

Title: *Consolidated convergence knowledge model*

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Management Summary

This deliverable describes the work done to achieve a Consolidated Convergence Knowledge Model as required at M33. Consolidation of the Knowledge Model is obtained on the basis of the results of the research agenda alignment, and of the new research results achieved by the different research work-packages. The current deliverable constitutes a follow-up of deliverable CD-IA-1.1.3, and offers an assessment of the KPIs (Key Performance Indicators) defined for the evaluation of the consolidation of the Knowledge Model.

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Chapter 1

Introduction

1.1 Objective of the KM

The Convergence Knowledge Model work-package has the aim of developing a Knowledge Model (KM) capturing the terminology used in the literature and within the S-Cube project and classifying the competencies of the beneficiaries and their research, as reported in the DoW [1]. The KM is provided as a Web-based repository¹ containing all the terms gathered by partners as well as the competencies associated to each terms. The KM integrates and synthesizes the diverse concepts and knowledge of partners in the different research areas. As better explained in [2], each term is represented by a set of definitions belonging to the intersection of the three WPs on service technology and the three WPs on service engineering and adaptation methodologies (Table1.1). The aforementioned relationships between definitions and their respective WPs are as follows:

- Service Technologies
 - Business Process Management (BPM)
 - Service Composition (SC)
 - Service Infrastructure (SI)
- Technology Principles, Techniques & Methodologies
 - Engineering and Design (ED)
 - Adaptation and Monitoring (AM)
 - Quality Definition, Negotiation and Assurance (QA)

1.2 Current Work/deliverable

One of the objectives of the Convergence Knowledge Model is to continuously provide information of research efforts being conducted and research actions being taken in order to provide a comprehensive understanding of how those research efforts and competencies fit into the larger body of knowledge relating to service-based applications. In this way, the Knowledge Model will be exploited in order to define short- and long-term research agendas of the S-Cube network beneficiaries and the overall research roadmap of the project as a whole.

The maintenance operations of KM is always running in order to keep the KM updated and satisfying the defined quality criteria[2] .

Periodically, the KM is updated by refining the definitions and competencies for all the terms in it: as reported in [2] a term is defined by means of a set of features representing the different layers in which

¹<http://www.s-cube-network.eu/km>

the term could be used. Moreover, a term could have some definitions that are not domain specific and, due to this, terms can be characterized by some generic definitions.

Table 1.1: Matrix of the term definitions

	Engineering and Design	Adaptation and Monitoring	Quality Assurance	Generic Issue
Business Process Management				
Service Composition				
Service Infrastructure				
Generic Layer				

For each term, a list of competencies is specified: a list of people (inside and outside the S-Cube network) recognised as being an expert in the domain to which the term refers, is reported.

KM has been updated with the terms derived from the Y2 deliverables released by the research work-packages, in addition to the refinement of the existing terms. In fact, the update of the KM consists not only in the refinement of the definitions for the existing terms, but also in the addition of new terms, if required. In particular, if new terms are used during the project (i.e. in the Y2 project deliverables), new entries in the KM should be defined. Obviously, such activities (updating and insertion of terms) are error prone, but the KM should satisfy certain quality requirements. In order to achieve a desired Quality Level for the KM, a Quality Assurance Process has been proposed in [2]. In particular, quality assurance activities have to be performed by the S-Cube partners and aim to check that all the terms and the related definitions and competencies satisfy some specific criteria. During the last period (M22-M33) the update of the KM and the activities of the QA process were performed as usual. In order to quantify the consolidation of the KM, some KPIs are considered.

The previous deliverable of the WP (CD-IA-1.1.3 [2]) proposed the progress on a series of short, medium and long-terms activities by deriving their KPIs defined for the work-package; progress on long-terms activities were reported in the deliverable PO-IA-1.1.4 [3]. The activities behind the writing of the last deliverables are directed making the definition of the KM more integrated, accurate, refined and specific. In order to achieve such goal, all the terms of the KM were checked in order to decide if they need a further specialization, modification of the definitions: the set of the activities performed in order to check the correctness of each term compose the quality assurance process needed to ensure that the information of the KM being of a high-quality.

The current deliverable reports the evaluation of consolidation of the KM based on some of the KPIs defined in the DoW for the KM (Table 1.2). Besides these, we considered some additional KPIs that are described in the next section.

The current deliverable has the following structure: Chapter 2 describes all the KPIs considered for the evaluation of the consolidation of the KM, Chapter 3 reports the measures for the proposed KPIs and finally conclusions and discussions could be found in Chapter 4.

1.2.1 M33 Key Performance Indicators

From the DoW, the progress on the consolidation of the KM for the current milestone (M4-IA-1.1) could be evaluated by the measure of a set of proposed KPIs (Table 1.2). A detailed description of the focus of each KPI is reported in the following chapter.

In addition to the ones proposed in the DoW we had taken into account some others KPIs that we considered as significant for the current milestone analysing the short and medium activities outlined in

Table 1.2: KPIs for the M33 Sub-Milestone (from the DoW)

Sub-Milestone Number	SubMilestone Name	Key Performance Indicators
M4-IA-1.1	Enhanced Model with engineering and adaptation principles	Number of items in Knowledge model from different S-Cube beneficiaries Total number of items in the Knowledge model Number of items per research area discipline Number of co-authored publications

[4].

Chapter 2

Updating the KM

2.1 KPI of M33

The KPIs for the converge knowledge model, measure the coverage of the KM, the use of the model as a means of integration and its effectiveness with respect to the achievement of the overall integration as aim of S-Cube.

In the following we describe the reported KPIs, summarized in Table 1.2.

- **KPI1: Number of items in Knowledge model from different S-Cube beneficiaries.** This KPI indicates the number of terms in the Knowledge Model, proposed by all the S-Cube beneficiaries. The work done during the last period, was aimed to the identification of the new terms to be added in the KM and to the refinement of the existing terms. Such KPI measures the total number of terms present at the moment, classified on the basis of the competencies that each beneficiary has reported.
- **KPI2: Total number of items in the Knowledge model.** The current KPI reports the total number of terms that compose the KM. The number of terms and of definitions populating the KM is always increasing since the updating activities are performed continuously.
- **KPI3: Number of items per research area discipline.** The current KPI reports the total number of terms that compose the KM, classified depending on the domain to which they belong; within the KM, the terms are defined by means of a set of definitions for the cells of the matrix (see Table 1.1). Each definition describes the terms with respect to a particular domain.
- **KPI4: Number of co-authored publications.** Research integration within S-Cube is evaluated using such KPI considering the number of co-authored publications. This figure is related to the KM since the KM provides a mechanism for S-Cube researchers to collaborate through the identification of common and complementary research interests and competencies. One of the most important goal of the S-Cube Network of Excellence is the integration of the research work made by different partners. In order to achieve such goal, visits among the partners are encouraged and meetings and/or workshop are organized to improve the cooperation among the different partners.

2.2 Additional KPIs

Although the KPIs presented above give some indication of the progress of the S-Cube KM, additional KPIs can be given to demonstrate the work carried out as part of task T-IA-1.1.2 in particular to show how major gaps, overlaps and inconsistencies in KM terms have been identified, landscaped and analyzed as required by the deliverable description in the DoW. From CD-IA-1.1.2's recommendations for short,

medium and long-term activities we have chosen a list of KPIs that we consider most significant to demonstrate this progress.

2.2.1 Short-term activities

- **KPI5: Number of new definitions.** This KPI indicates the number of new definitions introduced during the last year by all the users. This KPI measures the number of new definitions added to terms as a result of the efforts spent for the task T-IA-1.1.2. The number of new definitions since M22 (the month in which the deliverable CD-IA-1.1.3 was released) can be found through an analysis of the distribution of definitions in the 16 cells of the knowledge matrix (see Table 1.1) and comparing the distribution from M22 to the one in M33. In order to do this, a set of automated scripts has been developed and executed.
- **KPI6: KM Analytics.** In order to quantify the exploitation of the web-based KM by all the users spread in the world, we were interested to know how many visits were done, the most consulted terms and, finally, the place from which the request had started. Most of the requests were done by places hosting the S-Cube partners, but a certain importance have the accesses from countries not explicitly involved in the S-Cube NoE.
 - *Number of web visits.* This KPI reports the number of access to the KM done during the period M22-M33.
 - *Most popular terms.* This KPI reports which are the most accessed terms during the visits.
 - *Places from which the request is performed.* This KPI reports which is the origin place of all the requests.

2.2.2 Medium-term activities

- **KPI7: Number of users of the KM.** This KPI indicates the number of users that are contributing to the S-Cube KM. Not all the registered users are enabled for the editing of the terms, so we distinguish the editors from the others.
- **KPI8: Updated and corrected terms.** It is important that the KM could respect certain quality parameters, in order to guarantee the correctness of the contained information and to improve the usability. To this aim, it is important that a quality assurance process is continuously performed over time. As result of the QA process, it is possible to quantify such KPI: QA process comprises the set of activities performed in order to have all the terms compliant to a certain quality constraint. The activities performed to check the quality of the terms are the following:
 - check if the terms are formatted correctly (including spelling and grammar mistakes),
 - check if the terms contain the appropriate references and competencies, and
 - most importantly, check if the terms have non-generic definitions in the place of/in addition to the generic definitions (where applicable).

Chapter 3

Results

In this section an evaluation of the KPIs proposed in Chapter 2 is reported. All the statistical data refer to the situation observed on December, 13, 2010 at 7PM.

- **KPI1: Number of items in Knowledge model from different SCube beneficiaries.** This KPI takes into account the number of items for which the different beneficiaries had defined a competency (see Table 3.1).

Table 3.1: Number of items in Knowledge model from different S-Cube beneficiaries

S-Cube beneficiary	Number of terms
University of Duisburg-Essen	76
Tilburg University	73
City University London	32
Consiglio Nazionale delle Ricerche	18
Center for Scientific and Technological Research	44
The French National Institute for Research in Computer Science and Control	43
Lero - The Irish Software Engineering Research Centre	13
Politecnico di Milano	97
MTA SZTAKI - Computer and Automation Research Institute	40
Vienna University of Technology	37
Universit Claude Bernard Lyon	24
University of Crete	27
Universidad Politecnica de Madrid	21
University of Stuttgart	43
University of Hamburg	30
Vrije Universiteit Amsterdam	16

- **KPI2: Total number of items in the Knowledge model.** This KPI reports the total number of the items populating the KM. Figure 3.1 shows a chart indicating the number of terms modified each month. As we could notice, the maintenance process is continuously executed. Modifications to the term could imply changes to the definitions or even the addition of new terms. The number of terms increased during the last period: at March 2009 we had 275 number of terms in the KM, while at December 2010 the terms contained in the KM are 419.
- **KPI3: Number of items per research area discipline.** As said in the previous section, each term is defined by means of a matrix definitions belonging to the intersections of the three service technology and the three service engineering and adaptation methodologies (Table 1.1).

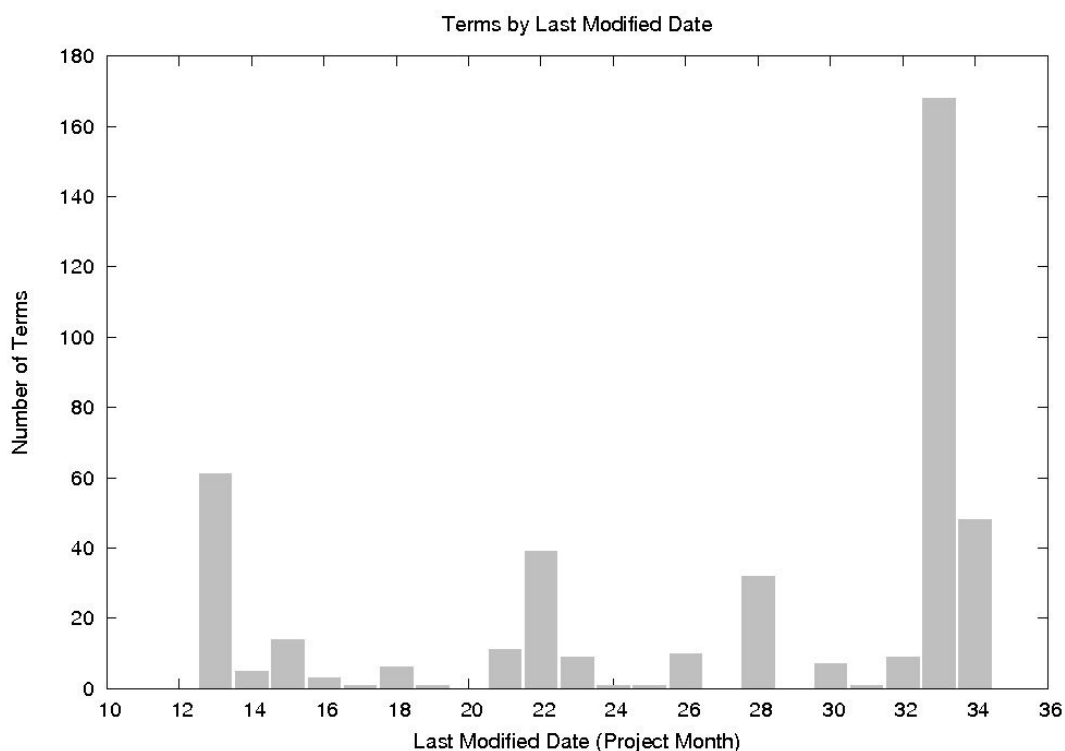


Figure 3.1: Landscape of the number of terms.

In the following table (Table 3.2) we observe how the definitions for each research areas are evolved during the period M22-M33. The couple of values reported in each cell gives the comparison between the number of definitions for that area at M22 and M33.

Table 3.2: Comparison between the number of definitions for each area at M22 and at M33

	ED	AM	QA	GI
BPM	17->23	14->18	18->23	31->47
SC	18->26	21->35	14->22	31->45
SI	9->9	17->27	12->19	18->33
GL	78->88	43->69	87->136	36->68

- **KPI4: Number of co-authored publications.** From the S-Cube portal we have determined that in the period M22-M33 there were 71 publications, 24 of them were co-authored by different partners.
- **KPI5: Number of new definitions (M22-M33).** During the last updating process for the KM, new terms and definitions were extracted from the Y2 JRA deliverables and added to the KM. Each definition in the matrix cell, contains, other than a textual description of the term for the given domain, a reference, and, if exists a relation, a link to another existing term. In particular, as could be retrieved from Table 3.2, the process lead to 224 new definitions for the period M22-M33, corresponding to a increase of 48% in respect to the ones collected in Y1 (464). Such data is very interesting, because we could expected a smaller impact on the number of definitions.
- **KPI6: KM Analytics.** Below all the data needed for the KPI6 are reported: in particular we have gathered the information about the number of accesses to the KM, the most popular terms, the places from which the KM was requested. Data were gathered by means of Google Analytics [5].

- *Web visits.* The analysis of the data for the period M22-M33, has resulted in over 2000 uses of the KM.
- *Most popular terms.* Not all the terms in the KM have been accessed the same number of times. From the analysis of the gathered data, we can note that some terms have been accessed less than 10 times, while some others have been accessed hundreds of times. In Table 3.3, the 20 terms most accessed during the reporting period are shown.

Table 3.3: Most Accessed Terms

Term	Number
Software Process Model	803
Ideal Model	458
Business Process Optimization	431
Quality Of Service Characteristic	402
Key Process Area	382
Service Process Model	333
Business Protocol	316
Business Transaction	315
Service Oriented Software Engineering	302
Grid Scheduling	285
Quality Of Service Dimension	260
Service Choreography	238
Stateful Service	219
Self Healing System	205
Stateless Service	200
Key Performance Indicator	199
Adaptation Requirements And Objectives	196
Soft Goal	190
Adaptation Mechanisms	188
Service Based Application	182

- *Places from where the KM is reached.* This KPI reports the nations from which the requests have been issued: interesting is the fact that, besides the expected accesses made by persons in places in which one of the S-Cube partners is located, some accesses were made from places not hosting S-Cube partners. Table 3.4 reports such data.

Table 3.4: Origin of the requests

Nation	Number of Accesses
United States	83
Germany	80
Italy	43
United Kingdom	42
India	37
Netherlands	26
France	25
Hungary	20
Canada	15
Austria	13
Greece	12
Spain	10

Australia	10
Philippines	9
Malaysia	9
China	6
Sweden	6
Pakistan	5
Ireland	5
South Africa	4
Uruguay	3
Poland	3
Vietnam	3
Singapore	3
Brazil	3
Thailand	3
Iran	2
Finland	2
Nigeria	2
Saudi Arabia	1
Hong Kong	1
Trinidad and Tobago	1
Slovakia	1
Portugal	1
Mexico	1
Sri Lanka	1
South Korea	1
Denmark	1
Indonesia	1
Ukraine	1
Czech Republic	1
Zimbabwe	1
Kenya	1

- **KPI7: Number of users of the KM (external users are most important).** Currently, 345 users are registered at the S-Cube Web portal and, among them, 142 can edit the KM. Among all the KM users, 52 edited the KM.
- **KPI8: Updated and corrected terms.** During the last period, all the terms were checked by the partners in order to identify some inconsistency or the need for an update or a correction. So, for each term, a quality assurance process has been performed. Figure 3.2 contains the number of revisions during each month. Revisions involved the check of the correctness of the format for each terms, the existence of all the needed information, and the check of coherence for the generic definitions.

3.1 Discussion on the results

The objective of this period of work for this workpackage has been to produce the Consolidated Knowledge Model, with major gaps, overlaps and inconsistencies in knowledge identified, analyzed and landscaped. Table 3.2 shows how the changes made by this activity (Figure 3.2) had led to an increase in the number of specialized definitions within the KM terms; moreover the increasing of the number of

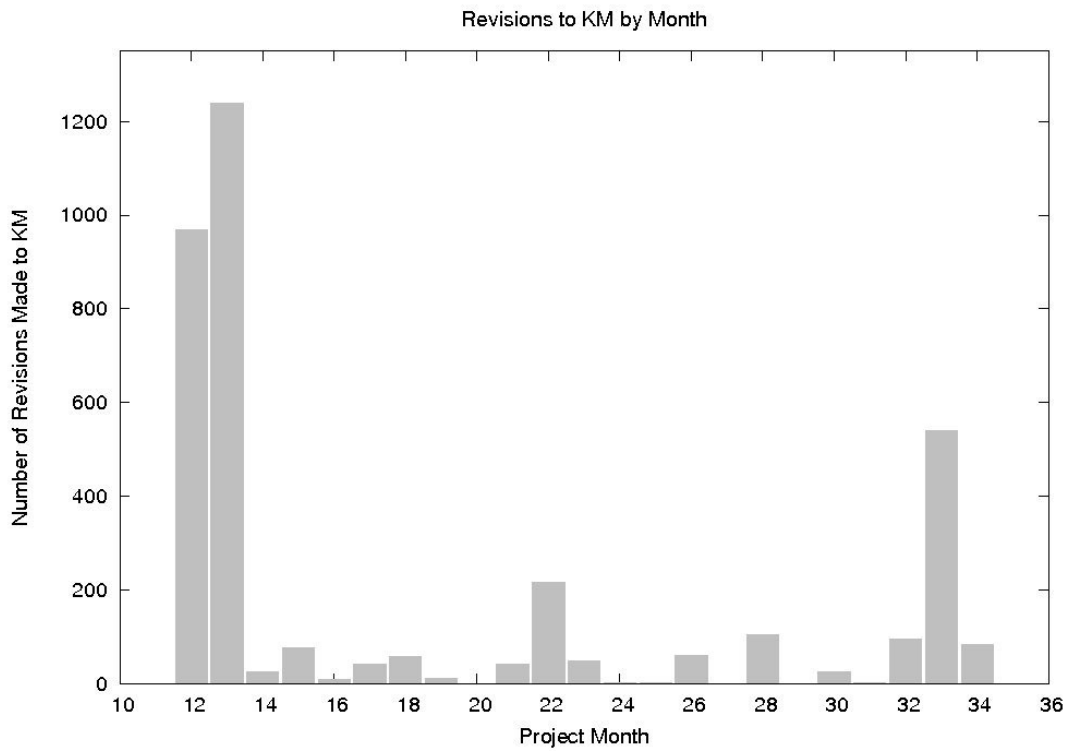


Figure 3.2: Landscape of the number of revisions.

definition during the last year was greater than the expected one. The development of a QA process has ensured this new knowledge is of a consistent and high-quality.

Chapter 4

Conclusion

As reported in the DoW[1], the aim of the WP IA-1.1 is the creation of links among different research communities in order to ensure durability of the results and the objective of the network. The S-Cube KM aims to achieve this goal giving a map and a structure for the complementarities of beneficiaries' knowledge, and defining and harmonising the research results. In order to measure the coverage and the exploitation of the proposed KM some KPIs were defined for the different milestones during the S-Cube project. The measures of the KPIs for the period M22-M33 are reported in the current deliverable. In this period we concentrated on the maintenance of the KM, on the enrichment of the terms and of the definitions, trying to guarantee a good quality level by executing a specific Quality Assurance process. The current deliverable reports on the progress of the short and medium term activities by deriving their Key Performance Indicators (KPIs) and the values for the mandatory KPIs required at this milestone of the WP-IA-1.1 activity. The next deliverable of this work-package (PO-IA-1.1.6), will document the long-term research agendas achieved through the knowledge model. The aim is to show how the research activities of the individual partners are aligned with the goals and objectives of the network. Moreover, the aim of the deliverable will be the demonstration of how the research activities and results of the S-Cube as a whole are progressing with respect to the overall research agenda.

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