# Reasoning & Recommendation

##### Session 1.1 (SEMANTiCS)

#### Time: Thursday, September 21, 2023 - 10:45 to 13:00

#### Chair: Robert Wardenga, Senior Researcher, InfAI

## **Talks**

### From Complexity to Clarity: Configuring Success in Industrial Compatibility Management with Semantic Reasoning and Knowledge Graphs

Across various industries and business models, companies face the need to assess compatibility, whether it’s industrial configuration management, terms in contracts, points of a supply chain, buyers and suppliers, and so on.

Whether this process is in relation to assemblies, production, or data analysis, it often requires managing and determining millions of combinations to assess whether components fit together and meet certain requirements. Traditional approaches often struggle with the complexity and scale of real-world scenarios, resulting in lengthy calculation times and restricted insights. Knowledge graphs, on the other hand, perfectly fit these needs and overcome the challenges facing current solutions. In addition to performance, such a semantic solution provides data in the context of domain knowledge, using simple yet expressive axioms and rules instead of disparate hard-coded procedures.

In this presentation, we will showcase a graph solution developed by Derivo for one of the world's largest automation companies, which is currently leveraging this technology in their production processes as well as in an interactive customer-facing configuration solution. The demonstration will highlight the cutting-edge capabilities of RDFox, a knowledge graph and reasoning engine, and how it can be used to streamline compatibility assessment in industrial configuration management. With its in-memory architecture and incremental reasoning, RDFox ensures real-time adaptability and scalability, while also providing increased functionality and analytical power over the industry standards.

As the complexity of commercial configuration management expands, so too does the need for innovative solutions. Derivo’s partnership with RDFox does just that, propelling us into the future where historical limitations dissolve, giving way to knowledge-based analytics and enhanced decision-making

| Thorsten LiebigCo-founder and CEO of derivo [Affiliation page](https://www.derivo.de/) | Peter CrockerCEO and Co-Founder at Oxford Semantic Technologies[Affiliation page](https://www.oxfordsemantic.tech/) |
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### From Skills to Service: How Fraunhofer Society's Skill Catalogue Optimizes Research Request Management

**Initial Situation:**

Our organization, the Fraunhofer Society, faced a challenge in handling the influx of research requests coming in from various external partners and customers. The task of sorting these requests to match with the relevant researchers within our organization (~22.000) was not streamlined and would either cause an information overload for our researchers or be a time consuming and manual task for their managers.

**Approach:**

To rectify this, we devised a strategy that leverages our existing internal skill catalogue, which is a hierarchical presentation of about 1000 skills and sub-skills that were self-reported in the Fraunhofer Society. The methodology entailed mapping each incoming research request to the corresponding skills within our organization. To achieve this, we used a pre-trained language model which had been fine-tuned for paraphrasing paragraphs. After extracting features from both the incoming texts and the skills in the catalogue, we determined their similarity. We engineered a pipeline that accommodates parameters such as text segments, similarity thresholds, target levels of catalogue hierarchy, and crafted prompts. We tested this pipeline by labeling an already labeled dataset of research requests.

**Business Value and Benefits of the Semantic Solution:**

Our method has proven successful in identifying an optimal set of parameters for labeling incoming research requests. The significant benefit of our approach is its ability to alert relevant employees about incoming research requests that match their skills. This strategy effectively minimizes information overload and ensures employees receive alerts only about relevant details and new research opportunities.

**Prospects and Recommendation:**

We are currently integrating this methodology into an internal application, developed by another organizational unit. The application serves as a platform for our external partners and customers to file their research requests digitally. Harnessing the power of language models and organizational resources like a skills catalogue can significantly improve request management and employee productivity.

| Jan-Peter BergmannFraunhofer Center for International Management and Knowledge Economy IMW[Affiliation page](https://www.imw.fraunhofer.de/en.html) |
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### Intelligent Service Agent at ZEISS

We are presenting the Intelligent Service Agent realized at ZEISS. It's a knowledge graph-based recommendation service to guide service technicians at the point of need. The agent is fed by various data sources from technical documentation, over spare part lists to maintenance reports. The talk will illustrate the project from data gathering, data enrichment, and machine learning to predictive maintenance.

| Andreas PawlikHead of Knowledge Management, ZEISS[Affiliation page](https://www.zeiss.com) | Maximilian GärberPartner and Technical Consultant, PANTOPIX [Affiliation page](https://pantopix.com/) |
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### Fusing Semantics and Property Graphs to power Enterprise Recommender Systems

Knowledge Graphs have become increasingly important for knowledge representation and data consolidation in enterprises. They provide the basis to solve complex data problems, provide insights into data and thereby support intelligent decision making at the digital workplace.

Knowledge Graphs technologically developed into two distinct directions. The Semantic Web stack provides standardised technologies for semantic descriptions, interoperability and reasoning, whereas the property graph domain is focused on high-performance problem solving based on graph structures.

In this industry talk, we present an approach to bring together these two domains to build a knowledge-based enterprise recommender that is powered by a semantic knowledge graph and that processes the recommendations using Neo4j and a property graph representation.

We present the use case of analysing ESG-related documents and supporting the writing of ESG reports by providing intelligent insights into ESG standard documents.

-Initial Situation

SWC is developing innovative enterprise recommender solutions based on Semantic AI. We want to leverage the modelling capabilities and scaling power of the Neo4j property graph database to support this scenario by integrating it with PoolParty Semantic Suite.

- Approach and IT-Solution

We develop an integrated architecture that can bridge the Semantic Web and property graph domain and leverage the best of both worlds. We use neosemantics to connect these technologies, which fits RDF data into the property graph before rebuilding the data to benefit from the properties of the relations. We utilize annotations of ESG-relevant documents generated by the PoolParty Extractor as data. Using these techniques, we can exploit semantically enriched data in the scalable Neo4j context.

-Success Criteria for / Benefit of the Semantic Solution

We demonstrate the solution based on an ESG use case and data set and show how the recommender provides valuable insights into ESG topics. To successfully build different paths for recommendations we need to restructure the RDF data in Neo4j knowingly. Properties that are relevant for the recommendation results have to be stored appropriately to use the advantages of property graphs fully.

- Prospects and Recommendations

As a next step, the developed prototype will be brought into a corporate setting to gain experience with different use cases and further develop the quality of enterprise recommendations.

- Demo (if applicable)

We will show a life demo of the prototype based on an ESG use case.

| Robert DavidSemantic Web Company |
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### TriplyDB: Building a Freemium Online Triple Store

Linked data has the potential to transform and replace traditionally proprietary database paradigms. Unfortunately, linked data infrastructure is often too immature to run comfortably in production systems, and first-time users get stuck in setting up disconnected tools in the command-line.

Triply wants to make linked data accessible to everyone. With a user experience that welcomes first-time users, and an infrastructure that can be deployed in large companies.

Operating from the vibrant campus of the VU University Amsterdam, Triply builds a freemium triple store that runs completely online, scales horizontally in K8s, and is certified to run in secure and mission-critical environments.

| Wouter BeekCo-founder of Triply[Affiliation page](https://triply.cc/) | Wouter Beek is co-founder of Triply BV (<https://triply.cc>), a company that offers Linked Data software and services, and guest-researcher at the Knowledge Representation and Reasoning (KR&R) research group at VU University Amsterdam.  Wouter is interested in the Semantic Web as a platform for knowledge-intensive applications, the deployment of large-scale knowledge bases for innovative reuse, and the interaction between Web semantics and pragmatics. |
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