Digital Transformation & Technology Innovations
AI & IoT

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Bentley’s Business

Engineering Design Tools for Plant, Infrastructure, and Building Modeling 2017 (EDT/BIM Market Analysis)
#2 Overall
#1 in Water and Wastewater Distribution
#1 in Electric T&D and Communication Systems

Asset Reliability Software & Services 2017
#1 Overall (Software)
#1 in Electric Power T&D (Software)
#1 in Oil & Gas (Software)
#1 in Pharmaceutical & Biotech (Software)
#1 in Transportation (Software)
#1 in Water & Waste Water (Software)

GIS 2017
#2 Overall (GIS)
#1 in Software as a Service

ProjectWise in the ENR Top Design Firms
44 of the Top 50
355 of the Top 641

AssetWise in the Bentley 2016 Infrastructure 500
25 of the Top 50 Owners
117 of the Top 500 Owners
Analysts project by 2025, data from connected devices will yield insights driving potential economic value of as much as $11 trillion.

Unlocking the potential of Internet of Things. McKinsey & Company, June 2015

Gartner says 8.4 Billion "Things" in use in 2017, up 31% from 2016

Accenture estimates the Industrial Internet of Things (IIoT) could add $14.2 trillion to the global economy by 2030.
Connected Assets

- Manage change across the asset lifecycle
- Improve asset integrity and performance while reducing costs
- Gain visibility of mission-critical asset information
- Achieve operational excellence
- Make better operational decisions

Asset Performance Modeling

- Asset Lifecycle Information Management
- Asset Reliability
- Enterprise Interoperability
- Compliance & Safety
- Operational Analytics

CONNECTION DATA ENVIRONMENT
Machine Learning

An application of artificial intelligence (AI) that provides systems the ability to automatically learn and improve from experience without being explicitly programmed.
In Just 4 Hours, Google's AI Mastered All The Chess Knowledge in History

"This algorithm could run cities, continents, universes."

PETER DOCKRILL  7 DEC 2017

Chess isn't an easy game, by human standards. But for an artificial intelligence powered by a formidable, almost alien mindset, the trivial diversion can be mastered in a few spare hours.
Solve These Types of Problems

- Predict events
- Predict asset failures
- Detect anomalies
Water Loss

Darwin Calibrator
Detecting Pipe Leaks and Bursts

Flow/pressure sensors
Structural Integrity
Sensor-based health assessment monitoring
Cold Turbine Findings

Predictive Maintenance of Cold Turbines at Gas Products User

Goal 1

Improve maintenance strategy

Goal 2

Develop a repeatable/reusable method for building predictive models
What did we learn?

- Early warnings give operators 5-10 hours advance notice
- Reduced asset end of life or severe stoppage
- Significant cost savings
- Maintenance strategy planned ahead of time
- Transition from preventive to predictive maintenance
- Provides a roadmap to future applications of Machine Learning with respect to asset reliability
Hot Mill Findings
Condition Monitoring of Manufacturing Assets at Steel User

Goal 1
Reduce defects and locate root cause

Goal 2
Concentrate on key variables that matter the most

Goal 3
Prioritize assets during shutdown
What did we learn?

- Developed a method of dealing with multiple products processed on one machine
- Identified top variables associated with defects
- Developed process for anomaly detection across industrial plant
- Reduced time on data and equipment analysis
- Machine Learning can provide the user with valuable insights and asset level intelligence without the need for complex equipment analysis or costly inspections
**PERFORMANCE**

Descriptive/Diagnostic
What happened and why
Focus on past performance
Data discovery tools

**PREDICTIVE**

Data Mining
What will happen
Rules & Algorithms applied to historical data
Predict future outcomes

**PRESCRIPTIVE**

Decision options and implications
Big data, data science, machine learning, business rules

Maturity Phases of Analytics and Business Intelligence – 3P’s

Increase Asset Intelligence

- **Dumb**
  - No software or control software only
- **Instrumented**
  - Provides data externally
- **Analytic**
  - Determine own status and needs
- **Active**
  - Seeks to maintain performance
- **Goal Oriented**
  - Seeks to optimize performance
- **Competent**
  - Self-driving

Intelligence Hierarchy

Courtesy of ARC Advisory Group
Thank you…

Bhupinder Singh
Chief Product Officer