



# Enterprise Interoperability

## Research Roadmap

### Annex II – Disposition of Comments

Version 0.2

31 July 2006



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# 1. Introduction

This document is an annex of the final version of the Research Roadmap on Enterprise Interoperability<sup>1</sup>. The research roadmap and its annexes are public documents of all interested stakeholders in Enterprise Interoperability research. They remain public documents now and in future. All interested parties are invited to contribute to the further development of these documents.

The Roadmap document, in its final form, is intended to represent the shared view of interested stakeholders in the Enterprise Interoperability research field who contribute to its development via open consultation coordinated by the European Commission<sup>2</sup>.

Several workshops were organised by the European Commission in order to give all stakeholders the opportunity to comment on the subsequent versions of the roadmap. In addition, written comments were welcomed and several persons provided comments.

This Disposition of Comments gives the editors' responses to the comments received. The comments were broken down into roughly 440 issues, and each issue is individually commented. The issues are classified according to a number of categories. This document presents the issues and the responses by contributor chronologically. Another document presents the issues and the responses by category<sup>3</sup>.

The Disposition of Comments (DoC) acknowledges the contributions from the stakeholders, disseminates and shares these contributions, uses these contributions to improve the Roadmap, ensures that the Roadmap incorporates as far as possible – within the objectives and scope of the Roadmap – the submissions of the contributing stakeholders, and reconciles any applicable differences to the extent possible.

A previous version of this Disposition of Comments, version V0.1, dealt with all comments received up to 31 May 2006. All the issues and our draft responses in the previous draft Disposition of Comments have now been reviewed and, where appropriate, revised and expanded. We have also carefully treated the (new) comments that had arrived after the cut-off date for the previous DoC, and the feedback from the final consultation workshop<sup>4</sup> on 16 June 2006. The result is this version V0.2 of the DoC.

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<sup>1</sup> [ftp://ftp.cordis.europa.eu/pub/ist/docs/directorate\\_d/ebusiness/ei-roadmap-final\\_en.pdf](ftp://ftp.cordis.europa.eu/pub/ist/docs/directorate_d/ebusiness/ei-roadmap-final_en.pdf)

<sup>2</sup> [http://cordis.europa.eu/ist/ict-ent-net/ei-roadmap\\_en.htm](http://cordis.europa.eu/ist/ict-ent-net/ei-roadmap_en.htm)

<sup>3</sup> [ftp://ftp.cordis.europa.eu/pub/ist/docs/directorate\\_d/ebusiness/ei-roadmap-final-annex2-cat\\_en.pdf](ftp://ftp.cordis.europa.eu/pub/ist/docs/directorate_d/ebusiness/ei-roadmap-final-annex2-cat_en.pdf)

<sup>4</sup> <http://cordis.europa.eu/ist/ict-ent-net/ws20060616.htm>

## 2. General responses

Several contributors have commented on similar issues, for which a similar, general response could be given. Two such general responses are described below. The following chapter frequently refer to the General Responses in this chapter.

### General Response 1 – Indicative Research Challenges

Compared to version V1.0 of the Roadmap, the roadmap has been substantially altered in version V2.0. Some written comments to V1.0 and some participants at the first consultation workshop mentioned the high level of technical detail of some of the proposed research challenges (see e.g. Section 3.7.5 of the January 2006 workshop report<sup>5</sup>). In response to these comments, and because it would not be feasible for the roadmap to encompass all technological approaches, later versions of the roadmap have moved away from specifying or endorsing particular technological approaches that should be researched in Enterprise Interoperability. Now, the Roadmap aims at laying out the goals (ideas) of the research in Enterprise Interoperability (what is to be accomplished) rather than the technology/methodology used to achieve these goals (how to achieve it).

By identifying a vision for Enterprise Interoperability research and four Grand Challenges, the editors hope the Roadmap is less prescriptive in nature, shorter, and more strategic. The strategic view permits a greater flexibility towards new technological approaches, particularly considering the long time-span of the research framework. It is also consistent with the principle of giving proposals for research projects the flexibility to suggest their own technological approaches to realise the stated goals. As stated in the Scope of the Roadmap (Section 2.3), “Specifically, in conformance with its objectives, this roadmap targets break-through research for stimulating and catalysing business innovation. Therefore, the research areas should not be prescriptive, in respect of methods, techniques, solutions, the implementation of those solutions, the way in which those solutions are provided, and who are to provide those solutions”.

Given the format of version V1.0 of the roadmap, a large number of contributors have proposed research areas for specific technological approaches. Some of these proposals have been included in the list of indicative research challenges in Annex I. For most of the others, which are less well-defined, but without in any way lessening their significance, it is indicated that they may be considered as part of proposals for individual research projects.

The aim of the indicative research challenges in Annex I is to propose explicit research ideas as specific research issues within the Grand Challenges established in the Roadmap. They are not meant to be prescriptive or comprehensive, i.e. specific project proposals may very well fall outside the scope of the research challenges listed in the Annex.

The editors have put considerable effort into tightening up the wording and, more importantly, the ideas presented in the Roadmap. Concerning the indicative Research Challenges in Annex I, it should however be noted that they originate from “bottom-up” contributions; the research challenges are grass-root submissions. As such, the editors very much relied on the original submitters as regards the contents and the formulation, and applied a “light-touch” approach in processing the submitted texts on these research challenges. The editors have only made changes to the research challenges of version V1.0 of the Roadmap and now in Annex I, where they felt there were substantial issues/problems in the text that needed to be corrected. Some of the research challenges with open issues were also removed from the annex. Most other descriptions of the research challenges from version V1.0 of the roadmap remain in their original form in Annex I.

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<sup>5</sup> [ftp://ftp.cordis.europa.eu/pub/ist/docs/directorate\\_d/ebusiness/20060110\\_report.pdf](ftp://ftp.cordis.europa.eu/pub/ist/docs/directorate_d/ebusiness/20060110_report.pdf)

## General Response 2 – Scope of the Roadmap

As mentioned in the Scope of the Roadmap (Section 2.3), the Roadmap covers those areas which relate to the interoperability of enterprises, including why enterprises need to interoperate, how enterprises interoperate, as well as what constitutes interoperability as a capability. Intrinsic to the concept of enterprise interoperability is that interoperability is a need; it takes place within the context and from the perspective of enterprises.

In addition, the present Roadmap is a research roadmap. Research is by its nature speculative and open-ended. It is carried out for the purpose of solving certain problems, within the context as described in the previous paragraph. Specifically, in conformance with its objectives, this roadmap targets break-through research for stimulating and catalysing business innovation. Therefore, the research areas should not be prescriptive, in respect of methods, techniques, solutions, the implementation of those solutions, the way in which those solutions are provided, and who are to provide those solutions. The actual research work must obviously take into account the state-of-the-art, the state-of-play, and the state-of-practice, as a baseline of the research work. It is also vitally important that the research work is not decoupled from considerations of the take-up of the research results and specifically the impact of the research (which are essential and complementary measures to the research). But the scope of the research field as a whole is not prescriptive of, or pre-determined by, specific solutions to the research problems – such solutions are the outcome of the research. It is not the purpose of a research roadmap to pick business, technology or other winners.

In principle, the Roadmap could be accompanied by other roadmaps – and indeed other policy actions – that focus on closing the gap between research and implementation, research and market developments etc.

In accordance with the principles set out in the above, the following issues are considered out of scope for the purpose of this Roadmap:

- Specific research proposals, execution of research activities
- Deployment issues, implementation aspects, take-up measures, bridging the gap between research and deployment
- Other types of roadmaps, e.g. technology roadmaps, standardisation roadmaps, and product roadmaps, and all issues that would fit in such types of roadmaps
- Specific sectorial issues
- Prescriptive architectures and/or frameworks
- The role of open source software, open source solutions versus proprietary solutions, open source and standardisation
- Specific proposals aiming at the definition of standards and focusing solely on standardisation issues
- Trust and security solutions, while of great importance to Enterprise Interoperability, are seen as part of specific project proposals rather than a specific research area in itself, in the context of this roadmap.
- The nature of science and the inter-relationship between science, invention, research and technology development
- General policy issues as regards the orientation, direction and implementation of FP7

Nevertheless, it is recognised that such issues are important and need to be addressed as well in other arenas. These arenas are indicated in the responses provided, to the extent possible.

## Comments on Roadmap version V1.0

### 3. Comments received from Guenter Boeckle, Siemens

Received on 22 December 2005.

#### Issue 1

Category: general

There are many overlaps with the NESSI Strategic Research Agenda (SRA). It would be beneficial to check that document. It will be published in January before the NESSI Forum workshop on 26 January.

#### Response

*We agree. We have had some feedback and interaction with NESSI members and we hope to have joint meetings to discuss how to best reflect that overlap. We note that NESSI has established a number of working groups to further detail its SRA, although none so far in the specific area of interoperability (although there were discussions on an "Interoperability and Standards Working Group" (July 2006)). We hope that the Roadmap will be a useful contribution towards the appropriate NESSI working group(s).*

#### Issue 2

Category: enterprise

Business processes are well covered in the roadmap document. However, I didn't find development processes there. We think about extending development processes for interoperability. That would help to extend the common make-or-buy decision (or make/buy/outsource/mine decision) to a "make alone / make in cooperation / buy ... outsource/mine").

#### Response

*We think that development processes are a particular type of processes. We have not described the research challenges for particular processes. The idea to develop such process in the context of Enterprise Interoperability is interesting.*

#### Issue 3

Category: general

Such collaboration can only work if there is trust; thus, one of the goals of the roadmap should be the creation of trust between collaborating partners (such partners could be not only companies, but also research institutes and universities). Trust means having common understanding of quality measures, adherence of milestones and other project management elements, and establishing procedures for quality control of processes and systems. Methods and process elements for doing this have to be developed.

#### Response

*Correct. In the final version of the Roadmap we now identify the issue of tacit knowledge (namely trust) in decision making. We believe this is a topic that could fit in the Grand Challenge Knowledge Oriented Collaboration. Trust is explicitly mentioned in Section 7.3.1.*

## 4. Comments received from Roland Jochem, University of Kassel

Received on 27 December 2005.

### Issue 4

Category: business-economic

Added Business – Economic Research Challenge to new section 6.13 “Decentralized Quality Management of Business Processes” (B. 13): Research Challenge Business Interoperability and Quality - Decentralized Quality Management of Business Processes

Research Challenge	Business Interoperability and Quality - Decentralized Quality Management of Business Processes
Description	<p>Problem statement: Does Interoperability influence Quality of Business (Product/Processes)? How ensure that interoperating business processes have the same quality (process and product quality) as an internal established business process. It is a question how to manage:</p> <ul style="list-style-type: none"><li>- Decentralized Quality Management Policies/Targets</li><li>- Decentralized Quality Management Requirements/Standards</li><li>- Decentralized Quality Management Organisational Structures</li><li>- Decentralized Quality Measurement System/Rules/Constraints</li><li>- Decentralized Quality Management Responsibilities</li><li>- etc.,</li></ul> <p>and how to support their diversity within business processes and how to represent quality aspect within Enterprise (Business/Knowledge) Model</p>
State-of-the-Art	Quality management methods and procedures for internal business processes; ISO 9001:2002; ISO TS 16949
Research Activity	This research activity will analyse and develop criteria and features in terms of methods and services (e.g. flexible QM-Modules) to manage the gap between decentralized Quality management Targets, Constraints, Structures, Standards, Rules, Responsibilities within digital business ecosystem environment

### Response

[See General Response 1.](#)

[Added to Annex I \(Indicative Research Challenges\) as Research Challenge B13.](#)

### Issue 5

Category: business-economic

Remark/Addition to B. 2: It is not enough to determine to optimal level of interoperability, but it is also necessary to develop a “measurement system or model” which tells us about the “quality profile of interoperability” when we have reached the optimal level for our company. So other companies can “read” the level and can identify the partner, which fits best to his “Quality profile” concerning interoperability. State-of-the-art example is CMMI.

### Response

[Research Challenge B2 has been deleted due to ongoing research work \(e.g. by ATHENA\).](#)

## Issue 6

Category: enterprise

Remark/Addition to T1.1.1; T 1.1.2; T 1.1.3 and T 1.1.4: Because modelling is still a kind of art, it is also necessary to develop here in this Task 1.1. a scheme of criteria (a model?) which describes the “quality” of an enterprise model concerning its applicability for interoperability.

### Response

*In the ATHENA Integrated Project, a method was developed to evaluate the quality of a model based on the concepts of the Capability Maturity Model. Since this is ongoing research, it was not taken into account as a future Research Challenge.*

## Issue 7

Category: enterprise

Remark/Addition to 1.3 (especially 1.3.3): Monitoring and Quality Management are the most important tasks in cross-organisational business processes to control interoperation and to ensure the quality of resulting products/services. These tasks have to be modelled on different levels from a strategic down to an operational level, to support and control the execution of cross-organisational business processes based on these models.

### Response

*We agree with this remark. We underline that some modelling techniques exist already that take into account Process Modelling from the strategic to the tactical and to the operational level.*

## 5. Comments received from Ville Saarikoski, TIEKE

Received on 28 December 2005.

## Issue 8

Category: SMEs

The vision statement of the research roadmap has an emphasis on SME`s by e.g. stating, “consequently, the successful organisations in the knowledge economy will be small, focused on innovation and information exploitation, with knowledge and links to other companies, with which they can combine rapidly and flexibly to market changes”. We feel that having an emphasis on SME`s is the right choice. However we would like the research paper to elaborate in more depth, how to ensure that the interests of SME`s will be brought onboard? It is after all traditionally the bigger companies who have had a deeper interest and the resources to be involved in EU research initiatives.

### Response

*The focus on SMEs has been further strengthened in the final Roadmap throughout. The SMEs aspect is now also a guiding principle for setting the Grand Challenges (see Section 4.5). Greater involvement of SMEs in European research is a priority for FP7 as a whole. It is also emphasised in the EU's i2010 policy framework, specifically the 2nd Pillar that addresses research and investment.*

## Issue 9

Category: general

The research proposal defined as a framework the figure 3 on page 7. We do not understand how this figure was derived.

## Response

*We have slightly modified the framework for Research Challenges. The earlier framework was derived on the basis of earlier FP6 research projects (ATHENA, INTEROP). The current framework seeks to encompass the full problem space for the enterprises. A research agenda needs to cover technical, business/economic, and policy aspects, although the emphasis in each of the aspects may differ from project to project. For example, it might be argued that policy aspects (liberalization of telecommunications in Europe) played an important role in the development of the telecommunications sector in recent years, and namely that technical developments followed from the initial policy changes.*

## Issue 10

Category: implementation

In the introduction part (page 2) you point out, that “isolated initiatives lead to islands of interoperability, lacking in critical mass and wider application, potentially further compounding problems.” (...) We are however aware that isolated initiatives are most often the quickest route to practical solutions. (...) Isolated initiatives have a potential to create new barriers to entry and this threat should specifically be stressed and addressed in the research proposal. We would like the research proposal to be more specific and state, if possible, examples of these islands. We suggest that the research proposal also contains historical case studies into potential islands of interoperability (e.g. the French Minitel), with a focus on learning from these case studies, how to identify the potential threats of “island solutions” and how to migrate from island solutions into solutions built on a larger critical mass.

## Response

*The sentence in question no longer appears in the Roadmap.*

*The comment is appreciated. Prospective research proposers may wish to note your comment. Given that the execution of research generally starts with a state-of-the-art analysis, it would be appropriate to consider historical case studies as part of that analysis.*

## Issue 11

Category: science base

We would also like to refer to recent research focusing on the new science of networks and on scale free networks. Researchers like Barabasi and his team have found the Internet to be a scale free network and researchers like Vespignani have shown that a scale free network is the most efficient type of network from the perspective of the diffusion of ideas. Instead of looking at interoperability solely from the perspective of bottlenecks, the new science of networks might very possibly provide tools to make our networks far more efficient than they presently are. For this reason we believe that the new science of networks should specifically be stated as a focus area of research.

## Response

*The comment is appreciated. The substance has been incorporated in developing the Science Base Grand Challenge, specifically the area of network science.*

*In addition to the work of Barabasi and Vespignani, that of Parson, Uzzi and Dunlap has also been considered.*

## Issue 12

Category: policy

Researchers focusing into the specific topic of policy seem to be very few in numbers and we are therefore concerned with, how the scientific findings on research policy will be diffused.

## Response

*This is indeed a challenge to the research community. It should be addressed through all the Grand Challenges, but especially in research on the Science Base Grand Challenge.*

## 6. Comments received from Asuman Dogac, METU

Received on 30 December 2005.

### Issue 13

Category: semantics

Added Research Challenge in Document Content Layer Interoperability, namely “Semantic Context based Business Document Content interoperability”

Research Challenge	Semantic Context based Business Document Content interoperability
Description	Different industries have different data requirements, and this has led in the past to the proliferation of variants even in such tightly controlled standards such as X12, EDIFACT, and RosettaNet. On the other hand, different industries need to communicate without having the interoperability problems. Therefore, there is a need to transform the content of the document from one standard or variant representation into another based on semantically enriched context. UBL and the business context domains it proposes (Business Process Context, Product Classification Context, Industry Classification Context, Geopolitical Context, System Capabilities Context, Supporting Role Concept, Official Constraints Context, Business Process Role concept) can be exploited as a basis to build upon them.
State-of-the-Art	There are several standards for addressing business document content interoperability such as xCBL, RosettaNet Document, UBL and Core Components and OAGIS BODs. UBLs long-term (post-1.0) strategy is to create a technology for the automatic creation of specific document types based on the particular business context in which they are to be used.
Research Activity	Developing Semantically Enriched Business Documents based on context for Automated Interoperability of Business Documents.

### Response

[See General Response 1.](#)

[Added to Annex I \(Indicative Research Challenges\) as Research Challenge T4.5.1, and addressed in the Knowledge Oriented Collaboration Grand Challenge.](#)

### Issue 14

Category: semantics

Added Research Challenge in Business Process Layer Interoperability, namely “Semantic based Interoperability of Business Processes”

Research Challenge	Semantic based Interoperability of Business Processes
Description	As already described business processes are composed of business transactions and OASIS ebBP has already defined the basic standard transactions in eBusiness in an abstract and generic way. These business transactions have to be specialized to specific application domains with well defined semantics to be able to support interoperability of business processes.
State-of-the-Art	- ebBP has already defined the basic standard transactions in eBusiness.

	- Semantic techniques are developing with well established ontology languages and tools.
Research Activity	Developing semantic mechanisms for business transactions to support the interoperability of business processes.

## Response

See [General Response 1](#).

Added to [Annex I \(Indicative Research Challenges\)](#) as [Research Challenge T4.5.2](#), and addressed in [the Knowledge Oriented Collaboration Grand Challenge](#).

## Issue 15

Category: semantics

Added Research Challenge under Service Oriented Architecture, namely "Enhancing Web service registries with reasoning capabilities"

Research Challenge	Enhancing Web service registries with reasoning capabilities
Description	Currently semantics is becoming a much broader issue than it used to be since several application domains are making use of ontologies to add the knowledge dimension to their data and applications. One of the driving forces for ontologies is the Semantic Web initiative. As a part of this initiative, W3C's Web Ontology Working Group defined Web Ontology Language (OWL). Enhancing Web service registries with ontologies and reasoning support will help with semantic interoperability in eBusiness.
State-of-the-Art	How to store OWL ontologies into ebXML registries and how to associate these ontologies with Web services have been realized within the scope of the IST 2104 SATINE Project <sup>6</sup> . OWL constructs are represented through ebXML registry information model constructs, and stored procedures are defined in the ebXML registry for processing the OWL semantics. These predefined stored queries provide the necessary means to exploit the enhanced semantics stored in the registry. In this way, an application program does not have to be aware of the details of how this semantics support is achieved in ebXML registry, and does not have to contain additional code to process this semantics. Hence, it becomes possible to retrieve knowledge through queries, the enhancements to the registry are generic and also the registry specification is kept intact. The capabilities provided move the semantics support beyond what is currently available in ebXML registries and it does so by using a standard ontology language. As a result of this work, the IST 2104 SATINE Project Coordinator, Asuman Dogac has been invited to become the primary author of the new normative specification "ebXML Registry Profile for OWL" by the OASIS ebXML Registry Semantic Content Management Subcommittee. Ontologies can play two major roles: one is to provide a source of shared and precisely defined terms which can be used formalizing knowledge and relationship among objects in a domain of interest. The other is to reason by using the ontologies. When an ontology language like OWL is mapped to a class hierarchy like the one in ebXML, the first role can directly be achieved. However, when we want to infer new information from the existing knowledge, we need reasoners.
Research Activity	Incorporating reasoners to Web service registries like ebXML or UDDI.

<sup>6</sup> Dogac A., Kabak Y., Laleci G. C. Mattocks, F. Najmi, J. Pollock, "Enhancing ebXML Registries to Make them OWL Aware", Distributed and Parallel Databases Journal, Springer-Verlag, Vol. 18, No. 1, July 2005, pp. 9-36. (Science Citation Index Expanded, Impact Factor: 00.897).

## Response

*See General Response 1.*

*Added to Annex I (Indicative Research Challenges) as Research Challenge T4.5.3, and addressed in the Knowledge Oriented Collaboration Grand Challenge.*

## Issue 16

Category: general

Added Research Challenge under Service Oriented Architecture, namely “Providing role and context based privacy in eBusiness”

Research Challenge	Providing role and context based privacy in eBusiness
Description	There are some important considerations in developing privacy mechanisms for eBusiness: Only the minimal pertinent information should be provided. Another critical issue is not to overwhelm the users while declaring their privacy preferences. Indeed declaring privacy preferences on the basis of service instances may be quite cumbersome and sometimes even not possible. A user may not in advance know which service she will need. Determining whether the data requested by a Web service violates user's privacy preferences should be automatic. More importantly, in addition to protecting the privacy of data provided by the service consumer, that the current efforts address, there is a need for mechanisms for protecting the privacy of data being accessed.
State-of-the-Art	In EU data privacy, namely the right to self-determine the disclosure of personal information in addition to the general principles of processing of personal data is ruled by the EU Directive 95/46/EC <sup>7</sup> . The supplementary Directive 2002/58/EC <sup>8</sup> concerns the processing of personal data in the electronic communication sector. The privacy mechanisms to be developed must be consistent with these directives. The Platform for Privacy Preferences Project (P3P) developed by the World Wide Web Consortium, is an industry standard providing a simple, automated way for users to gain more control over the use of personal information on Web sites they visit. At its most basic level, P3P is a standardized set of multiple-choice questions, covering all the major aspects of a Web site's privacy policies. Obviously, this is not adequate for the privacy of dynamic exchange of data in eBusiness. Furthermore, P3P concentrates on the privacy of the person accessing the data, not on the privacy of the data being accessed. Furthermore, current identity based privacy mechanisms should be extended based on roles because in enterprises, the roles are as important as personal identification.
Research Activity	Developing a context and role based privacy mechanisms for eBusiness

## Response

*See General Response 1.*

*Added to Annex I (Indicative Research Challenges) as Research Challenge T2.5.1.*

## Issue 17

Category: general

Added Research Challenge under Supply Chain Processes, namely “Intelligent Collaborative Planning on the Supply Chain based on Smart Products”

Research Challenge	Intelligent Collaborative Planning on the Supply Chain based on Smart Products
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<sup>7</sup> [http://europa.eu.int/comm/justice\\_home/fsi/privacy/](http://europa.eu.int/comm/justice_home/fsi/privacy/)

<sup>8</sup> [http://europa.eu.int/eur-lex/pri/en/oj/dat/2002/l\\_201/l\\_20120020731en00370047.pdf](http://europa.eu.int/eur-lex/pri/en/oj/dat/2002/l_201/l_20120020731en00370047.pdf)

Description	The smart tags of products together with the agent technology and semantic interoperability of planning data seem to provide opportunities for intelligent supply chain processes.
State-of-the-Art	The smart tag technology is improving. The “Collaborative Planning, Forecasting, and Replenishment (CPFR)” guidelines have been developed. Agent technologies as well as semantic mediation technologies are maturing.
Research Activity	Intelligent collaborative supply chain processes exploiting smart products and semantic interoperability

### Response

*See General Response 1.*

*Added to Annex I (Indicative Research Challenges) as Research Challenge T2.5.2.*

### Issue 18

Category: semantics

Added Research Challenge under Profiling versus Semantic Interoperability, namely “Semantic based interoperability profiles”

Research Challenge	Semantic based interoperability profiles
Description	The approach taken in developing the integration profiles is first to define the basic transactions describing the interactions between the IT systems and then to define the workflows describing the real life business processes by using these transactions together with the standard based interfaces. Although these integration profiles provide interoperability, they are restrictive: they are developed by considering specific use cases and whenever there is a need to cover another use case or any unforeseen variation in a use case, there is no flexible way of composing transactions to a new profile and still maintain the interoperability.
State-of-the-Art	- Integration profiles have been very successful in providing interoperability as demonstrated by the quick and extensive take up by the industry - There are well established domain specific standards, such as Open Travel Alliance in the tourism domain and HL7 in healthcare domain which provide extensive knowledge in the domain which can be used to obtain domain specific ontologies.
Research Activity	The research challenge is developing interoperability profiles where basic transactions together with their semantics are used to form flexible business processes. Considering the developments in the state-of-the-Art, this challenge is not far-fetched but the time is right to address this issue.

### Response

*See General Response 1.*

*Added to Annex I (Indicative Research Challenges) as Research Challenge T4.5.4, and addressed in the Knowledge Oriented Collaboration Grand Challenge.*

## 7. Comments received from Sergio Gusmeroli, TXT

Received on 2 January 2006.

### Issue 19

Category: general

Proposed changes in section headings.

Id	Old name	Proposed new name
<b>P</b>	<b>Policy challenges</b>	<b>Legal/Policy Research Challenges</b>
P.1	Dissemination of information about existing legislation and regulation Enlarged EU awareness of e-business existing regulations	
P.2	Harmonisation of national implementation of EU directives supporting e-commerce Enlarged EU harmonisation and adoption of e-business EU directives	
P.3	Encouraging adoption of IPv6 (TXT: this seems to me so specific!!) Promoting and Encouraging new Communication Infrastructures and Protocols for Enterprise Interoperability	
P.4	Software licenses for distributed and movable applications Innovative Software Delivery and Protection Policies for Enterprise Interoperability (TXT: including on-demand, pay-per-use models and not just "licence" models)	
P.5	Regulation of trusted certification authorities Regulation and Harmonisation of Trusted Certification Authorities	
P.6	Exchange of data across national borders Regulation and Harmonisation of cross-border Enterprise Data Exchange legislations	
P.7	Trans-European limited liability incorporation (TXT: this seems to me so specific!!) Trans-European legal entities for Enterprise Interoperability	
New	<i>Innovative Software Production Policies for Enterprise Interoperability (TXT to complement P4 which is for sw delivery)</i>	
New	<i>Promotion of an European Open Source Software directive for Enterprise Interoperability (TXT: study new OSS licence models to better support the EI in EU)</i>	
New	<i>A Single European E-Marketplace (SEEM): legal and policy issues.</i>	
New	<i>Legal issues for Enterprise Applications global production and delivery (China-India)</i>	
<b>B</b>	<b>Business – economic research challenges</b>	<b>Business/Economic Research Challenges</b>
B.1	Business interoperability framework Business Interoperability Framework (BIF) - Basics (TXT: just the concepts, definitions, indicators. What is an EI indicator? Or better what is an E lack of i/op indicator? How can we say that an E has i/op problems?)	
B.2	Business interoperability framework – long term Business Interoperability Framework (BIF) – Advanced (TXT: put here the benchmarking, assessment, recovery actions)	
B.3	Business interoperability and society Impact of Enterprise Interoperability onto the EU Society (TXT new competencies/education needed, manual data entry disappearing, BP outsourcing, employment levels, manpower emigrations)	
B.4	Business models for interoperability Business Models for Enterprise Interoperability Solutions (TXT: A business model is a conceptual tool that contains a set of elements and their relationships and allows expressing a company's logic of earning money. It is a description of the value a company offers to one or several segments of customers and the architecture of the firm and its network of partners for creating, marketing and delivering this value and relationship capital, in order to generate profitable and sustainable revenue streams (Osterwalder, 2004). How to propose and sell EI solutions to customers? I would stress the fact that EI Solution is not JUST SW!!!)	
B.5	Enterprise grid-based economics (TXT: too narrow and specific. I would extend it to a generic SOA and how to account-charge-bill EI services provided in pure ASP mode). Accounting and Billing Methods in EI Architectures (SOA)	
B.6	Interoperability impact analysis Impact of Enterprise Interoperability onto the EU Economy – Basics	
B.7	Interoperability impact analysis - long term Impact of Enterprise Interoperability onto the EU Economy – Advanced	
B.8	Contribution of interoperability to productivity (TXT in my opinion it is a part of the EU economy and should be merged with the previous 2 items)	
B.9	Decentralised governance of business processes (TXT too specific) Decentralised Decisional and Governance Models for EI	

<b>Id</b>	<b>Old name</b>	<b>Proposed new name</b>
B.10	SME-related economic and deployment considerations European SMEs and EI (TXT I would address here 3 aspects: industrial SMEs, ICT SMEs and Research SMEs)	
B.11	Technology trajectory of interoperability	Technology Trajectory to Enterprise Interoperability
B.12	Interoperability and digital ecosystems (TXT too specific)	Enterprise Interoperability in new, collaborative organisational forms
<i>Bn</i>	<i>EI in EU New Member States and Accession Countries</i>	
<b>T1</b>	<b>Enterprise [business/knowledge] research challenges</b>	<b>Enterprise level research challenges</b>
T1.1	Interoperability of enterprise models	Interoperability of Enterprise Models
T1.1.1	Process model/tool interoperability	Enterprise BP Interoperability – Basics
T1.1.2	Process model and tool interoperability generic	Enterprise BP Interoperability - Advanced
T1.1.3	Enterprise model interoperability [distributed] – def. of problem / domain / prototype	Enterprise models interoperability - Basics
T1.1.4	Enterprise model interoperability [distributed]	Enterprise models interoperability - Advanced
T1.2	Usability of Enterprise Modelling	Usability of Enterprise Models
T1.2.1	Model generated solutions and work places	--
T1.2.2	Enterprise model visualization	Enterprise Models Visualization and Presentation
<i>T1.2.3</i>	<i>Context-aware Intelligent Active Models</i>	
<i>T1.2.4</i>	<i>IPR Management in Enterprise Knowledge Models</i>	
T1.3	Cross-organisational Processes	Cross-organisational Business Management
T1.3.1	Organisational roles and policies	Organisational and Decisional Processes: Modelling
T1.3.2	Modelling cross-organizational business processes	Cross-organisational Business Processes: Modelling (TXT including collaborative interactive processes and task management)
T1.3.3	Monitoring of business processes	Cross organisational processes: simulation, monitoring, controlling and governing
T1.3.4	Aligning business strategy and ICT strategy	Aligning Business and ICT strategies for Enterprise Interoperability
T1.4	Agreements and contracting	--
T1.4.1	Service level agreements	Trust Management for Enterprise Interoperability
T1.4.2	Contracting	Contract/Agreement Management for Enterprise Interoperability (including SLA in SOA, but also inter-company contract mgmt and negotiation)
T1.5	Interoperability supports for SMEs	SME Interoperability
T1.5.1	Data mapping and conversion	SMEs Interoperability at Data level
T1.5.2	Services access to intermediaries	SMEs Interoperability at Application level - Basics & Advanced
T1.5.3	Beyond local services	(deleted)
T1.5.4	SME related economic and deployment	SMEs Interoperability at Business level
T1.5.5	SME digital ecosystems	SME Interoperability at Organisational level

<b>Id</b>	<b>Old name</b>	<b>Proposed new name</b>
T1.6	Intercultural interoperability	Intercultural Interoperability <i>EI Solutions Localisation</i>
<i>T1.6.1</i>		
<b>T2</b>	<b>ICT systems and A&amp;P research challenges</b>	<b>ICT level research challenges</b>
T2.1	Run-time aspects of business processes	Cross-organisational Processes: Enactment
T2.1.1	Networked business support through information / [document] exchange	Cross-organisational Data/Information exchange
T2.1.2	Networked business support through sharing [e.g. CPD scenario]	Cross-organisational Knowledge sharing
T2.1.3	Cross-organizational business process execution (TXT including user interaction like BPEL4PEOPLE)	--
<i>T2.1.3a</i>	<i>Cross-organisational Enterprise Applications Interoperability (TXT user mgmt, HCI, application logic, process logic, data logic)</i>	
T2.1.4	Monitoring and redesign of business processes (TXT included in the following in my opinion)	(deleted)
T2.1.5	Decentralized governance of business processes	Cross-organisational Monitoring, Governance and Re-design of Business Processes
T2.1.6	Observation & validation of collaborations between business processes and services (TXT not clear)	(deleted)
T2.1.7	Finding ways of representing enterprise knowledge architecture	Holistic Cross-organisational Interoperability Architectures
T2.2	Service discovery, brokering, negotiation & mediation	SOA for Enterprise Interoperability
T2.2.1	Service description	Service Description for EI (TXT add WSRF and GRID services)
T2.2.2	Service composition	Service Composition and Orchestration for EI
T2.2.3	Models and meta-models for service-oriented architectures	Model-driven approach to Service-Oriented Architectures
T2.2.4	Usability of the Enterprise Interoperability solutions	Usability of SOA solutions for EI
T2.2.5	Service discovery, brokering, negotiation and mediation	--
T2.3	Re-engineering of legacy systems	Re-engineering Legacy systems to SOA
T2.3.1	ADM	--
T2.3.2	Trust, confidence/security and policies interoperability	Trust, Confidence/Security and Policies Interoperability (NFA)
<i>T2.3.3</i>		<i>Knowledge Mining in Distributed Enterprise Models</i>
T2.4	Infrastructures & services NFA	Infrastructures & Architectures
T2.4.1	Autonomous architectures [agents, p2p]	--
T2.4.2	Grid-based enterprise interoperability	--
T2.4.3	Adaptive & self-adaptive systems	Evolutionary & self-adaptive systems
T2.5	Repositories and persistence services (TXT in my opinion are part of 2.4)	--
<i>T2.4.5</i>	<i>Semantically Empowered Service Architectures (SESA)</i>	
T2.6	Terminal interoperability	Terminal and Network Interoperability (TXT I would add here network i/op issues)

<b>Id</b>	<b>Old name</b>	<b>Proposed new name</b>
T2.7	Interoperability to support ambient intelligent applications	Ambient Intelligent Interoperability
T2.7.1	<i>Modelling the Ambient Intelligence (TXT Intelligence everywhere, invisible computing, Personal/Body Area Network, high interactivity, user-centric interoperability)</i>	
T2.7.2	<i>Enacting the Ambient Intelligence (TXT new generation BP execution engine and workflow engine)</i>	
T2.7.3	<i>EI in an Ambient Intelligence Environment (TXT Aml c-BP, Aml SOA, Aml EM, Aml Applications MDA)</i>	
<b>T3</b>	<b>Methodology research challenges</b>	<b>Methodology level research challenges</b>
T3.1	Interoperability frameworks and architectures	Conceptual Interoperability Framework
T3.1.1	Integrated paradigm interoperability	Integrated Paradigm for Enterprise Models Interoperability
T3.1.2	Unified paradigm interoperability infrastructure	Unified Paradigm for Enterprise Models Interoperability
T3.1.3	Federated paradigm interoperability infrastructure	Federated Paradigm for Enterprise Models Interoperability
T3.1.4	Interoperability methodologies	Enterprise Interoperability Methodology and Foundation
T3.1.5	Simplified SME enterprise infrastructure	Customised Methodology for SMEs Interoperability
T3.2	Networked enterprises operations support	Applicative Interoperability Framework
T3.2.1		<i>EI Projects Life-cycle Support</i>
T3.2.2		<i>Lack of Interoperability Discovery and Analysis</i>
T3.2.3		<i>Interoperability Solutions Negotiation and Selection</i>
T3.2.4		<i>Verification and Validation of Enterprise Interoperability</i>
T3.2.5		<i>Guidelines and Best Practices towards EI</i>
T3.3	Semantic interoperability	(deleted)
T3.4	MDI- model driven interoperability – specific	(deleted)
T3.5	MDI- model driven interoperability – generic	(deleted)
T3.6	Model design solutions	T3.3 Technical Interoperability Framework
T3.3.1		MDI Model-driven Interoperability - Basics
T3.3.2		MDI Model-driven interoperability - Advanced
T3.3.3		Semantic Enterprise Interoperability
T3.3.4		EI Design Solutions
T3.3.5		Distributed Enterprise Models Consistency and Synchronisation
<b>T4</b>	<b>Semantics and ontology area research challenges</b>	<b>Semantic level research challenges</b>
T4.1	Business process ontology	Enterprise level Semantics
T4.1.1	Business process description ontology	Business Process semantics
T4.1.2	Business process classification ontology	Enterprise Models semantics
T4.1.3	Behavioural mediation	Semantic Mediation for Enterprise Interoperability
T4.1.4		<i>Enterprise Applications semantics</i>
T4.2	Ontology infrastructure	EI Ontology life-cycle Management
T4.2.1	Business ontology authoring and management system	EI Ontology Management System
T4.2.2	Semantic data mapping & mediation	

<b>Id</b>	<b>Old name</b>	<b>Proposed new name</b>
		Semantic Models, Data and Services Mapping & Mediation
T4.2.3	Semantic annotation	Semantic Annotation for EI
T4.2.4	Business ontology evolution and versioning	EI Ontology evolution and versioning
T4.2.5	Business ontology validation	EI Ontology assessment and validation
T4.2.6	Enterprise ontology based query/retrieval, discovery, search	EI Ontology Intelligent Consultation
T4.3	Ontology languages and KR reasoning, evolution methodologies (TXT included in T4.2)	(deleted)
T4.4		
T4.5	Applications to other domains	Ontology-driven EI
T4.5.1	Ontology based system modelling	Ontology based ICT Systems Modelling
T4.5.2	Ontology based enterprise modelling	--
<b>T5</b>	<b>Generic modelling research challenges (TXT I would distribute it to the other T1-T4)</b>	
T5.1	Distributed active models [interoperation of models] – for simulation and enactment Distributed Active Models (interoperation of models) – for Simulation and Enactment (T1.2.3)	
T5.2	Simulation and enactment of distributed processes [models for interoperation effects]	(T1.3.3)
T5.3	Usability of models	(T1.2)
T5.4	MDA/DSL technologies	(T3.3.1 and T3.3.2)
T5.5	Distributed model synchronisation	(T3.3.5)
T5.6	Semantic based model mappings and transformations	(T4.2.2)
T5.7	Knowledge mining & ADM	(T2.3.3)

## Response

[See General Response 1.](#)

## 8. Comments received from Jan Goossenaerts, TUE

Received on 4 January 2006.

### Issue 20

Category: science base

Section 2.1 par. 7 (cited page 2-3): “The European economy can largely benefit from improved interoperability thanks to the so-called “viral” or “network effects”. The benefit for each individual adopter of an interoperability concept increases with the dissemination of this concept: as soon as a critical mass is reached, an interoperability concept “sells” itself (network externalities). Metcalfe’s law states that the value of a network increases as the square of the number of connections. So, the total value of a good or service that possesses a network effect is roughly proportional to the square of the number of customers already owning that good or using that service. This explains why markets with network effects tend to become monopoly markets as it is the case with computer software or some websites.”

The relevance of network effects for enterprise interoperability is given a too narrow interpretation. Network effects also act as barriers to adoption. (see Au, Joris A. and R.J. Kauffman (2005) Rational Expectations, optimal control and information technology adoption, Information Systems and e-business management, pp 347-370, Springer-Verlag)

In this context it must also be made explicit that lack of interoperability gives lock-in advantages to many solution providers, who therefore have no incentives to help achieving interoperability for their customers.

### **Response**

*The comment is appreciated. The study of network science is incorporated into the Roadmap – see Response to Issue 11.*

*The comment is also addressed in the specific Research Challenge B11 Technology Trajectory of Interoperability, in relation to consideration of various technology “laws”, including those of Moore, Metcalfe, Gilder, Negroponte, Lessig, Conway etc. The research here is also closely related to the theories and practices of networked organisations, economics, community etc as envisaged under the Research Challenge B3 Business Interoperability and Society.*

### **Issue 21**

Category: standards

(page 3 continued) “Therefore, from a consumer’s perspective interoperability concepts should be based on open standards in order to avoid monopoly prices.”

This statement jumps to a conclusion; open standards would offer one way of achieving interoperability, but not the only way. Consider for instance an approach in which solution providers guarantee interoperability as part of a service level agreement, where they achieve this with proprietary software and mappings. Open standard is just one element in a broader "socio-technical" design.

### **Response**

*You are correct. A causal relationship between non-standard (proprietary) interoperability to monopoly prices has – to the best of our knowledge – not been established empirically. It is also not clear that open standards per se avoid market power and/or monopoly prices. Later versions of the Roadmap (V2.0 and later) have been substantially altered so as to have a more strategic focus, and to be less prescriptive on how to achieve the stated goals.*

### **Issue 22**

Category: general

(Section 2.2 Objectives)

Par 1: “ ... a research roadmap for enterprise interoperability ..”

Par 4: “... the document has to address the needs of industry ... research challenges ..relevant for end-users ... stimulating innovation”

Par 5: “Furthermore, this research roadmap document should preferably be accompanied by another document which outlines a view beyond research. One of the main points where Europe is lagging compared to other regions is in innovation, the transfer of research results to practice. Actions should not only be anticipated in research, but also in demonstration and deployment. In addition, regulatory measures might be needed as well”

The editors should be aware that the research world and industry are two very different worlds. The research world is slow paced, with focus on experimental work and publishing (public knowledge) in archival journals. Industry needs proven solutions that it can deploy (invest in) immediately, it also favours "private" content that can be subject of (explicit) contracts.

### **Response**

*See General Response 2.*

*Thank you for the comment. The issue of bringing research to implementation is outside the scope of this Roadmap. Nevertheless, the European Commission is well aware of such issues and has for instance launched the Competitiveness and Innovation framework Programme (see [http://ec.europa.eu/enterprise/enterprise\\_policy/cip/index\\_en.htm](http://ec.europa.eu/enterprise/enterprise_policy/cip/index_en.htm)). The same issue is highlighted by high-level groups such as the eEurope Advisory Group in "Making i2010 work: creating value from research and innovation" (see [http://europa.eu.int/information\\_society/eeurope/2005/doc/all\\_about/advisory\\_group/eac\\_contribution\\_i2010.pdf](http://europa.eu.int/information_society/eeurope/2005/doc/all_about/advisory_group/eac_contribution_i2010.pdf)).*

### **Issue 23**

Category: general

Section 2.2, paragraph 5 shows the awareness of the broader scope of the enterprise interoperability problem.

Proposal is to include "SCOPE section" before the 2.2. Objectives. In the scope section the innovation cycle should be briefly presented, as well as their stakeholders, and researcher/industry expectations/assumptions regarding these stakeholders.

E.g., in the case that other (innovation) stakeholders are taking care of additional and precise "needs articulation", these other stakeholders and their services should be identified, and the roadmap could then focus on the research needs for these other stakeholders (this may impact the name).

The bottom-line is that the researchers should not be given tasks, already for which other stakeholders already take care.

### **Response**

*Thank you. A Scope section was added to Chapter 2 Introduction. We felt we needed to layout the objectives of the Roadmap upfront, immediately after the background. The Scope section follows the Objectives section. We have changed the content of the Objectives section.*

### **Issue 24**

Category: general

(Section 3.1 Roadmapping)

In this section, some attention should be given to the fact that (due to the importance of network externalities in interoperability) much value of the roadmaps should/could be derived from aligning public (e.g. this one), collective (e.g. industries) and private roadmaps (e.g. company "ICT" roadmaps). With (much) shared contents, much efficiency can be gained in the roadmapping process for all these actors.

### **Response**

*Indeed, we agree that efficiency in the roadmapping process could be gained by sharing contents among public, collective, and private roadmaps.*

### **Issue 25**

Category: general

(Section 3.2 Roadmapping method)

The roadmapping method is described in a very generic manner only, without methodological approach that are typical for enterprise interoperability. For example, given network externalities and the broad range of stakeholders involved the public or private status of roadmap contents is an issue; public content should be of high and demonstrable value, industrial (end-user) interest may be small, adoption of challenges.

The fast-paced development of ICT and how enterprises make use of it demands regular refreshing of the roadmap content, and a method/platform/repository capable to handle this.

### **Response**

*See General Responses 1 and 2.*

*Since version V2.0, the Roadmap has been substantially altered. The introductory text from version V1.0 (including the text you refer in your comment on the roadmapping method) was not included in later versions of the Roadmap (V2.0 and later) since it was felt it was too general and not necessary given the purpose of the document.*

## **Issue 26**

Category: general

(Section 3.2 Roadmapping method)

An Annex could be included that contains the database schema of the roadmap, and guidelines on using it. By the nature of roadmapping work, the chapters 5-10 should be presented as (result to a query at 12/2005 on the roadmap repository database).

The method section should also include some information on (research result) reporting against the challenges/gaps.

## **Response**

*See General Responses 1 and 2.*

*Since version V2.0, the Roadmap has been substantially altered. The introductory text from version V1.0 (including the text you refer in your comment on the roadmapping method) was not included in later versions of the Roadmap (V2.0 and later) since it was felt it was too general and not necessary given the purpose of the document.*

## **Issue 27**

Category: framework

(Section 3.3 Framework & 3.4 Product and Standardisation Challenges)

An effort should be made to integrate the explanation of Figure 4 with the framework in Figure 3. (into an extended framework section). In such a section also the different kinds of stakeholders should be distinguished.

Examples of integrating sentences are:

The scope of (research & innovation) policy (and macro-economy) is the regular and competitive flow of innovations, and the right-timing of the phase transitions (e.g. from invention to innovation, the retirement) of a particular technology. Policy instruments such as subsidies can accelerate scaling and consolidation of certain technologies, and tariffs can accelerate retirement of obsolete technologies. In such cases knowledge is needed on substitution relationships among technologies, and adoption in the market

The scope of business (customer/ micro-economics) is the adoption of a particular technology or solution (and the write-off of an earlier generation solution that is being substituted). The business (customer) must make a return on investment decision, for which it needs to gauge investment intentions of its business partners – due to the network externalities involved in interoperability) (see Au, Joris A. and R.J. Kauffman (2005) Rational Expectations, optimal control and information technology adoption, Information Systems and e-business management, pp 347-370, Springer-Verlag)

The scope of business (solution/technology provider) is (heavily) in T2, adopting vertical standards in T3,T4 and T5; regarding the phases in innovation life cycle (fig 4), its activities are mainly concerned with scale, consolidate and compose.

The scope of research institutes is multiple: from T1 and T2 (which is very much a micro-economic, private driven affair), the academic institutions must identify and further consolidate relevant elements into T3, T4 and T5.

In their education "core process" universities support the standardization and commoditization of T3, T4 and T5 results.

In their research 'core process' universities and research institutes support the invent and scale for all kinds of challenges (depending on the departments involved).

Technology institutions have a strong focus on invent/scale/compose/consolidate.

Industry federations have a focus on consolidate/ out-task/ insource and retire.

## Response

*Since Roadmap V3.0, Moore's Life Cycle no longer appears (Figure 4 in Roadmap V1.0); The framework for Research Challenges has been simplified, with the P, B and T dimensions indicated only (Figure 3 in Roadmap V1.0, Figure 1 in Roadmap V4.0). The text on the research framework has been completely re-written (see Section 4.4). T1 – T5 are now introduced in the Annex I to the Roadmap.*

*It must be emphasised that the Framework is intended to be used for the specific purpose of positioning the Research Challenges submitted by the stakeholders. Stakeholder interest and motivation is not part of the Framework.*

## Issue 28

Category: framework

In figure 3 several improvements are possible:

- the T1 area would also have an intersection with the B area.
- the T3, T4 and T5 areas would intersect with both B and P areas
- only T2 is (almost exclusively) at T level

## Response

*See Response to Issue 27. Please refer in particular to the latest text on the Research Framework (Section 4.4).*

## Issue 29

Category: general

The linkage of activities and innovations to stakeholders shows that multiple parties get involved in any innovation life-cycle. This calls for a reliable and authoritative, cross-enterprise (repository) of challenges and their solutions, first, and second, for reliable life-cycle status information (e.g., number of adopters, number of businesses considering adoption in the coming 6 months, etc.). (repository services?)

The needed level of trust and the dependency (for situation specific decisions on specific technologies or solutions), and the pervasive nature of the interoperability problem in an ICT intensive society, could suggest that the public domain should take some initiative here.

## Response

*Since version V2.0 of the Roadmap we propose two Grand Challenges (Interoperability Service Utility and Knowledge-Oriented Collaboration) that address the issues that you raise. The first of the challenges aims at creating Enterprise Interoperability infrastructures, possibly but not necessarily in the public domain, such as the one you suggest. One of the ideas identified in the Knowledge-Oriented Collaboration Grand Challenge is precisely to develop repositories of collaboration knowledge and best-practice.*

## Issue 30

Category: editorial

Section 3.4 "Product and Standardization challenges" should start with "The main part of this document is devoted to research challenges. In this section, product challenges and standardisation are briefly addressed."

## Response

*Section 3.4 "Product and Standardization challenges" (version V1.0) is no longer in the Roadmap.*

**Issue 31**

Category: editorial

A summary of Figure 4 and comment 8 [i.e. Issue 27] may well fit in the scope section of chapter 2.

**Response**

*Since version V2.0, the Roadmap has been substantially altered. The chapter on Roadmapping has been substantially rewritten and Figure 4 (Moore's life cycle) is not in anymore. While we have not included, as you suggested, the text you propose as motivation in the Scope (Section 2.3), we have sought to present the motivation for the Vision and the Grand Challenges we propose in the Roadmap.*

**Issue 32**

Category: editorial

The standards problems as highlighted on page 9 may be well addressed in "the other document on which there is mention on page 4 (see also Issues 22 and 23)

**Response**

*You are correct.  
See however General Response 2.*

**Issue 33**

Category: editorial

(Section 3.5 Interoperability and SMEs)  
The three last paragraphs repeat the three before them.

**Response**

*Section 3.5 "Interoperability and SMEs" (version V1.0) is no longer in the Roadmap.*

**Issue 34**

Category: editorial

(Section 3.5 Interoperability and SMEs)  
This SME problems section may be more fitted in "the other document on which there is mention on page 4 (see also Issues 22 and 23), unless the research challenges are clearly indicated (as part of T1 and T3 of Figure 3 for instance). But in that case, these challenges will return in later chapters. Alternatively, the problems could be used to further illustrate the figure 3 and 4 (see also Issue 27: SME as specific business (customer/micro-economics)

**Response**

*Section 3.5 "Interoperability and SMEs" (version V1.0) is no longer in the Roadmap.*

**Issue 35**

Category: SMEs

(Section 3.5 Interoperability and SMEs)  
Specific more scenaric or late-phase in innovation life-cycle could be addressed in sectorial sections, for instance on SME's, standards, e-government etc. (e.g. in an annex)

**Response**

*The point about sectorial issues is well made, which need to be brought into the execution of research activity. Take-up measures and implementation aspects need to be built into the execution of the research work.*

*It should however be noted that the scope of this Roadmap is about setting the overall direction for research in Enterprise Interoperability, see Section 2.3 in the Roadmap and General Response 2.*

### **Issue 36**

Category: vision

(Section 4.1 Vision)

The Vision lacks some more details on scope beyond the reference to the Lissabon strategy.

In (Goossenaerts, J.B.M., Interoperability in the Model Accelerated Society (2004) in: P. Cunningham and M. Cunningham (2004) eAdoption and the Knowledge Economy: Issues, Applications, Case Studies. IOS Press Amsterdam, pages 225-232) I have introduced a three scale "picture" that is stable, i.e. that is invariant for now and the future: society as a whole (macro), businesses (meso) , and the individual persons (micro): ICT acquisition decisions are required at each of these scales, for as many instances (territories, companies, people) as exist.

Further scoping can focus on the kinds of activities (e.g. regulation, business development and operation, health care, consumer buying ...), in reference to which vision "changes" can be articulated (e.g. using scenario, story telling).

If this is not done somewhat systematically, a vision will always have too much air, to gather believing researchers or developers, or it will have little guiding clout.

### **Response**

*For the purposes of this Roadmap, which is a research roadmap, the Vision has been formulated at a general, strategic level. Different interpretations of this vision at the implementation level are indeed possible, leading, for example, to "competing" research work as pointed out in the Roadmap.*

*In the longer term, it is likely that the Vision will require re-formulation, in order to encompass the many changes that are expected in the coming years. Hence, the Roadmap also proposes a long term strategy for maintenance.*

*A systematic approach to developing the Vision could be an outcome of the research in relation to the Science Base Grand Challenge.*

### **Issue 37**

Category: vision

(Section 4.1 Vision)

(on the first paragraph)..replacement of driving forces is a rather simplistic and destructive view, void of historic reality – knowledge and information have always played a role, and farming is still around (in those economies that have grown most in the past 50 years, with the exception perhaps of the city states). The use of a term such as *overtaking* as major driving forces would be more appropriate.

### **Response**

*The paragraph in question no longer appears in Roadmap V3.0 and later.*

### **Issue 38**

Category: vision

(Section 4.1 Vision)

(on 2nd paragraph) The vision statement should have relevance for society as a whole, in this and the following paragraphs, only an (edge-) fraction of the economy is in focus, and statements are loosely presented as relevant for the whole economy.

Information and knowledge may become more significant value-drivers, but in addition to all other value-drivers, not replacing them.

### **Response**

*The paragraph in question no longer appears in Roadmap V3.0 and later.*

### Issue 39

Category: vision

(Section 4.1 Vision)

Middle of third paragraphs: success= Small? After having had big power for thousands of years? Of course, the knowledge economy sees small initiatives becoming global players (MS, eBay, Google, Wikipedia, etc) but in all other sectors, the traditional players become knowledge intensive as well, while keeping their sizes or growing even bigger.

### Response

*The paragraph in question has been rewritten. There is no suggestion that success = small. The Roadmap however does have a strong focus on SMEs, see version 3.0, Chapter 4. The general point is that Enterprise Interoperability must be applicable for and of relevance to all enterprises, both big and small. But there are very specific issues and obstacles in respect of SMEs. At the final consultation workshop on Enterprise Interoperability research, 16 June, there were comments that the present focus on SMEs is still not sufficiently strong. Getting the balance "right" is a main challenge in the Roadmap.*

### Issue 40

Category: editorial

(Section 4.1 Vision)

Fifth paragraph: some very confusing sentence (see Issue 36, for an idea of what could be done about it.)

### Response

*From version V2.0 onwards, the Roadmap been substantially altered. The fifth paragraph of Section 4.1 in version V1.0 is no longer in the Roadmap.*

### Issue 41

Category: vision

(Section 4.2 From Vision to Roadmap)

In a sense, the list of vision, including the artistic ones in movies could have been covered in section 4.1. Most are technology visions, where there is a lot of dynamism.

Of Visions that have had a broader scope (including socio-technical), I remember VOMAP, members of this roadmap are in ECOLEAD).

I recommend the editors to read the VOMAP roadmap before restructuring chapter 4 (mainly the section 4.1) and to read VIPROAM prior to rewriting section 4.2 – in the latter roadmap a scenario based approach has been used to achieve the populating of the roadmap.

### Response

*The Vision chapter has been rewritten since the above comment was made. In particular, the Vision now presented is NOT a technology vision. Thank you for the pointer to additional resources.*

*VOMap: Roadmap design for collaborative virtual organizations in dynamic business ecosystems, <http://www.uninova.pt/~vomap/>*

*ViP-RoAM: The future of Virtual Product Creation – strategic roadmap, <http://www.vip-roam.org/>*

### Issue 42

Category: policy

(Section 5 Policy Challenges)

Many of the challenges are not really research challenges, but rather policy delivery challenges.

Given a more comprehensive presentation of the framework in sections 3.3 and 3.4 (see Issue 27) the different challenges can be given a better articulated context, within which the pieces of challenges can be allocated to their natural problem owners.

It will then appear that some "concerted" approach can be sketched, in which public utility (as aimed for by policy) is differentiated from private utility, and in which the impacts of network externalities, lock-in based rent-seeking, transaction cost etc, are explicitly considered when designing and using policy instruments.

## Response

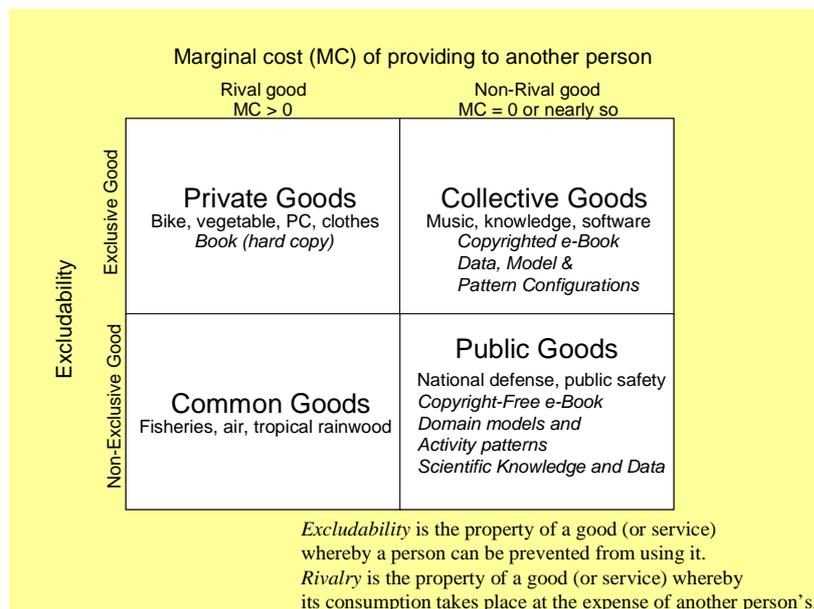
*Agreed – relates to the ISU Grand Challenge.*

## Issue 43

Category: policy

(Section 5 Policy Challenges)

An extra basic ingredient that must be considered when addressing the policy challenges is in the classification of goods (see Figure below)



## Response

*Thank you very much for this valuable contribution. We note that the figure is introduced in the paper "Adoption of Product Model Data Standards in the Process Industry" (J.B.M Goossenaerts, M. Dreverman, J.M. Smits, P.W.H.M. van Exel. [http://is.tm.tue.nl/staff/jgoossenaerts/4PublicPdf/2006\\_PMDS\\_adaptation\\_PI\\_draft.pdf](http://is.tm.tue.nl/staff/jgoossenaerts/4PublicPdf/2006_PMDS_adaptation_PI_draft.pdf)). Classification of "goods" on the basis of their economic properties is an important consideration for Enterprise Interoperability. For example, where "interoperable" products and services would be judged to position in the above figure has important consequences for their development, availability and adoption. In general, the economic dimension of interoperability is vital for considering the value proposition of interoperability. As indicated in the Problem Space section of the Roadmap (Section 3.2), the business case for Enterprise Interoperability is a problem area.*

*Considerations arising from the above figure have contributed to one of the strategic ideas that run through the entire Roadmap, namely that interoperability should become a utility-like capability (see the Vision Statement of the Roadmap). Flowing from that, the public interest dimension of Enterprise Interoperability as a strategic element of innovation ecosystems is a guiding principle for setting the Grand Challenges (see Section 4.5). The ISU Grand Challenge is directly built on the concept of "interoperability as a technical capability should be viewed as a public good – non-rivalrous and non-exclusive". The Science Base Grand Challenge also specifically refers to Economic science as one of its subject areas and highlights the need to research into the economic nature of interoperability.*

*In summary, the figure depicts extremely important issues. We note that the economic nature of goods (and services) within the ICT as a whole is leading to an increasing amount of scholarship and literature (e.g. Benkler, Hagel, Lessig, Rudd, to name a few).*

#### **Issue 44**

Category: policy

(Section 5.2 Harmonisation of ... EU directives...)

(as an example for illustrating how a better framework helps making crisp the challenges)

The underlying research challenge for a harmonisation capability in policy delivery is in the (upward extended – see Issue 28 and figure 3 – of T3, T4 and T5 areas).

We should not forget that a regulation is an "innovation" with Moore's life cycle – figure 4" (with short path from invention to commoditization)

#### **Response**

*The comment is appreciated. The nature of regulation and specifically the role that it has in the innovation cycle is critical for creating value from research. The ISU in particular reflects that interoperability at a "basic" level of information exchange could provide the overall environment for improved interoperability at the "upper" levels.*

*The more general issue of regulation and innovation, and the merit or otherwise of using policy instruments to help unlock the value of research, is however outside the scope of the Roadmap. See General Response 2. The same issue is highlighted by high-level groups such as the eEurope Advisory Group in "Making i2010 work: creating value from research and innovation" (see [http://europa.eu.int/information\\_society/eeurope/2005/doc/all\\_about/advisory\\_group/eac\\_contribution\\_i2010.pdf](http://europa.eu.int/information_society/eeurope/2005/doc/all_about/advisory_group/eac_contribution_i2010.pdf)). Note that this report on i2010 contains discussions relating to various aspects of e-business and interoperability as part of fostering an enabling environment for realising the 2nd pillar of i2010.*

#### **Issue 45**

Category: policy

(Section 5.2 Harmonisation of ... EU directives...)

A statement on the relevance for or contribution to the vision is missing.

#### **Response**

*The section in question is now one of the indicative Research Challenges included in Annex I. A Research Challenge is subject to validation in the course of the research, should it be included as part of the research, within the context of one or more Grand Challenges. See General Response 1.*

#### **Issue 46**

Category: business-economic

(Sections 6.3 and 6.11)

These sections should partially or completely be integrated in Chapter 5 because they concern the research areas/knowledge used to design policy instruments

#### **Response**

*The Research Framework of this Roadmap (Section 4.4) has adopted a certain sequence to depict the relationships between the Research Challenges in the different domains, starting with Business-Economic considerations. The wider context of the issues raised by the Research Challenges B3 and B11 (respectively Sections 6.3 and 6.11) is addressed in Chapter 4 Vision.*

#### Issue 47

Category: editorial

(Chapters 7 to 11)

Introductory sections should be cross-checked with vision and scope chapters.

#### Response

*See General Response 1.*

#### Issue 48

Category: editorial

(Chapters 7 to 11)

The challenges should be cross checked for overlap and "re-wording" – this is especially the case between T1 and T3+T4+T5

The contents of many templates must be harmonized.

#### Response

*Thank you. We have done as you suggested and modified and or removed a few of the Research Challenges. See General Response 1.*

## 9. Comments received from Peter Potgieser, Interpay

Received on 4 January 2006.

#### Issue 49

Category: general

Page 2 last / page 3 first paragraph:

Only if the concept mentioned is the same for all parties accepting it; otherwise not true. More in general: I suggest elaborating some more on the arguments of postulates used.

#### Response

*The paragraph in question no longer appears in subsequent versions of the Roadmap.*

*The concept of networks and network effects may have implications for interoperability in an enterprise context, such as acceptance or otherwise of technologies and technology solutions by communities and parties within those communities (as your comment indicates). The need to study the research work and results arising network science has been raised by various contributors to the Roadmap. This aspect is now included in the Grand Challenge on a Science Base for Enterprise Interoperability.*

#### Issue 50

Category: general

Page 3, paragraph 2 bottom and paragraph 4:

This says nothing about:

- what deliverables are targeted
- how deliverables will be assumed to be used to solve the problems found during research activities

It might be worthwhile assuming the concept of a 'cookbook' containing recipes where problems and their *practical* solutions are described. So in paragraph 4, after ... **means:** one could add something like *producing concrete / implementable and usable results*. More in general: it should be emphasized that the research results are delivered in such a way that the (e-)Business will be able to use them in their day-to-day business (-evolution)

## Response

*The referred paragraphs describe the context for this Roadmap, in particular the i2010 Strategic Framework and the FP7 programme of the European Commission. It is not up to this Roadmap to determine the deliverables for the i2010 Strategic Framework or the FP7 programme, nor how these will be used to solve the problems found during research activities. This general comment is outside the scope of this Roadmap.*

*The aim of the Roadmap is to lay out specific goals of what is to be achieved in research (the Grand Challenges), but not to prescribe how these should be achieved. Still, we feel the proposed aims of the research should not be rigid. There is the expectation that the main expected deliverables shall be measured by the rate of product/service innovations that follow from Enterprise Interoperability R&D and their economic impact.*

*Section 4.3 "The Research Context" of the Roadmap concludes that Enterprise Interoperability research should focus on problem-solving, rather than pure theoretical pursuits, so that Enterprise Interoperability solutions result that are directly beneficial, applicable, and easy to use. Concerning the general benefits expected from the research work arising from the Roadmap, please refer to Section 4.2 of the Roadmap.*

## Issue 51

Category: general

Page 2, first paragraph under 2.2 Objectives

I think, referring to the previous remark, that it should be emphasized here that the objective should not only be to produce a **research** roadmap, but also some (be it initial) thoughts or suggestions on how the deliverables will be delivered and how they could be used. The 'PEBBLES' proposal that has been submitted to FP6 (we could provide you with a copy of it if so desired) might be a guideline for an example as to how we think this should / could be done.

## Response

*See General Response 2.*

*The present Roadmap is limited to research issues. While recommendations on how the deliverables will be delivered and how they could be used could be of significant importance to stakeholders, they are considered outside the scope of this (Research) Roadmap. Other groups might follow-up on this Roadmap and come up with the mentioned recommendations.*

## Issue 52

Category: editorial

Page 4, paragraph 2 could strengthen the strive for *implementable and usable results*.

## Response

*See General Response 2 and the response to Issue 50.*

## Issue 53

Category: editorial

Page 4, 2.3

It could be worthwhile not only to mention the open issues, but also the process that could be used to formulate the criteria that should be used by the decisions about the open issues.

## Response

*Our aim is to produce a research roadmap for Enterprise Interoperability that is focused, ambitious, and yet not prescriptive. In that sense, we feel it is important that the Roadmap presents a comprehensive case for research on Enterprise Interoperability, particularly the Vision and Grand Challenges.*

*In the context of rapid technological change, it is not the best approach, we feel, to seek to identify all open issues (the situation keeps changing), nor to define ex-ante which criteria will be used to deal with the issues. We strongly suggest that the solution to open issues shall be project driven. Therefore, it is not considered worthwhile nor feasible to define the criteria for decisions about open issues at this point.*

#### **Issue 54**

Category: editorial

Page 5, paragraph below bullets:

Is it safe to assume that the audience understands the terminology, e.g. 'taxonomy' ? If not, then (not only here but in the entire document) do not use professional jargon.

#### **Response**

*This is a recognised dilemma and even the term “interoperability” might be considered jargon. The Roadmap is intended primarily for an informed audience with knowledge of the general field addressed, but clearly individual readers have varying knowledge of more specialist issues within the field. The final version of the Roadmap attempts to address commonly understandable issues, with specialist issues annexed.*

#### **Issue 55**

Category: editorial

Page 6, last paragraph before 3.2

Again I propose to elaborate on the arguments of postulates ..... things like .. *a roadmap can show that an organisation ... understands customer needs....* How is that shown then? How can it be verified?

#### **Response**

*The Roadmap been substantially altered. The Roadmapping chapter from version V1.0 (including the text you refer to in your comment) was not included in later versions of the Roadmap. Note that the sentence was written in the contexts of organisations or consortia developing product roadmaps. The sentence is ambiguous, and the word “show” is too strong in the context of the sentence. The ultimate test of a roadmap is, of course, true market demand after the roadmap has been brought to the market. Firms go through significant efforts to validate their roadmaps with potential customers (focus groups, user groups, etc), often with mixed results.*

#### **Issue 56**

Category: general

Page 6, 3.2 first paragraph:

Typical approach .... ? Will that still work if the user requirements are not known or, as I think the case with interoperability, the user is not aware yet of his problems and/or not able to formulate the requirements appropriately. I suggest that the text of the document in general be dedicated to the interoperability scene and that a verification is made whether or not the 'typical' case still holds here ....

#### **Response**

*The Roadmap has been substantially altered. The introductory text on roadmapping was not included in later versions of the Roadmap. As stated in the same section, the typical approach for developing a research roadmap in a certain domain was not followed.*

#### **Issue 57**

Category: general

Page 7 last paragraph, page 8 below figure 4:

.... the main part of this document is devoted to **research** challenges. But how are the (business) interoperability problems getting their benefits (if any) from that research?

### **Response**

*Thank you. Please refer to Section 3.2 and Chapter 4 of the Roadmap. The Roadmap has been substantially altered, so as to have a more strategic focus. The final version of the Enterprise Interoperability Roadmap identifies four Grand Challenges clearly focused on applied research. Nonetheless, it is clear that some of the Grand Challenges and specific research projects may, by their nature, require a greater degree of fundamental research, while others may exclusively be oriented to applied research.*

*Based on our understanding of the discussion at the higher levels of the European Commission, which are well aware of issues that you raise in your comment, we believe the spirit of this research programme is precisely to bridge the gap between basic research and the research companies need for innovations that translate into revenues. However, the Roadmap is not a proposal for deployment-type research projects, projects which are consistent with the research agenda of other EC programmes.*

*See also General Response 2 and the response to Issue 50.*

### **Issue 58**

Category: general

Page 7, paragraph 5:

This paragraph leaves out at least one dimension: which standard is used where. Hence the implications for interoperability must include both time- and application- dimensions. I feel they do not at this moment.

Note that there is a difference between 'norm' and 'standard'; they should not be used interminglingly. Using norms the interoperability problems one experiences might differ from the ones experienced using standards.

### **Response**

*See General Responses 1 and 2.*

*Since version V2.0, the Roadmap has been substantially altered. The introductory text from version V1.0 (including the text you refer in your comment on product and standardisation challenges) was not included in later versions of the Roadmap (V2.0 and later). Concerning the general issues of standards in the context of this Roadmap, please refer to the Scope section (Section 2.3).*

### **Issue 59**

Category: general

Page 9, paragraph 9

ontologically ?

it is evident .... ?? why

### **Response**

*Section 3.5 "Interoperability and SMEs" (version V1.0) is no longer in the Roadmap.*

### **Issue 60**

Category: general

Page 10, paragraph 2

..... generally makes it impossible .... Isn't that already one of the conclusions that the research activities are supposed to deliver. And, speaking about 'generally' .... why should that also be true in this case ?

### **Response**

*Thank you. Since version V2.0, the Roadmap has been substantially altered. The introductory text from version V1.0 (including the text you refer in your comment on Interoperability and SMEs) was not included in later versions of the Roadmap (V2.0 and later). The section in question no longer appears in the Roadmap.*

### **Issue 61**

Category: editorial

Page 11, paragraph 5:

First sentence: If I count correctly this sentence has 65 words. I think this should be avoided unless it is perfectly clear for the reader what is intended. And in this case, where a link is made between unresolved technological limitations .... that are approachable in the current legal framework I don't think a reader will understand. At least I do not ;-)

### **Response**

*From version V2.0 onwards, the Roadmap has been substantially altered so as to have a more strategic focus. The introductory text from version V1.0 (including the text you refer in your comment) was not included in later versions of the Roadmap (V2.0 and later).*

### **Issue 62**

Category: general

Page 12: 4.2

Is it correct to assume that the emphasis here is on Proof of Concepts as opposed to deployable results ?

### **Response**

*The section in question no longer appears in the Roadmap.  
In the context of the Framework Programmes, only pre-competitive research can be funded.*

### **Issue 63**

Category: editorial

Page 14:

How do the chapters 5 and beyond, e.g. the CHALLENGES, fit in this document? What is the objective of mentioning them like this?

### **Response**

*The essence of a research roadmap is to describe research challenges.  
However, from version V2.0 onwards, the Roadmap been substantially altered so as to have a more strategic focus, and to be less prescriptive on how to achieve (technically) the stated goals, in order to leave the choice of technological approach to individual research project proposals.  
The Research Challenges from V1.0 of the Roadmap are stated as indicative Research Challenges in Annex I. We have only made changes to the Research Challenges of version V1.0 of the Roadmap where we felt there were substantial issues/problems in the text, which were corrected for the final version of the Roadmap. Most research challenge texts from version V1.0 of the Roadmap remain in their original form in the Annex. The aim of these is to propose specific research ideas as specific research issues within the Grand Challenges established in the Roadmap. They are not meant to be prescriptive or comprehensive, i.e. specific project proposals may fall outside the scope of the Research Challenges listed in Annex I.*

## Issue 64

Category: general

**I will not go into the details of all Research activities mentioned in all these tables in the remainder of the chapters / document.**

Suffice to say that I think the (format of the) deliverables should be mentioned / indicated. Example related to 5.1: To support dissemination ..... What does this mean ? How is it achieved ? What are the SMART (Specific, Measurable, ....) criteria to determine whether or not the results could be successfully employed ?

Another example: 5.6 ... *it is unclear what solution could be applied* .... Yep, that could be the exact reason / argument for the research activity. But as formulated does not help business. So I suggest in this, and similar, cases the approach is elaborated in more detail.

## Response

*Concerning the general principles expected from the research work arising from the Roadmap, please refer to Section 4.2 listing of bullets and Section 4.3 listing of bullets.*

*In finalising the Roadmap, the editors have sought to tighten up the wording and, more importantly, the ideas presented in the Roadmap. Concerning the individual Research Challenges, it should however be noted that they are "bottom-up". As such, we very much rely on the original submitters as regards the contents and the formulation, and apply a "light-touch" in processing the submitted texts on these challenges. See also General Response 1.*

## Issue 65

Category: business-economic

Page 18: chapter 6 in general:

How is the business involved in the activities mentioned? If, as in the beginning of the document, the importance for the economy is stressed, then it should be clear that the gap between research(-deliverables) and stakeholders is as narrow as possible. Both in the way the business is enabled to provide information as well as the way in which the business is allowed / facilitated in absorbing the results.

## Response

*The comment is appreciated. Industry stakeholder involvement in research – from ideas generation to the implementation of research results is a consistent theme that underlines the Roadmap from V2.0 upwards.*

*As mentioned in the Scope of the Roadmap (Section 2.3), it should however be noted that the present Roadmap is a research roadmap. In principle, it could be accompanied by other roadmaps – and indeed other policy actions – that focus on closing the gap between research and implementation, research and market developments etc. These aspects are themselves highlighted in the Commission's i2010 policy document. See also General Response 2.*

## Issue 66

Category: editorial

Page 28, paragraph 4:

live cycle where life cycle is meant ?

By the way, I do not understand the 'consequently'

## Response

*Indeed it should be 'life cycle'. The paragraph has been modified.*

## Issue 67

Category: enterprise

Page 28, last paragraph:

.... the application of enterprise modelling promotes .... why? There must be some assumption about the way in which the 'interface' takes place. What is the assumption? Why does an interface description not suffice?

### Response

*The exact sentence is: "The application of Enterprise Modelling promotes the common understanding of the enterprise business processes within the company and across companies". Enterprise Modelling, by the precise description of a process (and also by a possible graphical representation), makes a business process explicit and thereby facilitates the understanding of the Business Process among the various stakeholders. An interface description seems insufficient for such situation. We believe strongly in the power of a well-documented graphical representation.*

## Issue 68

Category: editorial

Page 29, paragraph 4, first sentence:

*Legacy systems ..... etc.* This sentence seems incomplete to me?

### Response

*Indeed the sentence is incomplete. The sentence was changed to "The evolution of legacy systems and the need to migrate to or co-exist with other applications cause the requirement for a new environment of applications, information sources etc."*

## Issue 69

Category: general

Page 30, paragraph 3:

Difference in currency is used as an example for difference in culture?????

### Response

*The paragraph has been modified. Differences in currency are no longer linked to differences in culture.*

## Issue 70

Category: implementation

Page 30, figure 8 (and similar):

How are the relations between the areas indicated? Where are the 'tollgates' for transitions e.g. where and how are Go/NoGo decisions made? What are the criteria for these tollgates derived from?

For instance: T.1.6.1 runs for 5 years. That could become an unguided missile if no intermediate verification and tollgates are applied; some activities seem to have started already in 2005. Is that a correct assumption?

### Response

*Please refer to the Research Context concerning the general criteria for the research activity (Section 4.3 of the Roadmap).*

*The general comment about verification and tollgates is appreciated. They are however issues regarding the implementation of the research roadmap, which are outside the scope of this Roadmap. See General Response 2.*

*As noted in Annex I to the Roadmap, those Research Challenges for which there is already ongoing research activity have been deleted.*

## Issue 71

Category: editorial

Page 42:

8.1.6 says: TBD, I think that means To Be Defined. If so, I don't understand it. Either it is a clear subject and can be mentioned / described or it is not a clear subject and should be left out here (may perhaps come up as a spin-off on some other activity)

8.1.7 says TBC ? Usually that means To Be Confirmed ? If TBC is meant I do not understand and if it is a typo and TBD is meant: see my comments under 8.1.6

## Response

*Abbreviations such as "TBD" and "TBC" have been eliminated from the Roadmap and its annexes. The two Research Challenges in question (for which there was no supporting material) have been deleted.*

## Issue 72

Category: editorial

Page 47, 8.6

Are these terms in line with the regular use by for instance ETSI? One should not re-invent definitions, certainly not in a research environment.

## Response

*Agreed.*

*The text for the Research Challenge "Terminal Interoperability" has been considerably improved and scaled down. See Section 5.4.3 of the Annex I.*

## Issue 73

Category: editorial

Page 48

Some of the descriptions are incorrect or do not match reality. This should be corrected before any conclusions are drawn.

## Response

*The comment is not precise. It is not clear to what exact paragraphs/sentences the comment refers to.*

## Issue 74

Category: editorial

Page 55, chapter 10:

This should be completely freed from jargon. Unless it is not meant for the business to be understood.

## Response

*See also Issue 54.*

*This is a recognised dilemma. The Roadmap is intended primarily for an informed audience with knowledge of the general field addressed, but clearly individual readers have varying knowledge of more specialist issues within the field. The final version of the Roadmap attempts to address commonly understandable issues, with specialist issues annexed.*

*The editors have sought to make the Roadmap "business-friendly" and comprehensible to the average business personnel. For the (technical) Research Challenges in Annex I, we do however rely very much on the original submitters to make the text more jargon-free.*

## 10. Comments received from Idoia Echave, Tekniker

Received on 5 January 2006.

### Issue 75

Category: enterprise

There are some clear overlapping between ENTERPRISE and GENERIC MODELLING research challenges. Some examples are:

- Process model interoperability (T1.1.1) and Distributed Active Models (interoperation of models) (T5.1) seems similar things.
- Modelling Cross-Organizational Business Process (T1.3.2) and simulation and Enactment of distributed processes (models for interoperation effects) (T5.2)

Others:

ADM - Architecture Driven Modernization (T2.3) and Knowledge Mining & ADM (T5.7)

### Response

*It is difficult to describe all aspects involved, and overlaps might be almost unavoidable.*

*The main difference in focus between T1.1.1 and T5.1 is that T1.1.1 is more oriented towards the interoperability of various modelling tools, and that T5.1 is more oriented towards distributed models (interoperation of models) for Simulation and Enactment.*

*T1.3.2 is no more proposed as a future Research Challenge because it is ongoing research in, for instance, ATHENA. It focused on modelling cross-organisational business processes; T5.2 is more oriented towards simulation and enactment of distributed processes. Modelling and simulation could complement each other.*

### Issue 76

Category: editorial

The separation of T1, T4 and T5 generates some confusion. For example:

Business Process Ontology (T4.1) and Ontology Infrastructure (T4.2) is not to get Cross organization Processes (T1.3)?

### Response

*See General Response 1.*

*The comment is well made and efforts have been made to reduce overlap between the Research Challenges. On the other hand, this needed to be balanced against the principle of grass-root submissions from the stakeholders.*

*Various Research Challenges under Cross-Organisational Business Processes (T1.3) have been deleted due to ongoing research work, or incomplete entry.*

### Issue 77

Category: editorial

Probably would be better to consider just two technical strands (as it was the initial separation for the knowledge cafe sessions):

- 1) Business processes: Modelling, simulation, interoperability-mapping
- 2) ICT infrastructure: Architecture, platforms, services

### Response

*The main headings for the technical Research Challenges have been fixed in accordance with the wishes of the submitters of these challenges.*

## Issue 78

Category: general

We also think that it is necessary to pay better attention to the “semantic web services” as a key point for enterprise interoperability (T2 cross T4)

## Response

*This is now reflected in the Roadmap at the level of Grand Challenges, though using more general terminology concerning services in relation to information / semantics.*

## 11. Comments received from Ricardo Cabral, University of Madeira

Received on 5 January 2006.

## Issue 79

Category: editorial

However, some of the topics covered are outside my domain of expertise, in my opinion some of the research priorities overlap, and in particular Section 11 overlaps partly with 7, 8, 9 and 10, and the same happens to some extent to section 6 and 7. Therefore, while I understand that this results partly from the organization of the working groups, I would recommend that some of this work might be merged together.

## Response

*See General Response 1 and the responses to Issues 76 and 77.*

## Issue 80

Category: editorial

Further, in some research priorities I find that the research points are too prescriptive and excessive in number in particular in sections 6, 7, and 8, and that the roadmap would gain by the definition of broader and fewer research points within each of these areas.

## Response

*See General Response 1.*

*The comment is well made. As stated in the Scope of the Roadmap (Section 2.3), “Specifically, in conformance with its objectives, this Roadmap targets break-through research for stimulating and catalysing business innovation. Therefore, the research areas should not be prescriptive, in respect of methods, techniques, solutions, the implementation of those solutions, the way in which those solutions are provided, and who are to provide those solutions”.*

*However, see also the Response to Issue 76 about applying the principle of encouraging grass-root submissions from the stakeholders.*

## Issue 81

Category: general

(Page 2: Section 2.1, Paragraph 1)

I believe it would help to lay out upfront, maybe in a first section, why do we need enterprise interoperability (Motivation)? In my view, looking at it with an industrial economist lenses, to:

- enable SMEs/enterprises to have access to new product markets (e.g., new services) and new geographic (global) markets, thus enabling economies of scope and economies of scale
- to reduce transaction costs for enterprises, contributing to increases in output and employment
- to contribute to a technological advancement of these firms, e.g., improved knowledge management

- as a result of the former points, to increase productivity, leading to higher profitability and to higher wages

I would also suggest adding something like the following text to Paragraph 1:

“Recent years have seen a dramatic change in the process of globalization. Whereas in the past only large multinationals were able to manage operations in multiple markets and countries, the emergence of ICT, and in particular of internet related technologies, have resulted in the emergence of global (or multinational) SMEs, which sell, establish partnerships, and outsource/manufacture worldwide, a trend that is likely to grow in the future (e.g., Skype, Google, Juniper, etc).

The process of enterprise interoperability aids SMEs by enabling the creation of new services, giving them access to global markets and the possibility of achieving economies of scale not feasible otherwise, while at the same time enabling them to reduce costs and increase productivity.”

### **Response**

*The Roadmap now generally incorporates the points raised above, in Section 3.2 Problem Space, and the various sections under Chapter 4 Vision.*

### **Issue 82**

Category: editorial

(Page 3-4: Section 2.2, Objectives)

In my view, only first paragraph should be kept in this section, since the last paragraph of page 3 and first paragraph of page 4 are really background information, and I would include them in section 2.1.

I see second paragraphs of page 4 as goals/criteria for the research roadmap, and paragraph 5 as recommendations, and therefore not as part of the objectives.

### **Response**

*The Objectives section – indeed the entire Chapter 2 – has been re-written for Roadmap V3.0.*

### **Issue 83**

Category: editorial

(Page 7: Section 3.2, Roadmapping method, Paragraph 1)

I would delete the sentences in the first paragraph “*Consensus among stakeholders is essential. The end result should be a roadmap by all stakeholders, for all stakeholders.*”, since it amounts to generalities that are not realistic nor practiced in business settings.

If the short review of roadmapping principles is included, I would also include a reference to the problems that roadmapping has recently faced in ICT industries: namely that rapid technological change leaves roadmaps obsolete, leading firms to cancel and substitute these roadmaps. For example, Intel has cancelled several new products and made frequent roadmap changes (see “Intel’s right-hand turn”, The Economist, May 12th 2005)

### **Response**

*The section in question no longer appears in the Roadmap.*

### **Issue 84**

Category: editorial

(Page 12: Section 4.2, From Vision to Roadmap, Paragraph 1)

I would include a reference to (recently deceased) John Diebold’s 1952 “Automation” and other works laying out a vision for the impact of ICT and a vision for the modern electronic banking system (see <http://www.dieboldinstitute.org/>).

## Response

*Thank you for the suggestion. Many references have been proposed for inclusion in the Roadmap. It is not possible to include all of them in the main body of the document. Your suggestion and this response are however part of the Roadmap, Annex II "Disposition of Comments".*

## Issue 85

Category: policy

(Page 14: Section 5, Policy challenges)

The research challenges identified in this section seem to me too specific and insufficiently ambitious. If anything, I think research into policy challenges may be the most important component of this research program by enabling the unleashing innovation and economic growth by enabling a wider use of Enterprise Interoperability technologies and processes.

### Proposal 1: Policy Research Subject on Access to Existing Infrastructures

In my view, the one set of European Commission policies that has had most impact in the European ICT industry have been the EC 1987 Green paper on telecommunications (COM(87) 290, June 1987), which introduced competition in terminal equipment and services, and the directives issued by the European Commission and Council to accomplish the opening of the services market: the Services Directive (Commission, 1990) and the Open Network Provision (ONP) framework directive (Council, 1990a) and following papers (COM(94) 440, October 1994, COM(94) 682, January 1995). These initiatives laid out the foundations of the opening of competition in voice and internet telecommunications, which have now resulted in the emergence of numerous players in this market, of which Skype is but the most recent example.

Therefore, I believe it would be important to consider an equivalent policy research approach for Enterprise Interoperability. This policy research subject could focus on defining a framework for access (interoperability) to the infrastructure of firms with certain characteristics (e.g., market dominance, network externalities/economies) for the provision of novel services.

For example, one of the major issues that have delayed a widespread adoption of OSA-Parlay and more recently Jain-SLEE (technologies that enable the delivery of novel value added services based on existing network infrastructures of different providers) is the fear of network operators that new entrants may be able to use their infrastructure to provide new high-margin value added services, without the need to invest in network infrastructures, leaving operators with low-margin services.

A second example are the recent applications of mash-up technologies, which use public APIs of firms with given infrastructures or databases to provide new services. One recent successful example of such novel applications is HousingMaps.com, which combines the mapping capabilities of Google's search engine with housing listings from Craigslist to create maps showing houses or apartments in a particular city within a designated price range ("Mashing the Web", The Economist, Technology Quarterly, 2005).

This issue of access to existing infrastructures is still a hot debate topic within telecom interconnection pricing debates (FCC, Hausman, etc), and is in my view likely to grow in importance in the future in novel knowledge-based services based on the usage of infrastructures with network externalities.

## Response

*Parts of the topics referred in your comments are included in the final version of the Roadmap. For example, the policy issue is of great relevance for the proposed ISU Grand Challenge. Nonetheless, we believe there is more the case for policy research in the context of specific project proposals, than a whole encompassing approach*

## Issue 86

Category: policy

(Page 14: Section 5, Policy challenges)

### Proposal 2: Policy Research Subject on Promoting Enterprise Interoperability Standardization in one of the European bodies (CEN and ETSI)

A second important policy contribution of the European Commission to ICT development has been in its endorsement of the GSM standard and of the standardization work for digital mobile

telecommunications carried out within the CEPT and later ETSI. While this effort took many years (1982 to the first specification in 1990) it was a policy that has resulted in the leadership of the mobile telecommunications industry by European industry suppliers and European Telecom operators. In that sense, I believe a policy research subject within Enterprise Interoperability should focus on supporting and disseminating existing EI standardization efforts within European bodies (CEN TC310/WG1), or elsewhere (ISO TC184/SC5/WG1), and to the extent that it overlaps with EI, also with the network interoperability standardization work being carried by ETSI.

#### **Response**

*See General Response 2.*

#### **Issue 87**

Category: policy

(Page 14: Section 5, Policy challenges)

##### Proposal 3: Policy Research Subject on analysis of current government/public procedures

I would also suggest a policy research area focusing on developing recommendations on how to change current policy institutions and procedures in order to facilitate electronic enterprise interoperability and to make the “life” of enterprises easier while maintaining a high degree of accountability, in particular in the context of the different countries of the European Union.

#### **Response**

*We have not considered specific research areas directed at government or policy improvements with regard to Enterprise Interoperability. Policy aspects may and should be considered within the context of each project proposal.*

#### **Issue 88**

Category: policy

(Page 14: Section 5, Policy challenges)

##### Proposal 4: Policy Research Subject on Implications to data privacy of EI

Further, related to point 5.6., I suggest a policy research area that would investigate and develop recommendations for issues related with personal data privacy in enterprise interoperability, given the growing importance of personal databases to businesses.

#### **Response**

*This is considered a very specific research issue, which may be more appropriate to other forums.*

#### **Issue 89**

Category: policy

(Page 14: Section 5, Policy challenges)

On the other hand, I would not include 5.4 in the list of Policy research challenges. In my view, 5.4 is really a pricing strategy issue determined by the market and/or competition authorities.

#### **Response**

*Your comment is noted, but the policy challenge is maintained. See General Response 1.*

#### **Issue 90**

Category: business-economic

(Page 18: Section 6. BUSINESS – ECONOMIC Research Challenges)

I find 6.1. and 6.2 important components of this section, as providing an “how to” description for implementing EI.

I believe however, that 6.3. has too many research dimensions that make concrete measurable outcomes more difficult to achieve. In alternative, I suggest including the above proposals 1, 3, and 4, within the policy research area which, while probably too specific, would enable a more concrete measurement of the impact of EI to society.

### **Response**

*Research challenges B1 and B2, corresponding to 6.1 and 6.2, have been deleted due to ongoing research work (e.g. by ATHENA). B3 is intentionally multi-faceted in order not to delimit the research. B3 and B4 address different contexts: B3 is oriented towards broad societal and macro issues, whereas B4 is oriented towards enterprise and sector specific issues at a more micro level. Concerning moving these into the Policy research area, please note the Response to Issue 46. Impact measurement is among the main benefits envisaged for the research arising from the Roadmap – see bullet points in the Vision Description (Section 4.2).*

### **Issue 91**

Category: business-economic

(Page 22-23: Section 6.6 and 6.7, Impact analysis)

Impact analysis research should also, in my view, include monitoring and appraisal of EI implementation cases, namely by contributing to the development of a database of EI experiences (good and bad), and identification and dissemination of EI best practices. The goal would be in a sense to develop knowledge about what works in practice, which I believe would provide a helpful feedback to the other research subjects, and aid the overall EI research agenda.

### **Response**

*Regarding the development of a database of Enterprise Interoperability experiences and best practices, see General Response 2. Research Challenges B6 and B7 have been deleted due to ongoing research work (e.g. by ATHENA).*

### **Issue 92**

Category: business-economic

(Page 23-24: Section 6.8, Contribution of interoperability to productivity)

This section considers macroeconomic total factor productivity as the measure to assess and points out correctly the difficulties in measuring it. The impact of a given technology in total factor productivity is difficult to estimate and would require a long time series (Solow, 1987; Nordhaus, 1997; Oliner and Stichel, 2000), meaning an assessment of EI results would only be available a few years down the road, if at all. Therefore, I would suggest a simplified microeconomic approach to infer the contribution of enterprise interoperability to the firm’s capital and labour productivity, based on the firm production and cost theories, by analyzing the impacts of interoperability on the access of firms to new markets (economies of scale and scope) and as an enabler of a reduction in the firm costs.

This could be used as a basis for constructing a “Unique selling proposition” marketing points/business case for Enterprise Interoperability.

### **Response**

*The comment is appreciated. Indeed the microeconomic approach should be considered also, particularly in the context of the Grand Challenge A Science Base for Enterprise Interoperability, which identifies economic science among the various sciences as being potentially fruitful in enhancing the understanding and measurement of Enterprise Interoperability. The problem of long-term versus short-term considerations – such as macro versus micro economic considerations – is envisaged to be part of the research work. Intuitively, without pre-judging the direction of the research work, this problem is also closely linked to the Research Challenges B3 and B4.*

*The macro/micro economic aspects are now incorporated in B8.*

### Issue 93

Category: business-economic

(Page 23-24: Section 6.9, Decentralized governance)

I also consider this topic to be very important for EI. A closely related topic in firm management that should also be considered in this research subject is profit and loss responsibility, an issue that is in permanent debate particularly in large firms and in multinationals between subsidiaries in different countries.

### Response

*The comment is appreciated. Profit and loss issues are specifically addressed under Research Challenge B4. The governance aspect is now mentioned in B4. Profit and loss are also linked to microeconomic considerations – see Response to Issue 92.*

### Issue 94

Category: enterprise

(Page 28: Section 7. Enterprise (Business/Knowledge) Research Challenges)

I don't entirely agree with the initial statements of this section. A surprising recent development enabled by ICT has been that relatively small SMEs and start-ups have ventured and successfully mastered globalization and outsourcing of production in global production chains, imitating what has happened with large multinational companies (e.g., Juniper; Skype initially had headquarters in Luxemburg, Offices in the UK and Development in Estonia, and many other small firms and even start-ups are adopting international production chains).

In my view the enterprise interoperability research challenge is how to create the framework and tools to more easily enable enterprise interoperability and facilitate this process.

### Response

*We think there is no contradiction between this statement and the initial statement of Section 7. This last one indicates the difficulties to develop Interoperability in SMEs which cannot use some advanced tools as Enterprise Modelling in order to define the requirements. The objective "to create the framework and tools to more easily enable enterprise interoperability and facilitate this process" is effectively a priority. Project A8 "SME Interoperability in Practice" of the ATHENA Integrated Project is working on this subject.*

### Issue 95

Category: enterprise

(Page 28: Section 7. Enterprise (Business/Knowledge) Research Challenges)

Proposal 5: Research on knowledge management in an interoperable world

I suggest that a possible research challenge is to develop a framework that enables the firm to separate public knowledge from firm-internal (value adding) knowledge, ensuring security, and including considerations on enabling firms to leverage existing Virtual Private Network solutions to manage their operations.

### Response

*This proposition is interesting. We can mention the work developed in the IP ATHENA, project A2: Cross organisational Business processes, which analyses the cross-interoperation between processes belonging to different enterprises and which defines "public processes" and "private processes". It could be interesting to extend these concepts to Knowledge.*

*The issues are also addressed under Knowledge Oriented Collaboration in Section 7.3.1.*

## Issue 96

Category: ICT systems

(Page 40, Section 8. ICT Systems and A&P research challenges (T2))

### Proposal 6: Research on Enterprise Interoperability for Mash-up technologies

I believe mash-up technologies, where new services are created and offered based on knowledge generation by combining information from existing infrastructures/databases, have a large business potential. Therefore, I would recommend a research subject focusing on developing a framework for enterprise interoperability with this type of applications in mind, which could be included maybe under Section 8.4.

### Response

*Although the focus of the Roadmap aims at defining what the aims of the Enterprise Interoperability research are, rather than how to accomplish it, we do propose a Mash-up solutions research area under the Web Technologies Grand Challenge. Rather than specifying a particular technological approach, mashup solutions designate the combination of Web content seen as generating new value and wealth, and potentially generating new employment and growth.*

## 12. Comments received from Keith Popplewell, Coventry University

Received on 6 January 2006.

## Issue 97

Category: Knowledge-Oriented Collaboration

I added additional research challenges, which seem particularly appropriate to the idea of interoperable enterprises in a knowledge society. I have not presumed to number these and place them within the existing document structure, but my view is that they would fit most naturally in Section 7: Enterprise (Business/Knowledge) Research.

<b>Research Challenge</b>	Knowledge-driven support for interoperability in virtual organisations <sup>9</sup>
Description	<p>The activities of:</p> <ul style="list-style-type: none"><li>• assembling a virtual organisation (VO) through enterprise negotiation;</li><li>• detailing the design of the value chain within the VO;</li><li>• operational management of the value chain;</li></ul> <p>are creative processes where the knowledge and experience of individual experts within collaborating enterprises is the critical success factor. Whilst each may be expert in his own field and his own enterprise, his/her knowledge of the fields of other experts, and especially of other enterprises in the (potential) VO is likely to be very limited. This gives rise to major risks of suboptimal design and operation of the VO as individual experts make locally ideal choices which conflict with the interests of other enterprises and/or areas of expertise. Distributed decision making is an essential feature of the VO which restricts the opportunity for early recognition of such decision conflicts, but the cost is potentially very high (eg. re-design or re-construction of manufacturing facilities; reduced capacity leading to lost market; unplanned outsourcing, etc.).</p> <p>The challenge here is to design a methodology and software capable of acquiring and applying knowledge about each enterprise/expertise which is critical to decision making across the VO so as to detect conflict rapidly, as soon as design decisions are proposed, without requiring constant and detailed review of all</p>

<sup>9</sup> The term "virtual organisation" appears in the existing draft V10, though it is not explicitly defined. It is used in the above two suggested research challenges in the same spirit, to mean generally a grouping of legally distinct or related enterprises coming together to exploit a particular product or service opportunity, collaborating closely whilst still remaining independent and potentially competing in other markets or even other products/services in the same market.

	<p>decisions by all contributing experts. Only where conflict resolution is required are expert enterprise contributions invoked.</p> <p>The benefits to industry and the EU economy of meeting this challenge include:</p> <ul style="list-style-type: none"> <li>• reduced costs and improved productivity in VOs;</li> <li>• accelerated VO start-up and consequent enhanced opportunity to exploit markets;</li> <li>• enhanced operational flexibility leading to better market exploitation;</li> <li>• reduced risk in collaboration</li> </ul>
State-of-the-Art	<p>The principle of applying intelligent software agents called moderators, to detect decision conflict and orchestrate resolution, has been demonstrated in the fields of concurrent engineering design (MOSES project funded by EPSRC GR/H24273), and distributed manufacturing system design (MISSION project IMS/ESPRIT grant reference 29 656). However both these demonstrators were dependent on specific implementations of integrated design software and shared databases, which limits application in the field.</p>
Research Activity	<p>To meet this challenge research must extend currently demonstrated capabilities to include moderation of operational decision-making, whilst at the same time exploiting the development of interoperability of enterprise systems across the VO to make moderators independent of software platforms.</p> <p>Identification of the structure and range of knowledge needed for moderation and defining a meta-knowledge structure for this is necessary, and must recognise that each enterprise in a (potential) VO has knowledge about itself to contribute to the mutual benefit of the VO (but see also Research Challenge: Knowledge sharing and protection in virtual organisations)</p>

## Response

[See General Response 1.](#)

[Added to Annex I \(Indicative Research Challenges\) as Research Challenge T5.8, and addressed in the Knowledge Oriented Collaboration Grand Challenge.](#)

## Issue 98

Category: Knowledge-Oriented Collaboration

I added additional research challenges, which seem particularly appropriate to the idea of interoperable enterprises in a knowledge society. I have not presumed to number these and place them within the existing document structure, but my view is that they would fit most naturally in Section 7: Enterprise (Business/Knowledge) Research.

<b>Research Challenge</b>	Knowledge sharing and protection in virtual organisations
Description	<p>Each enterprise member of a virtual organisation (VO) brings with it knowledge about itself and about collaboration which it has evolved through experience over time: indeed in a knowledge economy this may be the enterprise's chief asset and most significant contribution to the VO. This knowledge can loosely be categorised as:</p> <ul style="list-style-type: none"> <li>• knowledge which must be shared with the VO to enable operational or design decision making (e.g. current despatch status of goods);</li> <li>• knowledge which is commercially sensitive but which will enable better decision making for the VO (e.g. current capacity availabilities);</li> <li>• knowledge which is part of the core intellectual property of the enterprise and which cannot therefore be shared (e.g. proprietary technology);</li> <li>• knowledge relating to other, competing VOs which therefore must not be shared (e.g. market planning);</li> </ul> <p>The challenge here is to provide flexible, but usable, mechanisms to allow enterprises to control the sharing of knowledge to the mutual benefit of the VO, without losing control of commercially valuable asset. Reliable and controlled</p>

	<p>mechanisms for this should also permit enterprises to routinely pool knowledge as they join a VO knowing that the existing structures and mechanisms protect sensitive knowledge automatically.</p> <p>The benefits of meeting the challenge will be:</p> <ul style="list-style-type: none"> <li>• enhanced control of the VO and thus more effective market exploitation;</li> <li>• improved trust within the VO leading to the widest acceptable knowledge sharing, leading to improved decision making;</li> <li>• accelerated and more flexible formation of VOs enhancing market opportunities</li> </ul>
State-of-the-Art	Little research has been found in this area.
Research Activity	Research must identify a more complete categorisation of knowledge “sharability” than above, identifying both the levels at which sharing can occur and the stages in the VO life-cycle where sharing requirements/restrictions may change. Structures to allow control of shared knowledge, and particularly to make shared knowledge properly available through interoperable systems are also needed.

### Response

*See General Response 1.*

*Added to Annex I (Indicative Research Challenges) as Research Challenge T5.9, and addressed in the Knowledge Oriented Collaboration Grand Challenge.*

### Issue 98.5

Category: Knowledge-Oriented Collaboration

<b>Research Challenge</b>	Knowledge capture, creation and application in virtual organisations
Description	<p>Each enterprise develops through experience its own knowledge of the process, requirements, risks and benefits of collaboration. Similarly each VO generates enterprise knowledge about the particular collaboration, this being not only valuable to the VO through the remainder of its life-cycle, but also contributes a legacy of knowledge for each and every participant in the VO.</p> <p>Enterprise knowledge includes, but is not restricted to:</p> <ul style="list-style-type: none"> <li>• best practice in formation of collaboration;</li> <li>• ways to access reliable sources of information on new collaborator capabilities;</li> <li>• current collaborator capabilities;</li> <li>• risk factors in collaborative working;</li> <li>• generic interoperable process templates;</li> </ul> <p>Such enterprise knowledge is not restricted to the needs of established enterprise processes: indeed the most valuable segments of enterprise knowledge are likely to arise out of the need to recover from failures of established processes, and to drive process re-design as necessary. Sources of enterprise knowledge are therefore informal, lying outside the range of data exchanged in documented enterprise processes, and including ad hoc informal communications between stakeholders who do not usually interact under documented processes, and understanding of one-off decisions beyond the scope of routine operation.</p> <p>Enterprise knowledge therefore cannot be seen as embedded in enterprise ontologies, but is perhaps independent of or orthogonal to these.</p> <p>The challenge is to create tools and methodologies for capture of enterprise knowledge, recognising that it is constantly evolving, and to make it available for re-use in a manner which benefits the competitiveness of EU enterprises. Issues relating to the structure and</p>

	<p>availability of enterprise knowledge include:</p> <ul style="list-style-type: none"> <li>• some knowledge is part of the core intellectual property of the enterprise and cannot therefore be shared (e.g. proprietary technology);</li> <li>• further knowledge relates to other, competing VOs which therefore must not be shared (e.g. market planning);</li> <li>• some knowledge must be shared with the VO to enable operational or design decision making (e.g. current despatch status of goods);</li> <li>• some knowledge is commercially sensitive but which will enable better decision making for the VO (e.g. current capacity availabilities);</li> <li>• underlying knowledge of best practice in collaboration, and available in the public domain can be embedded in all implementations of enterprise knowledge bases;</li> <li>• knowledge of best practice within an business sector may be made available to any implementation for that sector.</li> <li>• VO knowledge must be controlled and disseminated to VO members in a way which respects individual IP but gives added value to all collaborators;</li> </ul> <p>The benefits of meeting this challenge include:</p> <ul style="list-style-type: none"> <li>• enhanced ability to form new collaborations rapidly, thus encouraging collaborative enterprise and increasing competitiveness in global markets;</li> <li>• reduced risk of error in forming and operating VOs through the application of knowledge and experience available within the enterprise, within the VO and as public domain best practice;</li> <li>• increased confidence in enterprises embarking on collaboration, perhaps for the first time, and especially in the case of SMEs who have the opportunity to build on experience of others in the sector;</li> <li>• the progressive evolution of an EU knowledge base on enterprise collaboration, underpinning this area of the knowledge society.</li> </ul>
State-of-the-Art	Little research has been found in this area.
Research Activity	<ul style="list-style-type: none"> <li>• Review of the sources available sources of enterprise knowledge within a VO, and the potential methods of capturing this data.</li> <li>• Identification of appropriate knowledge structures to maintain enterprise knowledge, including control of shared access.</li> <li>• Determination of interoperability requirements for the sharing of enterprise knowledge.</li> <li>• Investigation and creation of implementation platforms to meet the above requirements.</li> <li>• Identification of collaboration best practice, to populate general and sector specific best-practice knowledge bases, and the implementation of these in a form accessible to enterprises.</li> </ul>

**Response**

*See General Response 1.*

*Added to Annex I (Indicative Research Challenges) as Research Challenge T5.10, and addressed in the Knowledge Oriented Collaboration Grand Challenge.*

**13. Comments received from Eugene Sweeney, Iambic Innovation Ltd**

Received on 6 January 2006.

## Issue 99

Category: general

### RFID and Wireless Sensor Networks

The ISTAG Report on "Grids, Distributed Systems and Software Architectures" (August 2004) notes:-

*"The rapid growth of computing power, in smaller physical packages at lower costs has meant that the global computing and communications systems in the 21<sup>st</sup> century are now all-pervasive, creating a world where individuals and businesses are able to operate anywhere, anytime. We are moving towards the complete virtualisation of resources and ubiquitous access. As well as fixed network infrastructures, we are increasingly surrounded by wireless and mobile infrastructures. Other devices, such as RFID (Radio Frequency Identification) tags or embedded sensors will also become part of this all-pervasive environment with intelligent interfaces that transmit information as and when required through global persistent and intermittently connected networks."*

In November 2004, Hans Mulder, associate director of Intel Research said: -

*"The widespread adoption of RFID to track goods through the global supply chain will mark the start of a new era in which the computers sense the world, anticipate the needs of people and act on their behalf. We are on the verge of a vast increase in the spatial and temporal fidelity at which we [measure] and analyze the world, RFID is the stepping-stone to sensor networks."*

RFID tagging systems represent a significant and early part of the commercial realization of the vision of Ubiquitous Computing.

The commercialisation of the technologies being developed in this area is likely to generate substantial business opportunities in computer services over the next decade.

Europe has a technological lead in areas related to wireless, RFID and embedded systems.

The roadmap makes only a small reference to this in Section 8 (8.7).

**The Roadmap should reflect the research priority areas which will allow Europe to capitalise on this and take advantage of these opportunities, particularly by addressing the specific interoperability issues for Wireless Sensor Networks at all levels (from technical to business models).**

### Response

*Since the above comment was submitted, the Commission has launched an extensive, dedicated initiative on RFID.*

*See [http://europa.eu.int/information\\_society/policy/rfid/index\\_en.htm](http://europa.eu.int/information_society/policy/rfid/index_en.htm) and*

*<http://www.rfidconsultation.eu/>*

*The implications of RFID/sensor networks, and more generally "The Internet of Things" for Enterprise Interoperability are expected to be of particular relevance for the research work to be carried out in relation to the ISU and Science Base Grand Challenges described in the Roadmap.*

## Issue 100

Category: general

### 2. Social, Ethical and Legal (Intellectual Property Rights) Issues

Social, ethical and legal issues will be of increasing importance in this ubiquitously connected environment, where computing is all-pervasive. Public acceptance of these new technologies will be a pre-requisite for their wide-spread deployment.

As enterprise, government and individual activities become increasingly digitised and connected, more personal, public and commercial information will be gathered, stored and possibly disclosed to third parties. Issues relating to privacy, civil rights, security and access rights must be addressed. – as mentioned in the i2010 Strategic Framework.

The roadmap framework identifies "innovation" as a key challenge, however the practicalities of introducing new "inventions" – and in particular the new challenges we face today as a result of trans-border, trans-culture, trans-everything interoperability have not been explicitly identified (sec 3.3, etc).

As resources are shared, traded or licensed, transaction authorisation/verification and identity verification over secure (and in many cases non-secure) communication channels must be addressed. Users will need to be assured that their transactions, analyses or resources are not being tampered with, that the results are “trustworthy”, and that their identities cannot be stolen. Solutions in this trans-enterprise, trans-national, trans-cultural environment must address privacy, anonymity (with need to know), security, confidentiality, identity verification and theft prevention, transaction authorisation and repudiation.

As resources are spread across national boundaries, and across national legal systems, workable “trans-national” access and usage rights for the Intellectual Properties must be established.

Other Legal issues related to the management of trans-enterprise, trans-border access and usage rights include:

- Outsourcing of data management (different legal environments and the management of data held in 3rd countries)
- EU database legislation
- Security/confidentiality
- Trans-national legal frameworks
- Software patent issues
- IP Harmonisation
- Legislation for the use of “common” public domain components (e.g. open source, licence free, etc)

The roadmap talks about “policy Challenges (sec 5) and identifies digital rights management as an issue – however the issues are broader than just content management, and include issues mentioned above.

Whilst the roadmap does refer to software licences for distributed and movable applications and other agreements (sec 5.4, 7), and cultural issues (sec 7) these are part of broader business issues which will require the input of non-technical specialists such as those with international legal and IP expertise.

These (business) issues are also important to resolve with regard to open standards and open source.

**The Roadmap should reflect these “non-technical” issues as research priorities areas, which I believe are essential to address if there is to be widespread take-up and acceptance.**

### **Response**

*The above extensive comment is well made and appreciated. Many – if not all – of the issues raised are within the scope of the research work expected in relation to the ISU and Science Base Grand Challenges in the Roadmap. Researchers interested in addressing these two Grand Challenges are recommended to take these comments into consideration in developing their research activity.*

## **14. Comments received from Wolfgang Wilkes, University of Hagen**

Received on 6 January 2006.

On behalf of Guy Pierra (ENSMA/LISI, France), Raymond Betz (ePDC coordinator, Belgium), and Helmut Beckmann (GFiM GmbH, Germany).

### **Issue 101**

Category: semantics

A group of people, basically from the CEN/ISSS eCAT/GEN-ePDC project, has drafted an extension to the roadmap. We are looking at Enterprise Interoperability from the viewpoint of product data exchange based on product ontologies (often also called data dictionaries or classification structures). Currently, a number of industrial groups and standardisation committees are developing product ontologies.

It is our belief that the exchange of product data is a crucial aspect of enterprise interoperability and that the integration of ontology based product information into business processes will become more and more important. Therefore it is required to consider the relationships between process models and process ontologies with product ontologies and to further increase the usability of product ontologies. The relevant research challenges have been sketched in the attached roadmap extension of chapter

10. We called it 10.1' to indicate that in our view it should be integrated between the current sections 10.1 and 10.2. Many of the aspects addressed in current 10.2 are also relevant for product ontologies which could be reflected by slight modifications in the wording (we have a proposal available).

#### 10.1' Business Product Ontology (T4.1')

<b>Research challenge group</b>	T4.1' Business Product Ontology
Description	Collaborating enterprises maintain shared views of product data. To ensure an effective collaboration they have to reach semantic agreement regarding the meaning of product data. This refers to the meta level where the concepts like classes and properties have to be defined, but also to the content level where the different domain specific properties have to be defined semantically correct. Encoding this knowledge in machine readable product ontologies is a pre-requisite for any inter-organizational exchange of product data. Since product data is an integral part of business processes it is important to link product ontologies to business processes and business process ontologies.
State-of-the-art	Currently, a number of product ontologies are in use and under development using a number of different languages. Examples are the RosettaNet dictionary, the ECALS dictionary, eClass, GS1/GPC, etc. In the area of standards, currently a number of developments are under way, e.g. for describing cutting tools (ISO13399), optical instruments (ISO 23584), fasteners, measuring instruments (both in ISO 13584), and electrical components (IEC 61360). All these are based on the product ontology language PLIB (Parts library, ISO 13584). There exist a number of other means for specifying product ontologies like ISO15926 which are targeted to specific purposes.
Research activity	Many of the research challenges which have been defined in the context of the business process ontologies are also challenges for product ontologies. But there exist some special aspects which have to be addressed specifically for product ontologies, namely the interaction of product ontologies with business processes and business process ontologies, the management of product data on the basis of product ontologies, and the overall collaboration of competing and partially complementary product ontologies. These are detailed in the following.

#### Response

[See General Response 1.](#)

[Added to Annex I \(Indicative Research Challenges\) as Research Challenge T4.4, and addressed in the Knowledge Oriented Collaboration Grand Challenge.](#)

#### Issue 102

Category: semantics

##### 10.1'.1 Link between product and process ontologies (T4.1')

<b>Research challenge</b>	Link between product and process ontologies
Description	Many business processes are related to products and information about products. Often the product information can influence the business processes - different products and different product groups require special treatment. On the other hand, the modeling of processes and product information should be seen as orthogonal to each other: Process models are developed by different people than product models, and it should be possible to combine advanced models / ontologies from either side to a most powerful

	tool.
State-of-the-art	Many business process models today do not deal with deep product data, particular if they mainly deal with procurement type processes. They only consider some business properties like identification of products as relevant. Other models which include processes related to engineering are bound to specific product ontologies, as e.g. the RosettaNet Partner Interface Processes (PIPs) which use the RosettaNet Technical Dictionary (RNTD) for definition of product data. The same is true for other e-engineering process models like ECALS (Japan, electronic components) or NAMUR/Prolis (Germany, electric instrumentation of plants) which are built around specific product ontologies.
Research activity	<ul style="list-style-type: none"> <li>• Analysis of the relationships between business processes and product information and the requirements of process models for dealing with general product ontologies</li> <li>• Development of mechanisms to link process models and process ontologies with product ontologies</li> <li>• Evaluation of these mechanisms by applying it to application cases and by integrating it into emerging process definition standards like ebXML to illustrate the orthogonality of process and product definition</li> </ul>

### Response

[See General Response 1.](#)

[Added to Annex I \(Indicative Research Challenges\) as Research Challenge T4.4.1, and addressed in the Knowledge Oriented Collaboration Grand Challenge.](#)

### Issue 103

Category: semantics

10.1'.2 Ontology based product management

<b>Research challenge</b>	Ontology-based product management
Description	Besides being used in inter-enterprise communication, product ontologies are also used internally for structuring corporate component databases. Development of local corporate ontologies will often precede the development of shared ontologies, requesting ontologies and ontology mappings to be explicitly stored in corporate product databases to enable seamless information exchange. To support different actors (e.g. from procurement, inventory management, system design, etc.) who use different product information, flexible view management mechanisms should support both autonomous discipline-specific views and the capability for sharing information between views. Such product databases should allow to store and to query efficiently millions of products.
State-of-the-art	While a number of global players still use item databases where product characterization is described in a single "designation" string, over the last years researchers have explored several database architectures for storing and for querying both instances and ontologies (e.g., OWL, RDF-S, PLIB). These architectures suffer from scalability problems. Concerning ontology mapping, the various ontology models (e.g., OWL, F-LOGIC and PLIB) define different kinds of mappings that are all necessary in the context of product databases.
Research activity	<ul style="list-style-type: none"> <li>• Develop and prototype new architectures for ontology-based product databases with improved scalability in order to satisfy industrial size applications and support ontology-mapping-based import and export</li> </ul>

	<p>services.</p> <ul style="list-style-type: none"> <li>• Introduce mechanisms into main stream ontology languages supporting autonomous discipline-specific views and information sharing between views</li> <li>• Design user-friendly ontology-based query languages both for retrieving product within a product data base and for searching over the global network.</li> </ul>
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## Response

*See General Response 1.*

*Added to Annex I (Indicative Research Challenges) as Research Challenge T4.4.2, and addressed in the Knowledge Oriented Collaboration Grand Challenge.*

## Issue 104

Category: semantics

10.1'.3 Business product ontology development infrastructure

<b>Research challenge</b>	Business product ontology development and deployment / maintenance infrastructure
Description	Designing a single product ontology encompassing all business products is hardly conceivable because of the numerous industrial domains. Because most enterprises use and produce products related to several industrial sectors, they need to deal with ontologies corresponding to several sectors. Thus a key research challenge is to define a framework in which ontologies may be described independently of each others by any consortium or standardization group but where overlaps may be avoided and where common concepts and properties may be shared. Such sharing capabilities should cross the boarder of ontology languages and models.
State-of-the-art	Numerous ontologies have already been developed providing partial (and not consistent) views of business products such as classification views (UNSPSC, eCI@ss), e-commerce views of retail-sold products (GPC from GS1) or engineering views (ISO 13584 / IEC 61360), sometimes restricted to some particular domains (RosettaNet). Over the last couple of years, the Open and Interoperable Domain Dictionary Initiation (OIDDI) gathering a number of global players (ECALS, RosettaNet, eCI@ss, GS1, etc) has shown the feasibility to share information across ontology model borders. Several projects, and in particular the CEN/ISS eCat/Gen-ePDC project, have worked on resolving semantic mismatches between concepts defined in overlapping product ontologies.
Research activity	<ul style="list-style-type: none"> <li>• Develop a framework offering mechanisms ensuring both interoperability and concepts sharing capabilities to decentralized ontologies.</li> <li>• Define an envelope model for sharing information between ontologies based on different ontology languages and models.</li> <li>• Define mechanisms for synchronizing the evolution of overlapping ontologies developed by independent organizations and processes that want to cooperate.</li> </ul>

## Response

*See General Response 1.*

*Added to Annex I (Indicative Research Challenges) as Research Challenge T4.4.3, and addressed in the Knowledge Oriented Collaboration Grand Challenge.*

## 15. Comments received from Pim van der Eijk, OASIS

Received on 9 and 29 January 2006.

### Issue 105

Category: standards

### OASIS Feedback to Enterprise Interoperability Research Roadmap

#### Author(s):

Pim van der Eijk (OASIS European Representative)

#### Abstract:

Four research projects participating in the cluster on enterprise interoperability within the European Commission's research framework have developed a research roadmap for enterprise interoperability as input to an FP7 consultation process. It has been circulated and comments have been requested in an open consultation process. This document presents some feedback to this document on behalf of OASIS. *It aims to show there is a very strong overlap between research topics identified in the roadmap and technical work currently being done by OASIS Technical Committees.* Based on that observation, we encourage FP7 projects not just to be aware of and benefit from these ongoing activities, but also invite them to actively contribute to these and future OASIS Technical Committees in this area.

#### 1 Introduction

Four research projects participating in the cluster on enterprise interoperability within the European Commission's research framework have developed a research roadmap for enterprise interoperability as input to an FP7 consultation process. It has been circulated and comments have been requested in an open consultation process. This document presents some feedback to this document on behalf of OASIS. It aims to show there is a very strong overlap between research topics identified in the roadmap and technical work currently being done by OASIS Technical Committees. Based on that observation, we encourage FP7 projects not just to be aware of and benefit from these ongoing activities, but also invite them to actively contribute to these and future OASIS Technical Committees in this area.

#### 2 OASIS

OASIS (Organization for the Advancement of Structured Information Standards) is a not-for-profit, international consortium that drives the development, convergence, and adoption of e-business standards. The consortium produces more Web services standards than any other organization along with standards for security, e-business, and standardization efforts in the public sector and for application-specific markets. Founded in 1993, OASIS has more than 5,000 participants representing over 600 organizations and individual members in 100 countries.

OASIS is an international organization and is not inherently tied to any specific geography. Currently, approximately one out of every four OASIS member organizations is based in Europe, which is a marked increase from only a few years ago.

End users, government agencies and organizations active in research and education, both in industry and academia, account for approximately half the OASIS membership. Our technology provider members include both well-known large international software platform companies, small and medium-size organizations (including many with less than ten employees) and individual members.

OASIS is distinguished by its transparent governance and operating procedures. Members themselves set the OASIS technical agenda, using a lightweight process expressly designed to promote industry consensus and unite disparate efforts. Completed work is ratified by open ballot. Governance is accountable and unrestricted. Officers of both the OASIS Board of Directors and Technical Advisory Board are chosen by democratic election to serve two-year terms. Consortium leadership is based on individual merit and is not tied to financial contribution, corporate standing, or special appointment.

The Consortium hosts two of the most widely respected information portals on XML and Web services standards, Cover Pages and XML.org. OASIS Member Sections include CGM Open, DCML, LegalXML, PKI, and UDDI.

### 3 Technical Work at OASIS in the Enterprise Interoperability area

Technical work in OASIS is carried out by Technical Committees. There are currently more than seventy technical committees in various areas. In this section we highlight (in alphabetical order) a number of technical committees that are particularly relevant to the subject matter and research agenda outlined in the enterprise interoperability roadmap. We will give an overview of each of these TCs and indicate, for each TC, the areas in the Research Roadmap which seem most relevant to.

#### **ebXML Business Process (ebBP) TC**

The purpose of the OASIS ebXML Business Process TC is to continue work on a royalty-free technology representation and model compatible with an underlying generic metamodel for business processes, activities, and collaboration. Its work is among other based upon the ebXML BPSS v1.01 specification (ebXML Business Process Specification Schema v1.01) jointly developed by OASIS and UN/CEFACT. In the context of ebBP, a business collaboration could occur within or between enterprises. The collaboration may be enforceable, easily manageable, and/or traceable. This representation and model will provide a set of guidelines to define the business process-rules, semantics and syntax for both binary and multi-party collaborations. The representation and model will work within the ebXML architecture (for metamodel and model exchange) and will also support standards-based development and exchange of business process definitions. The specification will support the computable and executable language used for business collaboration, rather than the processing accomplished from the view of a single party.

More information on this TC is available at <http://www.oasis-open.org/committees/ebxml-bp/>.

*This TC is of particular relevance to activities 7.3.2 Modelling Cross-Organizational Business Processes, 7.3.3 Monitoring of Business Processes, 8.1.3 Cross-Organizational Business Process Execution, 8.1.4 Monitoring and Redesign of Business Processes, 8.1.5 Decentralized governance of business processes, 8.1.6 Observation & Validation of Collaboration between Organizations.*

#### **Response**

[See response to Issue 120.](#)

#### **Issue 106**

Category: standards

#### **OASIS ebXML Collaboration Protocol and Agreement TC**

A Collaboration Protocol Agreement (CPA) describes how two trading partners engage in electronic business collaborations through the exchange of electronic messages. A Collaboration Protocol Profile (CPP) describes the message exchange capabilities of a single partner. A CPA may be created by computing the intersection of two partner CPPs. Included in the CPP and CPA are details of transport, messaging, security constraints, and bindings to a business process specification document that contains the definition of the interactions between two parties while engaging in a particular electronic business collaboration.

The ebXML Collaboration Protocols and Agreements technical specification is part of an international standard series, ISO 15000.

More information on this TC is available at <http://www.oasis-open.org/committees/ebxml-cppa/>.

*This TC is of particular relevance to activities in section 7.3 Cross-Organizational Processes and section 7.3.3 Monitoring of Business Processes, 7.4 Agreements and Contracting, 8.1.3 Cross-Organizational Business Process Execution, 8.1.4 Monitoring and Redesign of Business Processes, 8.1.5 Decentralized governance of business processes, 8.1.6 Observation & Validation of Collaboration between Organizations, 8.2 Service Discovery, brokering, negotiation and mediation.*

#### **Response**

[See response to Issue 120.](#)

#### **Issue 107**

Category: standards

#### **OASIS ebXML Implementation, Interoperability and Conformance (IIC) TC**

It is the intent of the IIC TC to provide a means for software vendors to create infrastructure and applications which adhere to the ebXML specifications and are able to interoperate. As such, the purpose of the IIC TC includes a conformance plan, a set of reference implementation guidelines and a set of base line interoperability tests.

In addition to its technically focused work, this TC is of particular relevance due to its work on *Deployment Templates* that address how the OASIS ebXML Technical Specifications can be profiled to match requirements of user communities and their business processes.

More information on this TC is available at <http://www.oasis-open.org/committees/ebxml-iic/>.

*This TC is of particular relevance to activities in section 9.1 Interoperability Frameworks and Architectures.*

### **Response**

[See response to Issue 120.](#)

### **Issue 108**

Category: standards

#### **OASIS ebXML Registry TC**

The OASIS ebXML Registry TC develops specifications to achieve interoperable registries and repositories, with an interface that enables submission, query and retrieval on the contents of the registry and repository. Further, the Registry TC seeks to develop specifications that serve a wide range of uses, covering the spectrum from general purpose document registries to real-time business-to-business registries. Additionally, as part of its specification development work, this TC explores and promotes various emerging models for distributed and cooperating registries.

The ebXML Registry technical specifications are part of an international standard series, ISO 15000.

More information on this TC is available at <http://www.oasis-open.org/committees/regrep/>.

*This TC is of particular relevance to the research activities in section 8.2 Service Discovery, brokering, negotiation and mediation, 8.5 Repositories and Persistence Services, 9.1 Interoperability Frameworks and Architectures, 10 Semantics and Ontology Research Challenges.*

### **Response**

[See response to Issue 120.](#)

### **Issue 109**

Category: standards

#### **OASIS ebXML Service-Oriented Architecture (ebSOA) TC**

This TC is working on advancing architectural patterns for using Service Oriented Architecture in electronic business. Existing work on which it builds includes the ebXML Technical Architecture document.

More information on this TC is available at <http://www.oasis-open.org/committees/ebsoa/>.

*This TC is of general relevance to section 7 Enterprise Research Challenges and 8 ICT Systems and A&P Research challenges and 9.1 Interoperability Frameworks and Architectures.*

### **Response**

[See response to Issue 120.](#)

### **Issue 110**

Category: standards

#### **OASIS Framework for Web Services Implementation (FWSI) TC**

This TC is defining methods and functional components for broad, multi-platform, vendor-neutral cross-industry implementation of Web services

Through the experience of developing Web Services solutions and working with the industry in actual implementations of web service-enabled applications, it became apparent that web services implementation needs a lot of actual implementation guidelines and there are also a lot of

commonalities that exist throughout these implementations. If harnessed properly, the movement towards getting web services to the mass market can be realised that much faster. As such, the thoughts for contributing this knowledge and harnessing the vast knowledge out there from all parts of the industry was mooted and hence the work towards the formation of this TC.

The purpose of OASIS FWSI TC is to facilitate implementation of robust Web Services by defining a practical and extensible methodology consisting of implementation processes and common functional elements that practitioners can adopt to create high quality Web Services systems without re-inventing them for each implementation. It solves the problem of the slow adoption of Web Services because of lack of methodologies to implement Web Services, and a lack of understanding of whether solutions proposed by vendors have the necessary components to reliably implement an application based on Web Services.

More information on this TC is available at <http://www.oasis-open.org/committees/fwsi/>.

*This TC is of particular relevance to the research activities in section 8.2 Service Discovery, brokering, negotiation and mediation and 9.1 Interoperability Frameworks and Architectures*

## Response

[See response to Issue 120.](#)

## Issue 111

Category: standards

### OASIS LegalXML eContracts TC

This TC aims to enable the efficient creation, maintenance, management, exchange, and publication of contract documents and terms. The scope includes negotiating and finalizing contracts in an application neutral format; exchanging contract contents as valid XML; automating processing of contract content, for example for use in contract management applications; to support the production of human readable output documents; and to facilitate the use of reusable or boilerplate information within a contract.

More information on this TC is available at <http://www.oasis-open.org/committees/legalxml-econtracts/>.

*This TC is of particular relevance to activities in section 7.3 Cross-Organizational Processes and section 7.4 Agreements and Contracting, 8.1.3 Cross-Organizational Business Process Execution, 8.1.4 Monitoring and Redesign of Business Processes, 8.1.5 Decentralized governance of business processes, 8.1.6 Observation & Validation of Collaboration between Organizations, 8.2 Service Discovery, brokering, negotiation and mediation.*

## Response

[See response to Issue 120.](#)

## Issue 112

Category: standards

### OASIS Semantic Execution Environment TC

This TC is looking at developing guidelines, justifications, and implementation directions for deploying Semantic Web services in SOA. The technology of Semantic Web services (SWSs) envisions easy access to various systems and facilitates the consumption of the functionality exposed by these systems on the Web. Seamless integration, ad-hoc cooperation between various business parties or dynamic collaborations on the Web, can be achieved only if tools for handling semantically enhanced services are provided.

The OASIS SEE TC aims to continue work initiated by the WSMX project and working group visible at <http://www.wsmx.org> and several other projects in Europe such as DIP (<http://dip.semanticweb.org/>), ASG (<http://asg-platform.org/>) and other projects in the area of Semantic Web Services. The aim of the SEE TC is to provide guidelines, justifications and implementation directions for an execution environment for Semantic Web services. The resulting architecture will incorporate the application of semantics to service-oriented systems and will provide intelligent mechanisms for consuming Semantic Web services.

Service-oriented architectures anticipate a large number of ambient heterogeneous computational services that may be utilized in various combinations. However, a typical composition of services to

meet a business goal often is an attempt to coordinate disparate resources from multiple sources -- services that may not know, or fully understand, each other in advance. When planning to invoke multiple services, it is not always readily apparent whether the methods and outputs of one service meet the requirements of another. So some interpretation, mediation or common understanding is essential for any significant deployment. The SEE TC will define methods for using semantic technologies to solve these coordination and automation issues.

The TC also will define the functional components of such an SWS system and the semantics descriptions of these components' interfaces. The TC will also define a formal description of execution semantics of such a system. In addition, the TC will define a generic and open framework, using metadata, to allow for new components to be plugged into the system and made available to the execution engine dynamically. Further, after providing the basic methods described above, or in parallel if appropriate, the SEE TC will seek to develop specifications addressing specific problem sets covering the spectrum from a general purpose environment to a specific business-domain-focused applications addressing financial, telecommunication, military and e-Government applications of Semantic Web Services technologies.

In the course of existing research, it has become clear that Semantic Web services and Grid Computing are closely related research activities with many shared objectives. Both address distributed computing systems from different perspectives and we believe that they should be investigated in parallel as complementary technologies enabling the next era of internet applications. According to the TC members, the usage of arbitrary resources (physical or logical) for building complex business applications should be simplified, so that their discovery, deployment, composition, provisioning and management, can be performed by the means of semantic-enhanced services. To reach this goal, on the one hand, current Grid technologies need to be extended to support semantically enriched resource descriptions and services, e.g. to simplify their discovery and composition. On the other hand, Semantic Web services technology has to be extended to support resource management, including dynamic provisioning of services and resources, execution management, and support of security-related issues concerning virtual organization management. This TC aims to combine Grid Computing with Semantic Web Services technologies and to take advantage of their different perspectives to provide architecture of the infrastructure for machine-to-machine enabled communication and cooperation.

The SEE TC's efforts will foster compatibility across specifications developed for Semantic Web Services, and where possible re-use existing standards and methods that already have been carried in areas of Semantic Web and Web Services. This TC will engage with industry, academic and research communities to facilitate understanding, awareness and possible collaborations regarding emerging semantic technologies and research applicable to semantically-aware Web Services.

Following a top-down, component based development approach, the TC will provide a whole framework capable of carrying out the dynamic discovery, mediation, selection, invocation and inter-operation of Web Services and any other functionality which will be revealed during the requirements analysis phase. While the focus of this group will remain on a high level semantic description of components interfaces, the TC will seek tight cooperation with any group working on semantics-enabled functional components that fulfill the requirements of such system.

More information on this TC is available at <http://www.oasis-open.org/committees/semantic-ex/>.

*This TC is of particular relevance to activities in section 7.4 Agreements and Contracting, 7.5 Interoperability support for SMEs 8.1 Runtime aspects of business processes, 8.2 Service Discovery, brokering, negotiation and mediation, 8.4 Infrastructure and Services, 8.7 Interoperability to support ambient intelligent applications 10 Semantics and Ontology, 11.6 Semantic-based model mappings and transformations.*

## **Response**

[See response to Issue 120.](#)

## **Issue 113**

Category: standards

### **OASIS SOA Adoption Blueprints TC**

The goal of this TC is to develop, publish and maintain archetypal "blueprint" sets of requirements and functions to serve as generic, vendor-neutral instances of service-oriented solutions for real business requirements. In planning and building Service Oriented Architectures (SOA), concrete examples often are useful. SOA designers, vendors and users can reference a wealth of abstract guidelines,

descriptions of functional layers and sets of specific standards or software that fulfill SOA requirements.

However, often there is a shortage of clear, demonstrable examples of working implementations based on real needs and requirements that can be used as best practices reference, to kickstart implementation projects and to compare implementations. One way to encourage these examples is to supply an archetypal "blueprint" set of business requirements and functions that can be fulfilled by SOA methods.

The SOA Adoption Blueprints TC will develop, circulate, maintain and update a set of example business profiles or "adoption blueprints" to illustrate the practical deployment of services using SOA methods. Each adoption blueprint will provide a (a) business problem statement, (b) a set of business requirements, and (c) a normative set of functions to be fulfilled, all on a vendor- and specification-neutral basis.

More information on this TC is available at <http://www.oasis-open.org/committees/soa-blueprints/>.

*This TC is of general relevance to activities in section 8 ICT Systems and A&P research challenges and 9 Methodology Research Challenges*

## **Response**

[See response to Issue 120.](#)

## **Issue 114**

Category: standards

### **OASIS SOA Reference Model TC**

The OASIS Service Oriented Architecture TC is chartered to develop a Reference Model for Service Oriented Architecture. This is primarily to address SOA being used as a term in an increasing number of contexts and specific technology implementations. Sometimes, the term is used with differing - or worse, conflicting - understandings of implicit terminology and components. This Reference Model is being developed to encourage the continued growth of different and specialized SOA implementations whilst preserving a common layer of understanding about what SOA is.

The second function of this Reference Model is to help architects and software vendors make consistent logical divisions in their architectures and products. This is important to large scale service oriented architectures involving products or offerings from multiple disparate vendors. Much like a car manufacturer needs to standardize a model for parts (axle, transmission, wheel) when they build a car, the vendors for those parts also need to scope their offerings and know where the boundaries are. Imagine trying to build a car with a wheel that also contained part of the axle and half a seat?

More information on this TC is available at <http://www.oasis-open.org/committees/soa-rm/>.

*This TC is of general relevance to activities in section 7 Enterprise Research Challenges, 8 ICT Systems and A&P research challenges and 9 Methodology Research Challenges*

## **Response**

[See response to Issue 120.](#)

## **Issue 115**

Category: standards

### **OASIS UDDI Specification TC**

The purpose of the Universal Description, Discovery, and Integration (UDDI) Specification TC is to continue work on the Web services registry foundations developed and published by UDDI.org. The UDDI specifications form the necessary technical foundation for publication and dynamic discovery of Web services implementations both within and between enterprises.

More information on this TC is available at <http://www.oasis-open.org/committees/uddi-spec/>.

*This TC is of particular relevance to the research activities in section 8.2 Service Discovery, brokering, negotiation and mediation, 8.5 Repositories and Persistence Services, 9.1 Interoperability Frameworks and Architectures, 10 Semantics and Ontology Research Challenges.*

## **Response**

[See response to Issue 120.](#)

## Issue 116

Category: standards

### **OASIS Web Services Business Process Execution Language (WSBPEL) TC**

The OASIS WSBPEL TC aims to enable users to describe business process activities as Web services and define how they can be connected to accomplish specific tasks

The purpose of the Web Services Business Process Execution Language TC is to continue work on the business process language published in the Business Process Execution Language for Web Services (BPEL4WS) specification in August 2002 [1]. Continuing the approach and design used in BPEL4WS, the work of the BPEL TC will focus on specifying the common concepts for a business process execution language which form the necessary technical foundation for multiple usage patterns including both the process interface descriptions required for business protocols and executable process models. It is explicitly not a goal of the TC to specify bindings to specific hardware/software platforms and other mechanisms required for a complete runtime environment for process implementation.

More information on this TC is available at <http://www.oasis-open.org/committees/wsbpel/>.

*This TC is of particular relevance to activities 7.3.2 Modelling Cross-Organizational Business Processes, 7.3.3 Monitoring of Business Processes, 8.1.3 Cross-Organizational Business Process Execution, 8.1.4 Monitoring and Redesign of Business Processes, 8.1.5 Decentralized governance of business processes, 8.1.6 Observation & Validation of Collaboration between Organizations.*

### **Response**

[See response to Issue 120.](#)

## Issue 117

Category: standards

### **OASIS Web Services Notifications TC**

The purpose of the Web Services Notification (WSN) TC is to define a set of specifications that standardise the way Web services interact using "Notifications" or "Events". They form the foundation for Event Driven Architectures built using Web services. With the WS Resource Framework specifications, this TC represents work developed in the Grid community and brought to OASIS for Standardization.

The WSN specifications provide a standardized way for a Web service, or other entity, to disseminate information to a set of other Web services, without having to have prior knowledge of these other Web Services. They can be thought of as defining "Publish/Subscribe for Web services".

More information on this TC is available at <http://www.oasis-open.org/committees/wsn/>.

*This TC is of particular relevance to the research in area 8.4 Grid-based enterprise interoperability.*

### **Response**

[See response to Issue 120.](#)

## Issue 118

Category: standards

### **OASIS Web Services Quality Model TC**

The OASIS Web Services Quality Model TC is defining common criteria to evaluate quality levels for interoperability, security, and manageability of services

With the widespread proliferation of Web services into software integration and service integration, the quality of Web services will become a very significant factor in executing the services successfully among service consumers, providers, brokers, managers, etc. Although most Web services systems adhere to standards, they may exhibit a wide range of quality in such aspects as interoperability, security, and manageability, etc. It is possible that a specific level of quality of Web services could be requested and agreed according to a contract between a provider and a consumer. However, there is no known common specific model or criteria to evaluate the quality level of services. So, we need an obvious quality model of Web services that may be composed of three components: quality factors, quality associates, and quality activity.

Each quality factor measure may specify classification and criteria for Web services quality. Each quality factor is a fundamental component that recognizes Web services quality as the target for control, such as manageability, security, interoperability, stability, etc. Measures of quality associates may define or constrain the role and responsibility of persons/organizations with a relationship to a service, in detail. Quality activity may provide a model for all the actions needed to specify, agree upon and obtain a specific level of services such as contracting, monitoring, and notifying. By specifying the quality model, service consumers could significantly reduce the risks associated with obtaining practical and stable Web services.

The TC has already developed a draft quality model (WSQM) in the context of contracting for Web services between associates conceptually, in order to secure Web services at a specific level of service quality. Probably as a second phase after the general model is described, the TC also will propose WS-QDL (Web Services Quality Description Language) to describe the WSQM in a standardized type of XML representation. Additionally, the TC will develop test guidelines for our quality model. We would like to specify an overall model of quality of Web services in WSQM TC. It will include specified quality factors, associate roles, and activities. It will not cover the detailed management of Web services which has already been covered in WSDM.

First, the TC has prepared the Quality model in the focus of contract for Web services between associates more conceptually in order to secure Web services Quality at some level. Then the TC will propose WS-QDL (Web Services Quality Description Language) to describe the WSQM in the type of XML schema. Additionally, if possible, the TC will develop the test guideline for our quality model. The TC anticipates the contribution of a Web Services Quality Model and Test Guideline, already developed and applied practically in the public arena of Korean e-government projects in 2004 to serve as a starting point. The TC will develop a global standard model for Web services quality by attaching and expanding various relationship of associates and contracts case by case. The TC will be open to anybody with interest in this topic and global cooperation.

The OASIS WSQM TC has prepared a quality model (WSQM) in the context of contracting for Web services between associates conceptually, in order to secure Web services at a specific level of service quality. After the general model is described, the TC also will propose WS-QDL (Web Services Quality Description Language) to describe the WSQM in a standardized type of XML representation. Additionally, the TC will develop test guidelines for our quality model

More information on this TC is available at <http://www.oasis-open.org/committees/wsgm/>.

*This TC is of particular relevance to activities in section 7.4 Agreements and Contracting, 8.1.3 Cross-Organizational Business Process Execution, 8.1.5 Decentralized governance of business processes and 8.2 Service Discovery, brokering, negotiation and mediation.*

## Response

[See response to Issue 120.](#)

## Issue 119

Category: standards

### OASIS Web Services Resource Framework TC

The purpose of the OASIS WSRF TC is to define a generic and open framework for modeling and accessing stateful resources using Web services. This includes mechanisms to describe views on the state, to support management of the state through properties associated with the Web service, and to describe how these mechanisms are extensible to groups of Web services. With the WS Notifications specifications, this TC represents work developed in the Grid community and brought to OASIS for standardization.

Web services implementations are often stateless in that they maintain no dynamic state whose lifetime exceeds the processing of an individual message. The statelessness of Web service implementations is a valuable asset to their availability and ability to accommodate dynamic workloads. Web service interfaces, on the other hand, often imply the need for some form of stateful interaction with the clients of the service. This may be manifest in a conversational style of use of a particular Web service interface in which some aspect of the result of one operation influences the execution of the next operation. The state in interactions with such interfaces is typically contained in or referred to from the messages that are exchanged with the target service. Inferences concerning the nature of the state may sometimes be made, but only in an application-specific fashion and not in a generic manner that can be exploited easily by tooling.

The goal of this TC is to define a set of royalty-free, related, interoperable and modular specifications that will allow the relationship between a Web service and state to be modelled in an explicit and standardized fashion. This will simplify the definition of new service interfaces and enable more powerful discovery, management and development tools. These specifications will be composable with other available Web services specifications enabling applications to access state with the qualities of service - for example security, transactions and reliability - provided for in those specifications.

The scope of this work is to define a framework within which Web services can access state in a consistent and interoperable manner, and an access pattern through which service requesters can interact indirectly with stateful resources through a Web service that encapsulates the state. The work of this TC will ensure that an architectural separation can be maintained between a stateful resource and the Web service that encapsulates it to promote the desirable loose coupling between service requestor and the stateless service provider and to provide a highly available and scalable means to interact with state.

More information on this TC is available at <http://www.oasis-open.org/committees/wsr/>.

*This TC is of particular relevance to the research in area 8.4 Grid-based enterprise interoperability.*

## **Response**

*See response to Issue 120.*

## **Issue 120**

Category: standards

Some existing OASIS Technical Committees are already based on work done in European projects or involve people and organizations that have participated in such projects. Various organizations that are partner in one of the four project consortia that have created the research roadmap are currently OASIS members. The OASIS Semantic Execution Environment TC mentioned in [Issue 112] an example of a TC that is building on results of EU Framework Programme research projects. We would very much welcome further collaboration and participation in the context of FP7.

## **Response**

*The editors of the Roadmap would like to thank you for providing this wealth of information on the activity of the various OASIS technical committees. We are aware that OASIS is among the most active and productive organisations in the standardisation arena today.*

*We fully agree that any research work that may arise from the Roadmap must use the state-of-the-art, including available and emerging standards and specifications, as a baseline of the research work. As stated in the Research Context, Section 4.3, Enterprise Interoperability research should not, among others, replicate what already exists or is in the pipeline, and should not reinvent what is in principle already available on the market.*

*In general, the present Roadmap is a research roadmap, and not for example a standards roadmap. The present Roadmap could in principle be complemented by other kinds of roadmap such as a standards roadmap, developed in other arenas. See further under General Response 2.*

*The indicative Research Challenges (now in Annex I) have been developed "bottom-up", particularly by – but by no means limited to – the projects participating in the European Commission's Enterprise Interoperability Cluster, as referenced in your contribution. As such, we very much rely on the submitters as regards the quality and comprehensiveness of the inputs. During the open consultation process of this Roadmap over many months, the Commission and the editors have repeatedly requested improvements to these inputs. The Annex I to the final version of the Roadmap (V4.0) therefore represents a "best effort" of the interested stakeholders. The editors emphasise also that these are indicative Research Challenges only. Other research challenges, including potentially "competing" research challenges, might be developed in the research work to be carried out in addressing the Grand Challenges. See further under General Response 1.*

*Active and meaningful collaboration between research projects and standardisation activities, as indicated in your contribution, is extremely important, at technical, business as well as strategic levels. We believe that the need for such collaboration will be further strengthened in the upcoming FP7. In this respect, the FP5 C-ECOM project and the FP6 COPRAS project offer a possible collaboration model for FP7.*

*Finally, we as editors of this Roadmap very much hope that the Enterprise Interoperability stakeholders, who are the target audience of this Roadmap, would pay careful attention to your*

*detailed contribution. The contribution should be taken into account in any project proposal that might arise from this Roadmap. The OASIS offer of collaboration with research projects should be welcomed and acted upon by organisations interested to participate in the research work.*

## **16. Comments received from Garry Barclay, Codescent**

Received on 9 January 2006.

### **Issue 121**

Category: vision

Vision is not clear at all – no intermediate steps and no testability of the steps vs. the vision. Should be able to objectively evaluate the merit and significance of each project against a (more complete) vision statement.

### **Response**

*The Vision chapter has been rewritten since the above comment was made. On evaluation, please refer to the list of bullets at the end of Section 4.2. Each bullet is potentially subject to measurement.*

*It is not the purpose of a research Roadmap to set out hard metrics for project proposal evaluation.*

### **Issue 122**

Category: general

No guarantee of completeness – how do we know there is no key technology missing?

### **Response**

*The answer is that there is no “guarantee” of particular technologies that will emerge. The present Roadmap adopts a general standpoint that research is by nature speculative and open-ended. Moreover, note that this is a research roadmap, not a technology roadmap. Please refer to the Scope of the Roadmap (Section 2.3).*

### **Issue 123**

Category: general

Plan seems to have great complexity in places compared to simple or missing subjects elsewhere. My analogy would be to a car design which has a turbo engine, but wooden wheels.

### **Response**

*The comment has not been detailed. It is hoped that the commentator would consider the improvements that have been made in successive versions of the Roadmap, which should be increasingly robust and consistent in comparison to previous versions.*

### **Issue 124**

Category: implementation

I see no deep consideration of how the overall solution will be taken up by the IT world. I would like to see considerations of:

- Seeding markets / Monopolism
- Benevolent Dictatorship
- Stealth Marketing
- Key customers (e.g. SAP)
- Incentives/Penalties

**Response**

*See General Response 2.*

*Take-up measures are outside the scope of this Roadmap, though they are expected to be addressed in the actual execution of the research work.*

*The ISU and the Science Base Grand Challenges in the Roadmap now contain consideration of the issues listed, for example in relation to the business case for ISU and the economic science covered in the Science Base.*

**Issue 125**

Category: general

An architecture description is required – one which is easy to communicate (simple) but complete (breadth vs. depth)

**Response**

*See General Response 2.*

*The comment is not fully understood. If the architecture in question is meant to be a technical architecture, then its description is outside the scope of the Roadmap (please refer to Section 2.3).*

**Issue 126**

Category: implementation

I would like to include leadership by example – governments to establish ‘interoperability’ key projects in a financially attractive way

**Response**

*Thank you for your comment. The Roadmap is not a policy document. Your recommendation about leadership by example by government does regularly appear in EU policy documents, e.g. the eGovernment Action Plan published by the EC in April 2006.*

**Issue 127**

Category: general

Recognition of ‘good enough’ standards, for example BPEL is ‘good enough’. Avoidance of over-specification. De Facto standards must be allowed to evolve & prosper.

**Response**

*It is not the purpose of this Roadmap to pass judgement of particular standards. BPEL is referenced in the State of the Art section (Section 3.1).*

*The balance between the “good enough” and “best effort” principles is however an important one. It is alluded to in the design principles of the ISU (Section 5.3.1).*

**Issue 128**

Category: vision

I don’t believe in ‘dynamic discovery’ of trading partners. I think this is a static process that won’t benefit greatly from automation (at least not in the early stages). Including directory functionality in the early models greatly increases the ‘problem space’ without a corresponding value. There may be other aspects of the vision that can be de-prioritized.

**Response**

*The emphasis of the Vision description in the final version of the Roadmap (V4.0) is on the process of innovation, competition and collaboration. There is no particular focus on how to find trading partners.*

## Issue 129

Category: general

As an architect I appreciate simple standards built to solve specific problems, and capabilities to grow those standards to solve gradually increasing problems. In my opinion, this must be the way the dynamic business process marketplace will evolve, the standards will only be accepted when they are simple and easy to use, but able to grow with the complexity of the business environment. It is obvious that the enabling standards of this effort are all characterized by their simplicity: Xml, SOAP, SNMP, MAPI, HTTP. Compare the BPMN standard to the far simpler graphical formats used in the real world by most process designers.

Consider the ISO 8583 (v1) standard for electronic payments. There are no real-world protocols in use which use this standard directly. Yet the level of interoperability in the EFT marketplace was hugely increased by this standard because it was the basis for almost every EFT protocol designed since it was available. It established a number of key benefits: It was simple, covering the basic functionality of the target market; it had obvious and simple extension mechanisms for adding private, additional data (for bilaterals, for example); it provided the basic definitions of codes, numbering schemes and syntactic validation (activity codes, number of digits in a merchant ID, account number checksum digit), and (most importantly) it established the lingua franca which was taken up by the whole industry. To be sure, this was not a certification-level of interoperability, but it was an enabler for new financial products, and a major factor in the successful early growth of the cross-border interactive payments market. If the original designers had tried to achieve certification-level interoperability I think they would have failed. My point is that taking a step back from the vision might achieve more in the long term. Instead of providing all-encompassing standards, how about adopting a simpler approach but making it very accessible?

For example, say my company (a software house) wishes to provide an automated software license extension facility. We need to expose a service which can support authentication, authorization, value exchange, non-repudiation etc. To implement such a system, I'd like to have a software package (unencumbered by license restrictions) off the shelf in a format I can use, with open facilities available on the Internet for samples, testing and validation. I can trust the third-party facilities (authentication etc.) because they're provided by the EC and supported by European Law. I may find a working sample that already touches my particular business area. I will have heard about the system in an industry publication, via a mail-shot, internet search, presentation from my IT suppliers (Microsoft, IBM, Sun, Oracle etc.) or word-of-mouth. I am able to post my own solution (schemas, WSDL, possibly process descriptions) to the Internet where the EC or Industry-backed moderators will review it, modified if necessary and add it to the samples base. The same website will publish my successful use of the technology, which might bring me new customers. In a situation like this, the barrier to entry is extremely low – and I think this is the first critical requirement to successfully create this new market. The second critical requirement of course is a successful implementation, which is where good quality, well-targeted research is required.

## Response

*Thank you for the detailed reflection and exposition, which is appreciated.*

*Specific issues about standards and their implementation are outside the scope of this Roadmap, which is a research roadmap – as opposed to a standards roadmap (see Section 2.3). See also General Response 2.*

*There is no suggestion or recommendation in the Roadmap concerning the merit or otherwise of “all-encompassing standards”.*

*The issues that are elaborated on service simplicity and ease of use are among the considerations that lead to the Web Technologies and ISU Grand Challenges in the Roadmap. The research results, and the implementation of these results, may well lead to the availability of commercial off-the-shelf software packages and the opportunity for SMEs and start-ups as you have described. The underlying point about open markets (reducing barrier to entry on the supply side and barrier to exit on the demand side) is part of the Research Context of the Roadmap (Section 4.3). This point has been strengthened in Roadmap V4.0.*

## 17. Comments received from Roland Jochem, University of Kassel

Received on 11 January 2006.

Based on the Consultation Workshop on 10 January 2006, Prof. Jochem has summarised his inputs to the roadmap in some slides.

### Issue 130

Category: general

General:

Quality is to meet/to fulfil (user/customer) requirements

Basis for interoperability is trust in the quality of

- Strategy and Processes
- Organisational Responsibilities and Competencies
- Systems and Technology
- Environment and Security
- Enterprise Modelling/Models

### Response

*Thank you for the interesting contribution. The Roadmap is not prescriptive of what constitutes "quality" or the "basis" of interoperability. Of course that would be an important consideration in the actual research itself.*

### Issue 131

Category: business-economic

<b>Business Economic Research challenge</b>	Business Interoperability and Quality - Decentralized Quality Management of Business Processes
Description	<p><u>Problem statement:</u> Does Interoperability influence Quality of Business (Product/Processes)? How to ensure that interoperating business processes have the same quality (process and product quality) as an internal established business process. It is a question how to manage/coordinate:</p> <ul style="list-style-type: none"> <li>- Decentralized Quality Management Policies/Targets</li> <li>- Decentralized Quality Management Requirements/Standards</li> <li>- Decentralized Quality Management Organisational Structures</li> <li>- Decentralized Quality Measurement System/Rules/Constraints</li> <li>- Decentralized Quality Management Responsibilities</li> <li>- etc.,</li> </ul> <p>and how to support their diversity within business processes, and how to represent quality aspect within Enterprise (Business/Knowledge) Models</p>
State-of-the-art	Quality management methods and procedures for internal business processes; ISO 9001:2002; ISO TS 16949; ISO 19011
Research activity	This research activity will analyse and develop criteria and features in terms of methods and services (e.g. flexible QM-Modules) to manage the gap between decentralized Quality management Targets, Constraints, Structures, Standards, Rules, Responsibilities within digital business ecosystem environment

Recommendation: Add this Research Challenge/Activity to the Roadmap as 6.13 Decentralized Quality Management of Business Processes (B. 13)

## **Response**

*Similar to Issue 4 – see Response to Issue 4.*

### **Issue 132**

Category: business-economic

(Business Economic, B.2)

It is not enough to determine to optimal level of interoperability

Research Activity: development of a “measurement system or model” which tells us about the “quality profile of interoperability” when we have reached the optimal interoperability level for our company.

State-of-the-art: Examples are CMMI, SPICE, BSC

So other companies can “read” the profile and can identify the partner, which fits best to his “Quality profile” concerning interoperability → **Interoperability Certificate or Scorecard as result of Interoperability Audit**

Recommendation: Add this Research Activity to B.2

## **Response**

*Similar to Issue 5 – see Response to Issue 5.*

### **Issue 133**

Category: enterprise

(Challenges in Enterprise (Business/Knowledge), T 1.1.1; T 1.1.2; T 1.1.3; T 1.1.4)

Research Activity: Because modelling is still a kind of art, it is also necessary to develop a scheme of criteria (a model?) which describes the “quality” of an enterprise model concerning its applicability for interoperability, that means how the model fulfils the requirements of usage for interoperability (purposes).

Recommendation: Add this Research Activity to T 1.1

## **Response**

*Similar to Issue 6 – see Response to Issue 6.*

### **Issue 134**

Category: enterprise

(Challenges in Enterprise (Business/Knowledge), T 1.3, especially T 1.3.3)

Remark: Monitoring and Quality Management are the most important tasks in cross-organisational business processes to control interoperation and to ensure the quality of resulting products/services. These tasks have to be modelled on different levels from a strategic down to an operational level, to coordinate and control the execution of cross- organisational business processes based on these models.

Research Activity: Representation of dynamically changing responsibilities, authorisations, delegation of roles and relationships of roles within a dynamic variation of organisational structures in Modelling Methods and Enterprise Models.

Representation of cross-organisational Monitoring and Quality Management Tasks on different enterprise levels within Enterprise Models

Recommendation: Add this Research Activity to T 1.3

## Response

*Similar to Issue 7 – see Response to Issue 7.*

## 18. Comments received from Robert Meersman, Vrije Universiteit Brussel

Received on 12 January 2006.

### Issue 135

Category: semantics

Proposed the addition of the following research challenge:

<b>Research Challenge</b>	Application of ontologies to collaborative community processes
<b>Description</b>	The internet permeates more and more aspects of society, resulting in accelerated progress towards the information or knowledge society. The previously "internal" free standing information systems that support societal functions, while still being developed and maintained autonomously, are increasingly becoming open to and interacting with external information technologies e.g. ubiquitous computing scenarios. Strategically, in this context, we feel that the focus of FP7 should include "collaborative community informatics" i.e. structured research into establishing and maintaining sustainable partnerships between practice, policy and research in the community and more specifically eliciting, modelling, organizing, analyzing, and applying semantic methodologies (such as so-called collaboration patterns) in order to support effective community interactions. To this purpose community-grounded, scalable and teachable methodologies for ontology engineering, and their corresponding software systems and tool suites are essential, as well as fundamental research into a suitable intermediate knowledge representation and analysis infrastructures. Such ontology servers can meaningfully catalyze community operations and modelling processes, thus supporting their growth into mature, effective socio-technical systems.

## Response

*See General Response 1.*

*Added to Annex I (Indicative Research Challenges) as Research Challenge T4.5.5, and addressed in the Knowledge Oriented Collaboration Grand Challenge. However, due to incompleteness of the challenge, it will be deleted.*

## 19. Comments received from Wico Mulder, LogicaCMG

Received on 19 January 2006, but originally submitted on 12 December 2005.

### Issue 136

Category: Business-Economic

Proposes Research Challenge "Enterprise Grid-based economics" to the Business-Economic Domain

<b>Research challenge</b>	Enterprise Grid-based economics
Description	<p><b>Problem statement:</b>  With respect to (the use of) Grid Technology for business, we expect to encounter a significant number of economic-related problems, ranging from incentives for participation and sharing of information, economic efficiency in resource allocation, information structures for making decisions and evaluating risk, to the capability to express preferences through charging (“pay more and get more”).  Therefore, unless the next generation of Grid technology provides the means for Grid participants to operate in this economics-aware environment and to resolve those economics problems, Grid will not realize its full potential and its commercial adoption will be in jeopardy!</p> <p>So far Grid economics research has focused mainly on simple resource definitions (CPU cycles) and price mechanisms (mainly auctions). The developed prototypes served the purpose of demonstrating, in a limited sense, the applicability of various market concepts to achieve efficient resource allocation. These ideas, which fall into the general category of market mechanisms for contention resolution in IT systems, fall short in capturing the important issues (e.g. risk and uncertainty, principle shift in business models, effect of disruptive technology) that distinguish Grid from traditional distributed systems.</p> <p>As discussions on business models for Grid computing have shown, there are many new interesting issues related to the economics of Grid computing. Addressing these issues while also targeting for a real commercial impact requires a multi-disciplinary approach which should be undertaken before Grid technology is fully settled.</p> <p>If these issues are neglected, two risk factors for Grid computing would arise. Firstly, a complex Grid technology could be developed, which is not as useful as it could be and, therefore, will be slowly adopted in new and innovative business models for Grid computing. Secondly, by not fully understanding the economics of Grid computing, the construction of a service-oriented economy could be delayed and jeopardize Europe’s success in Grid computing. This service-oriented economy will be the major source of jobs and revenues.</p>
State-of-the-art	<p>There are four major areas of activity, ranging from business intelligence services to actual Grid software / algorithms.</p> <p><b>Financial engineering paradigms for Grid computing:</b> Work in this area draws parallels between the Grid environment and markets for future contracts [4]. The major motivation is to provide instruments to handle stochastic effects (mainly resource unavailability) which creates risk for real businesses to outsource part of its IT on the future Grid (which will be spanning many organizations). This is definitely an interesting direction and consistent with the goals of the GridEcon project. The work done so far is very preliminary. The project will adapt its financial modelling to the actual business cases developed in the project.</p> <p><b>Service level agreement (SLA) management:</b> This work tackles the fact that the Grid is designed to be a best-effort service but businesses may need quality of service (QoS) guarantees. Available papers in this area propose a solution by defining contracts for time intervals where servers are idle and hence can be sold to the Grid for executing other tasks [5]. Here, a server is assumed to behave stochastically in terms of the length of time intervals during which it will not be used by its organization. The issue is that the length of these idling intervals sampled over many servers must have a certain empirical distribution defined by the contract. The idea is to work with stochastic guarantees similar to the ones for conventional commodities, e.g., Random Length Lumber traded on financial exchanges. There is an interesting issue of variance reduction, which can be achieved using an inventory of such intervals, i.e. a pool of deterministic intervals</p>

obtained by using some servers we have full control of. By mixing these with the other intervals produced by stochastic servers, we can fulfil contracts with tighter requirements on variance. The mixing alters some of the statistical parameters of the stochastic sample of intervals. Since this is a very interesting concept, we may be able to use this concept in Grid computing not only for scavenging cycles from machines but also in various levels, for example, for generating SLAs for higher level tasks. In this context, the consortium plans to investigate different definitions of QoS in SLAs and technical mechanisms to support such SLAs specialized for Grid.

**Accounting and payment architectures:** These technical mechanisms are necessary to support SLAs and the market managed resource allocation at the lower layers. Some work in this area has been performed recently. Usage-based charging is especially important in connection with the new form of licensing of software in the Grid environment. Grid software usage will be charged according to actual usage instead of selling a traditional license limiting the users of the software. Interesting directions of research include the investigation of scalable accounting architectures, which can monitor Grid events at various granularities and also provide the relevant information in order for such accounts to be verifiable and undisputable by any of the parties involved.

**Task scheduling:** In this context, the work of Buyya on the NIMROD scheduler (resource broker) is of interest [7]. The idea of this work is a centralized scheduler for all of Grid, which gets two inputs: i) the service requirements of applications (users), broken down to a fixed set of computing tasks with some kind of a specification of their budgets and constraints (e.g. deadlines + other computing specific attributes), ii) the available resources (CPU mainly), specified in terms of price (determined exogenously by some market mechanism) and computing speed. The task scheduler decides on the mapping between tasks and resources as well as performs real-time scheduling.

**Price setting and market mechanisms:** There is no theoretical work on this topic addressing truly Grid-specific issues. In the existing literature, it is assumed that any mechanism (e.g. auctions, commodity markets, bartering) can be used to define prices for resources to the scheduler. There is only some work on simulating double auction and repeated Vickrey auctions and their comparison.

- [1] Junseok Hwang, "Grid and P2P Economics and Market Models," GECON 2005, 1<sup>st</sup> Workshop on Grid Economics and Business Models, Seoul, South Korea, April 2004.
- [2] Steven Miller, "Analyzing Demand Patterns, Business Models and Governance to facilitate the growth of Grid Services in Singapore," GECON 2005, 2<sup>nd</sup> Workshop on Grid Economics and Business Models, Seoul, South Korea, March 2005.
- [3] Satoshi Itoh, "GridASP: A framework for a new utility business," GECON 2005, 2<sup>nd</sup> Workshop on Grid Economics and Business Models, Seoul, South Korea, March 2005.
- [4] Kenyon Chris, "Creating Services with Hard Guarantees from Cycle-Harvesting Systems," IBM Research Report RZ 3461 11/11/2002. CCGrid 2003, Tokyo, May 2003.
- [5] Kenyon Chris, "Grid Resource Commercialization: Economic Engineering and Delivery Scenarios." In: Grid Resource Management: State of the Art and Research Issues. Editors: J. Nabrzyski, J. Schopf and J. Weglarz, Kluwer, 2004.
- [6] Klaus Krauter, Rajkumar Buyya, and Muthucumar Maheswaran, A Taxonomy and Survey of Grid Resource Management Systems for Distributed Computing, International Journal of Software: Practice and Experience (SPE), Wiley Press, New York, USA, May 2002. (to appear).

	<p>[7] Rajkumar Buyya, David Abramson, Jonathan Giddy, Nimrod/G: An Architecture for a Resource Management and Scheduling System in a Global Computational Grid, The 4th International Conference on High Performance Computing in Asia-Pacific Region (HPC Asia 2000), May 2000, Beijing, China. IEEE Computer Society Press, USA.</p>
<p>Research Activity</p>	<p>The main activity is the investigation of key economic issues related to Grid computing, which derive from new and emerging Grid business models.</p> <p>A study on the economic and business issues in Grid computing is needed for its (fast) adoption by the industry and the creation of value to its participants.</p> <p>More specifically, the objectives that the research will pursue are to:</p> <ul style="list-style-type: none"> <li>• Define the scope of Grid economics based on the current and emerging Grid business models (e.g. outsourcing of hardware resources, utility computing, revenue from software and licensing models, integration of services/software modules) using a representative set of scenarios.</li> <li>• Define the appropriate micro-economic models that deal with the issues of market-based resource scheduling and resource sharing across organizations, and, through this, provide a bridge between system engineering and financial engineering for dealing with uncertainty.</li> <li>• Investigate and design solutions to the aspects of Grid technology that may hinder Grid Computing to reach its full potential by generating value (e.g. ROI) to its users.</li> <li>• Analyze, from the economics point of view, new paradigms of accounting, bill presentment and settlement in the utility services model as companies shift from “buy a computer” business models to “computing on demand” business models, and, based on this, develop tools that frees Grid users from dealing with unnecessary details.</li> <li>• Validate and demonstrate these findings by implementations of a representative number of test scenarios.</li> <li>• Maximize commercial impact of the project results by influencing existing technology trends at all layers of the software stack through strong collaboration with players in the Grid computing business.</li> </ul> <p>The benefits of studying grid economics and business models to the end-user will include:</p> <ul style="list-style-type: none"> <li>• The ability to generate income by selling services or sharing resources</li> <li>• The capability of choosing the appropriate level of service by paying the appropriate price</li> <li>• A reduced participation risk by deploying well defined SLAs appropriate for the Grid environment</li> <li>• The capability of defining participation policies that maximize its short term and long term benefit</li> <li>• A more robust and better utilized system that reacts more effectively to dynamic changes of demand and benefits from true decentralization</li> <li>• The availability of information structures which allows for appropriate decision making as this is performed in a true economy</li> <li>• The capability to collaborate in an environment that extends across individual organization boundaries without losing control</li> </ul>

	<p>of his own resources, where there is an economically fair sharing of costs and generated value</p> <p>The fast deployment of Grid infrastructures and the large externalities involved for the participants</p>
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**Response**

*See General Response 1.*

*Added to Annex I (Indicative Research Challenges) as Research Challenge B5. However, this Research Challenge has been deleted as the area of work is outside the scope of the Grand Challenges.*

**20. Comments received from Baptiste Lebreton, INSEAD**

Received on 19 January 2006.

**Issue 137**

Category: Business-Economic

Proposes research challenge

<b>Research challenge</b>	Interoperability impact analysis - long term (B.7) – 4; Assess the long-term impact of an interoperability increase
Description	<p><b>Problem statement:</b></p> <p>With the development of interoperable information systems, will firms continue their trend towards outsourcing their non-core activities?</p> <p>Will interoperability change the current industry structure by creating new players and modifying the power relationship within the value chain?</p>
State-of-the-art	<p>Ongoing Athena research at HSG and INSEAD</p> <ol style="list-style-type: none"> <li>1. Definition of the current state of interoperability</li> <li>2. Valuation of interoperability increase for all value chain partners</li> </ol> <p>Ongoing Athena research at SAP</p> <ol style="list-style-type: none"> <li>1. Which economic theories might provide insights into the future industry developments related to interoperability. Among other Schumpeter's creative destruction industry analysis.</li> </ol>
Research Activity	Since BIF and IIAM enables an impact assessment in the current situation, these are also adapted to forecast future developments. Nevertheless, an framework extension towards Schumpeter's creative destruction might be useful to see to which extent interoperable information techniques might revolutionize an industry.

**Response**

*See General Response 1.*

*Added to Annex I (Indicative Research Challenges) as Research Challenge B7. However, this Research Challenge has been deleted due to ongoing research work (e.g. by ATHENA).*

**21. Comments received from John Ketchell, CEN Pre-Standards**

Received on 24 January 2006.

## Issue 138

Category: standards

Proposes a research challenge related to interface between research and standardisation.

<b>Research challenge</b>	Ensuring seamless research/standardization interfaces
Description	EU and national projects seldom take due account of need to provide inputs into standardization. Understanding of complex standards issues, including knowledge of the plethora of standards bodies, is poor
State-of-the-art	COPRAS IST Project (CEN, CENELEC, ETSI, W3C, The Open Group) is preparing initial generic guidance material and helping improve awareness, including through specific case studies related to FP6 projects
Research Activity	FP7 will by its very nature (eg technology platforms) require specific arrangements by programme or sector, though hopefully these will be along generic guidelines. For standards issues related to enterprise interoperability, a systematic and dedicated centre of expertise should be established, with the participation of relevant standards bodies

### Response

*See General Response 2.*

*The Roadmap does not consider directly the relation between Enterprise Interoperability research and standardization.*

*While standardization issues are an important aspect of the Enterprise Interoperability research goals described in the Roadmap, the standardization effort per se is not seen as belonging to the focus/core of Enterprise Interoperability research.*

## 22. Comments received from Pim van der Eijk, OASIS

Received on 29 January 2006.

### Issue 138.5

Category: standards

#### Author(s):

Pim van der Eijk

#### Abstract:

On 10 January 2006, the European Commission (DG INFSO D5) organised an open consultation workshop on Enterprise Interoperability research in the next Framework Programme. The workshop was part of an ongoing activity to define research priorities for the future and was intended to identify key research challenges in Enterprise Interoperability. At the meeting, many participants felt that the discussion of the links between research and standards should be extended. This document proposes some additional text for consideration for inclusion in a future version of the roadmap. It is submitted on behalf of OASIS in response to the strong encouragement to provide written contributions.

#### Status:

Draft for comments.

### Background and Context

On 10 January 2006, the European Commission (DG INFSO D5) organised an open consultation workshop on Enterprise Interoperability research in the next Framework Programme. The workshop was part of an ongoing activity to define research priorities for the future and was intended to identify key research challenges in Enterprise Interoperability. The meeting discussed the work of a cluster of

research projects in the Enterprise Interoperability domain that have developed a draft roadmap. The roadmap currently has only a short section on standardization (3.4, Product and standardisation challenges) and is otherwise focussed on research challenges.

At the meeting, many participants felt that the discussion of the links between research and standards in the roadmap should be extended. This document proposes some additional text for consideration for inclusion in a future version of the roadmap. It is submitted in response to the strong encouragement to provide written contributions. It could be added to the existing section 3.4 or otherwise incorporated in the document.

This document is submitted on behalf of OASIS, the not-for-profit, international consortium that drives the development, convergence and adoption of e-Business standards.

### **Standardization Challenges**

The role of standards for Enterprise Interoperability differs from their role in the broader ICT field, and poses a series of unique challenges. In many more traditional areas, standards emerge after a prolonged period of invention, innovation, differentiation and well after the initial market adoption of the products, services supported or enabled. In these cases standardisation is sometimes unexciting and certainly not very interesting from a research point of view, as the fundamental technical challenges have long since been addressed, the application domain is well-understood and the type of solution provided and their business models are well-understood.

This is quite different in the area of Enterprise Interoperability, where standards are a prerequisite to even the initial adoption of particular products or services in this category due to the inherently collaborative nature and integration focus of the subject. Even short-term absence of standards is a considerable barrier to productivity. Entire classes of products, services, business processes, support infrastructures, and business models do not take off at all until interoperability has been established. As a result of this market pressure, the development phase for standards in this area has shortened a lot, in many cases to less than two or three years from inception to a published open standard. This means that the standards development work has to be taken up at a very [early] stage, and is closely related to early prototyping and initial product or service development work in the research and innovation stages. Organizations that do integrate these phases have a time-to-market advantage and can deliver compliant solutions shortly after a standard has been finalized.

A research process based on multi-year research projects (plus additional months of preparation for proposal submission, contract negotiation and project initiation) will in many cases not deliver (input to) standards in the timeframe required by the Enterprise Interoperability marketplace. This is even more the case if a project has an implicit or explicit assumption that any standards development work based on the research results is to be delegated to a post-research phase and possibly even to other actors. In those cases the research project will miss an opportunity to contribute to emerging standards in the area they are operating in and to disseminate its results, and the participants in the project will miss an opportunity to take an early lead in an emerging market area. If it is true that Europe is not so much lagging in the overall quality of its research community, but is markedly less successful at exploiting its results, this is an area where action should be taken.

One remedy for this would be to encourage that the standards work is taken up in the course of the research project, and that the standardization activities involve the expertise and skills of (some of) the participants of (some of) the organizations participating in the project. Their contribution to this standards work would still be an integral part of the research project, and the work and associated expenses, if justified in the context of the project, should be considered allowable costs in the project budget.

Fortunately, various research projects are already taking steps in this direction, and organizations are starting to join standards organizations and contribute to technical work. At OASIS, several organizations in Europe joined to do standards work related to their work in Framework Programme 6 projects, and some TCs are directly building on FP6 results. Certain areas of standardization, such as security, semantic Web, semantic interoperability and Grid computing already have a particularly strong backing in the research community in Europe. In the context of Enterprise Interoperability, a listing of relevant TCs related to the Research Challenges identified in the roadmap was previously submitted [see Issues 105-120]. The theme of the 2006 conference in the international OASIS annual Symposium is *The Meaning of Interoperability*, and other standards organizations have similarly launched initiatives related to the topic.

One possible objection to merging standards work and research work in a single project might be that standards work is inherently different from research work, in particular, that standards work is essentially about consolidation and more about precise technical specification than about invention or innovation. However, the reality is that a lot of work on standards in the area of Enterprise

Interoperability is in fact highly innovative. Evidence for this is that some research projects are actually taking some of these emerging standards as a basis for activities like prototyping, practical demonstrations, user community trials, and sector-specific adaptations which, in terms of an innovation lifecycle, actually are stages *after* the initial invention phase.

Other evidence that standards work in the Enterprise Interoperability is closely linked to research and development is that many companies host their standards work in R&D departments. There are lots of good technical specifications from standards committees that could easily be mistaken for research products, as there are equally many examples of research products that in content and form are very similar to a technical standards document and would be an excellent basis for further standardisation.

To meet the requirements of the concept of an *open* standard,<sup>10</sup> there are clearly additional requirements beyond the nature and quality of the standards specification documents. Deliverables of open standards work must be developed and/or affirmed in a transparent process open to all relevant players, including industry, consumers and regulatory authorities. For practical reasons, this means the standards work should be done in the context of a (*de jure* or *de facto*) standards developing organization, which can make the delivered work publicly available and can take responsibility for the long-term maintenance of the standard. In an open standards organization, the work cannot be limited to participants in a particular research project. Participation in the standards work must be open to other members of that standards organization, though their participation would not [be] part of the research project, only of the standards activity that (some of) the research project participants contribute to.

Another consequence of the increasingly shortening timeframe in which Enterprise Interoperability standards are created is that standards will get produced that have not been exposed to long-running end-user trials, and the fitness for use or purpose of which has not been validated by a very large community. Research projects that do not contribute to standards work directly themselves but are more focussed on user aspects, policy implications, adaptation to specific sectors, geographies, SMEs etc. could provide much value to the standards process, especially if they can interface directly with the standards development committees and provide community feedback.

## Response

*Thank you very much for your further contribution. Please refer to our (revised) response to your previous contribution (Issue 120).*

*Your follow-up contribution is very much appreciated. It raises highly important issues concerning the interface and interaction between research activity and standardisation activity. We hope that those organisations who are interested in proposing research work arising from the Roadmap would take your observations into careful consideration, such as building a research plan that incorporates active and meaningful contribution to and interaction with relevant standards activities. Accordingly, we highlight the need for interaction between research activity and standardisation activity in Enterprise Interoperability in the Scope (Section 2.3) of the Roadmap, and include a reference to your contribution, in Roadmap V4.0.*

## 23. Comments received from Dirk Werth, DFKI

Received on 10 February 2006.

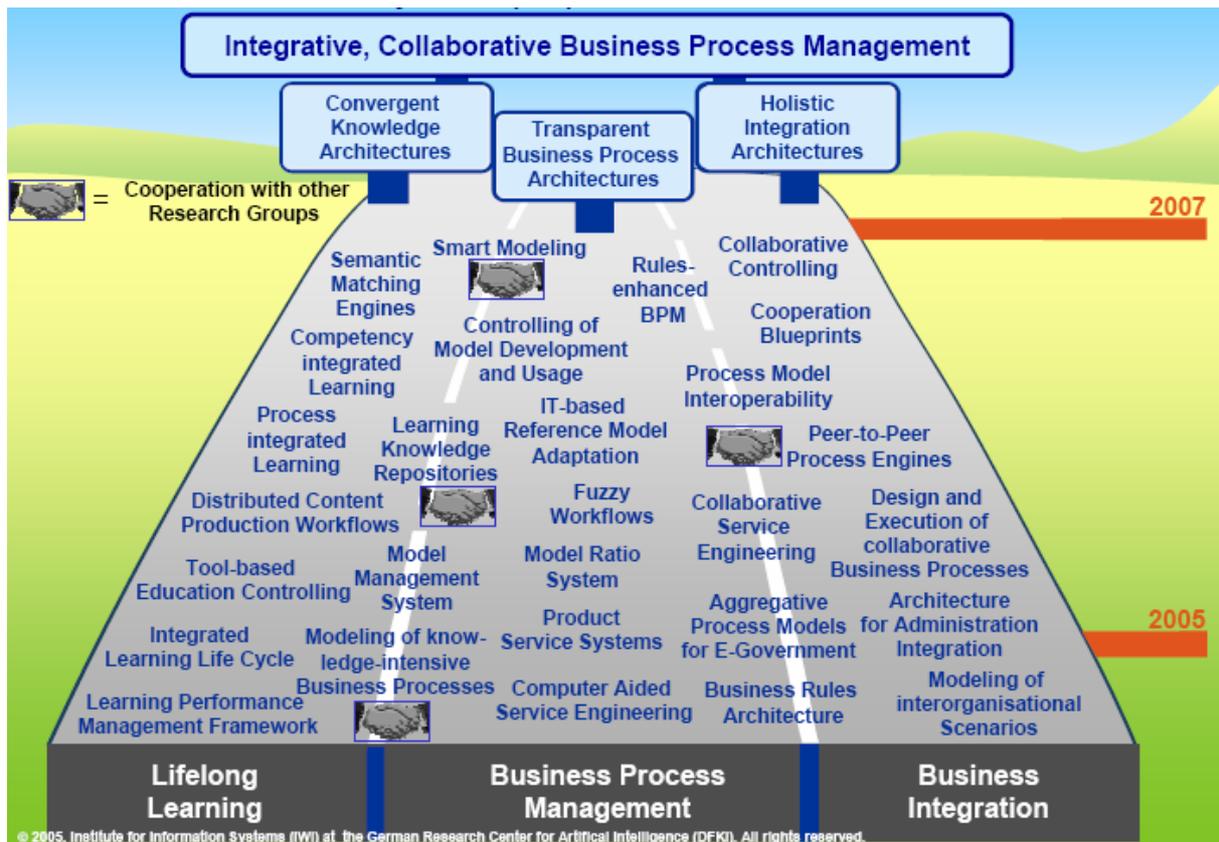
### Issue 139

Category: general

Roadmaps of the Institute for Information Systems (IWi) at the German Research Center for Artificial Intelligence (DFKI)

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<sup>10</sup> See [http://www.ictsb.org/ICTSFG/ICTSFG\\_report\\_2005-04-27.pdf](http://www.ictsb.org/ICTSFG/ICTSFG_report_2005-04-27.pdf) for a consensus definition of open standards.



**Response**

*Thank you for the suggestion. Many references have been proposed for inclusion in the Roadmap. It is not possible to include all of them in the main body of the document. Your suggestion and this response are however part of the Roadmap, Annex II "Disposition of Comments".*

## 24. Comments received from Michael Wilson, CCLRC

Received on 11 February 2006.

### Issue 140

Category: policy

Most of the policy suggestions in the first draft of the roadmap are irrelevant from the focus of the technical sections of the roadmap, and are just examples of different classes of policy action that can be taken - as I said in the talk at the workshop [on 10 January 2006, see [ftp://ftp.cordis.europa.eu/pub/ist/docs/directorate\\_d/ebusiness/ws20060110-pres-mw.pdf](http://ftp.cordis.europa.eu/pub/ist/docs/directorate_d/ebusiness/ws20060110-pres-mw.pdf)].

My experience of the workshop convinced me that we got technical people to attend rather than those most suited to generating the policy proposals that we were looking for.

There are many policy initiatives within the EU, most obviously i2010 and actions taken by DG Enterprise & Industry. These are already consulting with the community on a broad range of issues, and it is not clear to me what this roadmap consultation can add to those consultations, beyond focussing attention on specific barriers to the adoption of the business models and technologies proposed in the other sections of the roadmap.

Therefore, the only policies that should be presented in the roadmap should clearly be related to at least one proposal in the remainder of the roadmap. The best recent European consultation for policy issues on e-business started at a conference in Dublin in 2004 [1] and continued in Cambridge in Dec 2005 [2]. Unfortunately, neither the inputs nor conclusions of the Cambridge conference were available at the time the roadmap was drafted.

I have tried to raise the attention of those involved in these communities to the policy section of the roadmap and asked them to contribute their views to Arian. If we can't get this community to directly participate in developing the policy section of this roadmap, then should select policy issues raised in these and other forums, according to the criteria of vision and principle which arise from the description in [the 10 January 2006 workshop] report that will impact the adoption of the technological advances proposed.

Also, it would be worth Arian getting the Legal-IST project (probably Marco Conte [email address deleted] would be best) to edit or at least review the policy section since they do have the expertise in the relevant policy area.

[1] [http://europa.eu.int/comm/enterprise/ict/policy/b2b/FINAL\\_Report\\_Dublin.pdf](http://europa.eu.int/comm/enterprise/ict/policy/b2b/FINAL_Report_Dublin.pdf)

[2] <http://europa.eu.int/comm/enterprise/ict/conferences/cambridge.htm>

### Response

*Successive versions of the Roadmap since V1.0 have further clarified the "policy aspects". The general standpoint is that technology solutions that support enterprise interoperability must operate within a legal and regulatory framework underpinned by policy (Section 4.2). Indicative policy challenges that relate to, and address specific aspects of, one or more Grand Challenges are provided in Annex I to the Roadmap. Note that a couple of the policy challenges that appeared in Roadmap V1.0 have now been deleted, precisely because they are of a general nature.*

*It is fully agreed that it is not within the scope of this research roadmap to address general policy issues in respect of e-business or ICT (e.g. policy measures to stimulate take-up, policy measures concerning the orientation, direction and implementation of FP7; standardisation policy etc). See General Response 2.*

*It is also fully agreed that there are other – more appropriate – forums and arenas that are addressing the policy aspects of ICT and e-business.*

*On the other hand, given the general standpoint of the Roadmap (see above), it is important that the research community does not work in isolation of other communities including the "policy" community,*

as the above submitted comment also suggests. Policy measures can have technical implications, e.g. EU VAT Directive on eInvoicing. Conversely, technology developments may render review of existing policy provisions necessary, e.g. technology convergence in relation to the ongoing EU review of the Directive on electronic communications.

See also the following references:

- Final Report of "The European e-Business Legal Conference", Dublin, Ireland, 27-28 April 2004: [http://ec.europa.eu/enterprise/ict/policy/doc/legal\\_barriers\\_conf\\_sum\\_rep.pdf](http://ec.europa.eu/enterprise/ict/policy/doc/legal_barriers_conf_sum_rep.pdf)
- Report of "e-Business: The Way Forward" Conference, Cambridge, UK, 5-6 December 2005: [http://ec.europa.eu/enterprise/ict/conferences/doc/cambridge\\_report.pdf](http://ec.europa.eu/enterprise/ict/conferences/doc/cambridge_report.pdf)
- Legal-IST (FP6-004252): <http://www.legal-ist.org>
- IS Policy workshop 11 May 2006: [http://europa.eu.int/information\\_society/activities/policy\\_link/workshops/workshops\\_2006/smes\\_11\\_0506/index\\_en.htm](http://europa.eu.int/information_society/activities/policy_link/workshops/workshops_2006/smes_11_0506/index_en.htm)

## 25. Comments received from Michael Wilson, CCLRC

Received on 12 February 2006.

### Issue 141

Category: general

You raised the question of the purpose of the roadmap. Let me tell you my view of the purpose:

There is a traditional line of technical work on enterprise interoperability which is represented by the Ideas project in FW5, then the Interop NoE in FW6. This technological approach has concerned itself with standardising syntax, formats and semantics, moving to Model Driven Architectures. This R&D produces technology and is aware of the vertical market standardisation of terminologies by CEN etc which the technology can incorporate. However, this line of R&D is too technological to have an easy adoption or large/immediate impact in business in general since it has no clear business model driving it.

The Athena project in FW6 introduced the business model drivers with the traditional technology development, but I am unclear how happy or productive this marriage has been - I express ignorance, not criticism based on knowledge.

A novel approach to interoperability over the last 5 years has been to focus on the semantics of Service Oriented Architectures (SOA) in the form of ontologies which has involved both technology to support them, and the standardisation of terminology for both vertical markets, and generic business process modelling. This has produced technologies, and ontologies but again mostly lacks the business models. Also, the significant US investment in ontology work has meant that European teams who ignore the US are consuming money to little effect since global agreement is needed if ontologies are to be adopted seriously by industry. Hence the need for standardisation outside the European level to solve the ontology problems - which CEN don't like since they are very European focused, and therefore DG Enterprise and Industry don't like it since they have supported CEN for so long. W3C has been presented with several candidate web services semantics technologies for standardisation, but there are too many conflicting proposals so that the consensus required for global standardisation cannot be reached in this area. However, ontologies for the semantics of Web Services and Grids are still issues that need a lot of work, although it needs to incorporate legal and business issues to get anywhere - pure technology alone is not enough.

There has been in parallel a rise in the awareness of legal and policy issues in DG INFSO during FW6. This partly came from the ISTAG and partly from Commissioner Reding. A line of projects concerned with legal issues and e-business has been supported (Alive in FW5, Legal-IST in FW6) but these have been staffed by legal experts with little technology or business model participation - they have acted as experts on call to projects that are driven by technology trying to address their problems, but judging their work by their own standards without close integration with technical activity. DG Enterprise and Industry has more traditional activity on generating regulation than DG

INFISO, so linking the work of the two DG in this area is an obvious solution to take - although historically this has been a very hard thing to do across DG, and is not eased by the approach required for global standardisation beyond the CEN that DG Enterprise and Industry support.

The integration of legal researchers with technologists in projects is another obvious line to take. Trustcom was one of the first projects to accept that the technical work on SOA using Web Services had to be integrated with the business modelling and the legal issues. It started from the premise that the contract between companies drove the integration of their technologies. The legal, business model and technical themes have run in parallel for 2 years with little interaction - only now are the three lines seriously cross fertilising. New projects such as CONTRACT and ONE are following in this line, linking legal issues closely to technical development. Even these projects do not integrate ontology work with SOA, legal and business, leaving this strand out on its own.

The main commercial ERP providers for large companies - Oracle/PeopleSoft and SAP - acknowledge that they need to expand the value of their products with the result that they have provided in 2005 the first versions of products that add contract management into the Business Process Modelling. The enhancement of these and the inclusion of more advanced technology to monitor and enforce contract terms and conditions is planned in the next two years (the limit of the product division's horizon). The work of Trustcom etc.. mentioned in the previous paragraph are in line with this progressive development.

However, these suppliers don't support the majority of European business which is undertaken by SME unless they are forced to comply with the requirements of a single OEM contractor further up the supply chain, which increased IT based interoperability but constrains the customers that they can supply to since they can't afford to comply with the IT requirements of several OEM. The extreme reaction to the large IT suppliers is found in the Open Source community in Brazil, and in the Web2 participatory development of IT based social networks.

In the area of business models, we have seen the rise of interest in Virtual Organisations (VO) where SME partners share risks and benefits which is novel compared to the traditional business supply chain where liability and reward are hierarchically subdivided. In practice the VO model has not been adopted outside science and R&D areas where the rewards are limited. Consequently, VO has begun to be accepted as the mere IT based interaction of companies using any business model, often mediated by an SOA. One attempt to revive the reality of the shared VO has been through regional organisations of SME linked through SOA under the banner of Digital Ecosystems, VO Breeding Grounds or something similar. These activities need to link the technology and business models, although they have problems with the legal aspects (e.g. projects such as DBE). Projects under this heading could be linked to the participatory development of IT based social networks but again, these are global activities and not just European - especially in the BRIC countries which are the most important growing markets but also ones where there are political issues where social networks can have an impact.

In practice there are pressures on Commission DG INFISO heads of unit to ensure that they have a workplan for the next FW programme which is both innovatory by at least using new terminology, but also carries forward existing results and R&D teams to address the new goals/objectives. The FW7 IST workplan presents another problem in that it is for 7 years and not just 4 - in the past the EC has re-organised each 4 years, losing all responsibility for work still underway, but this time more projects will have completed before the re-organisation so more achievement within the programme rather than individual projects will be evaluable. So Gerald Santucci has a problem: how does he put these elements together to meet these constraints for a FW7 workplan ? The roadmap is one proposed solution to this problem.

Unless the roadmap proposes novelty it fails to meet the constraints for the FW7 workplan. If the technology development is too basic then it will not be credible to industry - for example, the CONTRACT project on deontic reasoning of the obligations entailed in contracts goes further into real computing research than I had expected FW6 non-FET to fund (although I like it).

The more the roadmap tries to integrate different technologies, or legal, business and technology developments, the more it causes integration problems that have been seen in the past. But these

often justify activity at the European level so not to push for these integrations could preclude the work from being appropriate for European funding.

To support work within Europe alone clearly shows the parliament that the funds are being spent on Europe's integration and future business. However, many of these problems need to be addressed by global standardisation or by global IT suppliers based outside Europe and funding those is less easily justified for Europe's future.

Sticking to technology development is not going to address the problems, but it can be done within one DG. Extending activities to e-business business models and regulation is required to get advances, but that requires interaction with DG Enterprise & Industry which causes more delays and diplomacy within the EC.

## Response

*Thank you very much for taking the time to write down your extensive view on the purpose of this Roadmap. The scope and sweep of the exposition, and the considerable historical references therein, is most impressive. It is however debatable whether many of these issues are within the scope of the present Roadmap, which is a research roadmap, as opposed to say a policy document, or an exposition of EU policy-making in research.*

*As both your comment and this response are part of the Roadmap, Annex II "Disposition of Comments", the opinions and references provided are therefore disseminated to the readership of the Roadmap.*

*Version 3.0 of the Roadmap has a very concise (perhaps in your view "over-simplified") statement on the objectives of the document.*

*As no other comment has been received concerning the purpose of the Roadmap, the editors would favour conciseness and simplicity. There are other forums (e.g. ISTAG, ISTC, the i2010 High Level Group) which are more appropriate, and a lot more qualified, to address your comments and concerns.*

*See also the following references:*

- ALIVE (IST-2000-25459): <http://www.vive-ig.net/projects/alive/>
- Legal-IST (FP6-004252): <http://www.legal-ist.org/>
- TrustCoM (FP6-001945): <http://www.eu-trustcom.com/>
- CONTRACT: [ftp://ftp.cordis.europa.eu/pub/ist/docs/directorate\\_d/ebusiness/contract.pdf](ftp://ftp.cordis.europa.eu/pub/ist/docs/directorate_d/ebusiness/contract.pdf)
- ONE: [ftp://ftp.cordis.europa.eu/pub/ist/docs/directorate\\_d/ebusiness/one.pdf](ftp://ftp.cordis.europa.eu/pub/ist/docs/directorate_d/ebusiness/one.pdf)
- Digital Ecosystems: <http://www.digital-ecosystems.org/>
- DBE (FP6-507953): <http://www.digital-ecosystem.org/>

## 26. Comments received from Freek Posthumus, UEAPME and NORMAPME

Received on 17 February 2006.

### Issue 142

Category: general

UEAPME<sup>11</sup>, the European Association of crafts, trades and Small and Medium-Sized Enterprises, welcomes the initiative of the Commission to launch the January 10 consultation meeting on the matter. We regret that due to the absence of the eBusiness Manager for a month we could not participate. Interoperability aspects of eBusiness are, together with trust aspects and easy usage methods, key to getting the SME to use more eBusiness. We would thus like to have an exchange of ideas with you on the subject. Hence we read the draft "20051221\_roadmap\_v10" and other

<sup>11</sup> UEAPME is the employer's organisation representing the interests, at European level, of crafts, trades and SMEs in the European Union and countries applying for accession to the European Union. It is non-profit seeking and non-partisan. Its 75 member organisations consist of national cross-sectoral federations, European branch federations and other associate members which support the SME family. Across Europe, UEAPME represents over 10 million enterprises with nearly 50 million employees.

presentations made during the meeting of January 10th carefully and allow ourselves to make some observations.

Although we agree with other commenters that this document has made an in-depth survey of many different ongoing research activities and pointed out the need for possible next research directions, we share also with them an uncomfortable feeling that the researchers seem to have concentrated more on trying to continue with the same ideas as before, only further widening the scatter without realising where the real market need is and without committing to a clear, practical goal to reach.

The amount of needed researches is so important and so much fragmented, that, with the difficulty to coordinate all these efforts and like we experienced in FP6, we are left with the fear that it cannot and will not be possible to achieve a lot of concrete results exploitable by industry and enterprises.

The section on SME projects proposals has drawn our full attention and we studied the arguments. For sure the writers have repeated some of our arguments and that is encouraging. But it seems they did so without understanding the thoughts behind them. The section 6.10 is only a general repetition of the various documents we have publicised over the years without providing anything strikingly new. More worrying is that they propose to spend money on studying structural roadblocks where we see them as one of the major ones: monopolising money streams into activities with too little prospects for impacting SMEs and not creating significant growth opportunities.

We understand that this report is written by those people who have a strong role in the ongoing research projects. So it is natural that there is again a strong emphasis in the proposed research subjects on the same long term research, on subjects that are a natural continuation of their present research projects subjects. Several programs under 6 fall into this category. Like 6.1-2, or the surprising 6.6. However, if the present research programs did not generate the hoped-for results, focus should be changed.

One of the recognised disadvantages of the FP6 program was that many projects attacked theoretical subjects with a limited scope for medium term application outcome and so, offered little value added to business. During the past 2 years we asked for more practical programs with a clear business aim and better geared towards implementation. This lack of practical usability was explainable in a context of FP6 objectives, but we were of the impression that FP7 was to correct it and leave part of the project funds for the practical R&D projects that industry, especially SMEs, so typically need. We saw good project proposals in the Interoperability usage field and, even if not approved, we would have hoped that the positive aspects of these projects would have been incorporated by the writers of the report.

## **Response**

*Thank you very much for taking the time to write down your extensive view on the orientation of the Roadmap.*

*We do not believe that the present Roadmap concentrates “more on trying to continue with the same ideas as before” or “on subjects that are a natural continuation of their present research projects subjects”. From the various consultations conducted in developing the Roadmap, such is not a view generally held or shared.*

*We would very much appreciate specific comments on the Roadmap document, including the Business-Economic Research Challenges. Various of these are mentioned in your comment but without providing detail on how they can be improved, or providing rationale for their deletion. Given the mission of UEAPME, any concrete suggestions as regards how the various texts on SMEs could be improved would be particularly welcome.*

*We draw attention to the Scope of the Roadmap (Section 2.3), such as in relation to the implementation issues. The more general arguments that have been put forward in your comment are at the level of EU policy-making on research. There are other forums (e.g. ISTAG, ISTC, the i2010 High Level Group) which are more appropriate, and a lot more qualified, to address your comments and concerns. See also General Comment 2.*

*It is not within the scope of the present Roadmap to address the merit or otherwise of FP7 or other EU programmes, or the implementation of any of these programmes.*

*As both your comment and this response are part of the Roadmap, Annex II “Disposition of Comments”, the opinions and references provided are therefore disseminated to the readership of the Roadmap.*

### Issue 143

Category: implementation

We are pleasantly surprised to find that they want under 5.1 the Commission to invest in programs "To support the dissemination of information" however we regret that this is only about existing legislation and regulation relevant to B2B enterprise e-commerce, while there is no dissemination program foreseen for the practical (e)Business usage programs as we require so much. So that aspect must be the main focus of this program

### Response

*Dissemination is expected to be an integral part of the FP7 research projects. The Commission also has specific dissemination and support initiatives concerning e-business, such as eBSN. Further information is available from the DG Enterprise website: <http://ec.europa.eu/enterprise/ict/policy/e-bus-snfsme.htm>.*

*See also General Comment 2.*

### Issue 144

Category: SMEs

Under 6.10 we read about SMEs:

"There is a vast volume of research work on SMEs, e-business and technology deployment. The interoperability aspects are being researched by INTEROP and ATHENA."

We like to see what part of that vast volume of research is relevant to SMEs as we only see far too little research in the ICT application and implementation for SMEs, the area where it is mostly needed. Nor there seems to be a statistically significant number of representative SMEs and SME organisations involved in the present work.

### Response

*INTEROP and ATHENA are recommended to note this comment, and disseminate the relevant research output.*

*The focus on SMEs has been further strengthened in the Roadmap throughout. The SMEs aspect is now also a guiding principle for setting the Grand Challenges (see Section 4.5).*

*Greater involvement of SMEs in European research is a priority for FP7 as a whole. It is also emphasised in the EU's i2010 policy framework, specifically the 2nd Pillar that addresses research and investment.*

### Issue 145

Category: SMEs

We further read:

"In contrast to numerous previous research studies, this research activity will seek to identify and recommend the kind of preconditions that are needed in improving SME participation in e-business."

One of the most important preconditions is certainly to involve, design and share research programs with the concerned parties involved and this has not happened in any significant way. Like it is to our disappointment that the writers have never consulted SME organisations like UEAPME in the course of preparing this roadmap. This worries us as it indicates that the real business SMEs once more are not felt important.

When we see that the writers want to "Specifically research to investigate the issues of SME participation at a systematic level, and to ascertain the kind of structural obstacles for SMEs" we would like to draw your attention to the fact that one of the most structural disadvantages existing is the lack of involvement of business SMEs in the FP6 research activities and the lack of programs fit for such real life SMEs. It needs no research money spent, only action taken to change that by creating the rightly oriented programs.

We are ready to discuss and propose ideas for the research effort and direction to take, as we have done with other activities and programs of the European Commission and would very much welcome a discussion about that with the Commission.

### **Response**

*Thank you for the detailed comments.*

*Broad consultation with SME organisations would need to be part of the actual research work concerning the Research Challenge B10 referenced in the comment, and indeed other Research Challenges that concern SMEs.*

*On the more general issue about consultation, note that the preparation of the present Roadmap is an open, inclusive exercise, to which all interested stakeholders are invited to contribute, including participation in the various consultation meetings organised by the EC.*

*Given the mission of UEAPME, any concrete suggestions as regards how the various texts on SMEs could be improved would be particularly welcome.*

*We draw attention to the Scope of the Roadmap (Section 2.3). The more general arguments that have been put forward in your comment are at the level of EU policy-making on research. There are other forums (e.g. ISTAG, ISTC, the i2010 High Level Group) which are more appropriate, and a lot more qualified, to address your comments and concerns.*

*It is not within the scope of the present Roadmap to address the merit or otherwise of EU research programmes, or the implementation of these programmes, or actual or possible discussions between the EC and other organisations. See also General Comment 2.*

*As both your comment and this response are part of the Roadmap, Annex II "Disposition of Comments", the opinions and references provided are therefore disseminated to the readership of the Roadmap.*

## **27. Comments received from Stuart Campbell, TIE Holding**

Received on 13 March 2006.

Comment by the editors: Please note that Mr. Campbell commented on V1.1 of the roadmap. V1.1 is a non-public version with some relatively minor changes as compared to V1.0 with respect to Chapters 3, 8 and 9. V1.1 takes into account corrections / revisions by the six cluster projects that were received after the publication of the V1.0 on 21 December 2005 and before the first consultation meeting on 10 January 2006.

### **Issue 146**

Category: general

General Remark:

- The paper is highly (incredibly) technology centric...there is limited business rational mentioned either at the individual or vision level....comes across a technical academics hoping there is a business problem in there somewhere. In some cases there are \_short word\_s: for example in the policy section there is a problem identified eg "**Encouraging adoption** of IPv6) but then in most of the in-depth section you don't get any business problem identified at all – for example in the repository one of section 5 you get just the area of repositories mentioned and there are some technical problems with them

### **Response**

*The starting point of the Roadmap are business-economic considerations – see Section 4.4, and Chapters 2, 3 and 4. The Research Challenge P3 concerning IPv6 adoption has been deleted due to not being referred to by the Grand Challenges. The linkages and flow between the Grand Challenges and the Research Challenges are among the main issues that were addressed in finalising the Roadmap.*

*As pointed out in the Research Context (Section 4.3), research for research sake is an insufficient justification for financing. Research challenges that fail to show their relevance beyond technical pursuit have not been retained in the final version of the Roadmap.*

## Issue 147

Category: standards

General Remark:

- There is nothing really mentioned about how this can be facilitated through standards – THE key to interoperability is open interfaces and ensuring these interfaces are complete. Thus THE prime resolver to this can only be interface specifications and thus open standards – this hardly gets a look in

## Response

*See General Response 2.*

*The Roadmap does not consider directly the specification of open standards. The specification of open interfaces, while of large importance, is foremost an ICT issue, while Enterprise Interoperability is more comprehensive.*

*While standardization issues are an important aspect of the Enterprise Interoperability research goals contemplated in the Roadmap, the standardization effort per se is not seen as belonging to the focus/core of Enterprise Interoperability research, particularly in the context of distributed solutions based on Web technologies and the Web as a platform. In fact we believe that the development of solutions based on the Web as a platform shall accelerate the convergence to de facto standards, which are more likely to be based on open interfaces than not.*

## Issue 148

Category: general

General Remark:

- Many aspects are too project centric (specifically Athena centric even compared to other projects). This paper should be more neutral since there is a sense that Athena has the \_only\_ solutions when this is far from obvious or clear. In addition I don't believe there should be an entry of a project name in any of the tables under description or 'state-of-the-art' – these are simply projects with their own thoughts. Of course under the research Row their inclusion is sensible

## Response

*Subsequent versions of the Roadmap (V2.0 upwards) are increasingly "neutral" of particular on-going EU financed projects. For example, the Research Context (Section 4.3) sets out specific principles on the orientation of the Roadmap.*

*The Roadmap is intended to be a roadmap by all interested stakeholders, for all interested stakeholders, in the field of Enterprise Interoperability. Accordingly, as from 10 January 2006, the roadmapping exercise has been broadened from the FP6 Enterprise Interoperability Cluster of projects to all interested parties.*

*The point about not including a project name in the Research Challenge description, except under the research row, is well taken. However, it is very difficult to be comprehensively implemented as the text here is very much bottom-up driven and therefore depends largely on the submitters. See General Response 1.*

## Issue 149

Category: general

General Remark:

- Paper is too long and imbalanced between the depth of sections. Some of the nitty-gritty goes down two-or-three more levels than I would have expected. I think the depth of the policy section is about right. In some case this level of depth causes you to wonder what is the difference between some of the grids

## Response

*Successive versions of the Roadmap are shorter than the one before, and by general opinion, increasingly strategic.*

*The detailed Research Challenges (Annex I) have been tidied up to the extent possible, without going against the spirit of grass-root submissions.*

### **Issue 150**

Category: editorial

General Remark:

- Editorials – eg spellings, grammar and style (inconsistent bullet types etc)

### **Response**

*Improvements have been made in successive versions. Further efforts will be made in producing the final version.*

### **Issue 151**

Category: standards

General Remark:

- It's quite incredible that perhaps the most solid and implemented interoperability framework, namely ebXML, gets hardly any mention – this is a major omission. A good example is in section 8.5 where ebXML repositories (nor indeed UDDI ones) are not mentioned under SOTA

### **Response**

*You are correct. It is a significant omission. ebXML is now mentioned in Section 3.1 on the state-of-the-art.*

*Version V2.0 of the Roadmap and later versions have been substantially altered so as to have a more strategic focus, and to be less prescriptive on how to achieve (technically) the stated goals, in order to leave the choice of technological approach to the individual research project proposals. Thus, it is possible and likely that ebXML (or OASIS ebXML) be adopted within project proposals for Enterprise Interoperability research.*

### **Issue 152**

Category: general

General Remark:

- What is lacking in this whole document (and Europe) is a realisable and necessary architectural picture made up of onion rings building up from a nucleus of what industry (users/providers) are missing or want to the more academic in-depth elements represented in this paper. This is exactly what other nations, particularly Asian ones like Korea, are doing – in their case they have e.g. selected ebXML to be this nucleus and you will see from leading eBusiness organisations like GS1 they are doing the same but none of this is unfortunately mentioned – see to be a lot about 'research for the sake of it'

### **Response**

*Please refer to the Scope of the Roadmap (Section 2.3). Specifically, it is not the purpose of a research roadmap to pick business, technology or other winners.*

### **Issue 153**

Category: framework

General Remark:

- There is a common interoperability model which is Policy / Business / Technical. I think this model is not correct (although I know it is well published). The issue is that wrapped in the 'technical' level (and in the paper) are two aspects technical and content. For example the harmonisation of frameworks is a technical issue, the meta data needed to support ontologies are a technical

issues but the definition of e.g. common ontologies, semantics etc (which are \_the most important) aspect being considered by industry right now is \_not\_ a technical issue. Is more related to 'business if I had to chose since it's the business experts that define them for later use in technical frameworks etc. Thus I would propose an additional content level

### **Response**

*See Response to Issue 27. Please refer in particular to the latest text on the Research Framework (Section 4.4).*

*The comment is well made. It should be emphasised that the starting-point of the Roadmap are business-economic considerations.*

*Efforts have been made to tidy-up the Research Challenges. On the other hand, this needs to be balanced against the principle of grass-root submissions from the stakeholders. See General Response 1.*

### **Issue 154**

Category: ICT Systems

General Remark:

- Another aspect I think is missing is the technical negotiation element – from an ebXML perspective this means CPA/CPs or their equivalents. Also messaging is missing...low-level IP6 is there but then nothing on top of it and e.g. ebMS/ SOAP harmonisation or also with AS1 or 2

### **Response**

*See General Response 1.*

*The Roadmap seeks to leave the choice of technological approach to the individual research project proposals. In the Web Technologies Grand Challenges, research is organized according to which activity creates value to the Enterprise, and from this perspective the technical negotiation element is a technical issue to the contracting entity or to the contracted entity (who offer the services that create the value in the transaction). Nonetheless your comment does have significant relevance if value results from the technical negotiation per se. Further consideration of this possibility may be required in the course of the research.*

*Since Roadmap V3.0, the ISU Grand Challenge has been added. Information and information exchange is at the heart of the ISU. Please refer to the ISU services (Section 5.3.2) which mentions messaging and payload among others. Note that this must be read in conjunction with the rest of the substance concerning the ISU in Chapter 7, including the ISU Design Principles.*

### **Issue 155**

Category: editorial

General Remark:

- I find section 3, which is an educational course of 'what is a roadmap' to be irrelevant padding (insulting even)

### **Response**

*The section has been deleted.*

### **Issue 156**

Category: general

General Remark:

- To address the grand challenges issues I think they are the following for enterprise interoperability:
  1. Focussing on short term research and innovation which fill in the holes of existing frameworks, link frameworks or provide better interoperability within frameworks – users have enough research...what they want is the missing elements fixed so they can easily and economically implement it

2. To provide an over all onion-layer architecture for Europe which specifies or suggests certain interoperability standards and interfaces to focus on – just like Asia has done with e.g. ebXML/webServices
3. To provide major support for industry based semantic harmonisation and interoperability initiatives such as the United Nations core components work. Industry has largely solved many eBusiness issues and now semantics are top of their list
4. To provide mutual acceptance of certificates with Europe wide policies
5. To make the semantic mapping and integration easier for business especially SMEs

#### **Response**

1. *The Roadmap is a contribution to FP7 and therefore it has a long term perspective - see Section 2.2 Objectives.*
2. *The Roadmap is a research roadmap. Research is by nature speculative and open-ended. The Roadmap targets break-through research for stimulating and catalysing business innovation. It is not the purpose of a research roadmap to pick business, technology or other winners (including standards winner). See Section 2.3 Scope.*
3. *Semantic research issues fall within all the Grand Challenges proposed. Indicative Research Challenges in the semantic and ontology area are provided in Annex I (T4). The actual research work to be carried out obviously would need to take account of state-of-the-art, including existing harmonisation and interoperability initiatives. The statement "Industry has largely solved many eBusiness issues" requires substantiation, in view of the modest implementation of even basic e-business solutions – see e.g. Community survey on ICT usage in enterprises, 2005, published by Eurostat.*
4. *It is unclear which certificates are at issue here from the submitted comment. General ICT certification policy issues are outside the scope of the Roadmap.*
5. *Part of the semantic research issues. See response to 3) above.*

*See also General Response 1 and General Response 2.*

#### **Issue 157**

Category: general

Page 2, paragraph 1

"Increasingly, enterprises are cooperating with other enterprises"

Ummmm! I think business has been doing this for quite some years and I don't think this makes a good start to the document. Maybe a word like "electronic" missing. On the other hand you can argue that this is happening less....with globalisation and corporitisation I wonder whether inter-company exchange has gone down?.

#### **Response**

*The sentence is replaced with "To meet their business objectives, enterprises need to collaborate with other enterprises" in Roadmap V4.0.*

#### **Issue 158**

Category: SMEs

Page 2, paragraph 1

"Not only large organisations set up cooperation agreements with other enterprises, but also SMEs are combining forces to compete jointly in the market"

Nice thought but hardly happens in reality.

#### **Response**

*The sentence is reworded to reflect a need for cooperation in Roadmap V4.0.*

#### **Issue 159**

Category: SMEs

Page 2, paragraph 1

“Enterprises form networks and business ecosystems”  
ditto

**Response**

*The sentence in question no longer appears in the Roadmap.*

**Issue 160**

Category: editorial

Page 2, paragraph 1

“Nowadays, an enterprise’s competitiveness is largely”

<<<<not convinced by the word ‘largely’ – sure it’s a factor, an important fact, but the greatest factor?

**Response**

*The word “largely” is replaced by “to a large extent”.*

**Issue 161**

Category: editorial

Page 2, paragraph 4

“However, seamless communication and integration of data and information as well as synchronised inter-organisational business processes are not possible in the absence of common standards, proper applications, shared understandings, adequate business processes, etc.”

<<<what is a “proper” application????

**Response**

*The sentence in question no longer appears in the Roadmap.*

**Issue 162**

Category: editorial

Page 2, paragraph 5

“Each itself respecting”

?????

**Response**

*The sentence in question no longer appears in the Roadmap.*

**Issue 163**

Category: editorial

Page 4, paragraph 1

“Moreover, additional editors are needed for the sake of transparency.”

<<<I would have thought the main reason is ‘a more balanced view’

**Response**

*The sentence in question no longer appears in the Roadmap. Indeed, a main reason for additional editors was as mentioned in the comment.*

**Issue 164**

Category: editorial

Page 5

Inconsistent formatting – look at the bullet type (round/capitals vs line/small characters) in this list compared to the ones just above – this is just an example

**Response**

*Improvements have been made in successive versions of the Roadmap.*

**Issue 165**

Category: general

Page 5

However, I find this educational course on what is a “roadmapping” exercise as being complete padding in this document – this should be dropped in its entirety...if people who read this document don't know what a roadmap is then probably they shouldn't be reading it

**Response**

*The section in question no longer appears in the Roadmap.*

**Issue 166**

Category: editorial

Page 7, Figure 3

I don't understand which T1 and t2 are horizontal and the rest are vertical...maybe its just style or space but still it prompts 'why'

**Response**

*The figure in question no longer appears in the Roadmap or its Annex I on Research Challenges.*

**Issue 167**

Category: general

Page 11, paragraph 1

"In March 2000, the EU Heads of States and Governments agreed in Lisbon to make the EU "the most competitive and dynamic knowledge-driven economy by 2010". For a thousand years economic growth has been based on labour and capital as wealth creating factors. The agreement in Lisbon that Europe was entering a knowledge-driven economy acknowledged that capital and energy would be replaced by information and knowledge as the driving forces for the economy, just as the former replaced land and labour 200 years ago."

Hmmm...political comment!: seems that in reality they decided to continue investing in the land and outdate agricultural practices and to devote little to innovation and research – as an individual that would be my conclusion

**Response**

*The paragraph in question no longer appears in the Roadmap.*

*The editors refrain from responding to political comments.*

**Issue 168**

Category: general

Page 12, paragraph 2

"Most famous visions, such as that of HAL in Arthur C Clarke's film "2001: A Space Odyssey", "

←-----WHAT!!!!!! Is this a literary project or a roadmap?

**Response**

*The sentence in question no longer appears in the Roadmap.*

**Issue 169**

Category: policy

Page 14

In general terms I think this policy section is at the right level of depth for this document – it's not to say I necessarily agree with its content but the text is concise, readable and considered

**Response**

*Noted.*

**Issue 170**

Category: general

Page 14, paragraph 3

"A key change resulting from inter-enterprise interoperability (e.g. through Web services or the Grid)"  
<<<I think the jury is still majorly out of whether the grid will have any impact on enterprise interoperability....even webServices are right now, and after 3-4 years, still minimally implemented in comparison with other information exchange mechanisms

**Response**

*See General Response 1.*

**Issue 171**

Category: general

Page 15, figure 6

These diagrams are used throughout (which is good) but I feel one of the introductory sections should introduce them with an example and to illustrate their purpose. In addition I couldn't see anywhere in the above text a link to reference this figure and I suspect the same elsewhere

**Response**

*The comment is appreciated. This is partially addressed in Annex I of the Roadmap. See also General Response 1.*

**Issue 172**

Category: general

Page 16, section 5.2

I think some where you should make a diagram representing the relationships between enterprise interoperability and eBusiness and eCommerce – which does this paper refer to too? One/both? Whats the difference?

**Response**

*The comment is appreciated. The Scope of the Roadmap (Section 2.3) goes some way in addressing the comment. Note that in recent years, there is a convergence between eBusiness and eCommerce (e.g. are Amazon, Google, Yahoo, and eBay eBusiness or eCommerce companies?). The difference was arguably one of perspectives – particularly analysts' perspectives in the dot.com era – rather than one of substance. Some commentators have repeatedly warned of artificial distinction and advised to look instead at business activities in terms of value creation and business models. Specifically on the EU Directive on e-commerce (P2), it impacts on both consumers and businesses.*

**Issue 173**

Category: policy

Page 16, section 5.2

“The implementation by member countries of various EU directives designed to support e-commerce differ either in legislation or in practice. The consequence is that international e-commerce within the EU is blocked.”

<<<< Blocked? I don't think so...seems to be working quite well...maybe more efficient but certainly it won't be and isn't blocked

#### **Response**

*Agreed. This V1.0 Research Challenge would require significant re-wording to form any part of a proposed research project.*

#### **Issue 174**

Category: policy

Page 16, section 5.3

I find this very weird to be in a policy section. You could equally apply this to any of the other technology mentioned. Lack of IPv6 I think has only limited (in the bigger picture) related to enterprise interoperability. Largely these communications aspects shouldn't be placed in such a level at the communications level of the stack even less so. On the other hand this then enters the choice of specific technologies so in this sense if we are recommended one then lets recommend not only a specific/low-level one but instead a whole eBusiness suite of standards such as ebXML which really does hit the knob of enterprise interoperability

#### **Response**

*The Roadmap deliberately avoids the assumption of any technology selection, as to do so would be to build obsolescence into the Roadmap. See General Response 2.*

#### **Issue 175**

Category: editorial

Page 17, section 5.5

“Certification Authorities grant certificates by many different criteria, and are relying on the market to resolve the appropriate one for different roles. A consequence is that most user businesses do not know which CA”

←--acronyms should always be introduced and in a paper like this which is so dispersed into sections, it is recommended you don't use them

#### **Response**

*The use of the acronym CA within this particular paragraph should be rather obvious. In general, the point is valid and is well taken.*

#### **Issue 176**

Category: general

Page 17, section 5.6

“Global companies find barriers in several countries to shipping [sharing or transferring] information obtained within that country across national boundaries. This presents a significant barrier to international e-commerce with those countries.”

I think you should expand on this to describe what you really mean – I didn't have a clue until I attended the roadmap meeting

#### **Response**

*The comment is appreciated, but has not been addressed. See General Response 1.*

#### **Issue 177**

Category: editorial

Page 18, section 6

To me this section is very waffly...often the grids [research challenge tables] are saying exactly the same thing from a slightly different orthogonal which makes the section very long and uninteresting...also goes into very very nitty gritty detail without really saying what is the core problem of each grid and the expected actions

#### **Response**

*Various Research Challenges have been deleted (See Annex I, V4.0). Specific comments on the text have been considered, leading to revision of the text in preparing the final version of the Roadmap – see Issues and Responses under the category Business-Economic.*

#### **Issue 178**

Category: general

Page 19, section 6.2

“As a consequence, it is vital to link interoperability to the company’s role within the value chain as well as to its’ business environment’ (e.g. industry dynamics, legal environment, etc.). In order to determine the relevance of interoperability, different interoperability levels have to be distinguished and operationalised”  
<what!

#### **Response**

*Research Challenge B2, corresponding to Section 6.2, has been deleted due to ongoing research work (e.g. by ATHENA).*

#### **Issue 179**

Category: general

Page 19, section 6.2

“State-of-the-art” row

I think this is far too detailed (for example) and very inconsistent in approach with Policy section

#### **Response**

*Research Challenge B2, corresponding to Section 6.2, has been deleted due to ongoing research work (e.g. by ATHENA).*

*The level of description across the Policy, Business-Economic and Technical Research Challenges has been harmonised, where possible, in finalising the Roadmap Annex I. One constraint however is that the Research Challenges are grass-root submissions. Accordingly, the editors prefer a “light touch” approach in processing them. See General Response 1.*

#### **Issue 180**

Category: business-economics

Page 21, section 6.4

“Is there a business case for interoperable products and services?”

<<<isn’t this relevant to the first grid instead

#### **Response**

*Comment not understood. If the “first grid” means Research Challenge B1, then the answer is no (B1 has been deleted due to ongoing research work).*

#### **Issue 181**

Category: business-economics

Page 22, section 6.5

I think this should be out of scope – focus on key enterprise interoperability issues rather than possibilities – the question is not about their economics but their validity in this context

#### **Response**

*Research challenge B5, corresponding to Section 6.5, has been deleted as the area of work is outside the scope of the Grand Challenges.*

#### **Issue 182**

Category: editorial

Page 22, section 6.5

“The middleware in Grid based applications is potentially capable of support accounting functions, and financial management functions driven by the business models of the organisations using it.”

<<<<this is a bit like say ‘cars can potentially fly’ – what’s the purpose of such a statement?

#### **Response**

*Research challenge B5, corresponding to Section 6.5, has been deleted as the area of work is outside the scope of the Grand Challenges.*

#### **Issue 183**

Category: general

Page 23, section 6.7

“There is a need to build upon the above developments in the next decade on interoperability of firms. The new technologies, processes and managerial systems concerning interoperability (ATHENA and the like) provide a new and improved platform for developing decentralized governance systems.”

This isn’t a problem statement and project should be mentioned here – to the layman this says – ‘lets pay lots of money to do research on top of research”

#### **Response**

*Research challenge B7, corresponding to Section 6.7, has been deleted due to ongoing research work (e.g. in ATHENA).*

#### **Issue 184**

Category: editorial

Page 23, section 6.7

“Ongoing Research at INSEAD”

This isn’t overly informative

#### **Response**

*Research challenge B7, corresponding to Section 6.7, has been deleted due to ongoing research work (e.g. in ATHENA).*

#### **Issue 185**

Category: business-economic

Page 23, section 6.7

“2. We need to build upon the ATHENA Business Interoperability Framework (BIF) and Interoperability Impact Assessment Model (IIAM) since this gives the opportunity to clearly show and monitor benefits from interoperability. These benefits can more easily convince companies to accept decentralized governance systems with sufficient trust (i.e. the expected benefits can be shown to clearly exceed the risks)”

Absolutely not....this is just one possible framework which represents a viewpoint of less than 20 companies – it is just ONE input which MAY turn out to be a good one and thus could be a basis but

still it represents a massively small consensus behind it so to say it should be that basis to 'build' upon is wrong

#### **Response**

*Research Challenge B7, corresponding to Section 6.7, has been deleted due to ongoing research work (e.g. by ATHENA).*

#### **Issue 186**

Category: business-economic

Page 23, section 6.7

"There is a need to develop good auditing mechanisms (building upon our current work in ATHENA) to include the measurement of the degree and success of decentralized governance."

ditto – this remark applies a lot in this whole section in particular

#### **Response**

*Research Challenge B7, corresponding to Section 6.7, has been deleted due to ongoing research work (e.g. by ATHENA).*

#### **Issue 187**

Category: enterprise (T1)

Page 28, section 7

Overall I find it very difficult to identify a clear separation between this section and section 6

#### **Response**

*Business-economic Research Challenges in Annex I (Section 6 in Roadmap V1.0) and Enterprise Research Challenges in Annex I (Section 7 in Roadmap V1.0) relate to different domains of research, in accordance with the overall research framework described in Section 4.4. As noted there, there are mutual relationships between these domains. Moreover, different sequencing of these domains yields different formulation of research challenges. In the Roadmap, Sequence 2 is adopted – meaning that the starting point for developing the Research Challenges is intended to be business-economic scenarios.*

#### **Issue 188**

Category: enterprise (T1)

Page 28, paragraph 5

"T1.1 Interoperability of Enterprise models"

This seems to be the same as 6.1

#### **Response**

*T1.1 "Interoperability of Enterprise models" (corresponding to Section 7.1 in Roadmap V1.0) resides within the technical research domain and B1 "Business Interoperability Framework" (corresponding to Section 6.1 in Roadmap V1.0) resides within the business-economic research domain. See response to Issue 187. Note also that B1 has been deleted due to ongoing research work (e.g. by ATHENA).*

#### **Issue 189**

Category: general

Page 30/31, figures 8 and 9

Similar to before in section 6 – this goes down to too many levels but now even more making a very complex document. Many comments apply here as above...ATHENA and other projects are simply one input

## Response

[See General Response 1.](#)

## Issue 190

Category: ICT Systems (T2)

Page 41, section 8.1.3 [**note: V1.1 has a different structure than V1.0**]

“This research challenge is concerned with the actual execution of cross-organisational business processes. ATHENA will study workflow engines and architectures that support the information exchange between workflow engines in different business situations.”

<<<is this paper about certain projects getting extended????? What is the research challenge???? This statement seems to be about State of the art – although you would have expected things like BPEL to be mentioned here

## Response

[Thank you for pointing out this issue. The proposed challenge \(now called T2.1.1\) has been deleted from the Annex I to the Roadmap due to ongoing work.](#)

[The indicative Research Challenges \(now in Annex I\) have been developed “bottom-up”, particularly by – but by no means limited to – the projects participating in the European Commission’s Enterprise Interoperability Cluster. As such, we very much rely on the submitters as regards the quality and comprehensiveness of the inputs. The Annex I to the final version of the Roadmap therefore represents a “best effort” of the interested stakeholders. The editors emphasise also that these are indicative Research Challenges only, i.e., they are not endorsed by the editors nor favoured with regard to other alternative research proposals.](#)

[Other research challenges, including potentially “competing” research challenges, might be developed in the research work to be carried out in addressing the Grand Challenges, based on the merits of the project proposals. See further under General Response 1.](#)

## Issue 191

Category: ICT Systems (T2)

Page 42, section 8.1.4 [**note: V1.1 has a different structure than V1.0**]

“Monitoring and Redesign of Business Processes”

<<<<these are two quite separate things with different solutions monitoring vs design and should be treated this way

## Response

[Thank you for pointing out this issue. However, it has not been corrected. See also the response to Issue 190 and General Response 1.](#)

## Issue 192

Category: ICT Systems (T2)

Page 42, section 8.1.4 [**note: V1.1 has a different structure than V1.0**]

“Monitoring Business Processes shall provide transparency of the processes operability and performance. Consequently, monitoring is a subject of Performance Management”

<<<not performance although that is one element – is about understanding where you are in the process – performance \_generally\_ implies some kind of speed measurement but this may not be relevant in a lot of cases

## Response

[Thank you for pointing out this issue. However, it has not been corrected. See also the response to Issue 190 and General Response 1.](#)

### Issue 193

Category: ICT Systems (T2)

Page 42, section 8.1.4 [**note: V1.1 has a different structure than V1.0**]

“Existing standards like ebXML provide limited opportunities to solve these problems and must largely be enhanced.”

Replace by “Existing standards such as ebXML do not fully address these issues and must be enhanced” [i.e. more positive]

### Response

*The text has been adapted as suggested.*

### Issue 194

Category: ICT Systems (T2)

Page 42, section 8.1.5 [**note: V1.1 has a different structure than V1.0**]

“Decentralized Governance of Business Processes”

This sounds, at least in the title, a policy section grid

### Response

*Thank you for pointing out this issue. However, it has not been corrected. See also the response to Issue 190 and General Response 1.*

### Issue 195

Category: ICT Systems (T2)

Page 43, section 8.2 [**note: V1.1 has a different structure than V1.0**]

“Service discovery, brokering, negotiation & mediation (T2.2)”

I would say that the last three are more or less the same thing (so make it simple)....and discovery is completely different...(so why include it in the same section)

### Response

*See General Response 1.*

*We have only made changes to the Research Challenges of version V1.0 of the Roadmap where we felt there were substantial issues/problems in the text, which were corrected for the final version of the Roadmap. All other text from version V1.0 of the Roadmap remains in its original form.*

### Issue 196

Category: ICT Systems (T2)

Page 44, section 8.2.3 [**note: V1.1 has a different structure than V1.0**]

“Models and Metamodels for Service-Oriented Architectures”

This seems to be something very general – in fact over the whole of this document – don’t understand why it is in a low level section

### Response

*See General Response 1.*

*We have only made changes to the Research Challenges of version V1.0 of the Roadmap where we felt there were substantial issues/problems in the text, which were corrected for the final version of the Roadmap. All other text from version V1.0 of the Roadmap remains in its original form.*

### Issue 197

Category: ICT Systems (T2)

Page 44, section 8.2.2 [**note: V1.1 has a different structure than V1.0**]

“Service composition (T2.2.2)”  
This isn’t mentioned in 8.2 title

#### **Response**

*See General Response 1.*

*We have only made changes to the Research Challenges of version V1.0 of the Roadmap where we felt there were substantial issues/problems in the text, which were corrected for the final version of the Roadmap. All other text from version V1.0 of the Roadmap remains in its original form.*

#### **Issue 198**

Category: ICT Systems (T2)

Page 43, section 8.1.6 [**note: V1.1 has a different structure than V1.0**]

“Observation & Validation of Collaborations between Business Processes and Services (T2.1.6)”  
Isn’t observation the same as monitoring which was addressed earlier – what’s the difference – should be combined

#### **Response**

*See General Response 1.*

*We have only made changes to the Research Challenges of version V1.0 of the Roadmap where we felt there were substantial issues/problems in the text, which were corrected for the final version of the Roadmap. All other text from version V1.0 of the Roadmap remains in its original form.*

#### **Issue 199**

Category: ICT Systems (T2)

Page XX, section XX [**note: V1.1 has a different structure than V1.0**]

“Automatic Service Composition”

You want a whole different grid on “service composition” and “automatic service composition” and separate them by one block to make it difficult to see the difference!

#### **Response**

*Thank you for pointing out this issue. However, it has not been corrected. See also the response to Issue 190 and General Response 1.*

#### **Issue 200**

Category: ICT Systems (T2)

Page XX, section XX [**note: V1.1 has a different structure than V1.0**]

“8.3.2 Semi automated Data mapping (T2.3.2)

8.3.3 Automated Data mapping (T2.3.3)”

This is too detailed – 8.3.2 vs 8.3.3

#### **Response**

*See General Response 1.*

*We have only made changes to the Research Challenges of version V1.0 of the Roadmap where we felt there were substantial issues/problems in the text, which were corrected for the final version of the Roadmap. All other text from version V1.0 of the Roadmap remains in its original form.*

#### **Issue 201**

Category: ICT Systems (T2)

Page 48, section 8.5 [**note: V1.1 has a different structure than V1.0**]

“MOF Repositories providing an infrastructure for models and meta-models. Independent Semantics Repositories with only one-way integration with Model/Meta-model repositories

Insufficient performance of repositories in enterprise scale environments.”  
UDDI, ebXML???????

#### **Response**

*Thank you for pointing out this issue. It has been corrected in the final version of the Roadmap.*

#### **Issue 202**

Category: ICT Systems (T2)

Page 48, section 8.6 [**note: V1.1 has a different structure than V1.0**]

“Terminal Interoperability”

I'm not sure if this is the best title: 'terminal interoperability' doesn't sound very encouraging

#### **Response**

*We agree. It is quite unfortunate terminology. However, it has not been corrected. See also the response to Issue 190 and General Response 1.*

#### **Issue 203**

Category: ICT Systems (T2)

Page 51, section 8.7 [**note: V1.1 has a different structure than V1.0**]

“Interoperability to support Ambient Intelligent applications”

What is one of these?

#### **Response**

*Thank you for pointing out this issue. The text has been changed, but the title is maintained. See also the response to Issue 190 and General Response 1.*

#### **Issue 204**

Category: editorial

Page 51, section 8.7 [**note: V1.1 has a different structure than V1.0**]

“There is an emerging trend to include more autonomous devices and interfaces into business ecosystems.”

'autonomous' <-meaning

#### **Response**

*“Autonomous” according to Merriam-Webster's Online Dictionary:*

*1 : of, relating to, or marked by autonomy*

*2 a : having the right or power of self-government b : undertaken or carried on without outside control : SELF-CONTAINED <an autonomous school system>*

*3 a : existing or capable of existing independently <an autonomous zoid> b : responding, reacting, or developing independently of the whole <an autonomous growth>*

*4 : controlled by the autonomic nervous system*

*Here, the second meaning is used.*

#### **Issue 205**

Category: ICT Systems (T2)

Page 51, section 8.7 [**note: V1.1 has a different structure than V1.0**]

“The area of Ambient Intelligence has been a focus area within EU in the last few years, and there is now an interesting foundation here for further integration in the infrastructure of business ecosystems.”

This is waffle – nothing to do with a precise measurement of state of the art

## Response

*Thank you for pointing out this issue. The state-of-the-art definition in this Research Challenge is indeed not very meaningful. However, it has not been corrected. See also the response to Issue 190 and General Response 1.*

## Issue 206

Category: ICT Systems (T2)

Page 41, section 8.1.1 [**note: V1.1 has a different structure than V1.0**]

“Networked Business Support through information / (document) exchange (T2.5.7)”

This is perhaps the key area that is really wanted by users but gets short mention and little real details.

## Response

*The final version of the Roadmap considers managing information as one of the main issues of Enterprise Interoperability (see Section 3.2 Problem Space) and identifies a number of ideas for knowledge identification and exchange within the Grand Challenge Knowledge-Oriented Collaboration.*

## Issue 207

Category: ICT Systems (T2)

Page 41, section 8.1.1 [**note: V1.1 has a different structure than V1.0**]

“The state of the art in the interchange area is characterized by document standards defined in rather technical specifications. Transformation and mapping is typically supported in a point-to-point fashion without using e.g. semantic information.”

‘rather technical specifications’: <<<<!!!

## Response

*The word “rather” has been deleted. For the rest, please refer to General Response 1.*

## Issue 208

Category: Methodology Research Challenges

Page 50, Section 9

“In the following, the different methodology research domain research challenges are described.”

Personally I think this section should be first – architecture before detail

## Response

*The comment is not understood. Is the commentator suggesting that Chapter 9 “Methodology Research Challenges (T3)” is architecture and the other chapters (7, 8, 10, and 11) are detail?*

## Issue 209

Category: Methodology Research Challenges

Page 50, Section 9.1.1

“Integrated Paradigm for Interoperability (T3.1.1)”

How about: Making interoperability frameworks interoperable...a little more obvious

## Response

*The objective is to define a framework in which the models will be interoperable. Three paradigms exist to define such a framework: by integration, by unification and by federation. The use of one paradigm depends on the conditions imposed to the modelling and the constraints for the modelling. So the three frameworks are exclusive.*

*A framework is (just) an organising mechanism, which aims to structure concepts and things in a domain. A framework is not an executable entity and does not represent any operational system. It is therefore not appropriate to say 'Making interoperability frameworks interoperable'.*

## **Issue 210**

Category: Methodology Research Challenges

Page 51, Section 9.1.2

"Unified Paradigm for Interoperability"

I don't easily see the difference between this and the above – certainly not in title – for one there is a "common model" and another a "common" "template" – what's the difference?

## **Response**

*ISO 14258 International Standard prepared by Technical Committee 184, identifies in §3.8.2 "Requirements for standards on model interoperability" three main possible approaches to interoperability: integrated (a common model to which all adhere), unified (a reference meta-model for semantic equivalence across the individual models) and federated (on-the-fly reconciliation and mapping negotiation, as no reference meta-model can be developed).*

*In the Integrated paradigm, it is necessary to use a common model form; all models use the same dimensions. In the Unified paradigm, the same dimensions are used for meta-modelling to create semantic equivalences. In other words, the Integrated paradigm means that models and systems must be built using the same template and this template must be as detailed as models and systems. The Unified paradigm only provides a meta-model allowing mappings between different models and systems.*

*The Unified paradigm has been deleted due to on-going work.*

## **Issue 211**

Category: Methodology Research Challenges

Page 51, Section 9.1.2

"This research is being addressed by ATHENA A1 project (POP\* enterprise modelling language and MCPE platform) and INTEROP DEM work package so far as enterprise model interoperability is concerned.

ATHENA will design and implement dynamic and adaptive mapping environments among existing state-of-the-art interoperability architectures, enterprise semantics, and models derived from the Enterprise Intelligent Infrastructures of the organisations involved. Mapping environments will be delivered both as downloadable Open Source components and as fully configurable services provided in ASP mode."

'ATHENA': This makes it sound as though its not necessary since ATHENA is addressing it <<<all very interesting but not for a Roadmapping paper – are we really interested that is going to be open source and asp mode – there is a lack of consistency between the levels and the approach throughout the document and this is a good example

## **Response**

*The Research Challenge has been deleted due to ongoing work.*

## **Issue 212**

Category: Methodology Research Challenges

Page 51, Section 9.1.3

"This research challenge is currently focused on the design and implementation of the infrastructure supporting interoperability in scenarios adopting the Federated Paradigm (i.e. a multitude of formats for all constituent subsystems is available). The federated model scenario exists if one assumes that no agent successfully or globally can impose requirements for semantic equivalence across all models of a network of enterprises. Models must be taken as encountered. The template is at the meta level and, as in the unified situation, the template is not executable. Interoperability requires that models be

*dynamically accommodated* rather than having a predetermined meta-model. This would be furthered with some sort of predetermined terminology system. In a standard that states rules for enterprise network models, where model interoperability is important, the assumption is that the federated situation exists and that the *rules* presented in the standard shall be rich enough to *accommodate the encountered models*, whatever the state.”

First sentence ok...but with the use of meta templates I have difficulty seeing the difference...however, a more generally comment is that this is far to detailed...should just leave it and the other two sections at the level of making paradigms interoperable

### Response

*This Research Challenge concerns the “Federated paradigm”. See Issue 210 for an explanation of the origins of the Integrated, Unified, and Federated paradigms. The technique used to determine the common framework imposes fewer constraints with this paradigm than for the other ones but the difficulty is to define the required ontology.*

*“Making paradigms interoperable” is not the concern and is not appropriate. There is no ‘universal interoperability’ through the use of the three paradigms. Establishing interoperability is concerned with operational entities, not paradigms.*

### Issue 213

Category: Methodology Research Challenges

Page 51, Section 9.1.3

“Main research is the development of a “mapping factory” which will generate on demand customised AAA (Anybody-Anywhere-Anytime) mapping agents among existing state-of-the-art interoperability architectures, enterprise semantics, and models derived from the Enterprise Intelligent Infrastructures of the organisations involved. The proposed contribution intends to overcome multilingual and multicultural barriers, to adaptively and proactively react to changes in the surrounding environment (Ambient Intelligence), and to behave and to negotiate intelligently according to knowledge-based policies and rules.”

‘Main research’: where?

### Response

*The main research is to develop methods, methodologies and associated tools which allow establishing interoperability on the ‘fly’, i.e. without using a **pre-defined** meta-model. Parties must dynamically adjust and accommodate to make their system components compatible in order to establish both syntactic and semantic equivalences.*

### Issue 214

Category: Methodology Research Challenges

Page XX, Section 9.3 [note: V1.1 has a different structure than V1.0]

“Interoperability concept and its domain are not clearly defined. Defining interoperability as a domain of research is one of the challenges.”

<<<<<<<I have no clue what this sentence is trying to say

### Response

*It is trying to say that ‘Interoperability’ is still a vague concept and there are too many different understandings and views. Interoperability as a domain of research is not defined. This situation creates a lot of confusion. Clarifying and defining the interoperability research domain itself is therefore considered as a challenge. Please refer also to the Science Base Grand Challenge (Chapter 8 of the Roadmap).*

### Issue 215

Category: Semantics

Page 57, Section 10.1.1

“To reach interoperability among different and heterogeneous enterprises, both at process and application level, a common point of reference has to be defined.”

This isn't true – in fact you support this in the previous section when you talk about federated approaches

### **Response**

*The sentence is no longer in the Roadmap.*

*Off-the-record: some argue that to achieve interoperability there always must be some common point of reference. The question is what constitutes this common point of reference and who defines it. Many vendors would like to control this: hence myriads of “standardisation” initiatives and the quest for controlling the software “platform”. However, in order to solve the problem fundamentally, we may need to look for answers at a different place: start with information and the basic problems of information exchange, and really stick with the fundamental concepts of Web services and the basic properties of services – not applications, not (software) processes, and not software as packaged products.*

### **Issue 216**

Category: Semantics

Page 57, Section 10.1.1

“Though various related ontologies exist (e.g. TOVE and the Enterprise Ontology by the University of Edinburgh), their adaptation for application in industry has been quite limited.”

How about mentioning some real state of the art which is being implemented by industry EDI, XML(sector specs like GS1) ebXML core components etc – these have user support

### **Response**

*Agreed.*

*The whole Research Challenge ‘Business Process description ontology (T4.1.1)’ has been deleted due to ongoing work.*

### **Issue 217**

Category: Semantics

Page 57, Section 10.1.1

“Define an ontology for business process modelling. ATHENA will identify an ontology language, with which a core business process ontology will be defined.”

Isn't this in e.g. BPEL??

### **Response**

*Agreed.*

*The whole Research Challenge ‘Business Process description ontology (T4.1.1)’ has been deleted due to ongoing work.*

### **Issue 218**

Category: Semantics

Page 57, Section 10.1.1

“Define a methodology for semantic annotations of business process models.”

I presume this relates to Athena and ditto below,,,but not very obvious the way it is presented

### **Response**

*Research Challenge T4.1.1 has been deleted due to ongoing research work (e.g. by ATHENA).*

**Issue 219**

Category: Semantics

Page 57, Section 10.1.2

“Once the process modelling language from 4.1.1 is defined, we need to proceed and define accepted classification/taxonomy of business processes.

Using a shared taxonomy of business processes can help companies understand what each is doing, and achieve interoperation at process level.”

This is well in situ through the likes of ebXML and the UN and even ISO stads on this since the description talks about the ontologies themselves. I fail to see what the suggest research adds here and don't understand why the SOTA doesn't mention real user initiatives

**Response**

*Agreed.*

*The whole Research Challenge ‘Business Process classification ontology (T4.1.2)’ has been deleted due to ongoing work.*

**Issue 220**

Category: Semantics

Page 57, Section 10.1.3

“Behavioural Mediation (T4.1.3)”

No clue what this is but I would but in semantics or ontology to make the context clearer

**Response**

*Agreed. The title has been changed to “Process Mediation”.*

**Issue 221**

Category: Semantics

Page 58, Section 10.2

“The development of ontology sharing infrastructure is a key research challenge in achieving semantic interoperability among collaborating enterprises.”

<<<<this description doesn't help me understand what this is about

**Response**

*See General Response 1.*

## Comments on Roadmap version V2.0

### 28. Comments received from Norbert Jastroch, MET Communications GmbH

Received on 20 March 2006.

#### Issue 222

Category: general

I have taken the opportunity and read through this document.

Instead of just commenting on it, I would like to raise some short questions to the roadmap editors:

(1) Which of the benefits Enterprise Interoperability is expected to deliver are qualitative (strategic) ones, and which are quantitative (operational) ones?

#### Response

*All Grand Challenge benefits are seen as strategic. Operational deliverables may be created through strategically directed research.*

*Note also that the overall benefits expected from successfully addressing the Research Challenges are described in Section 4.2. Each of the benefits listed is in principle quantifiable, measurable and verifiable.*

#### Issue 223

Category: general

(2) Can measures in pursuit of these benefits be identified by their nature, i.e. technological ones vs. organisational ones vs. hybrid ones?

#### Response

*Since all are strategic (Issue 222 above) they are, as the contributor rightly indicates, qualitative in nature.*

#### Issue 224

Category: general

(3) Given the great many of ICT tools available: which of the benefits of EI may be made accomplishable by utilizing the available tools? And which will require new ones? And which would mainly be a matter of organisational design (business processes)?

#### Response

*See General Response 2.*

*This is an aspect of research planning for any work addressing the GCs.*

## Issue 225

Category: general

(4) How to address the gap between "ex ante" research & development and "ex post" validation of ICT developed for EI?

### Response

*I do not understand this question.*

## 29. Comments received from Al Jones, NIST

Received on 26 March 2006.

## Issue 226

Category: editorial

Page 2, paragraph 2

The last part of [the last] sentence should be changed to say what these measures are and why they are needed. It should also lead into the next paragraph, which, as it stands, doesn't follow from this current paragraph. I tried to fix this [as follows:]

Information and Communication Technology (ICT) plays a significant role in the formation and continued existence of these ecosystems by both enabling and triggering the re-organisation and integration of business activities. ICT has become ubiquitous, having a major impact on all aspects of the business domain. It has the potential to have a profound impact on humanity as well by enabling an evolution from a society based principally on goods created using industrial technologies to a society based principally on knowledge created using ICT technologies. Yet, this evolution will take place reasonably smoothly only if adequate measures are in place, which take into account not only the technical aspects but also the characteristics of the specific environment within which they will have to function.

### Response

*We have rewritten and modified the text in the above mentioned paragraph (and section) deleting the reference to measures to be taken. The aim of this paragraph on ICT in the introduction to the Roadmap is to emphasise the importance of ICT to Enterprise Interoperability.*

## Issue 227

Category: general

Page 3, last paragraph

"Addressing an "Applications Research" activity in the terms of FP7, the document has to address the needs of industry, i.e. technology consumers. The research challenges identified in the roadmap need to be relevant for end users. After all, any future research financing must focus on stimulating innovation, not on research for research's sake. In that sense, the focus of the research challenges in enterprise interoperability should be more on "enterprise" than on "interoperability". However, this is an open issue which requires further consideration."

If you view an enterprise as a collection of systems, then you cannot separate the notion of enterprise from the notion of interoperability

### Response

*You are partly correct. There were two points we were trying to make: (i) when referring to a collection of systems within an enterprise, we feel that even in large enterprises, for example between business units of large enterprises, there is a need for interoperability; (ii) we suggest that the focus of Enterprise Interoperability research should be focused on solutions (innovations) for the enterprise, rather than as in the past focused on technical interoperability aspects (e.g., interface specifications, APIs, etc). The aim is that enterprises can use and benefit from the research outcomes.*

**Issue 228**

Category: science base

Page 10, paragraph 1

“The three proposed GCs are:

[...]

- A Science Base for Enterprise Interoperability Research”

Doesn't the inclusion of this grand challenge go against the applied research bullet in the preceding sections?

**Response**

*No, as this Grand Challenge is about applying the concepts, methods, techniques and other research results and insight of various sciences.*

**Issue 229**

Category: editorial

Page 14, 'Acquisition of knowledge'

“Data discovery tools founded on knowledge of how to access information through the knowledge and information interoperability infrastructures.”

This does not appear to be a complete sentence. Also, I am not sure what it is supposed to mean

**Response**

*The wording was corrected to form a complete sentence and therefore make more sense.*

**Issue 230**

Category: editorial

Page 17, paragraph 2

“Appropriability”

Not sure what this word means.

**Response**

*Thank you. The word “appropriability” has been replaced by “assignment”, i.e. whether the benefits of the service are circumscribed to a set of nodes.*

**Issue 231**

Category: editorial

Page 17, paragraph 4

“The research challenge is focused on enterprise interoperability solutions for the enterprise that initiates or produces the interoperability requests or solutions that support the interaction of the enterprise with its customer (the consumer), with the aim of enhancing the value of the service provided by the enterprise and/or improving the value of the service it provides to its customers. A key idea is to provide the customer with a much higher degree of control than now of the configuration of the service and the delivery of the service.”

[These two sentences] contain a total of 90 words. I found them nearly impossible to understand.

**Response**

*Thank you. The first sentence has been rewritten.*

**Issue 232**

Category: editorial

Page 17, paragraph 4

“Such developments involve lightweight programming models that allow for loosely coupled systems [to interoperate], and decoupling of transaction routines from vendors’ products.”  
Not sure what the last part of this sentence means.

**Response**

*Thank you. The last part of the sentence has been deleted.*

**Issue 233**

Category: editorial

Page 17, paragraph 5

“The research challenge comprehends research and development in semantics and ontologies for specification of the service to be delivered, enhancements to the web operating system to support improved transactions with the consumers (i.e., with improved downloadable client applications), in the enterprise SOA for software applications to support both better consumer service and an improved interoperability with other enterprises, in the use of intelligent agents and adaptive systems to enhance service choices and reduce costs, tools and procedures for improved transactions with the end user, and for improved service rating, pricing, and payment procedures.”

This paragraph is one sentence that contains more than 90 words, and many commas. I could not understand what you were trying to say. Several smaller sentences are needed to get the points across.

**Response**

*Thank you. We have shortened and rewritten the paragraph.*

**Issue 234**

Category: editorial

Page 17, paragraph 7

“This research challenge shall focus on solutions to enable enterprise interoperability characterized by the use of data and content available on the web (from other enterprises or individuals), allowing enterprises to enhance existing services or offer new services where a part of the value added results from the use of this diverse web platform data and content.”

Again, too many words

**Response**

*Thank you. We have shortened and rewritten the paragraph.*

**Issue 235**

Category: editorial

Page 18, paragraph 1

“The example of EPCglobal shows not only the possibility of globally federated databases based on access rights.”

Not sure whether EPC global is a good example or a bad example from these sentences.

**Response**

*Thank you. We have deleted the reference to EPCglobal.*

**Issue 236**

Category: editorial

Page 18, paragraph 3

“The research challenge should have an Enterprise Interoperability focus and address research and development on semantics, ontologies, and APIs for data and content location, exchange, and access,

tools for assessment and monitoring of data quality and consistency, tools and procedures for data and content retrieval rating, pricing, and payment, tools and procedures to support transactions between enterprises related to the acquisition or use of databases and contents, procedures and policies for addressing data privacy and intellectual property issues.”  
Almost 80 words.

#### **Response**

*Thank you. We have shortened and rewritten the above mentioned paragraph.*

#### **Issue 237**

Category: editorial

Page 18, section 6.3.3, first paragraph

“The emphasis of this topic shall be on the research and development of solutions to ensure appropriability and exclusivity the benefits of the services implemented for Enterprise Interoperability solutions. The aim is to develop tools and solutions to ensure that when enterprises decide to interoperate using ICT technologies, they are able to do so while assured that the value that is being created can be appropriated in its entirety by the parties involved in the transaction according to a predefined agreement.”

Don't know what appropriability means? And don't know what [the first] sentence means. If it means what the next sentence says, then why not delete it and use the next sentence only.

#### **Response**

*Thank you. We have shortened and rewritten the above mentioned paragraph.*

#### **Issue 238**

Category: editorial

Page 19, section 6.3.4, second paragraph

[In recent years, corporate Virtual Private Network solutions have been implemented on the web]. Thus, the staffs of large corporations are able to access their business e-mail and intranet resources using their notebooks, or access their corporate e-mail over the GSM phones using their RIM's Blackberry solution for example. On the other hand, the last few years have also seen a dramatic impact of P2P technology [that enables both file exchange and voice over IP (VoIP)]. Other related recent technologies include for example tag based folksonomies, or specific protocols like FOAF and XFN (both for social networking), which enhance site functionality or allow subnets of end-users to interact without centralized websites.”

Not sure what purpose this paragraph serves

#### **Response**

*Thank you. We have shortened and rewritten the above mentioned section and added a sentence to explain the purpose of the examples. The paragraph was meant to provide a context to the proposed Research Challenge.*

#### **Issue 239**

Category: science base

Page 20, paragraph 2

“sciences”

Existing ones, new ones, or both

#### **Response**

*This is clarified in the Roadmap; both existing and new sciences are addressed.*

**Issue 240**

Category: science base

Page 20, paragraph 3

“The Grand Challenge is expected to help mainstreaming enterprise interoperability by [...]

- Making enterprise interoperability relevant for enterprises”

I would say it is already relevant; it is just not cost effective.

**Response**

*This is clarified in the Roadmap; the domain Enterprise Interoperability is meant.*

**Issue 241**

Category: science base

Page 20, paragraph 4

“It further submits that the existing “boundary” of enterprise interoperability research needs reconsideration.”

Not sure what the current boundary is, so I don't know how to reconsider it.

**Response**

*The boundary sentence has been deleted to avoid possible confusion.*

**Issue 242**

Category: science base

Page 20, last paragraph

“The value proposition of enterprise interoperability starts with the enterprise, and the value creation of enterprise interoperability ends with the enterprise.”

This sounds really cool, but I am not sure what exactly it means!!

**Response**

*The sentence has been deleted to avoid possible confusion.*

**Issue 243**

Category: science base

Page 21, paragraph 2

“Science is a trajectory of ideas and defines a process to bring ideas to fruition as implementations.”

I thought science defined a process for testing the validity of the ideas and engineering defined the process for bringing them to fruition as implementations!!

**Response**

*The sentence has been reformulated, leading to a detailed footnote (footnote 40 in version V3.0, footnote 60 in version V4.0, the first footnote in Chapter 8). However, there were comments made at the final consultation workshop on Enterprise Interoperability research on 16 June 2006, to the effect that even a minimum definition of what constitutes science could delimit research. The footnote has been further clarified in the final version of the Roadmap, so that the nature of science is left “open-ended”.*

**Issue 244**

Category: science base

Page 21, paragraph 2

“Moreover, science advances by cross pollination of scientific disciplines.”

This certainly has not been true over the last many years. It is starting to happen again with the study of “systems”

#### **Response**

*The sentence has been deleted to avoid possible confusion.*

#### **Issue 245**

Category: science base

Page 21, paragraph 3 and 4

While all this [i.e. paragraph 3 and 4] is true, I am not sure of its relevance to this section. If it is meant to be justification, then it should probably go at the very beginning.

#### **Response**

*The relevant paragraphs have been re-written to bring out the central problem and issues.*

#### **Issue 246**

Category: science base

Page 20/21, section 7.2

I agree that EI is an applied science or engineering activity. The science is necessary to do EI in a more predictable way, rather than the hit or miss way it is done today.

#### **Response**

*Incorporated – see in particular the first paragraph under New Ideas (Section 8.3).*

#### **Issue 247**

Category: science base

Page 23, section 7.3.2, second paragraph

“Related sciences / disciplines that could bring new perspectives, methods and techniques in understanding and enhancing the application and value of interoperability to businesses include:”

How about “systems of systems”?

#### **Response**

*The concept of “systems of systems” has been introduced under Systems/Complexity science.*

## **30. Comments received from Jean-Pierre Lorré, EBM WebSourcing**

Received on 31 March 2006.

#### **Issue 248**

Category: open source software

According to my understanding of the current Enterprise Interoperability roadmap, there is no reference to open-source involvement into the document. Despite the fact that open-source is not mandatory for interoperability, we strongly believe in ObjectWeb that open-source is a key issue for interoperability. For example, the availability of an open-source implementation of a public standard is a key for large dissemination and community adoption.

We also think that interoperability has a lot in common with middleware technologies which is the core business of ObjectWeb.

Given this, I propose you to write some paragraph about interoperability and open-source with reference with NESSI SRA.

[...]

You will find enclosed some paragraphs about open-source and interoperability in order to contribute to the roadmap. The document may be read as a contribution of EBM WebSourcing as ObjectWeb member.

I also add some insight about relationship with the NESSI technologic platform.

### **Open-Source for interoperability**

The aim of this document is to stress a point that is not covered currently by the enterprise interoperability research roadmap, I mean relation between open-source and interoperability.

Despite the fact that open-source is not mandatory for interoperability, we strongly believe that open-source is a key issue for interoperability.

We address not only the software point of view about interoperability but also the business one. There is nowadays a growing momentum in the ICT world for open-source business models dedicated to different kinds of electronic artefacts (software, publication, book, etc.) that should not be forgotten in the interoperability roadmap.

We think that interoperability has a lot in common with middleware technologies, which is the core business of ObjectWeb.

According to IDABC European initiative "Interoperability means the ability of information and communication technology (ICT) systems, as well as, of the business processes they support in order to exchange data and enable the sharing of information and knowledge". Thus, interoperability concern has a lot of common with standardisation since it allows sharing the same language. Technology standards as the expression of a consensus between all industry actors have a key role in fostering healthy and competitive IT ecosystem.

Open-source position promotes standards since they are at its business cornerstone; an open-source solution takes generally all its strength by combination with others open or closed source solutions and has little to gain staying alone, at the contrary of some proprietary solutions. Openness of solution is a key issue since it allows each collaborative partner to have a deep view of requirements and improve trust.

Available open-source implementation of a standard allows in one hand to validate it thanks to a real test-case and in another hand to increase its durability since such development process is mainly involved for solution based on established business need. One can compare such process to OMG standardisation procedure where reference implementation is mandatory: of course, such process is slower than those implemented by other kind of organisations (think about the proliferation of the WS-\* stack and relative "standards" with no available implementation) but produce stability that is a key for business. Moreover, availability of an open reference implementation at no cost allows a very large distribution and fast standard adoption.

Open-Source Software allows individual groups of developers to participate openly in the creation of software. The modular architecture required to allow for this type of development inherently results in a more modular and extensible end solution. Such components now have compelling advantages: they are cheaper to buy and own than proprietary alternatives, they are often more reliable and trustworthy, and they are more flexible and extensible. These points will prove to be incredibly important according to interoperability requirements.

European implementation of a set of key open-source standards for interoperability is key for European growth and employment. Moreover, open-source facilitates European IT SMEs to penetrate interoperability market thanks to the mass effect provided by the European IT market with high skilled level.

ObjectWeb is a European consortium that leverages an open-source middleware stack, which is of tremendous importance for interoperability. Such open organisation allows knowledge capitalisation about interoperability artefacts and not to reinvent the wheel each time a solution is needed.

Main relative research challenges deals with:

- The cartography and business readiness evaluation of available open-source solutions. Lack of solution, or poor quality of, shall be identified and organised in the research plan.

- Open-source solution life-cycle management: what are the more relevant initiatives in order to promote the emergence and long-term stability of European open-source solutions.
- Legal issue dealing with open-source licences shall be address, in particular correlation with European Union member's local regulation.
- Open-source business shall be considered according to new models. In particular business model dealing with ecosystem organisation and corresponding tools will be developed.

#### Relationship with NESSI:

The NESSI Vision Document introduces and describes the initiative as to be about transforming the EU economy through Service Oriented business models. The service model as envisaged by NESSI has dynamicity as the key feature. Dynamicity here is intended as the characterising element of the continuous evolution and change in scope and form of business as well as of supporting technologies, in turn associated to deep modifications concerning social attitudes and models.

Among main principles at the heart of NESSI, one can find; trust, open standards and open source. These principles have a lot in common with interoperability domain.

- Open Standards: this principle is the core of the wider adoption approach of NESSI technologies without create barriers to business actors to benefit from NESSI results, and, the same way, it represents an important assets for the overall interoperability of service-based business applications.
- Open Source: fostering Open Source development not only allows to build a widely adopted NESSI reference implementation, but also to increase market competitiveness and transparency.

Open source plays a fundamental role in the standardization process, especially in the areas where interoperability is the basis of the economic model. By their nature, open source solutions may act as reference implementations of developing standards. The availability of their source code promotes open and democratic debate around the standard specifications they intent to implement, making them both more robust and interoperable. Therefore, development of open source solutions is an efficient way for results to be integrated either into a common reference implementation model or into proprietary solutions.

#### Response

*Thank you for your detailed comment. In response to comments to the first version of the Roadmap, namely concerning the technical detail of some of the proposed research areas, and because it would not be feasible for the Roadmap to encompass all technological approaches, later versions of the Roadmap (V3.0 and later) have moved away from specifying or endorsing particular technological approaches that should be researched in Enterprise Interoperability, i.e., the Roadmap aims at laying out the goals (ideas) of the research in Enterprise Interoperability (what is to be accomplished) rather than the technology/methodology used to achieve these goals (how to achieve it). The strategic view permits a greater flexibility towards new technological approaches, particularly considering the long time-span of the research framework. It is also consistent with the principle of giving research project proposals the flexibility to suggest their own technological approaches to realizing the stated goal, i.e., the idea of technology as a means to an end. In summary, the individual Enterprise Interoperability R&D project proposals may suggest solutions based on Open Source. The Vision and the Grand Challenges proposed in the Roadmap do not impose limitations in this respect. See General Response 2.*

*Concerning NESSI, see response to Issue 1.*

## 31. Comments received from Kim Jansson, VTT

Received on 3 April 2006.

#### Issue 249

Category: vision

In general a professionally written interesting paper.

Some comments

**Vision:** The vision statement describes the long term “ideal” situation when all interoperability problems are solved. It is well in line with other vision statements produced in related road mapping efforts. One of them being the FIATECH effort focusing only on Capital Projects (Technology Roadmap Element 9 Tactical Plan, Lifecycle Data Management and Information Integration) available at <http://www.fiatech.org/>.

An intermediate (less long term) vision statement would also be useful, describing more tangible target vision states.

### Response

*The comment is appreciated. Thank you for the pointer to additional resources.*

*The Roadmap is a contribution to FP7. The guidance given by the EC is that the Vision of the Roadmap should be a long-term Vision (10 year plus). Ultimately, at least some of the research work to be carried out will need to have more intermediate targets. These targets will need to be defined in the specific proposals for research activity. Annex I to the Roadmap provides indicative Research Challenges at a more detailed level. The time horizon of each would vary, including specific, shorter term targets.*

*The Responses to Issue 36 and Issue 121 are also relevant for the present comment.*

### Issue 250

Category: framework

**Research Framework and Dimension.** Three dimension are proposed Policy, Business/economic and Technical. The dimensions and interrelationships are well motivated. However the dimensions are not further used in the current version of the document.

### Response

*The issue is addressed in the final version of the Roadmap, including its Annex I, where the dimensions are used for positioning the Research Challenges.*

### Issue 251

Category: general

**Grand Challenges:** There is obviously a lot of works and effort behind aggregating these three Grand Challenges.

### Response

*Agreed!!!!*

### Issue 252

Category: Knowledge-Oriented Collaboration

**Knowledge-Oriented Collaboration.** The GC showing benefits within a short term horizon. Is not depended on the vision statement. The central theme must be the creation of preparedness for future collaboration. The ECOLEAD project contributes [to] solving some of the challenges identified. The ECOLEAD community and VTT can significantly contribute to further research in this field and would thus be open for further collaboration.

### Response

*The Vision is very much one of exploiting the capabilities offered by interoperable enterprise systems. Collaborations in this research are essential to achieving the Vision. See also Section 7.1. The relationship of the Knowledge-Oriented Collaboration Grand Challenge with the Vision is clarified in Roadmap V4.0.*

### Issue 253

Category: Web Technologies

**Web 2.0 Enterprise Interoperability Research.** A very technical GC. The vision of an ISU infrastructure being as useful and present as what we normally expect from e.g. electricity, phone and water must be the objective. ICT developers are the main contributors to this GC.

#### Response

*Since version V3.0 of the Roadmap we now propose a Grand Challenge designated ISU precisely aiming at developing the above mentioned infrastructure.*

### Issue 254

Category: science base

**A Science Base for Enterprise Interoperability Research.** A very demanding and heterogenic GC with high potential. The demand side and grass-root approach will give result that are possible to implement industrially in a medium term future, building on Web 2.0. The theoretical and value based approached will have to produce results before industrial application are thinkable. VTT can significantly contribute to further research in this field

#### Response

*Thank you for the very interesting comment, which should be considered by those seeking to carry out the actual research relating to this Grand Challenge. Note that this Grand Challenge is indeed closely related to other Grand Challenges in the Roadmap, as mentioned in the text.*

*VTT's expression of interest would undoubtedly be noted by the parties interested in doing the research.*

## 32. Comments received from David Shorter, IT Focus

Received on 3 April 2006.

### Issue 255

Category: implementation

#### 1) Engagement trajectory

1.1) The interoperability Roadmap 1 (RM1) has the concept of a technology trajectory (RM1, 6.11, p25). But what seems to be missing is the complementary 'engagement trajectory' to address take-up issues and timing relative to the trajectory and timing of the technology. This should address:

- (i) phasing of the likely take-up by the technology development community at large,
- (ii) how an individual SME might progress from one level of technological capability to another, e.g. using something equivalent to the BizDex menu as a shopping list of available capabilities, and
- (iii) the regional dimension, especially regional NGAs and social networks such as Chambers of Commerce, business clubs etc., addressing issues such as localization costs, regional impact, danger of lock-out.

#### Response

*Thank you for your comment. The actual research work under the Technology Trajectory Research Challenge (B11) is likely to include also research into stakeholder engagement with technology. Specific implementation measures are however outside the scope of this Roadmap, which sets the overall direction of research for Enterprise Interoperability (see Section 2.3). See also General Responses 1 and 2.*

## Issue 256

Category: business-economic

1.2) RM1 6.10 (B.10, p25) SME-related economic etc issues should also look at particular attractors and business drivers for SME involvement in networks and the possibilities for a gradual (or even viral) progress to interoperability. For example, an SME is persuaded of the benefits of X1, but the technology providing that also provides a Y2 capability that makes it easier (or even unavoidable) to move to X2 in the future. An example might be low cost access to VPN over P2P, which also implies implicit acceptance of some other things, e.g. standards and ways of working. This 'stair-case' kind of approach is somewhat similar to RM1 p32 7.1.2, built-in interoperability.

### Response

*The comment is appreciated. The "stair-case" approach is referenced in Research Challenge B10 (see Annex I).*

## Issue 257

Category: implementation

### 2) Social science dimension

2.1) In Roadmap 2 (RM2) 4.5, the way the Grand Challenges are formed (and the emphasis on sequence 2) runs the risk that the social dimension governing take-up and viability of the interoperability research outputs may not be addressed. For example, the processes by which SMEs and regional agencies could become convinced of the benefits of investing in an interoperability capability need to be researched. As stated in RM2 p13, while low entrance (or incremental) fees to access the needed Interoperability Service or similar service are needed, there is also the likely more difficult issue of persuading them to model their own outward-looking processes and business capabilities, and to codify those models to support interoperability. (RM1 p28, talks about the need to demonstrate the 'usefulness of IT systems' but in the past this has been even truer for Enterprise Models and especially for SMEs.) Predefined yellow pages and folksonomies will help, but at some stage SMEs have to differentiate their businesses and to represent their unique capabilities. That can't be done 'from the outside' purely by the injection of technology.

### Response

*The social science dimension, the community aspects, and SMEs considerations are now built into the Grand Challenges Web Technologies, ISU and Science Base. Specifically, social sciences are among the sciences proposed for research in the Science Base Grand Challenge.*

## Issue 258

Category: general

2.2) What metrics can be gathered about business social networks that could support the argument for ICT-supported interoperability? Can ICT be demonstrated to offer advantages in terms of scale-free and accelerated progress towards a critical mass needed for survival of the network? Can that progress be measured?

### Response

*These are topics for research under the Science Base Grand Challenge, particularly in relation to network science.*

## Issue 259

Category: Knowledge-oriented collaboration

### 3) The Grand Challenges

#### 3.1) Knowledge-oriented challenge

The new focus on collaboration in RM2 is to be welcomed, after all, that's what delivers the benefit, and interoperability is just an enabler! It may well be that an ISU should be owned and operated by a responsible service provider (because of the business liabilities and required confidence levels), but based on use of specifications and technologies provided by a Creative Commons and F/LOSS community. What viable business models are there? How do we know? Also (RM2, pp12, 13, 'ISU accreditation' is a delicate issue if ISUs are to be based on CC&F/LOSS societal values.

#### **Response**

*There are essential close links between Knowledge Oriented Collaboration and the facilities which may be provided by an ISU. The definition of appropriate business models is a significant part of both Grand Challenges (see e.g. Sections 5.3.3 and 7.3.4).*

#### **Issue 260**

Category: Web technologies

3.2) Web2-oriented research

3.2.1) An initial concern that should be addressed in the Roadmap proposition is, why do this in Europe? In competition or collaboration with the W3C? Will it be too late?

#### **Response**

*The Grand Challenge aims at encouraging research and development of Web Technologies focusing on Enterprise Interoperability. This should be complementary applied R&D for the specific aims of Enterprise Interoperability. The aim is not "to reinvent the wheel".*

#### **Issue 261**

Category: Web technologies

3.2.2) As rightly stated on RM2 p15, the second grand challenge should be based on the fundamental technologies underlying the 'vision of Web 2', e.g. the Web as providing a Composable Application / Information Platform (CAIP say), not necessarily 'Web 2.0' technology as it is regarded today. In the context of a five year (or longer) work programme, we need to get away from the term 'Web 2.0' - by midway through the programme, it will be 'Web\*' or 'OntoL2.0' or something else. (In this context, 'Web 2.0' might uncharitably be regarded as just another 'technology surge' cf. p21.) For these reasons it could be useful to rephrase Grand Challenge #2 in terms of 'Enterprise Interoperability using new web technology as the service platform' or some such.

#### **Response**

*Thank you. We have changed the title of the Grand Challenge accordingly to Web technologies for Enterprise Interoperability.*

#### **Issue 262**

Category: Web technologies

3.2.3) RM2, p19, is 6.3.4 (essentially VPN over P2P) a big enough topic to be a major component of a Grand Challenge? It may be better rolled in with SLEE, or treated as a variant thereof, because there are many common concerns, e.g. data privacy.

#### **Response**

*Thank you. We have changed the title of the section to "Web community solutions for Enterprise Interoperability" to emphasize the social and community role of the Web. VPN assigned it a too technical perspective, when we aimed at emphasizing the concept and value of networks (communities) within the network.*

**Issue 263**

Category: science base

3.3) A science base for EI

I have only one general comment here, that more consideration should be given to the role that Social Science could play in a new 'science' of interoperability-enabled business models.

**Response**

*Social Sciences has been identified as one of the relevant sciences in this Grand Challenge.*

**Issue 264**

Category: general

4) Some caveats and miscellaneous thoughts:

RM1, p9, maybe more is needed than conformance testing, e.g. self-checking interfaces with feedback to potential clients and users? On p27, would agree strongly with interactive development of enterprise interoperability - what assistance can ICT offer at the interface between would-be inter-operators? e.g., detect gaps, likely semantic mismatches with respect to ontologies/folksonomies, as well as missing/mismatched data structures and operations?

**Response**

*These are issues addressed under the Knowledge Oriented Collaboration and Science Base GCs.*

**Issue 265**

Category: policy

RM1, 15, what about preservation of rights to privacy and commercial confidentiality? Not addressed in a P\* topic.

**Response**

*Such rights are of course essential, and are recognised in the Roadmap.*

**Issue 266**

Category: business-economic

RM1, p27, there's an important and misleading implication here - the question is how to design the BIF to support the ecosystem layer, not the other way round.

**Response**

*The comment is appreciated. The text of Research Challenge B12 has been revised in finalising the Roadmap. The limitation of the BIF has been noted by another commentator (see Issue 185).*

**Issue 267**

Category: business-economic

RM1, p29, Service Level Agreements need to be generalized and embodied in mechanized implementations of codes of practice; compare eBay's reputation-based system that automatically enforces suspension after negative feedback above a certain level.

**Response**

*The comment is appreciated. eBay's and similar reputation-based systems are among the new "community-centric" developments which potentially lead to new perspectives of technology and its use. Such considerations are a consistent theme of the Roadmap throughout. The specific text mentioned has been revisited in light of the comment.*

## Issue 268

Category: vision

5) A condensed 'Vision'?

What about "To research and develop ICTs, policies and regulatory frameworks that enable mediating utilities to support seamlessly interoperable businesses in agile exploitation of opportunities within their enterprise 'ecosystem'". Just a thought - although it does put mediation at the centre which is probably too strong.

## Response

*Thank you for the suggestion. There has been a general consensus that the vision statement should be business-oriented.*

## 33. Comments received from Piero De Sabbata, ENEA<sup>12</sup>

Received on 4 April 2006.

## Issue 269

Category: general

### Background and short preliminary comments

1. **the metaphor.** In my view until today we have created islands of interoperability and archipelagos of such islands because in reality we have not addressed the issues of the creation of common and accepted applicative standards.

Many solutions, interesting architectures but completely incompatible and not interoperable solutions.

Thinking in terms of archipelagos of 'similar' services and architectures we have to decide to establish bridges (between the closest islands in terms of similarity), ferry boats (for the other islands of the archipelago) and liners (between archipelagos); a single interoperability paradigm (probably) cannot afford all the different situations<sup>13</sup>.

The efforts devoted to the construction of ontologies (upper ontologies as well) are affected by the same problem, because lacking of procedures to formalise specifications and aggregate/build consensus on a common understanding on semantic.

## Response

*We have also used the metaphor of "islands of interoperability" in the Roadmap (see the first paragraph in Problem Space (Section 3.2). We note that this metaphor is familiar to CEN/ISSS, e.g. in respect of the activities of the former CEN/ISSS Electronic Commerce Workshop and former CEN/ISSS eBusiness Standards Focus Group.*

*The semantic issues are a recurring theme in the Roadmap, and are specifically raised in the ISU and Science Base Grand Challenges. A set of indicative Research Challenges are provided under the heading Semantics and Ontology Area Research Challenges in Annex I. We note that a Multilingual Upper Level Electronic Commerce Ontology (MULECO) was a project started in the former CEN/ISSS*

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<sup>12</sup> Chairman of CEN/ISSS workshop TexWeave ("Standardisation and Interoperability in the Textile Supply Chain Integrated Networks").

<sup>13</sup> One of these fields is the inter-firms (lightweight) collaborative business processes; the basic instances in this area are all the processes related with supply chain management and customer relationships.

For example the 'interoperability' that is needed to exchange information managing a supply chain is probably different from that necessary to access data about mechanical fabric behaviour in a 3d virtual prototyping process; in the first case we can imagine asynchronous message exchanges that compose sequences of transactions with a time scale that is hours or days, where systems are loosely coupled and where legal and contractual issues are relevant and the exchanges are statefull; in the second case we think to synchronous calls to procedures, with a, desirable, time scale of seconds or less, where the exchanges are one-shot and stateless.

*Electronic Commerce Workshop, with the work eventually abandoned due to the closure of this workshop.*

## Issue 270

Category: SMEs

2. **a side of the problem.** The experience in these years has evidenced that the applicative standards for B2B, mainly sectorial data exchange standards, are expensive to build and to formalise and require a certain period of time; furthermore the need for customisation is an insuppressible need for real business as soon as the basic collaborative business processes have been established and the business processes become a competitive factor in themselves).

The running experiences in the field of standard adoption reveal that in the industrial sectors where few large players rule the sector, the adoption is forced by the agreement between the major players, where this is not possible, mainly sectors with a large number of SMEs, the problem of the creation of a critical mass for the adoption is still unsolved or only partially unresolved (Bizdex, Funstep, TexSpin/TexWeave, for example).

We could describe as a paradox the fact that SMEs could be the main beneficiary of standardisation activities while [they] are the less capable actors to promote and participate their creation and maintenance.<sup>14</sup>

On the other hand, the SMEs are the richness of the European industrial fabric and they should be supported to avoid their exclusion from the network of relationships that the internationalisation of the markets is pushing. Even in this case we can observe two different perspectives: technologies to support the splitting of the activities of large companies that outsource their productive capacity against the aggregation of small companies that need to converge to create critical mass and require technology to reduce errors and uncertainty in this process.

## Response

*The focus on SMEs has been further strengthened in the Roadmap throughout. The SME aspect is now also a guiding principle for setting the Grand Challenges (see Section 4.5).*

*We draw attention to the Scope of the Roadmap (Section 2.3). It is not within the scope of the present Roadmap to address standardisation or implementation issues.*

*Sectorial issues, take-up measures and implementation aspects need to be built into the actual execution of the research work. See General Response 2.*

## Issue 271

Category: standards

3. **the consequence.** The consequence of these short considerations is that we need a stronger attention to the aspects of interoperability and standardisation.

On the other hand standardisation lacks in agile approaches to **build** and **maintain** standards, in the balance between **customisation/standardisation** of the supported processes and in reaching a **critical mass** of adoption.<sup>15</sup>

## Response

*The present Roadmap is a research roadmap. Standards issues are important and a standards roadmap could in principle be developed to complement the present Roadmap. See General Response 2.*

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<sup>14</sup> Jakobs, K., "Standardisation and SME Users Mutually Exclusive?", Proc. Multi-Conference on Business Information Systems, Cuvillier Verlag, 2004

<sup>15</sup> N. Gessa, G. Cucchiara, P. De Sabbata, A. Brutti, "A bottom-up approach to build a B2B sectorial standard: the case of Moda-ML/TexSpin", pp 249-260, in "Interoperability of Enterprise Software Applications", workshops of the INTEROP- ESA International Conference, Geneva 22 February 2005, edited by Hervé Panetto, Hermes Science Publishing, Paris 2005, ISBN-1-905209-45-5. Pre-final version in <http://www.moda-ml.org/moda-ml/download/documentazione/materiali/INTEROP-ESA-2005-paper-prefinal.pdf>

## Issue 272

Category: standards

### Potential research areas contributing to face the standardisation bottlenecks

Thus, the starting point is that we need standards at applicative level to exchange knowledge in the inter-company collaborative processes but the standardisation and the standards in their present incarnations present a lot of problems that hamper their definition, use and maintenance.

Many standards exist of many different types (formal, de facto, pre-normative specifications, etc); in general we can consider the potential fall out in this area wide enough to embrace the formal standards as well as the common specifications that are needed to build a **local open B2B community** of enterprises.

1. The first point is to focus on the **life cycle of the B2B standards**: we need to change and innovate from a methodological point of view the standard life cycle<sup>16</sup>.

The objective is the reduction of the threshold to start a process of standard construction and the cost of their (incremental?) improvement and maintenance.

The objective could be pursued with the research on new methodologies and innovative, open source, semantic based architectures and tools.

### Response

*See General Response 2.*

*The starting point for any research projects that might arise from the present Roadmap would conceivably be the state of the art which includes among others the relevant existing and emerging standards and specifications.*

## Issue 273

Category: standards

2. The second point is the **shape of the 'standard'** in itself: the shape of a B2B standard is usually a set of textual specifications or, more recently, a set of XML definitions or schemas.

We should consider the opportunity to develop and investigate new '*containers*' for the standard specifications, that propose a convergence between semantic orientation and machine tractability (a first obvious step could be to formalise ontologies related to the standard specifications).

For example new languages based on co-constraining could become a part of a new way to specify the content of a standard.

### Response

*The significance of your research proposal and the difference relative to the Annex I Research Challenges are not immediately clear to the editors. Would this not make more sense as part of a specific research project proposal?*

*See General Response 2.*

## Issue 274

Category: standards

3. The third point, less visionary but extremely concrete in its potential fall out, is the investigation about the capability of open **semantic based tools/architectures** to support a knowledge exchange pivoted by standard specifications (import/export towards existing complex internal systems, company profile matching).

The challenging point in this case is to allow the **customisation** of the implementations of the collaborative business processes without losing a substantial compatibility with the common understanding represented by the standard: **customisable standards** should not be considered an oxymoron but a goal that could be implemented with different degree of efficacy.

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<sup>16</sup> Soderstrom E., "Formulating a General Standards Life Cycle", Proceedings of 16<sup>th</sup> International Conference of Advanced Information Systems Engineering - CaiSE 2004, Riga, Latvia, June 2004.

## Response

*We believe the Roadmap now addresses the issue identified in this comment. The Grand Challenge Knowledge-Oriented Collaboration addresses the issue identified in this comment, extending with some further research ideas, for example the issue of internal vs external knowledge.*

## Issue 275

Category: standards

4. The relationship between **ebXML and web services** and SOA has partially evolved: it appears clear that the ebXML and web services must be able to converge but it is still not clear the extent and the areas of this convergence. It is to investigate the real possibilities of convergence between ebXML and web services and the areas where it does not make sense. For sure we can identify in ebXML and Web Services two complementary approaches to many problems.

## Response

*We are aware that there are a lot of discussions in the standardisation arena concerning ebXML, Web Services, SOA and their (possible) convergence or otherwise. See General Response 2.*

## Issue 276

Category: vision

5. The resulting vision:

- a new environment where each enterprise finds easily the reference concepts to establish its basic collaboration with other partners;
- the framework offers semantic based tools that help the company to setup fastly and without errors the collaborations in a reliable and cheap manner, with a large reuse of open source components;
- in such environment, when the business grows or when the a new area of collaboration is discovered, even a small group of firms can decide to setup their own customised collaboration framework maintaining the compliancy (the capability to be understood) with the general specifications;
- communities of enterprises and their technology suppliers are able to setup their business processes as a competitive factor without loosing the possibility to interact with all the other actors of a dynamic open community;
- technology and service providers find a common reference to offer their services; the competition is on the quality and the cost/quality rate, the access to the market of new service (and providers) is simplified and the thresholds to join the communities are lowered.
- MicroSMEs can rely on local (cheap and flexible) suppliers specialised in supporting their business and offering services of connection towards all the other actors and communities without resulting the warder of an insulated island of interoperability.

## Response

*Thank you for the suggestion. The points are generally reflected in the Vision Description section of the Roadmap (Section 4.2).*

## Issue 277

Category: ISU

## Other (less important) comments on the roadmap<sup>17</sup>

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<sup>17</sup> Reference to the roadmap V.2:

<http://cordis.europa.eu.int/ist/ict-ent-net/ws20060321.htm>

[ftp://ftp.cordis.lu/pub/ist/docs/directorate\\_d/ebusiness/20060315\\_roadmap\\_v20.pdf](ftp://ftp.cordis.lu/pub/ist/docs/directorate_d/ebusiness/20060315_roadmap_v20.pdf)

The assumption that the 'ISU' approach is the ONLY key for all the aspects of interoperability is not completely convincing: the interoperability between organisations (that is asynchronous, loosely coupled and based on messages/transactions rather than on service demand) is only partially addressable in this perspective.

We cannot assume interoperability services as 'commodity' as far as they are deeply influencing the internal workflows.

The tools/services to exchange (secure) data could represent a commodity but they are strongly impacting the internal organisation and systems. Like a fax they will be easy to buy and activate, but, differently from such systems they are not effective without a true comprehension of the effects in terms of internal workflows and organisation (and inter-company relationships).

#### **Response**

*The ISU approach is positioned as one possible approach to interoperability. The relationships between the ISU type "commodity" services on the one hand, and value-added and other proprietary services on the other, are described in the ISU Grand Challenge chapter.*

#### **Issue 278**

Category: SMEs

A further point that is questionable is the assumption that the dimension of the company should not affect the approach and the tools to implement enterprise interoperability. In reality, for example, even in a P2P perspective we have to consider that medium and small companies could implement and support 'light' peers not 'fat' peers, overloaded of services and systems.

#### **Response**

*The assumption in question does not appear / is not implied in the final version of the Roadmap.*

#### **Issue 279**

Category: standards

A final aspect that should be addressed is the endorsement of B2B standards and meta-standards (like ebXML, UBL) that should be assumed as a reference also for the research projects: we do not need to re-invent the wheel each time that an IST project deals with the creation of a solution/methodology/architecture for interoperability.

Presently the ebXML framework is considered to be opposite to the Web Service and the SOA architecture that are in the mainstream of IST activities on interoperability. In reality this contrast is only partially true, but there is some confusion, even in the actors of the research activities.

For example, when discussing about virtual organisations, why not think about the contribution that could arise from an ebXML based approach to the construction of the company profile of collaboration and of the inter-company agreements?

#### **Response**

*Endorsement of particular standards or what you term "meta-standards" is outside the scope of this Roadmap.*

*The starting point for any research projects that might arise from the present Roadmap would conceivably be the state of the art which includes among others the relevant existing and emerging standards and specifications.*

*See General Response 2.*

## **34. Comments received from Jan Goossenaerts, TUE**

Received on 7 April 2006.

#### **Issue 280**

Category: general

Thanks a lot for reference and the information about the ISU. I am very pleased with the degree of acceptance of the ISU concept, but I see some problems emerging in its realization and sustainability if the right strategic approach is not taken within the Commission.

Below perspectives are those from an outside observer of EU RTD and Competitiveness policies.

1. Attached pls. find an interesting paper on innovation policy in China (from Science, published today); [note from the editors: paper is not attached to this Annex]

2. Regarding ISU, we must consider that its realization challenge may not just be a problem of FP 7, but also of the (new) competitiveness and innovation program (CIP 1) with its focus on inclusion. Other relevant links in these areas are:

- 'The European Strategy Forum on Research Infrastructures' (ESFRI) within which three 'roadmap working groups' are active: 'Physical Sciences and Engineering', 'Biological and Medical Sciences', and 'Social Sciences and Humanities', see <http://cordis.europa.eu/esfri/home.html>
- digital library; information market and knowledge and content technologies <http://cordis.europa.eu/ist/kct/> (see my KCT comment attached);
- Collaborative Working Environments [www.cwe-europe.org](http://www.cwe-europe.org)

3. The diffuse picture emerging from the above list (horizontal infrastructure is approached from multiple vertical function-focused EU directorates or their units) is in conflict with an OECD sourced recommendation that I made 8 years ago in CO-MIND D2.3 [http://is.tm.tue.nl/staff/jgoossenaerts/4PublicPdf/1998\\_COMIND\\_D2.3.pdf](http://is.tm.tue.nl/staff/jgoossenaerts/4PublicPdf/1998_COMIND_D2.3.pdf) (recommendations on SMEs and ICT for value chains); especially page 6/7 on strong strategic capacity).

The related report [http://is.tm.tue.nl/staff/jgoossenaerts/4PublicPdf/1997\\_COMIND\\_D2.1.pdf](http://is.tm.tue.nl/staff/jgoossenaerts/4PublicPdf/1997_COMIND_D2.1.pdf) (survey on SMEs and ICT for value chains, co-author Colin Piddington) gives some graphics and facts that expose the Competitiveness and Innovation challenges.

4. From an innovation perspective, especially /software tech/ innovations are very incremental and short lived. If we want to bring such innovations to the market via an ISU, that ISU must bridge the FP7 style infrastructures (as studied by ESFRI, and to keep the research edge-cutting) into the CIP industry scope.

5. The proposals I made in the KCT input represent a first trial to contain the problem and offer solution directions. Only after reading the CIP and FP7 official documents last Friday I came to the points listed above.

## Response

*Thank you very much for sharing a wealth of information with us.*

*Indeed there are many challenges relating to the ISU (hence ISU as a research Grand Challenge in the Roadmap). Note that the Roadmap spells out the basic concept, rationale and direction of the ISU only. As mentioned in the Roadmap, it does not specify: 1) how the ISU should be built; 2) the individual ISU services; 3) the validity and sustainability of specific business models for the ISU; and 4) specific ownership, operational and governance models. These issues and their inter-relationships need to be explored within the research to be carried out. Their validation, including the method of validation, is also part of the research work.*

*Specifically, your overall comment that the Commission needs to take the right strategic approach in respect of the realisation and sustainability of the ISU is outside the scope of the ISU description in the context of the Roadmap. It may emerge as a major issue (or recommendation) arising from the actual research work on the ISU. Therefore, parties interested in engaging research on the ISU may wish to note your comment and the resources that you have referenced.*

*Concerning the relationship and interaction between FP7 and CIP, we note that this issue has been raised in various policy groups of the EU and at the Member State level, who are the appropriate forum for addressing the issue. For example, it has been highlighted by high-level groups such as the eEurope Advisory Group in "Making i2010 work: creating value from research and innovation" (see [http://europa.eu.int/information\\_society/eeurope/2005/doc/all\\_about/advisory\\_group/eac\\_contribution\\_i2010.pdf](http://europa.eu.int/information_society/eeurope/2005/doc/all_about/advisory_group/eac_contribution_i2010.pdf)). In addition, this report recommends among others a horizontal and cross-DG*

*implementation unit for i2010 within the European Commission. However, such general policy considerations are outside the scope of the Roadmap. See General Response 2.*

## **35. Comments received from Hans Akkermans, AKMC**

Received on 4 May 2006.

In essence, it's three main points:

- many challenges are very much formulated technology-driven where they can/should be argued more from a business development point of view; B-T challenges might benefit from a better integration
- I see quite much of "heavyweight" ICT systems thinking, while I believe that the direction must be towards small collaborative components on the Web (in line with the ecosystems idea but also the Web 2.0) [This also applies to the ontology and KR parts]
- I would tend to stress business applications in this area and deemphasize deep-down technical things such as middleware and Web OS level solutions. Also knowing projects and partners, this suits better the area and its added value to FP7.

### **Issue 281**

Category: Web technologies

#### **Part I: Roadmap v2.0 (draft 15-03-2006)**

*(General, a)* I agree to the three formulated Grand Challenges; together they suitably capture the relevant RTD space and foci in networked business over the Web.

I wonder however whether the use of the term "Web 2.0" is wise in an official EC policy document. It gives the right flavour or connotation of the future "Web as a global infrastructure supporting new socio-economic development", and it is indeed difficult to find an alternative nice and short indicator, but it seems too strongly associated with a new wave of marketing by US Internet companies now trying to recover from the Internet bubble burst.

### **Response**

*Thank you. We have changed the title of the Grand Challenge accordingly to Web technologies for Enterprise Interoperability.*

### **Issue 282**

Category: general

*(General, b)* The intro of the roadmap emphasizes the Ecosystem idea. I think it's a pity that the RTD consequences of this idea are not always clearly visible in the rest of the two documents. At quite some places, one gets the impression that thinking is oriented towards big heavyweight infrastructure and information systems, instead of ecosystem principles: small interacting components, flexibility and adaptivity with respect to business/user needs and context, easy access for all, easy configurability (up to so-called self-\* capabilities incl. forms of self-organization). The need for "lightweight" structures is mentioned but not everywhere adhered to.

(This holds for example for the ontology-oriented parts, see below, but not only there.) The lightweight idea deserves much more emphasis in my opinion.

### **Response**

*Roadmap versions after V1.0, especially V3.0 onwards, acknowledge the need for flexible, lightweight and adaptive structures.*

### Issue 283

Category: Knowledge Oriented Collaboration

(p. 11, a) The formulation of Sec. 5.1.1 is a bit difficult to understand. Does the “next plane of interoperability” imply that the knowledge-oriented utilities or facilities work on top of the interoperability Service Utilities, or are a subset of them? Or is this left open? (Better I think).

### Response

*The wording has been amended in version V4.0 to clarify this point.*

### Issue 284

Category: Knowledge Oriented Collaboration

(p. 11, b) In 5.1.2 I would suggest “ontological and other semantics-based” knowledge; there are other useful semantic techniques than just ontologies (e.g. in semantic routing and overlay networks in P2P, and this is certainly relevant to this area).

### Response

*Agreed. The wording has been changed as suggested.*

### Issue 285

Category: Knowledge Oriented Collaboration

(p. 12) A key category of knowledge not mentioned here for networked business is business/service offering and market knowledge.

### Response

*This has been acknowledged in the final version of the Roadmap.*

### Issue 286

Category: Knowledge Oriented Collaboration

(General, c; p. 13/14) In Sec. 5.4 and 5.5 I suggest to rephrase the rather traditionally formulated issues and problems to be addressed (KR, Knowledge-based tools, KA) towards a more lightweight approach that operationalizes the ecosystem idea better. Accordingly, this is a good place to launch the notion of Service-Oriented Knowledge Utilities (SOKUs). What we need here in my opinion (in line with the Web 2.0 idea) is not heavyweight knowledge-based ontologies and tools etc. but a variety of relatively small and easy-to-use collaborating SOKUs that

- Act and communicate as Web Services (as ISUs)
- Can be flexibly adapted to purpose by business users
- Easy to configure to collaborative networked business services and service bundles (or are even self-configuring)
- Fit into decentralized/distributed service-oriented architectures, in bottom-up, P2P ways
- Provide accessibility to stakeholders in ways and languages that are natural to them

With the latter I mean that SOKUs should not be developed in the current heavyweight Semantic Web ways (e.g. directly to be programmed in RDF or OWL or even WSDL/SOAP). These are in fact equivalent to Web OS assembler low-level type languages that require heavy programmer or computer science knowledge that is a barrier to adoption by SMEs and even (in my experience) large but non-ICT industry companies. We need higher-level facilities that are closer to users and industries, not programmers. An example is visual modelling whereby the middleware-level Web standard formats are automatically generated but the user does not have to see or worry about this.

[The OBELIX project actually demonstrated that this is technically possible; see Akkermans et al., IEEE Intelligent Systems, August 2004, pp. 57-66; but this is not the only example.] We can safely leave the heavyweight KR stuff to the Semantic Web researchers – the really senior ones actually would agree (!) to the above comments and research needs.

## Response

*The issues addressed in the Knowledge Oriented Collaboration Grand Challenge are focused on the problems to be addressed in delivering benefit to virtual organisations. The issues of understanding sources (acquisition), repositories (KR), application and security etc. are independent of the technologies applied in implementation. However, it is agreed that indeed the tools and methodologies identified in this comment, are likely to provide this implementation path, although the Roadmap discusses these in more detail under the Web Technologies Grand Challenge. It is the editors' intention that the Grand Challenges are mutually complementary in providing one another with, on one hand, strategic direction and, on the other with solution paths.*

*For the concept of the Service-Oriented Knowledge Utility (SOKU), please refer to "Future for European Grids: GRIDs and Service Oriented Knowledge Utilities – Vision and Research Directions 2010 and Beyond", January 2006.*

*[ftp://ftp.cordis.europa.eu/pub/ist/docs/grids/ngg3\\_eg\\_final.pdf](ftp://ftp.cordis.europa.eu/pub/ist/docs/grids/ngg3_eg_final.pdf)*

## Issue 287

Category: Web technologies

*(General, d; pp. 15-19) This section 6 does mention the lightweight Web software idea (on p. 15) but could emphasize this importance later on more, by stressing distributed architectures and components. Virtualization of e-services is actually an industry issue now (e.g. is significant element of the Cisco strategy), and decentralized, semantic and context-aware techniques for virtualization are still insufficiently developed. Mentioning the issues of virtualization, for example in relation to the mentioned Service Execution Logic (p. 18) would not only make sense in itself, but also make the link to previously mentioned VO and ecosystem ideas more clear and operational.*

## Response

*Thank you. We have included a brief reference to virtualization of e-services (as an example).*

## Issue 288

Category: science base

*(p. 20) The science base is an interesting and relevant challenge, and I personally do think significant progress is possible now, but it is unavoidably an issue that requires a very interdisciplinary approach. This does not come natural to the average scientist (especially because the usual academic reward system is quite strictly discipline-oriented). The text also has a tendency to indicate more the scientific sources and foundation from exact and technical sciences. Social sciences (social networks), economics and business school research (innovation diffusion, market and networked business theory, transaction cost, experiential marketing), and communication theory (innovation adoption) are other sources. The soft factors are important: for example in the INKASS and especially VERITAS projects it appeared very clearly that the success factors for SME networks and VOs were first of all organizational (business case establishment, collaborative partner trust, limitation of upfront infrastructural investment before having a reasonable customer base for the new VO activity), more important than the technology issues.*

## Response

*The comment is appreciated. It has been incorporated as far as possible into the text of the Grand Challenge, without delimiting the particular direction of and source materials for the research. The need for an intensive interdisciplinary approach has been emphasised.*

*See also the following references:*

- *INKASS (IST-2001-33373): INtelligent Knowledge ASset Sharing & trading, <http://www.inkass.com/>*
- *VERITAS (FP6-511013): Virtual Enterprises for Integrated Industrial Solutions, <http://www.veritas-eu.com/>*

## Issue 289

Category: general

## Part II: Roadmap v1.0 (draft 21-12-2005)

*(General, e)* A general comment I have on the document as a whole is that I find the sections 7-11 covering the “T-challenges” very much dominated by and driven from a technical perspective only. It’s often difficult to see how the T-challenges relate to the “B-challenges” of Sec. 6, and also sometimes to the “P-challenges” of Sec. 5 as well. To an outsider it now reads as very separately written roadmap pieces. I think that it is well possible to derive the need for many of the T-challenges from the B-challenges, and that such a justification would be more convincing. Many mentioned technical challenges have their roots in business issues, but this is not clearly brought out in the present document.

#### **Response**

*See General Response 1.*

*Indeed, the T-, B-, and P-challenges were written as separate pieces. Various persons were responsible for a chapter, with little interaction between the responsible persons. Since V2.0, the Roadmap takes a more strategic and more business-oriented perspective.*

#### **Issue 290**

Category: policy

*(P-challenges)* It is somewhere mentioned that Europe is very much a service economy, with in addition a relatively large economic, social, and cultural diversity (compared to the US and the emerging big Asian economies). However, dealing with this diversity special to Europe such that there will be improved access and participation via the Web for a broader base of citizens, companies, and cross-national economic and social activities is not really mentioned as a challenge. But I believe that this is something from which many business (B) and technical (T) challenges naturally follow, especially if we speak about VO and SME collaborations (and moreover, the ecosystem ideal of such collaborations).

#### **Response**

*The comment is appreciated. The diversity aspect is now explicitly incorporated into Research Challenge B3 “business interoperability and society” (Annex I).*

*More generally, the viewpoint expressed in the comment is among the key contexts in setting the direction of the present Roadmap, specifically the Grand Challenges.*

#### **Issue 291**

Category: business-economic

*(B.5)* In this section on grid-based applications, the emphasis is very much on middleware. This is also the case in part of the T-challenges. I am not sure whether this emphasis is wise. It can be easily (mis)understood as a preference to see ISUs as low-level (Web OS-like) generic computer network facilities. There are two objections here. First, I think it’s technically open whether interoperability solutions will all or mostly be at the middleware level: I suspect that business-, service-, or domain-specific content is better situated at the application IS level rather than in middleware that then has a tendency to become very “fat”. Second, too strong a focus on middleware in this FP7 area is I believe seen as rather far away from the average SME or (even large) companies with core business outside ICT. But this is where ultimately the most use of the future Web will be.

#### **Response**

*The comment is appreciated. The Research Challenge B5 has been deleted as the area of work is outside the scope of the Grand Challenges.*

*More generally, the viewpoint expressed in the comment is among the key contexts in setting the direction of the present Roadmap, specifically the Grand Challenges.*

## Issue 292

Category: general

(General, f) I would therefore generally tend to stress the importance of practical industrial applications and business demonstrators in the field across the document, and put much less emphasis on purely technical middleware and Web OS type issues. This is also where the added value of the present area of FP7 will lie.

### Response

*As stated in the Research Context (Section 4.3), research needs to be relevant for industry ... both impact and the value created for enterprises must be tangible, measurable and verifiable. Pre-competitive prototyping of practical industrial applications and business demonstrators will need to be part of the research work to be carried out in relation to the Grand Challenges. It would not however be appropriate for the Roadmap to pre-define such applications and demonstrators. See General Response 2.*

## Issue 293

Category: general

(General, g; B-T) As said, the B and T challenges seem like rather separate areas. However, my experience is that companies interested in novel e-business and Web-based service, *first* want to establish an attractive *business case and model*, and then from this want to make a gradual step to the ensuing process, software, and infrastructural technologies. Developing such a methodology that *starts from the business viewpoint*, and then naturally moves to the needed ICT technologies (and not the other way around as is often the case in current business-ICT alignment) would be a research challenge that integrates important B and T issues.

(Note: A very recent example (related to one of the INTEROP task groups, by the way) how this might be approached in e-service design is the article by Gordijn, Yu, and Van der Raadt in IEEE Software, May/June 2006, pp. 26-33.)

### Response

*The comment is appreciated. Indeed the Roadmap does seek to start from business-economic scenarios in defining the Research Challenges ("Sequence 2" in relation to the Research Framework, Section 4.4). However, please note that the actual definition of the detailed Research Challenges has been a bottom-up activity of the current Enterprise Interoperability community. See General Response 1.*

## Issue 294

Category: general

(T-challenges) They generally go very much into detail. It may be that already the sheer number of T-oriented challenges and pages spent gives the impression of the technical-drivenness of the roadmap. I would shorten and simplify this part. It also tends to go into specific solution ideas, rather than stating the main problem areas and directions. I would leave the specific solutions as something that the future project proposers have to do rather than the roadmap.

### Response

*See General Response 1.*

## Issue 295

Category: semantics

(Sec. 10.2) This section on ontology infrastructure (and also 10.1 on process ontology) is generally formulated in a quite heavyweight fashion, and could be made much more in line with the Web 2.0 lightweight software component collaboration and VO ecosystem ideas. So, I repeat here some comments made above (see paragraph under General, c; p. 13/14):

What we need here in my opinion is not more heavyweight knowledge-based ontologies and tools etc. (both OWL-S and WSMO are examples of this) but a variety of relatively small and easy-to-use collaborating SOKUs that

- Act and communicate as Web Services (as ISUs)
- Can be flexibly adapted to purpose by business users
- Easy to configure to collaborative networked business services and service bundles (or are even self-configuring)
- Fit into decentralized/distributed service-oriented architectures, in bottom-up, P2P ways
- Provide accessibility to stakeholders in ways and languages that are natural to them (in terms of domain and business/service concepts, preferably graphical or visual, not specialist programming languages and formal logic KR such as OWL-DL etc.).

Specifically on ontologies, I am certain that the next research steps to be taken are:

1. Make easier tools to develop simple application and domain ontologies that can be done by non-specialists. (Although I like the job by Mark Musen in Stanford with Protégé (mentioned in the roadmap), it's still foremost a tool for specialists – and I know Mark well enough to know that he would agree). It's not accidental that in Web 2.0 circles the idea of “folksonomies” has emerged; conceptual models that are like ontologies but much simpler, but also do some useful job. There is a lot possible to do in-between folksonomy and formal ontology that is lightweight, user-friendly, useful domain-content oriented; and this is necessary to do for larger take-up outside the specialist semantic circles. The famous 80-20 rule applies here.
2. Ontologies must become dynamic and active facilities on the Web (a kind of SOKUs) that do something for you, rather than being static knowledge representations as they now are. They are to be turned into distributed components accessible as Web Services themselves, and to be combinable with other Web Services that support simple forms of reasoning. (For example, we already have experimented with business ontologies that cover business rules for a service, and that employ readily available (even for free) rule-based engines made available as a Web Service – and this works).

## Response

*The comment is appreciated.*

*Concerning “small and easy-to-use collaborating SOKUs”, the various elements are reflected in particularly the principles behind the Web Technologies Grand Challenge and the basic attributes of potential ISU services in the ISU Grand Challenge.*

*The points about Ontologies are well made and are in line with the general principles of the Roadmap and the Grand Challenges (see above paragraph). Therefore, the actual research on Ontologies, including tools resulting from the research, should hopefully be in line with the direction set out in the above submitted comments. The community aspects of Enterprise Interoperability are explicitly referenced in Web Community Solutions for Enterprise Interoperability (Section 6.3.4).*

## Issue 296

Category: vision

That's why we need SOKUs: simple, “lightweight” down-to-earth knowledge-based facilities that work together over the Web in strongly distributed service-oriented architectures. This is more consistent with the VO and ecosystems ideas, it is the step needed for wider take-up of semantic methods, and it fits better to the practical networked enterprise applications that are central to the present area of FP7.

## Response

*The ideas associated with SOKUs are reflected in the Roadmap. For example, both Web Technologies and ISU Grand Challenges make references to SOKU and related concepts.*

*The Vision itself is expressed in business terms.*

## Comments on Roadmap version V3.0

### 36. Comments received from Jan Goossenaerts, TUE

Received on 8 June 2006.

#### Issue 297

Category: framework

Thank you for your excellent work in this challenging job.

Though I not yet have had time to read the report in detail, my first impression are:

1. that policy/research/technology issues, market-scale and business-scale issues are not sufficiently decoupled to articulate "disciplinary research challenges" and to allocate and articulate tasks for all constituencies involved (over a 7 year period, public and private sector).

2. w.r.t. figures 1 and 2, and how they could be redrawn (with impacts for ISU grand challenge in particular), I wish to bring below report under your attention (just now sent to me by Prof. Jan Smits who is an expert on telecom regulation, following a brief conversation we had yesterday, a.o. about the interoperability roadmap).

[http://www.telecomreview.ca/epic/internet/intprp-gecrt.nsf/en/h\\_rx00054e.html](http://www.telecomreview.ca/epic/internet/intprp-gecrt.nsf/en/h_rx00054e.html)

A key issue is the separation of economic, social and technology policies (and the related regulation - if required - and research).

Another issue is that for the (software & applications) technology "tsunami" from creators to users, the ISU will be the channel to bi-directionally link the research community with the economic/social community (one way for solutions, the other way for problem/value/risk/situation awareness).

Hence, not all contents of this roadmap must be positioned as research in the "research activity" as implicit in chapter 4, the roles of many more stakeholders/agents must be emphasized.

Referring to the 3 sequences on page 13, my understanding is that all three are essential for this roadmap:

1. ISU GC is closely tied to Sequence 1 (link to European Research area/ ESFRI e.g., Nessi, CWE, utilities policy research, etc.)
2. Seq. 2 research is primarily to be driven by private sector, for instance in coord. with CIP , and supported by ISU to link to academe (GC KOC and some of GC Web )
3. Seq. 3 research is what FP 7 should (increasingly) focus on, because risks are largest here (GC science base)

Focus on seq 2 ONLY will just continue what we are doing (wrong) in current programmes.

For seq 1 the instrumental link to i2010 must be articulated more, with emphasis on, and differentiation of economic and social (inclusion) policies.

This brings us to a tree-pronged portfolio with (comparable and justified) budgets for all sequences:  
seq. 1: setting in high (because it is new), then gradually let ISU become self-sustaining (infrastructure initial investment, align EU-wide);  
seq. 2: decreasing budget because research excellence must off-load this kind of work to industry (self-service research)  
seq. 3: start up low, but increasing as we manage to articulate the core research challenges

## Response

*The general standpoint of the Roadmap is that the Policy/Business-Economic/Technical dimensions of Enterprise Interoperability are “mutually interdependent and reinforcing” (Section 4.4). We accept that for the purposes of carrying out the research work arising from the Roadmap, a differentiation is needed and hence the Research Challenges in Annex I are allocated in accordance with the above dimensions. We would appreciate specific comments in relation to your topline point 1.*

*Thank you for the link to the telecom regulation report concerning Canada. As this is a very large report, we would appreciate your pointer to specific aspects raised in the report.*

*Concerning separation of economic, social and technology policies, note that general policy issues, including their relationship with research (policy) issues, are outside the scope of the Roadmap. See General Comment 2.*

*The ISU Grand Challenge covers various Policy/Business-Economic/Technical research issues. Concerning the stakeholders and their roles in the research work of the ISU, it would be up to the consortia interested in the research work to propose; it is not a matter for the Roadmap itself to address.*

*We note your “role-based” analysis of the 3 domain-relationship sequences (ref: Figure 2, Relationship between the Domains) with interest. This line of enquiry could be a useful line of enquiry for particularly the business-economic aspects of the research arising from the Roadmap. However, we do not fully agree with your analysis in relation to the present sequences. Note that the sequences relate to the formulation of the Research Challenges, not the direction of the Roadmap as a whole, which targets break-through research with industrial relevance (Scope, Section 2.3,) and within the i2010 policy framework (Background, Section 2.1). The principles for setting the Grand Challenges are identified in Section 4.5. Budgetary considerations are outside the scope of the Roadmap.*

## 37. Comments received from Roland Jochem, University of Kassel

Received on 12 June 2006.

### Issue 298

Category: general

I read the new version 3.0 of the roadmap and I think it is on the right track. The vision, the grand challenges and the resulted ideas for very general are focused, interrelated and described more precise than in Version 2.0. But from my point of view it is not enough to formally allocate the very structured Research tasks from Version 1.0 to the grand challenges/new ideas. It is necessary to describe and elaborate the linkage/relation of the very general challenges/ideas and the more concrete research tasks from Version 1.0 (including the additional comments from the January and March workshops). Because then it becomes a “full and complete roadmap” from the vision to challenges, from Challenges to new ideas, from new ideas to more or less concrete research tasks. So only the last step is still missing.

That would be my wish for the **final roadmap**.

## Response

*In the final version of the Roadmap, each Grand Challenge provides links to the Research Challenges in Annex I. The Annex I, which is largely based on version V1.0 of the Roadmap, provides indicative Research Challenges. These are given as exemplary, not prescriptive challenges. Hence a rather loose link between the Grand Challenges and the indicative Research Challenges.*

*The general orientation of the Roadmap was confirmed during the 16 June 2006 workshop. A (more) prescriptive roadmap would need to contain the links that you mention.*

## 38. Comments received from Guenter Boeckle, Siemens

Received on 14 June 2006.

### Issue 299

Category: enterprise

After a brief look at the documents, I think a topic is missing that seems quite relevant to me: development processes. Nowadays, the fact that different companies have different development processes (well, some even have no defined process at all) is preventing a close collaboration. Currently, collaboration typically means that company A develops a requirements specification, sends it to company B, which takes it, develops its product and delivers it back to company A. (It may in the same way outsource some of its work to other companies). However, a close collaboration means that A, B, and others determine the requirements together, and have an incremental development processes, each increment synchronized so that their intermediate results can be tested together (for models this means that their partial models can be integrated into a full model, for software this means that the different software modules can run together). Thus, users or multi-partner review teams can immediately specify improvements for the intermediate results which can then be incorporated for the next process increment.

But how can I make sure that the results of A are of the same quality and content as from B? That they have the same interface interpretation? etc.

This means that we have to abstract from the common development process models, like SPICE, CMMI, V-Model XT, Métrica 3, etc. and bring them together in a higher abstraction level - in a process framework. This process framework must help so that:

- Participating partners can map their vocabularies (well, here the ontologies are necessary)
- Trust can be established; trust means more than just liking a guy. It means that a proper Quality Assurance Process is in place that has been agreed upon by all collaborating partners and that can be controlled by all collaborating partners.
- Different levels of agility are supported, adapted to the collaborating companies' cultures, yet still allowing integrating intermediate results, evaluating them, and deducing change requests to improve the common products continuously.

Defined processes are necessary to avoid chaos and to define the "rules of the game". However, they must be flexible, so that they are not felt as a straight jacket by the people in the companies. Development processes bring together the technology, the economy and business administration, the organisation, and the company culture.

We should also distinguish between the business processes that tell how to interact with the customers and the development processes that specify how development of products, systems, and solutions for customers is being performed.

It may help to mention that I work in a department where we perform process assessments and improvements for all Siemens divisions (so far hundreds of assessments and improvements). One of the major directions for changes of processes in the future is that there will be much more and also closer collaboration. We will have to define adequate processes for that. As in real life we need some simple rules how we would like to work together - in the business world we are then talking about processes.

### Response

*Thank you very much for your contribution, which is appreciated. We as editors are in agreement that the distinction between business processes and development processes is very important. It may be said that lack of clarity between these processes has contributed to the slow progress in the definition of Web Services protocol "stack" and continuing discussion about the nature of Web Services. A related question could be who defines the "rules of the game" (as you have put it) – developers, integrators or users?*

*Within the Roadmap, the ISU Grand Challenge, for example, is based on a differentiation between commoditising IT development processes and value-added business processes – please refer to Section 5.3 of the Roadmap.*

*More generally, we believe that the issues that you have raised will need to be comprehensively tackled by the stakeholders in Enterprise Interoperability. They could become a major focus of future research projects arising from the Roadmap and elsewhere. We hope that users of the Roadmap will pay careful attention to your contribution.*

## **39. Comments received from Piero De Sabbata, ENEA**

Received on 14 June 2006.

### **Issue 300**

Category: editorial

In the enterprise interoperability roadmap v. 3.0 available on Cordis, at page 5, near to 'sector specific specifications' it is written that one sector specification is

'Euratex in textile'

but surely the author thought to

'TexWeave in textile'

('euratex' is the industry trading association -promoting TexWeave but not focused in standardisation- while TexWeave are the specifications formalised in collaboration with CEN/ISSS and the workshop participants)

### **Response**

*Thank you. Actually, it was a list of organisations that produce sector specific specifications, not a list of the specifications. So, 'EURATEX' was correct.*

## **40. Comments received during the final consultation workshop**

Received on 16 June 2006. For a complete report of the workshop, please refer to [ftp://ftp.cordis.europa.eu/pub/ist/docs/directorate\\_d/ebusiness/ws20060616-report\\_en.pdf](ftp://ftp.cordis.europa.eu/pub/ist/docs/directorate_d/ebusiness/ws20060616-report_en.pdf).

The issues in Table 2 of the report are the same issues as represented under this chapter.

### **Issue 301**

Category: general

### **Discussion on Roadmap v3.0 Sections 1, 2, 3 and 4**

1) Jan Goossenaerts:

In addition to the "problem space", the Roadmap should highlight the "opportunity space" and the "directive space".

### **Response**

*The Grand Challenges could arguably comprise the "opportunity space". The meaning of the "directive space" is not understood. If it means policy measures, then such are outside the scope of the Roadmap. See General Comment 2.*

### **Issue 302**

Category: general

2) Eugene Sweeney:

ICT is becoming an available infrastructure, so interoperability relates to addressing enterprise problems using ICT. There is a need to include socio-economic aspects, human aspects, as well as technological aspects. Groups of researchers are also addressing legal and social implications of Web 2.0 etc.

#### **Response**

*Agreed. The Roadmap is not a technology roadmap and needs to address aspects beyond technology. The Roadmap covers issues within three dimensions – policy, business-economic and technical (Section 4.4).*

### **Issue 303**

Category: general

3) Alan Southall:

Additional relevant issues include P2P systems and globalisation.

#### **Response**

*These are mentioned in the Roadmap in respect of various contexts.*

### **Issue 304**

Category: general

4) Sergio Gusmeroli:

The scope of the Roadmap is quite broad. Is this a roadmap for the entire “ICT for Enterprise Networking” unit? It has some overlaps with Collaborative Business, and it would be useful to include some reference to “collaborative business networks” in (the title of) the Roadmap. Links to other communities are important.

#### **Response**

*This Roadmap does not cover the whole “ICT for Enterprise Networking” area. Other roadmaps and initiatives exist within and beyond the above area. This Roadmap concerns Enterprise Interoperability. See also General Response 2.*

### **Issue 305**

Category: general

5)

Should the focus be on a “Science” or on EI?

#### **Response**

*The focus is on Enterprise Interoperability, though a Grand Challenge concerns establishing a science base for Enterprise Interoperability.*

### **Issue 306**

Category: enterprise

6) Guenter Boeckle / Martin Hepp:

Previously, the focus was on internal processes, on how different parts of a company interoperate. The state-of-the-art was “Requirements Specification + Design Model”. Within their walls, enterprises have problems with development processes, which should not be prescribed.

Future focus will be on interoperability between different companies and different processes. Processes include development processes. Processes cannot be fixed and there is a need for a process framework.

Furthermore, like in the "Software as a Service" concept, building blocks are needed to assemble flexible processes. Ontologies are key to interoperability of these processes. Also, software design is very important. We need building blocks within process frameworks to be assembled as the process of building a VO. This may cut across the grand challenges.

In a few years CMMI level 3 will be mandatory within the automotive supply chain.

#### **Response**

*Agreed – see also response to Issue 299.*

#### **Issue 307**

Category: general

7) Rainer Ruggaber:

Some of the base technologies for EI are already there and available (e.g. SOAP, WSDL) although others are still only concepts.

#### **Response**

*It is understood (at the 16 June 2006 Workshop where the above comment was made) that the comment relates to specific technologies and standards mentioned in the Problem Space (Section 3.2, Roadmap V3.0). To avoid ambiguity, the text of this section has been reviewed and revised in finalising Roadmap V4.0.*

#### **Issue 308**

Category: general

8) Colin Piddington:

How do we take the challenges and then come back to projects? The difficulty is that management is focused on value increase and shareholder value, but EI is largely focused on innovation and new product introduction. The first requires a disconnected, static set of Key Performance Indicators, whilst EI is about change management, and there are few or no enterprise KPIs for change management.

#### **Response**

*The problem is recognised, perhaps as endemic to all change management and innovation. The trick must be to link the predicted results of a step change in operating practice consequent improvements in conventional management measures. This may well be addressed by research under Sections 7.3.2, 7.3.4, 7.3.7 and 7.3.8.*

#### **Issue 309**

Category: SMEs

9) Alan Southall:

There is a focus on large enterprises. The Roadmap should refer to and address long tail effects (e.g. Amazon, who gets 50% of its revenues from popular and 50% from non-popular (here: "the long tail") books). Time is critical. Capture and emphasise the dynamics to be able to exploit market opportunities, including in niche markets. This is vital for the future of small companies.

#### **Response**

*We sought to write a document that is not focused on large enterprises. In fact, we consider that even business units of large enterprises are today behaving more like small enterprises than like large enterprises. Hence, an emphasis on ISU, Web Technologies, and Knowledge Oriented Collaboration, which we feel will facilitate the adoption of Enterprise Interoperability solutions by SMEs.*

### **Issue 310**

Category: standards

10) Piero de Sabbata:

The problem space does not sufficiently address the requirements from SMEs. SMEs might benefit from standards and are also dependent on standards, but standards organizations are not really responding to SME needs. The Roadmap should address the process of generating standards for this reason, particularly in the context of the ISU.

#### **Response**

*The Roadmap put considerable emphasis on SMEs throughout. The ISU is conceived to be particularly attractive for SMEs and start-up companies (see ISU Grand Challenge). Standards issues are outside the scope of the Roadmap. See General Response 2.*

### **Issue 311**

Category: general

11) Jean-Pierre Lorré:

Open source middleware is not yet covered in the state-of-the-art section and is a vitally important issue to be addressed. Thanks to open source, there are new ways of innovation.

#### **Response**

*The open source aspect is added to the State of the Art section in Roadmap V4.0 (Section 3.1).*

### **Issue 312**

Category: general

12) Tapio Rissanen:

Trust and Security aspects are dispersed over the roadmap. Trust and security should be structural issues in the four Grand Challenges. With the right vision (e.g. Digital Signatures, Root CA and smart cards), this can and must be put in place now. The roadmap must be able to presume this is operational.

#### **Response**

*Similar to Issue 440, which is an expanded version of Issue 312. See response to Issue 440.*

### **Issue 313**

Category: general

13) Elmar Husmann:

There is an overlap between this roadmap and the questions being addressed in the DBE project. The Roadmap should specify how it relates to the priorities defined in DBE.

The approach to be taken is important. For example, NESSI adopts a process-driven approach. The concept of SOKU from the Grid community looks at services from the bottom. In contrast, the Roadmap looks at services from the top.

#### **Response**

*Concerning DBE, see response to Issue 304.*

*Concerning approach, the Roadmap is not prescriptive of the approach to be taken in the research work arising from the Roadmap. See the second paragraph of Scope, Section 2.3.*

*Concerning NESSI, see Response to Issue 1.*

*The "self-\*" characteristics and properties of services are envisaged to be of importance for the ISU services, with reference to SOKU (Section 5.3.2.).*

*Services science is among the sciences proposed for investigation in the Science Base Grand Challenge (Section 8.3).*

### **Issue 314**

Category: General

14) Max Lemke:

Many communities are coming together in NESSI. In addition, the Next Generation Grids Expert Group defined the concept of the Service-Oriented Knowledge Utility (SOKU), mainly from a service provision point of view. The result is a utility-like interoperability infrastructure.

### **Response**

*See response to Issue 286. See also response to Issue 313.*

*For the concept of the Service-Oriented Knowledge Utility (SOKU), please refer to "Future for European Grids: GRIDs and Service Oriented Knowledge Utilities – Vision and Research Directions 2010 and Beyond", January 2006.*

[ftp://ftp.cordis.europa.eu/pub/ist/docs/grids/ngg3\\_eg\\_final.pdf](ftp://ftp.cordis.europa.eu/pub/ist/docs/grids/ngg3_eg_final.pdf)

### **Issue 315**

Category: Knowledge-Oriented Collaboration

### **Discussion on Roadmap v3.0 Section 5: Knowledge-Oriented Collaboration**

15) Sergio Gusmeroli:

The objective of collaboration in EI is business oriented, and not knowledge oriented. The title of the first Grand Challenge should be re-visited. In addition, more reference should be made to existing research in the collaborative business area.

### **Response**

*Agreed: the Grand Challenge is concerned with enterprise collaboration based on the knowledge derived from and available to collaborators.*

### **Issue 316**

Category: Knowledge-Oriented Collaboration

16) Natalino Curci:

The concept and role of Trusted Third Parties should be introduced as this is very important when considering sharing and protecting knowledge.

### **Response**

*Importance agreed. It is a role of ISUs as described in the ISU Grand Challenge, and is a major contributor to this Grand Challenge.*

### **Issue 317**

Category: Knowledge-Oriented Collaboration

17) Michele Missikoff:

A distinction should be made between knowledge as an instrument and as a merchandise/product. In the KOC GC, is knowledge seen as an instrument or as a product?

### **Response**

*Knowledge is an instrument to drive collaboration, but everyone using it is potentially developing it. The comment is addressed in Section 7.3.1.*

### **Issue 318**

Category: Knowledge-Oriented Collaboration

18) Michele Missikoff / Eugene Sweeney / Jan Goossenaerts:

A definition of knowledge should be included as well as a reference to research on the Knowledge Economy and on access rights to the knowledge.

#### **Response**

*Research relating to the Knowledge Economy and its legal/commercial framework is intrinsic to the Grand Challenge. The comment is addressed in Section 7.3.1 and the related footnote.*

#### **Issue 319**

Category: Knowledge-Oriented Collaboration

19) Guenter Boeckle:

It is important that the process of developing collaborations to participate in the whole process of product exploitation is included in the GC. Future collaborations will include product design and design of the dynamically evolving VO to proceed through manufacturing system design etc. Western economies are dependent on maintaining this capability to survive.

#### **Response**

*Strongly agree. This is the major thrust of the Knowledge-Oriented Collaboration Grand Challenge. The comment is addressed in Section 7.3.2.*

#### **Issue 320**

Category: Knowledge-Oriented Collaboration

20) Hans Akkermans / Martin Hepp:

The roadmap should sharpen the focus of the KOC Grand Challenge to put knowledge to work. Knowledge is positioned as a kind of static thing; ontologies are almost like rocks. The prime research emphasis should be action oriented and focus not on how to represent things but more so on how to bring processes (and services) together and manipulate them. Shift to a functional view and on the business data that must be exposed for interoperability to occur.

#### **Response**

*The Knowledge-Oriented Collaboration Grand Challenge is focused on addressing the enterprise issues identified in 5.2. Knowledge is certainly not seen as static, and indeed many of the issues arise out of its constant evolution within individual enterprises and across virtual organisations.*

#### **Issue 321**

Category: Web Technologies

#### **Discussion on Roadmap v3.0 Section 6: Web Technologies for EI**

21) Sergio Gusmeroli:

Interpretation of Web 2.0 as presented is biased towards networks and telecoms, and not focused on social networking or social communities. The Roadmap should also emphasise human-machine interactions and the nature and social aspects of people being prosumers, i.e. both producers and consumers of knowledge. This Grand Challenge has a very broad scope, and might look more closely at what other clusters/communities/units are doing, in particular the Collaborative Working Environments community.

#### **Response**

*We sought to provide it with the social (network) dimension in the last research area (Section 6.3.4 Web Community Solutions). The challenge was slightly rewritten and we hope it now reflects adequately this dimension.*

*For the Collaborative Working Environments community, please refer to:  
[http://europa.eu.int/information\\_society/activities/atwork/index\\_en.htm](http://europa.eu.int/information_society/activities/atwork/index_en.htm)*

**Issue 322**

Category: Web Technologies

22) Guenter Boeckle:

If we broaden the research agenda, we need to listen carefully to others working independently on similar topic(s). For example, NESSI could start up a Working Group on Enterprise Interoperability.

**Response**

*See response to Issue 1.*

**Issue 323**

Category: Web Technologies

23) Natalino Curci:

There is a need to focus on intranet and extranet web transactional services and work on knowledge collaboration. For instance, business collaborations lead to new types of contracts. The same problem has occurred 500 years ago, leading to the emergence of Trusted Third Parties and Notaries.

**Response**

*We have not considered this as an explicit research category, although there is some overlap with research ideas in Knowledge-Oriented Collaboration Grand Challenge. Nonetheless, it is our view that this can and should be considered within the scope of one or more research project proposals.*

**Issue 324**

Category: Web Technologies

24) Jan Goossenaerts:

There is an overlap with the Collaborative Working Environments community. (Reference) architectures emerging from various communities need to be aligned. Coordination is needed to get a minimum set of requirements common to all proposed (reference) architectures.

**Response**

*See response to Issue 304.*

**Issue 325**

Category: Web Technologies

25) Peter Hofbauer:

The Roadmap also needs to focus on higher level protocols for supply chain interoperability (e.g. automotive supply chain)

**Response**

*We feel that solutions should be based on the Web as a platform. We feel that this approach is compatible with industry specific approaches (within the context of individual research projects).*

**Issue 326**

Category: Web Technologies

26) Colin Piddington:

Maybe we are looking too much at the details. A broader mind set is needed when addressing research on EI. The human dimension is often minimised whereas the human is the main decision maker of the system. This is also relevant for the Science Base Grand Challenge.

## **Response**

*In laying out the research Roadmap, we had to identify a number of research areas that could be addressed in spite of the human dimension aspect referred above. This would have to be specific enough to be considered by stakeholders.*

## **Issue 327**

Category: Web Technologies

27) Rainer Ruggaber:

The added value and goals of this Grand Challenge are not sufficiently clear. The requirement is for Web Community solutions for EI and it should be left to the market to define the reference architectures.

## **Response**

*We have rewritten this section in a way that we feel allows more scope for Web Community research proposals.*

## **Issue 328**

Category: Web Technologies

28) Robert Meersman:

The work in the Collaborative Working Environments and Knowledge Technologies communities has a lot of overlap with the work in Enterprise Interoperability. This Roadmap is holistic and elaborate, but it is perhaps too broad. One is almost prompted to ask what else exists in FP7. The roadmap should be made as useful as possible. There should be a crystal clear focus on specific enterprise factors such as addressing legacy systems and scalability requirements. The current document abstracts away from the enterprise.

## **Response**

*Agreed. The Roadmap must have a clear focus. We need to drill down to specific issues and link to these enterprise challenges. The Grand Challenges have been reviewed and where necessary revised to strengthen the focus on enterprises in Roadmap V4.0.*

*Concerning relationship with the work of other communities, see response to Issue 304.*

## **Issue 329**

Category: Web Technologies

29) Hans Akkermans:

Certain aspects are not generic. Some sections of the roadmap do not mention the word "enterprise". These should identify a number of points specific to enterprises and focus more on issues important to SMEs such as methodological aspects and on service layers.

## **Response**

*See response to Issue 328 concerning the focus on enterprises.*

*The Roadmap places emphasis on SME issues. The ISU, for example, is conceived to be particularly attractive for SMEs and start-up companies.*

## **Issue 330**

Category: Web Technologies

30) Sergio Gusmeroli:

More information on developments to be addressed in meeting this Grand Challenge will be presented and discussed at the 7th IFIP Working Conference on Virtual Enterprises, PRO-VE' 06, Helsinki, 25-27 September 2006 (see <http://www.pro-ve.org/>)

**Response**

*Thank you for the information which is noted.*

**Issue 331**

Category: ISU

**Discussion on Roadmap v3.0 Section 7: Interoperability Service Utility**

31) Guenter Boeckle:

Are business models a topic for research under this GC?

**Response**

*Yes, as identified in Section 5.3.3.*

**Issue 332**

Category: ISU

32) Suzanne Garcia:

The ISU is a paradigm shift, and needs more than just regulation, e.g. transition mechanisms.

**Response**

*The ISU may or may not need regulation (see Section 5.3.4.). Interworking with and transitioning from existing systems has been added to the discussion on ISU design principles in Roadmap V4.0.*

**Issue 333**

Category: ISU

33) Jan Goossenaerts:

The ISU could link FP7 and CIP. It could be the device to link research to industry (respectively FP7 and CIP). There is scope beyond the research agenda, which needs to be complemented by other measures anyway. The ISU therefore is a link to much more than the Roadmap, and needs to be sold to strategy groups like those working on i2010.

**Response**

*The same issue is raised by the same contributor in Issue 280. See response to Issue 280.*

**Issue 334**

Category: ISU

34) Jan Goossenaerts:

A comparison can be made with cars 200 years ago. When cars were added to the transportation network, mobility was achieved independently of the left/right rules. However, a new petrol service infrastructure was required. One needs to distinguish between left/right choices and true functionality. For example, to achieve competitiveness we need standards for determining who is responsible for giving right of way (e.g. access to technology considered proprietary). Also, in considering the mobility of data, the added value of mobility in an economic system is important.

**Response**

*The description of the ISU Grand Challenge does not prescribe left/right choices. This has been checked in finalising the ISU text for Roadmap V4.0. An explicit statement to this effect has also been added to the introductory part of Section 5.3 in Roadmap V4.0.*

*The economic consideration of the ISU, including its business model, is part of the ISU research.*

### **Issue 335**

Category: ISU

35) Michele Missikoff:

The comparison between moving people and moving data is not entirely correct. The differences between function and form should be made explicit. Information transfer requires new techniques to ensure that interpretation of information is also transferred. We must make transparent the semantic differences when moving data around. Transparent semantic reconciliation is needed.

### **Response**

*Noted. The need to provide transparent semantic reconciliation is added to the services section of the ISU (Section 5.3.2) in Roadmap V4.0.*

### **Issue 336**

Category: ISU

36) Dirk Werth:

The current ISU focus appears to mainly address back-office issues. Integration/interactions among humans and between humans and organisations are missing.

### **Response**

*The text has been checked. We do not believe that the ISU description has a focus on back-office issues. The ISU is about information exchange at the infrastructural level. Human related issues are not of particular relevance for the ISU (as opposed to other Grand Challenges in the Roadmap).*

### **Issue 337**

Category: ISU

37) Elmar Husmann:

There are interrelations between architectural paradigms, business models, and characteristics of the community. Choices in one limit the choices in the others. The Roadmap can either make choices or refrain from making choices. It is recommended to stay on the overview level, to provide transparency on different approaches, and not to make the individual left-right choices. The Roadmap should focus on the upper level, and leave the choices to the researchers and projects.

### **Response**

*Indeed the Roadmap is positioned at the strategic ("overview") level and does not make prescriptions as regards available/possible options. See the section on Scope, Section 2.3.*

*In the final version of the ISU in Roadmap V4.0 (introductory part of Section 5.3), the inter-relationships between 1) how the ISU should be built; 2) the individual ISU services; 3) the validity and sustainability of specific business models for the ISU; and 4) specific ownership, operational and governance models; are explicitly acknowledged. These issues and their relationships are also acknowledged as part of the research work on the ISU.*

*Concerning ISU and left/right choices, see response to issue 334.*

### **Issue 338**

Category: ISU

38)

When starting a business one can check the added value chain. The roadmap should provide equally valuable guidance for researchers about to embark on projects.

### **Response**

*The relationship between the two sentences above is not fully understood.*

### Issue 339

Category: ISU

39) Guenter Boeckle:

Does creation of a huge utility environment not seem at odds relative to impact on existing utilities?

#### Response

*The focus is on research. The results may or may not work in practice. The validation of the ISU concept is very much part of the research. There is no existing utility as that envisaged for the ISU.*

### Issue 340

Category: Science Base

#### Discussion on Roadmap v3.0 Section 8: A Science base for EI

40) Jan Goossenaerts:

There is a possible conflict of interest in the roadmap between relevance for industry and being good scientists. In solving a business problem, you do not know what science to use beforehand. Science creates knowledge for the public domain, research creates technologies. This potential conflict needs to be identified and described.

#### Response

*It is recognised that the inter-relationship between science, invention, research and technology development is a subject of debate. It is not within the scope of the Roadmap to specifically address such issues. The research work on this Grand Challenge could however shed insight (see Section 8.3, Footnote 60, Roadmap V4.0).*

### Issue 341

Category: Science Base

41)

Systems theory has a long record of producing science. We are facing increasing complexity. Research is required on the basic issues including how to manage the complexity, such as

- Fundamental research on complex adaptive systems
- Relationships between producers and consumers of knowledge
- The fundamentals of holistic frameworks; an interoperability science is maybe not needed, and might be integrated in other existing disciplines
- The space of education including both business and academic spaces.

#### Response

*Investigation into systems/complexity science is part of the research identified in the Science Base Grand Challenge.*

### Issue 342

Category: Science Base

42) Guenter Boeckle:

We need a theoretical foundation for things to work. For example, what does a transaction mean? We need a living list of topics for scientific work.

#### Response

*A list of indicative topics is provided for the Science Base Grand Challenge. As mentioned in this Grand Challenge, additional topics may be identified. The nature of (information) transaction is envisaged to be addressed particularly in relation to Information Science.*

**Issue 343**

Category: Science Base

43) Juan Martin:

A possible new science is the governance of business networks, including scientific study of reference models, transactions on the web, certification entities etc.

**Response**

*Business network governance science is included as a potential research topic (Section 8.3.8, Roadmap V4.0).*

**Issue 344**

Category: Science Base

44) Aurelian Mihai Stanecu:

The Science base for EI can/should a) draw on and apply information from other sciences, as well as b) develop an applied science related to enterprise interoperability. Research into the aspects of intention and motivation for cooperation is essential.

**Response**

*a) and b) are among the core concepts leading to the Science Base Grand Challenge. The research in relation to social sciences would cover intention and motivation for cooperation.*

**Issue 345**

Category: Science Base

45) Robert Meersman:

The focus of this Grand Challenge should be on enterprise issues. There must be business pull and an enterprise outreach (in this respect, the Semantic Web can be perceived as a failure so far). A topic that is missing is a methodology (or rather change management, or management science), which is needed as it plays a crucial role in adoption of technology by enterprises. The Roadmap needs to contain work items that appeal to decision makers in enterprises.

**Response**

*The enterprise issues have been further strengthened in finalising the Science Base Grand Challenge for Roadmap V4.0.  
Change management science is included as a potential research topic (Section 8.3.8, Roadmap V4.0).*

**Issue 346**

Category: Science Base

46) Eugene Sweeney:

The Science Base Grand Challenge is a new discipline for enterprise interoperability. The list of sciences is ring-fencing the enterprise interoperability domain. The "science" includes engineering, design and implementation. We need a new foundation of science for enterprise interoperability.

**Response**

*The above is reflected in the description of the Grand Challenge.*

**Issue 347**

Category: Science Base

47) Colin Piddington:

ICT makes people conform to the system. We must now learn to encapsulate the human interventions needed when non-conformities occur. This includes encapsulating the different interpretations which arise. This means we have to get modularity into the ICT systems to allow adequately flexible assembly of systems. Research is needed to identify where the modularity is needed.

### **Response**

*Modularity of ICT systems is envisaged to be addressed in relation to various sciences, including information science and the proposed topics of decision science and change management science. Human-machine relation is part of the proposed research in relation to Social Sciences. Note that the research work is envisaged to be multi-disciplinary and cross-cutting.*

### **Issue 348**

Category: Science Base

48) Hans Akkermans:

This Grand Challenge is an ideal but possibly steep challenge. The general opinion is that science precedes technology, which in its turn precedes applications. Generally today, science follows technology developments and not so much the other way around. For instance, the steam engine was around before thermodynamics; same for the computer and computer science. In other words, invention precedes research.

Science requires a period of reflection, hypothesis formulation and experimental investigations. In some contexts, the more scientific the research, the less relevant it may seem to everyday life. On the other hand, a science base is very relevant for effective dissemination, and for diffusion of concepts via student teaching etc. It must be recognised that there is usually a long cycle from research to the adoption of research results by industry. Education therefore is critical.

“Decision science” may be one of the most relevant scientific disciplines within the scope of EI. Areas of interest should include governance of networks, information management science and human aspects.

Ultimately, we must not delimit the scope of science and the nature of science.

### **Response**

*Concerning science and technology, see response to issue 340.*

*In addition, footnote 60 states: it is not the purpose of the present Grand Challenge to (re-)define / (re-)classify the various scientific fields or disciplines, or to enter into the general debate about the nature of science, and what may or may not constitute or merit the label of “science”.*

*Decision science is included as a potential research topic (Section 8.3.8, Roadmap V4.0).*

## **41. Comments received from Kurt Kosanke, CIMOSA Association**

Received on 18 June 2006.

### **Issue 349**

Category: editorial

General remarks: 1) references to previous versions is not helpful and has to be eliminated, 2) Sections seem to be written as stand alone parts e.g. restating rationales. The resulting redundancy could be removed and the document shortened accordingly.

### **Response**

*In the final version of the Roadmap, a relation has been established between the Grand Challenges and the challenges in Annex I. Although the Annex I is largely based on version V1.0 of the Roadmap, it is an annex and not a previous version.*

*In the process of writing the Roadmap, different sections were written by different people. The chapters with the Grand Challenges (Chapters 5 – 8) follow the same structure. Content may appear similar, but is different.*

### Issue 350

Category: vision

On Scope or Vision:

Following the discussion during the meeting [on 16 June 2006] I like to see the Roadmap restricted to ICT and its interaction with people. With other words we should not take into account the human to human interactions. Even with the problem of semantic distance in communications (the message intended by the sender vs. the message perceived by the receiver) we have an almost unsolvable problem, let alone the problem of human behaviour with all their included cultural and other differences.

### Response

*There is no suggestion in the Scope or Vision of the Roadmap that non-ICT human-to-human interactions are appropriate for addressing in the Roadmap as specific research challenges.*

### Issue 351

Category: vision

Another problem I see on the focal point on innovation. There has to be more emphasis on the enterprise operational needs as well. Collaboration is on current core competencies of companies as well (the state of practice). The legacy was mentioned as an important point. Another one may be education and training to manage the impact of changes of regulations, procedures, and the environment at large.

### Response

*The Roadmap is a contribution to FP7; see Objectives (Section 2.2). The overall focus of the Roadmap on innovation is entirely in line with the 2<sup>nd</sup> Pillar of i2010 (innovation and investment in research). Operation and legacy issues obviously are important and current state of practice as well as state of the art and state of play should be the baseline for the research work to be carried out. The need for enterprises to collaborate and to focus on core competencies is underlined in the Vision chapter of the Roadmap. Education and training is indeed important and is expected to be a basic requirement for IST Integrated Projects to be financed under FP7.*

### Issue 352

Category: standards

On State of the Art:

The current state of both de facto and de jure standardisation should be included (state of practice again). The attached file presents some information of standards developed by CEN and ISO including short descriptions of two de facto standards (BPML and ebXML) as well (see attachment below). These standards are aimed on integration and unification, but will support federated approaches as well by providing knowledge about entities to be exchanged between the collaborating partners. Special attention should be given to the ISO standards, 15745 and 16100. Both standards define profiles, which are to describe capabilities of the entities involved in transactions in terms of required inputs and provided outputs. Such profiles would enable partial matching of entities involved in an exchanged.

### Response

*Examples of some standards, both de facto and de jure, are given in the State of the Art section of the Roadmap (Section 3.1). Given the large number of available and emerging standards and other publicly available technical specifications, as well as profiles of these, which could be of interest to Enterprise Interoperability, it would be impossible to provide comprehensive citation. In any case, such is not the purpose of the Roadmap, which is a research roadmap as opposed to a standards roadmap. See also General Response 2.*

**Issue 353**

Category: editorial

On Problem Space: What is asymmetric information (please define)?

**Response**

*Thank you. Asymmetric access to information refers to situations where one or more parties have information that others do not. The most common case is in financial markets insider information about enterprises giving advantages in stock picking.*

*The sentence has been reworded, and now reads “privileged” instead of “asymmetric”.*

**Issue 354**

Category: editorial

On Vision: What is an ecosystem (please define)?

**Response**

*The concept of an ecosystem has been key to much of the work of the DG INFSO Unit D5. See the website of this unit <http://cordis.europa.eu/ist/ict-ent-net/index.html> or <http://www.digital-ecosystems.org/>.*

**Issue 355**

Category: general

On The Grand Challenges and Research Challenges: I do not really see any relation between the principles stated and the four GCs.

**Response**

*It is difficult to respond to this comment without going through the entire roadmapping exercise and/or perhaps starting another roadmap. The commentator is requested to make more specific comments.*

**Issue 356**

Category: editorial

On 5.2 Problem Statement: ... in order to exploit new product ~~s~~ and service ~~s~~ **Opportunities**.

**Response**

*Thank you. The sentence was corrected as suggested.*

**Issue 357**

Category: ISU

On 7 GC ISU: what are the perceived relations between the ISU and the Web OS?

**Response**

*The ISU is conceived to be a basic “infrastructure” that supports information exchange between diverse knowledge sources, software applications, and Web services. The Web OS is concerned with value-added solutions using the next generation of Web technologies. Therefore, the Web OS services would be among the value-added services that “flow” above the ISU.*

**Issue 358**

Category: editorial

On Problem Space: What is asymmetric information (please define)?

## Response

[See response to Issue 353.](#)

## Issue 359

Category: standards

### Standardisation related to Enterprise Engineering and Integration

<i>General Standards</i>		
ISO 14258 (1998) Concepts and rules for enterprise models		
ISO 15704 (1999) Requirements for enterprise-reference architectures and methodologies		
<i>Frameworks</i>	<i>Languages</i>	<i>Modules</i>
ISO 15745 (2001). Open systems application integration frameworks	ISO 18629(2001). Process specification language	ISO 15531 (1999). Manufacturing management data exchange: Resources usage management
CEN ISO 19439 (2002). Framework for enterprise modelling	CEN-ISO 19440 (2003). Language constructs for enterprise modelling	ISO 16100 (2003). Manufacturing software capability profiling for interoperability
ISO/IEC 15288 (1999). Life cycle management	ISO/IEC 15414 (2000). Open Distributed processing – reference model – enterprise language	IEC/ISO 62264 (2003). Enterprise control systems integration
ISO NWIP (2003). process model interoperability	BPML (2001). Business Process Modelling Language	
	ebXML (2001). Electronic Business using eXtensible Markup Language	
	POP* (2005). ATHENA (Process-Organisation-Product- Others	

Figure 1: Standards related to Enterprise Engineering and Integration

#### General Standards

*ISO 14258 (1998). Concepts and rules for enterprise models*

Defines elements for enterprise modelling, concepts for life-cycle phases and how these models describe enterprise hierarchy, structure and behaviour, together with guidelines and constraints for relating the real world to enterprise models through views.

*ISO 15704 (1999b). Requirements for enterprise-reference architectures and methodologies*

Places the concepts used in methodologies and reference architectures such as ARIS, CIMOSA, GRAI/GIM, IEM, PERA and EN ISO 19439 (2003) within an encompassing conceptual framework. The standard draws heavily on the work of the IFAC/IFIP Task Force on Enterprise Integration (1999). Starting with the requirements for a framework of process based enterprise modelling; the standard defines concepts of life cycle phases, model views and levels of genericity, together with framework elements for engineering methodologies, modelling languages, tools models and support modules as major components for business process modelling.

#### Framework type Standards

*ISO 15745 (2001a). Open systems application integration frameworks*

A multi-part set of standards that defines an application integration framework - a set of elements and rules for describing application interoperability profile(s) to enable a common environment for integrating applications and sharing life cycle information in a given application domain.

Subsequent parts of this standard define the rules for describing profiles based upon particular technologies - it is intended that such rules be used in conjunction with this part to form a complete application integration framework. The specifications of profiles for particular industrial applications are not in the scope of this International Standard.

*CEN-ISO 19439 (2002). Enterprise Integration - Framework for Enterprise Modelling*

Describes the modelling framework that fulfils the requirements stated in ISO IS 15704. The work is based on earlier work in ENV 40003. Following the framework of the Generalised Enterprise Reference Architecture (GERAM) proposed by the IFAC/IFIP Task Force and using the general solution identified in ENV 4003, the standard identifies a three-dimensional structure with seven life cycle phases, three levels of genericity and a minimum set of four model views.

*ISO/IEC 15288 (1999). Life cycle management*

Identifies a framework for a system life cycle from the conception of ideas through to the retirement of a system. It defines the processes for acquiring and supplying system products and services that are configured from hardware, software and humans. In addition, this framework provides for the assessment and improvement of the life cycle.

The processes in this standard form a comprehensive set from which an organisation may construct life cycle models appropriate to the product and service types and markets which they trade.

*ISO NWIP (2005) Requirements for enabling information interoperability in manufacturing-enterprise processes and their models*

This multiple-part standard establishes a base for interoperation in unified, integrated and federated operational environments of manufacturing enterprises. It defines in its different parts an interoperability framework and specifies processes and underpinning metadata that must be in place to establish or to negotiate and enable information-interoperability solutions for manufacturing-enterprise-processes (MEPs) and their models. It describes the different types of environments and their particular requirements. It is concerned with the operational interworking of MEPs and the interoperability of their supporting software applications. This standard focuses on enabling the communication rather than defining the communication itself, and is thus independent of specific technologies.

### **Language type Standards**

*ISO 18629 (2001b). Process specification language*

A multi-part set of standards that describes what elements inter-operable systems should encompass, but not how a specific application implements these elements and provides a description of the core elements of the language defined within the standard.

It is not the purpose of the standard to enforce uniformity in manufacturing process representations. Objectives and design of software applications vary. Therefore, the implementation of an inter-operable application must necessarily be influenced by the particular objectives and processes of each specific application.

*CEN-ISO 19440 (2003). Enterprise Integration - Enterprise Modelling*

Defines language constructs for enterprise modelling, supporting the enterprise model phases, view and genericity dimensions defined in EN/ISO 19439 (2002). The work is based on earlier work in CEN (ENV 12204) and contains definitions and descriptions of the core constructs necessary for computer-supported modelling of enterprises, possibly as a precursor to computer integration or mediated human-system.

It focuses on, but is not restricted to, the computer integration of the information aspects of manufacturing, including the management and control technology and the requisite human tasks. Models generated using constructs in accordance with that framework will be computer processable and ultimately enable the daily operations of an enterprise to be monitored and controlled by such models.

The meta model of this modelling language has been mapped to the meta models of ISO/IEC 15424 the ODP Enterprise Language and POP\* the ATHENA developed modelling language demonstrating a very large overlap of the three modelling languages.

*ISO/IEC 15414, 2000. Open Distributed Processing - Reference Model - Enterprise Language (ISO-IEC,)*

A multi-part set of standards that defines the reference model for Open Distributed Processing (ODP). The reference model comprises 5 viewpoints: enterprise, information, computation, engineering and technology.

The particular standard 15414 is concerned with the enterprise viewpoint. It is used to describe ODP systems and the environments in which they operate in terms of agents, artefacts and policies. The processes, actors and artefacts of an enterprise system are members of a distinguished community, populated by agents playing different roles

*BPML (2001). Business Process Modelling Language*

Is a meta-language for the modeling of business processes, just as XML is a meta-language for the modeling of business data. BPML provides an abstracted execution model for collaborative & transactional business processes based on the concept of a transactional finite-state machine.

BPML considers e-Business processes as made of a common public interface and as many private implementations as process participants. This enables the public interface of BPML processes to be described as ebXML (2004) business processes or RosettaNet partner interface processes, independently of their private implementations.

*ebXML (2001). Electronic Business using eXtensible Markup Language*

ebXML is a modular suite of specifications that enables enterprises of any size and in any geographical location to conduct business over the Internet. Using ebXML, companies now have a standard method to exchange business messages, conduct trading relationships, communicate data in common terms and define and register business processes.

*POP\* (Process-Organisation-Product-Others) Modelling Language*

POP\* has been developed by the ATHENA project

### **Module type Standards**

*ISO 15531 (1999a). Manufacturing Management Data Exchange: Resources usage Management*

A multi-part set of standards that provides for computer-interpretable representation and exchange of industrial manufacturing management data. The objective is to provide a neutral mechanism capable of describing industrial manufacturing management data throughout the production process within the same industrial company and with its external environment, independent from any particular system. The nature of this description makes it suitable not only for neutral file exchange, but also as a basis for implementing and sharing manufacturing management databases and archiving.

*ISO 16100 (2003). Manufacturing software capability profiling for interoperability*

A multi-part set of standards that specifies a manufacturing information model that characterises software-interfacing requirements. With interfacing requirements clearly expressed, standard interfaces can be more easily and quickly developed using the Interface Definition Language (IDL) or an appropriate programming language, such as Java and C++. These standard interfaces are expected to enable the interoperability among manufacturing software tools.

*IEC/ISO 62264 (2003). Enterprise Control Systems Integration*

A multi-part set of standards that defines the interfaces between enterprise activities and control activities. It describes in a rather detailed way the relevant functions in the enterprise and the control domain and the objects normally exchanged between these domains. Standard models and terminology for defining the interfaces between an enterprise's business systems and its manufacturing control systems are provided.

### **Response**

[Thank you for this information. See General Response 2. See also Response to Issue 352.](#)

## 42. Comments received from Eugene Sweeney, Iambic Innovation Ltd

Received on 19 June 2006.

### Issue 360

Category: general

#### Background

Today we live in a globally interconnected “village”. We can easily buy raw materials, components, products and services from anywhere in the world (wherever we can get the best value, quality or service). Today, the era of large monolithic “one-stop shops” is over. Increasing globalisation has led to increasing specialisation. Today we can produce our final service offerings or products from a plethora of specialist component and services providers located around the world.

For enterprises at the end of the supply chain, this leads to more local, focussed and well defined “Value Added Services” and/or products. Traditional “supply chain” relationships are no longer as “fixed” as they used to be, and we are seeing the development of more flexible supply chains or more appropriately “supply networks” operating in Digital Business Ecosystems.

This is true not just of software products and services – but of anything and everything an Enterprise does from both internal and external perspectives.

ICT is now not just a tool, service or product it is also the key enabler.

**We are therefore now seeing the emergence of a new “discipline” of “Enterprise Interoperability” which is needs driven and brings together a range of other disciplines including not just technical but also commercial, social and ethical.**

Even if some enterprises do not yet embrace this and use these technologies in critical business applications, their suppliers, customers and competitors are increasingly doing so.

Many different “digital ecosystems” are being developed to address the needs and opportunities presented by a globally interconnected knowledge based economy. Many are sector based, responding to a need for a solution. However, a key problem, typical of the early stages of any innovation is one of “fragmentation”. There are many different groups trying to establish standards and interfaces, and so we see islands forming often without bridges to other islands.

**If we are to achieve – and gain the benefits from – true global Enterprise interoperability a common open standard and infrastructure must be established, with supporting tools, services and business models, which will allow the rapid, flexible development of innovative enterprise solutions.**

It should also be noted that Innovation is not about technology but about needs and wants. **Research, particularly for a “near market” domain such as Enterprise Interoperability must be needs driven.**

Since much of the technology exists, and needs and opportunities are obvious, we have already seen the start of some needs-driven solutions – even though the underlying infrastructure leaves much to be desired (eg security, privacy, trust, etc). For example, eBay and Amazon have developed (proprietary) “infrastructures” to easily enable solutions to allow a large number of independent entities to buying and sell goods. The link to PayPal is part of this “ecosystem” to control financial transactions, and there is a “trust” system based on user feedback. Whilst these are seen by some as “sticking plaster” solutions, they are evidence of a clear need that needs to be addressed.

## Response

*Thank you very much for the elegant text. The main elements of your contribution are reflected in the Roadmap, though the terms used may be different. The general orientation of the Roadmap shares that of your text. We hope you would agree.*

## Issue 361

Category: general

### Some specific comments on version 3 of the roadmap

In section 3.1, Paragraph 5 a comment is made concerning web services and grids. In January 2004 a new Grid middleware specification was proposed by a consortium of major players in the industry, which introduced a new set of Web Services in WS Resource Framework (WSRF). In this approach, Grid services are just a specific collection of Web Services. This Grid middleware layer will be an important part of the emerging pervasive and corporate middleware infrastructure.

## Response

*Thank you for the information which is noted.*

## Issue 362

Category: semantics

In Section 3.1, Paragraph 8 there is a comment concerning the semantics of services. The ISTAG WG 8 report on Grids, Distributed Systems and Software Architectures (Aug 2004) notes that:

*“As integration and interoperability of resources between different sectors or communities grow, the need for semantics increases as a mediator between the structure and content of the different knowledge bases. **There will be a need, not just for semantics to mediate the structure and content, but also for the services themselves.** Whilst semantics helps to provide the interoperability, this only works if the different parties (or software) have the same understanding. This is only possible if the semantics are described explicitly. Although interoperability may be achieved without explicit semantics, this would be less efficient. The use of explicit semantics allows interoperability to become automatic, hence increasing both speed and agility.”*

## Response

*Thank you for the information. We seek not to be prescriptive in the specification of service semantics, but instead consider that it may be one of the relevant research areas. The idea of semantic-based or semantic-aware services is implied in the indicative services for the ISU (Section 5.3.2, Roadmap V4.0).*

## Issue 363

Category: general

Regarding the many comments made concerning Innovation Indicators. Whilst all the comments on indicators are pertinent and appropriate, I note there is no mention of the EC's Innovation Scoreboard.

## Response

*Thank you. This is noted, but has not been addressed in the final version of the Roadmap. See General Response 1.*

### Issue 364

Category: general

Concerning outsourcing and VA services, we are seeing today a trend towards the commoditisation of much of the software infrastructure and applications. As this progresses, the value will be in mastering the complexities of applying this “interoperability infrastructure” (middleware?) in real applications – i.e. the provision of services and their customisation and localisation for businesses. We may expect to see an increase in outsourcing of some of the commoditisation and localisation processes, **but the high added-value will be in the provision of services, the customisation and application of software – i.e. those activities that are closest to businesses, rather than the software infrastructure per se.**

### Response

*This is indeed one of the main ideas behind the ISU and is reflected in the description of the ISU Grand Challenge.*

### Issue 365

Category: general

Concerning issues of rapid change. There is an increasing need to develop more software applications, however there continues to be a shortage of software engineers. In this context it is thus essential to concentrate on developing higher quality software, in less time. This requires much better tools and techniques, as well as better-educated developers, thus raising productivity and competitiveness. There is therefore a need to address the issues of rapid development, software methodologies, tools, etc. **Specifically tools and methodologies for the rapid development, maintenance and support for Enterprise Interoperability.**

### Response

*The comment is well made. The research work in relation to both Web Technologies and Science Base Grand Challenges would likely raise important software engineering issues.*

### Issue 366

Category: general

I would also emphasise the importance of addressing legal and social issues in an international world. This is particularly important given the “national” or “cultural” nature of many legal rights (eg. Intellectual Property), privacy, ethical, access and usage.

### Response

*Agreed that this is important: understanding of these issues should form a part of the knowledge for collaboration available within an enterprise or VO or available to it through commercial (ISU) sources of business intelligence.*

### Issue 367

Category: general

Regarding “Open Innovation”. The fundamental premise of IP Rights is to stimulate publication and **openness** in return for a limited monopoly for the beneficial owner/creator. This is nothing new, however it is perhaps more evident or easier to disseminate knowledge in today’s globally connected world.

### Response

*Agreed.*

### **Issue 368**

Category: vision

In Sec 4.3, Para 2 I dispute the statement about monolithic solutions being unrealistic. I agree that we have the opportunity to move away from this, but I believe there is still a threat which Europe must address if it is avoid being dominated by “proprietary” standards and ecosystems.

### **Response**

*The word “unrealistic” is replaced with “untenable”. In general, the Roadmap refrains from making explicit remarks about specific “threats” and the sources of those threats.*

### **Issue 369**

Category: general

#### Specific research challenges

Specific research challenges which are missing and which I feel important concern development tools & methodologies and new business models.

#### **1. New tools and Methodologies**

It is important to develop new methods, technologies and tools to allow software engineering to emerge from its present strong dependence on manual activities towards a more automated and better-tooled environment.

There is a need to develop new design, checking, verification and certification approaches to achieve the required levels of trust and confidence in specifications and software.

Research must emphasise the highly efficient production of reliable, distributed software.

New tools and methodologies are needed for :-

- Software/application development
- Ongoing maintenance (updates, new data, new service discovery, etc)
- Autonomic approaches (since cannot rely on human intervention)
- Quality management tools/methodologies

### **Response**

*Thank you. We now include a brief reference to tools and methodologies for improvement of Enterprise Interoperability software.*

### **Issue 370**

Category: general

#### **2. New Business models for distributed DBE’s and VO’s**

In particular management of IP rights in a globally connected world/ecosystem.

Effective management systems for the business models (e.g. charging and accounting). Systems for the management of privacy, security, access and use and for the resolution of ethical issues.

### **Response**

*Thank you. Please refer to General Response 1.*

## **43. Comments received from Stuart Campbell, TIE Holding**

Received on 20 June 2006.

First I think its definitely has significant improved in the iterations. Seems to be a better structured document with less waffle and is quite readable. I didn’t read annex yet though

Some comments still...but I would classify most of these as artistic fine-tuning (not all of course) - S=Section, P=Para, L=Line

The more major ones I highlight with a \*\*\* and include the inconsistency of format/structure in section 5,6,7,8; the references to previous versions of the document and the obscure letter references

#### **Issue 371**

Category: editorial

- 2nd page - Im down as a 'commentator' - is this good or bad...ive no idea what one is? :-)

#### **Response**

*You were one of the few persons who reviewed draft versions before they were published. "Reviewer" is a more appropriate term.*

#### **Issue 372**

Category: editorial

- S2, P1, L2 it says 'for example' - if not ICT then what else? If there is something else then it would be good to give a few word example

#### **Response**

*Thank you. It has been rephrased.*

#### **Issue 373**

Category: editorial

- S2, P2 L1 'a possible'v - strange phrasing...simple say 'as one input'

#### **Response**

*Thank you. It has been rephrased.*

#### **Issue 374**

Category: editorial

- S2.1, P1, L1 'increasingly..' is still think this clause is a little disappointing - not a great start to the meat and not true

#### **Response**

*See response to Issue 157.*

#### **Issue 375**

Category: editorial

- S31., P3, L2 I object to the BizTalk Framework statement (im not anti microsoft) on two grounds - 1.Its vendor specific so should go under Para 7 and 2.(main reason) There realli is technically no such thing as the biztalk framework (there used to be - kind of) but now it simply is a product. With respect to FIPA ive never even heard of it - at the very least it should be spelt out and a footnote placed to website but I would recommended it be removed completely leaving just Rosettanet

**Response**

*Section 3.1 has been reviewed and where necessary amended to ensure neutrality and balance. The BizTalk Framework is no longer cited.*

**Issue 376**

Category: editorial

- S31, P4 this para about sector stuff doesn't link in with the rest well. I would recommend to put at end of para 3 with the words "However, in addition" proceeding it

**Response**

*Section 3.1 has been reviewed and where necessary amended to ensure neutrality and balance.*

**Issue 377**

Category: editorial

- S31, p5 (page 6) it mentions the grid just as computational resources where as the focus of grid, including calls in the CEC, is much more than that

**Response**

*The focus is on the Grid services and its relationship with Web services and P2P services. The text has been adjusted.*

**Issue 378**

Category: editorial

- S31 p6, L1 stateofplay to state-of-the-art

**Response**

*Comment not understood.*

**Issue 379**

Category: editorial

- S32 P1 I would remove microsoft since it currently has small market share in this space compared to other unlisted players

**Response**

*The list provides examples of players involved only. The list is not a comment on market share.*

**Issue 380**

Category: editorial

- S32 P4 'Schumpeterian' - what the hell is this - I saw it used elsewhere (P5) in the document. What usual reader of this document has ever heard of this? Please remove and restate for normal readers

**Response**

*Schumpeter was the economist who came up with the term "creative destruction" when talking about innovation. Nonetheless, we have removed the reference to Schumpeter.*

**Issue 381**

Category: editorial

- S32 P7 ISU is a completely new concept for most, I would suggest to repeat the full text a few more times before using acronyms to get people familiar to it

**Response**

*The use of acronyms has been checked in the final editing of the Roadmap. Acronyms are spelt out in their first appearance.*

**Issue 382**

Category: editorial

- S32 P11 "Its has proven" - I don't know what the first 4 lines are trying to say

**Response**

*The point is that business deals between enterprises have a large degree of personal interaction, namely from the decision makers (managers). Moreover, while there are typically teams working on particular business transactions, the last word is based on the assessment of managers at the top of the hierarchy. These decisions depend to some extent on their personal knowledge and experience, which is tacit knowledge and not so easy to make explicit.*

**Issue 383**

Category: editorial

- S32 P12 'The premises above state, ie' is strange phrasing

**Response**

*Thank you. We have rephrased the sentence.*

**Issue 384**

Category: editorial

- S32 P16 google and mashup. I personally not heard of mashup and I doubt if others have - the IBM linux example is clear but I would drop the google one

**Response**

*Mashup is strongly associated with recent Web technologies aiming at combining existing Web content to deliver new services. We believe that Web-based mashup-type applications have a significant potential for Enterprise Interoperability, particularly for SMEs. Therefore, we have included it in the Roadmap.*

**Issue 385**

Category: editorial

- S44 the graphic would be nice if you aligned the two misligned central boxes

**Response**

*No misalignment is perceived.*

**Issue 386**

Category: editorial

- S44 P7 - place 3 bullets in order as per diagram

**Response**

*The order of the bullets is in relation to the Sequence 2. The choice of sequences is discussed in the paragraphs immediately above the bullets.*

**Issue 387**

Category: editorial

- S45 You appear to use the acronyms GC and RC in this section - please replace for words - lot easier to read

**Response**

*Implemented.*

**Issue 388**

Category: editorial

- S51 You mention VO multiple times here and I think that's a bit scary. VO havnt had such a good press and what you are really talking about as collaborating enterprise - id recommend to use this and also it would make it more readable

**Response**

*The editors have discussed the difficulty of terminology in this field, and have settled on VO. For a definition, see Section 7.1.*

**Issue 389**

Category: editorial

- S51 p2 - what is: asymmetric information?

**Response**

*Actually, it is about asymmetric access to information, i.e. one competitor has access to more/different information than others). This is amended in V4.0 of the Roadmap. Please see also the response to Issue 353.*

**Issue 390**

Category: editorial

General comments on section 5,6,7,8

\*\*\*\*- in these sections it is very inconsistent how the subsection of the new ideas section relate to the section itself. For example in section there is no intro to the 5.3.x concept; contrast with section 6 where 63 has a half-page intro which goes through (introduces) each subsection by first, second third (would be even more usefu' to make the topics in bold as well); then in section 7 there is an intro section but this time no clear introduction to the subsections and section 8 seems to take a completely different approach. Please make these sections consistent

**Response**

*Consistency of presentation of the Grand Challenges (Chapter 5 – 8) is strengthened in Roadmap V4.0. We have sought to maintain the consistency, by the use of the same structure throughout the document.*

### **Issue 391**

Category: editorial

\*\*\*\* taking \*\*\*\* S53 P7 as an example ONLY ("This impacts...") - I don't understand these references. I think this relates to references in previous version 1. I don't think you should do this (make document stand alone) and 2. if they relate to annex this isn't obvious and 3. If you need to keep them in you need a single diagram that explains them

### **Response**

*The use of these references is explained in Section 4.5 where the Grand Challenges and the Research Challenges are introduced. That was obviously not sufficient. Further explanation is given in Roadmap V4.0.*

### **Issue 392**

Category: editorial

\*\*\* taking 63 p2 as an example - it references roadmap version 1 - this is very confusing to a new reader. I would recommend to scan and remove these references and then select one of the following in priority order 1. do nothing, 2. cross reference in a separate document, 3. place in annex 4, place in footnote

### **Response**

*We received a large number of comments relative to the first version of the Roadmap and there was a team of stakeholders that contributed to it. There are no references to earlier versions of the Roadmap in version V4.0 of the Roadmap, only to Annex I of the Roadmap, which is to a large extent based on the first version of the Roadmap.*

### **Issue 393**

Category: editorial

\*\*\*\* taking S32 P3 as an example there is an embedded numbered list in the para; other sections have up to 6 items - consider bulleting

### **Response**

*It is not clear what this comment refers to.*

### **Issue 394**

Category: editorial

S53 diagram - make it in black and white else difficult to tell lines

### **Response**

*The appearance of the diagram obviously depends on the screen and/or printer used. The intention is that the colours match the text to clarify the links.*

### **Issue 395**

Category: editorial

S532 same comment on letter references

### **Response**

*See response to Issue 391.*

**Issue 396**

Category: editorial

S533 p2 say "the risk"

**Response**

*Rejected. In this case, inserting "the" would render it grammatically incorrect.*

**Issue 397**

Category: editorial

S631 expand OS in title

**Response**

*Thank you. The title has been corrected.*

**Issue 398**

Category: editorial

S631 p4 - letter references although this time vs 1 is referenced

**Response**

*See response to Issue 391. All references to previous draft versions of the Roadmap are removed in the final version.*

**Issue 399**

Category: editorial

S632 personally I have never come across the term mashup and nor has anyone else I consulted so you might want to explain more but in the P2 definition I really fail to see what's new - isn't this what people have been doing for years? What's novel?. Maybe putting eg para 3 first would help with this section

**Response**

*We aim at having a short, concise, yet focused document. We already present a short overview of what mashup is. More detailed characterizations of mashup are available on the Web (Google search engine, Wikipedia). We feel the explanation of the terminology is provided there in better conditions than what we could ourselves do. Furthermore, if we open the exception for mashup, then we would also have to characterise other technologies in greater detail. This would lead to a larger, more general document that we feel is not what we are seeking here.*

**Issue 400**

Category: editorial

S61 this talks about new technologies yet in 62 it appears the focus is on better ones/gap filling - I felt there was inconsistency here

**Response**

*It is not clear what exactly this comment refers to.*

**Issue 401**

Category: editorial

S632 p2 - list says 1), 2) c)!!!! + ECPGlobal exaple is never described

**Response**

*Thank you. We have deleted the reference to EPCglobal.*

**Issue 402**

Category: editorial

S632 and 633 and 634 end all have letter references

**Response**

*See response to Issue 391.*

**Issue 403**

Category: editorial

S71 I would mention SMEs have particular problem in this para

**Response**

*Thank you. Implemented for Roadmap V4.0.*

**Issue 404**

Category: editorial

S72 bulletise P3 and P4

**Response**

*We believe that the existing presentation is adequate.*

**Issue 405**

Category: editorial

S73 general - shouldn't it be 'A' ISU as opposed to 'THE' ISU which sounds via central?; in P2 - if its not functional or technical what view is it?

**Response**

*ISU is prefixed with “the” rather than “a” as it is conceived as an open infrastructure analogous with the Internet and the Web. There is no implication for central control (in fact, the opposite – see the ISU Design Principles, Section 5.3.1). It is possible that there could be multiple implementations of ISUs, as stated in the ISU Business Case and Ownership, Section 5.3.3, but it is not within the scope of the Roadmap to prescribe particular implementations.*

*The figure in question depicts a conceptual view, as indicated in the sentence that introduces this figure (Section 5.3). For the avoidance of doubt, it is explicitly stated that the figure depicts a conceptual review in Roadmap V4.0.*

**Issue 406**

Category: editorial

S73 digram has two internet rows

**Response**

*Corrected for Roadmap V4.0.*

## Issue 407

Category: editorial

S731 what is an end-end argument + end para has letter references

### Response

*The E2E argument is a fundamental architectural principle of Internet, and originated from the work of Saltzer, Reed and Clark in the early days of internetworking design (DARPA / ARPANET, which preceded the "Internet"). It was formally raised and formulated within the Internet community in the late 1970s. Thirty years later, the E2E argument remains among the most influential of all communication protocol design guides.*

*Some reference papers:*

- *End-To-End Arguments in System Design (1984). Jerome H. Saltzer, David P. Reed, David D. Clark, ACM Trans. Comp. Sys., 2(4):277-88, Nov. 1984: <http://www.reed.com/Papers/EndtoEnd.html>*
- *A critical review of "End-to-end arguments in system design" (2002). Tim Moors, Proc. International Conference on Communications (ICC), May 2002: <http://www.ee.unsw.edu.au/~timm/pubs/e2e/submitted.html>*
- *Comment on Active Networking and End-to-End Arguments (1998). David P. Reed, Jerome H. Saltzer, and David D. Clark, IEEE Network 12, 3 (May/June 1998) pages 69-71: <http://web.mit.edu/Saltzer/www/publications/endoend/ANe2ecomment.html>*
- *Rise of the Stupid Network (1997). David Isenberg, Computer Telephony, August 1997, pg 16-26: <http://www.hyperorg.com/misc/stupidnet.html>*
- *Architectural Principles of the Internet (1996), B. Carpenter (ed.), RFC 1958: <http://www.ietf.org/rfc/rfc1958.txt>*

## Issue 408

Category: editorial

S732 self healing is never described - just a simple non-informative footnote + end para has letter references

### Response

*We disagree that the footnote is un-informative. The document referenced is generally recognised as a major source concerning "SOKU" and an important contribution towards defining the "self-\*" characteristics and properties of services.*

*Note that the self-heal concept of services has already been picked up by the market. For example, "autonomic computing" has been used by a major vendor.*

*Concerning letter references, see response to Issue 391.*

## Issue 409

Category: editorial

S733 bullet p1 + end para has letter references

### Response

*The existing presentation is adequate.*

*Concerning letter references, see response to Issue 391.*

## Issue 410

Category: editorial

S734 + end para has letter references

### Response

*See response to Issue 391.*

**Issue 411**

Category: editorial

S81 an example would be nice since this approach is quite different

**Response**

*Comment not understood. Example of...?*

**Issue 412**

Category: editorial

S81 p3 I don't particularly agree with this (but hey) I think its more that theres more than enough technology its simply not joined to gether, not sure which is best and not sure what to do with it

**Response**

*Please make more specific suggestions.*

**Issue 413**

Category: editorial

S83 the footnote 40 reference is in the wrong place on the line + table 1 llabel should be below table

**Response**

*Checked and implemented. Table labels should be above tables.*

**Issue 414**

Category: editorial

S83 is structured entirely different to other sections

**Response**

*We do not agree. See also response to Issue 390.*

## 44. Comments received from Kim Jansson, VTT

Received on 21 June 2006.

**Issue 415**

Category: general

**Scope:** The scope the roadmap is "enterprise interoperability" There are several dimension to this:

- Interoperability between the legacy and ERP system currently used in enterprises is of course important. However there are also other types of interoperability needed. Product data and (technical) design information need to be seamlessly shared between enterprises. This becomes increasingly important as much of the manufacturing works will move to lower cost regions. Europe needs to and will stay competitive in the area of project management and engineering and design of goods and services.
- The provision of services requires interoperability of product a life-cycles. Products and services manufactured and produced to day needs to be managed still after years of operation. The organisation delivering a product or services is often different from the

organisation actually using or deploying the service over time. There is a need for interoperability between enterprises over time.

### **Response**

*Thank you for this contribution. Concerning your first point, the issues that you have raised are indeed important and would conceivably be part of the research work arising from the Roadmap. The Roadmap is positioned at a strategic level, though the general problem of information exchange (without specifying the various types of data) is underlined in the Roadmap throughout. For example, it is a core concept of the ISU Grand Challenge.*

*Concerning your second point, a sentence has been added to the Problem Space (Section 3.2) on the time aspect.*

### **Issue 416**

Category: knowledge-oriented collaboration

#### **GC: Knowledge for Collaboration**

The problem space is larger than the one presented in the Roadmap. Additional challenges are the "collection of knowledge regarding experience of operating and VO", how this knowledge can be used in the creation and definition of future VOs. Replanning and/or reconfiguration of collaboration are other situations where collaboration knowledge is needed.

(The ECOLEAD project has put a lot of effort in this area. VTT as the co-coordinator of the project and the leader of the workpackage for "virtual organisations management" is prepared to share its knowledge in future activities.)

### **Response**

*Agreed, and it was intended that this be implicit in Figure 3. However, it is now explicitly noted in Section 7.3.6, second paragraph.*

## **45. Comments received from Aurelian Stanescu, University Politehnica Bucharest**

Received on 26 June 2006.

### **Issue 417**

Category: science base

Research & brief proposal related to §8.1. – E1 Research Roadmap

University POLITEHNICA of Bucharest  
Automation & Computer Science Faculty  
Research group for Intelligent Information Systems

The follow-up activity of very successful workshop, held in Brussels on the 16th of June, involves us in the process of Research Roadmap ( v 4.0. ) consolidation.

Taking into account the following basic statement:

"The vision of the roadmap relates enterprise interoperability beyond the technical domain to the much broader developments in the market and in the policy arena... This Grand Challenge is about creating a new "science base" for enterprise interoperability by making use of and synthesizing the findings from other established and emerging sciences", one could add the following remarks:

i) The Enterprise Interoperability is a promising challenge, but a holistic approach for this new (intrinsically multi-disciplines) field of research should integrate within the “broader arena” the “house of Education in common Europe”, according to “Bologna-Bergen” process. To stipulate the training activities only for achieving “best practices of organization interoperability” seems to be not sufficient enough.

The foundation of new scientifically discipline (E.I.) addresses the re-thinking of the role of university collaborative network.

The intersection conceptual space between e-University and e-Enterprise must promote the “Learning Enterprise” as an emerging strategic partnership “Learning Ecosystem” plus “Business Ecosystem”. The L3(Life-Long-Learning) paradigm requires to be implemented within university “incubator” form master and doctoral schools.

### **Response**

*A general statement on the education and training aspect has been added to the Strategic View of the Science Base Grand Challenge. The education aspect is also referenced in the final paragraph of this Grand Challenge.*

*The role of collaborative networks of academic institutions (and other types of networks) could conceivably be part of the research in relation to the various sciences, e.g. network science.*

### **Issue 418**

Category: science base

ii) There is an overlapping that has been induced by various important initiatives.

Example :

- the ECOLEAD project is going to develop an impressive “Virtual University”

- the ATHENA project has already include doctoral program for their conferences :

- Our Socrates-Erasmus project “ Business Informatics Joint degree master in common Europe” ([www.dke.univie.ac.at/binnet](http://www.dke.univie.ac.at/binnet))

### **Response**

*It is not within the scope of the Roadmap to comment on the overlap or otherwise of specific projects financed under different EU programmes.*

*The ECOLEAD and ATHENA Integrated Projects are recommended to take this comment into consideration.*

### **Issue 419**

Category: science base

iii) I agree with the Table I content. Science base for enterprise / organization interoperability should have the roots in science for system of systems complexity, web science, a.s.o. but the existing science disciplines like “Information Systems” could integrate the relevant topics in enterprise interoperability.

Proposal :

- To develop a synergetic L3 platform timing to provide support and consulting services for “Enterprise Interoperability” curriculum development in common Europe
- To create and implement a “Digital Virtual Enterprise” for education and training
- To develop a knowledge-based portal for e-Learning in the field of Enterprise / Organization interoperability.

### **Response**

*Thank you for the comment concerning "Information Systems" which would conceivably be investigated in the research work relating to this Grand Challenge.*

*See response to Issue 417 about the learning aspect. We further note that your proposals are very specific. It is not the purpose of the Roadmap to make detailed proposals in specific areas.*

## **46. Comments received from Pim van der Eijk, OASIS**

Received on 29 June 2006.

### **Issue 420**

Category: general

I was interested to receive this document [i.e. the Annex II, Disposition of Comments], but disappointed at its contents.

Your response to my issues 106, 107, 111, 116 are unedited copies of the comments to issue 105, that don't make sense in the context they have been pasted in. The response to 117 is a poorly edited version of the response to issue 115. It is understandable that given the large number of comments only a limited amount of time could have been spent on each individual issue. But these basic editorial errors suggests to me that my comments were hardly given any attention. I also wonder if anyone even bothered to proof-read the document?

### **Response**

*Regarding the previous draft of the Disposition of Comments (DoC), we were indeed pushed for time in responding to the many comments that had arrived. All the issues and our draft responses in the previous draft DoC have now been reviewed and, where appropriate, revised and expanded. We have also treated the (new) comments that had arrived after the cut-off date for the previous DoC carefully. The result is this version V0.2 of the DoC.*

### **Issue 421**

Category: general

In addition to the earlier document which are "discussed" in this document, I also sent you a separate document on 29th of January with some proposed additional paragraphs on the relation between standards and research, at the request of you and Mr. Doumeingts. In your attached message, you acknowledge receipt of it. Yet it is not referenced in this "Disposition of Comment" document, so it is not clear whether this document was ever read.

### **Response**

*All contributions received were forwarded to the editors. However, in ex-post consolidation of the list of contributions, your second contribution from 29 January was missed or it was assumed that it was the same issue as the January 9 contribution. We are sorry for the inconvenience.*

## **47. Comments received from Jean-Pierre Lorré, EBM WebSourcing**

Received on 30 June 2006.

### **Issue 422**

Category: open source software

Thank you for your answer to my comment dealing with open-source and interoperability. As you may imagine I don't fully agree with your argument since I don't think open-source deals only with some

technical matter among many others but instead it really deals with a strategic (and non technical) matter for Interoperability.

I try to summarize main arguments below:

Open Source software takes mainly its legitimacy on what is commonly recognized as “software commoditisation”. Software business evolves from a market based on fees coming from copyright to an ecosystem market with many stakeholders making money in different ways. I would like to demonstrate that open-source commitment is relevant for European software industry to renew with leadership and ensure autonomy on strategic domains.

Open source plays a fundamental role in the standardization process, especially in the areas where interoperability is the basis of the economic model. By their nature, open source solutions may act as reference implementations of developing standards. The availability of their source code promotes open and democratic debate around the standard specifications they intend to implement, making them both more robust and interoperable. Moreover, availability of an open reference implementation for free increases dissemination and fast standard adoption.

Open-source business models allow newcomers to penetrate easily a new market. Small start-up companies can enter the software industry. While proprietary software requires big teams to internally develop and support the product, what matters in open source initiatives is the community size, not the corporate size. Many activities are actually managed by the community, lowering the cost of producing the software, considerably increasing its quality: this leads to great business opportunities to build lean companies, quicker to improve and adapt. There is a lot of start-up born around open source projects. Moreover, open-source facilitates European IT SMEs to penetrate software market thanks to the mass effect provided by the European IT market with high skilled level.

Because OSS involves heterogeneous groups (i.e. ecosystems) of people working together, it facilitates innovation strategies and induces new innovative business models. Some classification has already been produced (see for example [http://www.objectweb.org/wws/d\\_read/marketing/public/FLT-FederatingEcosystems-June05.pdf](http://www.objectweb.org/wws/d_read/marketing/public/FLT-FederatingEcosystems-June05.pdf)). OSS seems to be a good candidate in order to reach scientific technological breakthroughs and new innovative models and to achieve the i2010 objectives.

## Response

*Thank you very much for taking the time to provide a further contribution.*

*Open Source is now mentioned in the scope (Section 2.3) and a reference is made to your contribution within the Scope section (as a footnote).*

*Text on open source has been added to the State of the Art, Section 3.1. The material that you have kindly provided has been carefully considered in preparing that text.*

*We also draw attention to Section 6.3.4 Web community solutions for Enterprise Interoperability, under the Web Technologies Grand Challenge, which reflects the community aspects in your contribution.*

*We further draw attention to the ISU Grand Challenge, which concerns an open, common infrastructure for basic services to facilitate information exchange. Open source is envisaged to be investigated as part of the research work on the ISU. Note that the rationale for the ISU explicitly references the “commoditisation” aspects.*

*Finally, we draw attention to the Science Base Grand Challenge. Software as a service and software commoditisation are envisaged to be part of the research in relation to Services Science. The community aspects including collaboration models are envisaged to be part of the research in relation to Economic Science and Social Sciences.*

*Please also see General Response 2.*

## 48. Comments received from Rainer Ruggaber, SAP Research

Received on 6 July 2006.

Please note that I very much appreciate your work in creating this document. The remainder of this document is not supposed to sound negative but to provide my view on potential improvements. If you feel that I should not only give advice but you would like to have text for the roadmap, please let me know.

## General Comments

### Issue 423

Category: editorial

Comment 1: Terminology used in the document

- Actually the document does not provide or reference a definition for Interoperability / Enterprise Interoperability. Later in the document it seems that the IEEE definition for interoperability is used when it is stated that „interoperability is a capability“. The „definition“ given on page 2 seems to be recursive (as it uses the term „interoperate“ to explain interoperability).  
I know that it is difficult to provide definitions (they usually create discussion). Still, reference to existing definitions and their contribution to the way the term is used in the document might be helpful.

### Response

*The very first paragraph of Chapter 2 Introduction has been revised and expanded in Roadmap V4.0, in light of your comment.*

### Issue 424

Category: editorial

Comment 2: Interchangeable Terminology used

- In the first sections of the document the term „enterprise“ is used. In later chapters the term „organisation“ seems to be used interchangeable. Further in the document the term „firm“ is also used.
- Also the terms „VO“ and „ecosystem“ may not be delimited sufficiently
- Are these terms interchangeable? Would it be helpful to provide definitions / a glossary?

### Response

- *Please refer to the context in which these terms occur. We follow conventional usage of English in using these terms, which, depending on the context, have different connotations. Thus, “organisations” are broader than “enterprises”. The term “firm” is used in the context of addressing issues at the micro-economic level. The use of these terms has been checked and amended where required in finalising Roadmap V4.0.  
A general point is that we seek to make the Roadmap “business-friendly” as far as possible, in order for it to be attractive beyond the technical community. Therefore, we also need to observe business conventions in the usage of these terms, recognising that they may have specific – even different – meanings and definitions in the technical domain(s).*
- *See response to Issue 388.*
- *The terms are not interchangeable. We however refrain from providing definitions – see the response to your first bullet above, in particular the general point.*

### Issue 425

Category: editorial

Comment 2.1: In the document it is mentioned that “more than a decade after interoperability issues ... have been raised and discussed ... interoperability is still a problem.” (section 3.2.). It might be interesting to see and evaluate how the raised questions changed over time. Where in the beginning mainly database integration was a topic, then data / message exchange moved to the centre focus with standards like EDI, we are now looking into linking business processes of enterprises. Overall, there could an analogy be made between enterprises moving up the value chain and interoperability issues changing (becoming harder) in this changing environment. Basically my statement is: Do we really have the same issues or are we adapting the meaning of the term interoperability to current needs at a certain point in time.

## Response

*Indeed it would be interesting to see and evaluate how “interoperability” evolves over time in terms of “what are the problems” and “what are the solutions”.*

*Your description of the evolution of issues in relation to interoperability over time may be subject to debate. For example, EDI was already much concerned with the definition and specification of business processes in the 1980s. Note that an EDI message is intended to denote a specific “business function”, in accordance with the formal definitions of UN/EDIFACT. Incidentally, a vast amount of work was carried out by the EDI community on semantics, though the terms “data elements” and “codes” were used by that community (and from the early 1990s onwards, the “semantic problem” was recognised by many in the EDI community as a major problem – with this exact term used). Nonetheless we feel the aim of the section is to aid motivate the Roadmap.*

*Your last point is indeed important, and is fundamental to the Science Base Grand Challenge – it also helps explain why research is needed for a “science base” for Enterprise Interoperability.*

## Issue 426

Category: editorial

### Detailed comments

Comment 3: Page 2; section 2.1; paragraph 3; Sentence „Likewise, many .....

- I believe this sentence is misleading in a couple of ways:
  - „established links“ – either they are members or not, i would not see what other links there could be.
  - „convenience“ – interesting ... i never noticed that organisations follow the concept of „convenience“ ;-).
- Furthermore: it is stated later on (page 7, section 3.2) that „the business case for interoperability has yet to be convincingly demonstrated and proven“. In this context the previous statements are a bit surprising as apparently technology providers are supposed to do business decisions without a business case.
- Proposal: Delete this sentence

## Response

- *Other links could include being a sponsor, a contributor to a specific activity / event / working group, a promoter in one manner or another, without being a formal member. Note that different standards-producing organisations have different rules on membership. Concerning “convenience”, an example – theoretical or otherwise – could be that the processes of a standard-producing organisation, such as the governance process, could be more “convenient” for some vendors than other stakeholders.*
- *Both difficulties in decision-making and lack of business case refer primarily to the perspective of the user, as the subsequent description of this issue in this chapter makes clear. Note that this Roadmap puts a lot of emphasis on the needs of end-users of technologies and related services. For example, please refer to the first paragraph of Section 2.3 Scope and the principles for developing the Grand Challenges in Section 4.5. We have rephrased the sentence mentioned in your second bullet point.*

## Issue 427

Category: general

Comment 4: Section 2.3 „Scope“

- At the beginning of paragraph 2 it is stated that „this is a research roadmap“. And later on „...this roadmap targets break-through research“.
- If this is the sole purpose of the roadmap then I have difficulties relating aspects like the business model and governance discussion of the ISU to the roadmap as well as the identified policy aspects.

## Response

*Business models and governance models research must be part of the research of the ISU, in order for the ISU to have relevance beyond theoretical pursuits.*

*Specific research may raise policy issues; specific research may also be impacted by policy developments (e.g. Directive on e-commerce on service provisioning; Directive on electronic communications in relation to technology convergence). The Roadmap however does not address general policy issues. See General Response 2.*

## Issue 428

Category: general

Comment 5: Section 3.1 „State of the Art“

Comment 5.1: I believe one of the most significant changes that we see is that the largest part of industry is cumulating behind a set of standards that are supposed to be the base for next generation enterprise applications. These include XML, SOAP, WSDL, BPEL. Furthermore, all vendors/technology providers are active in the same set of standards producing organisations to push adoption of WebService based SOA forward. Relevant organisations include OASIS, WS-I, W3C.

As a side note: we have seen different approaches for service provisioning in the past like DCE, (SUN)-RPC, CORBA. One of the reasons their impact is limited is that they did not achieve the required support by a broad industry base.

## Response

*Section 3.1 by no means aims to be comprehensive, particularly concerning individual standards and other technical specifications, or the organisations that produced them. See Response to Issue 352. See also General Response 2.*

## Issue 429

Category: general

Comment 5.2: Based on the previous comment I would recommend to rebalance paragraph 3 and paragraph 5. Where I believe that in paragraph 3 ebXML is treated too positively (even stating the vision), the WebServices stack in paragraph 5 is presented too negatively. Relevant initiatives to organise the abundance of recommendations in this space (as rightly noted) are not mentioned like the WS-I which produces „profiles“ that are considered the base infrastructure for service interoperability. Currently extended into the space of reliable and secure messaging with the recent establishment of the RSP working group.

## Response

*Rebalancing is attempted in finalising the Roadmap V4.0. See also General Response 2.*

## Issue 430

Category: editorial

Comment 5.3: The definition of Web Services might follow the definition of the W3C.

## Response

*It is not the purpose of this chapter (or the Roadmap in general) to give technical definitions. The sentence in question has been deleted in finalising the Roadmap.*

## Issue 431

Category: general

Comment 5.4; section on “commercial middleware solutions”.

- Statement: “Integration of external systems is limited to a number of predefined adapters”. Not sure that I can follow this statement. For SAP e.g. there are dozens if not hundreds of 3rd party adapters available providing connectivity to virtually every enterprise application provider.
- Statement: “The manual adaptation of further external systems is complicated and time consuming”. I do not doubt that integration is a non-trivial task. But is this statement only true for “commercial middleware solutions”. Can you substantiate this statement?

#### **Response**

*To avoid ambiguity, the text on commercial middleware solutions has been re-formulated in Roadmap V4.0.*

#### **Issue 432**

Category: general

Comment 5.5: section on “WS-BPEL”

- There are multiple extensions to BPEL proposed. I wonder why BPEL4People is mentioned and none of the others?

#### **Response**

*Reference to BPEL4People has been deleted in finalising the Roadmap. See also Issue 439 and the response to it.*

#### **Issue 433**

Category: editorial

Comment 5.6.: I like that you consider topics like “Semantic Web Services” and “ontology”. I would believe that a paragraph on the “Semantic Web” and its technologies (including RDF, OWL, Query Languages, Rule Languages, Reasoners) could be beneficial as some of the Research Challenges on Semantics are based on these technologies.

#### **Response**

*Enhancement to the semantic paragraphs is attempted in finalising Roadmap V4.0.*

#### **Issue 434**

Category: general

Comment 6: section 3.2 “Problem Space”

- Statement: “... a number of software suppliers ... have gained a de facto ascendancy ... but questions remain about the impact and significance of the vendor based solutions ...”.
- I believe this statement comes a bit out of the blue. The statement would either be needed to be substantiated or might be removed from the document.
- This would also be advisable in light of the statement that follows a few sentences later about “the business case for interoperability ....”.

#### **Response**

*We are reflecting opinions from the demand side of the market (see for example the Information Age survey of enterprise software users, published by Infoconomy, June 2006, and the Eurostat statistics referenced in Section 5.2 of the Roadmap).*

*See also response to Issue 426 (second part), which additionally addresses the issue of the business case.*

### Issue 435

Category: general

Comment 7: section 3.2 "Problem Space"; page 9, 2nd paragraph.

- In the ATHENA context we believe that Interoperability is not a product (in a traditional sense) but a characteristic of a system. Therefore I would change the statement on "weaker Enterprise Interoperability systems" to "weaker capability for Enterprise Interoperability".

### Response

*The phrase "weaker (if at all) Enterprise Interoperability systems" has been amended to "more limited capability to interoperate with other enterprises (if at all)" in Roadmap V4.0.*

### Issue 436

Category: vision

Comment 8: section 4.2 "Vision Description"

- I noticed that the roadmap states that it takes the viewpoint of the individual enterprise with respect to enterprise interoperability (section 2.3, first paragraph). Still, I believe that there could be worthwhile to not only look at benefits for the individual enterprise but for the European Economy and even Global trade in general.
- I provide you with a slide set of Mary Mitchel given at the OAG Meeting in June 2006 in Gaithersburg on "The role of Open Standards in Federal IT" [not attached]. It relates open standards to global trade.

### Response

*The wider impact of Enterprise Interoperability is indeed important. Research in this area is described in various Business-Economic Research Challenges in Annex I. See also the end of the introductory section to these Research Challenges (Chapter 2, Annex I), which classify the contexts for these Research Challenges at various levels, including the macro and societal levels.*

*Thank you for sharing with us the slides of Mary Michel. We note that these slides are published at: <http://www.openapplications.org/downloads/meetings/20060502-Gaithersburg/Tuesday/Policy%20Open%20Standards1.ppt>*

### Issue 437

Category: Web Technologies

Comment 9: section 6 "Web Technologies for Enterprise Interoperability"

- It seems to me that this grand challenge has more a technology-push than a scenario-pull. This is fine with me. It might just be made a bit more explicit in the text.
- Evaluation of technologies and their application for enterprise interoperability is for me an important research issue. On the other hand, it has to be ensured that this is not contradicted by other statements in the document like "de-coupling the main thrust of the research from particular technologies ...." (sec 8.3, 1st bullet in second list, p31).

### Response

- *The problem statement of the Web Technologies Grand Challenge links these technologies to the much broader business context and spells out the importance of these technologies within that context. It is not necessarily a technology push. While a number of software vendors are migrating their software solutions to Web based solutions, it seems that it is reflecting the desire of customers rather than that of suppliers.*
- *We do not see a contradiction, particularly that the sentence in question has been amended to "Decoupling the research from particular technologies and product strategies of providers" in Roadmap V4.0. The Science Base Grand Challenge emphasises technology evaluation and application using scientific concepts and principles.*

## Issue 438

Category: ISU

Comment 9: section 7.3 “New Ideas”

- “It should be independent of, rather than an extension ..... by technology vendors”. I understand the reasoning that the ISU should be available to the whole economy. Still, one implementation of an ISU could be provided by private organisation (I do not say the only one). As long as interoperability between ISU implementations is secured this could be a feasible set-up.

## Response

*This issue is very similar to Issue 405. See response to Issue 405.*

## 49. Comments received from Barbara Gatti, CEN - European Committee for Standardization

Received on 11 July 2006.

## Issue 439

Category: general

We suggest replacing the text at page 6 (of version 0.3)

“Various modeling and notation languages are available to orchestrate business processes and their execution. WS-BPEL, the Business Process Execution Language for Web Services (formerly known as BPEL4WS) is one of the most promising. WS-BPEL provides a language to specify business processes that are composed of Web services as well as exposed as Web services. It specifies business process behaviour based on web services, i.e. it can be seen as a (business) extension to the web services paradigm. BPEL4People is an extension of WS-BPEL to model how people interact with business processes.”

With:

“Several modelling and notation, and process languages are available to describe business processes and their execution. WS-BPEL, the Business Process Execution Language for Web Services, currently drafted in an OASIS TC, is one of the most promising. WS-BPEL provides a language to specify business processes that are composed of and exposed as Web services. It specifies business process behaviour based on web services, i.e. it can be seen as a (business) extension to the web services paradigm. \*\*BPEL4People is a draft paper that describes an extension to WS-BPEL to specify how people interact with business processes.”

## Response

*Thank you for this contribution. We have made the replacement as suggested in Roadmap V4.0, with the following changes:*

- *“is one of the most promising” is changed to “is generally considered one of the most promising”*
- *Reference to BPEL4People is not retained as various extensions to WS-BPEL have been put forward (as noted in Issue 432).*

## 50. Comments received from Tapio Rissanen, EuroConseils sprl

Received on 12 July 2006.

### Issue 440

Category: general

[...]

Nevertheless I would like to contribute to this exercise if it is still possible - in the texts I see two issues which could be taken up more clearly in the proposed R&D actions to make best use of the ICT-based digital economy:

#### 1: Hierarchical PKI Root CA scheme for Europe

#### 2: XML-based systems, structures and standards for digitally signed documents and transactions

[...]

Both of the above mentioned subjects are critical and urgent issues as well when speaking about the take up of proper local or cross border eServices and eBusinesses in Europe.

**The first issue** is part of the point 1.5. "Regularisation of Trusted Certification Authorities", Policy challenge on page 2 of the Annex I - Indicative Research Challenges.

If you could include in the "Description" box at the end of the text something like: "... and what is being certified, **as there are no common rules or structures available**".

In the "Research Activity" box a text could be added giving a broader view to this subject, e.g. **"Introduce regulation with appropriate technological (for example hierarchical PKI Root CA scheme for Europe) and corresponding legal framework for CAs giving them solid bases for trust and benefit ..."**

**For the second issue:** As the web-based systems and services are taking place needing also new ways for digital signature of documents online, hence the old, actual non interoperable systems & standards (like .pdf, .pm7 or .sig) will loose the grounds. **New structures, systems and standards based on XML should be developed for digital signature** - for that purpose there are neither suitable XML-standards nor structures available. Unfortunately I did not found directly any point for this important and urgent issue, I hope you could find where it would fit best to the final document.

### Response

*Hierarchical PKI Root CA scheme for Europe:*

*We note that this proposal and various aspects of its possible implementation have been on the agenda of many EU forums for some years. In light of all these discussions, it would be reasonable to conclude that the issue as such is no longer a research issue.*

*The suitability of particular CA schemes is not the focus of the Research Challenge P5, which concerns CA licensing. The main issue is one of trust (or lack thereof), not a lack of common rules or structures. It is not within the scope of P5 or any other Research Challenges of this Roadmap to make specific policy recommendations such as a root CA for Europe.*

*XML-based systems, structures and standards for digitally signed documents and transactions:*

*Various standards organisations have been addressing the above, resulting in specifications such as XML DSIG, XML ENC, XKMS, WS-Security, SAML, the large number of specifications produced under the joint effort of CEN/ISSS and ETSI on EESSI, and so on. It is not within the scope of this Roadmap to address specific standards issues. See General Response 2.*