TSN Interdomain Communications

IEC/IEEE Industrial TSN Profile

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Background Terms

- To be able to talk about TSN Interdomain Communications, a shared understanding of terms needs to be reached. The following terms and their definitions are taken from 802.1Q-2018:

  - **Transmission selection algorithms** – A set of algorithms for traffic selection which include Strict Priority, the Credit-based shaper and Enhanced Transmission Selection.

  - **Preemption** – The suspension of the transmission of a preemptable frame to allow one or more express frames to be transmitted before transmission of the preemptable frame is resumed.

  - **Enhancements for scheduled traffic** – A Bridge or end station may support enhancements that allow transmission from each queue to be scheduled relative to a known timescale.

Background Terms 2

- To be able to talk about TSN Interdomain Communications a shared understanding of terms needs to be reached. The following terms and their definitions are taken from 802.1Q-2018:
  - **SRP Domain** – A set of stations (end stations and/or Bridges), their Ports, and the attached individual LAN's that satisfy all of the following requirements for a given SR class:
    - A) Those stations that transmit streams all support the credit-based shaper algorithm, defined in 8.6.8, as the transmission selection method for the SR class.
    - B) The stations all support SRP as the means of creating bandwidth reservations for the SR class.
    - C) Those stations that transmit streams all associate the same priority value with the SR class.
    - D) Each Port in the set is either an SRP domain core port or an SRP domain boundary port.
    - E) Each SRP domain core Port in the set is connected, via an individual LAN that is part of the active topology, to an SRP domain core Port of another station in the set.
  - **Time-Sensitive Stream** – a stream of traffic, transmitted from a single source station, destined for one or more destination stations, where the traffic is sensitive to timely delivery, and in particular, requires transmission latency to be bounded.

TSN From a Traffic Shaping Perspective

- The core technologies that shape Time-Sensitive traffic according to 802.1Q-2018 and currently approved Q enhancements are:
    - The Strict Priority Shaper (QoS)
    - The Credit Based Shaper
    - Enhancements for Scheduled Traffic
    - Preemption
- Other technologies (Qch, Qci, CB) build on and use Time-Sensitive mechanisms. As such their use can be optionally implemented but are not considered a core traffic-shaping technology.

Proposed Definition: TSN Domain

- **TSN Domain:** A set of stations (end stations and/or Bridges), their Ports, and the attached individual LAN's that transmit Time-Sensitive Streams using TSN standards which include Transmission Selection Algorithms, Preemption, Time Synchronization and Enhancements for Scheduled Traffic and that share a common management mechanism (or "policy engine").

Proposed TSN Domain Characteristics

- One or more TSN Domains may exist within a single layer 2 broadcast domain.

- A TSN Domain may not be shared among multiple layer 2 broadcast domains.

  - A common time profile may be shared

- Two TSN Domains may implement the same requirements but stay separate.

- One port must only be a member of a single TSN domain

- Multiple TSN domains will often be implemented in one bridge

Interdomain Communications

- A method for reserving time-sensitive streams over multiple TSN Domains needs to be specified.

- The author's proposal:

  - The management mechanism (centralized, hybrid, fully distributed) of a time-sensitive stream will request time-sensitive stream resources from other management mechanisms on behalf of the time-sensitive stream requiring the resource.

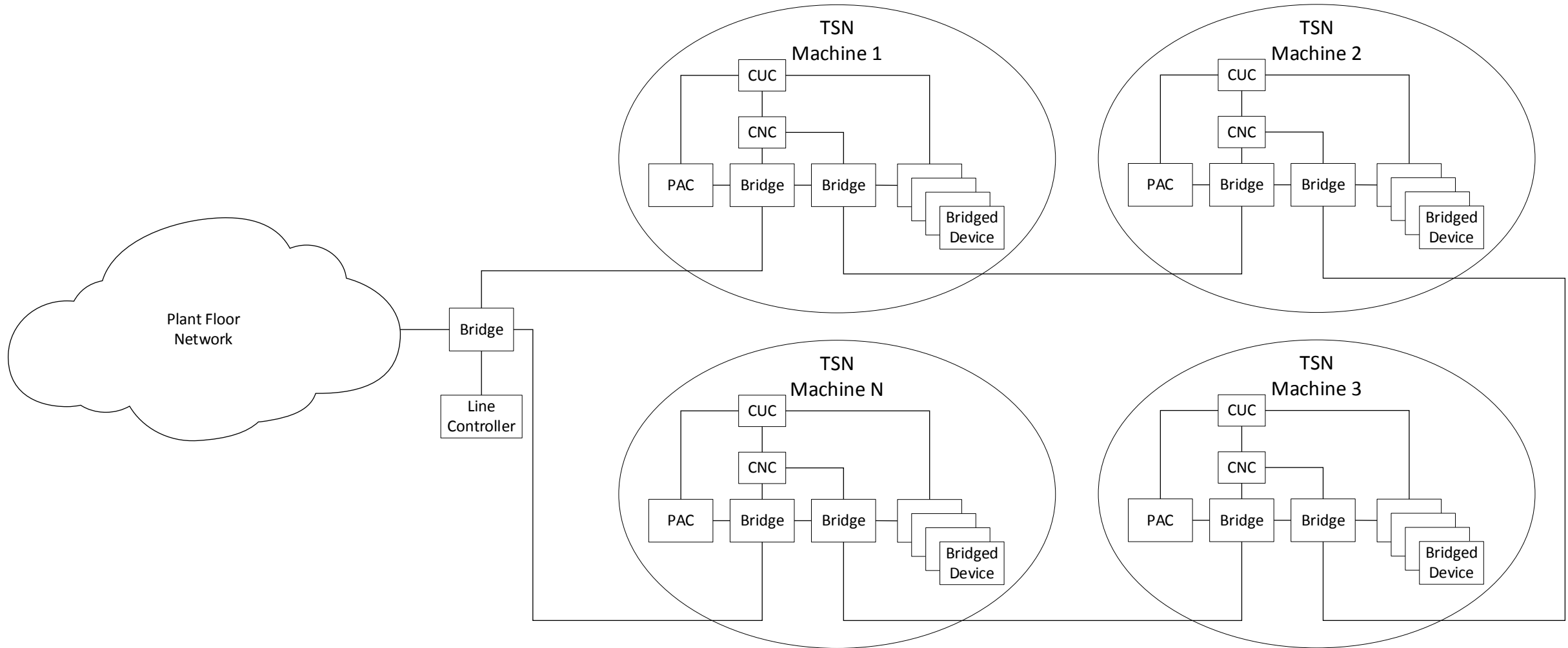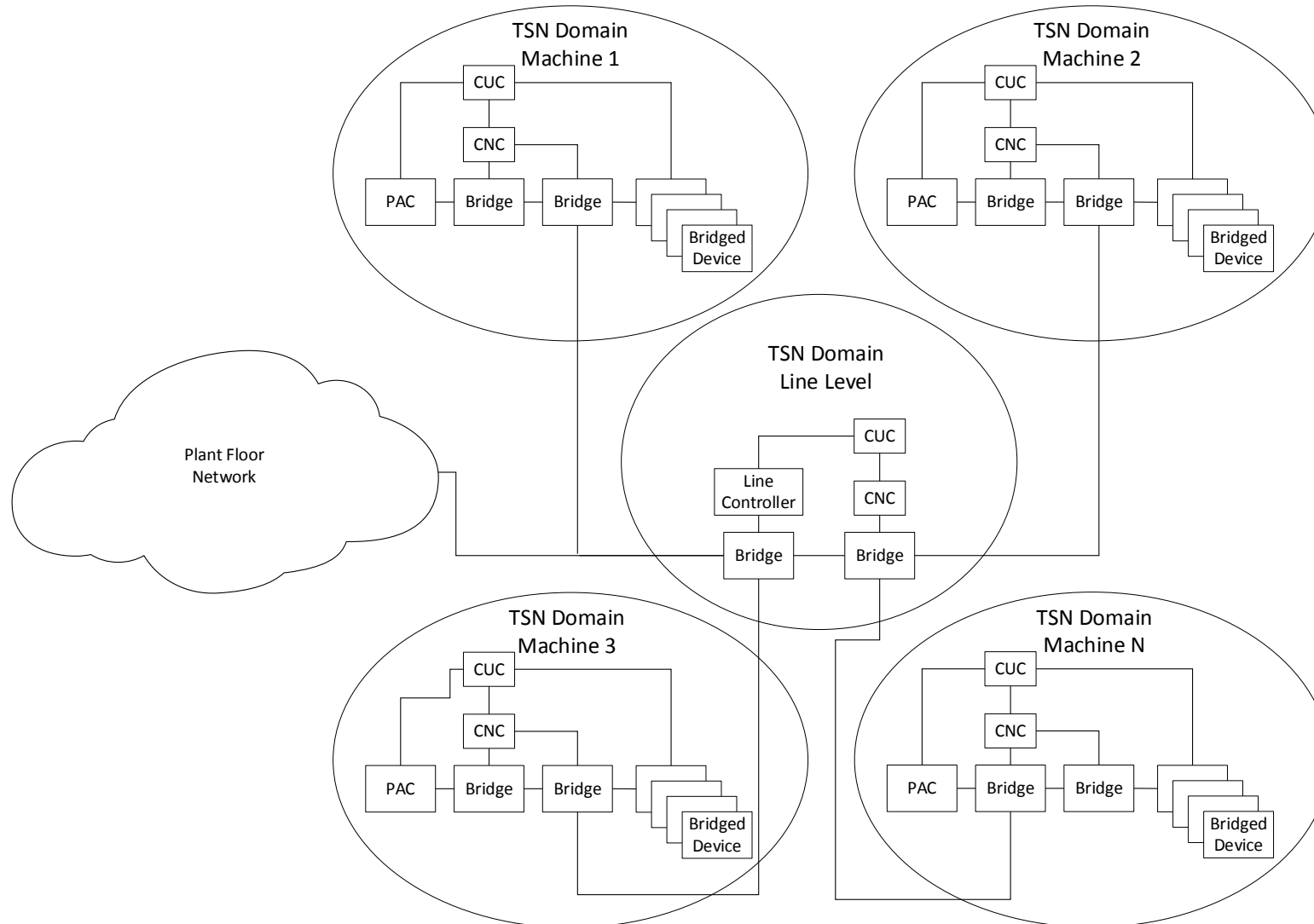# Interdomain Example 1 – Motion Controller Peer Connection
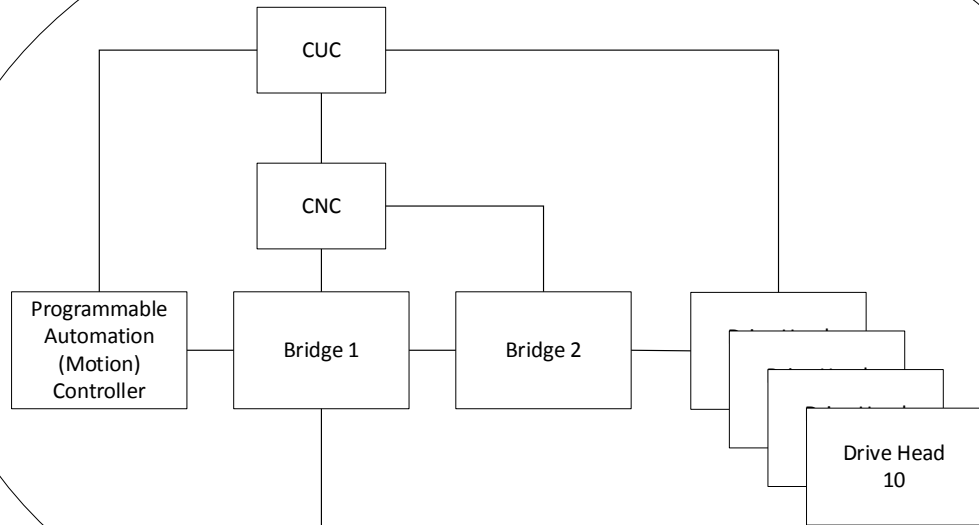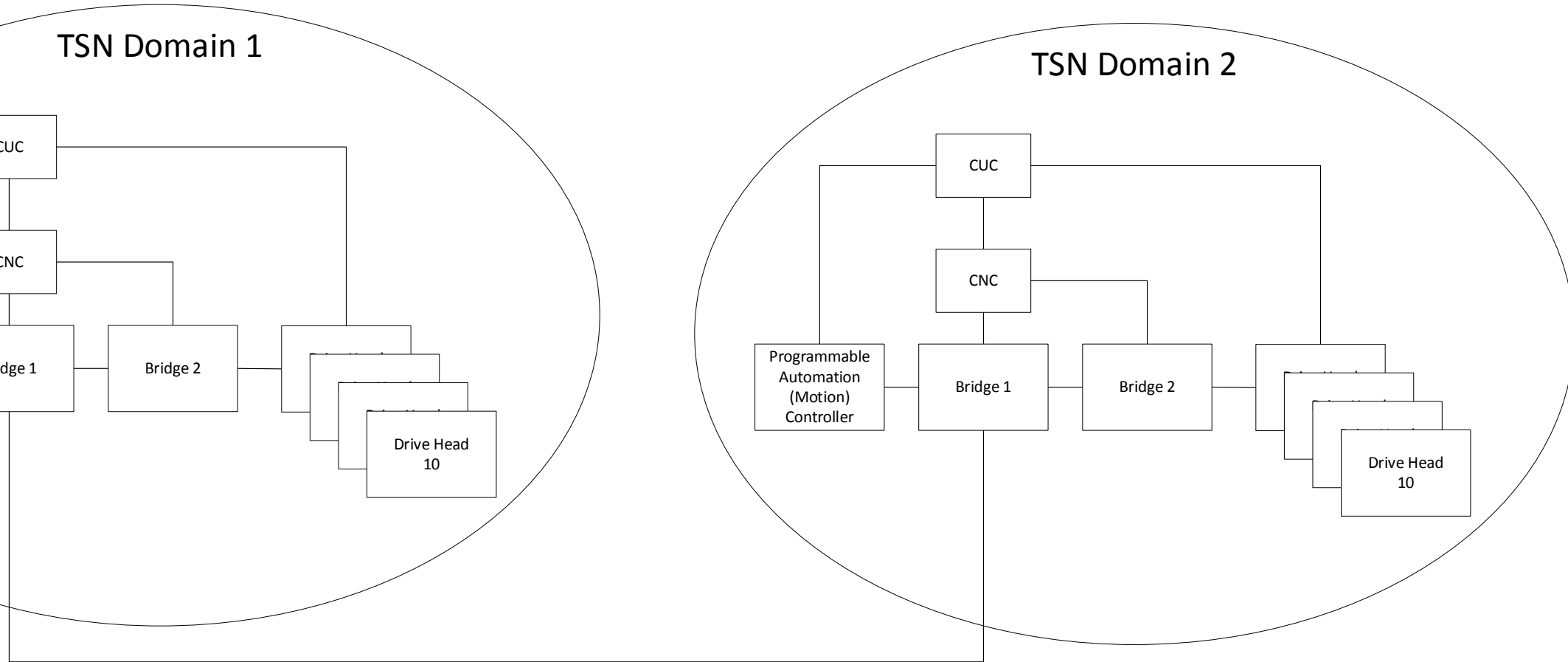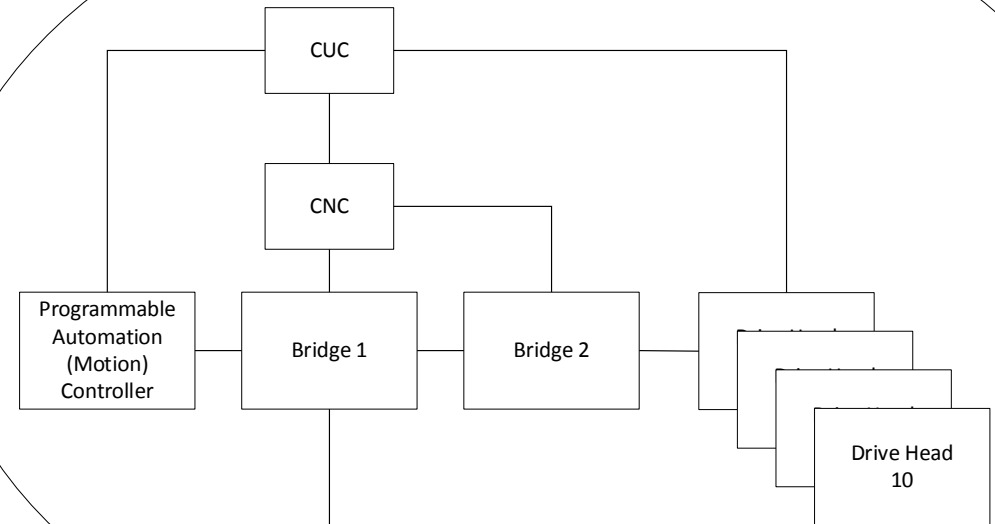
Interdomain Example 2 – Machines Talking with Line Controller

Interdomain – Fully Distributed Requirements

- These requirements are proposed to apply to 802.1Qdd (once approved)

  - A TSN edge port must have awareness of all the implemented TSN mechanisms in its domain.

  - A TSN edge port in a fully distributed model must have awareness that it's an edge port.

  - A method should be specified for a TSN edge port to request resources from an adjacent TSN edge port.

Questions?