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ARC
Advisory Group
GLOBAL WEBINAR
Digital Twins:
Myths vs. Reality
Wednesday, September 11, 2019

Speakers

Will Hastings
PLM Analyst at ARC Advisor

Enrique Herrera
Industry Principal at OSIsoft

Defining the Modern Digital Twin

Agenda

- What is a Digital Twin?
- Why are we discussing Digital Twins now?
- How are Digital Twins being utilized?

What is a Digital Twin?

What is a Digital Twin?

"…a cross-domain **digital model** that accurately represents a product, production process or performance of a product or production system in operation."

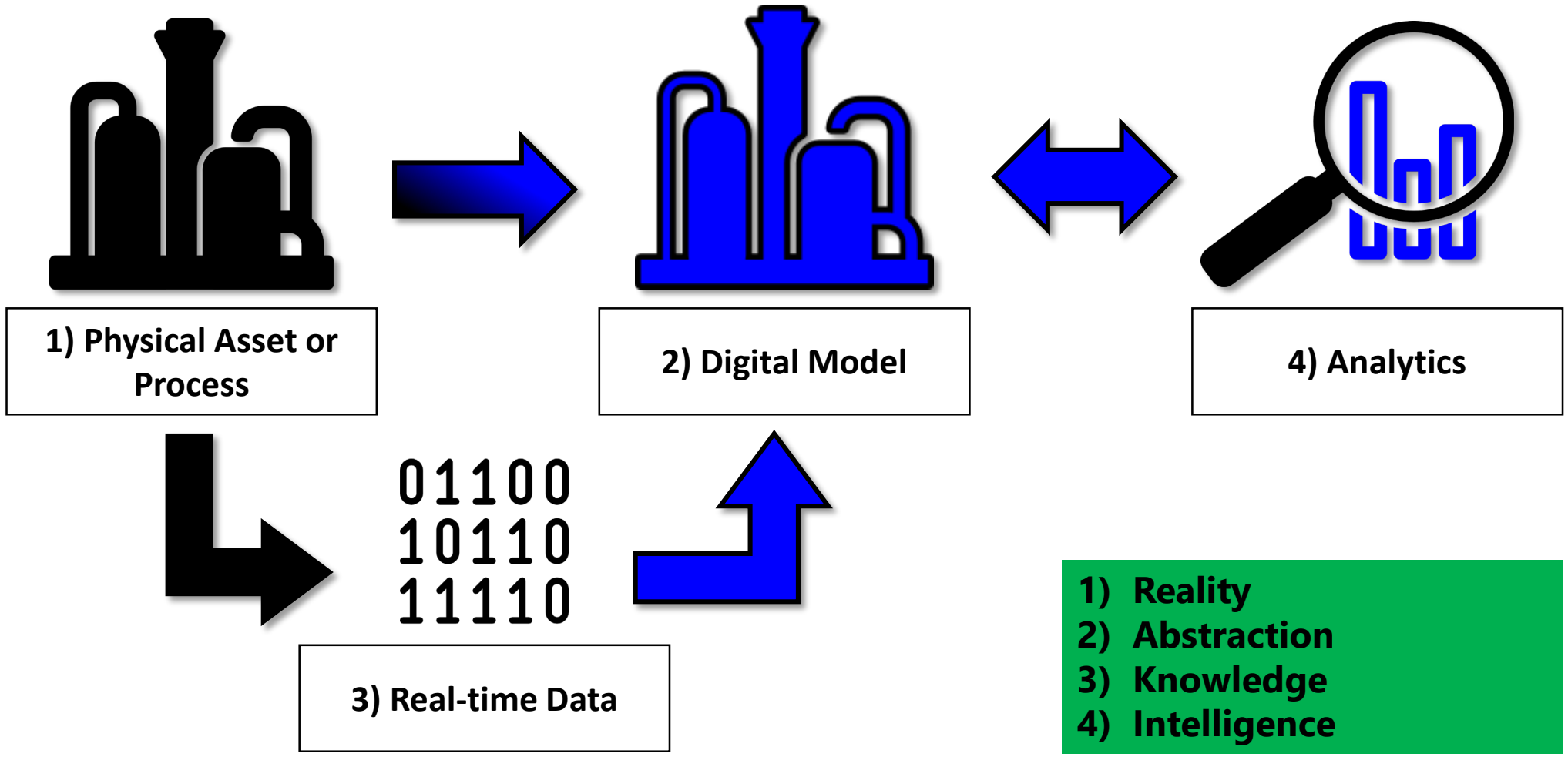
"…a near-**real-time** digital image of a physical object or process that helps **optimize** business performance."

"…a representation of a **physical asset** that has a level of completeness and accuracy and includes **context information** that allows the user to understand its behavior and performance."

"In short, the digital twin concept combines the ideas of **modeling** and the **Internet of Things (IoT)**."

"Digital twins are virtual replicas of physical devices that data scientists and IT pros can use to **run simulations** before actual devices are built and deployed."

Digital Twin: A Sum of Constituent Parts



1) Reality
2) Abstraction
3) Knowledge
4) Intelligence

Digital Twin Variations

Machine Health

Environmental Data

Process Data

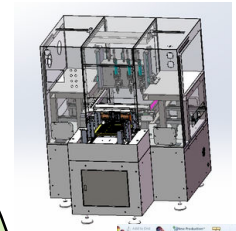
ASSET/PROCESS
- Product
- Production Asset
- Process

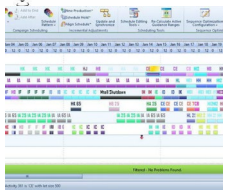
MODEL
- 3D Model
- Process Model
- Schedule

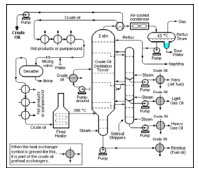
Unique Digital Twin

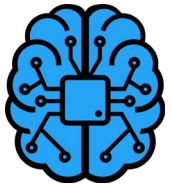
DATA
- Safety
- Process
- Equipment
- Environmental

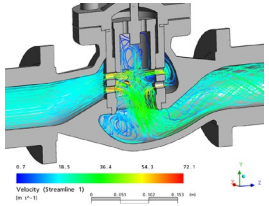
ANALYTICS
- Artificial Intelligence
- Physics Simulations
- Dashboards

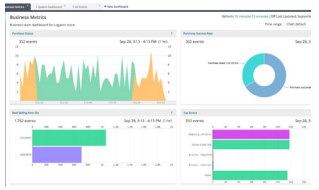






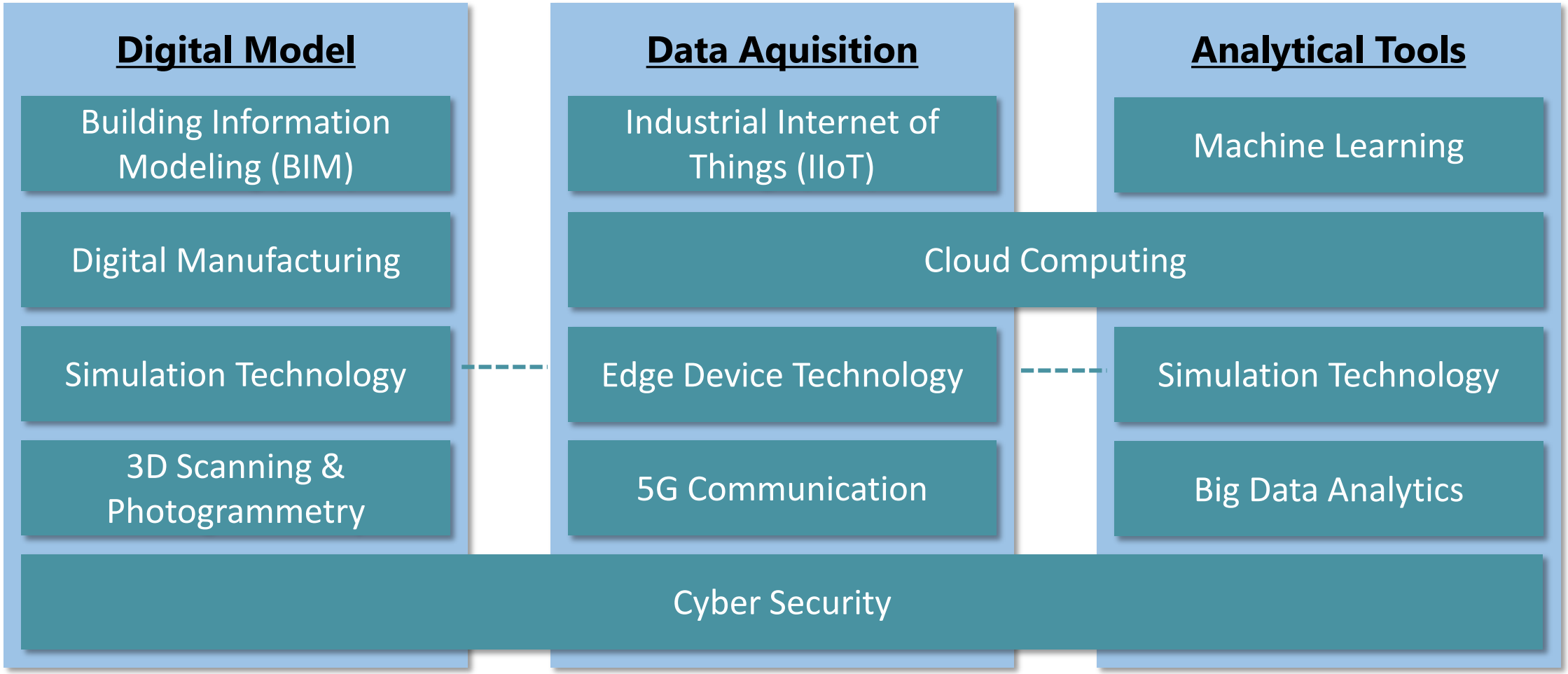






Why Are We Discussing Digital Twins Now?

Emerging Generation of Digital Twin Enabling Technologies



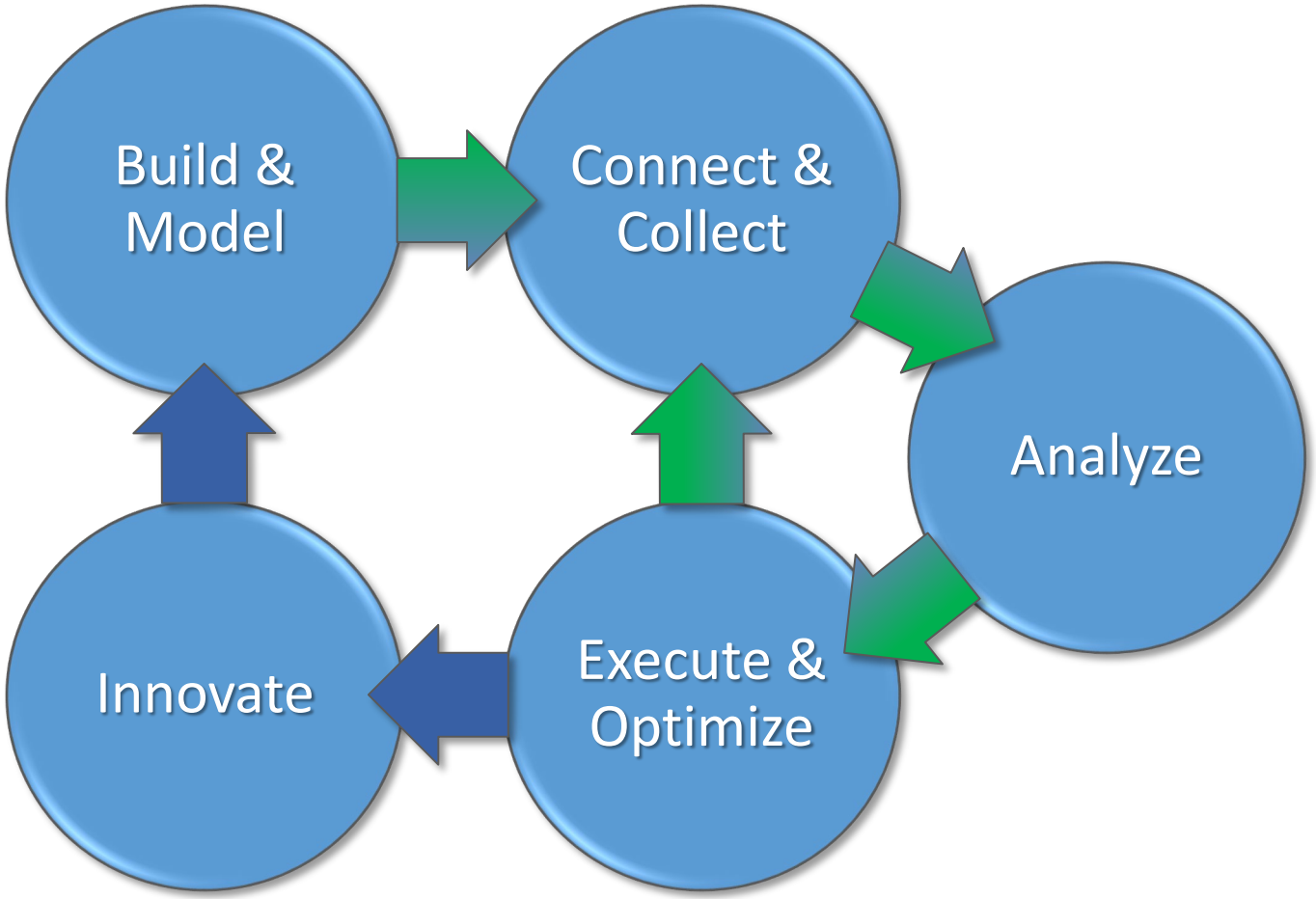
Enabling an Information Value Cycle

Project Digital Twin

- Accelerate Program Timing
- Increase Product Fitness
- Provide Performance Baseline
- Close the Engineering Loop

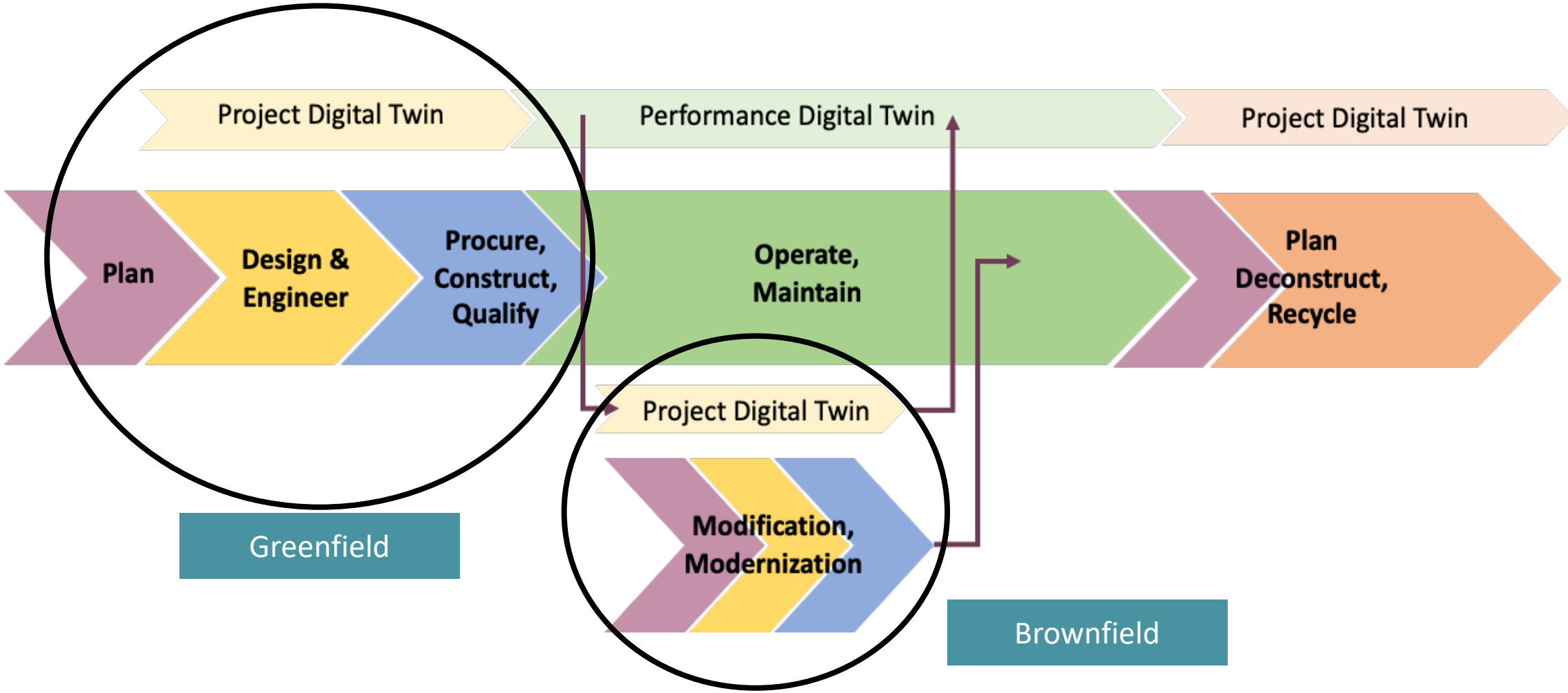
Performance Digital Twin

- Optimize Operating Performance
- Create & Optimize Services
- Drive Project Decisions



How Are Digital Twins Being Implemented?

Project vs. Performance Digital Twin

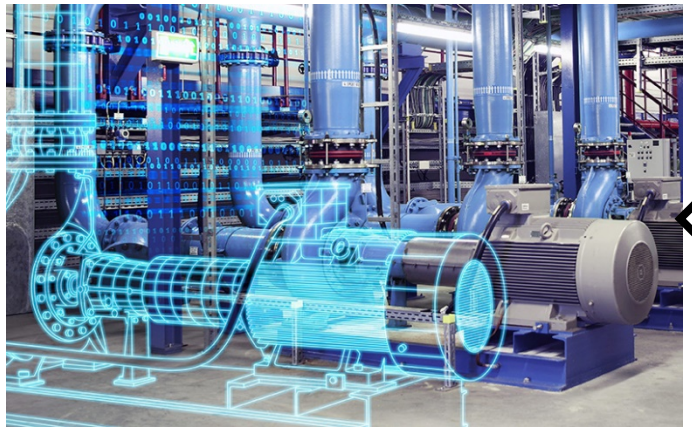


Digital Twins Throughout Asset Lifecycle

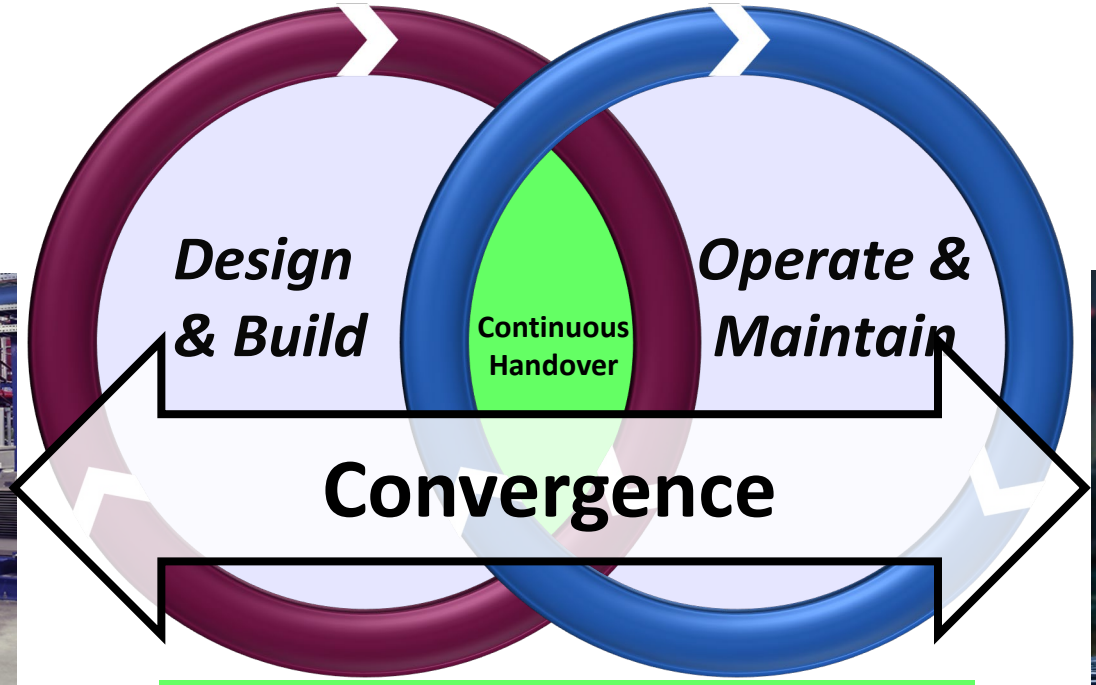
Modeling & Simulation

Construction Sequence

Virtual Commissioning



- As-Designed
- As-Built
- As-Maintained

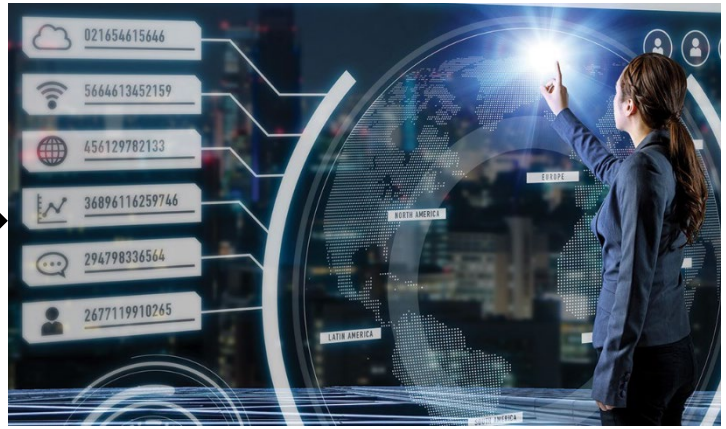


- Increase throughput
- Improve product quality/yield
- Simulate what-if scenarios for new processes/parameters
- Model demand-supply requirements
- Minimize energy costs

Predictive Maintenance

Process Optimization

Energy Management



- Real-time IoT data
- Analytics
- Alerts

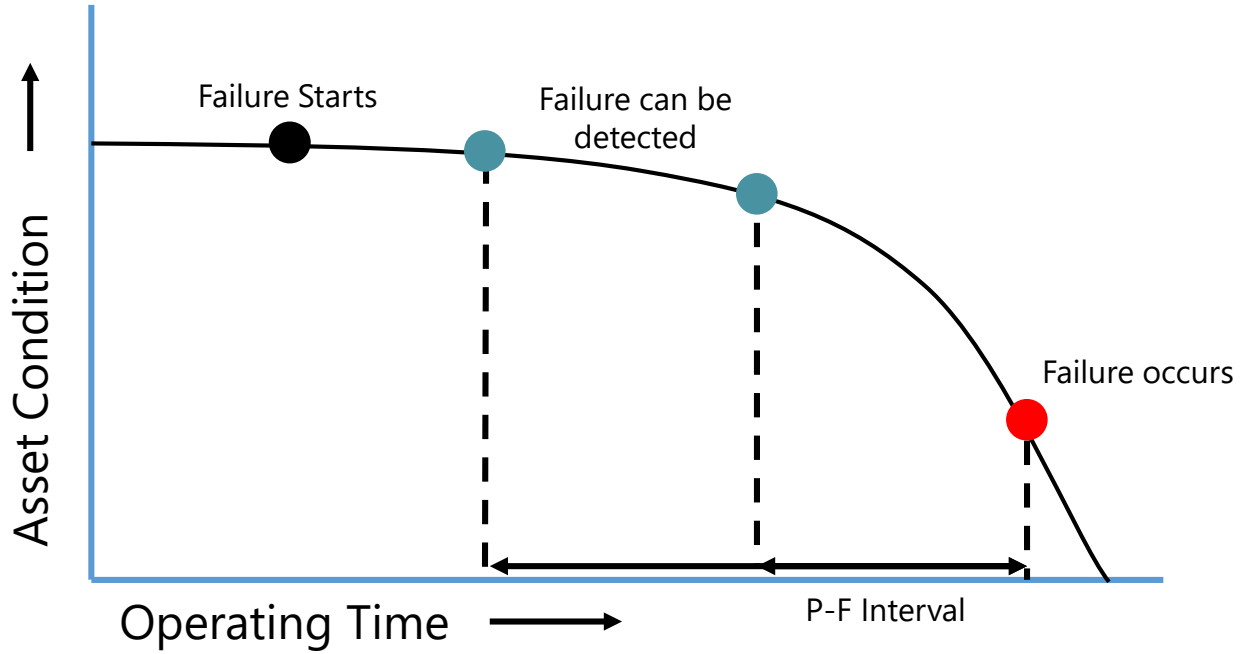
Digital Twin for Maintenance

Strategy	Description
Prescriptive	Model and knowledgebase* identifies an issue and what to do for repair.
Predictive (PdM)	Equipment specific algorithms* or machine learning*. Multi-variate.
Condition Based (CBM)	Alerts for bad trends or other rules-based logic using a single data value.
Preventive	Service in a fixed time or cycle interval
Reactive	Run to failure, and then repair

Mature Digital Twin

Asset Management Maturity Model

- First Time Fix Rate
- Mean Time to Repair
- Mean Time Between Failures
- Reduced Losses
- Optimized Equipment Lifecycles and Spare Parts Usage



P-F Curve

Considerations For Your Digital Twin Initiative

Economy of Data
- Volume
- Fidelity
- Application

Collaboration
- Build
- Maintain
- Utilize

Data Governance
- Integrity
- Availability
- Security

Scalability
- More Data
- More Analytics
- More Uses

Thank You.

For more information, contact the author at whastings@arcweb.com or visit our web pages at www.arcweb.com

Operational Digital Twins in Action

Enrique Herrera - Industry Principal, Manufacturing

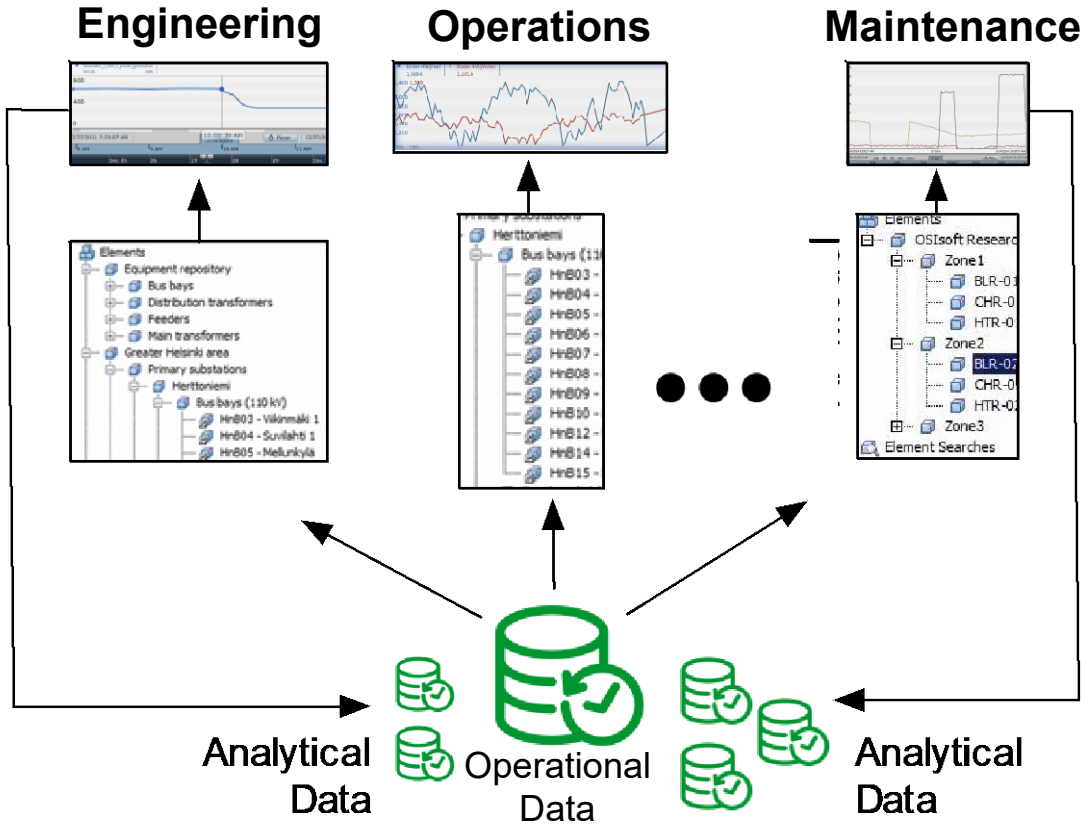
September 11, 2019

OSIsoft.

Operational Digital Twins in Action

- Organize operational for multiple users
- Visualize modeled results with actual measurements
- Train employees with actual operational data
- Optimize after service with advanced analytics

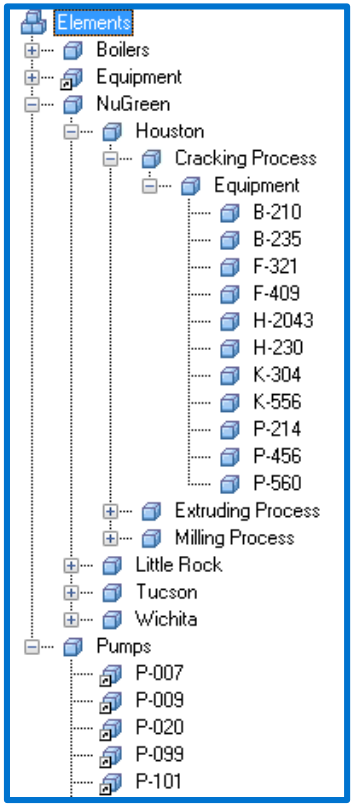
Organize Data for Specific audience and goals



- **Create asset-centric models:**
- **Target audiences and goals**
- **Implement models in operational analytics**
- **Re-use models across multiple sites**

Source: https://www.osisoft.com/pi-system/pi-capabilities/pi-server/

OSIsoft Asset Framework



Analyses
- Efficiency analysis
- Key Performance Indicators (KPI)

Time-series
- In-Flow
- Pressure
- Vibration data

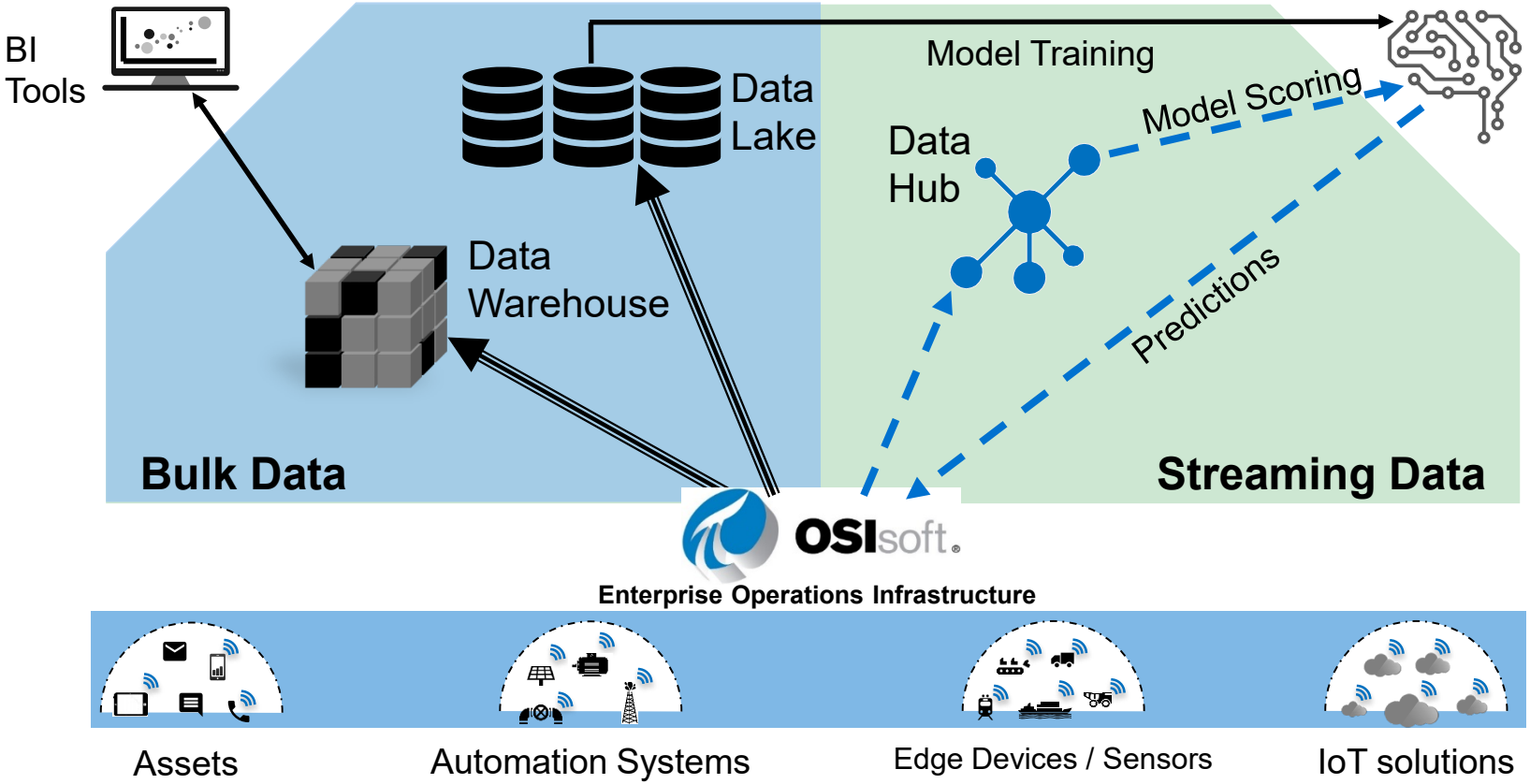
Events
- Downtime
- Startup
- Failure

Asset details
- Name
- Model
- Manufacturer

Notifications
- High speed
- Rotor failure
- Low pressure

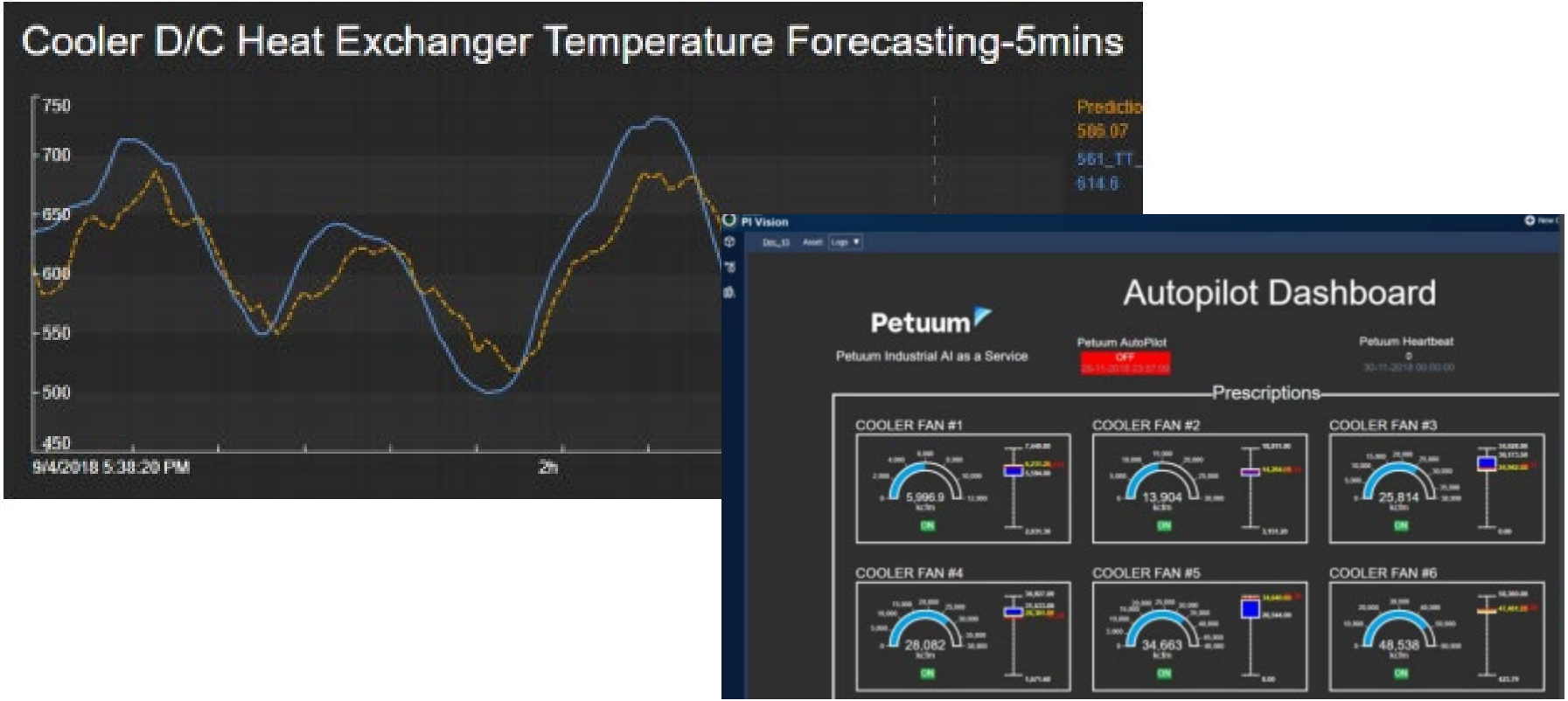
External data
- Performance curves
- Last maintenance date
- Design documents
- Best operating procedures

Organize and Synthesize Operations Data before Analyzing



Source: https://www.osisoft.com/pi-system/pi-capabilities/pi-server/

Visualize Actual with Desired / Predicted



Best Practices in the Integration of Modeling Software with the PI System

Seth Tate - IT Business Analyst
&
Joe Rose - SW Regional Manager

About Phillips 66

Midstream

- Moves crude oil, refined products, natural gas and NGL
- Gathering and processing, pipelines, fractionation, storage, and export facilities
- General partner of Phillips 66 Partners LP
- 50% interest in NGL and natural gas processor, DCP Midstream, LLC

Chemicals

- 50% interest in Chevron Phillips Chemical Company LLC
- Manufactures olefins, polyolefins, aromatics, alpha olefins, styrenics and specialty chemicals globally
- Advantaged ethane feedstock

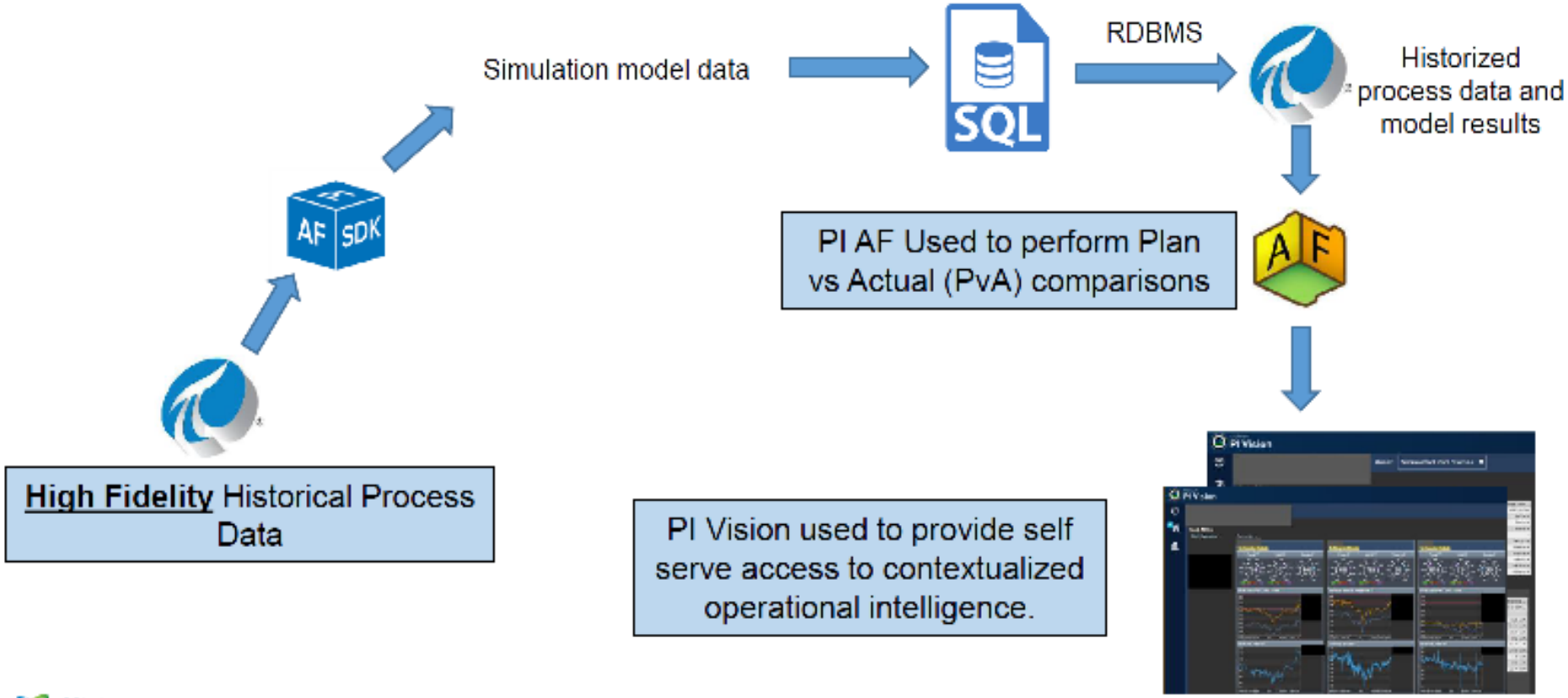
Refining

- Refines crude oil and other feedstocks at 13 refineries in the U.S. and Europe into products (mainly gasoline, diesel and aviation fuel)
- 2.1 MMBD in global refining capacity
- Large, complex refineries with integrated supply and distribution networks

Marketing & Specialties

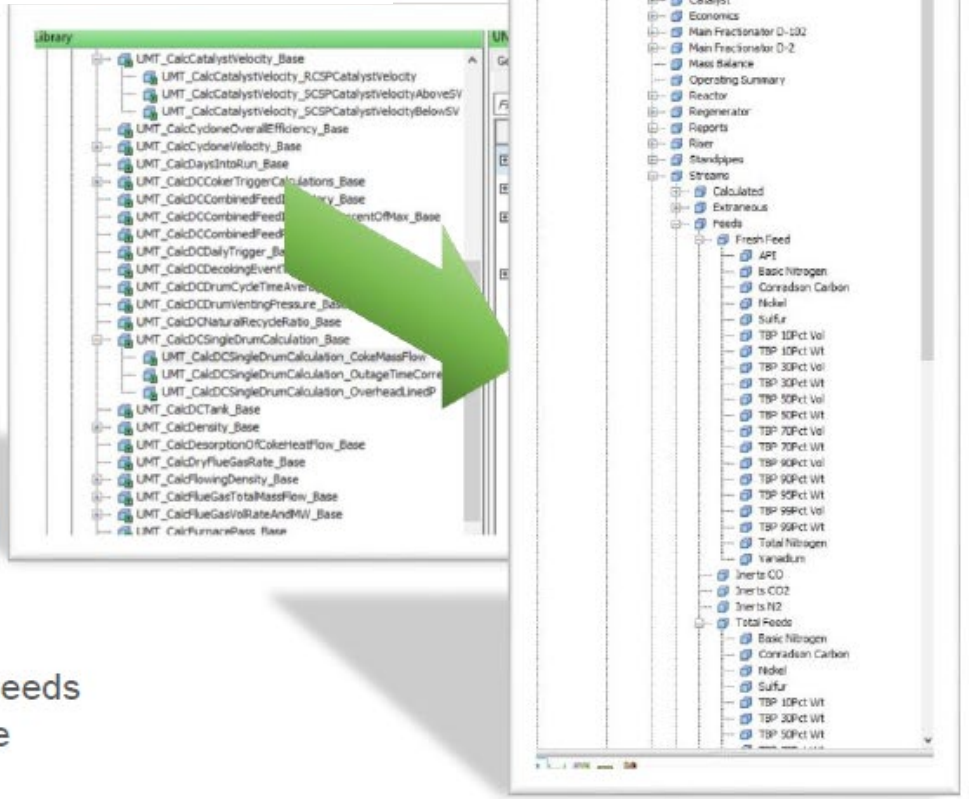
- Markets refined petroleum products (gasolines, distillates and aviation fuels) mainly in the U.S. and Europe
- 7,550 U.S. branded sites
- 1,630 European retail sites
- Finished lubricants and Excel Paralubes base oil joint venture

Data Flow



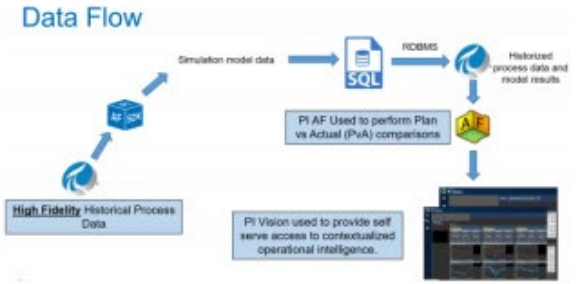
PI AF Template-based Solution

- **Leveraging the power of PI AF Templates of many flavors:**
  Elements, Analyses, Event Frames
  - Many commonalities across unit types
  - Unit-to-unit variations captured
- **Not just *physical* assets**
  - Product Streams, Yields, etc.
- **Dynamic and centrally managed design**
  - Standardized design library for deployment
  - Adaptable design, can evolve with business needs
  - Iterative approach to continuously improve the solution



Best Practices in Integration of Modeling Software with PI AF

PHILLIPS 66



CHALLENGE

Integrating PI System data with model data and comparing to actuals

- Different tools/spreadsheets with different data available
- Quality and consistency of monitoring varies
- Level of effort to maintain

SOLUTION

Integrate modeling data with the PI System to provide high fidelity, quality, rich dataset for trending, analysis, monitoring, optimization

- PI SDK to load high fidelity data in model
- PI RDBMS: interface to bring in modeling data back into the PI System
- PI AF: templatize and standardize process data, calculations, and analytics
- PI Vision: standard KPI, economic, summary displays

RESULTS

Improved KPI monitoring, optimization, and model usage resulting in improved economic performance

- Improved performance
- Data transparency
- Empowerment of SMEs with self serve access to model effectiveness

Ship Builder & Solution Provider:
Crew Training System

COMPANY and GOAL

DELFI ILS has to support the logistics in a highly complex system delivery adopting SHIPVIEW as a single, scalable and extensible platform

DELFI ILS SOLUTIONS

FINCANTIERI
The sea ahead

CHALLENGE

A single tool to manage all the information

- Data fragmentation & heterogeneity
- Ship automation integration
- Simulation functionalities

SOLUTION

SHIPVIEW: 3D Localized Multi Media Asset Manager

- Visual reference to reality
- Embedded real-time data as well as data support to simulation
- Visual reference to technical docs

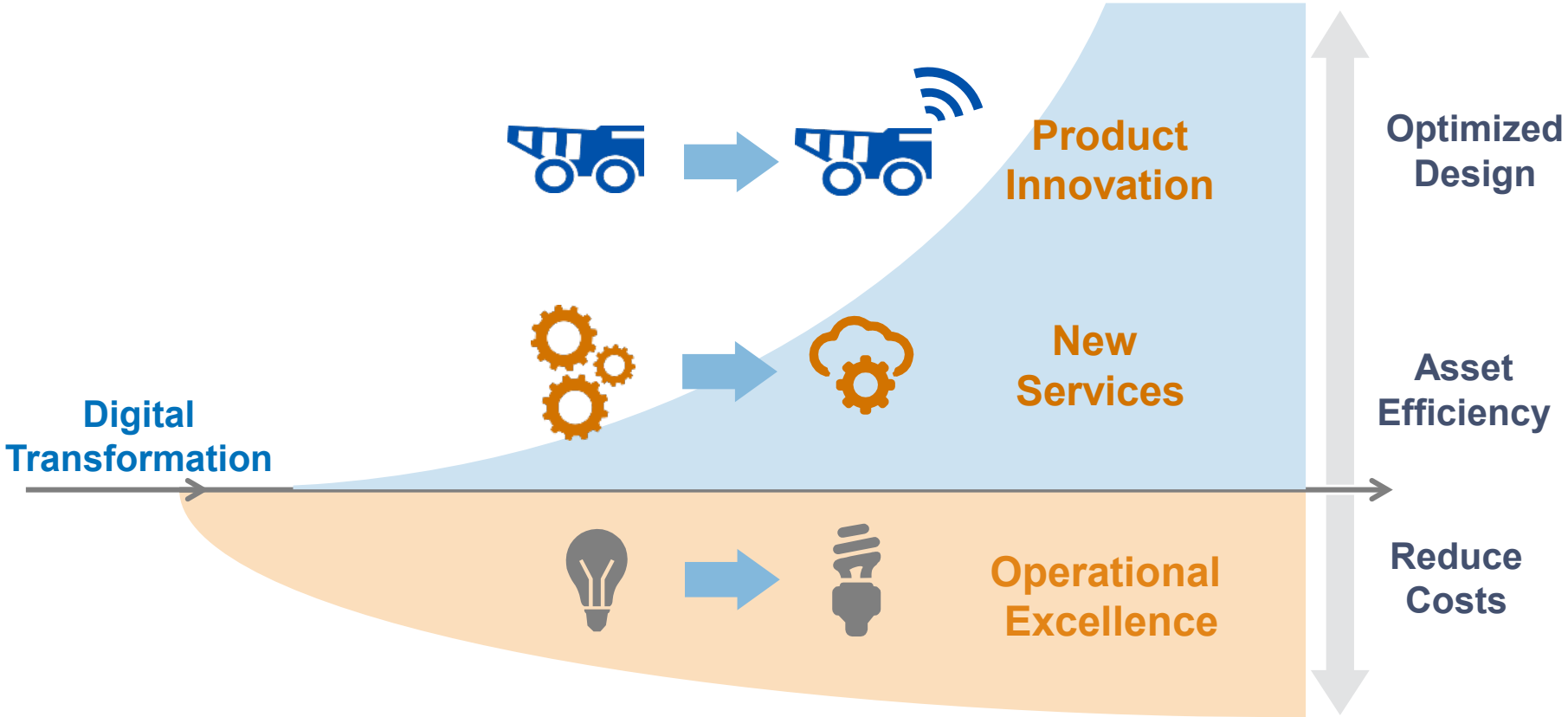
RESULTS

Entire ship information assets in one place ready to use

- Process data (real-time and for simulation)
- 200 operative manuals
- 40K spare parts
- 10K operative procedures video
- 6K technical drawings

Source: OSIsoft EMEA User Conference 2017 Presentation: https://www.osisoft.com/pi-system/case-studies-and-testimonials/all-case-studies/DelfiEMEA2017story/

Opportunities from New Digital Services



WELCOME TO THE AGE OF SMART IRON

HOW TECHNOLOGY INNOVATION IS DRIVING CHANGE IN THE MARINE INDUSTRY

OSIsoft Users Conference 2017

Rob Bradenham
Global Sales & Business Development Manager
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CAT

Source: OSIsoft User Conference 2017 Presentation: https://www.osisoft.com/pi-system/case-studies-and-testimonials/all-case-studies/caterpillaruc2017story/

CONNECTED INSIGHT:
CAT® ASSET INTELLIGENCE

- PREDICT & AVOID FAILURES
- OPTIMIZE MAINTENANCE
- REDUCE FUEL & OPEX
- ENSURE COMPLIANCE
- CREATE TRANSPARENCY

CHIEF ENGINEER & ONBOARD CREW

FLEET ADVISOR

CUSTOMER MANAGEMENT

CAT Onboard Viewer and Analytics

CAT Remote monitoring and analytics

CASE STUDY

OPTIMZE HULL CLEANING

Marine growth increases hull resistance, significant fuel cost driver

Environmentals make analysis difficult - typically practice is time based scheduling

RoRo vessels, Fuel is 70%+ of costs

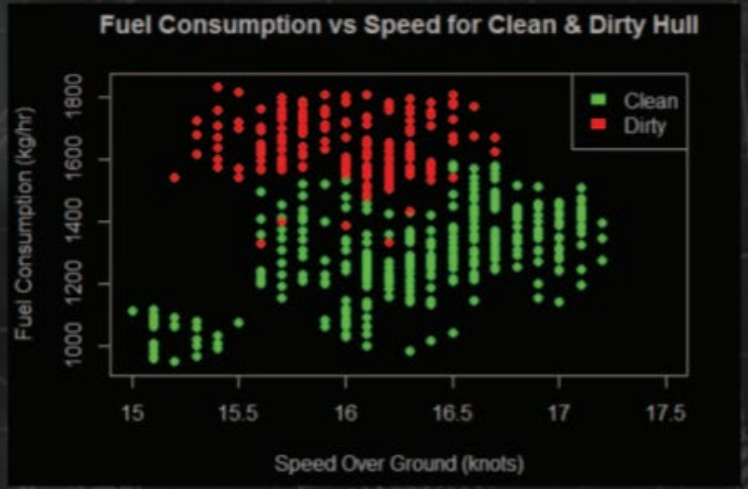
CASE STUDY

OPTIMZE HULL CLEANING

Marine growth increases hull resistance, significant fuel cost driver

Environmentals make analysis difficult - typically practice is time based scheduling

Used R & weka to account isolate for hull condition impact
Configured Asset Intelligence for continuous analysis



Using data analytics to shift to optimal / condition based cleaning:

$450K+ per vessel

Takeaways

- *Optimize “brownfield” in parallel to “greenfield” scenarios*
- *Contextualize operational data to also serve engineering*
- *Use digital environment with operational data to train employees*
- *Optimize equipment performance with after service providers*

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OSIsoft, LLC


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TAPADH LEIBH
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HVALA
GO RAIBH MAITH AGAT
ESKERRIK ASKO
MAHADSANID
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ТИ БЛАГОДАРАМ
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