

# Cabling in non-automotive applications

IEEE 802.3

10 Mb/s Single Twisted Pair Ethernet  
Study Group

Bernd Horrmeyer

Phoenix Contact GmbH & Co.KG

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# Typical Applications



Factory Automation  
Building Automation  
Energy Generation and Distribution  
Process Automation



# Typical Topologies

Source:  
IEC 61918 Industrial communication networks - Installation of communication networks in industrial premises

## Fieldbus, RS485, CAN

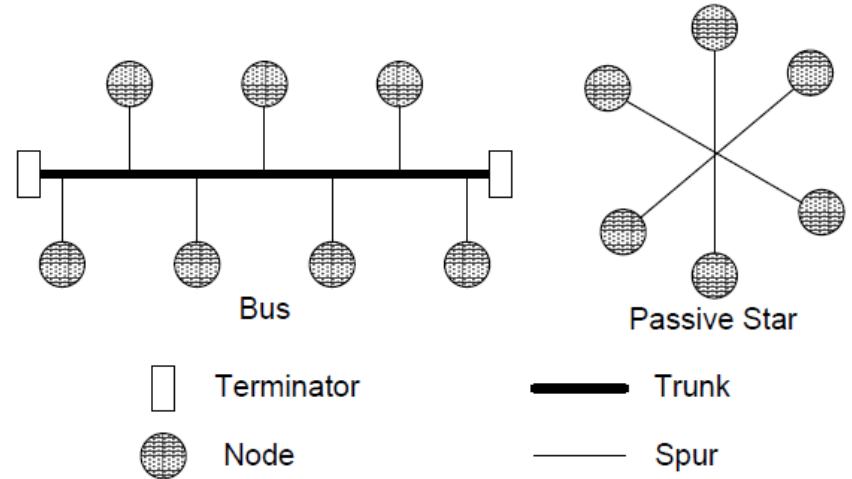
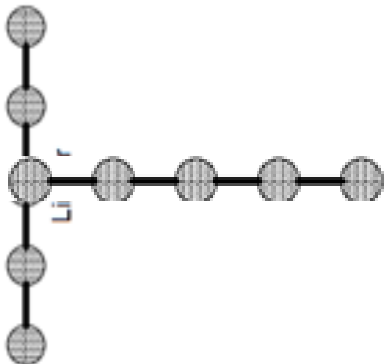


Figure 9 – Basic physical topologies for passive networks

Combinations possible



## Industrial Ethernet

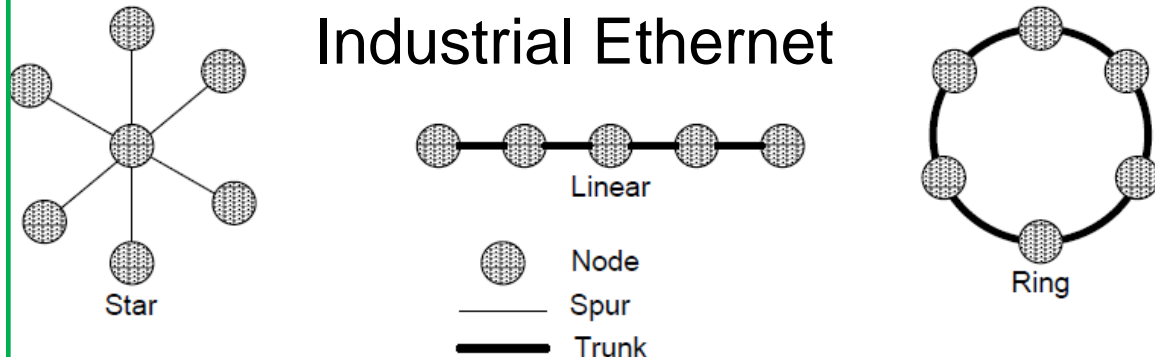


Figure 10 – Basic physical topologies for active networks

# Typical Installation Practices



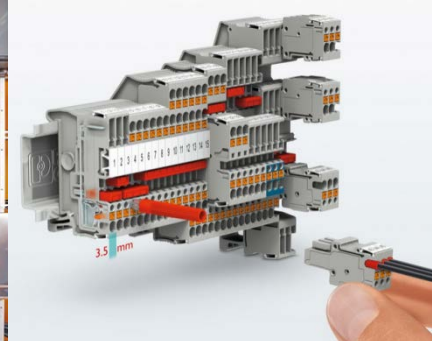
Cabinet



Field



Junction  
Box



# Migration theory

Now

## Fieldbus

Deterministic by  
protocol

## Ethernet 100BASE-TX

Deterministic by  
proprietary protocol  
enhancement

Future

**Deterministic Ethernet  
by 10SPE & TSN**

Ethernet at all  
Standardized  
Easy and cheap  
cabling

# Typical Cabling

## Routing

Passive Bus mostly with junction at the device / 2 ports at the device

Active topologies from device to device / 2 ports at the device

Trunk and spur cabling from DCS to device

=> Device-to-Device cabling is common

## Maximum Length

Factory 100m with Ethernet, 300m with Fieldbus

Building 300m

Process and Energy 1000m

## Cable types

Ethernet Cat5e, shielded or unshielded with advanced TCL, AWG22to26

Fieldbus 1to3 twisted pairs, shielded or unshielded, 100to120Ohms,  
~0,25mm<sup>2</sup>, signal integrity rudimentary specified

Digital/Analog cabling with trunk and spur, telephone grade pairs,  
0,25to0,75mm<sup>2</sup>, signal integrity not specified

# Typical Cabling

## Connectors

Ethernet with RJ45, ruggedized RJ45, M12-D or M12-X

Note: RJ45 causes sometimes problems in terms of reliability and space

Fieldbus with DSUB, M12 (twist and shielding neglected), Terminal blocks (twist and shielding less neglected)

Digital/Analog with terminal blocks (twist and shielding less or not neglected)

## Termination techniques

Pre-assembled patchcords with IDC or crimp

Ethernet field termination with IDC

Fieldbus field termination with screws or springs

Digital/Analog termination with screws or springs

# Conclusion

## Challenges

Different application areas

Different topologies

Different length

Different cable types

Signal integrity often not described or neglected

Power supply with 24VDC, 24VAC, 48VDC

## First working-hypothesis

Topology star, line, ring, branch with point-to-point channel

Cabling length 15m inside cabinet, 300m for factory and building, 1200m for process and energy

Cable quality Cat3, with and without shielding

## Proposal for next steps

Determine the necessary signal integrity parameters

Gather parameters and data from guidelines and standards

Measurement program for unknown data



Thanks for your attention

Bernd Horrmeyer  
Phoenix Contact GmbH & Co.KG  
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