Smarter interoperability with Federation and Artificial Intelligence (SIFAI) Workshop Report

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Abstract
This is a short report on the SIFAI online workshop that was held on 17 November 2020 in conjunction with the I-ESA conference. The objective of this workshop was to explore: (i) how federated approaches to interoperability can provide practical trade-offs between autonomy, control over data, flexibility, performance, and sharing of data; and (ii) how artificial intelligence (e.g., machine learning and knowledge graphs) can make interoperability 'smarter', in the sense of automating decision-making towards achieving interoperability and reducing human effort and intervention.

Keywords 1
Federation, artificial intelligence, machine learning, interoperability

1. Theme introduction

The ubiquity of data offers unprecedented opportunities to automate decisions and to improve IT services. An essential condition for exploiting such opportunities is that the data from potentially many sources can be received and used by the data-processing applications. We don't believe that one fixed set of common standards is a realistic solution for this. Instead, autonomous entities providing or requesting data will collaborate in a federated manner, aiming for interoperability using agreed rules to settle on a solution that is fit for the situation at hand. Moreover, the availability of ontologies and data schema descriptions allows for automated approaches to achieving semantic interoperability. These and other forms of data richness can be exploited using machine learning or other forms of artificial intelligence, contributing to 'smart' interoperability.text.

2. Summary of contributions and discussion

At the workshop, the following presentations were given:
1.   Personal Health Train: a federated metadata approach to support data interoperability, by Luiz Olavo Bonino (invited presentation);
2.   A federated interoperability approach for achieving data driven logistics support to SMEs, by Jean Paul Sebastian Piest;
3.   Increasing interoperability in the Web of Things using Autonomous Agents, by Edison Chung;
4.   Examining Enterprise Architecture for Digital Transformation, by Daniel Rozo;
5.   Smarter interoperability based on automatic schema matching and intelligence, by Jean Paul Sebastian Piest;
6.   Improving the planning of a logistic service provider with the use of machine learning, by Prince Singh;
7.   FAIRificaton platform: a federated approach for semantic rich FAIR data, by Joao Moreira.

Presentation 1 explains the Personal Health Train (PHT), an approach based on the FAIR principles, in which data are primarily "visited" instead of being exchanged between sources and interested parties. Although designed for health data, the approach itself is not domain specific. Discussion: Can a similar approach be of interest to other domains to enable controlled and secure access to data?

In the logistics sector, SMEs experience barriers that prevent them to use real-time data for achieving innovation, as argued in presentation 2. The presenter proposes an architecture for federated interoperability based on the IDS principles, however focusing on new methods and applications to lower the barriers for logistics SMEs, taking their specific needs and requirements into account. Discussion: Given that PHT (FAIR) and IDS are both high-level federated approaches, to what extent do they concur or complement each other?

Presentation 3 investigates semantic interoperability across the Internet of Things and application domains, using agents of multi-agent systems to autonomously interact with "things" on behalf of the application. Agents can be made self-sufficient and mask the heterogeneity of "things". Discussion: How is this agent-based approach different from existing mediator (mediation connector) approaches?

Many companies are engaged in a digital transformation to improve their digital products and services, and to better align their IT base and their business model. Presentation 4 examines the role of Enterprise Architecture (EA) for digital transformation, acknowledging the importance of interoperability and seamless integration. Discussion: Especially if new products and services entail the use of external data, would it be possible and desirable that the EA accommodates any of the afore-mentioned high-level approaches?

Presentation 5 assumes that parties/systems wanting to share data use local data schemas, and therefore schema matching is necessary. The presenter mentions initial guidelines for developing smarter interoperability applications based on schema matching automation, machine learning and manual intervention. Discussion: How can automation be improved and what are the hard tasks that require manual intervention?

Machine learning (ML) applied to contextual data can provide organizations with useful insights that help in better decision making. Presentation 6 describes the use of ML for improving the transport planning at a transportation company in NW Europe. The presenter shows how challenges were addressed in this representative use case. Discussion: What would be the impact on the method and on the results if the data was more diverse than in the considered case?

The last presentation (7) considers an important question that links to the first presentation: how to make existing data sets FAIR? The steps needed for this so-called FAIRification workflow are clarified, especially with respect to achieving semantic interoperability. Discussion: How can existing tools be used to support FAIRification in a federated environment?

Presentations 2, 3, 4 and 5 have accompanying papers, which are included in this proceedings.