



Digital, Data Analytics, and Automation: Value Creation Through Digital E&P

19-20 NOVEMBER 2024 | BANGKOK, THAILAND



Autonomous Gas Lift Operations and Optimization Proof of Value

Belly Agustinus Kartika Djaya (Sensia)

Roy Williams (Sensia)

Ajay Varma (Sensia)

Nilesh Suryarao (Sensia)

Christian Bonilla (SLB)

Rinaldi Sudarwoto (SLB)





Agenda

- Background & Challenges
- Real Time System & Edge Computing
- Solution Architecture
- Workflow Architecture
- Autonomous Gas Lift Optimization Workflow
- Value Proposition

Background & Challenges

- Mature field with gas lift injection system
 - Remote location and non-instrumental wells
 - Routine field visits for well operations checkup
- Delays in detecting well problem
 - No continuous parameter readings
 - Irregular production test
 - Lead to unplanned deferment production
- Time gap : well problem detection and remedial action
 - Anything can change over time.
 - Remedial action becomes obsolete/not applicable

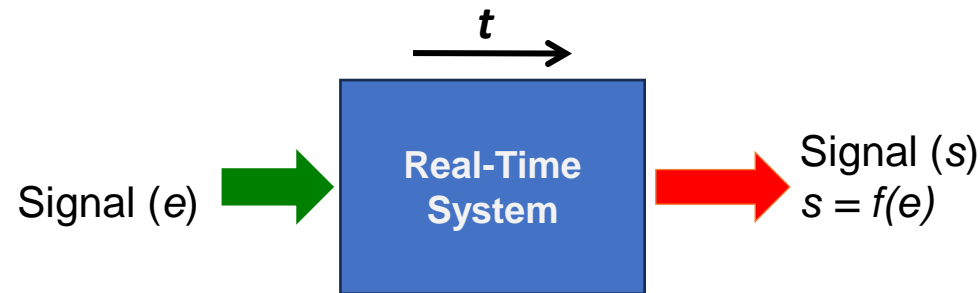
Real-Time System

Asset Management

- Field performance
- Business goals
- Non-productive time
- Human/Environmental incidents
- Cost control
- CAPEX management
- Sustainability

Operations

- Keeping operations running
- Operational envelope boundary
- Control and intervention
- Optimum throughput of automation devices



Engineering

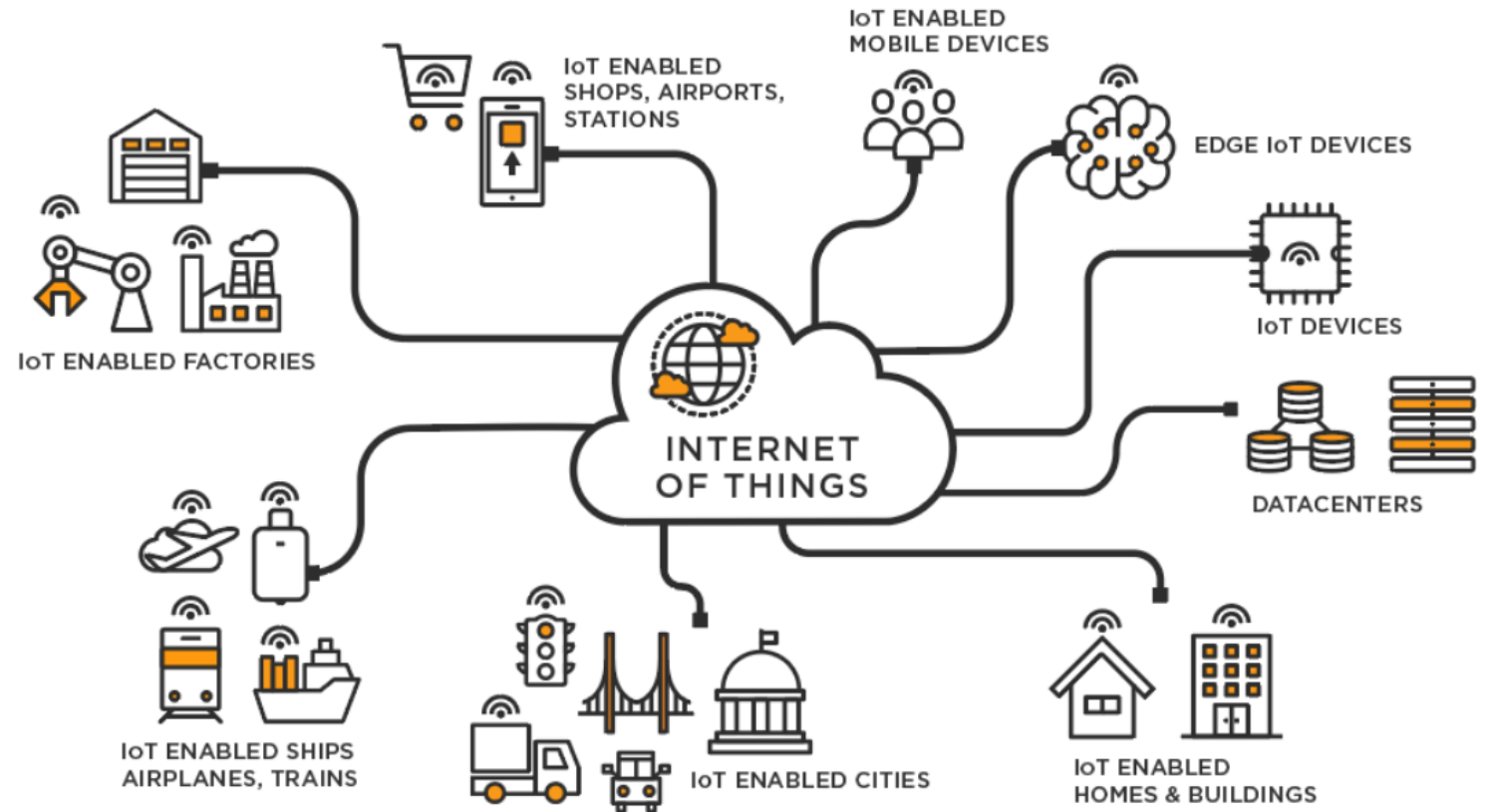
- Asset surveillance
- Asset prioritization
- Offline/down asset
- Asset recovery : what, how, when ?
- Target vs Actual

IT

- Cyber security
- System scalability and availability
- Control and delegation
- Backup and recovery

IOT : Technology from Industry Revolution 4.0

- IOT Definition
 - Network of physical objects (“things”) that are embedded with sensors, software, and other technologies.
 - Connecting those “things” to Internet



Edge Intelligence : The Convergence of OT and IT

Challenges: new ways of thinking, device and system compatibilities

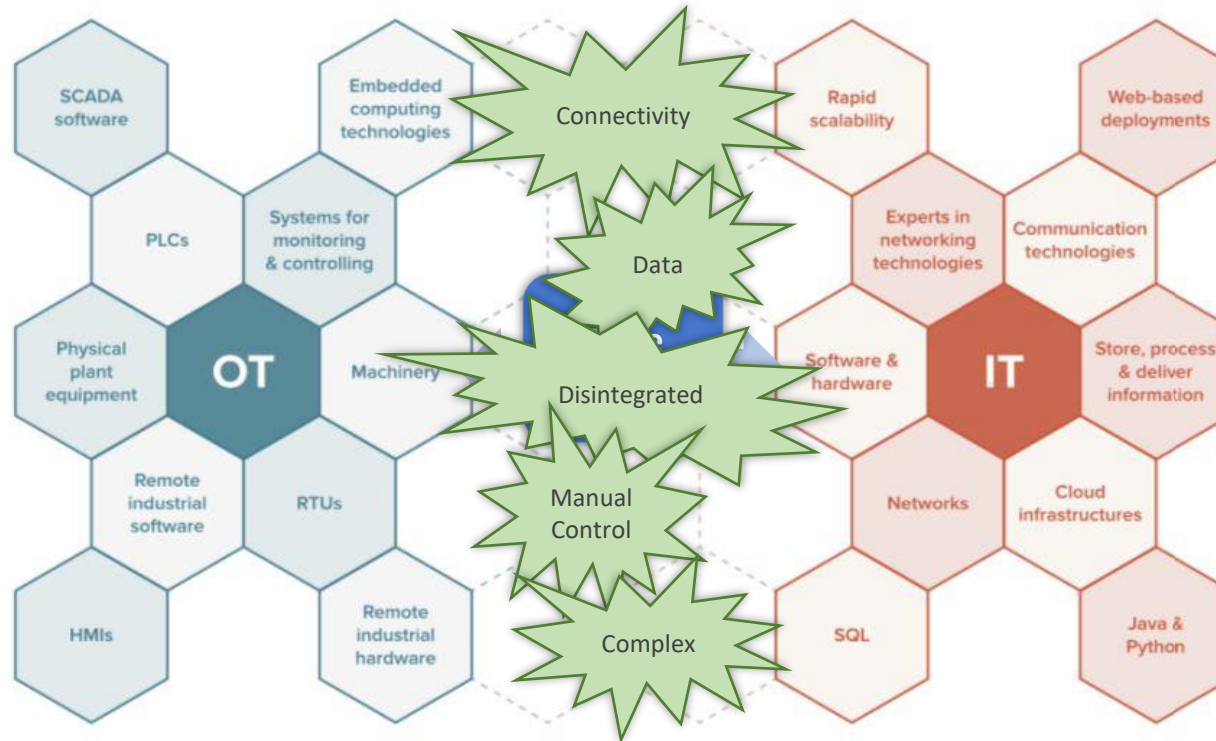
FIELD

Oilfield devices, equipment, and instrumentation



OT focuses on behaviors and outcomes.

- management and control of physical devices
- monitor events and processes
- adjust operation parameters



MQTT, Modbus	●—————●	TCP/IP
Hi frequency	●—————●	Lo frequency
Lo latency, μ s	●—————●	Medium latency, ms
Actions, Devices	●—————●	Insight, Decisions

OFFICE

Organization, human resources, and processes



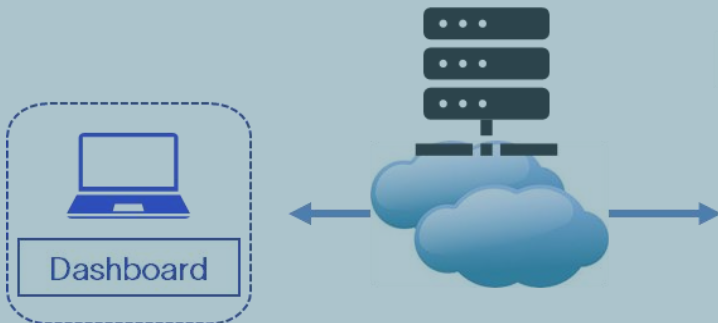
IT focuses on data, information, and communication

- data-centric computing
- managing information, networks, connectivity, data, and ecosystem
- app developments

Solution Architecture : Converging OT and IT

IT

- Cloud infrastructure
- Production engineering
- Smart surveillance



Edge

- Workflow automation
- Performance monitoring

Typical configuration per platform

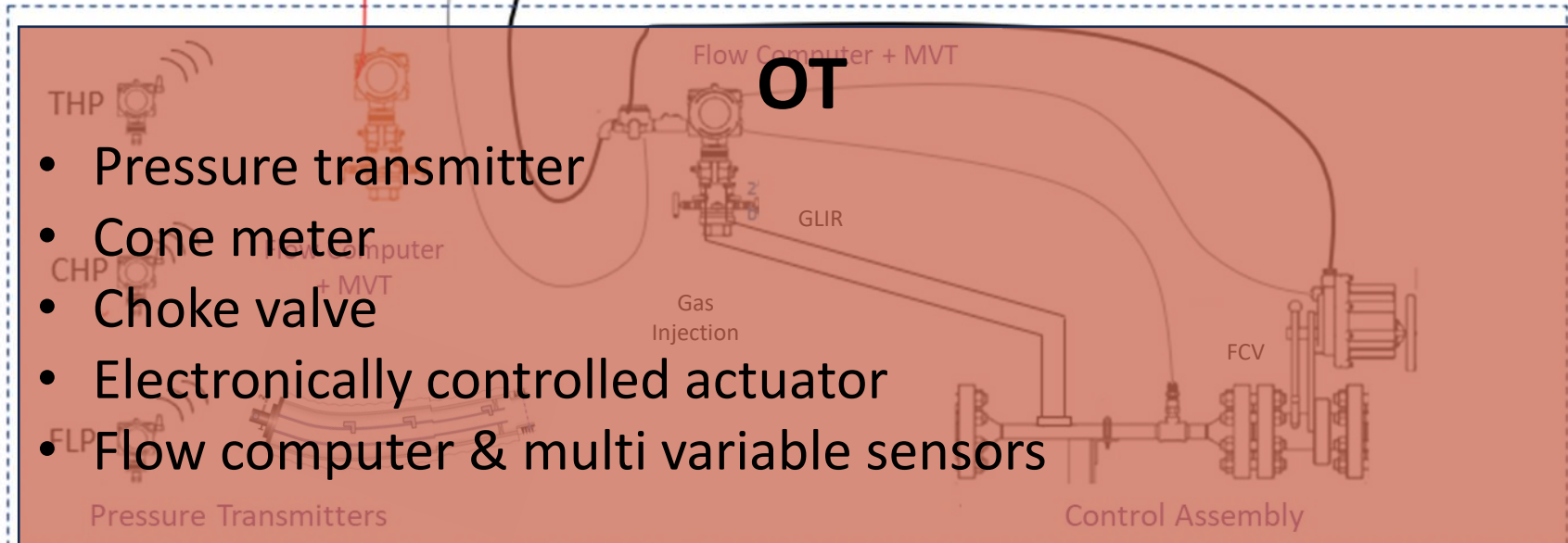


Infrastructure

- Solar powered electricity
- Remote transmission unit
- Wiring & safety control
- Remote Transmission Unit

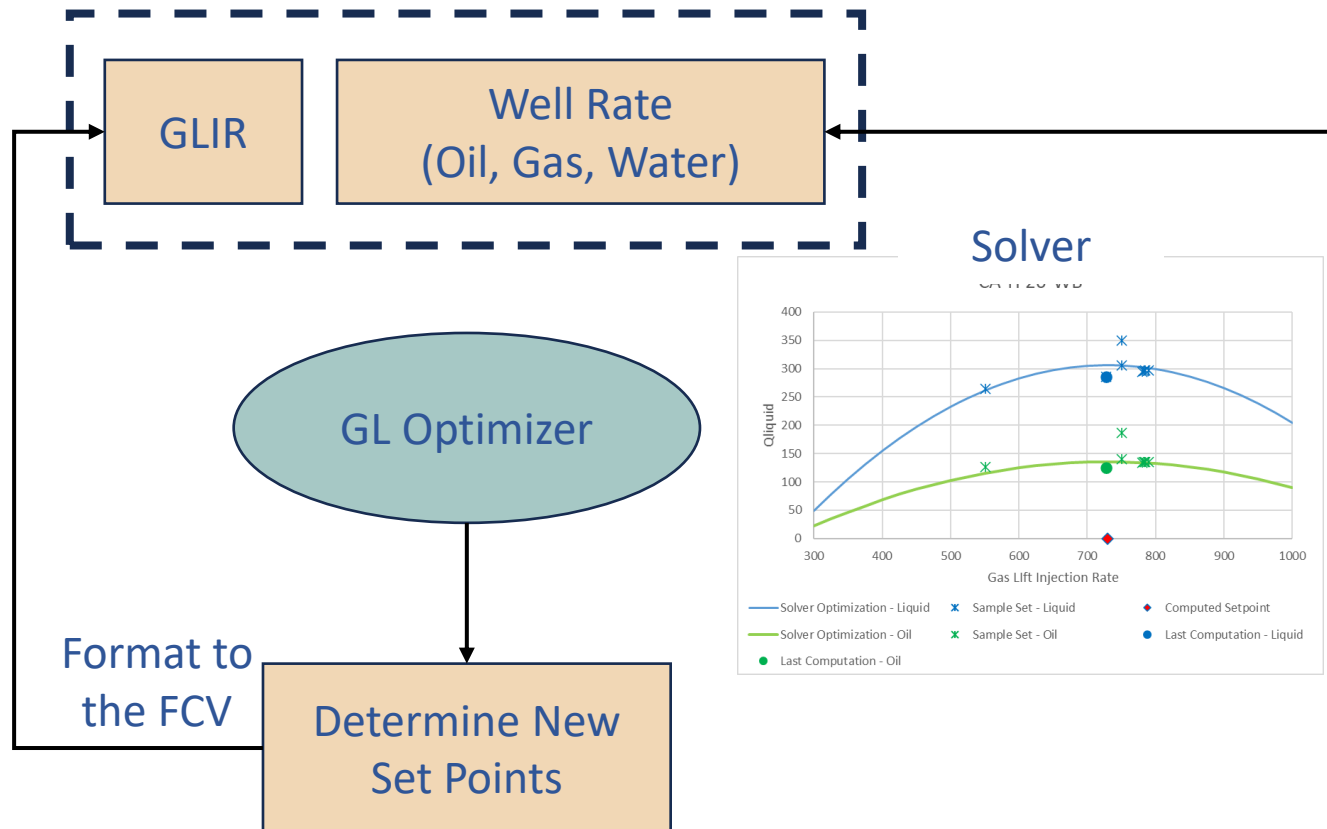
OT

- Pressure transmitter
- Cone meter
- Choke valve
- Electronically controlled actuator
- Flow computer & multi variable sensors



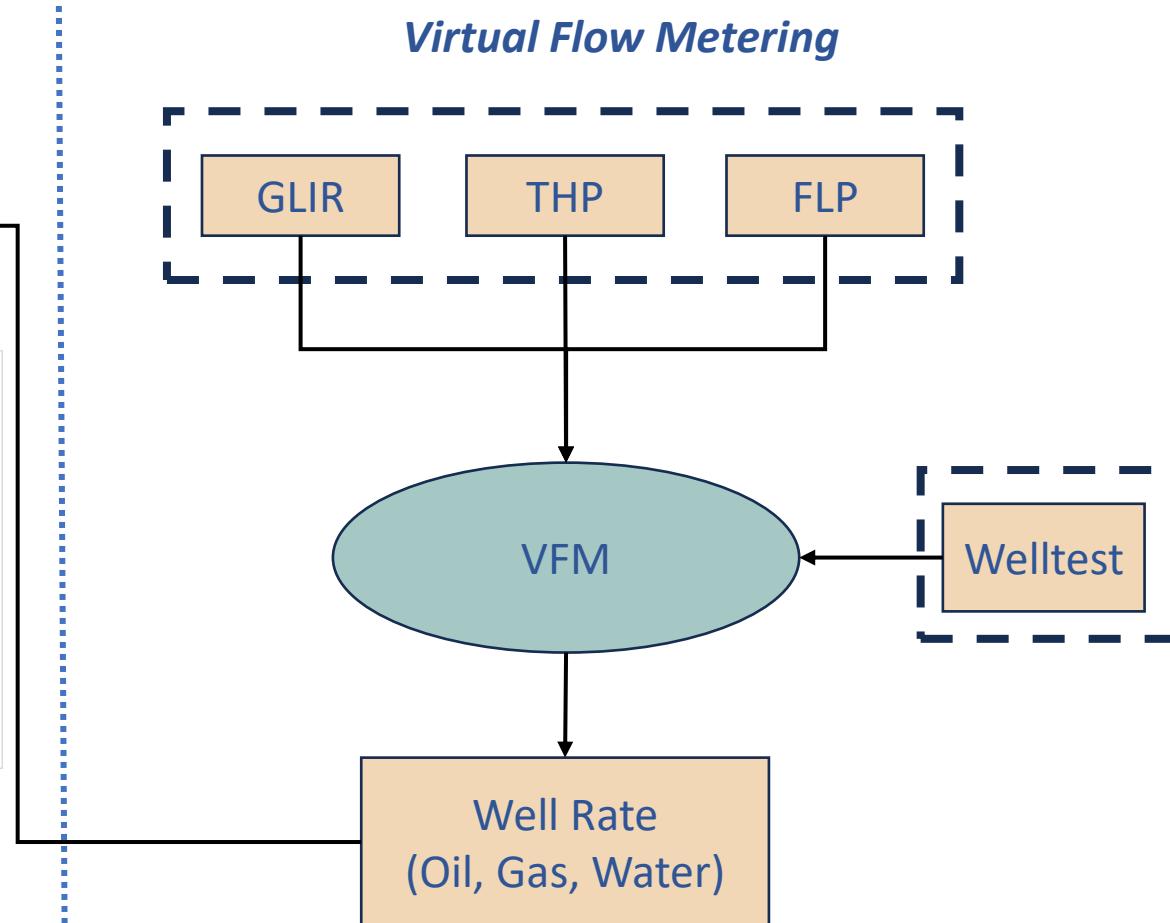
Workflow Architecture : VFM & GLO

Data Driven Gas Lift Optimization (n-Wells)



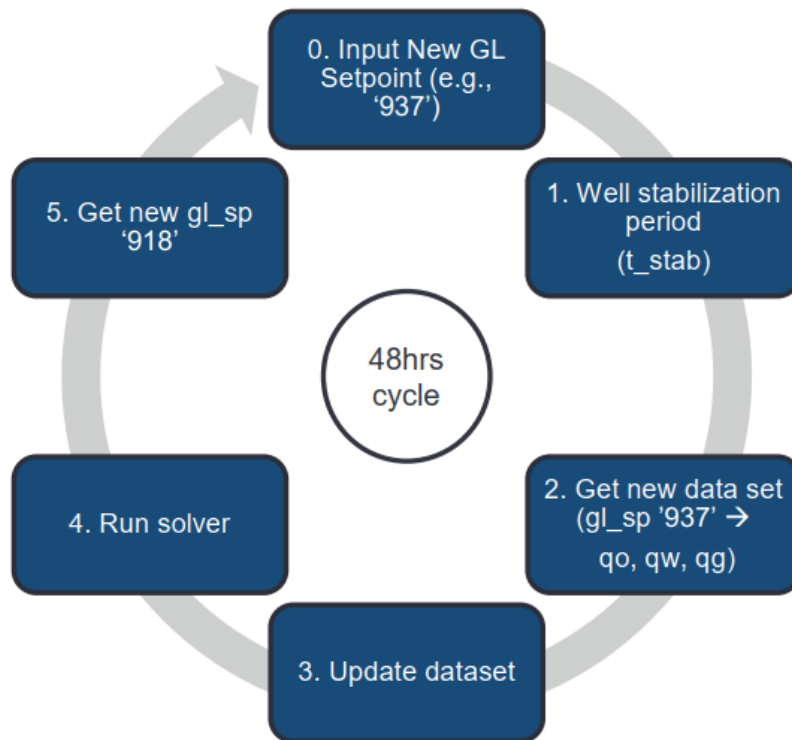
*Calibration-free model

Virtual Flow Metering

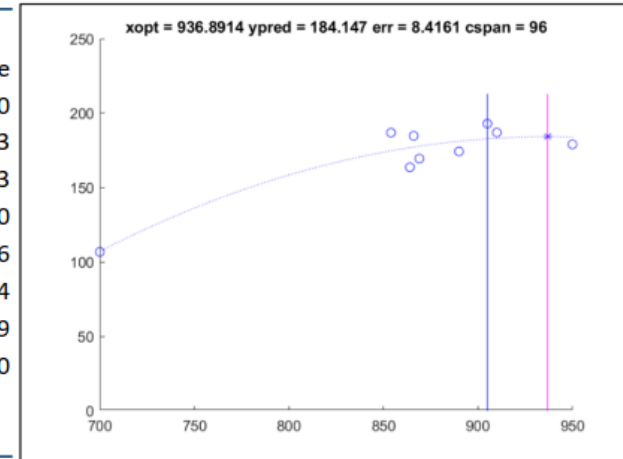


*Autonomous calibration based on validated welltest

Autonomous Gas Lift Optimization Workflow

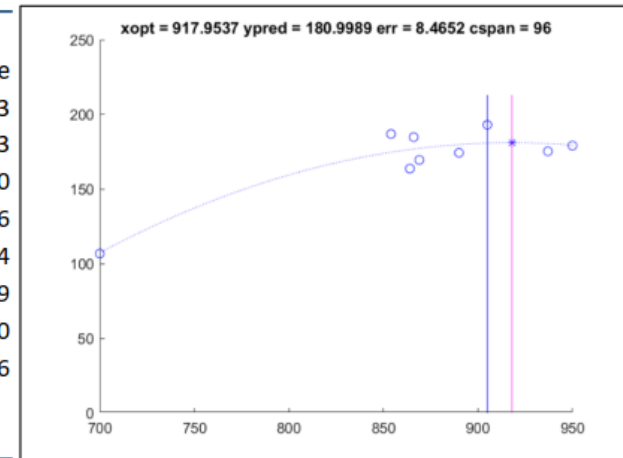


Dataset	
GL Setpoint	Oil Rate
910	187.00
854	186.93
905	193.03
890	174.30
864	163.66
869	169.54
866	184.79
950	179.10



Output → 937

Dataset	
GL Setpoint	Oil Rate
854	186.93
905	193.03
890	174.30
864	163.66
869	169.54
866	184.79
950	179.10
937	175.26



Output → 918

Autonomous Gas Lift Optimization Workflow

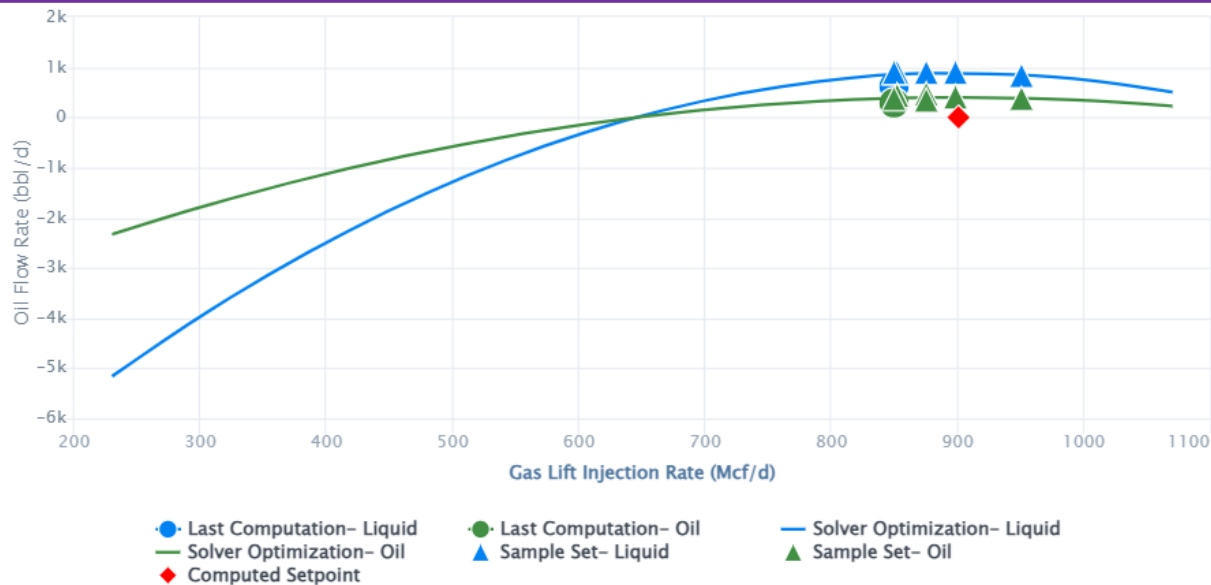
03-10-2024 22:49:00 - 08-10-2024 22:49:00

4h 12h 1d 1w 1mo 3mo

Selected time range doesn't have any data. Please select a proper time range

Edge result : GLO

Live



Date & Time: Aug 6, 2024 5:56 PM

Edge result : VFM

Edge input : Well Test

Search

GL Setpoint	Qliq.	Qoil(bpd)	WC(%)
875	895.3473541475648	453.53928463547487	49.34487910926179
876	909.3048789091984	356.35581374442165	60.81008449312337
899	894.5949662454555	398.4180994173182	55.46385633160361
853	894.6404724520196	433.0029264964158	51.60034227943582
853	891.1213071852153	424.6348471457426	52.3482556502844

1 to 5 of 8 Page 1 of 2

Computed Setpoint	901
Setpoint Type	Cycle was reset due to failed optimization
Uptime Computation for last cycle	100

Value and Benefits

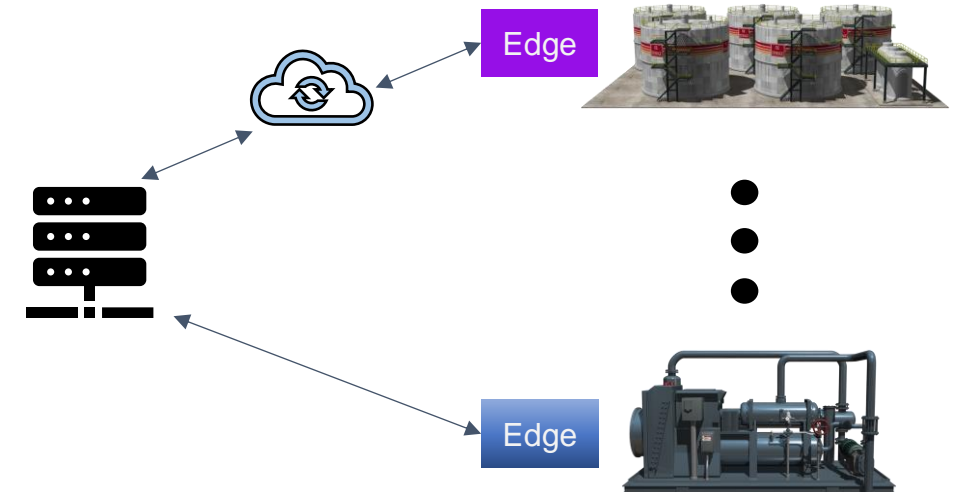
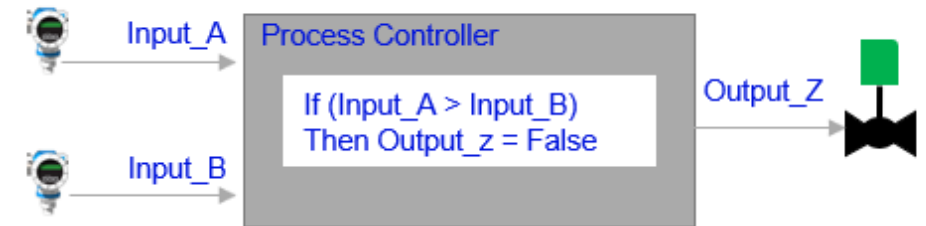
- Expected incremental production (oil gain) from 10 – 15 %.
- Expected reduction of injection saved by 10 %.
- Reduce number of well test cost.
- Saving for personnel mobilization.
- Reduce carbon footprint.



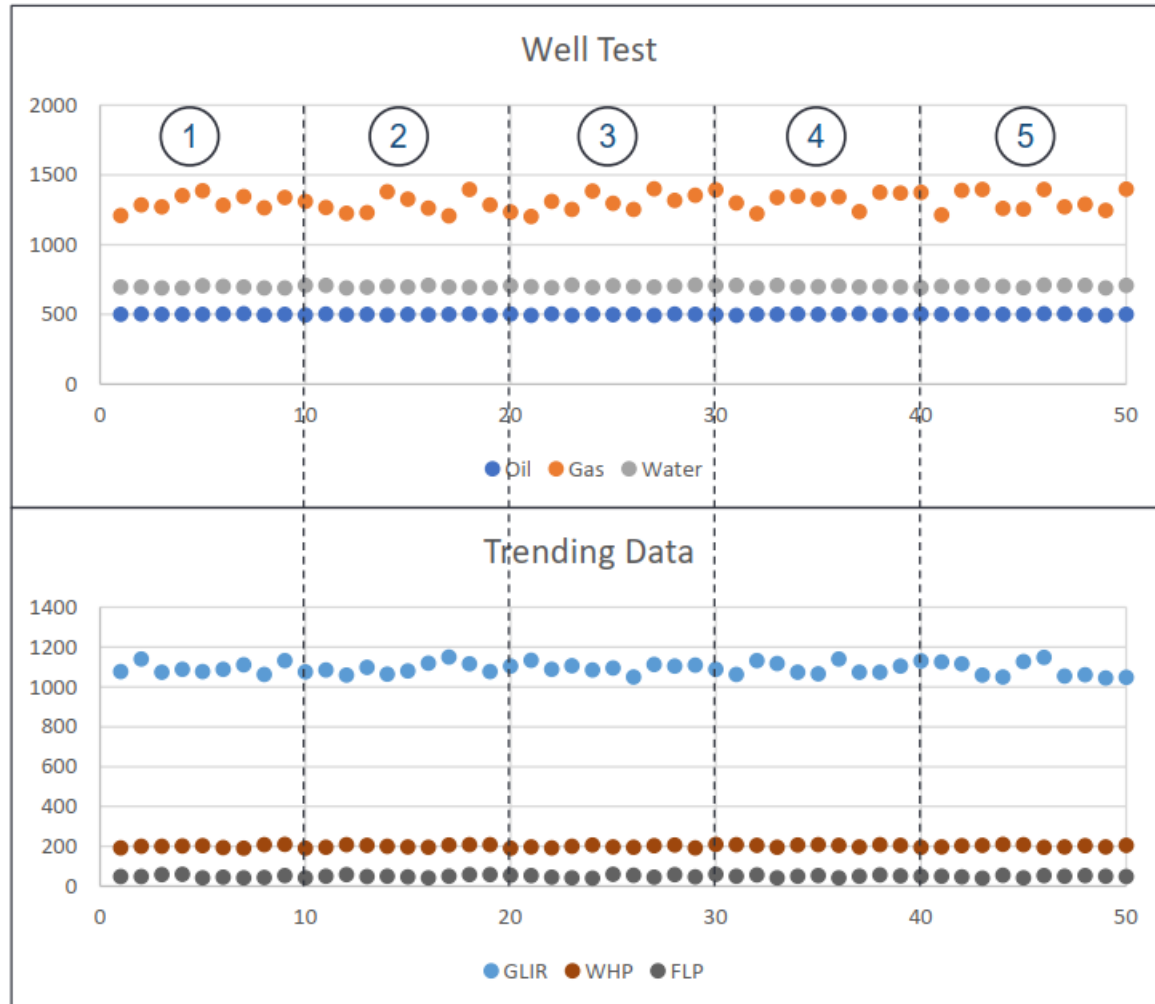
Backup Slide

Process Controller vs Edge Computer

- Process Controller
 - Monitor or adjust process parameters to achieve a desired output.
 - Leverage IOT devices within a network/process group.
 - Simple / single instruction.
- Edge Computer
 - Computer that controls data flow at the network boundary/endpoint.
 - Decentralization of cloud computing to empower a processing network.
 - Complex / multiple instruction.



VFM Calibration



Initial Calibration

Requirements:

- WT data (5 combinations with varying P1, P2 and QI)
 - avgTHP (P1)
 - avgFLP (P2)
 - avgGLR
 - Chk_diameter (d)
 - avgQI

Data preparation:

- 1 single 10hrs WT divided into 5 sections.
- Compute Avg of QI, Qg WHP and FLP for each section