CANRIG DRILLING TECHNOLOGY

NABORS

Robotizing the oil & gas drilling process

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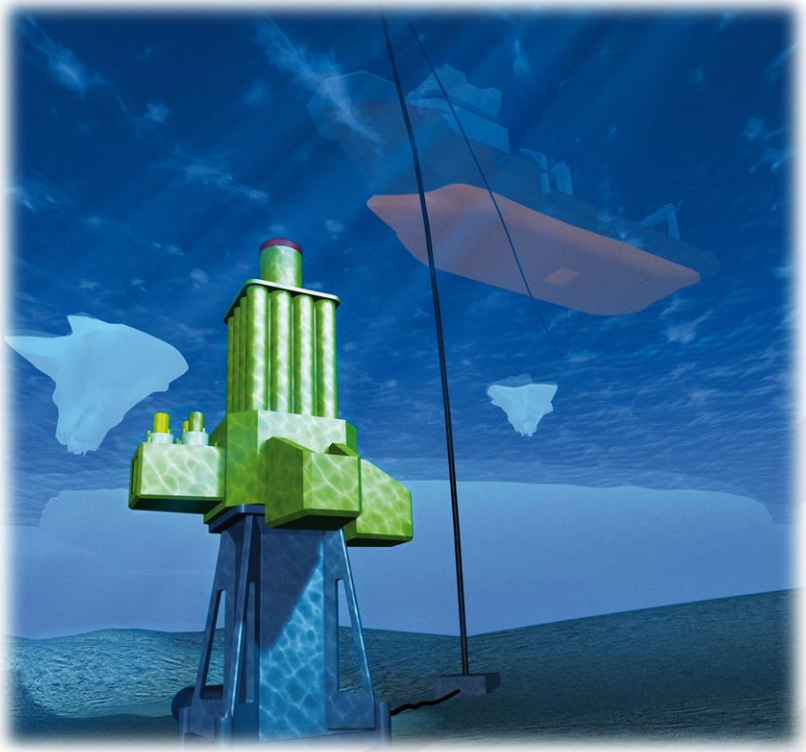
Software Manager

The dream

seabed RIG



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Nabors Industries LTD.

NABORS

- Founded 1966. Oil and natural gas.
- Houston Tx. 15 000 empl.
- World largest onshore fleet provider
- Main market are US and Middle-East
- Also provides offshore solutions
- Acquired Robotic Drilling Systems in 2017. Now **Canrig Robotics**.

CANRIG DRILLING TECHNOLOGY

Vision & Values

Purpose

To responsibly help our customers

meet the world's demand for oil and gas

Mission

We deliver best-in-class drilling performance through our exceptional people, execution, teamwork and technology

Vision

To be the driller of choice for employees, customers and investors

Values

Safety :Teamwork : Excellence : Accountability : Innovation

2018 rig market size

- 834 offshore drilling units today. ~53% utilization.
- 1110 land rigs in North-America. 972 elsewhere.
- All use ‘traditional’ drill floor technology with a high degree of manual operations

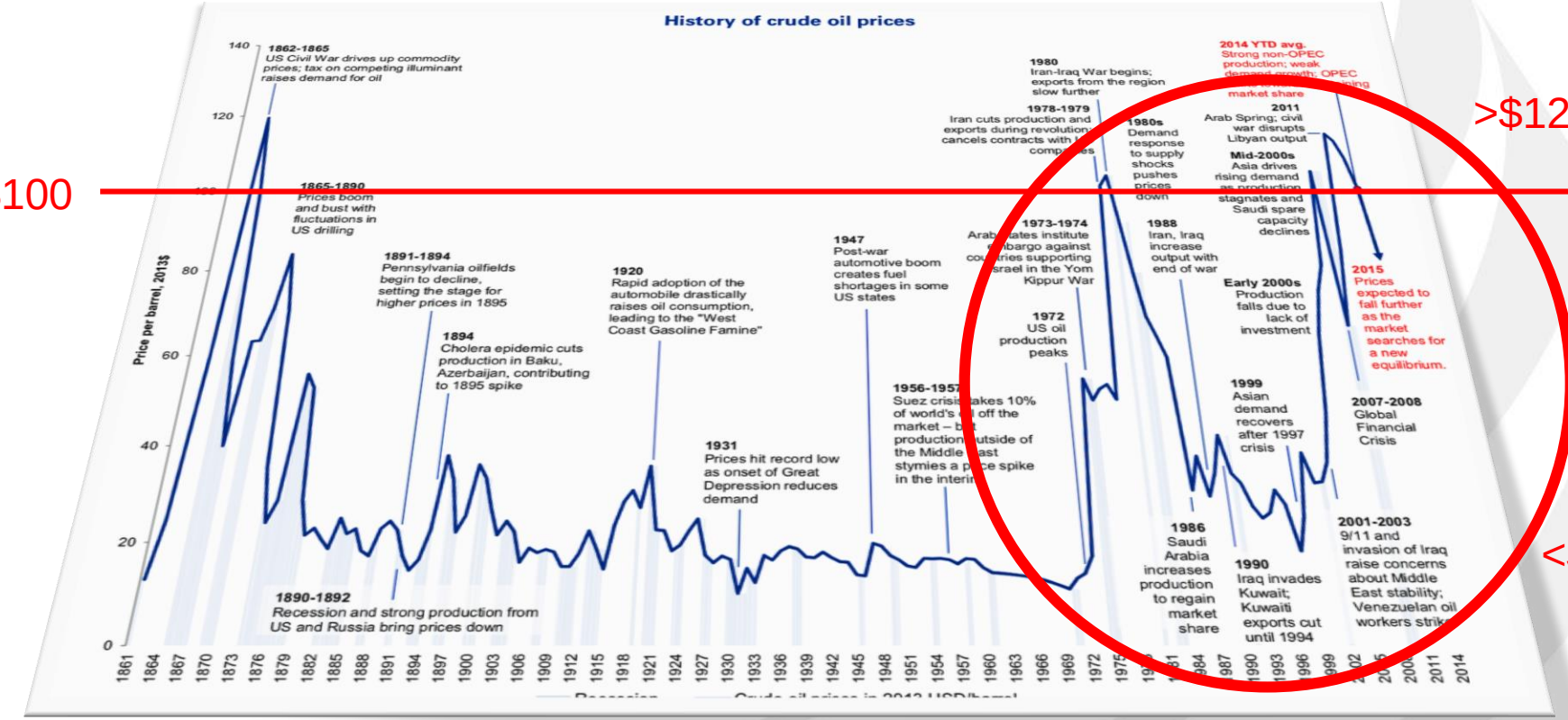
Data from RigLogix and Baker Hughes Rig Count

Oil price cycle drives investment, crises drives innovation

>$100

>$120

<$20



Courtesy of Business Insider

Problem formulation: minimize Non-Productive Time

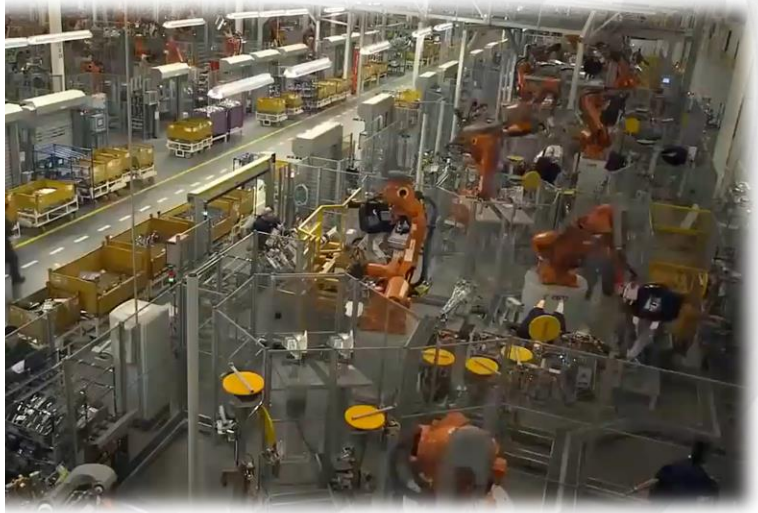
- Drill fast, but not too fast!
- NPT = time not drilling

1. Manual operations
2. Tripping operation

- These are ideal to robotize and automate

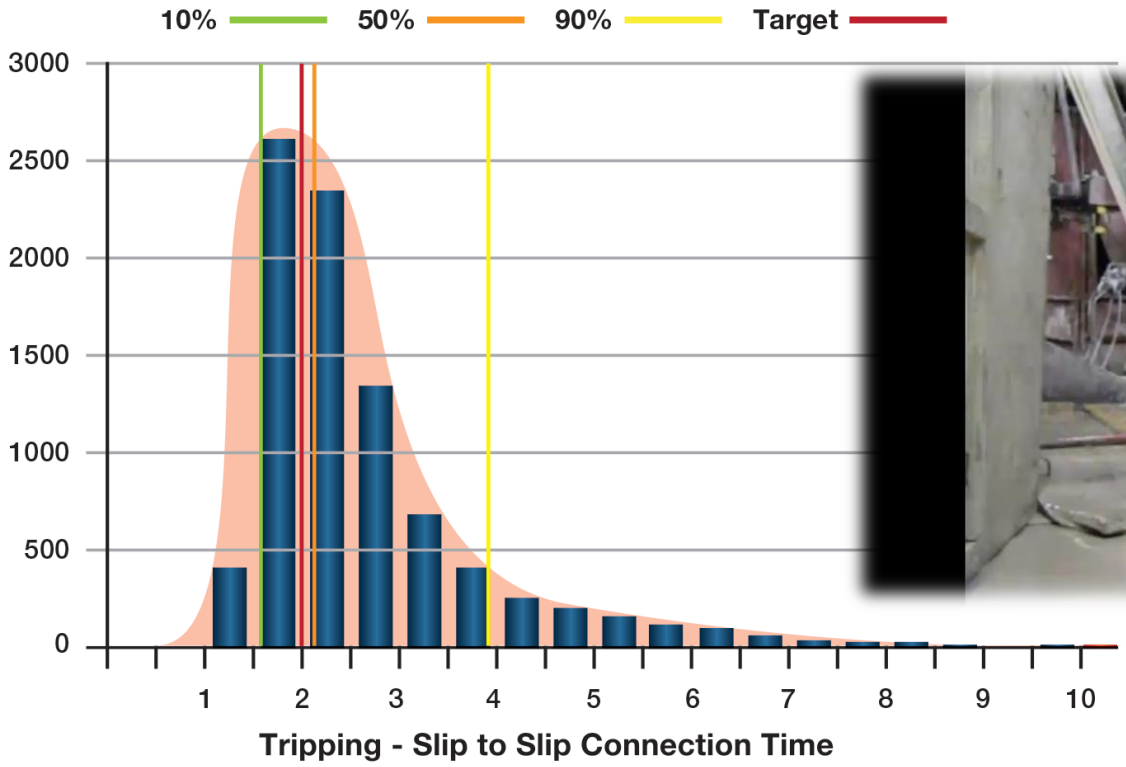
Automation in the car manufacturing industry

World’s first industrial robot in 1964



Courtesy of ABB and BMW

Key Performance Indicator: Connection time



Land rig in 2018

3 men to connect a pipe

Courtesy of proNova-TDE

Derrick man’s elevated office: Tripping in pipes

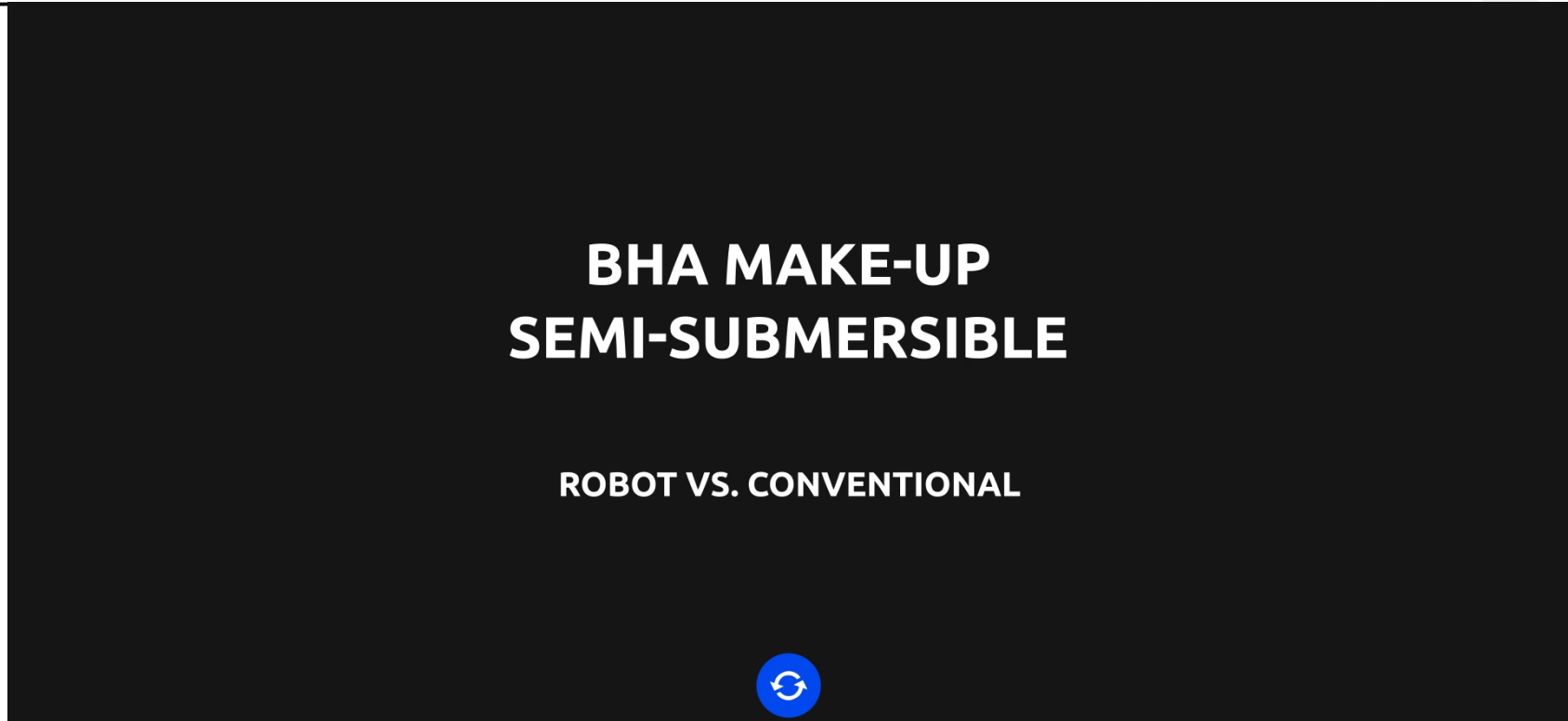
Derrick man’s elevated office: Tripping in pipes

Manual operati hore hi-tech rig

Manual operations

- Lifting subs
- Safety clamp
- Manual slips
- Stabbing guides
- Clamps for control lines
- Drill bit
- Mud bucket
- …

Video



Multipurpose robot solves manual operations

First installation of Pipe Handler at US land rig

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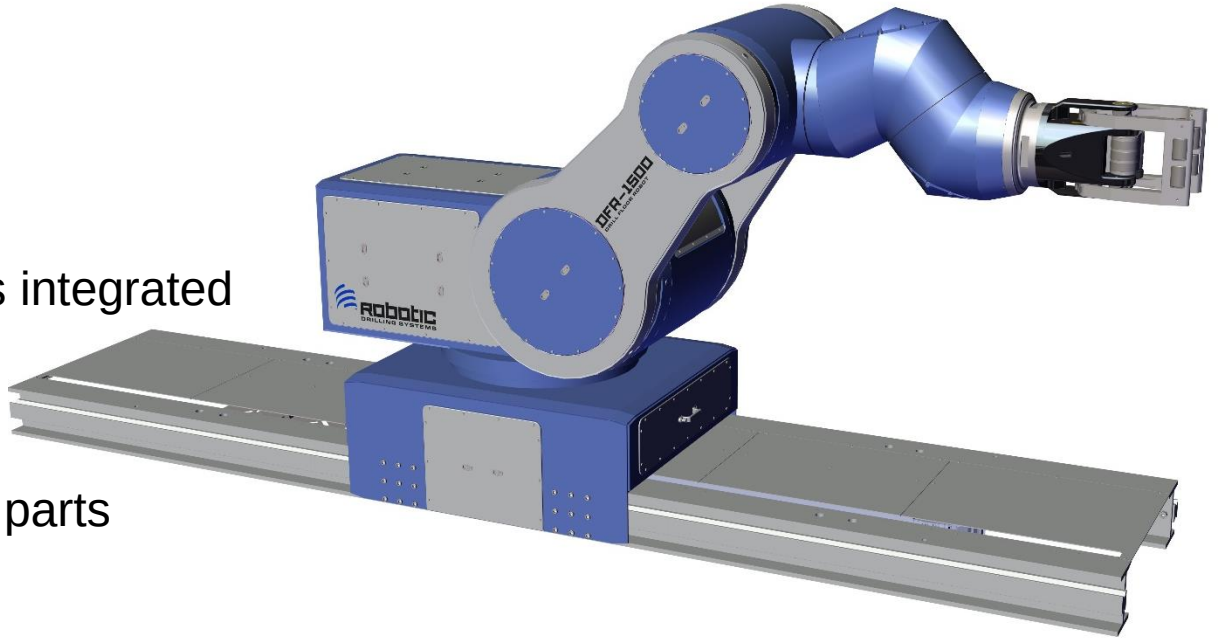
Behind the curtain

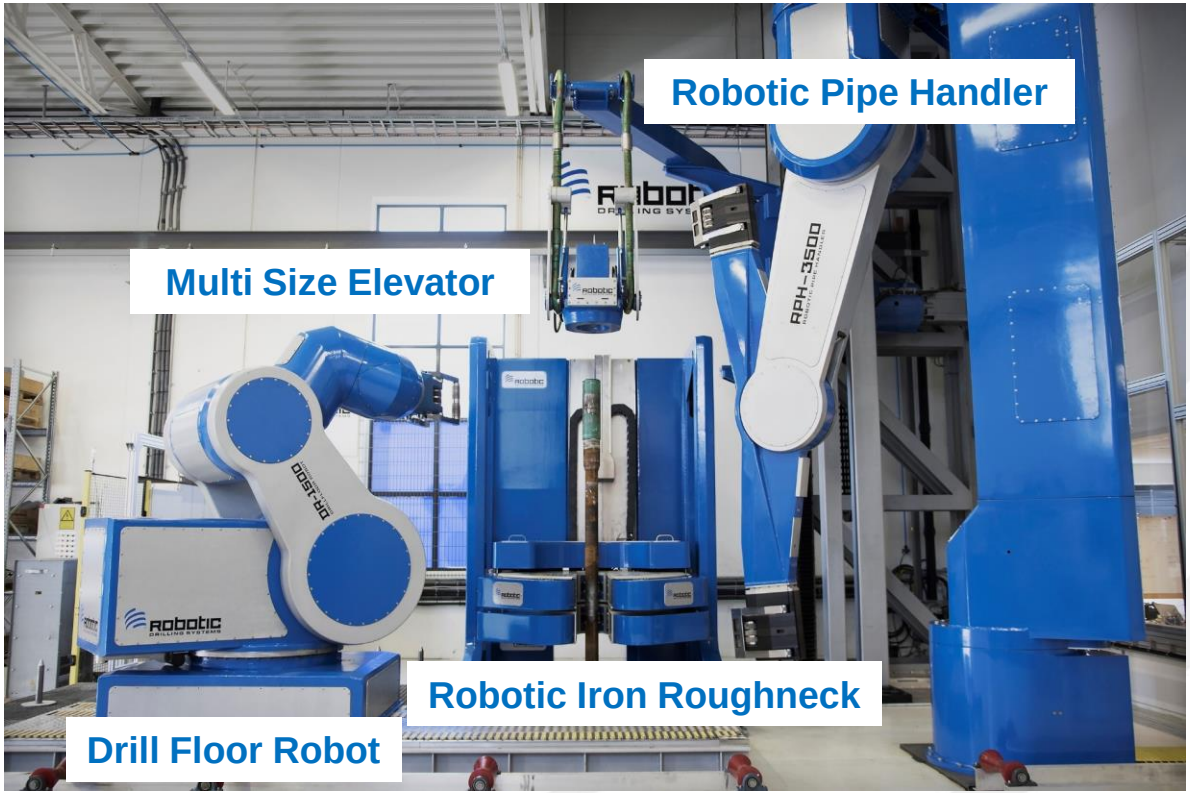
WHAT powers the robots?

Design Principles

1. Next generation products
2. Fully electric robots
3. All hardware components integrated
4. Maintenance free
5. Design life = 10 years
6. Standard equipment and parts
7. Focus on great design



Drill floor robots



High level control system topology

3D virtual world

Motion controller

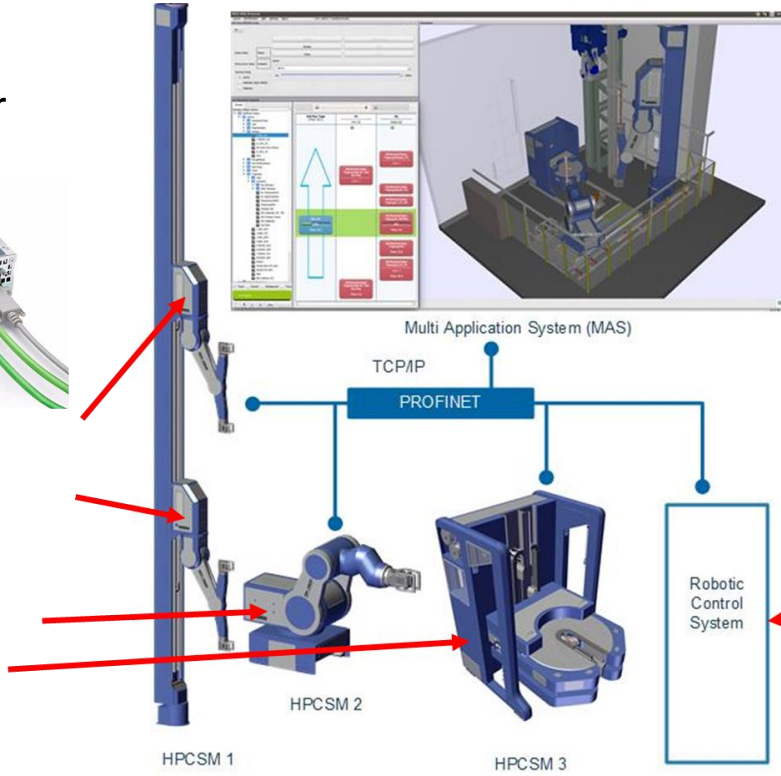
Multi Application System (MAS)

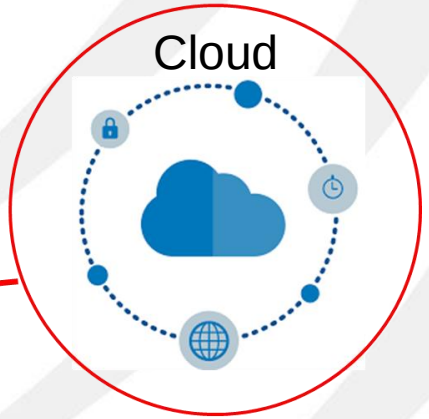
GUI

VFD

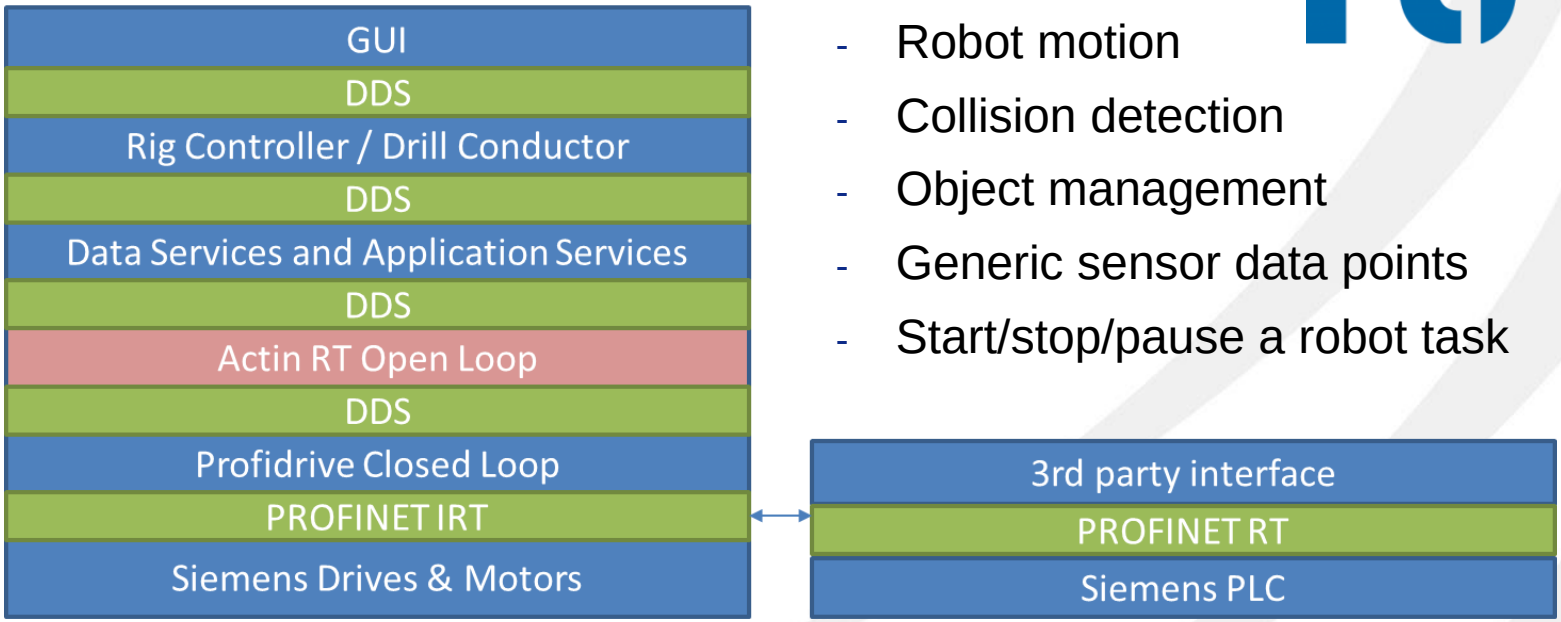
Motor

controller





DDS is the backbone of the robotic network



DDS topics

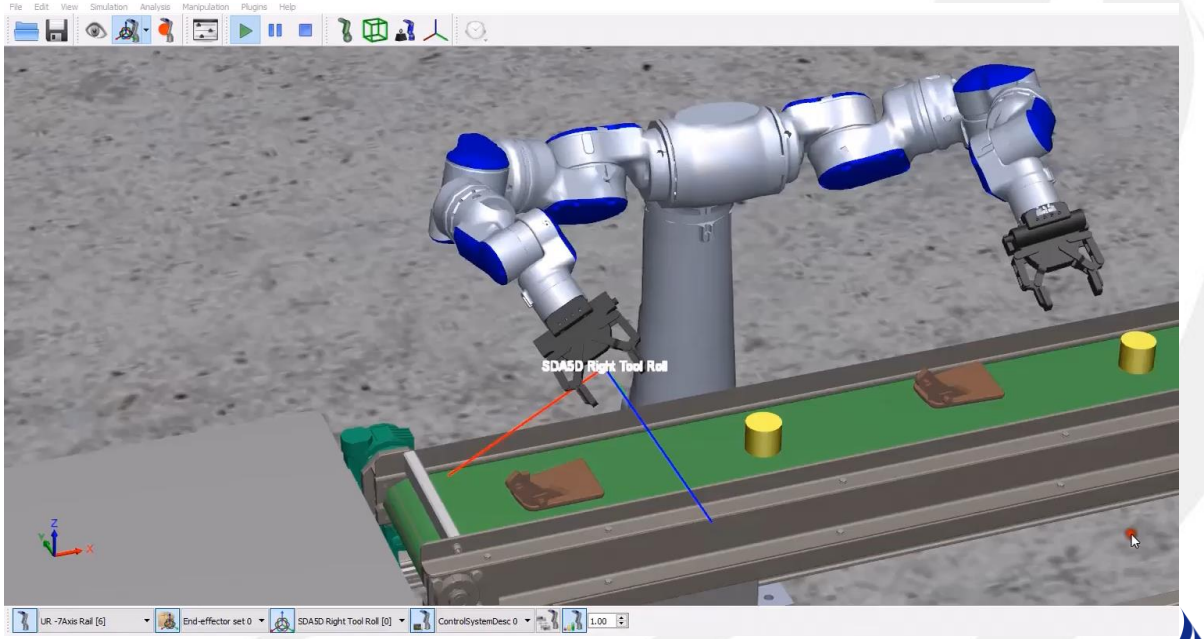
- Robot motion
- Collision detection
- Object management
- Generic sensor data points
- Start/stop/pause a robot task

Powered by RTI DDS and Siemens Profinet real-time communication

Robot software ecosystem

Design phase

- Convert models from Solidworks
- Build a 3D world
- Simulate & Validate
- Simulation of
  - Kinematics
  - Dynamics
  - Program sequences



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Robotics and Machine Vision

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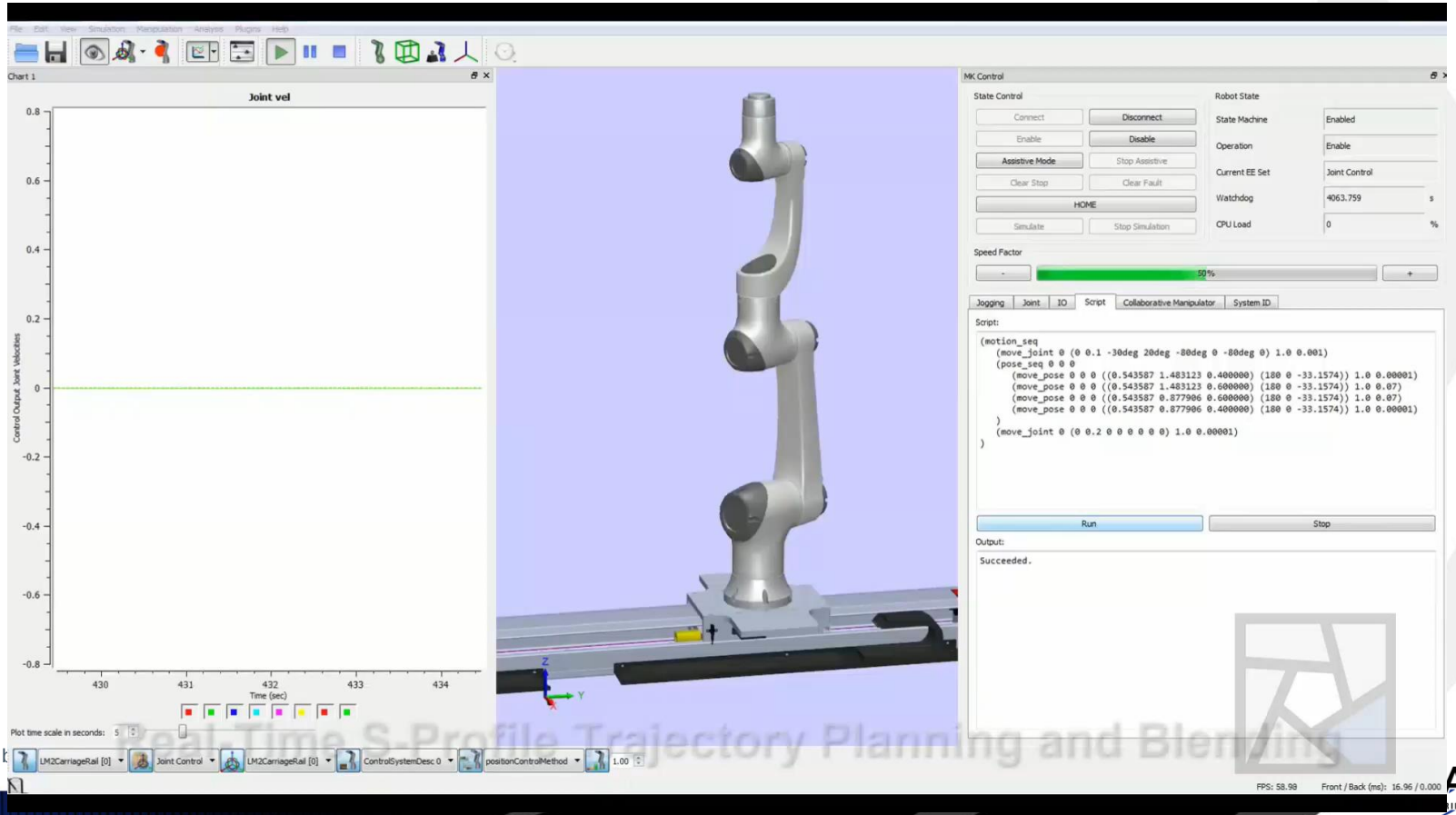
Robot software ecosystem



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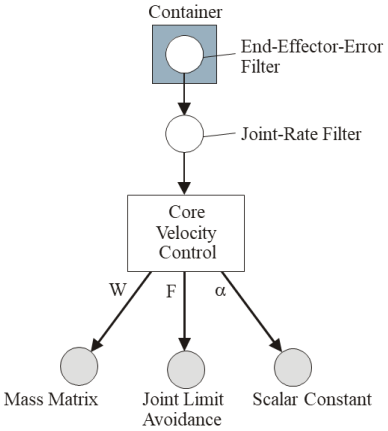
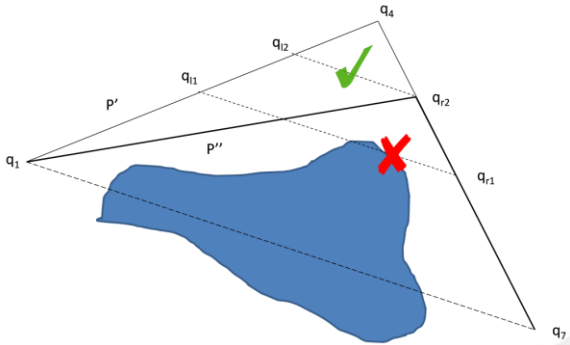
Robot real-time system

- On-the-fly path programming, A to B
- Real-Time collision avoidance
- Ahead of time 3D simulation
- Avoids joint limit, singularity and jerk
- High fidelity, high accuracy





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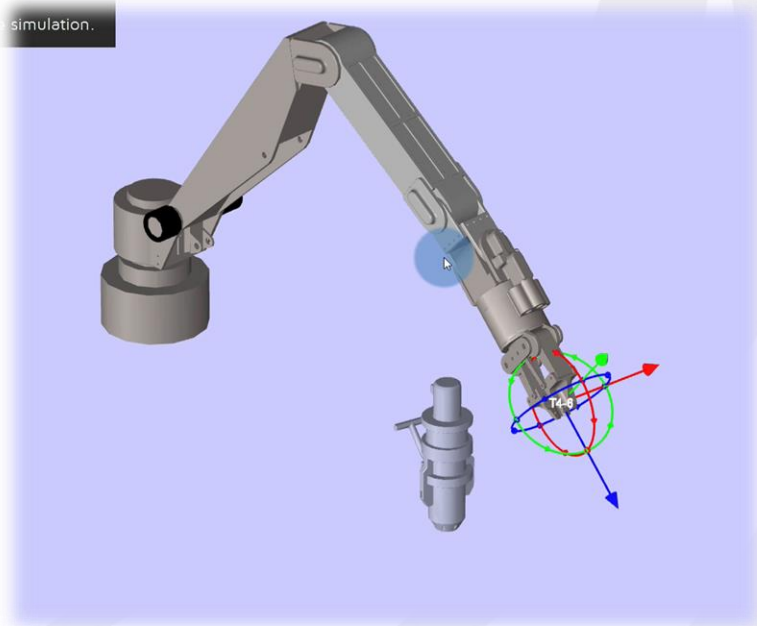

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Dynamic control system

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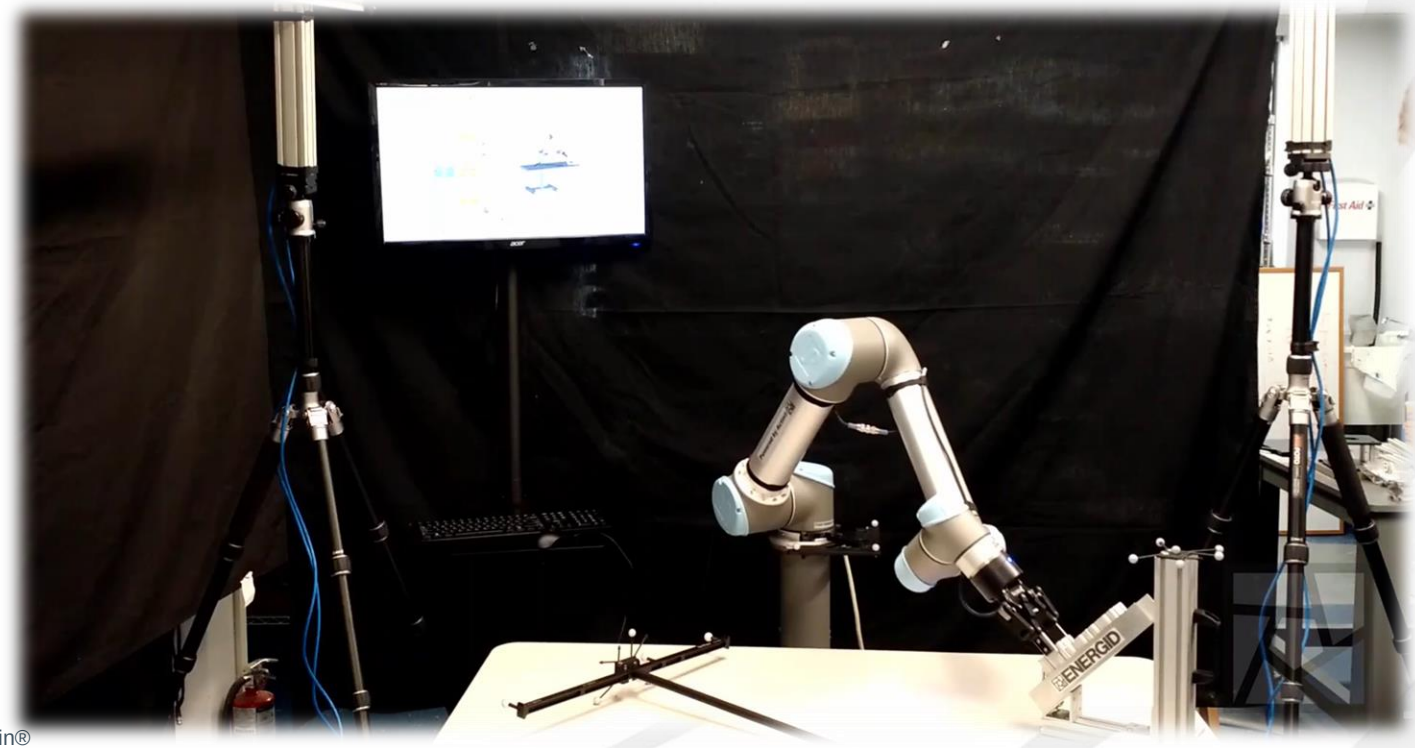

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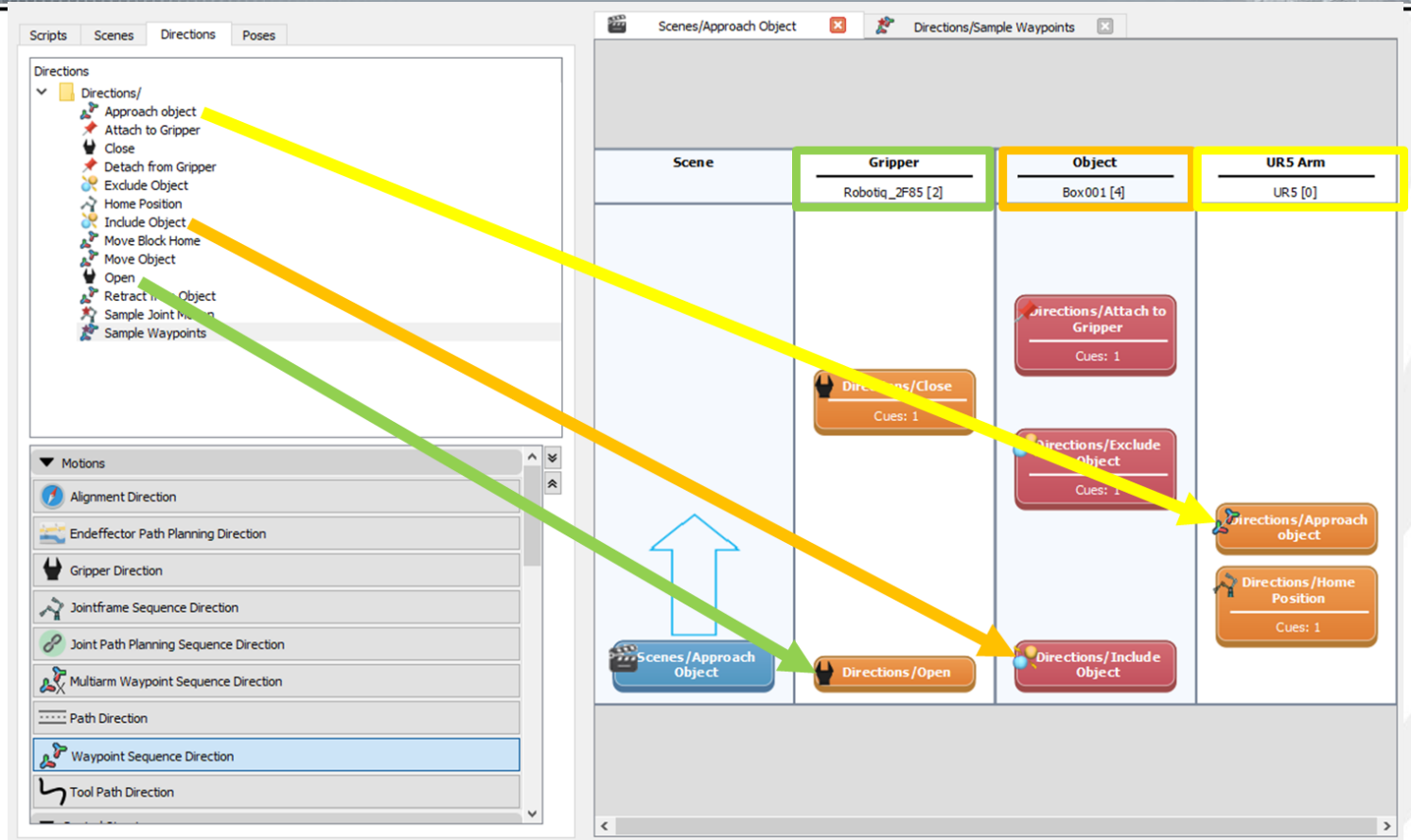
Programming the robots



Full robotic system

Summary

- Manual operations still dominates the global rig fleet

  = Robot will remove people from drill floor and save life and time.

- Tripping operation is the biggest time consumer

  = Robotizing the tripping process will gain significant time and cost savings

- RTI Connext plays a vital part distributing real-time messages across the robot system

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Thank you!