

Implementing an IP radio communications solution to achieve improved operational efficiency and enhanced diagnostic capability at remote facilities

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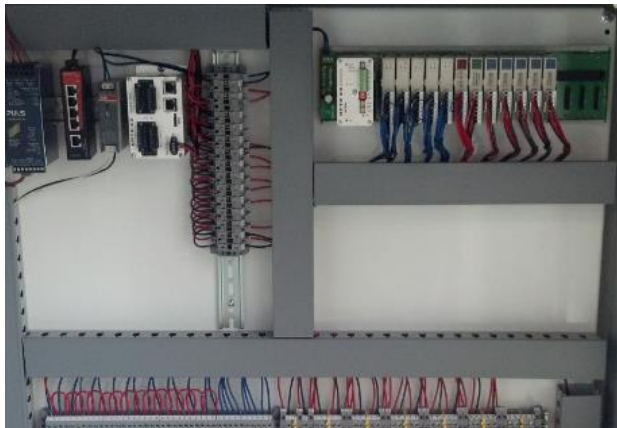
IP Radio Implementation

- **Previous communications / Diagnostics**
 - 130 Remote facilities communicating via 4800 baud digital radios
 - 27 land lines
 - A lot of local diagnostics
 - Limited critical status
 - Narrow band frequencies
 - Limited remote diagnostics
 - Couldn't always tell what device was causing problems



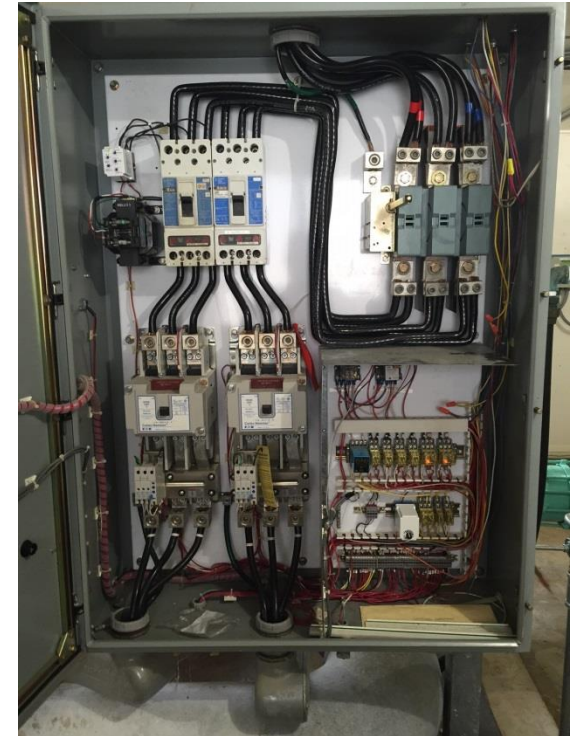
IP Radio Implementation

- **Facility equipment upgrades – VFD, PLC, HMI, etc.**
 - More diagnostic data
 - Communication protocols
 - Web server
 - Standardize on equipment - Standard data register location
 - MODBUS communication between devices.
 - Old radios needed to be replaced



IP Radio Implementation

- **Getting more complex**
 - Need for more analysis data
 - IIoT



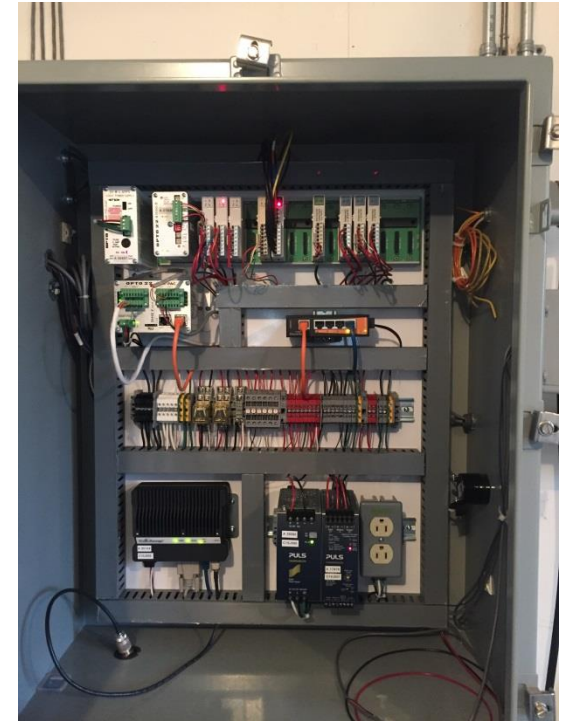
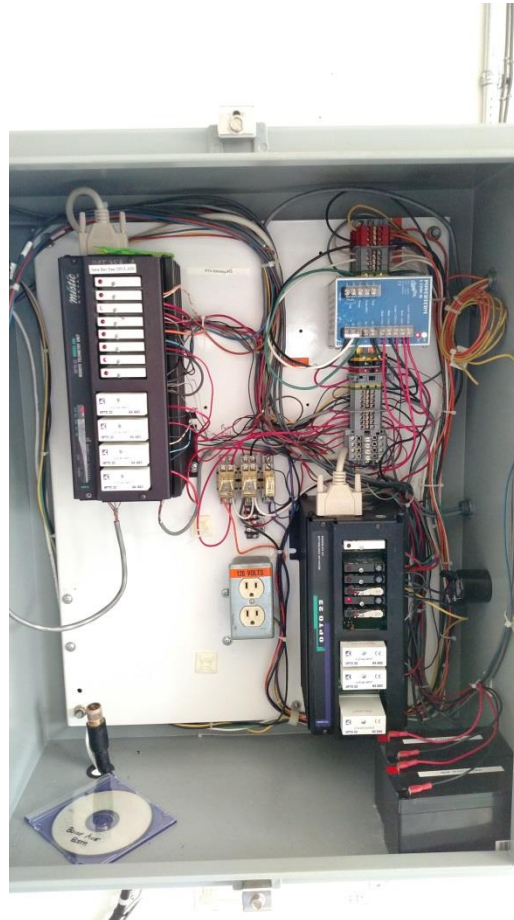
IP Radio Implementation

- **Selection of radio equipment**
 - Redundancy
 - Ease of replacement
 - Support
 - Common configuration and interface
 - Single or multiple units for redundancy
 - On air GUI, Telnet or both
 - Different models between frequencies
 - IP and serial
 - Alarm outputs to PLC
 - Encryption
 - Baud Rate
 - Multi-speed



IP Radio Implementation

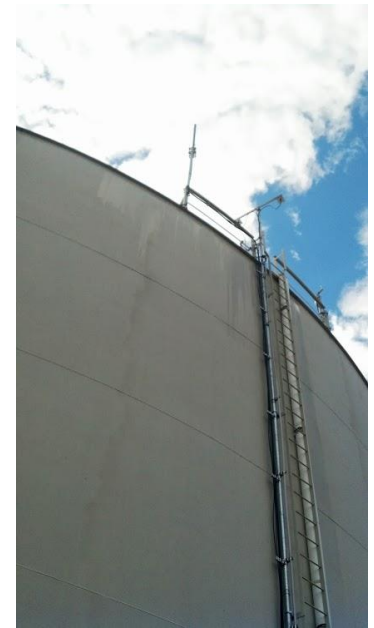
- **PLC capabilities**
 - Ethernet
 - Protocols
 - Interface



IP Radio Implementation

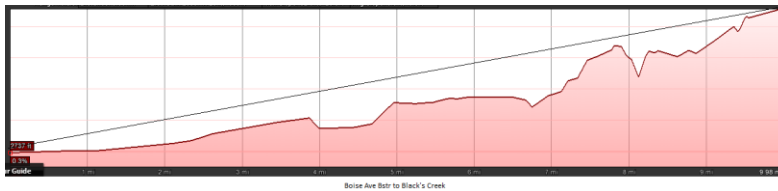
- **Antenna mounting limitations**

- Existing facilities
- HOA
- What is available?
- Local restrictions
- Facility maintenance
- Fall protection
- Own facility or rent
- Tower registration
- Antenna Relocation



IP Radio Implementation

- **Licensed and radio frequency issues**
 - Wattage Needs
 - Close proximity
 - Interference with others
 - Line of sight
 - Licensed or non-licensed
 - Area or per site license



IP Radio Implementation

- **In-house or contractors**
 - Tower climbs for antennas and cabling contracted out
 - Remote radio installation and configuration in-house



IP Radio Implementation

- **Radio change out planning**
 - Coordination with other departments
 - 15 - 30 radios on each frequency
 - Moved several facilities to other radio frequencies
 - Preconfigured and burned-in base, repeater, and remote radios
 - Premade cabling
 - Power supply upgrade
 - Trained in-house on radio and PLC changes needed
 - Prioritized sites for install order
 - Four technicians in field and one at SCADA



IP Radio Implementation

- **Control diagnostics**

- GUI vs Template
- Can catch problems earlier or while happening
- Configuration changes
- Program changes

Address	Parameter Name	Value
0xFFFF F030 0048	Always BootP/DHCP On Powerup	off (0)
0xFFFF F030 004C	Degrees F / C	C (0)
0xFFFF F030 0054	Comm Watchdog Time (msec.)	0
0xFFFF F038 0298	Out Of Range Value	0.000
0xFFFF F038 0054	Scanner Flays	0x0000
0xFFFF F030 005C	4-Channel Digital Scan Count	0
0xFFFF F030 0060	Analog & High Density Dig. Scan Count	0
0xFFFF F030 010C	Milliseconds Since Powerup	371780633
0xFFFF F030 0160	Elapsed Time Since Powerup (DD:HH:MM)	04:07:16
0xFFFF F030 0058	TCP Minimum RT0 (msec.)	250
0xFFFF F030 0064	TCP Initial RT0 (msec.)	3000
0xFFFF F030 0068	TCP Retransmits	5
0xFFFF F030 006C	TCP Idle Session Timeout (msec.)	240000
0xFFFF F030 0108	TCP Idle Session Timeout Count	0
0xFFFF F030 0070	Ethernet Errors: Late Collisions	0
0xFFFF F030 0074	Ethernet Errors: Excessive Collisions	0
0xFFFF F030 0078	Ethernet Errors: Others	0
0xFFFF F030 007C	Smart Modules Present (analog, serial, etc.)	0x0000
0xFFFF F030 011C	PID Loops Supported	0
0xFFFF F030 0148	Digital Modules Supported	0

```
Command Line Interface
Send CLI Command
Clear Rx'd Buffer

radio.diag

>radio.diag
200-Transceiver Temperature      : 40.0 C
200-Present PA Reverse Power    : 0.0 Watts
200-Present PA Forward Power    : 0.0 Watts
200-PA Reverse Power            : 0.2 Watts
200-PA Forward Power           : 5.2 Watts
200-RX Synthesizer Control Voltage : -5.6 Volts
200-TX Synthesizer Control Voltage : 1.4 Volts
200-PA Supply Voltage          : 10 Volts
200-Present PA Supply Current   : 0.1 Amps
200-PA Supply Current          : 1.4 Amps
200-PA Temperature             : 44.0 C
200 Supply Voltage             : 11 Volts
```

Control Engine: R8.5d (12:25:17 July 12, 2010)

Firmware Version: R8.5d (12:25:17 July 12, 2010)

Volatile RAM: 11.33 MB free

Battery-backed RAM: 7.00 MB free

File Storage RAM: 2.37 MB free

Up Time: 4 days, 7 hours, 15 minutes, 36 seconds

Device Time: 15:05:16 May 2, 2016 [Sync time to PC](#)

Message Queue: 4 messages

Strategy information:

Active: MB_Master (15:55:31 November 4, 2015)
1 char(s) running **Archive:** No

Alternate: Not Enabled

Stored in Flash: A strategy is stored in flash memory

Autoran: Enabled Disabled

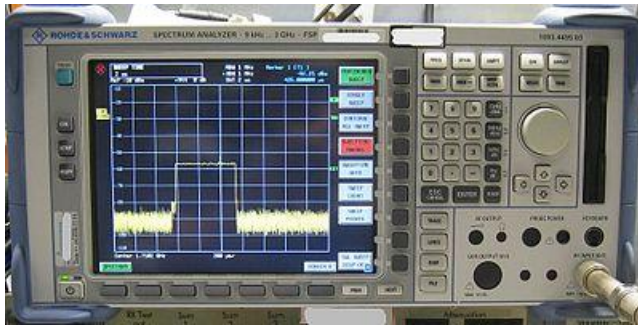
Communication:

Loop Time: 0.47 msec

Comm Errors: None

IP Radio Implementation

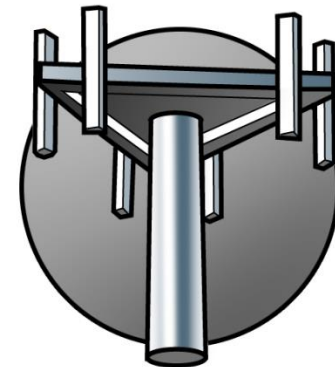
- **Maintenance - calibration – troubleshooting**
 - Yearly frequency check as part of routine instrument calibration
 - Older radios will fade from initial frequency
 - Power supply problems most common
 - Fittings on cabling
 - Inductance protection
 - License posting at site



IP Radio Implementation

- **Cellular and Radio**

- Testing cellular now for sites that have a high bandwidth need.
- 2G and 3G network still out there – but for how long?
- Limited video streaming
- Still have radio or landline as backup to cellular



IP Radio Implementation

- **Balance Operations \$\$ vs Operations needs**
 - Some locations still need a high speed connection but do you need all the data
 - Free install for DSL or cable, \$90/mo
 - \$1000 install for phone circuit, \$70/mo
 - \$1300 install for cellular, \$25 - \$60/mo
 - \$1500/site for radio, \$0/mo



IP Radio Implementation

- **Questions**

