Update on Marathon Oil Company's MaraDrill™ PI Based Drilling Optimization Solution
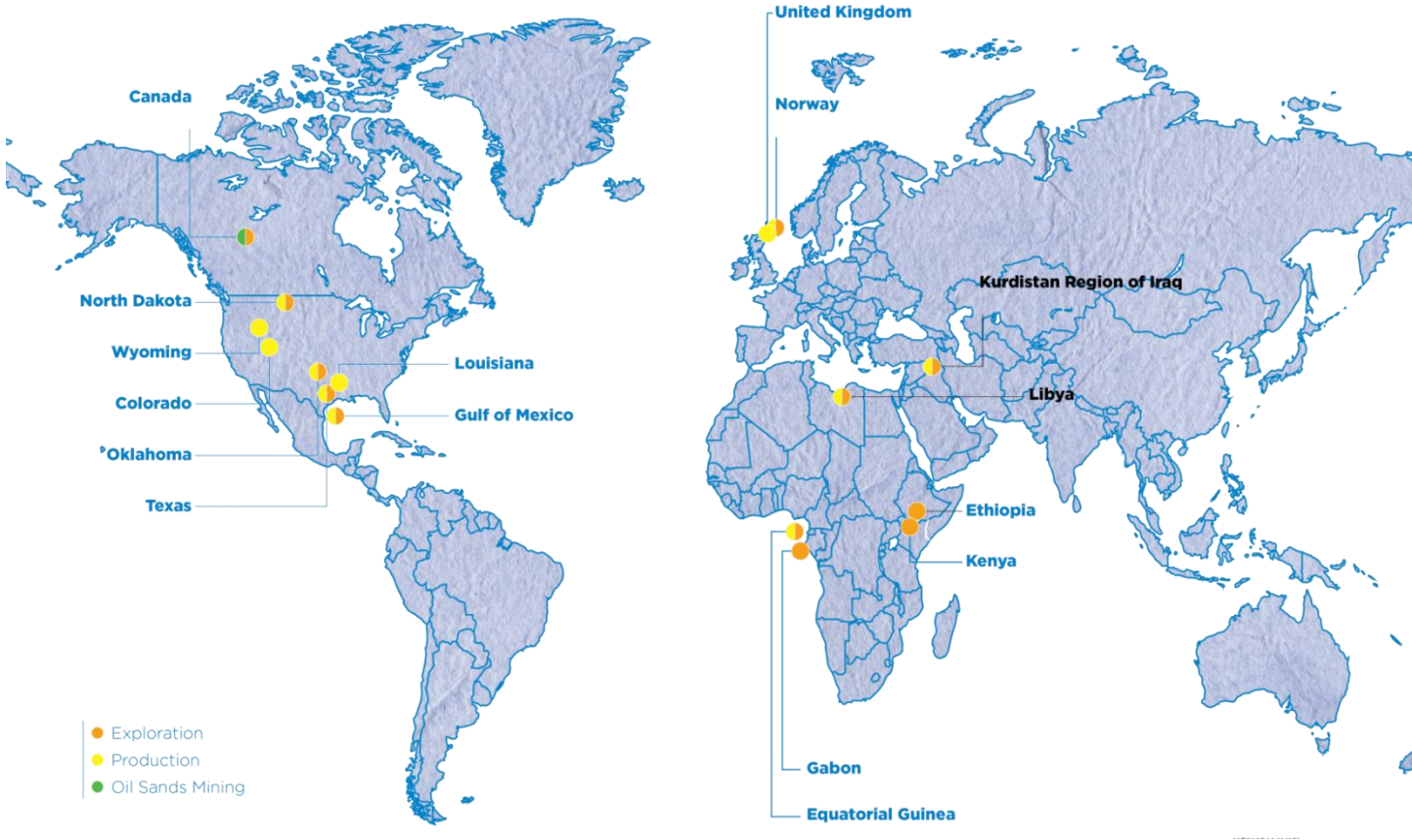
Presented by: **Ken Startz – Marathon Oil Company**
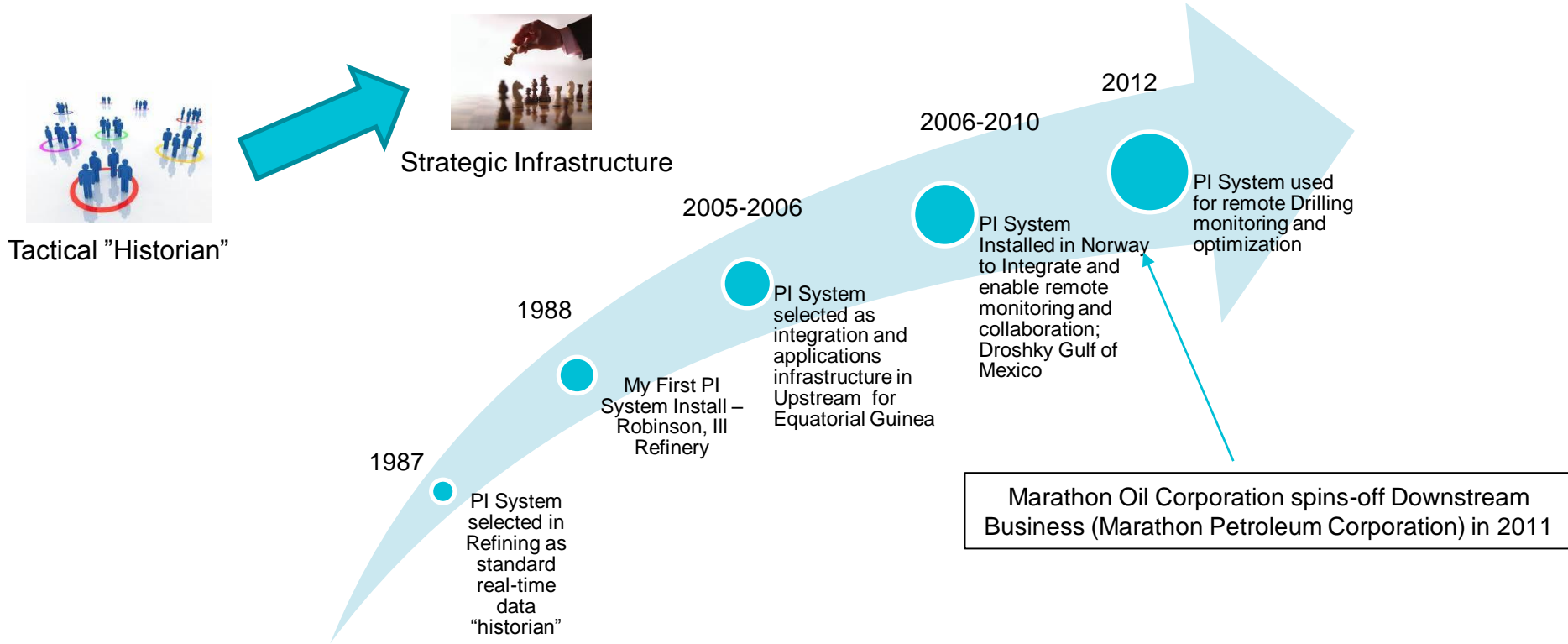
Agenda

- Brief Marathon Oil Overview

- Marathon Oil's Journey with the PI System

- MaraDrill^{TM} Overview

- Analytics and Visualization Examples

- Benefits
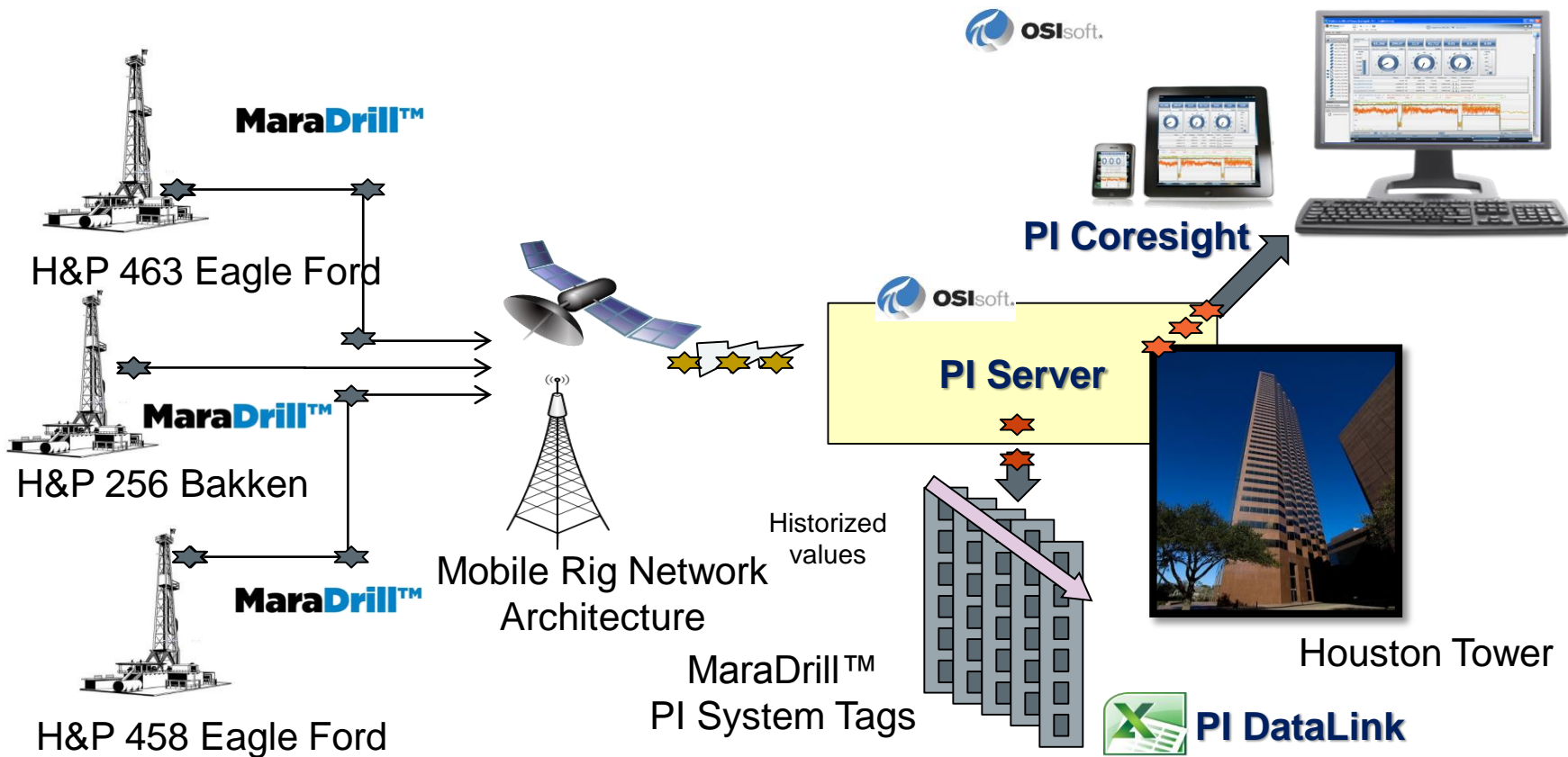
- Closing Comments – Vision for the Future

Marathon Oil – A Global E & P Company

Canada
North Dakota
Wyoming
Colorado
Oklahoma
Texas
Louisiana
Gulf of Mexico

United Kingdom
Norway
Kurdistan Region of Iraq
Libya
Ethiopia
Kenya
Gabon
Equatorial Guinea

- Exploration
- Production
- Oil Sands Mining

The Journey of the PI System at Marathon Oil

Strategic Infrastructure

Tactical "Historian"

2012

PI System used for remote Drilling monitoring and optimization

2006-2010

PI System Installed in Norway to Integrate and enable remote monitoring and collaboration; Droshky Gulf of Mexico

2005-2006

PI System selected as integration and applications infrastructure in Upstream for Equatorial Guinea

1988

My First PI System Install – Robinson, Ill Refinery

1987

PI System selected in Refining as standard real-time data "historian"

Marathon Oil Corporation spins-off Downstream Business (Marathon Petroleum Corporation) in 2011

Data Workflow

MaraDrill™

H&P 463 Eagle Ford

H&P 256 Bakken

H&P 458 Eagle Ford

Mobile Rig Network Architecture

PI Server

PI Coresight

Historized values

MaraDrill™ PI System Tags

PI DataLink

Houston Tower

Common Drilling Data Tags
Engineering Units

ROP = Rate of Penetration – Ft / Hr
WOB = Weight on Bit – K Pounds
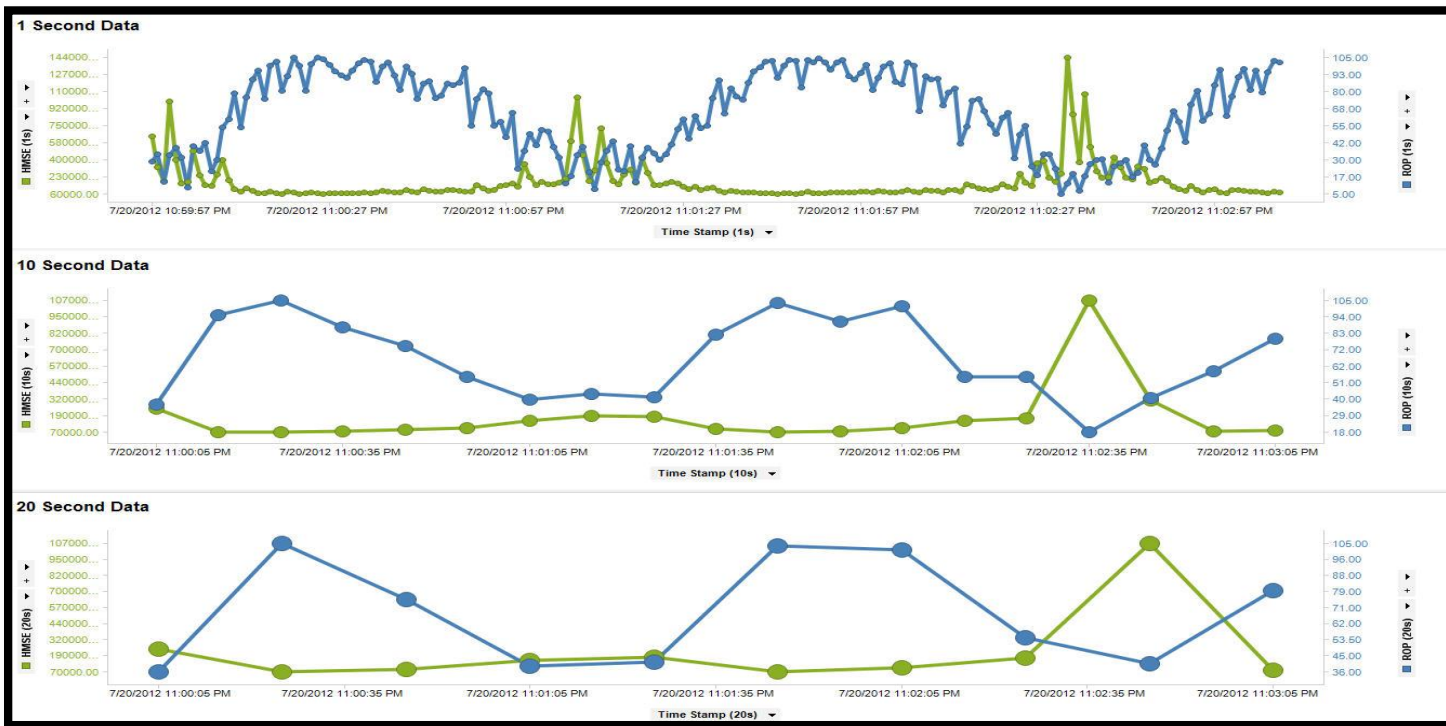RPM = Revolutions per Minute – RPM
Mud Flow Rate – GPM
Torque – kFt*Lbs

Need 1 second time stamp resolution!

PI Coresight/SpotFire – Stick-Slip Analyses

- **Importance of 1 second data**

PI Coresight – Stick-Slip Identification: H&P 463

"Perfect" drilling

Stick-slip: Non-uniform rotation of the bit/BHA
  Sticking phase → bit stops
  Slipping phase → bit "breaks" free
  Drillstring torsional oscillations
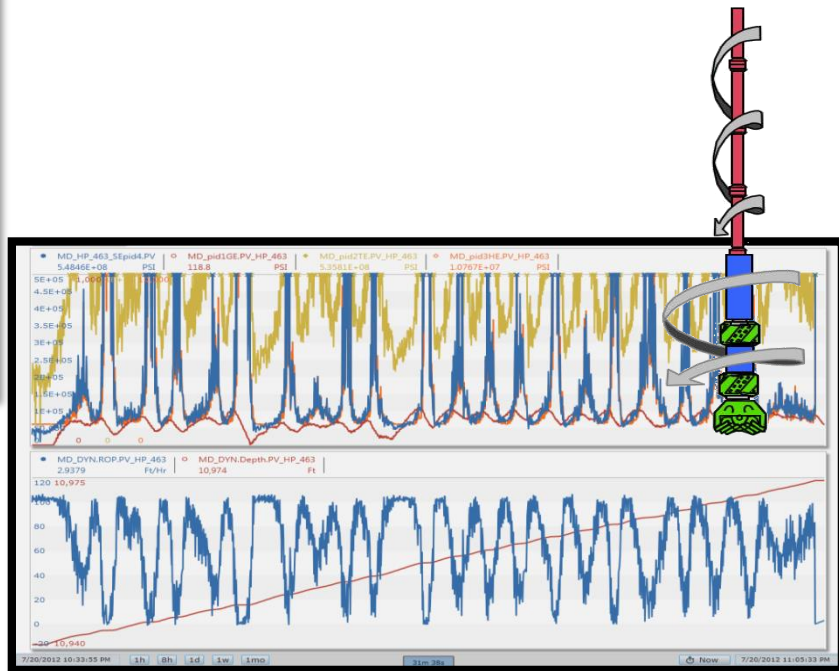
Stick-slip

MaraDrill™ – PI Data Flow Diagram
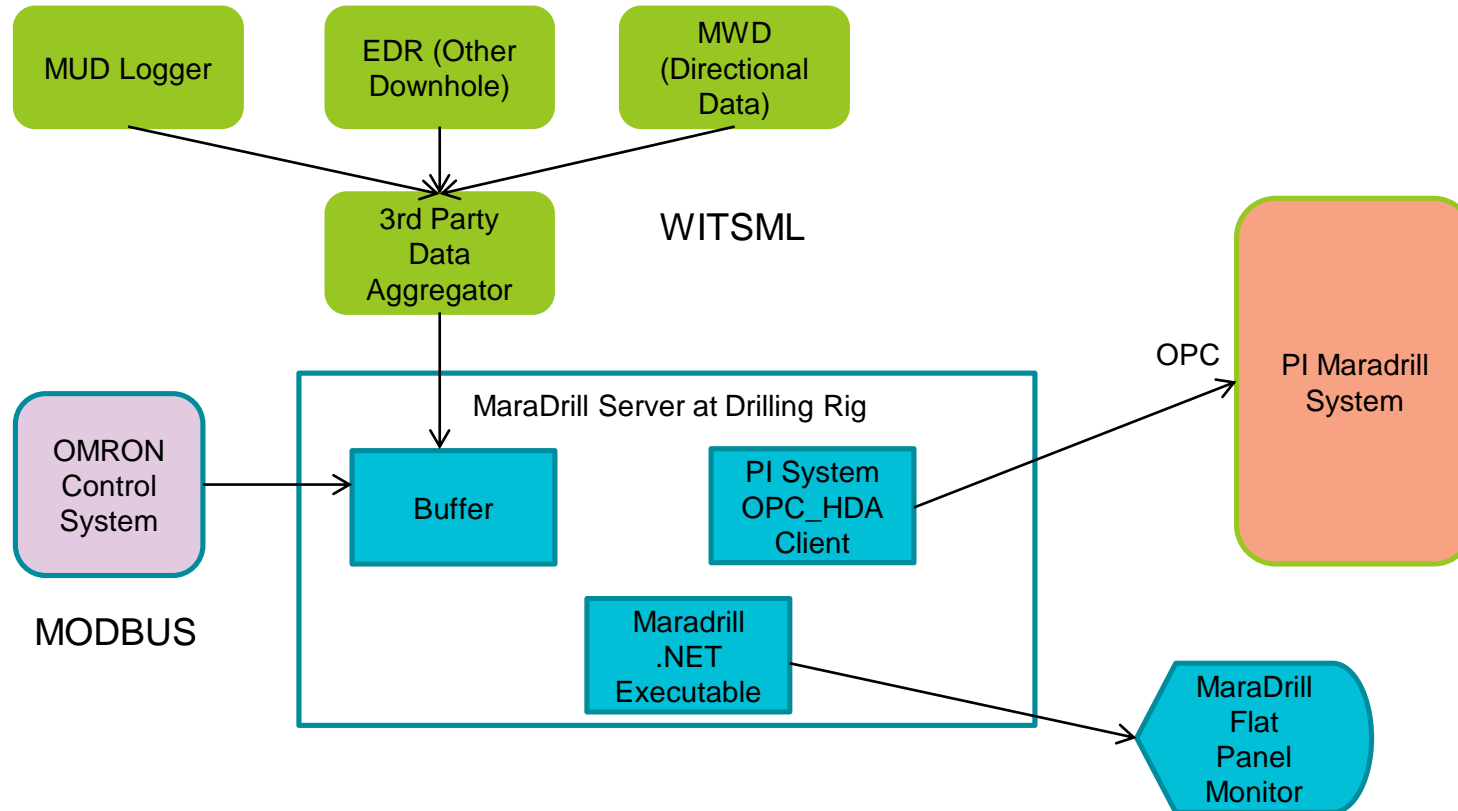
PI System Visualization
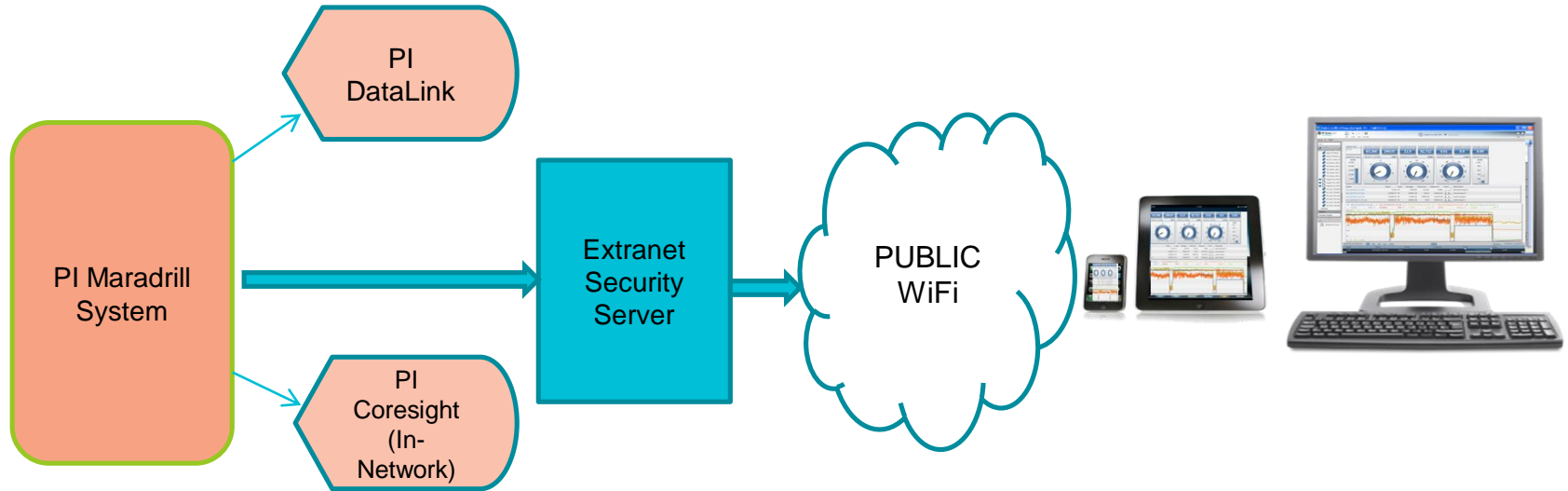
Helmerich and Payne Doghouse

Driller's Display in Dog House

PI Coresight View with XML Data Export

Enables integration with WellView data

Enables integration with Spotfire visualization

Custom Spotfire Interface

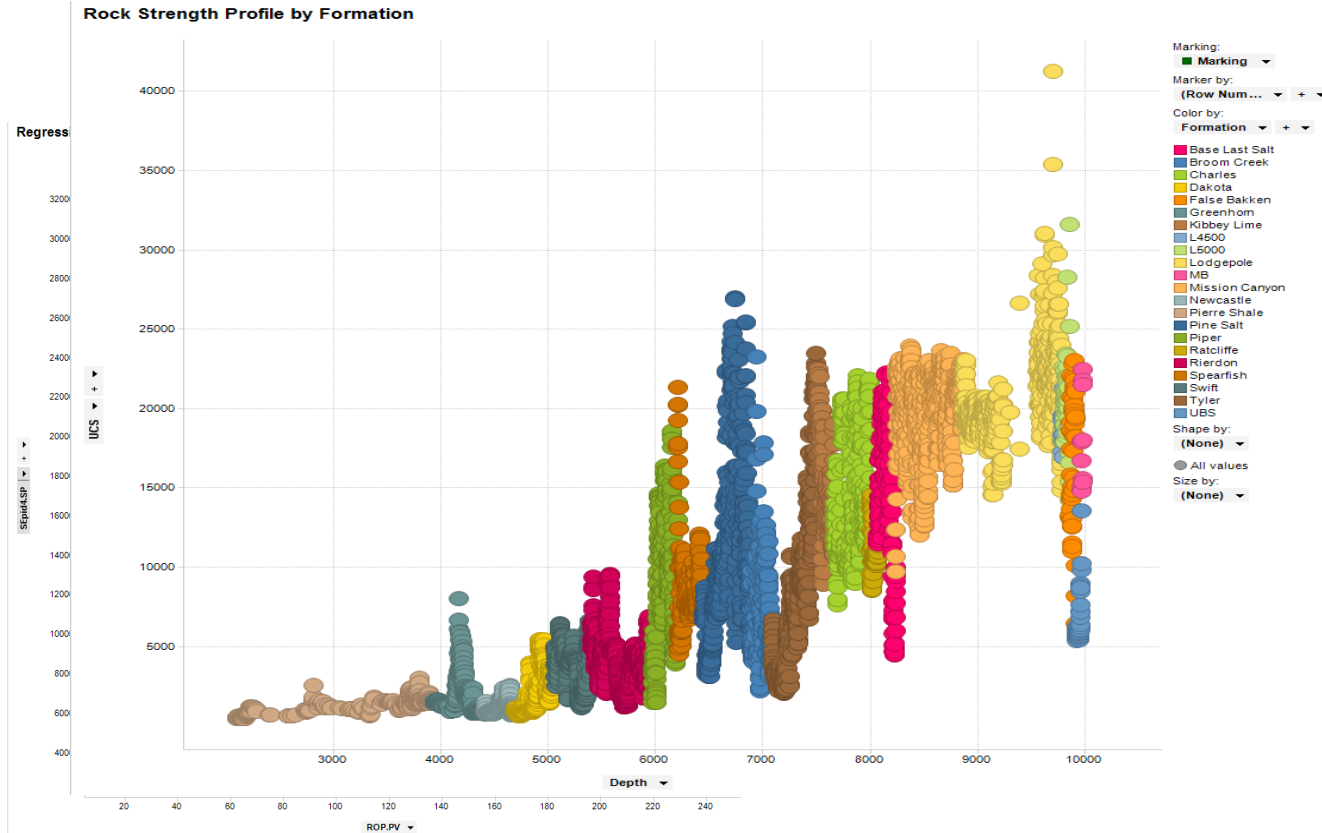Enables integration with PI System data from PI Coresight

Guided analytics
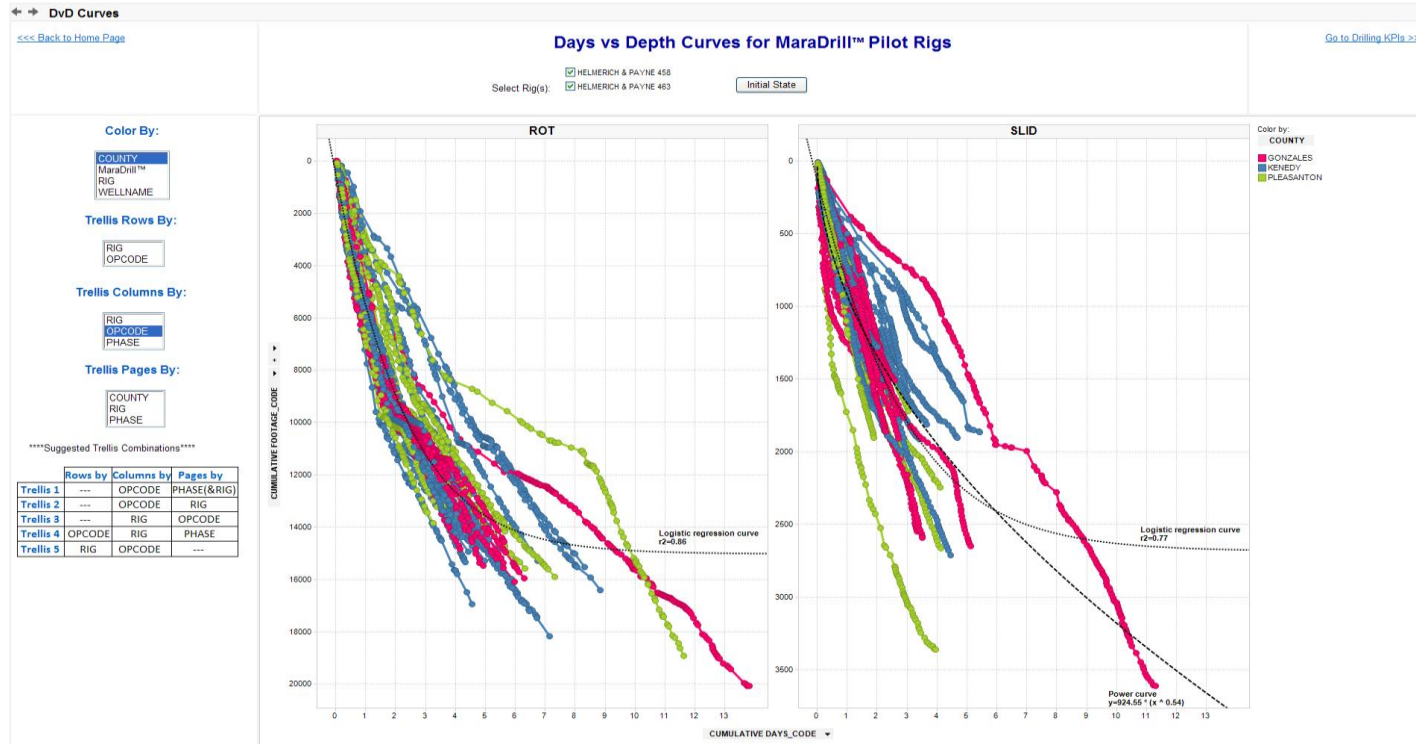
Guided Analysis – Time Based or Depth Based

Post-Well Science Using MaraDrill™ Data in SpotFire

Modeling the rock strength & predicting ROP's on subsequent wells in the area to improve logistics and planning

Rock Strength Profile by Formation

Days vs Depth Curves for MaraDrill™ Rigs
Black = MD, Teal = No MD

Post-Well Science Using MaraDrill™ Data in SpotFire
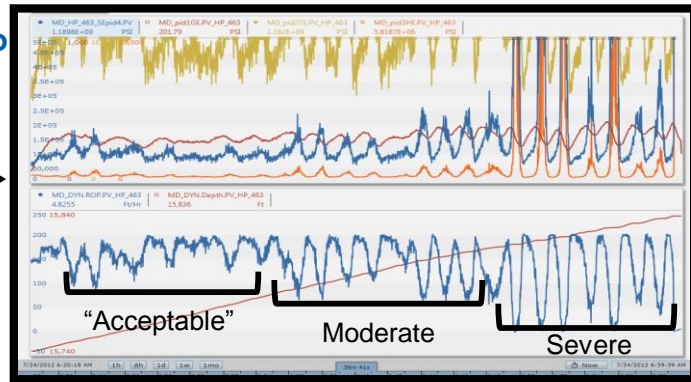## Formation Sweet-Spot Analysis
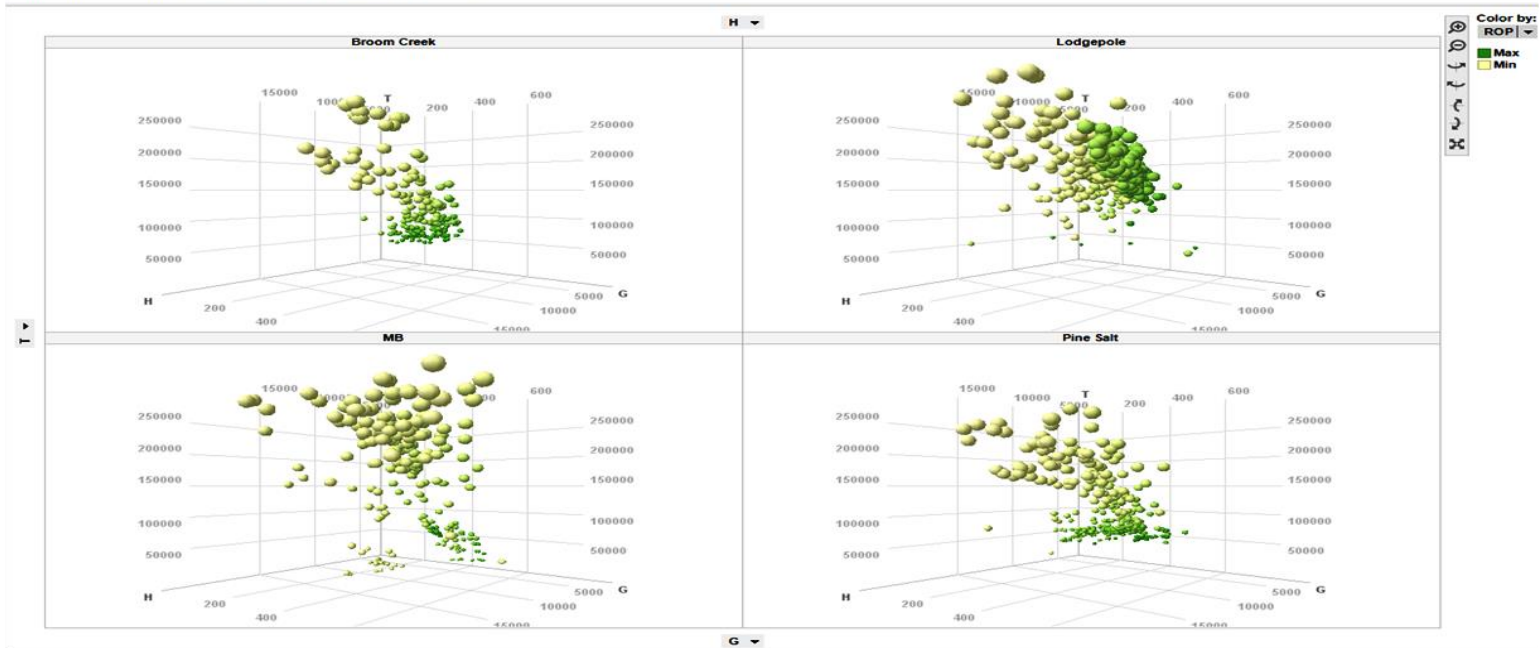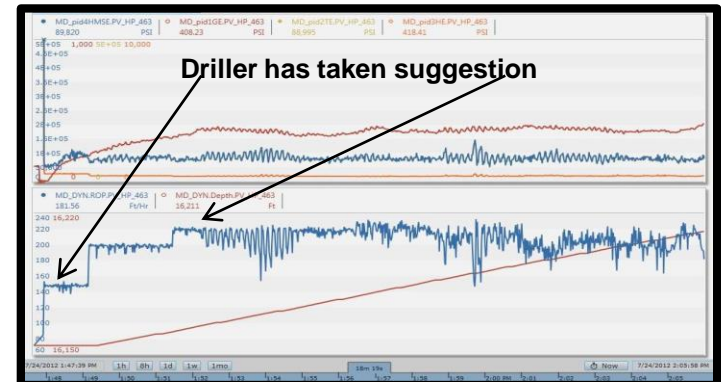
Real-Time Optimization PI Coresight

Stick-Slip Identification   …few stands later…→   Stick-Slip Mitigation
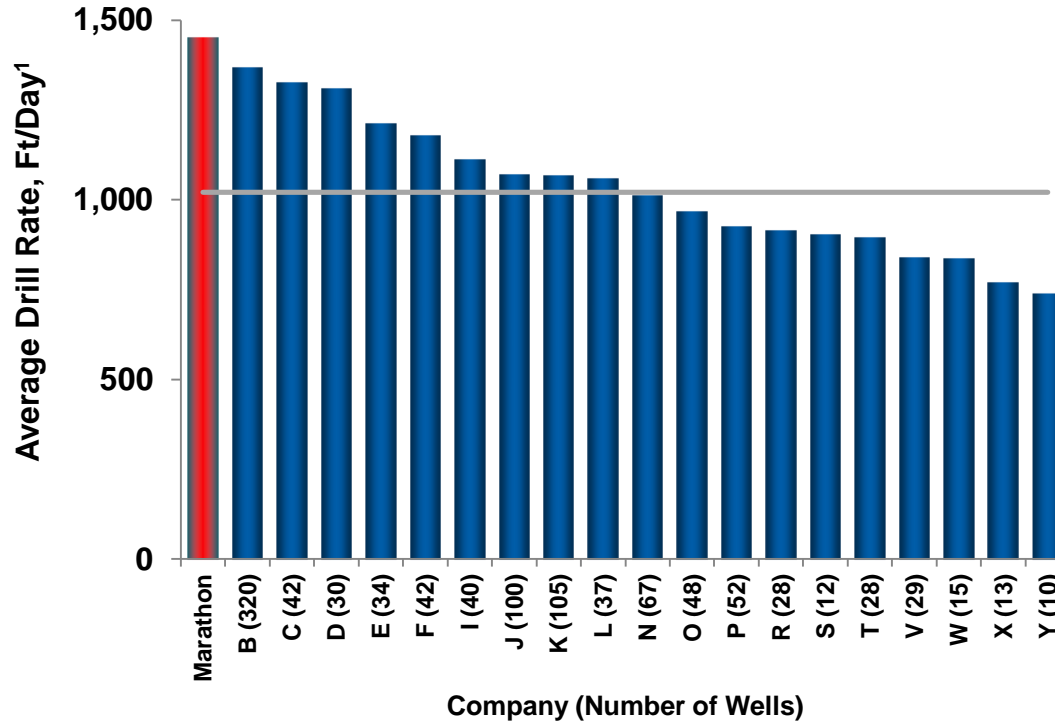
40% Sustained Increase in Rate of Penetration

Avg. ROP
for stand
is **144**
ft/hr

"Acceptable"   Moderate   Severe

Avg. ROP
for stand
is **201**
ft/hr

Driller has taken suggestion

Continuous Improvement in Rate of Penetration (ROP)

	Ft/Day	TD
Competitor Average	1,020	16,483
MRO Average	1,450	17,297

[1]Competitor Data Source: IHS – Drilling Wire; Wells drilled 2013 YTD (Oct) across Karnes, Wilson, Bee, Atascosa, Live Oak, McMullen, Gonzales, Lavaca and Dewitt Counties; Includes companies with at least 10 wells (AXAS, BHP, BHP, CHK, COP, CRK, EOG, FCX, FST, Geosouthern, HUNT OIL, MUR, PVA, PXD, PXP, Sea Eagle Ford, SFY, STO, TLM)

Eagle Ford Drilling – Spud to Total Depth
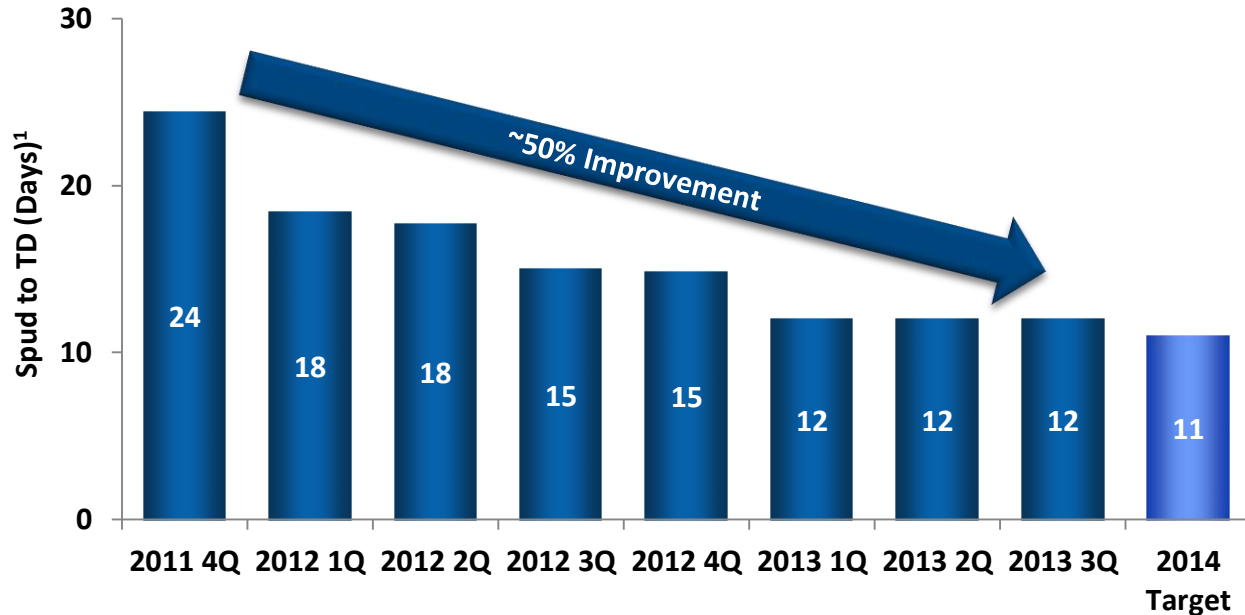
Note: Spud to TD Days: MRO-op wells, excludes pilot holes and wells with intermediate casing.

Value Now, Value Over Time with the PI System

- 25+ years – Continuing to Find Incremental Value

- Excited about Leveraging PI-AF, PI Coresight, Event Frames

- MaraDrill^{TM} is being rolled out across 25+ rigs

- MaraDrill^{TM} -key Element in Drilling Optimization Vision

- Moving from Tactical to Strategic in use of the PI System
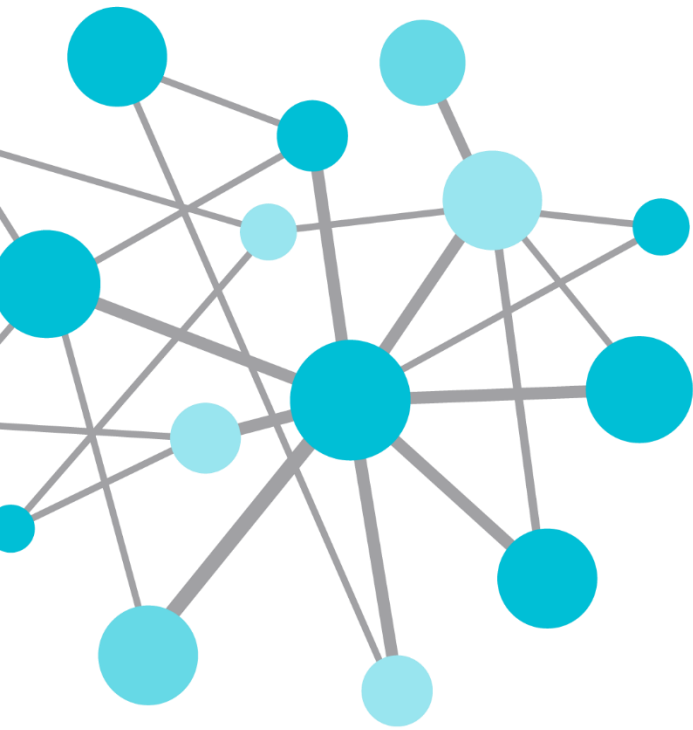
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Advanced Senior Business Analyst

Marathon Oil Company
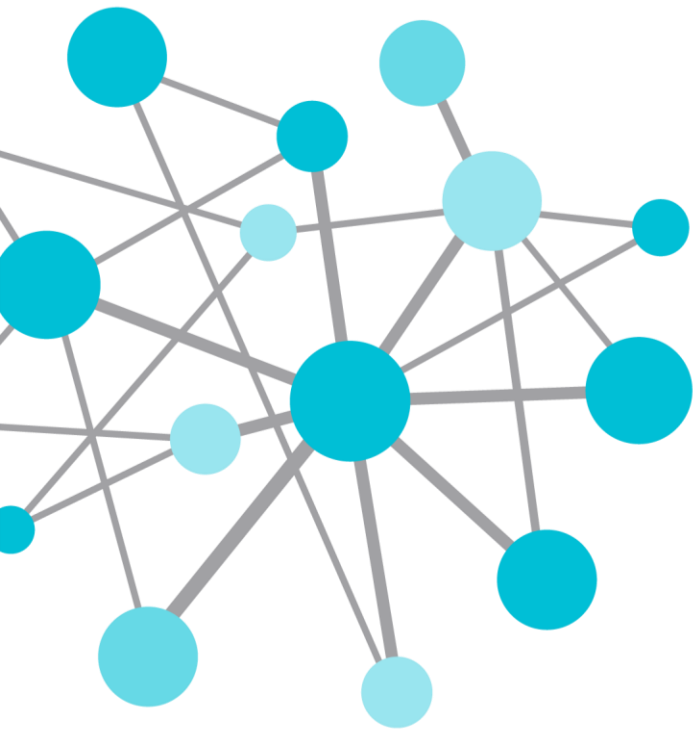
THANK YOU

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