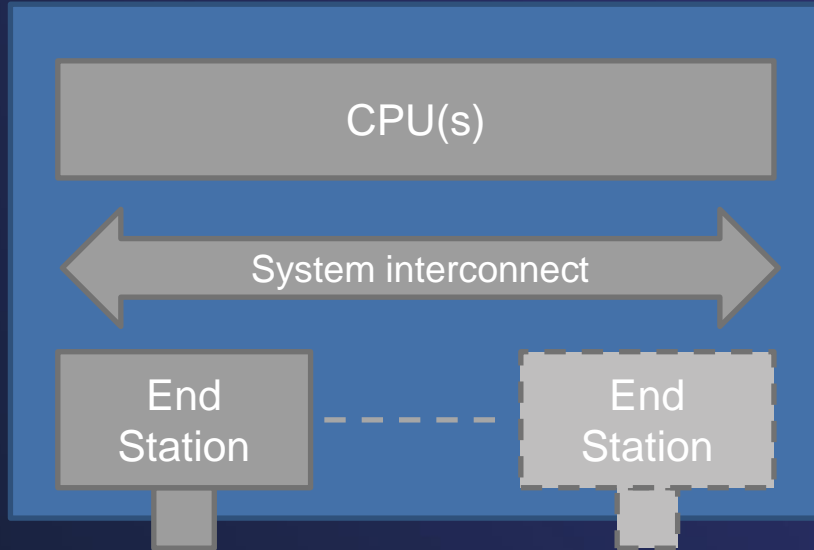
V0.1

JULY 2023
THORSTEN HOFFLEIT
AUTOMOTIVE CORE TECHNOLOGY
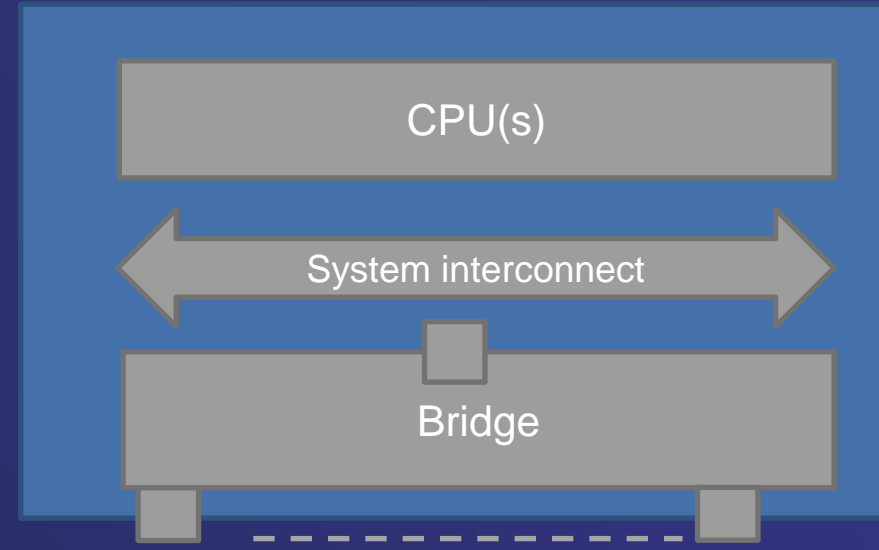RENESAS ELECTRONICS CORPORATION

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SCOPE

In scope

- System with at least one Ethernet port and embedded CPU

- System may include more than one Endstation

  - Conformance requirements shall be met for each End Station separately

Out of scope

- Systems with embedded Ethernet bridge and embedded CPU

  - There may be also more than one internal port present

- Even CPU may be responsible for data processing all the bridge features apply for internal end point

END STATION VARIANTS
TWO EXTREME EXAMPLES

Variant 1

- ECU with very limited capabilities (e.g. Sensor ECU)

- Required functionality

  - Time synchronization

  - Generation of (TSN shaped?) sensor data

  - Management and diagnostic functions

Variant 2

- Complex ECU with connected external bridge

- Required functionality

  - Time synchronization

  - Many streams in and out

  - Sophisticated TSN features

  - ….

IVN backbone → Management data → ES Sensor ECU
IVN backbone ← Management and sensor data ← ES Sensor ECU
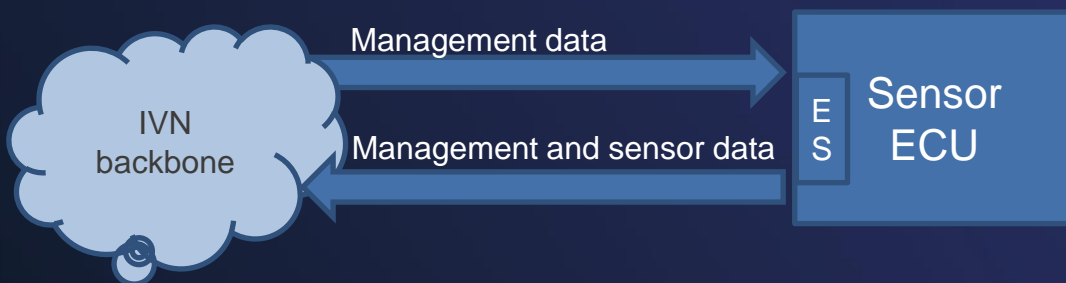
Within the automotive profile we should not over specify requirements for end stations to allow efficient DG compliant products

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END STATION REQUIREMENTS PROPOSAL (SHALLS)
COMPARED TO WHAT IS REQUIRED FOR BRIDGES

Any End Station claiming conformance to this present standard shall:

1. Process ingress frames in the order as specified in XXX

2. Process egress frames in the order as specified in YYY

3. Comply to CM-IS as specified in 5.6.

4. Comply to CM-Pol as specified in 5.7.

5. Comply to CM-BS as specified in 5.8.

6. Support the Learning Process as specified in 6.16.

7. Support the Frame lifetime limitations as specified in 6.26.

8. Support Congestion Isolation as specified in 7.2.

9. Support the maximum SDU size as specified in 6.4

10. Support the Frame Filtering ([Q]:8.6.3) as specified in 6.17

11. Support the Stream Filter ([Q]:8.6.5.3) as specified in 6.18

> To be defined (next slides)

> No requirement for ingress selection

> Basically required (also flow metering?). It can be done in SW also

> Required

> No requirement for end stations

> No requirement for end stations

> No requirement for end stations

> Required

> No requirement for end stations

> No requirement for end stations

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END STATION REQUIREMENTS PROPOSAL (SHOULD / MAY)
COMPARED TO WHAT IS REQUIRED FOR BRIDGES

Any End Station claiming conformance to this present standard may:

1. CM-TSyn as specified in 5.9

Any End Station claiming conformance to this present standard should:

1. comply to CM-TAS as specified in 5.10
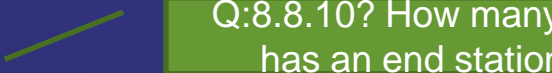
2. comply to CM-Pre as specified in 5.11

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RECEIVE PATH PROCESSING ORDER FOR END STATIONS
COMPARED TO WHAT IS REQUIRED FOR BRIDGES

On the receive path (ingress), the IEEE 802.1 Features are executed in the following order, if they are available and activated, in either hardware or software:

1. <MACsec as discussed on July 4th>
2. Default Priority Assignment ([AC]:13.1)
3. Support of the EISS ([Q]:6.9.1)
4. Frame Type Acceptance filter ([Q]:6.9 c))
5. Ingress VID translation ([Q]:6.9 f))
6. Port-based VLAN Classification ([Q]:6.9 d))
7. Port-and-Protocol-based VLAN classification ([Q]:6.12)
8. Priority Code Point Decoding ([Q]:6.9.3)
9. Priority Regeneration ([Q]:6.9.4)
10. Out-facing Ingress Stream Identification Function(s) ([CB]:9.1.1.5)
11. FRER Functionality, like Sequence decode ([CB]:7.6) / Sequence generation ([CB]:7.4.1)
12. In-facing Ingress Stream Identification Function(s) ([CB]:9.1.1.2)
13. Active topology enforcement ([Q]:8.6.1)
14. Ingress filtering ([Q]:8.6.2)
15. Frame filtering ([Q]:8.6.3 a) and b))
16. Stream filter assignment ([Q]:8.6.5.3 b) and c))
17. Maximum SDU Size Filtering ([Q]:8.6.5.3.1)
18. Stream Gating ([Q]:8.6.5.4)
19. Flow metering ([Q]:8.6.5.5)
20. ATS Eligibility Time Assignment ([Q]:8.6.5.6)

Q:8.8.10? How many VID has an end station?

Isn't is requi d and

Isn't is required to add here d and f as well?

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18. Stream Gating ([Q]:8.6.5.4)
19. Flow metering ([Q]:8.6.5.5)
20. ~~ATS Eligibility Time Assignment ([Q]:8.6.5.6)~~

> Q:8.8.10? How many VID has an end station?

> Isn't it required to add here d) and f) as well?

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TRANSMISSION PATH PROCESSING ORDER FOR END STATIONS
COMPARED TO WHAT IS REQUIRED FOR BRIDGES

On the transmit path (egress), the IEEE 802.1 Features are executed in the following order, if they are available and activated in either hardware or software:

1.   In-facing Egress Stream Identification Function(s) ([CB]:9.1.1.4)

2.   FRER Functionality, like Sequence generation ([CB]:7.4.1)

3.   Out-facing Egress Stream Identification Function(s) ([CB]:9.1.1.3)

4.   Queuing frames ([Q]:8.6.6)

5.   Transmission selection ([Q]:8.6.8)

6.   Priority Code Point Encoding ([Q]:6.9.3)

7.   Egress VID translation ([Q]:6.9 g))

8.   Support of the EISS ([Q]:6.9.2)

9.   Support of the ISS ([Q]:6.7.1)

10. <MACsec as discussed on July 4th>

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REMAINING SECTION 6 ITEMS

- Section 6 needs an walk through and check what is required for an end station and what not. E.g.

- 6.6 Flow Filtering

  - Drop counter required?

- 6.27 Number of Traffic Class queues

  - "A Relay supports no less than 8 Traffic Classes (TCs) per egress port." – needs rewording

- 6.32 Frame loss

  - "A Frame can be lost if the Relay is unable to process it:" – also valid for end stations

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CLARIFY HOW REQUIREMENTS CAN BE REALIZED

- Coming from bridge, users expect that several features are realized by hardware implementation with assistance software

  - e.g. MAC address (filter) table learned by hardware

  - Filtering done in hardware

  - Aging done in software

- An End Station

  - may provide MAC address filter but same task could be also done in software, …. if performance target is met

  - This applies to Policing function, stream identification

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