The Digital Eruption: Connecting the Internet of Things and Cognitive/Machine Learning Era

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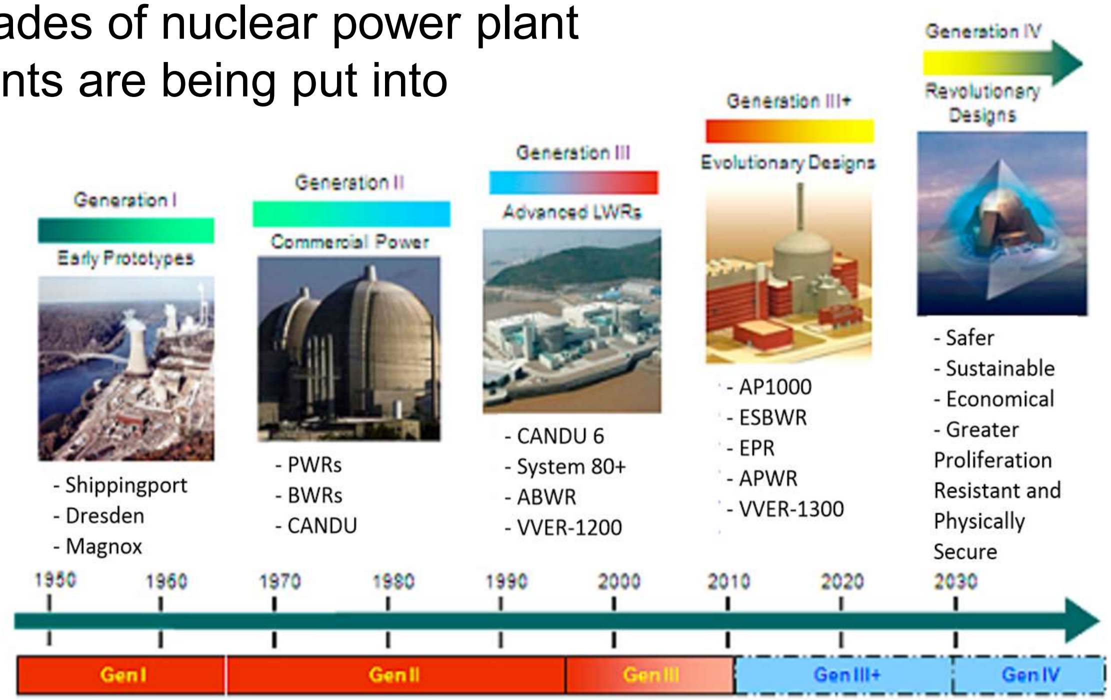
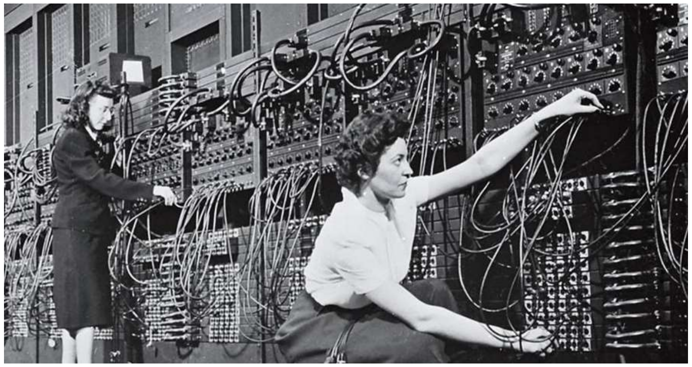
Worldwide Nuclear Power is Advancing

- A new fleet of advanced nuclear power reactors is taking shape around the world.
  - The fleet is being designed by multiple reactor vendors and architect-engineers.
- The worldwide fleet is diverse; nevertheless the reactor plants share two powerful foundations in science and technology.
  - First, more then seven decades of nuclear power plant experience and improvements are being put into positive practice.
  - And second, sophisticated information systems that were unavailable even one decade ago are now delivering significant practical results at these plants.

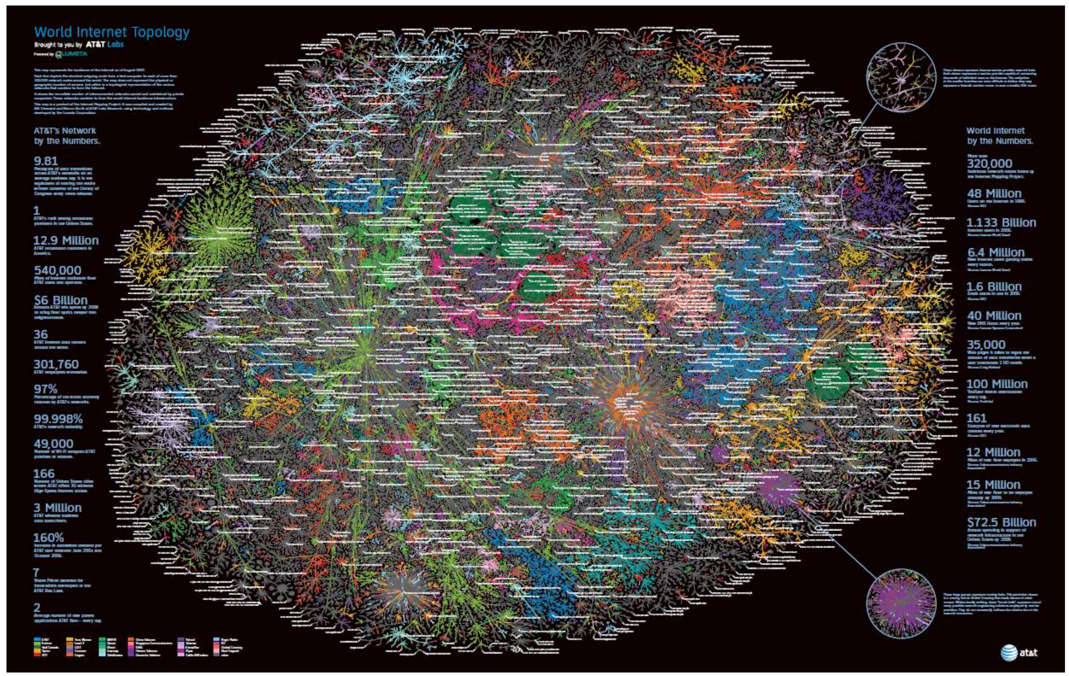


The Evolution of Information Systems



- Early information systems were information processing or automation islands.
  - Data was isolated, results were focused on specific tasks, interrelations were few, and there were few interconnecting links.

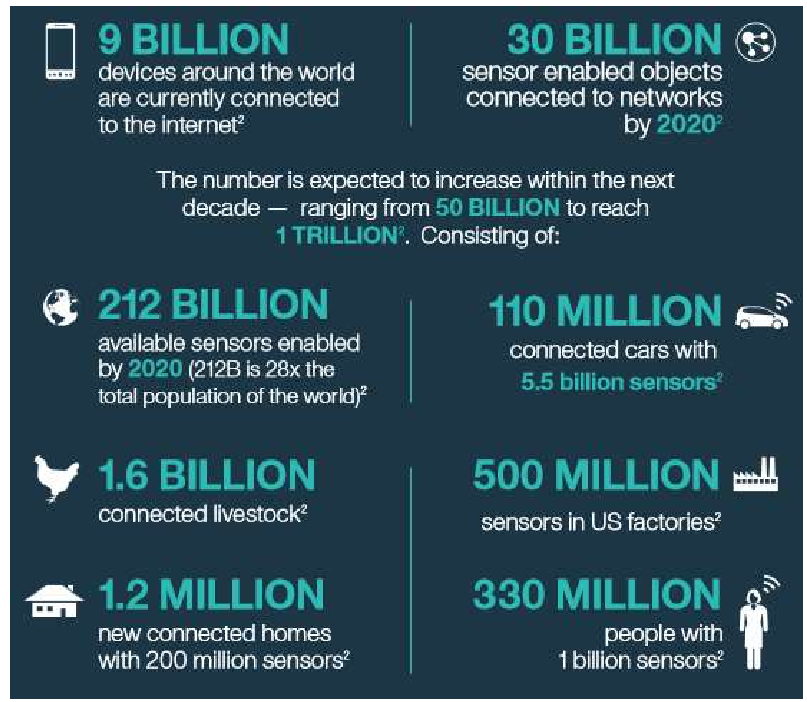
- Modern systems are built for purpose, yet are configurable to meet new requirements and are highly interconnected.
  - Business process applications follow industry best practices.
  - Data and status are shared freely among users, and with other machines wherever warranted.
  - Systems are adaptable to process simplification and new initiatives.
  - Software built to current technical standards simplify maintenance and support resource availability.



http://www.research.att.com/export/sites/att_labs/groups/infovis/news/img/ATT_Labs_InternetMap_0730_10.pdf

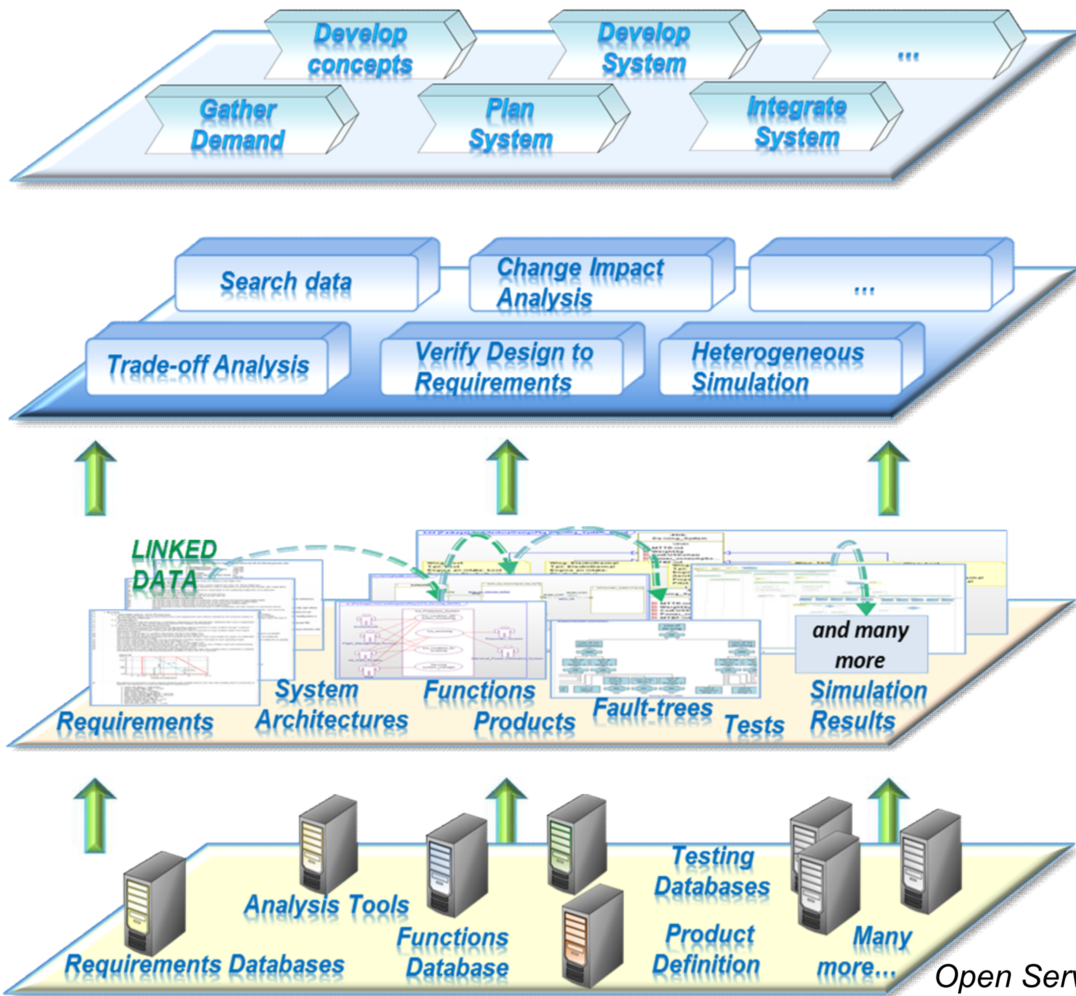
IoT: the Internet of Things

- A confluence of software and hardware enabling factors:
  - Widespread broadband communications
  - Decreasing connection costs
  - More devices with built-in sensors and wireless connectivity
  - Growing facility analyzing huge volumes of structured and unstructured data
- Metrics:
  - better manage change and configuration
  - better understand data and relationships



Design Phase using Systems Engineering Best Practice

Industrial Workflows



Enable New Engineering Methods:

Re-use/Product Line Engineering (PLE)

Model Based Systems Engineering (MBSE)

Users get better ways of working

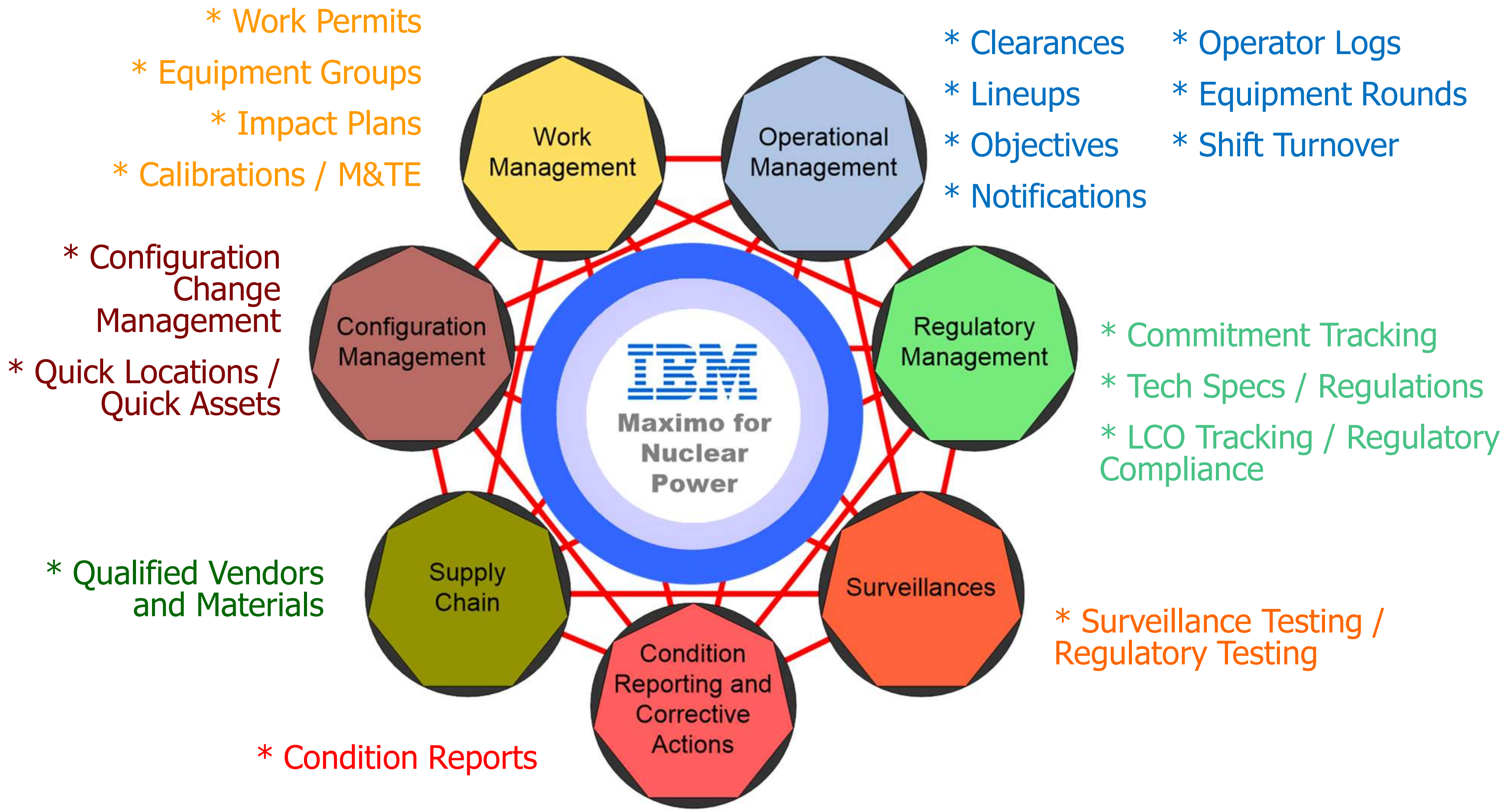
Open Integration Platform

- ***Standardized Interoperability Specification***
- ***Connect tools to expose & link data***

Tool Layer

Open Services for Lifecycle Collaboration (OASIS Open Standard)

Nuclear Process Support Extends Core Maximo EAM

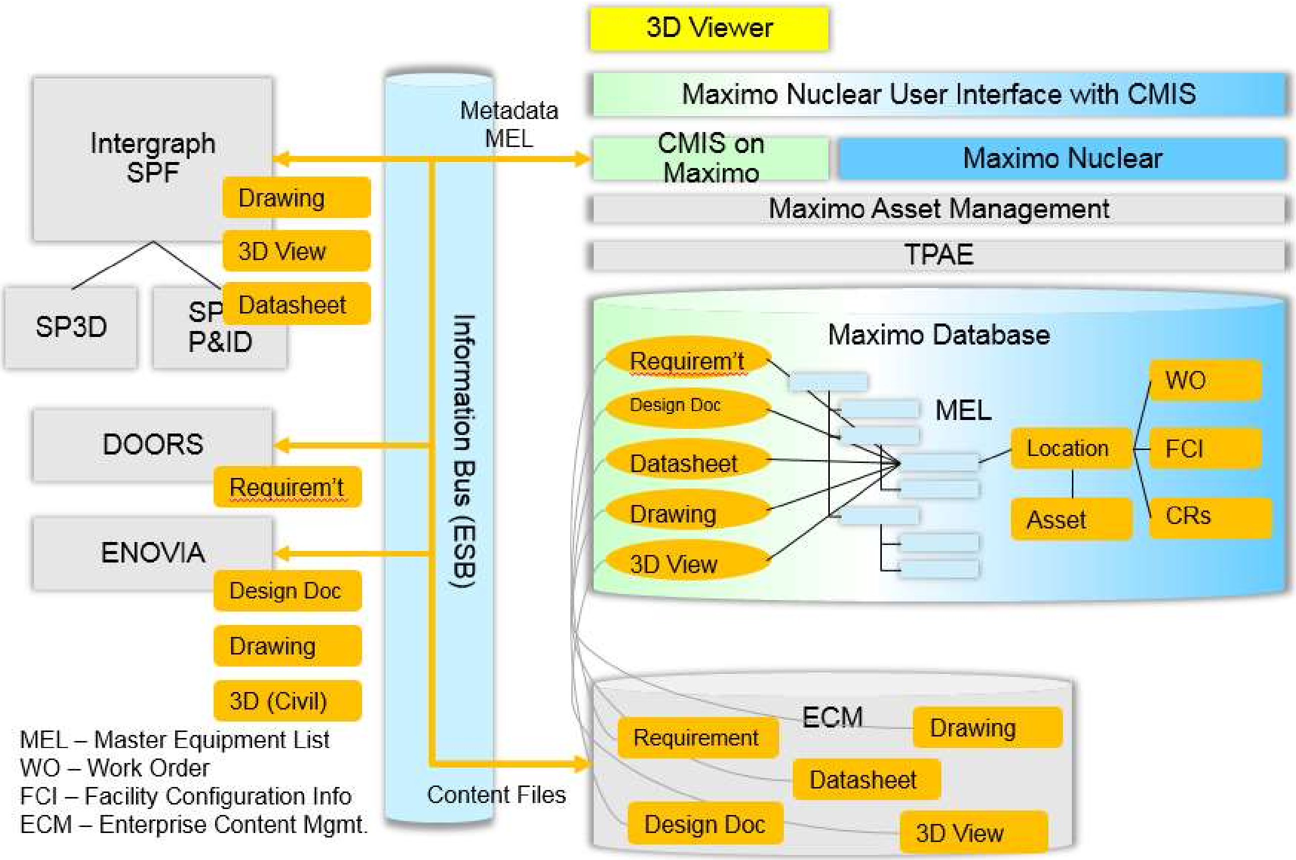


Reference information:

https://www.ibm.com/support/knowledgecenter/SSLL8M_7.5.1/com.ibm.nuc.doc/nuc_welcome.html

Maximo and PLM Integration Architecture – EPC Phase

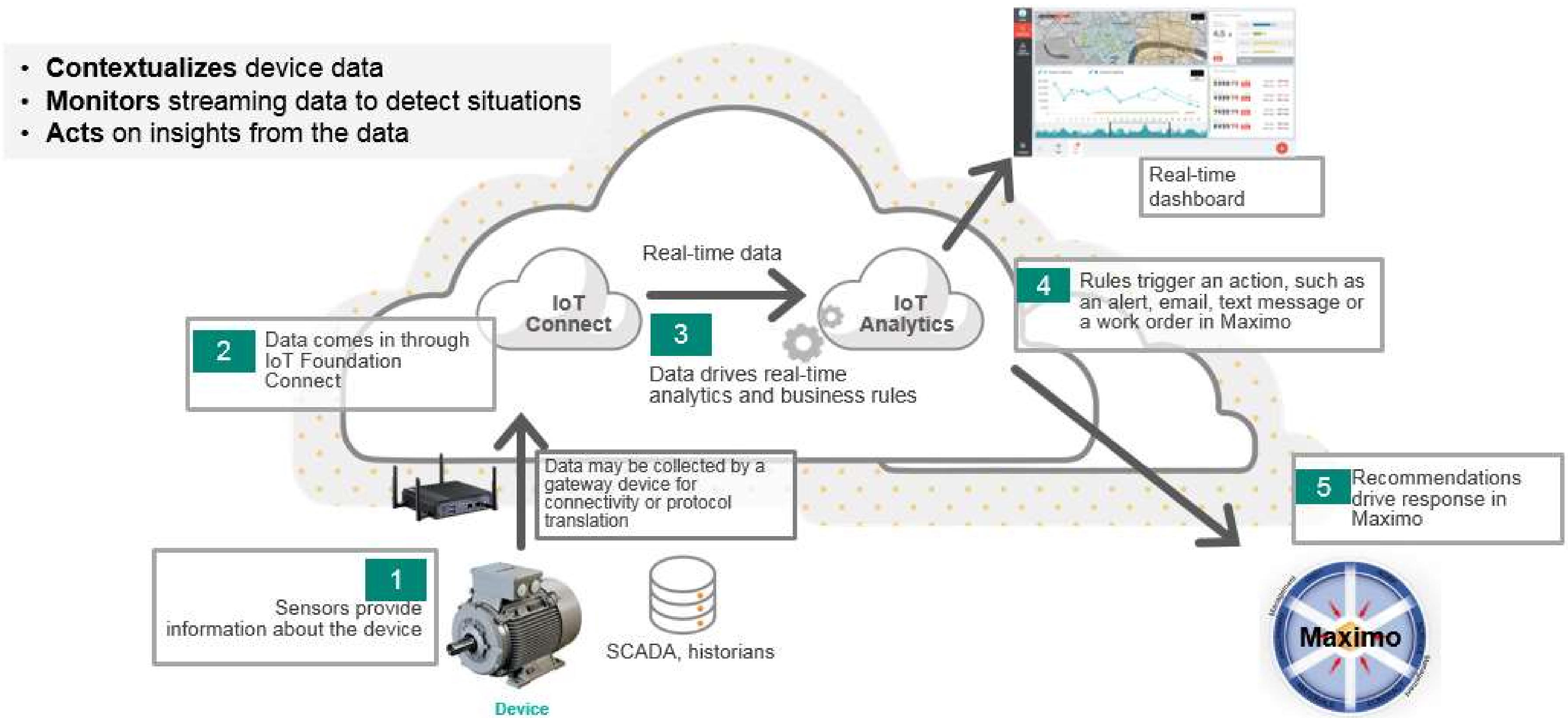
- The AtomStroyExport solution is supported by Intergraph; Dassault Systems; and IBM. The purpose of the integrated solution:
  - Enhance nuclear safety.
  - Minimize commercial risks to the plant owner and operator.
  - Standardization and improvements of plant engineering, design, and operations.
  - Increased efficiency during station commissioning.
  - Reduced total cost of ownership.
  - During operations, increased asset availability and reliability.
  - Early consideration of decommissioning.



MEL – Master Equipment List
WO – Work Order
FCI – Facility Configuration Info
ECM – Enterprise Content Mgmt.

Asset Health Insights – Released July 2016 on Maximo

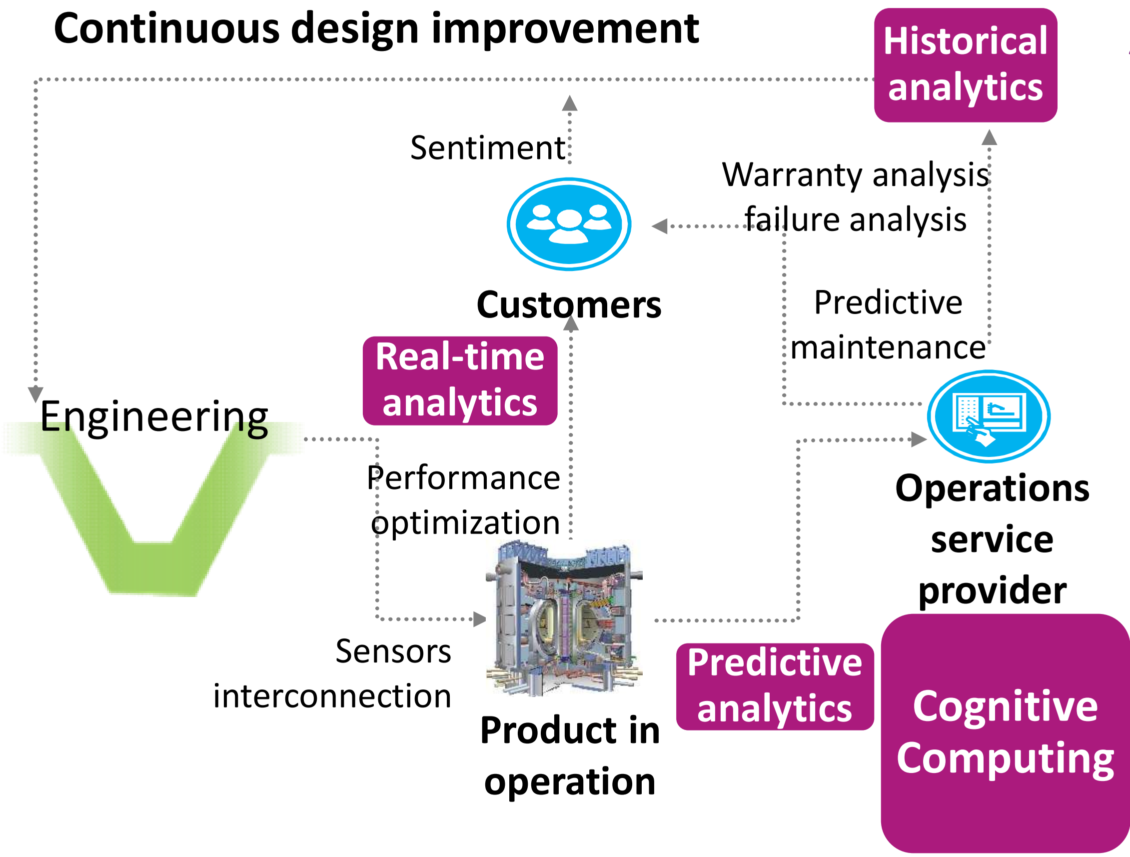
- Machine data from multiple sources is organized and brought into Maximo from standard solutions like Pi or business partner SCHAD.
- Insights Foundation for Energy provides similar capability and is available to non-Maximo customers.



Watson IoT Continuous Engineering

Not only providing world class capabilities to improve engineering but changing the way engineering is done !

Continuous design improvement



An aircraft engine manufacturer uses predictive analytics to prevent costly aircraft-on-ground engine events

100% prediction
of aircraft-on-the-ground events for high-risk engines

97% accuracy
in predicting engine events that lead to airline disruption

USD63 million
in extrapolated cost savings to airlines if prediction had been available in the previous year

Cognitive Image Analysis integrated with Maximo and IoT

Example: Wind Turbine Inspection Proposal

- Train Watson
  - Build Repository of Asset Images
  - Build Positive and Negative Classifiers
- Use in Real Time
  - Feed Real Time Images to identify abnormalities
  - Expert System Decision Support: Watson identifies abnormalities, and estimates prediction accuracy
- Continuous Learning
  - Accuracy increases as Watson “learns” from each new inspection
- Integrated and Analyze with…
  - Maximo (Asset History, Inspection Details, Follow-up Work Orders, PM Feedback, Problem Reports)
  - SCADA and IoT Data Sources (Sensor Data, Weather data)

Prediction Accuracy:

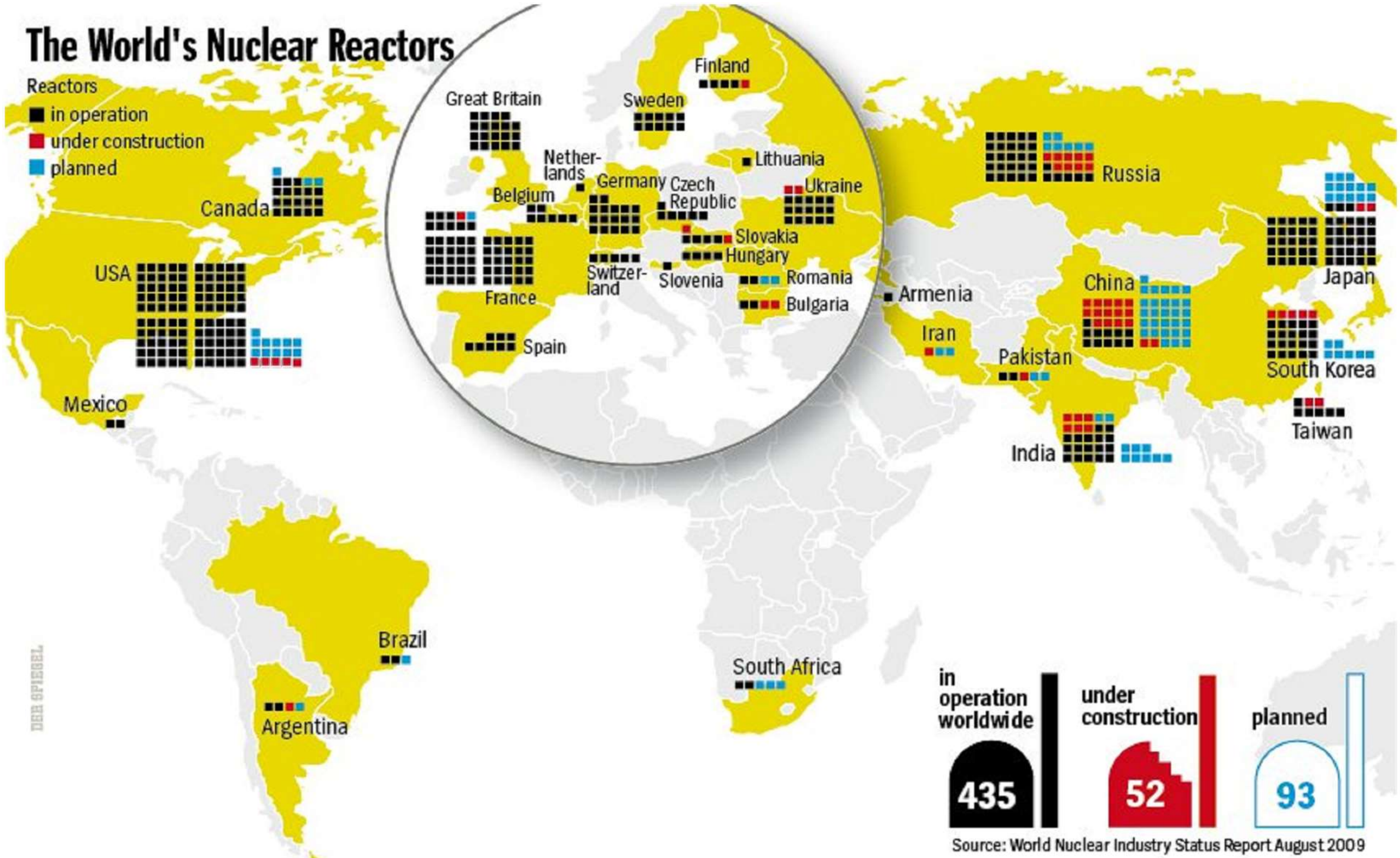
- **0.3**

- **0.6**

- **0.95**

- Proof-of-Concept Evaluation in progress: development partnership with Duke Energy T&D -> Line and Insulator Inspections using Video Drones.

Questions & Discussion



Asset Health Insights: Companion Product for Maximo

- Drilldowns into the data; configurable rules engines; alternate navigation methods.
- Dev Partners: Tampa Bay Water; Cenovus; Amtrak; NASA, Kiwi Rail; CSX; Southern Company.