

The "5S" Grid in the Roadmap for Networked Organizations

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1. Introduction

Interoperability has been a central topic in networked organization research since the late 1980s. At about that time the research and the industry was finding out that practically every intellectual engineering job already has or soon would have computerized support and started to think on how these tools could be interconnected so that the slow and error prone re-entering of data could be skipped and complex processes involving several tools could have been automated [1]. A well known illustration of this problem is the "islands of automation" picture [2]. Conceptually, the integration solutions have been betting on syntactic or structural interoperability and a well defined and agreed upon data formats and standardized conceptual models. A large body of work in this field has been done in the context of the ISO STEP [3] and IAI-IFC standards (http://www.iai-international.org/iai_international/).

This paper explores the possibility of semantic grids playing the role in the interoperability scenarios of networked organizations or collaborative enterprises. The two terms are used interchangeably in this paper.

2. Roadmap of networked organizations

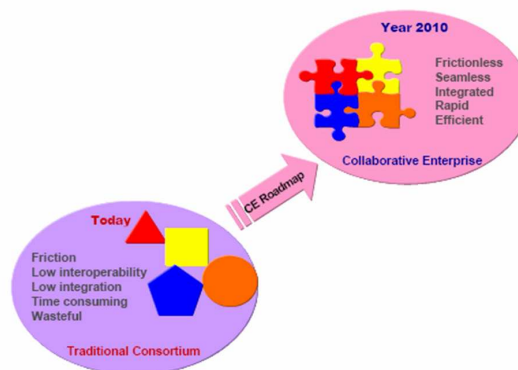


Figure 1: Collaborative Enterprise today and in 2010 (from [4]).

Technology roadmapping is a needs-driven technology planning process to help identify, select, and develop technology alternatives to satisfy a set of (product) needs. It can provide a framework to help plan and coordinate technology developments both within a company or an entire industry. One of the visions of collaborative enterprise is as follows [4]:

"The vision is to achieve a seamless collaborative enterprise which is a networked organization, dynamically formed to create sustainable value through the delivery of integrated Product-Service-Organization (PSO) configurations providing benefits to customers."

Figure 1 is showing the roadmap of collaborative enterprise. From the friction, low interoperability, low integration and a lot of time consuming and wasteful work, by the 2010 the collaboration will be frictionless, seamless, integrated and efficient.

| Actual Situation | Vision | Gap | Research Need | Gap | Foreseen solutions to fulfil the gaps | | |
|--|--|--|---|--|---|--|---|
| | | | | | Short Term | Medium Term | Long Term |
| Design Automation and process management tools are not covering all PSO lifecycle stages | New technologies to support PSO design and lifecycle management | Lack of tools for usability and environmental design | Develop meta-model of design concepts and related tools for PSO lifecycle stages | Lack of tools for usability and environmental design | Design for environment tools | New VR technologies to simulate services sustainability and usability | New DA technology based on meta-model of design concepts for all lifecycle stages |
| Collaborative work technologies are too restrictive | Engineering collaborative workplace fully supports participation of all stakeholders | Actual engineering tools framework is not covering needs of all stakeholders | Develop meta-model for open collaborative workspace | Actual engineering tools framework is not covering needs of all stakeholders | Community oriented collaborative environments | Shift from proprietary models to open source models | Collaboration workplace based on open source design environment |
| Actual DA tools do not cover the needs of product marketing design strategy for PSO | Product marketing design tools encompassing all sustainability aspects | Lack of integrated engineering and management systems | Analyse needed information to undertake strategic design decisions | Lack of integrated engineering and management systems | Align reporting engineering systems with management needs | Integration of engineering systems and management tools | Real time impact analysis between engineering and management decisions |
| Existing KM technologies have limited capabilities | KM is based on concepts and puts value on individual's knowledge | Lack of a conceptual foundation to link knowledge and individuals | Develop KM tools based on semantic network technologies to link and value individuals knowledge | Lack of a conceptual foundation to link knowledge and individuals | KM applications oriented towards individual knowledge | Implement meaning structure within KM tools | KM applications based on semantic network technologies and individuals knowledge |
| Current communication technologies have very low level of meaning | High level meaning for communication tools and shared applications | Lack of a meaning development approach | Develop communication and shared applications embedding meaning and context | Lack of a meaning development approach | Information structure is based on meaning | Communication and shared applications based on semantic web technologies | All applications embed meaning and context |

Figure 2: Identification of gaps and research needs (from [4]).

Figure 2 is providing a more comprehensive analysis of the actual situation, the vision and the gaps and research needs that could potentially lead us there. The reader should in particular note the problems in the collaborative work technologies, which are found to be too restrictive, the limited capacity of the knowledge management technology and the lack of "meaning" in the current communication technologies. The research needs for these three issues are

- (1) develop a meta-mode for open collaborative workspace,
- (2) develop KM tools based on semantic networked technologies and
- (3) develop communication and shared applications embedding meaning and context.

As we will show later on, the semantic grid technology fills those gaps well.

3. Placing semantic grid onto a roadmap

We define Semantic Grid as a grid where its components are semantically annotated and its management and use is supported through technologies that involve reasoning. This is a technology that addresses a set of needs specified by others. According to the discussion in Section 2 it is therefore more of a technology alternative - a road - in some other roadmap, than a need in itself.

Issues such as the friction (of workflow, information flow and to some extent communication), low interoperability (agreements on syntax and structures at best, but not on formal semantics), low integration and a waste of resources due to human intervention during CE operation are all issues that can potentially be resolved by increasing the semantic richness of the ICT infrastructure. Semantic Grid is a technology competing and overlapping particularly with the CORBA, web services and semantic web technologies [9]. Common to these is the commitment to the service oriented architecture, which is providing an opportunity for the convergence of these technologies, starting with the WSDL, UDDI and the rest of the WSRF framework.

4. The 5S Requirements

The IntelliGrid project (www.InteliGrid.com) made an extensive analysis of the end user requirements for a collaborative enterprise. They can be summarized into the list of "5S" requirements, as listed below:

- **security** - industry eager to move to a ground-up secure environment.
- **simplicity** - any solution must work seamlessly with current client applications and operating systems (read Windows).
- **stability & standards** - stable long-term specifications provide a security of investment in new technology; this investment is not only financial. It also includes investment in knowledge, commitment to tools and libraries deployed when creating software.
- **scalable** service orientation - Service orientation is a well accepted paradigm users and developers are familiar with.
- **semantics** - solutions must support rich, domain specific semantics. End users do not care about resource level semantics such as about disks and CPUs but rather about fuselages, walls, proteins ...

A more detailed discussion about requirements and an reference architecture that can address them will be discussed in the paper.

5. Conclusions

While the first level of information systems was built to assist humans in real world processes, the increasing complexity of the ITC infrastructures calls for a second level of information systems that will assist in making a better use of ITC. All business process roadmaps are foreseeing a strong role of ICT in the future. Semantic grid has a potential to be a highway in these roadmaps or a dead end into which substantial effort will be placed, but that will not address the needs of the users. These needs can be summarized as "5S" - security, simplicity, standards, semantics and service orientation.

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7. References

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