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# Traffic Shaping for Synchronous Profile: Proposal

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# Objective



***Proposal for synchronous profile shaping***  
***Further discussion on profile features***

# Recap: Two Profile Approach



## Asynchronous Profile

*targets current Ethernet based use cases*

- Asynchronous with slower cycle times (> 50 msec)
- Latency bounded with acceptable delay variation (jitter) up to latency bound
- Comfortable with rate constrained shaping
- Controlled network – no undefined traffic on the network
- Highly static – designed, analyzed, configured well ahead of operation
- Certification burden is significant – simplicity is valuable

**Asynchronous profile to provide an equivalent solution**

## Synchronous Profile

*targets current non-Ethernet and future use cases*

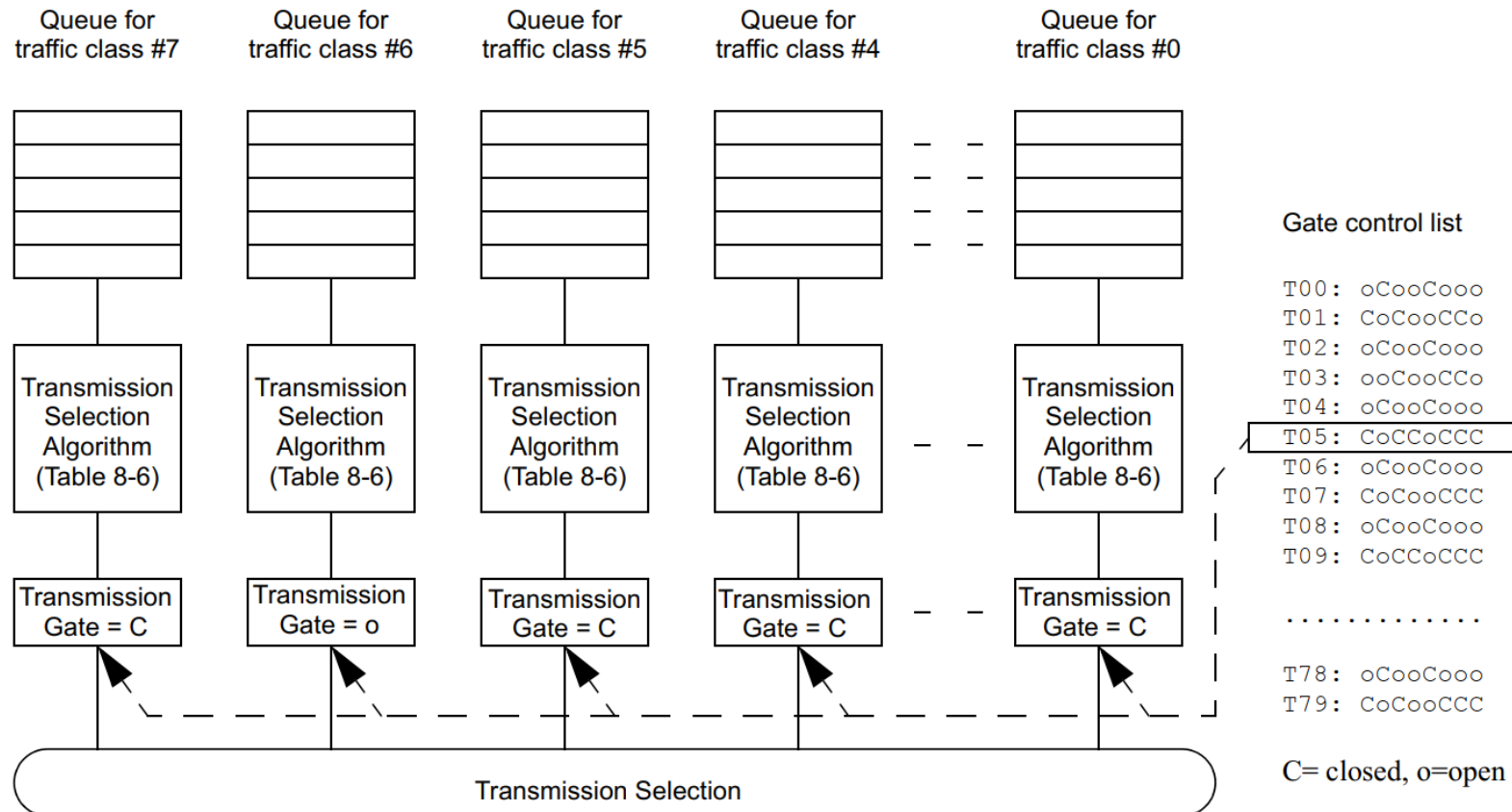
- Segmented/partitioned subsystems
- Synchronous with cycle times in the order of 1 msec. Future use cases with sub-millisecond cycle times
- Sensitive to latency (or deadline) and delay variation (jitter)
- Convergence of mixed critical traffic
- Interoperability of legacy buses on top TSN backbone
- Platform wide clock time distribution
- Potential for dynamic (re)configuration

**Synchronous profile to provide an ethernet based converged system**

# Traffic Shaping for Synchronous Profile



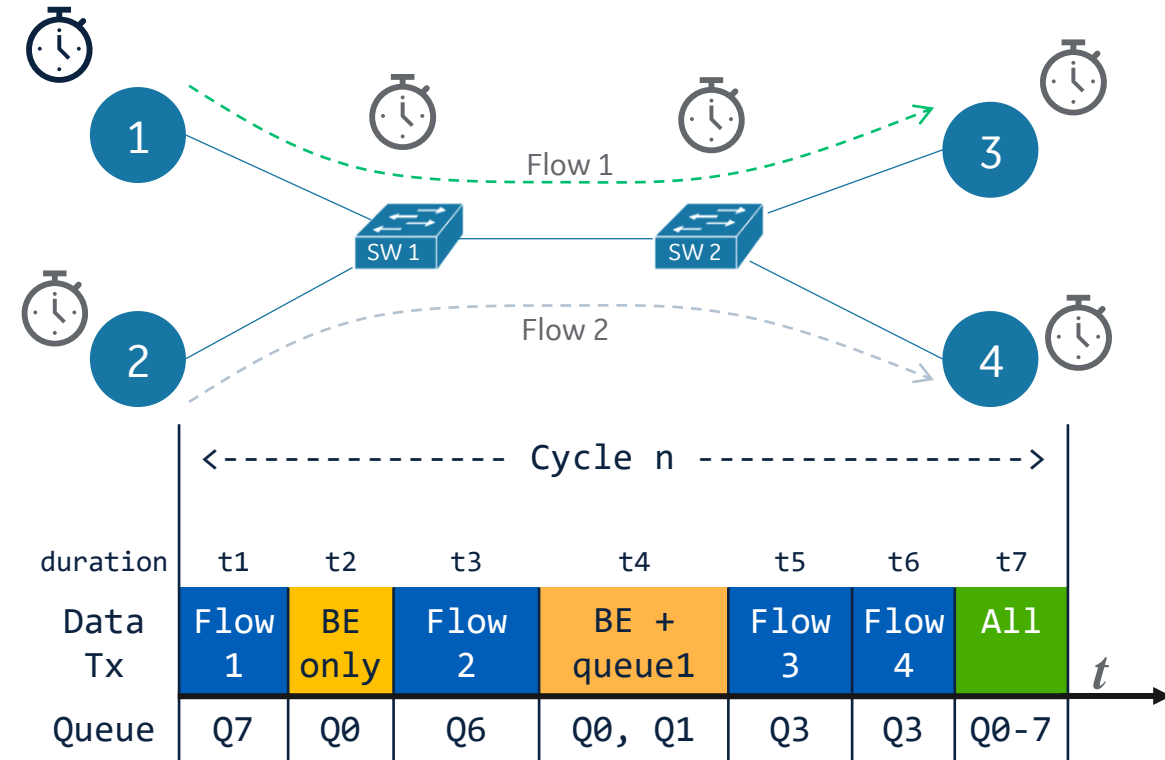
- IEEE 802.1Qbv-2015, IEEE 802.1Q-2018 Clause 8.6.8
- Enhancements for Scheduled Traffic
- Commonly referred to as Time Aware Shaper (TAS)



# Traffic Shaping with Time Aware Scheduler



- Requires time synchronization (802.1AS)
- End stations and bridges operate on a cycle/period (typically a single cycle time for the network)
- Schedule is based on **arbitrary** sized time slots repeated over a cycle
- Every egress port (and all its queues) on endpoints and bridges is gated
- Gates open and close precisely as per schedule – an offset into the cycle time and duration
- Conformant devices must have at least two queues to support TSN and BE traffic
- In some implementations, a data frame following a schedule may not encounter any buffering from source to destination → “green lights all the way” → bounded low latency
- Low delay variation – mostly the result of time sync error and Qbv implementation (at least for isolated streams)
- Interoperable with other shapers like Qav



Gate Control List for the above schedule at a given egress port:

```

OCCCCC t1
CCCCC0 t2
COCCCC t3
CCCCC0 t4
CCCOCC t5
CCCOCC t6
000000 t7
    
```

# Proposal



- Synchronous profile shall require time-aware shaper for conformant end stations
- Synchronous profile shall require time-aware shaper for conformant bridges
- More than one traffic classes may be designated for time-aware traffic