INTRODUCTION
INDUSTRIAL IOT

Software and Services Group
IoT Developer Relations, Intel

INTRODUCTION VIDEO

Intel is Inventing the Industrial Internet of Things – Trailer
https://www.intel.com/content/www/us/en/industrial-automation/overview.html

Intel Industrial IoT Overview Video
https://www.intel.com/content/www/us/en/industrial-automation/industrial-vision-video.html

IIOT WORKSHOP OVERVIEW

INTRODUCTION

1. Introduction to Intel and the IIoT
2. Formalized Structure to IIoT

Each Module contains a lecture and a hands-on lab exercise that builds towards an model of an IIoT infrastructure based on a formalized architecture.

CONTROL

3. Physical Sensors and Actuators
4. Communications and Protocols

OPERATIONS

5. Security and IIoT

INFORMATION

7. Automated Control Systems
8. Smart Video Systems

APPLICATION

~~9. Predictive Analytics~~
~~10. Business Analytics~~

HARDWARE USED IN THE LABS

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APPLICATION

9. Predictive Analytics
10. Business Analytics

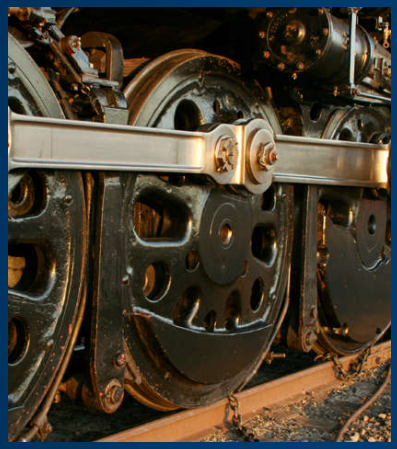
INDUSTRIAL REVOLUTION 4.0

1ST

1760'S

Steam, Water Mechanized Production

2ND



1860'S

Electrification, Oil, Mass Production

3RD

LATE 1900'S

Invention of the Microchip

4TH

NOW

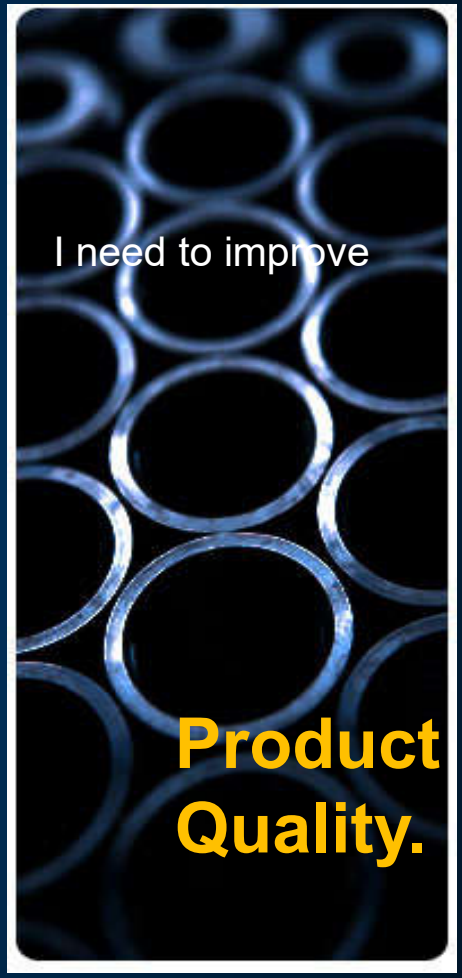
Invention of the computerized network

INDUSTRIAL CUSTOMERS ARE ASKING ...

How can I capture knowledge for my transitioning workforce?

How Can I Better Innovate?

I need to improve



Product Quality.

I need to achieve Real Time Visibility

How Do I Improve **workforce productivity**?

How Can I Introduce new IOT solutions faster?

How can I **Reduce Downtime?**

How can I have better visibility to manage my

Global Supply Chain?

VISIBILITY LEVERAGED FOR DECISION MAKING

"While manufacturers have long had access to data collected on the plant. floor, it's typically been locked away in proprietary manufacturing software silos, restricting their ability to leverage it for decision making, according to Matt Wells, product general manager for automation software at GE Digital, based in San Ramon, Calif. That changes with IoT, which makes it far easier to collect and manage large amounts of manufacturing data not just in a single factory, but across multiple production sites through the cloud, he said. When paired with analytics, companies will gain better insights, allowing them to optimize plant operations, reduce quality defects and perform preventative maintenance, according to Wells."

Matt Wells, product general manager for automation software at GE Digital, based in San Ramon, Calif.

INDUSTRIAL IOT

Industrial processes are taking on a dual nature, one physical and the other digital. Together Industry 4.0 runs on Cyber-Physical machines.

WHAT?

Sensors are connecting our tools to their physical environment. The Internet of Things is connecting our tools to each other, and large scale computing is connecting our tools to us through optimization of process and analytics.

WHY?

IIoT is about decoupling devices from applications and gaining visibility into business processes. When each manufacturing device can provide data about it's use and status then manufacturing processes can be dynamically configured and reconfigured by a data-driven, software processes. Manufacturing will be able to move faster, be more flexible, meet higher work safety standards and fulfill higher quality standards.

HOW?

Working through Industrial Consortiums and Open Industrial Standards to connect current industrial processes to physical sensors, secure protocols, new safety standards, virtualization, real-time automation and machine learning will able visibility and optimization of current business processes.

POLL

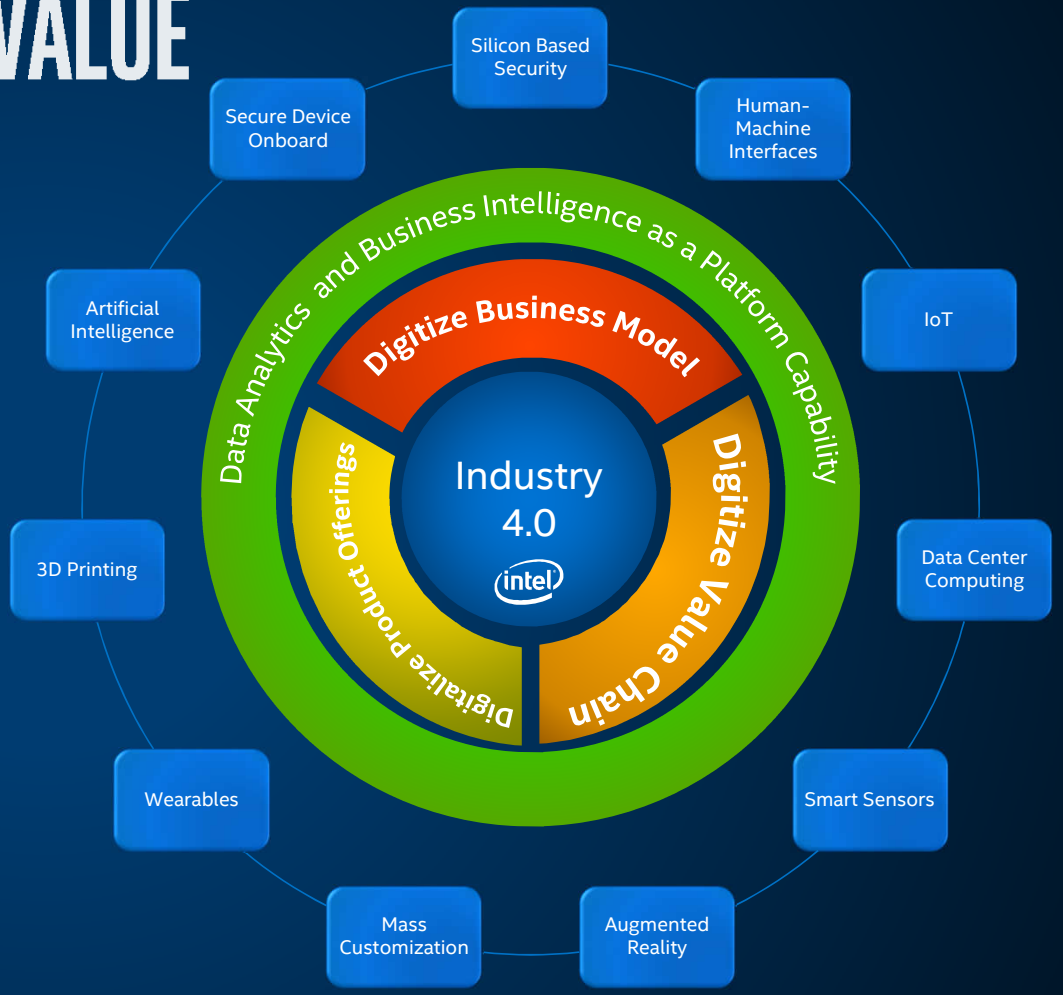
How close are you to adopting Industry 4.0?

https://goo.gl/forms/wxAP9j07IZy1NDCs2

- Doing it now.
- Plan to start in 2017
- It's in the 5 year plan
- We haven't considered it yet.

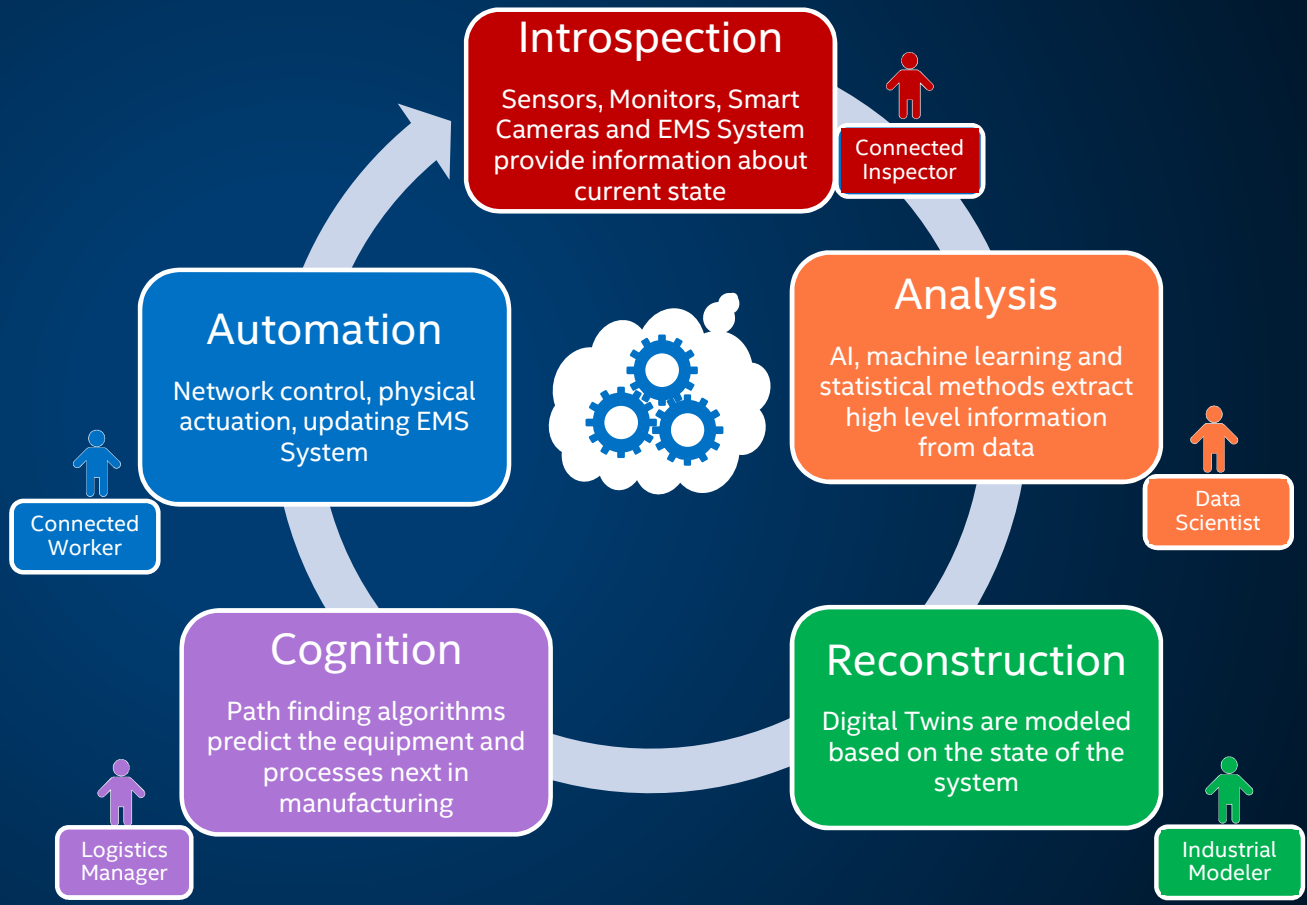
TECHNOLOGY ENABLES NEW VALUE

- *People, products and machines continuously communicate to optimize process and value chains.*
- *Digitalization of highly vertical processes and equipment. Integration of reusable horizontal capabilities backed by industry consortiums*
- *The product holds the information to its own production and guides itself through Industry 4.0 factories.*
- *Digital business models enable new revenue streams including direct to customer data and product services*
- *Deepen relations with customers through data analytics and mass customization*
- *First movers are set to outpace their competitors*



CYCLE OF CONTINUOUS SMART MANUFACTURING

Digitization and integration of vertical and horizontal value chains enables continuous visibility and feedback with the processes across an organization



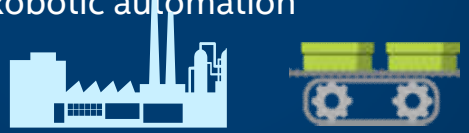
INDUSTRIAL IOT SOLUTIONS FOCUS AREAS

Asset Optimization

- Xeon to FPGA Embedded Technology
- Secure Provisions
- Device Manageability
- Functional Safety
- Real Time OS
- Intrinsic E2E Security
- Pattern matching and machine learning

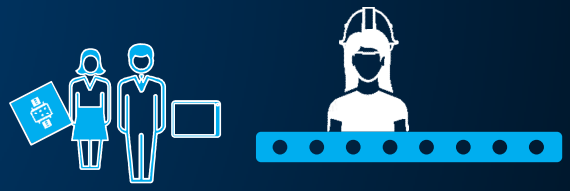
Product Optimization

- Material Staging
- Asset Logistics
- Inventory management
- Machine Learning
- Computer Vision
- Predictive Maintenance
- Edge Analytics
- Connected Machines
- Gateway aggregation
- Robotic automation



Worker Optimization

- Connected workers
- Augmented Reality
- UX Interface Support
- Wearables
- FUSA



Path to Autonomous Management

Actionable Outcomes & Metrics	Reliability MTF – No downtime Machine Ops	Yield /Efficiency Production Costs Quality	Safety Efficiency Capability	Agility Flexibility Customization

HONEYWELL CONNECTED FREIGHT

ASSET MANAGEMENT SOLUTION

Intel and Honeywell collaborate to develop 1st instantiation of Intel connected logistic platform through close partnership with key 3PL companies. The platform will deliver a cost effective and connected asset management solution.

Solution

- Smart sensor tags with proprietary wireless sensor network
- Intel based gateway with cellular and Wi-Fi connectivity
- Analytics capability
- End to end HW enabled security

Use Cases

- Asset location tracking
- Condition monitoring: Humidity, shock, tilt, fall, …
- Logistic routing optimization
- Speedier customs clearances
- Customer satisfaction
- Better forecasting

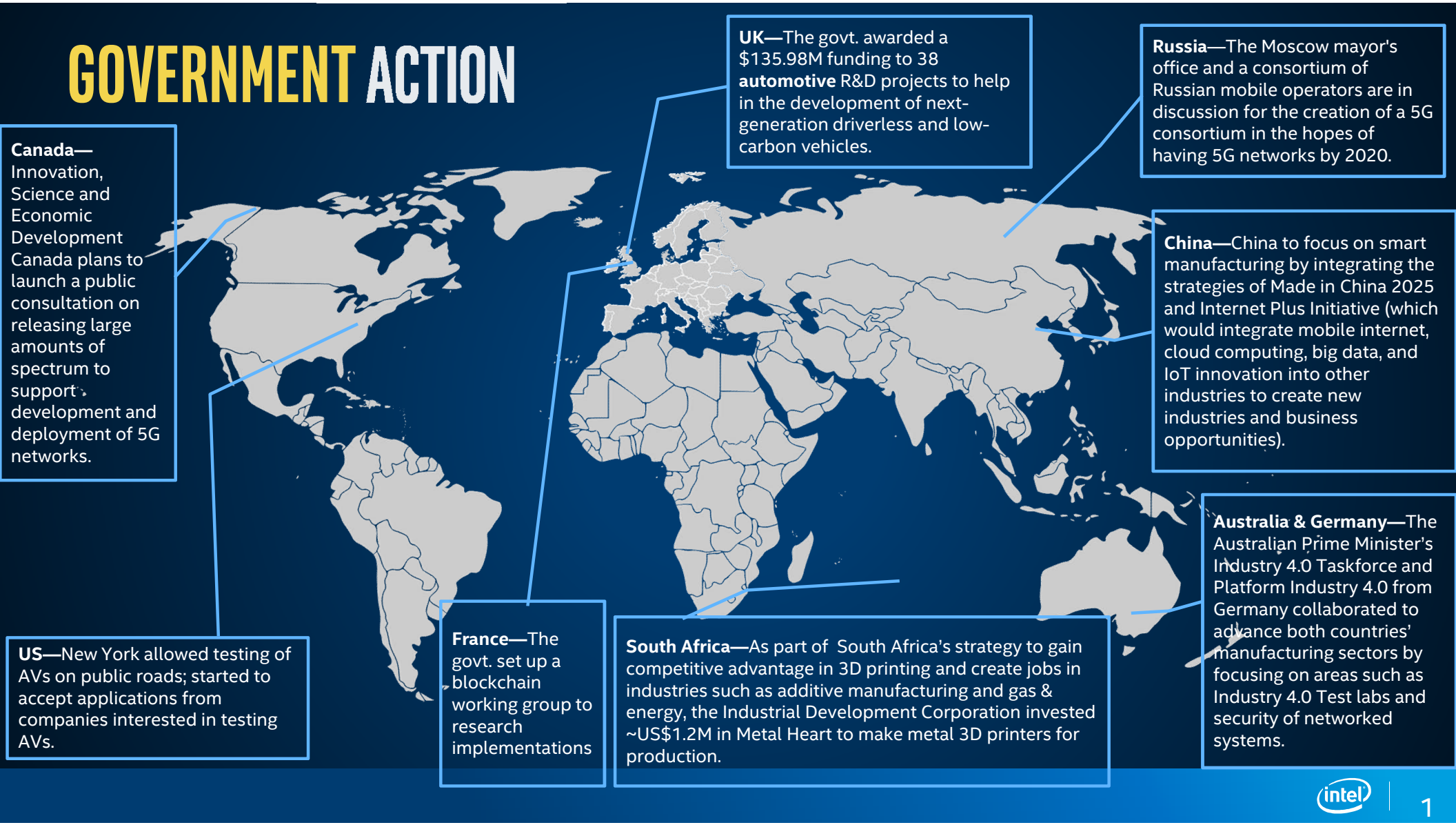
*Other names and brands may be claimed as the property of others.
https://www.honeywellaidc.com/solutions/workflow/connected-freight-solution

https://www.youtube.com/watch?list=PL6g2Y3N0CFAZUID8MIb48a33Lz3Hq0Y_8&v=zeRLY9ZanXA

GERMANY PIONEERS IN INDUSTRY 4.0

https://www.youtube.com/watch?v=Y990kaGbJD0&t=220s

GOVERNMENT ACTION



Canada— Innovation, Science and Economic Development Canada plans to launch a public consultation on releasing large amounts of spectrum to support development and deployment of 5G networks.

US—New York allowed testing of AVs on public roads; started to accept applications from companies interested in testing AVs.

France—The govt. set up a blockchain working group to research implementations

UK—The govt. awarded a $135.98M funding to 38 **automotive** R&D projects to help in the development of next-generation driverless and low-carbon vehicles.

South Africa—As part of South Africa's strategy to gain competitive advantage in 3D printing and create jobs in industries such as additive manufacturing and gas & energy, the Industrial Development Corporation invested ~US$1.2M in Metal Heart to make metal 3D printers for production.

Russia—The Moscow mayor's office and a consortium of Russian mobile operators are in discussion for the creation of a 5G consortium in the hopes of having 5G networks by 2020.

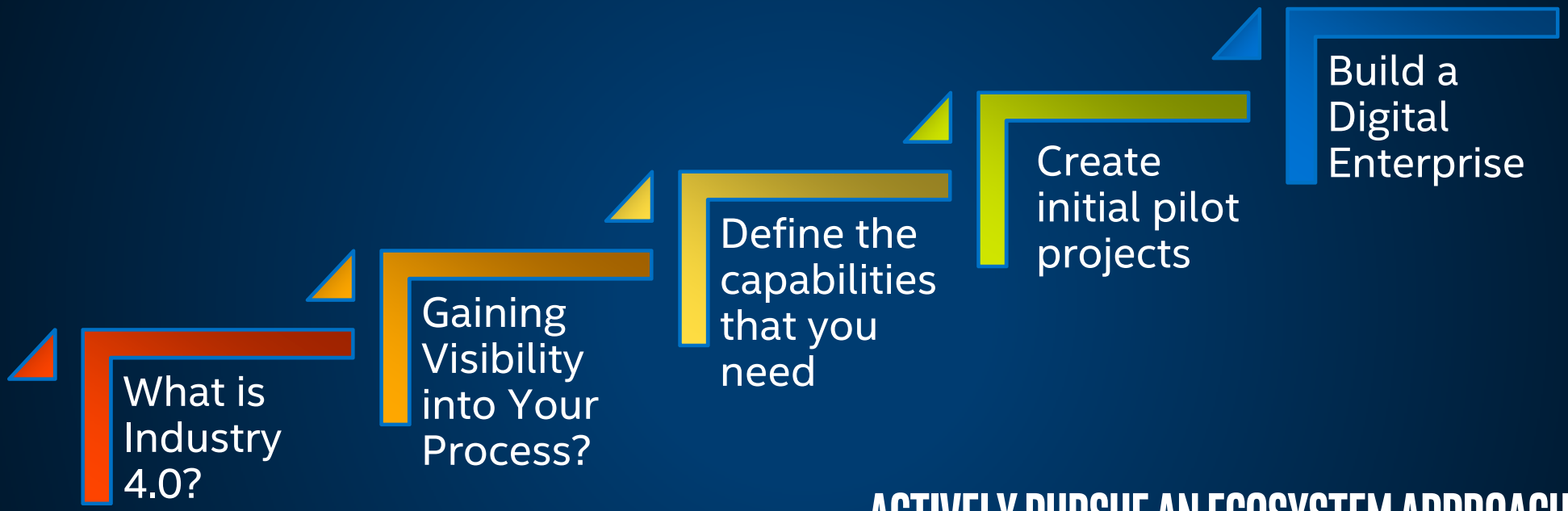
China—China to focus on smart manufacturing by integrating the strategies of Made in China 2025 and Internet Plus Initiative (which would integrate mobile internet, cloud computing, big data, and IoT innovation into other industries to create new industries and business opportunities).

Australia & Germany—The Australian Prime Minister's Industry 4.0 Taskforce and Platform Industry 4.0 from Germany collaborated to advance both countries' manufacturing sectors by focusing on areas such as Industry 4.0 Test labs and security of networked systems.

INTEL IS PARTNERING WITH THE ECOSYSTEM

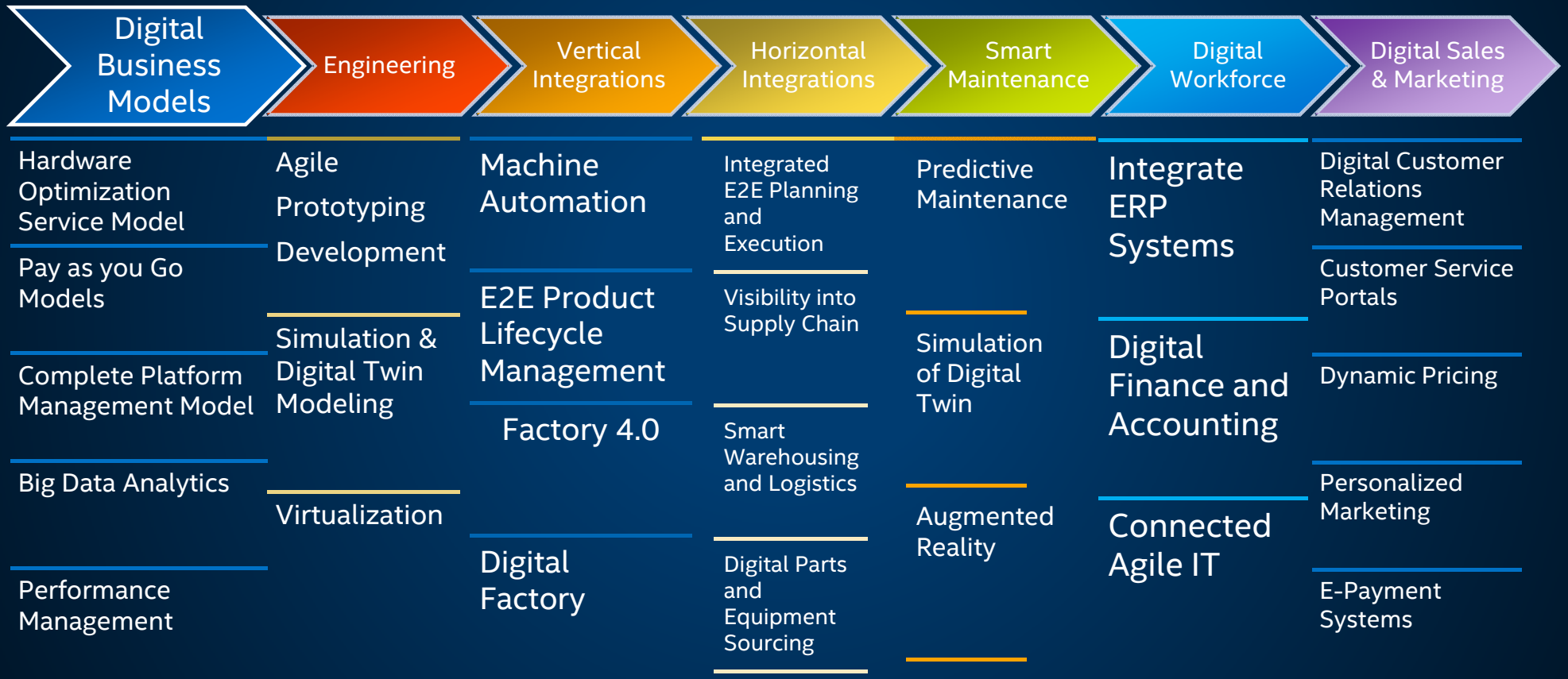
* Other names and brands may be claimed as the property of others.

PATH TO INDUSTRY 4.0



ACTIVELY PURSUE AN ECOSYSTEM APPROACH!

INDUSTRIAL 4.0 PILOT OPPORTUNITIES



POLL

How much visibility do you have into the real-time status of your company's manufacturing process?

- No visibility
- Limited to a single location
- Limited to personal operational dashboard
- Have access to instant real-time status of every product

POLL

How is your company leveraging its visibility data? Select all that apply.

- Real-time monitoring of performance against a plan
- To identify manufacturing defects as they occur
- Identify areas for improvement
- To identify equipment problems as they occur
- To inform and build automation systems
- To create better reporting and metrics
- To identify problems before they occur

VISION FOR INDUSTRIAL IOT

intel

INTEL TECHNOLOGY FOR INDUSTRIAL IOT/INDUSTRY 4.0

Open Platform

built with interfaces and APIs that enable integration with legacy systems and devices and with platforms from multiple vendors.

Interoperability

is designed into IA CPUs to offer backward compatibility to help SW and application reuse thus reducing development time and resources.

Performance at the Edge

that enables near-real-time analytics, local decision making, and tighter process controls.

Advanced Security

for trusted data from edge to cloud and protection from costly attacks.

Scalability

for varying levels of gateway performance, with a broad range of support from Intel® Quark™, Intel® Atom™, Intel® Core™ and Intel® Xeon® processor D and E families.

Manageability

for secure remote upgrades and services.

Faster, More Flexible Deployment

with a platform that supports your choice of operating systems and ecosystem applications.

SECURITY SOLUTION PORTFOLIO AT A GLANCE

IoT Security Portfolio

Roots of Trust Technologies

- Protected Boot
- SW Attestation
- Trusted Execution
- Crypto-Silicon capabilities
- Unified Programming
- White Listing

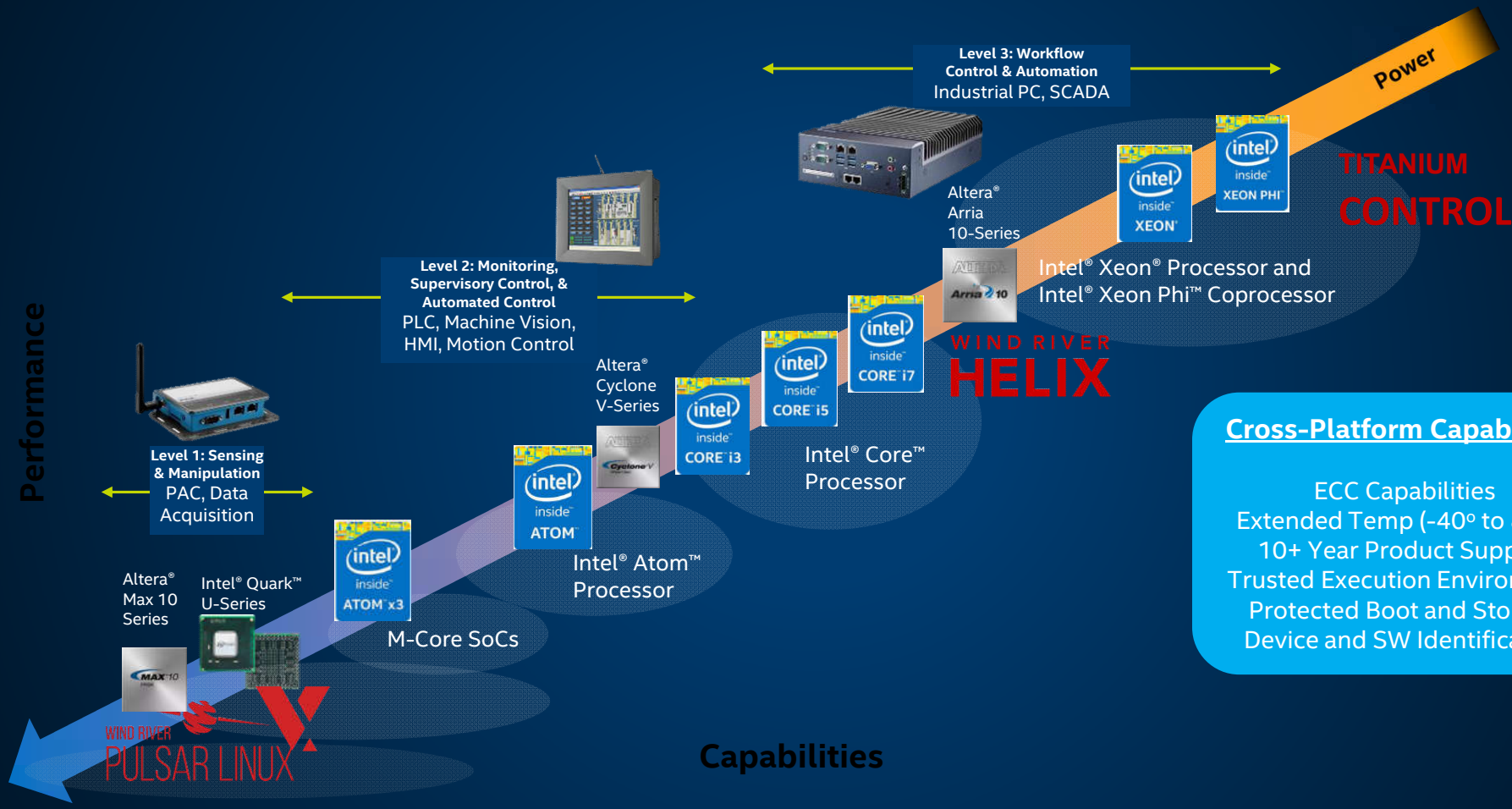
Security Management

- Enhanced Infrastructure Protection (EIP)
- Enhanced IoT Gateway Security
- Wind River Helix Device Cloud

Lifecycle Services

- Secure Device Onboard
- Remote Attestation Services

IOT END-TO-END SCALABILITY WITH INTEL

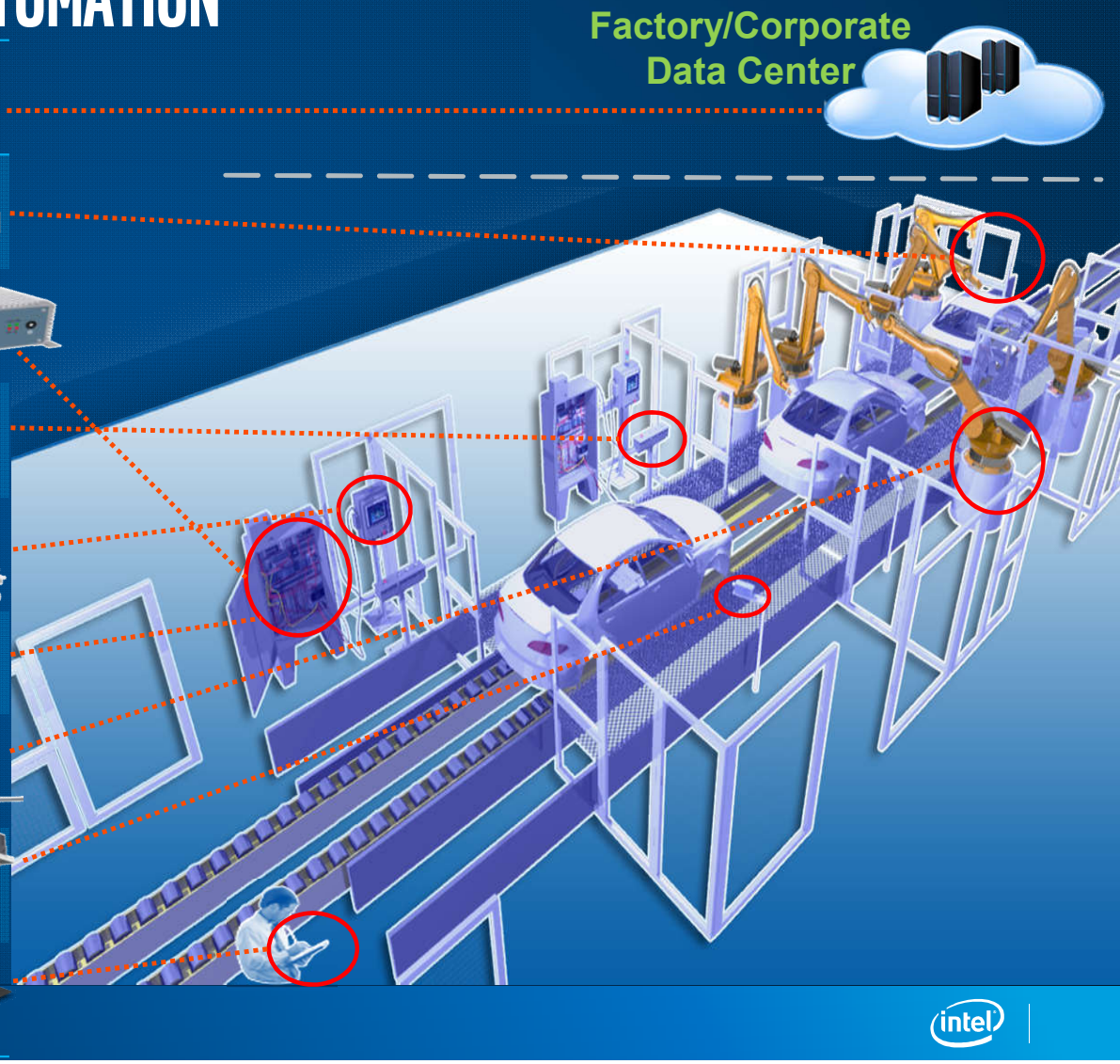


Cross-Platform Capabilities

ECC Capabilities
Extended Temp (-40° to 85°C)
10+ Year Product Support
Trusted Execution Environment
Protected Boot and Storage
Device and SW Identification

INTEL INGREDIENTS IN INDUSTRIAL AUTOMATION

Data Center	**Compute Performance** **I/O intensive**
Factory server	Compute Performance I/O intensive
Industrial PC	Compute Performance Visualization/ UX RT Perf
PLC/PAC	I/O intensive Form Factor Sensitive RT Perf
HMI	Compute Performance Visualization/ UX Form Factor Sensitive
Remote IO	I/O intensive RT Perf
Robots	Compute Performance I/O intensive RT Perf
Machine visions	Compute Performance Form Factor Sensitive
Mobile workforce	Visualization/ UX Form Factor Sensitive



WHAT IS VIRTUALIZATION

From this…

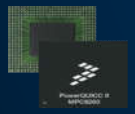

Distributed Control System (DCS)


Programmable Logic Controller (PLC)


Human Machine Interface (HMI)


Motion Control (MC)


Machine Vision (MV)


ARM, PPC, DSP based SOCs

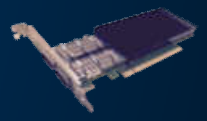
Workloads can be consolidated


Xeon


FPGA

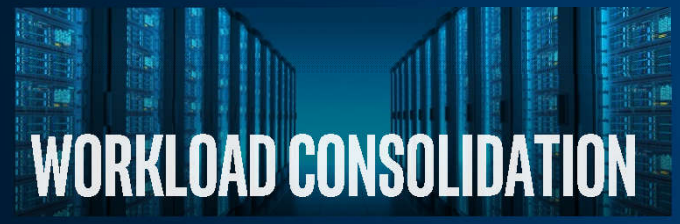

3DXPoint


Chipset Acceleration


NIC

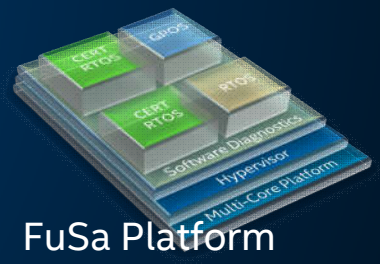
FUNCTIONAL SAFETY (FUSA)

CHALLENGES FACING FUSA



CERTIFIED SAFETY SOLUTIONS

- **Integrated Functional Safety Platform** Turnkey SoC, S/W and safety documented solution
- **Reduce Total Cost of Ownership** Run (safe and non-safe) mixed criticality workloads on SoC
- **Improve Operational Insight** Provides high levels of traceability and verification



FuSa Platform

ALTERA

intel XEON inside

intel ATOM inside

WIND RIVER

THE "EYE" FOR SMART MANUFACTURING

CHALLENGES FACING

INDUSTRIAL VISION SOLUTIONS

- All-in-one industrial smart camera and embedded vision system
- Wide range of referenced platforms - IA only, IA+FGPA or Movidius
- Video analytics with ML/DL capability

INTEL® MEDIA SDK
INTEL® COMPUTER VISION SDK
INTEL® MACHINE LEARNING SDK

INTEL STANDARDS AND CONSORTIA LEADERSHIP

industrial internet CONSORTIUM

MEMBERSHIP 215+

CAICT 中国信息通信研究院 SAP Schneider Electric

Industrial Internet Reference Architecture
Interoperability Testbeds Expanding Regionally
Intel® IoT Platform Fully Compatible

E2E Reference Architecture + **Frameworks & Testbeds** = **Interoperability**

OpenFog™

MEMBERSHIP 20+

intel CISCO ARM Microsoft DELL PRINCETON UNIVERSITY

Enterprise Fog Computing Reference Architecture
Operational Models and Testbeds
Intel IoT Platform Fully Compatible

Software-Defined Reference Architecture + **Operational Models & Testbeds** = **Composability**

OPEN CONNECTIVITY FOUNDATION™

MEMBERSHIP 150+

Microsoft QUALCOMM CAICT 中国信息通信研究院 IBM ZTE

IoTivity 1.0

IPR Policy

Cloud-Native approach

Industry Standards + **Open Source Solutions** = **Conformance & Compatibility**

CASE STUDY HEADLINES

- Fast Track IoT Smart Building, Industrial and City Solutions with Altiux and Intel
- Altiux Helps Integrated Steel Plant Reduce ACC Energy Consumption by 18%
- Altiux Helps Intelligent Glass Manufacturer Reduce On-site Maintenance Calls
- Alleantia - Achieving the Power of Industry 4.0 with Plug-and-Play Simplicity
- Intel Partner Simularity Delivers AI Software for Asset Monitoring
- Cut Energy Costs with a Smart Real-Time Occupancy Solution from Feedback Solutions and Intel
- The Infiswift IoT platform based on high-performance Intel® architecture enables more efficient agricultural operations.
- Enabling data-driven insight and holistic visibility for Telco, service providers, and the enterprise

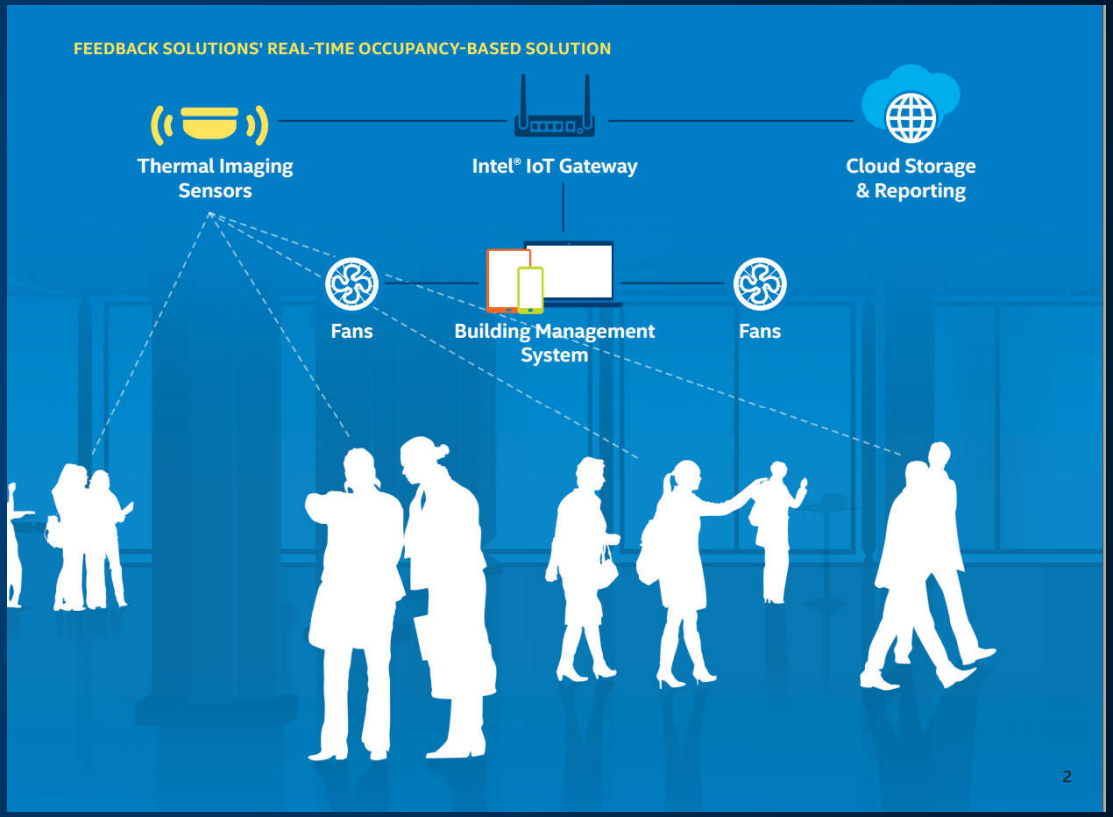
http://www.altiux.com/solution-brief-altiux-iot-and-intel.html

ATEZI AND INTEL OPTIMIZE CELLULAR TOWER OPERATIONS WITH INTELLIGENCE AT THE EDGE

CUT ENERGY COSTS WITH A SMART OCCUPANCY SYSTEM

Feedback Solutions offers a targeted solution that's focused on real-time occupancy as a key metric to control fan speed in buildings. This highly accurate, cloud-based solution enables real-time, automatic delivery of occupancy-specifc ventilation in order to maintain indoor air quality and occupant comfort, as well as drive ROI.

- **Thermal-Imaging Occupancy Counters**
- **Occupancy Calculation**
- **Automatic Adjustment**
- **Intel® IoT Gateway**
- **Storage and Reporting**



AUTOMATE INSPECTION AND REAL-TIME DECISION

MACHINE VISION

Intel collaborates with key industrial machine vision solution providers

ADLINK Inovance SIASUN alhua NATIONAL INSTRUMENTS

Solution

- Apollo Lake and Altera Cyclone V enabled referenced hardware platform
- Rich software suites
  - Open CV/CL
  - Media SDK
  - Computer Vision SDK
- Value proposition
  - Performance Scaling
  - Solving GIGI issues and control challenges
  - Ease of deployment with high performance, lower power and SFF

Use Cases

- Versatile metrology
- Packaging detection
- Quality inspection
- Robotics guidance

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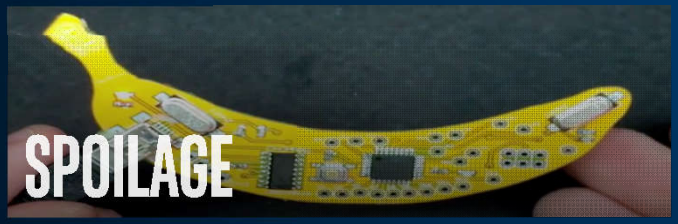
ENABLING CONNECTED LOGISTICS PLATFORM

ASSET MANAGEMENT SOLUTION

CHALLENGES FACING INDUSTRIES



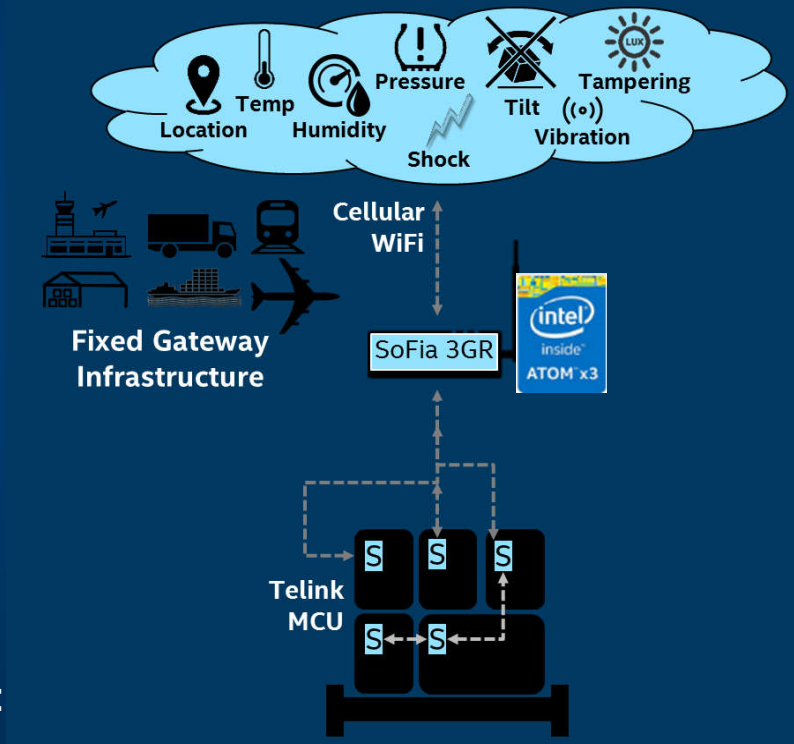
SAFE, EFFICIENT, SUPPLY CHAIN MANAGEMENT

Cloud analytics and software

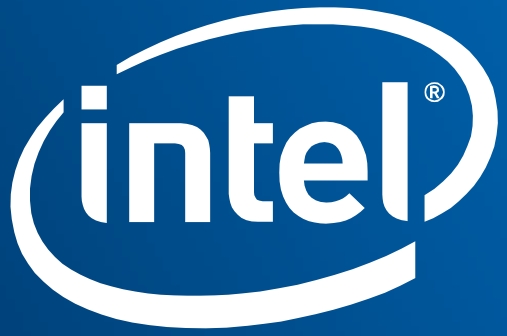
Intel Mobile/ Fixed Gateway

Intel low power wireless sensor network

On asset intelligence: sensor tags



WHERE TO GO FROM HERE?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RECENT MARKET PARTNERSHIPS AND ACQUISITIONS

Honeywell & Nextnine	• In June 2017, Honeywell announced that it has signed a definitive agreement to purchase Nextnine, a privately held provider of security management solutions and technologies for industrial cyber security.
Baidu & xPerception	• In April 2017, Baidu acquired US-based computer vision start-up xPerception to further its AI efforts.
SiriusXM & Automatic	• In April 2017, SiriusXM acquired Automatic, the maker of the Automatic Pro and Automatic Lite connected car OBD-II port accessories, for over $100M.
Altair & MODELiiS	• In May 2017, Altair acquired MODELiiS, a supplier of electronic design automation software for circuit modelling, system design, and simulation tools based in Grenoble, France. Capitalizing on strong expertise in digital and analog domains, their solutions are geared toward the Internet of Things (IoT), autonomous vehicles, and complex hybrid systems.
EarthBend & Clear2there	• In April 2017, EarthBend, a value-added distributor of business telecommunications and IT solutions, announced that it has acquired Clear2there, a provider of advanced video surveillance, smart-home, smart-business, smart-farm applications, and Internet of Things (IoT) solutions for service providers and enterprises.