SP IoT Overview

Patrice Nivaggioli
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https://developer.cisco.com
http://newnet.telecom-paristech.fr/
Agenda

Cisco SP IoT Architecture
SP IOT Access
Fog Networking
SP IOT Platforms and Applications
Summary
Cisco SP IoT Architecture
### SP IoT Reference Framework

**IoT World Forum SP Working Group**

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<th>Applications</th>
<th>Data Storage</th>
<th>Data Management</th>
<th>Data Virtualization</th>
<th>Data Analytics</th>
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<td>Connection Management</td>
<td>Fog Management</td>
<td>Cloud Management</td>
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<tr>
<td><strong>Cloud Platform</strong></td>
<td>Private, Public, and Hybrid IaaS/PaaS</td>
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<tr>
<td><strong>Fog Platform</strong></td>
<td>Fog Agent</td>
<td>Fog Apps</td>
<td>Fog Analytics</td>
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<td><strong>SP Managed Services</strong></td>
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**Edge**

**Things and Sensors**

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Cisco SP IoT System Architecture
Secure, convergence, scale with fog, validated architecture & solutions

VERTICAL SOLUTIONS
- Transportation
- Oil and Gas
- Manufacturing
- Entertainment
- City
- Defense
- Utility
- Public Safety

APPLICATIONS
- Application Enablement Platform (Data aggregation/normalization, Analytics, Service Creation)
- Connectivity Management Platform (include control and bearer planes)
- Fog Services Layer
- LTE
- Wi-Fi
- IoT Connectivity
- LPWA (LoRa, NB-IOT)

ECOSYSTEM
- Connectivity Management Platform
- Security
- Automation
- Cloud
- Edge
- IoT
- Security
- Systems

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Cisco IoT Products Portfolio

Industrial Switching
IE 2K, 3K, 4K, 5K, CGS

Substation Routing
ASR 902/903, CGR 2000

Embedded Networks
ESS, 5900 ESR 5921 SW ESR

Network Management
FND, IOT-DM, IOK, IOX/Fog Director

Industrial Wireless
AP 1552, IW 3700 Manufacturing WBG/AP Mobile IP GW

Field Network Mobile Routing
819H, IR 809/829, IR 509, IR 910, CGR 1000

Industrial Security
ISA 3000
SP IOT Access
Cellular & WiFi not Suitable for Constrained Devices

Many sensors are low cost, low power, constrained devices

- Battery/solar/scavenger energy
- Wireless
- Low CPU
- Autonomous
- Huge scale

New type of network is required
Low Power Wide Area (LPWA)
Cisco LoRa End-to-End Solution

**IP Backhaul Subsystem**
- Field Network Director
- AAA/CA
- VPN Connectivity

**LoRa Control Subsystem**
- App Connector
- App Connector
- LoRa App Router
- LoRa Network Server

**SP Play**
- e.g. Smart City

**Vertical Play**
- e.g. Public LoRa Network
- Private LoRa Network
- LoRa Gateway
- Unlicensed ISM Radio
- LoRa Endpoints

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Low Power Use Cases

- Smart metering
- Street lighting
- Smart building
- Smart parking
- Tracking
- Leak detection & irrigation
- Water level & flood management
- Smart Farming
- Smoke detectors
- Smart energy & fast demand response
- Waste management
- Traffic management
LoRa Sample Use Cases
Proximus Deployment

Food Control

Airport asset tracking

Smart Parking

Facility management
<table>
<thead>
<tr>
<th>Technology</th>
<th>2G</th>
<th>3G</th>
<th>LTE</th>
<th>WiFi</th>
<th>Zigbee</th>
<th>Wireless Hart</th>
<th>802.15.4g</th>
<th>LPWA (LoRa, Ingenu, SigFox, etc.)</th>
<th>NB-IoT EC-GSM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range</td>
<td>Long</td>
<td>Long</td>
<td>Long</td>
<td>Limited (&lt;200m)</td>
<td>Short</td>
<td>Limited (&lt;250m)</td>
<td>Limited (&lt;1 km)</td>
<td>Long</td>
<td>Long &gt;10 km (rural) &gt;1 km (urban)</td>
</tr>
<tr>
<td>Topology</td>
<td>P2P</td>
<td>P2P</td>
<td>P2P</td>
<td>P2P/Mesh</td>
<td>Mesh</td>
<td>Mesh</td>
<td>Mesh</td>
<td>P2P</td>
<td>P2P</td>
</tr>
<tr>
<td>Tx Current Consumption (3V)</td>
<td>30mA to 400mA</td>
<td>500 to 1000mA</td>
<td>600 to 1100 mA</td>
<td>19 to 400 mA</td>
<td>34mA</td>
<td>28mA</td>
<td>~ 35mA</td>
<td>&lt;20 mA</td>
<td></td>
</tr>
<tr>
<td>Standby Current Consumption (3V)</td>
<td>0.35 mA</td>
<td>1.2 to 3.5mA</td>
<td>1.5 to 5.5mA</td>
<td>1.1 mA</td>
<td>0.003mA</td>
<td>0.008mA</td>
<td>~.005mA</td>
<td>&lt;0.005mA</td>
<td></td>
</tr>
<tr>
<td>Energy Harvesting</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Possible</td>
<td>Possible</td>
<td>Possible</td>
<td>Possible</td>
<td>Possible</td>
</tr>
<tr>
<td>Operating Life on battery (2000mAh)</td>
<td>4-8 h (A) 36 d (I)</td>
<td>2-4 h (A) 20 d (I)</td>
<td>2-3 h (A) 12 d (I)</td>
<td>4-8 h (A) 50 h (I)</td>
<td>60 h (A)</td>
<td>8-10 years</td>
<td>Variable</td>
<td>10-20 years</td>
<td></td>
</tr>
<tr>
<td>Module Cost (est.)</td>
<td>$12</td>
<td>$35-$50</td>
<td>$40-$80</td>
<td>$5-$8</td>
<td>$6-$12</td>
<td>NC</td>
<td>$3</td>
<td>$5</td>
<td>?</td>
</tr>
</tbody>
</table>
A FULL LTE NETWORK RUNNING ON BATTERIES!

PMB Tactical LTE

- EPC, vPC from Cisco
- eNodeB and Server from Klas Telecom
- Cisco CSR1000v virtual router
- Netnumber TITAN HSS
- Thales Nexium Wireless MC-PTT
Fog Networking
Case Study:

7,000 wells x 1,000,000,000 bytes/day/well = 7,000,000,000,000 bytes/day (over a 3G network bandwidth)

- **Edge Processing**
  - 7,000 Oil Wells

- **Fog Processing**
  - 300 Platforms

- **Data Center**

- **IT Central**
Cisco Data-In-Motion (DMo) – fog supported analytics and data management

- **Real-time**
  - Analytics
  - Visualisation
  - Filter to process data locally
  - Remaining pass to cloud

- **Transitional**
  - Business Intelligence
  - Dashboards
  - KPIs

- **Response**
  - CISCO
  - milliSec/Seconds

- **Storage**
  - Transient
  - Semi-Permanent
  - Months/Years

- **Control Loop**
  - Sensors
  - Control/Actuation

- **Globalization**
  - In time and in space

- **Localization**

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## Extending the Cloud to the Things

**FOG COMPUTING**

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<th>WHAT IS IT</th>
<th>CISCO VISION</th>
<th>CISCO PORTFOLIO</th>
<th>ECOSYSTEM PARTNERS</th>
<th>HARDENED COMPUTE</th>
</tr>
</thead>
</table>
| Fog Infrastructure for Running Apps Close to Things | Rich Service Capabilities: APIs | | | |}

**FOG COMPUTING**

- **APIs**: IOx
- **Platforms**: CGR, 8X9 Series

**ECOSYSTEM PARTNERS**

- GE
- SK Solutions
- Itron
- OSIsoft

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IOx and Fog Capabilities Progress

Platforms at the Network Edge

Application Management

IOS

Operating Systems

- Distributed Applications
- IOx SDK and Fog Services

Embedded Compute
Embedded Storage
Accessible Interfaces
Cisco Fog Director

IOx Application Management Module
• Simplified application lifecycle management
• Stand Alone UI or may be integrated into 3rd party applications
• restful APIs

Understand your IOx resources
• Tracks IOx resource utilization (CPU, Memory, BW)
• Display per application and per device historical trends
• Establish per application status frequency from the onboard agent

IOx Application Rollout
• Stage the application image within the local application catalog
• Identify target devices directly or via sites, etc.
• Detailed application rollout tracking
SP IOT Platforms and Applications
Multi-access core with unified policy, charging and service capability layer.
Additional capabilities – analytics, data exposure provide monetization opportunities
Network Service Capabilities (NSC) based on ETSI framework exposes various network capabilities to the applications and includes adapters for different access types (Cat-M, NB-IOT, LTE-M, LPWA)
Connected Asset Management for Cell Sites

What Operations Needs To Know

- Diesel availability/theft
- Battery availability – potential to fail
- Position change of antennas
- Copper theft
- Perimeter breech
- Who entered and when in/out
- Alarm status
- Temperature and Humidity – in/out
- Cell throughput/signal
- Damage to facility – e.g. flooding
- Tenant specific Energy consumption
- Optimal source of energy
Cisco Solution for Fleet Management
System Architecture

**Cisco Service Delivery Platform**
- Provisioning Interface
- ZTP Workflow
- Vehicle Tracking
- Route Replay
- Vehicle Management
- ETA Interface
- Geo Fencing
- Telematics Interface

**Cisco Video Surveillance Manager**
- On-board Cisco Video Surveillance Media Server
- Video recording and storage based on event triggers
- Video offload via Wi-Fi in maintenance yard

**Vehicle Logic Unit**
- IE4K/2K
- IR829
- Cisco IP Cameras
- Ruggedized Server

**Mobile Operator Network**
- Cisco vPC
- Yard Wi-Fi Network

**Operations and Control Center**
- 5GHz Wi-Fi

**Mobile Devices**
- 2.4GHz Wi-Fi

**Cisco Solution for Fleet Management System Architecture**

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Cisco Automation and Integration Platform (AIP)
Expose, Compose and Govern across organizations

EXPOSE
Catalog of assets exposed securely as services via APIs and portals

COMPOSE
Create new apps and processes by connecting applications, data and users

GOVERN
Policy-based access and control via fully federated single sign-on, ID mgmt, and APIs
The Platform Enables Multiple Smart City Use Cases

- Citizen Engagement App
- Parking Enforcement App

Citizen Applications

- Operation Center
- City Dashboard

Urban Services Applications

Cisco City Digital Platform

Intercloud

Parked Parking

Lighting

Traffic

Others

Smart City Network

- Cisco GW with IoX
- Parking Sensor with ZigBee
- Smart Lights and Multi-Sensing Nodes
- Parking Sensor with LoRa Module
- Traffic
- Traffic

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Summary
VERTICAL SOLUTIONS
- Transportation
- Oil and Gas
- Manufacturing
- Service Providers
- City
- Defense
- Utility
- Public Safety

ECOSYSTEM
- OSIsoft
- BITSEW
- ALSTOM
- BOMBARDIER
- SK GROUP
- Rockwell Automation
- Itron
- Honeywell
- TP Networks
- Davra

APPLICATIONS
- Analytics & Automation
  - Connected Streaming Analytics, Enterprise Mobility Services Platform, Cisco Data Virtualization
- Application Enablement & Data Mgmt
  - Cisco AIP, CDP (Smart Cities), other 3rd party AEPs (Davra, Telit, etc.)
- IoT Data Path Management
  - Cisco/Jasper CC, Actility ThingPark (LoRa), others
- Fog/Edge Services
  - Fog Director, IOX, Cisco Asset Management, Cisco Connected Analytics
- IOT Connectivity
  - Industrial Routing/Switching, LoRa, 3GPP, WiFi, PMB