IoT/IoE Products and Solution from Cisco

Axel Dittmann
Consulting Systems Engineer IoT
Diplom-Betriebswirt (FH)
Diplom-Wirtschaftsinformatiker (FH)
Cisco IoT – in O’ahu, Hawaii ?
Cisco IoT in O’ahu, Hawaii !
**IoT: Cisco Aironet Outdoor Access Points**

*Industry's Best 802.11n & 802.11ac Series*

---

**Base**

**1530**

- Low Profile, Low Price
- Europe: Low Profile
- Emerging SP: Low Price
- Enterprise: Low profile & Price
- 11n, 2G: 3x3:3; 5G: 2x3:2
- In/External Antennas

---

**High-Functionality**

**1550**

- High functionality
- Enterprise, MSO
- DOCSIS3.0 8x4
- 11n, 2x3:2
- In/External Antennas

---

**Best in Class**

**1570**

- High-end Enterprise, MSO
- 11ac, 4x4:3
- NG-Cable: 24x8
- In/External Antennas
- Modular: Future proof
Development of Industrial Protocols

<table>
<thead>
<tr>
<th>Year</th>
<th>Market Share</th>
<th>Annual Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>1975</td>
<td>Feldbusse 66%</td>
<td>7%</td>
</tr>
<tr>
<td></td>
<td>Ethernet 34%</td>
<td>17%</td>
</tr>
</tbody>
</table>

Quelle: http://www.feldbusse.de/Trends/trends.shtml
Industrial Intelligence Requires Evolution

Relevant Innovations to Standard Networks

- **UNMANAGED**
  - 10Mb/s, Half-Duplex, slow convergence

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

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

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

**DETERMINISM**

- “Non-Deterministic”
- “More Deterministic”
- “Very Deterministic”
- “Strictly Deterministic”

**INDUSTRIAL APPLICATIONS**

- Safety-Critical
- Closed-Loop Control, Motion
- Input/Output
- Wireless, Wired

**Future**

Future developments in industrial networks will focus on time-synchronized, real-time applications with low latency and precise scheduling.
Industrial Network Convergence

Traditional – 3 Tier Industrial Network Model

Converged Plantwide Ethernet Industrial Network Model
Convergence Driving Adoption of IoT

Less Waste, More Efficiency, More Cost Savings
Constant Improvements in Productivity
Enhanced, Personalized Experiences
Networking Best Practices – Cell/Area Zone

Best Practices For Reducing Latency and Jitter, and to Increase Data Availability, Integrity and Security

- IP Multicast Control
  - IGMP Management
- Segmentation
  - Virtual LANs (VLANs)
- Prioritization
  - Quality of Service (QoS)
- Apply Resiliency Protocols and multi-path topologies
  - Use Fiber-media uplinks for fast convergence
- Defense-in-Depth Security
Support for Profinet

Highly Secure Integration With Corporate Networks, and Integration with Profinet-Based Devices

- PROFINET v2 certification, with PROFINET conformance class B compliance
- Cyclic data exchange between Profinet enabled programmable logic controllers, IO devices, and other mMotion controllers
- Support of ProfiSafe (Safety) applications with wire-speed switching
Logical Framework

- Strong Segmentation

Level 5

- Enterprise Network

Level 4

- E-Mail, Intranet, etc.
- Site Business Planning and Logistics Network

Level 3

- Terminal Services
- Patch Management
- AV Server
- Application Mirror
- Web Services Operations
- Application Server

Level 2

- FactoryTalk Application Server
- FactoryTalk Directory
- Engineering Workstation
- Domain Controller
- Site Manufacturing Operations and Control
- Area Supervisory Control

Level 1

- FactoryTalk Client
- Operator Interface
- FactoryTalk Client
- Engineering Workstation
- Operator Interface
- Batch Control
- Discrete Control
- Drive Control
- Continuous Process Control
- Safety Control
- Basic Control

Level 0

- Sensors
- Drives
- Actuators
- Robots
- Process

Manufacturing Zone

DMZ

Cell/Area Zone

Purdue Reference Model, ISA-95

ISA-99

Purdue Reference Model, ISA-95

ISA-99
Converged Plantwide Ethernet Architecture (CPwE)

**ISA 95**  
Enterprise Network Levels 4–5  
- Enterprise/IT Integration  
- Collaboration  
- Wireless  
- Application Optimization

**Demilitarized Zone (DMZ) Firewalls**  
- Application and Data share  
- Access Control  
- Threat Protection

**Manufacturing Zone Level 3**  
Distribution and Core  
- Site Operations and Control  
- Multi-Service Networks  
- Network and Security Management  
- Routing

**Cell/Area Zone Levels 0–2**  
Layer 2 Access  
- EtherNet/IP (Industrial Protocols)  
- Real–Time Control  
- Multiple Topologies, Fast Convergence  
- Traffic Segmentation and Management  
- Ease of Use

**Traditional Business**

**IoT**

- Patch Management  
- Terminal Services  
- Application Mirror  
- AV Server  
- FactoryTalk Application Servers

- Cisco ASA 5500  
- Cisco Catalyst Switch  
- Network Services  
- Cisco Catalyst 6500/4500  
- Cisco Cat. 3750 Switch Stack

- Web, Apps, DNS, FTP  
- Obeya Link for Failover Detection  
- Firewall (Active)  
- Firewall (Standby) ASA 5500  
- Cisco Catalyst Switch  
- Cisco Cat. 3750 Switch Stack

- L2 Industrial Switch  
- Distributed I/O  
- Drive  
- HMI  
- Controller  
- Cell/Area #1 (Redundant Star Topology)  
- Cell/Area #2 (Ring Topology)  
- Cell/Area #3 (Linear Topology)

- Gbps Link for Failover Detection  
- Cisco Catalyst 6500/4500  
- Cisco Cat. 3750 Switch Stack

- Demilitarized Zone (DMZ) Firewalls

- Firewall (Active)  
- Firewall (Standby) ASA 5500  
- Cisco Catalyst Switch  
- Cisco Cat. 3750 Switch Stack

- Web, Apps, DNS, FTP  
- Obeya Link for Failover Detection  
- Firewall (Active)  
- Firewall (Standby) ASA 5500  
- Cisco Catalyst Switch  
- Cisco Cat. 3750 Switch Stack

- L2 Industrial Switch  
- Distributed I/O  
- Drive  
- HMI  
- Controller  
- Cell/Area #1 (Redundant Star Topology)  
- Cell/Area #2 (Ring Topology)  
- Cell/Area #3 (Linear Topology)
Industrial Switching Portfolio

IE2000
- Modular/Scalable
- L2/L3/PoE(+) DIN Rail

IE3000
- Connected Industries with Enterprise S/W
- PoE(+)
- L2/L3/PoE(+) DIN Rail

IE3010
- Connected Energy Metro+Ent S/W
- PTP (C37.238)
- PRP Redbox
- HSR H/W Capable

IE2000U
- CGS2k FastBoot,
- Multiservice – Voice VLANs
- ESM – CG Swap Drive
- PoE+ on CGS2520

CGS2520

IE4000
- New
- Gigabit Ethernet
- L2/L3
alarm contact 1 description Magnet_Open
alarm contact 1 severity major
alarm contact 1 trigger open

event manager applet port_shut
event syslog pattern "PLATFORM_ENV-1-EXTERNAL_ALARM_CONTACT_ASSERT: Alarm asserted: Magnet_Open"
action 1.0 cli command "enable"
action 1.5 cli command "config t"
action 2.0 cli command "interface GigabitEthernet1/9"
action 2.5 cli command "shutdown"
action 3.0 cli command "end"

event manager applet port_up
event syslog pattern "PLATFORM_ENV-1-EXTERNAL_ALARM_CONTACT_CLEAR: Alarm cleared: Magnet_Open"
action 1.0 cli command "enable"
action 1.5 cli command "config t"
action 2.0 cli command "interface GigabitEthernet1/9"
action 2.5 cli command "no shutdown"
action 3.0 cli command "end"
Use Case: Key-Locked Remote Support

Problem Statement:
Manufacture with more than 100 locations needs a simplified solution to allow and deny remote support per machine or production line. The target is that the process of commissioning and decommissioning can be handled automatically without an engagement of the IT department. The machine operator must authorize the remote access per HW key to confirm that he is aware about remote manipulation with the possibility that machine safety systems can be influenced.

Physical View
Use Relevant CLI

CLI "ACL's"

ip access-list extended normal_operation
permit ip 192.168.100.0 0.0.0.255 any
deny ip any any
ip access-list extended remote_operation
permit ip 192.168.100.0 0.0.0.255 any
permit ip 10.0.0.0 0.255.255.255 any
deny ip any any

alarm facility input-alarm 1 relay major

event manager applet remote_operation
event syslog pattern "%PLATFORM_ENV-1-EXTERNAL_ALARM_CONTACT_ASSERT: Alarm asserted: external alarm contact 1"
action 1 cli command "enable"
action 2 cli command "conf t"
action 3 cli command "interface GigabitEthernet1/1"
action 4 cli command "ip access-group remote_operation in"
action 7 cli command "exit"
event manager applet normal_operation
event syslog pattern "%PLATFORM_ENV-1-EXTERNAL_ALARM_CONTACT_CLEAR: Alarm cleared: external alarm contact 1"
action 1 cli command "enable"
action 2 cli command "conf t"
action 3 cli command "interface GigabitEthernet1/1"
action 4 cli command "ip access-group normal_operation in"
action 7 cli command "exit"
Big Data has no value without a good question?
Data Collected may need an immediate response and the location or latency of the network is too great to wait for an answer.

Deterministic Control Loop
IoT Routing Portfolio

**IOx - Fog enabled**

CGR 1240
CGR 1120
819-4G

**Sensor Gateway**

IR 910
Java/Python/C/C++ enabled

Not available in every country yet

**ASR 900 Series**

IR 500
(only where 9xxMHZ is allowed)

**ESR Series Embedded**

EHWIC – 4G / 3G

**CGR 2010**

819-3G

CGR 1240
CGR 1120
819-4G

Java/Python/C/C++ enabled

Not available in every country yet

**ASR 900 Series**

IR 500
(only where 9xxMHZ is allowed)

**ESR Series Embedded**

EHWIC – 4G / 3G

**CGR 2010**

819-3G
IOx / DMo on 819-4G

IOx

DMo

For best results use a supported browser.

Cisco Application Management
Version 3

Username
Password
Log in

Application
Network

HTTPS + JSON

Sensor Gateway/Router
Rules Engine

API

Sensors
Data in Motion

Data to Information Capabilities
• Event Detection & Aggregation
• Rule-Based Data Normalization
• Dynamic Sensors Polling
• Unstructured Data Understanding
• Data & Information Caching
• μ-CDN (Controlled Distribution)
• Pub-Sub API (Eclipse IDE)

Use Cases
• Data Reduction and Compression
• Sensor Virtualization and Plug & Play

Supported Platforms
• UCS-E/Blade
• C8xx with IOx
Cisco & azeti – Management and Predictive Maintenance

Prime Analytics
Connected Analytics
Data Virtualization
Data in Motion

Real-Time View
Derive Value from Data
Data Consolidation
Data Consumption

Intelligence at the Edge

Edge Devices Cisco IR900
azeti - Overall Architecture

Customer NOC
Alarms, Tickets, BI

azeti Control Panel

Cisco Energy Manager

azeti Middleware

Alarms, Data

Alarms (SNMP, MQTT)

Digital I/O
Dry Contacts, Relays

Energy Meters
AC/DC: P, U,

Sensors
Temp./Hum., Fuel,
Pressure, Flow, Air

IP Devices

Legacy Devices
Generators, Batteries, non-IP

MODBUS

MODBUS

MODBUS

Serial

Ethernet

IP Devices

Legacy Devices

Generators, Batteries, non-IP

Presentation_ID
Cisco and/or its affiliates. All rights reserved.
Cisco Public
Create the Connected Vehicle

- Onboard Wi-Fi
- Preventative maintenance
  - Tie into existing program
  - Keep vehicles in operation for better service
- Driver information records
- Always Connected

- Real-time scheduling, notifications, & advisories
- Onboard video surveillance
  - Safety and security
- Location based mobility apps
- GPS / WiFi tracking of assets
- Real-time services & communications
Davra RuBAN platform is now on Cisco GPL
Embedded Products

Embedded Routing

Cisco 5915 ESR
Conduction cooled model

Cisco 5940 ESR – Conduction-cooled model

Cisco 5915 ESR
Air-cooled model

Cisco 5940 ESR – Conduction-cooled model

Impact Tactical Deployable Baseband

Impact Tactical

- Small Footprint, Modular Baseband
- Server, Router, Switch, MANET and UPS Modules
  - Cisco ESR 5915 Router
  - Cisco ESS 2020 Switch
- Supports VM Applications
- Rapid, Low Cost LRU
- 20 Lbs Fully Populated
- 12”x14”x6.5”
- Supports Cisco CME

Embedded Switching

Cisco ESS 2020
Questions?