AVB for Industrial Communication Networks
part 1 – requirements for low latency streams

Siemens

IEEE 802.1 Interim Meeting

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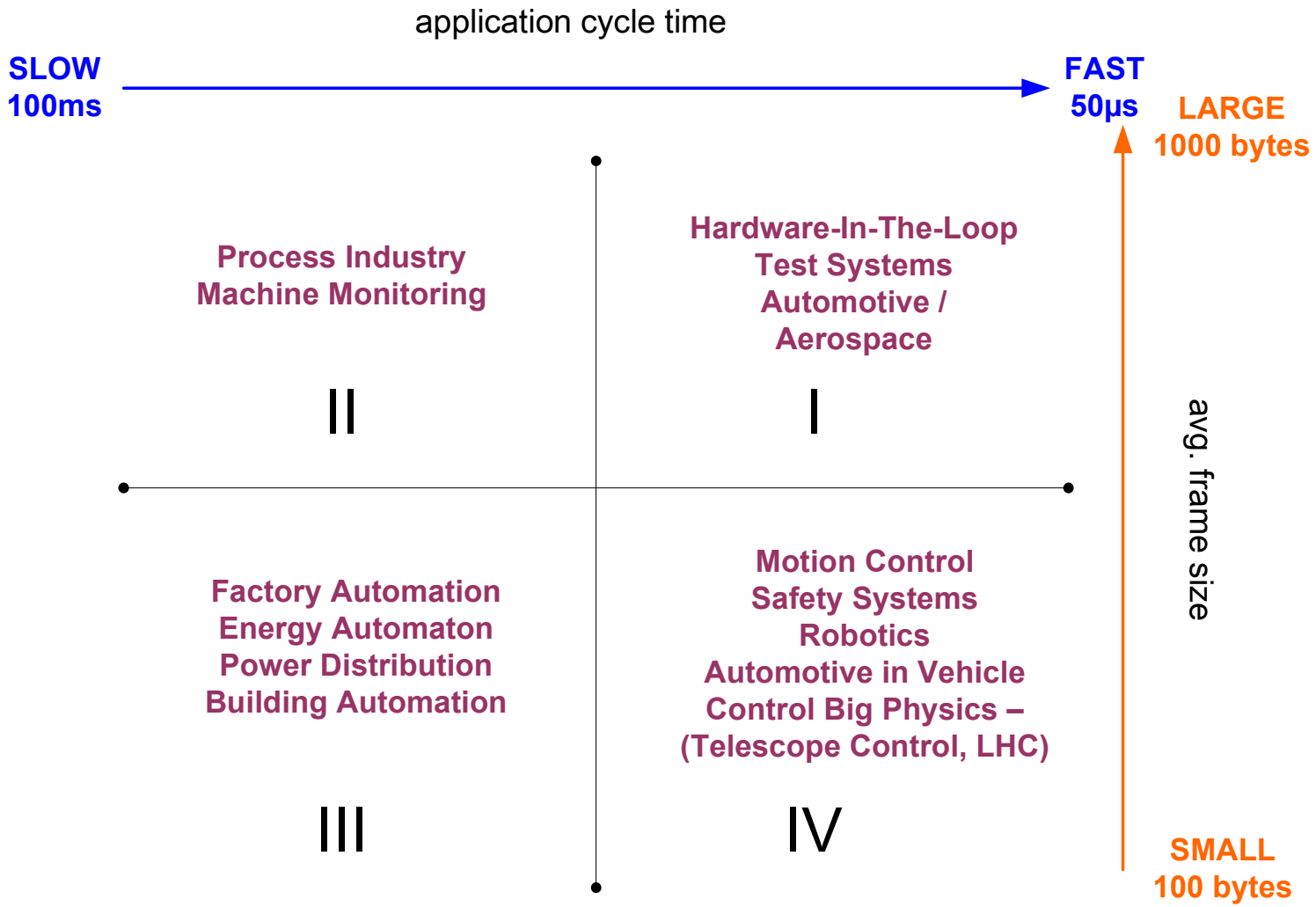
AVB for Low Latency Networks

Aims of this Presentation:

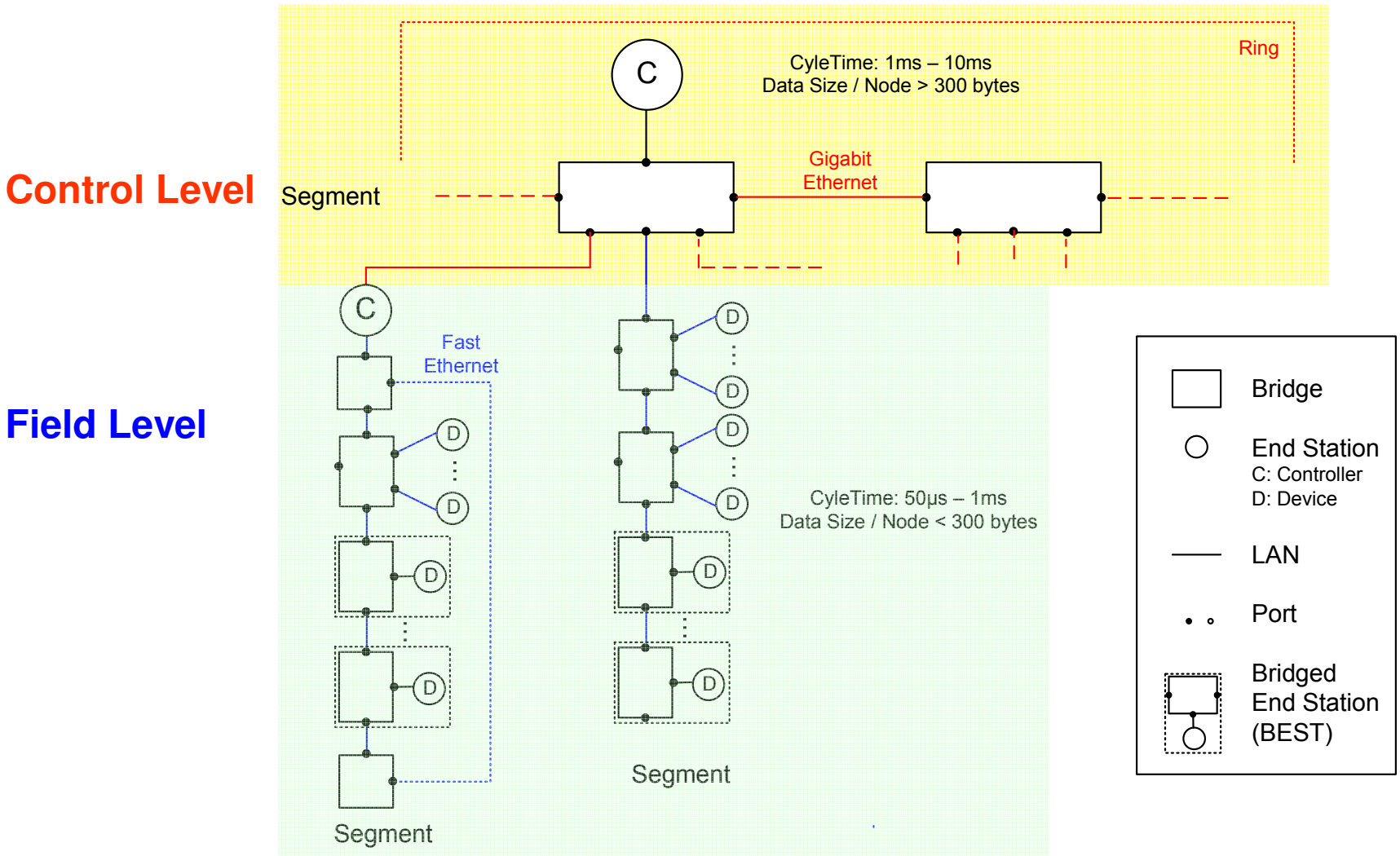
- Define requirements for low latency Streams
- Show possible solutions
- Trigger discussions

=> Define new work items for AVB TG which includes requirements for industrial communication

Broad Classification of different (industrial) Applications



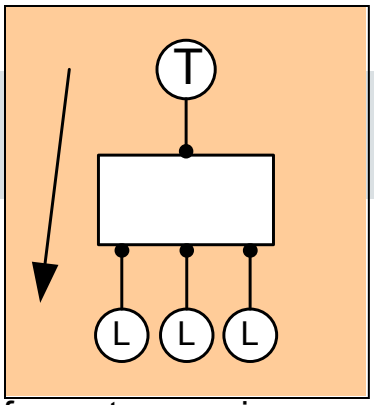
Typical Topology for Bridged LANs in Industry: Line, Ring and Star



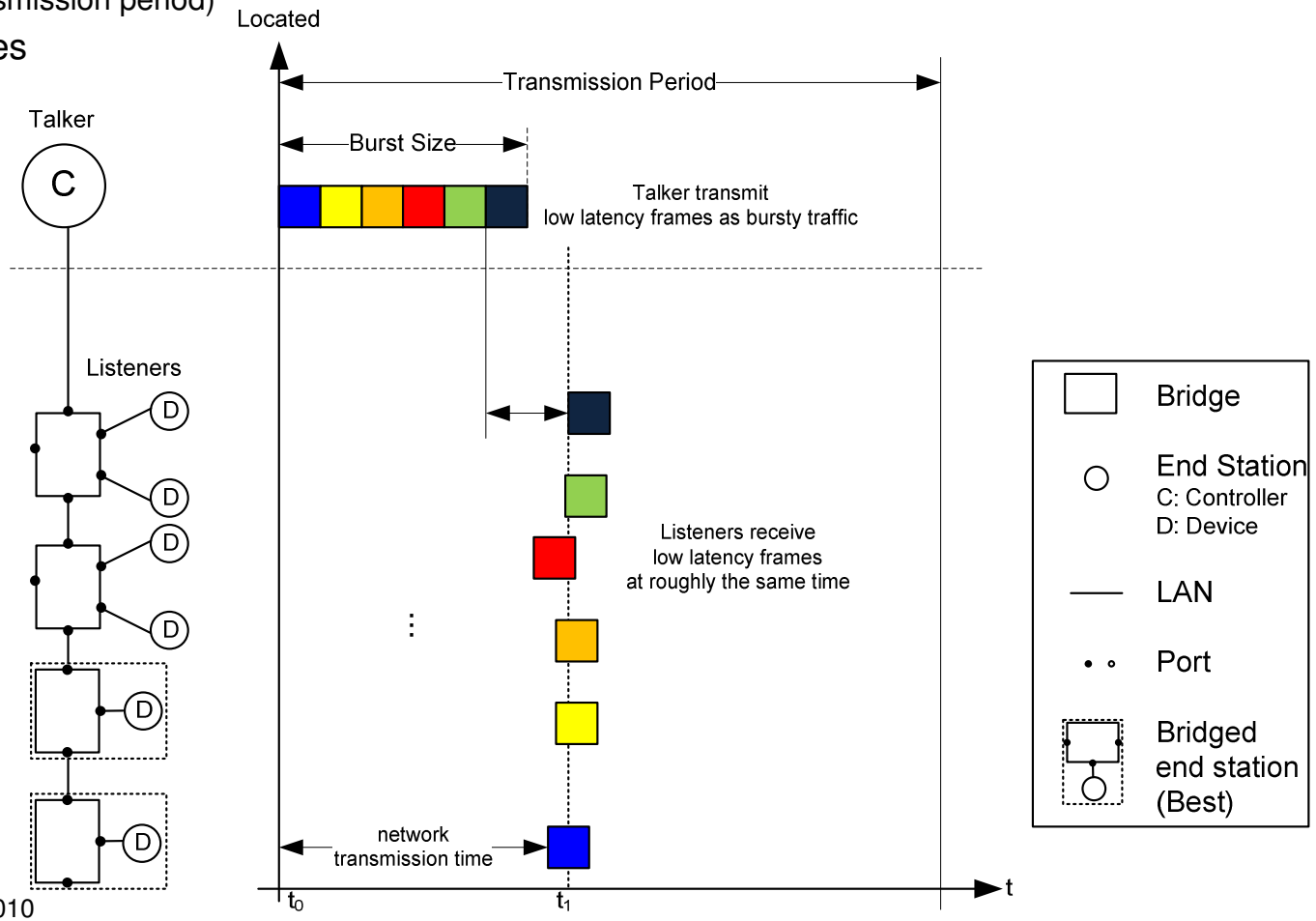
Traffic Pattern for low latency SRclass

Properties of low latency SRclass:

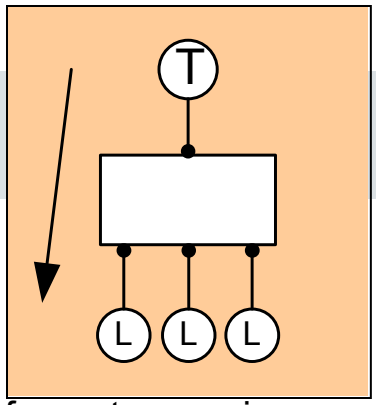
- Bursty
- Small frame size (typ. <100 Bytes)
- Listeners receive low latency frames at roughly the same time
  (if possible within the same transmission period)
- Huge number of small frames



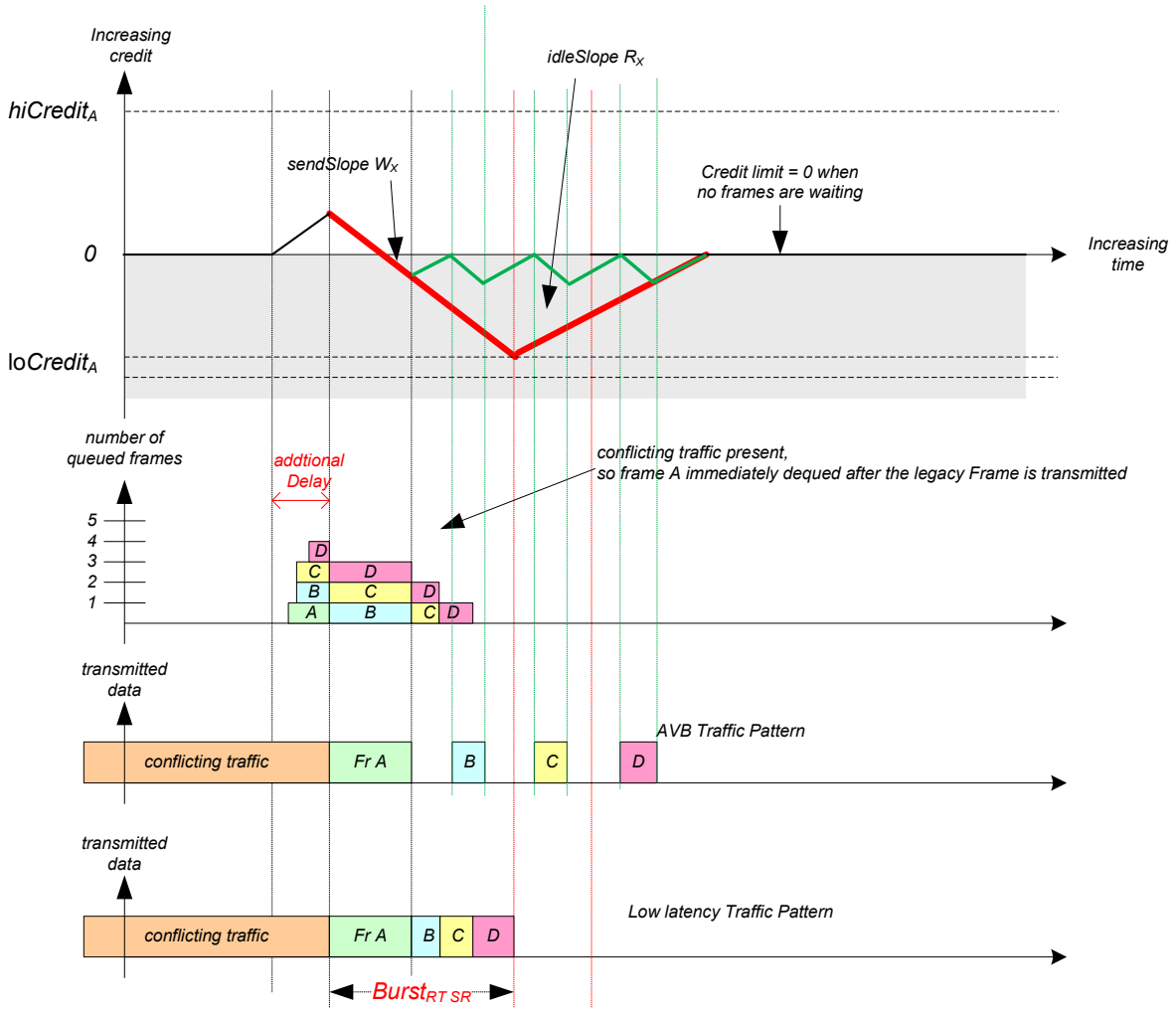
fan-out scenario



Scheduler for low latency SRclass



fan-out scenario

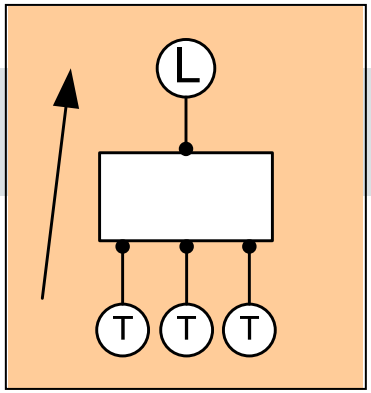


present AVB

low latency requirements

alllow, „bursty“ traffic with certain burst size

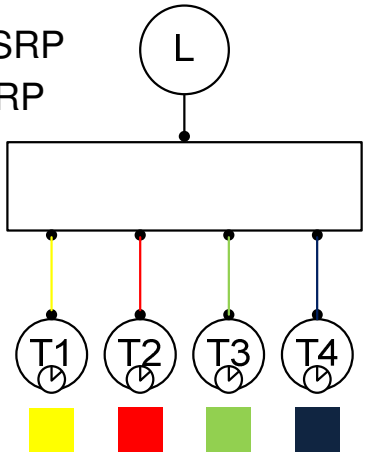
Multiple Talker with TDMA



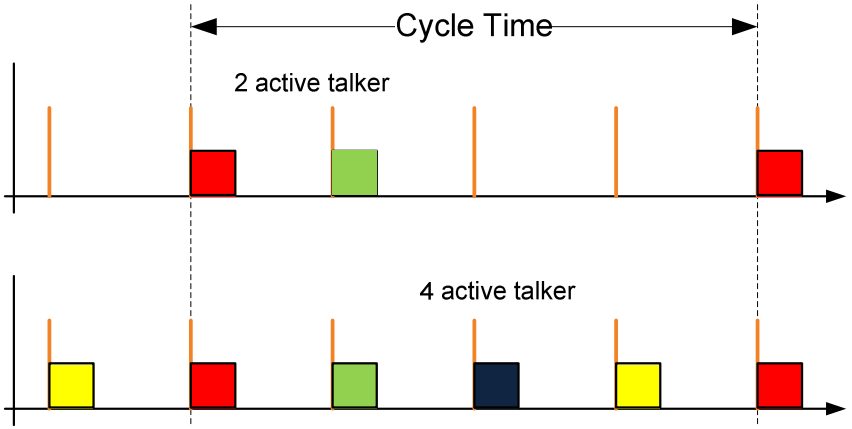
fan-in scenario

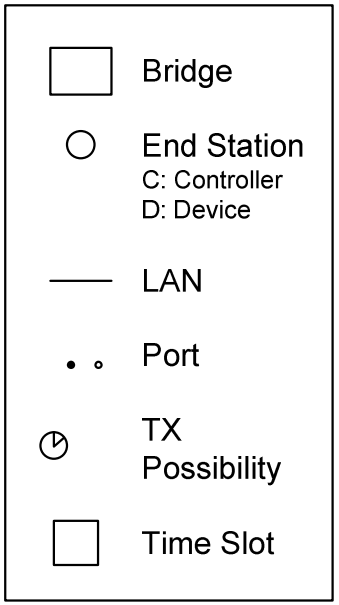
Requirements:

- Synchronized end stations
- Common Cycle Time (i.e. 1ms)
- Common Transmission Period (i.e. 125µs)
- Common reservation for one Stream by MSRP
- Defined slot reservation mechanism in MSRP

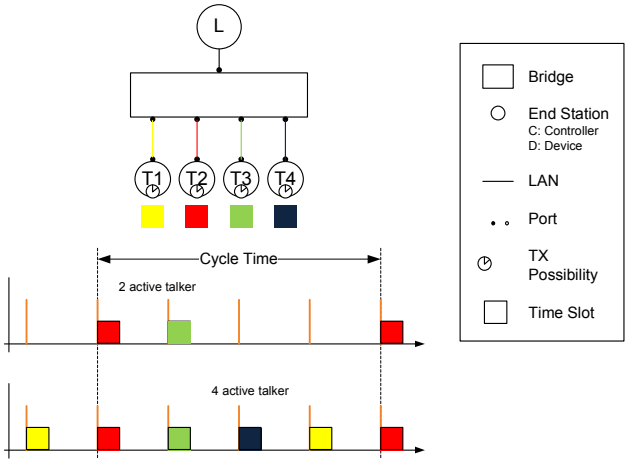


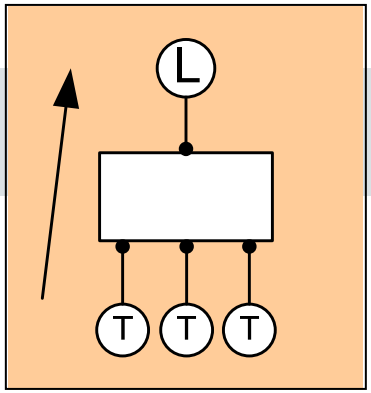
MaxSlot = CycleTime / Transmission Period
i.e.
MaxSlot = 1ms / 250µs = **4**





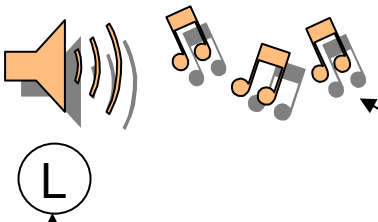
Multiple Talker with TDMA: „striking example“



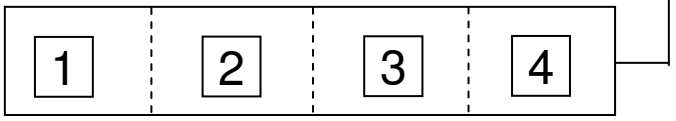


fan-in scenario

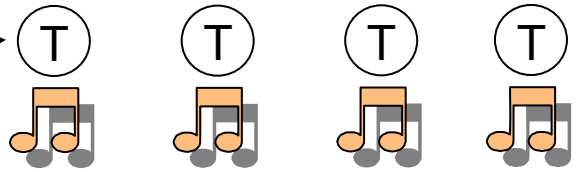
The listener is a speaker that receives the whole stream



„assembled stream = music“



Each talker is a flute, able to produce one distinct tone



„A“ „H / B“ „C“ „D“

Europe / America

Requirements for MSRP to support low latency SRclass

- **Low Latency SRclass with Burst**
  - Low Latency < 125µs over ~32 hops, data < 300 Bytes
    (-> avoid interference Best Effort Traffic with Low Latency Traffic)

- **Stream Preemption**
  - Defined Ranking for SR
  - Higher ranking SR must be able to preempt lower ranking SR

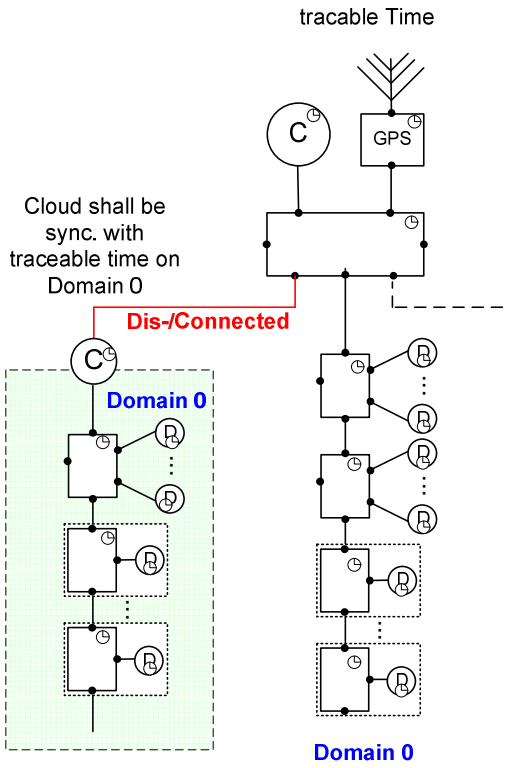
- **Multiple Talker with TDMA**
  - Mechanism to allocate fixed slot numbers to talkers

Additonal Transmition Selection Scheduler for low latency SRclass

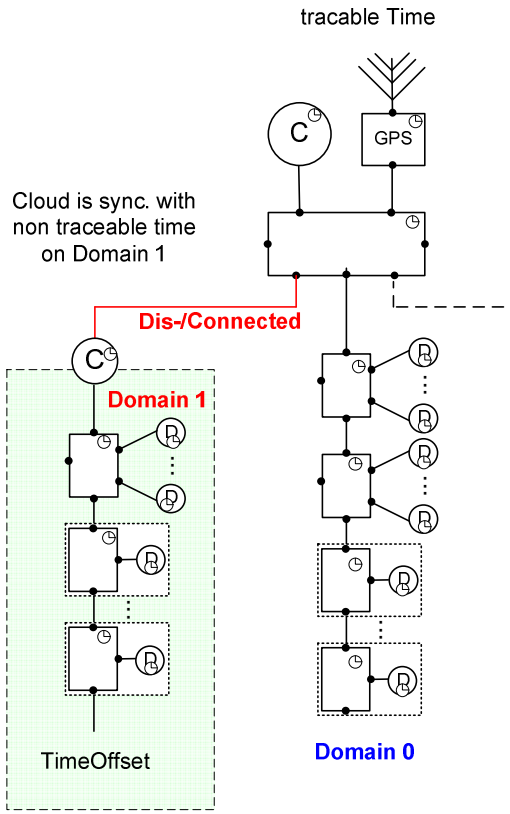
- **Support bursty low latency SRclass**
- **Fair scheduling behaviour with**
  - Guaranteed bandwidth and burst size for low latency SRclass
  - Guaranteed latency
  - Guaranteed ressources
  - Guaranteed bandwidth for legacy traffic

Requirements for Synchronization in Industry

I: Cloud is synchronized

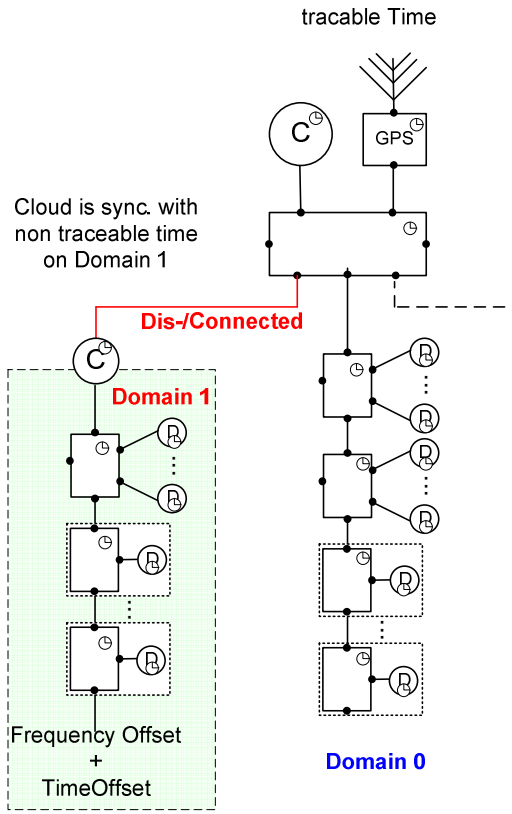


II: Cloud is syntonized



- Alternate Timescale + Domain 0 in FollowUp or Announce Message

III: Cloud is not syntonized



- TLV for Alternate Timescale Value + Frequency Offset + Domain 0 in Sync or FollowUp Message

- More than 7 hops will be the normal case and accuracy < 1µs
- Support for One-Step-Clock as an option?
- Determinable holdover time

FIN

Thank you!