

Instrumenting the Supply Chain with the Internet of Things

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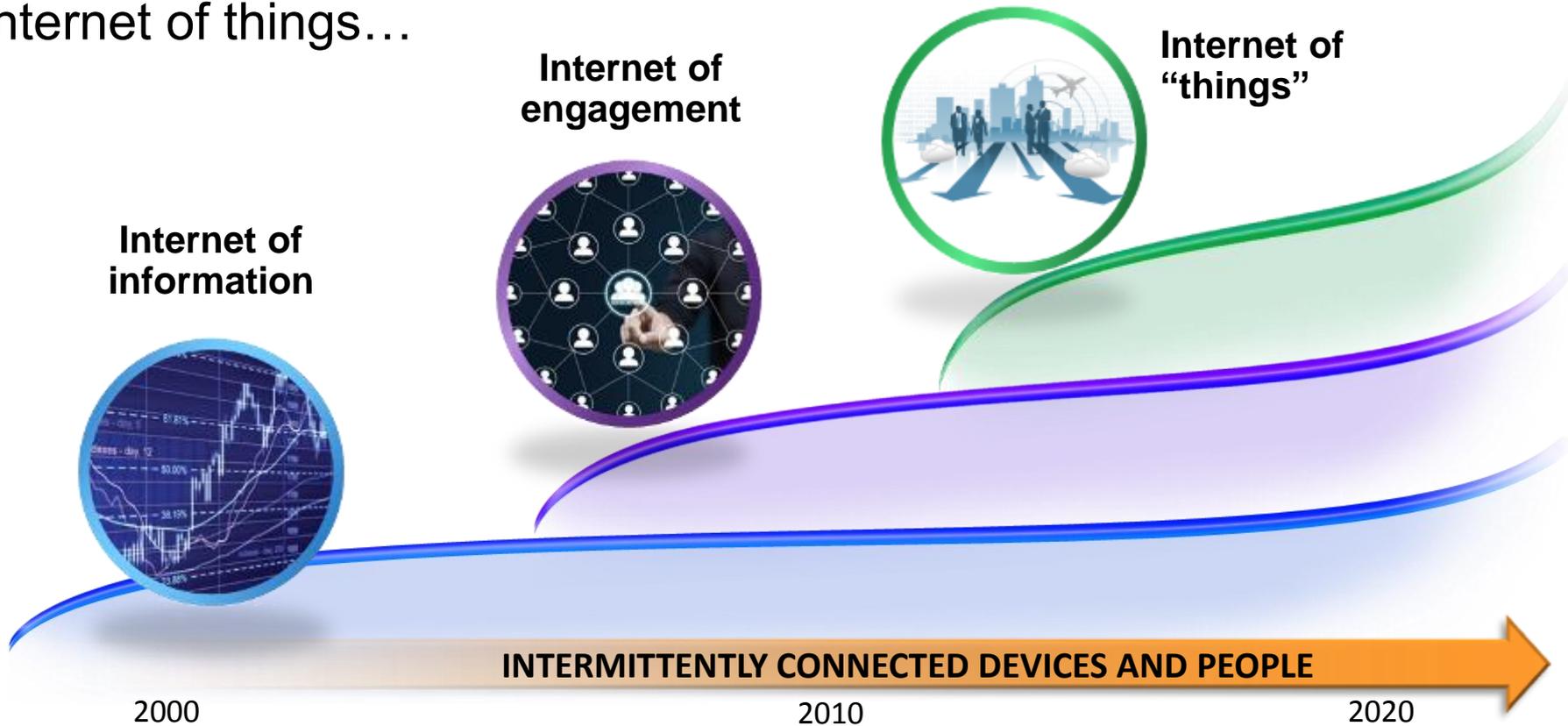
Pete Karns,
Director, Product Management & Strategy, Smarter Infrastructure

Instrumented, Interconnected, Intelligent

Patterns of Innovation Enabled by an Internet of Things



The convergence of technology is transforming the world into an Internet of things...



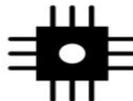
The world is changing and becoming smarter, which brings significant opportunity

INTELLIGENT



All the data generated by digital technology is providing intelligence to help us do things better, improving our responsiveness and our ability to predict and optimize for future events.

INSTRUMENTED



Digital technologies (sensors and other monitoring instruments) are being embedded into every object, system and process.



INTERCONNECTED



In the globalized, networked world, people, systems, objects and processes are connected, and they are communicating with one another in entirely new ways.

A World fueled by disruptive technology

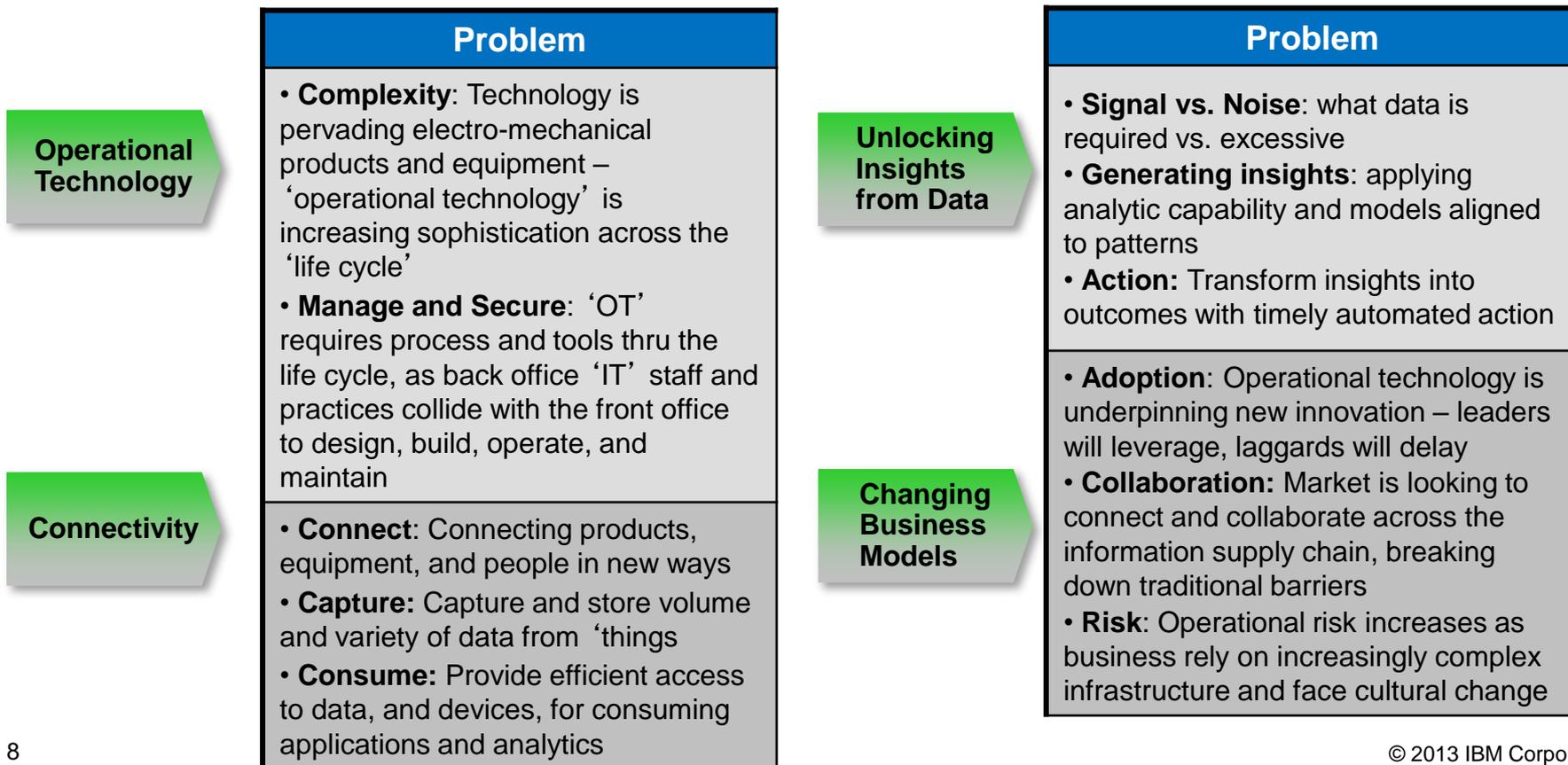


With opportunity, IoT increases technology challenges

- Scalability
- “Arrive and Operate” Devices
- Interoperability
- Software Complexity
- Data Volumes and Velocity
- Data Interpretation
- Fault Tolerance
- Power Supply
- Security and Personal Privacy
- Interaction and Short-range Communication
- Wireless Communication



Four complex challenges are crucial for better outcomes...



IoT forces systems of record to expose information to new modes of engagement...

Systems of Record

- Data & Transactions
- App Infrastructure
- Virtualized Resources

Next Generation Architectures

New Modes of Engagement

- Expanding Interface Modalities
- Big Data and Analytics
- Social Networking

Data & Transaction Integrity

Smarter Devices & Assets



IoT enabled Patterns are emerging within industry context



A&D



Auto



Electronics



Telco



Transportation



Utilities



Cities



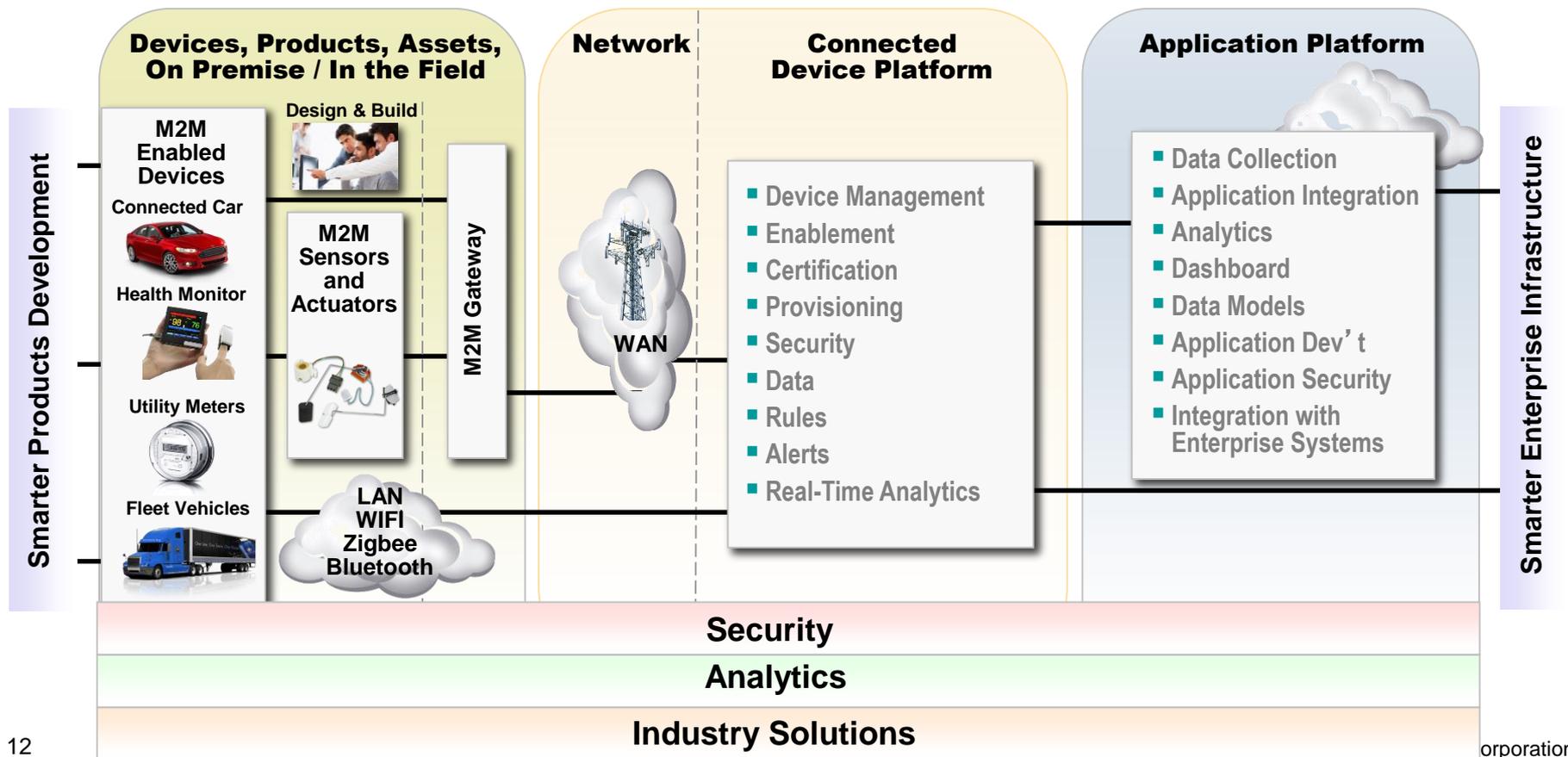
Natural Resources

	Priority for Industry	Secondary Priority
Operations and Maintenance Optimization		
Connected Communities		
Product Life cycle Innovation		
Operational Technology Utilization & Management		
Connecting Assets & M2M		
Predictive Analytics and Action		

IoT enabled Patterns are emerging within industry context

Pattern	Value Statement
Operations and Maintenance Optimization	Increase productivity and reliability of assets and infrastructure without jeopardizing service quality or compliance. Reduce and more effectively utilize CAPEX and OPEX
Connected Communities	Drive sustainable economic growth, and citizen centricity across operations. Enable leaders to analyze data, including social sentiment, to proactively resolve issues and opportunities and coordinate resources to operate effectively.
Product Life cycle Innovation	Accelerate innovation and time to market for products by coordinating processes and information across design domains and the product life cycle
Operational Technology Utilization & Management	Enable visibility, control, and automation to effectively manage the increasingly complexity of asset infrastructure, devices and products.
Connecting Assets and M2M	Connect diverse devices to a network, with two way communication, to enable process automation and feed information to business applications and analytics
Predictive Analytics and Action	Generate insights to identify and execute operational efficiencies, and opportunities for innovation, across people, processes, and infrastructure.

IoT Patterns are enabled by a range of capabilities



IoT enables new opportunities to deliver better business outcomes...



React

Achieve

Reduce

with agility to changing
landscapes

outcomes from limited
investments

unnecessary risk and cost

*Increasing sales with new
promotions from 15% to 75%*

*Speeding service delivery
from 45 days to 20 minutes*

*Recognizing & repairing over 50%
of issues before operations
impact*

Well field optimization for Oil/Gas field service operations

Business Challenges

- Improve Production (reduce downtime or non-productive time) at lower costs AND
- Optimize the Safety Case (reduce operational risk)
- Operators must have both social and legal license to operate
- Increasing reliance upon communications network and operational technology

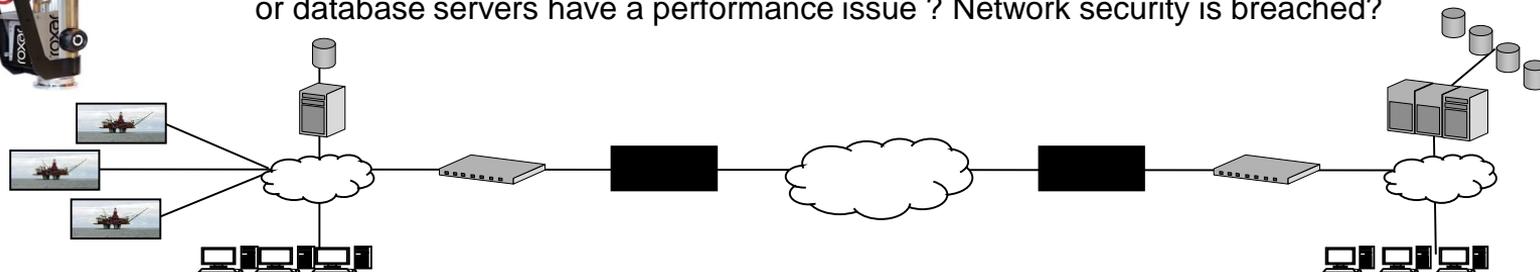
Opportunities for Innovation

- Well head optimization
- Public / private stakeholder visibility
- Operational efficiency – remote monitoring with pre-planned response plans
- Reduce time to production and operational delays thru more effective collaboration between operators, contractors, and public stakeholders

What happens to the ‘well field optimization’ process if:

- The metering equipment fails? The communication network(s) fails? The application or database servers have a performance issue ? Network security is breached?

Smart Devices



Increasing supply chain efficiency from 'Pit to Port'

Business Challenges

- Decrease time to operation for new sites and improve return on capital investments
- Improve production reliability (across supply chain)
- Operational compliance with environmental, health, and safety regulations
- Increasing operational efficiency with real time visibility and process automation

Opportunities for Innovation

- Predict and act on potential failures
- Increasing production thru resource optimization
- Operational efficiency – remote monitoring with pre-planned response plans (internal / 3rd party)
- Reduce time to production and operational delays thru more effective collaboration between operators, contractors, and stakeholders



Managing complexity of connected cars to ensure profitability

Business Challenges

- Deliver new vehicle innovation to maintain / extend market differentiation
 - Particularly software / electronics
- Reduce quality and reliability issues
 - >50% of life cycle warranty costs
- Ensure security of electronic systems and comply with safety critical engineering process regulations

Opportunities for Innovation

- Reduce life cycle warranty costs and improve product differentiation
 - Lower dealership visits via OTA software updates
 - Improving analytics for early problem detection
 - Adopting secure design-in practices and vulnerability testing
- Integration to vehicle-to-vehicle and connected vehicle systems

Remote diagnostics and software updates

Integration to other smarter systems



Vehicle as application platform generating new innovation



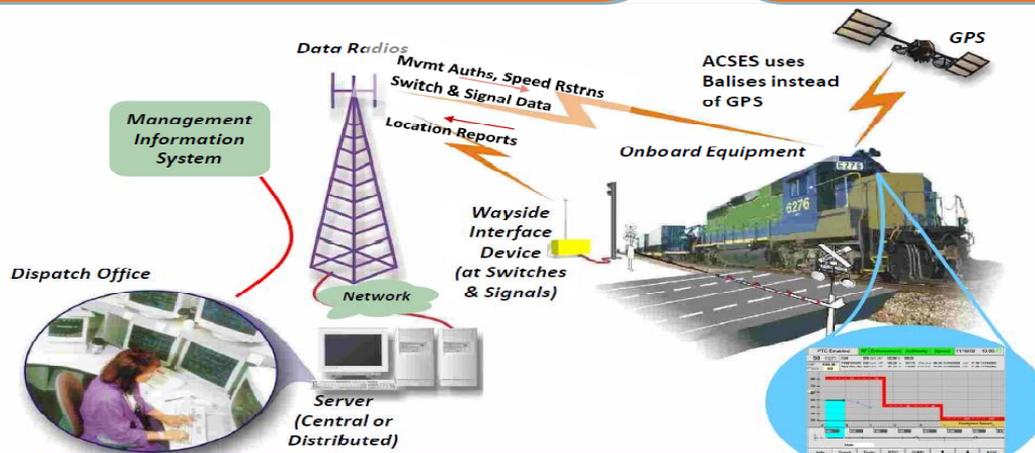
Turning a Government mandate into a business opportunity

Business Challenges

- Implementation of Positive Train Control (PTC), a collision avoidance system, **mandated by the U.S. Government**, to be completed by YE 2015
- PTC-based systems need to interoperate with existing 'aged' signal and train control technologies
- PTC Requirements will cover route-mile networks, locomotives, and freight cars
- Support mobile workforce

Opportunities for Innovation

- US \$B investment in the PTC implementation
- Improve audit & compliance requirements by acquiring equipment within the PTC specifications
- Improve service quality and operating costs through failure analysis; e.g. how often a signal goes out to identify manufacturer design flaw
- Improve safety through better decision making based on real time environment and asset data – consists, tracks, signals, switches



On board equipment governs train movement and speed, ensuring it operates within the track limits.

Innovating to create a new business model

Business Challenges

- **Grow services revenue from 10% to >50%** of revenue (in less than six years) – per challenge from Board
- Effectively, move to selling ‘thrust’ availability vs. selling an engine and spares
- Operational technology is essential to manage the servicing and maintenance of the engines

Opportunities for Innovation

- Client has identified an **additional \$\$\$ of expense** to address through a combination of:
 - Engineering design for service (as opposed to design for manufacture)
 - Accurate parts traceability
 - Currently only 1% of parts are traced through the 30 yr lifecycle

A Smarter Infrastructure enabled business model



1) Fault identified and communicated in near real time.

2) Process optimization and analytics identifies approach to minimize disruption and cost.

3) Field technicians notified and resources aligned for work plan.

4) Field tech completes work to restore service. Analytics identify other engines that may develop this failure – to proactively address.

Business value from IoT requires...



1. Enabling **process and data integration** within and across the life cycle



2. **Managing and securing** 'operational technology'

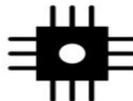


3. Turning vast amounts of operational data into **insights, and outcomes**



The world is changing and becoming smarter, which brings significant opportunity – to those who adopt, manage, and change

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