Basic SCADA for Operators

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Richmond
Geographical and Infrastructural

- Average elevation 1 meter above sea level
- Waste water, drainage water and fresh water infrastructure below sea level
Presentation Outline

1. What is SCADA?
2. Benefits of SCADA
3. Core Components of a SCADA System
4. Communications and Networks
5. Security
What is SCADA?
SCADA

• **Supervisory Control And Data Acquisition**
  • This is a scalable, distributed measurement and control system
  • In our case, to monitor all City utility infrastructure which includes Sanitary, Drainage, and Water Pressure Reducing Valve (PRV) stations

• IT or OT – “Operational Technology”

• Industrial Process Control and Monitoring
  • Oil and Gas
  • Manufacturing
  • Food and Beverage
  • Energy
  • Transportation
  • Water and Wastewater
Pump Station Monitoring

RED LIGHT FLASHING?
PLEASE CALL OUR EMERGENCY NO. IMMEDIATELY.

2019 BCWWA SCADA & IT WORKSHOP
Benefits of SCADA
Benefits of SCADA

• System monitoring and remote control of infrastructure
  • Alarms/Events Processing and Management
• The ability to collect quality information anywhere in your system infrastructure no matter how far it is!
  • Status and Sensor information from pumps, levels, power, water quality, and faults
• Historical data collection
• Data Analytics
(cont.) Benefits of SCADA

• Increased efficiency and productivity
• Reduced operating cost
• Reduced overtime and callouts
• Process forecasting
• Troubleshooting and preventative maintenance
Historical Processing – I&I
Historical Processing – Weather Events
King Tides and Storm Surge
Analytics – Predictive / Forcasting
Video
Core Components of a SCADA System
Core Components of a SCADA System

- Field Instrumentation or Devices
- Controllers
- Communications
- SCADA Host
Field Instrumentation or Devices

- Digital or Analog
- Input or Output
Controllers

- PLC vs. RTU

- Control or Communication?
Programming

IEC-61131

- Ladder Diagram
- Instruction List
- Function Block Diagram
- Structured Text
- Sequential Function Chart
Communications

Wired Communications:
• Ethernet
• Serial
• PSTN
• Fibre-optic

Wireless Communications:
• Radio
• Cellular
• Satellite
• WiFi
## Communications Comparison

<table>
<thead>
<tr>
<th></th>
<th>Initial Investment</th>
<th>Monthly Cost to Operate</th>
<th>Bandwidth</th>
<th>Resiliency / Reliability</th>
<th>Coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radio</td>
<td>High</td>
<td>Very Low</td>
<td>Low - High</td>
<td>Very High</td>
<td>Limited (by line of sight or transmit power) to Good</td>
</tr>
<tr>
<td>Cellular</td>
<td>Medium</td>
<td>Low-Medium</td>
<td>High</td>
<td>Low*</td>
<td>Dependent on service provider coverage</td>
</tr>
<tr>
<td>Satellite</td>
<td>Medium</td>
<td>Very High</td>
<td>Low - Medium</td>
<td>Medium</td>
<td>Good with sky view</td>
</tr>
<tr>
<td>Fibre Optic</td>
<td>Very High</td>
<td>Very Low</td>
<td>Very High</td>
<td>High</td>
<td>Good for backhaul and hubs</td>
</tr>
</tbody>
</table>

*wait until 5G!
SCADA Host, HMI, Historian
Traditional vs. High Performance HMI
Traditional vs. High Performance HMI
Traditional vs. High Performance HMI

Figure 2: Analog depiction of information
Dashboards
Dashboards on Mobile Device
Dashboards on Mobile Device
Alarm Notification and Management

• Too much, Stale, Chattering and Nuisance Alarms
• Keys to an effective Alarm Management:
  • Alarm Definition
  • Alarm Priority
  • Alarm Tracking
  • Accountability
Historian

- Minimal disk space
- Quick data retrieval
- “Big Data” Analytics
Data Logging

Toilet Flushing (Game 1)
Richmond Centre Water Pressure

- Pressure April 10, 2007 (24Hr Before)
- Pressure April 11, 2007 (Game 1)

Key Times:
- 22:20 End of OT1
- 23:09 End of OT2
- 23:53 End of OT3
- 0:34 End of OT4
Communications and Networks
Network Architecture

• Monolithic
Network Architecture

• Distributed
Network Architecture

• Networked
Wireless Radio Network

- De-centralization of radio network
  - Not to have “all your eggs in one basket”
  - Creating “cells” or segments
  - Robustness and Resiliency
  - Utilizing Backhaul Radios
  - Radio Management Software
Security
Modern SCADA System Features

- Remote Access
- Web-based Clients
- Mobility
- Inter-organization demand for SCADA Data (MMS, GIS, etc.)
- Cloud Computing
SCADA Site

- Signage
- BFL - Big Front Locks
- Alarm and Access Control
- Video Surveillance
Risks and Considerations

- Physical security
- Legacy components
- SCADA network <> corporate network
- Default out-of-the-box user credentials
- SCADA Host access to the internet
- Employee transition protocol
Thank You!
Questions?