Background

Arne Svendsen

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1980: M.Sc. EE(P) + Computer Science
1980-1991: PLC firmware and SCADA software development
1990-2002: Consultant, Computer Integrated Manufacturing
2002->now: Driving Arla corporate IT standards within Manufacturing-IT & Automation
Engaged in Open Industry Standards. Board member in OMAC & SESAM organisations.
Agenda

1. Arla Foods, Introduction (3 slides)
2. IoT & I4.0 – which Business Benefits? (5)
3. Using ISA-95 in building the future Platform (10)
4. Industrie 4.0 – look out to Germany! (4)
5. The IT/OT dilemma - solved at Arla Foods? (2)
6. Take aways + Q&A

Arla Foods Introduction

Our vision: Creating the future of dairy to bring health and inspiration to the world, naturally
Arla Foods Introduction
1000’s of Variants - Arla Brands & Private Label

Farmer owned Cooperative since 1880

Rødkaersbro Mozzarella Dairy

Aylesbury, UK
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Industry 4.0 - high level
My view – one of many ..

The 1st (Steam)
The 2nd (Ford T)
The 3rd (www, PC)
The 4th Industrial Revolution
Why I4.0 is on our agenda?

Arla Value Chain

Digitalisation, IoT, etc.

I 4.0 (IIoT, Digital Supply Chain)

Supplier
Owner/farmer
Inbound
Production
Administration
Outbound
Customer
Consumer
Activities

Motivators:

Future logistic of food

Flexibility, scalability, & NPI

Food Quality

Volume production & Speciality

Data foundation for digital services

Industrial IoT – Why
Power up Digital Supply Chain, increase Value from Data

Examples

Data science

Product story

Real time transparency

Data for new digital technologies

Plug&Play External Digital Services

IT Operations
Balancing On-Premise & Cloud
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Wanted: “Faster and more flexible”
Yes – but with structure.
A Dairy is a complex factory with a large number Of 24x7-critical systems. Handle with care!

The large Dairy/Factory has:

- 2 redundant, large Virtual Data centers.
- 80-100 Windows Servers
- Admin Network
- Firewall(s)!
- Production Network(s)
- 100-300 PLC CPU’s with large amount of program code. PLC-networks
- 10-50,000 IO’s and/or Devices
Today’s ”I4.0” solutions

- Losing control
- Complex setup
- Vendors holding our data
- DISCONNECTED Clouds

Industrial IoT – How
We think, we need an IIoT Eco-system
**Industrial IoT Platform— Why**

2 Ways to Digitalization, only ONE with Arla Control

<table>
<thead>
<tr>
<th>Black Box Digitalization</th>
<th>Eco system based Digitalization</th>
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<tbody>
<tr>
<td>+ Quick to get started</td>
<td>+ Plug &amp; play digitalization</td>
</tr>
<tr>
<td>+ Low internal competence level needed</td>
<td>+ Arla data ownership &amp; ability to do analyze, develop, &amp; change vendors</td>
</tr>
<tr>
<td>+ No cross service data use or possibility to do our own analysis</td>
<td>+ Possible to have one shared front-end</td>
</tr>
<tr>
<td>+ Hard to control security</td>
<td>+ Initial investment &amp; project dependencies</td>
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<tr>
<td>+ End in high complexity, high vendor power, low flexibility, &amp; costly setup</td>
<td>+ Require internal competence, developers and platform operations/maintenance</td>
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**We need Connectivity: Both Carrier protocols AND Semantic OPEN-INDUSTRY-Standards**

**Semantic Standards:**
Cross-industry: ISA-95, PackML, …
Many existing Industry-Specific …

1. Equipment, Devices, …
2. PLCs, EDGE-units, …
3. MES Platforms & Modules
4. Business-IT Applications

**Carrier protocols:**
OPC-UA, MQTT, …

**Level-1 Semantic Protocol**
**Level-2 Semantic Protocols**
**Level-3 Semantic Protocols**
**Level-4 Semantic Protocols**
DATA need to be in CONTEXT to become valuable INFORMATION

Planning/Execution/QA view:
- Production Plan
- Orders
- BOM, Recipe
- "Reporting"
- QM, Trends, SPC, ...
- Traceability

Materials view:
- Material Classes
- Material-ID
- BOM
- Recipe

People view:
- Peoples
- Competences per shift ...
- Training plans
- ...

Plant Asset view:
- Equipment Model
- Site, Areas, Units ...
- State-Engine
- Parms, Alarms, OEE

We think, the
ISA-95
Data Model
is the only OPEN STANDARD,
answering to our Challenge …
ISA-95, Significant work going on ...

- Extend the ISA 95 Part 3 Activity model to include the “activities” (often automated) of Levels 1 and 2
- Levels 1 and 2 will be general definition and references to other standards for specific subactivities
- Coordinate with the work of IEC 65E AHG1 to identify missing information models needed to exchange information between activities
- Coordinate with the work of IEC 64 AHG3 by providing a structure for looking at missing IEC/ISO standards

Dennis Brandl 2017

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Check out "Industrie 4.0" home

Industry 4.0 "home": www.Plattform-i40.DE (Check out the Online Library, mainly in English) www.acatech.de

Industrie 4.0 - Gathering momentum:
2016: 14.0 & Industrial Internet Consortium/US:
2016: "Made in China 2025" builds directly on I4.0
2017: I4.0 at G20 meeting
2017: Germany & Japan starts cooperation on I4.0

Example reading:
"Industrie 4.0 in a Global Context"
p.62: Recommendations for Businesses.
p.63: Recommendations for Researchers & associations

Industry 4.0
Reference Architecture Model Industrie 4.0 (RAMI4.0) English translation of DIN SPEC 91345:2016-04
"Industrie-40-in-a-Global-Context.PDF"
Nov. 2016

Quote:
"...There is a danger that isolated, proprietary stand-alone or Silo solutions could emerge. This would expose purchasers of I4.0 solutions to the risk of technological lock-in, resulting in technological dependence and high costs."

But Standards will save us, Right?

Reference: Dennis Brandl
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**About the IT/OT dilemma – Arla Foods’ status**

Continuous Convergence – in Arla Foods
- 2002 Corporate MES/Automation team
  From day-1 integrated into Global-IT.
- 2003 First ISA-95 based SAP/MES integration
- 2005-2017 Global MES ”rollout” – 45 sites
- 2012-2017 Adoption of PackML
- 2016 ONE Arla Supply Chain Excellence ctr.
- **2017 Arla-IT Going Agile => Bringing IT/OT people into same Agile teams.**

(There is still some “disconnects” to local OT organisation on the dairies)
**About the IT/OT dilemma – Arla Foods’ status**

Central IT understands the needs of the local OT organisation:

- 24x7 Resilient systems on 70 local sites
- Systems are built to last for many years
- UPTIME is king, very short "windows" for upgrades

Local OT on sites understands that central IT:

- Needs strict procedures to keep a complex central landscape running
- Ensures Arla global IT-Security, set rules.
- Central IT can "run" local infrastructure (from remote) if requested

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Message recap.

Takeaways ..
Arla Foods is preparing our Global IT Solutions for Digitized Supply Chain by creating an Enterprise IoT Platform.

Our current focus:

• **INTERCONNECTION:**
  - Connecting Current-state MES, current state PLC, NEW Edge solutions, NEW smarter Devices.
  - We want Plug-and-Play Open Industry Standards

• **INFORMATION TRANSPARENCY:**
  - Create an Enterprise IoT platform for fast data-collection AND Information Delivery.

• I4.0: Denmark should look to Germany and cooperate, pushing Open Standards forward.
Arla Foods is presenting next time at **SESAM conference 12th October** in Odense, by Steffen Lundgaard Jørgensen – more details.
Q & A