SCADA or Industrial control system

- Collect data on the process
- Monitor health of process
- Improve performance
- Enhance efficiency
- Improve diagnostics
- Transmitted to controller
- Influence process
  - Human machine interface
    - Human operator
    - Monitor status of process
  - Data logging/Data Historian
Analog data $\rightarrow$ Digital

Analog to Digital Converter

What is measured?
- Power system
- Voltage
- Current
- Power
- Gas pipeline
- Flow rate
- Pressure
- Converted to
- Binary
- Case 8
- Case 16

Sample Interval

Z differs with process
Filtering

- 16 sample per period

→ useful information is below alias frequency (Nyquist frequency)

→ ½ of sampling rate

→ for 1600 samples/sec can track up to 800 Hz
- Low pass filter to remove high frequency response
Why use SCADA?
- Local control devices in the process
- Wide view of the process
- Integrate to work together
- Automate larger system
- Manage complex system with fewer operators
Evolution of Industrial Control Systems

- Built in house
  - Variety of communication schemes
  - Documentation?

- Early companies started developing products
  - Distributed controls
  - Energy management system
  - Remote Terminal Units
- Each had proprietary format
- Couldn't mix equipment from different vendors
- More discrete, hardwired, less flexible
- Components
Transmit DATA

process measurement

Local HMI

magnitude, angle
RTUs

- Open/Non-proprietary
- Standard protocols
- Organizational standards
- Modbus - de facto standard
- DNP3
- New standards
- IEC 61850

Distributed networks, measurement, control/data, substations, Lims, comm., oper. center