Internet of Things – Cisco’s Vision & Approach

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What is IoT?

Leveraging Machine Generated Data for Business Benefit
It Always Starts with a Business Problem…

- Real-time Quality Detection
- Preventative Maintenance
- Personnel Safety
- Remote Monitoring
- OEE (Overall Equipment Efficiency)
- Condition-Based Maintenance
- Asset Tracking & Management
The Essence of an IoT Project

1. Capture the device generated data
2. Move it to where it is needed
3. Transform it to suit the target
4. Deliver it to meet the consumer’s needs
5. Reliably and securely
6. With high performance, despite the immense volume of data
Leveraging Machine Generated Data and Networking for Business Benefit

The Network has become The Platform

The Basic Issues
- Capturing data from the devices
- Moving it reliably across the network
- Converting data into information
- Delivering it to the right consumers
Industry’s Most Comprehensive IoT Network/Computing Hardware

**Field Area Network (Wi-SUN)**
- AMI smart metering
- Distribution automation
- Street lighting
- O&G wellhead monitoring
- Water/wastewater

![CGR1000](image1)
![IR500](image2)

**Fleet Vehicles Mass Transit**
- Automated Vehicle Location tracking, Data Uploaded in Seconds with 4G / LTE
- Handles Multiple Wireless Laptops, Smartphones, Tablets Simultaneously

![IR829](image3)
![IE4000](image4)

**Remote Asset Monitoring**
- Pipeline monitoring
- Roadside infrastructure
- Distribution automation
- ATMs
- Digital Signage

![IR809](image5)
![IE4000](image6)

**Premium Mobile Broadband (PMB)**
- Public safety and security CPE

![IR829](image7)
![IR809](image8)

**Low Power Long Range Wireless (LPWA – LoRA)**
- SP IoT Infrastructures
- Battery powered sensors
- Environmental monitoring
- Smart Cities, parking, and Agriculture
- SP cell tower monitoring

![IR910](image9)

IR8x9 + LoRA Modem (future)
Common IoT Edge Software Hosts

**Broad Connectivity**
- Ethernet
- Cellular 3G, 4G LTE
- Wi-Fi
- LoRaWAN

**Pervasive Security**
- HW Accelerated Encryption
- IPSec VPN
- 802.1x
- Firewall
- Identity Services

**Industrial Grade**
- Ruggedized for shock / vibration, humidity, temperature, dust
- DC power supplies

**Policy-based Management**
- Centralized control
- Network
- Security
- Fog applications
IOx: Enabling Network devices as IoT Gateways
Transforms Network Appliances into Microservices Hosting Infrastructure

Single Framework for Distributed Microservices

- Uniform
- Remote Manage
- Secure
- Remote Deploy
The Total Cisco IoT System

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Why Compute at the Edge?

- There may not be enough network bandwidth
- Most of the data is not interesting
- The use of data may be at the edge
- Computation can be optimized for some purposes
- Data normalization
- Data redirection based on the content of the data
- Data time stamping for later forensic analytics

- Data Reduction
- Filtering
- Latency Optimization
- Partitioning
- Application Simplification
- Dynamic Changes
- Analytic Support
The Edge and Fog “Fabric”

1. Device
   - Filter / Evaluate Data
   - Communicate with Device

2. Edge Node
   - Communicate with Device
   - Transform to a canonical format
   - Format for a specific target

3. Fog Node
   - Store as Time / Series Data
   - Transform to a canonical format
   - Format for a specific target

4. Data Center
   - Format for a specific target
   - Integrate with IT
   - Pass to Kafka

5. Cloud
   - Integrate with IT
   - Pass to Kafka
“Edge & Fog Fabric”: A Smarter Network

Enabling Apps & Creating Business Results

Computing Fabric

IP Network

Microservices Run in Software Routers, UCS, Data Center, Cloud
The Total Cisco IoT System

Implementation Methodology

Remote Provisioning & Management

Data Pipeline

Edge & Fog Computation

Network Equipment Software Environment

Network / Computing Hardware
Methodology

1. Device: Many interfaces, protocols, data formats

2. Edge Node: Converge to a common protocol

3. Fog Node: Converge to a common data format

4. Data Center: Converge to a common location

5. Cloud: Converge to a single common global interface
An Open System

Microservices (Develop or Buy)

- Time-Series Historian Database (ParStream)
- Correlation
- Aggregation
- Filtering
- Event Stream Processing
- Machine Learning
- Access & Integration (CIS)
- Analytics

Device or Controller
- Generating Data

Edge Node
- Capturing Data

Fog Node
- Aggregating Data

Data Center
- Leveraging Data

Cloud
- Analyzing Data
IoT Case Studies