Clarifying and Assisting Smart Manufacturing Standardization with URM-MM

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By the way,
How to make Smart Manufacturing?
So many methods, Initiatives.... We’re CONFUSING!
We need GUIDE for Smart Manufacturing system construction with standards as open eco-system!
What is URM-MM?
Unified Reference Model – Map and Methodology

• URM-MM illustrate a procedural guide that enables users to identify specific use cases that then link the relevant international standards to existing models. The process appears to be the basis of a required navigation tool for the smart manufacturing system.

• URM-MM contains properties such as:

  ✓ the development process defined for each use-case at appropriate scales and granularity,

  ✓ user assistance for selection of an appropriate model from pre-categorized models for each development process to fulfill their aim,

  ✓ list of relevant international standards for the selected model which come from existing reference models/architectures such as RAMI4.0.

SDO: Standards Development Organization
URM-MM: Scheme
Unified Reference Model – Map and Methodology

- RAMI4.0 / Platform Industrie 4.0
- IIRA / Industrial Internet Consortium
- IMSA / Made in China2025
- Smart Manufacturing Ecosystem / NIST
- IoT Reference Architecture / JTC1/WG10
- Architectural Framework for IoT/IEEE P2413
- Architecture Reference Model / oneM2M
- IoT Reference Model / ITU-T SG20
- Big Picture 3D Diagram / ISO TC184
- Framework for the smart manufacturing standards landscape / AIF
- IVRA / IVI
- Demachi Proposal / TC65 ahG3
- UML / OMG

Focus Area

Canvas

Use-case

Function

Data

Clarification & Mapping Method
BUT,
our factory is still in Industrie3.0!
Maturity Level of Smart Mfg System

- Level 6 Sharing
  - Symbiotic Optimization among Stakeholders

- Level 5 Optimizing Prediction
  - Mfg Condition Prediction & Proactive Measure
  - Eng Condition Prediction & Proactive Measure

- Level 4 Managed Measure
  - Mfg Planning, Mfg Problem-solving
  - Eng Planning, Eng Problem-solving

- Level 3 Defined Analysis
  - Mfg Bottleneck Analysis
  - Eng Bottleneck Analysis

- Level 2 Repeatable Connection
  - 4M Resource Track & Trace
  - Eng Info Track & Trace (Dwg No, ID, …)

- Level 1 Initial Visualization
  - 4M Resource Visualization
  - Mfg Result Visualization
  - Eng Result Visualization

Key Functionalities

- Communication Infrastructure
- Unified Data Format

- Encapsulation of Knowledge
- Edge Computing

- AI Technology
- Total Optimization
URM-MM: a method from Japan that arranges international standards mapping and smart manufacturing system development methodology

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Publication of the collaboration

The common strategy on international standardization in field of the Internet of Things/Industrie 4.0

https://www.plattform-i40.de/I40/Redaktion/EN/Downloads/Publikation/common-strategy-international-standardization.html
URM-MM: Description in Canvas phase
Unified Reference Model – Map and Methodology

Toward Human-centric Industries

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URM-MM: Description in Use-case phase
Unified Reference Model – Map and Methodology

Production System

- Production Management
- Maintenance Management
- Asset Management

Simulation based Production Scheduling
Prediction based Maintenance Scheduling
Fine-grained Performance Analysis

ISO 20140-1:2013 – Evaluating energy efficiency and other factors
ISO 22400
ISO 10218
ISO/IEC 18044 Security incident management
ISO/IEC 20000
ISO/IEC 38500:2016 (Governance of IT for the organization)
IEC62264/ISA-95
IEC62443 (ISA-99)
IEC61508
IEC61511
VDI/CDE 2182
**URM-MM: Description in Function phase**

*Unified Reference Model – Map and Methodology*

*Cloud Management* OpenStack, CloudStack

*Virtualization* KVM, docker

*ETL (Extraction/Transformation/Loading)* Sqoop, Talend, Informatica, Pentaho DI

*Data Collection* Fluentd, Flume-NG

*Message Queue* Kafka, ActiveMQ, RabbitMQ

*Distributed Framework* Spark (In-memory batch processing), MapReduce, Tez (Batch processing), Spark Streaming, Storm (Stream data Processing)

*Scientific Computation* MPICH, OpenMP, OpenCL, OpenACC

*Data Storage* HDFS (File system)

HBase, Cassandra, MongoDB (NoSQL)

PostgreSQL, MySQL (DB)

Elasticsearch, Solr (Search Eng)

memcached, Redis (Cache)

*Data Analysis* R, Python, Octive

*Visualization* Kibana, Tableau

Pentaho BA

*Data Search* Hive, Pig, Drill

Spark SQL, Impala

*Machine Learning* Mahout

Spark/MLlib

*Monitoring* ZABBIX

Nagios

*Cluster Resource management*

Hadoop YARN, Apache Mesos
URM-MM: Description in Data phase
Unified Reference Model – Map and Methodology

KPI:
- ISO 20140
- ISO 22400 Part 2
- ISO 10303-59
- ISO 8000-100
- IEC 6264 (ISA-95)
- OASIS PPS

ISO 18435
VDMA24582

ISO 10303/ISO 13584-32
ISO 14306/ISO 17506
ISO 18876/ISO 22745
ISO 29002/ISO 6523
IEC 61360/IEC 62683
ISO/IEC 9834-8

IEC 6264.03 (ISA-95)
Detailed production activity
Detailed maintenance activity

IEC 6264.03 (ISA-95)
ISO 18435
VDMA24582

ISO 3592/ISO 4342
ISO 4343/ISO 6983
ISO 14649/IEC 62714
IEC 62424/IEC 61131
PLCopen XML 2.0

Production: B2MML

IEC 6264.03 (ISA-95)
Production Execution Activity

IEC 62794
IEC 62832
VDI/VDE 2651

Maintenance:
DIN 13306
DIN 31051
VDI 2885

Engineering:
IEC 62264.03 (ISA-95)
Detailed production activity

IEC 62264.03 (ISA-95)
Detailed maintenance activity

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URM-MM: Benefit, Future Plan
Unified Reference Model – Map and Methodology

Benefit

• URM-MM illustrate a procedural guide that enables users to identify specific use cases that then link the relevant international standards to existing models. The process appears to be the basis of a required navigation tool for the smart manufacturing system.

Current Status and Next Action

• URM-MM are going to be promoted to many organizations such as IEC-SEG7, IEC-TC65, ISO/IEC-JWG21, ISO-TC184 and so on.

• Japan members have been describing some use-cases by URM-MM for the verification of URM-MM’s usefulness as a RRI initiative.

• Also, IEC-SEG7 conveners requested that URM-MM should be systemized in IEC-SRG, so Japan members are discussing with related international experts how to communicate with IEC-SRG for the realization.

SRG: System Resource Group