Remote Monitoring

Jeff Done
Automation Engineer – Measurement, Control & Automation
Dominion Energy Utah/Wyoming/Idaho

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Outline:

1. Why Remote Monitoring?
2. Hardware.
3. Site Communications.
4. Remote Telemetry Model.
5. Data Access.
6. Operational Considerations.
7. IT and Cybersecurity.

Why Remote Monitoring?

- What are our goals?
  - Data collection: flow, pressure, temperature, etc.
  - Alarming
  - Control
  - Security

Why Remote Monitoring?

- How often do we need the data?
  - Log data
  - Real time
  - Quasi real time

- Who needs the data?
  - Operations
  - Gas Control
  - Engineering

Hardware – Electronic Data Recorder

- Useful for data logging
- Typically, not real time
- Less expensive
- Allows local or remote access

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Hardware – Flow Corrector

- Records and corrects flow
- Quasi real time
- Less expensive than RTU type options
- Allows remote measurement data collection

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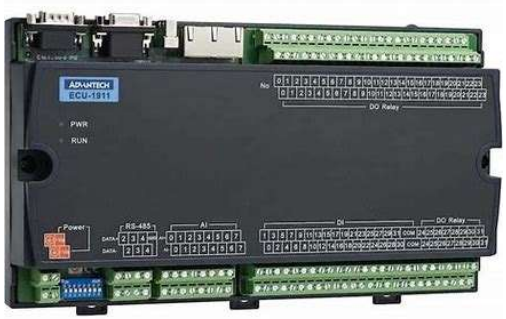
Hardware – Remote Terminal Unit (RTU)

- Can record flow, pressure, temperature, etc.
- Real time
- More expensive than other options
- Capable of simple control
- Some models are modular to handle more I/O



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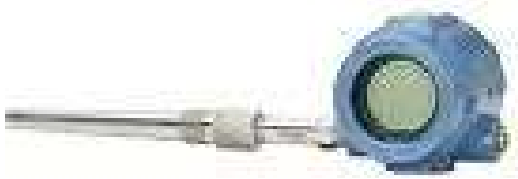
Hardware – Programmable Logic Controller (PLC)

- Can record pressure, temperature, etc.
- Real time
- Most expensive option
- Capable of advanced control
- Implemented at larger gate stations

Hardware – IO Devices

- Pressure transmitter
- Temperature transmitter
- Pushbutton / switch



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Hardware – IO Devices

- Ultrasonic meter
- Rotary meter
- Solenoid valve

Hardware – IO Devices

- Control valve
- Odorizer
- Gas detector

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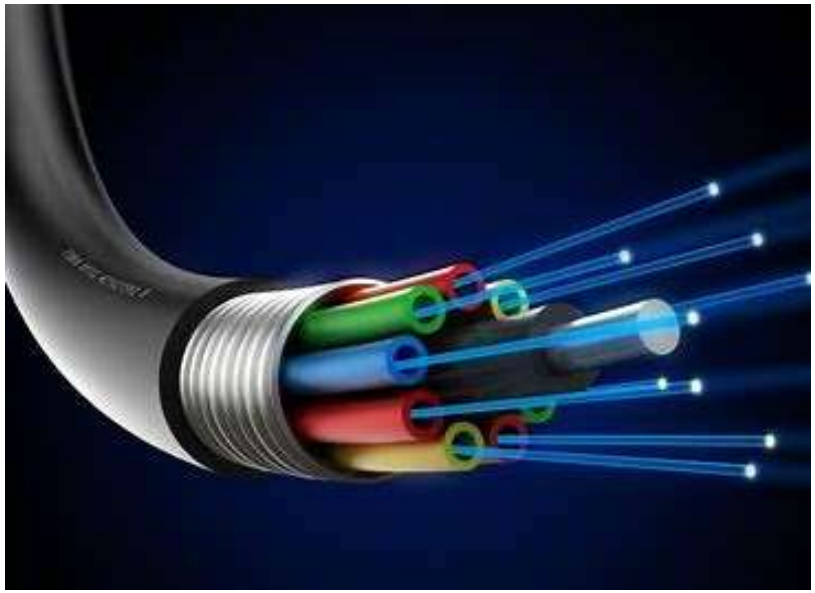
Site communications – Fiber Optic

- Fiber optic
  - Fastest option
  - Expensive
  - Relies on third party provider



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Site communications – IP Network

- IP Network – real time comms
  - BGAN / VSAT
    - Relies on satellite
    - Slowest IP option
  - Microwave
    - Relatively fast
    - Private company network
  - Cellular
    - Easiest to deploy
    - Subject to coverage issues

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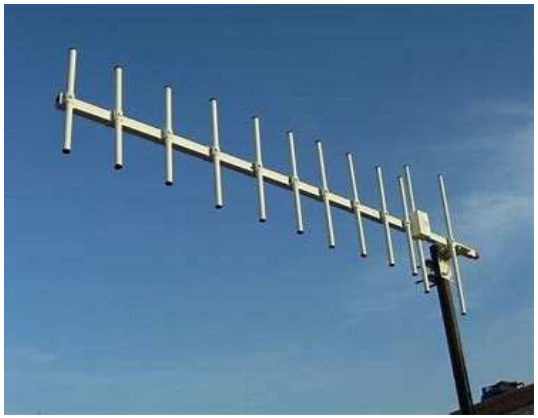
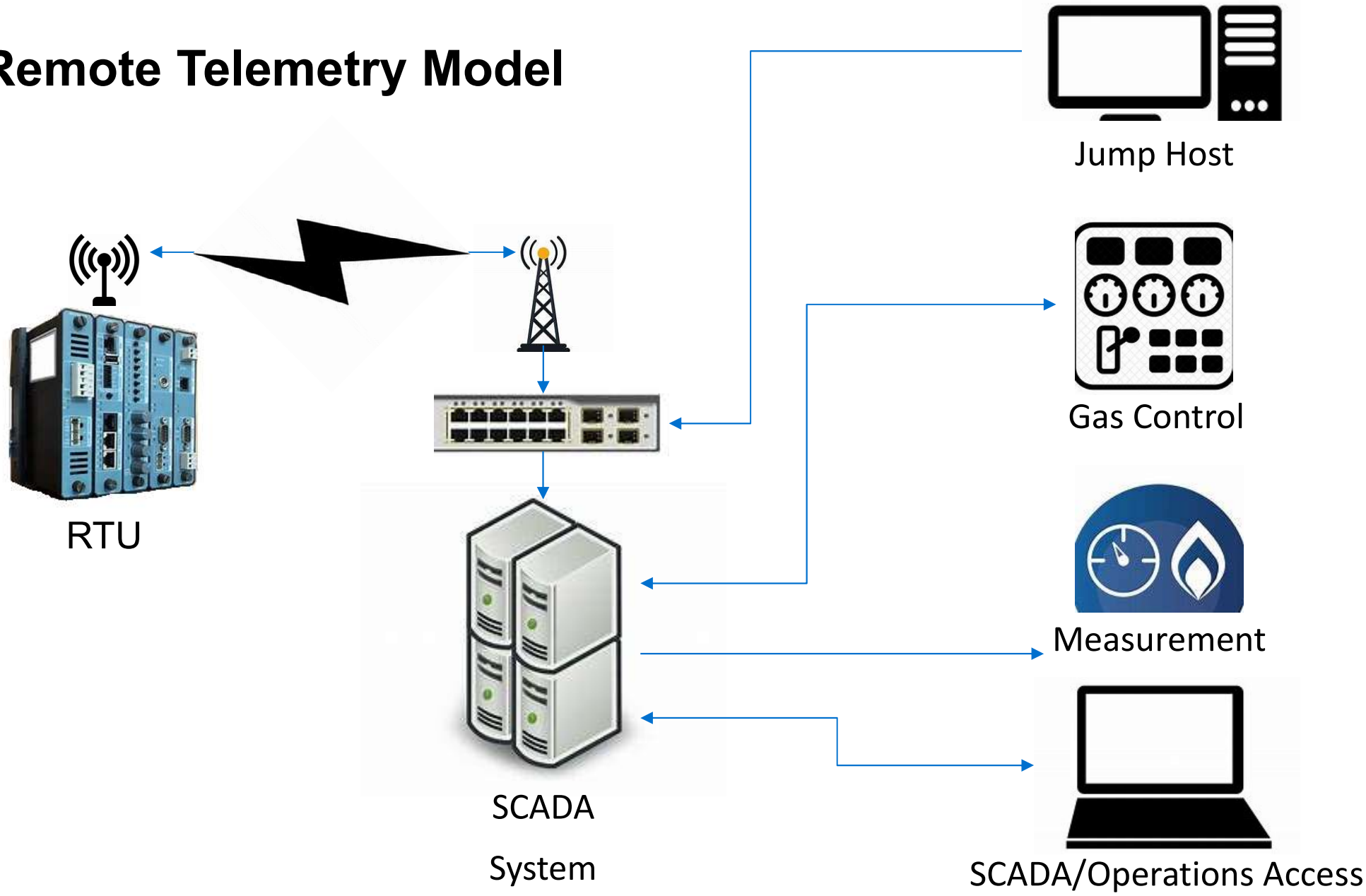
Site communications – Serial Radio

- Serial radio
  - Slowest option
  - Relatively inexpensive
  - Private company network
  - Still offers real time

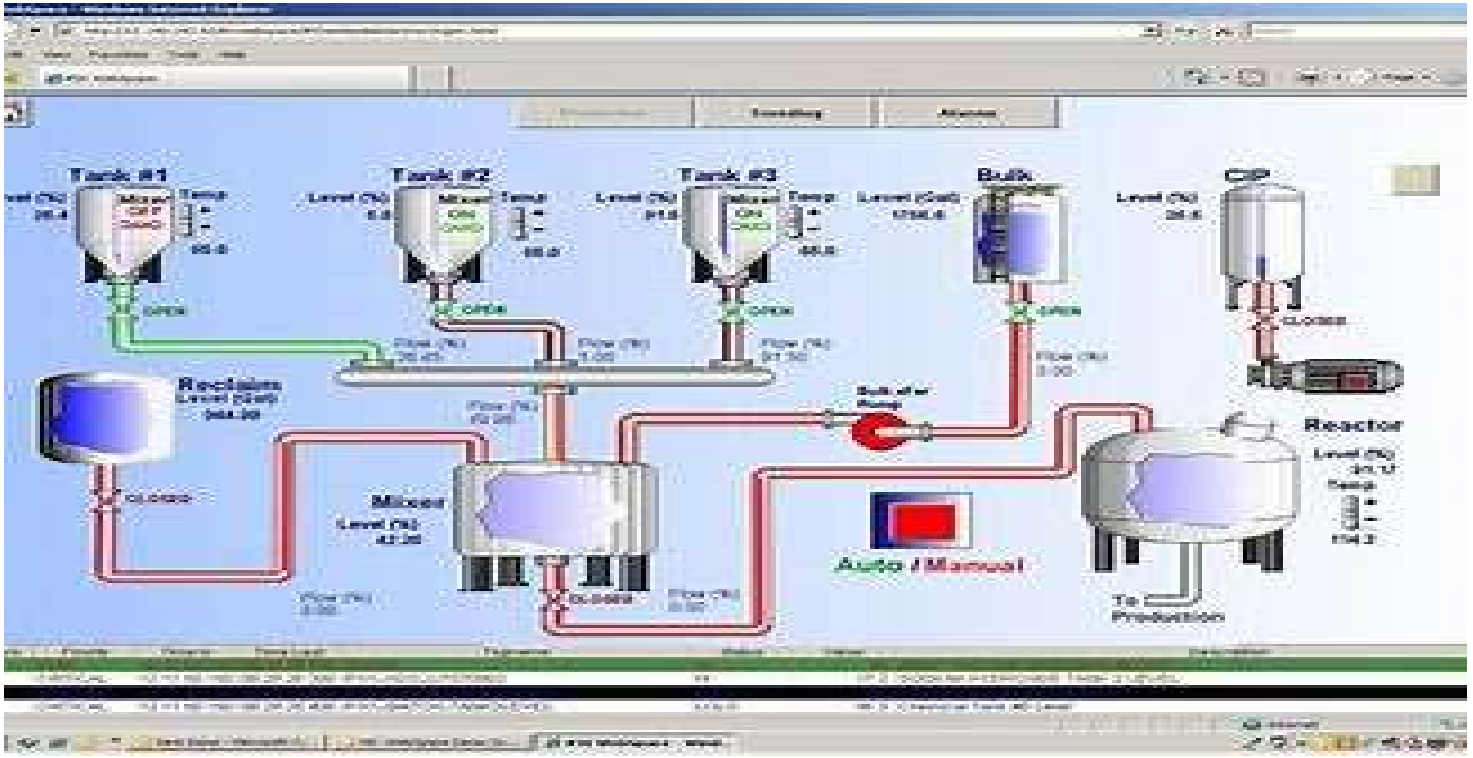


Remote Telemetry Model



Data Access

- Gas control – real time data and alarming



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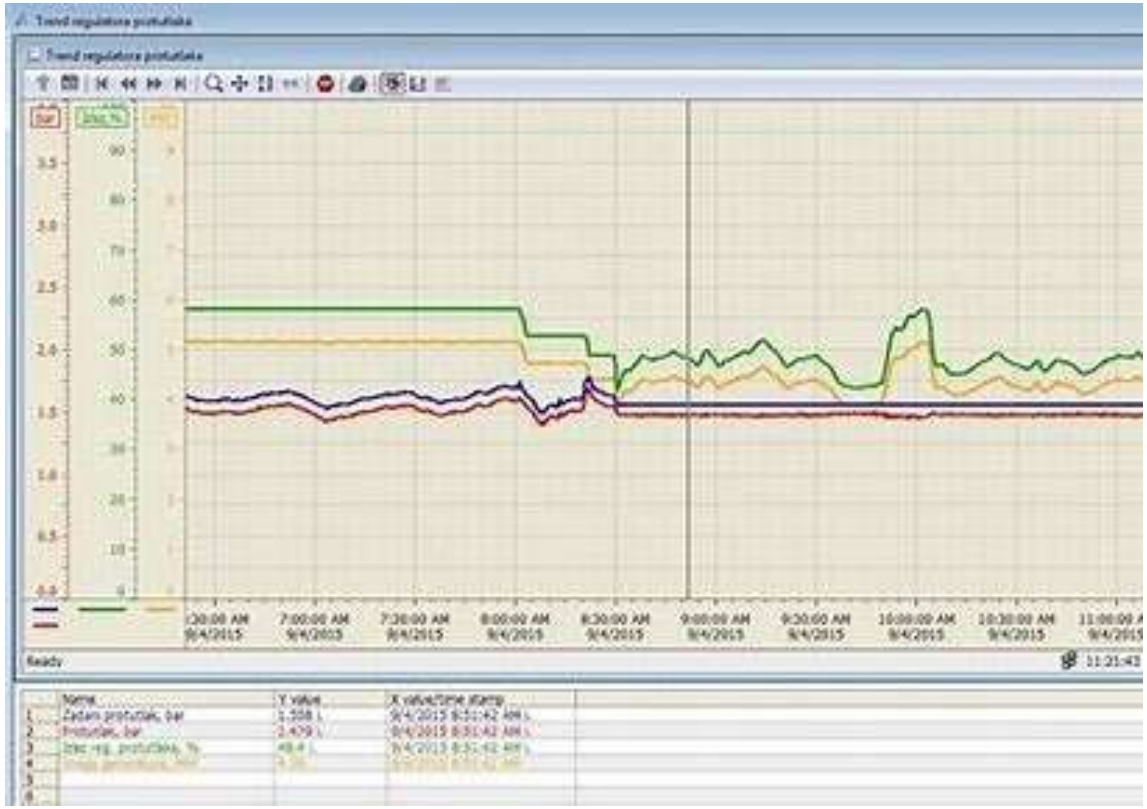
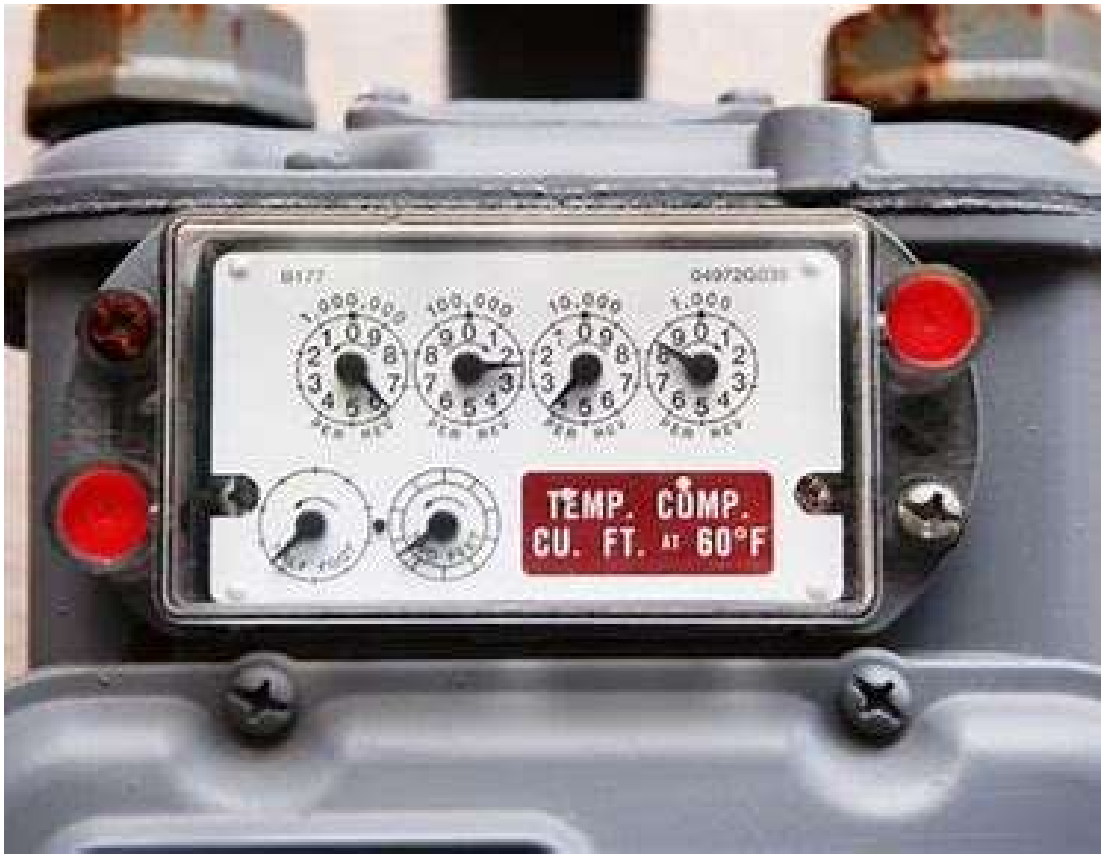
Data Access

- SCADA system - archive historical data



Data Access

- Measurement / billing – meter data



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Data Access

- Operations – remote access to field devices
- Engineers – data for system / project planning

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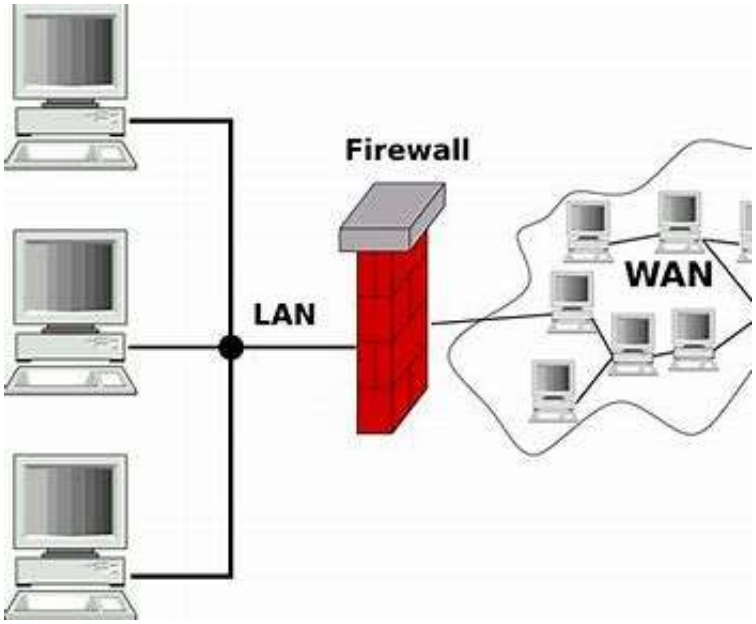
Operational Considerations

- Capital costs
  - Benefit vs Cost
  - Equipment life
  - Equipment quality vs Cost

- Ongoing maintenance
  - Replacement items (batteries, etc.)
  - Calibrations
  - Inspections

IT and Cybersecurity

- Network capable devices increase cyber risk
  - Physical security
  - User access
  - Network security



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Questions?