STRATEGIC CHOICES AND THE NEXT GENERATION OF IIOT USER EXPERIENCE

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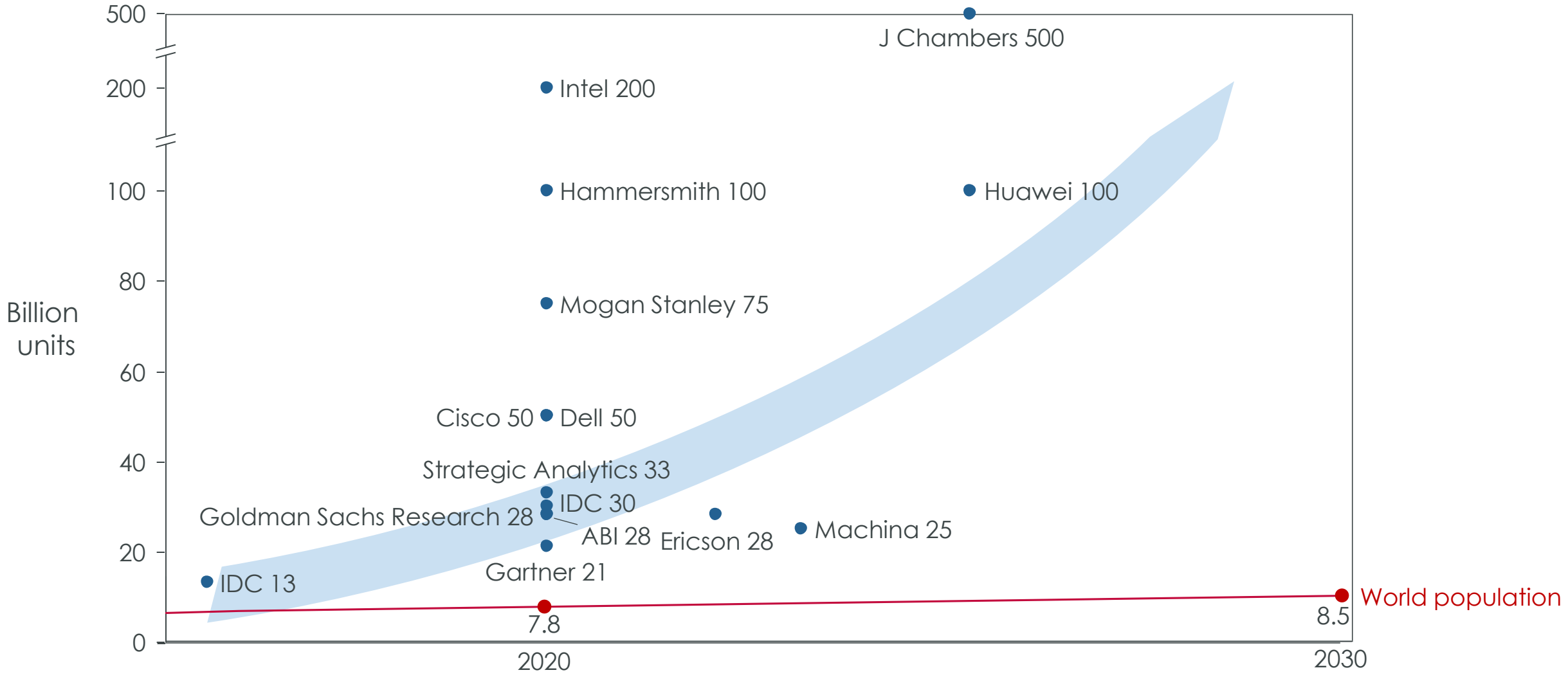
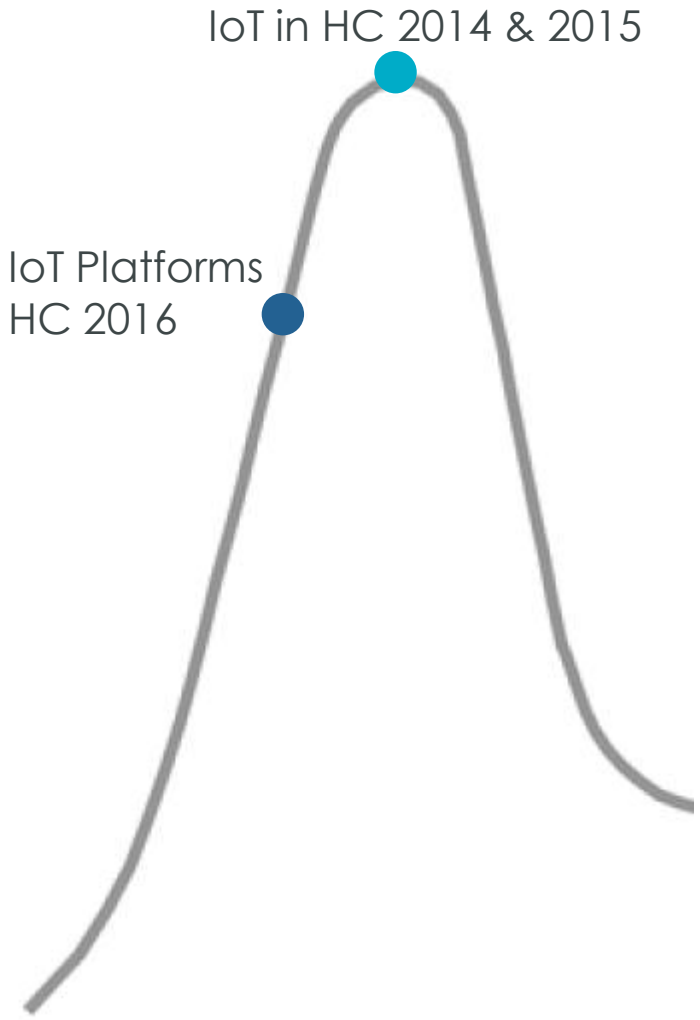
PROJECTED GROWTH IN CONNECTED DEVICES IS STAGGERING



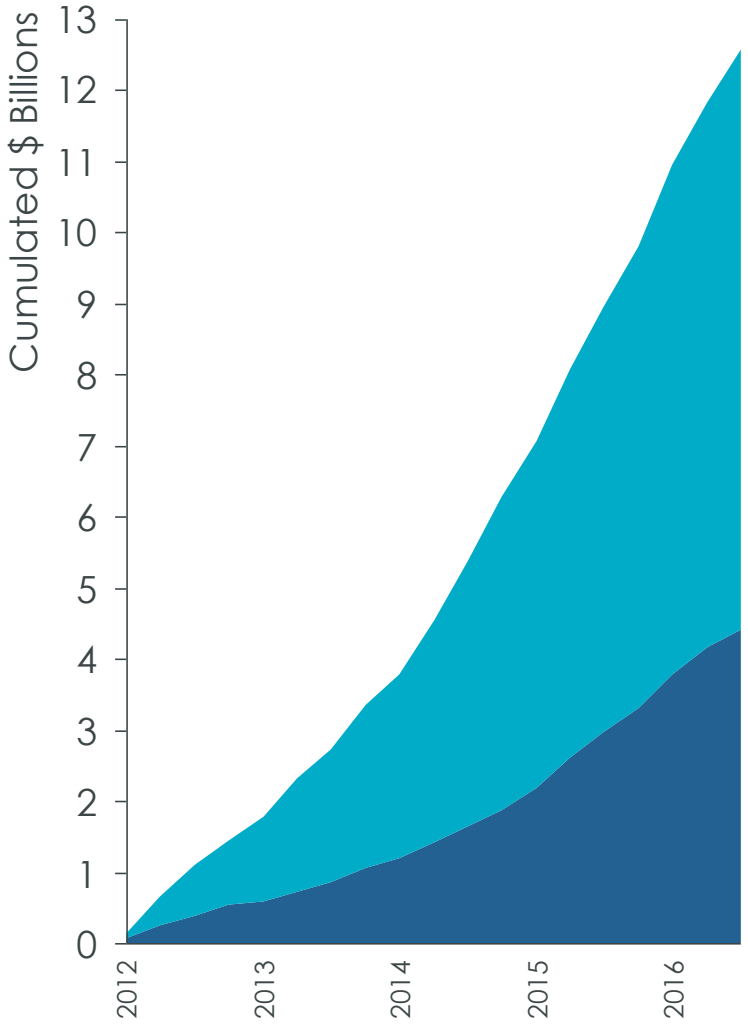
CB Insights, Sigfox, IDC (2015,2016), Gartner (2014, 2015), Morgan Stanley (2013, 2014), Machina Research (2015), Strategy Analytics (2014), Ericsson (2015), Dell (2014, 2015), Intel (2016), Huawei (2015), Cisco (2014), J Chambers (2015, former CEO and Executive Chairman of Cisco), The Hammersmith Group (2010), UNDP Databases 2016

THE IOT WAVE IS GROWING

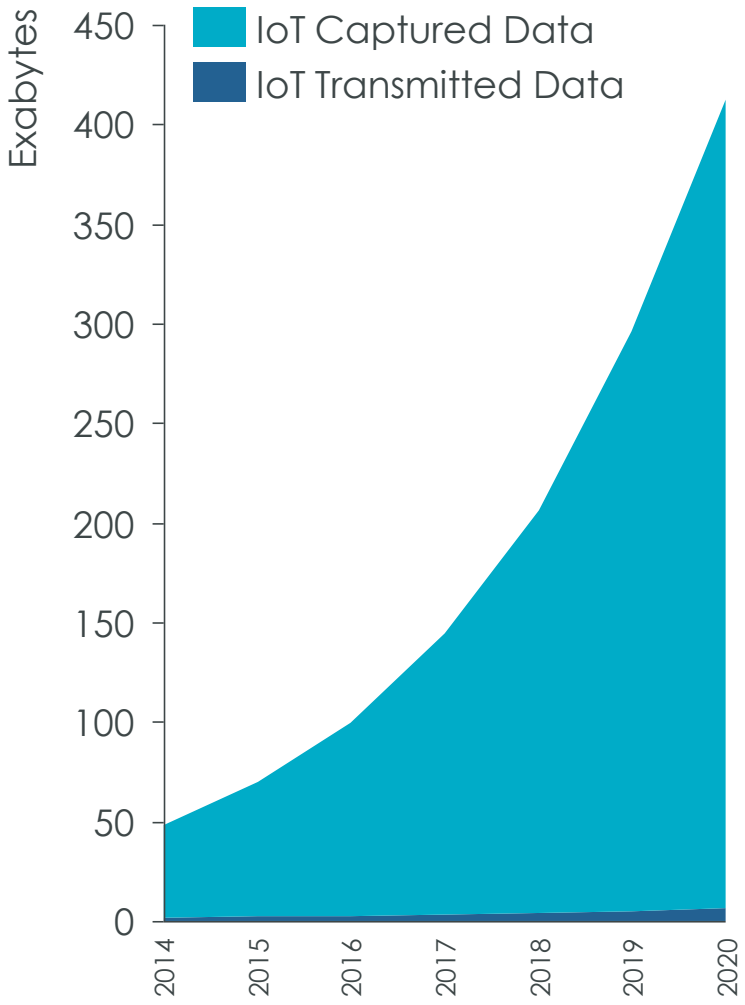
Hype Cycles



IoT Funding



IoT Data

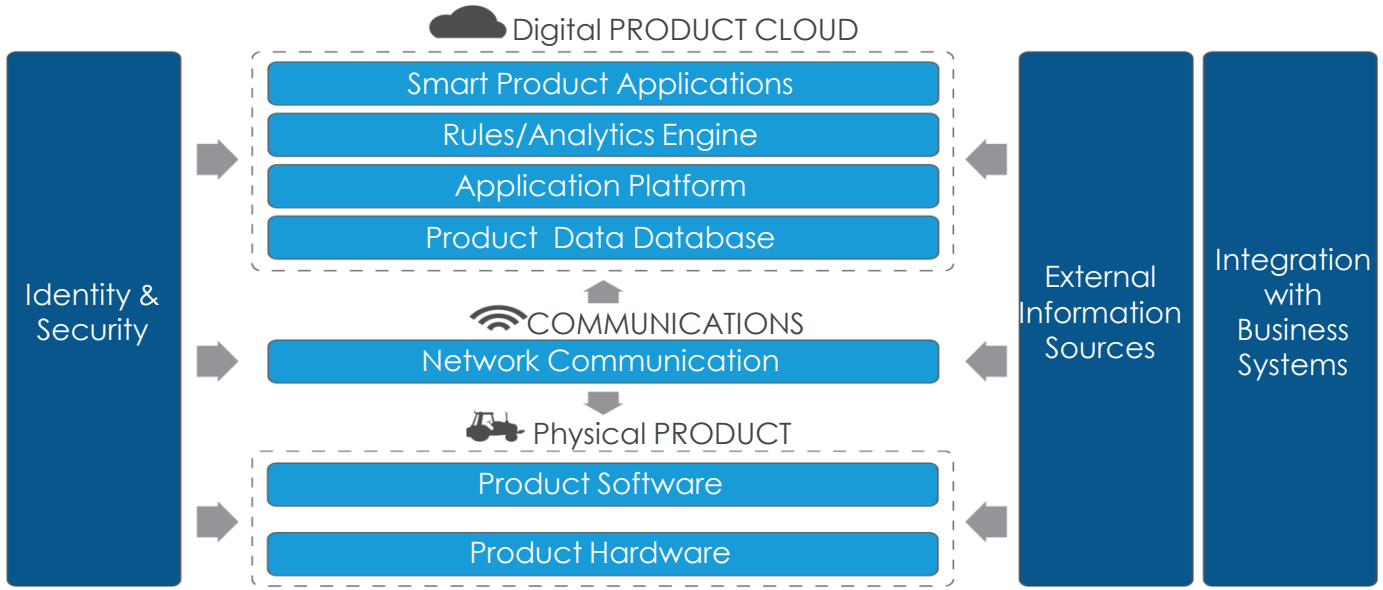


Gartner Hype Cycles 2014, 2015, 2016

CB Insights, Industrial IoT vs. Broad IoT Funding, 2016 Q3

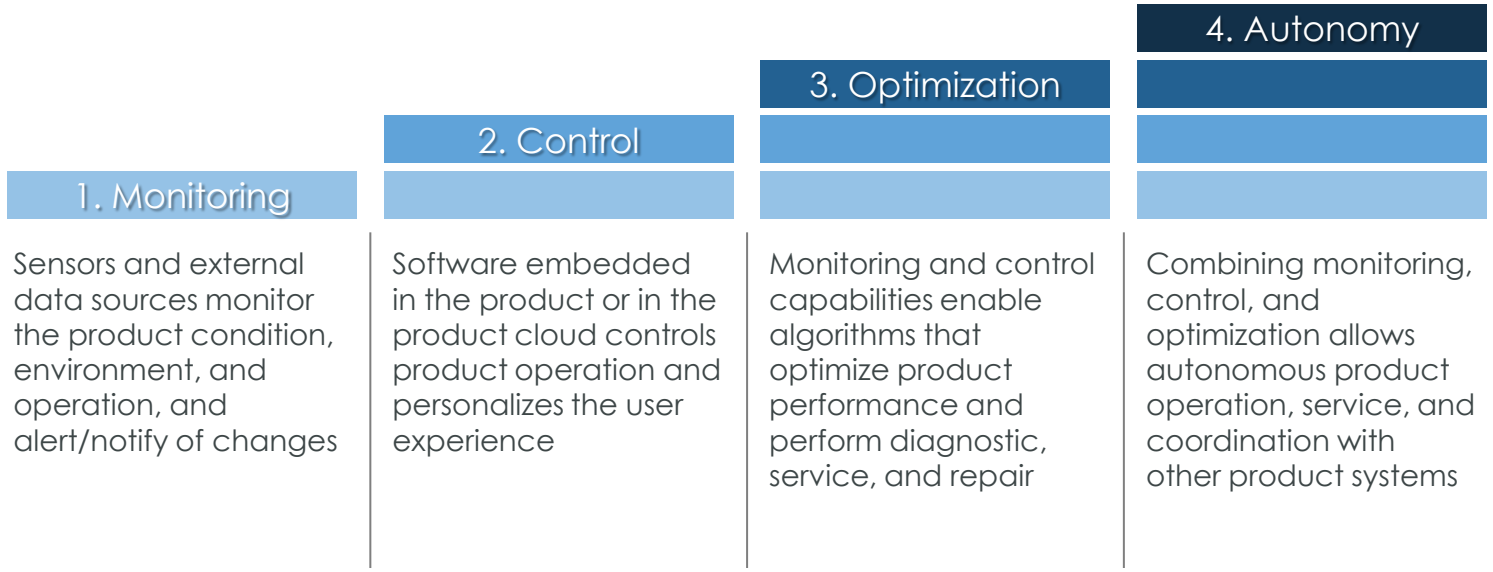
ABI Research, Edge Analytics 2015 AN-1914

IMPOSES A NEW PRODUCT ARCHITECTURE AND TECHNOLOGY STACK



- The definition of a product has changed, they are now physical (mechanical), smart (software), and connected (cloud)
- This requires companies to build and support an entirely new technology infrastructure, the "technology stack"

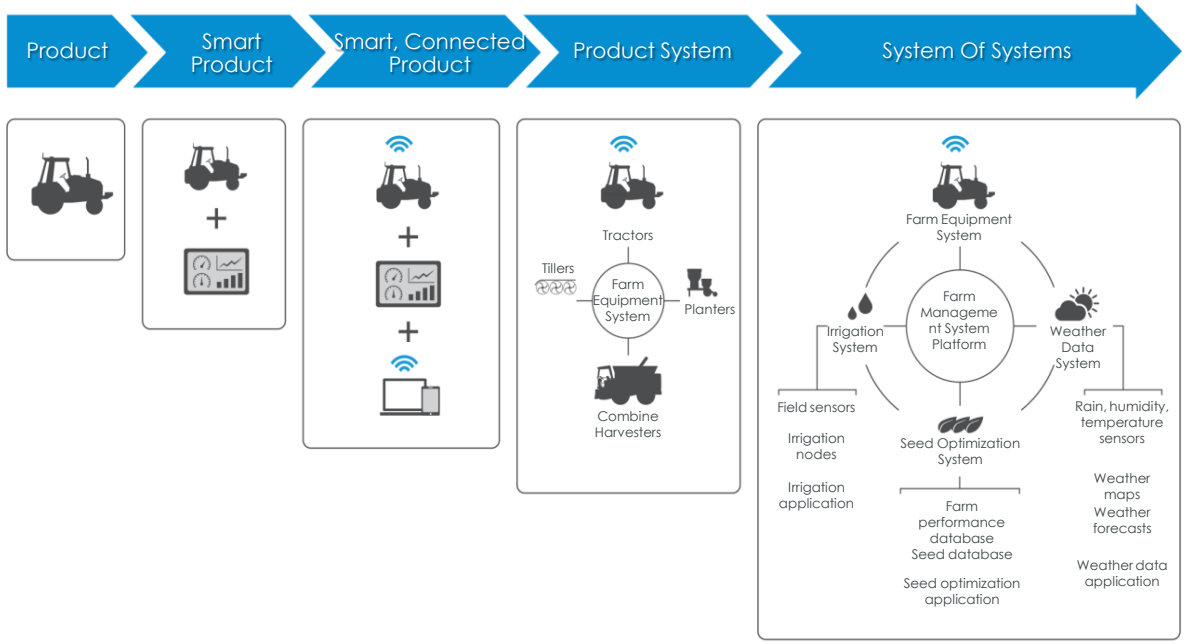
ENABLES BREAKTHROUGHS IN BOTH DIFFERENTIATION AND OPERATIONAL EFFECTIVENESS



- Smart, connected products and the data they generate enable 4 new categories of capabilities, where each category builds on the preceding

- These new capabilities enable companies to create both:
  - Differentiation (e.g. New and unique value-added services)
  - Operational Effectiveness (e.g. Monitor products to improve service efficiency)

REDEFINES INDUSTRY STRUCTURE AND BOUNDARIES



- Analysis using Michael Porter's (Harvard Business School) Five Forces framework defines the substantial impact on industry competition and profitability
- Smart, connected products not only reshape competition within industries but expand industry boundaries (e.g. tractor industry to farm automation)
- The basis of competition thus shifts from the functionality of a discrete product to the performance of the broader product system

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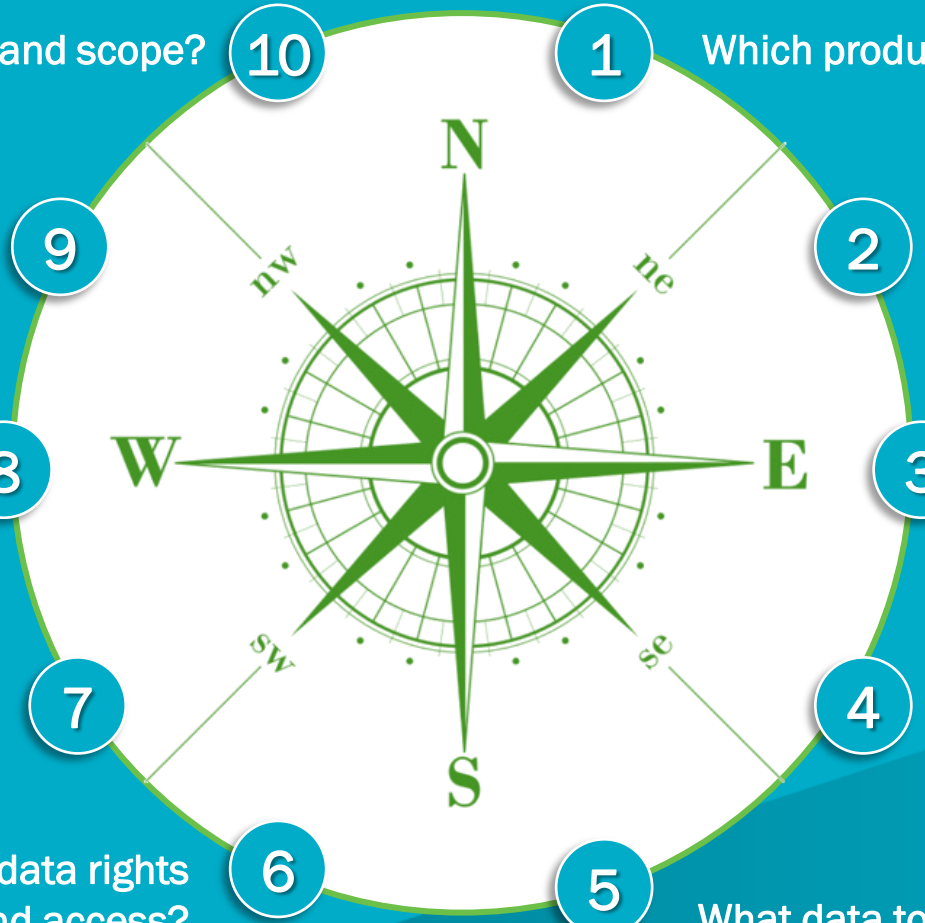
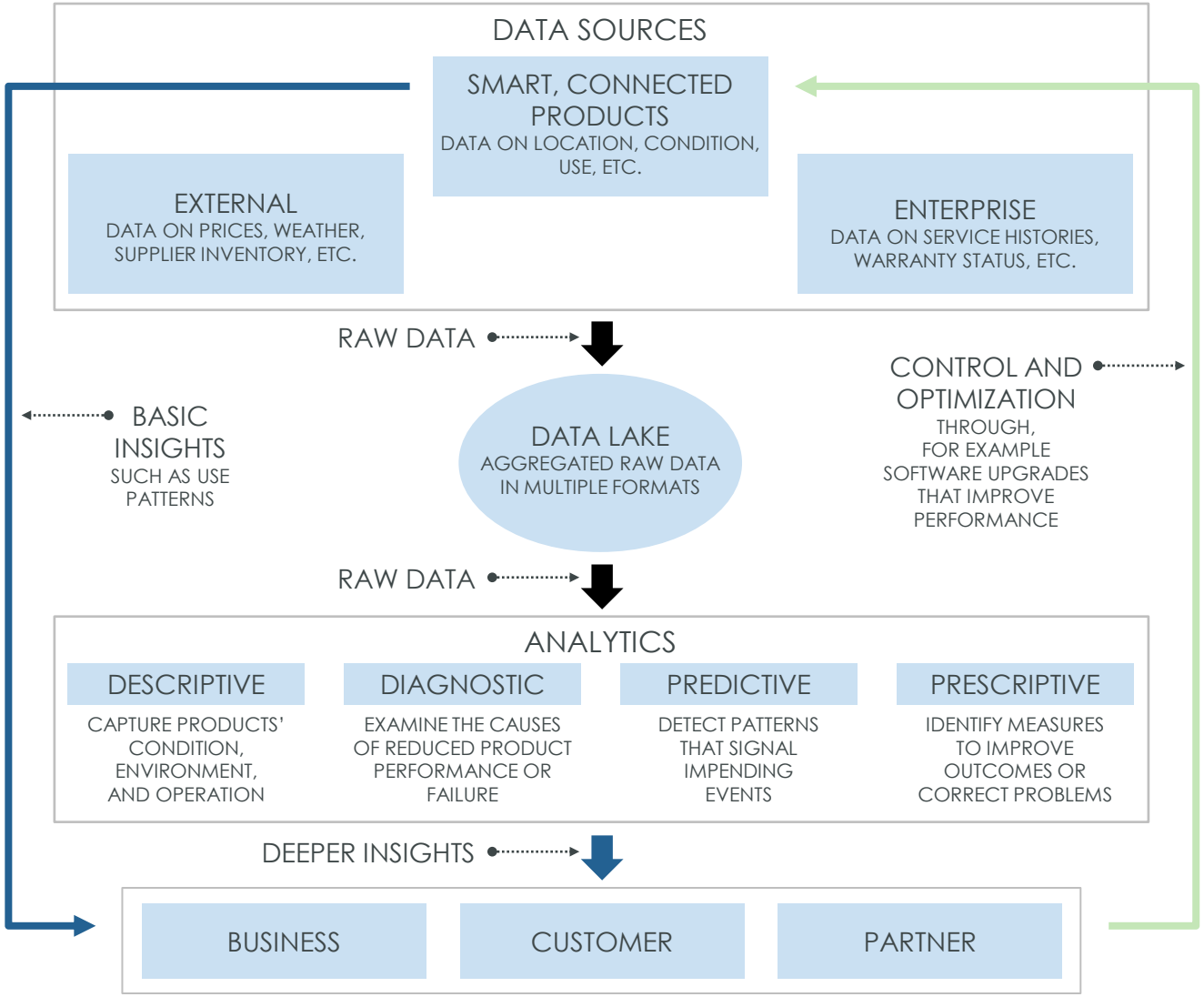


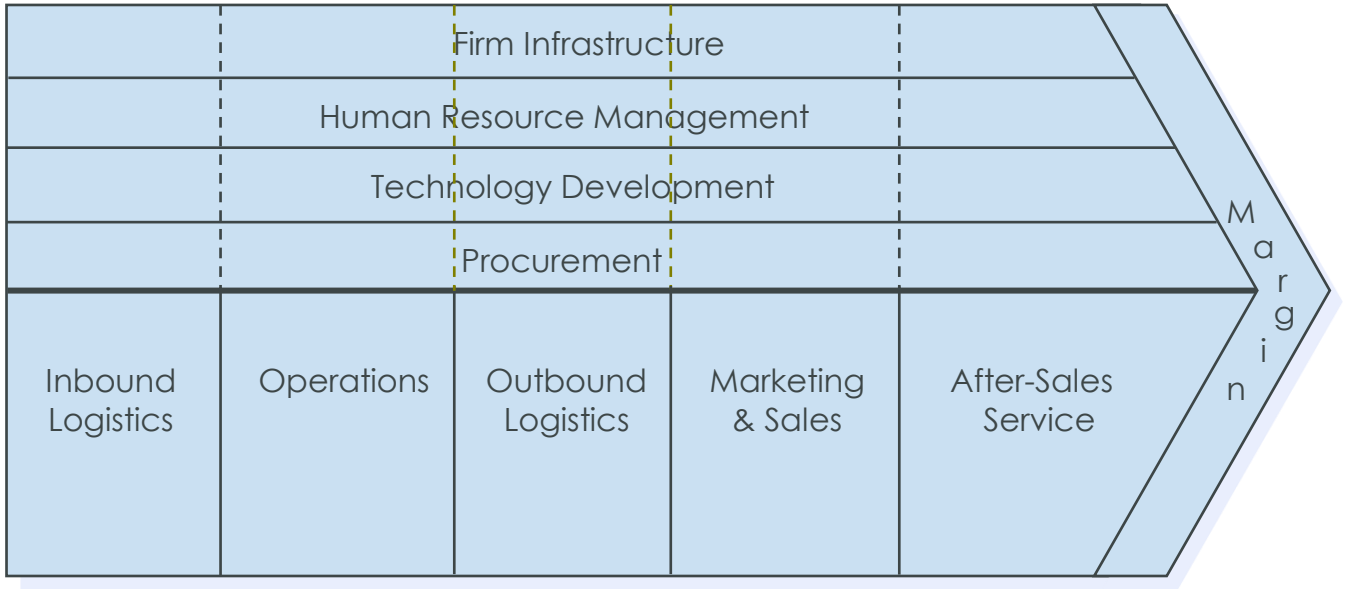
1. Which product capabilities to pursue?
2. Functionality: embedded in the product vs. the cloud?
3. Open or closed system?
4. Technology development: internal or outsource?
5. What data to capture?
6. How to manage data rights and access?
7. Disintermediate distribution or service channels?
8. Change the business model?
9. Sell data to outside parties?
10. Expand scope?

CREATES NEW SOURCES OF DATA AND VALUE UNLOCKED BY ANALYTICS



- Data now stands with people, systems and devices/machines, and capital as a core asset
- Companies unearth powerful insights directly from the product or by identifying patterns with new data analytics tools
- Product data value increases exponentially when integrated with other data
- To better understand the rich new data companies are also beginning to deploy a "digital twin"

TRANSFORMS HOW COMPANIES DESIGN, MANUFACTURE, OPERATE, SELL, SERVICE, AND SECURE PRODUCTS



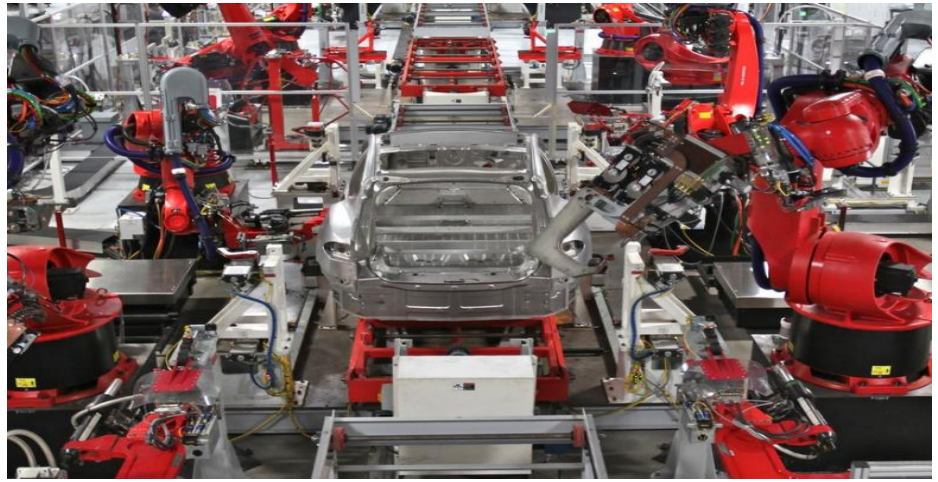
- The new capabilities and data generated by smart, connected products is transforming business functions across the Value Chain. For example:
  - **Product Development:** Design enables evergreen products that can be continually upgraded, often remotely
  - **Manufacturing/Operations:** Industrie 4.0/Smart Manufacturing network machines to automate and optimize production
  - **Service:** Analytics can anticipate problems to enable predictive service, and create revenue streams through new value-added services

TRANSFORMS PRODUCT DEVELOPMENT

New Principles of Product Design

- Design becomes a systems engineering problem with increased IT and R&D collaboration
- Software-driven product variability enables new low-cost options
- Design enables evergreen products that can be continually upgraded, often remotely
- New user interfaces and augmented reality reduce the need for controls on the product itself
- Continuous monitoring of real-world performance data enables ongoing quality management

TRANSFORMS MANUFACTURING/OPERATIONS



New Production Requirements and Opportunities

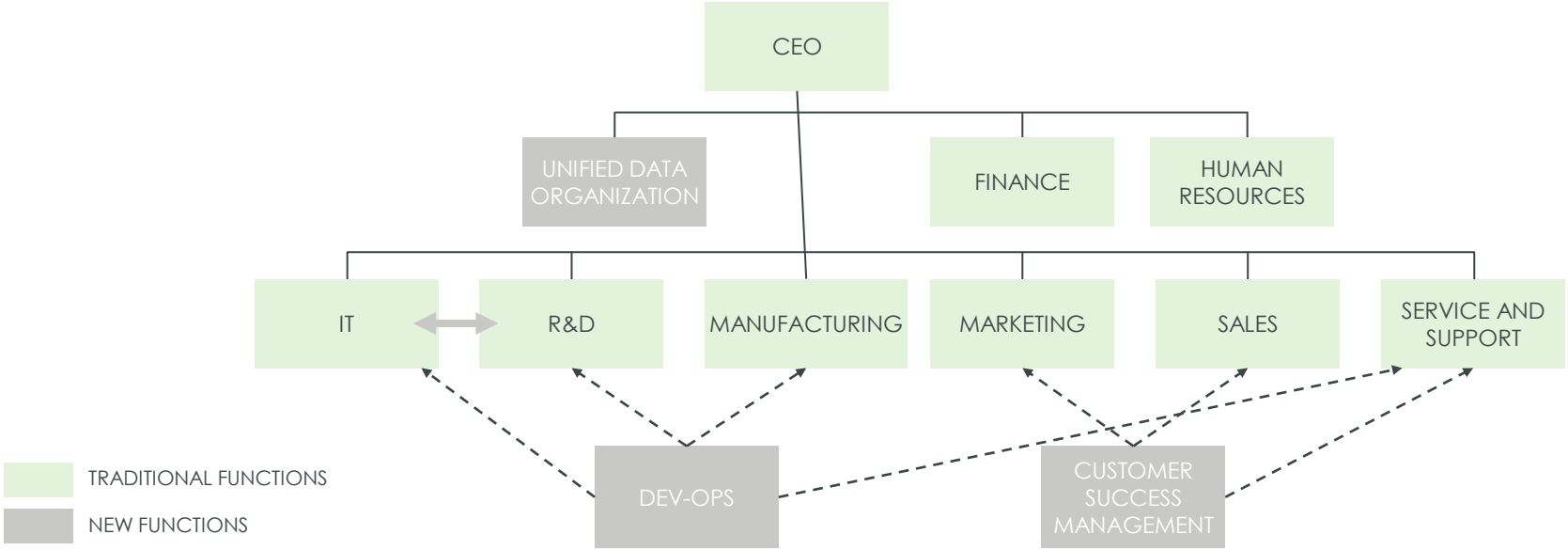
- Manufacturing goes beyond physical production via a cloud-based system for continuous product operations
- Industrie 4.0 and Smart Manufacturing network machines to automate and optimize production
- Shift from mechanical parts to software eliminates and simplifies physical components and production steps
- Reconfigure assembly processes so product design changes and customization can be incorporated later, even after delivery

TRANSFORMS AFTER-SALES SERVICE

New Service Delivery Approaches

- Technicians can diagnose problems remotely to enable one-stop service, and predictive analytics can anticipate problems
- Shift from reactive to proactive and remote service and potential to optimize or disrupt service channels and providers
- Augmented-reality-supported service increase service efficiency and effectiveness
- Service expands to new value added services via the new data, connectivity, and analytics available

REQUIRES A NEW ORGANIZATONIAL STRUCTURE



- Organizational structures are in rapid flux, but a number of important shifts are becoming evident
  - **IT & R&D Collaboration:** Reflecting the new need for IT in product development
  - **Unified Data Organization:** Enterprise-wide data management and analytics
  - **Dev-Ops:** Ongoing product updates and efforts to shorten product-release cycles
  - **Customer Success Management:** Ensures customers gain ongoing value to reduce churn

REQUIRES TRANSITIONAL MODELS

Model	Example	Description	Benefit	Risk
Cross-Business Unit Steering Committee	VENTANA	A cross-functional committee of thought leaders across the various business units, who champion opportunities, share expertise, and facilitate collaboration	• Distributes input and learning across the organization	• Shared resources and lack formal decision-making authority, which can limit ability to drive change.
Center of Excellence	GE	A separate corporate unit houses key expertise on smart, connected products. It is a center that business units can tap.	• Centralizes skills and resources	• Can deter, rather than enable, initiatives in the individual business units
Standalone Business Unit	BOSCH	A separate new unit, with profit-and-loss responsibility, is put in charge of supporting the company's smart, connected products strategy and bringing such new offerings to market.	• Centralizes skills and resources • Able to innovate without the organizational baggage	• Knowledge acquired may disseminate more slowly across the firm • Focus may be on external opportunities

THE LARGER OPPORTUNITY AND NEXT STEPS

- Smart, connected products dramatically increase opportunities for value creation and higher productivity throughout the economy
  - Create a whole new generation of lean, driving out waste
  - Transform competition in many service industries, not just in manufacturing
- This wave of innovation alters the nature of work, creating new roles and training tools and reducing others
- The impact of smart, connected products is still in the early innings
- Organize a cross-functional executive workshop to align on these concepts and identify and prioritize use cases

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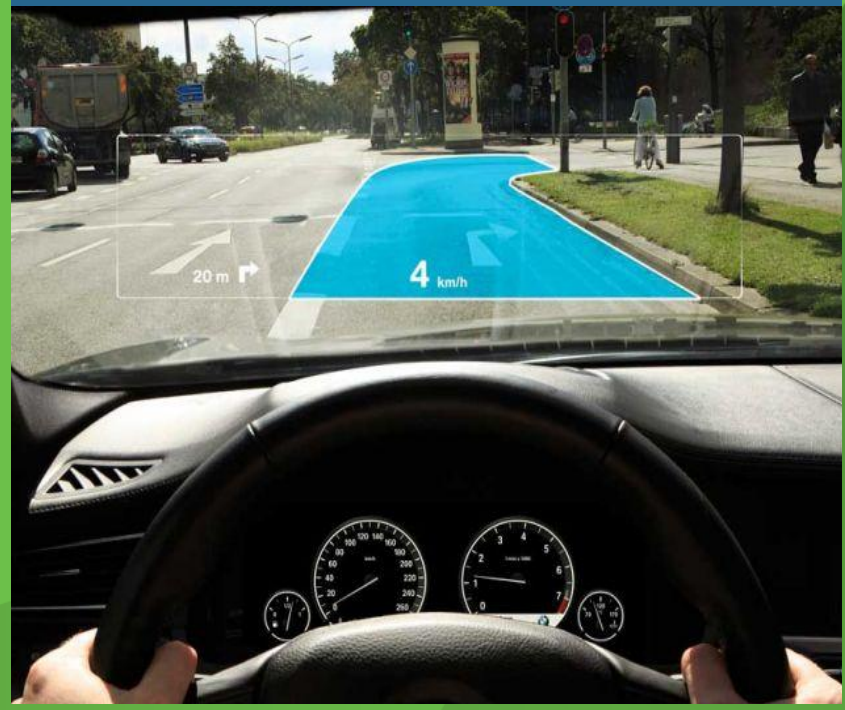
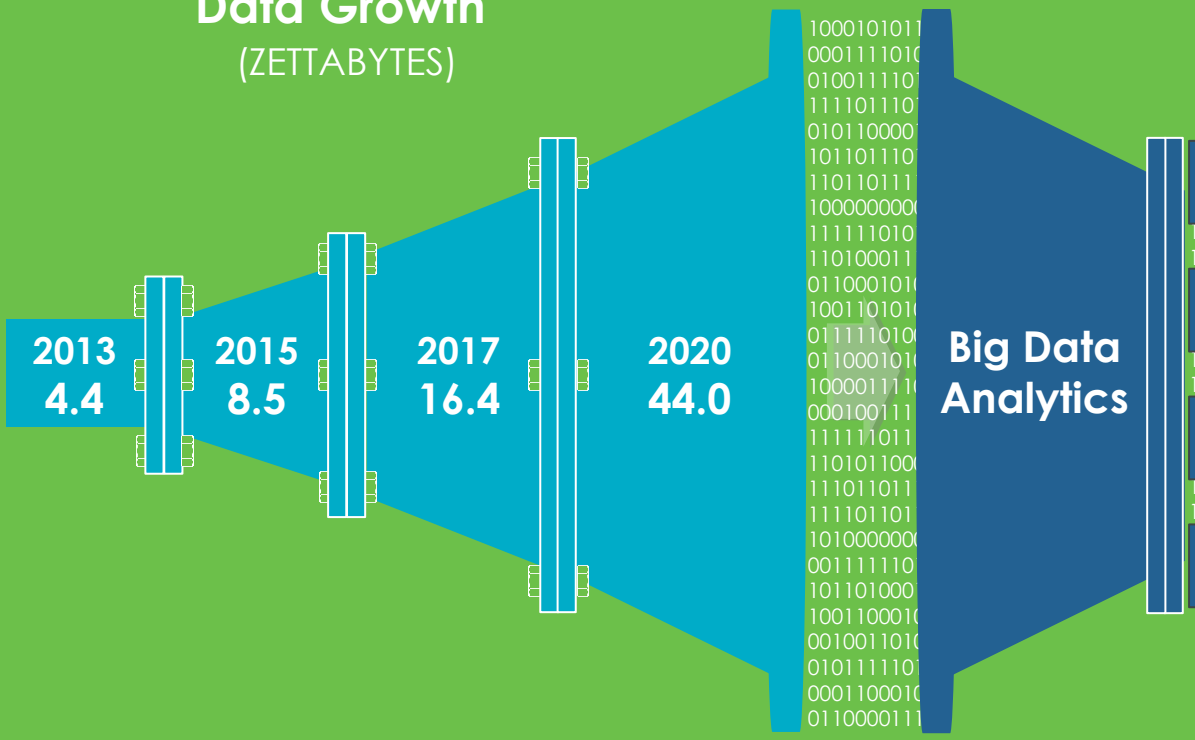
Physical Experience

Digital Experience

Converged Experience



Data Growth
(ZETTABYTES)



Types of Analytics

"What Happened?"	Descriptive Analytics
"Why Did It Happen?"	Diagnostic Analytics
"What Will Happen Next?"	Predictive Analytics
"How to Improve Results?"	Prescriptive Analytics

HUMAN INTERACTION WITH OUR PHYSCIAL ENVIRONMENT

What are coming changes that will impact HOW WE EXPERIENCE AND INTERACT WITH OUR PHYSCIAL ENVIRONMENT

- This new era of IT encompasses the Internet of Things (IoT), cognitive computing, augmented and virtual reality (VR)
- Over time, we will move from Dashboards to real time insights
- Use human ability to do cognitive recognition in real time
  - humans can comprehend visual images faster than the written world.
  - A PICTURE IS WORTH A THOUSAND WORDS

NEW WAYS TO INTERACT WITH SYSTEMS AND EXPERTS

- Transcend space and time:
  - Look at video from another location while overlaying actual current readings over the video
  - Look at a time in the past when there was an alert or downtime event, and watch the data playback leading up to the event, while watching video at the time of the event

- Deliver the right data to the right person at the right time, in a easy to consume format
  - Think of a machine service expert looking at the same visual, with actual data readings, that the on-site technician is looking at

WHAT'S YOUR IMMEDIATE IMPRESSION OF THIS PICTURE?

OR THIS?

PSYCHOLOGISTS DISCUSS 2 MODES OF THINKING ABOUT VISUAL CONTENT

- System 1 and System 2:
  - System 1 operates automatically and quickly, with little or no effort
  - System 2 allocates attention o the effortful mental activities that demand it – more associated with choice or concentration, for example
- System 1 identified objects, but also uses experience – and memory to add immediate context
  - this is not just simple object recognition
  - Generate and identify complex patterns
  - System 1 then mobilizes System 2
- System 2 takes over when things get more difficult
- System 2 can construct an orderly series of steps to react

Source: Kahneman, Daniel. Thinking, Fast and Slow (p. 71). Farrar, Straus and Giroux. Kindle Edition.

- Maintaining a high level of effort using System 2 to monitor the state of a lot of machines, for example, can also be tiring, resulting in being less effective
- But what if we make it easier, and make System 2 more effective, by enabling System 1 with better weapons?

DIGITAL TWIN EXAMPLE

- GE Transportation >20,000 Diesel Locomotives worldwide. All diesel engines are serviced in Grove City, PA
- 1,000 engines & 12,000 components per year are serviced at this single facility
- https://www.youtube.com/watch?v=UEyv5CVF0g0

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