Automation Systems from IoT
Arrowhead Framework: concepts and basic architecture

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IoT Product Segments

Conveyor (Tier2) Components and Parts (Tier3)

- Drive Heads
- LTU & Winches
- Belt Structure
- Belting
- Pulleys
- Feeder Breakers
- Components (a.u. idlers, motors, etc.)

Suppliers of these Products are:

- Potential partners, and;
- Future Service Providers

One customer, KGHM, one component

- 120 km conveyers
- 720,000 idler bearings
The automation challenge

- Annual growths more than 10% and over 500 billion connected devices are expected worldwide by 2025. - Cisco 2013

- Massive automation systems not possible with current technologies

- Not enough many engineers on the globe to do the job with current technology
Arrowhead
Process and energy system automation

4 years project
68M€
79 partners
Coordinated by

an ARTEMIS CoIE

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www.arrowhead.eu
ISA-95 systems in to the cloud?
Arrowhead approaches

- **TCP/IP** everywhere, middleware nowhere.
  - Internet of Things - IoT
  - System of systems - SoS

- The Integrating approach
  - Service Oriented Architectures - SOA
  - Local cloud approach
Classical automation system characteristics

- Centralised controllers, DCS, SCADA, PLC,
- Pull based - time slotted streaming of all data
- Hard real time
- Design time bindings
- Seams to have an upper bound of $X \times 10^5$ I/O’s
Cloud based automation systems

- Choice of centralised or distributed control and data to information computations
- Push on event or pull
- Late binding - runtime binding
- Hard real time?
The global cloud approach
Collaborative automation in local clouds

- Automation is local - requirements on:
  - Real time
  - Security and safety
  - Continuous engineering

- Local clouds are beneficial to:
  - Latency - real time
  - Security - supporting safety
  - Less engineering dependencies

- Inter cloud actions are necessary and possibly secure!
Arrowhead Framework - support for: System of systems in a local cloud

- Mandatory core systems:
  - Information infrastructure
  - System management
  - Information assurance
Real time local cloud automation & inter cloud automation

Real time
Local cloud #1

Real time
Local cloud #2

Real time
Local cloud #3
Hard real time IoT cloud

- Hard real time dependent on underlaying communication capabilities
  - Local hard real time cloud to prescribe communication technology
  - e.g. Industrial ethernet, TTTech, time slotted 802.15.4

- SOA overhead eats bandwidth
  - Use compression
  - EXI

EXIP: A Framework for Embedded Web Development
In : ACM Transactions on the Web. 8, 4, 29 p.23
Necessary technology for large automation systems in the cloud

Robust communication, wired or wireless

IoT sensors, actuators, PLC:s, etc.

DCS and SCADA functionality’

MES and ERP functionality

Cloud integration technology

Engineering tools for cloud automation systems

Test tools and simulators for debugging

Migration of cloud automation into legacy production system

Suitable security
Can we build Arrowhead automation systems today?

Robust communication
IoT sensors, actuators, PLC:s, etc.
DCS and SCADA functionality
MES and ERP functionality

Cloud integration technology
Engineering tools cloud automation
Test tools and simulators
Migration to cloud automation
Suitable security

➡ Products on the market
➡ Some products on the market
➡ First products on the market
➡ Demonstrated in industrial env.

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Arrowhead Framework

- Public by fall 2015 (in a few weeks)

  - Documentation
  - Cookbook
  - Mandatory core systems: images and code
  - Tools
    - System management
    - Test tool
  - Sample simple service - code
  - Sample automation services - code

Selected/interested people to be invited for pre-usage!
Automation engineering time

- Simplicity of automation service engineering is market key

- Arrowhead Framework reduces engineering time
  - From 5-6 days -> 6-8 hours (Abelko)
  - From 4-5 weeks -> 1 week (BnearIT)
Conclusions

Arrowhead Framework - local cloud concept offer advantages regarding Security
- Scalable and flexible security solutions

Latency
- Local clouds can provide latency guarantees

Engineering
- Reduces system engineering costs

Scalability
- Can integrate massive numbers of IoT and CPS devices
Arrowhead.eu

Arrowhead a project created by ProcessIT.EU and Artemis
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