Full disclaimer

This presentation reflects the direction Infor may take with regard to the products or services described herein, all of which is subject to change without notice. This presentation is not a commitment to you in any way and you should not rely on any content herein in making any decision. Infor is not committing to develop or deliver any specified enhancement, upgrade, product, service or functionality, even if such is described herein. Many factors can affect Infor's product development plans and the nature, content and timing of future product releases, all of which remain in the sole discretion of Infor. This presentation, in whole or in part, may not be incorporated into any agreement. Infor expressly disclaims any liability with respect to this presentation.

21TECH

inforum 2017

IoT and EAM

Dilraj Kahai
Managing Partner, 21Tech

Kevin Price
Product Director, EAM

infor

What is IoT?

1999!

“THE INTERNET OF THINGS IS ABOUT EMPOWERING COMPUTERS… SO THEY CAN SEE, HEAR AND SMELL THE WORLD FOR THEMSELVES”

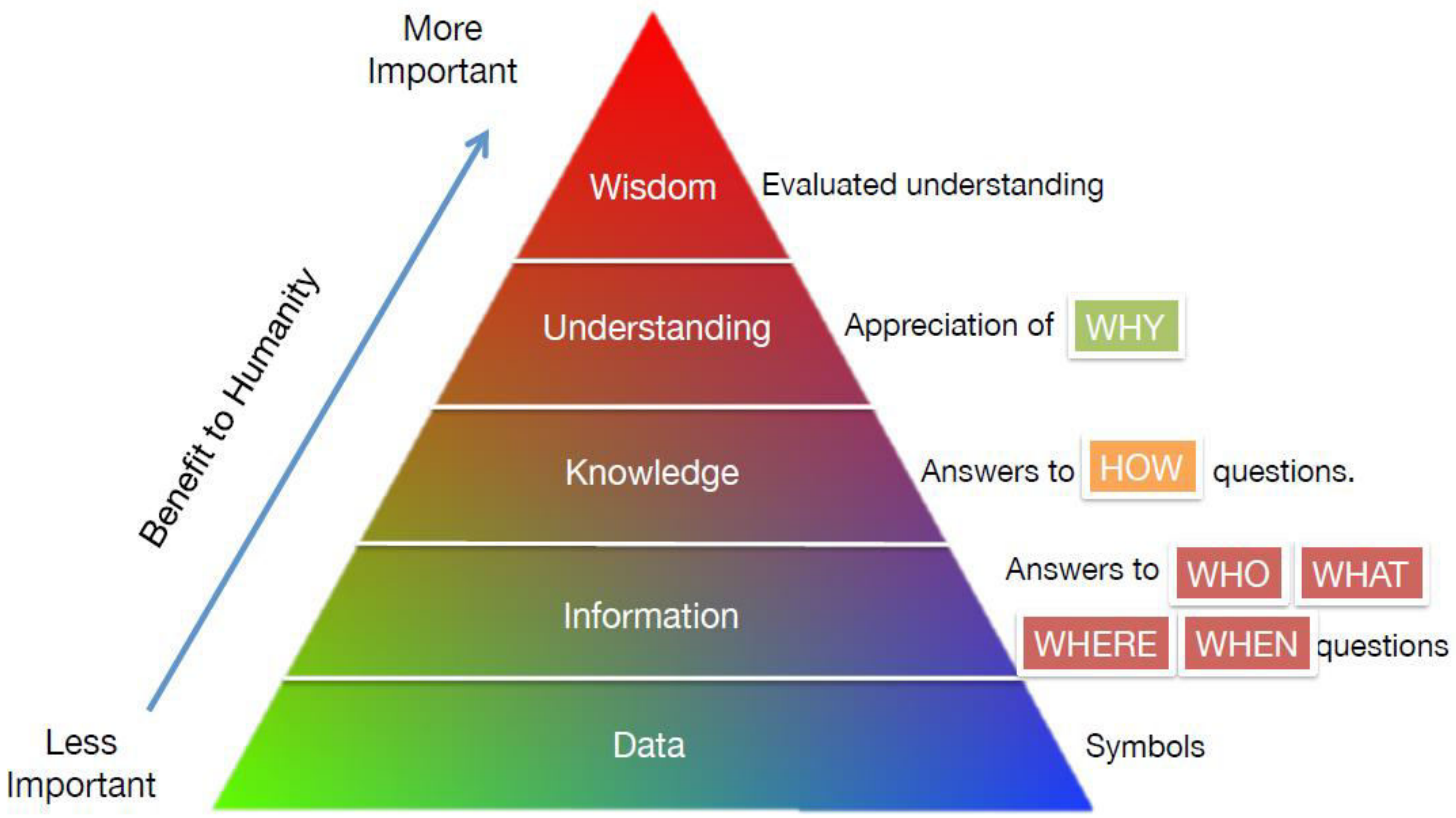
Kevin Ashton
Inventor of the term
“Internet of Things”

infor

infor

21TECH

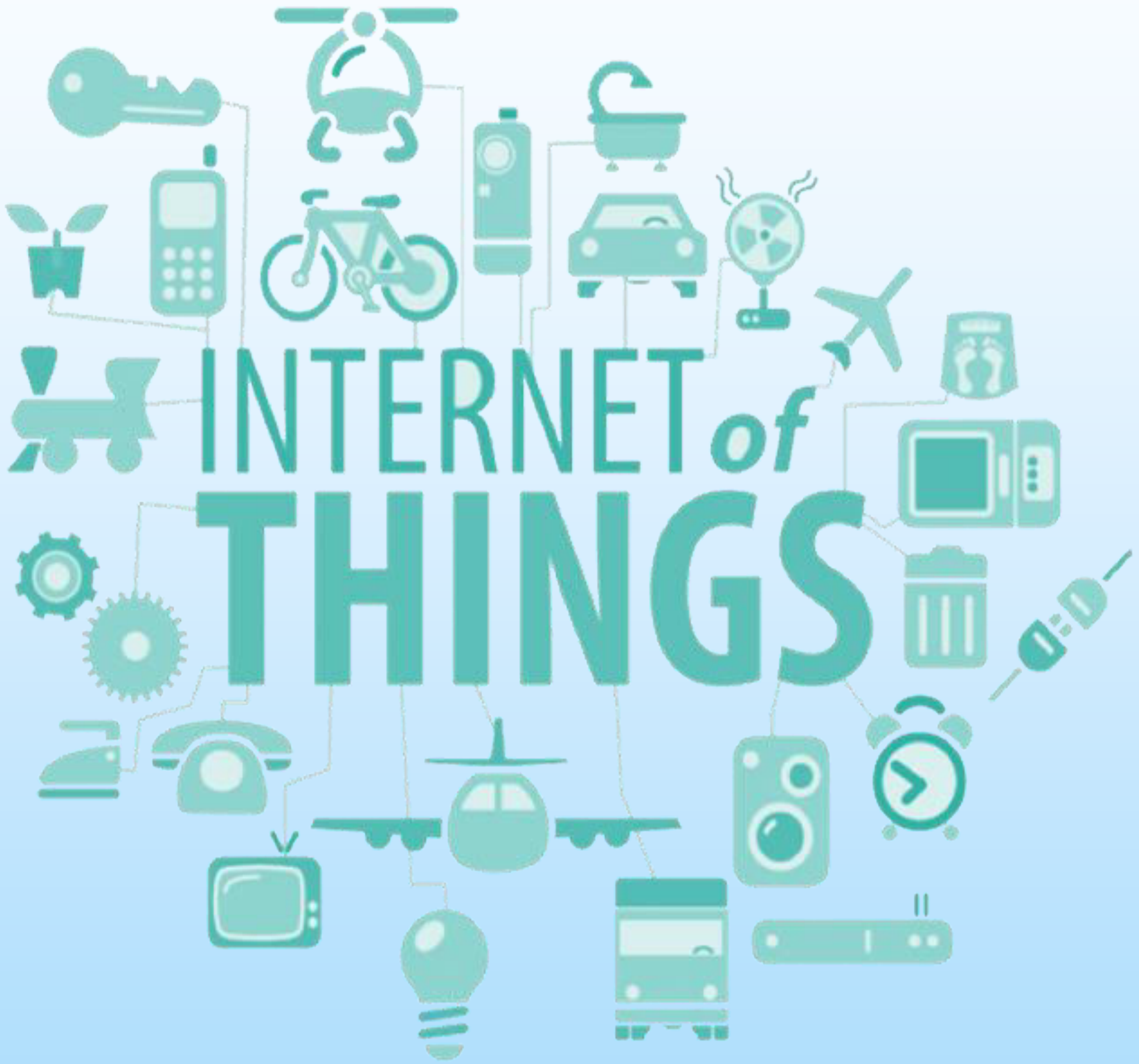
The Key Benefit of IoT -
Turning Data into Wisdom



The more data that is created, the better understanding and wisdom people can obtain.

Characteristics of IOT:

- Ordinary objects are instrumented
- Autonomic terminals are interconnected
- Pervasive services are intelligent



4 Major Layers:

- Object Sensing Layer
- Data Collection Layer
- Information Integration Layer
- Application Service Layer

Smart Cities

Why we focus on Cities

POPULATION EXPLOSION

TRANSPORTATION INFRASTRUCTURE

ENVIRONMENTAL CONSTRAINTS

PUBLIC SAFETY

ENERGY CONSTRAINTS

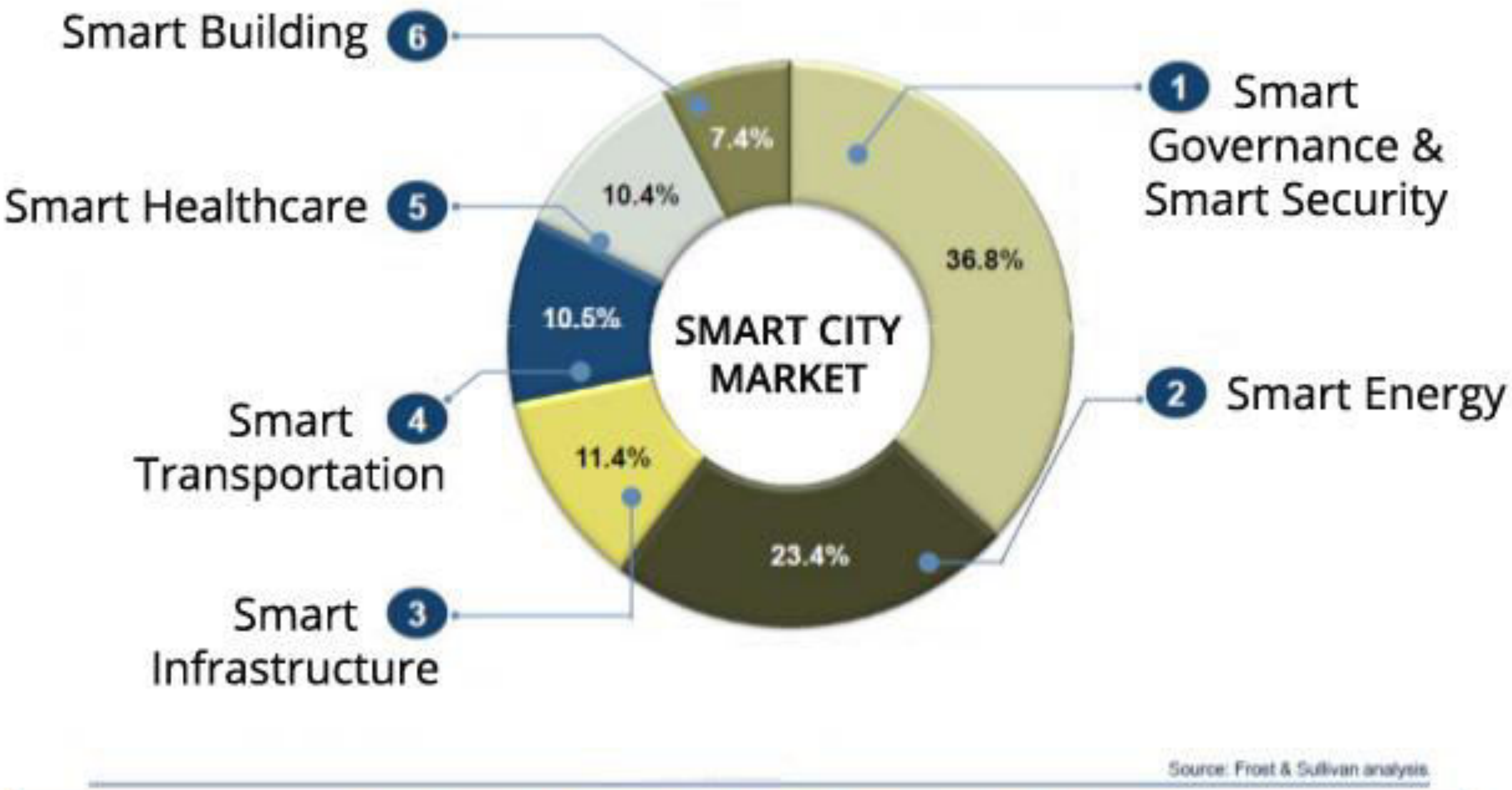
FOREFRONT OF GLOBAL INNOVATION

What is a SMART CITY?

A Smart City is about having sensor data that then gets used to create actions in a large scale over various applications

Transportation, waste management, law enforcement, buildings, governance, healthcare, and energy use to make them more efficient and improve the lives of citizens.

A BIG MARKET: 3.3 Trillion $ in 2025



Smart City Market by Segments, Global 2025

Technological Solutions for Smart Cities (1 of 2)

Smart Energy	• Smart Grid automation & flexible distribution • Smart Metering management • Renewable Integration & Micro Grid • Real time Smart Grid software
Smart Transportation	• Transportation sensors • Traffic management • Integrated Transportation • Real time Smart Grid software • Traveler information • Intelligent lighting
Smart Water	• Water Network management • Distribution management • Leak Detection • Storm Water & Urban Flooding management

Technological Solutions for Smart Cities (2 of 2)

Smart Buildings	• Energy efficiency • Security solutions provided by temperature & movement sensors • Connection to the Smart Grid • Centralized system for control of temperatures
Smart Communications	• Providing smart and green solutions in daily activities • Building an intelligent digital infrastructure for exchanging information, services, and applications between all municipal departments in various areas
Smart Networks	• Providing IT network services • ICT networks & fiber telecom infrastructure • IoT-ready wireless sensor network solutions

IOT MAKE SENSE WHEN YOU BLEND THE DATA

Creating New Compound Applications

By 2022, Gartner predicts that the IoT will save consumers and businesses $1T a year in maintenance, services, and consumables.

infor

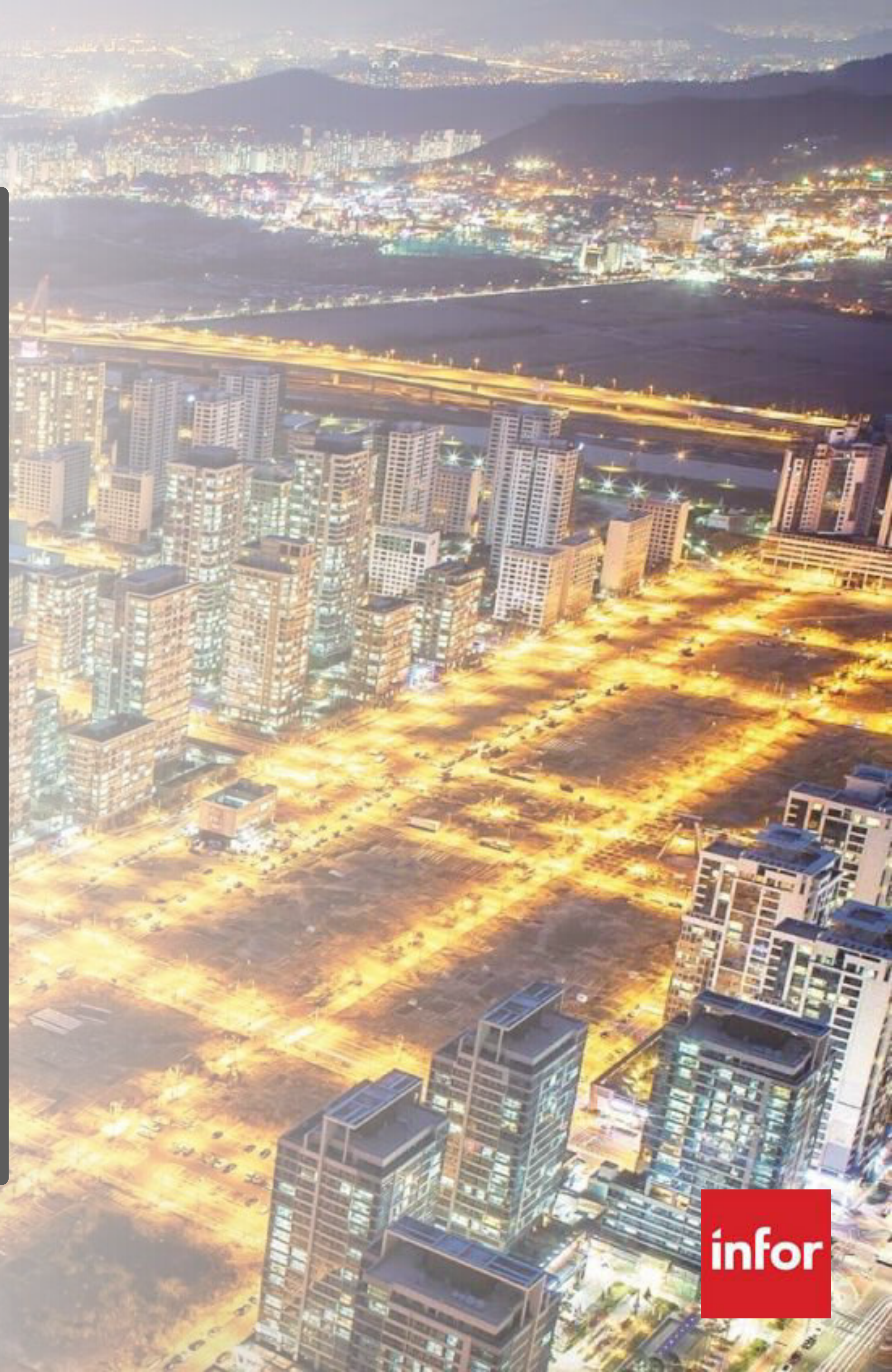
Case Studies

Intelligent Cities – Innovators

City	Smart Technology & Results
Amsterdam, Netherlands	Traffic reduction; energy conservation; improved security level
Stockholm, Sweden	Providing global fiber optic networks all over Stockholm
Fujisawa, Japan	Fully automated buildings; smart street lighting; smart meters; telepresence
Groening, Netherlands	Improvement of public transportation systems with real-time access to locations and schedules
Norfolk, England	Improvement of data delivery services, data collection, and system analysis for the
Hudson Yards, New York	Smart Soil, Air quality, Traffic, Pedestrian Flow, Environmental conditions, Rainwater collection and Smart Temperature Control
Vienna, Austria	Increasing energy efficiency and climate protection; reduction in carbon footprint
Plan IT Valley, Portugal	Deployment of 100,000,000 sensors
City of Tel-Aviv, Israel	Traffic Light Optimization, SLA Adherence and Warranty Recovery
Santa Cruz, California	Analyzing the information of criminal actions to predict the requirements of police and to find the maximum presence of police in needed regions
San Antonio, Texas	Streetlights adjust in stormy weather to improve visibility and reduce accidents

Case Study: Songdo, South Korea

- A $35 billion, 1,500-acre private real estate development
- The city has cut energy and water use by 30% compared to what a similarly sized city would use without smart features
- Significantly reduced operating costs by regulating electricity and water usage in buildings
- There are no wires (underground). There are no garbage trucks (pneumatic process underground).
- In homes, parents can connect to schools and talk to teachers through telepresence.



21TECH

infor

Case Study: Barcelona, Spain

Focusing on transportation, water, energy, & waste

- Smart Parking
- 19,500 smart meters that monitor and optimize energy consumption
- Smart bins that monitor waste levels and optimize collection routes
- Utilization of evaluative traffic flow information to design bus networks and smarter traffic
- 1,100 lampposts have been transitioned to LED
- Sense and control of park irrigation, monitoring rain and humidity

Results

- $60+ million on water savings
- $50+ million increase in parking revenues
- 47,000 new jobs
- $37 million in additional savings

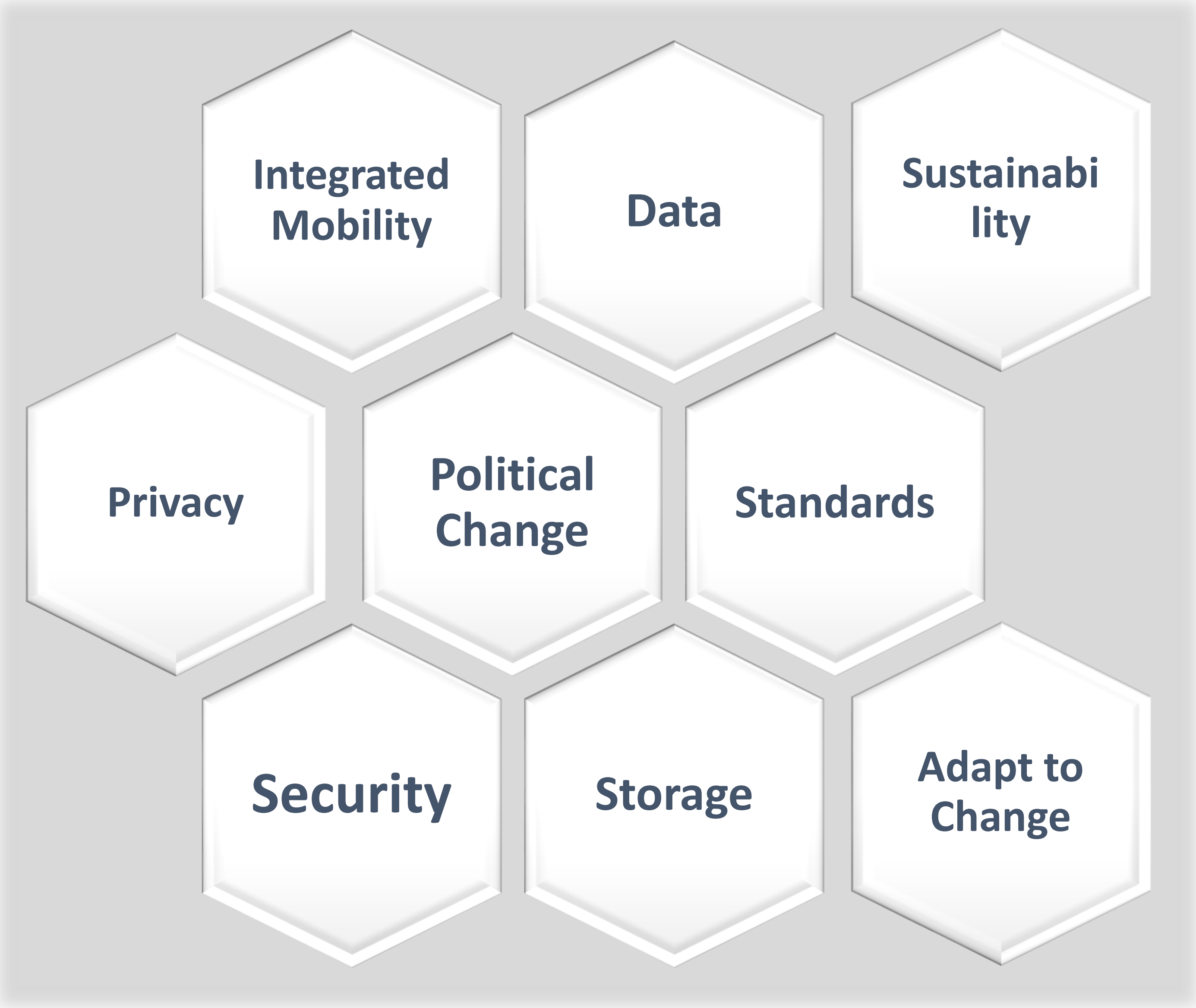
Case Study: Chicago, United States

- 20% more efficient in controlling the rodent population by using predictive analytics to determine which trash dumpsters are most likely to be full and attract more rats
- Installing 500 sensors throughout the city, providing the public with real-time, block-by-block environmental factors, such as traffic, air quality, temperature, and sound levels
- Imagine Project: 112 acres in Bronzeville to be turned into the first truly Smart City in the U.S., built from the ground up
- Tech Hub1871, Incubator for 500 IoT startups, hosts 1,000 events and 350 workshops annually

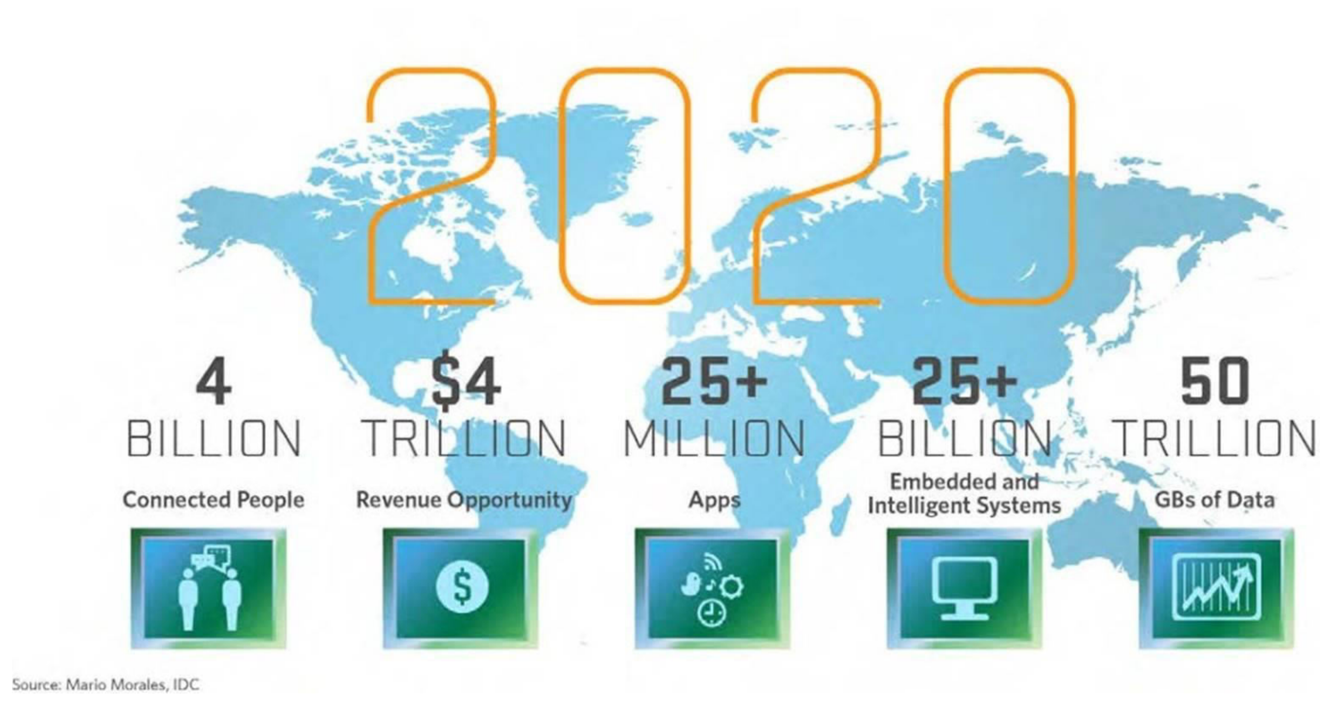
Challenges

IoT Challenges

- Massive Volume and Complexity
- Data Storage and Data Brokers
- Standardization
- Security and Privacy
- Integrated Mobility
- Adapting to Rapid Change
- 25 year EAM Sustainability Plan
- Need for Political Change Management



IoT Considerations – Regardless of Industry



New Data Sets

Move to Near Real Time Predictive Maintenance

Work Force and Change Management

Areas of Business Effected

- Supply Chain
- Distribution
- Assets
- Data Management
- Critical Management Driven Strategies

PREDICTIONS:

- There will be a large-scale IoT security breach.
- IoT will simultaneously shrink and enrich mobile moments.
- Big Data Analytics: 35 ZB of data by 2020
- Department of IoT
- And…

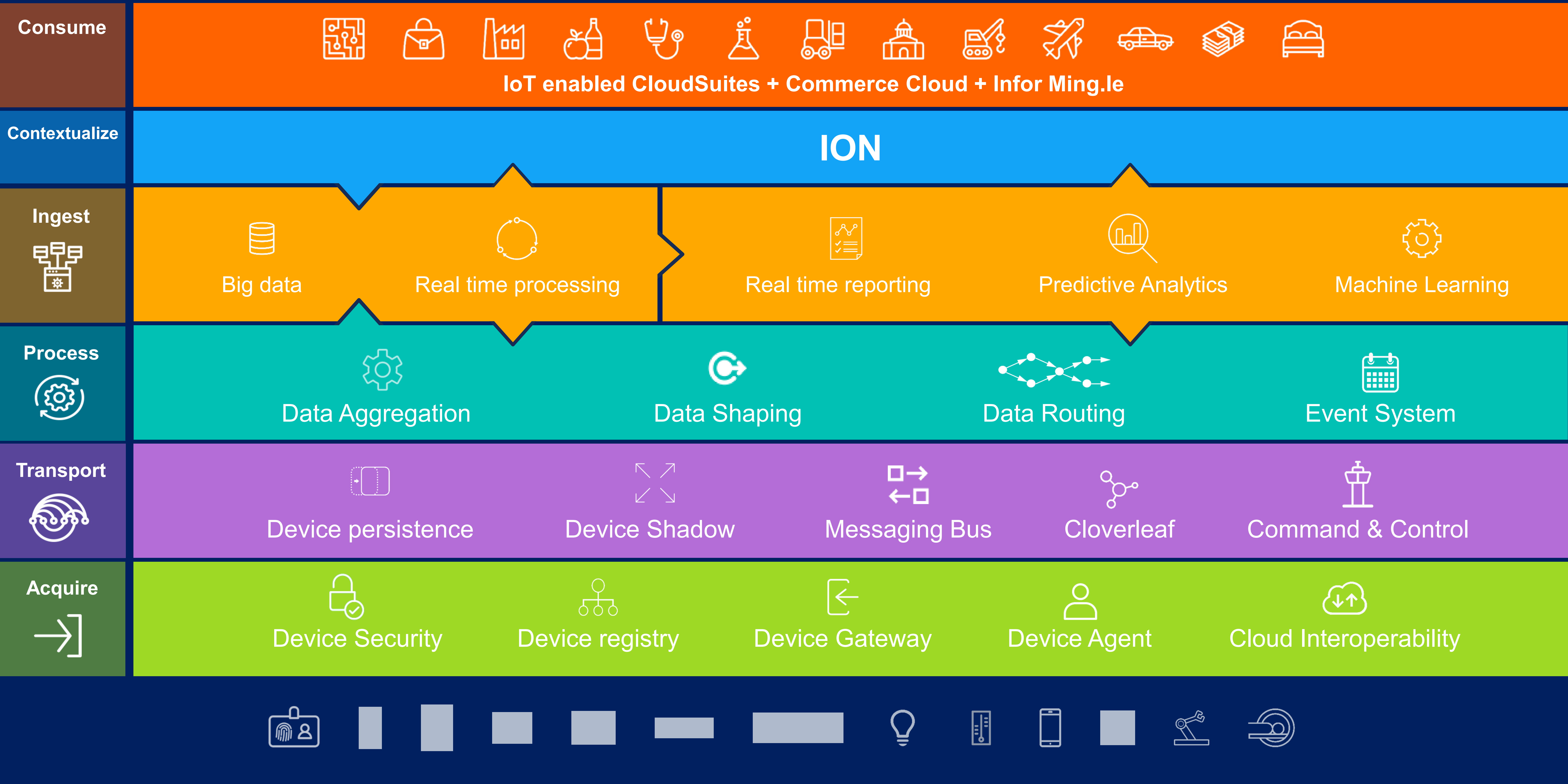
21TECH

infor

Internet of Brains: Brain-to-Brain Interface

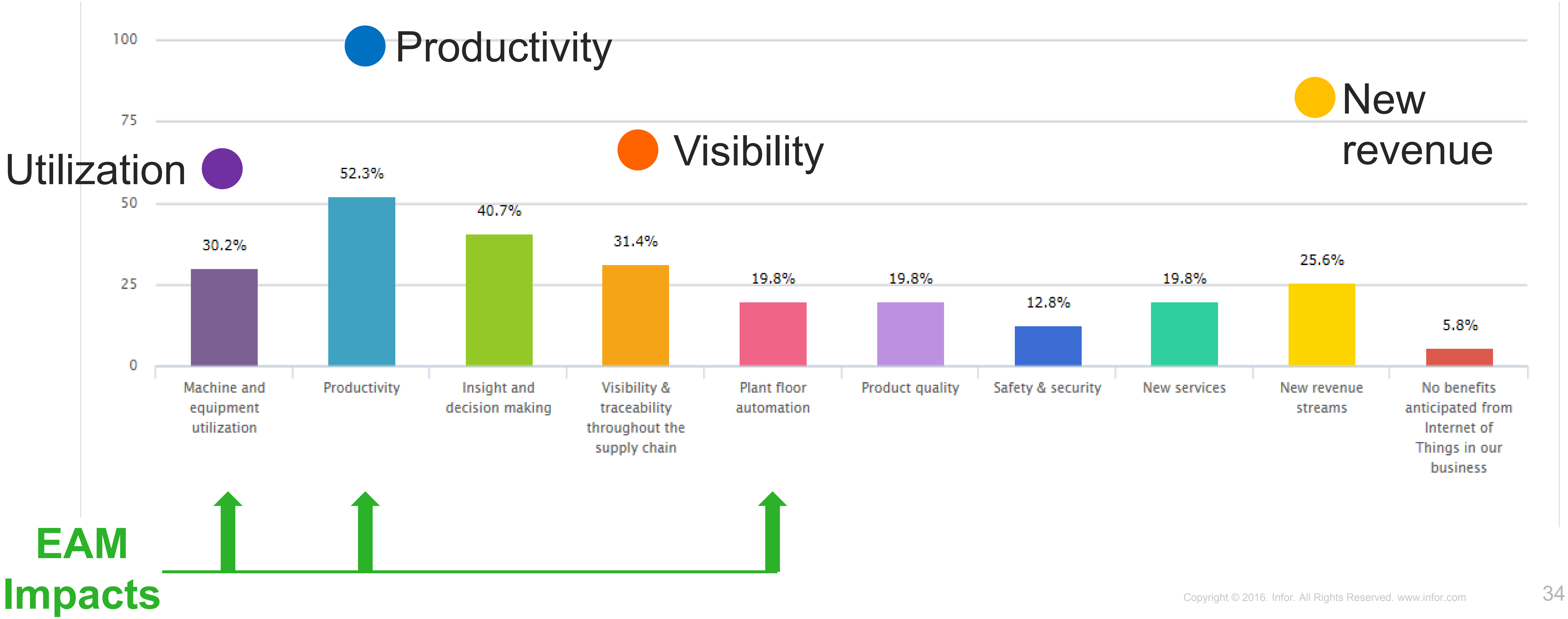

INTERNET OF THINGS
Only the TIP of an Iceberg
infor

Infor IoT — Architecture



Benefits

Where do you anticipate the biggest benefits of IoT in your business (select 3)?



IOT Elements

infor

IOT – Key Ingredients

People	• How are they identified? • How do they interact with data (near-real time)? • How do they consume the data (notifications, trends, alerts)?
Devices	• What are they? • How do they communicate with systems? • How are they managed?
Data	• What happens with data flowing in? • What happens when data needs to flow out? • How can data converted into business value (monetization)?

What qualifies as complete IOT use case?

There are many flavors but these four components are required

- Uniquely identifiable and connected things
- Data capture, contextualization and storage
- Analytics triggering automated responses
- Measurement and reporting of relative changes in performance

EAM related benefit areas

- Extend the use of successful product features, improve responsiveness to customer needs, reduce production costs, improve "design for" capabilities.
- Optimize maintenance schedules, monitor tooling locations, provide proactive repairs/replacement, reduce energy use, and reduce scrap.
- Improve space utilization, optimize energy use (HVAC, lighting), control employee access, manage alarms and security.
- Optimize service routes and schedules, manage repair parts and supplies, monitor product use and performance, provide proactive repairs, replacements and recalls.
- Optimize delivery routes, match shipments with demand patterns, maintain location visibility, trigger receivables, manage 3PLs, improve security, reduce claims.
- Improve scheduling, monitor capacity, balance production, improve quality, reduce scrap, optimize inventories, improve utilization of labor and machines.
- Optimize inventory levels by location, trigger 3rd party production capabilities, increase supply chain visibility, automate order placement and fulfillment.
- Respond more quickly to customer needs, match production with demand, capitalize on important product features, optimize pricing and promotions.

Manage and Maintain Assets

Return on Assets
Use case theme

Sense → Analyze → Intervene → Learn

Sense

Visual
Temperature
Vibration
Wear
Energy Consumption
.
.
.

Analyze

Maintenance History
Asset Specifications
Useful Life
Repair Parts/Spares
Resource Availability
Usage Schedule
.
.
.

Intervene

Alert Operators
Schedule Inspection
Order Parts
Schedule Maintenance
Reroute Production
Update Records
.
.
.

Learn

Asset Selection
Maintenance Planning
Operating Conditions
Training
ROI
.
.
.

Production Efficiency/Quality Use case theme

Sense → Analyze → Intervene → Learn

Sense

Throughput
Activity
Capacity
Utilization
.
.
.

Analyze

Material Availability
Orders
Production Plans
Resource Schedules
Maintenance Schedules
.
.
.

Intervene

Alert Operators
Adjust ATP
Adjust Schedules
Order Materials
Schedule Maintenance
Adjust Resource Schedules
Shift Production
.
.
.

Learn

Product Improvements
Production Flow
Production Optimization
Material Specifications
Operating Conditions
Training
.
.
.

Locate and Monitor Assets

Operational Efficiency Use case theme

Sense → Analyze → Intervene → Learn

Sense
Location
Consumption
Usage
Levels
.
.
.

Analyze
Orders
Production Plans
Resource Schedules
Maintenance Schedules
Usage History
.
.
.

Intervene
Alert Operators
Alert Controller
Adjust CTP/ATP
Adjust Production Schedules
Adjust Inventory Orders
Schedule Maintenance
Shift Production
.
.
.

Learn
Security
Process Design
Material Planning
Tooling Needs
Asset Planning
Training
.
.
.

infor

Product Performance Use case theme

Sense → Analyze → Intervene → Learn

Sense
Product Performance
Operating Environment
.
.
.

Analyze
Notices/Recalls
Contracts/SLAs
Maintenance History
Product Specifications
Repair Parts/Spares
Resource Availability
Customer Availability
.
.
.

Intervene
Alert Customer
Alert Service Manager
Schedule Service Call
Check/Order Service Parts
Identify Alternatives
.
.
.

Learn
Product Design
Process Design
Product Constraints
Service Planning
Training
.
.
.

This really works

infor

Business challenges

- To capitalize on the availability of American Recovery Act Funds for Energy Efficiency and Conservation block grants by reducing energy consumption, emissions and operating costs for critical equipment in the government infrastructure.

- Des Moines WRA has achieved a benefit level nearly ten times what was used to justify the project and the returns just keep on growing. To do this the city pulled data from Infor EAM, SCADA, Meters, and PLC’s to better understand how to operate and manage their equipment.

Solution – Infor EAM

Why Infor?

- Infor provided the expertise and systems required to manage an extended enterprise consisting a wide variety of equipment spread across a large metro area.

Profile

CITY OF DES MOINES

- As Iowa's capital city, Des Moines is a hub of government action, business activity and cultural affairs.

- With a Metro population of 569,633, Des Moines is a bustling metropolis.

- The community offers quality schools, superb public services, and friendly neighborhoods.

Predictive analytics – A research case

Infor $10x^3$ - Internet of Things

infor

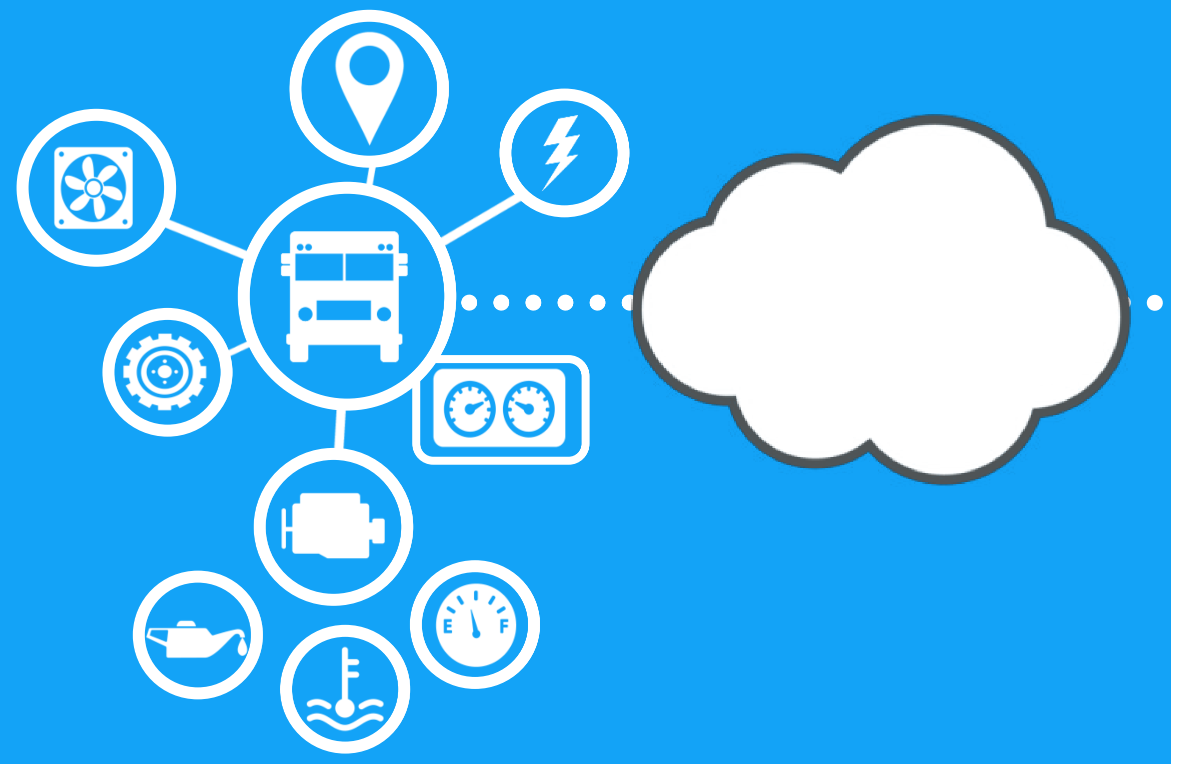
Traditional maintenance approach

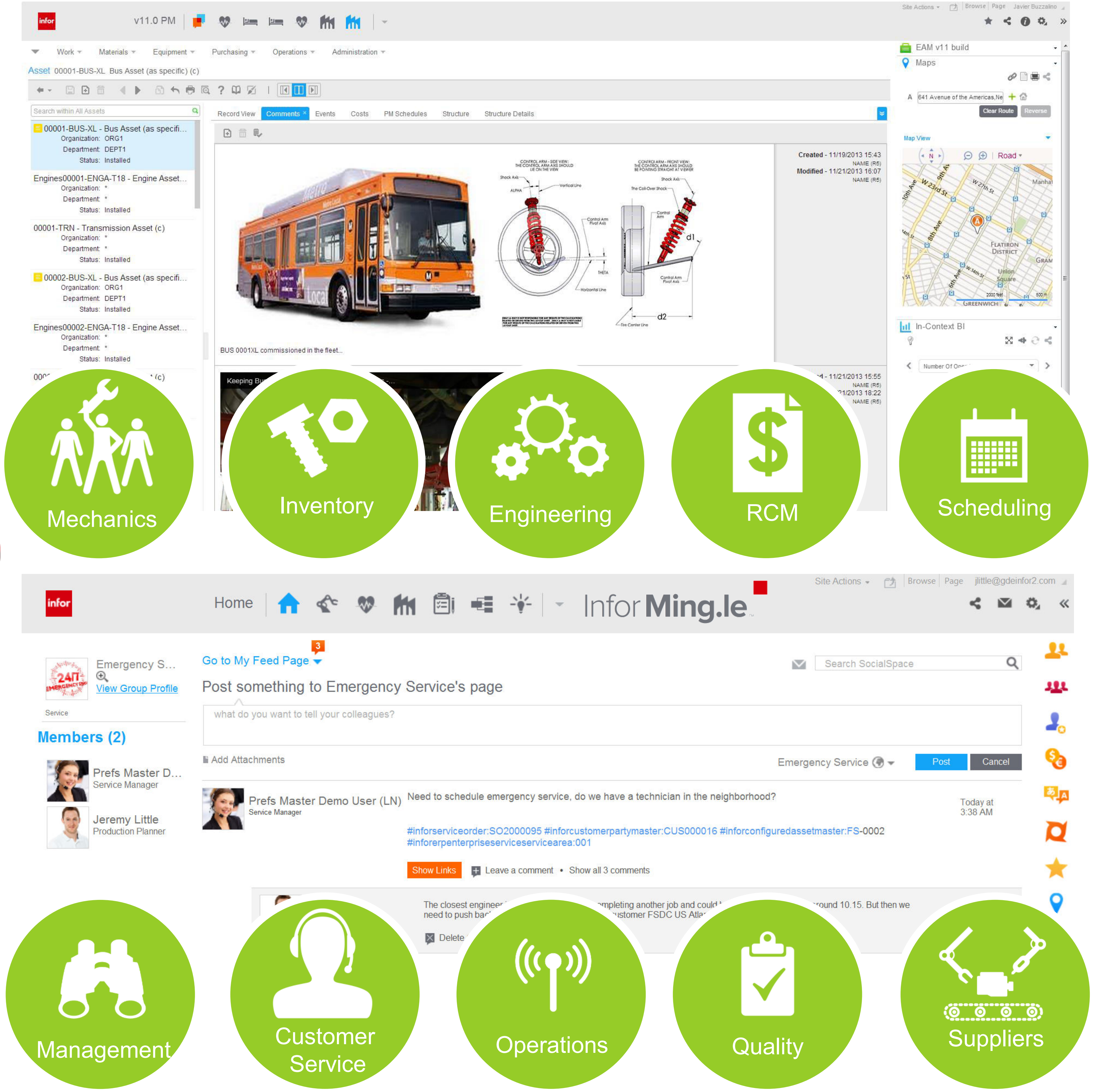
- Clients typically implement a maintenance strategy for their assets based on:
  - time-based maintenance schedules
  - usage based maintenance schedules (i.e.: vehicle mileage, hours of use, etc.)
  - maintenance patterns based on time and/or usage

A new approach…

- Current maintenance schedules, while effective as a whole, do not take into account parameters such as:
  - driving patterns (i.e.: frequency of stop-starts)
  - variance of environmental factors (i.e.: operating temperatures, routes)
  - vehicle telematics
- This variability leads to failures/ineffectiveness that cannot be accurately predicted with regular maintenance.

Can we develop a predictive algorithm, to determine imminent failure by correlating dependent data?

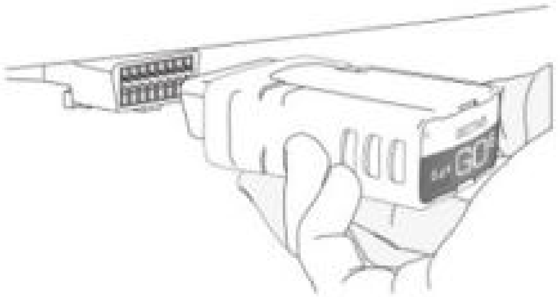




Real-time sensor collecting and analytics

Proof of Concept - Battery Predictive Model

- We developed a predictive algorithm, to determine when battery failure is imminent through correlation of dependent data
  - Cranking voltage pattern
  - Outside environment temperature
  - Driving duration (as the battery is recharged)
  - Frequency of stop-start activity (was the battery fully recharged)
- Vehicle telematics provide battery data related to pre-start, post-start and during the cranking activity or otherwise known as a battery cycle
- But in the process we realized we would collect a big dataset ! We need the right enabling technology !



Collected readings of 14 vehicles for 1 week

Row Labels	R40253	R40258	R40681	R40758	R40773	Z32234	Z32421	Z32542	Z32548	Z32549	Z32555	Z32686	Z33152	Z33155
Acceleration forward or braking	307	393	484		730	51	100	299	129	97	376	269	133	
Acceleration side to side	307	393	484		730	51	100	299	129	97	376	269	133	
Acceleration up down	307	393	484		730	51	100	299	129	97	376	269	133	
Accelerometer Calibrated (1=calibrated)						1		3		14		4		
Cranking Voltage	558	546	468	93	661	312	545	577	346	300	557	869	708	827
Device power change (1=powered)				1		2		6	1	28		8		2
Device Total Fuel	98	116	153	18	140	61	148	101	63	64	114	158	146	162
Device Total Idle Fuel	98	116	153	18	140	61	148	101	63	64	114	158	146	162
Driver Seatbelt (1=unbuckled)				1		75	203	159	99	84	188	269	210	179
Engine Coolant Temperature	179	180	297	48	287	53	229	196	101	116	198	234	209	222
Engine Speed	1219	1810	4707	274	2488	481	1970	4498	961	1157	1615	3964	1585	1593
Ford ISO Protocol Detected (1=detected)	49	58	76	8	70									
Fuel Level	8	9	16	5	18	6	11	28	10	43	6	42	20	23
Gear Position	40	28	60		68	14	36	21	56	40	60	40	32	
GO Device Voltage	306	406	501	51	409	114	338	275	147	183	324	399	415	402
Headlight Light Status (1=On)						1		3		12		4		1
Ignition	100	117	156	20	142	62	152	106	66	78	116	162	152	165
OBD\CAN 11BIT 500K Engine Protocol Detected	49	58	76	8	70	31	74	51	31	26	57	77	73	80
Odometer	98	116	142	17	140	42	142	99	56	55	114	144	142	146
Parking Brake (1=on)						1		2		9		4		1
Passenger Occupancy (1=occupied)				1		1		3		9		2		1
Passenger Seatbelt Violation(1=unbuckled)				1		1		3		9		2		1
PositionValid	2		34	6	4		58	36	6	26	4	22	6	28
Total Trip Fuel Used	49	58	77	10	70	29	74	51	31	37	57	80	73	81
Total Trip Idle Fuel Used	48	50	76	10	62	24	71	52	29	35	57	73	71	67
Vehicle Active	98	116	153	18	140	61	148	103	63	64	114	158	146	161
Grand Total	**3920**	**4963**	**8597**	**608**	**7099**	**1586**	**4647**	**7371**	**2516**	**2744**	**4823**	**7680**	**4533**	**4304**

average 4,670 readings per week and per vehicle

Expected telematics data volume

- 17,418 class 1-2 trucks
- 3,973 class 3-6 trucks

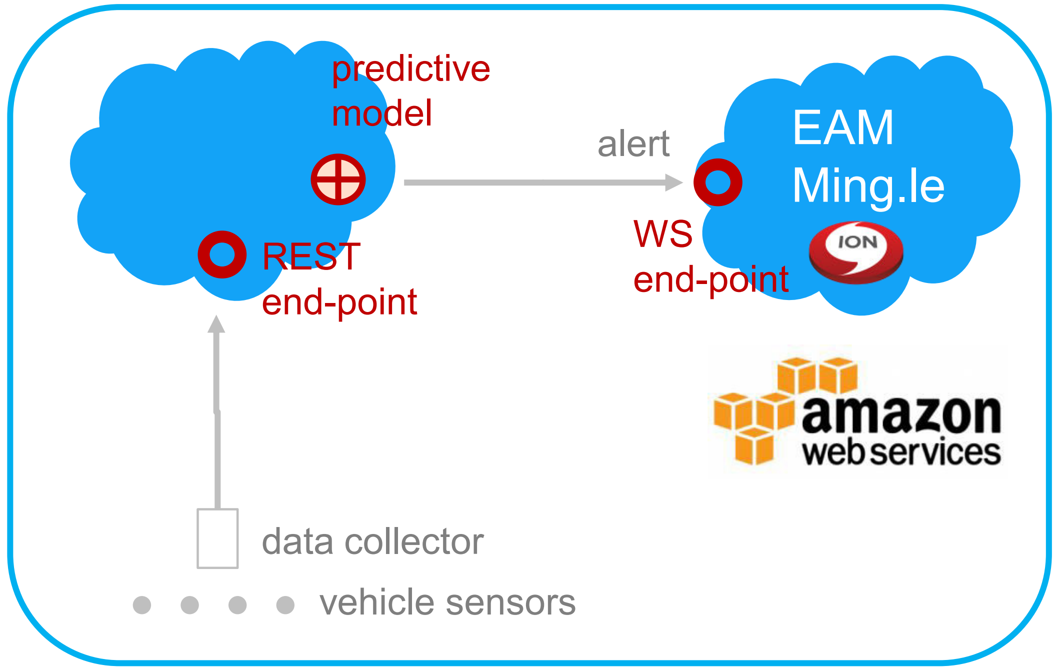
21,391 vehicles * 4,670 readings/week * 52 weeks/year * 3 years =

15.6 billion readings !!!

This data volumes would require Big Data analytics . . .

Proof of Concept: cloud architecture

Real time predictive analytics of telematics and device/sensor data



Pre-conditions:

- Repository in the Cloud
- Infor EAM, Infor Ming.le and Infor ION in the Cloud

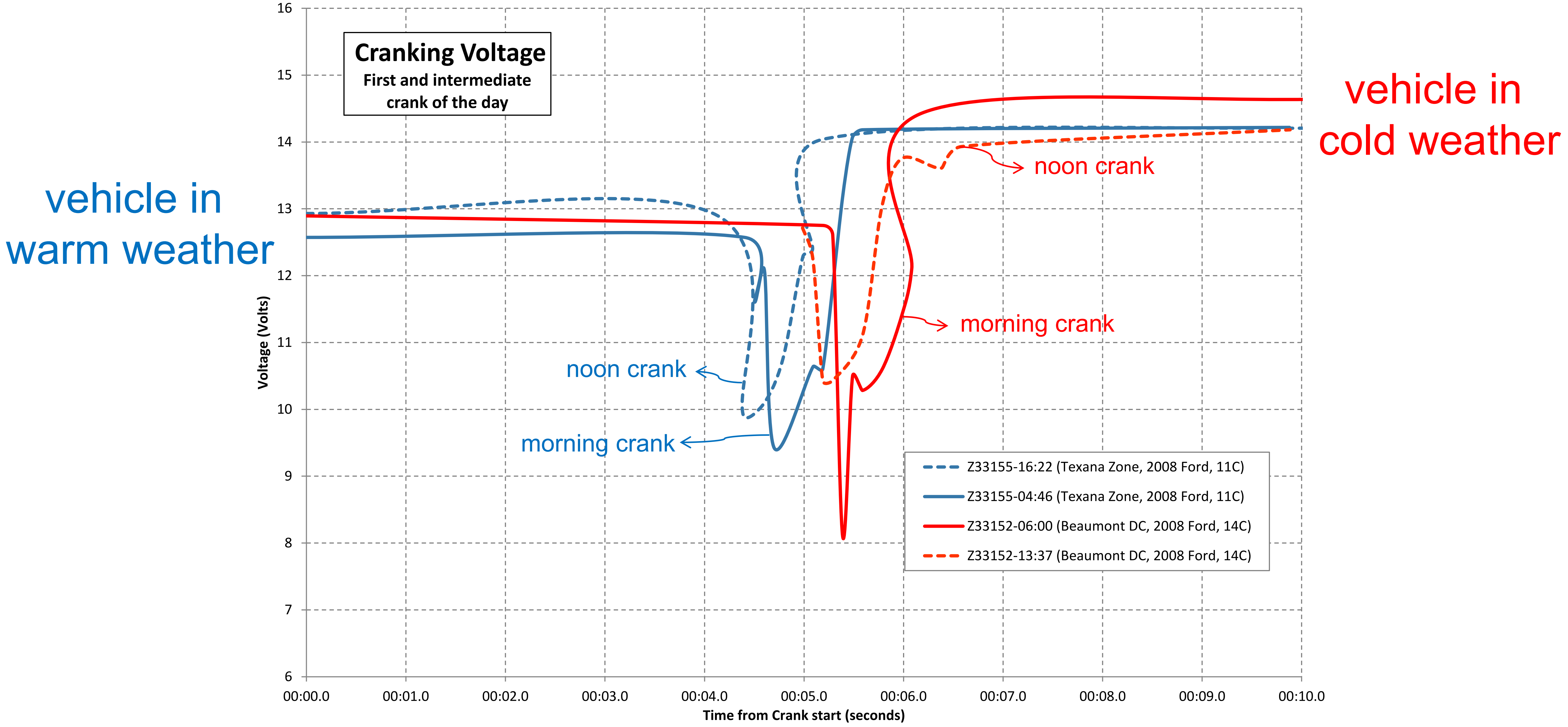
Process:

- Upload in real-time raw sensor data
- Using a predictive analytics library (PAL) we executed in real-time a battery life predictive model
- Model results generate alerts that are sent back to Infor EAM / Infor Ming.le via Infor ION

Use cases:

- Telematics engine sensor captures, on engine startup, the instantaneous battery voltage. Through an anomaly detection model, a weak battery is identified and alerted.
- Analysis of the battery cranking voltage, cross-referenced with vehicle stops and environmental factors (outside temperature) for increased effectiveness of the predictive model

Cranking voltage – Function pattern



infor