

# Preface for the 2nd International Workshop on Semantic Industrial Information Modelling (SemIIM)

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## Abstract

SemIIM2023 was a full-day workshop that took place on 7th November 2023 in Athens, Greece, co-located with the 22nd edition of the International Semantic Web Conference (ISWC2023). This workshop invited industrial as well as academic keynotes and papers, covering the challenges and solutions for addressing industrial information modelling, including methods and practices of representing concepts, relationships, constraints, rules and operations to specify data semantics for a chosen domain of interest. The workshop gathered the interested community and discussed the latest approaches for challenges both from the perspectives of academia and industry.

## 1. Introduction

Information Modelling (IM) has been under the spotlight of both academia and industry for decades [1, 2]. Important aspects of IM include methods and practices of representing concepts, relationships, constraints, rules and operations to specify data semantics for a chosen domain of interest. As a response to the IM challenge a number of modelling paradigms and languages arose and they range from ERM [3], UML [4], ORM [5] to OWL [6] and Knowledge Graphs [7] and come with a wide range of systems to support the life cycle of information models [8, 9].

Despite the past success, existing approaches and systems for IM fail to cope with new challenges of overwhelming global industrial digitalization that requires advanced information models and aims at fully computerized, software-driven, automation of production processes and enterprise-wide integration of software components [10, 11, 12, 13, 14]. Such trend and the technological and industrial developments that come with it are an important part of Industry 4.0 and industrial Internet of Things [15]. It requires IM that, for example, allows to capture the functionality of and information flow between different assets in a plant, such as equipment and production processes. Moreover, it requires IM and models that are based on ISA and

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IEC standards and have a number of desirable properties, e.g., reusable, explainable, scalable, simulatable etc [16, 17]. Such IM should allow for seamless data sharing and integration e.g., via data market places and across value chains [18, 19].

These new challenges require new theory, methodology, best practice, systems and this should be developed, shared, and discussed by a wide range of stakeholders. Therefore, we initiated the 1st International Workshop on Semantic Industrial Information Modelling (SemIIM) to provide a venue for the community of industrial information modelling.

This is the second edition of the workshop. The first edition [20] was held on 30th May 2022, in Hersonissos, Crete, Greece.

## **2. The SemIIM2023 Workshop**

The 2nd International Workshop on Semantic Industrial Information Modelling (SemIIM) aims at gathering researchers and practitioners who work on addressing these challenges with the help of semantic technologies. We in particular invited IM experts who are excited and committed to push the frontiers of IM further and support modern industry in its current technological transformation. In our workshop we welcomed novel methods, systems, solutions, experience, and practice for semantic industrial information modelling.

The workshop included the sessions described in the following sections.

### **2.1. Academic Keynote**

The Academic Keynote was given by Oscar Corcho at Universidad Politécnica de Madrid (Spain) on the topic: “On the Governance of all the Artefacts used in Knowledge Graph Creation and Maintenance Scenarios”.

Abstract: The creation and maintenance of knowledge graphs is commonly based on the generation and use of several types of artefacts, including ontologies, declarative mappings and different types of scripts and data processing pipelines, sample queries, APIs, etc. All of these artefacts need to be properly maintained so that knowledge graph creation and maintenance processes are sustainable over time, especially in those cases where the original data sources change frequently. It is not uncommon to have situations where ontologies are governed by an organisation or group of organisations, while mappings and data processing pipelines are handled by other organisations or individuals, using different sets of principles. This causes mismatches in the knowledge graphs that are generated, including the need to update all the associated artefacts (declarative mappings, sample queries, APIs, etc.) so as to keep up to date to changes in the ontologies, or in the underlying data sources. In this talk we will discuss several of the challenges associated to the maintenance of all of these artefacts in real-world knowledge graph scenarios, so as to provide some light into how we could set up a complete knowledge graph governance model that may be used across projects and initiatives.

### **2.2. Industrial Keynote**

The Industrial Keynote was given by Sten Grüner at ABB Corporate Research (Germany) on the topic “Asset Administration Shell – Industry 4.0 in theory and practice”.

Abstract: Industry 4.0 is a more than 10-year-old vision of digitalised, adaptive and resilient industry based on converged IT/OT technologies breaching the gap between engineering and computer science. Over the year an understanding of gaps between different information domains across product and equipment lifecycle and supply chain emerged. Asset Administration Shell (AAS) concept was created to close this gap by implementing Digital Twin concepts for industrial applications. In this talk, I will give a brief introduction into AAS information model, implementations and present some selected pilots and demonstrators making use of this technology.

### **2.3. Workshop Papers**

Eleven papers were submitted and accepted. The reviews were hosted at EasyChair. Each paper received at least three reviews from reviewers with different background and status. The following papers were accepted for publication and presented at the workshop:

- Automating Building Regulations Conformance Checking Using a Semantic Approach - Preliminary Results [21]
- Semantic Association Rule Learning from Time Series Data and Knowledge Graphs [22]
- Extending PLASMA for Industrial Semantic Modeling [23]
- GraphGuard: Enhancing Data Quality in Knowledge Graph Pipelines [24]
- The Design of the Diagrammatic and Semantic Models for Process Modelling Language for Digital Triplet [25]
- SHM: A Light-weight, Mid-level Ontology for Reliable System Health Monitoring [26]
- Multi-Architecture Unified Modeling for Manufacturing Service Value Net System Design [27]
- Term Frequency Analysis for Semantic Modeling of Geological Fault Knowledge in the Energy Industry [28]
- Towards a Knowledge Graph-based Data Mesh for Smart Manufacturing [29]
- Towards Semantic Modeling of Camera from Image Quality Testing Perspective: Valeo Vision Systems Case [30]
- Towards Standardised Product Data Exchange with Information Modelling Framework at Siemens Energy [31]

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## References

- [1] B. Succar, Building information modelling framework: A research and delivery foundation for industry stakeholders, *Automation in construction* 18 (2009) 357–375.
- [2] S. Tang, D. R. Shelden, C. M. Eastman, P. Pishdad-Bozorgi, X. Gao, A review of building information modeling (bim) and the internet of things (iot) devices integration: Present status and future trends, *Automation in Construction* 101 (2019) 127–139.
- [3] P. P.-S. Chen, The entity-relationship model—toward a unified view of data, *ACM transactions on database systems (TODS)* 1 (1976) 9–36.
- [4] B. Dobing, J. Parsons, How uml is used, *Communications of the ACM* 49 (2006) 109–113.
- [5] T. Halpin, Object-role modeling (orm/niam), in: *Handbook on architectures of information systems*, Springer, 1998, pp. 81–103.
- [6] D. L. McGuinness, F. Van Harmelen, et al., Owl web ontology language overview, *W3C recommendation* 10 (2004) 2004.
- [7] A. Hogan, E. Blomqvist, M. Cochez, C. d’Amato, G. D. Melo, C. Gutierrez, S. Kirrane, J. E. L. Gayo, R. Navigli, S. Neumaier, et al., Knowledge graphs, *ACM Computing Surveys (CSUR)* 54 (2021) 1–37.
- [8] N. Al-Qaysi, N. Mohamad-Nordin, M. Al-Emran, A systematic review of social media acceptance from the perspective of educational and information systems theories and models, *Journal of Educational Computing Research* 57 (2020) 2085–2109.
- [9] R. Sacks, C. Eastman, G. Lee, P. Teicholz, *BIM handbook: A guide to building information modeling for owners, designers, engineers, contractors, and facility managers*, John Wiley & Sons, 2018.
- [10] M. A. Hossain, A. Nadeem, Towards digitizing the construction industry: State of the art of construction 4.0, in: *Proceedings of the ISEC*, volume 10, 2019.
- [11] A. Borrmann, M. König, C. Koch, J. Beetz, Building information modeling: Why? what? how?, in: *Building information modeling*, Springer, 2018, pp. 1–24.
- [12] R. Crotty, *The impact of building information modelling: transforming construction*, Routledge, 2013.
- [13] A. Ghaffarianhoseini, J. Tookey, A. Ghaffarianhoseini, N. Naismith, S. Azhar, O. Efimova, K. Raahemifar, Building information modelling (bim) uptake: Clear benefits, understanding its implementation, risks and challenges, *Renewable and Sustainable Energy Reviews* 75 (2017) 1046–1053.
- [14] A. Darko, A. P. Chan, Y. Yang, M. O. Tetteh, Building information modeling (bim)-based modular integrated construction risk management—critical survey and future needs, *Computers in Industry* 123 (2020) 103327.
- [15] S. Li, L. D. Xu, S. Zhao, The internet of things: a survey, *Information systems frontiers* 17 (2015) 243–259.
- [16] X. Liu, B. Akinci, Requirements and evaluation of standards for integration of sensor data with building information models, in: *Computing in Civil Engineering (2009)*, 2009, pp. 95–104.
- [17] J. Patacas, N. Dawood, D. Greenwood, M. Kassem, Supporting building owners and facility managers in the validation and visualisation of asset information models (aim) through open standards and open technologies, *Journal of Information Technology in Construction*

(2016).

- [18] L. Seligman, A. Roenthal, Xml's impact an databases and data sharing, *Computer* 34 (2001) 59–67.
- [19] J. Strassner, W. W. Diab, A semantic interoperability architecture for internet of things data sharing and computing, in: *2016 IEEE 3rd World Forum on Internet of Things (WF-IoT)*, IEEE, 2016, pp. 609–614.
- [20] A. Waaler, E. Kharlamov, B. Zhou, D. Zhou, Preface for the 1st international workshop on semantic industrial information modelling (semiim) (2022).
- [21] F. Ramparany, M. Bernert, T. Hassan, Automating Building Regulations Conformance Checking Using a Semantic Approach - Preliminary Results, in: *Proceedings of the 2nd International Workshop on Semantic Industrial Information Modelling (SemIIM 2023) co-located with 22nd International Semantic Web Conference (ISWC 2023)*, 2023.
- [22] E. Karabulut, V. Degeler, P. Groth, Semantic Association Rule Learning from Time Series Data and Knowledge Graphs, in: *Proceedings of the 2nd International Workshop on Semantic Industrial Information Modelling (SemIIM 2023) co-located with 22nd International Semantic Web Conference (ISWC 2023)*, 2023.
- [23] A. Paulus, A. Burgdorf, T. Meisen, A. Pomp, Extending PLASMA for Industrial Semantic Modeling, in: *Proceedings of the 2nd International Workshop on Semantic Industrial Information Modelling (SemIIM 2023) co-located with 22nd International Semantic Web Conference (ISWC 2023)*, 2023.
- [24] R. Dorsch, M. Freund, J. Fries, A. Harth, GraphGuard: Enhancing Data Quality in Knowledge Graph Pipelines, in: *Proceedings of the 2nd International Workshop on Semantic Industrial Information Modelling (SemIIM 2023) co-located with 22nd International Semantic Web Conference (ISWC 2023)*, 2023.
- [25] H. Takeda, S. Koide, S. Joo, M. Kato, L. Akiyama, J. Goto, S. Kondoh, Y. Umeda, The Design of the Diagrammatic and Semantic Models for Process Modelling Language for Digital Triplet, in: *Proceedings of the 2nd International Workshop on Semantic Industrial Information Modelling (SemIIM 2023) co-located with 22nd International Semantic Web Conference (ISWC 2023)*, 2023.
- [26] E. Tsalapati, M. Koubarakis, SHM: A Light-weight, Mid-level Ontology for Reliable System Health Monitoring, in: *Proceedings of the 2nd International Workshop on Semantic Industrial Information Modelling (SemIIM 2023) co-located with 22nd International Semantic Web Conference (ISWC 2023)*, 2023.
- [27] Q. Lyu, P. Qi, Multi-Architecture Unified Modeling for Manufacturing Service Value Net System Design, in: *Proceedings of the 2nd International Workshop on Semantic Industrial Information Modelling (SemIIM 2023) co-located with 22nd International Semantic Web Conference (ISWC 2023)*, 2023.
- [28] F. C. Cordeiro, Y. Qu, Term Frequency Analysis for Semantic Modeling of Geological Fault Knowledge in the Energy Industry, in: *Proceedings of the 2nd International Workshop on Semantic Industrial Information Modelling (SemIIM 2023) co-located with 22nd International Semantic Web Conference (ISWC 2023)*, 2023.
- [29] I. Grangel-González, M. Rickart, O. Rudolph, R. Dias, Towards a Knowledge Graph-based Data Mesh for Smart Manufacturing, in: *Proceedings of the 2nd International Workshop on Semantic Industrial Information Modelling (SemIIM 2023) co-located with*

- 22nd International Semantic Web Conference (ISWC 2023), 2023.
- [30] M. Yahya, A. Breathnach, F. Khan, I. Abaspur, R. Ranganathan, Towards Semantic Modelling of Camera from Image Quality Testing Perspective: Valeo Vision Systems Case, in: Proceedings of the 2nd International Workshop on Semantic Industrial Information Modelling (SemIIM 2023) co-located with 22nd International Semantic Web Conference (ISWC 2023), 2023.
- [31] M. M. Brandt, F. Psarommatis, C. Simon, A. Waaler, B. Zhou, Towards Standardised Product Data Exchange with Information Modelling Framework at Siemens Energy, in: Proceedings of the 2nd International Workshop on Semantic Industrial Information Modelling (SemIIM 2023) co-located with 22nd International Semantic Web Conference (ISWC 2023), 2023.