Collaborative Geological-Engineering Integration for Unconventional Reservoir Development

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Case Study: How IoT Edge Technology Unlocking Value in Well Optimization and Enhancing IT Security in KOC

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Introduction

- As part of its digital transformation journey, Kuwait Oil Company (KOC) set out to modernize production operations across its thousands of active wells.
- Traditional SCADA systems proved difficult, as they offered limited analytics, delayed insights, and lacked predictive capabilities. At the same time, KOC's strict IT and cybersecurity regulations restricted the use of cloud-based solutions,

Challenges

Key Challenges:

- Limited visibility into real-time well production performance
- Dependence on standard methods such as well testing, higher operational expenditure (OPEX). (well test every 3 months/well)
- The project required replicating full cloud functionality within an on-premise environment.

Objective

Achieving Proactive asset management

- Monitor reservoir deliverability & well productivity
- Maximize operational efficiency
- Minimize HSE risk and environmental footprint

Implement Edge-Computation to assist in the digital vision

- Deploying on edge-computation & IoT technology in KOC
- Deploy On-prem solution
- Implemented fit-for-purpose AI based workflows.

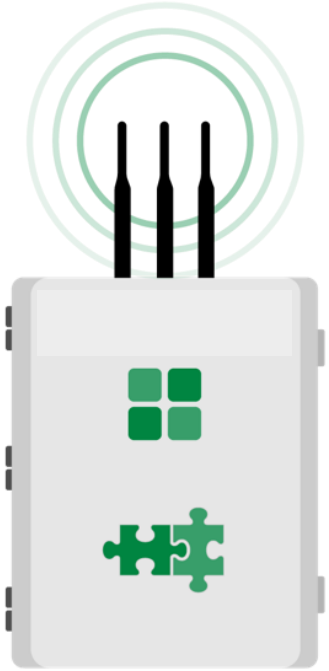
Design framework

Joint effort with KOC IT, SCADA, INFOSEC and field operation teams

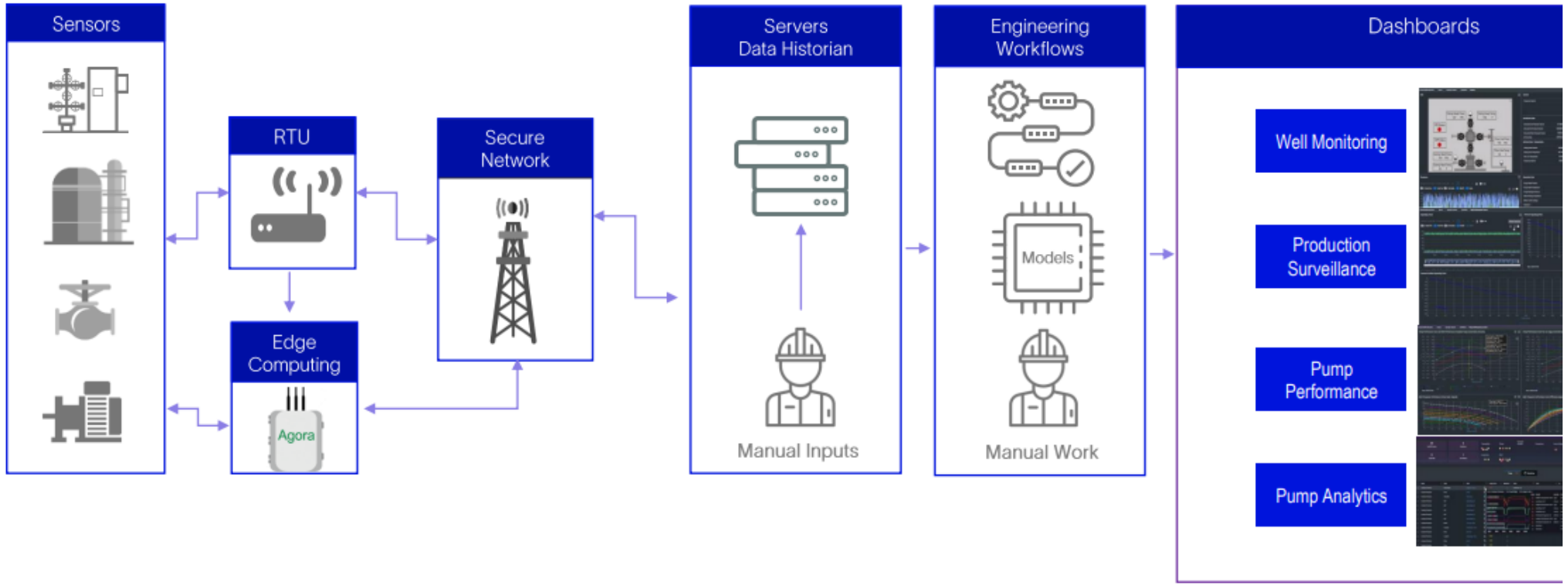
1. Understand the need of high-frequency data
2. Determine access to required data by connecting existing equipment/ systems
3. Install Edge instrumentation
4. Train the model and test
5. Implement Edge-computing for high frequency data computation
6. Enable visualization & full visibility on well performance

Solution deployment

- Edge IoT gateway installed near well site and connected to RTU.
- Executes AI-Driven Engineering workflows locally.
  - Virtual flow meter
  - Asphaltene detection
- Transmits only processed results to the central server system
- Deployed Demilitarized Zone (DMZ) to isolate the field network from KOC’s corporate network.
- Compliance with KOC IT Security policies. Data encryption at rest and in transit.



Architecture overview



Testing and validation

Performance Metrics:

- Gateway uptime exceeding 99%
- Connectivity rate above 98%
- Workflow execution success rate over 98%

- Strengthened network segmentation and security.
- Solution design aligned with existing KOC infrastructure and cybersecurity standards

Benefits to KOC

First-ever successful On-prem IoT edge deployment within KOC's infrastructure.

Demonstrates AI + Edge Solution can enhance well performance and setting foundation for autonomous workflows.

Operational reliability through local processing

- Optimized bandwidth and reduced latency over WIMAX network.
- Data integrity and confidentiality ensured by DMZ solution.
- Scalable IoT framework for future AI and digital projects in KOC.

Reference

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Case Study: Edge Computing Solutions for Well Performance Monitoring and Asphaltene Detection in Deep Carbonate Reservoir, Greater Burgan Oilfield.

Thank you