ICoTA Canada Tech Forum

Intelligent Conveyance Technology

Agenda

- What is Intelligent Conveyance Technology?
- Why is it important?
- Where is our industry right now?
- What’s coming next?

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Intelligent Conveyance Technology

- Intelligent Conveyance, as defined by Stimline, is three key components **working together to reduce risk and increase efficiency**
  - Hardware
    - Purpose designed Injector Heads and Reel Systems
  - Control systems
    - Mechanical automation to maximise performance and minimise
  - Software
    - A well model and job plan, updated in real-time from downhole data
    - A on-line solution that focuses on deviations from the plan
    - A collaborative solution that allows experts to view all relevant data to make key decisions in real-time

Intelligent Conveyance Technology
Hardware: 130k Injector Head

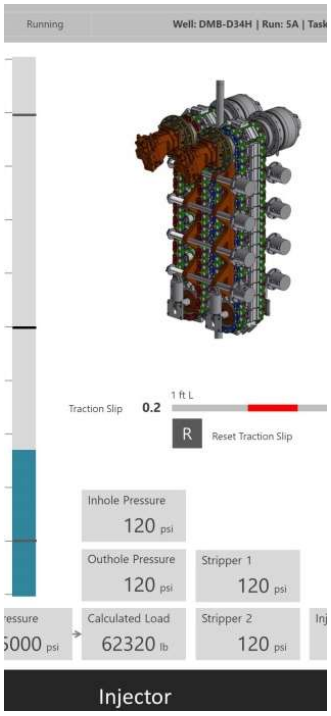
- Designed from first principles with two key goals
  1. Reduce pipe damage
  2. Reduced repair costs

- Designed for automation
  - Drive hydraulics optimised for better control
  - Automated traction zone control

Intelligent Conveyance Technology
Hardware: RX12 Reel System

- 12 ft wide Reel System specifically designed for high grade heavy wall tubing
- Automated spooling system

Intelligent Conveyance Technology Control System



- Based on several years of evolution from the system deployed on many Drilling Rigs, the XOS Control system and HMI is designed to improve operational efficiency
  - Operator cannot cause unintentional damage – limit alarms
  - Simplified user interface focused on key information
  - Early detection of operational issues

Intelligent Conveyance Software

- Cloud-based infrastructure for well intervention & completion
  - Collaboration key to success – all data available to everyone at all times
  - Notification of key events
    - No need to watch the job
  - Real-time updating of models
  - Operational focus - data analysis and reporting

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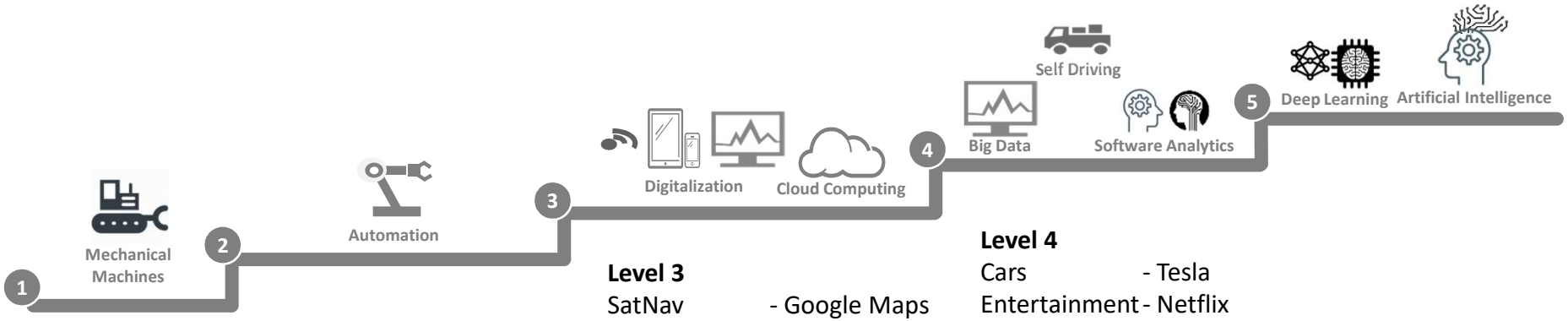
Intelligent Conveyance
Why is it important?

- Skilled field personnel harder to come by
- Operations more expensive and focused on fracturing
  - Downtime costs are higher
- Tracking of performance is limited when it is not integrated with all job data.
  - Identifying areas for potential improvements is difficult and time consuming
- Without knowing how we are performing now, how can we improve?
  - Updating best practices, optimizing procedures
  - Sharing learnings from previous jobs

Intelligent Conveyance will bring Digital Transformation to the Well Intervention & Completion industry to mitigate these human risks

Digital Transformation

Digital transformation is the integration of digital technology into all areas of a business, fundamentally changing how you operate and deliver value to customers**.**



Level 3

SatNav	- Google Maps
Banking	- Most

Level 4

Cars	- Tesla
Entertainment	- Netflix
Retail	- Amazon
Oil & Gas	- Drilling

Digital Transformation
On All Oil Company Agendas

IMPROVE

Digitalization opens up for massive improvements

Big data & analytics

Instant analysis of large data sets to identify new patterns

Cloud computing/storage

Highly scalable, variable-cost storage & processing on demand

Collaborative technology platforms

Employee engagement and collaboration enabled by digital platforms and communities

Virtual reality

Interact more naturally with digital devices and services

Real-time communication and tracking

Every asset, equipment, employee always connected

3D scanning

Analyses of real-world object or environment to collect data on its shape / appearance

Additive manufacturing

Print objects & parts on demand with increasing precision, and range of materials

Mobile connectivity & AR

Virtual telepresence to remove the need for on-site humans and omnipresent mobile devices

Unmanned aerial vehicles

Autonomous, low-cost vehicles able to perform complex tasks and remove human presence

Sensors

Low cost, low power, connected sensors capturing spatial and environment information

Robotics & automation

Intelligent robots take on complex assignments

Cyber security

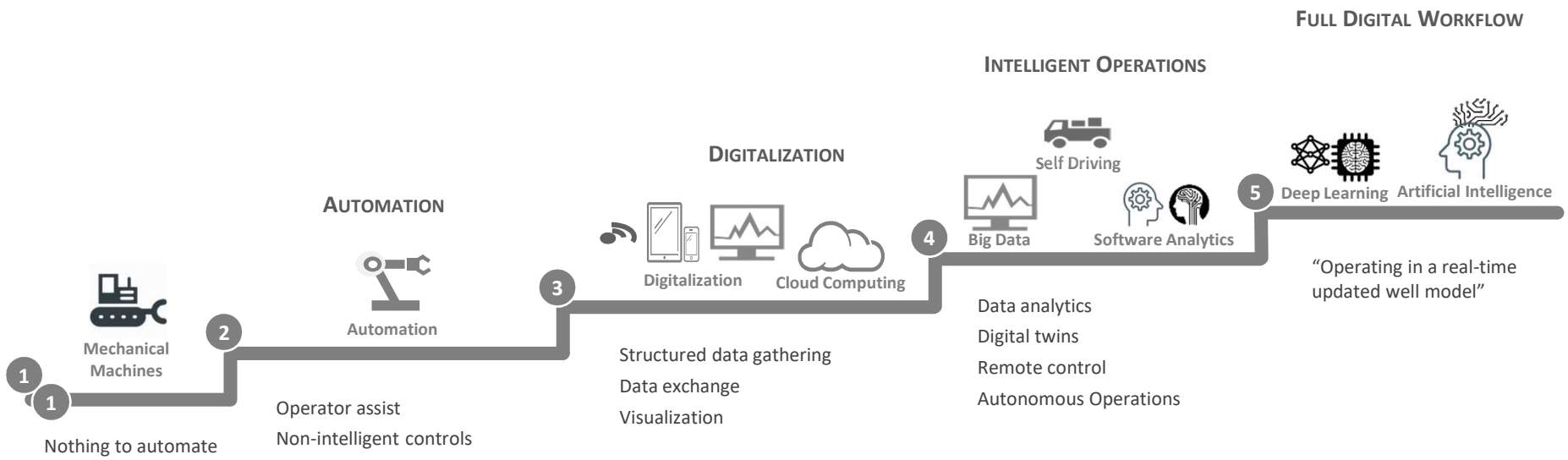
Protecting system integrity is a "must-have"

Digital Transformation Google

- Recently employed VP of Google Cloud Oil & Gas unit
  - A geologist, from BP, who worked on Wamsutter
  - 180 wells from Wamsutter hooked up to an AI program which led to
    - Operating costs reduced 22%
    - Production increased 20%
    - Gas venting cut by 74%

Digital Transformation Well Completion & Intervention Intelligent Conveyance

HARDWARE | CONTROL SYSTEMS | SOFTWARE



Software Will Be Driving Future Well Completions and Interventions

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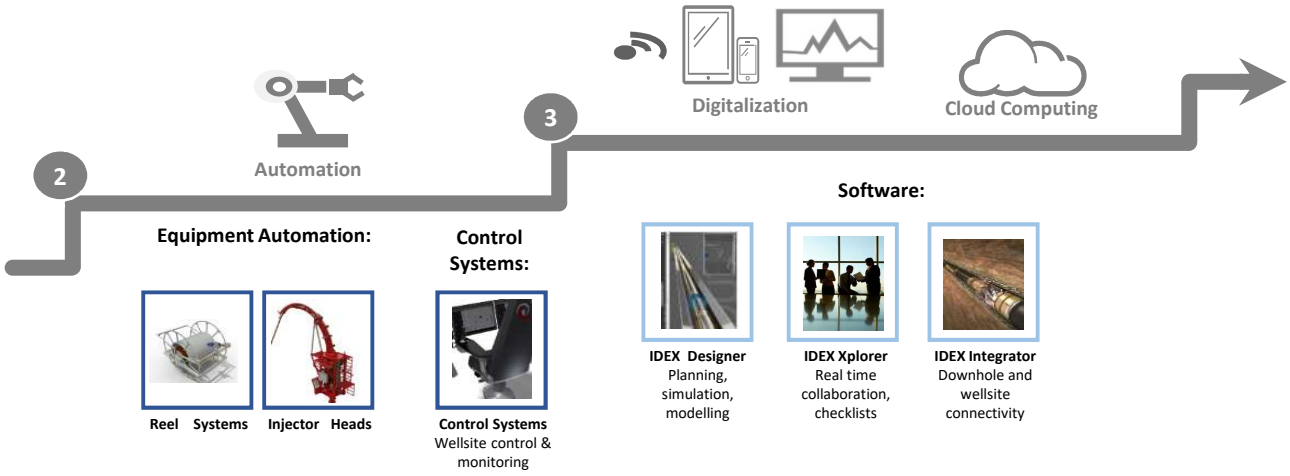
Intelligent Conveyance
Smarter Operations Through Digital Transformation



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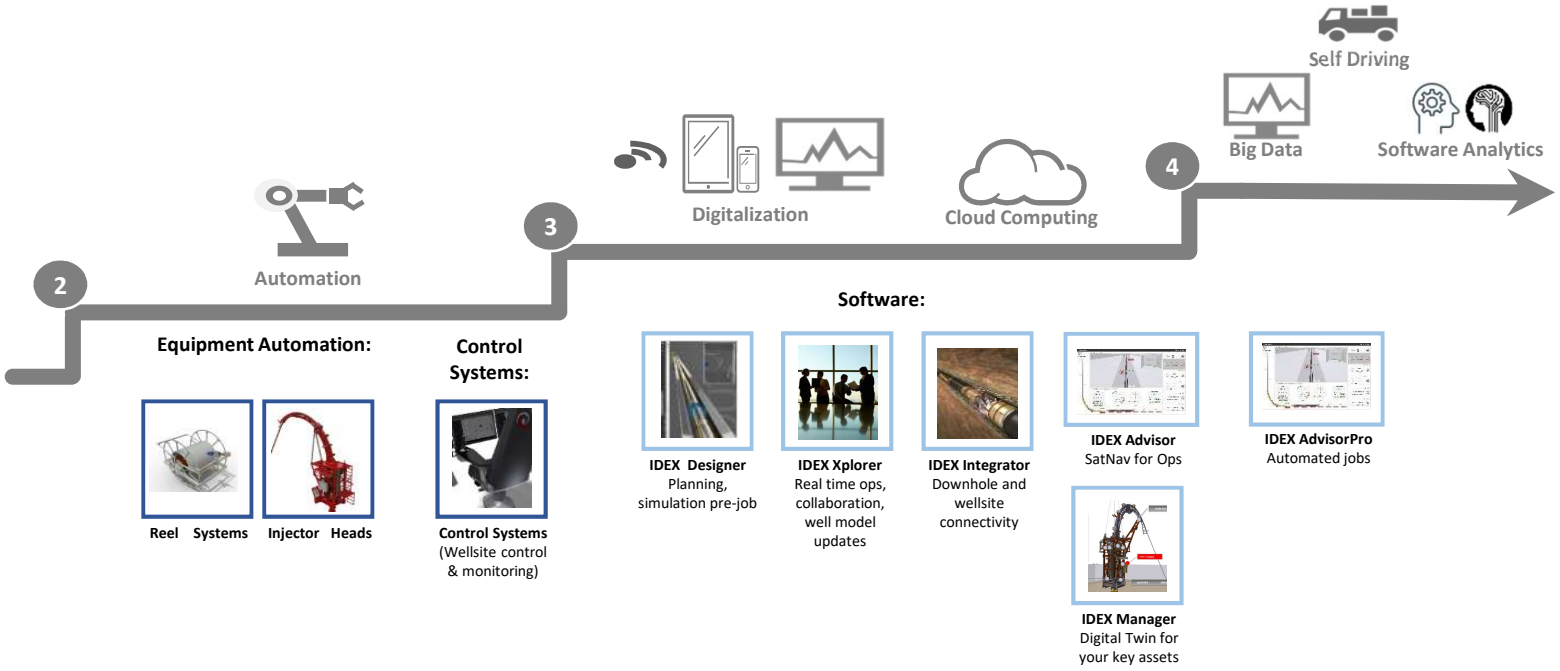
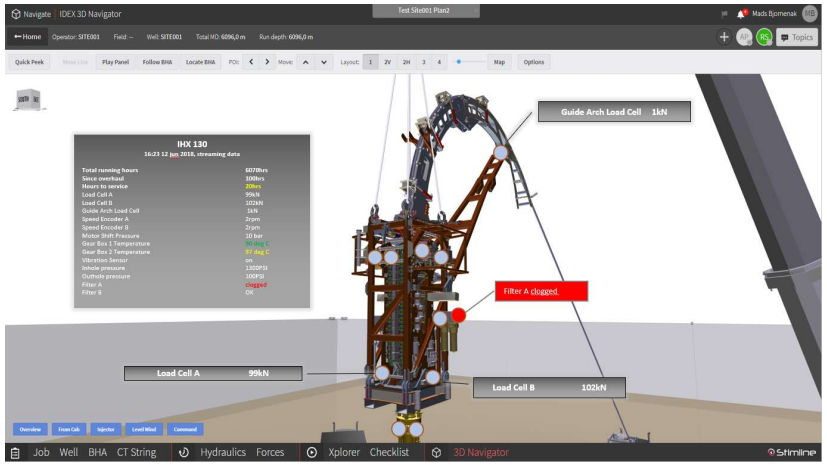


Digital Twin
Running A Model In Parallel



- Full 3D model of an injector
- All job data run through the model
  - Predicted wear calculated
  - Operating parameters reviewed
  - Full history of operational conditions
    - Failure analysis
    - Best Practice review

Complex Operations Need Digitalization To Enhance Efficiency Decision Making Based On Relevant Information

Where we are coming from

The Traditional Way

The Operator is manually driving the equipment

He/She is a "machine operator"

- The unit gives raw data about the equipment.
- The job consistency and efficiency is lower priority than just keeping the unit running

Where we are going to

Operator Situational Awareness

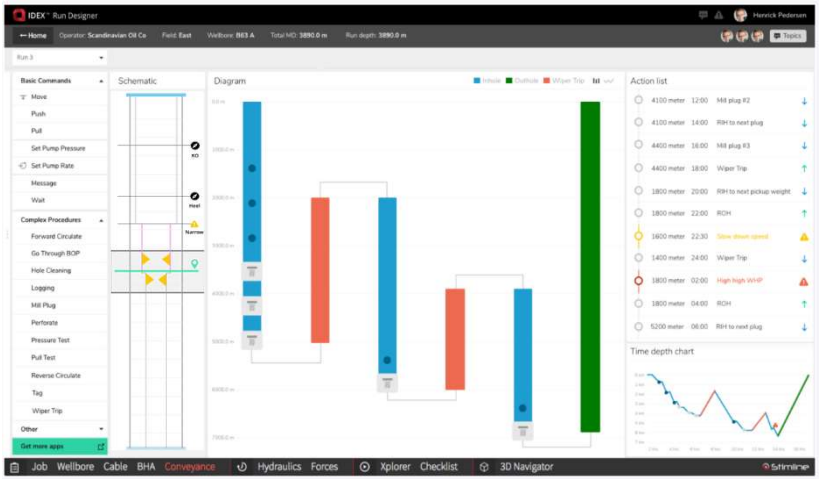
The Operator is running the job.

He/She is a "Process Operator" no longer a machine operator

- The job procedure is created automatically and followed by the unit
- The equipment controls itself within its own limits
- The data is converted into relevant information and presented to the operator as required

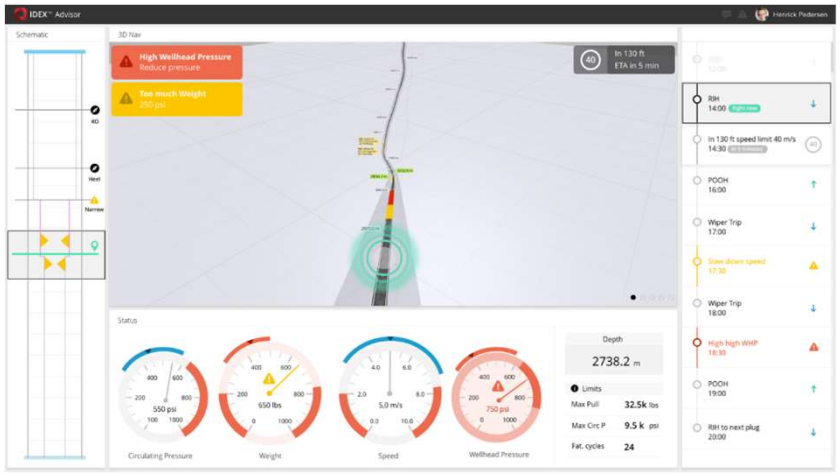
Job Planner
Creating The

- Set Up
  - Define the Job objectives
  - Pick the equipment: CT String, Injector, Reel, CT Unit.
- Result
  - Full Job Procedure created automatically based on company SOP's:
  - Target Depths, Speeds, Pull Tests, Wiper Trips, Differential Weights
  - Estimates for job time, fatigue accrual, volumes required



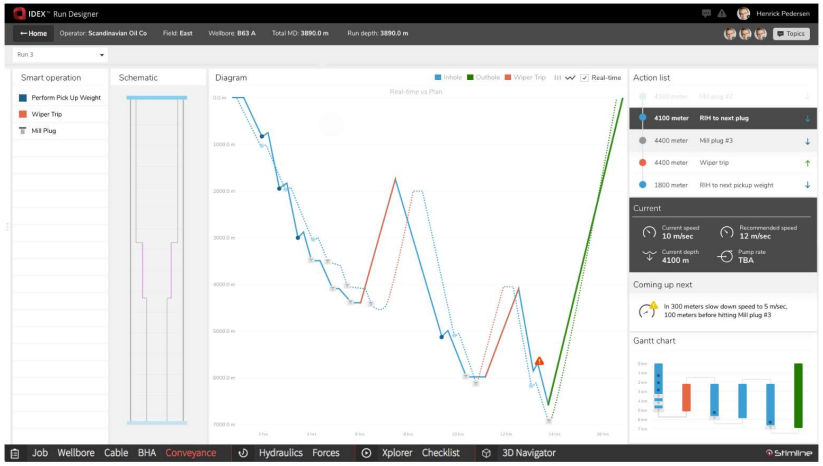
Job Execution
Sat Nav For Coiled Tubing Operator

- Where is the BHA in the Well
  - Downhole view, upcoming trajectory changes.
  - Where might we encounter a cuttings bed?
- Current limits
  - Are we at the optimum parameters:
  - Skate pressure, chain tension, reel back tension, differential pressure, differential weight
- What's next
  - Next step in the procedure: Which set points should change.
    - Reduce Circ Pressure if cycling to manage fatigue. Speed for a different well section



Data Analysis

- Real-Time Status
  - How are we progressing against the plan?
- KPIs
  - Did we consistently perform within our SOP's but at maximum efficiency
- What's next
  - Where do we need to improve
    - Running at close to max speeds, reduce milling speeds to achieve smaller cutting size
  - Test these changes on the next job, realise efficiency gains.



Automated Conveyance

Set up the unit

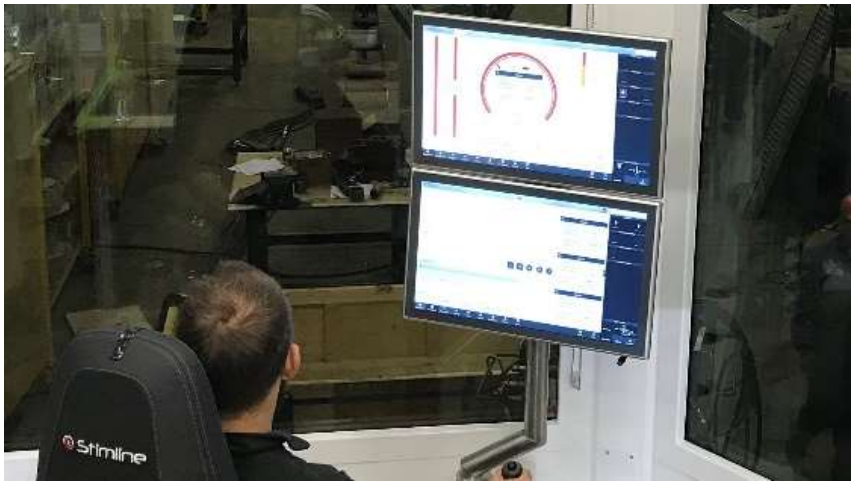
- Select the relevant job plan inside the control system

Execute the job

- The unit executes the job
  - Spooling, traction pressure and chain tension for the given weight and speed set points

How are we doing?

- The operator monitors the job and the equipment.
- Relevant information is brought to his attention as required
  - Downhole visualisation and weight analysis



Digital Transformation Well Completion & Intervention Intelligent Conveyance

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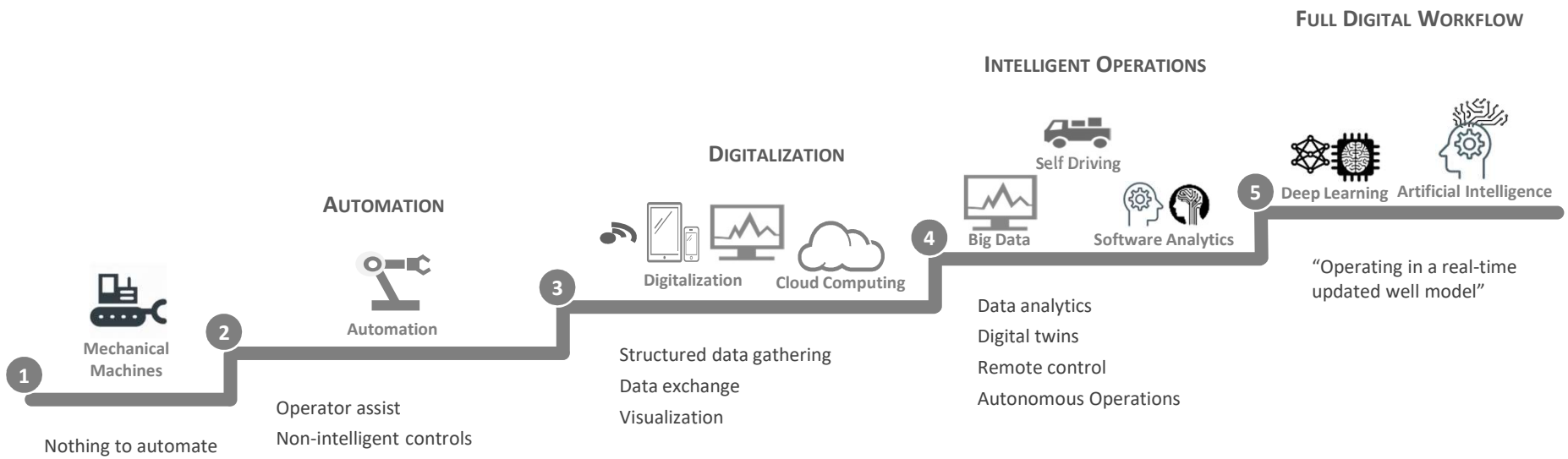
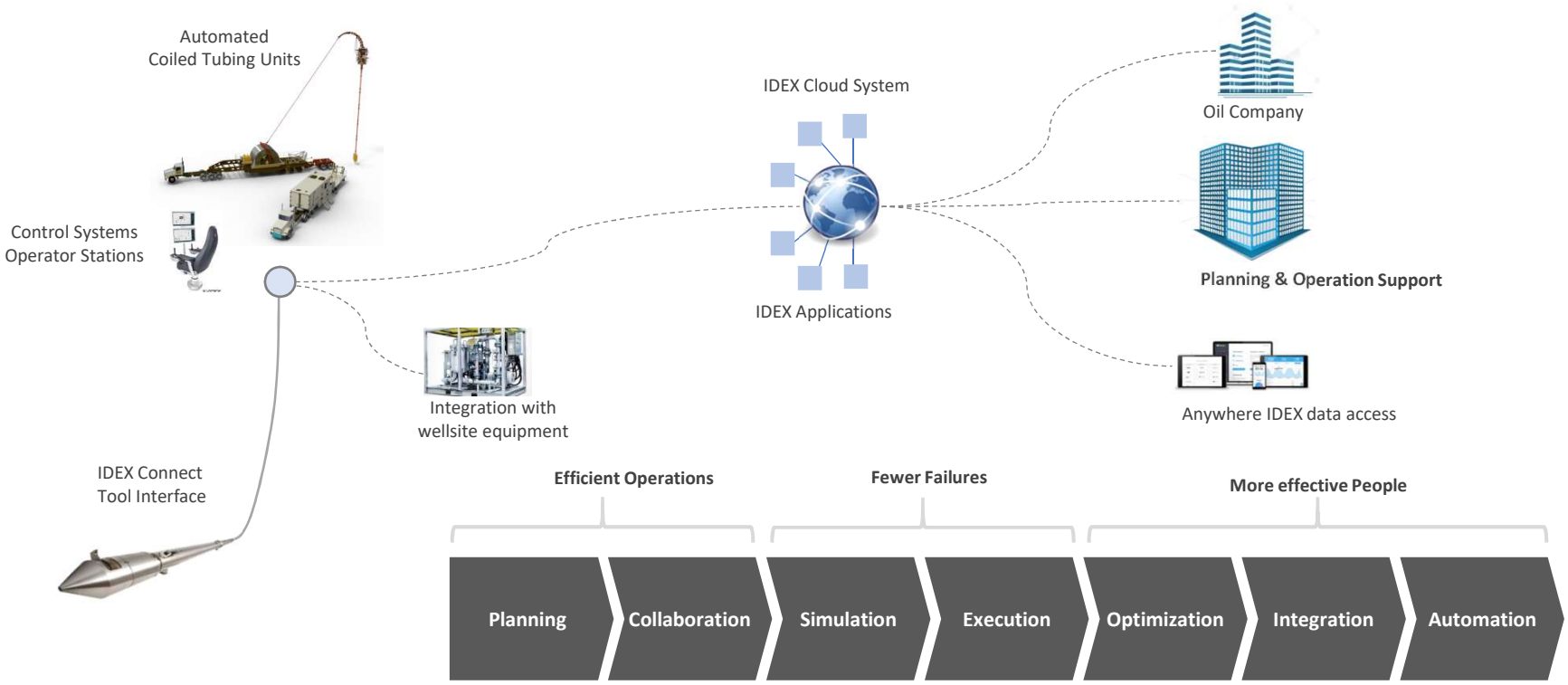


Software Will Be Driving Future Well Completions and Interventions

Intelligent Conveyance
Digital Transformation of Well Interventions



Stimline