

*Title:* *Organizational structure for virtual campus*

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## **Management Summary**

This deliverable provides a detailed description of the organizational structure of the Virtual Campus, together with its infrastructure, and list of researchers participating in it. The deliverable is structured as follows. Section 1 and Section 2 outline the goals of the Virtual Campus platform and its stakeholders. The following Section addresses the organisational structure (Section 3.1 describing the assembling of Public Campus, Section 3.2 describing the Knowledge Base and Section 3.3 discussing the issues of the Internal Campus). Section 4 discusses the implementation issues. Section 5 represents the proposed mechanism of material collection and updating. Finally a list of participation researchers is given in Section 6 followed by the Conclusions in Section 7.

Software Services and Systems Network

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Software Services and Systems Network

## **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-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.

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

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# 1 Introduction

Virtual Campus is a part of the integration activity SoE-1.1 of the S-Cube Network of Excellence that aims to use a flexible combination of communication and collaboration technologies to encourage and facilitate knowledge exchange, news circulation, debate, feedback to support the interaction and dissemination in the community of Software Services and Systems. The Virtual Campus platform should enhance the cooperation and facilitate the integration of research of geographically distributed organizations of different countries and different research perspectives related to Service-oriented computing (SOC).

Besides the integration of research, the Virtual Campus aims to provide a distributed and flexible e-Learning environment supporting the co-joined master and PhD programs of S-Cube as well as to maintain the basis for further cooperation and integration especially in teaching in the SOC Community and related communities.

The aim of deliverable CD-SoE-1.1.2, as part of the spread of excellence activity, is to specify the organizational structure of the virtual campus and recommend possible realization infrastructures, and to provide the list of senior and junior researchers that will participate in it. The work in the deliverable takes into account the analysis performed in the scope of PO-SoE-1.1.1. The deliverable document is meant to serve as a basis for the realization of the Virtual learning Centre of S-Cube; this is a task that will be described in CD-SoE-1.1.6.

The work package SoE-1.1 Virtual Campus and this deliverable in particular are related to following work packages of S-Cube:

- WP-IA-1.2 establishes the Pan-European Distributed Service Laboratory (EDSL). EDSL will “support the testing, integration, evaluation and benchmark SBA relevant emerging technologies, methodologies and tools”; EDSL will also “support the communication within and across communities by providing a common forum for access and dissemination of resources, including intermediate and final results of the joint research activities, online publications, computing resources and infrastructure.” Virtual Campus is related to the EDSL since there are a variety of intersections and commonalities, which will be reflected in future deliverable documents accordingly.
- WP-IA-1.1 aims to provide a comprehensive overview of the “state of the art and an in-depth analysis of the research areas relevant to service based applications (SBAs)”. WP-IA-1.1 will provide “the initial definition and incremental evolution of the Convergence Knowledge Model”. Thus the results of this WP will be adopted by in the Knowledge Base of the Virtual Campus; the Virtual Campus will constantly be updated to include the valid and update version of the Knowledge Model.
- WP-SoE-1.2 “Community Outreach” focuses on the dissemination of research results of S-Cube Consortium to the wider community. This WP comprises also activities related to electronic dissemination including creation and maintaining of the S-Cube Web portal. The Virtual Campus will maintain links to contents provided on the S-Cube portal in order to avoid redundant copies of information.

These relationships to other work packages may be a subject of update during the course of the project and will be reflected in the subsequent deliverables.

## 2 Stakeholders and the Virtual Campus community

In Table 1 we identify a set of stakeholder groups targeted by the Virtual Campus. The proposed structure of the Virtual Campus aims at satisfying their particular needs within technological, temporal, and budgetary constraints.

**Table 1. Stakeholders of Virtual Campus**

Stakeholder group	Members	Requirements
1.External to S-Cube	Broader academic community, industry, general public	Collaboration, information sharing, community building as well as insight into S-Cube. Make use of <ul style="list-style-type: none"> <li>• overview and insight in newest achievements of SOC community</li> <li>• insight in the achievements of S-Cube Consortium – spread of excellence</li> <li>• announcements (e.g. announcements of events, conferences as well as free PhD positions)</li> <li>• Participation in the discussions</li> </ul>
2.S-Cube members	Member institutions-, EC	All the concerns from p.1 and additionally: <ul style="list-style-type: none"> <li>• Insight into teaching materials</li> <li>• S-Cube internal information</li> </ul>
3. Contributing researchers	Researchers from S-Cube Member-organizations	All the concerns from p.1 and additionally collaboration, information sharing, community building as well as teaching actions such as <ul style="list-style-type: none"> <li>• Posting and receiving information regarding the overview of actual state of the SOC community research and achievements (i.e. of S-Cube).</li> <li>• Posting and receiving the announcements (e.g. announcements of events, conferences as well as free PhD positions)</li> <li>• Participation in the discussions</li> <li>• Support of the teachings of joined S-Cube master and PhD programs</li> </ul>
4. S-Cube students	Masters & PhD students (join)	All the concerns from p.1 and additionally: <ul style="list-style-type: none"> <li>• participation in the joined S-Cube study programs (access to the teaching materials of internal campus as well as to the materials of the knowledge base such as lectures, tutorials, videos, tools)</li> <li>• information sharing, discussions in topics related to the studies as well as general research topics</li> </ul>

### **3 Organizational Structure of Virtual Campus - Overview**

The organizational structure of the Virtual Campus contains public as well as internal areas. Public Campus is meant as an open discussion portal for the SOC/SOA and related communities, a meeting place for researchers, practitioners and students where they can be informed of new research, methodologies and development activities. Public Virtual Campus will contain an overview part with facts and figures about the S-Cube Project, mission statements of Virtual Campus itself as well as a list of contributing researchers. Furthermore, Public Campus will provide public discussion forums, bulletin board, mailing lists and job fair. Detailed discussion about the Public Campus is provided in Section 3.1.

Another publicly accessible component of Virtual Campus will be the Knowledge Base. It will use the Convergent Knowledge Model from WP-IA-1.1 as input. In addition, the Knowledge Base will contain a publication database of S-Cube research communities (SOC/SOA and related areas, such as BPM, Grid, SE), as well as technology reports, book reports etc. Section 3.2 describes the Knowledge Base in detail.

The Internal Campus will serve as an E-learning portal for Joint PhD and Master Programs, thus creating a personal virtual working area for students and teachers. The access to this part of Virtual Campus will be restricted to participants of joined PhD and Master Programs as well as participants of S-Cube Project. It will contain a collection and consolidation of course material on Software Services and Systems research and applications. Section 3.3 addresses the issues related to Internal Campus.

The implementation issues around the Virtual Campus are depicted in Section 4. Section 5 describes the general procedure of material collection and updating. Section 6 provides the list of participation researchers in the Virtual Campus.

In a later deliverable document the definition of different user types, also known as roles such as administrator, moderator, PhD and Master's student, etc. will be provided. These roles will be coupled to the security privileges of the different kinds of users.

#### **3.1 Public Campus**

The goal of the Public Campus is to provide researchers and practitioners from different domains with an integrated discussion and information area for S-Cube related areas. Through Public Campus they will be able to obtain comprehensive and up-to-date information regarding the progress in the corresponding areas; to share ideas, to cooperate, and to interact with each other by means of public forums and announcement mechanisms. Moreover, one of the main goals of the Public Campus is to introduce and present the Virtual Campus as a whole, promoting its mission and facilities to a wide range of young and senior researchers from different countries, institutions, and areas of interest.

In order to accomplish these goals, the Public Campus will comprise different information modules and will target various research and application areas. Apart from the Service-Oriented Computing domain itself, these areas will include other related research fields, such as Grid and Cloud computing, Business Process Management, Software Engineering, Human Computer Interaction, etc. As for information modules, the Public Campus will provide the following components:



- An introduction and description of the Virtual Campus, its organization, content, and contributors, as well as up-to-date information regarding its evolution, use, and experience.
- A bulletin board, which will aim to provide the guests and users of Public Campus with the information on what is going on in the various fields of S-Cube related areas.
- A set of public forums and discussion areas, where people can discuss and share their visions, opinions, and ideas. As in other cases, the forums will not be restricted to Service topics (e.g., Web services, service middleware and standards), but will involve areas for other disciplines too (BPM, Grid, HCI, etc.).
- A recruitment area, where institutions and organizations working on the key topics will contain announcements of open positions and in this way contribute to the cross-institute and cross-discipline mobility of researchers across Europe.

### 3.1.1 *Virtual Campus at a glance*

The goal of the “Virtual Campus at a glance” section is to provide an introduction and description of the Virtual Campus as a whole, its mission, content-wise and organization-wise structure, as well as to provide information about its use, progress, and achievements.

More precisely, the structure of this section is described in Table 2: Structure of the “Virtual Campus at a glance” section.

**Table 2: Structure of the “Virtual Campus at a glance” section**

<b>Subsection</b>	<b>Description</b>
What's new	This part will provide information about new events, changes and activities within Virtual Campus and within the S-Cube project. This may include, announcements of the relevant upcoming activities in the project; announcements of new materials/courses in Internal Campus; new procedures and use cases, etc.
Facts and Figures	This section will provide a more detailed description of the ongoing activities and results of both the S-Cube project and the Virtual Campus. In addition, the following statistical data will be presented: information about participations and involvement, the statistics on the use of Virtual Campus facilities, etc.
Overview and Mission	Here the overall description of the Virtual Campus will be provided. This will include, in particular, the elements: <ul style="list-style-type: none"> <li>• Mission and Objectives of Virtual Campus</li> <li>• Organizational structure</li> <li>• Content and Materials</li> <li>• Policies and Regulations</li> </ul> This description, however, is not supposed to be comprehensive; instead, references to the other areas of Public Campus, to the other structures of Virtual Campus and/or S-Cube project will be provided.
Contributors	The section on the Virtual Campus Contributors will provide a description of the participants of the organizational structure of the Virtual Campus. This description will contain the description of the participating organization (or even a single person), the role this participant plays in Virtual Campus (e.g., education center, content provider, application provider) and the content it contributes with

	(e.g., materials, case studies, user groups) /
Feedback	This section is supposed to collect the feedback obtained from Virtual Campus guests and residents regarding the usage and experience with the Virtual Campus as a whole, and regarding the materials of the Public Campus in particular.

### 3.1.2 News (bulletin board)

The news section of the Public Campus, or, more precisely, the bulletin board aims to provide the users of the portal with the information on what's going on in the corresponding fields, i.e., service-oriented computing, business process management, software engineering, distributed systems, grid computing, human-computer interactions, etc. This part of the portal, however, will provide not only the relevant content, but also the necessary instrumentation for the users to manage it.

Content-wise, bulletin board will provide the news according to the classifications represented in Table 3: Content of the bulletin board.

**Table 3: Content of the bulletin board**

Type	Description
Announcement of Journals and Book Chapters	Here the announcement of new journals and corresponding special issues, as well as calls for book chapters and proposals will be published. The list of journals may include (but not limited to): <ul style="list-style-type: none"> <li>• JWSR (Journal on Web Service Research)</li> <li>• JSOCA (Journal on Service-Oriented Computing and Applications)</li> <li>• TSE (IEEE Transactions on Software Engineering)</li> <li>• TOSEM (IEEE Transaction on Software Engineering and Methodology)</li> <li>• RE (Requirements Engineering Journal)</li> <li>• TOIT (ACM Transactions on Internet Technology)</li> <li>• TWEB (ACM Transactions on the Web)</li> <li>• TSC (IEEE Transactions on Service Computing)</li> <li>• IJCIS (Int. Journal on Cooperative Information Systems)</li> <li>• IJBPIIM (Int. Journal on Business Process Integration and Management)</li> </ul>
Announcements of Events	Here the portal will publish various calls for publications, contributions, and participations of conferences, workshops and symposiums in the S-Cube relevant areas. This may include (not limited to): <ul style="list-style-type: none"> <li>• ICSOC (Int. Conf. on Service-Oriented Computing)</li> <li>• SCC (IEEE Service Computing Conference)</li> <li>• ICWS (Int. Conf. on Web Services)</li> <li>• ServiceWave</li> <li>• BPM (Int. Conf. on Business Process Management)</li> <li>• ICSE (Int. Conf. on Software Engineering)</li> <li>• RE (Requirements Engineering Conference)</li> <li>• GCC (Grid Computing Conference)</li> </ul>
Announcements of Standards and Tools	Here the novel standards and tools may be announced. This may include service-related standards, service execution frameworks and

	platforms, design tools, monitoring engines, etc.
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The Virtual Campus will provide the tools and facilities listed in Table 4: Tools of the portal.

**Table 4: Tools of the portal**

<b>Tool</b>	<b>Description</b>
News archive	The News archive will provide an access to the various announcements over the whole period of the portal functioning. It will also give a possibility to search, filter and sort the archive information according to the topics, kinds of information, period, publisher, etc.
Calendar	This tool will allow the calendar representation of relevant events and deadlines. The tool will provide various views according to the category of information, search criteria, etc.
Subscription	Corresponding subscription mechanisms will be enabled for the bulletin board. The subscription will be provided in different forms, using also the standard Web 2.0 technologies.
Publication	A special procedure will allow certain registered user groups to publish relevant announcements to the bulletin board. In this way, the users will be able to publish their own tools, achievements, and materials relevant to all the Virtual Campus users.
Search	Apart from tool-specific search (e.g., archive and calendar), the portal will enable search facilities over all the content of the public area of the portal.

### 3.1.3 Public Forum

The public forum section of the Public Campus portal aims to provide its users with a discussion facility. The public forum section of the Public Campus portal will allow anonymous visitors to view the contents and consist of a group of contributors who've registered into the system, becoming known as members. The members submit topics for discussion (known as threads). These threads are used to stimulate and structure discussions in the corresponding fields, i.e., service-oriented computing, business process management, software engineering, distributed systems, grid computing, human-computer interactions, etc. Users communicate with each other using publicly visible messages (referred to as posts) or private messaging. This part of the portal, however, will provide not only the relevant content, but also the necessary instrumentation for the users to manage it (search, user administration, posts backup, ...). Some users can be promoted as moderators. They are users of the forum which are granted access to the posts and threads of all members for the purpose of moderating discussion (similar to arbitration) and also keeping the forum clean (neutralising spam and spambots etc). Because they have access to all posts and threads in their area of responsibility, it is common for a knowledgeable and trustworthy member to be promoted to moderator for such a task.

Compared to the bulletin board, the public forum will prefer a premise of open and free discussion. Most common topics on forums include questions, comparisons, polls of opinion as well as debates.

The public forums will be governed by individuals, commonly referred to as staff or administrators, which are responsible for the forum's conception, technical maintenance and policies. So, in this public forum, any discussion regarding anything but s-cube point of interest may be outlawed, with

the exception of the general chat section. Common rules found on our virtual campus public forums include:

- No swearing or otherwise vulgar language,
- no insulting or harassing fellow member,
- no free criticism about the Universities or institutions,
- etc...

A public forum provides information according to the categories represented in Table 5: Content of the forum

**Table 5: Content of the forum (Threads)**

Type	Description
Standards and Recommendations (Tips, evaluations, etc.)	Here the SOA standards and recommendations may be discussed and evaluated.
Tools for SOAs	Here the services tools may be discussed and evaluated. Tips on each tool can be also announced
Hot Topics in Services Research	Here, young researcher can discuss about hot topics in service Research.
Discussion about scientific articles	Here, young researcher can discuss about scientific paper to improve their comprehension of those papers

The main target group of the public forum are PhD students, young researchers and associate professors. The public forum of the virtual labs would provide a real benefit, totally decoupled from the vision of a joint European PhD program, and could really catch on if advertised appropriately. The Public Forum will provide the tools and facilities listed in

**Table 6: Tools of the portal**

Tool	Description
Subscription	Corresponding subscription mechanisms will be enabled for the forum. The subscription will be provided in different forms, using also the standard Web 2.0 technologies.
Moderation	A special procedure will allow certain categories of the registered user to moderate the forum to publish achievements, and materials relevant to all the Virtual Campus users.
Search	Apart from tool-specific search (e.g., archive), the portal will enable search facilities over all the content of the public area of the portal.

### 3.1.4 Mailing list

Several mailing-lists will be opened to give information to all Virtual Campus residents. The content of the mailing may duplicate information provided as news (see above), e.g. job offers.

But the portal will allow user to create/destroy mailing-list to improve the communication on a project, a deliverable or a joint publication.

The Mailing list will provide the tools and facilities listed in Table 7.

**Table 7: Tools of the portal**

Tool	Description
Mailing-list archive	Mailing-list archive provides access to the complete history of each

	mailing list. It will also give a possibility to search, filter and sort the archive information according to the object, kinds of information, period, publisher, etc. If a mailing list is private, only the mailing list members may use the search engine for this list.
Subscription	Subscription mechanisms will be available for all mailing-lists. The subscription will be provided in different forms.
Moderation	A special procedure allows registered user to moderate mailing list. In this way, the users will be able to accept messages relevant to all the Virtual Campus residents registered to a mailing list only.
Search	Apart from tool-specific search (e.g., archive and calendar), the portal will enable search facilities over the mailing lists.
Creation	Registered user can create, administrate, and destroy easily new mailing lists to allow discussions on a project or on a join paper.

### 3.1.5 Similarities and Differences of the Virtual Campus Applications

One significant difference between the use of the forum and electronic mailing lists is that mailing lists automatically deliver new messages to the subscriber, while forums require the member to visit the website and check for new posts. Because members may miss replies in threads they are interested in, many modern forums offer an "e-mail notification" feature, whereby members can choose to be notified of new posts in a thread, and web feeds that allows members to see a summary of the new posts using aggregator software. The main difference between bulletin board and forums is that forums are more used for debating on open-issue, tools evaluation, etc and bulletin board are devoted to deliver official contents.

The public forums of the virtual campus differ from chat rooms and instant messaging in that forum participants do not have to be online simultaneously to receive or send messages. Messages posted to a forum or Usenet are publicly available for some time, which is uncommon in chat rooms that maintain frequent activity.

### 3.1.6 Job Fair (Job/PhD Positions)

A job fair is a market place for employers, recruiters and schools to meet with prospective job seekers. Job fairs provide a convenient location for students to meet employers and perform first interviews. Electronic job fairs provided by the virtual campus should offer the same convenience online.

Student should be able to submit a resume; University should be able to give description of team and submit job/Phd opportunity; a data model for job/Phd position and resume have to be designed. A search engine will also be provided to find a candidate for a job position or a job position for a candidate. Next as plenty of social network portals as linkedIn, it will be possible to recommend colleague and create easily an appointment with internal tool similar to Doodle.

The list of job/Phd position will be available through a RSS feeds.

The job fair application should provide services to allow its integration with other job fair online system like <http://www.jobing.com/> .

## **3.2 Knowledge Base**

The S-Cube Knowledge Base contains consolidated materials on S-Cube related areas (Grid, BPM, SE) for learners.

The Knowledge Base should be made available to participating institutions and the SOC community. We expect that it becomes the first point of access for academics, researchers, industry developers and students to access up-to-date SOC knowledge. For other related areas, such as Grid, Business Process Management and Software Engineering, we do not expect that the S-Cube Knowledge Base will be the first point of access, but rather, will be a major source of information for when Business Process Management, Software Engineering, and Grid Computing researchers need to have domain-specific, in this case, SOC, input to their specific disciplines. Therefore, the Knowledge Base should be internationally accessible – it will most likely be a web-based system with easy but controlled access to updates. It is important that once information is complete (or reviewed), it is made available in a timely manner. The Knowledge Base will also be used as the repository for the Virtual Campus.

### **3.2.1 Knowledge Base Content**

Within S-Cube, we expect to publish information through a variety of modes: courses and tutorials, research publications and technical reports, informal articles and commentary and input from other research communities.

#### *3.2.1.1 Courses and Tutorials*

The S-Cube Convergence Knowledge Model will present the state of the art for SOC. Therefore it is important that all output from here is available. Currently, some of the partners have courses, tutorials, video material etc. available (as detailed in PO-SOE-1.1.1). This material, where possible, should be included in the Knowledge Base. However, there may be issues of copyright and ownership to be negotiated before this can happen.

#### *3.2.1.2 Research Publications and Technical Reports*

S-Cube researchers are publishing their research in journals (e.g. ACM TWEB, SAE, IEEE IC, IJCIS) and conferences (e.g. CAiSE, ICSOC, ServiceWave), and taking copyright issues into account, these papers will be either referenced, linked to, or available in the Knowledge Base. It will be made clear that such publications are peer-reviewed. In addition, the S-Cube community is writing a series of technical reports. In the initial stages of the project, these reports are presenting current state of the art. It is anticipated that, as the project progresses, these reports will present new research results from the S-Cube project.

#### *3.2.1.3 Informal Articles and Commentary*

In the Knowledge Base, the S-Cube community requires that there will be more informal articles and commentaries. This section will be used by people who are less aware of the business and technical requirements of SOC, but rather, by those who are interested in developing a general knowledge of the area. It will contain articles written by the S-Cube community and by others who have an interest in this discipline. We expect that contributors to this section will be drawn from S-

Cube researchers, from other researchers interested in this topic and from the wider community. In this section, we will also include book reports relating to SOC.

#### *3.2.1.4 Input from other Research Communities*

One of the aims of S-Cube is to bring together the three research strands: Business Process Management, Software Engineering and Grid Computing. In doing this it will be important that the sections of the Knowledge Base will allow for input from each of these communities. While relevant BPM, SE and Grid outputs from S-Cube research will be included in the Knowledge Base, we will also include lists of peer-reviewed research publications, technical reports and books which can be relevant to the development of SOCs.

### **3.2.2 Considerations for the Knowledge Base**

There are a number of issues which must be considered when setting up the Knowledge Base including:

- design and development of the knowledge base,
- accessibility and maintenance of the knowledge base,
- management and control of the materials contained in the knowledge base and
- copyright of the materials contained in the knowledge base.

These issues are discussed below.

#### *3.2.2.1 Design and Development of the Knowledge Base*

The Knowledge Base will be, in itself, a service which S-Cube is providing to its own research community, to the wider research community and to the general community. Therefore, this should be designed to ensure that it will run efficiently and effectively. It will be the S-Cube ‘window to the world’, and should be developed with this in mind. There will be design issues and user issues to be taken into account.

#### *3.2.2.2 Accessibility and Maintenance of the Knowledge Base*

Given that we expect this service to be used widely, and will also require that Virtual Campus students use it, we need to ensure that there are levels of accessibility available. We need to identify who are the stakeholders for this system and set up accessibility levels for the different stakeholders. Additionally, the system needs to be maintained. How can we deal with the situation where publications are not updated, or where articles are not forthcoming from the community?

These need to be discussed and processes put in place when the system is developed. Often, within the web, there are repositories which are not kept up-to-date. It will be important to ensure that this does not happen to the S-Cube Knowledge Base, especially when the project itself is completed.

### *3.2.2.3 Management and Control of the Materials*

While the purpose of the Knowledge Base will be to have a wide availability of knowledge, this knowledge should be managed effectively. Material will need to be reviewed and accepted for input to the Knowledge Base, and this may require human intervention. Some management process should be implemented.

### *3.2.2.4 Copyright of the Materials*

While some of the SOC materials will be public domain, much of the knowledge which we will want to be available will be copyrighted. In some cases, this means that we will be unable to put actual materials into the Knowledge Base, but we may only be able to reference this material. In addition, we need to ensure that those stakeholders who have rights to access the material are set up correctly.

## **3.3 Internal Campus**

The Internal Campus represents an E-learning Platform to support sharing teaching material among academic institutions involved in S-Cube, and to provide a common basis for joint initiatives, to be developed in the following years, towards joint courses, joint PhD and Master Programs and Summer Schools. In this section we illustrate the structure for internal campus material and for support functionalities.

### **3.3.1 Course material collection**

#### *3.3.1.1 Course material collection*

The internal campus should contain a collection and consolidation of course material on Software Services and Systems.

The goal of internal campus course material collection will be:

- To provide support for self-paced instructions, for participants in the project, and in particular for young researchers and PhD students,
- for instructors who design new courses at their institution, to find shared teaching materials and
- for development of joint courses under the S-Cube framework.

The collection of teaching materials will start from the analysis of available courses at the institutes of the participating institutions in S-Cube.

To allow sharing of material and information in an organized way for each course, its syllabus will be analyzed and classified to identify the basic learning objects in the virtual campus. A learning



object can be the basis for the composition of personalized learning paths based on the needs of the students and instructors.

From a first analysis of the courses listed in deliverable SoE.1.1.1, many institutions provide specific master’s and PhD programs on software services and systems, which include both general courses and courses, which are more specific to software services. The course material collection should provide a reference both to specific software service courses and to closely related general courses. For software service and systems courses, a syllabus and learning objects should be defined in detail, while for general related courses some information should be provided without going into the details of single learning objects in the platform.

The courses will be classified and analyzed according to the structure of the S-Cube framework. The following classification schema is proposed, to be further refined while the Internal virtual campus is being constructed, with following categories:

- S-Cube “layers”: 1. service value networks, 2. business processes, 3. services, and 4. infrastructure
- Quality and SLA topics
- Related courses, which may be classified into principles and methods courses or within one of the S-Cube “layers”.

For each class within the classes listed above, its learning objects will be defined according to the general S-Cube framework:

- Principles and methods
- Technologies
- Adaptation and monitoring
- Engineering and design

Learning objects will be derived from the syllabi of the available courses and from terms in the S-Cube knowledge model.

The general classification schema is therefore the following:

Class	topic classification	terms
<b>1. Service Value Networks</b>	principles and methods	List of Knowl. Objects (terms)
	Technology	Knowl. Objects (terms)
	adaptivity and monitoring	Knowl. Objects (terms)
	engineering and design	Knowl. Objects (terms)
<b>2. Business Process</b>	principles and methods	List of Knowl. Objects (terms)
	Technology	Knowl. Objects (terms)
	adaptivity and monitoring	Knowl. Objects (terms)
	engineering and design	Knowl. Objects (terms)
<b>3. Services</b>	principles and methods	Knowl. Objects (terms)

	Technology	Knowl. Objects (terms)
	adaptivity and monitoring	Knowl. Objects (terms)
	engineering and design	Knowl. Objects (terms)
<b>4. Infrastructure</b>	principles and methods	Knowl. Objects (terms)
	Technology	Knowl. Objects (terms)
	adaptivity and monitoring	Knowl. Objects (terms)
	engineering and design	Knowl. Objects (terms)
<b>5. Quality and SLA</b>	principles and methods	Knowl. Objects (terms)
	Technology	Knowl. Objects (terms)
	adaptivity and monitoring	Knowl. Objects (terms)
	engineering and design	Knowl. Objects (terms)
<b>6. General related courses</b>	general classification	Knowl. Objects (terms)

The classification of the Knowledge model terms is to be refined to obtain Knowledge objects as a basis for instructional purposes. Other terms will be added from the syllabi of the courses; for instance, model-driven service composition will be further classified according to the model being used in modelling the composition.

From the initial classification, terms may be added or reference among terms.

A bottom up approach should be followed in filling in the internal virtual campus material. For each course a template will be filled in according to the following structure:

- Course title
- Level (Master, PhD, Master/PhD, Summer school)
- Description
- Goals
- Syllabus
- Lecture/exercise/lab hours
- Classification inside the above table (class and class topics)
- Covered learning objects
- For each learning object: short description, link to provided material and support (see sections below)

An example of course table is provided in appendix 1.

### *3.3.1.2 Types of course material*

The Internal campus should support both reference to available materials from different universities, and the creation of materials developed within S-Cube.

In general, references to available materials will be inserted, and copying the materials to the S-Cube internal campus should be limited to those materials with appropriate (e. g. public domain) copyrights.

Learning materials for students should be organized according to the learning object's structure and might include:

- lecture notes & slides
- e-books
- problem sets and solutions
- labs
- lecture videos
- demonstrations
- case studies

### **3.3.2 Additional supportive functionality**

In addition to the organization of materials according to the structure indicated above, the internal virtual platform should provide support both for unsupervised and for supervised learning. It is assumed that within S-Cube, supervised support will be limited to joint courses, while for the other course unsupervised support is provided

#### *3.3.2.1 Unsupervised functionalities*

Unsupervised functionalities include:

- search in course materials
- Forums (generic)
- learning path composition to create a personalized course from available material for self-paced learning.

#### *3.3.2.2 Supervised functionalities*

Supervised functionalities include:

- on line lecturing (live sessions),
- on line labs,
- joint project execution (for groups of students from different institutions),
- creating a personal virtual working area for student/teacher (restricted access) and
- examination support (with identity management and validation)

## 4 Implementation

From a technical point of view, the public campus, the knowledge base and the internal campus will each be built on separated technical platforms: the Public Campus will be implemented on top of standard WWW forum technologies; the Knowledge Base will be developed using a Wiki; the Internal Campus will utilize e-learning technology. However, cross-cutting concerns such as identity management will be provided on top of these separate technological bases. All three levels will be integrated under one cover, giving the Virtual Campus a homogeneous look-and-feel for the users. Links between the levels will be implemented using hyperlinks (e. g., courses administered in the Internal Campus may point to reading material in the Knowledge Base, or to relevant discussions in the Public Campus).

The screenshot shows the S-Cube website interface. At the top left is the S-CUBE logo. To the right are links for Site Map, Accessibility, and Contact. Below these is a search bar with a search button and a checkbox for 'only in current section'. A horizontal navigation menu includes Home, News, Events, About S-Cube, Consortium, Results, Get Involved, and Disclaimer. Below the menu, it says 'You are here: Home' and 'Log in Register'. The main content area starts with a heading 'Welcome to S-Cube, The Software Services and Systems Network' followed by a paragraph describing the network. Below this are two sections: 'S-Cube's Major Research Objectives' and 'S-Cube's Major Integration Objectives', each with a bulleted list. To the right of the text is a map of Europe with a legend for 'S-Cube Member Country'. At the bottom left, there is a link to 'S-Cube factsheet' and a paragraph about the ServiceWave 2008 conference. At the bottom right, there is a 'ServiceWave 2008' logo and date 'December 10<sup>th</sup> - 13<sup>th</sup> 2008, Madrid, Spain'. On the far right, there are two vertical sections: 'Upcoming Events' and 'News', each with a list of items and dates.

Figure 1: S-Cube Web Page

The overarching look-and-feel of the Virtual Campus, colouring and structure of presentation, will be based on the styling of the S-Cube project web page<sup>1</sup> (see Figure 1). Furthermore, the Virtual Campus will be integrated into the S-Cube web page: a top-level link from the main S-Cube portal will link to the Virtual Campus. S-Cube Results will still be made available through the S-Cube portal (as it is done at the moment), however these research outcomes will also be linked from the Virtual Campus Knowledge Base. Please note that material already available from the S-Cube web page will not be duplicated. The Virtual Campus will only directly provide material which is not available from the S-Cube portal itself (e.g., educational material). S-Cube events and announcements will also be announced in the Public Campus News section. This is to make sure that important information about S-Cube events is also disseminated to people who use only the Virtual Campus, but are otherwise not related to the S-Cube NoE (e.g., students, practitioners, and so on).

The responsibility of technically hosting the actual Virtual Campus will be taken over by Vienna University of Technology. That means that the Virtual Campus and the S-Cube web portal will be logically connected, but physically hosted on different servers, which are geographically and

<sup>1</sup> <http://www.s-cube-network.eu/>

organizationally disparate. The effort of integrating the Virtual Campus into the S-Cube portal will be shared by Vienna University of Technology and University of Duisburg-Essen (as host of the S-Cube portal).

In the following subsections we will describe the implementation platforms for the three levels of Virtual campus in more detail.

## 4.1 Public Campus

The implementation of the Public Campus will be based mainly on forum technology: the various discussion forums as well as message and bulletin boards will be implemented as WWW forums. The reasons for this decision are twofold: firstly, because of the wide acceptance of forum technology through the Internet users are accustomed to this type of discussion board, reducing the acceptance and learning threshold for new users of Virtual Campus; secondly, easy-to-use and reliable open source software solutions are available to implement internet forums, reducing the effort for setting up and hosting the Public Campus. The non-interactive parts of the Public Campus (e.g., Facts & Figures, Mission Statement, ...) will be implemented using static HTML.

Many possible alternatives are available to implement the Public Campus. A few popular choices will be summarized below:

A regular among Internet bullet boards is bbBoard<sup>2</sup>. It is known to be stable, scalable and feature-rich. However, the software is commercial, and needs to be either bought or rented.

Phorum<sup>3</sup> states to be the original PHP and MySQL based open source forum software. The software has already reached version 5.2, is open source, widely used, and known to be both stable and scalable. Another big plus of Phorum is its easy customization.

phpBB<sup>4</sup> is the most widely used open source bulletin board software. The BBCode markup language invented for phpBB is a de facto standard amongst Internet forums by now. It is relatively easy to set up, however, customization features do not seem to be as advanced as in Phorum.

A solution built on Java instead of the more common Perl or PHP-based solutions is mvnForum<sup>5</sup>. mvnForum is available in both a commercial and an open source version. The software is used by some big commercial players (e.g., by the Sony Vaio Community). However, setup seems to be overly complex, and little documentation is available for the open source version.

A low-footprint and low-overhead message board solution is Silentium Boards<sup>6</sup>. This simple PHP script implements a full-featured message board without relying on a database backend. However, the solution currently seems to lack community support and reliability.

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2 <http://www.bbv2.com/>

3 <http://www.phorum.org/>

4 <http://www.phpbb.com/>

5 <http://www.mvnforum.com/>

6 <http://www.scripts.com/viewscript/silentium-boards/24422/>

We have chosen to use **Phorum** as technological backend for the Public Campus. The main reasons for this decision were:

- The software seems mature and well-documented, more so than most of its open source competitors.
- Hosting Phorum is relatively easy, since it is implemented fully in PHP (which is enabled in most Apache web servers). Installation of MySQL is also relatively simple. The resource consumption of Apache, MySQL and PHP is considerably smaller than e.g., a Java-based solution.
- Many different skins (often with accompanying skin documentation) are publicly available. Many of these skins offer a professional and ‘serious’ look, which is suitable for a European Research and Teaching platform. For the Public Campus we plan to use the *Aerial Boundaries*<sup>7</sup> template, with some adaptations (e.g., exchanging the default brownish colouring for the S-Cube trademark colours).
- Phorum has a good tradition of fixing security problems quickly.

## 4.2 Knowledge Base

The Virtual Campus Knowledge Base is a static repository of services knowledge. In that sense the Knowledge Base should serve a similar purpose in the services community as Wikipedia serves for general knowledge: it should be the first place that newcomers to the services field should turn to in order to find an overview over all topics associated with services computing, and should be able to give specific answers to specific questions. It is therefore a natural decision to use the same technological background that made Wikipedia successful for the implementation of the Virtual Campus Knowledge Base.

We will again summarize a few popular Wiki software solutions in the following:

- In the case of Wiki software, the most common choice is clearly **MediaWiki**<sup>8</sup>, the software originally written for Wikipedia. The software is now used for a large percentage of all Wikis out there, and for various topics. The biggest advantage of the project is its stability; however, the look of MediaWiki is notoriously hard to tweak, giving all MediaWiki-based web pages a very similar layout.
- Probably the most general Wiki-like solution is **TikiWiki**<sup>9</sup>. The project’s motto is “*Yes, Tiki does that*”, and the project lives by that motto. Tiki unifies a Wiki, forum, blogging, and much more under one hood. However, that feature set also contributes to the complexity of the software (and most of these features are not needed for the S-Cube Virtual Campus).
- A relatively simple approach to Wikis is propagated by **PmWiki**<sup>10</sup>. PmWiki is a rather small project, and focuses on pure Wiki functionality. PmWiki is very simple to install. Customization is possible, even if cumbersome at times. However, PmWiki offers a plugin and extension architecture, with hundreds of open source plugins being available free of charge.

For the Knowledge Base the decision was to use PmWiki as technological grounding. Basically, all of the above alternatives could well be used, however, Vienna University of Technology already has some experience with PmWiki (since this is what they use for teaching, e.g., lab pages, ...).

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7 <http://www.phorum.org/phorum5/read.php?63,133056,133056#msg-133056>

8 <http://www.mediawiki.org/wiki/MediaWiki>

9 <http://info.tikiwiki.org/tiki-index.php>

10 <http://www.pmwiki.org/>

PmWiki goes well with Phorum, since it is also based on PHP5. Figure 2 shows a screenshot of a PmWiki installation (a lab page of TUW). Obviously, the look-and-feel still needs to be adapted to S-Cube standards.

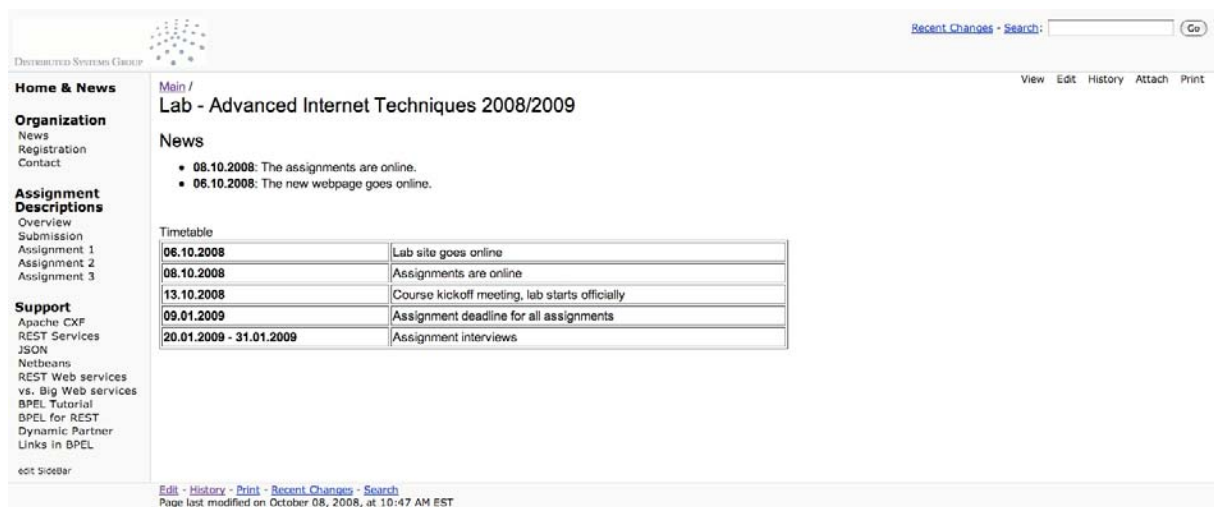


Figure 2 PmWiki Example

## 4.3 Internal Campus

The implementation of the virtual campus will consider the following issues:

- **Organizational.** This issue is the most difficult to address. We have to consider the case a course will be delivered between numerous partners across international boundaries and languages. Also related to this issue is differing government, political and legal systems which can affect important concerns such as copyright in terms of publishing and the ownership of materials and courses that have been developed. The problem of language will be solved by delivering courses in English. In relation to project management, we expect to have a leader for the virtual campus with effective project management skills.
- **Technological.** The issues of effectively utilizing technology can present a number of problems both in terms of getting the technology infrastructure set up, as well as overcoming peoples' attitudes to the technology. It will be important to provide sufficient guidance and support to both staff and students in the use of the virtual campus platforms and technologies. Also, we will frequently evaluate and monitor the use of the virtual campus platforms to ensure that staff and students were using them in the most effective way.
- **Pedagogical.** The choice of appropriate pedagogical models and approaches underpinning virtual campuses is very important. We will investigate proper guidance for students.
- **Student/User.** The importance of focusing on the needs and learning experiences of the student is important. Important elements associated with this issue are the need to have in place clear and effective communication strategies in order to be able to interact with students at different levels, whether using formal or informal mechanisms.
- **Consolidation.** It is important that the benefits achieved from the development and running of a virtual campus are not lost. Therefore, consolidation issues will reflect the kind of activities that can help achieve this such as developing adequate marketing and dissemination plans targeted at groups of key stakeholders such as students, researchers and companies.

## *Implementation perspectives*

As we know nowadays there are several e-learning platforms and tools, some commercial and others open source/freeware, so it's very difficult for to choose the best solution to fit specific needs, always dealing with several problems. We want a solution based on technology that allows the expansibility of the functionalities, the assurance of the level of availability, the importation, exportation and integration of information with other applications already developed.

As used in EU Project, We propose two distinct temporal strategies to implement the S-Cube VC.

The first one, the S-Cube Project Certification strategy, where the implementation of the chosen platform is divided in different phases: installation, functional architecture, training and certification according to predetermined requirements.

The second one, the post-certification strategy, where we avail the impact of the platform's usage and start to plan different scenarios so it can best fit our needs in terms of adaptability and extensibility.

### **Phase 1**

For this phase we technically advise the adoption of an e-learning platform that has consistent functionalities, already applied to several other educational institutions with success, so the number of errors can be minimal and users can acquire knowledge and get familiarized with e-learning. By adopting this kind of platform we can benefit from all the engineering project already made for other institutions. Regarding the certification process we must cover the S-Cube Project objectives and a set of requirements that are going to be tested on the content verification process. An important analysis and a comparison of the existing e-learning platforms are addressed in this paper (e-Learning Enhanced Technology Implementation Virtual Campus Case, Hugo Rego, Tiago Moreira, João Branco, Francisco García)

In parallel with the pure LMS (Learning Management Systems) have appeared the LCMS, Learning Content Management Systems that permit the management of content or in a new level the LOs. So, with these platforms we have possibility of accessing the LOs, we have LO repositories and we can search for a specific LO.

About the LMS's new platforms have arrived that introduce new features, better communication tools, with the possibility of audio & video streaming, videoconferencing, also the Multilanguage support that permit to reach more people with different cultures, making a new of personalization. Also these "new" platforms try better to reach people with disabilities being compliant with the different accessibility levels of the Web Content 1.0.

So we have all of these tools and platforms at disposition, both in commercial and Open source "world", but what we find to be an "ideal" e-learning system is one that uses these different kinds of tools, Authoring & Packaging tools, LCMS, LMS and combine them to promote better results for the different actors.

### **Phase 2**

Before the end of the first year of usage of the platform it is important to choose the strategy to follow as well as to analyse the impact of the platform. In order to make this analysis we should consider the data that comes from the collection of statistics about the platform usage and from the community inquiries about the level of satisfaction of the platform usage.

To conclude, as we have seen the choice of a platform (Moodle,...) involves a whole process and deals with many factors. First we have to know the e-learning system and tools we want to analyse,



because we have several LMSs, LCMSs and Authoring and Packaging tools. We have to make that choice regarding the architecture of the system we want to implement. After choosing the framework we have to see we are doing an empirical analysis or if we are choosing an e-learning system to implement in an organization. In real scenario, we have to consider the environment and the factors regarding the implementation of the e-learning system, so we have to define the criteria and its weights for selecting a platform that gives a good functional perspective of e-learning. In this analysis we have to take into account more context and project management factors than on an empirical analysis. Another sensible factor that should be considered is the accessibility, where the system should respect the accessibility directives of Web contents regarding users with incapacities. It is important that the system is accessible to everyone. Finally, the system should support several languages - the native language of the country where the platform or tool is being installed and provide information in foreign languages – preferentially English and optionally French or Spanish.

## **5 Material Collection and Updating**

Selection of materials will be made by the participants from S-Cube. Before uploading any material into the virtual campus, a validation by all the participants will be required. The Virtual Campus will be Web based both for delivery and day to day administration.

All users will require a username and password to access the Virtual Campus. Each user will have a personal file area where to put the material. This provides an individual user with space to place files. Collaborative file areas will enable groups of users to share files and to record modifications and commentaries against them.

A Content manager will be used to assemble learning material into *learning packages*. Learning packages will be made available to the appropriate users using the tool.

## 6 Participant List

The Table 8 represents a suggested list of senior and junior researchers that will participate in organization/running of the Virtual Campus. We distinguish the roles of participation as administrative/technical support (e.g. administration of forums), content providers (provide inputs to knowledge base, keep the content up-to-date) and (test) users. The list of participants will be refined/modified in upcoming deliverables and whilst the realization and implementation of the Virtual Campus, but the gathered here information may provide the basis contingent of people potentially involved.

**Table 8. List of researchers of S-Cube who are suggested to participate in the Virtual Campus**

Org.	Name	Contact Information	Section	Type of part.
TUW	SchahramDustdar	dustdar@infosys.tuwien.ac.at	Service-Based Systems	C/A
TUW	Michael Kipar	kipar@infosys.tuwien.ac.at	Hosting	A
TUW	Philipp Leitner	leitner@infosys.tuwien.ac.at	SBS	A/T
TUW	Florian Rosenberg	rosenberg@infosys.tuwien.ac.at	SBS	T
TUW	Ivona Brandic	brandic@infosys.tuwien.ac.at	Grid Computing	C
TUW	Martin Treiber	treiber@infosys.tuwien.ac.at	SBS	C/T
UPM	Irena Trajkovska	irena@clip.dia.fi.upm.es	SOC	T
UPM	Dragan Ivanović	idragan@clip.dia.fi.upm.es	SOC	T
UPM	Manuel Carro	mcarro@fi.upm.es	SOC	T
UOC	Christos Nikolaou	nikolau@tsl.gr	Service networks	C,T
UOC	Marina Bistaki	bitsaki@tsl.gr	Service networks	C,T
UOC	Dimitris Plexousakis	dp@ics.forth.gr	Service composition	C,T
Université de Rennes 1	Olivier Barais	barais@irisa.fr	Software Engineering – CBSE – New Technologies	C,A
Université de Rennes 1	Jean-Marc Jézéquel	jezequel@irisa.fr	Software Engineering - MDE	T
INSA	Jean Louis Pazat	Jean-Louis.Pazat@irisa.fr	Grid Computing	C
Université de Rennes 1	Françoise André	Francoise.Andre@irisa.fr	distributed systems, adaptation frameworks	T
Université de Rennes 1	Noel Plouzeau	nplouzeau@irisa.fr	CBSE – Software Engineering	C,T
POLIMI	Barbara Pernici	barbara.pernici@polimi.it	Internal campus	C,T
USTUTT	Frank Leymann	Frank.leymann@iaas.uni-stuttgart.de	Service composition	C,T
USTUTT	Dimka Karastoyanova	Dimka.karastoyanova@iaas.uni-stuttgart.de	Service composition	C,T
USTUTT	Olha Danylevych	Olha.danylevych@iaas.uni-stuttgart.de	Service composition	C,T
USTUTT	Branimir Wetzstein	Branimir.Wetzstein@iaas.uni-stuttgart.de	Service composition	C,T

UniDue	Klaus Pohl	Klaus.Pohl@sse.uni-due.de	Requirements Engineering, Variability Management	C
UniDue	Andreas Gehlert	andreas.gehlert@sse.uni-due.de	Requirements Engineering	C, T, A
UniDue	Andreas Metzger	andreas.metzger@sse.uni-due.de	Quality Assurance incl. Testing	C, T
City University London	Neil Maiden	N.A.M.Maiden@city.ac.uk	Service-centric systems engineering methods, service discovery, requirements engineering for service-centric systems	C
City University London	George Spanoudakis	G.Spanoudakis@soi.city.ac.uk	SOC (service discovery, composition, specification, negotiation monitoring of SLA, trust assessment and e-contracting for SBA); verification	C
City University London	Andrea Zisman	A.Zisman@soi.city.ac.uk	automated Software Engineering, automated support of distributed data, SOC	C
City University London	Angela Kounkou	sbbc775@soi.city.ac.uk	HCI and service-centric systems	C
FBK	Raman Kazhamiakin	raman@fbk.eu	A&M, QA, E&D	T
FBK	Antonio Bucchiarone	bucchiarone@fbk.eu	QA	T
FBK	Heorhi Raik	raik@fbk.eu	A&M, Service Composition	T
FBK	Asli Zengin		A&M	T
UCBL	Mohand-Said Hacid	mshacid@liris.cnrs.fr	Security in SBS	C, A
UCBL	Salima Benbernou	Salima.Benbernou@liris.cnrs.fr	Security in SBS	C
UCBL	Emmanuel	Emmanuel.Coquery@liris.cnrs.fr	SBS	T

	Coquery			
MTA SZTAKI	Gergely Sipos	sipos@sztaki.hu	Grid computing	C
MTA SZTAKI	Attila Kertész	keratt@inf.u-szeged.hu	Grid computing	C,T
MTA SZTAKI	Gábor Kecskeméti	kecskemeti@sztaki.hu	Grid computing	C,T
MTA SZTAKI	Zsolt Németh	zsnemeth@sztaki.hu	Grid computing	T
Lero	Sadhana Deshpande	Sadhana.deshpande@ul.ie	Software Engineering	T
Tilburg	Amal Algammal	a.f.s.a.elgammal@uvt.nl	Business Process Management	C, T
Tilburg	Vasilios Andrikopoulos	v.andrikopoulos@uvt.nl	SBS, SC, SE	C, T
Tilburg	Willem-Jan van den Heuvel	w.j.a.m.vdnHeuvel@uvt.nl	BPM, SBS, SE	C
Tilburg	Michele Mancioffi	m.mancioffi@uvt.nl	SBS, SC	C, T
Tilburg	Koah Nguyen	d.k.nguyen@uvt.nl	SBS	T
Tilburg	Mike Papazoglou	m.p.papazoglou@uvt.nl	BPM, SBS, SE	C
Tilburg	Michael Parkin	m.s.parkin@uvt.nl	Grid Computing, SBS, SOC	C, T
Tilburg	Oktay Türetken	o.turetken@uvt.nl	BPM	C

A – administrative/ technical support

T – test users

C – content providers – should provide inputs to knowledge base, keep the content up-to-date

## **7 Conclusions**

In this deliverable we have described the issues regarding the organization structure of the Virtual Campus together with the implementation issues and suggested list of the participants. The deliverable presents for each part of the Virtual Campus its goal and purpose and outlines its contents. The implementation section describes the structure of Virtual Campus from the implementation perspective. Finally, the list of participating researchers is suggested.

## 8 Appendix 1: Example of course table

<b>Course title</b>	<b>Service Technologies 2</b>	
<b>Institution</b>	Politecnico di Milano	
<b>Description</b>	Aim of the course is to present concepts and technologies for the realization of complex service-based applications. Applications studied in the course are realized through service composition, using paradigms of service coordination, service modeling, and Quality of Service negotiation. Service management aspects are also introduced, focusing on service management in distributed environments and security.	
<b>Level</b>	Master, PhD, Master/PhD, Summer school)	
<b>Goals</b>	Provide a working knowledge on service composition design and technology	
<b>Syllabus</b>	Introduction: cooperative systems and workflows	
	Process models and execution engines	
	Process Modelling: workflow patterns, activity diagrams, BPMN, DFD, comparison among models	
	Executable languages: BPEL; XPD	
	Orchestration and choreography	
	Quality of processes: definitions, optimization, negotiation, contracts	
	Process design: methodology, service identification, quality-oriented design	
	Advanced topics	
	Process evolution, adaptation, dynamic service binding	
	Grid, scientific workflows	
	Green information systems	
	Lab: lab on process modeling with BPMN and composition with BPEL	
<b>Lecture/exercise/lab hours</b>	20 lecture hrs, 16 exercise hrs, 20 lab hrs	
<b>Classification</b>		principles and methods
		technology
		adaptivity and monitoring
		engineering and design
<b>Knowledge objects</b>	1. Business Process	
	adaptation requirements and objectives	
	service binding	
	design for adaptation	
	Optimization	
	quality of service-based applications	
	quality of service level	
	quality dimensions	
	business process	
	Workflow	
	Activity	
	business protocol	
	business process integration	
	value chain	
	BPM software suite	

	business process modeling	
	business process execution	
	business process measurement	
	business process optimization	
	service orchestration	
	service composition	
	service coordination	
	model-driven service composition	
<b>new terms (non incl. in KM)</b>	BPMN	
	BPEL	
	XPDL	
	workflow patterns	
<b>Teaching material</b>	DFD	
	On request (available on university platform with restricted access) e-mail: <a href="mailto:barbara.pernici@polimi.it">barbara.pernici@polimi.it</a>	

