

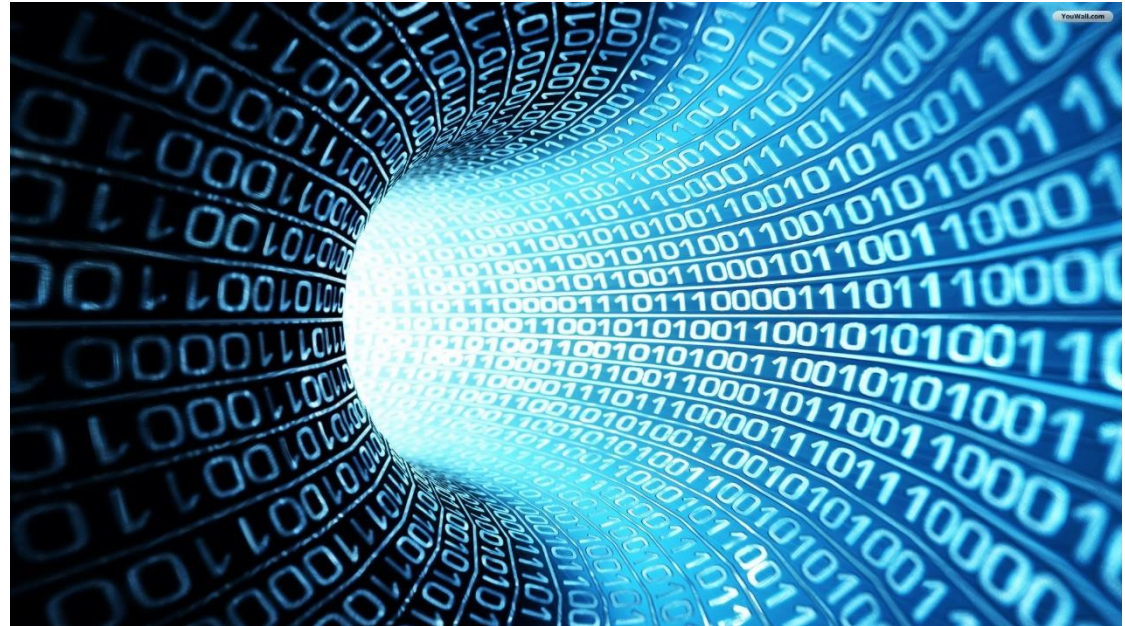
Digital Communication Protocols

Kalle Sandvik

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Why digital communication?

- Get rid of unneeded A/D D/A conversions
 - Loss of precision
- More tolerant to noise
- Error detection



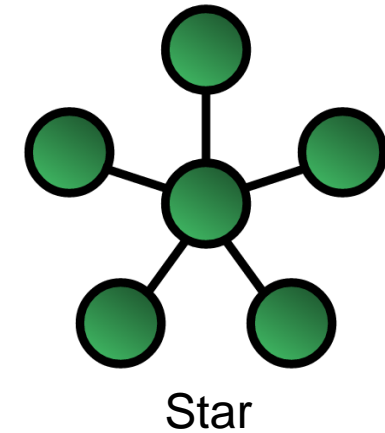
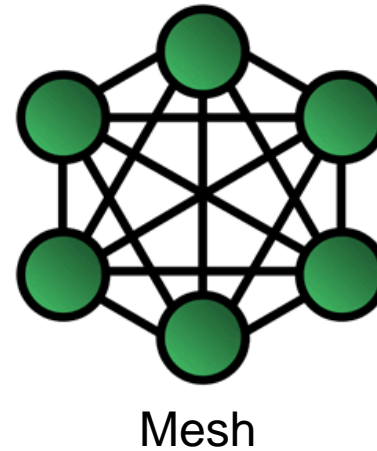
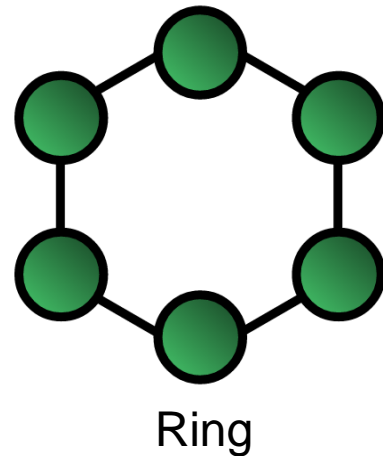
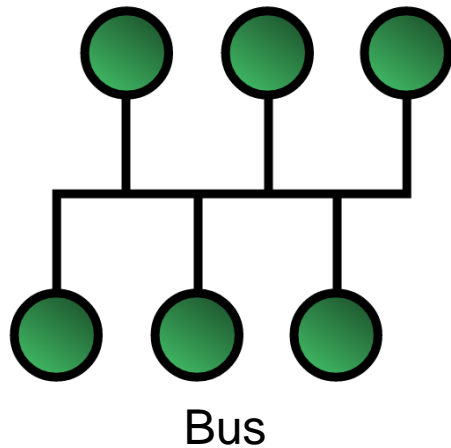
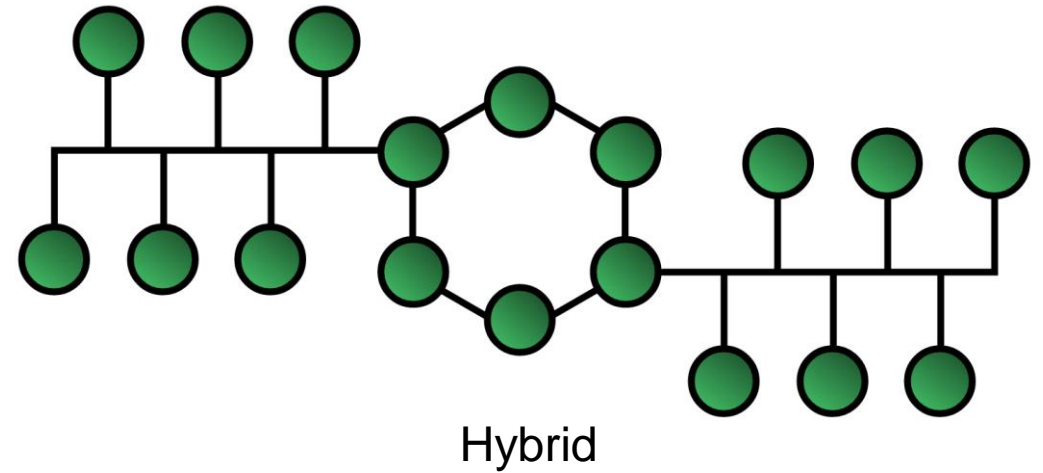
Choosing a protocol

- Network topology
- Communication model
 - Peer-to-peer, master/slave, client-server, multimaster
- Communication speed
- Maximum number of devices
- Maximum wire length



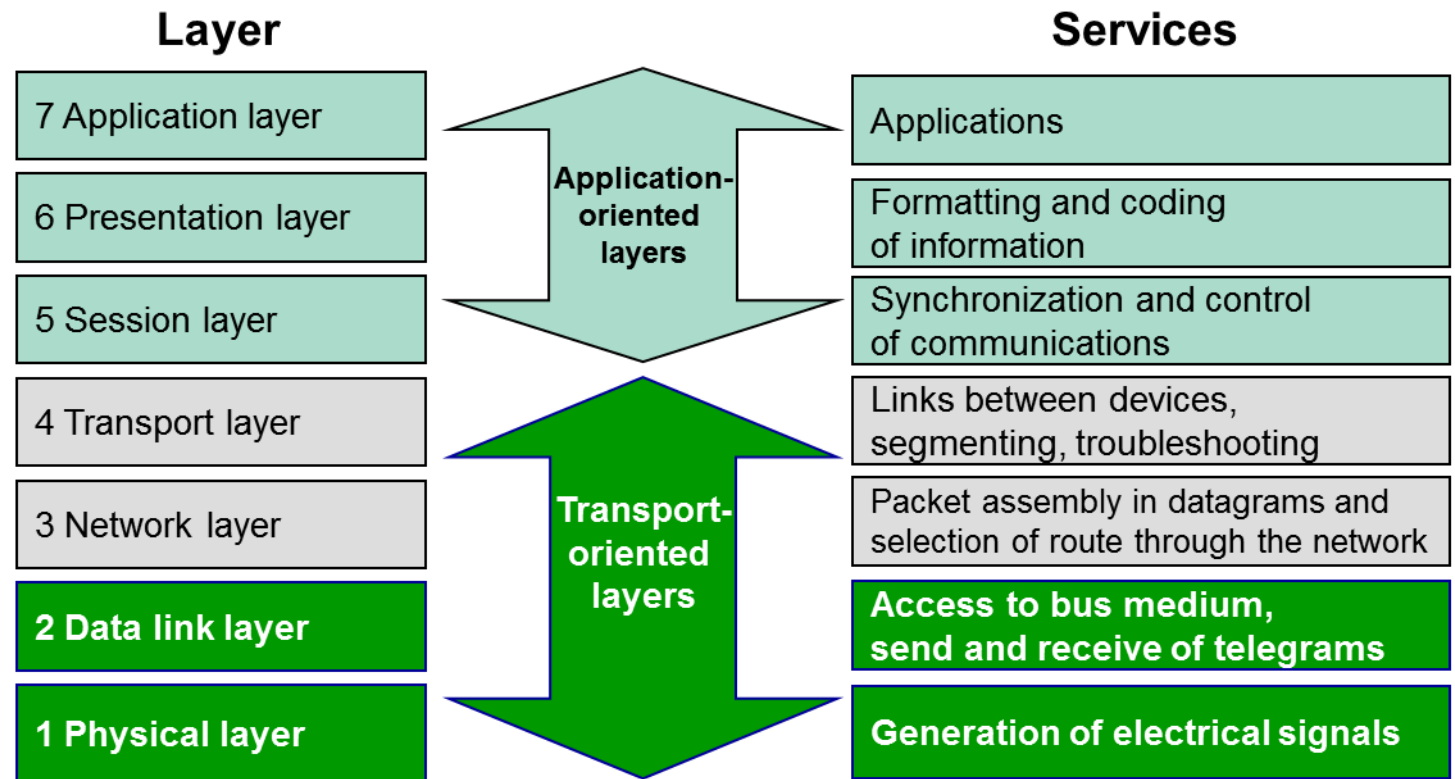
Network topologies

- Impact on wiring costs, robustness and troubleshooting



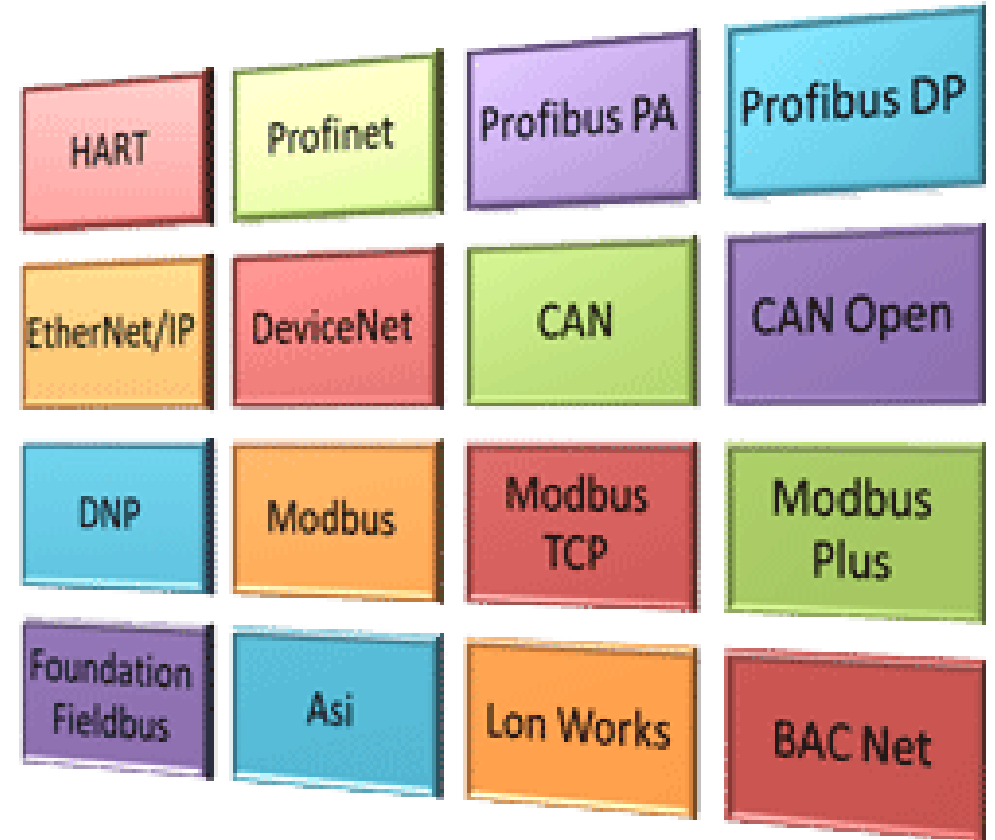
OSI model

- Open System Interconnection model
- Standard for information exchange between systems
- Not a protocol, but a framework for defining protocols



Fieldbuses

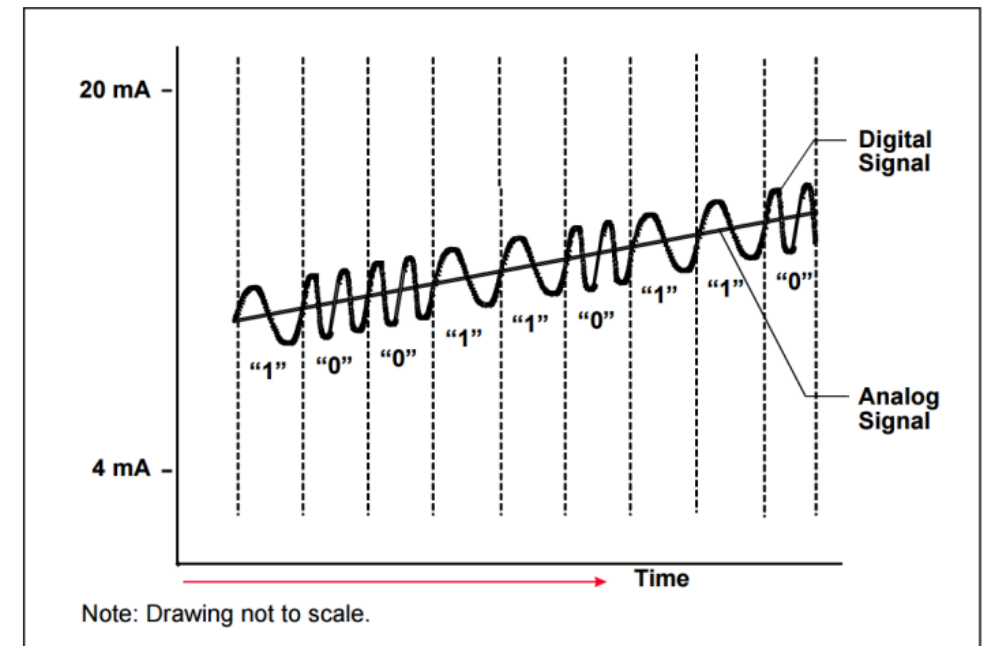
- Industrial computer network protocols
- Distributed control systems
- Usually implement only application, data link and physical layers of the OSI model



Highway Addressable Remote Transducer (HART)



- Digital signal modulated on top of analog 4-20 mA
 - Backward compatible
- Frequency Key Shifting (FSK)
 - Does not modify analog signal
- Low transmission rate
 - 2-3 times per second



Foundation Fieldbus

- Two level architecture, H1 and HSE
 - H1 32.5 kbit/s, HSE 100 Mbit/s
 - HSE connects H1 segments
- HSE acts as backbone for the bus
- Standard ensures compatibility between devices from different manufacturers



Profibus



- Designed for process automation and factory manufacturing
 - For time-critical applications
- Three versions for different purposes
 - Decentralised Peripherals (Profibus DP)
 - Process Automation (Profibus PA)
 - Fieldbus Message Specification (Profibus FMS)

Modbus



- Industrial de facto standard
- No formal certification
 - Responsibility of the manufacturer that their device can communicate with other Modbus devices
- Describes how to access information and respond to queries
- Fixed and user selectable characteristics
 - Fixed: frame format, frame sequence, error handling
 - Customizable: transmission medium and characteristics

CAN Bus

The word "CAN" is written in a large, bold, green, sans-serif font.

- Controller Area Network
- Developed in the automotive industry
- Standardized by ISO
- Bus access controlled by message priorities
- Easy to configure
 - Devices are not assigned an address

Conclusions

- Plethora of communication protocols
- Need to find comparable characteristics
 - Determine requirements for use case