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Unconventional Gas Ventures

Presentation to ANIMP

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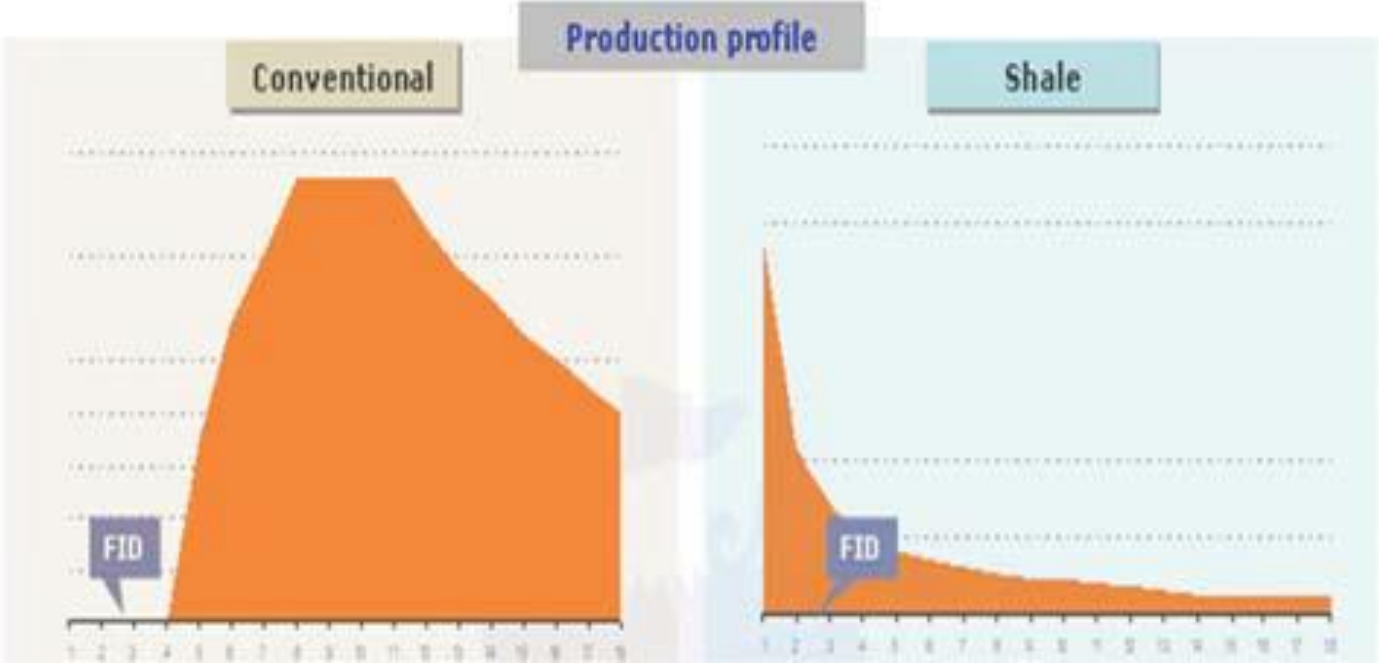
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Invensys

Unconventional Gas/Oil Experience

- Major North American Producer, >15,000 wells
- Major North American Producer, >6,000 wells
- HiMount Energy, USA, ~6,000 wells
- Cimarex Energy, USA, ~1,000 wells
- PVR Midstream, USA, ~1,000 wells
- Chevron Bakersfield, ~18,000 production & injection wells
- AERA, USA, ~17,000 production & injection wells

Production Profile



Typical Production Project

- Exploration & Appraisal
- Drilling production wells, around 20 for a typical project and 100 for a large one
- Building processing facilities in parallel with the drilling of the initial production wells
- Starting up those initial wells and the processing facilities
- Periodic drilling campaigns, say every 1 to 3 years, to add more wells for greater production or to replace depleting wells

Shale Gas Production Project

- Exploration and Appraisal
- Drilling the initial production wells, say 500 or more
- Building processing facilities in parallel with the drilling of the initial production wells
- Starting up those initial wells and the processing facilities
- **Continuous** drilling, completion, connection and production from additional wells
 - To complete 5000 wells, 2 per day, will take ~6 years with about 15 drilling crews working 7/24/365

Shale Gas Automation Project

- New wells will be added **every day** → new automation, new reports, new screens, new alarms will be added **every day**
- Unconventional wells have a dynamic life cycle requiring frequent changes to operating equipment and operational mode.
- Span of Control issues – manage many more wells with same resources

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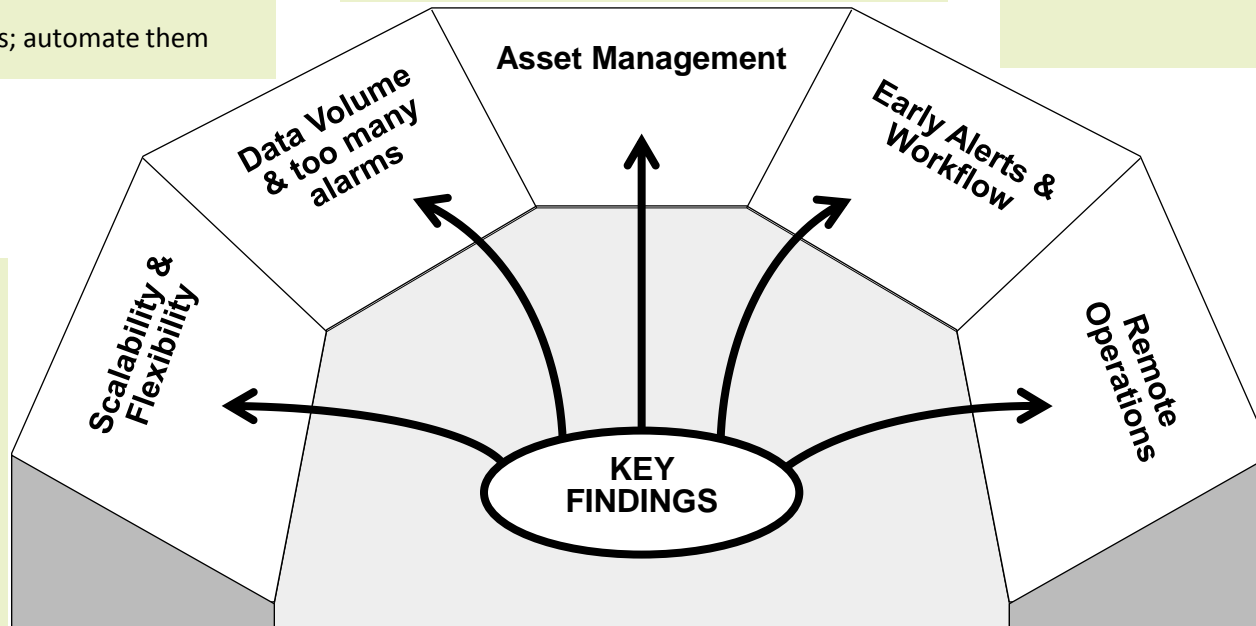
Unconventional Gas Automation Challenges

- Too much data creating confusion.
- Present information for easy analysis/ solving problems
- Avoid multiple historization steps and data replication
- Too many alarms; prioritize them.
- Handwritten Operator logs; automate them

- Improve Quality of well data, Equipment status.
- Avoid unscheduled down time
- Avoid costly round trips to wells.
- Reduce asset maintenance costs.
- Integrate of Work Orders and Work Permitting

- Monitoring 1,000's of wells with fewer operators is complex, challenging
- Operate on Exception basis
- Early alerts on impending problem
- Alerts trigger workflows & automatic escalation

- Scalability from 1 to 5,000 wells without costly engineering .
- Ability to add, modify wells "on the fly"
- DCS, SCADA, OMS in single architecture.
- Operate from 'anywhere'

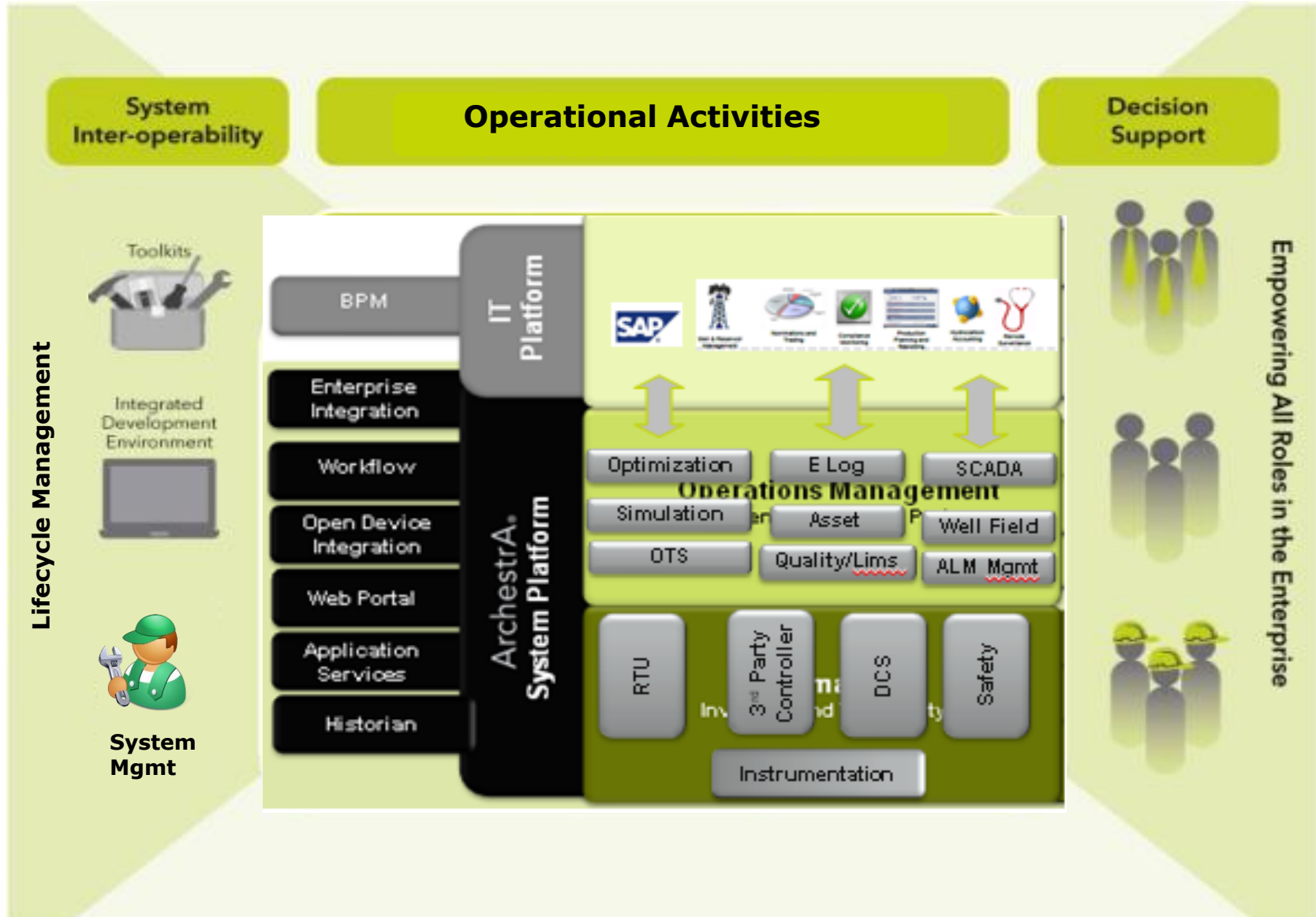


- Operations with fewer mobile operators
- Prioritize problem wells
- Mobile viewing tools
- Work order & scheduling
- Automatic trigger for routine daily tasks

Unconventional Gas Internal Learning Cycle

- Close linking of Drilling-Completion-Operations Cycle
- Lean Manufacturing Approach
- Shale Fracking example
 - Equidistant frac pattern: cheaper, quicker, but maybe lower rate of production & lower eventual recovery
 - Targeting frac pattern based on logging: more expensive, more time but potential for higher production and recovery
 - Takes a year of careful measurement, event tracking to make evaluations

High Level Architecture for Shale



Well Field Application

Interface – Graphical Well Site View

Field Office Select (Distributed Architecture)

Well in Focus

Tree View – Main Well Navigation. Select Well to be in Focus.

User Logged In

The interface displays a graphical well site view for 'BROWN, ROY GAS UNIT A 2'. The main area shows a 3D schematic of the wellhead, tubing, and compressor. A 'Compressor 1 Status' window indicates it is 'Running'. A 'Water' tank is also visible. The interface includes a tree view on the left for navigation, a top menu bar with options like 'Sites', 'Reports', and 'Tools', and a bottom status bar showing 'Displaying 287 to 292 of 805 alarms'.

Well Site Summary:

- Well Name: BROWN, ROY GAS UNIT A 2
- Well Status: Active
- Meter ID: Sales
- Run #: Run01
- Area: Area 1
- MSCF Today: 43.9
- MSCF Yesterday: 74.0
- Curr Flow Rate: 0.0
- DP: 0.0
- Static: 49.6
- Temp: 74.0
- TP: 0.0
- CP: 0.0
- BATT: 13.6
- Node ID: 0007
- Last Scan: 06/13/2009 06:24:07

Compressor 1 Status:

- Run Status: Running
- C Day Hrs: 0.0
- P Day Hrs: 0.0
- Suction: 0.0
- Discharge: 0.0

Well Parameters:

- Tube I.D. (Inches): 6.0030
- Orifice (Inches): 2.3750
- Rate (MCFD): 0.00
- P Day Volume (MCF): 74.00
- C Day Volume (MCF): 43.87
- Static Press (PSIG): 49.59
- Diff Press (INH2O): 0.00
- Temperature (DEGF): 73.99
- Nomination (MCF): 0
- Eng Forecast (MCF): 0

Operator Information:

- Operator: engineer
- Node ID: 0007
- User: PUR_User01
- Log On / Log Off buttons

Alarm Log:

Time	Name	State	Class	Type	Priority	Value	Limit	Operator	Alarm Comment
06/12/2009 08:07:12 AM	LBR_0034 #Tank2Level.HiHi	UNACK	VALUE	HiHi	15	15.4	13.0		Tank 2 Level
06/12/2009 08:07:12 AM	LBR_0034 #Tank2HighHigh	UNACK	DSC	DSC	500	Full	Full		
06/12/2009 08:07:12 AM	LBR_0034 #Tank3High	UNACK	DSC	DSC	500	Filling	Filling		
06/12/2009 08:07:12 AM	LBR_0034 #Tank3HighHigh	UNACK	DSC	DSC	500	Full	Full		
06/12/2009 08:07:12 AM	LBR_0034 #Tank3High	UNACK	DSC	DSC	500	Filling	Filling		
06/12/2009 08:07:09 AM	LBR_0032 RTU1 #BatteryVoltageCur.Lo	UNACK	VALUE	Lo	215	0.0	11.0		Battery Voltage

Well Field Application

Almost Self Configuring

Interface - Manage Well

Select Edit Well from Tab

Set Well Status, Location, Accounting ID, Partners

Configure Equipment Associated with a well

Set RTU Type, Register Definition, Route to IO Server

Set RTU Type, Register Definition, Route to IO Server

The screenshot displays the 'Edit Well' configuration interface for well 'SO UTE 5-35 1'. The interface is organized into several sections:

- Navigation:** A top menu bar includes 'Sites', 'Reports', 'Exceptions', 'Tools', 'Comms', 'Admin', and 'Map'. Below this, a secondary menu has 'Well Site', 'Trend', and 'Edit Well' (the active tab). Other options include 'Daily History', 'Hourly History', 'Comments', 'Header Only', 'Daily EFM', and 'Hourly EFM'.
- Well Information:** Fields for 'Node ID' (0040), 'Well/Site Name' (SO UTE 5-35 1), and 'Screen To Show' (Default Well Screen).
- Well Status & Location:** 'Well Status' is set to 'Active'. Location fields include 'Longitude' (37.05699684) and 'Latitude' (-107.9877218).
- Site Configuration:** A grid of checkboxes for various equipment and sensors, such as 'Beam Pump', 'Show Wellhead', 'Show Tank 1', etc.
- Meter Configuration:** A table listing meters with columns for 'Meter Number', 'Accounting #', 'Description', and 'Meter Type'. The first row shows meter 3530 with description 'Sales'.
- Communication Configuration:** Two sections for 'RTU1' and 'RTU2' with fields for 'RTU Type', 'RTU Load', 'Topic', 'Proxy', 'IP Address', and 'Radio Serial #'. RTU1 is configured with 'Bristol Teleflow' and 'TeleFlow3530'.
- System Platform Deployment Statistics:** A table showing 'Object Name', 'Platform', 'Area', and 'IO Server' for the well.
- Bottom Panel:** Includes 'Log On' and 'Log Off' buttons, user information (Operator engineer, Node ID 0040, User PUR_User02), and 'Save & Update' and 'Poll History' buttons.
- Data Table:** A table at the bottom shows real-time data for tank levels. The first row indicates a 'UNACK' state for 'PUR_0020 #Tank1Level Hi'.

Well Field Application now in use in > 20,000 wells in North America

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