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TRANSFORMING HOW CARS OF THE FUTURE ARE BUILT

IEEE802.1DG – TRAFFIC CATEGORIES | 2020-08-04

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IEEE802.1DG/D1.2

1 **11. Latency and congestion loss**

2 **11.1 Introduction**

3 << Editor's note: This clause is a suggestion based on the presentation *Suggestions for Automotive Profile*
4 *outline* http://www.ieee802.org/1/files/public/docs2019/dg-finn-auto-prof-outline-0119-v02.pdf, presented 15
5 Jan 2019 at the IEEE 802.1 interim~~plenary~~ in Hiroshima, Japan.

6 Possible content could include:

7 1. Best effort flows
8 2. Continuous vs. Intermittent flow
9 • Intermittent flows can be scheduled. Hard to mix both types on same port
10 3. Time scheduling for intermittent flows
11 4. Bounded latency, zero congestion loss
12 • Pick queuing method(s) for continuous flows
13 5. Frame preemption
14 6. Cut-through forwarding
15 7. Separation by time (802.1Qbv)
16 8. Separation by traffic class
17 9. Filtering and policing (so that misbehavior cannot ruin latency)

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Proposal for IEEE802.1DG

Type			QoS		Security
Alarms/Events	Continuous	Periodic (1ms-10ms)	Minimum Latency	Safety	Authenticate
Control	Continuous	Periodic (1ms-100ms)	Fixed Latency	Safety	Authenticate
Audio/Video	Temporary	Periodic (50µs-1ms)	Bounded Latency	Quality (drop and mitigate)	tbd
Sensor-Data	Continuous	Periodic (~10ms)	Bounded Latency	Last is best (drop)	Authenticate
Diagnostics	Temporary	Bursty	Best Effort	Lossless (retransmit)	Authenticate/Encrypt
User-Data	Temporary	Bursty	Best Effort	Lossless (retransmit)	Encrypt

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Safety Critical

- Usually small fixed size constant payload (exception warning-chime?).
- Must be periodic, to ensure alive status.
- Single loss may lead to action.
- Alarms and Events
  - Must be delivered at minimum latency
  - Negative/alive messages must take same route to ensure configuration
  - Can PreEmption be guaranteed?
  - Policing should be avoided.
- Control
  - Must be delivered at Fixed Latency, meaning minimum jitter as linked to control-loop
  - PreEmption desired.
  - Policing accepted to limit effect of malfunction.

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Audio/Video

- Does not include warning-chimes.
- Driven by customer perceived quality in normal operation.
- Can drop for emergency.
- Policing to limit effect of malfunction.
- High data volume (video) – consider Jumbo-Frames
- Transient Noise Compensation
  - Minimum latency (50μs).and jitter
  - Consider Cut-Through (same line rate requirement).
  - PreEmption desired.
- Intercom
  - Low latency (100μs) and jitter for echo compensation
  - PreEmption desired.
- Entertainment and Navigation
  - Constant average bit-rate over 1ms-10m.
  - Jitter within limits.

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Proposal for IEEE802.1DG

Type	Policing	PreEmption	CutThrough	Redundancy
Alarms/Events	No	ensured?	ensured?	to ensure delivery? (fail safe/fail operational)
Control	?	ensured?	Not needed	to ensure delivery? (fail safe/fail operational)
Audio/Video	Yes	No	Use-Case/Topology	to ensure quality?
Sensor-Data	Yes	No	No	align with sensor redundancy (fail safe/fail operational)
Diagnostics	Yes	No	No	No
User-Data	Yes	No	No	No

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Redundancy Discussion

- Where does data loss occur?
  - In the network
    - Congestion (ingress or egress)
    - Link or Device (multiple link) failure
  - Loss of data source
  - Loss at/of data consumer
    - Congestion (buffer overrun)
    - Device failure
  - Power loss

- After one path is lost
  - Ignore – only for quality driven data (second failure will loose system)
    - Fail safe – after full loss immediate transition to a locally safe state (extend mission - wearout)
  - Fail gracefully – incoming data used to mitigate transition to a system safe state (choose time to limit chance of second failure)
  - Fail operational – continue mission for extended period (no reduction of safety level)

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