Components for a SCADA System

- Data Acquisition
- Data Transmission
- Data Processing/Presentation
- Data Delivery

Chapter 3
Overview of Topics

Communication Requirements
Plus other considerations

Communication Media

Architecture & Topology

Communicating the Data
- Protocols
Considerations That Shape Requirements

- New Site or Refurbishment
- Greenfield
- Life extension
- Brownfield

- Life span of equipment
- In house expertise
- Documentation
Data Uses/Applications

- ICS
  - SCADA or PMU - 15 - 50 ms
  - Measurements from application to master control actions
  - Protective Actions responding to short circuits

- Communicate with end of line
  - Response time in subcycle class (less than 1/60 sec)

TX
DQ
Local
- Slower response due to slow operator that uploaded
- 1 sec

- Engineering Access
- Security
- Setting up updates
- Upgrading firmware
- Downloading logs

- Financial Information (real-time price)
- 15 min
- Power use for billing to monitor

- Bridge between 0.0 to 1.0
- Paper output
- User authentication
- Cybersecurity
- Also need different data formats for different access

- Protection data
  - moving from vendor specific to standardized

- SCADA - DNP3, MODBUS

- PMUs - some vendor formats
  - IEEE Standard

- Market

- Engineering access
  - SFTP
  - SSH
Resilience of Communication System

- Geographically Dispersed
  - Patchwork of communication media
    - ages of hardware
    - microwave
    - line of site
    - terrain
    - weather conditions
    - vegetation
  - Electromagnetic Interference
    - copper conductors
    - wireless

measurements
controls

utilities
vendors
ISO
neighbor utility
- power system events/storms
  \rightarrow\text{power line corridor}

- storms taking out common equipment

- Designing system to minimize disruption
Requirements

- Bandwidth → analog digital
  - Grown significantly over time
  - Early systems
    - 1200 Bits/s
      - Serial
  - Speed & latency - requirements by application

- Scalability → System with a substation
  - Within part of a transmission or distribution system
  - System wide for a utility
  - Regional
- Reliability - uptime is even high priority

- Security - cyber/physical security

- Will it operate correctly, be stable, and not make incorrect decisions?

- Affordability
Communication Media

- Wired (metallic conductors)
  → Becoming legacy equipment

  - Powerline carrier
    "high frequency signal over the power line
    (Different than broadband over power line)

  - Modulated copper wire (telephone)

  - Direct Digital over copper wire

  - Fiber optic
- wireless

- next time