Innovation with Connected Products

Build your digital industry
September 30, 2015

#IndustrialInternet
VIDEO 1 - Machine to Machine
Innovation with Connected Products

Build your digital industry

NIKHIL CHAUHAN
Director Product Marketing: Predix
GE Digital
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The Business Value of Connected Products and Services

Glen Allmendinger
Founder and President
Harbor Research

GE Minds and Machines Event

October 2015
What Is The Internet of Things?

Sensor, actuator and other analog and machine inputs are now getting digitized and placed on networks.
What Is The Internet of Things?

Industrial Smart Systems Driven By Connectivity

Embedding Software Intelligence In Everything

We are adding software and intelligence to all devices, sensors and machines which is enabling new levels of awareness for machines and smart systems.
What Is The Internet of Things?

Bi-directional intelligence informs new levels of systems transparencies and better decision making which drives new and expanded business values.

Integrating Physical Systems, People and Processes
Intelligence Drives New Business Innovations

Significant increases in production system flexibility to enable lot size-1 production

Revolutionary short engineering process

Radically shorter and virtual value chains

Revolutionary autonomous production systems
We Are Just At The Beginning of This Technology Wave..

Simple Applications
Applications tend to be remote support-driven applications that involve monitoring/upgrades of installed base of machines in the field – such as motors, instruments, machines, etc.

- Tracking
- Product Support
- Diagnostics / Monitoring

Compound Applications
Applications that involve multiple collaborating (peer-peer) devices or significant interactions between and among devices, systems and people.

- Multi-Party Equipment Support
- Demand Response
- Maintenance Support & Collaboration

Complex Applications
Applications that drive interactions between and among devices, device sub-systems and people, and can also allow extending/expanding values from third party collaboration and large scale (big) data integration/analytics.

- Multi-Vendor Brokered Services
- Integrated Real Time Pricing for Electricity
- Multi-vendor Maintenance Collaboration

Connections

Simple
- Equipment Monitoring
- Maintenance Dispatch
- Alerts & Alarms

Compound
- Integrated Automation, Condition Monitoring & Asset Management Systems
- Managed Security Services

Complex
- Crowd-Sourced Content for Machine Troubleshooting
- Brokerage / Auction for Spare Parts or Sub-Contractors

Time
Benefits To Manufacturers Across Entire Value Chain

Product Usage & Requirements:
Apply rich new data on how products are used in next gen product designs

Create smart systems and services to make products easier to adopt and more valuable to use

Design transparency, visibility and real-time insight into product and systems

Leverage design and data management tools to collect customer intelligence on usage, configuration and systems management
Life Cycle Cost To Support Equipment Can Range from 5X To As Much As 15X The Purchase Cost of the Equipment or Device

Investment case and ROI is very short when life cycle costs rise above 5X the equipment purchase cost

- Monitor asset performance in real-time can improve asset productivity by up to ~20%
- Monitoring asset performance in real-time can reduce accident frequency by up to ~85%
- Integrated real-time inventory management can reduce field inventories by up to ~60%
Smart Services Models Drive Participation and Collaboration

Solo

Partnered

Collaborative

MODELS

Simple

Compound

Complex

ENVIRONMENT

Largely focused on remote support automation & data value for specific product

Builds broad support capabilities across the entire life cycle of target equipment or delivery chain

Leverages services automation to feed diverse needs across product provider delivery chain

Foster Multi-Vendor, Multi-User Interactions & Cooperative Mgmt

Manage System/User Experience & Delivery Chain Relationships, Intelligence and Interactions

Google

ABB

Honeywell

SIEMENS

IBM

EMC

EMERSON

ROCKWELL AUTOMATION

FAN

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FAN
Market Requires Open Nets, Data and Common Platforms

Connections

Simple
- Enablement for device management
- Connectivity management
- Application development tools

Compound
- Hybrid network standards
- Systems and application integration platforms
- Vendor ecosystems
- Device management services

Complex
- Open information sharing, data fusion and brokering
- Information architecture

- Value Added Services enable varied interactions across many relationships
- Product, Service and Business Systems become inexorably linked
- Digitized content fed through basic Information Architecture
- Analytics, Virtualization Services and Information Brokerages extend device value
Customers demand
A platform for all operating assets

“Link up all my assets and devices.”

What I really need is a platform that connects my stuff together.

“Connecting systems is like a thousand octopuses.”

Leverage the collective knowledge.

“Will be my system of systems.”

Source: GE, 2014

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Technical challenges
To connect and make all machines intelligent

- Lack of interoperability
- Vendor-specific solutions
- Tedious retrofitting of legacy machines
- Difficult to manage
- No standard way to connect machines
- Service Provider specific connectivity
- No plug-n-play
- Inconsistent application connectivity

Cannot connect ALL my assets with varying vendors and vintage
Business challenges of end-customers

- Rising operational expenditure
- Limited lifespan of machines
- Lack of actionable insight
- Longer time to value
- Inflexibility to meet business demands
Connect ALL operating assets: GE’s belief

Using Predix Machine, Predix Connectivity Services

“Finally, ALL my assets are connected regardless of vendor or vintage”
Business benefits for customers

- Lower operational expenditure
- Extended lifespan of machines
- Meet fluctuating business demands
- Shortened time to value
- Actionable and scalable decision-making
Predix Machine Services: DEPLOYMENT TOPOLOGIES

On Gateways
- Predix Cloud
- Gateway
- IT / OT Protocols
- Sensor/Device 1
- Sensor/Device n

On Controllers
- Predix Cloud
- Gateway
- Machine Controller
- On Cloud
- On Premise

On Sensor Nodes
- Predix Cloud
- Gateway
- Sensor Nodes
- Direct to Cloud
Predix Machine
On Gateways and/or Controllers

Predix Cloud

Machine Data Services
- Data Receive, Data Store

Remote Management Portal
- Device, Application, Identity and Security Management

Predix Machine

Cloud Gateway
- File & Data Transfer
- Sensor Data Aggregation
- Certificate Management
- Store & Forward
- Edge Analytics

Device Provisioning
- Local Data Store & Access
- Configuration Management
- Device Commissioning

Core Framework

Human Devices

Industrial Machines

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M2C

M2H

M2M
Predix Connectivity

Predix Cloud
CaaS Monitoring / Ops

Service Provider

Networking Stack / WAN connection
Edge Applications (business/solution specific)
Predix Machine / Net (UMF)
Runtime (Java/OSGi)
OS (Linux, Windows & RTOS)

WAN
Predix Connectivity 2015 Scope

Edge Gateway
(Predix Machine & DDS/Messaging)

LAN / PAN / FAN

ASSETS #IndustrialInternet
# Predix-Ready

MACHINES, DEVICES, AND SOFTWARE THAT INTEROPERATE WITH PREDIX THROUGH PUBLISHED API’S AND OTHER INTEGRATION POINTS.

## Devices

<table>
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<tr>
<th>Sensors, Actuators, Logic Systems</th>
<th>Controllers</th>
<th>Aggregators</th>
<th>Infrastructure</th>
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<tr>
<td><strong>2015 FOCUS</strong></td>
<td>Temp/flow/pressure sensors, gauges, industrial I/O...</td>
<td><strong>2015 FOCUS</strong></td>
<td>Avionics, ground systems, medical systems, telematics...</td>
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## Connectivity

<table>
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<tr>
<th>NETWORK</th>
<th>CSPs</th>
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<tr>
<td>WAN, LAN, PAN</td>
<td><strong>2015 FOCUS</strong></td>
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VIDEO 2 - GE’s Equipment Insight
GE’s Equipment Insight:
Predix-Ready Field Agent
Predix Connectivity
VIDEO 3 - GE’s Digital Wind Farm
GE’s Digital Wind Farm:
Predix-Ready Gateway
Predix Cloud
Predix-Ready Partnerships

DEVICES
See “Tech Hall Connected Predix Demo”

REFERENCE ARCHITECTURE FOR ADOPTERS
GE and Intel

PREDIX-READY CISCO NEXT-GEN DEVICES
From Cisco

#IndustrialInternet

odm1
odm2

Justin Christiansen
Global Account Manager
Intel

Vikas Butaney
Senior Director, Product Management
Cisco Systems
Cisco Internet of Things

Vikas Butaney
Senior Director, IoT Systems
Introducing the Cisco IoT System

INTERNET OF THINGS

APPLICATIONS

Network Connectivity | Fog Computing | Data Analytics | Security Cyber and Physical | Management and Automation | Application Enablement Platform

Cloud

Fog

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Cisco Fog with IOx: Extending the Cloud application towards the Things

CISCO PORTFOLIO

RICH SERVICE AND MANAGEMENT CAPABILITIES:
- Cisco Fog Director
- Fog Data Services
- Cisco Connected Streaming Analytics

ECO SYSTEM PARTNERS:
- Cisco Fog Director
- Fog Data Services
- Cisco Connected Streaming Analytics
- Networking Devices
- Compute Devices
- Predix-Ready

FOG NODE CHOICE:
- Networking Devices
- Compute Devices

BROAD PORTFOLIO OF IOX DEVICES

CISCO PORTFOLIO

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IR8x9 – IoT Gateways: Predix-Ready

**Compact**
Small form-factor with integrated DC power supply

**Industrial Grade**
Built for challenging environment – shock/vibe, humidity, temperature, dust

**Services-Rich**
IPv4/IPv6, Routing, Security, QoS, Segmentation (VLAN, VRF), VPN

**Pervasive Security**
HW crypto, IPsec VPN, 802.1x, Firewall, Certificate management

**Fog Computing**
Hypervisor, Linux Guest OS, SCADA Protocol

**Manageability**
Comprehensive Network & Security Management, Zero Touch Provisioning, IOT Field Network Director

**Broad Customer applications**
Utilities, Oil & Gas, Transportation, M2M, Public Sector

**Connectivity & Sensors**
Ethernet, Cellular 3G/4G Serial, Wi-Fi, GPS, Accelerometer, Gyroscope
Justin Christiansen
Intel Global Account Manager
@jd_christiansen
GE and Intel: Advancing the Industrial Internet

Industrial Endpoints

Predix-Ready Gateway
- Advantech UTX 3115
- Dell IoT Gateway
- GE IP RXi
- HP DL320
- Others

Predix Cloud
CONSIDER HOW GE’S PREDIX CAN CONNECT ALL YOUR ASSETS AND HELP YOU MEET YOUR BUSINESS DEMANDS

EXPLORE THE POSSIBILITY OF PARTICIPATING IN PREDIX’S ECOSYSTEM.
http://predix.io or http://predix.com
Thank you

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