IEEE IoT Vertical & Topical Summit for Agriculture

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What Is the Internet of Things?

“The Internet of Things is the intelligent connectivity of physical devices driving massive gains in efficiency, business growth, and quality of life.”
IoT Is Here Now – and Growing!

The New Essential Infrastructure

Source: Cisco IBSG, 2011
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Smart Agriculture

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1. Based on 640+ publicly known enterprise IoT projects (not including consumer IoT projects e.g., Wearables, Smart Home) 2. Trend based on IoT Analytics’s Q2/2016 IoT Employment Statistics Tracker 3. Not including Consumer Smart Home Solutions  
Source: IoT Analytics 2016 Global overview of 640 enterprise IoT use cases (August 2016)
Big Data becomes Open Data for Customers, Consumers to Use

IoT Transforms Data into Wisdom

Wisdom (Scenario Planning)
Knowledge
Information
Data

More Important
Business Benefit
Less Important
But It Also Adds Complexity

APPLICATION AND BUSINESS INNOVATION

- Data Integration
- Big Data
- Analytics
- Control Systems
- Application Integration

Application Interfaces

IoT CONNECTIVITY PLATFORM

Infrastructure Interfaces

IoT SPECIFIC NETWORK ELEMENTS

Device and Sensor Innovation

Services

Cloud-based Threat Analysis / Protection

Network and Perimeter Security

Security

Physical Security

Device-level Security / Anti-tampering

End-to-End Data Encryption
Cisco IoT Architecture:
Secure IT & OT Convergence
What Industries Are We Focused On?

Manufacturing  Mining  Energy-Utility  Oil and Gas  Transportation  City  Defense  SP/M2M

REAL TIME  SCALE  BIG DATA/ANALYTICS  SECURITY
The Data Aggregation Challenge

500 Gigabytes
Data generated by an offshore oil rig weekly

10,000 Gigabytes
Data generated by a jet engine every 30 minutes

1.1 Billion
Data points generated by sensors daily

1000 Gigabytes
Data generated by an oil refinery daily

2.5 Billion Gigabytes
Data generated worldwide daily

90% of the world’s data
Has been created in the last 2 years!

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It’s a Game Changer in all technical domains

- Architecture
- Addressing
- Security
- RF Allocation / Planning
- Gateways
- Low Power
- Determinism
- Wireless

- Standardization
- Regulation
- Privacy
- Deployment models
- Sustainability
- Analytics
- Learning Machines
LPWA Low Power and Wide Area
IoT LoRa Architecture
Low Powered Wireless Access (LPWA) provides optimal economics for low bandwidth applications, but does have some competition.
LoRaWAN™ Use Cases Applicability

- Smart water/gas metering
- Public lighting
- Smart building
- Smart parking
- Assets Tracking
- Smart Agriculture, i.e. leak detection and irrigation
- Water level and flood management
- Fault management
- Security services, i.e. Smoke detectors
- Smart energy and fast demand response
- Waste management
- Traffic management

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Addressing and Gateways
Where are we?

IPv6 for the IOT is a must (same as radio technologies)
- ETSI ISG IP6 best practices documents
IPv6 up to the end device
- Close but not yet there
- IETF 6lowPan, 6lo, LPWAN, IPWave

Gateways will be your (our) next nightmare:
- Manageability (maintenance, configuration, deployment...)
- Energy consumption
- Security: Breaking end to end security, Network entry point.
Distributing Intelligence
Why Distributed Intelligence?

- Vast Amounts of Data
- Local Control Loops
- Detached Applications
- Expensive Bandwidth
- Low Cost of Edge Compute
- Scale

IoT CONNECTIVITY

Converged, Managed Network
Resilience at Scale
Security
Distributed Intelligence
Application Enablement
Traditional Computing Architecture

Terminal-Mainframe, Client-Server, Web

Data Centre/Cloud

Does not meet IOT requirements

Core Network

Endpoints
IoT and Fog Computing Architecture

Data Points, Variety & Velocity, Security, Resiliency, Latency

- **Hundreds**
  - Data Centre/Cloud
  - Hosting IoT Analytics

- **Thousands**
  - Backhaul
  - IP/MPLS, Sec., QoS, Multicast

- **Tens of Thousands to Millions**
  - Multi-Service Edge
  - 2G/3G/LTE/WiFi/RF Mesh/PLC
  - TSN: Time Sensitive Networks
  - 6TiSCH

- **Tens of Millions to Billions**
  - Embedded Systems & Sensors
  - Low power, low bandwidth

**Fog Network**

- Sensing
- Control
- Correlation

**Core Network**

- Transactional response times

**Data Centre/Cloud**

- Transactional response times

**Smart Objects**

- Millisecond /seconds response

**Backhaul**

- IP/MPLS, Sec., QoS, Multicast

**Data Centre/Cloud**

- Infinite

**Fog Network**

- GB-TB

**Core Network**

- TB-PB

**Data Centre/Cloud**

- KB-GB

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Need for more determinism
Industrial Intelligence Requires Evolution

DETERMINISM

"Non-Deterministic"  "More Deterministic"  "Very Deterministic"  "Strictly Deterministic"

REAL TIME

Gb/s, IEEE 1588 PTP, 802.11n, Low-latency, CleanAir, Very Fast Convergence (ms)

MANAGED

10/100Mbs, 802.11a/b/g, QoS, RSTP Fast Convergence (s), IGMP, Full-Duplex, Wireless Mesh

UNMANAGED

10Mb/s, Half-Duplex, slow convergence

Wired

Wireless

Relevant Innovations to Standard Networks

Safety-Critical
Closed-Loop Control, Motion
Input/Output
Information

INDUSTRIAL APPLICATIONS

DETERMINISTIC NETWORKING

10 Gb/s, Low Jitter, Precise Scheduling, Loss-less Convergence, Multi-path switching

Future

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Analytics
Analytics vs. Overall M2M connection ratio *

15M to 115M Analytics related connections*
Classical Monitoring only doubles
Analytics related M2M connections surge

* Source: ABI Research
Industrial Internet Application: OPEX reduction

Maintenance and operation represent 75% of the Total equipment cost

→ Deployment of Wireless sensors is seen as an efficient solution
key take away

IOT requires Innovation and new paradigms not only communications:
Distributed Intelligence
Intelligent Networks
Deterministic Networking
Analytics

...
Thanks You