Integration for manufacturing
The eScop Approach

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Title of the presentation:
Integration for manufacturing
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Integration for manufacturing
The eScop Approach
Sergii Iarovyi, eScop
From enterprise solutions to embedded devices - how to use new technologies to overcome current challenges in manufacturing.
Outline:

• Introduction
• Challenges
• Technology review
• Approaches
• Conclusions
Introduction:

MES users have boosted performance more frequently than others against the most commonly measured operations KPIs.

Source: "MESA Metrics that Matter: Uncovering KPIs that Justify Operational Improvements," © 2006 MESA International & Industry Directions Inc.
How to...

…reduce vendor dependency for MES components?
…introduce open ecosystem for MES function implementations?
…adjust MES for the mass customization?
…adapt MES for SMEs requirements?
Background:
1. Cyber-physical systems
2. Service orientation
3. Knowledge representation
4. Automation system hierarchy
Background: Cyber-Physical System

60s: PLC born
ARPANET

70s: Terminals, Networking, PC

80s: Networking (MAP) Ethernet

90s: IEC61131-3 the Internet

00s: IEC61499 Web standards
Background: Service orientation

**Principles**
- Standardized service contract
- Service loose coupling
- Service abstraction
- Service reusability
- Service autonomy
- Service statelessness
- Service discoverability
- Service composability

**Benefits**
- Increased federation
- Increased intrinsic interoperability
- Increased vendor diversity options
- Increased business and technology alignment
- Increased ROI
- Increased organizational agility
- Reduced IT burden

**Strategic goals**
Background: Knowledge Representation

The Semantic Web Technology Stack
(not a piece of cake...)

Most apps use only a subset of the stack
Querying allows fine-grained data access
Standardized information exchange is key
Formats are necessary, but not too important
The Semantic Web is based on the Web

Linked Data uses a small selection of technologies

Background: Automation Systems
eScop Approach
Challenges on:

- Physical layer
- Representation layer
- Orchestration layer
- Visualization layer
- Function layer
Challenges on Physical layer:

- Smart devices on the shop-floor level for Web Services
- Web services for all levels
- Web service implementation
- Plug and Produce
Challenges on Physical layer:
- Smart devices on the shop-floor level for Web Services
Challenges on Physical layer:
- Web services for all levels

REST

Flexible
Simple
Accessible
Widely used
Challenges on Physical layer:
- Web service implementation
Challenges on Physical layer:
- Plug and Produce

Description:
- Swagger
- Hypermedia
- Semantics
- Hydra API

Discovery:
- Hello/Bye
- Probing
- Heartbeat
Challenges on Representation layer:

- Service inventory
- The model of the manufacturing system knowledge
Challenges on Representation layer:
- Service inventory

- Discover API
  - Get initial links
- Traverse through hypermedia
  - Analyze semantics
  - Populate Ontology
- Provide access to operations by semantics
Challenges on Representation layer:
- The model of knowledge
Challenges on Orchestration layer:

- Decisions vs Composition
- Orchestration on changes
Challenges on Orchestration layer:
- Decisions vs Composition

How complex can it be?

... and this is still a pretty “SIMPLE” process ;-)
Challenges on Orchestration layer:
- Orchestration on changes
Challenges on Visualization layer:

- Knowledge defined visualization
- Exploitation of knowledge complexity
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- Knowledge defined visualization
Challenges on Visualization layer:
- Exploitation of knowledge complexity
Challenges on Function layer:
- MES Functions as modules
Conclusion

- Re-configurable
- Adaptive
- Modular
- Loosely-coupled
- Knowledge-driven
- Dynamic
Future challenges:
- Widely accepted taxonomy for data in manufacturing
- Taxonomy on functional level
- The better service definition
- Usage of implicit knowledge
- Knowledge-driven orchestration
- Safety and security
- Big data & Artificial cognition
Thank you for your attention!

Any questions?