Part 1
SCADA Technology Update

2015 Joint Annual Meeting
West Virginia AWWA
West Virginia WEA

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Brief Historical Overview of SCADA Landmarks

(Supervisory Control And Data Acquisition)

1860-1920

1940’s

1950’s

1970’s

1980’s

1990’s

Y2K

Today
#1 Fiber optic network replaces copper pairs

- Buried conduit issues
  - Water infiltration leads to corrosion
  - Copper pairs damaged during installation
  - Space required

- In room conduits
  - High humidity and corrosion
  - Airborne corrosive dust and chemicals

- Addressable hubs for control and troubleshooting

- Redundant pairs for reliability

- Bi-directional vs. uni-directional
  - Self healing reliability
#1 Fiber optics replaces copper

**Pro’s**
- Life cycle cost
- Life cycle reliability
- Fast
- Networked devices and panels
- RJ-45 or coax connector is plug and play connectivity to media convertor

**Con’s**
- Potentially higher initial cost but flexible fiber has helped
- Actual fiber installation and repair requires a specialist
#2 Redundant processors and store and forward

- Focus on critical facilities
  - Processors are essentially computers and will fail at the least convenient time
- Term redundant processor is loosely used
  - Parallel, parallel and redundant, fully redundant are not all the same capability
- Bottom line is the degree of seamless control. If everything shuts down until the “redundant” processor assumes control, process issues can occur, pump start limitations can be created
- Remote sites will lose connectivity at times, count on it
  - Store and forward architecture holds the data that is still being generated at the remote site like water quality and uploads it as soon as communications is restored.
#3 What is proprietary hardware, and why is that an issue?

• All processor and I/O hardware is fundamentally “proprietary”
  • Major brand PLC’s are not interchangeable and do not share I/O cards
  • Major brand DCS are not interchangeable and do not share I/O cards
  • Issue is not the hardware but application and support

• Connectivity to the processor is interchangeable at different system price points
  • Industry standard communication protocols
    • Modbus
    • Profibus
    • TCP-IP
    • Serial
  • Addressability
    • Get the basic data from a device, send a command to the device
    • Communicate and control a device seamlessly
#3 What is proprietary hardware, and why is that an issue?

- Key point is to always specify a developer license in the spec so that you or a instrumentation tech can modify and create new code, screens, alarms etc.
- Anyone who is comfortable programing on Platform A can quickly get up to speed on Platform B. Major manufacturers all offer significant training opportunities and some offer college credits for the training.
#4 Integrator or system supplier?

• A bit of full cycle
  • 1960’s to ~1980’s virtually all systems came from 4-5 major vendors
    • Complexity; military, industrial, power, very large municipal
    • Component manufacturing limits
    • Technical repairs
  • Late 1970’s into 1980’s
    • Spin off companies found niche markets like smaller muni plants
    • Printed circuit board technology costs came down
    • Early “small” processors
  • Mid to late 1980’s to Y2K
    • Early PC’s, grass roots programmers, birth of “integrators”
    • Reduced component manufacturing
    • Y2K illustrated challenges for smaller manufactures and integrators using off the shelf computers and software
#4 Integrator or system supplier?

- Integrators...are independent businesses
  - Buy and resell proprietary processors, I/O cards, support devices like PC’s **from** a manufacturer
  - Selects and buy proprietary software from the processor, MMI and PC manufacturer
  - Provides engineering, programming, testing, startup, post sale support with their employees or subcontractors
#4 Integrator or system supplier?

- System suppliers...are manufacturers
  - Design, manufacturer and sell proprietary processors, I/O cards and support devices develops proprietary software for the processor, MMI
  - Selects and supplies support PC’s; manufacturer or purchase and resell
  - Provides engineering, programming, testing, startup, post sale support with their own employees
#4 Integrator or system supplier?
Differentiation points:

• Depth
  • Most integrators are small independent businesses, 5-10 employees
    • Loss of a key engineer or tech can decimate the company or reputation
    • Unexpected success or problems can stretch resources
  • Major system manufactures are large multinational players
    • Employ market specialists
    • Regional engineering teams
    • Regional and national technical support
    • Dedicated training facilities
#4 Integrator or system supplier?
Differentiation points:

• Experience
  • Integrators tend to know their core market and preferred product family, may or may not be on top on new methods, materials etc.
  • System manufactures participate in multiple industries, multiple markets and are forced to keep up with newest trends and expectations to survive

• Life cycle support
  • Integrators are at the mercy of the vendors they rep
  • Integrators incur costs to continue support legacy equipment or to migrate forward can cost $$$ bucks, Costs can lead to cut and paste issues
  • Manufacturers can design migration into products and map out phase outs and end of lifecycle support like exchange stock
#4 Integrator or system supplier?
Differentiation points:

• Security
  • Water sector approach to security varies widely
    • Close the new gate to encrypted padlock keys
    • Post it note passwords to rolling code devices

• Integrator approach to overall security varies greatly
  • Employee screening
  • Employee training
  • Overall security and backup practices, office and field; the guy YOU know and trust may or may not be the problem

• System suppliers driven by the highest risk industry they serve; military, nuclear, chemical, pharmaceutical, water
  • All employees screened and trained
  • All systems and practices documented
#5 Managed Cellular Data SCADA

How Does Work?

Has 5 Parts:

1. Field RTU
   - Standardized
   - Power supply, radio, I/O
   - Cell tower
   - Data cellular... not voice
   - 4G Data: GPRS & CDMA
   - Available on all 3 types of cell data

2. National, wireless data networks
   - Private “pipes”, increased security
   - Flexibility for permanent connections

3. Managed Central Servers
   - All carrier issues/data managed
   - Flat fees

4. OPC Database at customer MMI
   - MMI scans RTU tags
   - Redundant servers can retrieve data

5. OPC Database and Customer HMI (With Redundancy)

Managed Cellular Data SCADA System Diagram:
- Managed RTU
- Local Cell Tower
- Cell Carrier Network
- Managed Central Servers
- VPN, Frame and Internet Backup
- Integrated Hardware With Cell Radio and Digital/Analog I/O

Illustrations:
- Managed RTU
- Local Cell Tower
- Cell Carrier Network
- Managed Central Servers
- OPC Database and Customer HMI (With Redundancy)
#5 Managed Cellular Data SCADA

- **Pro’s**
  - Affordable
    - Distributed design and engineering
    - Minimal customization
    - Flat rate annual services and support contracts
  - Reliable
  - Shared infrastructure costs
  - Fast to ship and install, often installed by the operator
  - Access from any WEB enabled device

- **Con’s**
  - Distributed design and engineering
  - Minimal customization
  - Technology too accessible, leads to uneven product performance
  - Limited control capability
Managed Cellular Data SCADA

• Secret Weapons: Distributed design and engineering
  • Traditional SCADA systems are a la carte and every feature and function carries a cost, average is about $1000 per applied point. Managed SCADA is typically 1/3 that cost per point. Traditional modern SCADA resides on multiple Windows based PC’s that require upgrades every 4-8 years.
  • Windows updates may drive replacement of otherwise non-obsolethe hardware. Managed SCADA processing and data storage occurs on shared, secured service and main frames maintained by the supplier, data is accessed from any WEB enabled device.
  • All subscribers receive all updates and enhancements as part of the annual contract. Costs are shared across 1000’s of units.
#6 Hybrid SCADA

- Best of both worlds!
  - Power for process control and customization possible with traditional SCADA
  - Affordable pre-engineered managed SCADA for redundancy and remote sites with limited or no control
  - Consolidated control room presentation using secure OPC/VPN connection to the MMI screens
  - Substantial potential savings
    - Major public water company standard PLC based pump station RTU $55,000 typically
    - Managed SCADA RTU with connectivity to plant SCADA essentially the same data and control ~$3,500
    - NOT identical, but close enough?
#6 Hybrid SCADA

Tuscaloosa Alabama

- 100+ Water and Waste Water Sites
- Original Quotes Were $6 million +
- CH2M Hill mixed managed cellular in at 35% of the sites and winning bid was approx. $4.5 million
Hybrid SCADA

Why Data Cellular SCADA:

• Usability
  • Very Simple & Flexible

• Reliability
  • End To End Uptime: Can Be 99.7+%. Dependency by public safety agencies and lost billing revenue results fast repairs

• Cell carriers provide tower sites and maintenance, no tower rentals, construction or repeaters
#6 Hybrid SCADA

- Survivability
  - Proven In Hurricanes And Severe Storms
- Security
  - Meets AWWA & Homeland Security Standards with 128 bit encryption automatically. Leading “real time” units use secure socket connections the same as banks and ATM’s
#6 Hybrid SCADA

Some New Ways It Can Help:

• Use it for:
  • Stand alone sites where this is all you need
  • Backup to existing SCADA sites using PC based alarm software
  • Fill-in for hard to reach or lower priority sites which might take an expensive tower and or repeater