Report on the IFIP WG5.8 International Workshop on Enterprise Interoperability (IWEI 2008)

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1. Motivation and History

One of the trends emerging from globalization is the increasing collaboration among enterprises. An enterprise, in this context, is an organization or a collection of organizations with a mission, goals and objectives to offer an output such as a product or service.

Organizations, such as large companies but also SMEs, have to cope with internal changes concerning policies, organizational structure and IT support. In addition, organizations have to flexibly and continuously react to changes in markets, trading partners and trading channels. Such changes in intra- and inter-organizational environments are expected to persist if not intensify in the future. Changes occur at different levels, notably at a business level (focusing on profit, merges, re-organizations, outsourcing, resource sharing etc.) and at a technology level (focusing on application software, IT infrastructure, software and hardware technologies etc.). More importantly, although most changes will originate at a specific level, i.e. they are business-driven or technology-driven, they affect all other levels.

The competitiveness of an organization thus not only depends on its internal performance to produce products and services but also on its ability to seamlessly interoperate with other organizations. This involves internal and external collaboration for which we need enterprise interoperability solutions. A major challenge is then to achieve and sustain multi-level interoperability in the face of planned and spontaneous changes, with proper alignment between and integrity of the different levels.

The International Workshop on Enterprise Interoperability, IWEI, aims at identifying and discussing challenges and solutions with respect to enterprise interoperability, both at the business and the technical level. The workshop promotes the development of a scientific foundation for specifying, analyzing and validating interoperability solutions; an architectural framework for addressing interoperability problems from different viewpoints and at different levels; a maturity model to evaluate and rank interoperability solutions with respect to distinguished quality criteria; and a working set of practical solutions and tools that can be applied to interoperability problems to date.

The IWEI workshop was organized by the IFIP Working Group 5.8 on Enterprise Interoperability, and was held in conjunction with the 12th IEEE International EDOC Conference (EDOC 2008).

The theme and scope of IWEI is very much linked to that of IFIP WG5.8. IFIP WG5.8 reached its current status of Working Group in September 2008, after a Special Interest Group status of 2 years. The SIG was motivated by the perceived interoperability problems that prevent seamless collaboration among organizations. Such problems primarily emerge from proprietary development or extensions, unavailability or oversupply of standards, and heterogeneous hardware and software platforms. But there is also no well-founded overall approach to address interoperability issues across system levels and stakeholders views. Consequently, new collaboration endeavors are hindered, and achieved interoperability is costly. Despite the efforts already spent to overcome interoperability problems, interoperability is recognized by organizations as a major concern and solving interoperability problems represents a considerable portion (over 30%) of their IT costs [5]. On the other hand, opportunities for value creation based on enterprise interoperability have drastically increased [4]. More flexible enterprise interoperability solutions would allow for profitable strategies targeting differentiated products and services in dynamic value networks [1, 2].

2. Contributions

The papers selected for oral presentation at the IWEI workshop [6] were scheduled in 3 sessions A fourth session was devoted to an open discussion on future challenges, involving both the speakers and participants, based on previously submitted statements of the speakers.

2.1 Session 1: Ontologies and the Semantic Web

Successful enterprise interoperability depends on the proper understanding of information that is exchanged between organizations. This explains the interest in ontologies that formalize universes of discourse, and in the semantic web that provides technology for dealing with meaning in service networks.

In their paper "Framework for interoperability analysis on the semantic web using architecture models" J. Ullberg et al. describe a framework for assessing service interoperability over the semantic web. The authors claim that interoperability is influenced by five factors: transmission protocol compatibility, discoverability, ontology completeness, quality of formal denotation markup, and quality of requirements description markup.

Extended influence diagrams are used in the framework to capture the relations between the various interoperability factors and to enable aggregation of these into an overall interoperability measure.

N. Zouggar et al. explain how conflicts can arise with the interpretation of enterprise models after their creation. Such conflicts potentially lead to problems with the operation of organizations, including their interoperability, based on these models. In their paper "Semantic enrichment of enterprise models by ontologies based semantic annotations" the authors identify interpretation conflicts that can occur and propose a systematic approach for semantically enriching enterprise models using ontologies. The approach for semantic enrichment consists of 6 steps, which are detailed in the paper.

2.2 Session 2: Inter-organizational interoperability

As a consequence of market globalization, collaboration between organizations has drastically increased, and the ability to collaborate with other organizations can be key for an organization's competitiveness.

Truyen and Joosen propose in their paper "A reference model for cross-organizational coordination architecture" a reference model for the coordination of service provisioning across organizational boundaries. This reference model supports comparison and analysis of existing coordination architectures, and allows proposals for their improvement. The reference model has 3 main dimensions: type of agreement, language for describing agreements, and middleware for establishing and executing agreements. With the proposed reference model 7 different coordination architectures are compared and potential improvements are identified.

In the paper "Design of services as interoperable systems – an e-commerce case study" Kassel presents important principles of a decision support model for composing reliable software systems from service components. The decision support model can be used to guide the negotiation between a service provider and customer, explicitly addressing interoperability and price issues. The presented work is part of a project under development in cooperation with an industrial partner.

Santana Tapia et al. present a maturity model for collaborative networked organizations in their paper "Towards a business-IT aligned maturity model for collaborative networked organization". The maturity model allows collaborating organizations to assess the current state of business-IT alignment and take appropriate action to improve the alignment where needed. The problem of alignment has so far hardly been studied in networked organizations. The proposed model is a first version derived from various alignment models and theories.

2.3 Session 3: Service-orientation

Flexible enterprise interoperability requires a proper architectural foundation for developing and connecting IT systems to support collaboration. Service-oriented architecture (SOA) could be such an architecture, having an already established web services technology base.

Elvesæter et al. present the vision and initial results of the EU project COIN in their paper "Towards enterprise interoperability service utilities". The project develops open source services, which will be integrated into a coherent pool of enterprise interoperability services according to the Interoperability Service Utility challenge of the Enterprise Interoperability Roadmap. This is seen as a contribution to the Software-as-a-Service Utility (SaaS-U) vision. An enterprise interoperability services framework has been defined, based on previous work from the ATHENA project. Following a state of the art analysis, a set of baseline enterprise interoperability services were specified. These services will be implemented as semantic web services and tested in industry pilots.

Mantovaneli Pessoa et al. propose a conceptual framework for service composition. They discuss this framework in their paper "Enterprise interoperability with SOA: a survey of service composition approaches", considering enterprise interoperability issues related to service composition and different phases of the service composition lifecycle. Five different service composition approaches are described and compared using the framework. The results indicate that none of the approaches cover all the lifecycle phases, but mainly focus on service design-time phases while neglecting others like support for end-user service composition at run-time.

In the paper entitled "Model-driven development of a mediation service" Quartel et al. present a framework to guide the development of mediators for service-based business collaboration. The framework has the following objectives: (i) uncover and capture the actual interoperability problem that needs to be solved; (ii) allow the involvement of non-IT experts in the development of the solution; (iii) support evolution of the solution and re-use of results in case of changing interoperability requirements; (iv) facilitate automation of parts of the process. Available tool support for the different steps in the framework is indicated, and has been demonstrated at workshops of the Semantic Web Services Challenge.

2.4 Session 4: Challenges of enterprise interoperability

Several challenges and future development issues were identified during this session:

Interoperability
• Methods and tools for interoperability assessment are needed. These can utilize for example model-based techniques and influence diagrams.

- The field of interoperability should also incorporate pragmatics, or context-sensitivity. Pragmatics is a domain that should be addressed, not a solution itself.
- Business-IT alignment and interoperability are two non-reachable goals bound together. The key is to keep improving them in iterations. A helpful tool is the development and use of maturity models.

Enterprise models
- In enterprise modeling, one of the major problems is catching the semantics of the model in order to minimize misunderstandings when the model is communicated. Techniques that can be used here include annotations, ontologies, formalization, and iteration of refinement and verification.

Platforms and architectures
- Current coordination architectures are not very mature. Comparison of them using a reference model shows major differences on the addressed scope and concepts (such as the key concept of contract).
- Platforms should utilize both behavior interoperability and semantic interoperability. Both lead to a reference ontology and a set of utilities for model interchange, cross-organizational process coordination, information exchange and assessing the maturity of interoperability.
- Platform-specific solutions for service composition start to emerge, but they still lack full coverage of all the service composition lifecycle phases.

Overarching issues
- Will computing service providers allow an open service market to emerge? The emergence of an open service market requires that the disciplines of IT and service governance, business-driven IT management (system adaptation, service selection), validation of software engineering and business value are more closely intertwined. In order to support service compositions for real business cases there needs to be an environment to integrate services from different companies, identify fitting services, choose between them, integrate the service processes, and provide decision-support for providers and customers.
- Have we addressed the category of "meta-interoperability" problems, caused by the diversity of platforms, methods, languages etc. that have been developed to solve interoperability problems?

3. Conclusion

Enterprise interoperability is a growing research topic, rooted in various sub-disciplines from computer science and business management. Enterprise interoperability addresses intra- and inter-organizational collaboration and is characterized by the objective of aligning business level and technology level solutions and reconciling viewpoints of the different stakeholders. Enterprise interoperability comprises issues which are not yet well-understood and an overall framework for dealing with these issues is still lacking. On the other hand, enterprise interoperability is an essential property of organizations to have successful business operations in the globalized market. This is also recognized by the European Union, as demonstrated by various study reports [3].

We believe that the IWEI workshop provides a useful forum for researchers and practitioners to discuss enterprise interoperability solutions and challenges, and, in collaboration with IFIP WG5.8, to address the identified challenges in future work. The next IWEI workshop is planned in Valencia, Spain, 29 Sept. - 1 Oct. 2009.

4. Acknowledgments

5. References

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