ETHERNOVIA

TRANSFORMING HOW CARS OF THE FUTURE ARE BUILT

IEEE802.1Q – CBS AND TAS INTEROP

2021-04-20

IEEE contribution

ETHERNOVIA
TRANSFORMING HOW CARS OF THE FUTURE ARE BUILT

IEEE802.1Q-2018
8.6.8.4 Enhancements for scheduled traffic

- Continuous Gate-Open within cycle
- Limit Transmission Selection choices
  - Total
  - Per port

Table 8-6—Transmission selection algorithm identifiers

Transmission selection algorithm	Identifier
Strict priority (8.6.8.1)	0
Credit-based shaper (8.6.8.2)	1
Enhanced Transmission Selection (ETS) (8.6.8.3)	2
Reserved for future standardization	3–254
Vendor-specific Transmission Selection algorithm value for use with DCBX (D.2.8.8)	255
Vendor-specific	A four-octet integer, where the most significant 3 octets hold an OUI or CID value, and the least significant octet holds an integer value in the range 0–255 assigned by the owner of the OUI or CID.

- Cycle Start Control
- Worst case latency calculations
  - With combinations

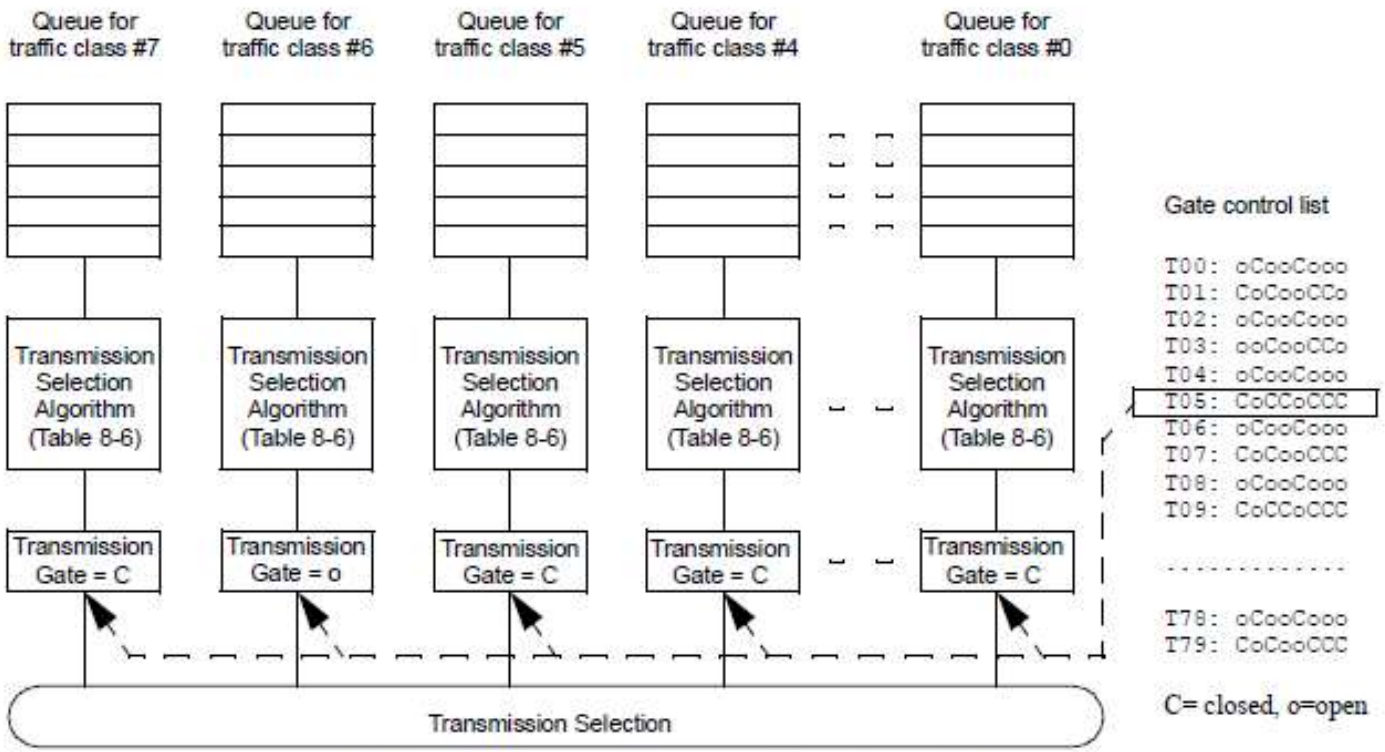
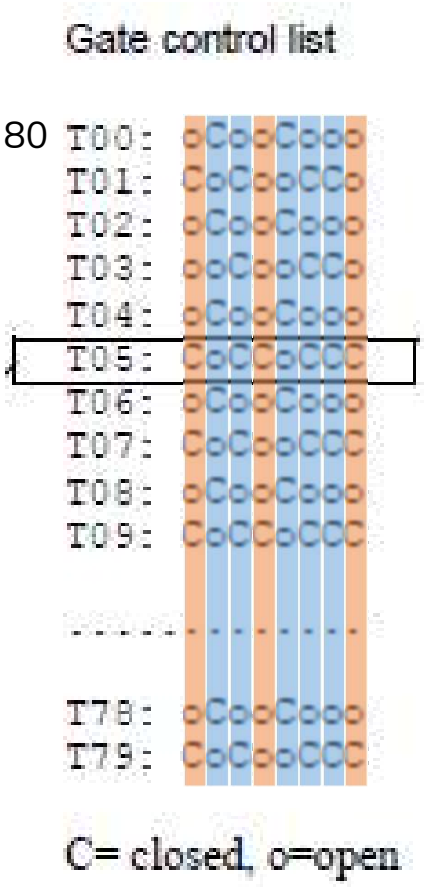


Figure 8-16—Transmission selection with gates

ETHERNOVIA
TRANSFORMING HOW CARS OF THE FUTURE ARE BUILT

IEEE802.1Q-2018
Continuous Gate-Open within cycle



- Opening and closing the same gate within one OperCycle, creates sub cycles (compare FlexRay).
- All sub cycles must divide into OperCycle.
  - OperCycle/40

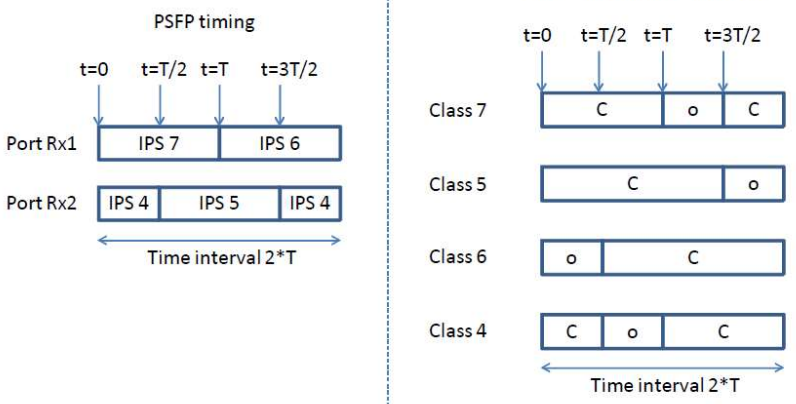
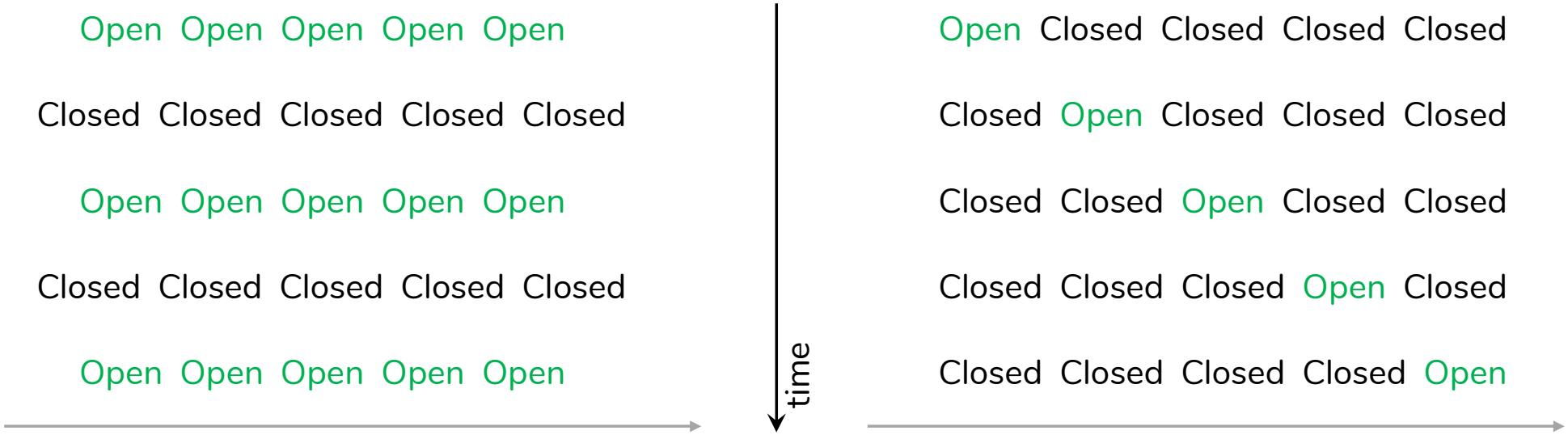


Figure T-5—Interleaving example—factor of 2

ETHERNOVIA
TRANSFORMING HOW CARS OF THE FUTURE ARE BUILT

IEEE802.1Q-2018
8.6.9.1.1 SetCycleStartTime()

NOTE 1—Since the origin of the PTP timescale is 1 January 1970 00:00:00 TAI, CycleStartTime will be larger than 1.3×10^{18} ns. If sufficient precision is not maintained when computing N, CycleStartTime will not be an integer multiple of OperCycleTime, which could result in misalignment of the cycles at ports on different bridges.



Looking at the one Gate a specified Frame will encounter through the network.

ETHERNOVIA
TRANSFORMING HOW CARS OF THE FUTURE ARE BUILT

IEEE Std 802.1BA-2011 page 15
6.5 Meeting latency targets for SR classes A and B

$$\text{Max Latency} = t_{Device} + t_{MaxPacketSize+IPG} + (t_{AllStreams} - t_{StreamPacket+IPG}) \times \text{Rate/MaxAllocBand} + t_{StreamPacket}$$

where

t_{Device} = the internal delay of the device (in increments of 512 bit times)

NOTE 3—t_{Device} is an integral multiple of 512 bit times so that it scales with the speed of the media.

$t_{MaxPacketSize+IPG}$ = the transmission time for a maximum size interfering frame (1522 octets to 2000 octets) plus its preamble and start of frame delimiter (SFD) (8 octets), and the following inter-packet gap (IPG) (12 octets)

$t_{StreamPacket}$ = the transmission time for the maximum frame size of the stream that is being reserved, plus its preamble and SFD (8 octets)

$t_{StreamPacket+IPG}$ = the transmission time for the maximum frame size of the stream that is being reserved, plus its preamble and SFD (8 octets) and the following IPG (12 octets)

Rate = the transmission rate of the port

MaxAllocBand = maximum allocatable bandwidth, the maximum amount of bandwidth the AVB system is able to allocate for Class A streams on the port

$t_{Interval}$ = the Class A observation interval or 125 µs

$t_{AllStreams}$ = (MaxAllocBand × $t_{Interval}$) / tRate = the sum of the transmission times of all Class A stream frames the AVB System is able to allocate in an observation interval (125 µs) on a port

g) ***sendSlope***. The rate of change of *credit*, in bits per second, when the value of *credit* is decreasing (i.e., while *transmit* is TRUE). The value of *sendSlope* is defined as follows:

sendSlope = (*idleSlope* – *portTransmitRate*)

h) ***transmitAllowed***. Takes the value TRUE when the *credit* parameter is zero or positive; FALSE when the *credit* parameter is negative.

75% ≥ MaxAllocBand(CBS)/LineRate

ΣMaxLatencies ≤ 2ms / 7Hops

IEEE802.1Q-2018
8.6.8.2 Credit-based shaper algorithm

c) ***portTransmitRate.*** The transmission rate, in bits per second, that the underlying MAC Service that supports transmission through the Port provides. The value of this parameter is determined by the operation of the MAC.

d) ***idleSlope***. The rate of change of *credit*, in bits per second, when the value of *credit* is increasing (i.e., while *transmit* is FALSE and the transmission gate for the queue is open [8.6.8.4]). The value of *idleSlope* can never exceed *portTransmitRate*. If the enhancements for scheduled traffic (8.6.8.4) are not supported, or if GateEnabled is FALSE (8.6.9.4.14), the value of *idleSlope* for a given queue is equal to the value of the *operIdleSlope(N)* parameter for that queue, as defined in 34.3. If the enhancements for scheduled traffic (8.6.8.4) are supported, and GateEnabled is TRUE (8.6.9.4.14), then

idleSlope = (*operIdleSlope(N)* × OperCycleTime / GateOpenTime)

where OperCycleTime is as defined in 8.6.9.4.20 and GateOpenTime is equal to the total amount of time during the gating cycle that the gate state for the queue is Open.

IEEE Std 802.1BA-2011

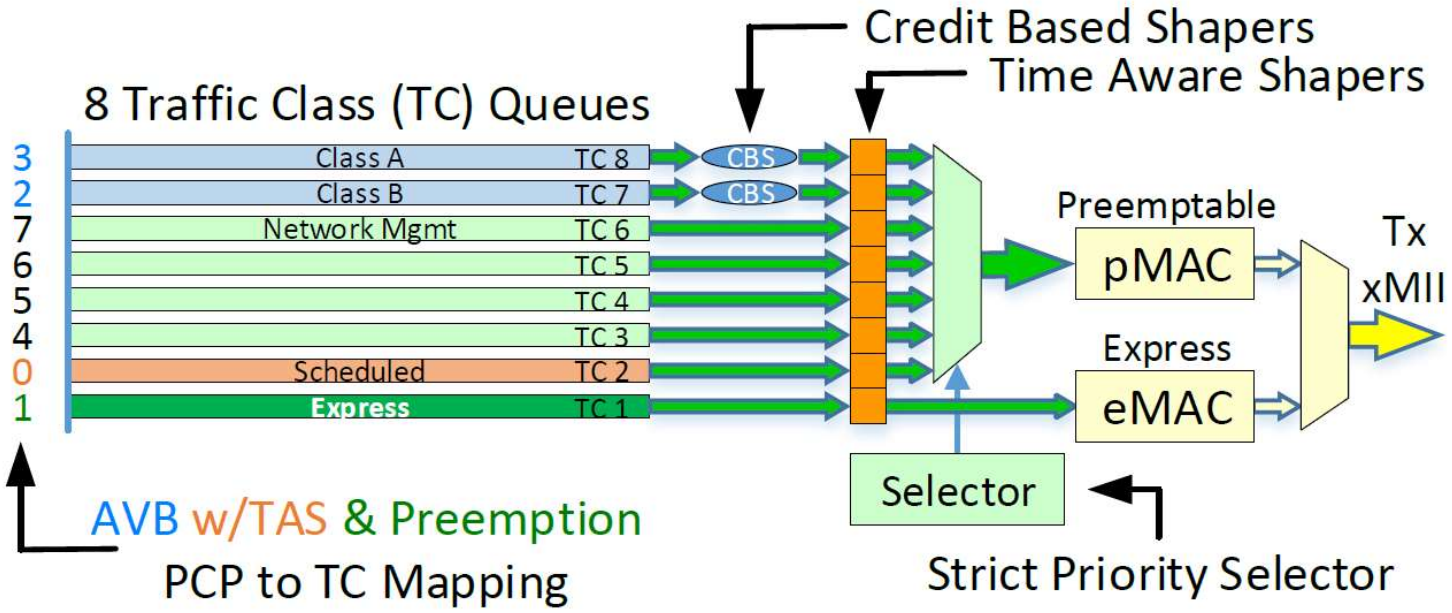
$$\text{Max Latency} = t_{Device} + t_{MaxPacketSize+IPG} + (t_{AllStreams} - t_{StreamPacket+IPG}) \times \text{Rate/MaxAllocBand} + t_{StreamPacket}$$

75% ≥ MaxAllocBand(CBS)/LineRate

ΣMaxLatencies ≤ 2ms / 7Hops

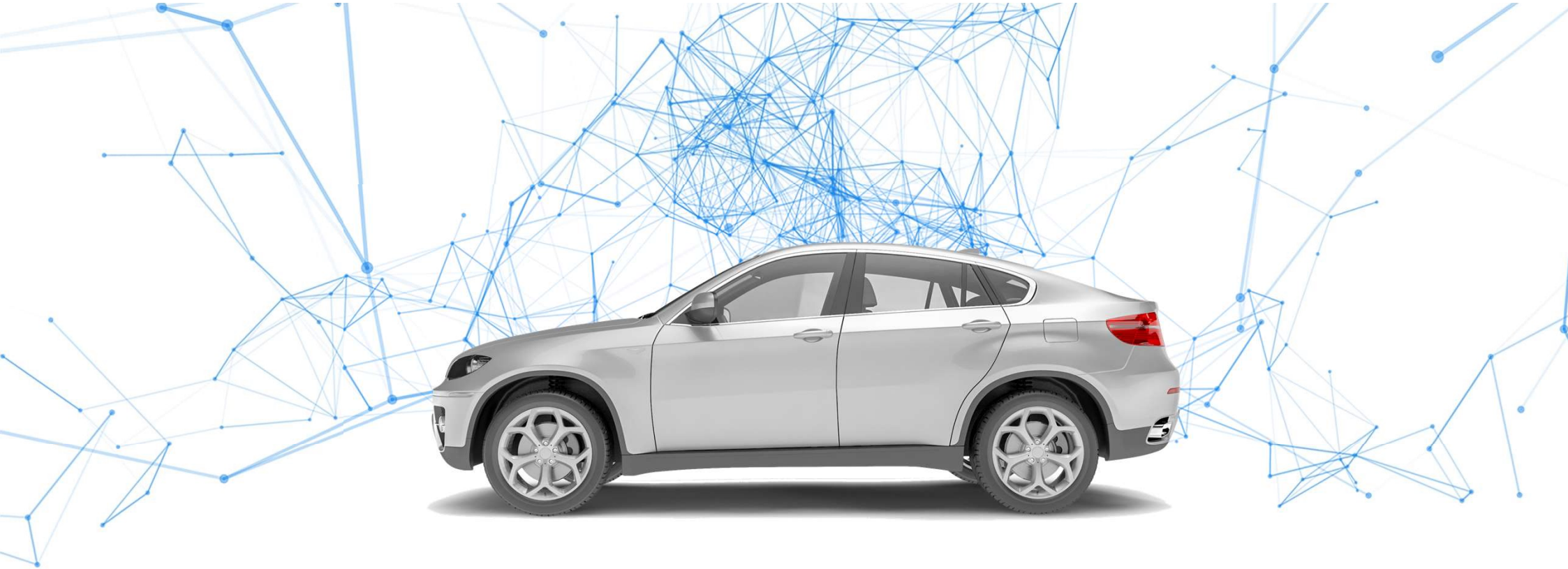
OperCycleTime(gate)/GateOpenTime(gate) ≥ MaxAllocBand(CBS)/LineRate
(Sum or per sub-cycle?)

Goal: Limit the possible configuration to what can be “understood”



- Worst case Latency for each Queue?
- Dependencies for dynamic configuration?
- Requirements on Policing?

“Random” example, curtesy of Don Pannell (NXP)



THANK YOU

ETHERNOVIA | max.turner@ethernovia.com