RTPGE
IoT Connectivity

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Background - connecting the things…

•IoT is about putting things on the Internet….. door locks, appliances, smart meters, video surveillance, health care devices, thermostats…sensors…

•Structured cabling and pathway standards continue to evolve to address connectivity between network devices;

•Industrial

•Building automation

•Health care

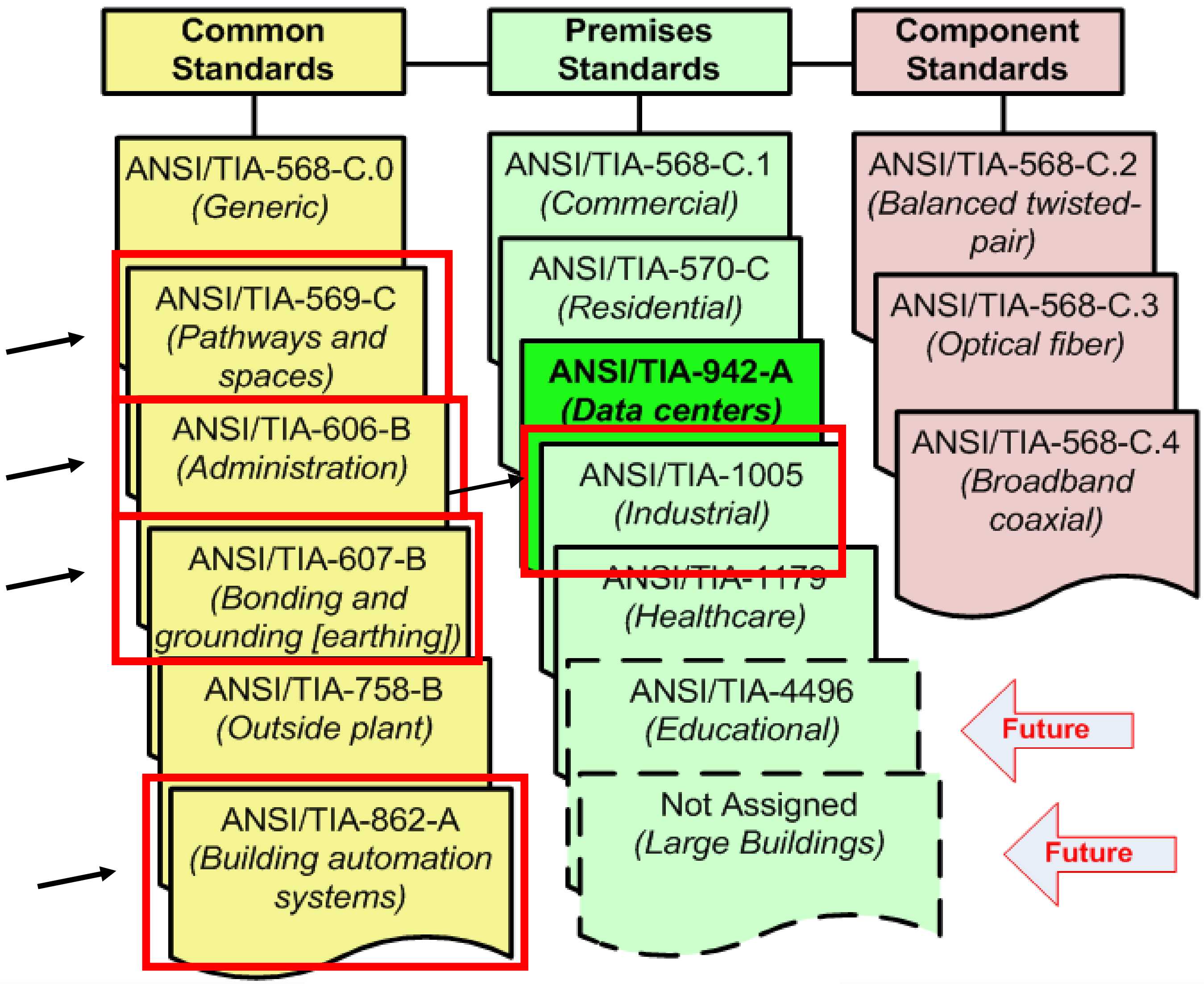
•Educational facilities

•“Intelligent Building” technologies

•Data centers

TIA/TR42 Cabling Standards – IoT Cabling

Industrial Cabling – ANSI/TIA-1005
Building Automation – ANSI/TIA 862-A



Background - connecting the things…

- Networking standards continue to evolve enabling features to facilitate connecting all sorts of things on the Internet….. door locks, appliances, smart meters, video surveillance, health care devices, thermostats and so on……….
- Power over Ethernet (PoE)
- Reduced Pair Gigabit Ethernet (RTPGE)
  - Power over Data Lines (PoDL) CFI

RTPGE Objectives

- Define the performance characteristics of an automotive link segment and a PHY to support point-to-point operation over this link segment with less than three twisted pairs supporting up to four inline connectors using balanced copper cabling for at least 15m for the automotive link segment.

- Define the performance characteristics of optional link segment(s) for the above PHY for industrial controls and/or automation, transportation (aircraft, railway, bus and heavy trucks) applications with a goal of at least 40m reach
- Define optional startup procedure which enables the time from power_on=FALSE to valid data to be less than 100ms

Growth Industrial Consortia

- About 23% of the 31.3 million industrial networked nodes in 2011 were based on Ethernet or an Ethernet variant, reported by John Morse, senior analyst at IMS research.
- This will grow to 26% by 2015 or just short of 12 million nodes.
- Currently (2011) 42.8% of the Ethernet nodes are Industrial with standard TCP/IP nodes consisting of 42.4% in industrial installations.

Source: INDUSTRIAL CABLING
Bob Lounsbury, Principal Engineer, Rockwell Automation, IEEE 802.3BP, EMC Task Group, 2-May, 2013

Industrial Cabling performance requirements

- Transmission performance
  - The cabling shall be designed to support the intended applications during exposure to its environmental conditions as specified in ANSI/TIA-568-C.0 MICE (Mechanical,Ingress,Climatic,Magnetic)

- Balanced twisted-pair cabling
  - Requirements as specified in ANSI/TIA-568-C.2 and the additional requirements of industrial cabling standard and the environmental conditions specified in ANSI/TIA-568-C.0.
  - UTP Balance parameters
    - Transverse conversion loss (TCL)
    - Equal level transverse conversion transfer loss (ELTCTL)
  - Screened twisted-pair cabling
    - coupling attenuation

- Optical fiber cabling
  - Optical fiber cabling shall meet the performance requirements of ANSI/TIA-568-C.0 and ANSI/TIA-568-C.3. Depending on the environmental conditions, additional enhancements of separation/isolation may be required.

Telecommunications outlet (TO)

- TO - outside the automation island area – Protected based on environmental requirements either by encapsulating the TO or the telecommunication outlet connector.
  - –Copper
    - ▪8-position modular connector
  - –Fiber
    - ▪ LC
- TO - services (into and within) the automation island area
  - –Copper
    - ▪8-position modular connector or
    - ▪M12-4 D-Coding connector - IEC 61076-2-101
      - ❖2-pair – specified to support up to 100 Mb/s Ethernet
    - ▪M12 type X - IEC 61076-2-109
      - ❖4-pair – specified to support 1 Gb/s Ethernet
  - –Fiber
    - ▪LC – (environmentally protected)

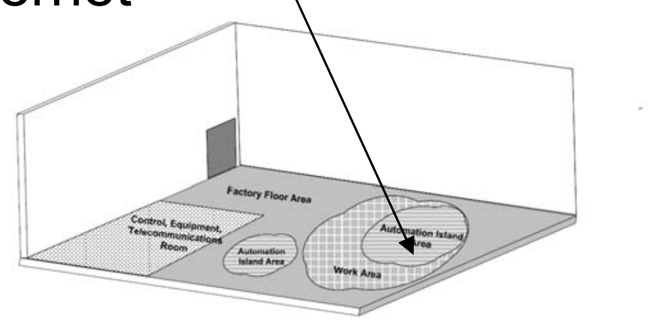
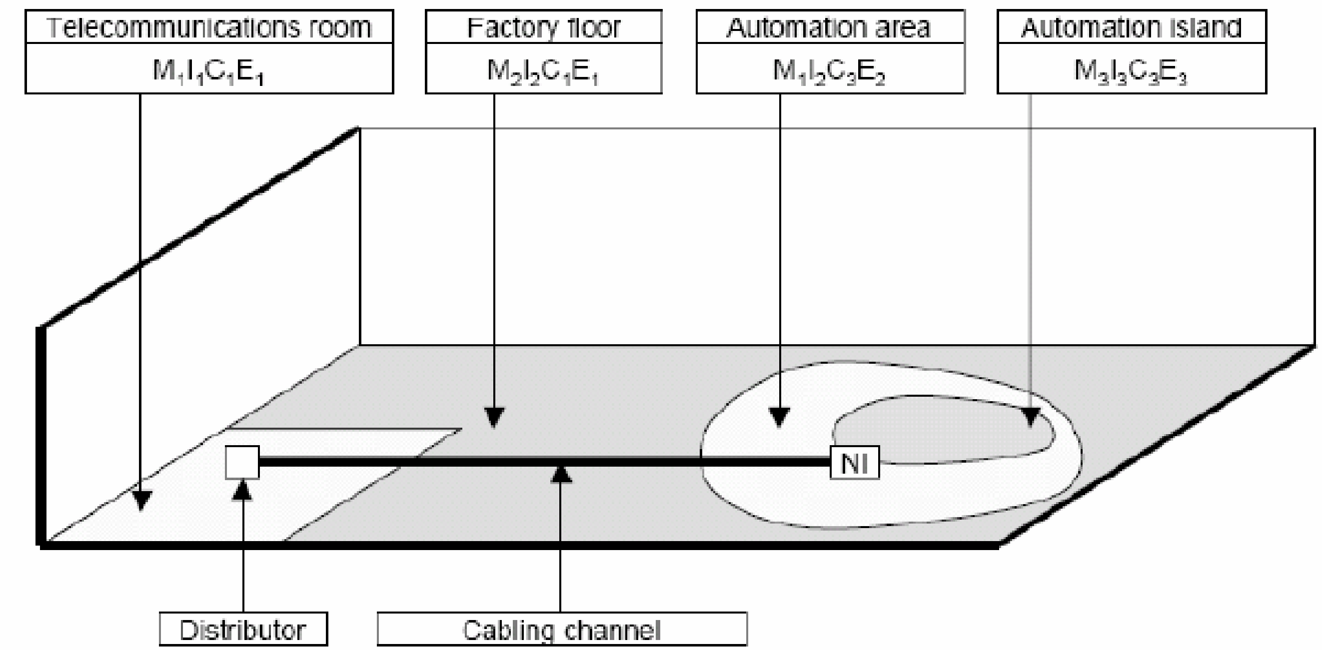


Figure 3 - Example of industrial areas

ISO/IEC TR 29106 – MICE - Environment

	Class I (commercial)	Class II (light industrial)	Class III (heavy industrial)
Mechanical	M_1	M_2	M_3
Ingress	I_1	I_2	I_3
Climatic	C_1	C_2	C_3
Electromagnetic	E_1	E_2	E_3



Example MICE industrial cabling environments

ISO/IEC TR 29106 – MICE - Environment

Mechanical	M_1	M_2	M_3
Shock/Bump peak acceleration	40 ms^{-2}	100 ms^{-2}	250 ms^{-2}
Vibration displacement amplitude (2- 9 Hz)	1.5 mm	7.0 mm	15.0 mm
acceleration amplitude (9- 500 Hz)	5 ms^{-2}	20 ms^{-2}	50 ms^{-2}
Crush	45 N	1100 N	2200 N
Impact	1 J	10 J	30 J

Ingress	I_1	I_2	I_3
Particulate Ingress (max diameter)	12 mm	50 micron	50 micron
Immersion	none	intermittent liquid jet $\leq$12.5 l/min $\geq$6.3mm jet >2.5m distance	intermittent liquid jet $\leq$12.5 l/min $\geq$6.3mm jet >2.5m distance & immersion $\leq$1 m for $\leq$30 min

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Specifying Environmental Requirements for Cabling Systems & Components with MICE, Alan Flatman LAN Technologies

ISO/IEC TR 29106 – MICE - Environment

Climatic	C_1	C_2	C_3
Ambient temperature	-10°C to +60°C	-25°C to +70°C	-40°C to +70°C
Rate of temp change	0.1°C per min	1.0°C per min	3.0°C per min
Humidity	5% to 85% (non condensing)	5% to 95% (condensing)	5% to 95% (condensing)
Solar Radiation	700W/m^2	1120W/m^2	1120W/m^2
Liquid Pollution			
Gaseous Pollution			

Electromagnetic	E_1	E_2	E_3
ESD	8kV air 4kV contact	8kV air 4kV contact	8kV air 4kV contact
Radiated RF-AM	3V/m 80MHz-1GHz 3V/m 1.4-2.0GHz 1V/m 2.0-2.7GHz	3V/m 80MHz-1GHz 3V/m 1.4-2.0GHz 1V/m 2.0-2.7GHz	10V/m 80MHz-1GHz 3V/m 1.4-2.0GHz 1V/m 2.0-2.7GHz
Conducted RF	3V/m 150kHz-80MHz		10V/m 150kHz-80MHz
EFT/B (comms)	500V	1000V	1000V
Surge (transient ground potential)	500V	1000V	1000V
Magnetic Field (50Hz)	1 Am^{-1}	3 Am^{-1}	30 Am^{-1}

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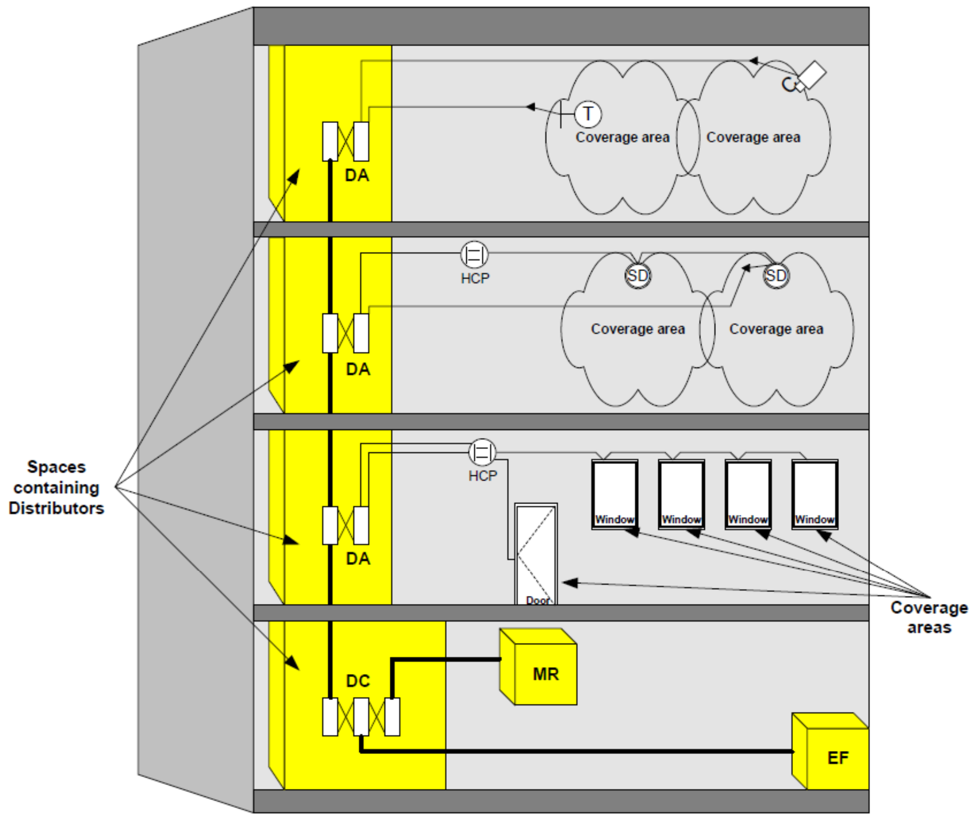
Building Automation Systems – ANSI/TIA-862-A

- The standard establishes a structure for BAS cabling based on the generic cabling system structure in ANSI/TIA-568-C.0.

- The elements of a BAS cabling system structure are listed below.
  - Cabling Subsystem 1, Cabling Subsystem 2 and Cabling Subsystem 3
  - Coverage area (space containing equipment outlets)
  - Telecommunications room (TR) or common telecommunications room (CTR) (space containing Distributor A, Distributor B or Distributor C)
  - Equipment room (ER) or common equipment room (CER) (space containing Distributor A, Distributor B or Distributor C)
  - Entrance facilities (EF)
  - Administration

Building Automation Systems – ANSI/TIA-862-A

ANSI/TIA-862-A



LEGEND

EF	Entrance facility
DA	Distributor A
DC	Distributor C
HCP	Horizontal connection point
MR	Mechanical room
MC	Main cross-connect
SD	Smoke detector (a BAS device)
T	Thermostat (a BAS device)
◂	Equipment Outlet
(camera symbol)	Camera (a BAS device)

BAS using a star topology

Summary

- Considerations for reduced twisted pair Ethernet (RTPGE) for industrial and building automation applications and other sensor based network applications.