LONMARK® INTERNATIONAL

Disrupting Technology with a 100-Year Building Automation Control Network

100 Year Building

Build to ***Last***!

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Disruptive Technology

- *Sustainable Infrastructure*
- *Proven Technology*
- *Upgrade not Obsolete*

Past 100-Years

1920 – Pneumatic Relay (First Open Protocol)

1930 – Electromechanical Relay

1940 – Logic

1950 – Transistor

1960 – Integrated Circuit

1970 – Microprocessor

1980 – Direct Digital Control

1990 – Distributed Control (peer-to-peer)

2000 – Open Protocol

2010 – Cloud Based Data and Control

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Disrupting Technology

Change is a ***Constant***!

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Next 100 - Years

Where Does
the next 100-Years
Take Us?

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Control Networks

- Look at Past to Learn for the future.
- Seen an Electronics Revolution.
- Gone from Air to the Cloud.

So what do we learn form the Past?

Capital Property

Control Systems are *Capital Property* not Personal Property

Meaning: The Control System has to last!

Replacing/Upgrading: 3 - 5 years not acceptable

Life(Hardware & Software): 15 - 20+ years minimum

Infrastructure

Infrastructure Key to Long-Term Sustainability

1) Physical Media
2) Communication Capability

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Physical Media

1) Electrical – Copper Wire
2) Electro-Magnetic – Radio Frequency
3) Light - Fiber Optic

Electrical – Copper Wire

2-Wire (1 pair)

- RS-485
- EIA-709.3 (Free-Topology, FT)
- Power Line (50/60 Hz)
  - HD-PLC, HomePlug

8-Wire (4 pairs)

- IEEE 802.3 (Ethernet)

Radio Frequency

IEEE 802.11 (Wireless Local Area Networking, WLAN)

- Wi-Fi

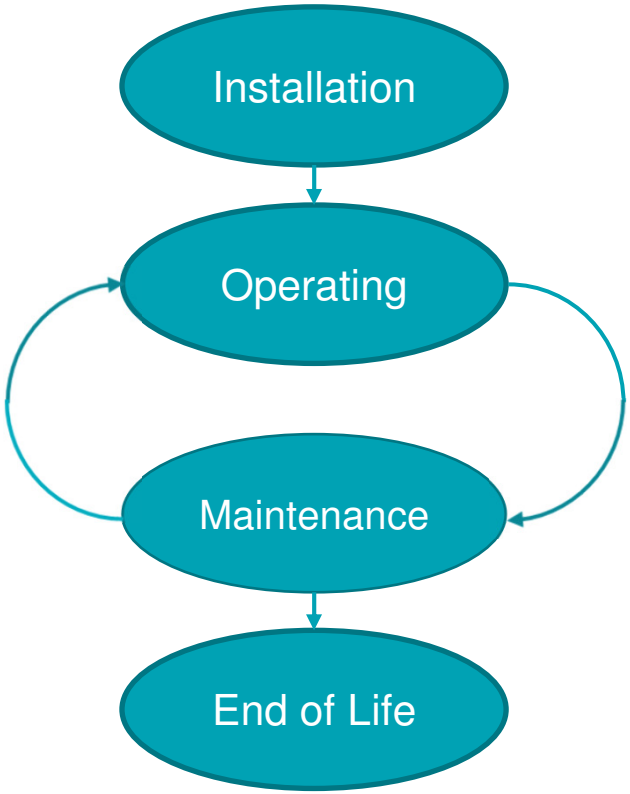
IEEE 802.15 (Wireless Personal Area Networking, WPAN)

- Blue Tooth

-ZigBee, Thread (Mesh Networks)

Cost of Ownership

- Installation
- Operating
- Maintenance
- End of Life

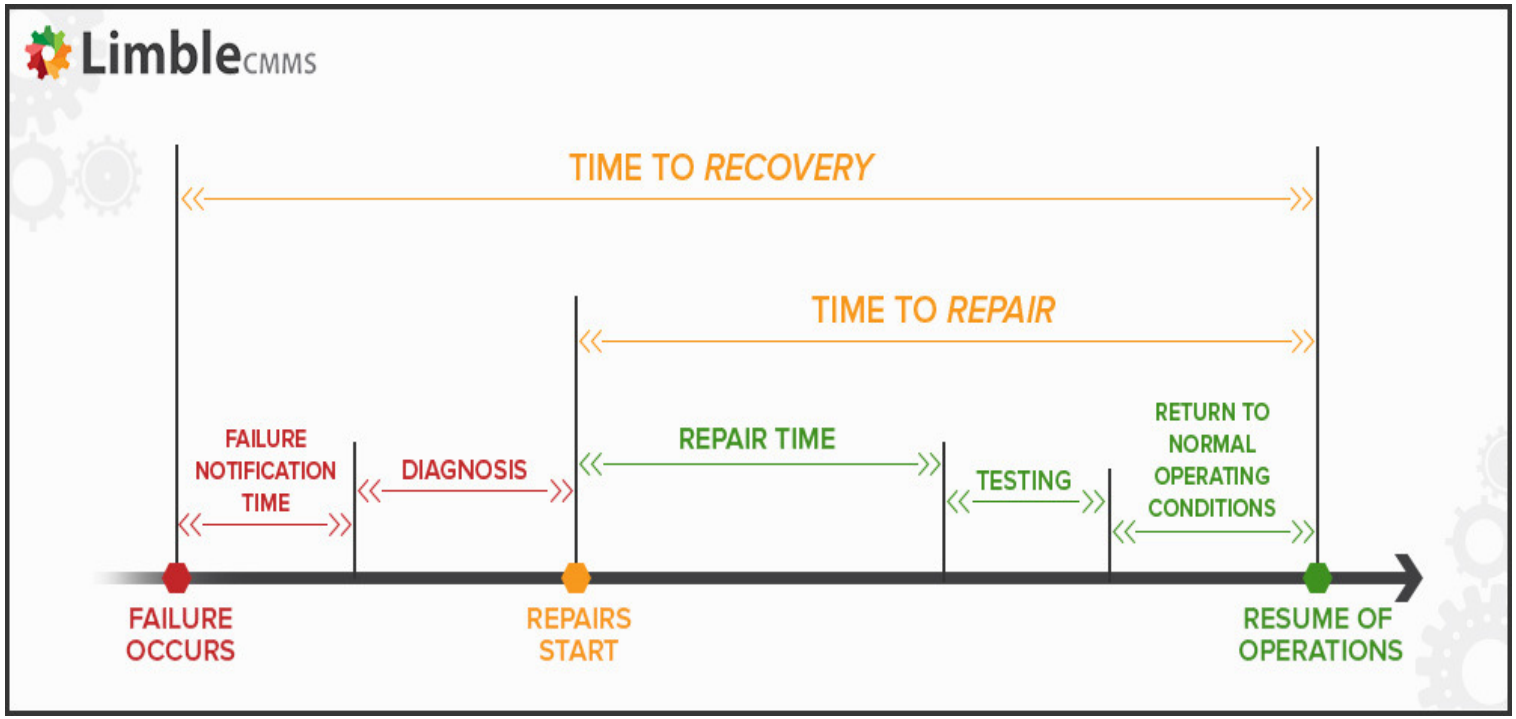


Reliability Metrics

Equipment will fail:

1) MTTR (Mean Time To Repair)
2) MTTR (Mean Time to Recovery)
3) MTBF (Mean Time Between Failure)
   For Repairable Products
4) MTTF (Mean Time To Failure)
   For Non-Repairable Products

MTTR



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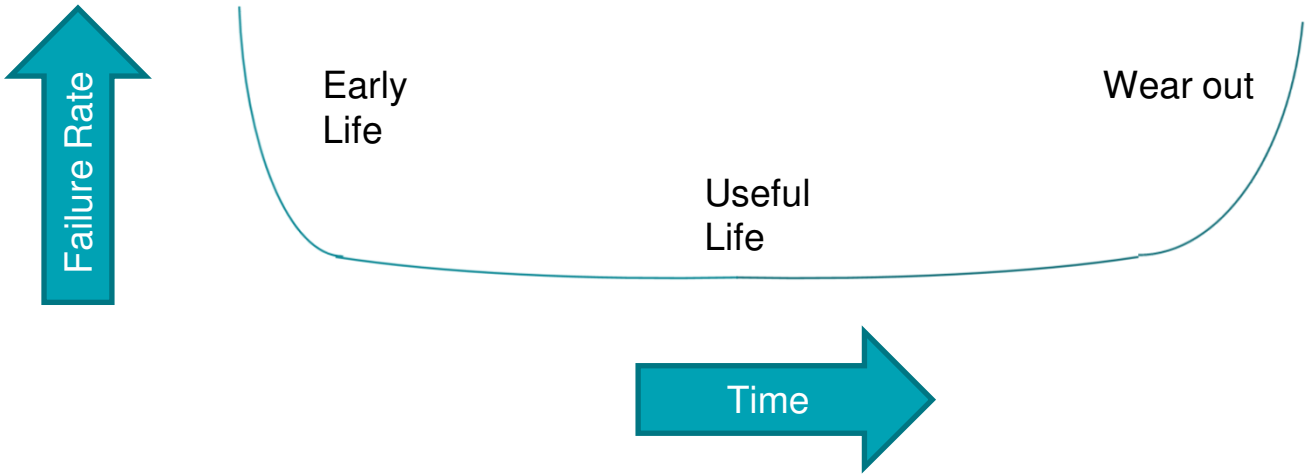
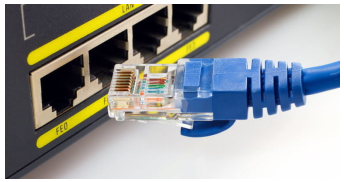
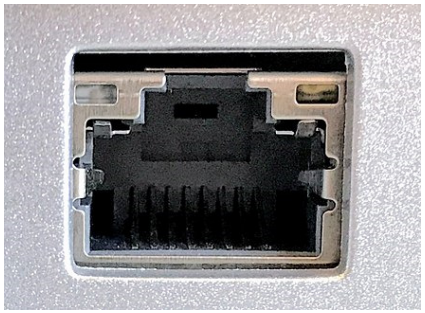
MTBF

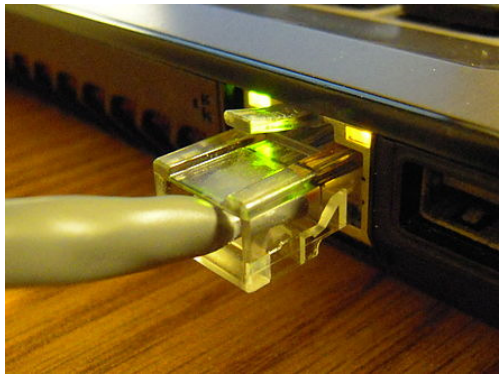
$$\text{MTBF} = \frac{\text{total operational time}}{\text{total number of failures}}$$



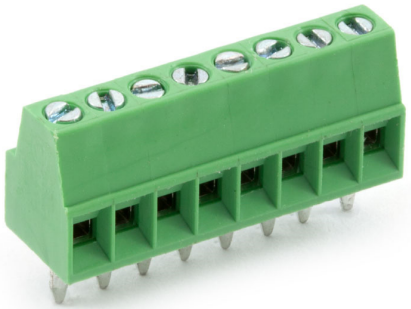
RJ45 Connection

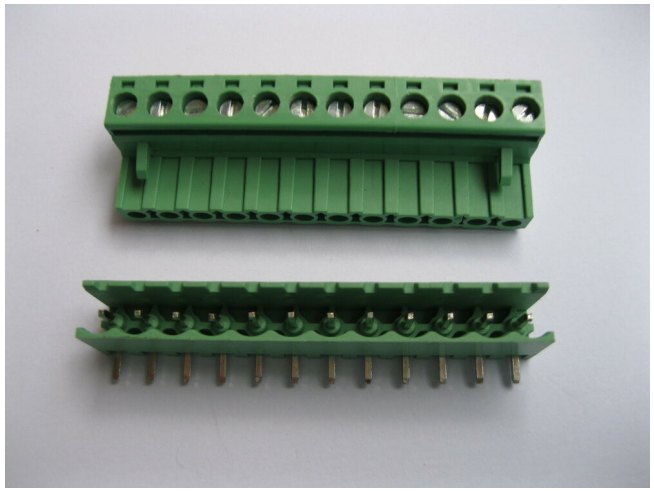






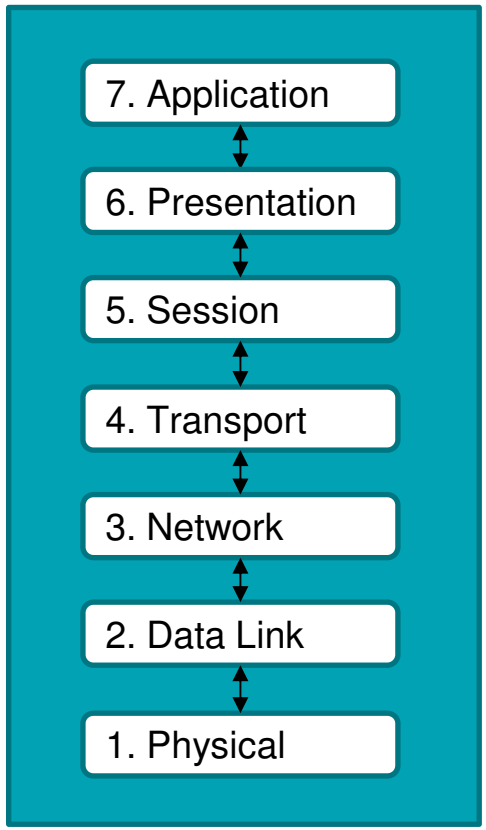
RJ45 Connection



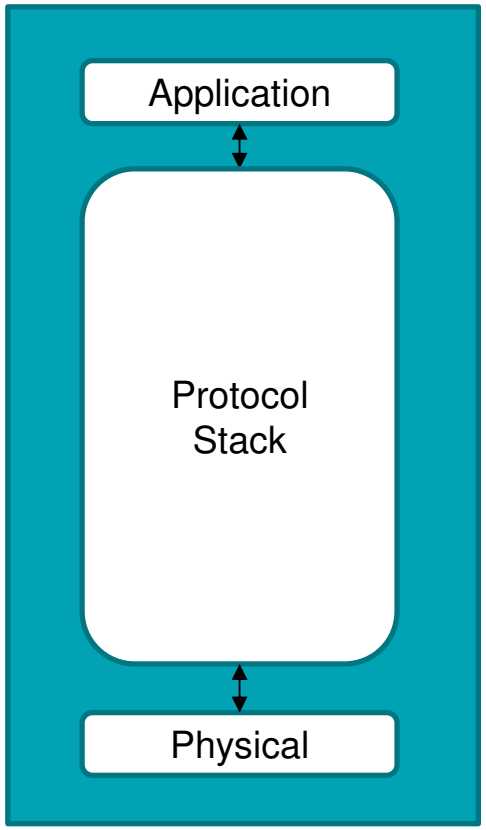


Communication

OSI Model



Protocol



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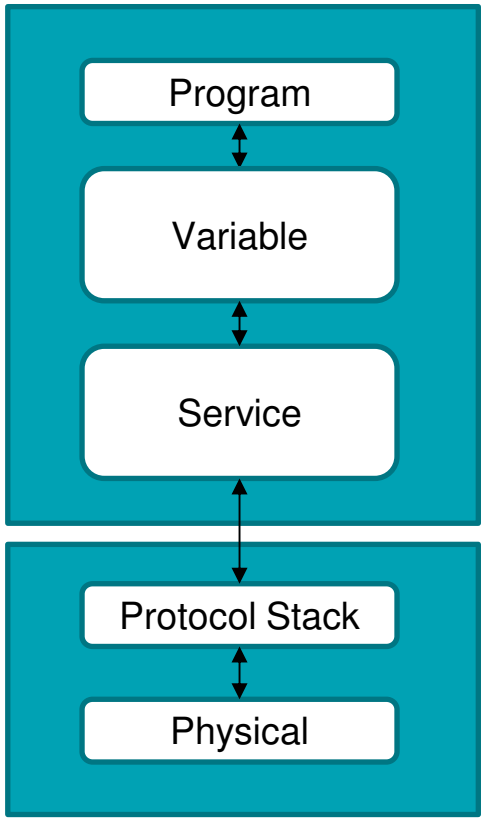
Application Variables & Services

Application



BACnet

Objects
Services

Modbus

Addresses
Services (Function Codes)

LonTalk

Network Variables
Commands

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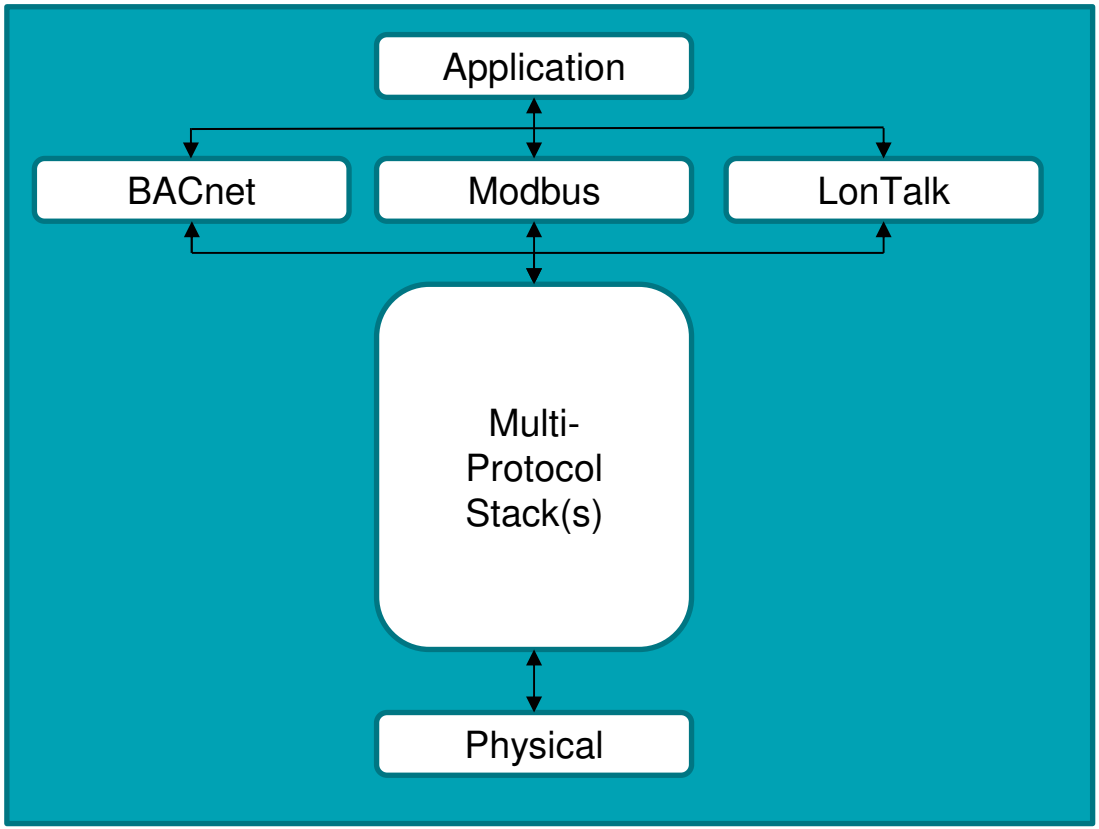
Multi-Protocol



Control Network Attributes

- Small Packets
- Lots of Packets
- No Single Point of Failure
- Noise Immunity
- Secure
- Peer-to-Peer

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Control Networks

1) Infrastructure that lasts
   - Copper Wiring
   - Connections
2) Field Proven Solutions
   - Cost Effective
   - Sustainable
3) Upgrade not Obsolete
   - Protocols

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Disrupting Technology

Questions?

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