

# IEEE P802.3cg 10 Mb/s Single Twisted Pair Ethernet (10SPE) Study Group (SG)

## Contribution to CSD and Objectives

- Rationale for the length requirement 1 000 m
- Proposal for Objectives concerning Phy and reach

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# Rationale for the length requirement 1 000 m

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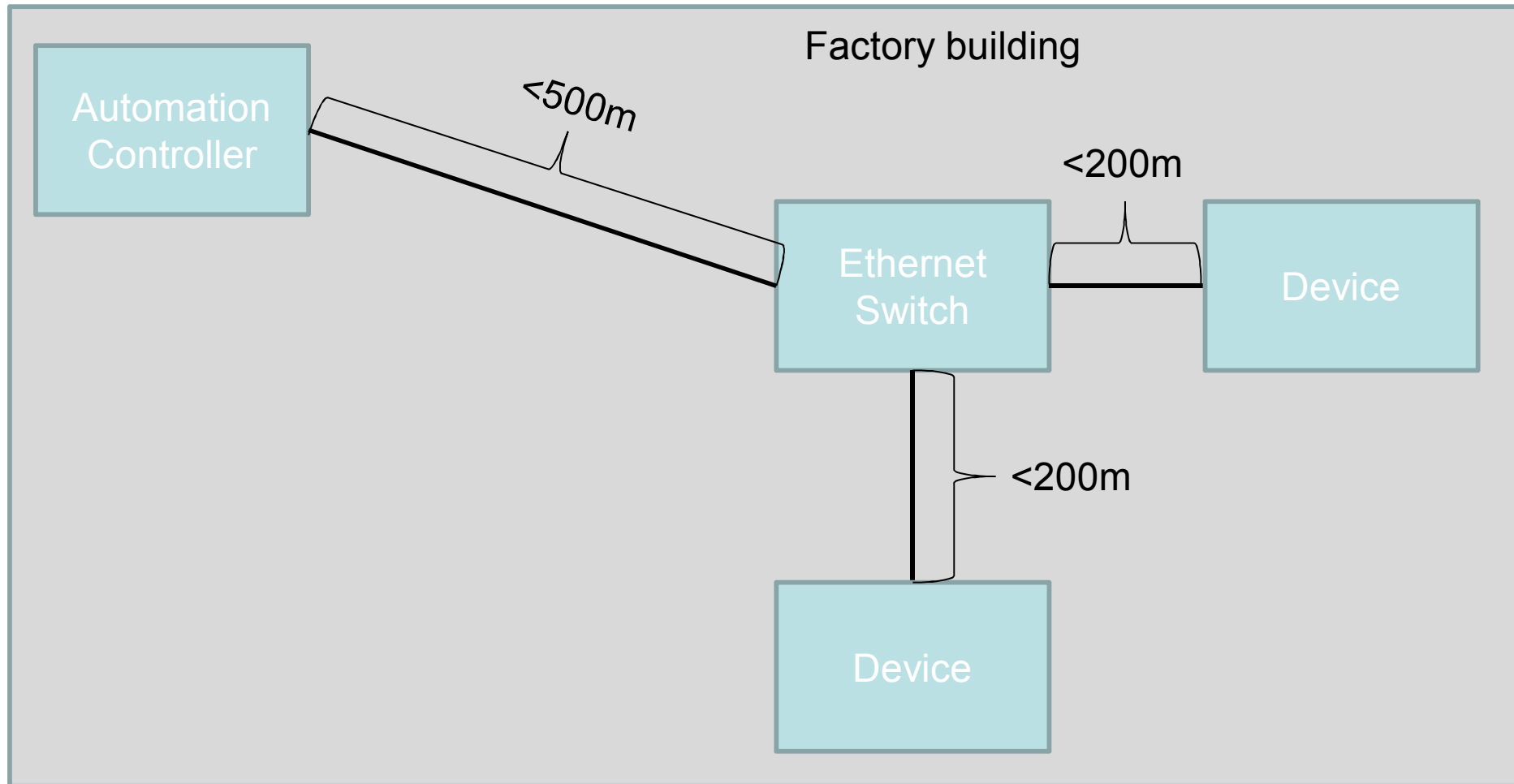
## **Intro:**

### Industrial Automation Applications:

- **Factory Automation**
  - Connecting Communication Infrastructure
  - Connecting Automation Controller to IO
- **Process Automation**
  - Connecting Control Level to Field Level
  - Connecting Field Infrastructure to Field Devices
  - Incorporate Power Supply for Field Level Devices and Field Infrastructure
  - Connecting Field Devices and Field Infrastructure in hazardous areas
- **Building Automation**
  - Connecting Control Level to Field Level
  - Connecting Communication Infrastructure

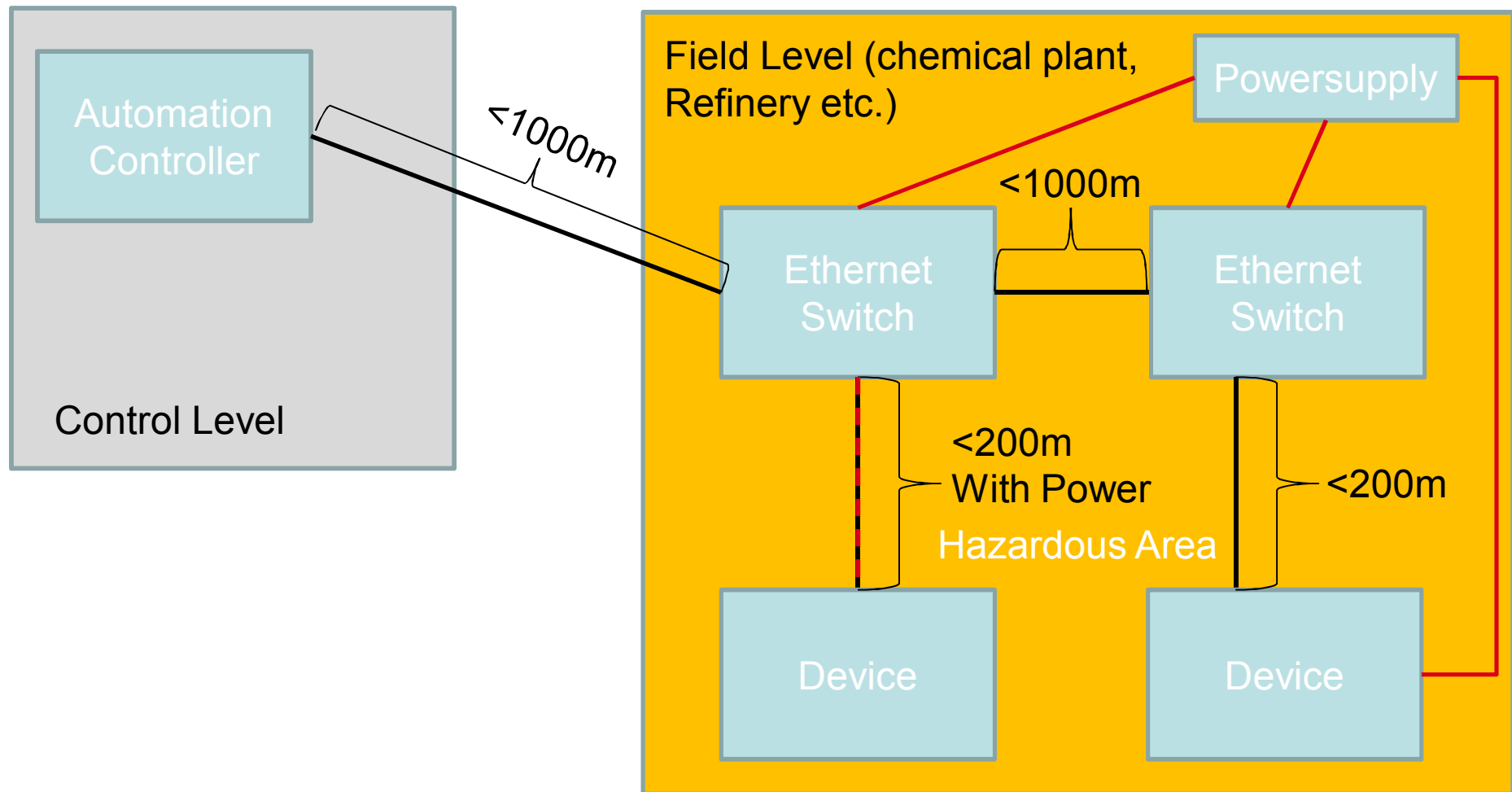
# Rationale for the length requirement 1 000 m

## Factory Automation



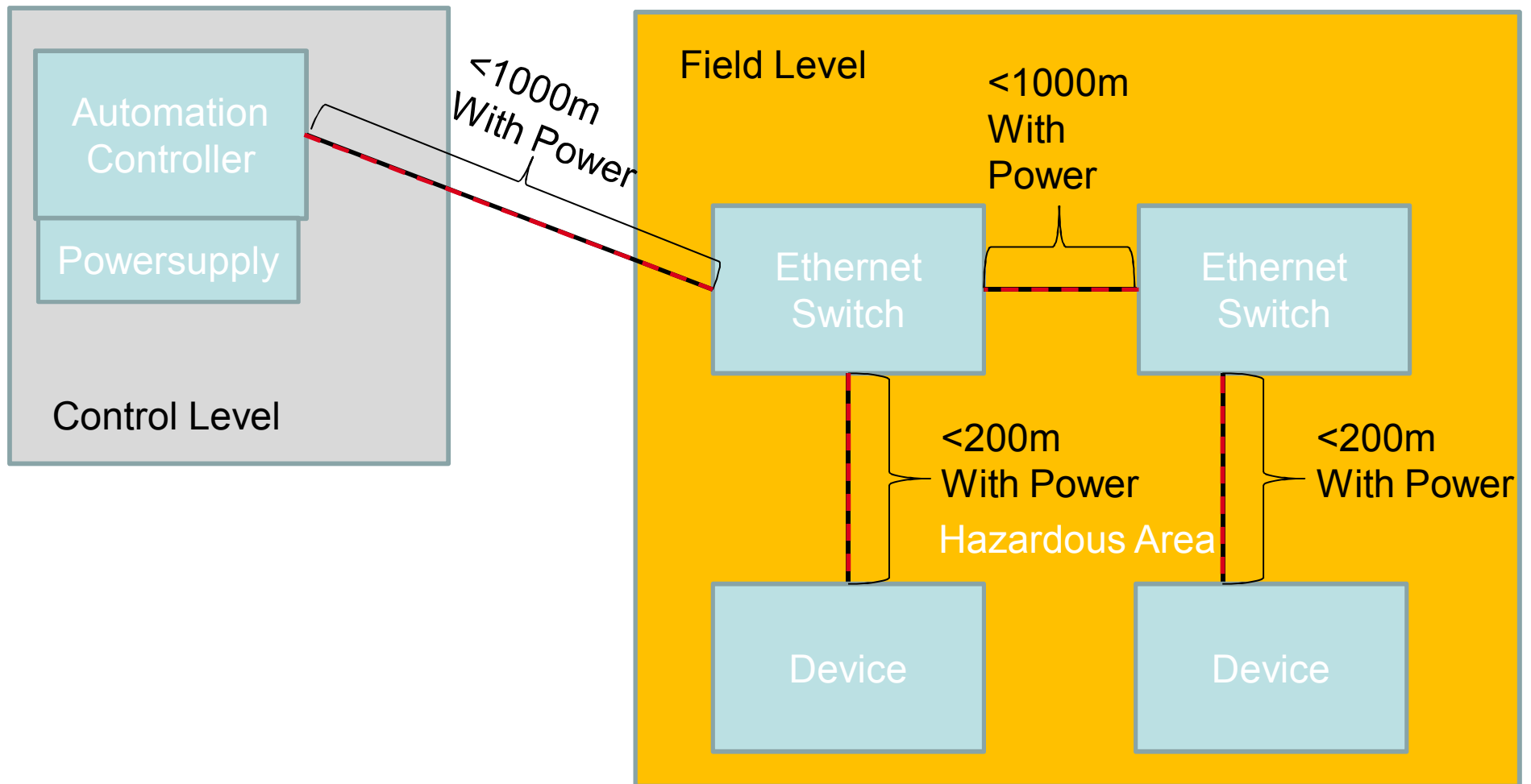
# Rationale for the length requirement 1 000 m

## Process Automation I



# Rationale for the length requirement 1 000 m

## Process Automation II



# Proposal for Objectives concerning Phy and reach

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## Conclusion for 1000m reach

- All applications in industrial automation can live with 1 000 m trunk + 200 m spur length. This matches the CFI requirement saying 1 200 m. This is the best compromise between length and speed.
- The Objectives should read:

**At least 1000 m reach with at least 12 connectors** (10 inline connectors).

6 connectors (4 inline connectors) as suggested by automotive lead to an insertion loss of:

$$6 \times 0.05 \text{ dB} = 0.3 \text{ dB @ 4 MHz signal frequency}$$

12 connectors (10 inline connectors) as suggested for industrial applications lead to an insertion loss of:

$$12 \times 0.05 \text{ dB} = 0.6 \text{ dB @ 4MHz signal frequency}$$

The additional insertion loss of 0.3 dB for the 6 additional inline connectors compared to 4 inline connectors required before is **negligible**.

# Channel definition

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Cable insertion loss (100m)  $il_{\text{cable}} = 1.23 \times \sqrt{f} + 0.01 \times f + \frac{0.2}{\sqrt{f}}$

Connection insertion loss: min 0.05  
 $il_c = 0.02 \times \sqrt{f}$

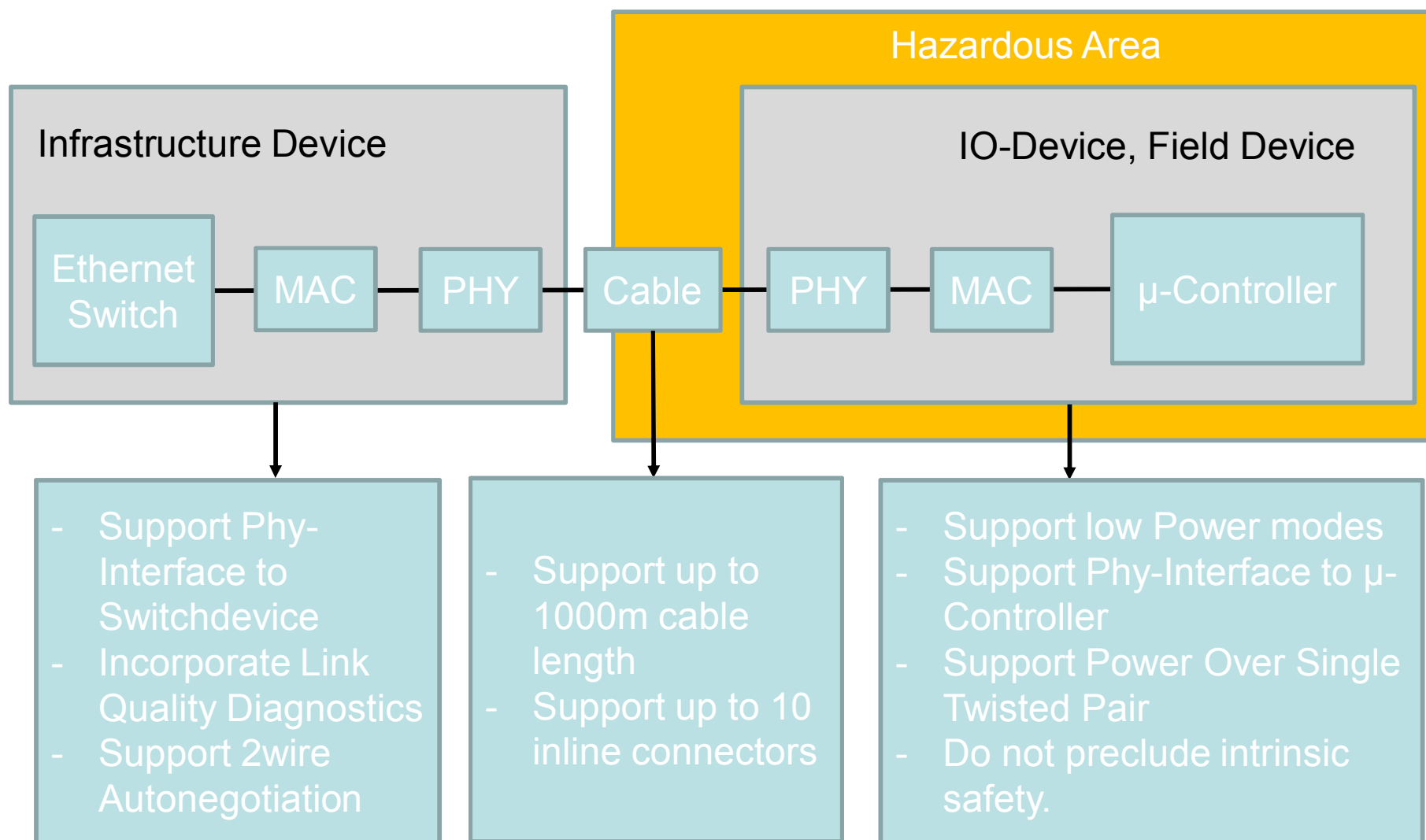
Link insertion loss  $il_{\text{link}} = 10 \times \left( 1.23 \times \sqrt{f} + 0.01 \times f + \frac{0.2}{\sqrt{f}} \right) + 12 \times (0.02 \times \sqrt{f})$

All other values TBD

Values valid for 1MHz..30MHz

Installed cable installations comply with these values

# Proposal for Objectives concerning Phy and reach





# Adopted Objectives

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1. Preserve the IEEE 802.3/Ethernet frame format at the MAC client service interface.
2. Preserve minimum and maximum frame size of the current IEEE 802.3 standard.
3. Support a speed of 10Mb/s at the MAC/PLS service interface.
4. Do not preclude meeting FCC and CISPR EMC requirements
5. Support for optional single-pair Auto-Negotiation
6. Support optional Energy Efficient Ethernet
7. Support 10 Mb/s operation in industrial environments (e.g. EMC, temperature) over single balanced twisted-pair cabling.
8. Support 10 Mb/s operation in automotive environments (e.g. EMC, temperature) over single balanced twisted-pair cabling.

# Proposed Additional Objectives (1/2)

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9. Do not preclude working within an Intrinsically Safe device and system as defined in IEC 60079
10. Do not preclude the ability to survive automotive and industrial automation fault conditions (e.g. shorts, over voltage, EMC, ISO16750)
11. Specify an optional power distribution technique for use over a single twisted pair link segment.
12. Support voltage and current levels for the automotive, transportation, and industrial control industries.
13. Define the performance characteristics of a link segment and a PHY to support point-to-point operation over this link segment with single twisted pair supporting up to 10 inline connectors using balanced cabling for at least 1000 m reach

# Proposed Additional Objectives (2/2)

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14. Support a BER better than or equal to [below] at the MAC/PLS service interface
  - $10^{-9}$  for <1000m Cable Length
  - $10^{-10}$  for <100m Cable Length
15. Support fast startup and link loss recovery operation
16. Support Phy-Interface to Switch device
17. Incorporate Link Quality Diagnostics
18. Support 2wire Auto-negotiation

Questions?

Thank you!