

Digital Transformation

Smart and Connected Oilfield Operations



Introduction

Digital



What is it : Why it Matters

Motivations



\$: Technology : Culture

E&P



Lifecycle (Exploration, Drilling etc.) : Back Office

HAL



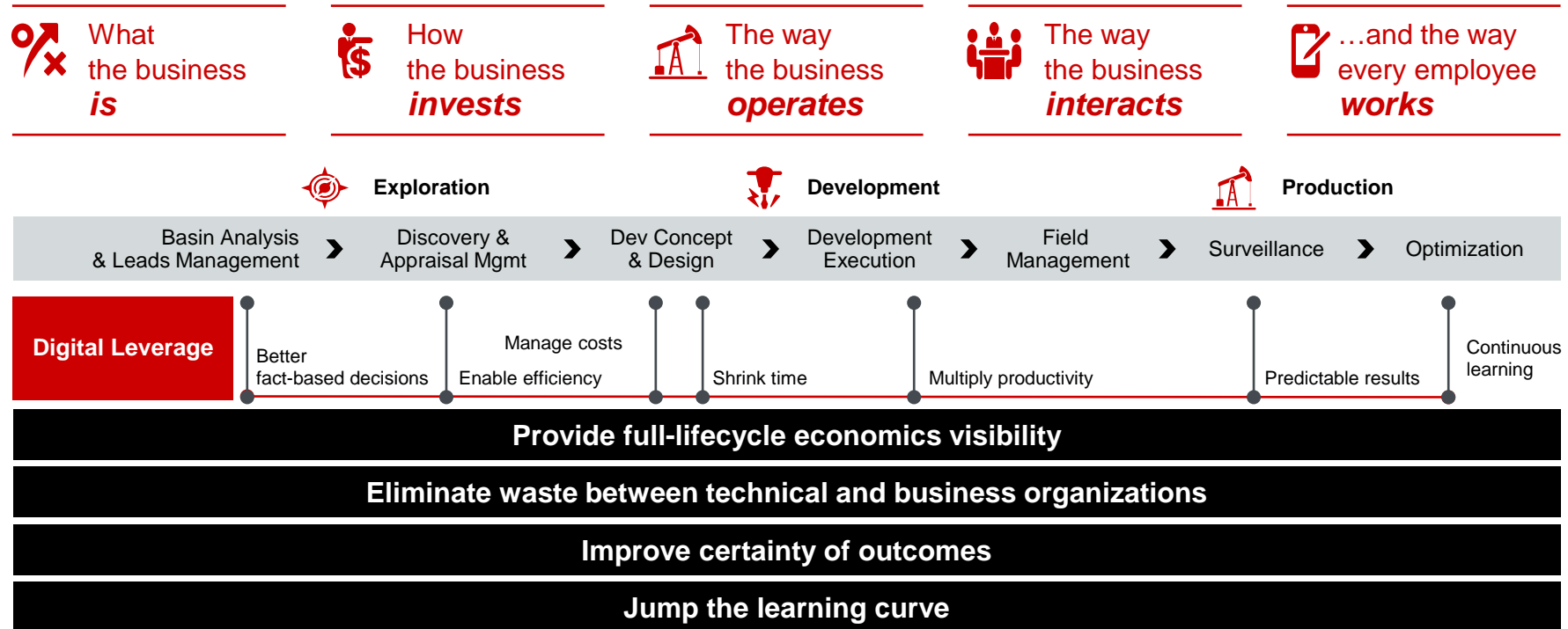
What's Different and Why



DIGITAL SHIFT

THE TRANSITION TO NEW BUSINESS PARADIGMS
THAT LEVERAGE DIGITAL TECHNOLOGY TO CHALLENGE
PREVIOUSLY HELD ASSUMPTIONS ABOUT THE INDUSTRY

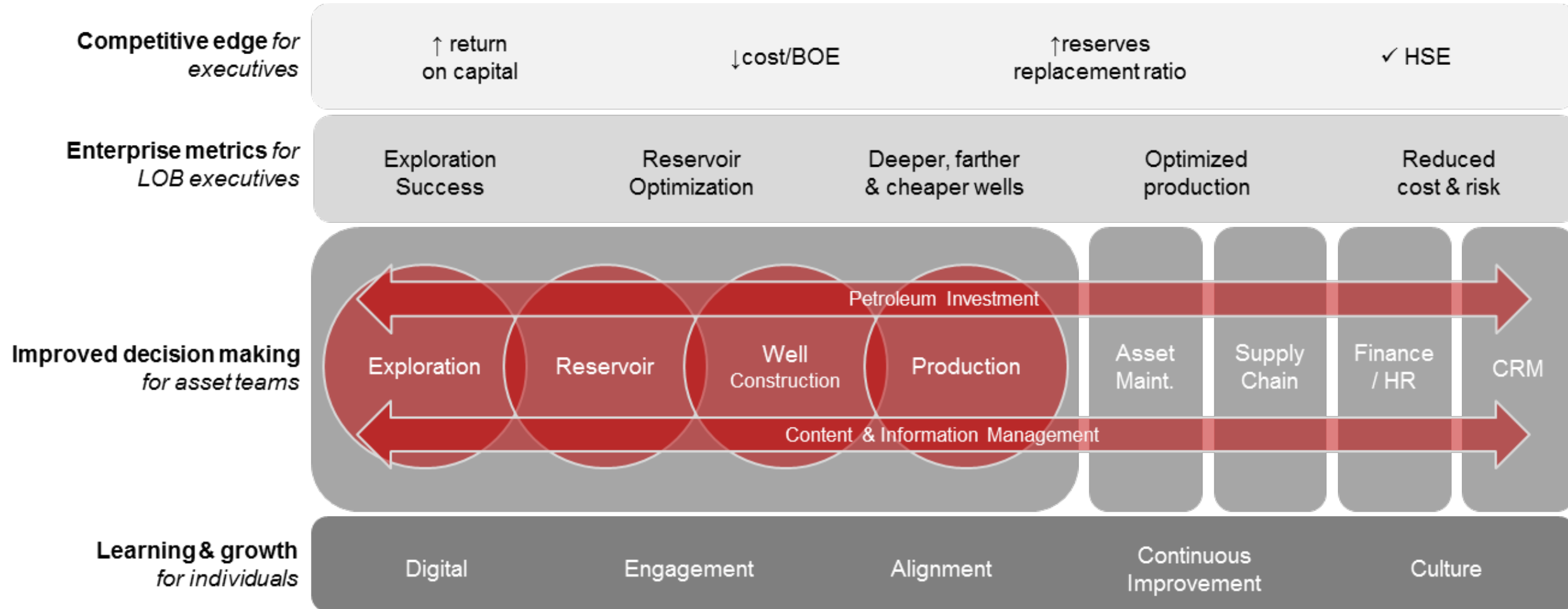
Digital Vision : E&P Business Outcomes



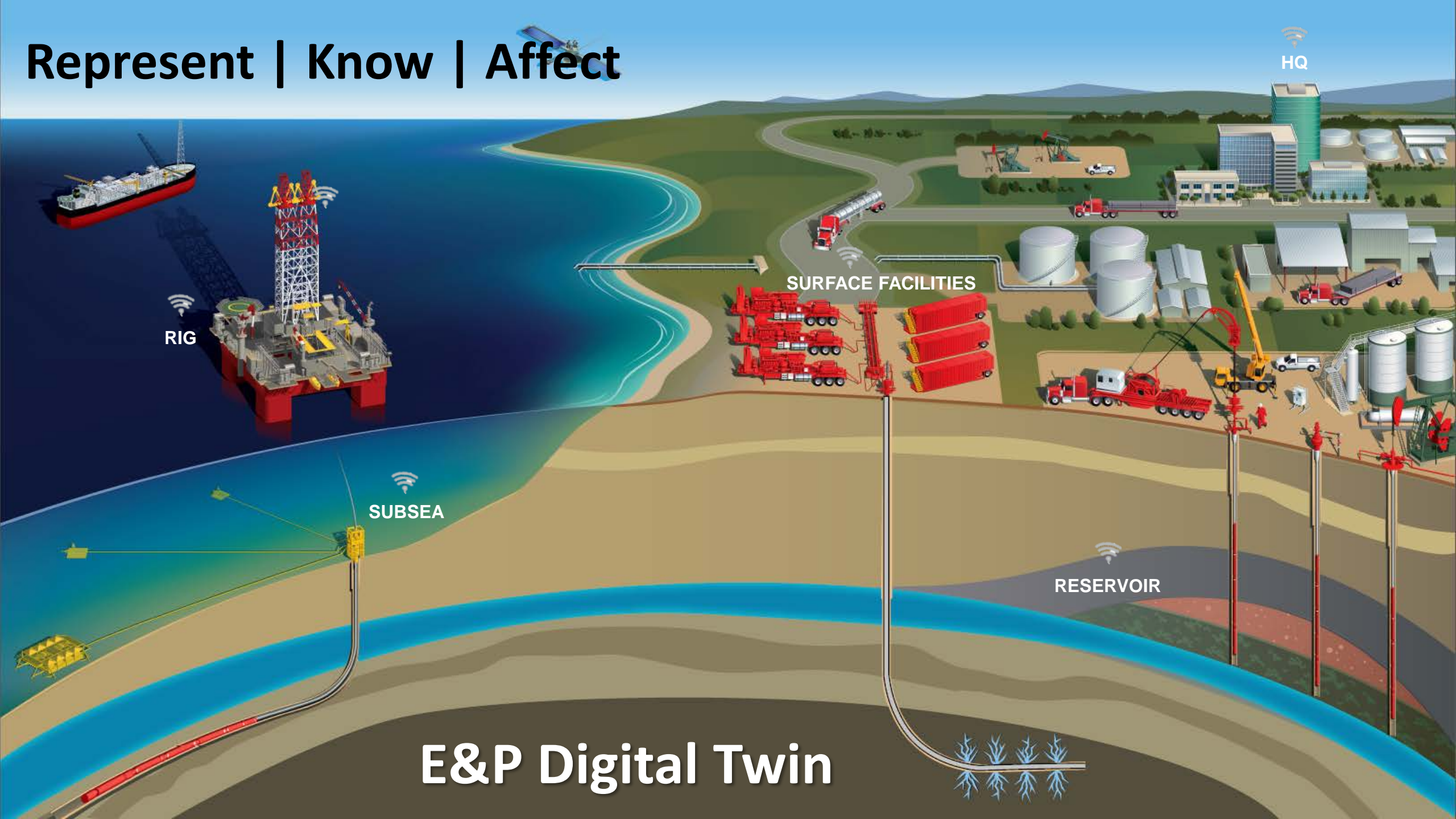
Harnessing the NEW requires:

- Focus on business transformation, not technology
- Asset intimacy
- New relationships, partnerships, ecosystem

E&P Digital Transformation relies on Asset Intimacy



Represent | Know | Affect



E&P Digital Twin

What is Digital trying to do?

Objective Function: Hydrocarbon Recovery

Constraints: Cash Flow, ROI, Safety

**Ground Reality: Complex, Interdependent,
Simultaneous Optimization**

**SYSTEMATICALLY
&
REPEATEDLY**

*Objective Function:
Hydrocarbon Recovery*

*Constraints:
Cash flow, Profits, Safety*

*Objectives are:
Complex
Interdependent
Simultaneous Optimization*

EFFICIENCY
(do more with less)

EFFECTIVENESS
(be better)

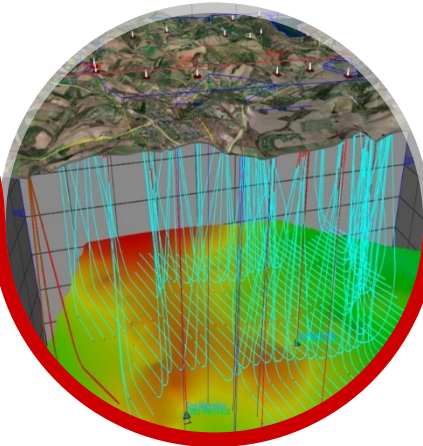


Smart and Connected Oilfield Operations

Enabled by Digital Solutions



ASSET INTIMACY
REAL TIME
AUTOMATION



CLOUD



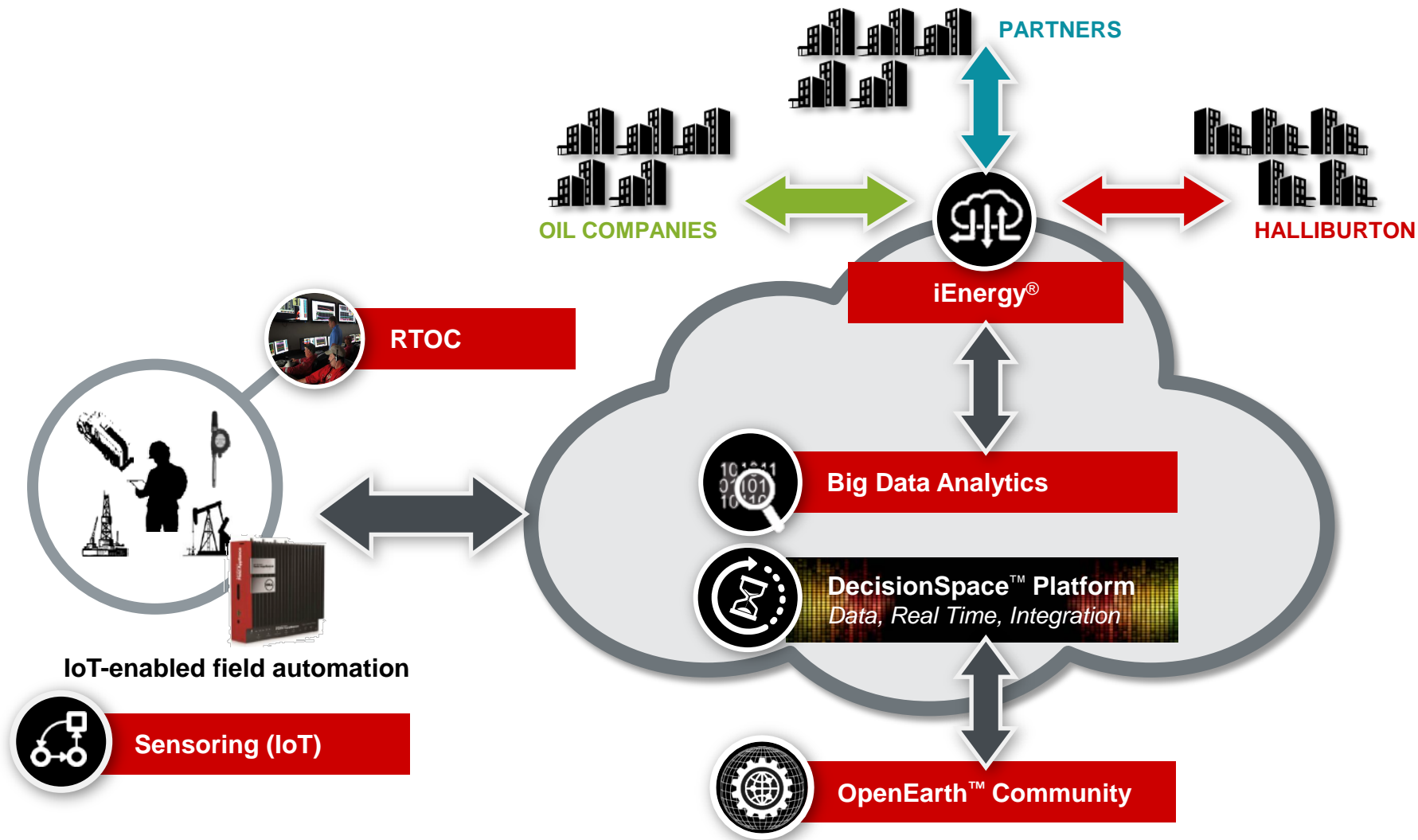
ANALYTICS,
MACHINE LEARNING,
BIG DATA



OPEN PLATFORM
CO-INNOVATION

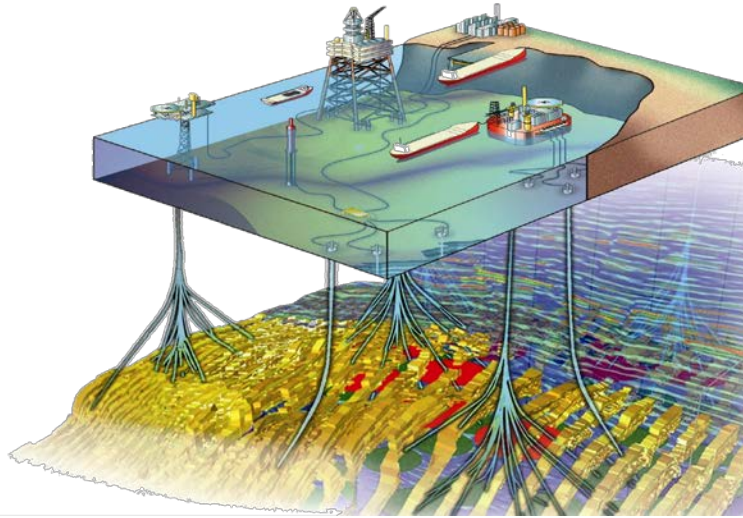
Enterprise Architecture: Open, Modular, Collaborative

Business Strategy + Technology Architecture



Digital Twin

The Physical Asset

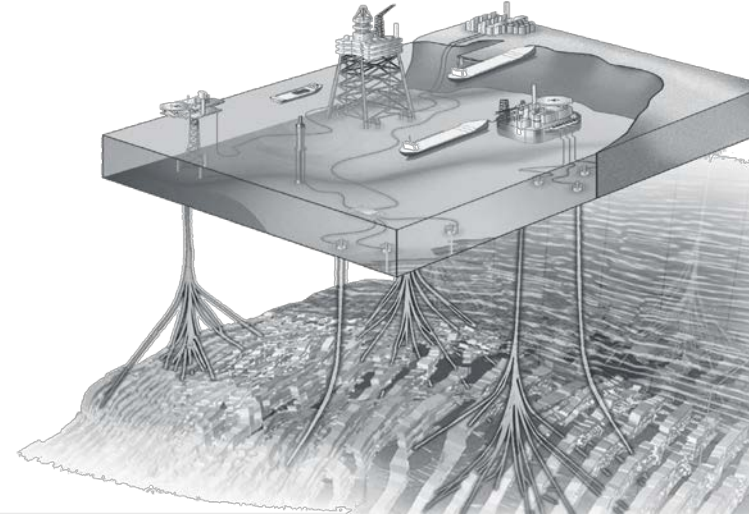


Types of Reservoirs, Wells & Equipment

Telemetry, Smart Wells, Real Time Data

Actuators
Feedback Controls

The Digital Twin



Prototypes modeling physical assets

Twin that simulates, models real data and
creates advisory plan

“EVERGREEN” digital representation + SAP +
Backoffice, updated in near real time on a
single platform

Key components of the Well Digital Twin

Environment Powered by DecisionSpace®

Transient

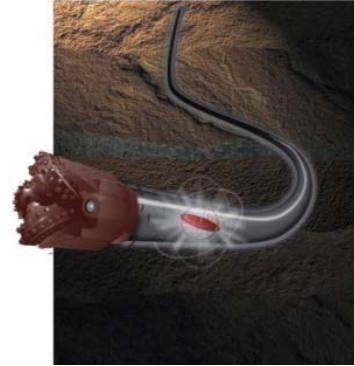
EDM



Rig(s)



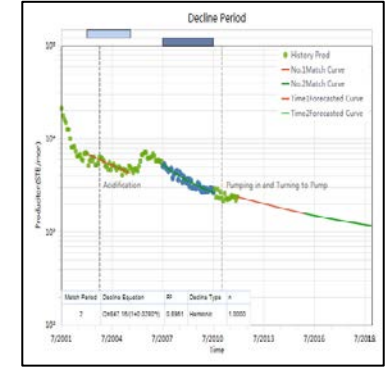
Other surface equipment



Downhole equipment



Fluids

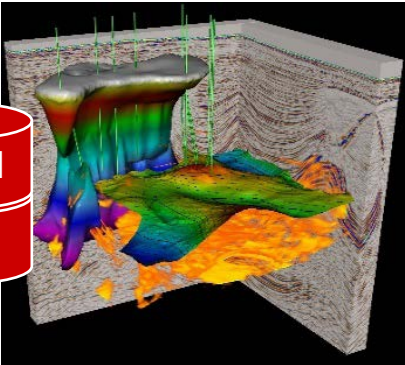


Production

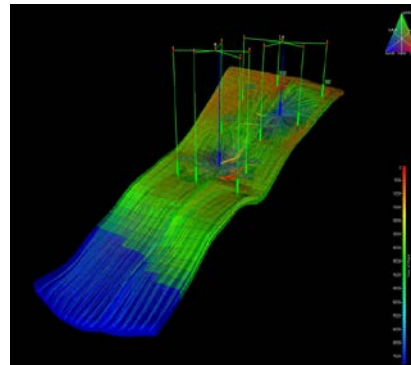
Permanent

EDM

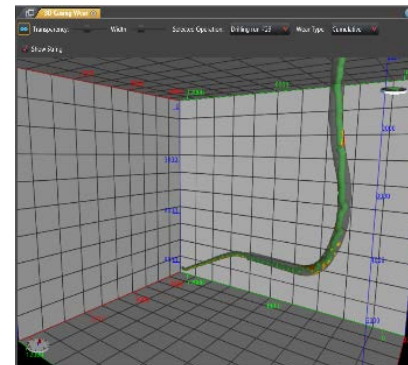
OW



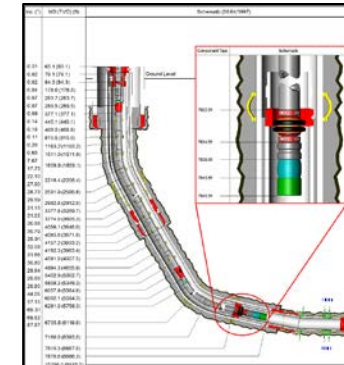
Sub-surface



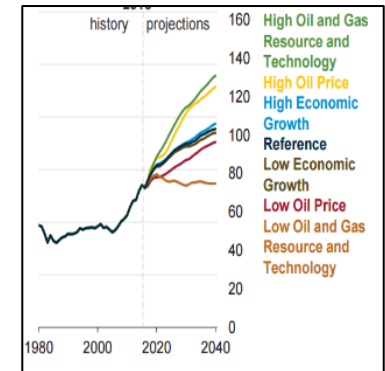
Reservoir



Wellbore(s)



Tubulars



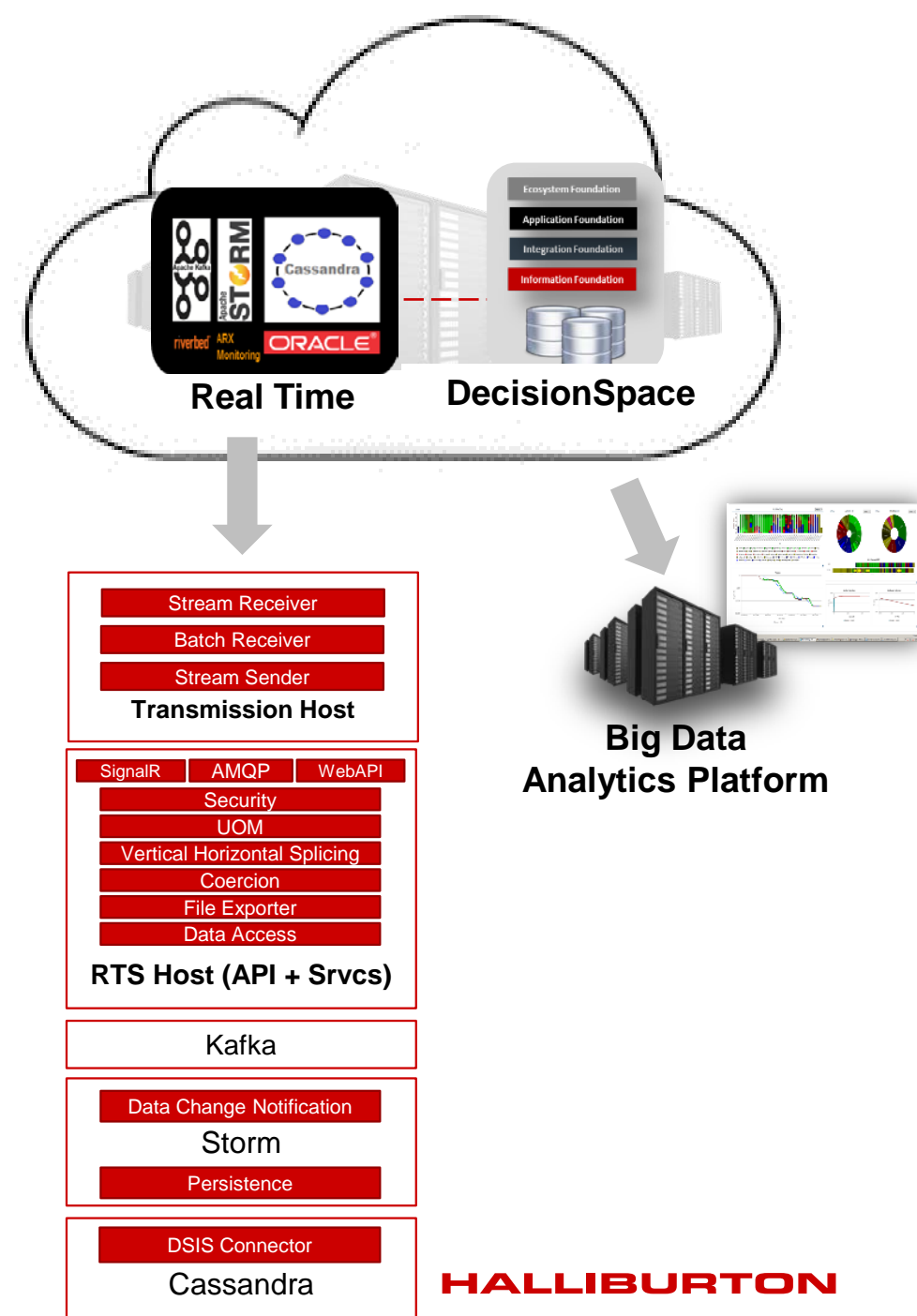
Economics

Prototypes

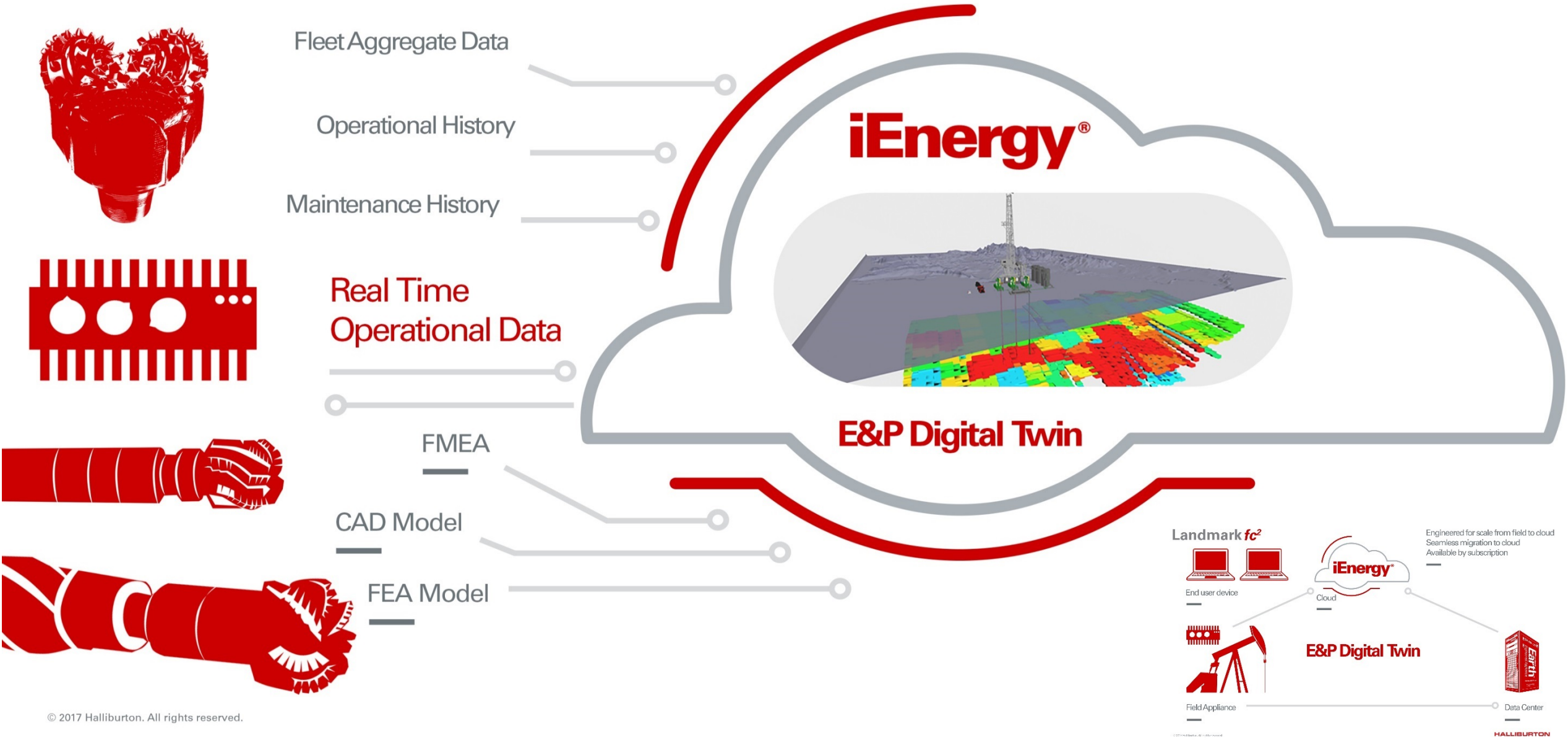
Instances

Cloud-Based Digital Platform

- Real time data historian through cloud-based services
 - » Off-the shelf technology
 - » Flexible (logs, reports, unstructured context info)
 - » Scalable nodes, replicas, active DC failover
- DecisionSpace® integration enables:
 - » Multi-domain data integration
 - » Workflow orchestration
 - » Multi-well/job real time analytics
 - » On-demand simulation
- Plans for engineered, private-cloud solution
- Post job available for big data analytics

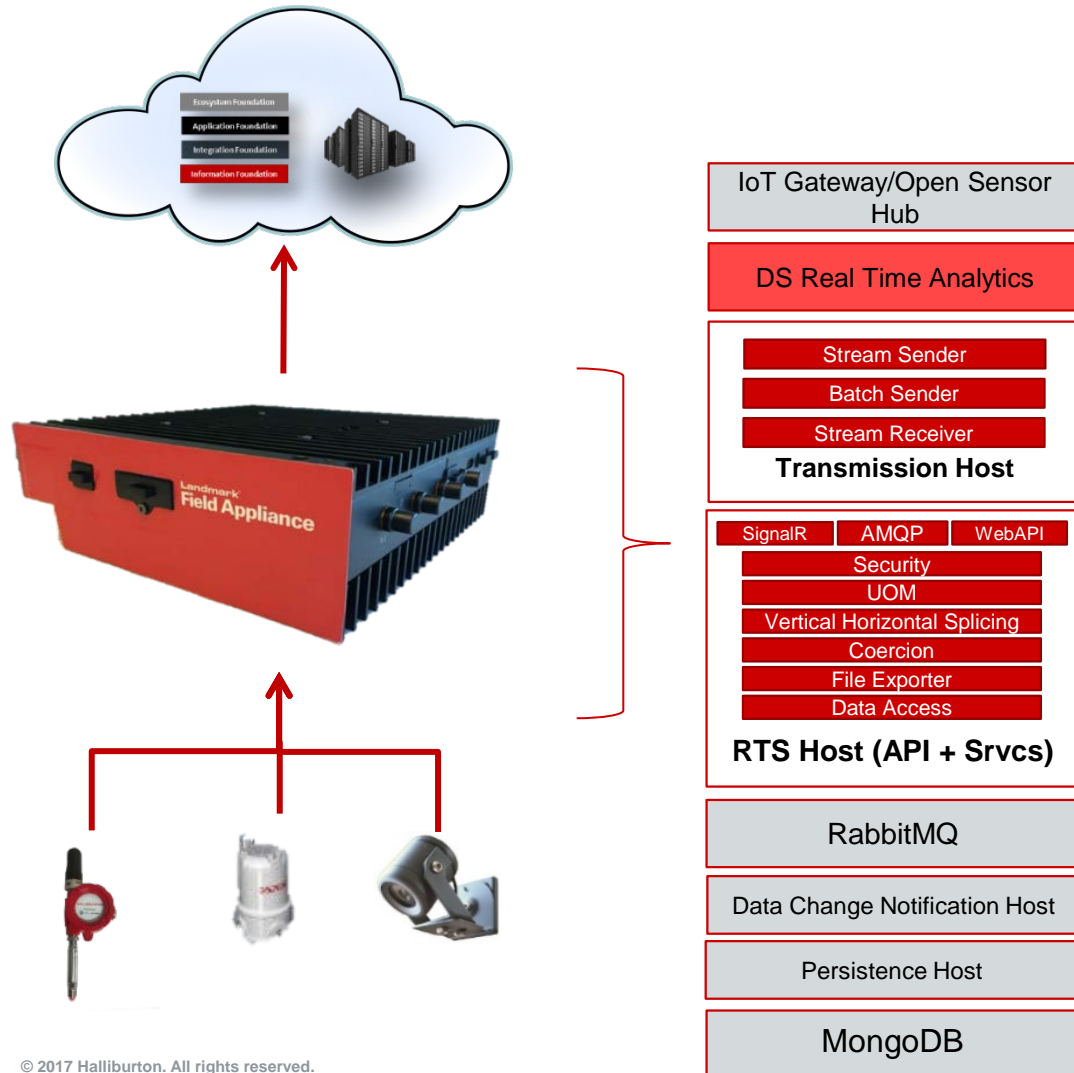


Halliburton Solutions for Digital Twin: *fc*²



Halliburton Field Appliance™

Edge Analytics enabling Intelligent Operations

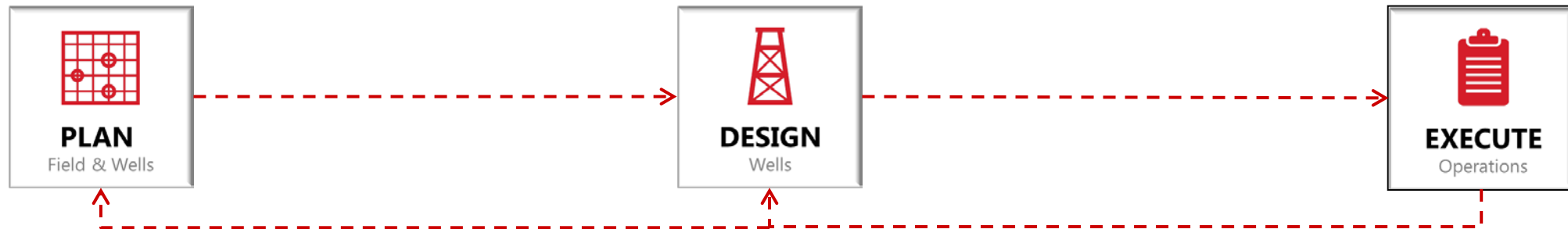
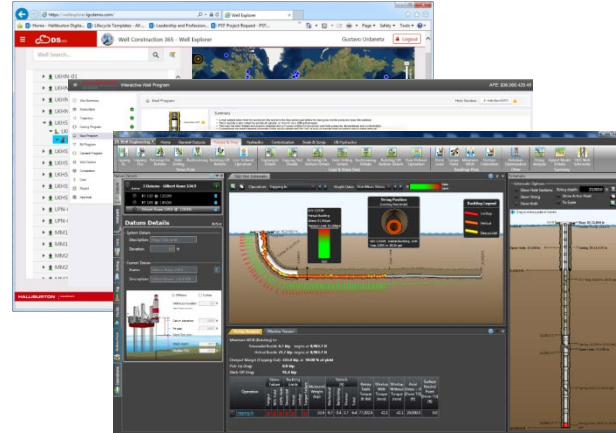
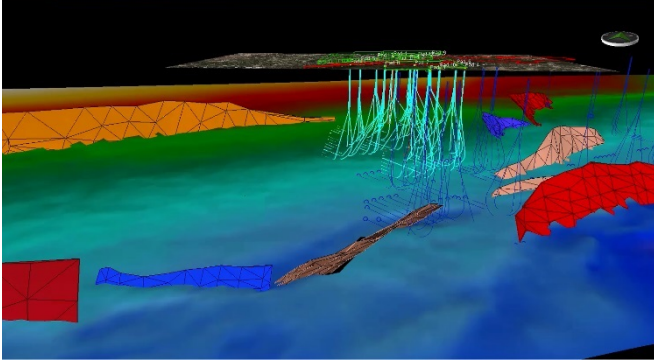


- Executes real time analytics data close to the operation
- Provides a “reflex” capability to the well/facility, giving it a greater degree of autonomy.
- Enables events/failure detection and prediction
- Enables real time optimization
- At the same time guarantee the integration through the cloud with the field analysis and simulation systems
- IoT gateway, self-discovery simplifies configuration
- Integration w/ 3rd party rig equipment, automation support

Halliburton Solution: Well Construction 4.0



Well construction lifecycle

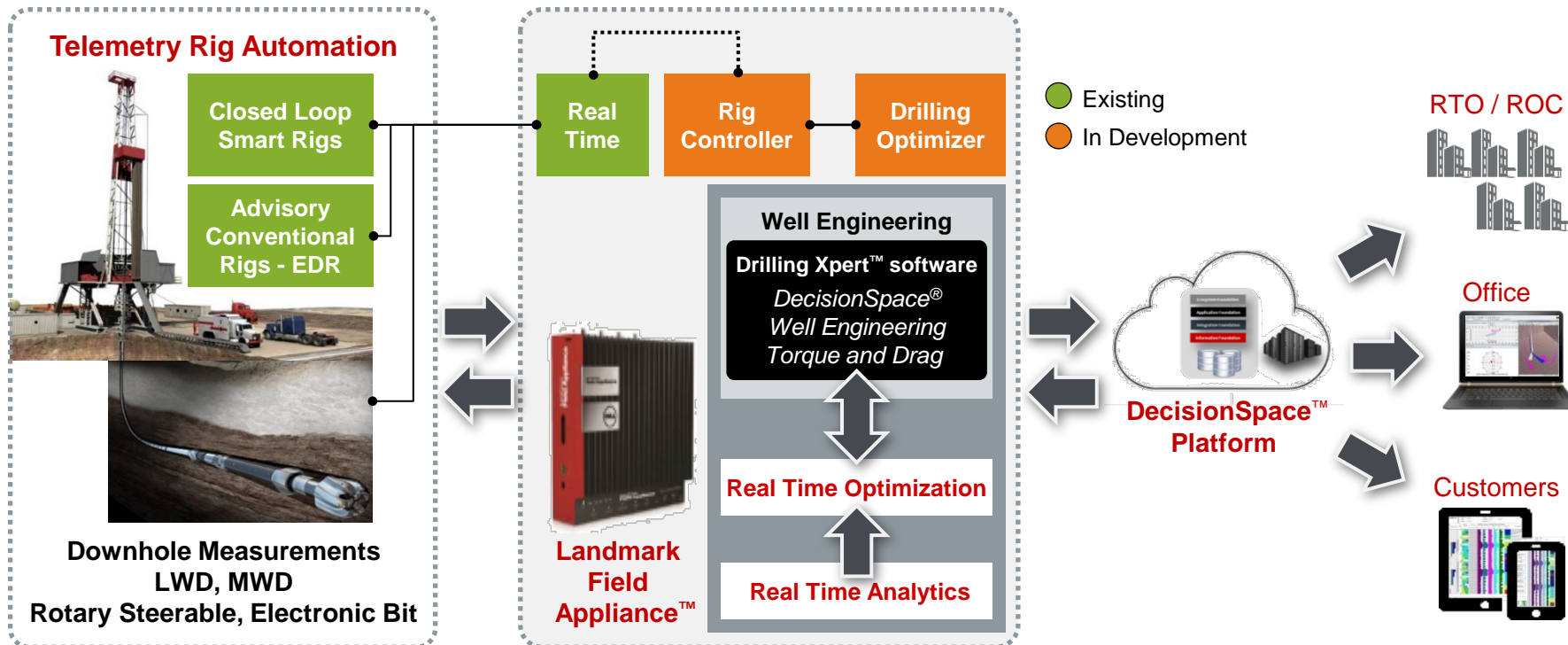


Digital Leverage: Drilling Automation

Optimize Objective Functions for Real Time, Advisory and Planning

Optimize drilling time, reduce NPT, improve quality and reliability

- **Drilling Optimizer:** ROP Optimization Engine, Geosteering/Trajectory
- Surface (Advisory): conventional/smart rigs (PASON, EDR, NOV, NBR) through **open standards**
- Subsurface: **Real time control** / geosteering





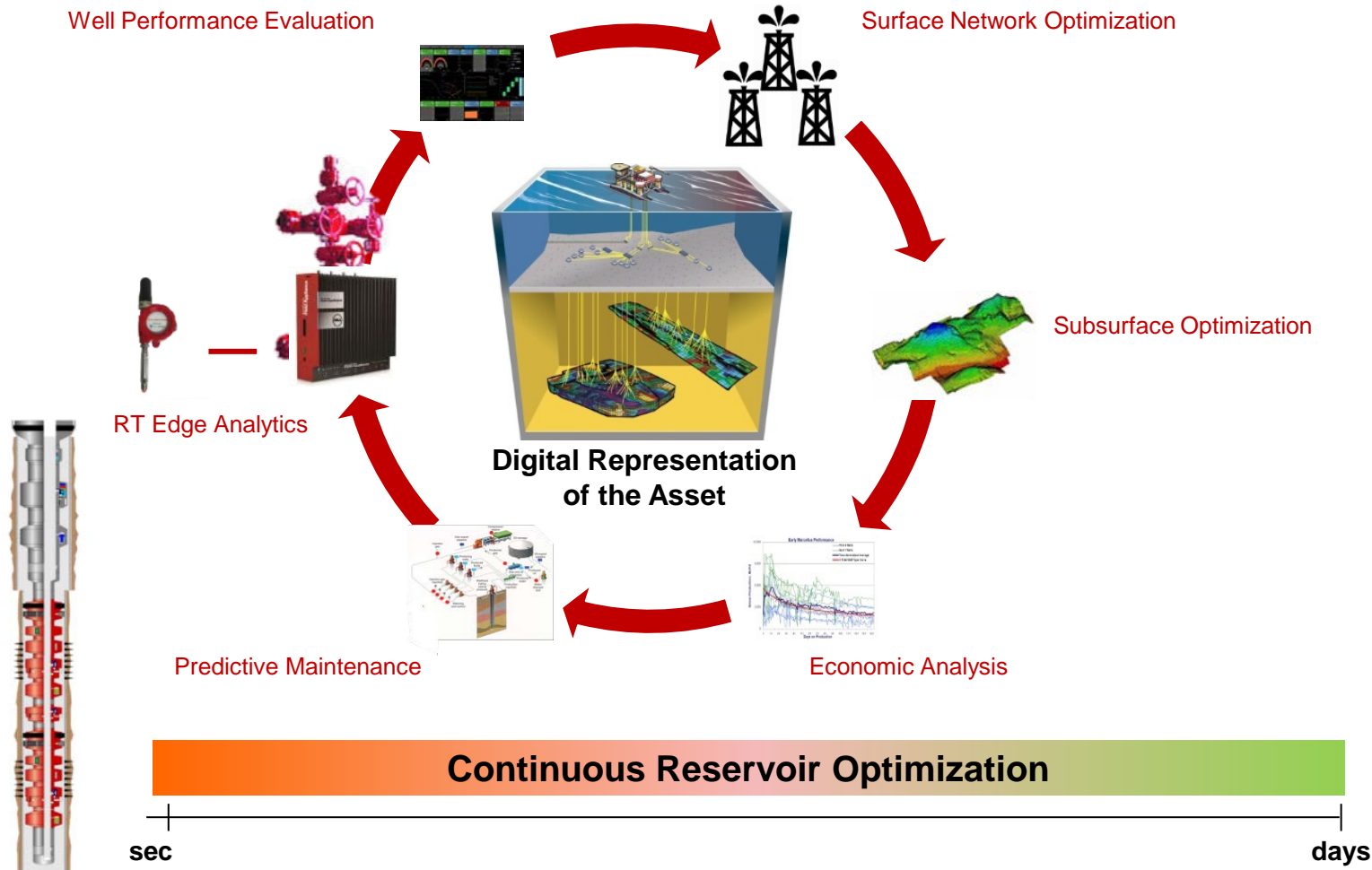
Enhancing Voice of the Oilfield

Combining OPT's best of breed petroleum and
production engineering with DecisionSpace®
Production

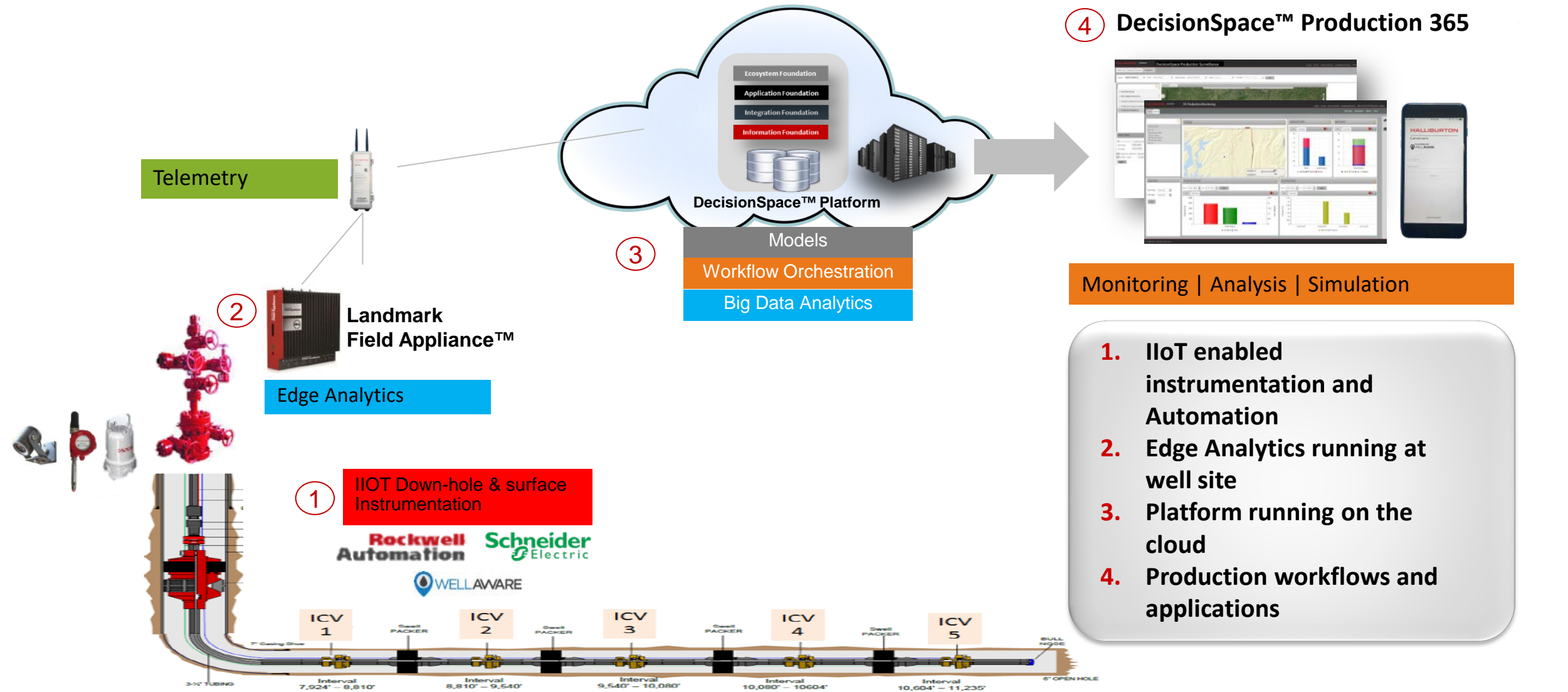
HALLIBURTON

OPT
A HALLIBURTON SERVICE

Continuous Reservoir Optimization with The Voice of the Oilfield™



Digital Twin in Action with The Voice of the Oilfield™



1. IIoT enabled instrumentation and Automation
2. Edge Analytics running at well site
3. Platform running on the cloud
4. Production workflows and applications

Case Study: Digital Well Pad PoC

Complete and integrated view of all relevant information from the well pad to enable optimized production management



- Co-innovation PoC with major operator
- Digital Transformation of 2 Well Pads located at Bakken and Eagle Ford Assets
- Targets: Increase Well Pad Regularity by 50%, Reduce Driving time by 50%, Reduce Spills and Emissions by 30%

Digital Leverage: Connectivity, Integration

E&P's Only Open, Cross-Domain Platform





The Open Earth Community

Lowering cost and accelerating
the pace of innovation

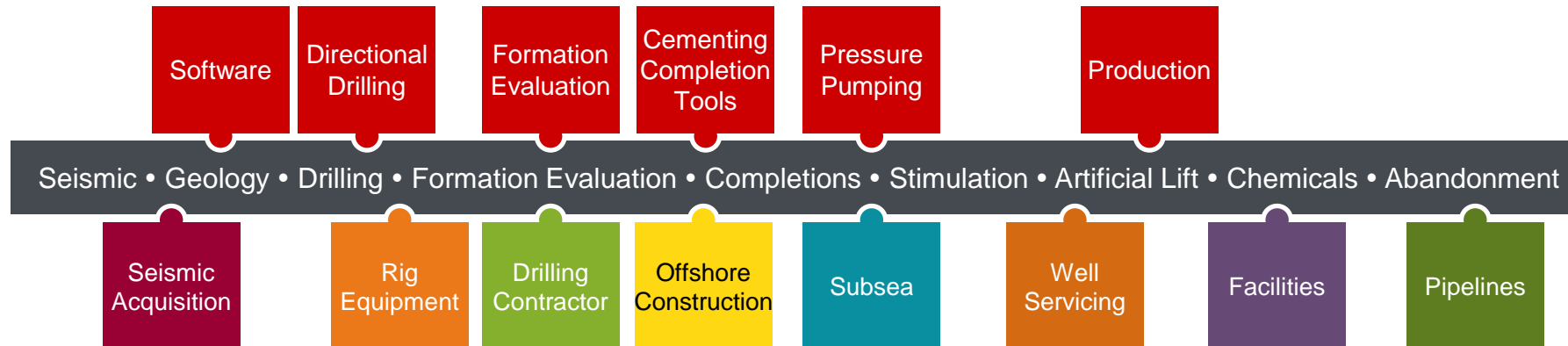


Digital Ecosystem Based on an ^{Industry} ~~Application~~ Platform



OpenEarth[™]
Community

A free, global and open community of scientists, engineers and software developers in oil and gas companies, service companies, software providers, data vendors and technology developers committed to producing an open and shared E&P software platform to rapidly **lower the cost** and **accelerate the pace** of innovation in the E&P Industry.



Co-Innovation, Co-Engineering, Partnerships



- Shared vision for E&P transformation from field to board room
- Accenture's business / IT transformation expertise
- Complementary capabilities



- Joint collaborative solutions (December 2016)
- Commitment to open, standards-based integration
- Real-time digital representation of assets:
Technical, Operational and Economic insights



- Develop intelligent cloud solutions for Oil & Gas Operations
- Collaborate, Co-innovate on technologies for machine learning, AI, AR/VR, IoT
- DecisionSpace 365™ on Azure, enable real-time streaming for drilling, production solutions



- Development of 4D seismic, unconventional workflows
- CGG software integrated with DecisionSpace™ platform
- Machine learning for seismic quality
- Collaboration across Wireline, PE for frac analytics, unconventional