TSN Requirements Customer Feedback

The road to adoption may be rockier than expected

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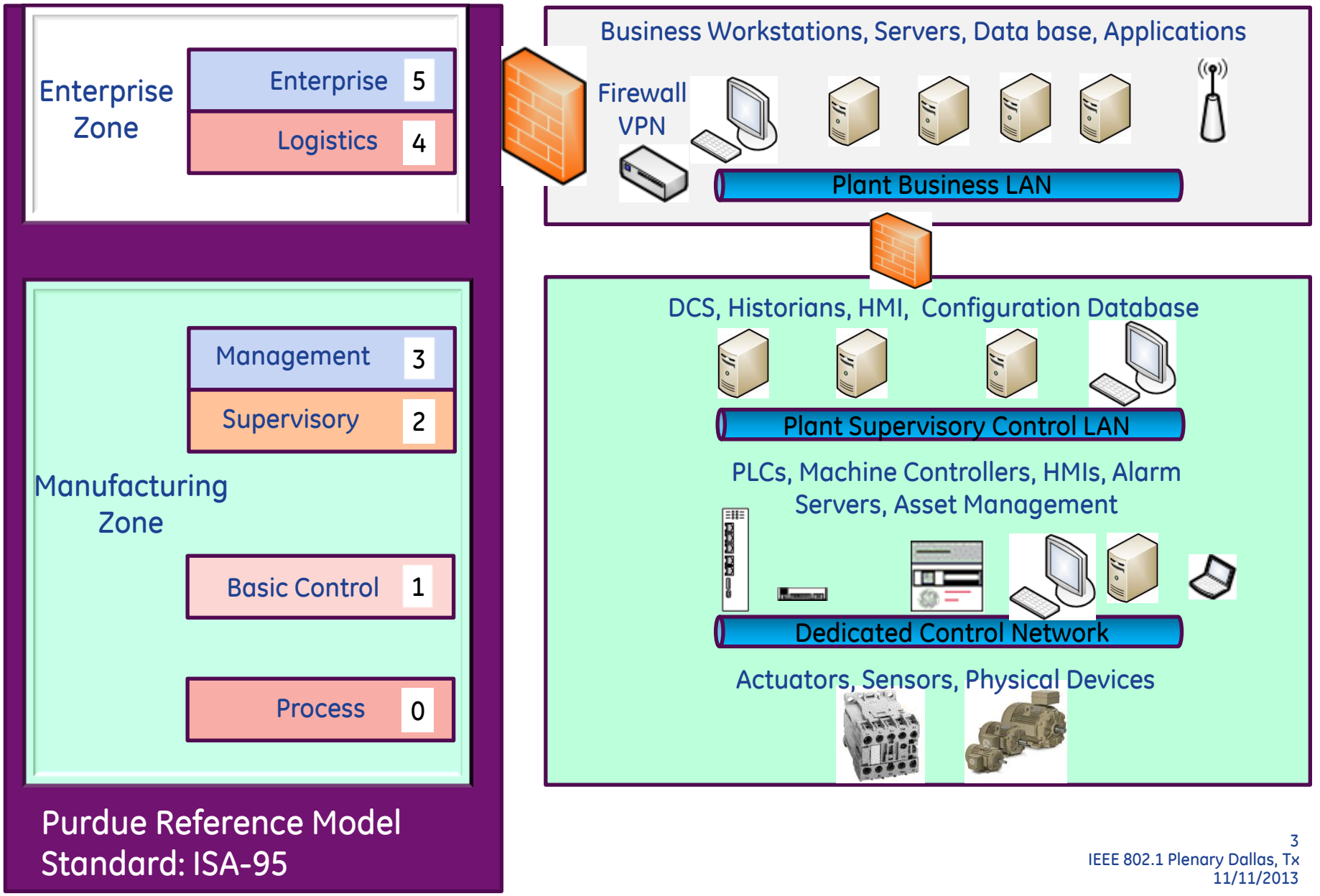
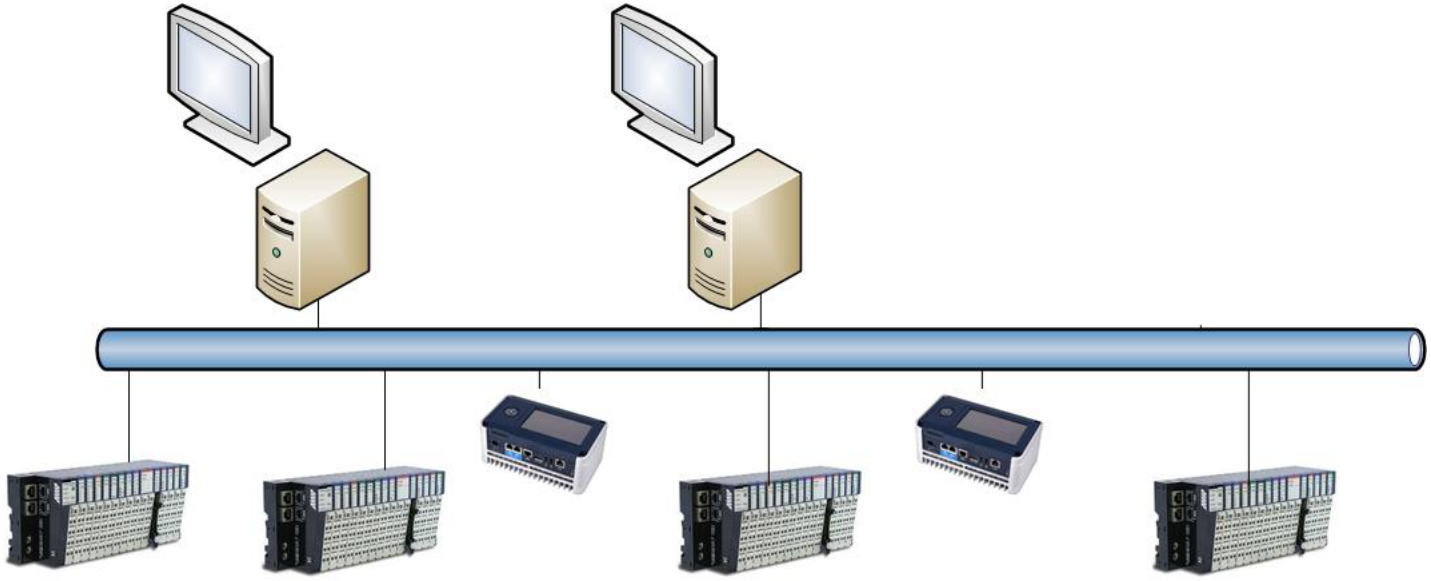
Why this Presentation

- To discuss input from end users and systems providers.
- Introduce additional requirements that may impact what we include in the standards.
- Identify the gaps between the vision from the top and the perception from the bottom.

Recap: Typical Plant Control Model



Vision: Convergence



Claimed Advantages:

- One network is simpler
- Low level data is accessible
- Easily upgraded
- Better Security
- Lower costs
- Better Reliability
- On a standards path

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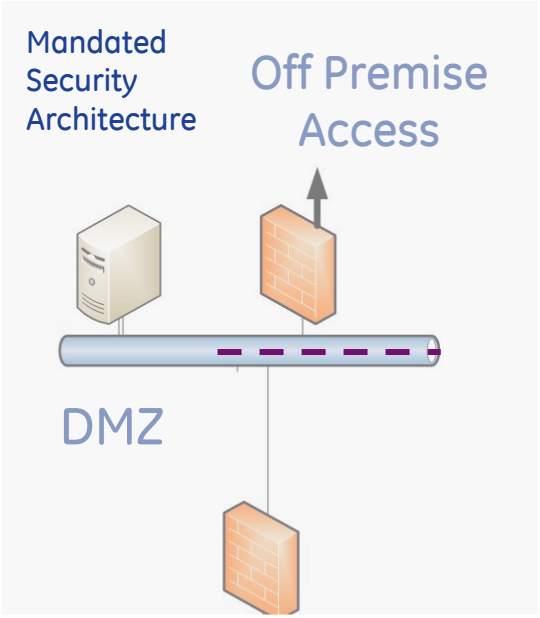
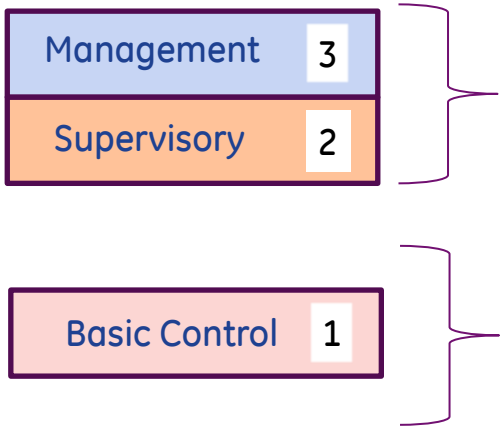
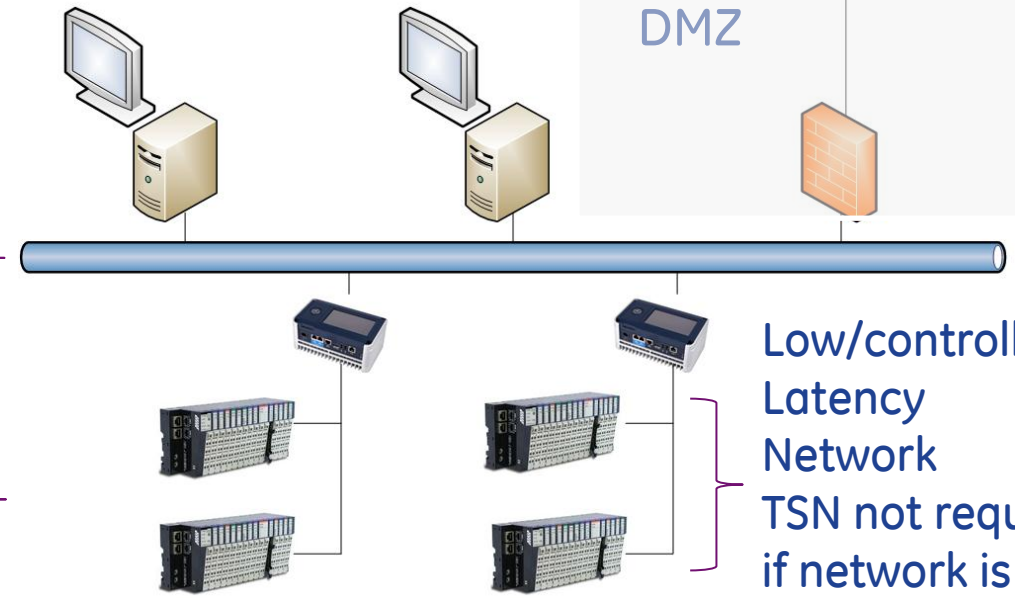
Plant Control Network Details - Today



Converged Using
VLANS & Priority





Low/controlled Latency Network
TSN not required if network is controlled & Isolated.

Reality:
Convergence above Lavel 3 not possible
Level 2 and 3 already converged in many applications without TSN
Can we converge Level 1 with Levels 2 and 3?

Vision vs. Perception

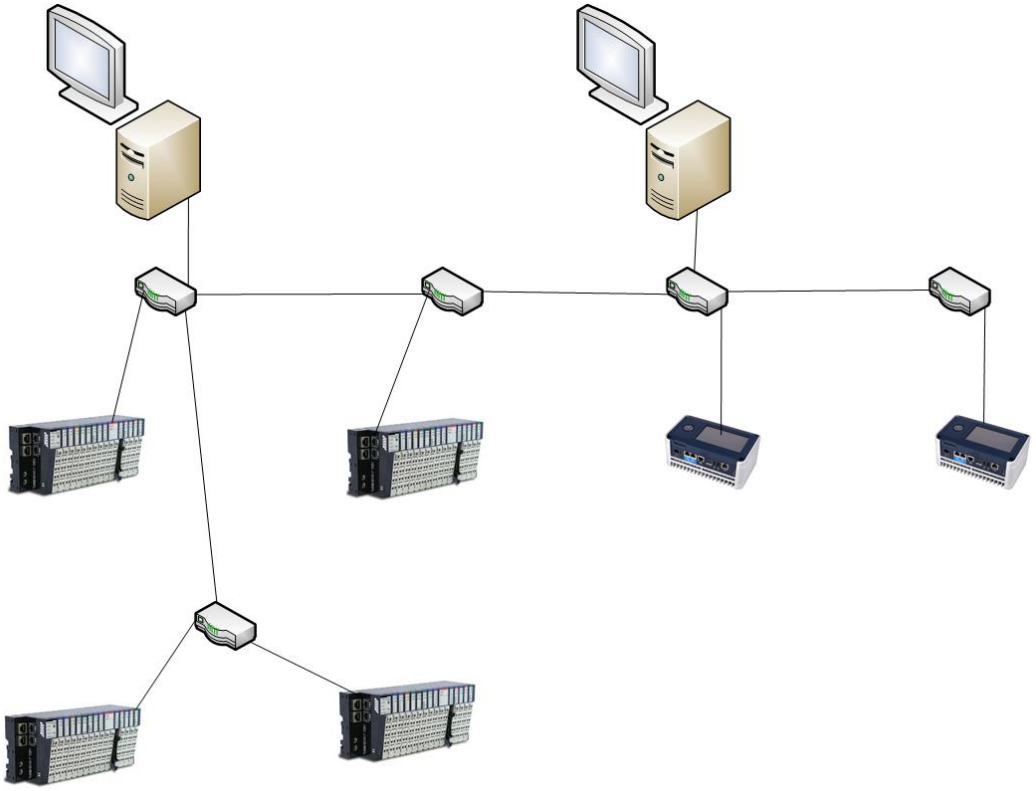
Vision:

- One network is simpler
- Low level data is accessible
- Easily upgraded
- Better Security
- Lower costs
- Better Reliability
- On a standards path

Perception:

- One network is more complex
- Low level data has little value, data from the controller is already available.
- Remote upgrades are impractical
- Security is not an issue
- Higher switch cost (10x), more configuration
- Adequate reliability with todays configurations
- Standards are good but cost is the issue.

If TSN is like AVB



All devices support 802.1AS
All devices support schedules
All devices are managed
All or nothing at all.

End User Perception

Cost of switch increases 10x or more
More configuration steps
Increased skill level for personnel
Devices more difficult to replace
Complexity at every step

From the end users perspective

Today:

1. You don't need expensive managed switches.
2. You don't need to configure control network devices (switches).
3. Information at the device level is of limited value above the basic controller, besides – the controller can provide any data requested. You don't need deep data access.
4. We are just replacing wires – if it gets too complex we will go back to the old ways.
5. Plant wide network convergence sets up a complex reliance on a common time. Too much potential for failure.
6. Physical security is adequate – as long as you firewall off outside access then the security requirements can be met.
7. Plant level networks (where we use VLANs and managed switches) don't need tight latency control, they need congestion control.
8. The most clear advantage seen is when seamless redundancy is added, although many systems don't need it and are not willing to pay for it.
9. We think (very) fast preemption is all we need to mix traffic.

So what makes the transition difficult?

1. 802.1BA requires that every device is an AVB device. Every switch must be managed, the cost is significantly higher. Will TSN be the same way?
2. 802.1AS requires that every device follows the same 1588V2 Profile (time aware bridge). Will TSN utilize 802.1AS as it is today?
3. It will take experience before computed configurations are trusted. Initial instantiations will be small.

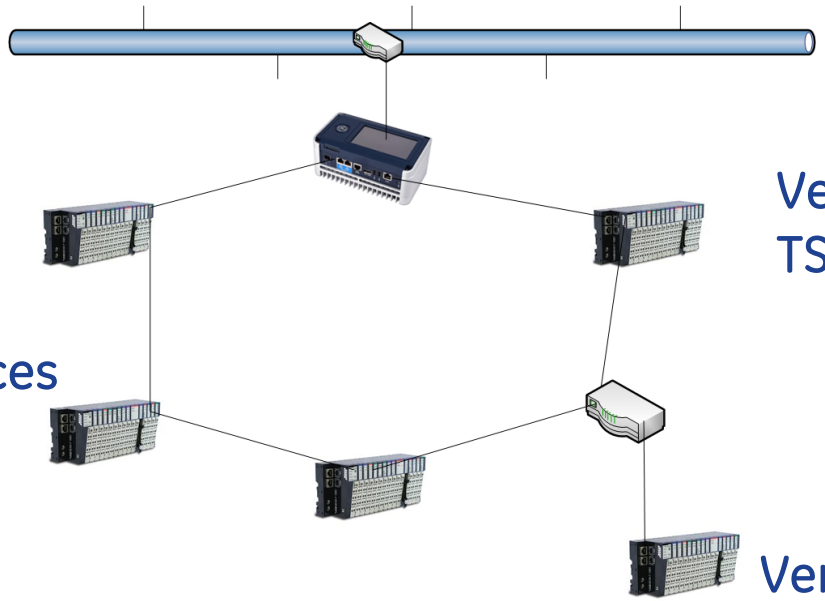
Currently It's all or nothing at all, managed switches that must have precision time, all devices with rate limiting queues. The transition is too big and seen as too costly.

End users are saying – *"What we have works today, it's easily understood, it's relatively inexpensive so why change it?"*

The classic dilemma in a conservative market.

If we can remove or moderate the cost and complexity implications, many of the other arguments will fade away and the intangible benefits will become tangible.

Likely First Adoption - Rings



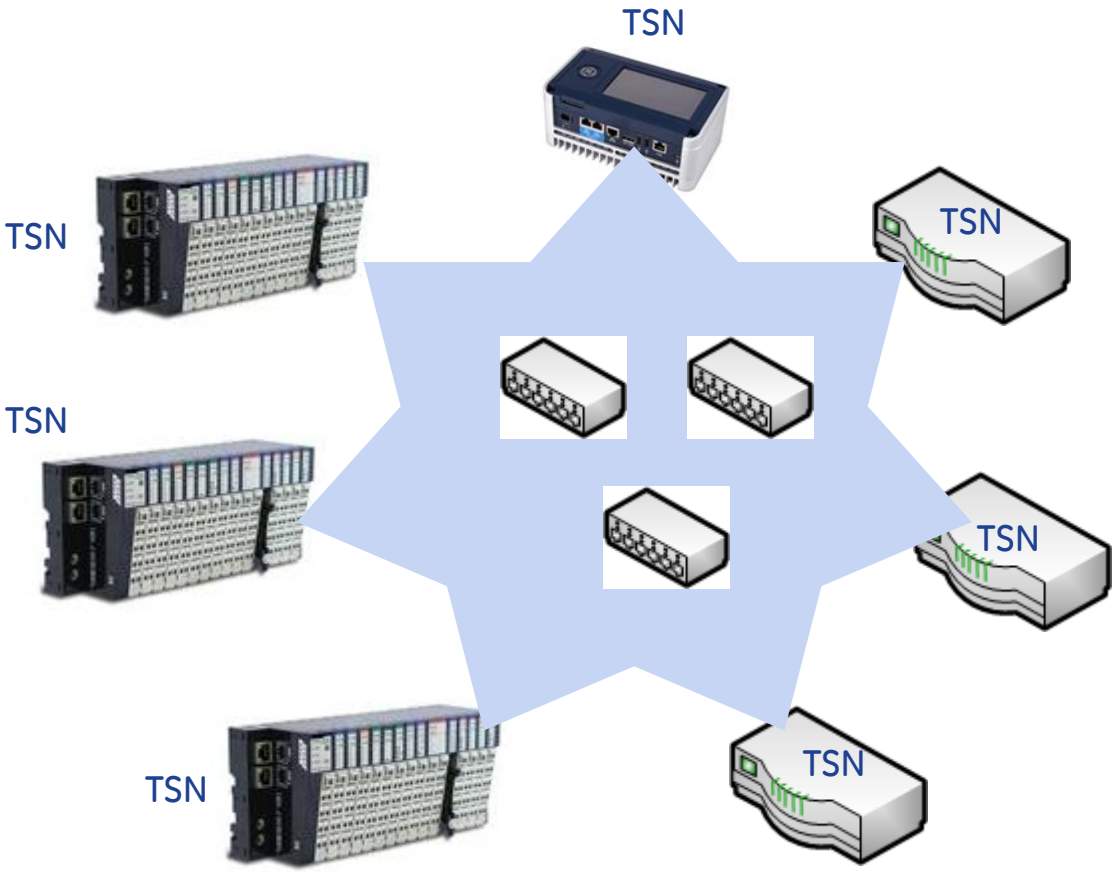
Vendor A
TSN Devices

Vendor B
TSN Devices

Vendor C
Non-TSN Devices

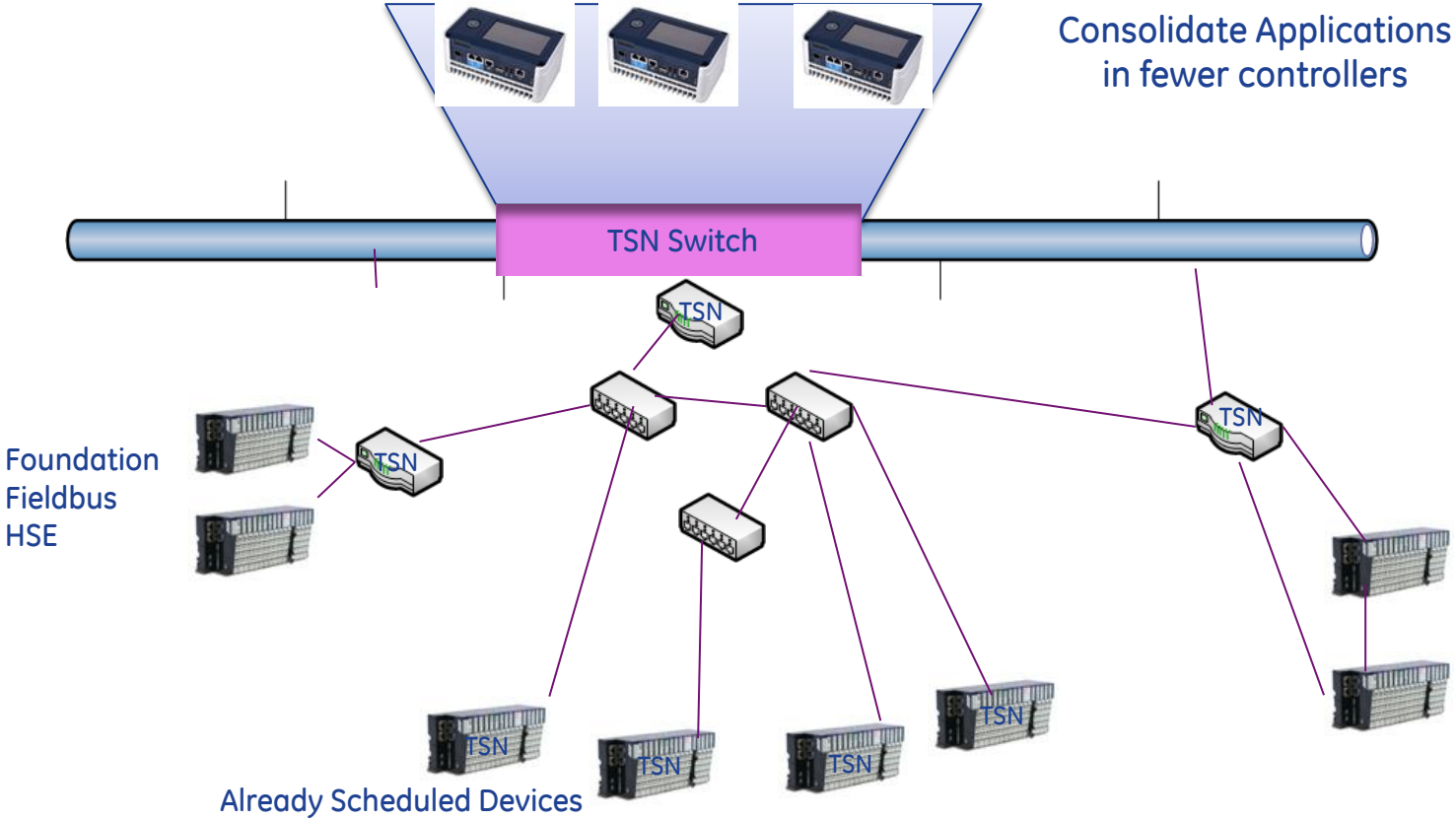
Likely early adoption on current path will be devices with embedded TSN switch capability and a few Non-TSN to TSN bridging devices.
Reasoning: Not all vendors offer the best devices for certain applications.
But this does not add any significant advantage over what we have today unless every vendor utilizes TSN in their Fieldbus protocols and they are configured in a standard way.

What I would like to debate/consider



TSN at the Edges

TSN at the boundaries



Drivers:

Users don't want the cost of managed switches everywhere at the I/O level if they don't need extremely precise time – just pretty precise time.

Many Applications don't need microsecond synchronization

There is a tremendous investment in existing I/O systems

It will take years to switch over the plethora of field devices.

We need a solution that is more scalable based on application requirements

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Points for discussion:

1. Can we use a 1588 profile that does not require every bridge to be time aware?
2. Can we define a standard that is meaningful and robust that does not require every bridge to be managed?
3. Can we determine the performance levels (or class) a system can meet if we have limited knowledge about the devices in the network?