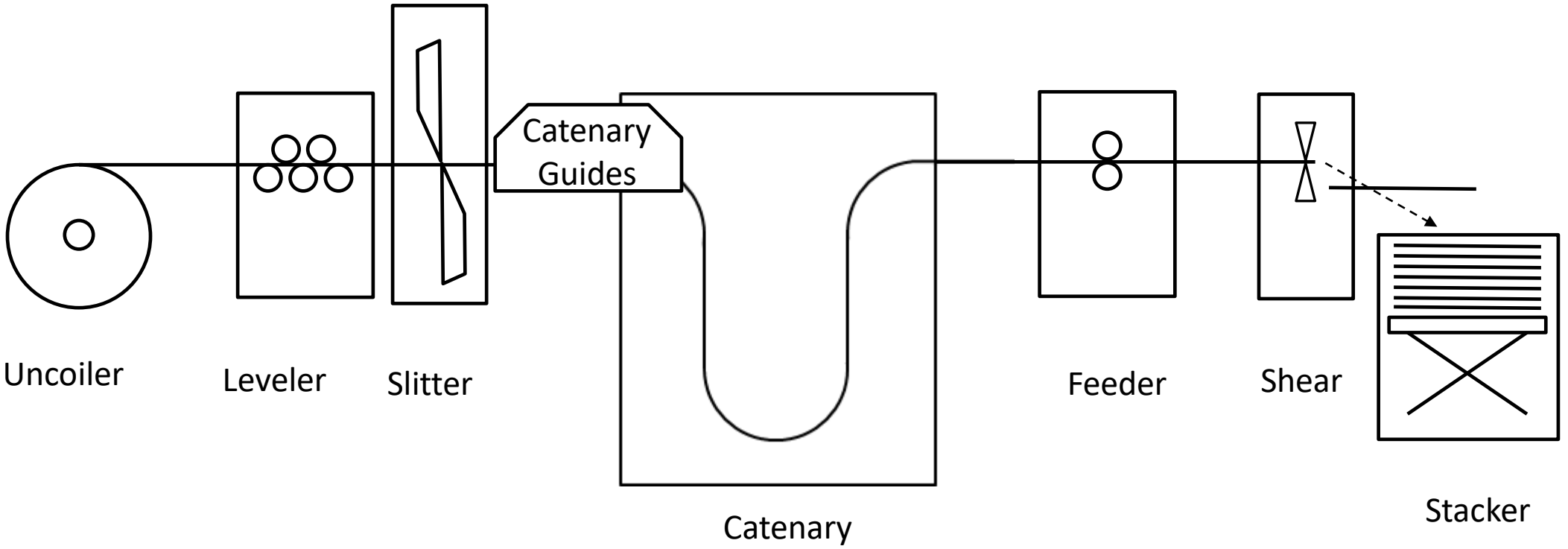
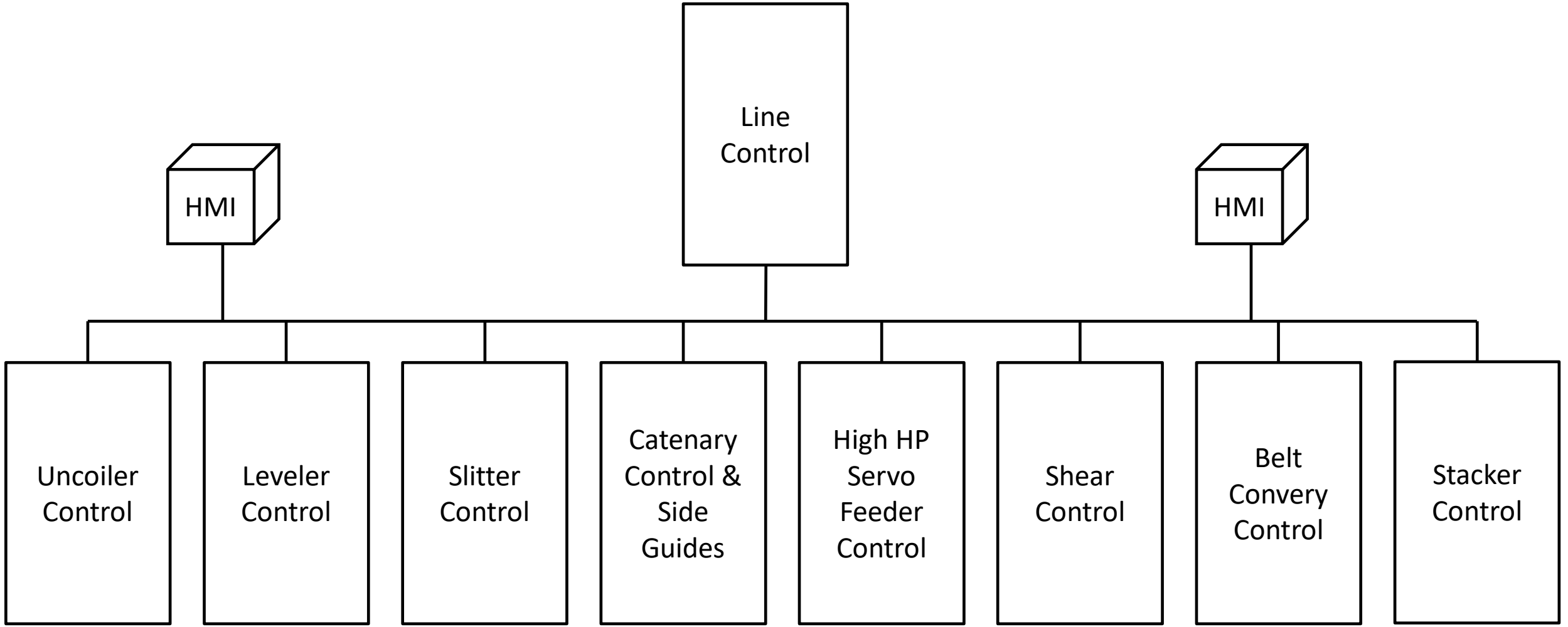
# Workflow Discussion

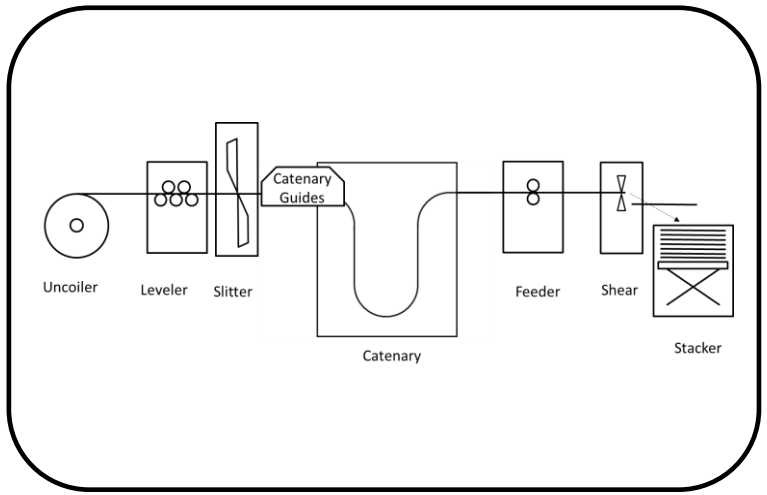
# Example: Blanking Line Application

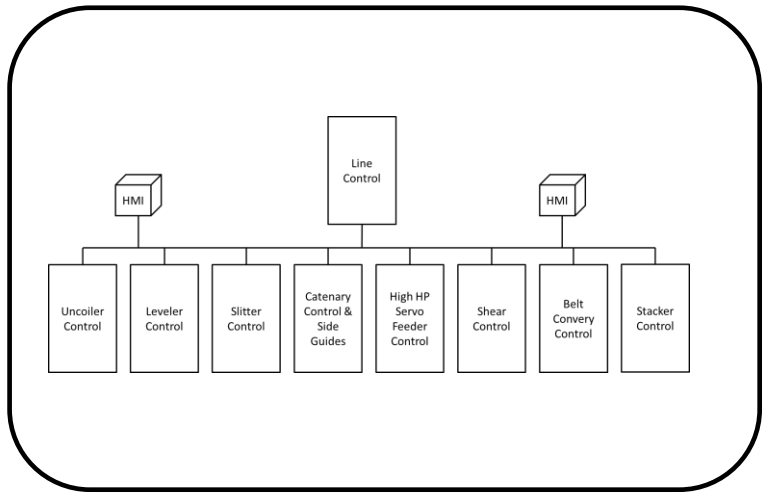


# Architectural Segmentation: Subsystem Identification



# Workflow



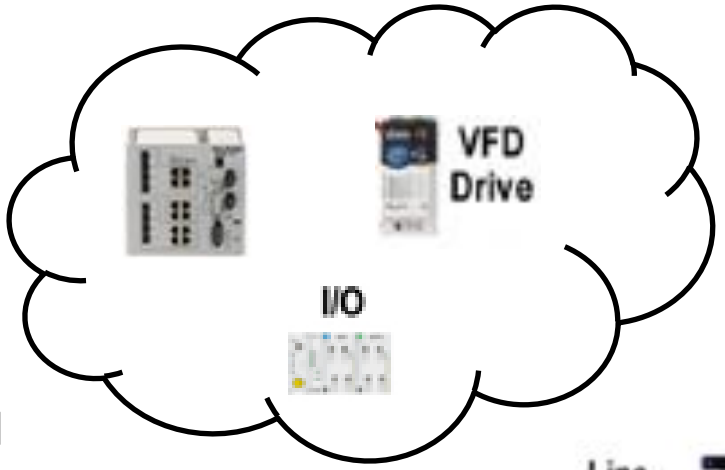

OEM A

OEM B

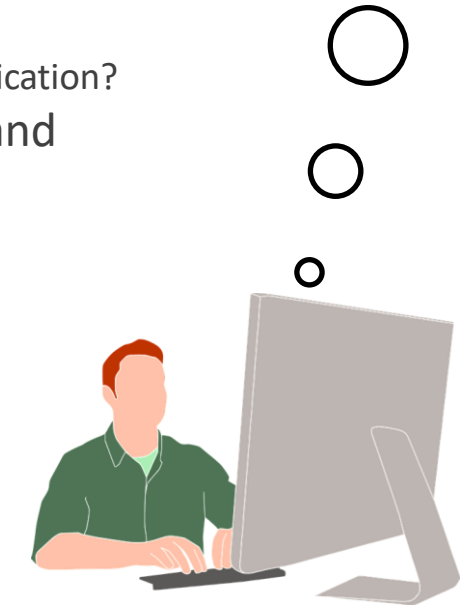
OEM C

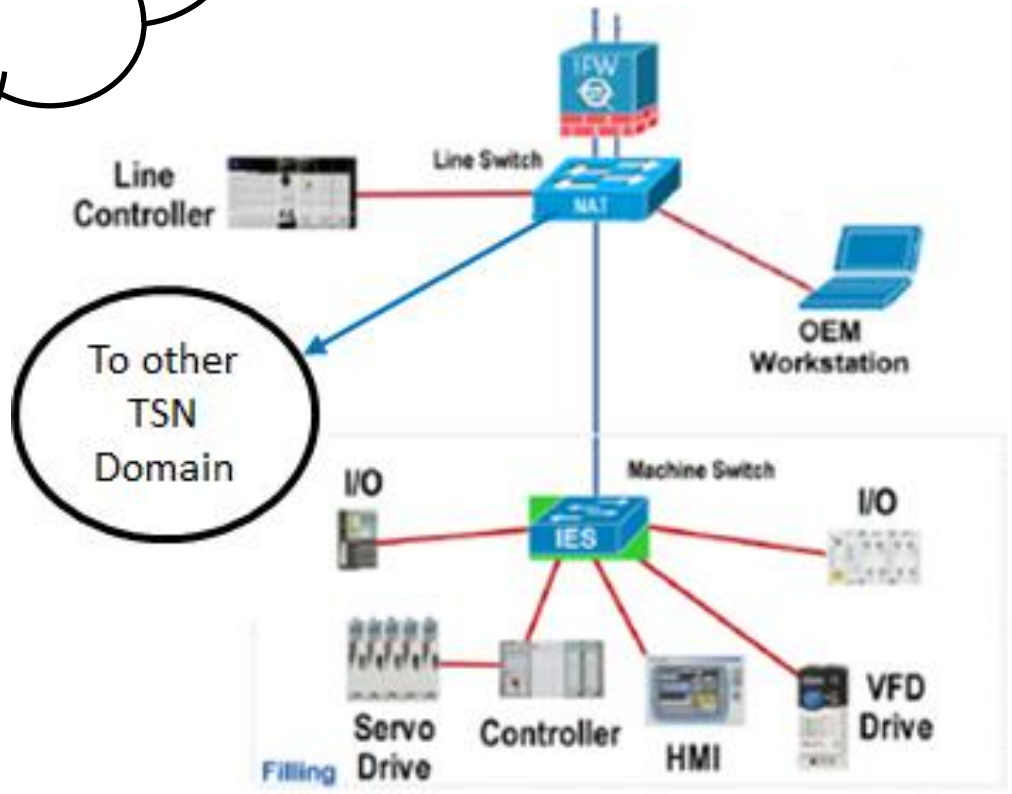
# Datasheets Enable New Workflow

- Multi-vendor database contains TSN validated components, devices, and infrastructure
- Design Time
  - Layout system architecture
  - Select Devices / Infrastructure with required attributes.
    - Which device is best suited for my application?
    - Which bridge / switch is best suited for my application?
  - Configure components at system level and offline
- Modeling & Simulation
  - Run system simulation
    - Model traffic and loading
    - Does it work?
- Runtime
  - Download system configuration
  - Run and monitor



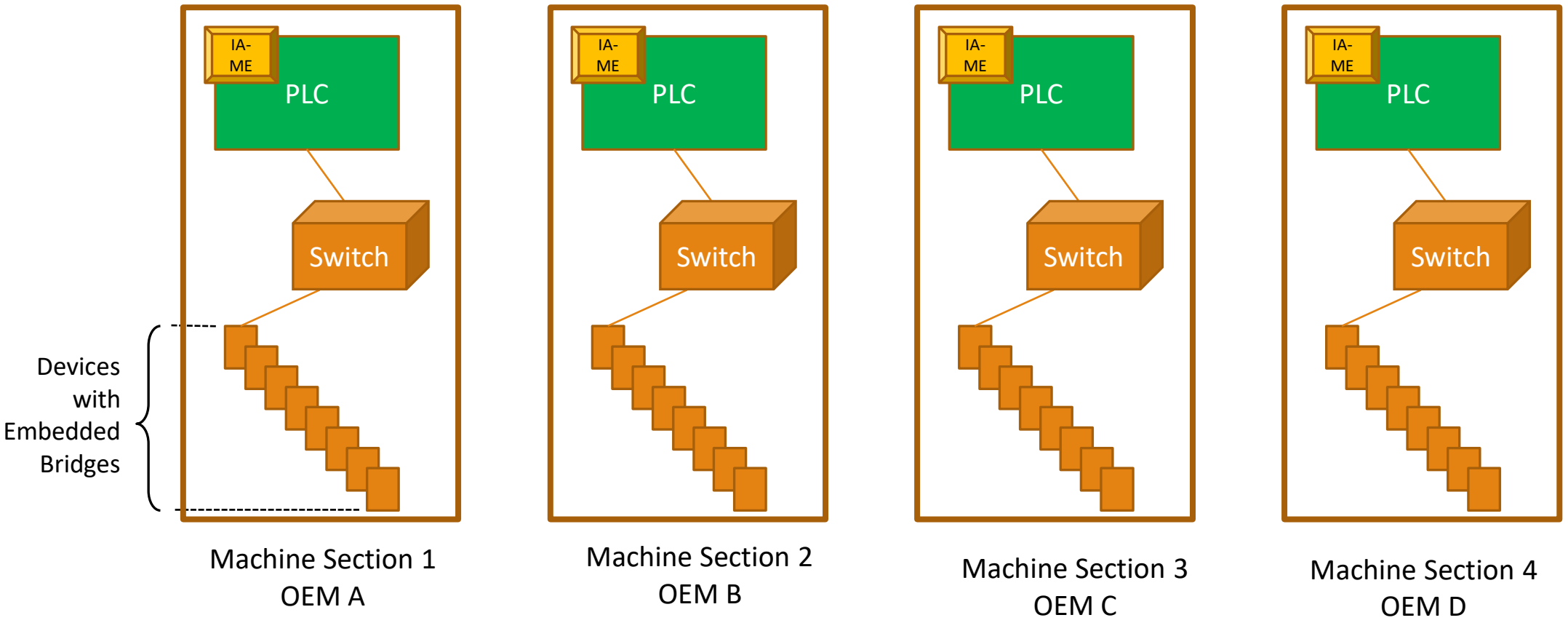

Multi-Vendor
TSN Database



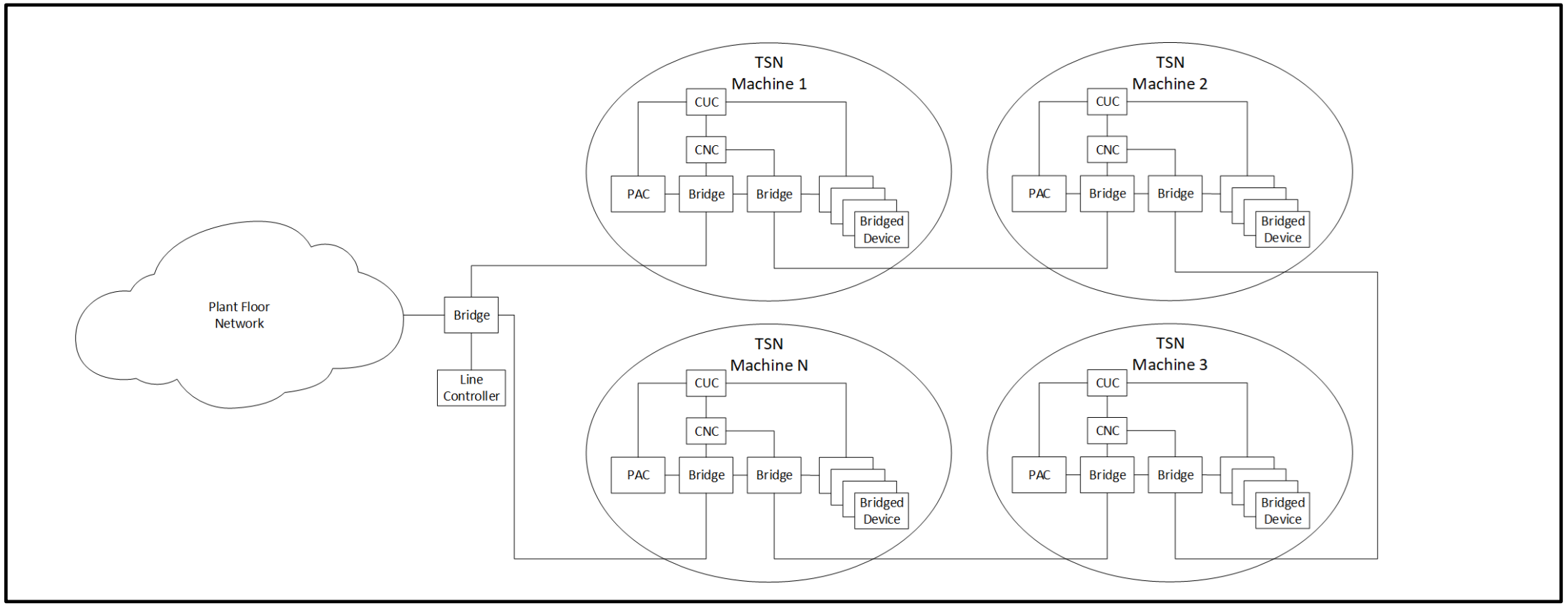


# Each OEM has different configuration tools

- Potential for different TSN domains to be created at each section or group of sections.



# Multiple TSN domains need to interconnect and communicate



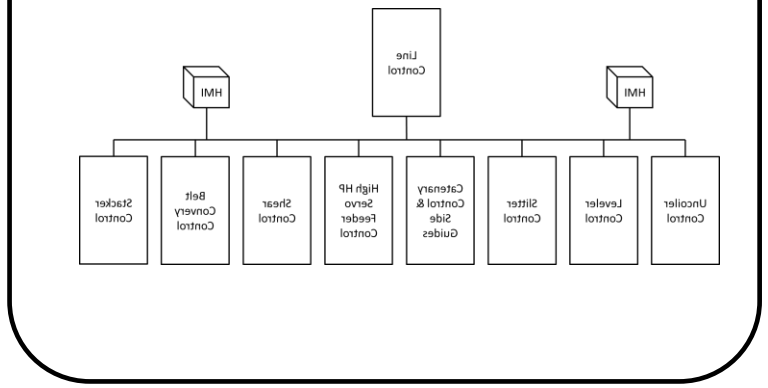

- *TSN Domain: A set of stations (end stations and/or Bridges), their Ports, and the attached individual LAN's that transmit Time-Sensitive Streams using TSN standards which include Transmission Selection Algorithms, Preemption, Time Synchronization and Enhancements for Scheduled Traffic and that share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

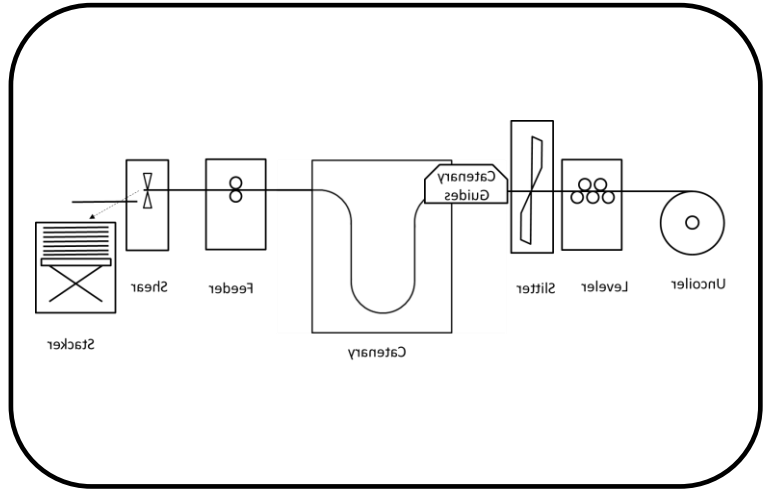
# Workflow

OEM A

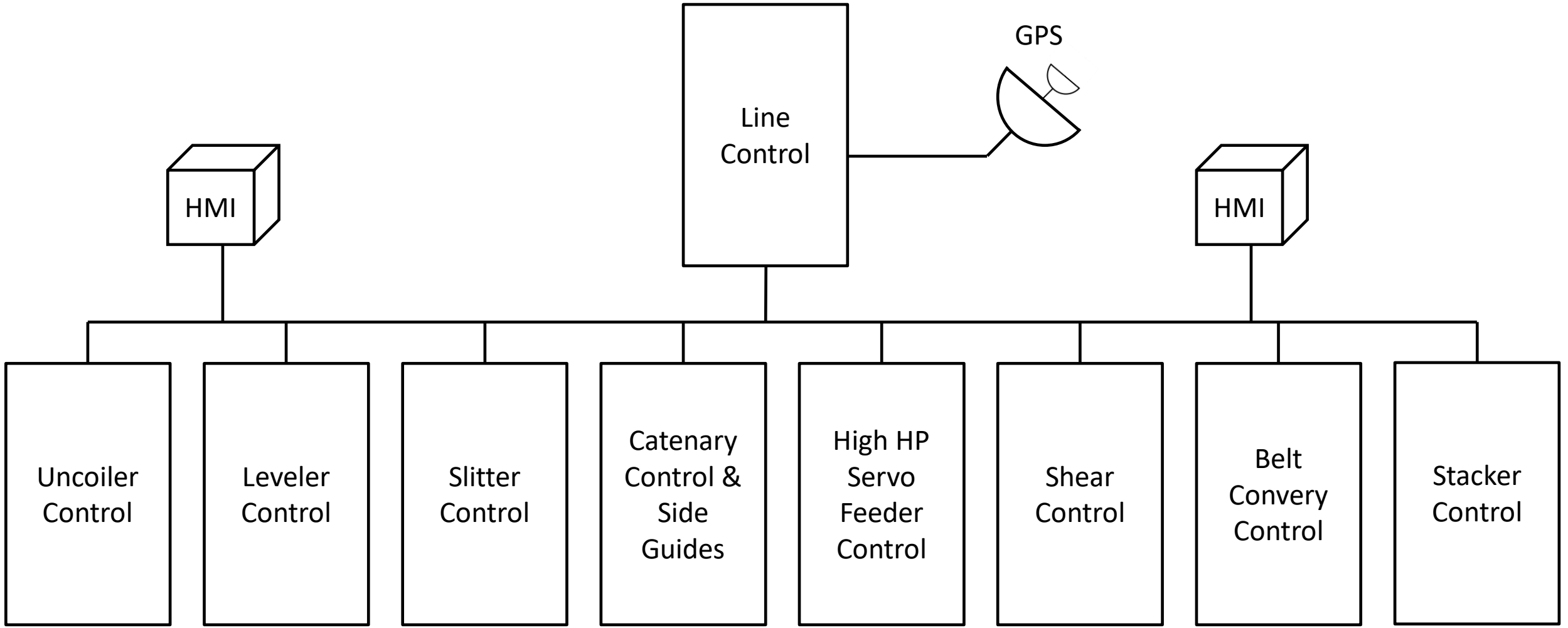
OEM B

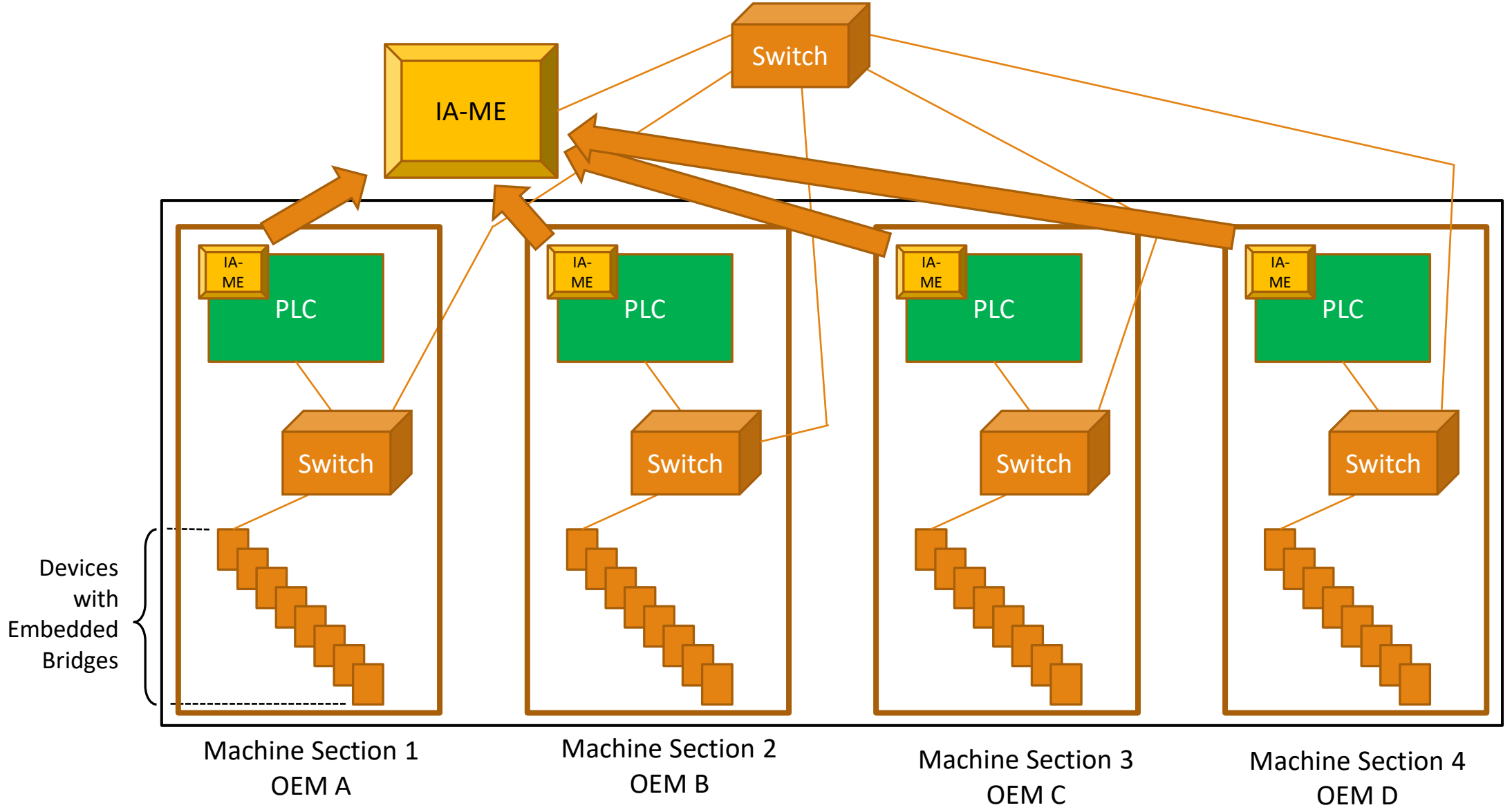
OEM C



# Architectural Segmentation: Subsystem Identification




IA-ME
Switch
IA-ME
PLC
Switch
IA-ME
PLC
Switch
IA-ME
PLC
Switch
IA-ME
PLC
Switch
Devices with Embedded Bridges
Machine Section 1 OEM A
Machine Section 2 OEM B
Machine Section 3 OEM C
Machine Section 4 OEM D

# What is a converged network?

# TSN Standardization Focuses on a Shared Network

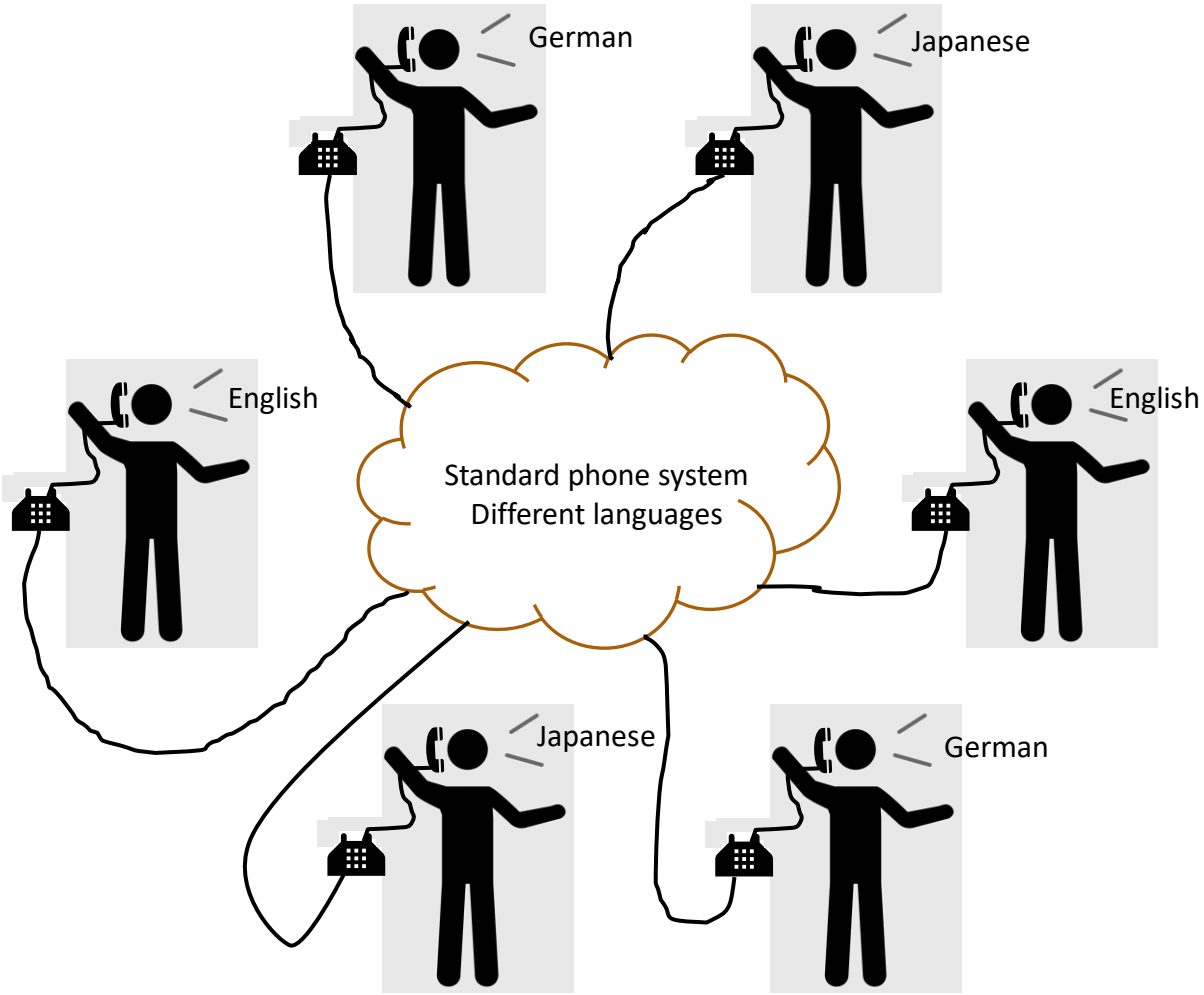
## OSI Communications Model

| | |
|---|---|
| **Application** | This is the layer that interacts with the application. |
| **Presentation** | Takes the data from Application layer converts it into a standard format. |
| **Session** | Establishes, maintains and ends communication with the receiving device |
| **Transport** | Flow control for data, error checking and recover of data between the devices |
| **Network** | Manages the way that data is sent to recipient device |
| **Data Link** | Appropriate physical protocol is assigned to the data |
| **Physical** | Hardware level |

Application layers:
- Profinet,
- EtherNet/IP
- CC-Link
- etc.

TSN works here

Ethernet physical layer



**System specification** **vs.** **Station features specification**
(per device specification)

- Network management engine
  - Dynamic behavior when combining devices in a TSN domain
  - Interface for dynamic management of stream (e.g. establishment, removal, persistence, …)
  - Interface for dynamic management of stations added to the TSN domain
  - Topology discovery – sequences, …
  - Network policy deployment – sequences, …
  - …

- System behavior
  - Startup of the TSN domain
  - Split and join of TSN domains

**->** Creates input for the IEC/IEEE 60802 station requirements

- Inter TSN domain
  - Dynamic behavior when attaching TSN domain (building an automation cell out of machines)
  - Interface for dynamic management of inter TSN domain stream (e.g. establishment, removal, persistence, …)

**<-** Uses station features as input from IEC/IEEE 60802

- System behavior in case of station replacement

- Security as a system feature

- Redundancy as a system feature

- **Time synchronization as a system feature**
- …

END