VENIS

Virtual Enterprises by Networked Interoperability Services

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VSI Requirements Report

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EXECUTIVE SUMMARY

The vision of VENIS is to implement a system for enterprises of all sizes to be used for realizing competitive advantage via collaborative enterprise interoperability on their business processes: the VENIS Services for enterprises Interoperability (VSI).

The main goal of the VENIS project can be summarized on two levels: organizational and technological. The organizational level is to allow the management of interoperability processes of enterprises within a collaboration environment. The technological level is to develop interoperability service utility as additional capabilities, while keeping almost unchanged the existing enterprises platforms and the network software architectures. Implemented utility (VSI) gives enterprises solutions for inter-enterprise interoperability, collaboration through reference scenarios and guidelines for their use.

In order to achieve these goals the requirements for such a system have to be properly defined. The instruments used to gather the VENIS requirements are three application cases (AC), which were defined by the VENIS partners Engineering, Link Technologies and InterSoft.

The application cases are: Submission process of a research project/bid proposal (AC1), ISO conformity (AC2) and development resources allocation (AC3). Each application case is structured into use cases. The use cases are the most important method describing the dynamic functional behavior of the VSI.

In AC1 the VSI will be used to control and automate the processes of collaborative project proposal documents preparation. It is described by six use cases.

AC2 describes the requirements for the automated process that eliminates the need for human intervention for the in-time renewal of the ISO. AC2 is described by two use cases.

AC3 will allow outsourcing company to automatically allocate development resources to the projects offered by the customers and support negotiation via collaborative environment. AC3 is described by four use cases.

The process of development will be characterized by deployment from early beginning. Therefore prototypes and their demonstration tests will be conducted. The VSI will be developed in an iterative process giving the VENIS user partner the opportunity to modify their use cases after each test.

The prototypes integration and their demonstration, running from month 23 to month 27, will focus on the following aspects: basic platform services, basic process operational services, basic collaboration support, and applications integration with the focus on embracing existing applications.

The requirements coming from all sources are listed in chapter 6, classified as "functional" or "non-functional" and prioritized as "must", "medium", "low" and "future" ("future" means fulfilled after the end of the VENIS project).

Document Information

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Abstract (for dissemination)	VENIS services for enterprises interoperability (VSI) platform brings additional collaborative capabilities, while keeping almost unchanged the existing enterprises platforms and the network software architectures. The integrated VSI platform will be adopted and evaluated in three prototype application cases based on the collaboration of three organizations Engineering, Link Technologies, and InterSoft which are user partners of the VENIS project. The report specifies applications and processes and users with their roles were identified. The set of functional and non-functional requirements has been listed. They will serve as input in creating an overall outline of the VENIS project including design and development.			
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GLOSSARY

AC	Application Case
BPMN	Business Process Model and Notation
CPU	Central Processing Unit
CWE	Collaborative Working Environment
EU	European Union
FInES	Future Internet Enterprise Systems Cluster
FTP	File Transfer Protocol
HQ	Headquarter
ICT	Information and Communication Technology
IMAP	Instant Messaging Access Protocol
ISO	International Organization for Standardization
IST	Information Society Technologies
ISU	Interoperability Service Utility
IT	Information Technology
LDAP	Lightweight directory access protocol
LE	Large Enterprise
ME	Medium Enterprise
NFS	Network File System
POP3	Post Office Protocol
R&I	Research and Innovation
SOA	Service Oriented Architecture
SE	Small Enterprise
SME	Small and Medium Enterprise
SMTP	Simple Mail Transfer Protocol
SSL	Secure Sockets Layer
VSI	VENIS Services for enterprise Interoperability
WST	Web Service Technology

1 INTRODUCTION

The software development companies often bypass the requirements analysis phase of the software development life cycle process and skip directly to the implementation phase in an effort to save time and money. The results of such an approach often lead to projects not meeting the expected deadline, exceeding budget and not meeting user expectations.

Therefore, when a software product has to be developed, one of the first tasks in the project manager's schedule must be the requirements analysis. One of its primary benefits is to catch problems early and minimize their impact with respect to time and money.

The requirements analysis process aims to identify and document the customer's requirements for a proposed system. Most times, the client will have only a brief idea of what they need in the proposed system. The analyst must get customer needs out, add implied requirements and regulatory requirements the client may not be aware of.

The first level clients in the VENIS project are the user partners and consortium members Engineering, Link Technologies and InterSoft. In addition to them second level clients can be identified. These are the participants of the application cases of partners. The role of the analyst is played by the consortium as a whole and especially by InterSoft and the development partners: Fraunhofer Institute for Applied Information Technology, IT Link and Institute of Informatics of Slovak Academy of Sciences.

The VENIS requirement definition follows a strategy which is described in five steps. Goals and user groups have to be identified (steps 1 and 2) before the requirements can be gathered (step 3). Once the requirement specification is written (step 4), it needs to be validated (step 5). Chapter 2 explains these 5 steps with reference to the VENIS project. The chapter also describes the instruments used to define the VENIS requirements, where the use cases are by far most important.

The requirement analysis of the three user partners in chapter 3 to 5 describes user groups, applications and use cases in detail based on three application cases: submission process of a research project/bid proposal, ISO conformity and Development resources allocation. The example scenarios will serve as sketches for prototypes, based on all three application cases. Each application case is provided by one of the three VENIS user partners.

Engineering will apply the VSI for the interoperability among possible partners during preparation of project proposal. The goal of this application is to enable close collaboration and communication between all involved partners in the process of the project proposal documents preparation. This is described in chapter 3.

The interoperability presented by Link Technologies applies the automotive processes during the renewal of ISO. The goal is to automatically initiate the collaboration of all organizations involved in the renewal process. This is described in chapter 4.

Application allowing collaboration during negotiation process of the outsourcing project is presented by InterSoft. The goal is to automatically find and allocate the development resources for offered development projects according to specific technologies used in the projects. This is described in chapter 5.

VENIS aims to reduce organizational and technical overhead, by introducing a quick and straightforward implementation of a collaboration infrastructure. This opens up more new business opportunities to the VENIS user partners Engineering, Link Technologies and InterSoft enabling them to offering their services more efficiently to customers from outside.

Chapter 6 presents the results of the requirements analysis. All requirements from all described sources are listed and specified. Its structure follows the structure of the applied instruments from chapter 2.

Chapter 7 describes the special activities of the project to assess the dimension of expected policy and societal impact, and the viability of the project in view of expected acceptance of such impact.

Annex A presents the taxonomy of the collaborative software. Existing criteria for various kinds of taxonomies are described and taxonomy categories and sub-categories for the purpose of the VENIS project are identified. Finally the existing software solutions are categorized.

The requirements specification is the direct input for the technology assessment (WP2) and has a crucial impact for the technology assessment report (D2.1) and VSI specification report (D2.2).

2 METHODOLOGY

Understanding user requirements is an integral part of the VSI design and is critical to the success of any software system. The purpose of our requirement analysis is to obtain a thorough and detailed understanding of the business needs and to break it down into discrete requirements, which are then clearly defined, reviewed and agreed upon with the later defined users.

2.1 Analysis of Project Goals

The vision of VENIS project is to research and implement a system for enterprises of all sizes to be used for realizing competitive advantage via collaborative business processes. These processes can take place along analysis, design, and production stages with different consortium configurations during each project stage.

In the past years, the lack of a proper ICT solution for interoperability compelled some LEs and most of the SMEs to adopt empirical and approximate approaches. When possible, the project or product information was shared by ad-hoc transfers by FTP or email attachments, with partial distribution, missing of context transfer, absence of semantic, etc. thus resulting in unpredictable control on the flow of data and knowledge, causing an overall inefficiency. This situation was experienced during R&D projects, consulting services providing and products commercialization.

Today, latest evolutions in the ICT research offer new powerful solutions, by merging:

- Collaboration Working Environment (CWE), so far focused at personnel resource level;
- Service Oriented Architectures (SOA), to create services from legacy systems;
- Web Services Technology (WST) to open the Web access to the networked SME.

In particular, new levels of enterprise interoperability are available by using i) the existing technologies in CWE to create shared repositories, ii) a set of services (using SOA) to connect the enterprises Information Systems and iii) the Web Services Technology approach (WST) to make the application available on the Internet.

In this frame, VENIS is proposing the implementation of an Interoperability Service Utility (ISU) matched with LEs and SME needs and based on:

1. a **Virtual Common Repository**, able to unify the scattered information of the enterprises,
2. a **Distributed Data Sharing**, offering a smart mechanism for the exchange of the distributed data,
3. a **Business Process Handler**, offering an interactive assistant for joint projects and business, where the information is automatically collected, merged and served to enterprises users.

At the same time, the VENIS approach will properly manage some critical aspects including the sharing of the proprietary knowledge, the administration of resources, the monitoring of decisional processes, the market-sensible data, etc. The abovementioned functionalities are expected to be achieved as additional capabilities, while keeping almost unchanged the existing enterprises platforms and the network software architectures. The goal is to preserve the past investments of the enterprises by a seamless integration with the existing legacy working procedures and internal ways of working.

In this frame, the data repositories of existing legacy applications owned by the LEs and SMEs must be linked in order to create a single logical view of the distributed information.

The logical view must be able to contain heterogeneous information, such as documents, meetings and events planning, milestones, activities results, etc. The existence of a single virtual place where all the joint information is stored avoids mismatch of knowledge among enterprises. This goal should be achieved without requiring that the enterprises will trust other organizations in storing their information.

The widly adopted mechanism to communicate among Enterprises is currently email. A goal of the project is to transparently integrate the system with the existing SMTP infrastructure. In the meanwhile the email must be used to build a knowledge base to support the collaborations.

The output of the project must support several adoption scenarios. Participant Enterprises that will adopt the project will live in a heterogeneous ecosystem, where not all their partners will adopt the project. It is important that the Enterprises can take benefits from the adoption of VENIS even if their partners do not use the system.

Moreover, the adoption of VENIS from an Enterprise should not force its partners to change their collaboration methodology.

This will allows the support to the project interoperability methodologies to gradually grow. In this scenario it is important that the project produces the necessary specifications to allow the resulting prototype to coexist with different implementations.

In order to support the IT infrastructures and requirements of Enterprises, the VENIS project should provide several deployment methodologies, ranging from hosting based solutions to platform as a service approaches.

In conclusion, the VENIS project offers a solution specifically matched to the LEs-SMEs interoperability, by designing, developing and demonstrating a collaboration approach able to cover the gap between the needs coming from different sized companies.

2.2 Identifying Actors and Their Roles

Before gathering requirements for VSI, which are necessary to the above already presented visions and goals, the actors and their relation to the VSI have to be identified. This step is vitally important to find out the specific needs

of the targeted user groups for example in the VENIS application cases. After defining the user groups the involved roles and responsibilities within the user groups will be identified.

The VENIS infrastructure roles and responsibilities within VENIS infrastructure are related to people, who interact with the software and/or use the products, information and results of the system. The roles and responsibilities of the users and operators are described individually for each application case (chapter 3 to 5, e.g. the qualifications and the operations they perform).

User groups usually cover different roles. Roles can be the same in different user groups.

The general user groups have been defined and identified for the VSI. The VENIS user partners (Engineering, Link Technologies, InterSoft) describe more detailed user groups, roles and responsibilities for their case settings. The results are provided in chapter 3, 4, and 5.

Technology Provider

Technology Provider is responsible for technology application. Technology providers ensure the successful design, deployment, operation, maintenance and decommissioning of hardware and VENIS software assets.

Portal Administrator

Portal Administrator's obligation is to maintain basic data/functions to run the VSI itself and to create user accounts for Service Providers, administer their access rights etc. The portal administrator can also be called collaboration host.

Content Manager

The Content Manager is responsible for all functionality of the VSI. The Content Manager works with other business areas, e.g. marketing to understand their requirements and translate them into effective and usable way. The Content Provider is also responsible for the development and design of the VENIS application site.

Service Provider

The provider of a specific service provides all necessary information for the service via the Service Catalogue (including configuration of the service, descriptions, pricing etc.), maintains the related contracts (access rights for Service Users for a specific service, duration for the contract etc.) and uses the reporting/auditing functionality of the service portal to keep track of the use of his service offered/sold. He also configures all parts of the workflow if the service provided consists of more than one step. The service provider is neither an IT-Service company nor a department of a partner in a collaboration project.

Service User

User of the specific service that has been ordered from the Service Provider. The Service User completes the required business tasks of his responsibility and during this "workflow" (can be a real workflow, controlled by a separate

workflow engine outside of VENIS or also just a sequence of business tasks) he triggers the requested service via the service portal.

Service Executor

Depending on the individual kind of service this can be a piece of software or also a human being (or organization) executing the requested service.

Service Locator

The Service Locator tries to find a provider for a specific service (performed by a piece of software or also by organizations/human individuals) from the service portal. If he finds the required service in the service catalogue he gets in contact with the Service Provider, settles all business related questions/contractual issues and orders/buys the service itself. The Service Locator is usually the main responsible company in a consortium.

2.3 Analysis of Requirements

After identification of the different actors, the next step will be to find out what users would desire the VSI system to do, which demands they have, and which constraints there are relevant for the given case. Purpose of this step is to capture reasonable requirements.

2.3.1 Gathering Requirements

Within the VENIS project the initial phase is a main instrument for gathering user requirements: application cases. VENIS project team can learn a great deal about potential users of the platform, their needs, how to meet those needs and how the software is going to meet those needs.

Gathering requirements and use cases from three VENIS application cases will focus on the needs of integrating legacy systems, Virtual Common Repository, Distributed Data Sharing, and Business Process Handler.

After collecting, the requirements have to be classified and documented. The following chapter describes both steps.

2.3.2 Classification of Requirements

The VENIS requirements are ordered by functional and non-functional requirements as can be seen in chapter 6.

Functional Requirements

Functional requirements are requirements which define those features of the product that will specifically satisfy a consumer/user need, or with which the consumer/user will directly interact.

Functional user requirements may be high-level statements of what the system should do; functional system requirements should describe the system services in detail.

For finding out the VENIS functional requirements business rules like regulations, quality attributes, external interfaces, data definitions and constraints have been considered.

Non-Functional Requirements

Non-functional requirements describe system qualities. Very important for the quality of a product are the aspects of performance, reliability, and system resources.

For finding out the VENIS non-functional requirements business requirements, user requirements, system and security requirements have been considered.

- **Business requirements** describe the primary benefits that the new system will provide to its users. They specify the desired behavior of the system. For gathering business requirements the VENIS team identified vision and scope of the project. Precise vision and scopes will be defined for each application case by the user partner.
- **User requirements** describe user goals or tasks that the users must be able to perform with the product. User requirements will be acquired by application cases of user partners.
- **System requirements** describe what the system should do.
- **Security requirements** normally originate in business rules, so any security, privacy policies or regulations have to be identified.

2.3.3 Requirements Specification

The VENIS requirements are classified to a variety of functional and non functional requirements. This detailed classification helps checking the completeness of the identified requirements.

A requirement specification is a blue print of the VSI product and a reference for the different actors. It should ideally restrict itself to specifying "what" the product should do rather than "how" to do it. Ideally, it should include the following information:

- Overall description with descriptions of the applications and functions of the application case.
- Actors and their characteristics identify the various actors/users that will use VSI product.
- External interface requirements with descriptions to user-, hardware-, software-, communication interfaces.
- Other non-functional requirements with descriptions to performance-, safety- and security requirements and software quality attributes.

External interfaces and other non-functional requirements gathered from the user partner will be listed in chapter 6.

The **use case template** describes a sequence of interactions across the system boundary between one or more system actors and the system. It is a procedure by which the active actor achieves the goal of the use case.

A use case template within VENIS project includes following components for describing the gathered use cases:

Table 1: The VENIS use case template.

USE CASE#	<the name is he as a short active verb phrase>	
Context of Use	<a longer statement of the context of use is needed>	
Scope	<what system is being considered black box under design>	
Level	<one of summary, primary task, sub-function>	
Primary Actor	<a role name for the primary actor, or a description>	
Actor and Interest	**Actor**	**Interest**
	<name of the actor>	<put here the interests of the actor>
	<name of the actor>	<put here the interests of the actor>
Preconditions	<what we expect is already the state of the world>	
Description	**Step**	**Action**
	1	<put here the steps of the scenario from trigger to goal delivery>
	2	<…>

2.3.4 Validating Requirements Specification

Validation ensures that the requirement statements meet the goal that was laid down. They demonstrate the desired quality characteristics and will satisfy the needs of identified actors.

In this step it is also important to prioritize the requirements. The VENIS project team ranked the requirements shown in chapter 6 according to the following prioritization scale:

- **Must** – Without this requirement the concept of VENIS will not work at all.
- **Medium** – Standard case.
- **Low** – If there is enough time and resources the VENIS partner should take care on this requirement.
- **Future** – to be fulfilled after the end of the VENIS project. The requirements are relevant for specific commercial use. But developers have to have them in mind when developing the VSI.

The following list has developed for the VENIS quality check. It shows the quality criteria and the list to check the requirements. As result of this quality check some requirements were deleted, some reworked and some consolidated.

Preciseness

- Is the goal, or measurable value, of the use case clear?
- Is there sufficient explanation of the requirements space?
- Is it clear which user group's benefit from the use case?
- Is the dialog sequence for each course clearly written, unambiguous, and complete?
- Are all the use cases at the same level of precision?
- Are all scenarios at the same conceptual level?
- Are all the terms used in the case and the related scenarios clearly defined?
- Is the system reaction in the case of an exception clearly described?

Conciseness

- Is the use case written at the essential level, rather than a specific scenario?
- Is the use case free of design and implementation detail?
- Is every user groups and step in the use case pertinent to performing the task?
- Are there any common action sequences that could be split into separate use cases?
- Is there any unnecessary or unused information?

Completeness

- Is the definition of goal success specified?
- Does a textual description exist for each use case and vice versa?
- Do the pre- and post-conditions properly frame the use case?

Robustness

- Are all known exception conditions documented?
- Is the behavior following unrecoverable failure specified?

Feasibility

- Is each course defined in the use case feasible?

Verifiability

- Can test cases be generated for every use case?

Validity

- Does the use case correctly describe what users want to be able to do with the system?

Consistency

- Are all the exceptions described in the use case consistently described in the related scenario?

3 USER REQUIREMENTS FROM ENGINEERING APPLICATION CASE

The objective of this use case is to demonstrate the validity of the VENIS Services for Enterprises Interoperability (VSI), within the context of Engineering, in particular in the field of R&I direction. However, the identified issues are common in other commercial and production areas such as Engineering participation of bid formulation, in the form of consortia. The proposals and tendering process is strongly document-based and often unstructured. Several documents are gathered, exchanged and shared, with several access policies. These results in a highly complex management challenge when conducting multiple projects simultaneously, with some partners involved in more than one consortium. In the worst case, as often happens, small and medium-sized enterprises don't have collaboration and sharing systems.

3.1 Overall Description

The scenario proposed by Engineering is related to the submission process of a research project for a European or Italian call for proposals. The main process is divided, for simplicity, into two sub-processes:

1. collaborative writing of the technical proposal;
2. definition of the project budget.

Actually the two sub-projects are of course interwoven, but their separation allows us to better identify the problems that the VSI should address and the actors involved.

The first sub-process is typically a collaborative process in which the project coordinator (or the scientific coordinator) assigns the writing of parts of the technical document to each partner and collects, accepts or rejects their contributions (with motivations and guidelines to improve the contribution in case of rejection). Updated versions of the entire technical proposal are periodically circulated among all the partners in order to collect feedbacks.

More in details, when a new research consortium is established among organizations in order to write a technical proposal, the Proposal Coordinator/Collaboration Administrator is in charge of initializing this collaboration, defining the involved group in order to outline the scope of collaboration. He also defines a set of roles for this new group. After completion of this phase, the administrator sends an invitation to all participant organizations in order to complete the collaboration creation. The contact person for each partner of the consortium, can accept or decline the invitation, on behalf of his organization. If he accepts, in turn, assigns the above roles to the users of his team that will be involved within the collaboration. Defined the collaboration scope (organizations, roles, users), the sharing process of one or more joint documents (e.g. the master document or separate documents for each proposal section) have to be started. In this step, the proposal coordinator shares these documents by means of a repository system. Three types of repository are possible:

- FTP

- website
- document management system

The coordinator creates a folder, uploads the document templates and defines the access policies according to the collaboration model and policies. When he needs to send a request for document contributions among the organizations belonging to collaboration, he opens his mail client and sends the request mail to the appropriate partners, according to the selected collaboration, resource, actions and with the appropriate token that will be generated by the system. The contributor mail client elaborate the request token and the contributor can download the document in order to provide its contribution. The contributor modifies the documents and saves it. Then he opens its mail client and starts a response to the previous request for contribution mail. According to request token the contributor client upload the document contribution on the coordinator original virtual repository. A notification has been sent to coordinator. The coordinator retrieves the partners' document contributions uploaded in its virtual repository. The proposal coordinator wants to define a process in order to track the contribution steps triggered by the events of contribution (upload, request responses, acceptance, rejection, etc.).

The main issues that the VSI should solve in this sub-process are related to the complexity of managing many versions of many contributions from many partners.

The second sub-process is typically a composition of negotiation activities carried on by the project coordinator with each partner, in a separated way. Usually, during this process, partners are not aware of other partners' budget. The definition of an upper and lower bound for the budget of a project and the assignment of portion of such budget to the different partners is a complex task that must take into account financial constraints, political factors and privacy requirements and the cost structure of the project. For this reason usually the Project Coordinator (PC) has to negotiate separately with each partner the assigned financial resources, without disclosing information about other partners' budget. The PC coordinates the negotiation activities and has both a global perspective on the total budget of the project and a detailed view on each single partner's budget. In this context it is necessary to upload and share several datasheet files among partners, one per Partner plus one that gives an complete view on the total project budget. Each Partner is allowed to access only its file. This scenario (see annex B for a detailed description of the use case) starts with the uploading of the files. The PC sends an email as request of contribution on definition of project budget. All access grants modalities provided in the previous scenario are common to this one. Each contributor receives the request and starts the process of contribution by activating additional person who carries on operative activities in the definition of the partner's budget.

The main issues that the VSI should solve in the budget definition sub-process are related to the risk of sharing budget information with unauthorized partners and to the complexity of managing many budget versions for each partner, with

the necessity, for the coordinator, to have always a coherent, updated and unified vision on the overall budget.

The Figure 1 summarizes the context just described. Multiple actors belonging to different enterprises, by dimension, geographic location, or technological background.
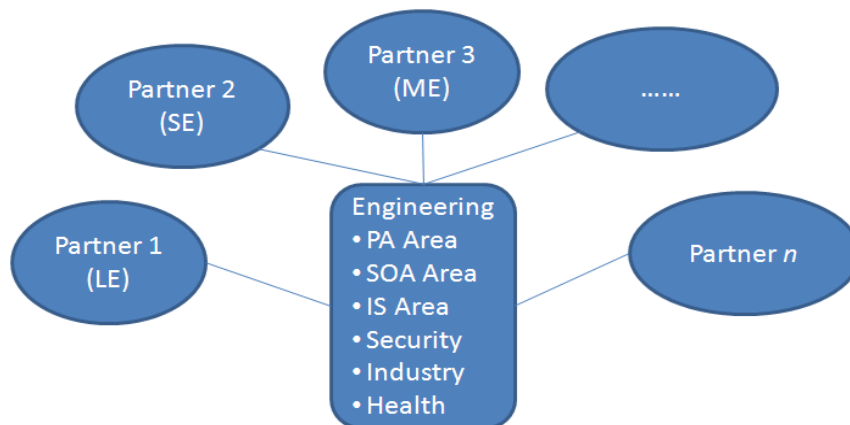
Figure 1: Collaborations are intra/inter organization. They are composed by several actors belonging to internal and external units.

Some useful tools or collaboration work environments (CWE) recently used, are Liferay[1], Google Docs[2], Opengoo/Feng Office[3] (see Table 8) or dedicated Virtual file systems or Websites.

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[1] Liferay: http://www.liferay.com

[2] Google docs: http://www.google.com/apps/intl/en/business/docs.html

[3] Feng Office: http://www.fengoffice.com
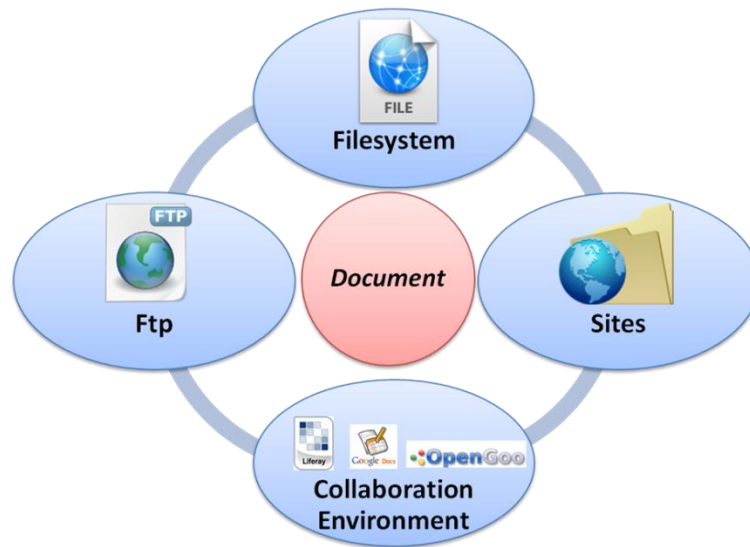
Figure 2: A document during the scenario is shared among different collaboration software.

In the Figure 3, according to the scenario described in the next section, the three main functional requirements are summarized:
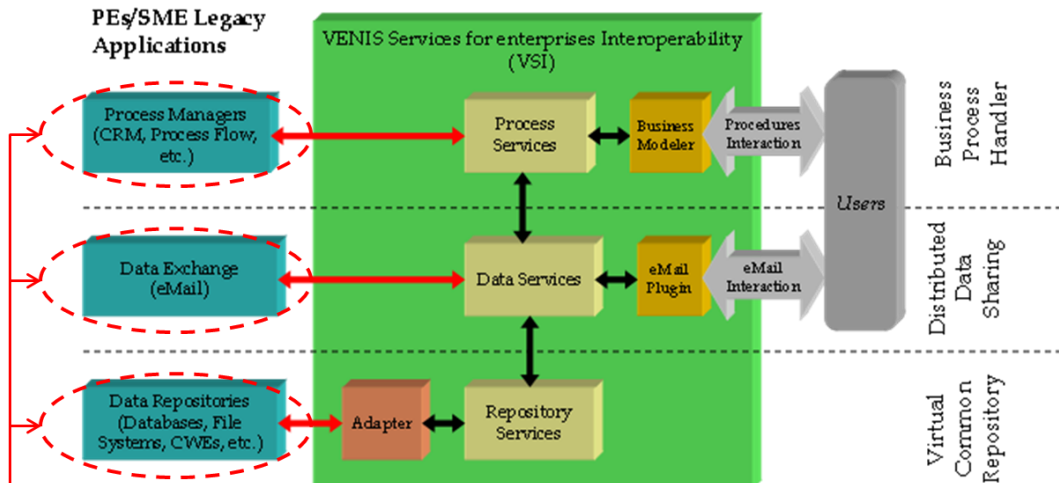
- Integration of Process Handler in Engineering Business Process Management System (*Business Process Modeller- BPMN*)

- Integration of Distributed Data Sharing with collaboration system (*Access policy and Security Token*)

- FTP and Liferay Social Office integration with VSI components (*Adapters, Security with opensocial*)

Figure 3: Mapping of the three main functional requirements with the three layer VSI logical architecture.

Below Engineering internal constrains access limitations, privacy and security policy models are provided. Engineering provides a regulation corporate document in order to regulate, in all units companies within the Engineering Group, the use of electronic mail, Internet and corporate network.

The CWEs used during the described scenario are integrated with the internal LDAP or by mean ad hoc user profiler. It is possible in many cases to have several user profiler simultaneously (in the worst case one per collaboration).

The corporate network accesses are managed by a centralized system for the "provisioning" and "profiling" of the Business and Information System ("Sistema Informativo Interno- SII") for managing access to applications and access data in the system.

This system regulates primarily:

- **Standard Authorizations** are granted automatically when the subject joins for the first time a specific unit and the request is validated by the its responsible.
- **Non-standard authorizations** are granted to subject to the occurrence of specific requirements for access to data/systems relating to the duties assigned and based on explicit request by its responsible.

According to the above authorization model we can have three types of users:

- Employees and administrative
- External Collaborators
- External consultants "Guests"

The last definition includes all persons who require access to enterprise systems on an occasional basis and not related to the existence of a contract and/or partnerships.

Some support applications are provided:

- **IAM**. Application accessible via the internet that implements the process of managing access authorizations.
- **ENGAGE** (Corporate Intranet). It is the Corporate CWE application through which regulations, procedures and guidelines are published and searched. On Engage it is possible to "open" a community after approval by using IAM.

The above applications are administrated only by SII responsible.

Mail Server

Engineering owns an internal and self managed mail server. The mail server is accessible only to engineering group employee by means of internal LDAP.

- Two type of access: SMTP/POP3 and IMAP
- A web based mail client is provided, accessible externally and internally to corporate network.

- No application and extensions are allowed.
- It is prohibited the division of the mail messages into multiple messages in order to push the limits on attachment size.

Access to enterprise applications

Any enterprise application has to be deployed in DMZ (DeMilitarized Zone) in order to be externally and internally accessible. No public API are provided.

FTP

The corporate ftp server is regulated by the following procedure:

- *File direct towards the inside (public to private).* External collaborator/customer must connect to the public "in" section of FTP server (without authentication) and place the files in this directory. During the transfer the external collaborator/customer will see 'the progress bar 'but he/she is not able to see any file in the directory. The Eng employee have to connect (with authentication) in order to get the file.
- *Files towards the outside (private to public).* The ENG employee must connect (with authentication) to ftp server in the "out" section and copy the file there. External collaborator/customer must connect to the public "out" section of FTP server (without authentication) and get the file.

Some constrains and behavioral policies:

- It is not possible to create, delete, manage directories by anyone
- It is not possible to delete other files than those included in an authenticated manner
- The residence time of the file into the server is 7 days and after this period it will be automatically deleted
- It is strongly advised to manually delete large files as soon as the receiver will have removed them, to free up space on the server.
- It is strongly recommended to use a common prefix in the files comprising the project and the date.
- It is strongly recommended to compress the file (with password if confidential) in order to reduce bandwidth usage.

The Engineering application case can be described by six use cases (detailed in Annex B):

1. Create collaboration
2. Document upload
3. Contribution request
4. Contribution response
5. Process tracking
6. Definition of the project budget

3.2 Actors

The Table 2 provides a description of the main actors involved in the use cases related to the proposal submission process and the role of each of these actors.

Table 2: Actors of Engineering application case.

Actor	Description and role
Collaboration Administrator	He is in charge of initializing the collaboration, creating the prerequisites for preparing the submission process and setting up the collaborative writing workspace. He identifies the participants in order to outline the scope of collaboration inside the collaboration management system. This role can be played by the same person of the proposal coordinator or by a technical expert of his team.
Contact person (for each partner of the research consortium)	User who represents its own organization against the proposal coordinator and the other consortium partners. He also assigns the roles to the members of his team who will actively participate in the collaboration through the collaboration management system.
Proposal coordinator	He is responsible of managing the proposal submission process, assigns the writing of parts of the technical document to each partner and collects, accepts or rejects their contributions. He is also responsible of the negotiation activities with the other consortium partners in order to define the project's budget. So he is in charge of sharing the suitable workspace, assigning the appropriate rights according to the roles and contributions of each partner in the proposal writing.
Contributor	He is a member of any partner of the consortium involved in the proposal submission process. This actor can play different roles and actions depending on his nature and the kind of contribution required. This may be a technical involved in the proposal writing or the administrative contact that has to check the proposal meet the requirements of the funding source or a strategic contributor that has to approve the budget for his organization.

4 USER REQUIREMENTS FROM LINK TECHNOLOGIES APPLICATION CASE

4.1 Overall Description

Link Technologies S.A. is the parent company of the Link Technologies Group of companies. Under this umbrella, there are a number of smaller or "child" companies in operation. Information is shared between the companies involved in the group.

For example, when quotations are put together for various customers, each quotation must have a unique protocol number so as to keep track of these quotations under the rules of ISO standards. The same is the case for purchase orders to suppliers and from customers.

When Link Technologies puts together a quotation for a customer, it involves various steps for the completion of the quotation. There may be brochures and product descriptions that may need to be sent along with the quotation. As the current process stands, if a sales rep is in the process of putting together a customer quotation and requires attaching a brochure, the sales rep must get a copy of the brochure from a location on the Link Technologies server. This is all well and good if the sales rep is located at the head office of Link Technologies but if the sales rep is from one of the umbrella companies then they must contact the head office by either telephone or email requesting a brochure for the desired product. At the moment there is no central repository of literature that all members of the group have access to and there is a manual process in place for the acquirement of such literature.

The same is the case for the procurement of the unique ISO protocol number that needs to accompany each quotation or order. For the purpose of the VENIS project, we will concentrate on the ISO factor as it is a very important process for Link Technologies as the ISO must be renewed on a yearly basis and traditionally, the renewal process is a time consuming and stressful period for the ISO officer as they must go through the numbers manually every time to ensure that all numbers are matched.

Automating this process as desired via VENIS would prove a huge saving in time and resources for the company as it would eliminate the need to double and triple check entries as the time for renewal approaches. VENIS will ensure the process is automated and will eliminate the need for human intervention and will ensure accuracy at the time of the ISO renewal.

VENIS will take care of the authorization of all the relevant actors for each scenario providing the necessary access to the relevant players after certain steps in the sequence or workflow have been completed.

The environment as we see it may be based on the Web or cloud configuration with a combination of client server aspects. Email would be via the company email system which is SMTP/POP3 and IMAP based using Yahoo! Bizmail[4]

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[4] Yahoo! Small Businesses http://smallbusiness.yahoo.com

services. Some employees use Microsoft Outlook[5] to access their POP3 accounts but seeing as this updates the Yahoo! Bizmail account; it does not present a problem.

A cloud repository would be ideal and would allow access to the system for employees who are based in various locations across Greece and Internationally.

VENIS would need to sort who has access to the relevant systems that will be available on the cloud seeing as that we are discussing ISO Standard Systems and employee data. Users of the system would receive the notifications via their mail and with the relevant authorizations granted would be able to act on the tasks as required by their roles.

The Link Technologies application case can be described by two use cases (detailed in Annex C):

1. ISO conformity process
2. Employee document repository

4.1.1 ISO Conformity Process

One LE company has a number of SME subsidiaries. Both LE and SME companies have an ISO 9001 in place for the workflow of documents such as offers, quotations and orders.

But there is only one ISO security officer and one repository for the ISO documents in the LE Company.

So what is the current process of the SME when they want to send documents such as a report or an order? They have to call or email the ISO security officer in the LE mother company to ask for a unique ISO protocol number. They then have to supply the title of the document to the ISO security officer so that it may be inserted into the ISO database.

The ISO security officer must then reply by email with the ISO protocol number and wait to receive the document from the employee of the SME so they may then store to the ISO server.

There have been cases where the SME employee may forget to send the document to the ISO security officer or they may send a previous version and not the final document that has been sent to the client.

The VENIS project will integrate itself into the whole procedure and thus the workflow will be as follows:

An employee of the SME requires a protocol number. They send an email to the ISO security officer with an application for an ISO protocol number.

The ISO security officer replies back with the ISO form document and security tokens so that the SME employee can fill in the details. The SME employee then replies back to the ISO officer with all details of the form completed.

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[5] Microsoft Outlook http://office.microsoft.com/outlook

When the ISO security officer receives the completed form, they reply back to the SME employee with access rights to send back the document for the ISO server containing the offer, report or order.

The SME employee replies back to the ISO security officer with the final document. Only then will a protocol number be issued.

The whole procedure gives the ability to the ISO officer to index and track all the ISO documents. This will also enable the ability to track all ISO documents internally and externally from the company.

The tool will have the ability to create reminders for not receiving or sending documents or security tokens.

All final documents that are leaving outside of the LE and SME Company are totally indexed so changes can be tracked.

If the customer has accepted the order the sales rep will have an option in the system via a check button acknowledging that the order was successful and may then flow to the next department in the chain which is procurement. When the procurement officer is notified that there is an order to be procured, they can proceed with the order knowing that it is valid because it has reached inbox. By the order reaching the procurement officers in-box he knows it has gone through all the required protocol steps.

The protocol officer completes the order and when the goods are received, he clicks the items received inbound button when the goods come into stock which notifies the accounts department to issue an invoice.

The accounts department receives the request for invoicing and sees the relevant protocol numbers attached for the order. The invoice is issued and notification is sent back to the procurement officer along with the invoice that is to be attached to the goods for shipping.

During this whole sequence, the ISO Officer is copied on all notifications and has an overall view of what the status is for each protocol number issued. This being said we can also suggest that another role that the ISO officer plays is that of a project manager but on a much smaller scale as they are kept informed of the transaction from beginning to end.

4.1.2 Employee Document Repository

An LE company has outsourced personnel to another LE company or an SME company has outsourced personnel to an LE company.

The usual workflow of documents is by delivering these by fax or email from the HQ to the outsourced personnel to revise it or simply to deliver it to the LE Company.

The VENIS project will integrate itself in the same manner as scenario 1 and will keep track of all these documents and manage access to the documents in question by giving the relevant authorization to each person or department involved. Especially documents that need revision from the outsourcing personnel such as contracts and offers will remain on the NFS server of the

mother company and the outsourcing personnel will have the security privileges for simply reading or revising the documents in question.

The system may also be integrated to include brochures and technical information for staff requiring putting together quotations or offers to customers. It will ensure the central location of these documents and allow only the latest documents to be stored there.

Overall, it will be a secure repository of indexed documents that may be accessed by personnel with the correct security tokens, always ensuring that the most current document versions can be accessed by appropriate staff.

4.2 Actors

Actors of ISO conformity process are shown in Table 3 and actors for Employee document repository are shown in Table 4.

Table 3: Actors of ISO conformity process of Link Technologies application case.

Actor	Description and role
ISO Officer	Is responsible for the administration of the ISO system. Must ensure that all correspondence with the customer has the correct protocol sequence numbers attached so as to be able to pass the yearly ISO inspection / certification process. This person must ensure that all relevant information is complete before ISO protocol number is released.
Sales Representative	Represents the SME and acts as the middle man or contact person between the SME and the customer. They are responsible for ensuring that all relevant customer details are entered into the system before a protocol number is attached to any formal correspondence with the customer. Also responsible for supplying the customer with the information they requested whether it be a quotation, report or product information, all the way to fulfilling the customer's order if it has been placed.
Procurement Officer	Is responsible for procuring items to fulfill an order that has been placed by a customer. Must ensure that all relevant ISO protocols have been fulfilled before procuring any items so as to have a valid order to act on.
Customer	Is a member of the public who has requested information from the SME.
Accounts Department	Is responsible for the issuing of any invoices after having received valid orders from a customer.

Table 4: Actors of Employee document repository of Link Technologies application case.

Actor	Description and role
Company Administrator	Responsible for updating the records for not only the employee but for the company as a whole. They must ensure that the repository is kept up to date with the latest company literature and must also ensure that each employee's folder on the repository is kept up to date with the latest personnel files for the individual along with any relevant contracts that the employee is acting on behalf of the company. Human Resource documents such as employee handbooks will also be kept here and must be distributed by the company administrator.
Employee	Responsible for acting on behalf of the employer. Will receive any relevant commercial information via their folder on the repository. Will be notified of any changes to their employment and status with all relevant documentation stored in their repository workspace where they will be able to acknowledge and act on these changes.
Human Resources	Responsible for the Human Resources aspect within the company. They act not only for the employer but also the employee. Must ensure that all employees are receiving all relevant documentation so as to enable them to perform their roles within the organization.

5 USER REQUIREMENTS FROM INTERSOFT APPLICATION CASE

5.1 Overall Description

The application case of InterSoft is related to the allocation of development resources to the various projects and customers in the same time. InterSoft is outsourcing company and it is a supplier of software development works. There are usually more customers offering software development projects. While the InterSoft has limited resources available it is difficult to allocate them for offered projects.

Various problems arise when assigning developers to the projects:

- Knowledge of the developers in the software development area differs and free developers that are going to be assigned to a new project are not suitable.
- Sometimes it is possible to exchange developers among projects, but it is hard to identify them.
- Some possible projects are refused, just because other projects are only in the negotiation phase.

The VSI can help InterSoft to easily collaborate with its customers during the negotiation phase of their projects.

All developers are registered in the VSI and their knowledge is categorized according the software development technologies supported by InterSoft. Developers are assigned to the running projects and their availability is identified.

Customers send the project offer via VSI where they indicate demanding software development technologies and delivery date. The manager of InterSoft is directly notified which developers are suitable and when they are available for each sent offer. When the work effort of the offered project is calculated, suitable developers are selected. To help the selection of the developers, VSI can indicate possible exchange of the already allocated developers among running project.

The InterSoft application case can be described by four use cases which are detailed in Annex D:

1. Create collaboration
2. Submit project offer
3. Handle project offer
4. Finalize project offer

5.2 Actors

The actors involved in the application case are shown in Table 5.

Table 5: Actors of InterSoft application case.

Actor	Description and role
Collaboration administrator	Administrator is in charge of initializing the collaboration, creating the prerequisites and settings for the development resources allocation. He identifies the possible categories of outsourcing projects in order to outline the scope of collaboration inside the collaboration management system. This role can be played by the same person of the manager.
Customer	Customer registers to the collaboration and he is allowed to submit the project offer. He is able to accept or deny the proposed work effort from the supplier.
Supplier	Supplier is responsible for accepting the project offer. He calculates the work effort of the projects. He assigns developers to the projects and indicates their availability. He release assigned developers or exchange the developers among running projects.
Developer	Developer is responsible to register in the created collaboration and assign his skills according proposed knowledge categories.

6 LIST OF REQUIREMENTS

The following list contains requirements based on the use cases collected on the basis of the applications cases from the user partners:

- Application case 1 (AC1): Submission process of a research project (Engineering)
- Application case 2 (AC2): ISO conformity (Link Technologies)
- Application case 3 (AC3): Development resources allocation (InterSoft)

The list of requirements can be broken down into two specific fields. They are Functional Requirements and Non-Functional Requirements.

A **functional requirement** defines a function of a software system or its component. These may be calculations, technical details, data manipulation and processing and other specific functionality that define *what* a system is supposed to accomplish. Functional requirements specify particular results of a system.

A **non-functional requirement** is a requirement that specifies criteria that can be used to judge the operation of a system, rather than specific behaviors. Non-functional requirements are often called qualities of a system.

6.1 Functional Requirements

FR #1	Collection of documents into one central repository		
Description	A central point of document storage space accessible by all involved actors.		
Implication	The derived central location must be accessible to all actors at all times so as to be able to add, edit and modify documents in either real time or as delayed transaction. This will assist in putting an end to documents being lost misplaced and unavailable due to multiple locations being unavailable for maintenance for example.		
Reference	AC1, AC2, AC3	**Importance**	MUST

FR #2	Issuing of ISO protocol numbers for the specified documents	
Description	The system must be able to issue ISO protocol numbers to relevant documents.	
Implication	So as to be able to pass yearly inspection and validation of ISO 9001 Criteria, the system must ensure that protocol numbers are issued in accordance with ISO 9001 Standards and must be able to verify that all forms are	

	completed before the issuance of such protocol numbers.
	A failure to do so may invalidate the certification process and result in the company's standard being revoked.
Reference	AC2	**Importance**	MUST

FR #3	**Indexing and searching of all documents**		
Description	Indexing must be a prerequisite of the system to allow for the ease of document retrieval and storage. The system must be able to provide search functionalities according to access grants and policies.		
Implication	The system must allow for various indexing fields to encompass multiple filters when a search of a specific document is undertaken. Examples of some fields may be; customer, author, date or ISO number.		
	The system must provide a web based search engine that ensures the ability of search & retrieval of documents according to the access policies derived by the collaborations which have been defined among organizations.		
Reference	AC1, AC2, AC3	**Importance**	MUST

FR #4	**Ensuring only the latest versions of documents are held**		
Description	The latest version of each document must be available in the repository.		
Implication	The implication of not having the latest version of the document stored in the repository is that modifications to earlier documents by various authors may be undertaken and placed into the incorrect document. This will throw the whole ISO process out of synchronization as modifications may be carried out on documents that are no longer relevant.		
	Prior versions of the documents must be moved from the repository to a different location so as to minimize confusion as to which version is the latest to be worked on.		
Reference	AC1, AC2, AC3	**Importance**	MUST

FR #5	Database containing superseded documents		
Description	Storage space on a server or cloud should be identified and be made available to allow for the storage of superseded documents no longer relevant to the common repository as they are no longer the latest versions.		
Implication	It is a requirement of the ISO 9001 standard that revisions of documents with an ISO protocol number be kept for a minimum period of time so that they can be referred to in case of litigation from the parties involved in the transaction. It would be recommended that these documents be kept in a different location to that of the latest versions of each document that will be stored in the common repository.		
Reference	AC2	**Importance**	MUST

FR #6	The ability to track changes of documents		
Description	The system should provide the ability to track revision changes to the documents stored.		
Implication	The ability to do this will provide the user with the ability to see who has made what changes and what changes were actually made.		
Reference	AC1, AC2, AC3	**Importance**	MUST

FR #7	Ensuring that only users who have the correct security rights access these documents		
Description	Authentication of the system		
Implication	The system must provide the ability to only allow access to authorized users of the system so as to minimize security risks. The system must also be able to determine the level of access rights for each user as to whether they have full change access or whether to have read access only. This will minimize the chance of unlawful changes to documents resulting in fraudulent transactions.		
Reference	AC1, AC2, AC3	**Importance**	MUST

FR #8	Management of access grants and policies
Description	The system must provide governance functionalities in order to manage access policies among partners. The management of access grants and policies will be ensured by a definition of a collaboration scope. In this scope companies' participation, roles, resources, actions will be related each other in order to define standardized and sharable policies.
Implication	A web based tool must be implemented in order to enable the administrator of each company to manage collaborations. According to the defined relationships between actions, roles and resources the system must generate the suitable access policies and related authorization tokens, in standardized formats, in order to be used in the company's systems.

Reference	AC1, AC2, AC3	**Importance**	MUST

FR #9	The ability to track process based interactions
Description	The system must track changes of documents uploaded and modified. The system must provided process based tracking functionalities according to the process defined by the user. The user must be able to define and run a process in order to track the contribution steps triggered by the events of contribution (i.e. mail sent, upload, request responses, acceptance, rejection etc.)
Implication	A collaborative process management system must be provided in order to deploy process tracking definition among the collaborations.

Reference	AC1, AC2, AC3	**Importance**	MUST

FR #11	Integration of social networks
Description	Developers have their profiles on social networks (Facebook, Google+, etc.) where they specify their knowledge and software development skills. This information can be used for assigning developers to offered projects.
Implication	Distributed Data Sharing system is able to retrieve information from the profiles stored in social networks and apply their protocols.

Reference	AC3	**Importance**	MEDIUM

FR #12	**Aggregation of linked documents**		
Description	Starting from a document it should be possible to discover all relevant information stored inside the repository and accessible by the user. Similarly, the user be able to browse mail conversations that were involved by the document history		
Implication	Distributed Data Sharing system should be able look for all other documents which are in some relation to the relevant information.		
Reference	AC1, AC2, AC3	**Importance**	FUTURE

6.2 Non-Functional Requirements

NFR #1	**Performance**
Description	It will make sense and be appreciated to differentiate between end-user-screens and e.g. screens for administrators only for this requirement. Of course for the acceptance of the product the end-user-performance has to have a higher priority.
Implication	System shall reach the following online response times: Simple transaction, e.g. open one specific/simple screen Total response time 0.75 s, consisting of: • Transfer over WAN: 0.25 s (assumptions: 256 KBit/s, about 7 KByte data volume, compressed, HTTPS) • Latency time of network: 0.1 s • Server response time: 0.2 s (assumptions: client data taken from database, average server load) • Time to display HTML page on client: 0.2 s (With 64 KBit/s, the total response time would be around 1.5 s.) Complex transaction, e.g. open a complex screen (a lot of different data, from different sources etc.): Total response time: 1.5 s, consisting of: • Transfer over WAN: 0.4s (assumptions: 256 KBit/s,

about 12 KByte data volume, compressed, HTTPS)
- Latency time of network: 0.1 s
- Server response time: 0.6 s (assumptions: 0.4 s for middleware/backend access, average server load)
- Time to display HTML page on client: 0.4 s

(With 64 KBit/s, the total response time would be around 2.5 s.)

Reference	AC1, AC2, AC3	Importance	MEDIUM

NFR #2	Reliability		
Description	Backup/restore/basic concept allowing to run software in a disaster recovery scenario (cluster). Since the services provided by Service Providers via VSI might also be safety-critical ones (depending on the context in which they are used maybe also ones upon which also human lives may depend) the whole platform as such has to be treated as a safety-critical subsystem. This statement will have to have impact to the whole software design process because it affects all parts of the platform.		
Implication	User interface has to be designed in a way that reduces the probability of human errors as much as possible.		
Reference	AC1, AC2, AC3	Importance	LOW

NFR #3	External interfaces		
Description	VSI has to be developed in a manner that ensures highest stability, availability and safety. Therefore the whole software development process needs a setup that ensures state of the art software engineering basics.		
Implication	Special attention has to be paid in the design of all external interfaces because they have to be very flexible and also stable.		
Reference	AC1, AC2, AC3	Importance	MUST

NFR #4	Application interoperability
Description	Application interoperability provides full support for platform-independent web services, business web applications, and development based on open standards.
Implication	Support for terminal protocols is clearly a very important first step in providing access to existing system. Integration of all products described in application cases.

Reference	AC1, AC2, AC3	**Importance**	MUST

NFR #5	Extensibility
Description	VSI can easily acquire and adapt features supporting the augmentation of existing functions and the deployment of new ones alongside the existing.
Implication	The three modules are the most likely targets of customizations, since they have a direct impact on the core VSI system features.

Reference	AC1, AC2, AC3	**Importance**	MUST

NFR #6	Integrity
Description	This service is offered by others such as data integrity service or system integrity service.
Implication	Security service that protects against unauthorized changes to data, including both intentional change or destruction and accidental change or loss, by ensuring that changes to data are detectable Security service that protects system resources in a verifiable manner against unauthorized or accidental change, loss or destruction.

Reference	AC1, AC2, AC3	**Importance**	MUST

NFR #7	Privacy		
Description	The right of individuals to control or influence what information related to them may be collected and stored and by whom and to whom that information may be disclosed. This term relates to the right of individuals, it cannot be very precise and its use should be avoided except as a motivation for requiring security		
Implication	A mode of communication in which only the explicitly enabled parties can interpret the communication. This is typically achieved by encryption and shared key(s) for the cipher. A way to ensure that information is not disclosed to anyone other than the intended parties. Information is usually encrypted to provide confidentiality.		
Reference	AC1, AC2, AC3	Importance	MUST

NFR #8	Availability		
Description	The services provided via VSI must be critical for users and the change of the service must be available in time. This will have to have an impact to the whole software design process and it affects all parts of the platform.		
Implication	Software design capable to ensure 24*7 availability (which means most probably also the possibility of hot-deployment)		
Reference	AC1, AC2, AC3	Importance	MUST

NFR #9	Usability		
Description	The system is user-friendly and implements up-to-date usability features.		
Implication	Intuitive usable interfaces, online-help available for key functionality		
Reference	AC1, AC2, AC3	Importance	LOW

NFR #10	Robustness		
Description	VSI provides services that are critical for the users' collaboration. The system must be robust enough to ensure the consistent state of the system.		
Implication	Designed-in failure modes in all software components. A malfunctioning of a component may not terminate the whole application and should result in that the user is informed and the application reset of a consistent state.		
Reference	AC1, AC2, AC3	**Importance**	MUST

NFR #11	Structured development		
Description	The development process of the VSI must be fault-tolerant to ensure the all changes are applied. This can be achieved by structuring of the development and setting up the responsibilities of the developers and testers.		
Implication	Structured and well organized development environment ensuring proper testing and possibility of keeping track of all changes (incl. fallback scenarios).		
Reference	AC1, AC2, AC3	**Importance**	MEDIUM

NFR #12	New version		
Description	Development of VSI must ensure the accuracy of releasing new versions. The whole software development process needs to implement state of the art software engineering methods.		
Implication	All changes of a new version of VSI compared to an existing one have to be tracked by the system in order to keep control for the testers (to be able to adopt test cases and testing itself), for the maintenance team etc.		
Reference	AC1, AC2, AC3	**Importance**	FUTURE

NFR #13	Deployment process
Description	VSI has to be able to clearly distinct among various versions suitable for the actual situation of the deployment. The software development process has to apply accurate software engineering techniques.
Implication	Deployment process for new software versions has to ensure that in case of problems with new version the step back to the existing version is possible.

Reference	AC1, AC2, AC3	Importance	FUTURE

NFR #14	Runtime environment
Description	VSI must be developed in a manner that it is possible to use it in various runtime environment according user demands. The whole software development process is based on up-to-date software engineering processes.
Implication	Deployment process has to ensure that no unintended changes in the runtime environment are possible.

Reference	AC1, AC2, AC3	Importance	MEDIUM

NFR #15	Comparison of versions
Description	During the VSI development it should be clear to compare changes and updates among various released versions. Therefore the software development process needs to implement best available software engineering principles.
Implication	Procedures need to be in place to support automatic comparison of software versions (e.g. runtime with test environment etc.)

Reference	AC1, AC2, AC3	Importance	MEDIUM

NFR #16	VSI software design		
Description	VSI has to be developed in a manner that ensures state of the art software engineering principles and tools.		
Implication	Software design (especially for all interfaces but also for other software components) has to be verified by a structured Review Process as well as also the software code itself has to be reviewed accordingly.		
Reference	AC1, AC2, AC3	**Importance**	MEDIUM

NFR #17	Professional test environment		
Description	The VSI development process implements up-to-date testing environment to ensure the quality of the released system and to ensure the desired functionality by the users.		
Implication	Professional Test Environment has to be in place and controlled procedure for the transport of versions between different environments (e.g. from test environment to production environment etc.) is also necessary. Testing it has to be planned (not only intuitive testing but creation/execution of documented test cases etc.) and performed properly as well as the detected bugs have to be managed (prioritization, controlled fixing and re-testing of bugs etc.).		
Reference	AC1, AC2, AC3	**Importance**	MEDIUM

NFR #18	Software design		
Description	The development process of VSI should use software engineering principles that reduce errors during the development phase.		
Implication	Software designers have to develop fault-tolerant designs, which will detect and compensate for software faults "on the fly". This is necessary because it is usually impossible to develop software without any errors.		
Reference	AC1, AC2, AC3	**Importance**	FUTURE

NFR #19	Source code documentation		
Description	The development of VSI is provided by many analysts and programmers. To eliminate errors and reduce the time of source code analysis the appropriate documentation is used.		
Implication	VSI will be developed in cooperation between different parties and also for the future enhancements it is important that the code is readable for other programmers. Therefore the coding has to be very structured/readable and the quality of the source code commenting has to be checked!		
Reference	AC1, AC2, AC3	**Importance**	MEDIUM

NFR #20	Rapid deployment		
Description	One of the most significant goals of VSI is to ensure the setup of short term collaborations (around 6 months) between different organizations.		
Implication	Therefore it is obvious that the portal itself has to be designed with a very strong focus on great usability and as much as possible customization (in best case no coding should be necessary to setup a new cooperation between two partners by outsourcing parts of the value chain). Integration of legacy applications has to be ensured by tailoring of connectors to the portal (service bus), without coding. This goes also for registering new services and definition of workflows.		
Reference	AC1, AC2, AC3	**Importance**	FUTURE

NFR #21	Portability		
Description	The VSI system has to be portable to most platforms which are suitable to the environment of the user.		
Implication	Executable on today's most spread platforms		
Reference	AC1, AC2, AC3	**Importance**	MUST

NFR #22	Marketability		
Description	The quality of the VSI must be suitable for marketing and other commercial application.		
Implication	VSI at the end of this project is a commercially available product		
Reference	AC1, AC2, AC3	**Importance**	FUTURE

NFR #23	Issuing of ISO protocol number		
Description	Generation and issuance of unique protocol numbers.		
Implication	The system must be able to generate and attach a protocol number to the relevant document after the document has met the specified criteria.		
Reference	AC2	**Importance**	MUST

NFR #24	Sequencing of protocol numbers		
Description	Sequencing & numbering modules of documents is a part of the system.		
Implication	The system must be able to keep a list of protocol numbers that have been issued and be intelligent enough to issue the next sequential protocol number that is in the list.		
Reference	AC2	**Importance**	MUST

7 POLICY AND SOCIAL IMPACT

7.1 VENIS Impact on European Strategies

In a changing world, the EU must become a **smart, sustainable and inclusive economy**[6] as set out in the **Europe 2020** strategy. These three priorities should help the EU and the Member States deliver high levels of employment, productivity and social cohesion.

The financial and economic crisis has refocused attention on the central importance of a **strong, competitive and diversified European market** based on European innovative enterprises. In this context, the Enterprise Interoperability concepts are accepted as a mean to improve European Industry competitiveness specifically for bridging the competitiveness gaps with emerging Countries.

In European strategies, **Small and Medium-sized Enterprises** (SME) and their collaboration with the **Large European enterprises** are very important. *"SMEs make up some 2/3 of industry's employment and a large share of EU industry's growth and jobs potential is to be found in its lively and dynamic SMEs. Promoting the creation, growth and internationalization of SMEs thus has to be at the core of the new EU integrated industrial policy"*[7] as highlighted in the Europe 2020 flagship on **An Industrial Policy for the Globalisation Era.**

In today's evolving industry, the ability of European SMEs to cooperate and interoperate plays a crucial role. *"To meet their business objectives, enterprises need to collaborate with other enterprises. Small and medium sized enterprises (SMEs), who need to specialise in niche activities in order to raise their own added value, particularly have to combine forces to compete jointly in the market. Today, an enterprise's competitiveness is to a large extent determined by its ability to seamlessly interoperate with others."* [8]

Following the suggestion of the **IST Enterprise Interoperability Research Roadmap**, the VENIS project conceives interoperability as a **utility-like capability** (Interoperability Service Utility – ISU) for enterprises.

Today's individual, specialized SMEs and large enterprise (LE) are seeking solutions that enable them to cooperate and to establish a network through which they can offer complementary services to be able to stay competitive in the international markets. The only way for SMEs to innovate themselves is, in fact, to leverage on Large Enterprises collaboration. This step change is necessary, especially for those firms that are not high-tech and that struggle to innovate.

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[6] Europe 2020: A European strategy for smart, sustainable and inclusive growth.
http://europa.eu/press_room/pdf/complet_en_barroso___007_-_europe_2020_-_en_version.pdf
[7] An Industrial Policy for the Globalisation Era: Putting Competitiveness and Sustainability at Centre Stage
http://ec.europa.eu/enterprise/policies/industrial-competitiveness/industrial-policy/files/communication_on_industrial_policy_en.pdf
[8] IST Enterprise Interoperability Research Roadmap.
ftp://ftp.cordis.europa.eu/pub/ist/docs/directorate_d/ebusiness/ei-roadmap-final_en.pdf

In this context, **Information and Communication Technologies** are key enablers to create a strong and continuous collaboration between SMEs and LEs. "*This means that industry is increasingly in need of open and interoperable solutions to exploit ICT across all sectors*"[9] as set out in the Europe 2020 flagship on the **Digital Agenda.** Enterprises interoperability is the emerging need in Europe to joint projects and business facing new marketing challenges.

Consistent with the main European Directives, VENIS project aims to create **new level of interoperability** between Large and Small Enterprises, according to "**Virtual Enterprise**" paradigm. VENIS is proposing the implementation of an **Interoperability Service Utility** (ISU) matched with LEs and SME. The VENIS results aims to strongly increase the **competitiveness of the European enterprises** against extra-European companies.

Also, as shown in the Europe 2020 flagship on **An Industrial Policy for the Globalisation Era,** "*Clusters and networks improve industrial competitiveness and innovation by bringing together resources and expertise, and promoting cooperation among businesses, public authorities and universities.*"

A smart and sustainable growth can be achieved only supporting European enterprises in the adoption of a **global value network model** and in the use of new technological solutions finalized to cost reduction, resource optimization and efficient production processes. The VENIS project supports the competitiveness of European enterprises by fostering **knowledge and competences sharing** and by promoting a process of innovation through the injection of **novel IT knowledge** into the legacy systems that are used in collaborations among LEs and SMEs.

VENIS project:

- Supports European enterprises competitiveness, by joining knowledge and competences and improves interoperability and collaboration of SMEs;

- Increases business opportunities and reduces product costs;

- Promotes innovations by the injection of novel IT knowledge (CWE, SOA and WTS technologies), over the legacy systems of the LEs and SMEs;

- Paves the way towards a full industrial interoperability, with a direct impact on many application areas, such communication, transport, etc., and on the European citizens living.

7.2 VENIS Impact on Future internet priority and research

Internet will drive more positive changes. By 2020, innovative forms of **online cooperation** will result in more efficient governments, businesses and non-profits institutions. Internet technologies, systems and services can create real value and generate new business opportunities in Europe. Online cooperation

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[9] Digital Agenda. http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2010:0245:FIN:EN:PDF

will increase. The means are already there, and will only become more numerous and functional.

"*The full potential of the Future Internet is accessible to, relevant for, and put to use by European enterprises including SMEs. The Internet thus becomes a universal business system on which new values can be created by competing as well as collaborating enterprises - incumbent as well as new - through innovation in a level playing field, with sustainable positive benefits for the economy, society and the environment*".[10]

Following the suggestion of the **FInES Research Roadmap Task Force,** VENIS project conceives Future internet as a strategic opportunity able to provide the next generation of Enterprise Software Applications.

The Future Internet Assembly Research Roadmap highlighted "*in the sphere of the enterprise, the necessary transformation of business into **innovative virtual enterprises** continues, transforming the roles of customer and employee, providing opportunities to exploiting networked knowledge through open innovation and collaboration.*"[11]

The VENIS project, consistent with the opportunities of future Internet, addresses the **Virtual Enterprise** concept by providing an interoperability solution able to merge the data and processes of different sized companies in a single "**Virtual Organization**". In order to reach this "Virtual Enterprise" target, the VENIS project assembled a critical mass of research and technology competences coming from universities, research institutes and other organizations.

"*A networked innovation ecosystem will pervade the **European networked enterprise** – a sophisticated, collaborative, knowledge sharing, connected services space in which innovation at the edges of the network, by individuals and SMEs, in cities and spaces can be rapidly exposed to markets and customers.*"

VENIS main objective is to offer a **dynamic and open environment,** supporting **interoperability** between SMEs and LEs, by designing, developing and demonstrating a **collaboration approach** able to cover the gap between the needs coming from different sized companies.

The VENIS project aims to develop an innovative **utility-like web solution**, tailored for the LEs-SMEs interoperability: the **VENIS Services for enterprises Interoperability (VSI)**.

Using the VSI, the interoperability functions will be delivered as services, expected modular, cheap, fast, reliable, and without major integration efforts. Interoperability will become a routine, and not a problem. The VSI will be a transparent and invisible infrastructure of the business operation.

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[10] FInES Research Roadmap Task Force. http://cordis.europa.eu/fp7/ict/enet/documents/fines-researchroadmap-final-report.pdf
[11] Future Internet Assembly Research Roadmap. http://fisa.future-internet.eu/images/0/0c/Future_Internet_Assembly_Research_Roadmap_V1.pdf

Following the suggestion of the **FInES Research Roadmap Task Force,** those services will be simple to use, adaptable to dynamic needs, affordable to small budget holders, as well as having the required technical attributes of accessibility, reliability and interoperability.

"*Thus Future Internet, through **networked innovation, networked data, networked interaction,** and augmentation provides a foundation for transforming industries and addressing big social challenges.*"

Consistent with **Future Internet Assembly**[12] (FIA) vision, VENIS is proposing the implementation of an Interoperability Service Utility based on:

- a **Virtual Common Repository**, able to unify the scattered information of the enterprises,

- a **Distributed Data Sharing**, offering a smart mechanism for the exchange of the distributed data,

- a **Business Process Handler**, offering an interactive assistant for joint projects and business, where the information is automatically collected, merged and served to enterprises users.

VENIS vision is that the creation of a **trans-enterprise knowledge collaboration environment** by the combination of different services and relationships/dependencies becomes as **easy** as the creation of a spreadsheet by the combination of different cells (services) and functions (dependencies). Table 6 provides a summary of priorities and research pillars extracted from European strategic documents.

Table 6: Summary of priorities and research pillars.

Strategic document	Priority	Research Pillars
An Industrial Policy for the Globalisation Era: Putting Competitiveness and Sustainability at Centre Stage	• Industry must be placed centre stage if Europe is to remain a global economic leader. • SMEs make up some 2/3 of industry's employment and a large share of EU industry's growth and jobs potential is to be found in its lively and dynamic SMEs. Promoting the creation, growth and internationalization of	• Support European enterprises competitiveness, by joining knowledge and competences. • Increase business opportunities and reduces product costs. • Create **new level of interoperability and collaboration** between European Large Enterprises (LEs) and SMEs, according to "**Virtual Enterprise**" paradigm.

[12] http://www.future-internet.eu/home/future-internet-assembly.html

	SMEs thus has to be at the core of the new EU integrated industrial policy. • Clusters and networks improve industrial competitiveness and innovation by bringing together resources and expertise, and promoting cooperation among businesses, public authorities and universities.	• Support European enterprises in the adoption of a global **value network model**.
IST Enterprise Interoperability Research Roadmap	• To meet their business objectives, enterprises need to **collaborate with other enterprises**. Small and medium sized enterprises (SMEs), who need to specialize in niche activities in order to raise their own added value, particularly have to combine forces to compete jointly in the market. Today, an enterprise's competitiveness is to a large extent determined by its ability to seamlessly interoperate with others.	• Pave the way towards a **full industrial interoperability**, with a direct impact on many application areas, such communication, transport, etc., and on the European citizens living. • Implementation of an **Interoperability Service Utility** (ISU) matched with LEs and SME needs. • Providing an interoperability solution able to merge the data and processes of different sized companies in a single "**Virtual Organisation**".
Digital Agenda	• Industry is increasingly in need of **open and interoperable solutions** to exploit ICT across all sectors. • Improved use of ICT for industrial competitiveness, resource optimization and innovation will be essential for future competitiveness.	• Promote innovations and support the competitiveness of European enterprises by fostering **knowledge and competences sharing** and by promoting a **process of innovation** through the injection of **novel IT knowledge** (CWE, SOA and WTS technologies), into the

		legacy systems that are used in collaborations among LEs and SMEs.
FInES Research Roadmap Task Force	• The full potential of the **Future Internet** is accessible to, relevant for, and put to use by European enterprises including SMEs. The Internet thus becomes a **universal business system** on which new values can be created by **competing** as well as **collaborating enterprises** - incumbent as well as new - through innovation in a level playing field, with sustainable positive benefits for the economy, society and the environment	• Conceive Future internet as a **strategic opportunity** able to provide the **next generation of Enterprise Software Applications**. • Use the Future Internet concept as instrument able to support a **new collaborative vision** and able to contribute effectively to build up a novel level of interoperability between LEs and SMEs.
Future Internet Assembly Research Roadmap	• In the sphere of the enterprise, the necessary transformation of business into **innovative virtual enterprises** continues, transforming the roles of customer and employee, providing opportunities to exploiting networked knowledge through open innovation and collaboration. • A networked innovation ecosystem will pervade the **European networked enterprise** – a sophisticated, collaborative, knowledge sharing,	• Offer a **dynamic and open environment,** supporting **interoperability** between SMEs and LEs, by designing, developing and demonstrating a **collaboration approach** able to cover the gap between the needs coming from different sized companies. • Developing an innovative **utility-like web solution**, tailored for the LEs-SMEs interoperability: the **VENIS Services for enterprises Interoperability.** • Implementation of an **Interoperability**

	connected services space in which innovation at the edges of the network, by individuals and SMEs, in cities and spaces can be rapidly exposed to markets and customers; • Future Internet, through **networked innovation**, **networked data**, **networked interaction**, and augmentation provides a foundation for transforming industries and addressing big social challenges.	**Service Utility** based on: a Virtual Common Repository, a Distributed Data Sharing, a Business Process Handler. • Provide services simple to use, adaptable to dynamic needs, affordable to small budget holders, as well as having the required technical attributes of **accessibility, reliability and interoperability**.

7.3 Stakeholders engaged in VENIS project

"As stated by the European Commission, the exit from the crisis should be the point of entry into a new sustainable social market economy, which is moreover a smarter, green economy. The new drivers for prosperity and growth will come from innovation and from using resources better, where the key input will be knowledge (European Commission, 2009). In other words, the social-economic as well as policy context within which Europe's enterprises will operate in the coming years is rapidly changing. Future competitiveness will be driven by factors far beyond conventional economic dynamics"[13] and sharing knowledge becomes one of the most important success factor. In particular enterprises, companies, public and private organization and single entities are called to collaborate in order to share their capabilities and expertise so as to create new growing business opportunities. The new technologies, connected with the Future Internet concept, will become the instrument enable to support this new collaborative vision contributing effectively to build up **a novel level of interoperability between the European Large Enterprises (LEs) and the huge number of SMEs** (in 2008 EuroSTAT counted 20,4 millions European SMEs, representing 99.8% of all registered businesses and with about 87,9 millions employees). This is the **next challenge to create new competitive edges** for the European industry. This collaboration need is strongly perceived by both LEs and SMEs, especially if active at international level in R&D projects, high-tech products and joint businesses.[14]

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[13] http://cordis.europa.eu/fp7/ict/enet/documents/fines-researchroadmap-final-report.pdf

[14] Virtual Enterprises by Networked Interoperability Services, Annex I - "Description of Work".

In particular, both LEs and SMEs are suffering from the lack a collaboration environment able to enhance their interoperability at knowledge and process level, to achieve:

- synergy in technological research, by covering gaps and creating complementary capabilities;
- joint development of products, by merging new or already existing solutions;
- common businesses, by phasing marketing efforts and new customers identifications.

Under these assumptions, the **possible** stakeholders, that will take advantages of the VENIS project results, will be surely all companies operating within European reality that collaborate with their partners in the management of business processes. Not only the large multinationals but also small enterprises with their suppliers and partners, as well as single user, in the services offered by the project will find an innovate solution that can create new kinds of interoperability with minimal impact in their information technology systems. Potentially the services introduced by VENIS with its platform will be applied within different models of companies' interaction that will produce various competitive advantages (Table 7). VENIS will bring future enterprises to be community-oriented in their innovation, organization, production and business partnership laying the groundwork for the birth of "the network as the enterprise"[15]. So the establishment of new forms of collaboration, the creation of new business networks and the rise of the Knowledge Interoperability, will appear as the development keys for the near future.

Table 7: Models of companies' interaction.

Relationship Models	Scenario	Advantages
Public and Private organization	The patterns of interaction, growing up between public organization (like universities, associations, government) and private companies (whatever are their size), are often characterized by evident difficulties in terms of interoperability because of collaborative systems inefficient and subjected to excessively bureaucratic mechanisms which disagree	- Simplification of procedures for document management. - Debureaucratization of the management of relations between public and private organizations - Creation of a new communication channel in order to connect directly public and private organizations.

	with a market more and more dynamic and flexible. Using tools for documentation sharing, and knowledge more generally, will contribute substantially: 1. to simplify procedures for document management. 2. to debureaucratize the management of relations between public and private organizations 3. and to create a new communication channel in order to connect directly public and private organizations.	• A better security system because of new accreditation processes
Large Enterprises with Large Enterprises	The project management is part of the activities in which large firms tend to engage in processes of mutual cooperation and interoperability. Within the project management, it can identify a set of activities in which the different partners involved will work together to achieve their goals. The writing and the sharing of deliverables, or more generally the documentation produced are ones type of collaborative processes. VENIS results will contribute significantly to support these activities in order to pass communication and collaboration problems that could often arise in the case of a partnership between companies belonging to different business and geographical contexts. Collecting, exchanging, and	• Increased efficiency in the support document management processes, • Overcoming the problems of communication and sharing processes in case of heterogeneous ICT system. • Homogenization of various document management policies

	sharing documents will pass through a single instrument capable to create a single and consistent channel of communication with the minimum impact on existing IT systems.	
Large Enterprises with SME	As noted before in the case of collaborations between large companies, can be repeated within the partnerships between large and small enterprises where quite often not only the presence of highly heterogeneous systems, but also a certain impossibility economic and cultural may prevent the adoption of complex inter-connective and interoperable systems. The results of the project, therefore, could also be fully implemented within this context because the creation of a structured document management process combined with a minimal impact on computer systems will help to create new partnerships in which even small and medium-sized enterprises can play a decisive role.	- New Structuring of document management process - Open to new collaborative models for SMEs
SME with SME	Opening the VENIS results to SMEs could contribute to change their approach to manage business activities. In particular simplify the processes of collaboration and interoperability could enable small and medium-sized enterprises to expand their action range in the economic market, contributing effectively to increase their business opportunities. The	- Change SMEs focus on communication and collaboration system - Create new kind of partnership between SMEs with minimal effort - Introduce a more structured process in management of strategic decisions and operative business activities

	competitive advantage, that will gain, will be greater than they will be able to create forms of expanded partnerships devoted to flexibility and dynamism, where the presence of large enterprises will be reduced to a minimum. In particular, large companies have increasingly assumed the role of mediators able to provide the tools enabling communication and collaboration allowing effectively to small and medium-sized enterprises to open up beyond the local boundaries in which they operate, at the expense of a strong technological and cultural dependence. VENIS with its results will lay the groundwork for the rising of a new forms of collaboration between only SMEs with minimal effort. In particular an internet connection and an email address will be the minimum requirement to start any kind of sharing and interaction process. Moreover VENIS services will bring other two significant changing in SMEs culture regarding with strategic decisions and business activities. Firstly the introduction of new structured knowledge management processes could overcome the problems related to a management often inefficient and "family oriented", characterized by the absence of policy and rules well stated. Secondly	• Improve the adoption of ICT solution

the introduction of simple ICT solution could introduce SMEs into a new glocal world where networking become a new form of enterprise.	

However we might join a further category of actors (indirect stakeholders), who will participate indirectly to VENIS project results, to the just identified stakeholders (direct stakeholders).

In particular, within this new category will be part all those companies that may gain important profits from the interaction with the VENIS companies' network without coming into the network itself. They will make, in fact, an outside contribution, which will be complementary to the main objective of the project, the creation of forms of network interoperability, because their aim is to identify new market segments in which invest. An example could be the interest of large IT companies such as Google, which could get an economic benefit from interaction with business networks through the creation of forms of interface between their products / systems with services offered by the project (for example we can think the use of Google doc in the case of doc-sharing services offered by the platform). The final result will be, on one side an increase in earnings for these indirect stakeholders, and on the other hand an improvement of the services offered by the system VENIS itself.

8 CONCLUSION

VENIS goal is to develop services for enterprises interoperability platform that brings additional collaborative capabilities, while keeping almost unchanged existing enterprises platforms and network software architectures. Supported VENIS services provide Virtual Common Repository, Distributed Data Sharing, and Business Process Handler. The integrated VSI platform will be adopted and evaluated in three prototype application cases. Based on the collaboration of three organizations Engineering, Link Technologies, and InterSoft which are user partners of the VENIS project, the specific applications and processes as well as users with their roles were identified.

The report at hand presents the results of efforts undertaken to provide the thorough user partners analysis indicating their specific needs and expectations regarding the VSI platform. The requirement analysis, which is a crucial phase in the process of VSI development, has been conducted only after the overall framework on how the VENIS approach linking collaborative business processes has been designed. The set of functional and non-functional requirements has been listed. They will serve as input in creating an overall outline of the VENIS project. Finally the requirements have been evaluated during the meeting with user partners and then were prioritized and divided into three groups: must, medium low and future.

The systematic categorization of requirements with an additional formal functional description gives the basis for the work in the subsequent work package WP2. The goal of the WP2: Information Technology Assessment is the assessment of the current information technologies and to detail the software specifications of the VENIS services, as emerged in WP1, and matched with the assessment on latest information technology.

Assuming that the collaboration among enterprises can be efficiently made only if all business partners are involved in the process of creating it, our VSI platform has to meet real needs of user partners and other potential users, and enables to conduct smooth LEs/SMEs interoperability by collaborative environment of services.

ANNEX A: TAXONOMY OF COLLABORATION SOFTWARE

A.1 Taxonomy of Collaboration Tools

There are hundreds if not thousands of collaboration tools available on the market. It seems as if there is a new collaboration tool released on the market every few weeks. The enormous number of tools does not help appropriate tool selection for collaboration based on the context on hand.

Given the enormous number of collaboration tools, many taxonomies and classification frameworks have been proposed by different authors. To name just a few, DeSanctis and Gallupe[16] (1987) discuss a taxonomy based on users' space proximity (face-to-face, dispersed), group size (smaller, larger), and task type (planning, creativity, intellective, preference, cognitive conflict, mixed motive). Johansen[17] (1988) takes into account time (synchronous, asynchronous) and place (face-to-face, electronic). Bishop and Rama[18] (2006) have outlined the following criteria for characterizing collaborative tools:

- **functional criteria** which specify what a user can expect of the system in terms of functionalities: Messaging, Conferencing and Electronic Meeting Systems, Group Decision Support, Document Management, Document Collaboration, Compound Document Management;
- **architectural criteria** which define where and how the collaboration is managed: Central Architecture, Replicated Architecture, Hybrid Architecture;
- **focal criteria** that define the focus of the collaboration: User Centered, Artifact Centered, Workspace Centered)
- **time criteria** for specifying how collaboration is enabled in time: Synchronous, Asynchronous, Mixed, Serial)
- **platform criteria** which define the execution platform for the application: Mobile Platforms, Operating System based Platform, Browser based platforms, Platform independent (Multi-platform)
- **user involvement criteria** that define the level of involvement required from the user to gain advantages by the application: High, Medium, Low.

Typical dimensions to classify collaboration tools are Space (with two possible values: Distributed and Same Space) and Time (with two possible values: Synchronous and Asynchronous). Figure 1 shows some examples that fall into the four quadrant identified by those values.

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[16] DeSanctis, Gallupe (1987) A Foundation for the Study of Group Decision Support Systems. In Management Science, Vol 33, No. 5, May 1987

[17] Johansen, Bullen (1988) Thinking Ahead: what to expect from teleconferencing. In Computer-supported cooperative work: a book of readings.

[18] Rama, J. Bishop, J. (2006) A survey and comparison of CSCW groupware applications. ACM International Conference Proceeding Series; Vol. 204.
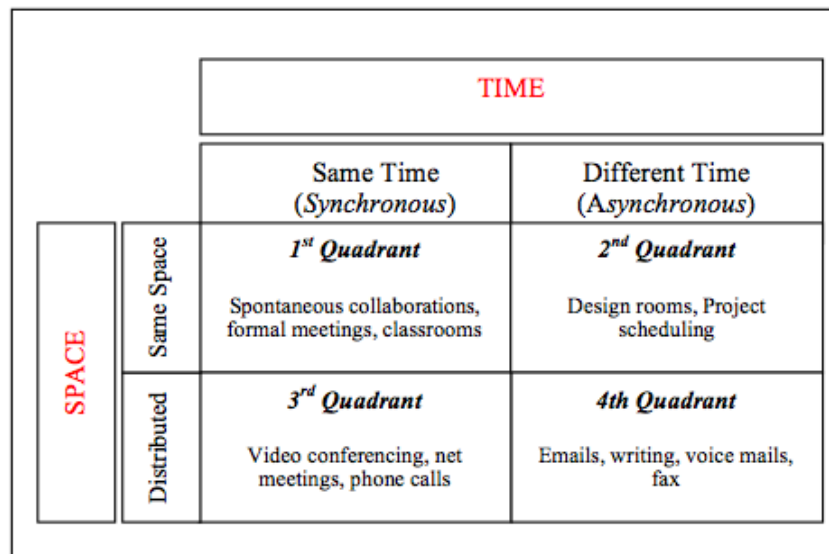
Figure 4: Time-Space quadrants for collaboration tools.

The taxonomy that will be defined in this report does not have the need to encompass every possible criteria, but must consider those that are relevant for SMEs that are evaluating the adoption of a collaborative tool for their business. In particular we will focus on platform/architecture criteria, which mostly impact on **costs** and **security** aspects.

Collaborative tools can be classified into a few various platforms based on the methodology and requirements used to execute them.

The taxonomy of collaborative tools can be broken down into the following main categories:

- Web Based or Cloud solutions
- Non Web Based Solutions
- Client / Server solutions
- Hybrid Solutions

These four categories can then be broken down further into the following sub categories:

- Open Source Solutions
- Proprietary Solutions

A.2 Web Based or Cloud Solutions

Many businesses, regardless of size, prefer to manage critical business data online. The main advantage of doing so is cost. Supporting database software that is not web based, involves high support and administrative costs.

Web based collaboration software aims to facilitate working with data and storing information online in a cloud environment which allows for easy access by employees no matter where they are geographically located.

Using a web based solution means that all employees and anyone else who has been given the appropriate permissions, may have access to the system at anytime and from anywhere in the world. All that is really required is connectivity to the internet and a web browser, and seeing how nowadays with the invention of the Smartphone, many employees can literally work from anywhere in the world provided that they have cellular coverage.

The distinct advantage of web based or cloud solutions, is cost. There is an initial cost for the collaboration software to be purchased by the organization and some providers charge on a per capita license meaning an initial cost per user. There is no client software cost involved and of course being web based, no client software needs to be installed on each user's device. This drastically negates the cost of maintenance for each individual device. There are no software update costs and usually the only software update required is for the actual web browser used to access the internet. This again is usually at no expense to the user.

There is also a huge saving towards hardware costs by pursuing a web based solution. With Web Based or Cloud solutions, the organization usually buys server processor resources and storage space from either a server farm vendor or as a package with the web based software. This negates the cost of capital expenditure such as the procurement of a file server and the infrastructure involved in having the server being able to communicate with the outside world.

Management of the server is also usually the responsibility of the server farm or cloud provider thus in effect providing a further cost reduction for the organization using Web Based software.

Handing over management to the provider is also a double edged sword though. The organization cannot control when the provider will perform essential tasks such as server maintenance. The organization's data is left solely in the hands of the provider so it is the responsibility of the provider to guarantee the availability, integrity and security of the organization's data. In other words, there must be a level of trust between the provider and the organization.

A further factor is that an essential task such as a software update must be scheduled with the provider. For example, a security issue has been highlighted and a software update must be installed immediately to close the loophole but the organization may not have the flexibility of ordering the update to be done immediately seeing it is on a cloud server that is most probably shared with other organizations. A time slot must be scheduled with the provider for the update to be installed. So we can see that this solution can sometimes limit an organization's flexibility.

A.3 Non Web Based Collaborative Software Solutions

The Web Based or Cloud solution over Internet is not ideal though for every organization. Institutions with specific policies (for example financial institutions) have the habit of using non web based collaborative solutions for the mere fact that they are dealing with sensitive information, money and other valuable

commodities and therefore cannot trust solutions that they do not have maximum control over.

Non Web Based solutions are usually installed locally on the organization's server(s). Now, when we say the word "local" we must bear in mind that many organizations run global networks. In other words, local area networks that span the globe. So the term must be used loosely. These solutions are not a hosted or web based solutions and are usually run behind company firewalls. These systems are ideally installed on servers with SSL support so that all interaction between the user and the software is encrypted. Security is a huge factor in the decision to go to a non-web based solution.

Non Web Based Solutions are usually installed at a higher cost as opposed to web based solutions. There is a high initial capital expenditure cost for the procurement of the hardware required for the software to run on, i.e. servers and the infrastructure cost of communications outlays that enable the servers to run on the global network.

Another cost to factor into the equation is the cost per client. Meaning the per device cost of not only the purchase but for the technical installation also to the device. The organization then must budget for client failures and maintenance as well as management of the capital expenditure items such as servers and telecommunications infrastructure. This does not only mean the physical management of the system, but also staff who are experienced enough to ensure the security of the system and the integrity of the data. Costs of data backup must also be taken into account.

Once all of these factors have been accounted for, the end result will be a solution that is totally managed in house, eliminating the TRUST derivative described in the Web Based solution. Full control is in the hands of the organization as are the responsibilities.

A.4 Client / Server Solutions

Non Web Based solutions usually must provide an interface that will allow the user to communicate with the server and this interface is usually installed on the user's device or also called the "client". Whether it is PC based or for a mobile device, a client must be installed allowing the interfacing between device and server. This concept is also called the client server model. In definition, a client server network involves multiple clients connecting to a central server or servers.

In the sense of non web based collaborative software, there are specific collaboration solutions that are meshed to work on a client / server environment. An example of this would be the IBM Lotus Notes / Domino solution.

IBM Lotus Notes and Domino is a family of client and server based offerings for messaging and collaboration on a wide variety of operating environments. Lotus Notes is the desktop component or client side of this relationship and Lotus Domino is the server infrastructure side. These two items are co-dependent. Meaning that one will not function without the other.

IBM describes the Lotus Notes software as "an integrated desktop client option for accessing business email, calendars and applications on IBM Lotus Domino Server".

IBM stipulates that both must be present for the solution to be viable.

If we look at the term on a broad scale, we can say that even web based solutions are somewhat client / server based also. In the web based variant, the client is the web browser used to access the internet and the server is the internet.

A.5 Hybrid Solutions

There are collaborative software solutions in existence that use a combination of the Web based or Cloud solution and the Non Web Based solution. These are called Hybrid solutions.

Hybrid solutions provide integration between on premises systems and the cloud. These systems may allow you to replicate local databases and repositories to the cloud whilst still allowing organizations to utilize their solution using on premises infrastructure for local employees and or customers whilst having the replicated data accessible to employees and other customers around the globe, creating a seamless or transparent transaction to all involved.

The reason some organizations may choose a hybrid solution is usually a cost based decision. Critical or sensitive data may be kept in house for security and integrity purposes and other data such as email databases may be kept in the cloud environment so as not to utilize expensive in house data storage space.

Some of the benefits of a Hybrid solution are:

- Segment users and data based on user/organizational needs
- Avoid security infrastructure needs for external collaboration
- Reduced IT and administrative needs
- Cost Savings

A.6 Open Source Software versus Proprietary Software

Vendors providing Collaborative software solutions, whether they be Web Based or Non Web Based, will usually provide solutions that are either open source or proprietary.

An organization will have to take this factor into account when deciding which solution is the right one for them.

Wanting to modify a solution after the organization has made the purchase may be a fatal move and render the purchase of the solution a failure. This is due to the fact that some solution providers use proprietary software and to make the modifications could be as costly as the initial purchase itself. Software sold under a proprietary license suggests that the source code of the solution is usually kept secret and can only be modified by the programmer who wrote it.

As a definition, proprietary software is software that is owned by an individual or a company (usually the one that developed it.) There are almost always major restrictions on its use, and its source code is almost always kept secret.

Source code is the form in which a program is originally written by a person using a programming language and prior to being converted or compiled to machine code which is directly readable by a computer's CPU. It is necessary to have the source code in order to be able to modify or improve a program.

Open Source software is computer software that is available in source code form. The source code and certain other rights normally reserved for copyright holders are provided under a software license that permits users to study, change, improve and at times also to distribute the software.

In regards to collaborative software, the promise of open source may include but is not limited to, better quality, higher reliability, more flexibility, lower cost and an end to predatory vendor lock in.

Running an open source collaborative system may be cheaper in the long term as the system may be customized to the needs of the organization, making the system more flexible. The organization may employ a programmer to customize the open source solution for them for the software to suit their needs. This is an advantage not to be seen with proprietary solutions, and if they are available they would come at a much higher cost to the organization.

Some industry observers believe that the role of proprietary software will decrease in the future because of the growing competition from open source software. This view holds that open source solutions will eventually dominate major collaborative applications. Proprietary software will remain strong in some niche markets, mainly for business and technical applications for which demand is relatively small or specialized and for which organizations will be willing to pay relatively higher prices.

The table below (table 8) is a snapshot of the most popular collaborative solutions currently available on the market. As mentioned previously, the list of collaborative solutions can number in the hundreds so the selection criterion of the table below is based on sales figures.

Table 8 outlines a list of Collaboration Software Solutions and outlines whether they are Web Based or Cloud Solutions, Non Web Based or a combination of the two, known as a Hybrid Solution. The table further identifies which of these solutions works via the client server model and furthermore whether the solution is an Open Source Solution or Proprietary.

Table 8: Taxonomy of collaborative software.

Product Name	Web Based	Non Web Based	Hybrid	Client/ Server	Open Source	Proprietary
Ace Project	X					X
Air Set	X					X
AtMail		X		X		X
Axigen		X		X		X
Basecamp	X					X
Binfire	X					X
Blogtronix			X	X	X	
Box.net	X				X	
BSCW	X			X		X
Cadac Organice		X		X		X
Celoxis			X	X		X
Clearspace	X			X	X	
codeBeamer	X					X
Collaba			X	X		X
Collanos Workplace		X		X		X
CoMotion		X		X		X
Contactizer Pro		X		X		X
Creately	X					X
Debategraph	X					X
EMC Documentum eRoom			X	X		X
Feng Office/Opengoo	X				X	
FirstClass		X		X		X
FMYI	X				X	
GForge Advanced Server	X			X		X
Glasscubes		X		X		X
Google Docs	X				X	
GroveSite	X			X		X

Huddle	X			X		X
Hyperoffice	X			X		X
i-sense	X			X	X	
IBM Lotus Notes and Domino	X	X	X	X		X
IBM Quickr	X	X	X	X		X
IBM Lotus Sametime	X	X	X	X		X
Kerio Connect		X		X		X
Knowledge Tree	X			X		X
Liferay	X				X	
LiquidPlanner		X		X		X
LucidChart	X					X
Mavenlink	X					X
Microsoft (MS) Exchange Server & Outlook Client	X	X	X	X		X
MS Windows Live Messenger	X			X		X
MS Live Meeting	X			X		X
MS Office Live Comms Server	X			X		X
MS Project Server			X	X		X
MS SharePoint Server			X	X		X
MS SharePoint Workspace		X		X		X
MS Team Foundation Server			X	X		X
MindMeister	X					X
MixedInk	X					X
Nefsis	X			X		X
Novell Groupwise		X		X		X
Oracle Beehive			X	X		X
OWIS			X	X		X
Pivotal Tracker	X					X

ProjectSpaces	X	X	X	X		X
ProtoShare	X					X
Qontext	X					X
CommunityZero	X					X
Saba Software	X					X
SamePage	X	X				X
Smartsheet	X					X
Socialtext	X					X
Synovel Collabsuite	X	X	X	X	X	
tmsEKP		X		X		X
Teamwork	X			X	X	
TeamWox	X	X	X	X		X
TrackerSuite.NET	X	X	X	X		X
Ubidesk	X					X
Wiggio	X					X
Workspot	X				X	

Overall we can see that there are variants in the classification of collaborative software solutions whether they are Web based or Non Web based or a combination of the two known as a Hybrid solution. These can be further classified into categories of whether they are licensed as Open Source Software or Proprietary Software. There are distinct advantages and disadvantages to each solution and the final decision on which solution is best suited for each individual organization must come down to the requirements that each organization has and of course their budget.

ANNEX B: USE CASES OF ENGINEERING APPLICATION CASE

USE CASE #1	Create collaboration	
Context of Use	When a new research consortium is established among organizations in order to write a technical proposal, the Collaboration Administrator, which is in charge of initializing the collaboration, creates a new group in order to outline the scope of collaboration inside the collaboration management system. He also defines a set of roles for the new group. Completed this phase, the administrator sends an invitation to all participant organizations in order to complete the collaboration creation. The contact person for each partner of the consortium, in turn, assigns the above roles to users who will actively participate in that collaboration.	
Scope	- Accreditation System. This system will provide only authentication features in order to reach the correct user profile within the collaboration.	
Level	- Primary task	
Primary Actor	Proposal Coordinator / Collaboration Administrator	
Actor and Interest	**Actor**	**Interest**
	Contact person for each partner	To establish his internal group that will contribute within the collaboration leading to the proposal submission and assign to its members the main roles and specifically, at least, the key role to be made known to the coordinator as the technical or administrative reference or legal representative for his organization.
	Contributor	To insert or update the user information needed such as, for example, email address and telephone contact
Preconditions	A partnership has been established with the goal of submitting a research proposal and the organizations invited to participate and the related contact people for each of them are already identified	

USE CASE #1		Create collaboration
Description	**Step**	**Action**
	1	*Register Organization*
		The Proposal Coordinator/Collaboration Administrator starts the registration procedure of a new organization among the participant ones. The system shows the registration form containing required fields (name of the organization and the specific units involved) and optional (e.g. telephone, address and home page, etc.)
	2	*Register User*
		The Proposal Coordinator/Collaboration Administrator wants to create a user for the system. The system displays the registration form containing a set of mandatory and optional fields. The coordinator enters data and saves them.
	3	*Create Collaboration*
		The Proposal Coordinator/Collaboration Administrator starts the registration process of a new collaboration proposed by his organization ("owner" of the collaboration). The system displays the related registration form, containing mandatory (name), and optional (description, start date, end date) fields and a field (owner) already filled out with the name of the proponent organization, not modifiable by the user.
	4	*Add Role*
		The Proposal Coordinator/Collaboration Administrator selects the option to register a role in the system. The

USE CASE #1		Create collaboration
		system displays the registration form, which contains the fields name and description of the role. The coordinator/administrator enters role data. The system checks the entered data and displays a message confirming the role registration. The coordinator/administrator can complete the registration by selecting a resource and associating it to the role just registered.
	5	*Add Organization to Collaboration* The Proposal Coordinator/Collaboration Administrator wants to associate a particular collaboration with one or more registered organizations. The system displays the list of collaborations and, respectively, of registered organizations. The coordinator/administrator chooses the collaboration and selects organizations that wish to associate.
	6	*Accept collaboration* Each contact person of the participant organizations receives a notification providing the list of collaborations to which his organization has been invited to participate. The contact person may, on behalf of his organization, accept or decline the invitation. The system notifies about the choice carried out (acceptance or rejection).
	7	*Add user* The contact person of each organization registers the users of

USE CASE #1		Create collaboration
		his team that will be involved within the collaboration
	8	*Associate role*
		The contact person for each organization wants to associate one of the available roles inside a certain collaboration with one or more members of his organization that have been previously registered in the system. He selects the user-role assignment option.
		The steps are the following:
		the system displays a list of the collaborations.
		The contact person chooses the one of his interest.
		The system displays the list of available roles within the selected collaboration and the list of the registered users belonging to the specified organization.
		The contact person chooses the role and selects the users to be associated

USE CASE #2	Document upload	
Context of Use	The collaboration scope (organizations, roles, users) has been created and a sharing process of one or more joint documents (e.g. the master document or separate documents for each proposal section) have to be started. The proposal coordinator in charge of managing the many contributions from different partner shares these documents by means of a repository system. Three types of repository are possible: - ftp - website - document management system The coordinator creates a folder, uploads the document templates and defines the access policies according to the collaboration model and policies (e.g. everyone should be able to view all the proposal sections, specific user groups should be able to edit any section of the proposal document or only one person, usually the coordinator, should be able to edit the master document).	
Scope	- Accreditation System. This system will provide only authentication features in order to reach the correct user profile within the collaboration. - Collaboration system. This system will allow to manage collaboration among organizations - Repository system. The system where the resource are saved and published.	
Level	- primary task	
Primary Actor	Proposal Coordinator / Collaboration Administrator	
Actor and Interest	**Actor**	**Interest**
	Coordinator	To make the proposal documents available to all people involved in the collaboration for proposal submission and define related access policies
Preconditions	The collaboration scope has been previously defined and the related organizations, roles and users have been identified.	
Description	**Step**	**Action**

USE CASE #2		Document upload
	1	*Upload Document*
		The coordinator/administrator accesses to the selected type of repository (ftp, website, CMS) and starts document upload process. At the end the above system will provide a resource identifier.
	2	*Associate Collaboration – Resource*
		The coordinator/administrator associates the uploaded resource to collaboration by selecting collaboration-resource assignment option. The steps are the following:
		the system displays the list of collaborations and resources respectively, with the option of publishing a further resource.
		The coordinator chooses the collaboration of his interest, selects the resources to be associated and saves this association.
	3	*Define Policies*
		The coordinator/administrator requires the association of an access policy to a resource associated with a collaboration. By selecting the resource, he identifies the possible actions that can be performed on it.
		To this purpose, the coordinator, inside of the collaboration of his interest, selects one or more roles associated to it, that will allow him to perform some actions on that resource.
		This association can be made for each action associated with the resource. Once all possible triplets have been created, the coordinator saves the policies set.

USE CASE #3	Contribution request	
Context of Use	The coordinator wants to send a request for document contributions among the organizations belonging to a collaboration. The action policies are identified by the selected collaboration.	
Scope	- Accreditation System. This system will provide only authentication features in order to reach the correct user profile within the collaboration. - Collaboration system. This system will allow to manage collaboration among organizations - Repository system. The system where the resource are saved and published.	
Level	- primary task	
Primary Actor	Coordinator	
Actor and Interest	**Actor**	**Interest**
	Coordinator	To request a document contribution according to well-defined action policies on the selected resource
	Contributor	To access to the shared documents according the specified rights
Preconditions	A collaboration has been established and a set of resource access policies has been defined.	
Description	**Step**	**Action**
	1	*Fill out the request* The coordinator opens his mail client and sends a new request for contribution mail. A template of request for contribution mail is provided. According to the selection of the options described below the body and the attachment of the mail are filled out
	2	*Select the collaboration* The coordinator selects the collaboration from a select menu, in order to define the scope of request

USE CASE #3		Contribution request
		for contribution.
	3	*Select Resource* Once Collaboration is selected, the mail form displays a list of related resources. The coordinator select a resource and, optionally, can filter the available actions, according to the policy associated to the resource.
	4	*Upload additional resources* The coordinator can upload further documents(view USE CASE#2)
	5	*Submit request* The coordinator sends the request mail to the appropriate partners, according to the selected collaboration, resource, actions and with the appropriate token that will be generated.
	1- bis	*Trigger the request for collaboration* Once the resource is published the system triggers a request for contribution, with a mail sent to the contributors according to the selected collaboration (option prompted).

USE CASE #4	Contribution response	
Context of Use	Once the document is uploaded and shared among partners, its access policies are configured and the contribution request has been forwarded, each contributor fills out the document and notifies document changes. Two modalities of response are possible: upload a new version document in the original virtual repository or the contributor send a notification mail providing access grants to access on its virtual repository	
Scope	External systems - Accreditation System. This system will provide only authentication features in order to reach the correct user profile within the collaboration. - Collaboration system. The system to manage collaboration among organizations - Repository system. The system where the resource are saved and published.	
Level	- primary task	
Primary Actor	Contributor	
Actor and Interest	**Actor**	**Interest**
	Contributor	to response to request for contribution by providing a contribution of the a new version of technical proposal or check and forward consultant contribution
	Consultant	Consultant user in charge of providing document contribution
	Coordinator	To retrieve contributors' responses (document contributions)
Preconditions	The document is uploaded and shared among partners, its access policies are configured and the contribution request has been forwarded. Each contributor has received the request.	
Description	**Step**	**Action**
	1	The contributor mail client elaborate the request token and the contributor can download the document in order to provide its contribution.

USE CASE #4		Contribution response
	2	The contributor modifies the documents and saves it
	3	The contributor opens its mail client and starts a response to the previous request for contribution mail. A response mail template is provided according to the selected request for contribution. According to the selection of several options the body and the attachment of the mail are filled out.
	4	According to request token the contributor client upload the document contribution on the coordinator original virtual repository.
	5	A notification has been sent to coordinator
	6	The coordinator retrieve the partners' document contributions uploaded in its virtual repository.
	2.bis	The contributor forwards the request to a consultant in charge of providing document contribution. The request forwarding elaborates an additional request token. Then the contribution is sent to contributor in order to check it and forward the response to the coordinator.
	3.bis	The contributor uploads its document contribution on its virtual repository and produce a response token to be attached in the response mail. Once the resource it published the system triggers the response, with a mail sent to the coordinator who started the request. The coordinator according to contributor token downloads the document contribution

USE CASE #5	Process tracking	
Context of Use	The collaboration scope (organizations, roles, users) is just created and a joint document process have to be started. The proposal coordinator wants to define a process in order to track the contribution steps triggered by the events of contribution (upload, request responses, acceptance, rejection etc.).	
Scope	Accreditation System. This system will provide only authentication features in order to reach the correct user profile within the collaboration.	
Level	• primary task	
Primary Actor	Proposal coordinator	
Actor and Interest	**Actor**	**Interest**
	Coordinator	To define the process of document writing in order to check the phases.
Preconditions	The consortium is established and the document master is just ready.	
Description	**Step**	**Action**
	1	The coordinator starts the process designer and models the process. He defines the steps, the rules and the process variables.
	2	The coordinator deploys the process in the runtime engine.
	3	After uploaded the document (see USECASE#2) the coordinator starts a process instance linked to the document just uploaded.
	4	The process engine tracks the step of the process instance.
	5	The coordinator opens the process monitor and checks the contribution process status.

USE CASE #6	Definition of the project budget
Context of Use	The definition of an upper and lower bound for the budget of a project and the assignment of portion of such budget to the different partners is a complex task that must take into account financial constraints, political factors and privacy requirements and the cost structure of the project. For this reason usually the project coordinator has to negotiate separately with each partner the assigned financial resources, without disclosing information about other partners' budget. Of course after the project submission the detailed budget is available to everyone, but during the definition of the consortium and of its resource distribution, this strategy helps keeping the process less complex.
Scope	The definition of a project's budget is not independent from the writing of the technical proposal because costs claimed by each partner should be proportional to their assigned activities. Nevertheless we assume, for simplicity, that the two sub-processes are parallel and independent, that is we will not consider their interactions and dependencies. For simplicity all aspects related to collaboration, token generation, mail form generation and process tracking are views in this use case as external/ black box system: - Accreditation System. This system will provide only authentication features in order to reach the correct user profile within the collaboration. - Collaboration system. This system will allow to manage collaboration among organizations - Repository system. The system where the resource are saved and published.
Level	- one of summary
Primary Actor	Proposal Coordinator: the PC coordinates the negotiation activities and has both a global perspective on the total budget of the project and a detailed view on each single partner's budget.

Actor and Interest	Actor	Interest
	Proposal Coordinator:	The person who actually carries on the coordination activities.

USE CASE #6		Definition of the project budget
	Operative (PCO)	Interested in formulating a balanced and coherent budget that maximizes the funding possibilities of the project and that meets the requirements of each partner.
	Proposal Coordinator: Strategic (PCS)	The person who has to approve or reject the budget assigned to the PC. He/she gives guidelines and financial constraints to PCO
	Contributor: Operative#N (CO#N)	Each partner has a person who carries on operative activities in the definition of the partner's budget. This person usually has the interest to maximize his/her budget.
	Contributor: Strategic#N (CS#N)	The person who has to approve or reject the budget assigned to the Partner#N. He/she gives guidelines and financial constraints to CO#N
Preconditions		• The composition of the consortium is in its final form. • The PCS already decided upper and lower bounds for the total project budget.
Description	**Step**	**Action**
	1	The PCO uploads N +1 excel files on the Virtual Repository (ftp, website, cms), one per Partner plus one that gives an complete view on the total project budget. Each Partner is allowed to access only its excel file. The PC is allowed to access any excel file.
	2	The PCO sends an email to each CO, granting access to the proper excel file and requiring an initial budget proposal or requiring feedback on a predefined budget assignment.
	3	For each Partner: Each CO#1 receives the email, downloads the excel file and, after elaborating its data, sends it to the CS#1 for feedback and approval. The excel

USE CASE #6		Definition of the project budget
		file is accessible only by CO#1 and by CS#1.
	4	CS#1 downloads the excel file and sends it back to CO#1 with some modifications. Again the file and is accessible only by CO#1 and by CS#1.
	5	CO#1 sends back the excel file to PCO. The file is accessible to CO#1, CS#1, PCO and PCS. PCO and PCS approve or reject the budget of Partner#1. In case of rejection the motivations are specified and sometimes a proposal is made to solve the problem. The new version of the excel file is sent back to CO#1.
	6	During the whole process PCS and PCO have access to the overall excel file in order to check the total project budget and verify that financial constraints are always met.

Steps 2 to 5 are repeated until the budget of each partner is finalized.

ANNEX C: USE CASES OF LINK TECHNOLOGIES APPLICATION CASE

USE CASE #1	ISO conformity process	
Context of Use	When a new potential customer comes on board and requires a quotation for stated works, quotations for work and contracts must have a unique protocol number so as to conform to ISO9001 standard. The process starts with either the customer making contact with the SME or the contact is via a sales staff member. Once contact is made, a protocol number must be assigned to the quotation and subsequently protocol numbers must follow on any work contracts that come to fruition from the initial quotation. These protocol numbers must be issued during every phase of the contact with the customer meaning that a protocol number must accompany from the stage of initial quotation to final invoicing. The system will keep a secure log of protocol numbers issued and ensure the assignment of protocol numbers is adhered to so as to keep in line with the ISO9001 standard. The ISO security officer must ensure that these protocol numbers are distributed justly and the rules regarding the ISO9001 standard are adhered to.	
Scope	Accreditation System. This system will provide authentication features in order to reach the correct user profile within the organization. Management System. The system will manage the list of Protocol Numbers issued. Repository System. The system where the resources are saved and published.	
Level	Primary Task	
Primary Actor	ISO Officer	
Actor and Interest	**Actor**	**Interest**
	ISO Officer	Responsible for issuing and tracking ISO9001 protocol numbers.
	Sales Representative	Requires access to Protocol Numbers so as to attach to customer documents.

USE CASE #1		ISO conformity process
	Customer	Uses the Issued Protocol number as a point of reference for any query regarding their request.
Preconditions	A customer via a sales representative requires a quotation for goods or services.	
Description	**Step**	**Action**
	1	*Request from Sales Rep for Protocol Number.* The ISO officer opens their mail client and finds a request for a protocol number from the sales rep.
	2	*Issue Forms and Tokens* ISO Officer replies back with an ISO form document and security token that the sales representative must complete and send back to the ISO Officer.
	3	*Issue Access Rights to Repository.* ISO Officer receives back the completed form and replies back to the sales rep with access rights to send back the completed offer document to the repository.
	4	*Submit Quotation, Offer or Order.* The sales representative then attaches the offer and submits it to the repository. A notification is sent to the ISO officer. Trigger Event sent to the ISO officer.
	5	*Issue ISO Number* Once the ISO officer has checked the relevant documentation to ensure it is properly completed they then issue the ISO Protocol number to the sales rep by accepting the work submitted by the Sales rep.
	6	*System will issue a valid Protocol Number.* The system will issue the next

USE CASE #1		ISO conformity process
		protocol number in sequence to the last issued number so as to keep the numbers in order and avoid a duplicate number being issued or a number out of sequence being issued.
	7	*Issue Quotation, Offer or Report to Customer.*
		With the ISO number issued, the sales rep can then forward the Offer to the customer who can use this protocol number as a reference point with the Organization regarding their inquiry.
	Variable 1	*If a Quotation is accepted.*
	V1.1	*Notification to Procurement Dept. and Accounts Dept.*
		If the Sales rep receives a confirmation of an order from a customer then they must acknowledge this via an accept / reject button in the system. If the sales rep select the accept button then notification must be sent to the procurement officer with a history of the correspondence which will include the quotation and any instructions that the sales representative has included to go with the order.
		This will in turn trigger authorization and notification to the Accounts department to be able to access the documents involved with this order so as to be able to invoice the customer.
	V1.2	*Procurement Proceeds with Order.*
		The procurement officer knows that by reaching this stage and he has a valid order in front of him he can proceed with the order as all protocol issues have been covered.
	V1.3	*Order Completed and Invoiced.*

USE CASE #1		ISO conformity process
		Once the items have been received and acknowledged as such by procurement, the accounts dept is notified so that they can invoice the items to the customer. Having completed this step and acknowledged as invoiced the procurement dept receives a copy of the invoice to attach with the goods. The goods are then shipped and acknowledgement is sent to accounts that this is done.
	V1.4	*Payment Received and Folder is activated as completed.* To close the cycle of the transaction, once the customer has paid the outstanding invoice and payment has been received by the Accounts dept. they acknowledge that the transaction is completed and the folder can be marked with completed in the system and stored in the repository.

USE CASE #2	Employee document repository	
Context of Use	When a company acts as an outsourcer of resources to other companies, it requires a workflow of documents to be able to be shared between the parent company and the outsourced employee who is usually off-site whether in the same geographical region or outside of this region. The usual workflow is by delivering these documents by fax or email from the parent company to the outsourced personnel. This method is very hit and miss allowing for documents to be misplaced by either party and not allowing for evidence to be kept of receipted documents and furthermore not allowing for indexing and tracking of any changes of the documents in question. The system must ensure a secure and stable repository of employee / Parent company written communication exchange. It will be a secure repository of indexed documents that may be accessed by personnel with the correct security tokens, always ensuring that the most current document versions can be accessed by appropriate staff.	
Scope	Accreditation System. This system will provide authentication features in order to reach the correct user profile within the organization. Repository System. The system where resources are saved and published.	
Level	Primary Task	
Primary Actor	Company Administrator	
Actor and Interest	**Actor**	**Interest**
	Employee	To be able to keep a secure repository of documentation relevant to the employees relationship with the parent company but not only limited to this as they may keep other relevant company data also such as brochures etc to be used for the information of the client.
	Human Resources / Management	Requiring Read access to any communication between the employee and the parent company.
Preconditions	An employee working for the parent company has	

USE CASE #2	Employee document repository	
	been outsourced as a resource to a Third Party Company (Also known as the customer).	
Description	**Step**	**Action**
	1	*Register the Employee.* The administrator initiates the registration process of the employee onto the system. The registration process will include a form that must be filled out by the employee ensuring their details are fully completed. Information that will be gathered must include the name and contact details of the employee in question and employee personnel data. Optionally it will also include details of where the employee is outsourced to if this may be the case. Once the registration form is sent to the employee it will trigger a notification to the employee that a form is waiting to be completed by them. The administrator sending this form will be the trigger event.
	2	*Notification.* The employee receives notification that a form has been sent for their perusal.
	3	*Detail Completion.* The employee will then complete the form with the appropriate details and send this back to the administrator, triggering a notification to the administrator that the form has been completed and sent back.
	4	*Add the Employee.* The administrator will check the details and if all are ok then add the employee to the system and notification and security token will be sent to the employee allowing them access to their allocated space on the server.

USE CASE #2		Employee document repository
	5	*Automated steps of the system.*
		Once the employee is added the system must automatically give the correct access rights to each concerned party and allocate appropriate disk space which will be predefined for the user. The Human Resources / Managers will have READ access to the content of the employees partition and the employee will have read / write access. Notification will be sent to all parties concerned that they now have access to this newly created employee.
	6	*Relevant Documents to be inserted.*
		The administrator will then ensure that the employee's partition will contain the most relevant and up to date company information that the employee can use whilst at the customer's site (company brochures and advertising), and will also include any relevant HR documentation for the employee.
	7	*Variations for updates on mass scale or single update.*
		From time to time as company information is updated say in brochure form, the administrator will have the option to select via a drop down menu whether a single or multiple employees will receive the attachments that they are forwarding to employees. Whatever the case may be once something is added to the employee's repository, notification will be sent to the selected employee(s) with the correct token allowing them to access the file in question.

ANNEX D: USE CASES OF INTERSOFT APPLICATION CASE

USE CASE #1	Create collaboration
Context of Use	When a new customer of the outsourcing company, the Collaboration administrator that is in charge of initializing the collaboration creates a new Customer in order to outline the scope of collaboration inside the collaboration management system. He also defines a set of roles for the new Customer. When a new developer is employed in the outsourcing company, the Manager creates his profile and the Developer fills in his knowledge according specified categorization.
Scope	Authentication system, Collaboration system
Level	Primary task
Primary Actor	Collaboration administrator

Actor and Interest	Actor	Interest
	Customer	To insert his project offer and specify the knowledge needed for the project
	Supplier	To add/update the developers for the outsourcing projects in the collaboration
	Developer	To fill in his technology knowledge

Preconditions	Outsourcing company is in a business relationship with a customer.

Description	Step	Action
	1	*Register list of technologies* Collaboration administrator registers all possible technologies that can be used within a software development.
	2	*Register customer* Collaboration administrator registers the customer by fulfilling its general information and its software development needs.
	3	*Register supplier* Collaboration administrator registers the supplier of the (outsourcing

USE CASE #1		Create collaboration
		company) by fulfilling by filling its general information and used software technologies.
	4	*Create collaboration* Collaboration administrator creates the collaboration among customers and suppliers by filling in the general contract information.
	6	*Register developer* Supplier registers all developers that can work within the outsourcing projects. General information about the developer is registers
	7	*Add skill to the developer* Developer selects and assigns the technology skills according his actual knowledge.

USE CASE #2	Submit project offer	
Context of Use	When the collaboration between supplier and customer is created the customers are ready to enter the project offers. Supplier is notified and initializes the negotiation process. Usual way of sending the offer is e-mail communication or web based system.	
Scope	Collaboration system, Repository system	
Level	Primary task	
Primary Actor	Customer	
Actor and Interest	**Actor**	**Interest**
	Customer	To send/upload the project offer
	Supplier	To initiate the negotiation process
Preconditions	The collaboration between customer and supplier must be created and all related users must be registered.	
Description	**Step**	**Action**
	1	*Submit offer* Customer submits the project offer either by sending the project requirements and specification via e-mail or uploading it via web based file repository system. Customer also assigns the technologies needed for the project and general information about the delivery.
	2	*Select developers* The developers are automatically selected according the assigned technology needs and registered skills of the developers. The possibilities are shown to the supplier to use the information for initialization of the negotiation process.
	3	*Initialize negotiation process* In the collaboration system Supplier sees the submitted offer, its general delivery information and selected possible developers with their availability. Supplier then initialize the negotiation process.

USE CASE #3		Handle project offer
Context of Use		The project offer is submitted by the Customer with all initial data that are needed to perform the negotiation process. The Supplier initialized the negotiation process and the handling of the negotiation can be performed.
Scope		Collaboration system, Repository system
Level		Primary task
Primary Actor		Supplier
Actor and Interest	**Actor**	**Interest**
	Customer	To register work effort and other development conditions.
	Supplier	To accept or refuse the effort and conditions of the development.
Preconditions		The project offer is submitted and the negotiation is initialized
Description	**Step**	**Action**
	1	*Add conditions* The Supplier calculates the work effort and delivery plan according submitted requirements and specification. The effort and delivery plan is entered to the collaboration system. Supplier can enter requests for additional information about the project.
	2	*Revise offer* Whether the conditions of the Supplier are not suitable or the request for additional information is received the Customer can revise the offer. Also new version of the requirements and/or specification can be submitted. (The action can be repeated many times together with action 3)
	3	*Revise condition* After the revision of the offer the Supplier revises his conditions

USE CASE #3		Handle project offer
		which include work effort and delivery plan. (The action can be repeated many times together with action 2)
	4	*Accept the offer* The Customer accepts the submitted offer when the development conditions presented by the Supplier are suitable for him.
	5	*Refuse the offer* The Customer refuses the project offer when the development conditions are not suitable for the project.

USE CASE #4	Finalize project offer	
Context of Use	The project offer is accepted by the Customer and the Supplier. Now the collaboration system and/or the Supplier should assign the Developers suitable for the project. Sometimes it is needed to reassign the developers from other running projects.	
Scope	Authentication system, Collaboration system	
Level	Primary task	
Primary Actor	Supplier	
Actor and Interest	**Actor**	**Interest**
	Supplier	To assign Developers to the offered project.
	Developer	To be notified that a new project is started.
	Customer	To receive delivered results of the project.
Preconditions	The project offer is accepted by both the Customer and the Supplier.	
Description	**Step**	**Action**
	1	*Assign developer* The Supplier assigns developer to the project according the automatic selection of the collaboration system or manually without any specific conditions.
	2	*Release developer* After the project is finished the Developer is released from the project by the Supplier. The release can be done also before the end of the project to manage development resources during the running phase of the project.
	3	*Deliver project* When the project is finished the results are delivered through the Repository system from Supplier to Customer. The project is marked as finished.