Universal Wellpad Control based on Open-Architecture Design

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Outline

- Motivation
- Open-Architecture Solution
  - Use case – Plunger Lift Automation
  - Field Test
  - Live Demo
- Conclusion and Next Steps
Motivation

- Recurring Challenge due to Obsolescence in Process Control
  - Software:
    - Proprietary automation software built in metering system hardware
    - Available software and application space are vendor specific
  - Hardware:
    - Proprietary communication between flow measurement device and RTU
    - Devices and components are vendor specific
  - Operator are forced to
    - Adapt unplanned change due to system obsolescence
    - Migrate to another proprietary system which may go obsolete in few years
Open-Architecture Solution

- Decouple SW and HW
  - Data exchange on open protocols
  - User defined or 3rd party automation
  - Data analytics and optimization apps

- Standard Communication Protocols
  - Open protocols to instrument
  - Open protocols to metering
  - Open Protocols btw modules
  - IIoT solution enabled

- Interoperability
  - Independent to platform OEM
  - Independent to software provider
  - Independent to Cloud service
Use case – Plunger Lift Automation

- **Objective:**
  - Demonstrate concept of Open-architecture design for plunger lift automation

- **Hardware Design**
  - Commercially available platforms in multiple O/S
  - Low power consumption fit for deployment in remote locations
  - Scalable computing capabilities and expandable digital/analog IOs

- **Software Design**
  - Modularized software framework
  - Separate runtime of control logic and user interface
Field Test

Well #1
- Emerson ROC 107 Flow Computer
- Industrial PC
  - Windows 7
- Software by Naonworks
- Lease operator
  - Remote office
- ABB G4 Flow Computer
- KETI Gateway
  - Linux
- Field I/O

Well #2
- Field I/O
Software – Remote/Local Login

Universal Wellhead Control Plus Naonworks Program IP

127.0.0.1
26977
admin

Connect
Software – IO Setup
Software – Main Page

Real-time demonstration

Hidden Production Data
Software – Alarms/Shut-in

- **High Line Pressure Shut-in**
  - Close Out On Cycle if Line Pressure > 70
  - Enable Permanent ESD on Close-out

- **Low Line Pressure Shut-in**
  - Close Out On Cycle if Line Pressure < 20
  - Enable Permanent ESD on Close-out

- **High Pressure Shut-in Delay**
  - Enable
  - Delay High Line Pressure Shut In for 5 Seconds

- **Low Line Pressure Shut-in Delay**
  - Enable
  - Delay Low Line Pressure Shut In for 5 Seconds
Software – Production Trend

Hidden Production Data
Software – Plunger Specs

UWC Plus

Controller Status
- Lifting
- Advance Control
- Alarms

Plunger Speed and Estimated Plunger Drop Time
- Nominal Plunger Drop Speed: 250 ft/min
- Estimated Minimum Plunger Drop Time: 45.68

Plunger Drop Time
- Plunger Drop Timer: 120
- Plunger Drop Timer Counter: 120.00

Non-Arrival Actions
- Go to Afterflow
- Go to Normal Shut In
- Always Extra Mandatory Shut In
- Progressive Mandatory Shut In

Mandatory Shut-In Time
- Mandatory Total Mins: 240
- Mandatory Shut-In Counter: 0.00
- Execute Mandatory Shut-In After: 3
- Consecutive Non-arrivals: 0
- Consecutive Non-arrival Counter: 0
- Mandatory Transit: 0

Well Geometry Configuration
- Collar Stop Depth: 11420 ft
- Tubing Diameter (I.D.)
  - 2 in.
  - 2 3/8 in.
  - 2 7/8 in.
  - 3 in.
  - Other: 10 in.

Lifting Time
- Lifting Timer: 60
- Lifting Time Counter: 31.90

Universal Wellhead Control
- XTO Energy
- ExxonMobil

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Software – Auto Adjust
Software – User Groups
Conclusions and Next Steps

- Proved concept of open-architecture design
  - Open protocol communication
  - Interchangeable hardware platform, parts and instruments
  - Interoperable software to standard operating environment

- Next Steps
  - Commercialize open-architecture hardware and software technologies
  - Identify and develop more upstream use cases and applications
  - Engage with industry partners to participate in the design and development of open architecture environment
  - Advocate an joint industry efforts to specify and maintain open standards
Field of Future

Camera monitoring conditions within the containment area

Tank Level Sensors to record tank levels and controlled by UWC

Open Architecture Platform: conduct real-time control and automation of wellpad production

Production: Open-architecture software for artificial lift

Optimization: through advanced analytics and "AI"

Remote Monitoring

Camera enabling flare conditions to be monitored remotely
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