
IHS Markit™
How IoT is transforming the industrial ecosystem
Market drivers, the changing industrial landscape and strategic considerations
Start

IIoT: Industrial as an IoT application

The Internet of Things (IoT) will affect broad portions of the manufacturing process in large and significant ways.

- Industrial Ethernet has been around since early 2000, but products like field devices remain unconnected or provide only one-way communication.
- Industrial Internet of Things (IIoT) features two-way communication: Data is fed up to controller level (and to the Cloud in the future), but feedback is also provided to devices.

A host of considerations

When—and how—to introduce IIoT into manufacturing environments is not a one-size-fits-all endeavor.

→ Where are we now?

Discover industry challenges driving demand to implement IIoT solutions

→ Ecosystem review

Explore factors contributing to the changing industrial ecosystem

→ Future & expansion

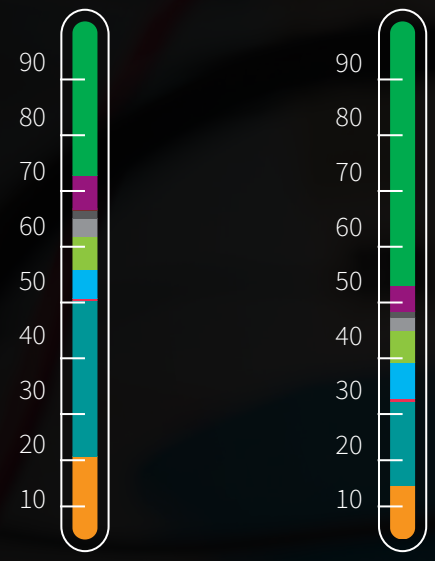
Examine device- and connectivity-level opportunities for introducing IIoT

→ Strategic considerations

Review relevant factors while navigating the changing landscape

Technology development

Sensors are widely used in the manufacturing environment. But while their use will become more widespread, the ability to connect and transmit more data faster and with improved integrity will be the true enabler of IIoT.



2016: 99M IIoT
devices shipped

2021: 252M IIoT
devices shipped

- Discrete control and visualization
- Encoders
- Industrial robots
- Mobile assets
- Motor controls
- Motors, generators and turbines
- Process control and instrumentation
- Pumps and compressors
- Sensors
- Switchgear

Improved data transmission

Connectivity protocols and frameworks enable customers to collect and transfer more data quickly and accurately, from sensors up to the Cloud, for data aggregation and analytics.

Examples include IO Link, quickly being introduced by sensor suppliers; and OPC UA, supporting greater interoperability and more secure information transmission to the Cloud.

Convergence of platforms

New IoT platforms have been introduced by players from both operation technology (OT) and information technology (IT) markets.

Platforms are key differentiators supporting data consolidation and communication across multiple machines, facilities and companies, creating connected organizations and supply chains.

IIoT demand drivers

Below are the key drivers for making IIoT a reality.

Connectivity, technology & innovation

Industrial sectors such as energy are **generating massive amounts of data**. Technology for data capture and analysis opens up new opportunity for optimization and monetization.

Standardization & security

The industry needs **common standards** to allow smart connected products, machines and equipment from different manufacturers to interact seamlessly. With industrial use of the Cloud, **security** remains the biggest concern.

Business models

The industry is struggling with challenges, including **loss of engineering expertise** because of a retiring workforce. **New business models** arise as a result for machine builders, supporting customers with IIoT-related services (e.g., remote monitoring and servicing).

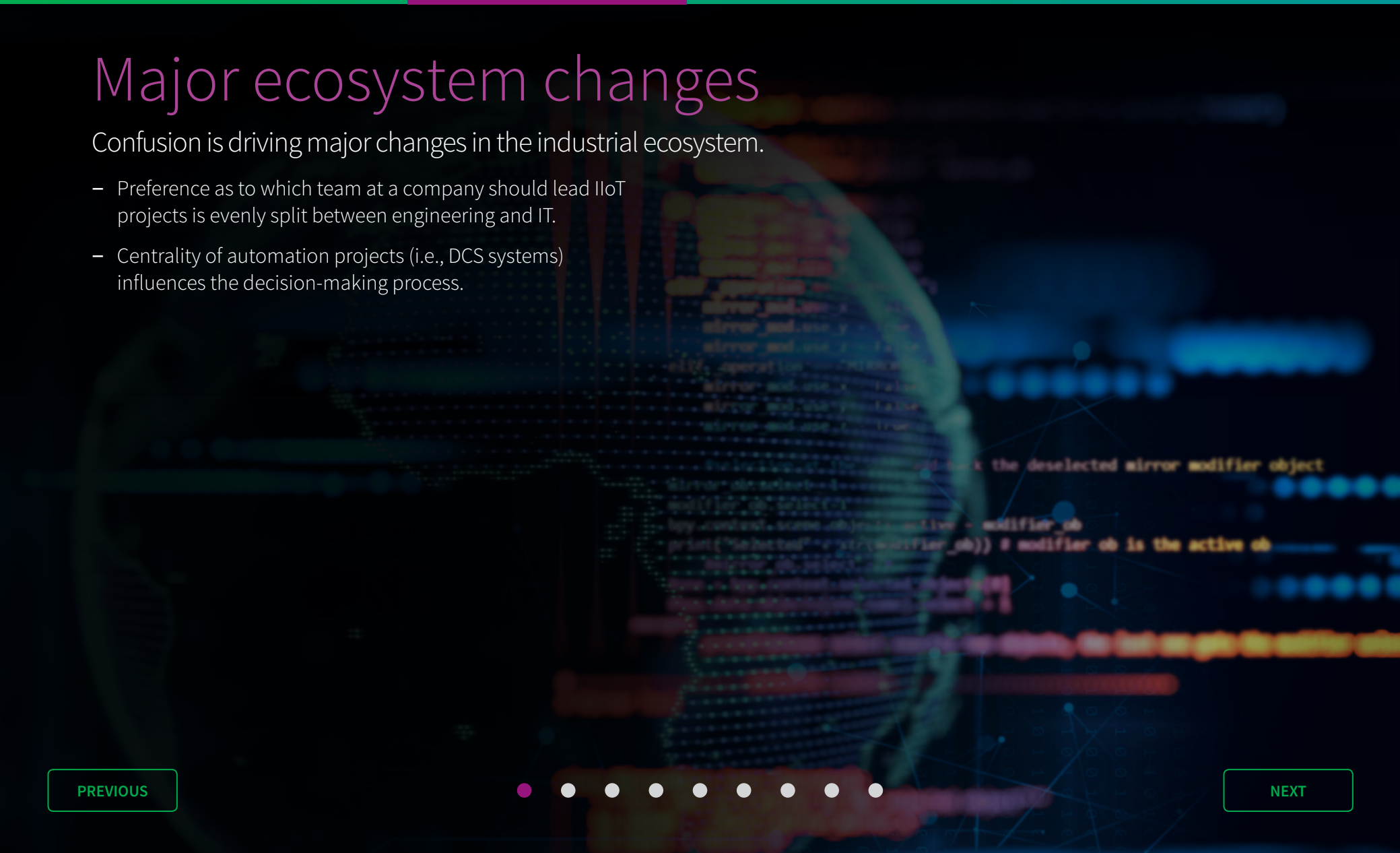
Innovation & competitiveness

IIoT adoption can accelerate factory productivity rates, via reduced unplanned downtime and easier product customization, increasing the level of competition.

Major ecosystem changes

Confusion is driving major changes in the industrial ecosystem.

- Preference as to which team at a company should lead IIoT projects is evenly split between engineering and IT.
- Centrality of automation projects (i.e., DCS systems) influences the decision-making process.



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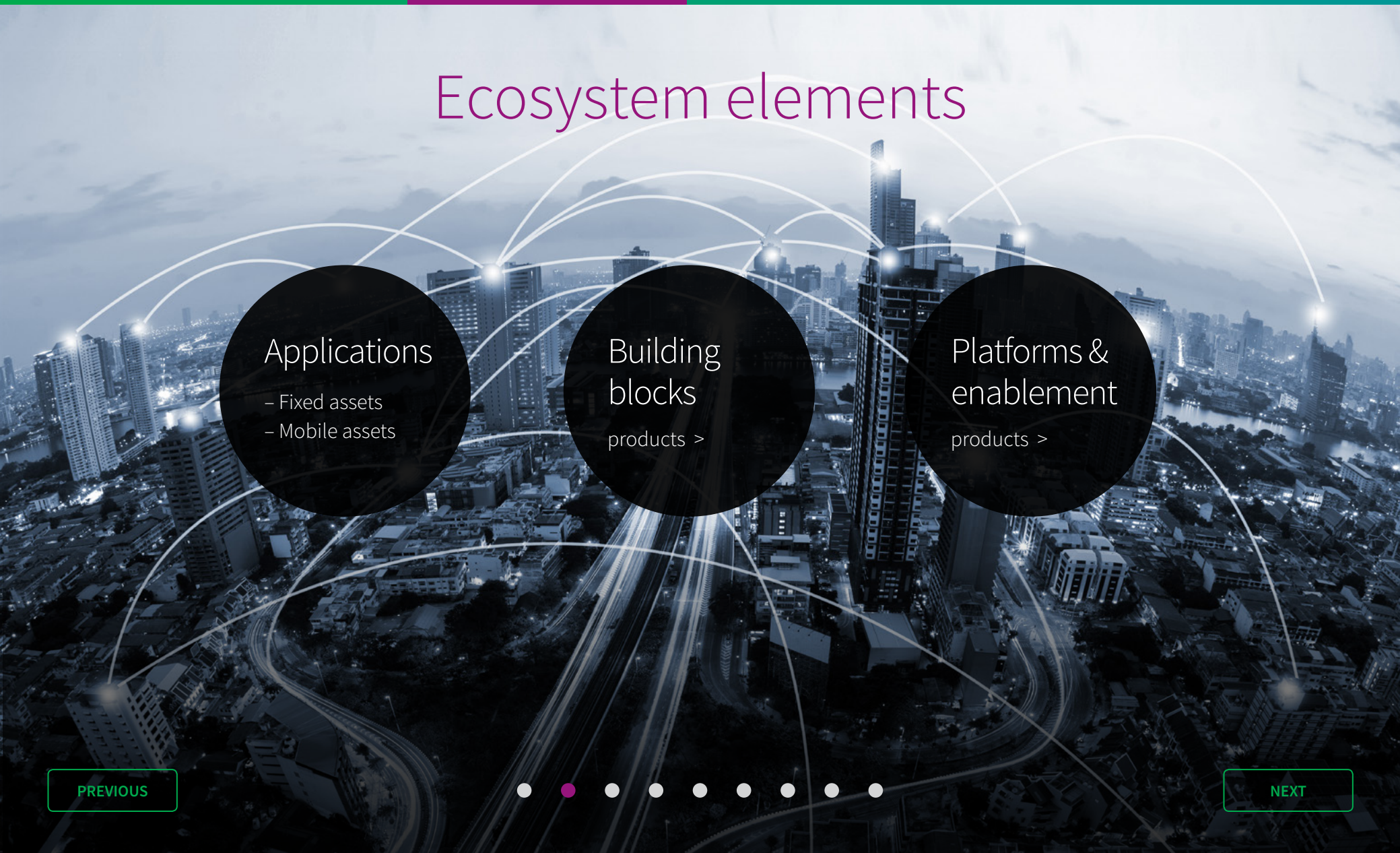
Ecosystem elements



Applications

Fixed assets

Motors, generators & turbines

- ABB
- Alstom
- Danfoss
- DEC
- Emerson
- GE
- Mitsubishi Electric
- Rockwell Automation
- Schneider Electric
- Siemens
- Yaskawa

Measurement instrumentation

- ABB
- Azbil
- Cameron
- Emerson
- Endress+Hauser
- Honeywell
- Krohne
- Magnetrol
- Siemens
- Vega
- Yokogawa

Process controllers

- ABB
- Emerson
- Honeywell
- Metso
- Rockwell Automation
- Schneider Electric
- Siemens
- Yokogawa

Discrete controllers

- Advantech
- B&A Electric
- Beckhoff
- Mitsubishi Electric
- Omron
- Pro-face
- Rockwell Automation
- Schneider Electric
- Siemens

Motor controls

- ABB
- Danfoss
- Emerson
- GE
- Mitsubishi Electric
- Rockwell Automation
- Schneider Electric
- Siemens
- WEG
- Yaskawa

Industrial robots

- Fanuc Robotics
- Kawasaki Robotics
- Kuka
- Mitsubishi Electric
- Nachi
- Staubli
- Toshiba Machine
- Yamaha Robotics
- Yaskawa

Measurement instrumentation

- ABB
- Azbil
- Cameron
- Emerson
- Endress+Hauser
- Honeywell
- Krohne
- Magnetrol
- Siemens
- Vega
- Yokogawa

End-equipment

- Gardner Denver
- Atlas Copco
- Grundfos
- Ingersoll Rand
- Sulzer
- Flowserve
- KSB
- Xylem
- Sullair

Mobile assets

Service robots

- ActiveLink
- Adept
- Aethon
- Amazon Robotics
- Carbon Robotics
- Fetch Robotics
- Locus
- Open Bionics
- Savioke
- Siasun
- Softbank
- Titan Medical
- Yaskawa

Heavy vehicles

- Caterpillar
- Daimler
- Ford
- John Deere
- MAN Truck & Bus
- Navistar
- Tata
- Toyota
- Volvo

Virtual/Augmented reality

- APX
- Autodesk
- Daqri
- HTE Vive
- Microsoft HoloLens
- Virtalis
- Vuforia
- Vuzix
- Worldviz

Drones

- 3D Robotics
- AEE
- AeroVironment
- Ascending Technologies
- CybAero
- DJI
- Ehang
- Insitu
- Parrot
- Precision Hawk
- Skycatch
- Yuneec

Beacons

- Bluvision
- Estimote
- Kontakt.io
- Radius Networks
- Sensorberg
- Sensoro

Automated guided vehicles

- Daifuku
- Muratec
- SSI Schaefer
- Dematic
- Terex

Building blocks

Hardware (chips & modules)

- ARM
- Analog Devices
- Infineon
- Intel
- Nexcom
- NXP
- Sierra Wireless
- Texas Instruments

Software (embedded OS)

- DDC-l
- ENEA
- Green Hills Software
- Linux
- Mentor Graphics
- QNX
- Texas Instruments
- Wind River

Connectivity (field networks)

- Bluetooth
- LoWPAN
- Neon
- SigFox
- Wi-Fi
- ZigBee
- Z-Wave

Partners (system integrators)

- Leidos Energy
- Intech
- Wood Group Mustang
- Maverick Technologies
- Prime Controls
- Automated Technology Group
- CG Controls

Sensors and actuators

- Advantech
- Bosch
- Honeywell
- Infineon
- Libelium
- Memsic
- Sensirion
- TE
- Texas Instruments

Cloud hosting

- SAP
- Amazon Web Services
- IBM
- Microsoft
- Oracle
- Salesforce
- ThingWorx

Industrial Ethernet

- CC-Link IE
- EtherCAT
- Ethernet/IP
- Powerlink
- PROFINET
- Sercos

Change management services

- Accenture
- Deloitte
- PWC

Routers & gateways

- Adlink
- Advantech
- Cisco
- Eurotech
- Intel
- Kontron
- Multi-Tech
- Sierra

Development kits/SDKs

- Anaren
- Atmel
- Avnet
- Eurotech
- Marvell
- Texas Instruments
- VMware

Industrial Fieldbus

- ASI-Interface
- ControlNet
- DeviceNet
- FireWire
- Hart
- INTERBUS
- IO Link
- Link
- Profi Bus
- USB

Industrial-specific alliances

- Manufacturing USA
- Made in China 2025
- Asia IoT Alliance
- Industrie 4.0
- Industrial Internet Consortium

Platforms & enablement

Industrial platforms

ABB
Bosch
Cisco Jasper
Emerson
Fujitsu
GE
Hewlett-Packard Enterprise
Hitachi
Honeywell
Hewlett-Packard
Huawei
IBM
Microsoft
Predix
Rockwell Automation
RTI
Schneider Electric
Siemens
ThingWorx

Analytics

Azima
DLI
N3N Visualize
KCF Technologies
Pruftechnik
Senseye

Interface (Virtual/Augmented reality)

APX
Autodesk
Daqri
HTC Vive
Microsoft HoloLens
Virtalis
Vuforia
Vuzix
Worldviz

Cyber security

Software

Belden
Lockheed Martin
Phoenix Contact
Siemens
Symantec
Trend Micro

Hardware

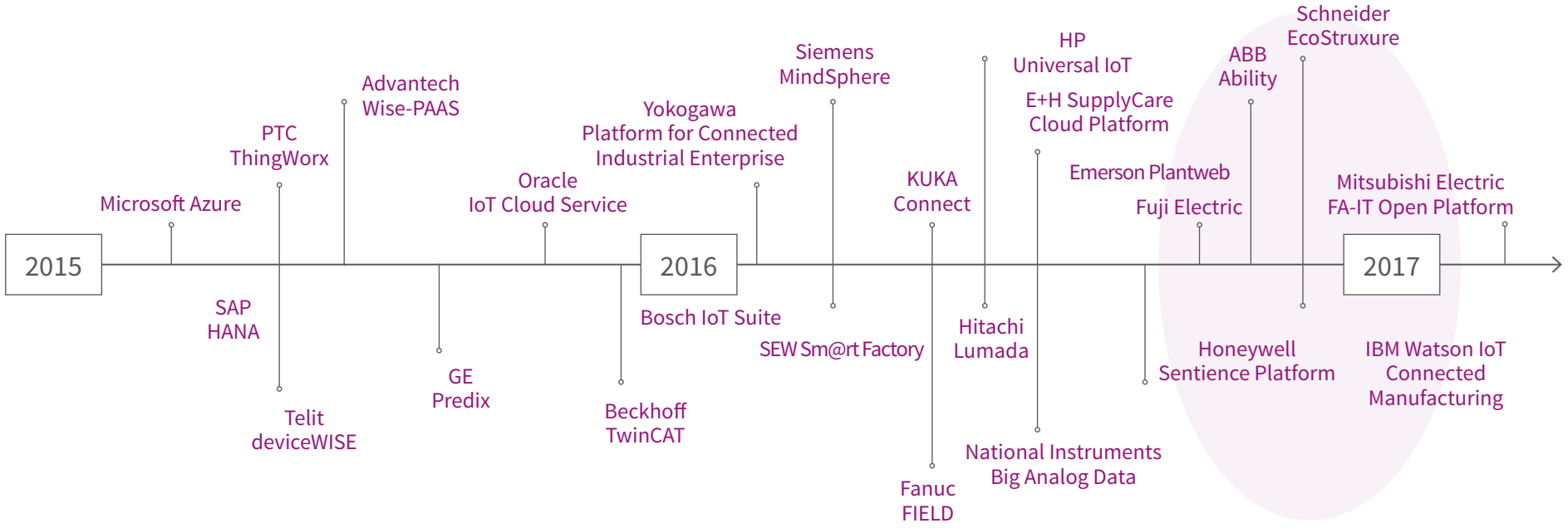
BAE Systems
Belden
Moxa
Phoenix Contact
Radiflow
SEL
Siemens

Services

Accenture
BAE Systems
Deloitte
Lockheed Martin
Siemens
Yokogawa

Rush to IIoT platforms

The growing conversation on IIoT potential is attracting many new players to compete for a share of the market.



Disruptive entrants

New solutions could drive disruption in the industrial market.

IIoT platform

Huawei

Key player in IoT connectivity management platforms with broadening capabilities

Machine learning

SpaceTime

Provides situational intelligence to process industries by analyzing data across assets, operational functions and enterprise resources

IIoT operating systems

Ubuntu

Operating system offers open environment for developers in their language of choice, complete with downloadable snaps for quicker/cheaper path to market

Security

Fortinet

Solves IIoT security challenges for “headless” OT devices as well as traditional IT assets

Virtual reality

ESI Group

Industrial-grade immersive VR solution facilitates decision-making process of global interdisciplinary teams

Augmented reality

ThingWorx

Enables augmented reality experiences for field support services as well as engineering and design

Partnerships, mergers & acquisitions

The complex IIoT supply chain necessitates an ecosystem of partnerships.

Partnerships are necessary between:
a) IT companies supporting cloud platforms and analytics; and
b) OT companies providing deep-domain knowledge and hardware utilized by manufacturers.

Besides forming partnerships, firms are also actively acquiring software vendors, introducing new elements or augmenting existing parts to their own smart manufacturing portfolio. Such firms include GE Digital, Honeywell and Siemens, in digitalization as well as in technologies supporting cloud platforms and data analytics.

Challenges in IIoT adoption

Industry change is required for full IIoT adoption to take place.

Despite IIoT's growing sophistication in processing power, software and platforms, the broader understanding and acceptance of IIoT within the industrial culture remains elusive. The goal: to move manufacturers toward wider implementation.

For traditional players, fears of placing data in the Cloud must be addressed, given the rampant and pervasive cyber security threats of today.

The road ahead to IIoT

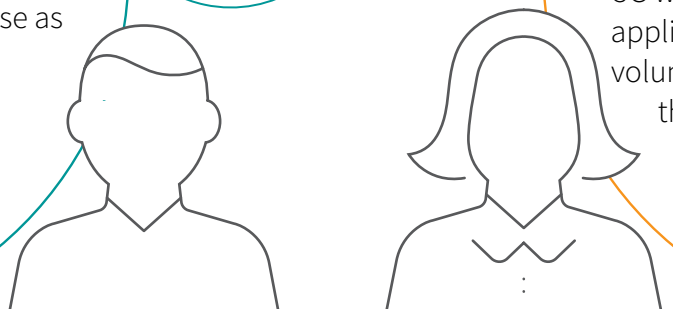
IIoT is a story in the making, and many uncertainties remain.

Many manufacturing companies remain hesitant to place confidential data on a remote Cloud.

IoT platforms are evolving by offering Edge or Fog analytics, where data is collected and processed at the edge of the network, allowing companies to retain data in-house as an alternative or in addition to a cloud-based solution.

Cloud/Edge analytics used for manufacturing operations is set to double by 2020.

Where is the Cloud going?



Is 5G an opportunity for Industrial?

5G's ability to provide high reliability, ultra-low latency connectivity, strong security and availability should create and drive significant new market opportunity for mission-critical applications as well.

5G will enable IoT support in more pervasive applications and uses cases, at much greater volumes, and eventually at lower cost points than traditional cellular technologies.

What lies ahead?

IoT expansion will continue with new technologies and growth in the IoT base.

By 2030, the installed base of IoT devices including newer technologies like LoRa, Sigfox, NB-IoT and 5G will exceed 120 billion.

- Analytics provided through platforms are key to taking full advantage of massive data transmission, set to double in volume to 50% on average yearly for the next 15 years.
- Ethernet is continuing to influence fixed assets and will grow to reach more than 100 million in shipments by 2021.
- Automation products supporting connectivity to the Cloud will expand at more than 60% CAGR during the next five years.

Finding a place in the new landscape

For key market players, navigating the changing industrial landscape can prove challenging. Companies can consider the following to find their place:

- Variation in IIoT adoption, depending on vertical sector
- Importance of partnerships
- Company fit in platform strategy

IIoT adoption varies

The roadmap to IIoT adoption is as complex and diverse as its users.

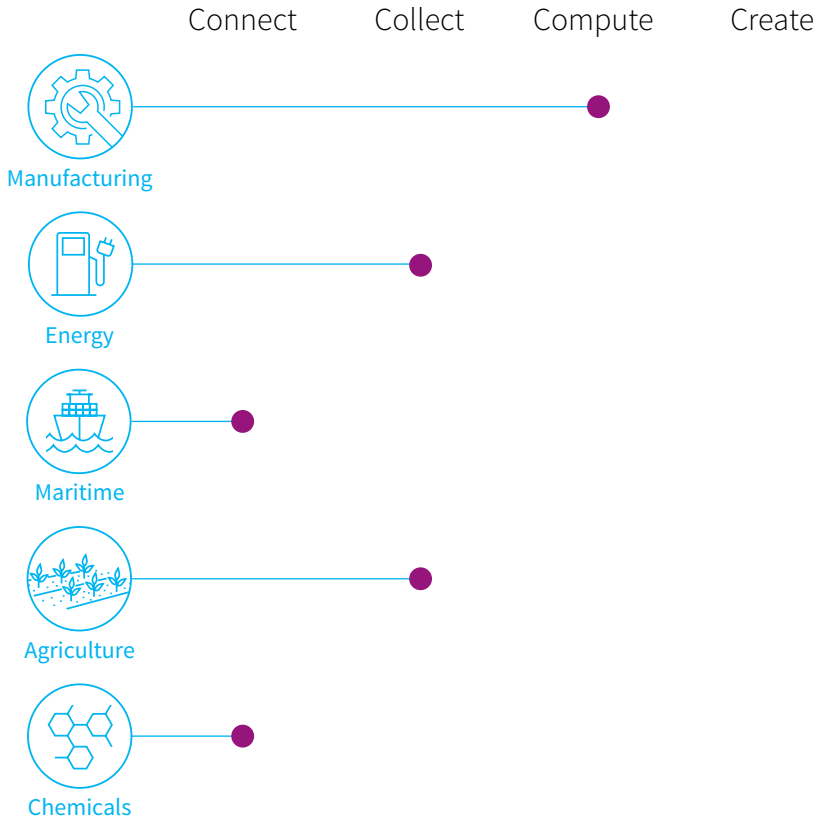
Adoption of the IIoT will vary. It will depend on the openness of each vertical in embracing IIoT technologies; and on individual industry knowledge, conservatism, access to capital and integration challenges.

Analysis is complex in IIoT because industrial coverage is broad and intersects with multiple vertical markets, resulting in incredibly diverse sets of end-customers, compared to verticals in the IoT universe.

Ramifications of adoption in IIoT are much greater than in consumer-centric IoT applications. IIoT factors of production are much larger while also covering critical spheres of human activity, where **failure of systems** is not an option.

The roadmap to IIoT adoption will be dictated by a manufacturer's own needs and customers. A direct relationship and impact can be measured by a manufacturer's adoption of—or failure to adopt—IIoT.

Position of each vertical relative to its IIoT evolution phase



Partnering with the competition: cooperation vs. coopetition

Competitors can also be partners in a new paradigm.

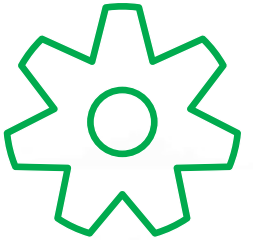
A more complex marketplace necessitates acknowledgement and appreciation of new competition through partnerships, or a cooperation vs. coopetition strategy. Coopetition is the cooperation that occurs between competing companies—a business strategy using insights from game theory on when it is better for rival companies to work together.

- Partnerships are crucial, as automation vendors lack experience in cloud services, while cloud service providers lack relationships or knowledge of the industrial sector.
- "New business models and revenue streams are becoming online through the convergence of IT and OT solutions, and broad expertise necessary to the development of ecosystems to support these services will be critical. Expect to see ongoing activity in 2018 as vendors look to augment and fortify partnership arrangements." - Alex West, IHS Markit Principal Analyst, Manufacturing Technology

Platform space is converging: Where do you fit?

- Partnership-led approaches to IoT platform development will continue to intensify competition in the IIoT space.

Industrial IoT research



Designed for companies looking to expand or establish a foothold in the Industrial IoT

Industrial IoT package

Research supporting this ebook is sourced from the following products:

- **Smart Manufacturing Intelligence Service** – analysis and commentary on the latest news and developments around the "factory of the future"
- **Industrial Communications Intelligence Service** – examination of industrial automation networking adoption and trends
- **MEMS & Sensors Intelligence Service** – coverage of the MEMS and sensors market, including analysis of leading and potential applications using the technology
- **Cellular IoT Intelligence Service** – perspectives and insights into machine-to-machine (M2M) communications
- **IoT Devices & Connectivity Intelligence Service** – analysis of the devices and connectivity technologies used for the IoT
- **Industrial Robots Report** – highly detailed market analysis of robot systems used in manufacturing and production
- **Industrial Cybersecurity Report** – detailed view of the world market for industrial cybersecurity hardware, software and services
- **Service Robots & Drones Report** – examination of professional and consumer service robots as well as the drones market, including trend analysis across 16 key industries

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