

802.3 EPLCA: Differentiated Services on Half-Duplex Media

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Background

July 2026 CFI: Problem Presented

Call for Interest

PLCA Multidrop Latency, Jitter, and Scalability Enhancements

10BASE-T1-S multidrop are being widely adopted in automotive Ethernet applications across e.g., body, chassis, and powertrain control applications, whose functions span a broad range of latency and jitter requirements, from tightly bounded control loops to more timing-tolerant comfort and convenience functions.

The Physical Layer Collision Avoidance (PLCA) layer developed as a part of 802.3cg and refined in 802.3da provides a fair and equal access to stations on the mixing segment while providing bounded maximum access latency. The maximum access latency is not sufficiently bounded for many of the tightly bounded control loops. Likewise, the variable length of the PLCA cycle results in high jitter (lack of determinism) that such applications cannot tolerate. PLCA as defined today is cannot treat traffic differently based on latency and jitter requirements. Additionally, adding traffic to multidrop networks engineered to meet latency and jitter requirements can change the latency and jitter of existing traffic in ways that are difficult to predict resulting in scalability issues and the need to frequently reengineer networks.

Half-duplex & Transmission Selection – a recap

(previously presented to Nendica 9 July 2026 as
[1-26-0023-00-ICne-differentiated-services-on-half-duplex-media](#))

Another way of looking at it

- Problem Restatement

“The current set of 802.1 and 802.3 tools do not provide sufficient control over the selection of the next frame to be transmitted on 10BASE-T1S/M multidrop media.”
- Who does what?
 - 802.1Q:
 - provides several tools (e.g., scheduling algorithms, Priority-based Flow Control) to determine the next frame to be sent.
 - 802.3:
 - is class unaware
 - is “frame at a time”*
 - accepts a frame before checking media access
 - transmission stalls until media access obtained

*MAC Merge/Preemption uses 2 MACs (eMAC & pMAC). EPON is point-to-multipoint and uses one MAC at the head end per remote client

How did we get here?

- Half-duplex Ethernet was considered an oddity until 802.3cg added 10BASE-T1S, followed by 802.3da with 10BASE-T1M
 - 10BASE-T1S/M multidrop stations use CSMA/CD
 - They may also use Physical Layer Collision Avoidance(PLCA) Reconciliation Sublayer (RS) to improve predictability
 - 10BASE-T1S includes point-to-point half-duplex
- Half-duplex is widely deployed on systems supporting 10/100/1000BASE-T

Half-duplex & Transmission Selection

- Transmission selection happens before media access
 - In point-to-point you only contend with a single peer
 - In multi-point, collisions/back-offs can be persistent
 - PLCA provides bounded latency $\sim ((\text{number_stations} - 1) * \text{MTU})$.
- Choosing which frame to send significantly before it's sent can produce the “wrong” result

Note: 802.3 PAUSE can delay full-duplex media access for extended periods

Half-duplex & Transmission Selection (cont.)

- All the 802.1Q transmission selection algorithms are impacted by media access delay after selection, e.g.,:
 - strict priority: a higher priority frame arrives between lower priority frame selection and frame transmission
 - credit-based shaper: frame transmitted significantly after the shaper update
 - scheduled traffic: gate open without access to the media
 - ATS: frame is transmitted significantly after selection

Half-duplex & Scheduled Traffic

- Scheduled Traffic can be used for 10BASE-T1S/M segments but:
 - requires time synchronization between peers
 - unused scheduled time can't be recovered
 - defining/provisioning the traffic flows is complex

Enhanced Transmission Selection for Half-Duplex Media

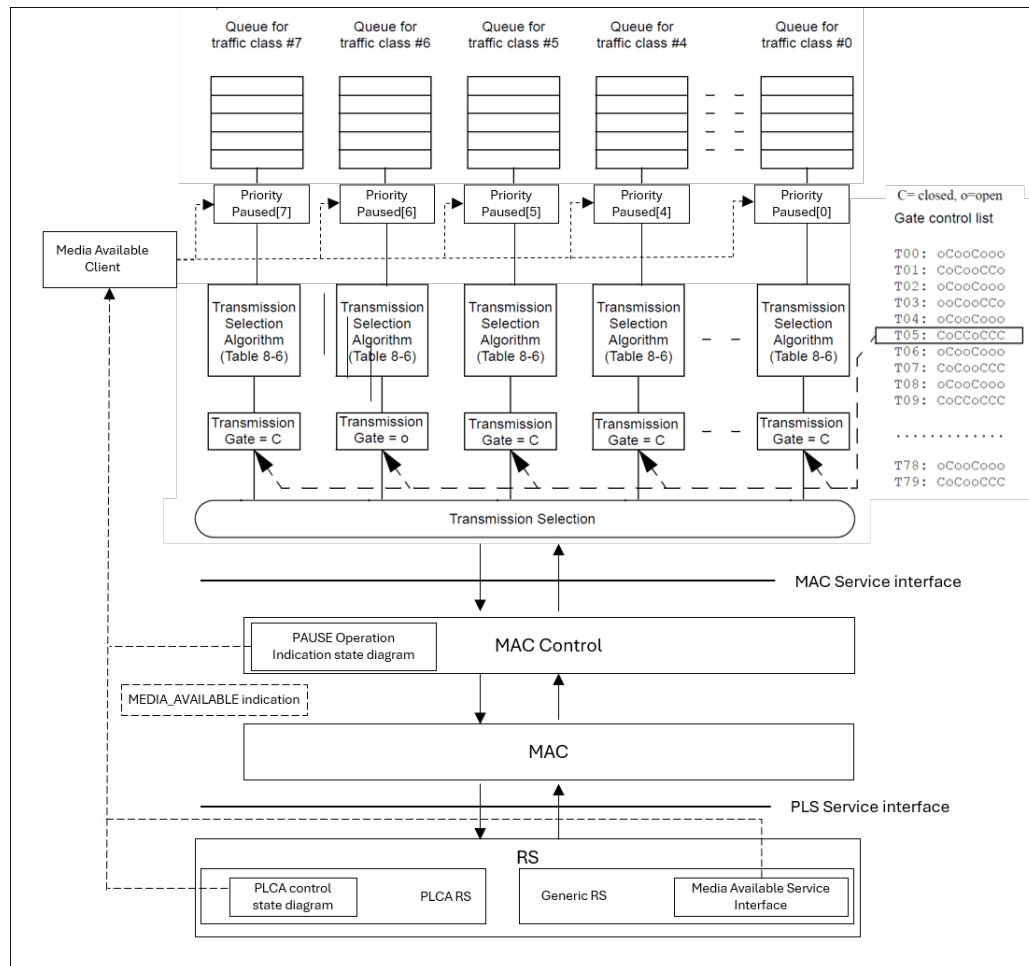
Enhanced Transmission Selection for Half-Duplex

- Do the selection when the media is available
- 802.3 signals media availability to transmission selection
- Transmission selection processes media availability signals using the same mechanism as PFC, i.e., setting Priority_Paused[n] vector
- Transmission selection accuracy approximates full-duplex performance*

*CSMA-CD in-flight collisions are not addressed

Tell me more

Please review [Enhanced Transmission Selection for Half-Duplex Media](#) for detailed writeup

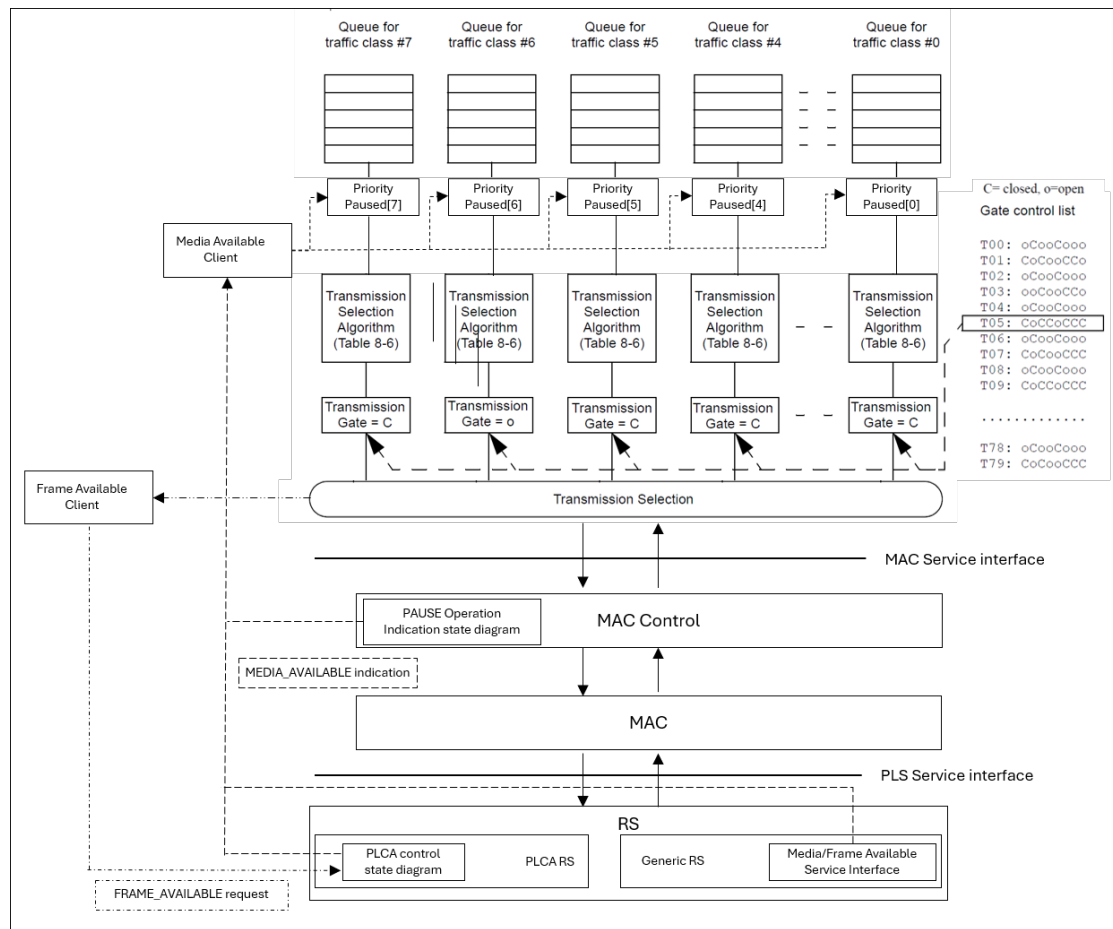


Delay between TO and transmission

- PLCA performance is sensitive to any delay between a TO being claimed and the start of packet transmission.
- Everything in the path from the PLCA Control State diagram -> Transmission Selection -> PLS Service interface takes zero time
- PLCA PLS_DATA.request processing takes 4 bit times.
- If the latency between signaling MetaAvailable and getting the first 4 bits of data is material, it could be addressed by having transmission selection signal PLCA which priorities have frames available.

And more

Please review [Enhanced Transmission Selection for Half-Duplex Media](#) for detailed writeup



Next

Goals

- Do the right work in the right place
- Use Nendica as forum for 802.1/802.3 discussion/coordination

Thank You!

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Consensus

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