2017 NIST/OAGi Workshop: Enabling Composable Service-Oriented Manufacturing Systems

One of the most exciting new capabilities in Smart Manufacturing (SM) and Cyber-Physical Production Systems (CPPS) is the provisioning of manufacturing services as unbundled "apps or services," which could be significantly more flexible and less expensive to use than the current generation of monolithic manufacturing applications. However, bundling and integrating heterogeneous services in the form of such apps or composite services is not a trivial job. There is a need for service vendors, cloud vendors, manufacturers, and other stakeholders to work collaboratively to simplify the effort to "mix-and-match" and compose the apps or services.

Background

This workshop is the third in the series of smart manufacturing workshops organized by the National Institute of Standards and Technology (NIST) and the Open Applications Group Inc. (OAGi) to address technology and standards needs for easier discovery and easier integration of services based on improved interoperability and composability. Joining the organizers again this year is the SM & CPPS Special Interest Group (SIG), recently established under the International Federation of Information Processing (IFIP) WG 5.7, Advances in Production Management Systems.

At the first Open Cloud Architecture for Smart Manufacturing workshop, the attendees recognized that open cloud service ecosystems provide a promising new platform to advance innovations in manufacturing production and supply chain management. Yet, they also identified and prioritized a number of standards and technology issues that hinder the adoption of the new innovation platform. Participants indicated the need to close the gaps and overlaps among standards, and the need to simplify and assist in the use of standards and SM technologies, as top issues.

At the second Drilling down on Smart Manufacturing -- Enabling Composable Apps workshop, the attendees started work to address the identified top issues within five working sessions. The first three working sessions were focused on the analysis, methods, and tools to address those top issues. The sessions include SM model-based standards development, Standards capability analysis for SM, and SM systems characterization. The other two sessions looked into realizing the innovation platform. The sessions include SM apps and service marketplaces and Crowdsourcing of manufacturing knowledge.

Call for participation:

This year's workshop will continue work within the five working sessions initiated last year. The plan is for this year to complete the identified goals, capability gaps, and needed technology descriptions for each of the sessions. In addition, the sessions will propose one or more priority roadmap topics to be addressed by the community, based on the interests and commitment from the community to work on these topics. Based on the previous year's workshop results, we have identified a common topic across the sessions to be *reference models*, as key enabler to the capabilities leading to Service-Oriented Manufacturing. Therefore, this year's sessions will be focused on the topic of *reference models and their life-cycle management, enabling composable Service-Oriented Manufacturing (SOM) systems*. It is expected each session will take its own perspective on this topic and lead towards creating priority roadmap topics.

The workshop will consist of an opening plenary where the session chairs present objectives and planned work for their sessions, parallel working sessions where the participants discuss the existing and propose new material towards defining focus of the future community effort within priority roadmap topics, and a closing plenary where the session chairs present the results from the breakout sessions. Each session will have its specific focus and an agenda that will be formulated and announced by the session chairs. Please direct your interests and session-specific questions to the respective session chairs indicated below.

Interested professionals and researchers are invited to submit short statements including their positions on these workshop topics, contribute their materials, and share technical insights. Please contact the session chairs and copy the workshop chairs, indicating your intention to participate and/or submit your position contributions. The results from the workshop will be published as a compendium of reports from working sessions as contributed by session chairs.

Workshop Sessions:

Session chairs and general descriptions are provided below. Planned work and objectives will follow.

SM model-based standards development: Chairs – Dr. Nenad Ivezic (link sends e-mail), NIST and Dr. Serm Kulvatunyou(link sends e-mail), NIST. The session is seeking to advance the methodology for messaging standards (e.g., OAGIS) development and usage. The vision of the group is to develop a method and tools that drive more effective and easier-to-use messaging standards.

***SM systems characterization*:** Chairs – Dennis Brandl(link sends e-mail), MESA/BR&L Consulting and Marco Macchi (link sends e-mail), Politecnico di Milano. The session is focused on classification of SM technologies. The vision of

the group is to come up with a method for assessing a manufacturing system and recommending SM technologies and standards for adoption by manufacturers.

SM standards capability analysis: Chairs – Dr. Yan Lu (link sends e-mail), NIST and Dave Noller(link sends e-mail), IBM. This session is intended to bring standards developers, technology providers and manufacturers together to discusses needs, opportunities and challenges for standards relevant to SM in order to accelerate smart manufacturing technology adoptions.

SM apps and service marketplaces: Chairs – Dr. Jim Davis (link sends e-mail), SMLC/UCLA and Dr. Thorsen Wuest(link sends e-mail). In this session, the potential of SM apps and service marketplaces will be explored. The aim is to work towards shared, secure, open-access infrastructure rich in functionality for easier systems integration and composability and a marketplace that can drive technological capability beyond just products by integrating services on standards, uncertainty quantification, benchmarking, performance-use metrics, systems modeling, and many more. A special focus will be on current technological and other challenges as well as requirements from the stakeholders' (e.g., designers, providers & users) perspectives.

Industrial Ontology Foundry (was Crowdsourcing of manufacturing knowledge): Chairs – Dr. Dimitris Kiritsis (link sends e-mail), EPFL, Dr. Paul Witherell (link sends e-mail), NIST. The session focuses on the potential of the Industrial Ontology Foundry, a new effort for the convergence of existing knowledge acquisition research in the manufacturing domain. The primary purpose of the IOF is to develop a standardized upper ontology for the manufacturing domain. In this way, the manufacturing knowledge is expected to be leveraged to capture and refine additional knowledge about smart manufacturing practices and resources, especially to assist small-and-medium-size manufacturers on their production management problems.

Planned Workshop Format:

Agenda for Monday, April 10th:

9:30am - 11:30pm	Plenary
11:30pm - 1:00pm	Lunch
1:00pm - 5:30pm	Break-out Sessions

Agenda for Tuesday, April 11th:

8:00am - 8:30am	Gather for morning charge
8:30am - 11:30am	Break-out Sessions
11:30pm - 1:00pm	Lunch
1:00pm – 3:45pm	Break-out Sessions

3:45am - 4:30pm	Closing Plenary
4:30pm	Adjourn

Break-out Session Locations:

- **Model-based Messaging Standard**
  - Monday - Bldg. 220/Room B321
  - Tuesday - Bldg. 220/Room A112
- **Standard Capability Analysis**
  - Monday - Bldg 220/Room B105
  - Tuesday - Bldg. 220/Room B105
- **SMS Characterization**
  - Monday - Bldg. 101/Portrait Room
  - Tuesday - Bldg. 101/ Portrait Room
- **SM Marketplace**
  - Monday - Bldg. 227/Room A202
  - Tuesday - Bldg. 227/Room 302
- **Industrial Ontology Foundry**
  - Monday - Bldg. 101/Lecture Room F
  - Tuesday - Bldg. 224/Room B245

Workshop Timeline:

- 20 January - Workshop CFP distributed
- 30 March – Position statements received from participants
- 4 April – Slides from presenters received
- 5 April – Session presentations distributed
- 10-11 April – Workshop held