

Industrial Switches for SPE

Uwe Nolte

Phoenix Contact



Single Pair Ethernet
System Alliance

Industrial Switches for SPE

Topics

- ◆ Use cases in different industrial fields
- ◆ Power over Data Line (PoDL) vs. PoE
- ◆ Industrial Switch Features
- ◆ SPE Switch Concepts and Challenges
- ◆ Pilot Products: Industrial SPE Switches



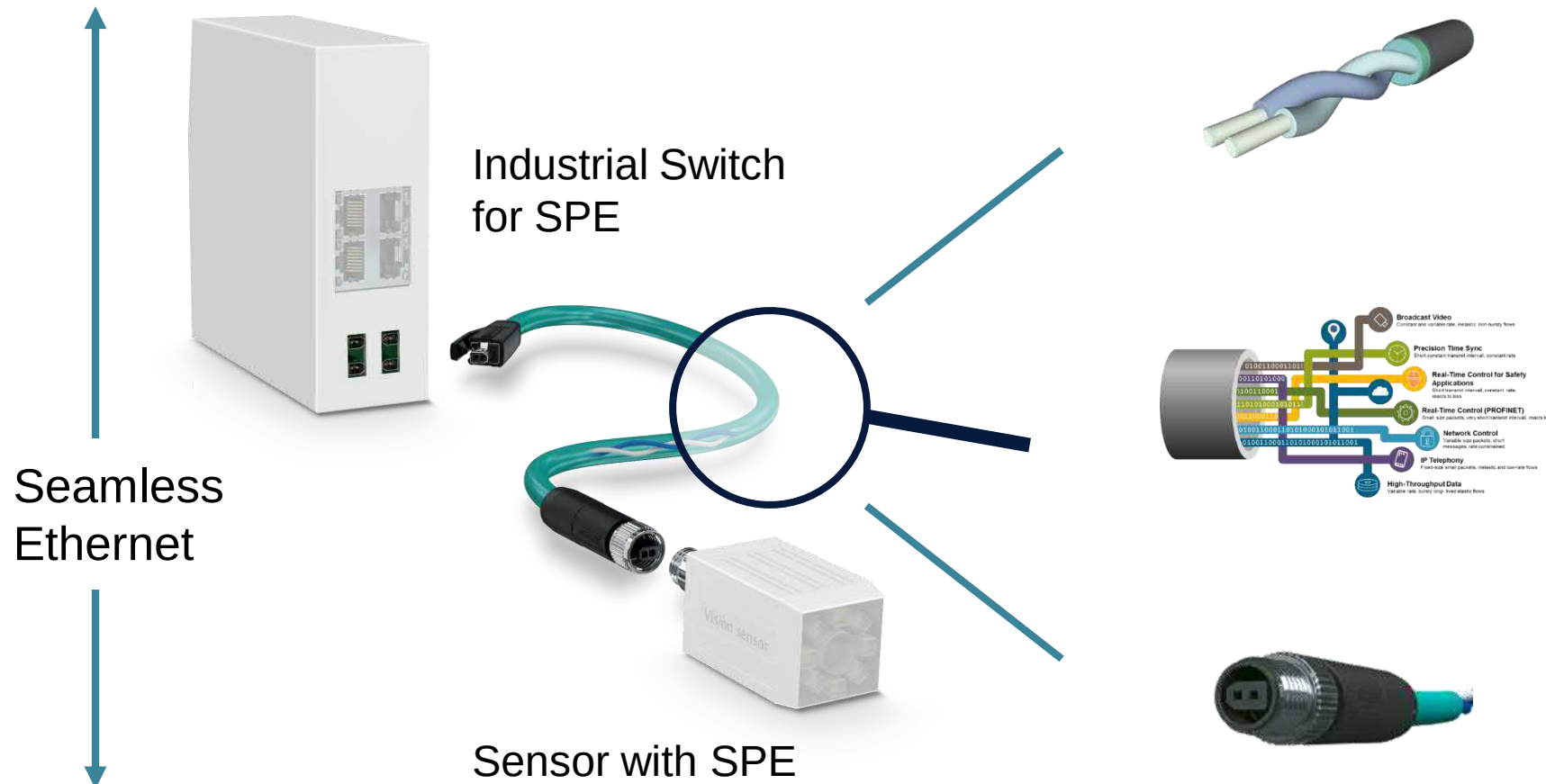
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SPE Use Case: Connect Sensors to Ethernet

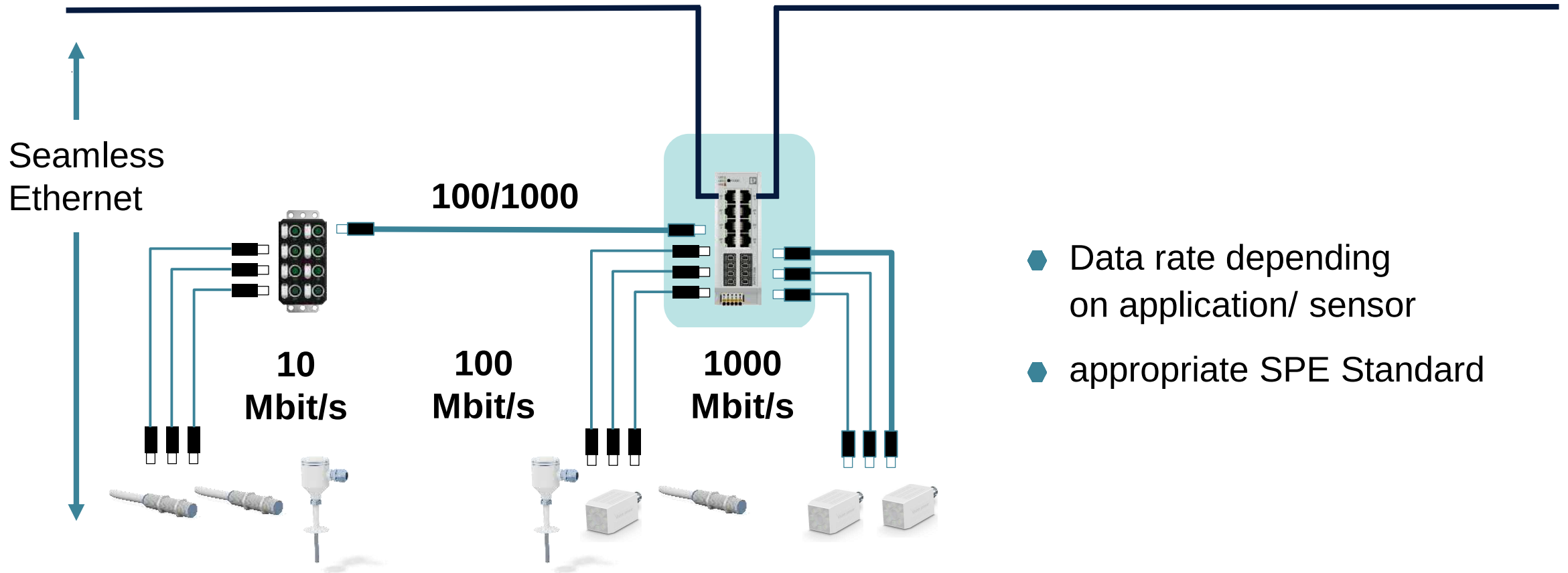


One two-wire line for data and power

One cable for all services

One compact connector for all (industrial) applications

SPE Use Case: Connect Sensors to Ethernet



SPE Use Case: Sensor Ethernet Integration

Sensor

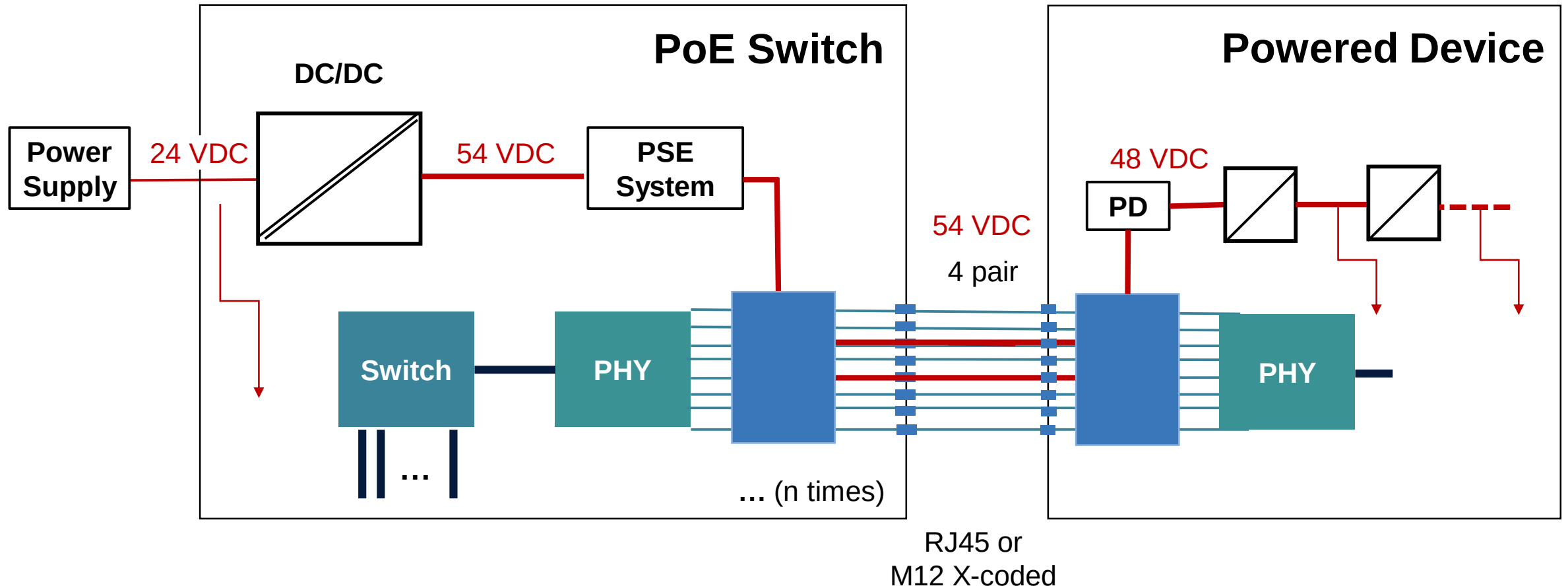
- ◆ needs power
- ◆ Ethernet connection up to 1 Gbit/s



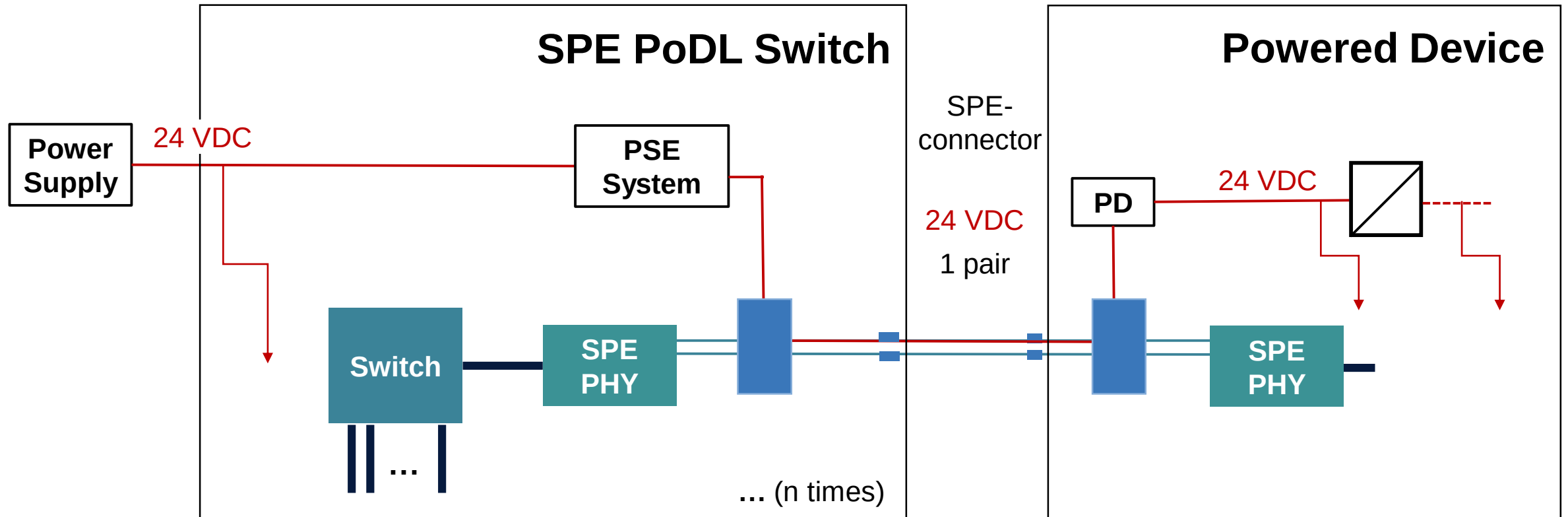
	Data & Separate Power	PoE
Ethernet	1000 BASE-TX (4 pairs) M12-X coded, 8 -pin	1000 BASE-TX (4 pairs) M12-X coded, 8 -pin
Power	Separat M12	Power over Ethernet (PoE) 802.3af,at or bt
		
	Two connectors, More space needed	



Power over Ethernet (PoE)



Power over Data Line



SPE Use Case: Sensor Ethernet Integration

Sensor

- ◆ needs power
- ◆ Ethernet connection up to 1 Gbit/s



	Data & Separate Power	PoE	SPE PoDL
Ethernet	1000 BASE-TX (4 pairs) M12-X coded, 8 -pin	1000 BASE-TX (4 pairs) M12-X coded, 8 -pin	1000BASE-T1 (single pair) M8, 2pin (IEC..-5)
Power	Separat M12	Power over Ethernet (PoE) 802.3af or bt	Power over Data Line (PoDL) 802.3bu
			
	Two connectors, More space needed	One connector but higher effort on electronic (PoE 48 V DC conversion)	One small connector, 24 VDC supply

802.3 bu : Power over Dataline

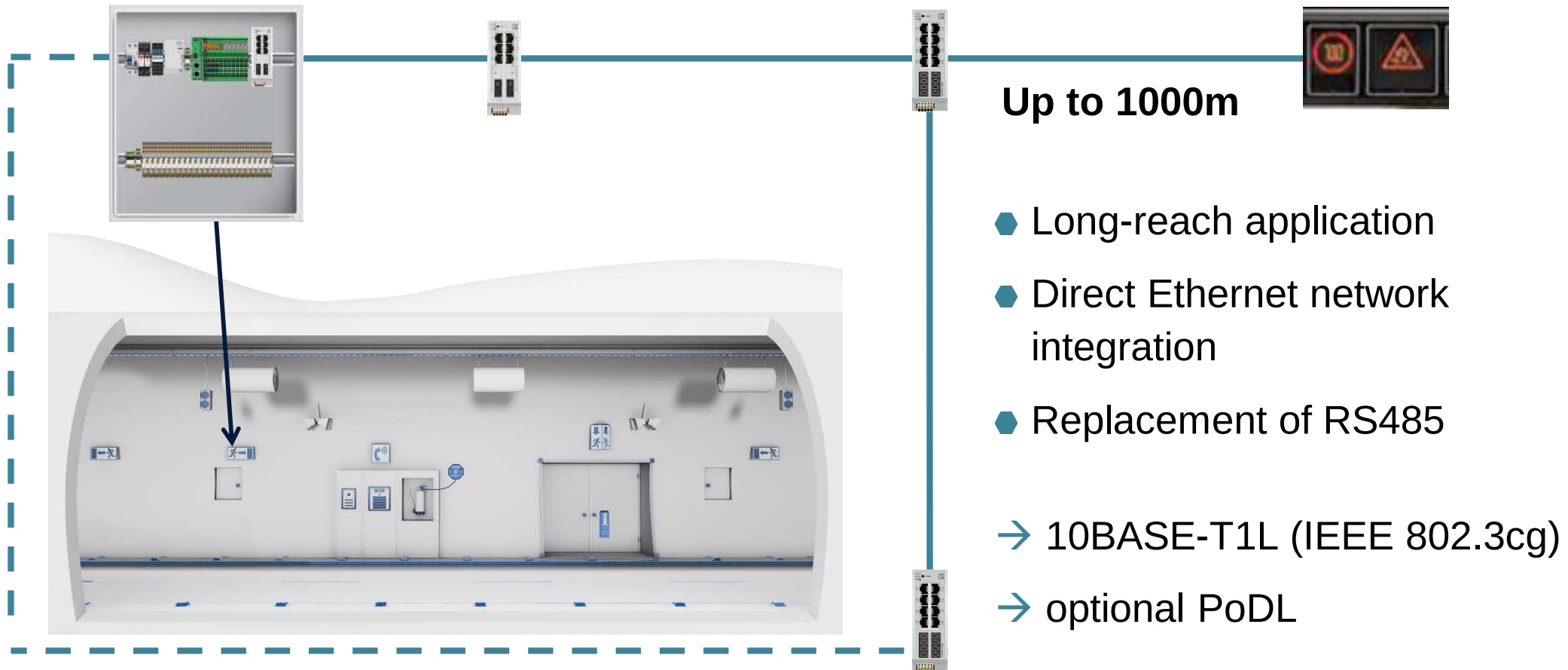
Table 104–1—Class power requirements matrix for PSE, PI, and PD

	12 V unregulated PSE		12 V regulated PSE		24 V unregulated PSE		24 V regulated PSE		48 V regulated PSE	
Class	0	1	2	3	4	5	6	7	8	9
$V_{PSE(max)} (V)^a$	18	18	18	18	36	36	36	36	60	60
$V_{PSE_OC(min)} (V)^b$	6	6	14.4	14.4	12	12	26	26	48	48
$V_{PSE(min)} (V)$	5.6	5.77	14.4	14.4	11.7	11.7	26	26	48	48
$I_{PI(max)} (mA)^c$	101	227	249	471	97	339	215	461	735	1 360
$P_{Class(min)} (W)^d$	0.566	1.31	3.59	6.79	1.14	3.97	5.59	12	35.3	65.3
$V_{PD(min)} (V)$	4.94	4.41	12	10.6	10.3	8.86	23.3	21.7	40.8	36.7
$P_{PD(max)} (W)^e$	0.5	1	3	5	1	3	5	10	30	50

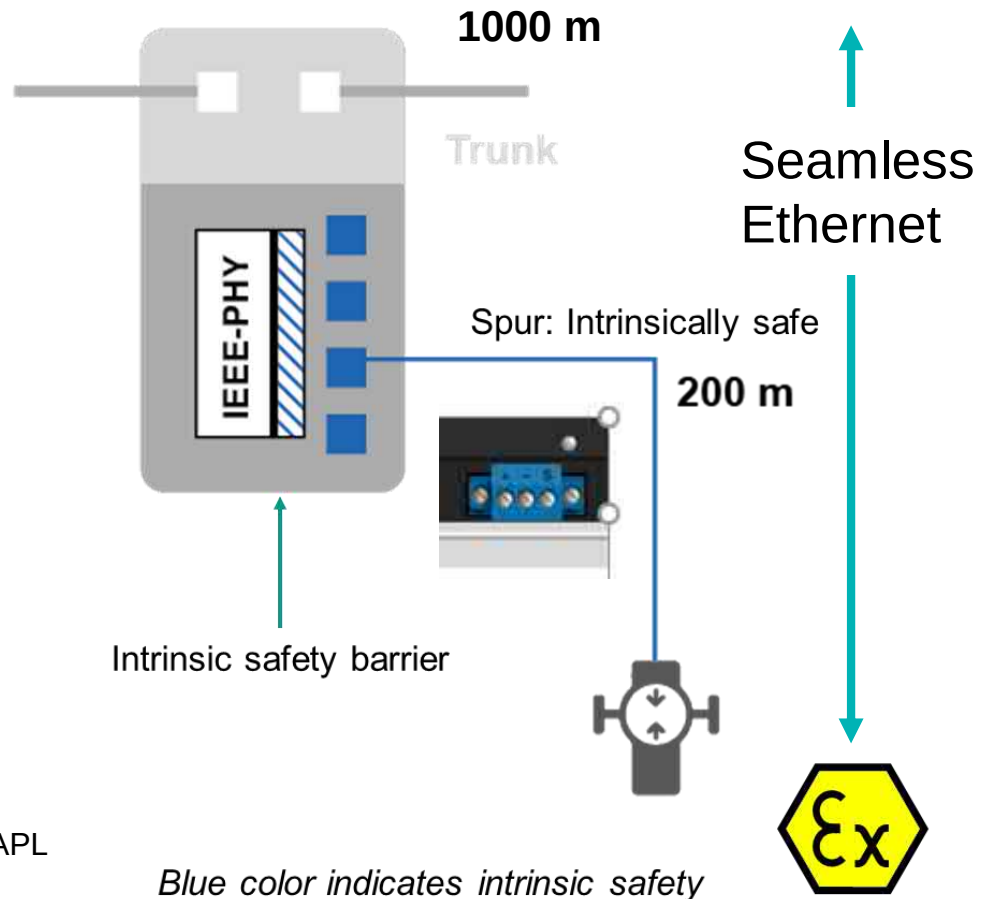
- Point- to- point DC Powering
- Power over Dataline (PoDL) IEEE 802.3bu
- Up to 50W
- Various power profiles
 - 48 VDC
 - 24 VDC** (up to 10W)
 - 12 VDC



SPE Use Case: Traffic Infrastructure



SPE Use Case: Process Automation



Source:
Ethernet-APL
Project

Ethernet to Field

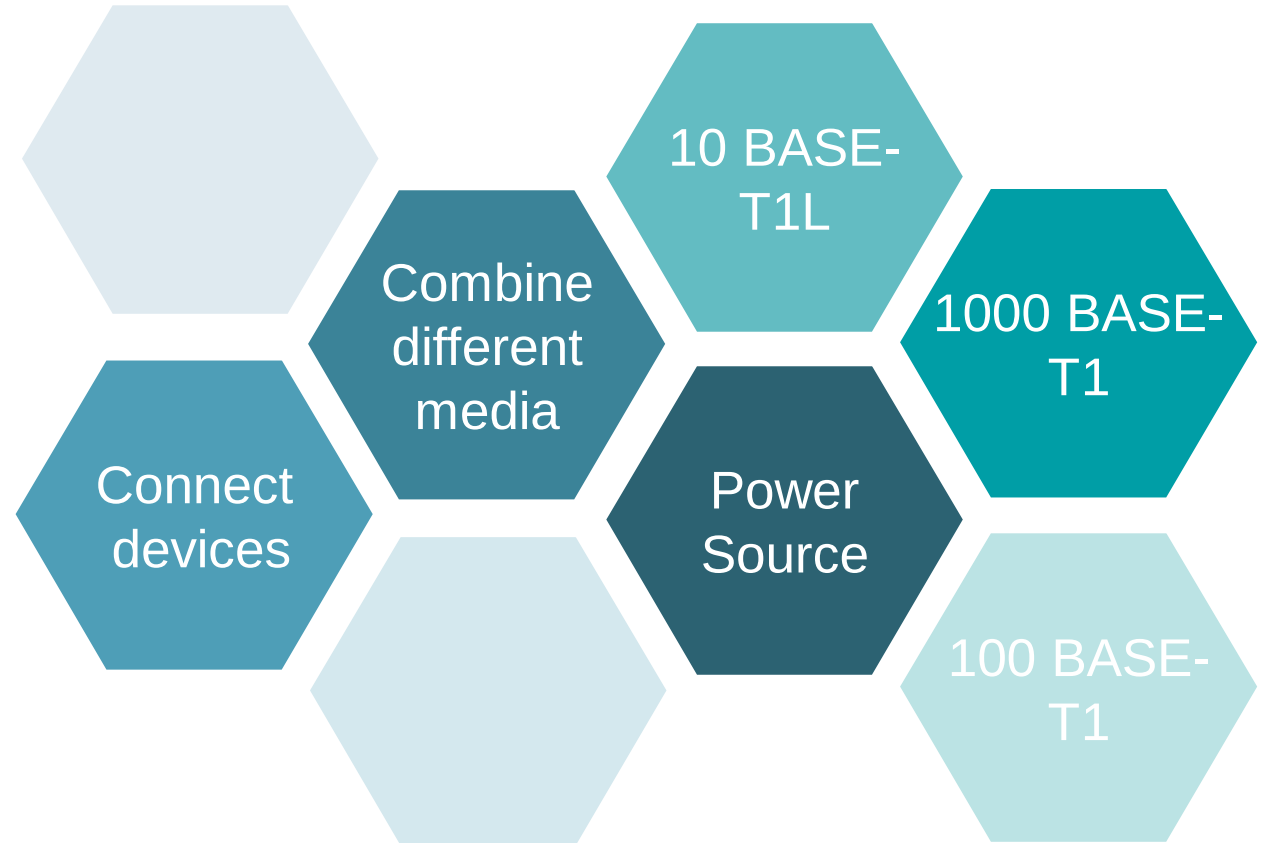
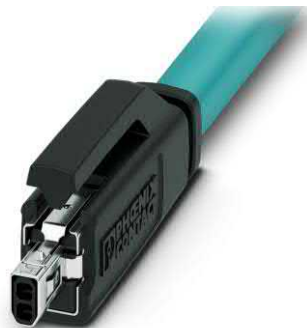
- ◆ Two-Wire Installation:
install easily like 4-20mA loops (with screen)
- ◆ Trunk and spur - concept
- ◆ Intrinsically safe spur to connect field device
in Ex zone 0/1

→ Ethernet-APL

- 10BASE-T1L (IEEE 802.3cg)
- 2WISE (IEC 60079)

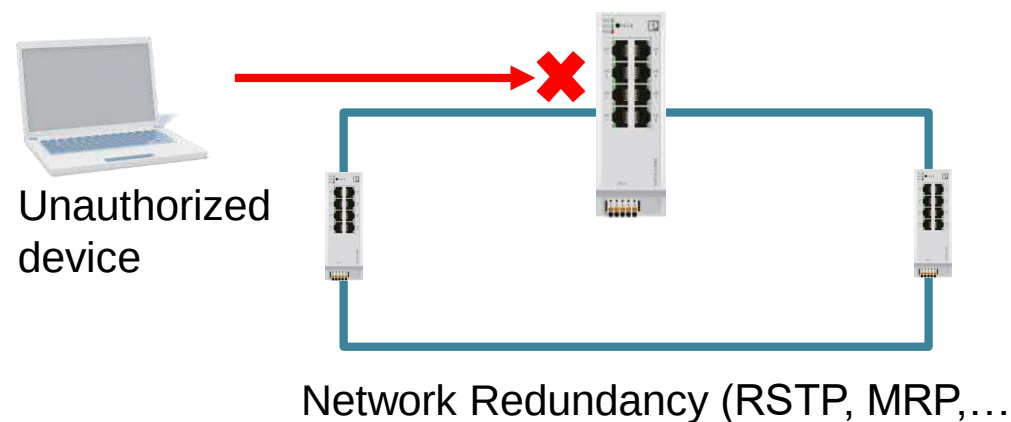


Industrial SPE Switch



Industrial Ethernet Switch - Features

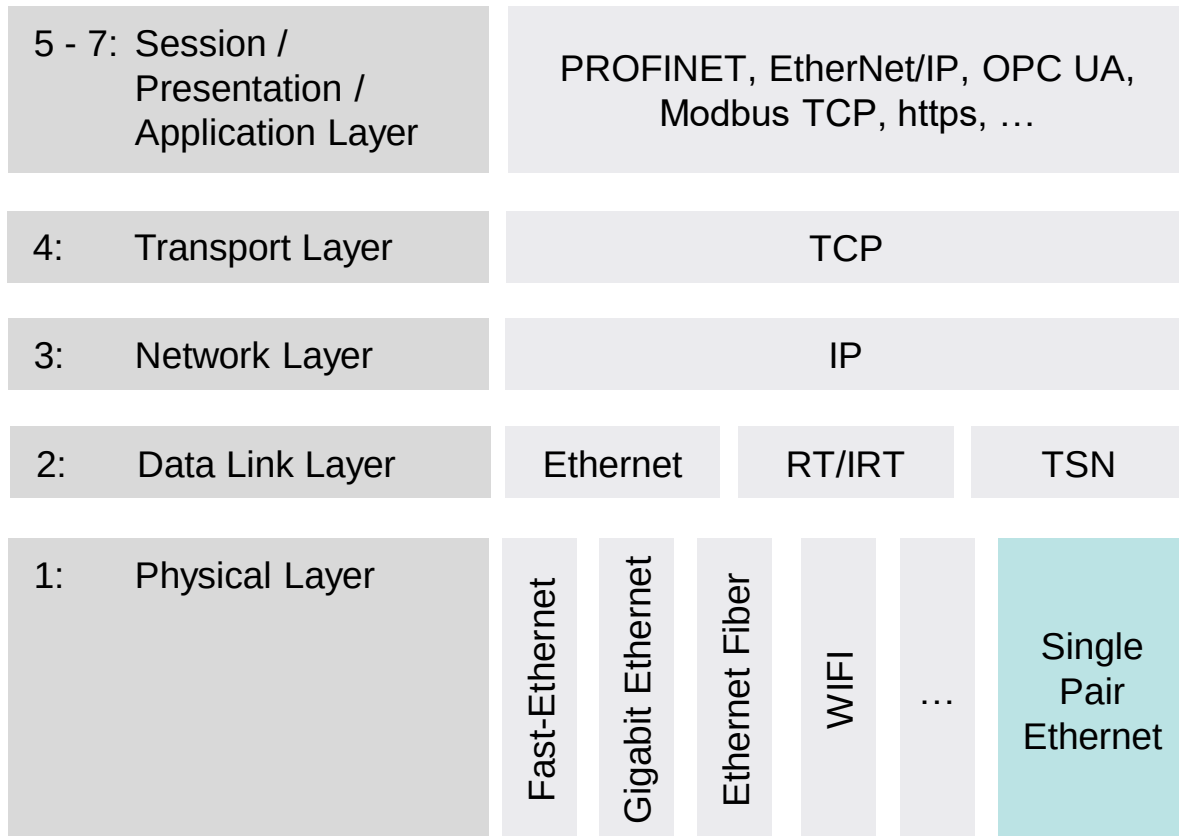
- ◆ Quality of Service
- ◆ Realtime
- ◆ Network Redundancy
- ◆ Automation Protocol Support (Profinet, EtherNet/IP...)
- ◆ Security Features
- ◆ Diagnostics Features



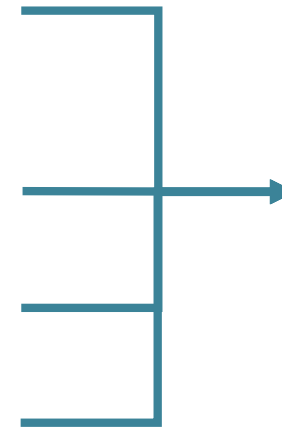
The screenshot shows a 'Port Counter' window with a 'Surveillance' tab selected. It displays 'CRC Surveillance Details' for three interfaces. The table includes columns for Interface/Port, CRC Errors, Crit. Threshold (ppm), Proportion Peak (ppm), and Status.

Interface/Port	CRC Errors	Crit. Threshold (ppm)	Proportion Peak (ppm)	Status
1	40	40000	15533	Ok
2	75	40000	681818	Critical
3	95	300000	171171	Warning

SPE - Just Another Physical Layer



The ISO OSI Model



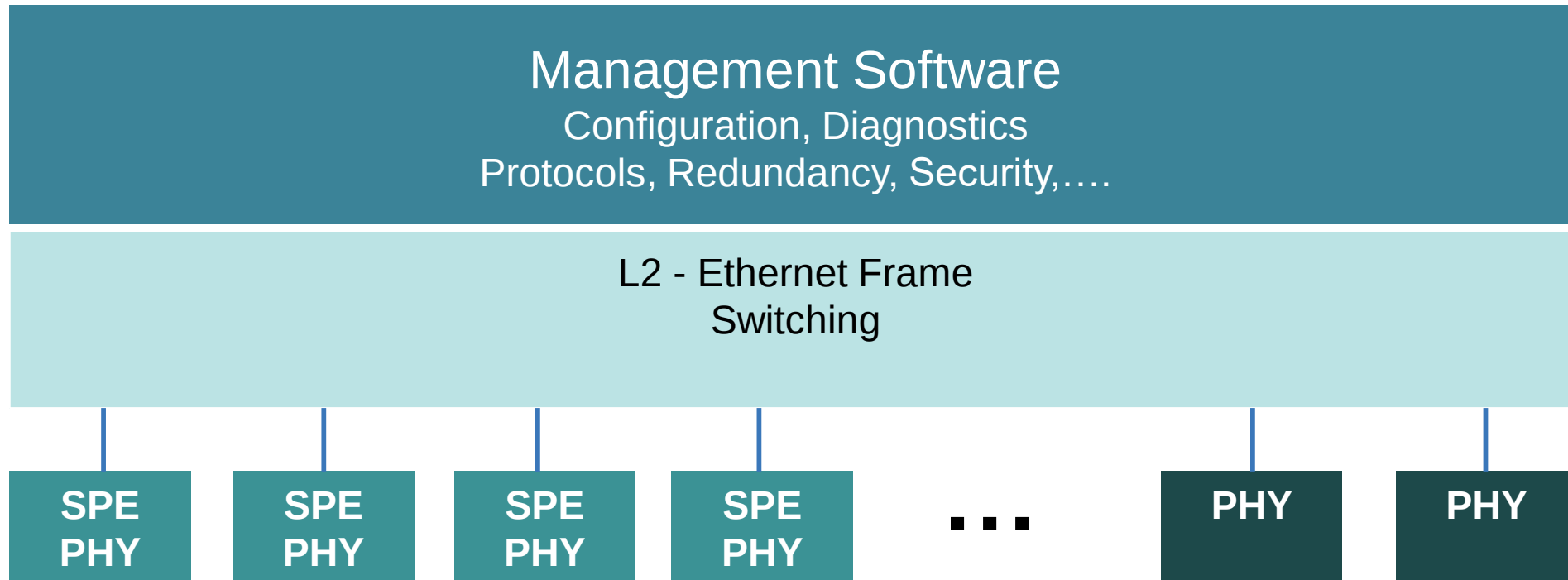
Higher layers operate independent of the physical layer



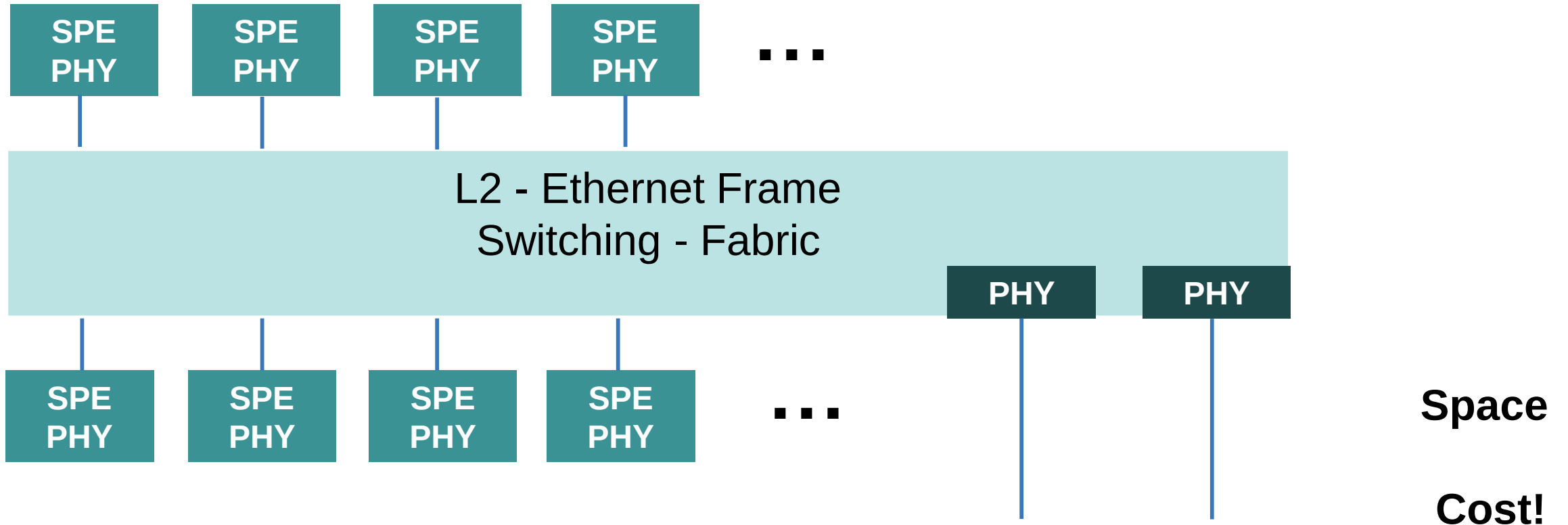
SPE is one of many physical layers



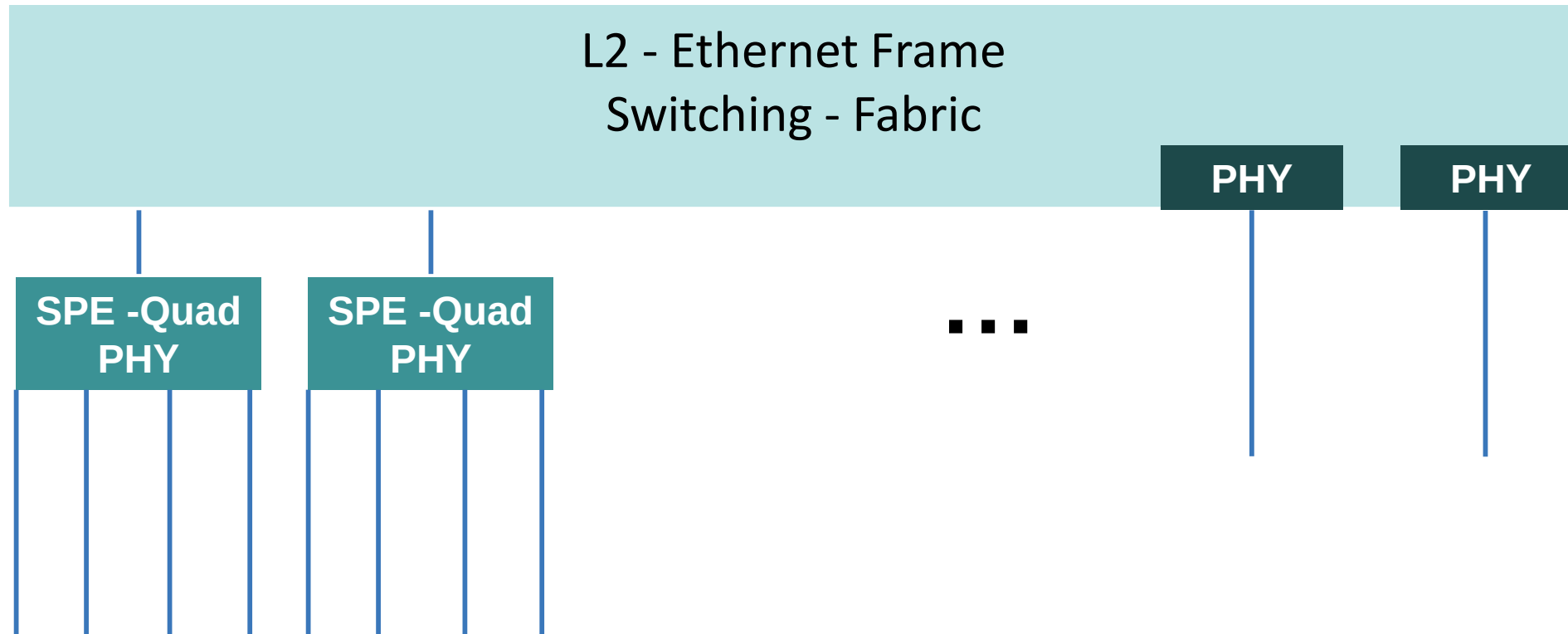
SPE Switch Concept



Challenges: SPE and Switching Fabric



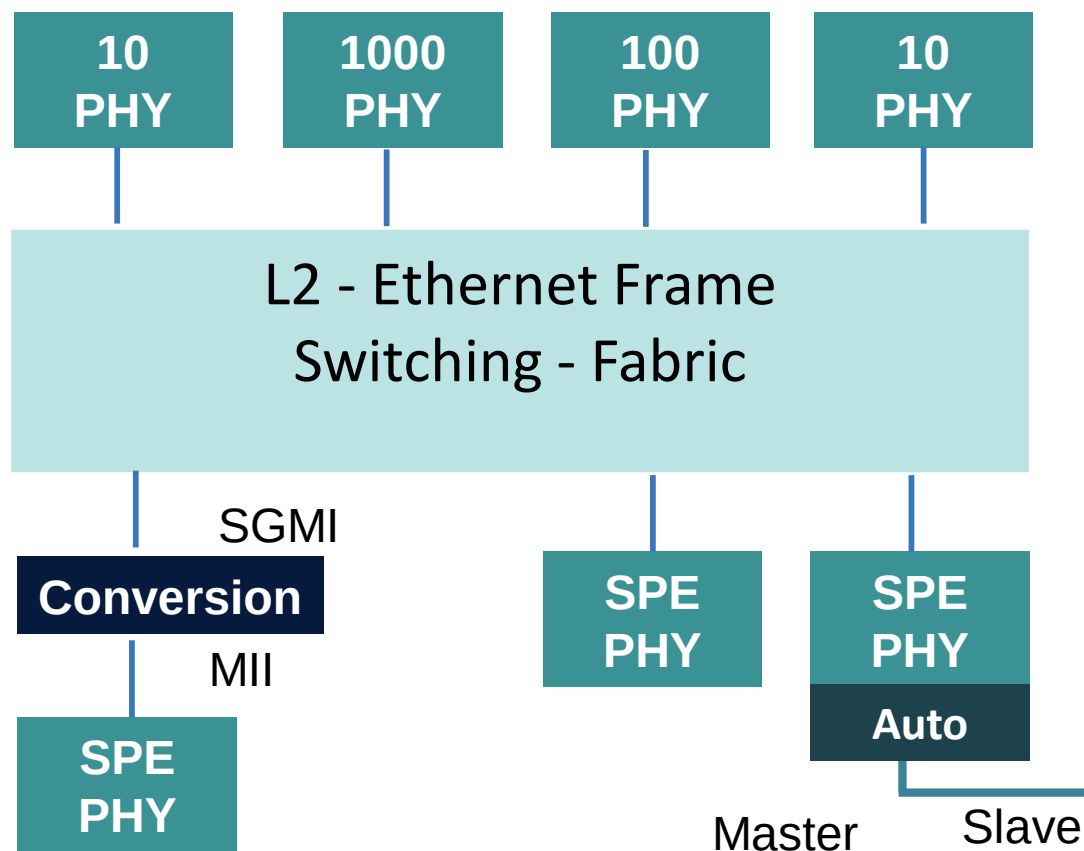
Challenges: SPE and Switching Fabric



Better !



Challenges: SPE and Switching Fabric

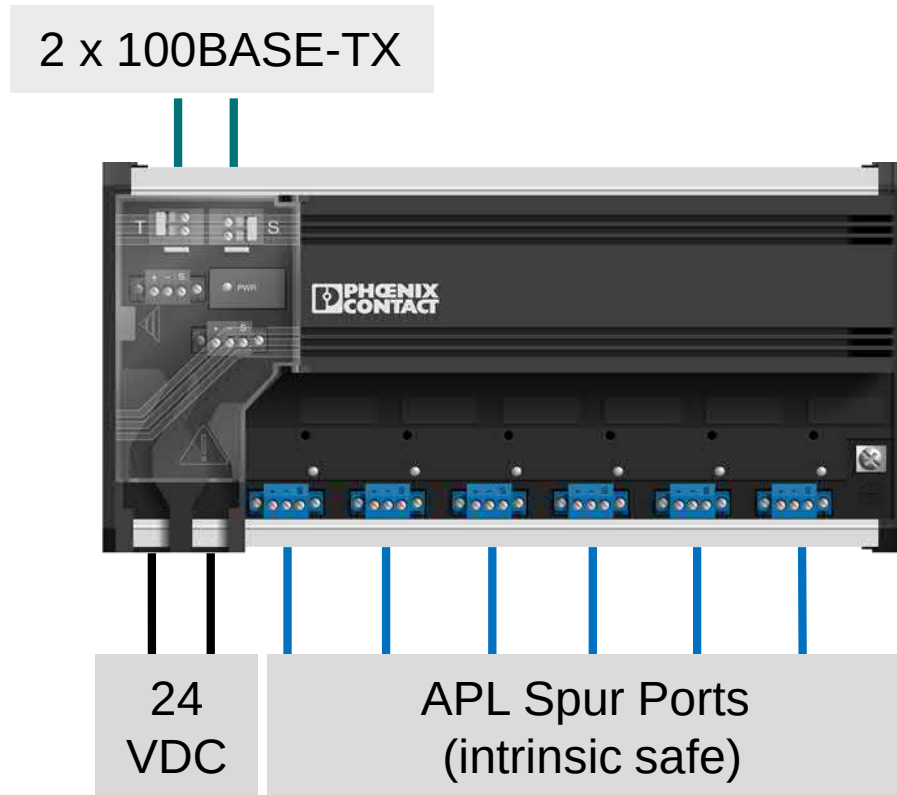


- ◆ Different SPE –Standards
- ◆ Match PHY Interface
- ◆ Autonegotiation would be very helpful!



Pilot Products: Ethernet-APL Switches

- 2 Ethernet ports 100BASE-TX (RJ45)
- Ethernet-APL spur (Screw terminals)
- Managed Features: Web based, SNMP, CLI, Network diagnostics
- Quality of Service, 8 priority queues
- Network redundancy
 - MRP ring acc. IEC 62439 and Profinet
 - RSTP
- Ex Zone 1 and 2

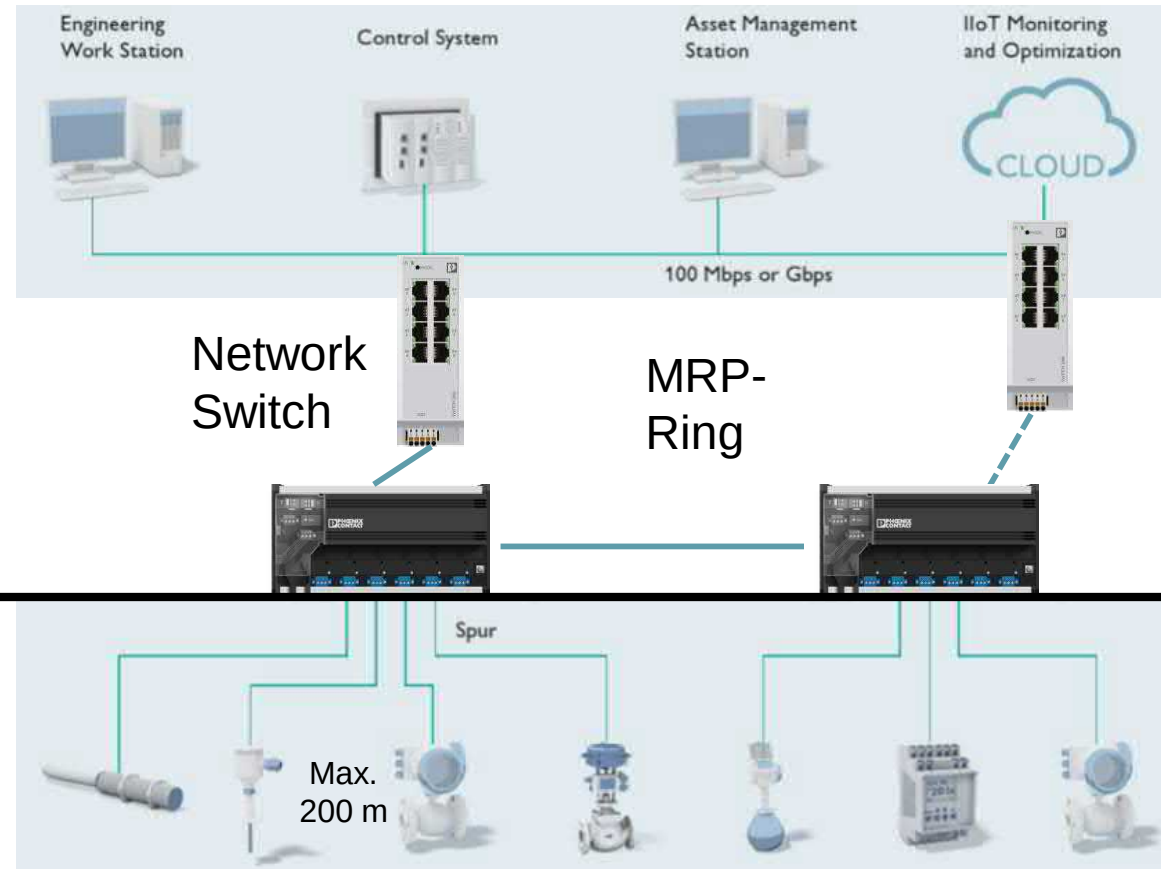


Working samples



Ethernet-APL

Zone 2/ Div 2



Zone 0-1/ Div 1



Pilot Products: Industrial SPE Switches

FL SWITCH 2303-8SP3

- ◆ Managed Switch
 - ◆ 8 SPE Ports **100/1000 BASE-T1**, 40m
 - ◆ Autonegotiation
 - ◆ PoDL Power Class 7 (802.3bu)
 - ◆ 3 Ports 10/100/1000 (RJ45)
- ◆ Realtime (Quality of Service)
- ◆ Automation Protocol Support (Profinet, EtherNet/IP...
- ◆ Network Redundancy (RSTP, MRP,...
- ◆ Security Features

Under construction



Pilot Products: Industrial SPE Switches

FL SWITCH 2303-8SP1

- ◆ Managed Switch
 - ◆ 8 SPE Ports **10 BASE-T1L**, up to 1000 m
 - ◆ PoDL Power Class 12 (extended in 802.3 cg)
 - ◆ 3 Ports 10/100/1000 (RJ45)
- ◆ Realtime (Quality of Service)
- ◆ Automation Protocol Support (Profinet, EtherNet/IP...
- ◆ Network Redundancy (RSTP, MRP,...
- ◆ Security Features

Under construction



Common Goals

SPE Device



Ease of Use
Interoperability

Definition of SPE port profiles needed!



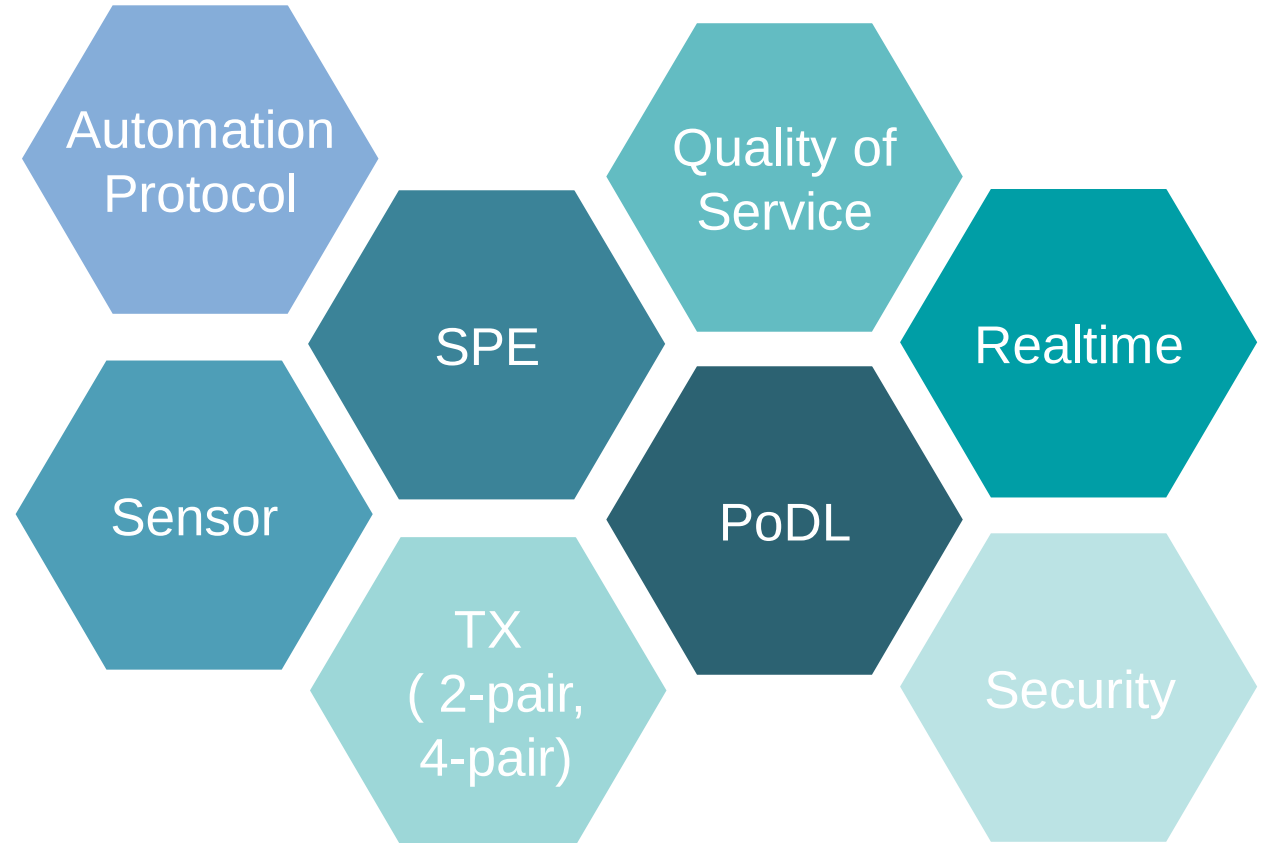
SPE Switch

- ◆ Data transmission parameter
 - ◆ (data rate/standard, setting, autoneg?)
- ◆ Powering parameter
 - ◆ PoDL Power Class?

- ◆ SPE Ports
- ◆ Power Source Equipment (PoDL)



Industrial SPE Switches



Thank you!

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Single Pair Ethernet
System Alliance