



Grant Agreement N° 215483

Title: **Release of Research Roadmap on SBAs and sustainable convergence knowledge model**

Authors: **SZTAKI, TUW, UniDue, UniHH, UPM, CITY, CNR, FBK, INRIA, Tilburg, USTUTT + S-Cube Associate Members**

Editors: **Andreas Metzger (UniDue), Oktay Turetken (Tilburg)**

Reviewers: **Widura Schwittek (UniDue, NESSoS NoE)**

Identifier: **CD-IA-1.1.8**

Type: **Deliverable**

Version: **1**

Date: **10.03.2012**

Status: **Final**

Class: **External**

Management Summary

The aim of this deliverable is twofold. First, it summarizes the S-Cube activities and results for what concerns the release of a research roadmap on service-based applications. Secondly, it describes the activities and outcomes to update the S-Cube Knowledge Model (KM) as well as to ensure its sustainability.

Copyright © 2012 by the S-CUBE consortium – All rights reserved.

The research leading to these results has received funding from the European Community's Seventh Framework Programme FP7/2007-2013 under grant agreement n° 215483 (S-Cube).

Members of the S-Cube consortium:

University of Duisburg-Essen (Coordinator)	Germany
Tilburg University	Netherlands
City University London	U.K.
Consiglio Nazionale delle Ricerche	Italy
Center for Scientific and Technological Research	Italy
The French National Institute for Research in Computer Science and Control	France
Lero - The Irish Software Engineering Research Centre	Ireland
Politecnico di Milano	Italy
MTA SZTAKI – Computer and Automation Research Institute	Hungary
Vienna University of Technology	Austria
Université Claude Bernard Lyon	France
University of Crete	Greece
Universidad Politécnica de Madrid	Spain
University of Stuttgart	Germany
University of Hamburg	Germany
Vrije Universiteit Amsterdam	Netherlands

Published S-Cube documents

All public S-Cube deliverables are available from the S-Cube Web Portal at the following URL:

<http://www.s-cube-network.eu/results/deliverables/>

The S-Cube Deliverable Series

Vision and Objectives of S-Cube

The Software Services and Systems Network (S-Cube) will establish a unified, multidisciplinary, vibrant research community which will enable Europe to lead the software-services revolution, helping shape the software-service based Internet which is the backbone of our future interactive society.

By integrating diverse research communities, S-Cube intends to achieve world-wide scientific excellence in a field that is critical for European competitiveness. S-Cube will accomplish its aims by meeting the following objectives:

- Re-aligning, re-shaping and integrating research agendas of key European players from diverse research areas and by synthesizing and integrating diversified knowledge, thereby establishing a long-lasting foundation for steering research and for achieving innovation at the highest level.
- Inaugurating a Europe-wide common program of education and training for researchers and industry thereby creating a common culture that will have a profound impact on the future of the field.
- Establishing a pro-active mobility plan to enable cross-fertilization and thereby fostering the integration of research communities and the establishment of a common software services research culture.
- Establishing trust relationships with industry via European Technology Platforms (specifically NESSI) to achieve a catalytic effect in shaping European research, strengthening industrial competitiveness and addressing main societal challenges.
- Defining a broader research vision and perspective that will shape the software-service based Internet of the future and will accelerate economic growth and improve the living conditions of European citizens.

S-Cube will produce an integrated research community of international reputation and acclaim that will help define the future shape of the field of software services which is of critical for European competitiveness. S-Cube will provide service engineering methodologies which facilitate the development, deployment and adjustment of sophisticated hybrid service-based systems that cannot be addressed with today's limited software engineering approaches. S-Cube will further introduce an advanced training program for researchers and practitioners. Finally, S-Cube intends to bring strategic added value to European industry by using industry best-practice models and by implementing research results into pilot business cases and prototype systems.

S-Cube materials are available from URL: <http://www.s-cube-network.eu/>

Table of Contents

1	Introduction	6
2	S-Cube Research Roadmap	7
3	Knowledge Model Status and Advances.....	8
3.1	<i>Interlinking KM Terms</i>	8
3.2	<i>Paper on the S-Cube Knowledge Model Endeavor</i>	8
4	Sustainable S-Cube Knowledge Model.....	9
4.1	<i>Experiences with Wikipedia.....</i>	9
4.2	<i>Alternative Means to Ensure Sustainability.....</i>	11
4.2.1	Schloss Dagstuhl.....	11
4.2.2	IFIP Working group on Service-Oriented Systems (WG 2.14/6.12/8.10).....	11
4.3	<i>Collaborations with other EU Projects and External Bodies</i>	12
4.3.1	HOLA! Initiative	12
4.3.2	OMELETTE Project.....	13
4.3.3	External Bodies.....	13
5	Conclusion.....	14
	Bibliography	15
	Appendix A S-Cube’s Experience with Wikipedia	16
A.1	<i>Examples from Previous Efforts.....</i>	16
A.2	<i>Relating our Experiences with Wikipedia Content Standards.....</i>	18

1 Introduction

The aim of this deliverable is twofold:

- First, this deliverable summarizes the S-Cube activities and results for what concerns the **release of a research roadmap on service-based applications (Section 2)**. Beyond other activities, S-Cube has secured a dedicated ICSE 2012 workshop to showcase the research challenges as identified by the network and its collaborators and to foster follow-up roadmap activities.
- Secondly, this deliverable describes the activities and outcomes to **update the S-Cube Knowledge Model (Section 3)** as well as to ensure its **sustainability (Section 4)**. S-Cube members took great strides such that the Knowledge Model will remain publicly available and will be updated after the end of the funding period of the network.

2 S-Cube Research Roadmap

The Future Internet will see the convergence of the physical (“Internet of Things”) and digital worlds, into a completely new reality, where richer real-time and mobile communication modalities will arise. Services will play a key role as building blocks, providing abstraction and virtualization, not just of data storage, processing and networks, but also of devices, connectivity, physical goods and applications, content and associated intellectual property, and even physical presence.

Future software technology and methods thus will need to cope with trends such as the convergence of the Internet of Things and the Internet of Services; novel life-cycle models where the boundary between design and runtime will increasingly blur; online quality assurance and self-adaptation; as well as novel architectural styles for large-scale, long-living service-oriented systems.

To understand which challenges the services community should address in the longer term and also to involve communities beyond the S-Cube network, the network set out to identify a research **roadmap on “Adaptive Software and Services in the Future Internet”**.

The identification of the S-Cube Research Roadmap constitutes the following major activities:

1. In November 2011, S-Cube gathered 40 experts in the field (including S-Cube full and associate members, as well as invited scientists) to openly identify and discuss long-term challenges of the field. As part of the S-Cube plenary meeting in Barcelona, a whole day was devoted as an **S-Cube Research Roadmap Workshop**. The day was organized into four topical sessions:
 - “Service life-cycle and software engineering”
 - “Service technology foundations”
 - “Multi-layer and mixed-initiative monitoring and adaptation for service-oriented systems”
 - “Online service quality prediction for proactive adaptation”.
2. The workshop led to two major kinds of outcomes, which are individually **published as papers at ICSE 2012**:
 - a. An assessment of the **relevance of the research challenges** identified (in terms of their impact). Based on a survey study, the findings of the Roadmap Workshop have been analyzed and prioritized according to their expected impact on research and industry. Those results are published in [1].
 - b. For each of the topical sessions, workshop participants jointly authored papers providing **detailed research challenges and relating those challenges to the state of the art** in the field. Those results are published in [2], [3], [4] and [5] respectively.
3. To conclude the roadmap activities and to foster wider discussion and uptake by the community, S-Cube has been successful in securing a dedicated **ICSE 2012 workshop on “European Software Services and Systems Research - Results and Challenges”** (<http://www.s-cube-network.eu/icse>). During this workshop, they key findings from above will be presented and openly discussed with other researchers in the field. The workshop is thus intended to serve as a springboard to discuss software engineering research challenges for future service-oriented systems.

3 Knowledge Model Status and Advances

The below sections summarize the activities performed during year 4 of S-Cube to update the Knowledge Model.

3.1 Interlinking KM Terms

For the purpose of enhancing the browsing experience of S-Cube KM visitors, the S-Cube team has initiated a set of enhancements in the KM structure and presentation, which included the analysis of visitors' browsing patterns using Google Analytics. In order to increase visitors' retention time and discovery of terms, it was decided to increase the interlinking between KM terms and pages.

As a result of coordinated partner efforts, the number of links in the KM has risen from ~300 to over 1000 by the end of October 2011, which we believe will improve the retention-time and the overall browsing experience of future KM visitors.

3.2 Paper on the S-Cube Knowledge Model Endeavor

S-Cube's experience in establishing the KM has been published [1] and presented at one of the premier conferences on knowledge management – KMIS 2012 (International Joint Conference on Knowledge Discovery, Knowledge Engineering and Knowledge Management)¹.

The paper is a description of the motivation, methodology and implementation of the S-Cube KM and a presentation of S-Cube's experiences in capturing, curating, managing and refining the knowledge gathered from researchers in the S-Cube NoE. It describes how a large, multidisciplinary research project went about ensuring a common understanding of research, capabilities and outputs by using a holistic and consistent knowledge management framework and a set of procedures for content validation and quality assurance.

¹ KMIS 2011: <http://www.kmis.ic3k.org/KMIS2011/>

4 Sustainable S-Cube Knowledge Model

S-Cube aimed at creating strong, long lasting and evolving links among the different research communities to ensure durability and sustainability of the network objectives [7]. S-Cube established consensus on a common research agenda, consolidation, as well as integration and exploitation of research results from European initiatives and institutes (within and outside the network beneficiaries). One instrument employed for achieving this objective is the S-Cube's Convergence Knowledge Model (KM), which aimed at mapping and structuring the complementarities of beneficiaries' knowledge, identifying research gaps, determining the research issues that are of importance for the next generation services technologies, and harmonizing research results.

The KM provides a common understanding of diverse knowledge in the form of a free, open-content 'living' encyclopaedia, accessible through the Web. It provides public, read-only access for non-network users through the S-Cube Web Portal. It also offers a dynamic, interactive application for network beneficiaries and external bodies interested in contributing to the knowledge, to define concepts, approaches and methodologies, as well as associations between them. The KM helps users to negotiate a large body of knowledge by providing them with mental cues for navigating knowledge from different knowledge domains related to all aspects of service-oriented research and associated methodologies and supporting environments.

Promoting the use of the S-Cube KM outside the network, encouraging its use in academia, industry through dissemination and 'spread of excellence' activities have been essential agenda items for ensuring durability and sustainability of the knowledge model. This section of the deliverable summarizes the efforts towards this key objective. It highlights the activities performed for furthering the use and integration of KM by external bodies, broadening its reach and subsistence in the community, and thereby ensuring that it 'lives on' after the network ends. Further importance has been placed to align these activities to address the reviewers' recommendation in the 3rd year review regarding the sustainability of the KM.

4.1 Experiences with Wikipedia

S-Cube reviewers recommended the KM workpackage (WP-IA-1.1)

"shall look into tooling support (requiring reasonable but limited efforts) to transform the content of the knowledge model into a self-contained Wikipedia section."

As for the network's objectives of promoting research into Service-Based Applications and SSME in general through effective means, the S-Cube consortium has put extensive effort to integrate with Wikipedia since the early stages of the project. However, our previous experiences with Wikipedia have led us to be wary of adding content as it is reviewed and removed almost immediately, with only limited success. Having experienced severe difficulties and considered how to achieve this request, we doubted this task could be completed to the reviewers' satisfaction. This section sets out the reasons why we think this is the case and our experiences with Wikipedia to support those reasons. In the remaining sections, we introduce our alternative efforts for ensuring the sustainability of the KM and contributing to its expanded and continual use.

Appendix A lists some of our previous examples where our efforts to integrate with Wikipedia left fruitless. Our early experiences start with the removal of the links in Wikipedia terms to S-Cube KM definitions (such as 'Software Services', 'Web Services', 'Service Networks', etc.), with no explanations. Despite a repeated series of discouraging experiences, in our latest attempt in September 2011, the network members created links to 16 KM terms in Wikipedia with a collective effort. Table

1 (in Appendix A) lists these terms and the details regarding the effort of integrating with Wikipedia. *Eight out of sixteen terms were removed by Wikipedia without any valid explanation.*

Our investigations on the cases we have faced also revealed parallel experiences in other European projects. In the Internet of Services 2011 Collaboration Meeting, Ad Emmen of the Contrail project² shared their project's experiences of adding content to Wikipedia in his presentation in the Dissemination Working Group session. Emmen states that any contributions from their project were removed immediately and adds:

“Be ready to face: Wim C, who has a night job as remover of European project descriptions on Wikipedia”

Daniel Field from Atos Origin confirmed the same experience with Wikipedia in the BREIN and BEinGrid projects - i.e., the content they added was immediately deleted.

As illustrated by the experiences in the community, adding our own work to Wikipedia is difficult under Wikipedia's content standards mainly due to a conflict of interest - defined as:

“... adding material that appears to promote the interests or visibility of an article's author, its author's family members, employer, associates, or their business or personal interests.”

We describe Wikipedia's Content Standards and corresponding justifications from Wikipedia in Appendix A. According to the Wikipedia policy, the KM could be considered a 'self-published source', which is largely 'not acceptable'. It is not allowed to add knowledge to Wikipedia from 'self-published' sources as it is considered 'original research'. As the S-Cube KM is an aggregation of knowledge of project deliverables and original publications of S-Cube members and third parties, much of the content is not considered to be independent or not allowed as it is not from a reliable source according to Wikipedia. Although the addition of term definitions from third parties (with references to the sources) would be allowed, a link back to the KM term from these articles seems possible only if it is *not* considered advertising by a more assertive editor. In our last attempt, half of such links were removed. The benefit to S-Cube of carrying this out was therefore debatable, as we could not promote our own work in Wikipedia.

In addition to the concerns discussed above, we cannot find a previous instance of a self-contained section in Wikipedia for a particular topic. The categorization of articles is possible but - with the same reasons mentioned above - we could not promote S-Cube using a category page as these are usually provided without motivation and any extra content would be considered 'advertising'. We have not found any category pages that have links to sources external to Wikipedia, such as to the KM.

Furthermore, we feel there is a mismatch between goals of Wikipedia and the Knowledge Model:

1. The objective of a Wikipedia article is in conflict to a KM term: In Wikipedia homonyms (words that share the same written form but have different meanings) must be on separate pages. In the KM we place these on the same page to demonstrate the relationship between service technology layers and cross-cutting issues.
2. Wikipedia articles are encyclopaedic accounts with a much broader scope than the focused knowledge the KM contains. Transforming KM terms into Wikipedia articles would require additional information (e.g., links to other Wikipedia articles, use context explanation, history, "see also", external links) that is currently not encoded in the KM.

² Internet of Services 2011, Dissemination WG (Brussel, 2011-09-28), Presentation by Ad Emmen (Contrail Project), Titled "Cloud communication in the Cloud" at http://ec.europa.eu/information_society/events/cf/ios11/item-display.cfm?id=7402

4.2 *Alternative Means to Ensure Sustainability*

S-Cube has been in collaboration with several institutes and bodies renowned in the field to foster the use and sustainability of the KM, as well as to secure and to ease the hand-over process for its reliable and continual hosting and maintenance. In this section, we discuss two bodies that S-Cube has contacted in particular for the latter purpose. Among these efforts, the discussions with IFIP Working group on Service-Oriented Systems yielded successful results.

4.2.1 **Schloss Dagstuhl**

Schloss Dagstuhl - Leibniz Center for Informatics is a non-profit institute funded jointly by the German federal government and a number of state governments. The center promotes fundamental and applied research, continuing and advanced academic education, and the transfer of knowledge between those involved in the research side and application side of informatics. Dagstuhl supports computer science by organizing high ranked seminars, which bring together internationally renowned leading scientists from academia and industry for the purpose of exploring innovative topics in informatics.

S-Cube communicated with Dagstuhl on the possibility of Dagstuhl hosting the KM. As outcome of the correspondence between the Founder and Scientific Director of Dagstuhl Prof. Dr. Reinhard Wilhelm, and Prof. Dr. Frank Leymann (the director of the Institute of Architecture of Application Systems at the University of Stuttgart – USTUTT) and the Scientific Director of S-Cube Prof. Dr. Mike Papazoglou (Tilburg) on the subject matter, Dagstuhl expressed their interest on the activity and results. However, they were concerned with the effort that is required for establishing the infrastructure to migrate and host the KM.

4.2.2 **IFIP Working group on Service-Oriented Systems (WG 2.14/6.12/8.10)**

The International Federation for Information Processing (IFIP)³ is a non-governmental, non-profit multinational organization in Information & Communications Technologies and Sciences. It was established in 1960 under the auspices of UNESCO, and currently represents members from 56 countries and regions with a total membership of over half a million. IFIP links more than 3500 scientists from academia and industry and has over 100 working groups (WG) and 13 technical committees (TC). It sponsors 100 conferences yearly providing unparalleled coverage from theoretical informatics to the relationship between informatics and society including hardware and software technologies, and networked information systems. IFIP scientific and technological leadership is warranted by working group membership, based solely on individual excellence and asserted by the organization of highest quality international events, and the publication of some 30 new books annually that are distributed worldwide.

The IFIP Working Group (WG 2.14) on Service-Oriented Systems⁴ is established with the aim of organizing and promoting the exchange of information on fundamental as well as practical aspects of service-oriented systems. In doing so, the working group considers service-oriented systems from technological and business as well as economic perspectives. It shapes a research community that comprises both academia and industry and aims to become an active, permanent, and international forum on service-oriented systems. Besides the technological underpinnings, the working group addresses the different facets of the discipline. It also targets at organizing current initiatives and research, and proposing suitable and sustainable future research directions. The WG is chaired by

³ International Federation for Information Processing (IFIP): <http://www.ifip.org/>

⁴ IFIP Working Group (WG 2.14) on Service-Oriented Systems: <http://home.dei.polimi.it/baresi/ifip/>

Luciano Baresi and Barbara Pernici (Politecnico di Milano - POLIMI, Dipartimento di Elettronica e Informazione) and Winfried Lamersdorf (University of Hamburg – UniHH, FB Informatik).

Given the current level of activities in service orientation, the WG aims at consolidating initiatives instead of proposing new ones, and as such becoming a glue among existing activities, identifying the right synergies among existing initiatives, and acting as catalyst among existing (sub-) communities. The working group also pursues the objective of consolidating fundamental and theoretical aspects, and identifying future research directions in the discipline. This will provide proper and shared means to conduct research in the field to whoever is interested in service-oriented computing and systems. A first foreseen incarnation of these activities is the provision of qualified support to PhD-level research through the creation of dedicated workshops addressed to supervisors of PhD theses in the field. Shared and strong foundations also serve to strengthen the relationships with related fields (e.g., Internet of Things and Cloud Computing) and to base the coordination of efforts with standardization groups.

As a part of its mission of gluing existing undertakings in the field of service-oriented systems, the WG agreed to promote the use of the KM and guarantee its sustainability. This will be accomplished by creating awareness of KM and its artefacts in the research and practitioners community through promotions and furthering its use at supported events and activities including premier conferences (such as ICSOC, ICWS-SCC-Cloud, ECOWS, ServiceWave). As regards to the agreement between WG Chairs and S-Cube partners (many of which have members in the WG), the hosting and technical maintenance of the KM will still be in charge to the S-Cube partner that are currently responsible for these activities. Accordingly, KM will be hosted, maintained and secured for integrity and quality in its current locality and settings by UniDue (as a WG member) and will be directly accessible through the WG's web site under its auspices.

In addition to KM, the WG will also promote and ensure the sustainability of two other long-lasting artefacts produced by S-Cube; namely, the Use Cases Repository and the Virtual Campus, under the same principles of the agreement.

4.3 Collaborations with other EU Projects and External Bodies

4.3.1 HOLA! Initiative

HOLA!⁵ is an EC initiative to enhance collaboration and promote advancement of future ICT services in Europe. It aims at supporting the EC in the creation of a critical mass of SSAI stakeholders working together in building concepts for services in the Future Internet. To this end, HOLA! implements strategic mechanisms for establishing and upholding long-term collaboration and knowledge management. One of the key instruments employed for this purpose is raising consolidated knowledge from the European Research Projects within the Internet of Service (IoS) area. This is supported by creating a *Digital Library of project deliverables* of these projects. The Digital Library hosts public deliverables of research projects in the IoS area, facilitating technology transfer and knowledge sharing, management, maintenance and creation. These deliverables include technical documents but also presentations, source code archives, etc.

Since October 2010, S-Cube and HOLA! are collaborating⁶ for the purpose of using S-Cube KM as a meta-data schema that provides the keywords attached to HOLA! IoS Digital Library⁷ contents.

⁵ HOLA! Initiative: <http://www.holaportal.eu/node/12>

⁶ HOLA! Contact point: Angelos Yannopoulos, National Technical University of Athens

HOLA! is currently using KM terms to structure the digital library through keywords, which assist classification and searching in the digital library, and allow relationships to be found between researchers (through their competencies) and research outputs. Please refer to HOLA! IoS Digital Library site⁷ for video-tutorials presenting how S-Cube KM structure and terms are integrated to HOLA! Digital Library contents.

4.3.2 OMELETTE Project

OMELETTE Project⁸ is an FP7 project aiming at defining interoperable service mashups focusing on the Telco domain. It proposes a process of service development based on a mashup-oriented approach, which will enable the development of multimodal services in the Telco domain by assisting end-users with automatic compositions or composition recommendations and by speeding up the work of developers. To this end, OMELETTE will produce a vocabulary to be used as a common reference that will assist in creating mashups. This requires a platform to record the vocabulary and some method of structuring the content. With S-Cube KM offering a rich repository of terms, OMELETTE has decided to use the KM as the basis for their vocabulary and is collaborating⁹ with S-Cube for this purpose since April 2011.

OMELETTE has also initiated the extension of S-Cube KM with terms in the Telco domain and in the NEXOF-RA glossary¹⁰. To ensure the quality, homogeneity, and consistency amongst terms, the KM adopts a governance structure, including a quality assurance process [6]. Special care is taken with entries added or modified by the non-network users, and their content are reviewed and edited accordingly. The process of extending the KM with new terms (by OMELETTE) and their quality assurance has started in December 2011 and is on-going at the time of writing this report.

4.3.3 External Bodies

S-Cube KM has attracted interest also from non-European research institutes and universities. The initial steps have been taken by S-Cube members and Prof. Aditya Ghose (the research leader in the Smart Services CRC for the ‘Strategic Alignment of Services’), who has expressed their interest in referring to S-Cube KM in their research activities and establishing a long-lasting collaboration. Smart Services CRC is headquartered at the Australian Technology Park in Sydney and with research nodes in Brisbane, Melbourne and Sydney. The KM has been also one of the pillars of the on-going collaboration between S-Cube and Tsinghua University (China) through Prof. Chi-Hung Chi, the Director of Internet Content & Service Engineering Laboratory.

⁷ HOLA! Digital Library: <http://www.holaportal.eu/content/gilvus-euismod-suscipit-euismod-neo-typicus-refoveo>

⁸ OMELETTE Project: <http://www.ict-omelette.eu/home>

⁹ OMELETTE Contact point: Vadim Chepegin, at TIE Holding RDI, Netherlands

¹⁰ NEXOF-RA Glossary: <http://www.nexof-ra.eu/?q=node/187>

5 Conclusion

This deliverable summarized the two major outcomes of workpackage IA-1.1 that have been achieved by its members within year 4 of S-Cube. We consider those outcomes a profound contribution to the community:

- First, the **S-Cube Research Roadmap** provides a clear vision of S-Cube and its collaborators on what research issues and challenges will become relevant in 5-10 years.
- Secondly, the **S-Cube Knowledge Model**, which will be maintained even after the end of S-Cube, will provide an extensive reference on terminology and concepts for the field.

Acknowledgments: As editors of this deliverable, we cordially thank all S-Cube members, associate members, visiting scientists and collaborating project members for their contributions.

– *Andreas Metzger & Oktay Turetken*

Bibliography

- [1] A. Metzger, K. Pohl, M. Papazoglou, E. D. Nitto, A. Marconi, and D. Karastoyanova, “Research challenges on adaptive software and services in the future internet: Towards the S-Cube research roadmap,” in ICSE 2012 Workshop on European Software Services and Systems Research Results and Challenges (S-Cube), 2012.
- [2] E. Di Nitto et al. “Research challenges on service life-cycle and software engineering,” in Proceedings of the ICSE 2012 Workshop on European Software Services and Systems Research – Results and Challenges (S-Cube), 2012.
- [3] D. Karastoyanova et al. “Research challenges on service technology foundations,” in Proceedings of the ICSE 2012 Workshop on European Software Services and Systems Research – Results and Challenges (S-Cube), 2012.
- [4] A. Marconi et al. “Research challenges on multilayer and mixed-initiative monitoring and adaptation of service-oriented systems,” in Proceedings of the ICSE 2012 Workshop on European Software Services and Systems Research – Results and Challenges (S-Cube), 2012.
- [5] A. Metzger et al. “Research challenges on online service quality prediction for proactive adaptation” in Proceedings of the ICSE 2012 Workshop on European Software Services and Systems Research – Results and Challenges (S-Cube), 2012.
- [6] Andrikopoulos, V., Parkin, M., Papazoglou, M.P. and Lago, P. (2011). The S-Cube Knowledge Model – Experiences in Integrating SSME Research Communities, KMIS 2011. Paris, France.
- [7] Andrikopoulos V., Metzger, A. (Ed.), CD-IA-1.1.2: Separate knowledge models for functional layers, S-Cube Deliverable. Mar.2009.

Appendix A S-Cube's Experience with Wikipedia

A.1 Examples from Previous Efforts

This section details the integration efforts of S-Cube -and KM in particular- with Wikipedia by going through several examples of the content previously added to Wikipedia and the editors' reactions.

Example 1

18 Dec 2009: All hyper-links to S-Cube partner home-pages, all keywords ("Software Services", "Web Services", "Service Networks") and the project logo was removed from the S-Cube Wikipedia page. No explanation given.

Example 2

20 Jan 2010: The following was added to the S-Cube page in Wikipedia:

"The [http://www.s-cube-network.eu/km/km-frontpage S-Cube Knowledge Model] is a collection of technical definitions that are used in the S-Cube project. Its intention is to create a living knowledge base for researchers in the field of software services and software systems."

21 Jan 2010: Returned to Wikipedia to find the text and link had been deleted from page with the explanation: "removing advert section".

10 Feb 2010: Added the text and link again, which were immediately removed with the following explanation:

"The section was removed because it was not sourced to an independent reliable source. All of the information on Wikipedia must be independently verifiable. Please also note that if you have a conflict of interest with a subject, you are highly discouraged from editing its article. TNXMan 16:14, 10 February 2010 (UTC)"

Example 3:

17 Feb 2010: Added project objectives to S-Cube Wikipedia page and a link to the KM:

Project objectives:

- Establishing an open community of Software Engineering and Service Researchers from both, industry and academia
- Creating a common [http://www.s-cube-network.eu/km/km knowledge-base]
- Developing long term visions and research directions

17 Feb 2010: The project objectives and link were removed from the S-Cube Wikipedia page. No explanation given.

Example 4:

8 Mar 2010: Added a sentence and link from Wikipedia article to Service Choreography term. This has remained but the added value is minimal: the link does not have a context and the relationship to cross-cutting concerns, for example, has been lost.

Latest Attempts:

In September 2011, the members put links to 15 KM terms in Wikipedia. Table 1 lists these terms, their link addresses, the time when they were added and by whom. As can be seen, eight out of 16 terms were removed by Wikipedia without any valid explanation.

Table 1. List of Terms added to Wikipedia

Wikipedia Term	Wikipedia Address	S-Cube KM Term	Who Added	When Added	Removed?
Performance Indicator	http://en.wikipedia.org/wiki/Performance_indicator	http://www.s-cube-network.eu/km/terms/k/key-performance-indicator	Alex Nowak (USTUTT)	22/09/11	Yes
Business Process Modelling	http://en.wikipedia.org/wiki/Business_process_modelling	http://www.s-cube-network.eu/km/terms/b/business-process-modeling	Alex Nowak (USTUTT)	22/09/11	Yes
Business Activity Monitoring	http://en.wikipedia.org/wiki/Business_activity_monitoring	http://www.s-cube-network.eu/km/terms/b/business-activity-monitoring	Alex Nowak (USTUTT)	22/09/11	Yes
Service-oriented Software Engineering	http://en.wikipedia.org/wiki/Service-oriented_software_engineering	http://www.s-cube-network.eu/km/terms/s/service-oriented-software-engineering	Angela Kounkou (City)	30/09/11	Yes
Self Management	http://en.wikipedia.org/wiki/Self-management_(computer_science)#cite_ref-0	http://www.s-cube-network.eu/km/terms/s/self-healing-system	Angela Kounkou (City)	30/09/11	
Web Services Invocation Framework	http://en.wikipedia.org/wiki/Web_Services_Invocation_Framework	http://www.s-cube-network.eu/km/terms/s/service-binding	Angela Kounkou (City)	30/09/11	Yes
Context (computing)	http://en.wikipedia.org/wiki/Context_(computing)#See_also	http://www.s-cube-network.eu/km/terms/c/context	George Baryannis (UoC)	23/09/11	
Service Level Agreement	http://en.wikipedia.org/wiki/Service_level_agreement#See_also	http://www.s-cube-network.eu/km/terms/s/service-level-agreement	George Baryannis (UoC)	23/09/11	
Service Discovery	http://en.wikipedia.org/wiki/Service_discovery#See_also	http://www.s-cube-network.eu/km/terms/s/service-discovery	George Baryannis (UoC)	23/09/11	
Semantic Web Services	http://en.wikipedia.org/wiki/Semantic_Web_Services	http://www.s-cube-network.eu/km/terms/s/semantic-web-services	Dragan Ivanovic (UPM)	26/09/11	Yes
Quality-of-Service	http://en.wikipedia.org/wiki/Quality_of_service	http://www.s-cube-network.eu/km/terms/q/quality-of-service-qos	Dragan Ivanovic (UPM)	26/09/11	Yes
Workflow	http://en.wikipedia.org/wiki/Workflow	http://www.s-cube-network.eu/km/terms/w/workflow	Dragan Ivanovic (UPM)	26/09/11	Yes
Service-Choreography	http://en.wikipedia.org/wiki/Service_choreography#cite_note-0	http://www.s-cube-network.eu/km/terms/s/service-choreography	Martin Trieber (TuW)	NA	

Wikipedia Term	Wikipedia Address	S-Cube KM Term	Who Added	When Added	Removed?
Business-Transaction Management	http://en.wikipedia.org/wiki/Business_transaction_management#cite_note-4	http://www.s-cube-network.eu/km/terms/b/business-transaction	Martin Trieber (TuW)	NA	
Process-Modeling	http://en.wikipedia.org/wiki/Process_modeling#External_links	http://www.s-cube-network.eu/km/terms/b/business-process-modeling	Martin Trieber (TuW)	NA	

A.2 Relating our Experiences with Wikipedia Content Standards

- 1) As illustrated in the examples, adding our own work to Wikipedia is difficult under Wikipedia's content standards as there is a conflict of interest - defined as:

"... adding material that appears to promote the interests or visibility of an article's author, its author's family members, employer, associates, or their business or personal interests."

- 2) Much of the content of the KM has been added from the original research and findings of S-Cube. However, Wikipedia editorial guidelines stress that contributions must be independently verifiable and they should not contain original work.

- 3) According to Wikipedia policy, the KM could be considered a "self-published source":

"... self-published media [...] are largely not acceptable. This includes any website whose content is largely user-generated". "Self-published material, whether on paper or online, is generally not regarded as reliable."

- 4) It is not allowed to add knowledge from "self-published" sources as it is considered "original research" (see also point 2 on independence):

"... used on Wikipedia to refer to material—such as facts, allegations, ideas, and stories—for which no reliable published source exists".

- 5) Content "promoting" a piece of work, such as the S-Cube network or its output, is considered "an advertisement" and removed (see examples above). Adding KM items, such as references to deliverables and competencies (a directory of names and institutions), would not be possible.