Arrow IoT Overview

Marco Sangalli
IoT Business Development Manager Southern Europe
• Arrow

“Our strategic roadmap includes advancing our leadership in IoT and providing the engineering services and support that are integral for our customers to bring new, compelling products and services rapidly to the market”

Mike Long
President, CEO, Chairman
Arrow Electronics
Mission

To offer a complete solution enabling businesses to deploy, manage, monitor, analyze and monetize secure connected devices throughout their entire lifecycle globally. From Sensor to Sunset™
IoT 2017 Sales
$1.1 Billion

- Arrow Electronics partners with IBM to grow IoT business in APAC
- Arrow ranked 7th in Top IoT Implementers Classification by PYMNTS.com
- Newly Launched Arrow Open Lab at Science Park Drives the Pursuit of Innovation in Hong Kong.
- Arrow Electronics' IoT Program Demonstrates Distributors' Value in the 3rd Platform,
- Arrow introduces single billing service to reduce IoT complexity
- Arrow introduces services to monitor and manage connected devices
- DSEDP selected Arrow as lead IoT Technology Advisor for Colorado Smart Cities Alliance
Success Story
Smart Farming Solutions Framework
Smart Farming Solutions Framework direct and general benefits

FARMERS
• Crop yield optimization
• Better use and management of farming equipment
• Increased competitiveness
• Certainty in experimentation bases
• Useful information and resources can be shared among companies in the same supply chain
• Farmers will change farming practices and expand their vision

CONSUMER
• More information for consumers
• Complete product traceability for food safety
• Increased protection against product counterfeit

PRODUCTS
• Quality improvement through the usage of Machine Learning to support decisions.
• Fertilizer usage reduction
• Product waste reduction
• Overall costs reduction

POLICY MAKERS
• Enhancement of Regional Agri-food Systems
Smart Farming Solutions Framework (SF2)

Overview

• **SF2** is a unique set of components for the development of **End to End solutions** for the Smart Farming Sector.

• Is designed for a **broad target market** and, for large projects, promotes an adaptive **co-design approach** that allows incremental development of functionalities based on customer priorities.
## Framework modules (planned)

<table>
<thead>
<tr>
<th>Field</th>
<th>Soil &amp; Environment</th>
<th>Plant Field Equipment</th>
<th>Product processing and tracking</th>
<th>Process equipment</th>
<th>Product Distribution</th>
<th>Consumer experience</th>
</tr>
</thead>
<tbody>
<tr>
<td>Telemetry and basic monitoring</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Analysis</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Machine learning and predictive analysis</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>External systems integration</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Business elements management</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>
Broad target market

Vineyards and Olive Groves

Traditional local productions

Modern Vertical indoor farming
Years of experience: 29
Sites (in Italy and abroad): 7
Employees: 360
Customers: >120
BOS1 is a Vertical Business Unit of Euris Group that is focused on Industry 4.0 and IoT Projects

**360-degree view of customers digital transformation processes**, from the analysis and re-engineering of production processes to the implementation of solutions (HW / SW), centered on a logical, flexible and integrated model

**Adaptation**
An open approach that adapts the model to the Customer’s context, guaranteeing continuity in the choices and existing alliances, while bringing a technical-functional evolution.

**Top solutions**
Partnership with top market players for specialistic solutions, suitable to address specific problems for each phase of the process, for each component of the model, with a winning time-to-market.

**No lock-in**
Open Model without any lock-in to particular vendors for the Customer, guaranteed by the use of a "white box" approach, based on a modular and cloud-ready architecture and open source technologies.
Framework architecture
Smart Farming Solutions Framework

**Architectural overview**

- Multi-tenant Architecture
- Truly distributed application based on Microservices Architecture for an effective handling of complexity and to ease scalability
- Edge intelligence for a better device management and a simple reuse of cloud components and functionalities
- Cloud services based on ruling Cloud Platforms
Multitenancy
Microservices architecture

- Separate components
- Increased availability
- Technology stack independence
- Easy to understand in distributed environments
- Organized around business capabilities
- Reusability
- Easy to deploy
Distributed solution

SF2 favors the development of distributed solutions leveraging on existing Cloud services.
Data flow overview
Field level data flow overview

**Field (sensors)**
- Continuous Data Collection

**Field (Sensor Nodes)**
- Distributed, autonomous
- and radio connected

**Edge (Gateway)**
- Data collection from Sensor Nodes
- Edge analytics and real-time decisions
- Devices Management
- Offline operations management
- Multiplexing and security
- Bandwidth optimization

**Cloud**
- Data ingestion and storage
- Stream Analysis
- Cognitive Services
- Machine Learning
- Business Intelligence
Field level data flow details

Continuous Data Collection
Field (Sensor Nodes)
Distributed, autonomous and radio connected

Edge (Gateway)
Data collection from Sensor Nodes
Edge analytics and real-time decisions

Devices Management
Offline operations management
Multiplexing and security
Bandwidth optimization

Cloud
Data ingestion and storage
Stream Analysis
Cognitive Services
Machine Learning
Business Intelligence

IoT devices
Field Gateway
running Azure IoT Gateway SDK

Ingestion Module (Modbus, OPC-UA, MQTT, etc.)
Azure Stream Analytics on edge devices
IoT Hub Module

Microsoft Azure

IoT Hub
Azure Stream Analytics
Other Azure Services
(Storage, ML, Power BI, etc.)
Field level communications

Gateway
- ZigBee / BLE
- LTE
- WiFi
- IP 65
- Automotive cert.
- Operational Shock: 30 G (?)
- Operational Vibration: 3 Grms (?)
- Wide Temp: -30°C to +70°C
- Offline Storage: 2 MB / Day
- Encryption: AES 128b
- Authentication: ?

Sensor node
- LoRa
- (xbee, ...) Rechargable Battery
- Solar Panel
- IP67
- Shock protection
- Wide Temp: -30°C to +70°C
- Offline Storage: 0.5-1 MB / Day
- Encryption: AES 128b
- Authentication: ?

Gateway
- Ethernet
- LTE
- LoRa (AES 128b) – Net Server ...
- WiFi
- Offline Storage: 50-200 MB / Day
- Encryption: AES 128b
- Authentication: ?

Internet of Things (IoT) Hub
- (Ingestion and command exec.)
- Authentication: MQTT client...
- Encryption: ...
- IP filtering: y
- Certificates: y (x509)

Farming

Product Processing...
Edge intelligence and real time data collection

Sensor Nodes are distributed on land lots. Sensor Nodes continuously collect field data which are sent to Edge Gateways. Edge Gateways normalize data and send them to Cloud ingestion services. Edge gateways can operate with intermittent Internet connections and they offer a fully managed service that delivers cloud intelligence locally. They can seamlessly run artificial intelligence, cloud services, and custom logic.
Field level

Things
(Land parcels, Line Production stations, …)

Sensors/actuators
Sensor Nodes, PLCs,
Sensor Enclosures, Operational
Technology Gateways

Field

XYZ vineyard

ABC vineyard

Land

Production line ABC

Station 1

Station 2

Product transformation

Shop Floor LAN

PLC Siemens
Modbus

OPC-UA Node

OPC-UA Node

OPC-UA Node

OPC-UA Server

OPC-UA Server

Wireless sensor node + LoRa

RS 232

Arduino

PLC Siemens
Omnio

Sensor Nodes, PLCs,
Sensor Enclosures, Operational
Technology Gateways
Cloud level

Cloud services

- Ingestion
- Monitoring
- Storage
- BI and Analytics
- Management/Control/
- Command
- Control

Proprietary cloud services (Energy consumption, agriculture smart equipment platforms, ...)

Managing:
- Factories
- Assembly lines
- Stations
- OPC UA servers

Applications for the following roles:
- Research and development
- Manufacturing
- Logistics
- After-sale service

Fluid interfaces
- Responsive environments

Monitoring:
- Factories
- Assembly lines
- Stations
- OPC UA servers
- KPI
- MES - assembly line interface (Power BI)

Power BI App Service

User Control:

Desktop Management
- IoT devices / Edge devices
- Edge data registry
- User Control / Desktop
- Power BI
- Desktop / Desktop

Logical device connection
- Multiplexing
Cloud level – data ingestion monitoring
Business analytics functions
From telemetry to relevant land events
Farm assets - Land lots, soil and harvest data

Bos1 Smart Farming Solutions Framework allows effective management of farm assets, of their characteristics and performances.
Alarms and stress events management

Different types of stress (temperature stress, hydro stress, ...) can be detected in single land parcels.

History of stress events and results of corrective actions can be analyzed.
Harvest forecasting and harvest calendar by land parcel
Stress events
Equipment management
Mobile application field Data Collection and Inspection
Contacts

TEST S.p.A.
Viale Robert Schumann, 3
33100 UDINE - ITALY
www.testspa.com

luisa.benvenuto@testspa.com
gianpaolo.propedo@bos1.eu