Unlocking the Value in your Production Control System

Gary Silverman
SCADA Engineering Manager – Bill Barrett Corporation
Things I have learned

• Things I will NOT be talking about……..
A Manufacturing Model for Upstream O&G
Intelligent Field Devices

- Performance Diagnostics
- Travel Deviation
- Cycle Counter
- Valve Signature
- Step Response
- Dynamic Error Band
- Drive Signal
- Output Signal

- Electronics Failure
- Density Out of Limits
- Temperature Out of Range
- Slug Flow
- Frequency Output Saturated
- Security Breach
- Enhanced Density Alarm

- RTD Drift
- RTD Life Estimation
- Electronics Failure
- Sensor Failure
- Process Condition
- Configuration Warning

- Electronics Failure
- Sensor Failure
- Reverse Flow
- Low Cut Off
- Primary Value Degraded
- Simulation Active
- Sensor Out Of Range
Biography

- BSME – 1982, San Diego State University
- 30 Year’s Experience in Controls, Automation and Systems Integration (mainly Process Industries)
- Most recently:
  - July 2011 →: Bill Barrett Corporation – SCADA Engineering Manager

e: gsilverman@billbarrettcorp.com
m: 720-556-1858
As-Found State

- Architecture did not provide for Autonomy of Basin Systems for Operations or Data Integrity for Corporate Users
- Inadequate security:
  - Generic Operator Logons/Shared Workstations
  - Security not configured by role
- Backup Strategy required improvement
- Still running 2 yr. old release of SCADA System – latest release improved database integrity, performance, polling improvements, etc.
- Various RTU/SCADA Services Vendors – little collaboration between them
As-Found State

• Various approaches to SCADA configuration (no common standards between basins) – some templating had been implemented
• Some common approaches to Pad Automation/Measurement (Fisher), but no standard for instrumentation or Pad Wireless
• Expensive instruments – no gain for the extra $
• Significant number of configuration errors in systems – these caused performance and data integrity problems
As-Found State

- Expensive Radios/Poor Polling Schemes and Radio Network Design
- Well/Pad/RTU Naming Conventions differed by Basin
- Graphics did not serve any User Group well
- Poor Data Integrity/Low Trust of System by Users
- Poor Graphic/Facility Navigation
- No Internal Ownership of Platforms (RTU, Pad Automation, SCADA, Comms)
- No use of Alarming or Callout
Cost Savings Opportunities

- Lower overall cost of equipment, installation and maintenance by leveraging ‘fit for purpose’ instruments, ‘right sized’ RTUs and appropriate wireless technology on well pads
- Fewer trips to a pad for Pumpers by improving focus on issues and wells that need attention – mainly by having additional data, trending and improved graphics
- Improved well optimization through leverage of existing Plunger and Gas Lift Programs in RTU and better data integration/visibility
Architecture – As Found State
Architecture – Current State

BBC Production Management System
CygNet Detailed Architecture - Current

- Backups
  - Backup 1
- Client
  - Replication
    - Parachute: Replicated SCADA/VHS
    - Waltman: Replicated SCADA/VHS
    - Roosevelt: Replicated SCADA/VHS
    - Greeley: Replicated SCADA/VHS
- Polling
  - SILT Domain 20217
    - SCADA Server SIL08-CYG
    - Client
  - Waltman Domain 20217
    - SCADA Server CAS02P-CYG
    - Client
  - Roosevelt Domain 20217
    - SCADA Server RS08-CYG
    - Client
  - Greeley Domain 20217
    - SCADA Server GE08C-CYG
    - Client

Access Database

Volumes

2/25/2012
RTU Platforms/Capabilities

**ROC800 RTU**
- Up to 12 Meter Runs
- 6 Comm Ports (incl. LCD)
- Up to 6 Plunger Wells AND 6 Injection Meters
- 16 PID Loops
- GC Interface
- Logic Capabilities
- Up to 256 I/O
- Hart/Fieldbus Capable
- Always Custom Enclosure
- Factory LCD, IDEC, Proface

**FloBoss 107 RTU**
- Up to 4 Meter Runs
- 5 Comm Ports (incl. LCD)
- Up to 4 Plunger Wells (or Gas Lift, Fuel Gas, Sales Meters, etc.)
- 8 PID Loops
- GC Interface
- Logic Capabilities
- Up to 56 I/O
- Hart Capable
- Factory Enclosure
- Factory LCD
- Integral Sensor available
Improved Installation Practices

- Standard Panel Designs by Application/RTU Type
- Improved Installation Process and Speed of Installation
- Documented Commissioning Procedures
Current Panel Layouts and Install Details

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Wireless Wellheads and Pad Instrumentation

WIO Base Unit
- RS485 Port
- RS 232/485 Port
- Modbus Master/Slave
- Comms to RTU/PLC
- Peer Comms to other Base Units
- 2 DI, 2 DO, 4 AI
- Expands to 256 I/O

DH2 Base Unit
- RS 232/485 Port
- Modbus Master/Slave
- Comms to RTU/PLC
- Peer Comms to other Base Units

Temperature Transmitter
Pressure Transmitter
Discrete Transmitter
Tank Level Transmitter
Tank High Level Switch

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Wireless Quad Example
RTU with Wireless Instrumentation-16 (up to n) Well Pad
Scalability with Shared Facilities

CTB

Pad 1

Pad X
Gas Lift - Wireless Data Communications
Gas Lift - Technology Leverage

- Prior Gas Lift Pads only had fixed chokes or PID control of Injection
- Utilization of Separate RTUs and Data Comms allows Optimization of Injection to Economize Injection Gas or Maximize Sales

Results:

**Predictable 850 MCF/D vs. 600 MCF/D prior to Gas Lift**
SCADA Communications

- Ethernet Radio Network to the Wellhead
- Very fast, but poor polling performance

WHY?
• TCP/IP sessions are opened with all endpoints at once
• No way to ‘throttle’ comms
• Overwhelms radio network bandwidth
• Overwhelms SCADA – Disk I/O, Memory, etc.
• Overwhelms SQL DBs for Volume Data
• Results:
  – Poor polling performance
  – Low Data Integrity
  – Lots of missing trend data and volume data
SCADA Communications – Solution

TCP/IP MULTIPROPOINT DEVICE
• We also conducted a Radio Coverage Study (NOT a ‘Path’ Study) and developed a Communications Strategy

• Results:
  – Reorganized Radio Network
  – Installing 3 New Repeaters, retiring existing
  – Implementing a High Speed Backbone

NO Missing Trend or Volume Data
Backbone and RF Coverage

[Map and diagram showing Backbone and RF Coverage]

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Denver, Colorado
SCADA Upgrade Principles

• ‘One Click to Data’
• No Reports outside the System
• We can always start over!

This is NOT Burger King
SCADA Security

Role Based
- Pumper
- Supervisor
- Manager
- Engineer
- Field Measurement
- Corp. Measurement
- Field Technicians
- System Administrators

By Basin
- Piceance
- Uinta
- Wind River
- Denver Julesberg

Functions Managed
- System Access
- Screen Access
- Facility Access
- Data Access
- Setpoint/Alarm Changes
- Meter Configuration Changes
- Device Configuration Changes
- System Configuration Changes

INTEGRATED WITH NETWORK SECURITY!

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Data Acquisition/Polling – Standards

• ‘Spot Flow’ Data – once/hour:
  – DP, SP, T, Rate
  – Casing, Tubing
  – Tank Levels
  – Today’s Volume, Y’Day Volume

• Trend Data – once/hour:
  – 1 Minute Averages
  – DP, SP, T, Rate
  – Casing, Tubing
  – Environmental Data
Group Hierarchy/Facility Navigation

- Company
- Business Unit
- Basin
- Area
- Field
- Business Route
- Pumper Route
- Pad
- Hauler Route (Tanks)
Naming Conventions

- Accounting number used as part of Facility ID for all meters/wells
- Legal Well Names/Pad Names used for Displays
- All Meters have ‘Type’ – Well, Gas Lift, Fuel Gas, Buyback, Sales, Check, Flare, Station Inlet, etc.
Enterprise System/Basin Navigation

Enterprise Cygnet SCADA

Bill Barrett Corporation

HOST TIME: 10:21:11 AM

Denver Office  DJ Basin  Piceance Basin  Uinta Basin  Wind River Basin
## Well Summary

### WELL SUMMARY - GAS LIFT

| Field | Pod | Area | Rate MCFD | Today MCF | Today Net MCF | Taking PSI | Setting PSI | Bill in HDD | Static PSI | Gas Temp | Today HRS | YDay HRS | Month HRS | Notes | Week trend |
|-------|-----|------|-----------|-----------|--------------|------------|-------------|-------------|------------|----------|----------|----------|----------|----------|-------|------------|
| MTRFUEL | 5 | 7 | 76.73 | 6.70 | 30.31 | 80.60 | 59.39 | 2.09 | 18.46 | 121 | | | | | |
| | 5 | 5 | 76.73 | 6.70 | 30.31 | 80.60 | 59.39 | 2.09 | 18.46 | 121 | | | | | |
| MTRINJ | 146.11 | 156.48 | 156.48 | 156.48 | 0.00 | 12.79 | 13.78 | 200.43 | 399.96 | 0.84 | 87.89 | 78.81 | 0.40 | 4.21 | 58 |
| MTRINJ | 146.11 | 156.48 | 156.48 | 156.48 | 0.00 | 12.79 | 13.78 | 200.43 | 399.96 | 0.84 | 87.89 | 78.81 | 0.40 | 4.21 | 58 |
| MTRINJ | 146.11 | 156.48 | 156.48 | 156.48 | 0.00 | 12.79 | 13.78 | 200.43 | 399.96 | 0.84 | 87.89 | 78.81 | 0.40 | 4.21 | 58 |
| MTRINJ | 146.11 | 156.48 | 156.48 | 156.48 | 0.00 | 12.79 | 13.78 | 200.43 | 399.96 | 0.84 | 87.89 | 78.81 | 0.40 | 4.21 | 58 |
| MTRNL | 1,640.14 | 2,301.93 | 2,301.93 | 2,301.93 | 0.00 | 12.79 | 13.78 | 200.43 | 399.96 | 0.84 | 87.89 | 78.81 | 0.40 | 4.21 | 58 |
| MTRNL | 1,640.14 | 2,301.93 | 2,301.93 | 2,301.93 | 0.00 | 12.79 | 13.78 | 200.43 | 399.96 | 0.84 | 87.89 | 78.81 | 0.40 | 4.21 | 58 |
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| MTRNL | 1,640.14 | 2,301.93 | 2,301.93 | 2,301.93 | 0.00 | 12.79 | 13.78 | 200.43 | 399.96 | 0.84 | 87.89 | 78.81 | 0.40 | 4.21 | 58 |

**Host Time:** 10:23:12 AM
Well Detail
Selectable Trends
Reporting
System Diagnostics
Historical Data Model

‘Spot Flow’ Data (Hourly Polls)
- Rates, Daily Volume, Casing, Tubing, Static, Temp, Flow Times, etc.

Trend Data (one minute averages):
- Gas Rate, Differential Pressure, Static Pressure and Temperature
- Casing Pressure, Tubing Pressure

Data Retention:
- 1 Month at Full Resolution on Polling Server
- ‘Thin’ to daily min/max/average and statistically significant data after 30 days
- 1 Year of thinned/hourly/daily data online (Field and Corporate the same)
- 2 Years of Environmental Data
- 7 Years of Volume/Event Data
New Business Processes

- New Business Processes for Automation Deployment, Configuration and Implementation put in place for BBC and Vendors.
- SharePoint Portal designed and implemented to support Basin Automation Workflows, Documentation and CygNet Project.
Business Results

- Improved Production due to:
  - Easier/Faster access to SCADA, including mobile access
  - Improved data visibility (trend data/trend displays, analytical displays)
  - Focus on wells that need attention (well goals)
  - Better system reliability and speed
  - Improved data integrity and polling performance

- Improved Decision Making Capabilities for Management – more timely data interfaces with Production Accounting and Reserves Systems

- Faster and Cheaper Field Installations

- Fewer configuration errors
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