

SPE in Commercial Buildings

SPE Technology Days

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Single Pair Ethernet
System Alliance



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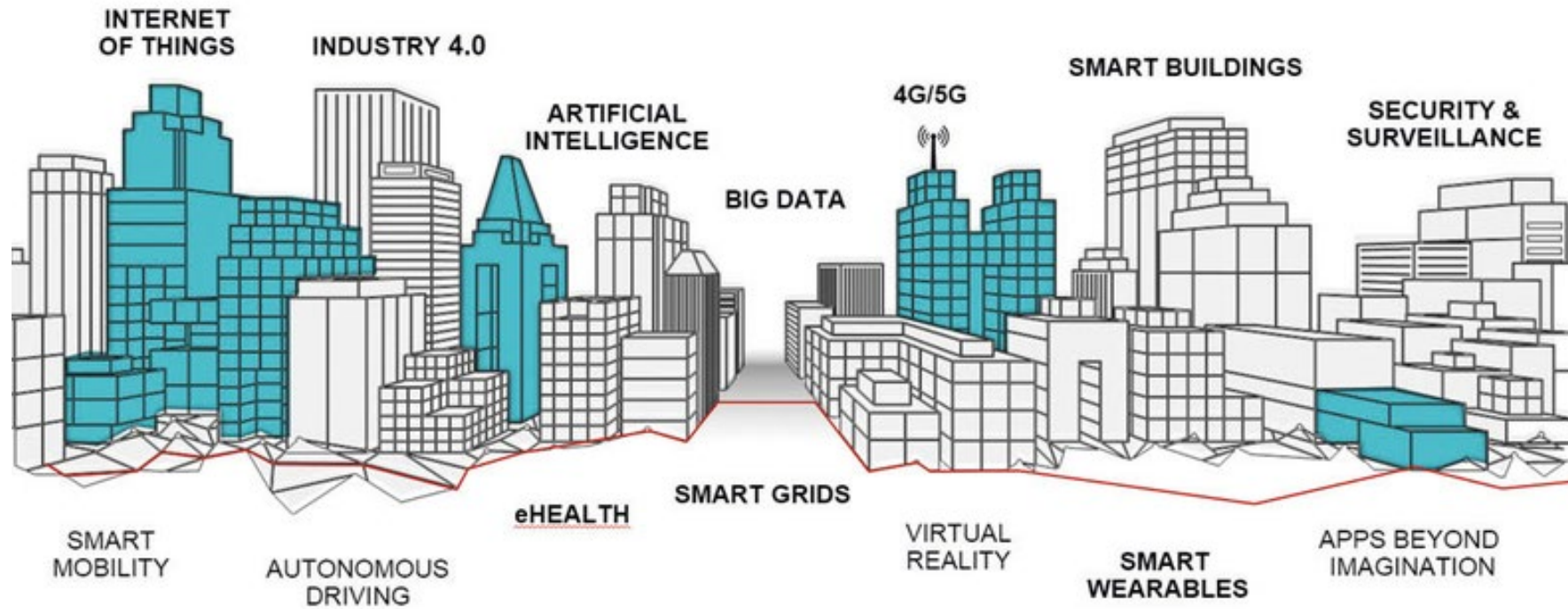
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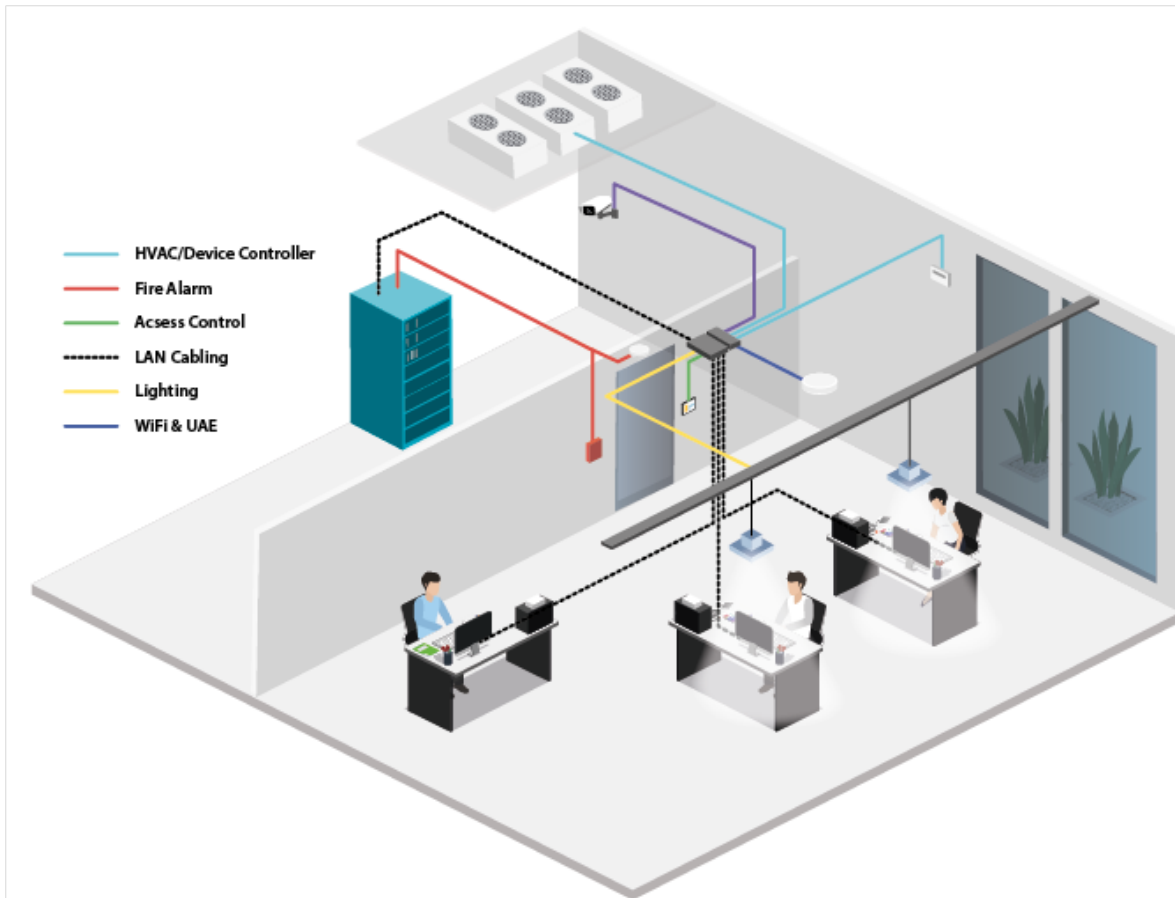
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Information is key







Data Communication in Buildings



- **ARCNET** Deterministischer, echtzeitfähiger Feldbus, eingesetzt in den Bereichen Automotive, Industrieautomatisierung, Medizintechnik
- **ARINC 629** Schneller Avionik-Bus, der Firma Arinc, eingesetzt in der Boeing 777
- **AS-interface** (Aktuator-Sensor-Interface) zum Anschluss von Sensoren und Aktuatoren
- **BACnet** Building Automation and Control Networks für Gebäudeleittechnik, aber auch teilweise bis zur Feldebene hin
- **BITBUS**
- **CAN** z. B. im Automotive-Bereich
- **CANopen** (CAN-basierendes, höheres Protokoll) Standard für die Aufzugstechnik, Automatisierungstechnik, Fahrzeug-Schiffselektronik. Gepflegt von CAN in Automation (CIA)
- **CC-Link** im asiatischen Raum verbreiteter Bus für industrielle Applikationen
- **ControlNet**
- **DALI** für Beleuchtungen in der Gebäudeautomatisierung
- **DeviceNet** (CAN-basierendes, höheres Protokoll)
- **EIB** Europäischer Installationsbus hauptsächlich Hausinstallation, Vorgänger von KNX
- **EtherCAT** Ethernet-basierender Feldbus in der Automatisierungstechnik
- **Ethernet Powerlink** Ethernet-basierender Feldbus für den Maschinen- und Anlagenbau
- **EtherNet/IP** (Ethernet-basierendes, höheres Protokoll), zumindest ersteres vor allem in den USA
- **FAIS-Bus**, ein japanischer Feldbus-Standard
- **Foundation Fieldbus (FF)** der Fieldbus Foundation (Prozessautomation)
- **FIP-Bus**, französischer und italienischer Feldbus-Standard, Konkurrent zu Profibus
- **FlexRay-Bus** im Automotive-Bereich (X-by-Wire)
- **Hart Communication** für industrielle Feldgeräte
- **INTERBUS** Maschinenbau, Anlagenbau in Sonderausführung für Sicherheitstechnik
- **KNX-Standard** für Gebäudeautomatisierung, Nachfolger von EIB
- **LCN** Local Control Network Universelles Gebäudeleitsystem
- **LIN-Bus** im Automotive-Bereich
- **LocoNet** für Modelleisenbahnen
- **LON** hauptsächlich für Gebäudeautomation
- **M-Bus** (Feldbus)
- **MIL-STD-1553** hauptsächlich in der militärischen Luftfahrt
- **Modbus** Industrie
- **MOST-Bus** im Automotive-Multimedia-Bereich
- **MVB** (Multifunction Vehicle Bus) Schienenfahrzeuge IEC 61375
- **P-NET** Der P-NET Feldbus
- **PROFIBUS** (Varianten: DP & PA), **PROFINET**: Roboter, Maschinenbau, Anlagenbau, Prozessautomation
- **SafetyBUS** p sicherheitsrelevante Anwendungen
- **SERCOS interface** Motion Control, CNC, Roboter, Maschinenbau, Anlagenbau
- **SmartCAN** Integratives low-cost/low-power System, hauptsächlich für Gebäudeautomatisierung (aber auch allgemein)
- **SMI Standard Motor Interface** zur Ansteuerung von elektronischen Antrieben, z. B. für Jalousien oder Rollläden
- **Spacewire**
- **T-Bus** hauptsächlich eingesetzt in Landwirtschaft, Bewässerungstechnik und Umwelt-Monitoring
- **Time-Triggered Protocol (TTP)**
- **VARAN** Ethernet-basierender Feldbus für die Automatisierung von Maschinen und Anlagen



Standards Landscape “Building”

			
Transmission Protocol “Ethernet” : Global	Cabling : Global	Cabling : Europe	Cabling : Americas (Global)
Fiber : SM & MM IEEE 802.3	Cabling: Architecture Performance, Testing	Cabling: Architecture Performance, Testing	Cabling: Architecture Performance, Testing
Copper : 2-4 Pairs IEEE 802.3	Cabling: Architecture Performance, Testing	Cabling: Architecture Performance, Testing	Cabling: Architecture Performance, Testing
Copper : 1 Pair IEEE 802.3	Cabling: Architecture Performance, Testing	Cabling: Architecture Performance, Testing	Cabling: Architecture Performance, Testing
Wireless : IEEE 802.11	Referenced	Referenced	Referenced
PoE / PoDL IEEE 802.3	Implementation Reference (Best Practice)	Implementation Reference (Best Practice)	Implementation Reference (Best Practice)



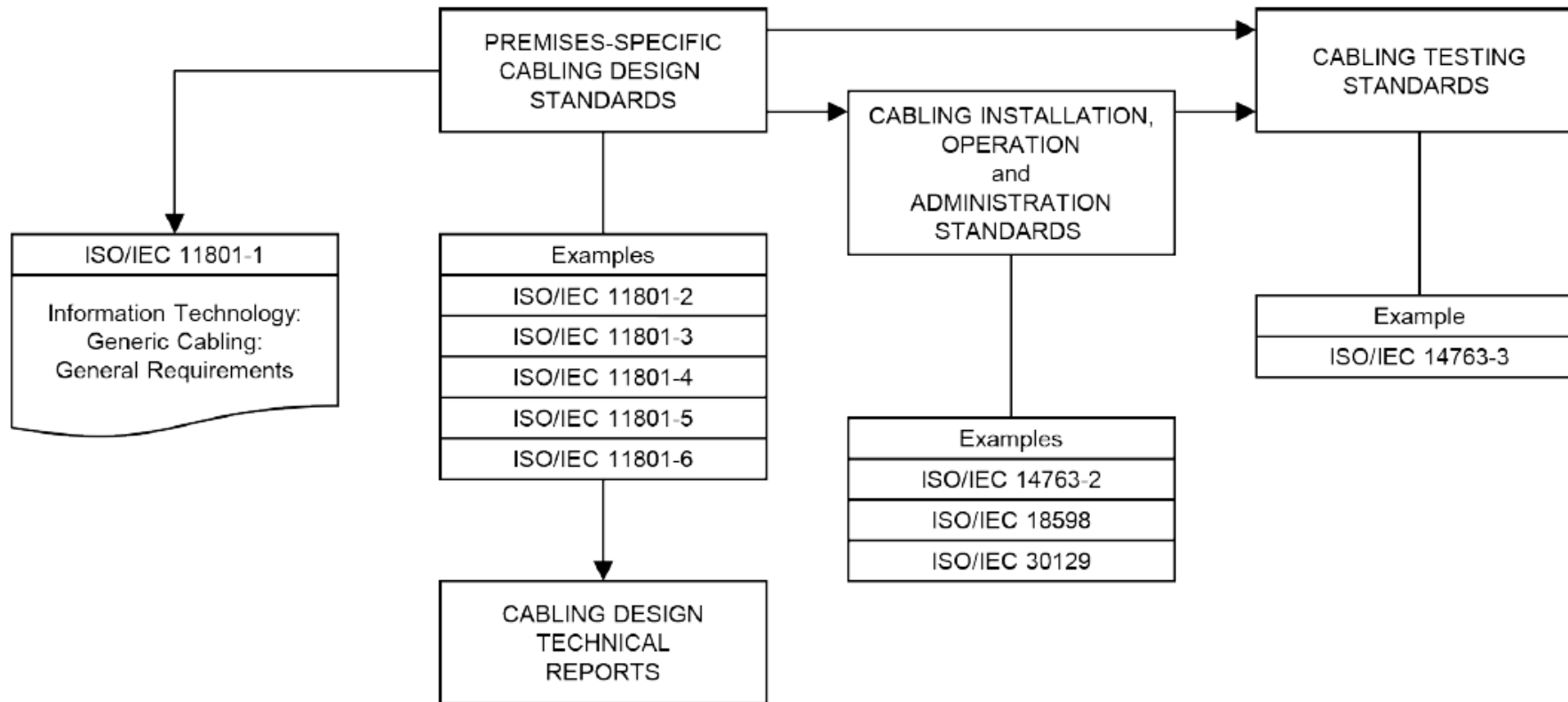
Ethernet Protocols for SPE

IEEE project	Description / Application	Reach			
		15 m	40 m	100m	1000 m
802.3bp	1000Base-T1 Automotive, Industrial, IoT	Type A Screened and unscreened channel	Type B screened channel		
802.3bw	100Base-T1 Automotive	unscreened channel			
802.3ch	MultiGigBase-T1 (2.5/5/10 Gb/s)	Screened			
802.3cg	10Base-T1 Industrial	T1-S Screened and unscreened channel			T1-L Screened and unscreened channel
IEEE 802.3 bu	Power over Data Line (PoDL)				



ISO/IEC 11801-1

Standardisation of Communication Cabling in a building

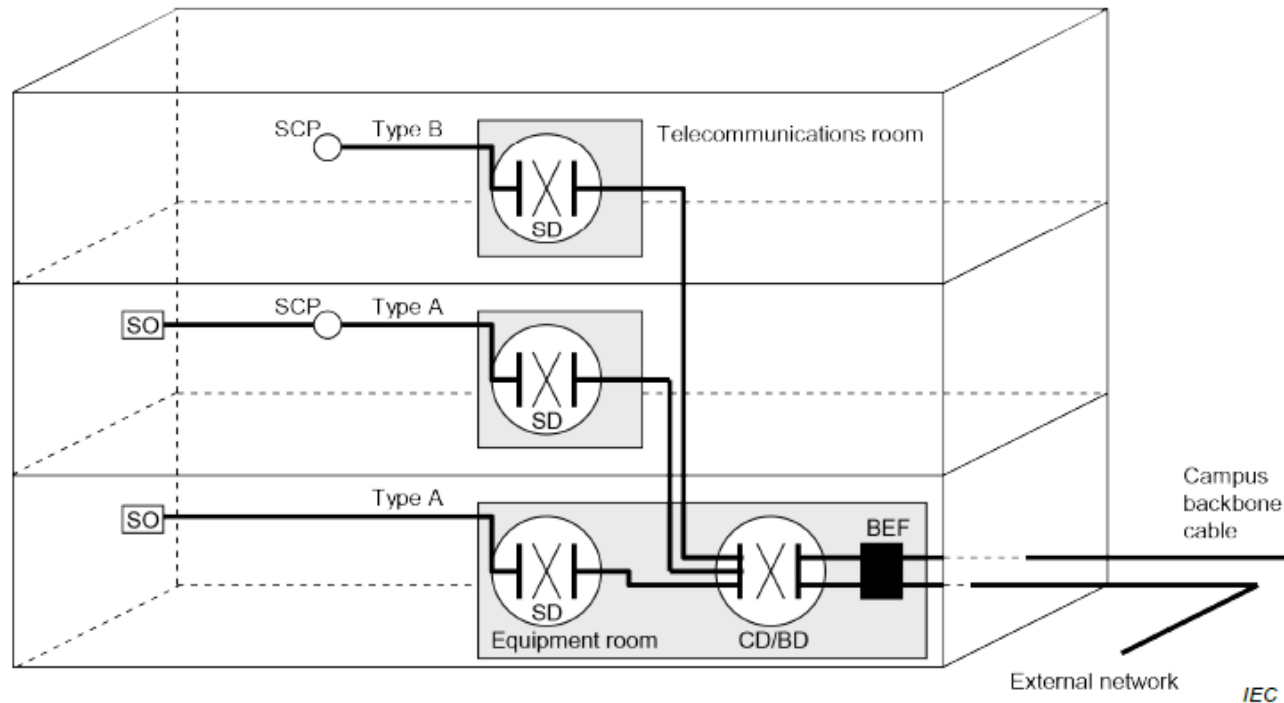


Cabling Classes ISO/IEC 11801-1

Class	Subclasses	Description BW / IEEE Application	Channel-Reach			
			100 m	250 m	400 m	1000 m
T1-A	-1000 -400	20 MHz 802.3cg 10Base-T1			Cables acc. to IEC 61156 -13/-14; up to 10 connections	
T1-A	-250 -100	20 MHz 802.3cg 10Base-T1	Cables acc. IEC 61156-13 /-14; up to 5 connections			
T1-B	100	600 MHz / 802.3bw 100Base-T1 up to 15m 802.3bp 1000Base-T1 up to 40m	61156 -11/-12; Max. 4 con. compatible to T1-A- 100			
T1-C	100	1250 MHz (ffs.) / depending on IEEE 802.3ch				



Cabling Structure



SCP service concentration point
SD service distributor (~ floor distributor)
SO service outlet
CD/BD campus distributor / building distributor
BEF building entrance facility

◆ Type A :

- ◆ at SCP no transmission equipment (no Switch / Gateway)

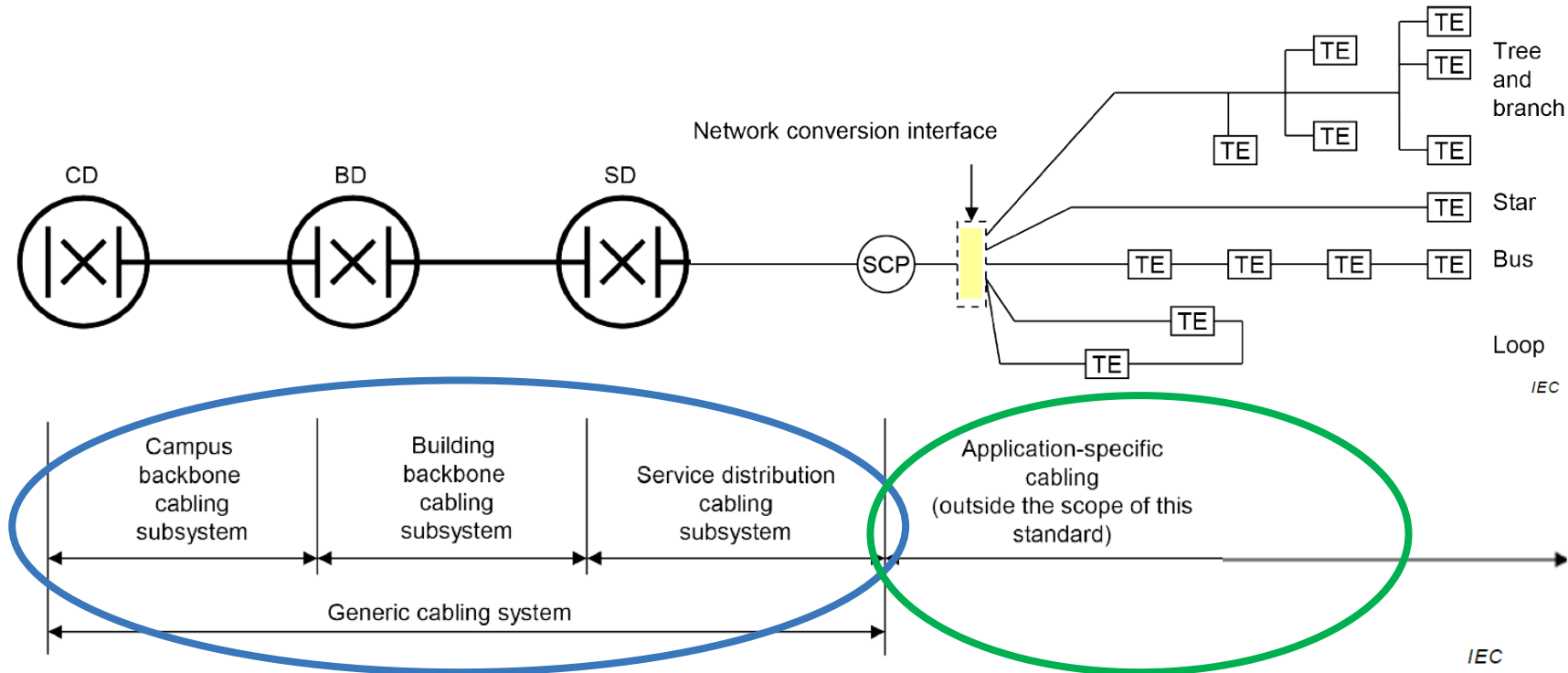


◆ Type B :

- ◆ Transmission Equipment may be used at SCP (with Switch / Gateway)



Generic cabling system



In scope of ISO/IEC 11801

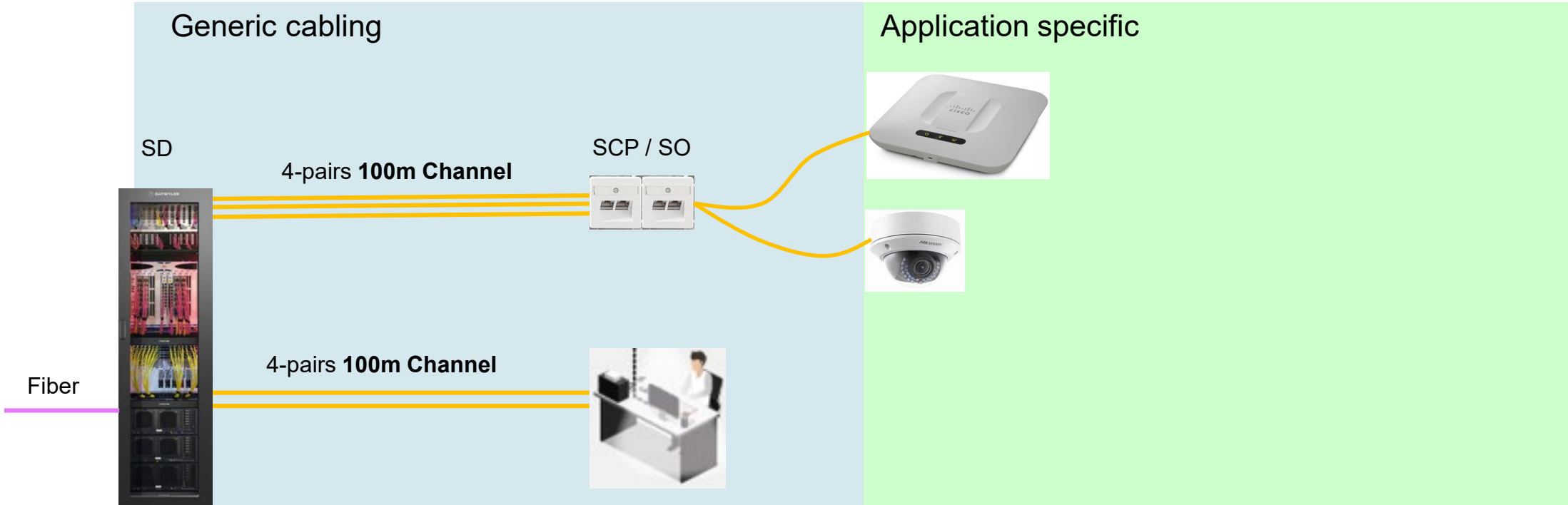
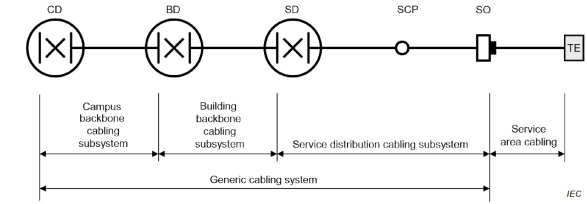
Out of scope ISO/IEC 11801

- SCP service concentration point
- SD service distributor (~ floor distributor)
- SO service outlet
- CD campus distributor
- BD building distributor
- BEF building entrance facility



Service Distribution Type A

- 4-pair generic cabling

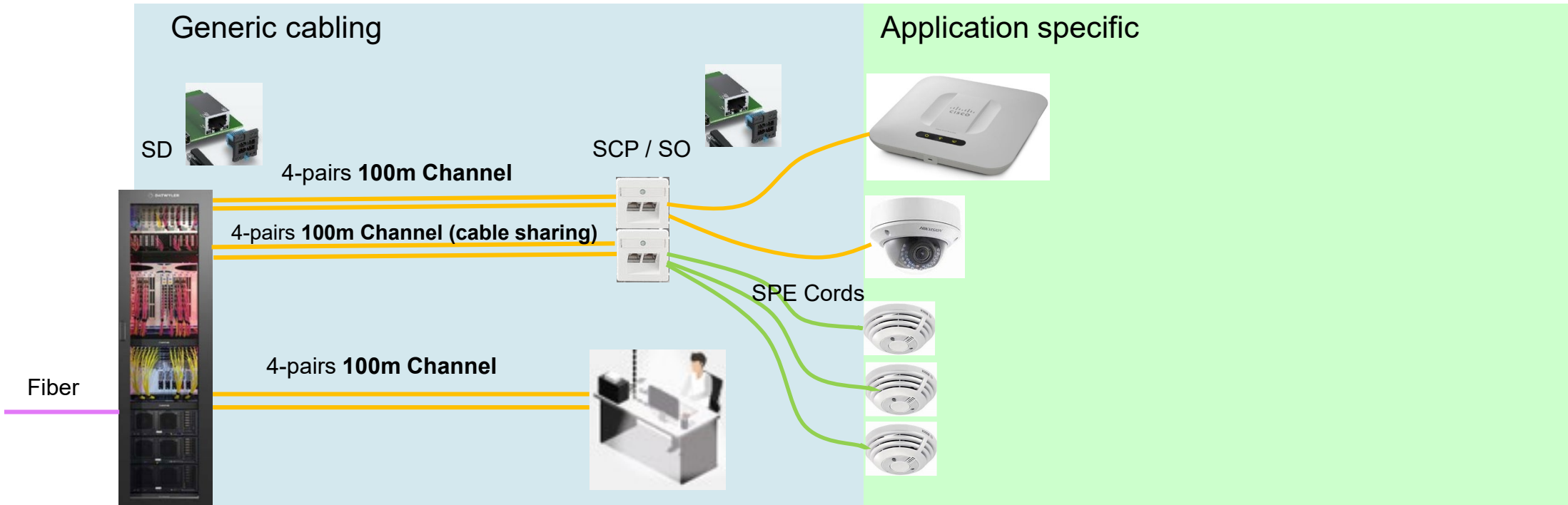
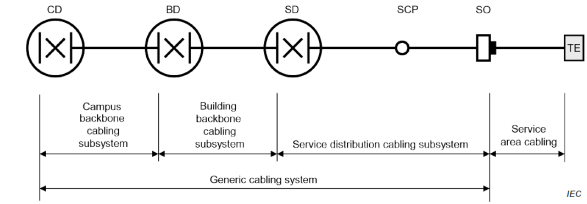


SCP service concentration point
SD service distributor (~ floor distributor)
SO service outlet



Service Distribution Type A

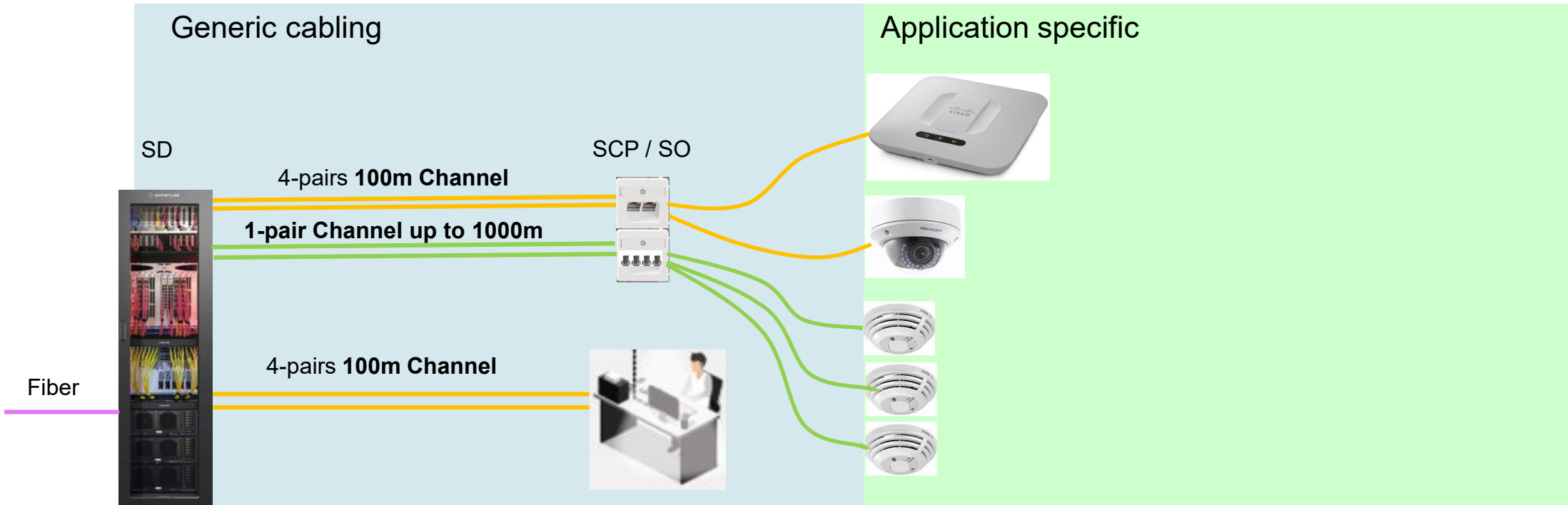
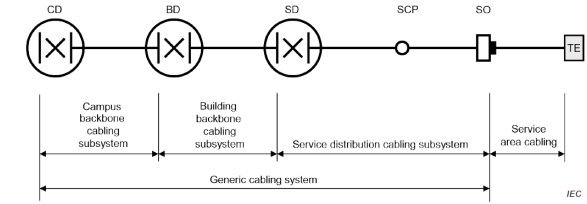
- 4-pair and 1-pair generic cabling (cable-sharing)



SCP service concentration point
 SD service distributor (~ floor distributor)
 SO service outlet

Service Distribution Type A

- 4-pair and 1-pair generic cabling

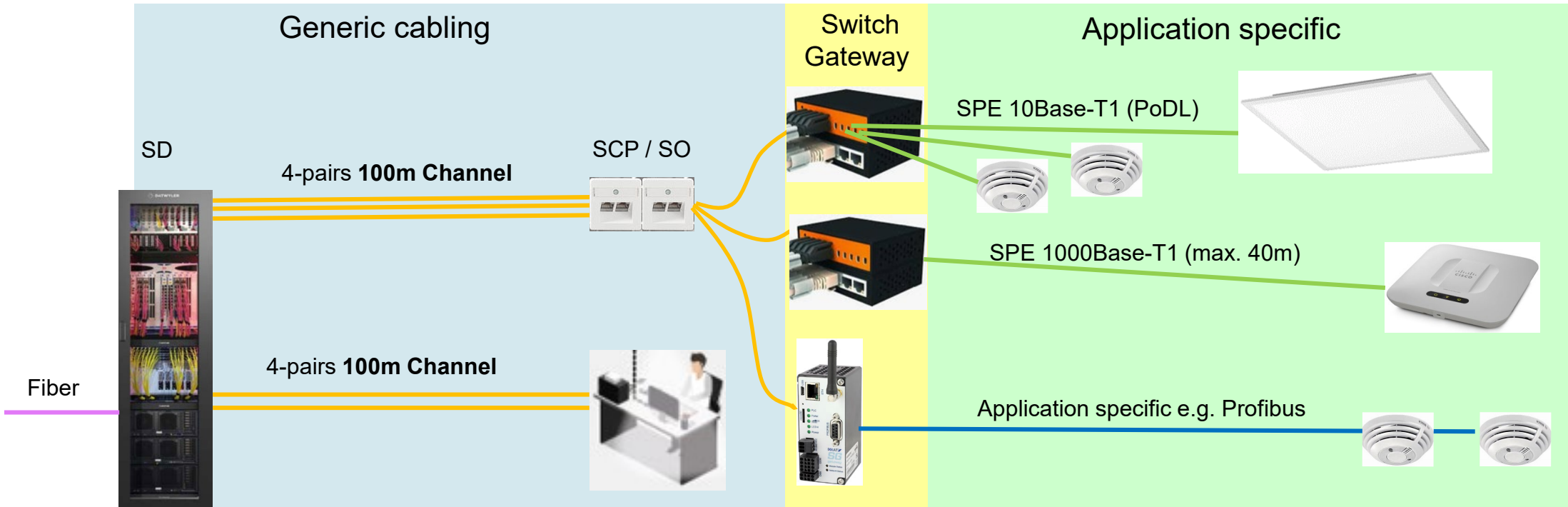
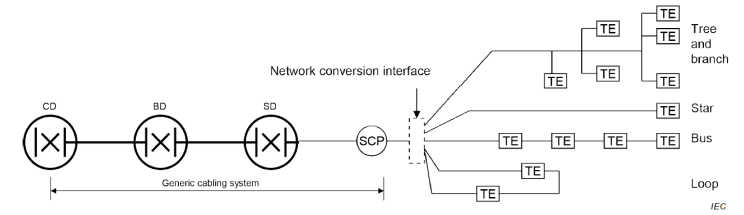


SCP service concentration point
 SD service distributor (~ floor distributor)
 SO service outlet



Service Distribution Type B

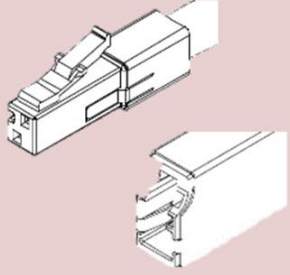
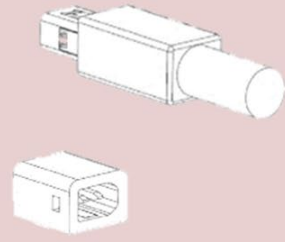
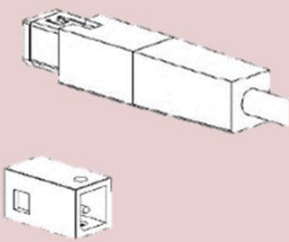
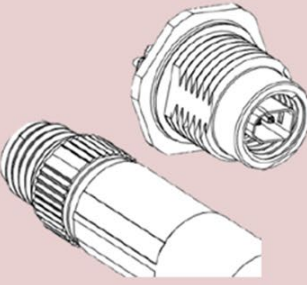
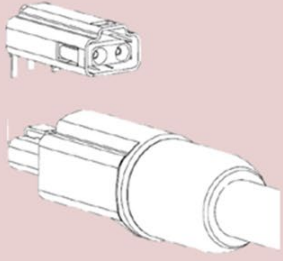
- 4-pair generic cabling + Gateway (Switch SPE)

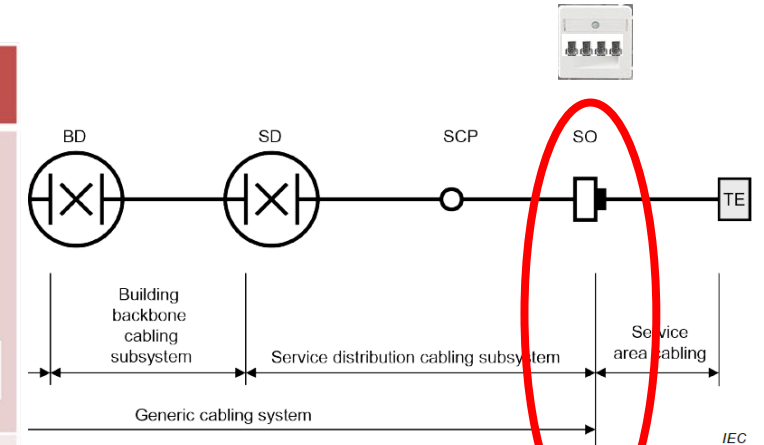


SCP service concentration point
SD service distributor (~ floor distributor)
SO service outlet



SPE Connectors

IEC 63171-1	IEC 63171-2	IEC 63171-4	IEC 63171-5	IEC 63171-6
				
<ul style="list-style-type: none"> • LC-Copper • Selected by 11801 and TIA for MICE1 • Mentioned by IEEE for MICE1 MDI 	<ul style="list-style-type: none"> • MSP-MICE1 • Compatible to 63171-5 	<ul style="list-style-type: none"> • MMC3000-1P • Proprietary design by BKS 	<ul style="list-style-type: none"> • MSP-MICE3 • Compatible to 63171-2 • Only real M8 compatibility 	<ul style="list-style-type: none"> • Harting T1 • Selected by 11801 and TIA for MICE3 • Mentioned by IEEE for MICE 3 MDI
<ul style="list-style-type: none"> • Promoted by Commscope 	<ul style="list-style-type: none"> • Promoted by R&M 	<ul style="list-style-type: none"> • Promoted by BKS 	<ul style="list-style-type: none"> • Promoted by Phoenix Contact 	<ul style="list-style-type: none"> • Promoted by Harting



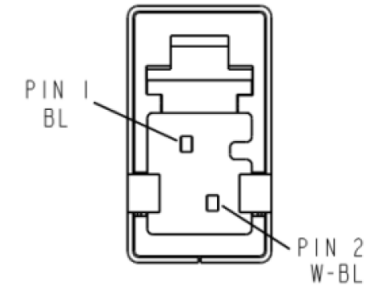
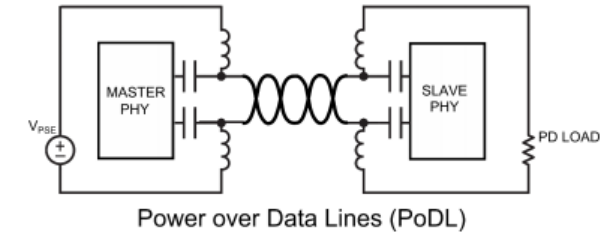
- ISO/IEC 11801-6 (MICE1)
 - SO Service outlet: RJ45 or LC-Copper
 - Application specific: **free choice of connector** (out of scope of ISO/IEC 11801)



PoDL Power over Data Line

Table G.1 – Remote powering information for single pair balanced cabling

PoDL Class	Min Voltage	Loop resistance at 20° C cable temperature	Loop resistance 65° C cable temperature	Loop resistance at 80° C	Max power available	Max current	Comments
	V	Ω	Ω	Ω	W	A	
10	20	51,2	65	ffs	1,2	0,09	Low voltage
11	20	19,7	25	ffs	3,2	0,24	Low voltage
12	20	7,5	9,5	ffs	8,4	0,62	Low voltage
13	50		65	ffs	7,7	0,23	
14	50		25	ffs	20	0,60	
15	50		9,5	ffs	52	1,58	



Pin Number	Signal	Remote Power
1	TX+	+
2	TX-	-

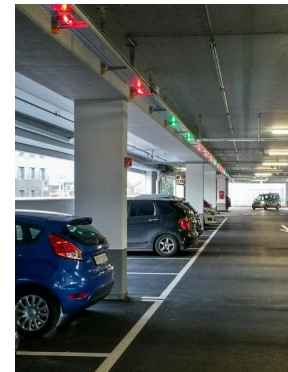


Cable Impact on PoDL

PoDL Class	Min Voltage V	Loop Resistance at 65°C Ohm	Max. Power at PD W	Max. Current A	Loop Resistance AWG18 (65°C) Ohm/km	Loop Resistance AWG22 (65°C) Ohm/km	Loop Resistance AWG26 (65°C) Ohm/km	Max. Reach AWG18 m	Max. Reach AWG22 m	Max. Reach AWG26 m
10	20	65	1.2	0.09	54	150	376	1200	430	170
11	20	25	3.2	0.24	54	150	376	460	165	65
12	20	9.5	8.4	0.62	54	150	376	175	63	25
13	50	65	7.7	0.23	54	150	376	1200	430	170
14	50	25	20	0.60	54	150	376	460	165	65
15	50	9.5	52	1.58	54	150	376	175	63	25



Multi-storey car park



- Traffic guiding system (Smart City)
- Park space indicator (empty spaces per deck) (KNX)
- Dimmed light – bright light, when used; move detection (KNX/Dhali)
- Elevator management (CAN), Elevator cabin arrives when person arrives in front of Elevator
- Emergency escape guiding lights based on triggering event (Smoke, Fire) Parking meter system (proprietary system)
- Parking meter system (proprietary system)
- Building management system (TCP/IP)



SPE in Commercial Buildings

- ◆ Summary:

- ◆ SPE enables an information highway sensor to cloud (1-Pair → 4-Pair → MM Fiber → SM Fiber)
- ◆ SPE enables transparent and flexible communication within a building
- ◆ PoE / PoDL enables powering of sensors without additional battery management
- ◆ Service Distribution Type B (with Switch) 4-pair RJ45 Cabling at SO is recommended (15m/40m restriction of many XBASE-T1 protocols)
- ◆ With RJ45 at SO, best matching SPE connector can be used for distributed building services



Thank you for
your attention



Single Pair Ethernet
System Alliance