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Authors:	*UniDue, Tilburg, CITY, CNR, FBK, INRIA, Lero, POLIMI, SZTAKI, TUW, UCBL, UOC, UPM, USTUTT, UHH, VUA, UPC*
Editors:	*Mohand-Saïd Hacid, Kreshnik Musaraj*
Reviewers:	*Emmanuel Coquery, Salima Benbernou, Marta Esteban*

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Management Summary

This deliverable updates the figures provided in Deliverable CD-IA-2.1.3 "Initial assessment of results of a separate mobility program for researchers and students" and CD-IA-2.1.4 "Mobility program determined based on the S-Cube Convergence Knowledge Model" about how the scientific subjects for mobility and the S-Cube integration framework elements have been covered by the mobility initiatives. The reference period goes from month 1 to month 36.

Members of the S-Cube consortium:

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Tilburg University	Netherlands
City University London	U.K.
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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-fertilisation 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.

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Table of Contents

Contents

List of Acronyms

A&M	Adaptation and Monitoring
ASN	Agile Service Network
BPEL	Business Process Execution Language
BPM	Business Process Management
CEP	Complex Event Processing
EAI	Enterprise Application Integration
GUI	Graphical User Interface
KPI	Key Performance Indicator
PPM	Process Performance Metric
QA	Quality Assurance
QoS	Quality of Service
SC	Service Composition
SC&C	Service Composition and Coordination
SI	Service Infrastructure
SLA	Service Level Agreement
SN	Service Network
SOA	Service Oriented Architecture

1   Introduction

The S-Cube mobility program supports researchers of the network in carrying out joint research through the reimbursement of travel and living expenses at the host institution. The goal of the mobility program is to support the integration of knowledge and the alignment of research activities between different research groups and across S-Cube research domains.

In Deliverables CD-IA-2.1.3 "Initial assessment of results of a separate mobility program for researchers and students" and CD-IA-2.1.4 "Mobility program determined based on the S-Cube Convergence Knowledge Model" we have reported about the visits that have been performed during the first 18 and 30 months of the project respectively. In this deliverable we update the figures to take into account all visits occurred till month 36.

Overall, 71 mobility stays took place. For each stay the results have been collected and summarized (see Appendix B). Based on that data, we have analyzed the results using different views. The objective is to assess the results of the mobility program and use them to understand how we can proceed in the remaining year for the project to cover the identified gaps. We first analyze how the scientific subjects have been covered so far, and how the competencies of the partners have been combined. Then, we analyze how the results have contributed to research workpackages and how the integration framework baseline with its different views has been covered. We finally perform a quantitative analysis based on S-Cube KPIs and further indicators.

The structure of this deliverable is as follows. Section 2 focuses on assessing if the mobility visits performed from the beginning of the project until M36 cover the scientific subjects defined for the mobility program. Section 3 focuses on evaluating how the visits cover the areas of study of the various workpackages. Section 4 analyzes the coverage of the S-Cube integration framework. Section 5 provides some indicators to evaluate the mobility performance of the entire project and of each partner. Section 6 provides a summary of the assessment of mobility visits performed in the previous sections. Section 7 proposes a vade-mecum to be developed to support partners involved in mobility both in the identification of the best mobility opportunities and in the reporting of performed initiatives. Section 8 briefly presents additional actions aiming at improving mobility. Section 9 provides a short conclusion. Finally, Appendix A lists the mobility subjects that have been used for collecting and classifying the current data on mobility, Appendix B provides the list of the mobility stays performed so far, Appendix C provides tables that map each visit on mobility subjects, partners' competences, and S-Cube research workpackages, and Appendix D gives the outcomes, in terms of publications, of some of the accomplished research stays..

2 Scientific Subject Coverage and Synergy of Competencies

Based on the descriptions of the mobility stays provided by the visitors and summarized in Appendix B, we can assess the coverage of mobility subjects. These subjects have been defined in Deliverable CD-IA-2.1.2 and updated in Deliverable CD-IA-2.1.4. They are summarized in Tables 1 and 2.

The result of this analysis shows that the subject "Cloud and Grid Computing" is not covered. However, some partners are investigating this issue.

	Number of visits
Business Processes and Protocols (2,3)	25
Cloud and grid computing (7)	0
Adaptation (1)	17
Evolution (4)	6
Quality of Service (5,12)	8
Service Discovery (17)	4
Service Composition (16)	21
Negotiation and QoS Agreement (10)	5
Monitoring and Prediction (9)	11
Lifecycle (21)	1
Requirement Engineering (13)	7
Service Design and Modelling Methodologies (14,18)	9
Quality Assurance (11)	1

Table 1. Number of visits per each subject.

	1.1	1.2	1.3	2.1	2.2	2.3
Business Processes and Protocols (2,3)				25		
Cloud and grid computing (7)						
Adaptation (1)		17				
Evolution (4)	6					
Quality of Service (5,12)			8			
Service Discovery (17)						4
Service Composition (16)					21	
Negotiation and QoS Agreement (10)			5			
Monitoring and Prediction (9)		11				
Lifecycle (21)	1					
Requirement Engineering (13)	7					
Service Design and Modelling Methodologies (14,18)	9					
Quality Assurance (11)			1			
Total	23	28	14	25	21	4

Table 2. Number of visits per subject per main WP.

The synergy of competences between hosting and visiting partners is highlighted in Table 13 (see Appendix C). This table indicates a synergy of research at different institutions.

Table 3 synthesizes the research visits by considering the pairs sending institution (lines) and hosting institution (columns). The numbers show that the situation has improved as now all institutions except

VUA have acted as sending institutions and all except SZTAKI and VUA have acted as hosts. VUA, however, is actually involved in mobility, both as a visitor and as a guest, but it is not claiming for funding for internal reasons. SZTAKI has significantly improved its performance in the last year, but, because of its geographical decentralization, has not attracted visitors so far.

		UniDue	Tilburg	CITY	CNR	FBK	INRIA	Lero-UL	SZTAKI	POLIMI	TUW	UCBL	UoC	UPM	USTUTT	UniHH	VUA	UPC
	UniDue			1	1	1				1					2			
	Tilburg							1		1		2		2	3			
	CITY												1					
	CNR						1				1							
	FBK									1					1			
	INRIA			1												1		
	LERO-UL		1	2	1							1						
	SZTAKI			2	1						1				3			
	POLIMI		1	1									3		1			
	TUW		1		1									1	1			
	UCBL		2		2		1											
	UoC		1		1					1		2			2			
	UPM										3							
	USTUTT	1	1			1					1		2					
	UniHH														1			
	VUA																	
	UPC													1				
	T.U. Dortmund									1								

(Row label column: "Visiting Institutions". Column header group spanning: "Hosting Institutions")

Table 3: Research exchanges between partners

3   Workpackage Coverage

Analyzing the reports concerning each visit, we have identified the association between visits and workpackages that is reported in Appendix C (Table 14). This association is summarized in Figure 1. On average we have about 17 visits per WP for the period M1-M30 and 21 visits per WP for the period M1-M36.
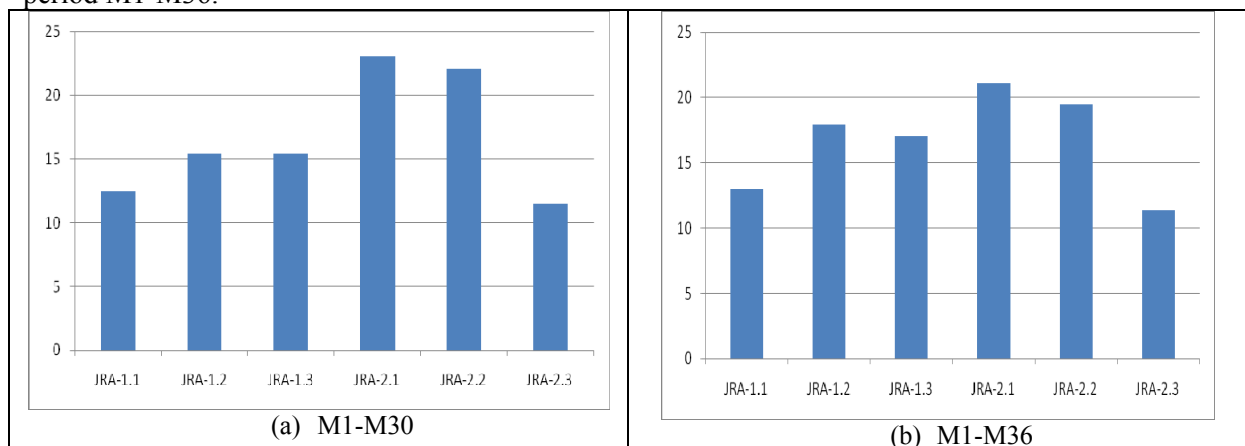

(a) M1-M30   (b) M1-M36

Figure 1: Percentage of research visits devoted to each workpackage

4   Integration Research Framework Coverage

The goal of this section is to perform a coverage analysis of mobility stays with respect to the S-Cube Integration Framework Baseline as defined in Deliverable CD-IA-3.1.1. The section is divided into two subsections covering the views "Reference Lifecycle" and "Runtime Architecture", respectively.

4.1   Coverage of the Reference Lifecycle View

Figure 2 shows the Reference Lifecycle and Table 4 shows how it has been covered through visits. Each visit in the table is identified by a unique ID, as defined in Table 11 (see Appendix B). Most results have addressed the "Requirements Engineering & Design" phase while "Early Requirements Engineering" and "Enact Adaptation" phases have clearly not been in the main focus. As far as the "Early Requirements Engineering" phase is concerned, this may be simply due to the fact that early requirement activities for service-based applications are not dramatically different from those undertaken when considering other kinds of applications. Therefore, the attention of the consortium to this phase has been low. As for the "Enact Adaptation" aspect, the small number of visits is due to the fact that S-Cube does not aim at building new enactment environments. Instead, it reuses the existing ones, either standard or developed by the partners in the context of other projects.

The relatively small number of visits concerned with the "Identify Adaptation Strategy" phase, instead, needs to be considered and possibly improved.
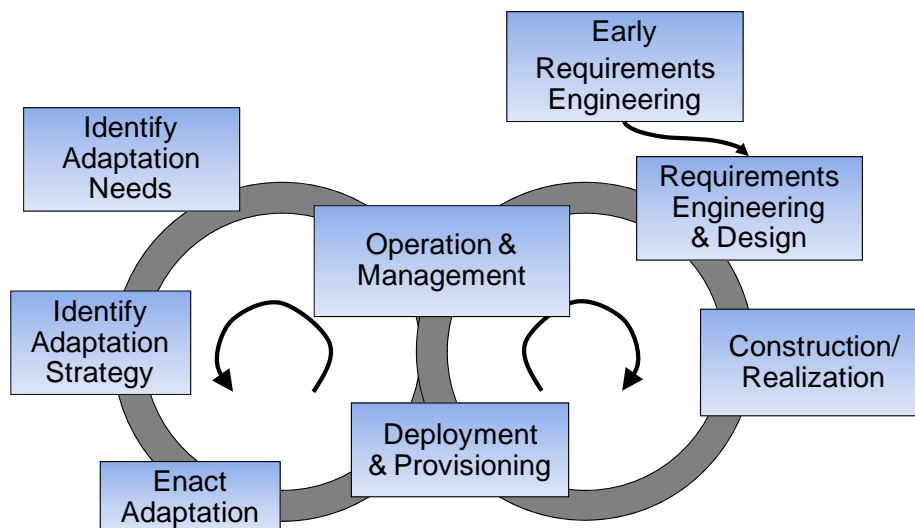

Figure 2: Reference Life Cycle View.

Lifecycle phase	Visit ID
Early Requirements Engineering	18, 19
Requirements Engineering & Design	1, 2, 3, 4, 5, 8, 9, 10, 11, 14, 15, 16, 17, 18, 20, 21, 22, 23, 25, 26, 27, 28, 29, 32, 34, 36, 37, 38, 41, 43, 44, 45, 48, 49, 50, 51, 52, 53, 55, 57, 58, 59, 62,68,67
Construction/Realization	1, 2, 5, 8, 14, 15, 17, 19, 21, 23, 24, 27, 28, 36, 38, 42, 44, 45, 48, 49, 50, 51, 52, 54, 57, 58, 61, 62
Deployment & Provisioning	2, 6, 7, 8, 17, 19, 20, 21, 33, 38, 43, 46, 48, 51
Operation & Management	2, 4, 10, 11, 12, 13, 17, 18, 19, 26, 32, 41, 48, 51, 55, 59, 67
Identify Adaptation Needs	2, 4, 6, 10, 11, 13, 16, 17, 18, 20, 29, 31, 32, 34, 35, 39, 40, 41, 43, 48, 51, 55, 64, 67
Identify Adaptation Strategy	16, 22, 29, 34, 35, 39, 40, 43, 64, 65

| Enact Adaptation | 7, 11, 12 |

Table 4. Mapping of visits to the lifecycle phases.

4.2   Coverage of the Runtime Architecture View

Figure 3 shows how the Runtime Architecture has been covered. Most of the performed work (see table 5) has addressed monitoring and adaptation engines and the service container, while the resource broker has not been addressed. This can be explained by the fact that this element is not considered to be critical by the S-Cube partners, as the focus is mainly on services and not on other kinds of web resources.
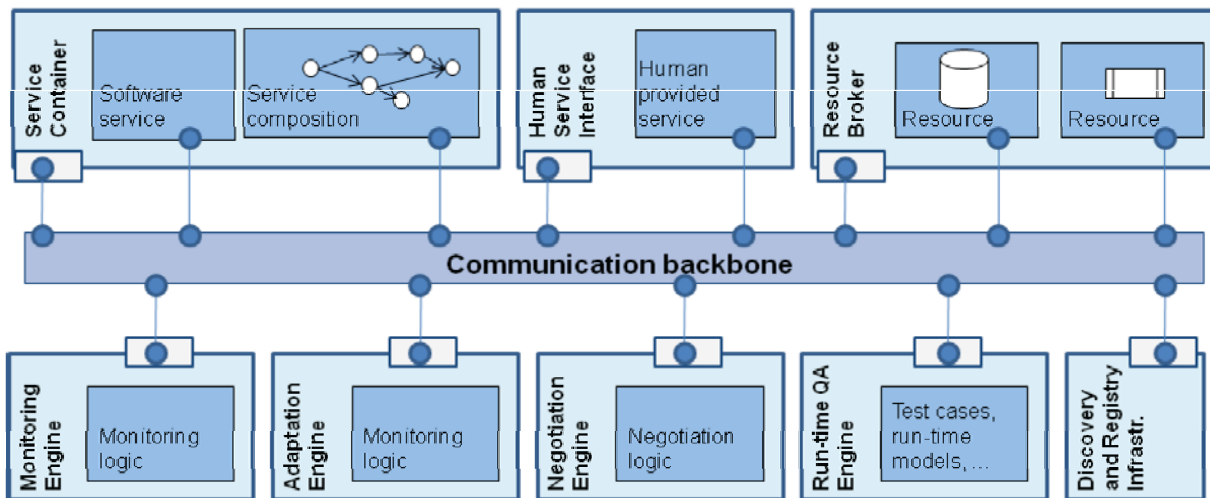

Figure 3: Runtime Architecture View.

Runtime Architecture elements	Visit ID
Service container	2, 4, 11, 20, 27, 28, 31, 32, 36, 38, 40, 42, 44, 57, 56, 62, 65, 67
Human service interface	28, 41, 49, 60
Resource broker	
Monitoring engine	2, 17, 18, 28, 31, 34, 39, 56, 59, 57, 62, 64, 65
Adaptation engine	11, 12, 16, 18, 22, 24, 29, 31, 32, 34, 39, 40, 43, 64, 65, 67
Negotiation engine	7
Runtime QA Engine	11, 18, 24, 30, 33, 40, 46, 47, 48, 63
Discovery and registry infrastructure	6, 17, 20, 37, 67

Table 5. Mapping of visits on the lifecycle phases.

5   Key Performance Indicators (KPIs)

In this section we analyze the mobility program based on a set of performance indicators. In particular we have included in our analysis the KPIs specified in the DoW as part of the S-Cube Key Objective (Obj-4) "Bonding of Research Staff". Table 6 shows the performance indicators measured on the whole consortium.

Metric	M1-M12	M13-M24	M25-M36	Overall
Number of research visits (KPI)	16	19	36	71
Number of participating researchers (as visitors) (KPI)	13	16	29	58
Number of participating S-Cube beneficiaries as visitors (KPI)	7	12	13 (+2)	16
Number of participating S-Cube beneficiaries as hosts	8	8	12	14
Average Duration per visit (in days)	10.5	8.12	7.72	8.78
Number of co-authored publications resulting from mobility (KPI)				27

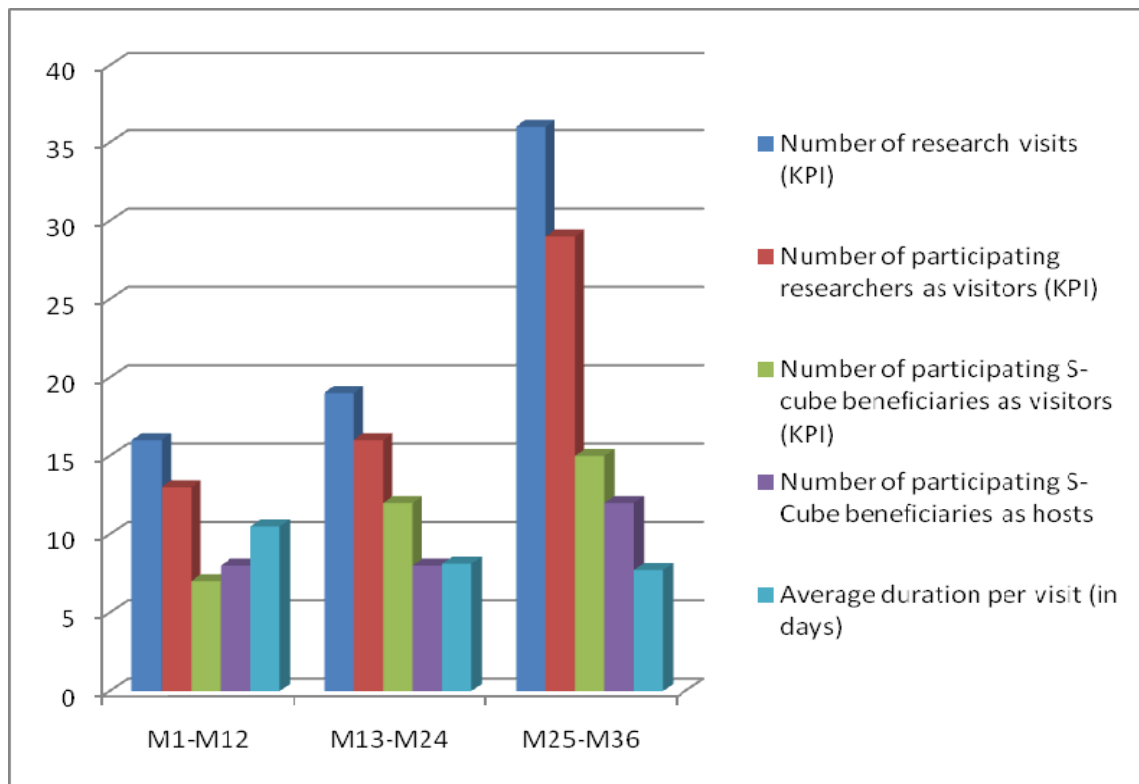**Table 6: Performance Indicators**

Figure 4: Variations of KPIs for the three years of the project

Table 6 and Figure 4 show that the number of mobility stays has significantly increased each year, even though they seem to have generated a slightly smaller number of publications. So far, the mobility stays have generated 27 joint publications (see Appendix D) and many others are in the publication queue.

As already shown in Section 2, most of the partners have participated to the mobility program. Concerning the volume of visits, the DoW specifies that: "…each partner will have on the average two researchers visiting other institutes for a cumulative period extending on the average for up to four weeks (in total for both researchers) per annum…". Table 7 shows the corresponding data for each partner and whether it meets the targets in the two reference periods. Numbers in brackets refer to the second period, while the others refer to the first period. As it can be seen from the last row (and Figure 5), the average numbers have improved. However, the table shows that the situation varies significantly from partner to partner and that many partners should take corrective actions in order to increase the volume of research visits.

Visiting Partner	# of visits	Duration of all visits	# of visiting researchers	Recommendations/actions
UniDue	4 (2)	14(13)	2(2)	Increase visit time
Tilburg	3 (6)	42(83)	2(3)	OK
CITY	1(0)	14(0)	1(0)	Increase # of visits
CNR	1(1)	19(6)	2(1)	Increase # of visits
FBK	1(1)	5(4)	1(1)	Increase volume
INRIA	1(1)	14(13)	1(1)	Increase # of visits
LERO-UL	1(4)	14(34)	1(3)	Increase # of visits
SZTAKI	0(7)	0(35)	0(4)	Increase visit time
POLIMI	4(1)	37(4)	3(0)	Increase # of visits
TUW	1(3)	15(30)	1(2)	Increase # of visits
UCBL	1(4)	2(23)	1(3)	Increase volume
UoC	1(6)	14(51)	1(4)	Increase # of visits
UPM	0(3)	0(21)	0(1)	Increase volume
USTUTT	4(2)	48(22)	3(2)	Increase # of visits
UniHH	0(1)	0(6)	0(1)	Increase volume
VUA	0(0)	0(0)	0(0)	Increase volume
UPC	(1)	(6)	(1)	Increase volume
Average	**1,35 (2,53)**	**14 (20,64)**	**1,2(1,70)**	**Increase overall volume**

Table 7: Volume of visits at M18 and M36.

Table 8 shows the situation from the point of view of the hosting institutions. As it can be seen, there is a significant variability between partners in this case too.

Hosting Partner	# of hosts	Duration of all hosts	# of hosting researchers	Recommendations/actions
UniDue	1(0)	4(0)	1(0)	Increase volume
Tilburg	3(4)	36(23)	3(4)	OK
CITY	4(3)	43(26)	4(3)	OK
CNR	0(7)	0(44)	0(7)	Increase hosting time
FBK	1(1)	4(7)	1(1)	Increase volume
INRIA	1(1)	2(6)	1(1)	Increase volume
LERO-UL	0(1)	0(22)	0(1)	Increase volume

SZTAKI	0(0)	0(0)	0(0)	Increase volume
POLIMI	1(5)	5(22)	1(5)	Increase hosting time
TUW	2(4)	34(27)	3(2)	Incresae # of hostings
UCBL	2(5)	19(34)	1(5)	Increase volume
UoC	5(1)	62(15)	4(1)	Increase # of visits
UPM	2(1)	23(14)	1(1)	Increase # of hostings
USTUTT	4(10)	22(87)	4(8)	OK
UniHH	0(1)	0(13)	0(1)	Increase volume
VUA	0(0)	0(0)	0(0)	Increase volume
UPC	0(0)	0(0)	0(0)	Increase volume
Average	**1.53 (2.59)**	**14.94 (20)**	**1.41 (2.35)**	

Table 8: Volume of hostings at M18 and M36.
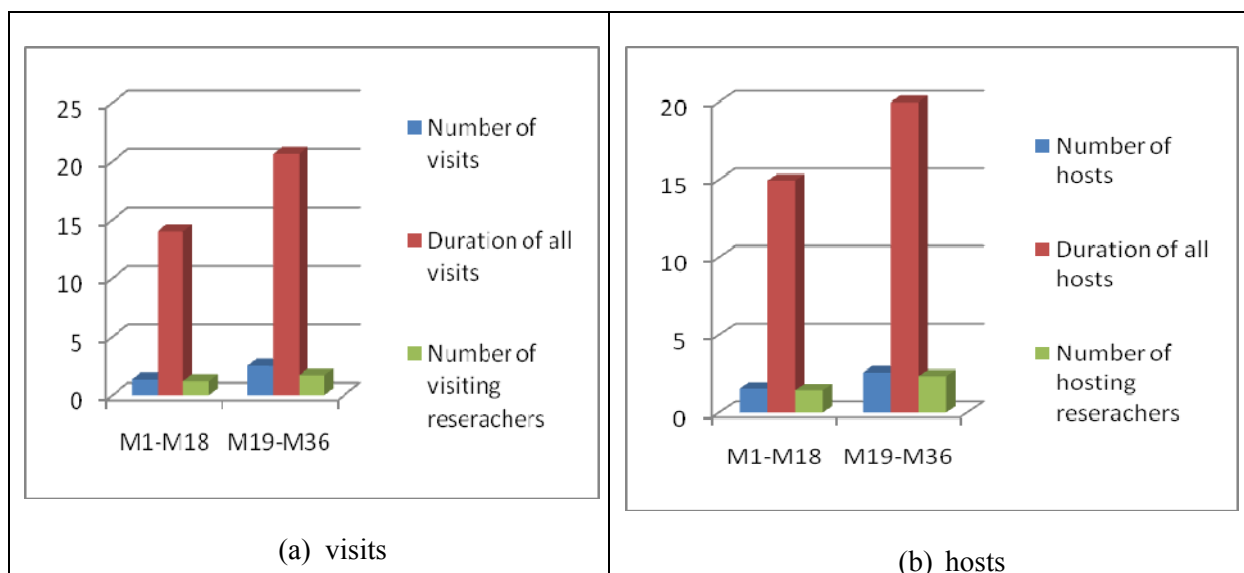

(a) visits

(b) hosts

Figure 5: Variations of the visits for the periods M1-M18 and M19-M36

6   Summary of assessment

Table 9 summarizes our main findings and proposed intended actions to address the problematic situations.

Analyzed Aspect	Main Results and Identified gaps	Recommended actions
Scientific Subject Coverage	The following scientific subjects has not yet been covered: Cloud and Grid computing.	Encourage mobility on this uncovered subject. Some partners have already started investigating this issue.
Synergy of Competencies	Synergy of competencies has been clearly shown: In most cases there is a combination of competencies in a	None

	complementary way.	
Workpackage Coverage	The workpackages are equally covered.	Additional effort, in terms of joint research through visits is required for workpackages JRA-1.1 and JRA-2.3.
Integration Framework Coverage	The integration framework is in general well covered. Some model elements are covered less in relation to the others, in particular: Reference Lifecycle: - Early Requirements Engineering - Identify Adaptation Strategy - Enact Adaptation Runtime Architecture - Resource Broker	The lack of coverage of the listed elements is generally not critical. The early requirement engineering phase and the resource broker component are not among the main focuses of the project. The phase "Identify Adaptation Strategy", instead, would require more care as it is part of the core focuses of the project. We will encourage the occurrence of more visits focusing on this aspect.
Indicator Evaluation	Considering the trend, there is an increase in the volume of mobility visits during the period M18-36 compared to the first period. As shown on Figure 4, the number of visits increases each year.	All partners should participate. The volume should be increased.

Table 9: Summary of Assessment Results

7 Definition of a vade-mecum for visitors and visiting organizations

The redefinition of subjects, as well as the explicit definition of the mappings between WPs and subjects, aims at offering to the institutions interested in visiting other institutions the information useful to correlate in the best way their mobility initiative to the S-Cube objectives. Another important tool to simplify mobility and to encourage its development consists in developing a vade-mecum for visitors and visiting organizations, that packages all needed pieces of information in the proper format and makes them available on the S-Cube portal under the mobility area. This vade-mecum should contain the information to be checked before organizing a visit and the process to be followed during and after the visit.

General information to be checked before organizing a visit

The aim of this information is to make all S-Cube partners aware about the possibilities offered by the mobility program as well as about the situation of partners and workpackages with respect to mobility. In particular, this section of the vade mecum will contain the practical guidelines published in Deliverable CD-IA-2.1.1 as well as the following data:

- Subject list (Table 10) and mapping on workpackages (Table 11)
- List of competences per partner (see Deliverable CD-IA-2.1.2)
- Coverage of subjects and WPs (Table 2 and 13)
- Visit performance of each partner (Tables 12 and 14)

Process to be followed during or after the visit

Information about this process is already partially available on the S-Cube portal, but it is encapsulated in a number of different pdf files. Thus, it is not immediately visible. Moreover, the process lacks an explicit definition of the information needed for assessing the result of mobility. This results in the fact that collecting all data and building the synthetic metrics provided in this report has been a cumbersome activity. To overcome this problem, we will explicitly require visitors to follow the steps listed below:

- Introduce information about visits even if they are not directly paid by the S-Cube mobility program. Of course, we will make sure that these visits are clearly distinguishable from the others. This process has already started.
- Select the subject of visit and indicate the WPs the visit is contributing to, by specifying the rationale for this choice.
- Indicate the deliverable the visit is contributing to.
- Indicate if the visit is a follow up of a previous visit (either performed by the same visitor or by another researcher from the hosting organization).
- Indicate the status of joint publications resulting from the visit. This part is supposed to be updated when new data are reported in the partner's quarterly report.

  All the information mentioned above is made available in the final reports the visitors should provide after completing their research stays.

8 Other actions to encourage mobility

Other actions to encourage mobility will be the following:

1. We will specifically focus on increasing the number of mobility initiatives impacting on JRA-2.3 and on the vertical workpackages (JRA-1.1, JRA-1.2, and JRA-1.3).
2. Cross-workpackages contributions will be encouraged, for instance, by allowing for longer staying in these cases.
3. The production of concrete outcomes out of each mobility initiative will be encouraged by explicitly asking all researchers to indicate these outcomes in their quarterly reports. This is done for visits from Month 24 to Month 36.
4. Associate partners will be actively involved in collaborations with the other S-Cube members, taking into account their specific competences and the way these complement the ones already existing in S-Cube.
5. Even if mobility funding cannot be used for refunding the "additional personnel" as established in the DoW, from Month 36 the mobility performance indicators will consider visits performed by these researchers as well.
6. Information about the best performing partners in terms of mobility will be periodically distributed to all partners. A presentation of the updated situation of mobility will be given at each global meeting to ensure partners' awareness.

9   Conclusions

This deliverable reports about the status of mobility at Month 36 and provides an evaluation of the current situation. The introduction in the S-Cube project of Associate Members will help covering the existing gaps. In particular, we expect an improvement for what concerns the subjects on Cloud and grid computing as partners with specific skills in these areas are now part of the NoE.

Please note that based on the analysis of the collected data, one notes that the number of research stays and outcome in terms of publications increase each year.

As a concluding remark, we highlight the fact that the current report does not provide a complete overview of all mobility initiatives as it reports only on those initiatives that have been funded by the mobility program. Other initiatives self-funded by the partners are not reported here. An updated version of this deliverable will report on this.