20th Annual Meeting of Members

March 5, 2020
Agenda

- Call to Order
- Activities of the Corporation
  - 20th Term in Review
  - Introduction to Candidates for Election by the Regular Membership
- Can 5G and Wi-Fi 6 Deliver on the Factory Floor? The Industrial Wireless Use Cases for EtherNet/IP
- Election and Break
- The Effect of Digital Transformation on the Industrial Automation Product Ecosystem at the Edge and Beyond
- Looking Ahead to the 21st Term
- Adjourn
20th Term in Review

- Al Beydoun, President & Executive Director
- Adrienne Meyer, VP of Operations and Membership
20th Term in Review

- Overall Review of Activities
  - Organization and Board update
  - Key accomplishments
  - Key activities in specific regions
- Membership Review
  - Current status
  - Planned updates
- Technology Review
Board and Organization Updates
Board of Directors Update

Mr. Fabrice Jadot
SVP Next Gen Automation
Industrial Automation Business
Schneider Electric

Served on the Board
Sept 2014 – March 2020

Mr. Raja Ramana Macha
SVP of Innovation & Tech and CTO
Industrial Automation
Schneider Electric

Effective March 3, 2020
Mr. Masaru Takeuchi  
Deputy Senior General Manager, Technology and Intellectual Property H.Q.  
OMRON  
Served on the Board  
Oct 2015 – March 2020

Mr. Satoshi Kojima  
General Manager  
Network Product Management Group, Controller Div.  
OMRON  
Effective March 3, 2020
Technical Review Board Update

Congratulations to David VanGompel on his retirement and many thanks for his dedicated service and contributions to ODVA

Served on the TRB from the ?? Start of ODVA! – May 2019

Mr. David J. VanGompel
Rockwell Automation
Technical Review Board Update
Marketing Director – Steven Fales

• Joined ODVA in September 2019
• 15 years of progressive marketing and product management experience in manufacturing companies serving the industrial and automotive sectors
• Most recently, held a role as product marketing manager for fieldbus electronics and pneumatic valves
• BS Economics - Wayne State University (Michigan)
• MBA with a concentration in Marketing (brand management) - Olin Business School at Washington University in Saint Louis
The ODVA Team
20th Term in Review

- Completed a strategic plan for the organization
- Grew membership to over 350 members and expanded overall licensed EtherNet/IP vendors to over 700
- Continued to expand and enhance ODVA’s technologies through 13 active working groups bringing specification enhancements in key areas like CIP Security and IO-Link integration.
- Promoted ODVA’s technologies at global events and trade shows
- Grew adoption of ODVA’s technologies by offering training and seminars globally
- Adapted EtherNet/IP to the process industry: NAMUR NE107 Diagnostics, HART integration, and active participation with the Ethernet-APL project
- Added a Marketing Director to expand marketing activities and communications to drive adoption of EtherNet/IP
- Aided growth in China by initiating a project for further standardization in country
- Formed new SIG for xDS Digital Device Descriptions to develop ODVA’s next generation device descriptions
- Continued to develop a high level adoption plan for EtherNet/IP over TSN via working committees of the TRB
- Collaborated with other organizations to expand the EtherNet/IP ecosystem in areas of cloud connectivity and with device integration host systems
Summary of the Strategic Initiatives
## Strategic Initiatives

<table>
<thead>
<tr>
<th>IOT and Cloud Interface</th>
<th>Device Integration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ensure EtherNet/IP devices will connect and interoperate with other key technologies and future ecosystem of OT and IT systems</td>
<td>Ensure that EtherNet/IP devices can be integrated and configured by various device integration systems/tools</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Emerging Standards and Protocols</th>
<th>Adoption of ODVA Technologies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ensure support of emerging standards and technologies related to Physical and Data Link Layers</td>
<td>Increase adoption of ODVA technologies and maintain leadership role in industrial networks</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Membership Needs and Feedback</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understand the needs of the membership and create an ongoing feedback loop to provide continuous input</td>
</tr>
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</table>
Expansion of the EtherNet/IP Ecosystem

EtherNet/IP Industrial Control System

- Gateway
- OPC UA Server
- OPC UA
- FDI Host (FDI Device Package)
- FDT Host (FITS FDT 3.0)
- EtherNet/IP on TSN Networks
- EtherNet/IP (Controller)
- CIP Safety
- CIP Security
- EtherNet/IP HART
- EtherNet/IP IO-Link
- EtherNet/IP (Controller)
- xDS Package
- EtherNet/IP SPE
- EtherNet/IP SPE Constrained Devices

Cloud/Enterprise Data Centers

Existing

In-process
Highlights of Key Activities
Overall Global Activities

– EtherNet/IP training courses and interoperability events
  • Quick Start courses in the US, India, and Germany
  • Implementer seminars in Japan
  • PlugFests in the US and the Netherlands
  • Connection tests in Japan
– CIP Safety training courses
  • Protocol courses in Germany and the US
– EtherNet/IP end user seminars
  • Seminars in China and Japan
  • ODVA College in Japan
– Trade shows
  • Hannover Messe
  • SPS IPC Drives
  • IIFES (Industry Innovation Fair for E & E Solutions)
  • Open Network Fair
2019 Promotional Activities in China

- **Seminar**
  - EtherNet/IP Seminar in NanJin, JiangSu Province
  - EtherNet/IP Seminar in NingBo, ZheJiang Province
  - EtherNet/IP Seminar in JiNan, ShanDong Province
  - EtherNet/IP Seminar in ShiJiaZhuang, HeBei Province
  - EtherNet/IP Seminar in FoShan, GuangDong Province

- **Forum**
  - Enabling Reliability and Security for IOT in Industrial Automation
    Shanghai, China
Activities in China
Activities in China

Global Automation & Manufacturing Summit – CEC Forum
Activities in China

Industrial Automation Show
Activities in Japan

IIFES 2019 (Industry Innovation Fair for E & E Solutions)
Activities in Japan

*Industrial Open Network Fair*

<table>
<thead>
<tr>
<th>Date</th>
<th>Location</th>
<th>Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>July 23, 2019</td>
<td>Osaka w/Seminar</td>
<td>450</td>
</tr>
<tr>
<td>July 30, 2019</td>
<td>Tokyo w/Seminar</td>
<td>800</td>
</tr>
</tbody>
</table>
Activities in Japan

ODVA College

<table>
<thead>
<tr>
<th>Seminar Name</th>
<th>Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>ODVA College @Nagoya</td>
<td>May 15th, 2019</td>
</tr>
</tbody>
</table>

Exhibition

Seminar
Activities in Japan

Seminars

<table>
<thead>
<tr>
<th>Seminar Name</th>
<th>Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>EtherNet/IP Implementer Seminar @Tokyo</td>
<td>September 12th, 2019</td>
</tr>
<tr>
<td></td>
<td>February 13th, 2020</td>
</tr>
<tr>
<td>EtherNet/IP Network Seminar @Tokyo</td>
<td>September 13th, 2019</td>
</tr>
<tr>
<td></td>
<td>February 14th, 2020</td>
</tr>
</tbody>
</table>

Exhibition
Activities in Japan

Connection Test

<table>
<thead>
<tr>
<th>Event Name</th>
<th>Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>EtherNet/IP Connect Test @Schneider Japan</td>
<td>September 26-27th, 2019</td>
</tr>
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Membership Update
ODVA has a solid foundation and is ready to tackle new challenges

- Membership grew 6.8% since 2018 Annual Meeting and 5% in 2019 alone
- EtherNet/IP adoption increased with over 67 new vendor IDs issued in 2019 alone
Mix of Membership by Principal Place of Business, as of February 11, 2020

<table>
<thead>
<tr>
<th>Country</th>
<th>Number of Members</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>149</td>
</tr>
<tr>
<td>Canada</td>
<td>11</td>
</tr>
<tr>
<td>Germany</td>
<td>58</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>12</td>
</tr>
<tr>
<td>Other Europe (inc. Ireland)</td>
<td>42</td>
</tr>
<tr>
<td>Japan</td>
<td>52</td>
</tr>
<tr>
<td>Korea</td>
<td>13</td>
</tr>
<tr>
<td>China</td>
<td>10</td>
</tr>
<tr>
<td>Other</td>
<td>13</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>360</strong></td>
</tr>
</tbody>
</table>
Looking to the Future

Our focus for the coming year

– Learn from our members
– Understand our evolving industry
– Continue to re-engage our membership
– Create consistency while preserving adaptability of messages
Looking to the Future

How we will deliver

– Data collection
  • Member survey and member feedback roundtables/interviews

– Product/service/activity evaluation
  • Adaptation, addition, and/or deletion of activities, products, or services based upon feedback and alignment
  • Engagement to relaunch activities in specific regions, based upon member interest locally and feedback globally from surveys

– Overhaul of messaging and key marketing tools to align better with current ODVA strategy and technologies
  • Modernize and reorganize ODVA website; provide regional language sites
  • Align messaging in all trainings and other events to ensure consistently of driving out current messages
  • Drive a “Think Global, Act Local” approach to create a consistent message and look globally, while adapting to local preferences and needs
ODVA MEMBER NEEDS SURVEY

Conducted by
Vault Consulting
Why.

• Better meet needs of members and industry by learning from you:
  – Pain points and needs
  – Where market and technologies are going, and where you are taking products to align
  – What you want from ODVA and how we can best serve you

• This learning allows us to adapt to best meet your needs
Vault.

• Full-service outsourced accounting & research programs for associations, nonprofits and their affiliates
• Supports nearly 200 nonprofits today – including 90% of the clients we began working with over 2 decades ago
• Provides steadfast support, secure handling of sensitive information & resourceful counsel necessary to transform information into action
How.

• Vault will distribute survey on our behalf
• The survey will:
  – Take under 15 minutes to complete
  – Remain open for only a couple of weeks, so please take it early
  – Be offered in English as well as Chinese, Japanese and Korean
• All individual responses will be anonymous!
• You will have a Vault contact for any questions
ODVA Technology Development Process

- Special Interest Group
- Technical Review Board
- Board of Directors
- Conformance Test (via the ODVA Conformance Authority)
- ODVA Specification
- Policies and Procedures

- EtherNet/IP Roundtable
- Set SIG Work Plans
- Submit SE or TDE
- Approved SE or TDE
- Update
- Update (TRB review)
- Strategic Initiatives
- Update
Active Special Interest Groups and Working Groups

- CIP System Architecture – Darren Klug and Pat Telljohann (Rockwell Automation)
- EtherNet/IP System Architecture – Brian Batke (Rockwell Automation)
- CIP Safety – Arun Guru (Rockwell Automation)
- EtherNet/IP Physical Layer – Bob Voss (Panduit)
- EtherNet/IP Infrastructure – George Ditzel (Schneider Electric)
- DeviceNet Physical Layer – Brad Woodman (Molex)
- Distributed Motion and Time Synchronization – Steve Zuponcic (Rockwell Automation)
- EtherNet/IP In Process Industries – Michaël Voegel (Endress+Hauser)
- Common Industrial Cloud Interface – Stephen Briant (Rockwell Automation)
- IO-Link Integration – Frank Moritz (SICK)
- Modbus Integration – Todd Snide (Schneider Electric)
- xDS Digital Device Descriptions – Matthew Frazer (ODVA) – New SIG
- Conformance – Hamza Choudhry (ODVA)
- EtherNet/IP Roundtable – Kevin Knake (HMS Networks)
Key Accomplishments since last Annual Meeting

• A total of 78 SEs (Spec Enhancements) and TDEs (Tech Design Docs)

• A total of 18 volume revisions
  – Vol 1 – 3
  – Vol 2 – 2
  – Vol 3 – 1
  – Vol 5 – 2
  – Vol 7A – 1
  – Vol 7B – 2
  – Vol 7C – New volume – Integration of IO-Link into the CIP Architecture
  – Vol 8 – 3
  – Vol 9 – 3
Key Accomplishments since last Annual Meeting

• IO-Link
  – Introduced Volume 7C – Integration of IO-Link into the CIP Architecture
    • Provided seamless integration of IO-Link devices into CIP Originators
  – IO-Link has shown double digit growth in the last years
    • Will aid in future adoption of EtherNet/IP
    • Mainly when it comes to IoT and with the addition of OPC UA Companion Specification
Key Accomplishments since last Annual Meeting

- **Network Diagnostics**
  - Implementation of Phase 2 of the EtherNet/IP roundtable diagnostic initiative
  - Adds a common, scalable network diagnostic assembly definition for diagnostic connection points
  - Provides statistics and diagnostics information to assist in network troubleshooting:
    - TCP/IP (Number of connections and resource usage)
    - Ethernet (Ethernet error counters and statistics)
    - Connections (Resource usage and missed packets)
    - Other diagnostic information (e.g. CPU utilization)
Key Accomplishments since last Annual Meeting

• Device Diagnostics
  – Provides a device’s current diagnostics and signal status
  – Built using NAMUR NE107 Standard
  – Supports asset supervision and monitoring
  – Allow the different stakeholders, e.g. application programmers, operators, and maintenance technicians to understand the state of its devices and the whole system, thus making better decision to improve quality and OEE (Overall Equipment Effectiveness) of the whole operation.
Key Accomplishments since last Annual Meeting

• I/O Connection Aggregation
  – Provide a mechanism to multiplex individual connections into one
  – Saves network bandwidth
  – An enabler for efficiency in both new and existing use cases
    • IO-Link
    • HART
    • Modular I/O
    • Etc
  – Seamless runtime reconfiguration without having to stop the operation
Key Accomplishments since last Annual Meeting

- Constrained EtherNet/IP devices
  - Protocol definitions for EtherNet/IP and CIP Security
  - Foundation for in-cabinet use case
  - Drives down the cost for end nodes
    - Reduced number of components
    - Game changer together with Single Pair Ethernet (10BASE-T1S)
  - Enabling EtherNet/IP (UDP only) all the way to the edge device
    - Core part in the IoT infrastructure
    - With the OPC UA Companion Specification, the smallest sensors may be modeled via CIP Routers
Key Accomplishments since last Annual Meeting

• LLDP – Link Layer Discovery Protocol
  – Protocol for nodes and infrastructure to detect its neighbors
  – Supports tools to discover and visualize the physical network topology
  – A required component for TSN
Key Accomplishments since last Annual Meeting

• Safety Base Format Deprecation
  – CIP Safety today requires devices to support both the base and extended format
  – With new requirements in IEC 61784-3, only extended format are allowed so the base format has to be dropped
Key Accomplishments since last Annual Meeting

• Conformance Tests
  – Important part of ensuring interoperability of CIP devices
  – Developed Conformance Tests (CT17 for EtherNet/IP and CT31 for DeviceNet) to support the latest specifications, including:
    • Network diagnostics
    • CIP Security
    • HART and IO-Link
    • Etc
Key Accomplishments since last Annual Meeting

- **CIP Security Demo**
  - Participants
    - Rockwell Automation
    - HMS Networks
    - Danfoss
    - Hilscher
    - Cisco
    - Real Time Automation
  - Defense against a cyberattack
  - Certificate Enrollment
Key Planned Activities for Next Term

• CIP Security Authentication Profile
  – Introduces user level authentication and limited authorization
  – A foundation for a flexible and customizable authorization scheme
  – Built on open and proven technologies for user authentication
    • Username and passwords
    • OAuth 2, OpenID Connect, and JWT used by services like Facebook, Google, ....
  – Important measures to close the gap with IEC 62443-4-2
    • (There was a session in the Technical Track on this)
Key Planned Activities for Next Term

• Integration of SPE (Single Pair Ethernet)
  – Will reference international standards
  – Define cabling and connectors for SPE
  – 10BASE-T1L and APL specifically
    • Allow for EtherNet/IP in intrinsic safe environments
    • Longer distances
    • Use of EtherNet/IP in the process industry
  – 10BASE-T1S
    • Reduces cabling and physical component cost
    • Enabler for EtherNet/IP and in-cabinet use case
Key Planned Activities for Next Term

• 1 Gigabit Ethernet physical layer
  – Will reference international standards
  – Define cabling and connectors for 1 Gigabit Ethernet
  – Already used in EtherNet/IP products
  – Will become important together with TSN
    • Specifically converged traffic
Key Planned Activities for Next Term

• Process Device Profile
  – Develop device profiles for the process industry to improve interoperability for process devices
  – Investigation and consideration for the PA-DIM Standard
Key Planned Activities for Next Term

• **EtherNet/IP on TSN**
  – Finalize the high-level approach under development by the TSN committee of the TRB
    • Identify major technical aspects
    • Define required decision points for EtherNet/IP with respect to TSN
  – Task SIGs to start develop required SEs
Key Planned Activities for Next Term

- Complete analysis of the xDS design
  - Data model analysis
  - Development of ‘reference device’ library
  - Analysis of candidate modeling tools
  - Packaging model
  - Begin writing the xDS Specification
Introduction to Candidates for Election by the Regular Membership
Candidates

**BOARD OF DIRECTORS**

Dave Lagerstrom  
Turck

Thomas Petersen  
Danfoss

**TECHNICAL REVIEW BOARD**

Joakim Wiberg  
HMS Networks

Roxana Sudrijan  
Molex
Can 5G and Wi-Fi 6 Deliver on the Factory Floor? The Industrial Wireless Use Cases for EtherNet/IP
Can 5G and Wi-Fi 6 Deliver on the Factory Floor?

First demonstration of 5G to the general public

5G is much more than just a new mobile communication standard. From 1 to 5 April 2019 this will be evident in Hall 16 at HANNOVER MESSE. The 5G Arena will showcase live and in action – industrial applications which capitalize on the special characteristics of 5G, the next generation of mobile communication.

21 Mar. 2019

The existing 4th generation mobile communication standards (LTE+ and LTE
Can 5G and Wi-Fi 6 Deliver on the Factory Floor? The Industrial Wireless Use Cases for EtherNet/IP

• Kyle Crum, Rockwell Automation
• Paul Didier, Cisco Systems
• Tom McKinney, HMS Networks
• Harry Forbes, moderator and ODVA analyst from ARC Advisory Group
Cisco WiFi6/ 5G Views

March 2020
Cisco is excited about 5G & Wi-Fi 6, and the possibilities they hold...

- **Higher data rates & lower latency**
- **Increase in network capacity**
- **IoT at scale**

Support new applications and outcomes

Seamless Connectivity

Explosion of devices including IoT

The world has two dominant wireless access ecosystems in transformation today, Wi-Fi 6 and 5G, which are built on the same wireless foundation.
Complementary Nature of 5G & Wi-Fi

5G

Outdoor
- Transportation
- Outdoor Wireless

Outdoor + Indoor
- Virtual / Augmented Reality Apps
- Massive IoT

Indoor
- Capacity, density
- Indoor Enterprise
- Retail

Carrier managed

Enterprise owned

New wireless technology
Optimization for
Target applications
Data and experience ownership

Wi-Fi 6 (802.11ax)
Wifi 6 (802.11ax) Enhancements

- **Higher data rates**
  - Improved modulation for up to 9.6Gb/s per radio and single-antenna speeds of 1.2Gb/s
  - 8x8:8 Spatial streams (vs. 4x4:4) increasing density – Multiple Input, Multiple Output (MIMO)

- **Increase in overall network capacity**
  - More Industry, Scientific and Medical (ISM) spectrum
  - 3-4x more throughput than 802.11ac via improved modulation scheme
  - Up to 4x capacity gain in dense scenarios with underlying infrastructure services

- **Reduced latency and greater reliability**
  - Scheduled uplink/downlink windows for deterministic ‘cellular-like’ latency, reliability i.e. Quality of Service
  - Optimized for IOT scale with 100s of devices per AP
  - Spectrum w/o Listen-Before-Talk (LBT)

- **Improved power efficiency**
  - Up to 3x better battery life with Target Wake Time (TWT)
  - New coding structure and signaling procedures for better Transmit/Receive efficiency

Wi-Fi 6 will mainstream well ahead of 5G

- First Wi-Fi 6 APs
- Full-featured Class Wi-Fi 6
- Massive expansion of Wi-Fi 6 Clients

- 2018: 3GPP R15
- 2019: 3GPP R16
- 2020: Ubiquitous 5G in all big cities in US, EMEA, Japan, China
- 2021: Massive mainstream 5G NR roll-outs
- 2022 and beyond

Design / PoC Initial Deployment Expand / Scale

Device and Application Readiness/Availability are key bottlenecks
Use Cases Targeted

• **Use cases:**
  • Smart devices (Text, Voice, Video), PTT
  • Automated Guided Vehicles (Latency <50ms)
  • Surveillance Cameras (Latency <50ms)
  • Human Machine Interface (Latency <50ms)
  • Remote Expert (Latency <50ms)
  • Augmented Reality (Latency <50ms)
  • Sensors, Actuators (Latency >100ms)
  • Wireless Tooling ()
  • Mobile Work-Cell (Latency > 100ms)
  • Product Downloads (10s of Mbs)

• **Coverage:** 100s of square meters per AP
  • Indoors and/or outdoors

• **Number of clients:** 100s-1000s

• **Bandwidth per client:**
  • Low: >1Mbps
  • High: >20Mbps
Decision Factors

Use Case Particularity
- Indoor/Outdoor
- Fixed/Mobility
- Low/High Data Rate
- Best Effort/Mission Critical
- Device Availability

Spectrum Options
- Licensed/Unlicensed/Shared
- Low/Medium/High Band
- Public/Private
- Country’s regulations

Technology Differentiation
- Throughput
- Transmit Power
- Coverage
- Power input

TCO Consideration
- Capex & Opex
- Compatibility
- Scalability
- Eco-system

Customer's Choice
HMS Extends Industrial Edge to Every Asset

- Anybus CompactCom
- Protocol Converter Gateways
- Edge Gateway Solutions and VPN

Industrial Embedded Solutions
Machine to Machine Communications
Edge Gateways for Industrial IoT

Years in Business: 30+
Globally over 600 Employees
Number of Global Offices: 30
Public Stock YoY Growth Avg.: 20%
Countries Worldwide: 156
Testing Wireless Networks

HMS Gateways and Bridges

3G  4G  NB-IoT  WiFi

Bluetooth

Device

5G Test Platform
5G Test Results 2019

Wired Ethernet

Latency Wired Ethernet (Histogram, 4 µs bins)
Max Latency: 366µs

Classic WiFi

Latency WiFi AP (Histogram, 0.5ms bins)
Max Latency: 203ms

1-2 years

<1ms 10ms >200ms

2019 2021

5G
Panel Discussion

Can 5G and Wi-Fi 6 Deliver on the Factory Floor? The Industrial Wireless Use Cases for EtherNet/IP

- Kyle Crum, Rockwell Automation
- Paul Didier, Cisco Systems
- Tom McKinney, HMS Networks
- Harry Forbes, moderator and ODVA analyst from ARC Advisory Group
Election and Break
The Effect of Digital Transformation on the Industrial Automation Product Ecosystem at the Edge and Beyond
Digital Transformation at the Edge and Beyond

Cloud/Enterprise Data Centers

Gateway
OPC UA Server
OPC UA
FDI Host (FDI Device Package)
FDT Host (FITS FDT 3.0)

EtherNet/IP Industrial Control System

EtherNet/IP (Controller)
EtherNet/IP
EtherNet/IP
EtherNet/IP
EtherNet/IP
EtherNet/IP
EtherNet/IP
EtherNet/IP

CIP Security
CIP Safety
CIP Security
CIP Safety
CIP Security
CIP Safety
CIP Security
CIP Safety

EtherNet/IP on TSN Networks
SPE GW

Existing
Ongoing

OPC UA
EtherCAT
EtherCAT
EtherCAT
EtherCAT
EtherCAT
EtherCAT
EtherCAT

FDT Host
(FITS FDT 3.0)

EtherNet/IP SPE
EtherNet/IP SPE
EtherNet/IP SPE

Constrained Devices

xDS Package

EtherCAT
EtherCAT
EtherCAT
EtherCAT
EtherCAT
EtherCAT
EtherCAT
EtherCAT

HART
IO-Link

EtherNet/IP
EtherNet/IP
EtherNet/IP
EtherNet/IP
EtherNet/IP
EtherNet/IP
EtherNet/IP
EtherNet/IP

CIP Safety
CIP Safety
CIP Safety
CIP Safety
CIP Safety
CIP Safety
CIP Safety
CIP Safety

EtherNet/IP Industrial Control System

Existing
Ongoing
Digital Transformation at the Edge and Beyond

Cloud/Enterprise Data Centers
AWS in Manufacturing

Douglas Bellin
Global Head, Business Development, Smart Factory
Manufacturing Industry Trends

- Data is the enabler
- Digitally “Executed” Manufacturing
- Product-as-a-Service
- Connected Products
- Sustainability
Manufacturing Industry Challenges

- Create new revenue sources
- Improve OEE & optimize production
- Optimize supply chain, reduce inventory
- Worker attrition and training
- Protecting and securing production and IP
- Liberating data and revealing insights
- Cost reduction
Unprecedented scale

Hyper speed

Relentless innovation

Customer obsession
Unprecedented scale

Hyper speed

Relentless innovation

Customer obsession
Why AWS for Manufacturing?

AWS was born from complex automation & factory operations at Amazon

AWS has the most comprehensive and advanced set of cloud services & features available today

AWS customers take advantage of security designed for the most sensitive organizations

AWS massive, global scale reduces risk
This is the kind of challenge we’re built for

For 25 years Amazon has designed and manufactured smart products and distributed billions of items across our global network.

We use cutting-edge automation, IoT, machine learning and AI, and robotics, all with cloud at its core.

Amazon continuously transforms itself to drive customer delighting goals like Cashierless Convenience, 1-Day Shipping, and Net Zero Carbon Shipments.
Case study: Improve production efficiency and productivity by a goal of 30%

Challenge

- Improve VWs production processes based on the combined data ingested from all VW plants (through connecting the machines and legacy applications).
- Scaling of solutions (such as a Digital Shop-Floor Management solution) in production across plants based on a standard platform across the entire enterprise.

Solution

- Connecting the shop-floor through IoT Core and AWS platform services to a central data catalogue, using ML/AI for the heavy lifting, and well architected security standards for the entire enterprise cloud.
- Driving and scaling platform capabilities through a set of microservices that can be swiftly adopted by VW business communities rather than on a per use-case basis.

Benefits

- Onboarding entire plants already using available standard solutions that enable the VW builder community at large.
- Core assets in the form of microservices and blueprints that allow the VW business to quickly deploy ready-made solutions on the digital production platform (DPP).

“We chose AWS not only because of technology, but because of the ability to scale, to provide us with standards for our factories, the implementation speed that we are getting from AWS methodologies, the flexibility and the culture is helping us to really accelerate this project.”

Dr. Martin Hofmann, Volkswagen Group CIO

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VOLKSWAGEN GROUP

Industry: Automotive Manufacturing
Headquarters: Wolfsburg, Germany
Employees: 240,000
Website: https://www.volkswagenag.com

About VW

With its “TOGETHER – Strategy 2025” future program, the Volkswagen Group is paving the way for the biggest change process in its history: the realignment of one of the best carmakers to become a globally leading provider of sustainable mobility. To achieve that, the Group will be transforming its automotive core business, and will among other things be launching a further 30-plus fully electric cars by 2025, as well as expanding battery technology and autonomous driving as new core competences.
AWS services for VW Industrial Manufacturing

Machinery
- CNC
- Ovens
- Lathes
- Presses
- Welders
- Conveyors
- Paint Guns

End Users
- Plant Managers
- Supervisors
- Technicians
- Industrial Engineers
- Equipment Mechanics
- Operations Managers
- Logistics Specialists

DPP Capabilities & Services
- AWS IoT Analytics
- AWS IoT Core
- Amazon Kinesis Data Firehose
- Amazon S3
- Amazon DynamoDB
- Amazon EKS
- Amazon SageMaker
- Amazon Athena
- Amazon QuickSight
Our use cases deliver value to the end user

**USE CASE**  
**Digital shop floor management**

*Measure equipment effectiveness*

**Location:** Polkowice, Poland  
**Business value:** expose Overall Equipment Effectiveness (OEE) of the cylinder head production line including process steps to shop floor customers  
**Platform value:** create a generic OEE calculation microservice that can be used for various manufacturing systems

**USE CASE**  
**Press shop**

*Increase production efficiency*

**Location:** Wolfsburg, Germany  
**Business value:** correlate data from various sources to identify root causes for scrap in real time and render recommendations for optimized machine configuration to improve efficiency  
**Platform value:** reduction of scrap and increase in stroke rate that can be used by any press shop worldwide

**Digital Production Platform**

- Multi-tenant, secure, and scalable
- Spans cloud to the edge
- New microservices
- Standardized data layer
- Common interfaces
- Process and machine data integration
The foundation digital platform spans key production and supply chain capabilities

DPP Production Equipment Tier
- OT-IT Gateway
  - OPC UA
  - MQTT Broker
  - Data Transformation
  - Fieldbus Connectors
  - OPC UA Server

DPP Industrial Edge Tier
- Edge Gateway
  - AWS IoT SiteWise
  - AWS IoT Greengrass Connectors
  - OT-IT Infrastructure Services

Plant Cloud
- AWS Outposts
  - DPP Plant/Edge Services
  - On-prem Applications

DPP Enterprise Cloud
- DPP Application Landing Zone
  - DPP Use Case Application Framework
  - API Gateway
  - AWS Lambda
  - Amazon QuickSight
  - Amazon EKS

- DPP Data & Service Catalogs
- AWS IoT SiteWise IIoT Data/Metrics
- AWS IoT Analytics Data Prep & Analysis Pipeline
- AWS IoT Events Event Detection & Response
- Amazon S3 + Lake Formation Data Lake & Storage
- Amazon Sagemaker ML Training

Managed Landing Zones

Direct Connect
Case study: paper and building product manufacturing

Challenge
Georgia-Pacific wanted to gain new insights from manufacturing data collected at paper production plants, but it relied on disparate sources to analyze data on material quality, moisture, temperature, and other features.

Solution
Georgia-Pacific uses an AWS advanced analytics solution, featuring Amazon Kinesis and Amazon SageMaker, to collect and analyze data from equipment at manufacturing facilities across North America.

Benefits
• Boosts profits by millions of dollars
• Predicts equipment failure 60‒90 days in advance
• Runs more production lines in a predictable manner
• Ensures highest quality products

“We are using AWS data analysis technologies to predict... precisely how fast converting lines should run to avoid tearing. By reducing paper tears, we have increased profits by millions of dollars for one production line.”

Steve Bakalar, VP of IT & Digital Transformation
Business Architecture – Manufacturing Operations

Plant 1

- MES
- Asset Management System
- Quality Management System
- HMI/SCADA
- Gateway (OPC SRV)
- HISTORIAN
- PLC/Controller
- IMAGE

Plant 2

Plant 3

Applications

- Global Monitoring Dashboard
- Predictive Maintenance
- Quality Control
- Maintenance

Ingestion

Real Time Process

Batch Process

Machine Learning Rule Engine Optimization

Modeling

Management Operators
IDEAL SOLUTION ARCHITECTURE FOR SMART MANUFACTURING

Level 4
- Enterprise Applications (ERP, CRM, PLM & SCM)

Level 3
- MES (Or similar functionality)

Level 2
- Plant Level Infrastructure
  - Digital Factory Platform (Cloud)
  - Digital Factory Platform (Edge)

Level 1
- Aggregate
- Connect
- Acquire
- Control
  - PLC
  - Ethernet Switchers
- Gateway (IoT Agent)

Level 0
- HMI
- Machine 1
- Machine 2
- Additional Sensor (vision, pressure, vibration)

Additional Data Sources
- Part
- Bin
- Robots
- Worker

Digital Factory Platform (Cloud)
- Product Quality
- Machine Operations
- Inventory Tracking
- Connected Worker
- Energy Tool & Equipment Management Tracking
- Analytics/Machine Learning
- Reporting

Digital Factory Platform (Edge)
- RFID Reader (IoT Agent)
- Bar Code Reader (IoT Agent)
- Controller
- BLE Node (IoT Agent)
But Customers Face Challenges

Security
Keep devices and data secure

Downtime
Operate at top performance even without cloud connectivity

Legacy equipment
Onboard Greenfield and Brownfield devices
AWS Helps You Overcome Challenges with Software and Services for Key Use Cases

- Predictive maintenance
- Predictive quality
- Asset condition monitoring
Predict Failure Before Business Operations are Impacted

- Reduce costs
- Avoid unplanned production outages
- Plan optimal maintenance work schedule

Predictive maintenance
Predict Failure Before Business Operations are Impacted

**Requirements**

- Ingest sensor data from devices in plants and offsite
- Securely connect billions of devices to the cloud and manage trillions of messages

**AWS IoT Capabilities**

- Run edge software and services like Amazon FreeRTOS and AWS Greengrass for local triggers, actions, and data sync
- Securely connect to AWS IoT Core
- AWS IoT Device Defender fleet audit and protection

Predictive maintenance
Predict Failure Before Business Operations are Impacted

Requirements

- Build and train predictive models based on device data
- Deploy models on devices
- Detect anomalies
- Trigger alerts
- Predict failures

AWS IoT Capabilities

- AWS IoT Analytics collects, processes, and analyzes IoT data. Use built-in templates for predictive maintenance
- Run predictive models on devices using AWS Greengrass
- Use AWS Greengrass Machine Learning Inference to take local action even without cloud connectivity

Predictive maintenance
AWS IoT Services

- Endpoints
  - Secure local triggers, actions, and data sync
  - Secure device connectivity and messaging
- Gateway
- AWS Greengrass
- AWS IoT Core
- Fleet onboarding, management, and SW updates
- Fleet audit and protection
- IoT data analytics and intelligence

Intelligence
Insights & Logic → Action

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AWS Greengrass extends AWS IoT onto your devices, so that they can act locally on the data they generate, while still taking advantage of the cloud.
Extend AWS IoT to the Edge

- Local Messages and Triggers
  - Local Message Broker

- Local Actions
  - Lambda Functions

- Data and State Sync
  - Local Device Shadows

- Security
  - AWS-grade security

- Local Resource Access
  - Lambdas Interact With Peripherals

- Machine Learning Inference
  - Local Execution of ML Models

- Protocol Adapters
  - Easy Integrations With Local Protocols

- Over the Air Updates
  - Easily Update Greengrass Core
Thank you.

bellin@amazon.com
Looking Ahead to the 21\textsuperscript{st} Term

- Al Beydoun, President & Executive Director
**Leadership in the 21st Term**

<table>
<thead>
<tr>
<th>Board of Directors</th>
<th>Technical Review Board</th>
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</thead>
<tbody>
<tr>
<td>Dr. Rolf Birkhofer</td>
<td>Mr. Raj Bandekar</td>
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<tr>
<td>Mr. David Lagerstrom</td>
<td>Mr. Rudy Belliardi</td>
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<td>Mr. Satoshi Kojima</td>
<td>Mr. Mirko Brcic</td>
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<tr>
<td>Dr. Jürgen Weinhofer</td>
<td>Mr. Joakim Wiberg</td>
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Looking Ahead to the 21\textsuperscript{st} Term

- Continue to grow our membership and adoption of CIP technologies; engage with membership to understand and support their needs
- Execute on our strategy to expand the EtherNet/IP ecosystem and to support IIoT and Industry 4.0 initiatives
- Continue to monitor emerging technologies in Industrial Automation and integrate to ODVA technologies where it makes sense
- Collaborate with other organizations to expand and better address the challenges of tomorrow
- Expand support for vendor development
- Align our marketing and communication efforts globally
- Continue adaptation of EtherNet/IP to the Process Industries
Technology and Standards

Working Groups are Calling!

- Common Industrial Cloud Interface: OPC UA communication to the cloud - Companion Specification
- EtherNet/IP in the Process Industries: Device profile, PA-DIM evaluation, …
- Time Sync and Distributed Motion: CIP Sync and TSN, 60802 Industrial Profile, …
- EtherNet/IP Physical Layer: Single Pair Ethernet for Ethernet-APL, 10BASE-T1L and 10BASE-T1S, …
- xDS Digital Device Technology SIG: Robust and secure device description, specification development, …
- Joint Working Group for OPC UA Companion Specification for CIP devices
- Working Group for FDT IIOT server (FITS) architecture support for EtherNet/IP
- Working Group for FDI device package support of EtherNet/IP
THANK YOU!