User-driven Service AssemblY
U-SAY

Small or medium-scale focused research project (STREP)

Call FP7-ICT-2007-1

Objective ICT-2007.1.2: Service and Software Architectures, Infrastructures and Engineering

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Strategic Objective Addressed:
ICT-2007.1.2: Service and Software Architectures, Infrastructures and Engineering

Proposal Abstract

The transformation into a service society is one of the most important trends today. ICT can support this trend by enabling efficient consumption and production of services by individuals acting as consumers, employees, knowledge workers or entrepreneurs. Within the current Web Service technology, however, technical complexity is a major obstacle to simple consumption and assembly, since the target end users are mostly non-programmers. Optimising service consumption and assembly support for such end users requires research to understand how service consumption and assembly tools are best designed for specific domains, how such tools can be efficiently engineered, and finally how users can work in collaborative communities to solve common or related problems.

U-SAY intends to answer these questions by delivering:

- domain-specific service assembly environments for home automation and production which
  - offer user-centered and domain-specific representations of services based on suitable service assembly metaphors, and
  - provide behind-the-scenes support and guidance to ensure quality of user-developed service assemblies, using formal composition and verification;
- a generic method and framework for the engineering of domain-specific assembly workbenches for end users based on reusable principles and components;
- an infrastructure for the efficient collaboration between users and developers to stimulate innovation and community-based expertise sharing.

To achieve these results, U-SAY will follow an iterative prototyping approach, integrating theoretical models of service composition, end user development, and community-based collaboration, juxtaposing them with experimental findings from contextual enquiries in chosen application domains, and using the results to drive prototype development. Thus U-SAY can be expected to leverage service-oriented ICT strengthening Europe's economy and society by enabling end users to act as drivers of this technology.

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B1. SCIENTIFIC AND/OR TECHNICAL QUALITY, RELEVANT TO THE TOPICS ADDRESSED BY THE CALL

B1.1 Concept and Objectives

Concept and Vision

People are increasingly using web services in a variety of work or leisure contexts, and are starting to interact with this technology in a number of nontrivial ways. These interactions would often cross the boundary from setting dates and other parameters to activities which are in effect software development, such as devising information filtering rules in Yahoo! Pipes, or even composing services to visualize various data sources in new ways ("web mash-ups"). Extrapolating this trend (Figure 1) brings us to the vision of the "Internet of Services", where people create and compose web services with the same ease as they currently write their blogs.

A key problem with this vision is the lack of technical and programming skills for the majority of potential "end users", who will not be software professionals. However, the consumption of available services as well as the assembly of new services requires familiarity with a variety of technical concerns, and ability to master the inherent complexity of software (Brooks, 1986), and especially the complexity of the target web service technologies.

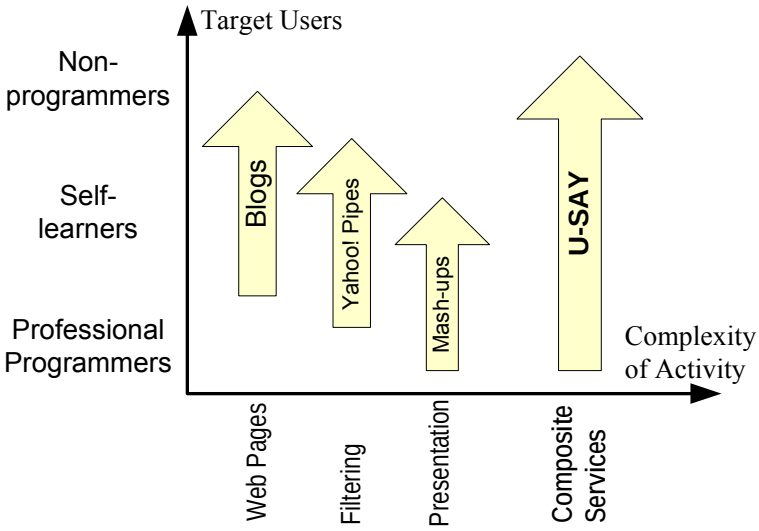

Figure 1. Evolution of Web Service Development

U-SAY aims to address this problem and make service assembly accessible to people who are not programmers. We focus on creating service assembly mechanisms, representations and tools which can *demonstratably* alleviate the actual problems faced by non-programmers when they assemble web services.

U-SAY is building upon the theoretical advances and practical successes (such as spreadsheets, macro recording and database form painters) of a discipline called *End User Development* (EUD) (Mehandjiev and Sutcliffe, 2006; Lieberman *et al.*, 2006; Scheidl, 2006; Sutcliffe and Mehandjiev 2004). Bringing together a consortium with a wealth of theoretical and technical expertise from across the European Community, U-SAY integrates experimental and theoretical EUD input with advances in web service composition and formal verification, to address the challenges of a technically advanced domain such as Web Service Assembly, especially when we attempt compositions over and above the simple representation-layer nature of Web "mash-ups".

EUD has achieved successes in important areas such as cognitive design of end user development environments, and studies of representations, collaboration patterns and problem-

solving models of end users acting as developers. It is now clear that such end user development environments should be tuned to the target domain and tasks of the end users, and they should employ languages (either textual or visual), which are based on concepts and metaphors from that target domain. For example, *spreadsheets* are hugely successful in the domain of mathematical computations because they employ the textual language of formulae and the metaphor of accounting tables to organise computations. LabView (Baroth&Hartsough,1995) is a successful environment for creating instrumentation software, with studies of actual use reporting *4 to 10 times increase of productivity*. This is mainly attributed to LabView's visual language using symbols and metaphors from electronics (wiring together electronic components), which are familiar to its target group of end users.

When such a domain-oriented environment provides explicit support for the design and problem-solving activities of its users, it is known as a Domain-Oriented Design Environments (DODEs) (Fischer, 1994). Whilst it has been accepted that DODEs provide effective support for End User Development, their feasibility for niche domains has been questioned because of the effort necessary for their development. Indeed a DODE for service assembly will have to be tuned to the different domains of application, such as information aggregation in manufacturing, or optimising home energy use.

To address these concerns, U-SAY will deliver a reuseable application development framework for building Domain-Oriented Design Environments for Service Assembly (DODE-SA). This will be exemplified with concrete languages for three application domains, resulting in three separate DODE-SAs. The resultant structure of a DODE-SA is illustrated in Figure 2

- an application development framework for building DODE-SAs, which is independent of the target application domain;
- a set of domain-specific representations and support techniques which customize the framework to the target domain such as manufacturing or home automation; and
- a section on collaboration and feedback, which brings in community-based development dimensions, allowing users and developers to share programming tips but also service rankings as a result of monitoring the performance of the deployed services.

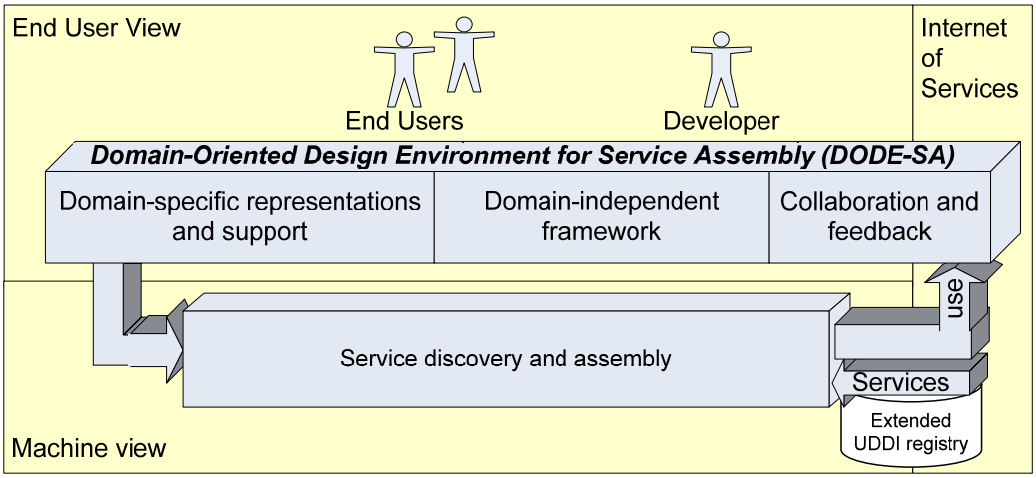

Figure 2. Top-level view of U-SAY

To ensure the quality of the resultant service assemblies, the environment's '*Service discovery and assembly'* section will employ a set of advanced mechanisms for translating between different abstraction levels, discovering services using extended meta-data and ensuring the reliability of the composition through formal verification of service compositions. The results of service operation will be monitored by the *'Collaboration and feedback'* module thus closing the feedback loop.

U-SAY will develop an innovative user-centric process-oriented approach to service compositions, based on the transformation of domain-specific service assemblies such as LabView-style wiring diagrams, into detailed service composition orchestrations which can be executed on standard web service execution platforms.

At the user level, research will focus on discovering domain-specific user perspectives on service compositions and patterns of collaborative design. We will initially target two contrasting domains: *steel manufacturing* with its process-oriented nature and process managers as target users; and *home energy efficiency* with its complex interaction between components and house-owners as target users. Our findings will be abstracted into domain-independent reusable structures, seeded by the structures underpinning the Domain Theory of Sutcliffe (2002), allowing efficient construction of domain-specific service assembly languages, supporting tools and appropriation support methods. Then the findings will be validated by applying them to a third target domain, that of *customer service centres*, which is also contrasting to both the other two target domains.

At the service composition level, the focus of research will be on creating domain-independent mechanisms for bridging domain-specific service assemblies which have a high level of abstraction to detailed web service compositions with appropriate guarantees for end-to-end Quality of Service and reliability. Three particular research aspects will be:

- developing mechanisms allowing the composition of process-based service descriptions fragments, taking into consideration associated meta-data such as service rankings and style of connections to the other services (e.g. data-flow vs. event-driven connections);
- creating innovative matchmaking and contract generation techniques for service provisioning; and
- mechanisms for verifying the composed service and providing feedback to support users in their assembly efforts.

In this way, U-SAY will unite three main strategies for supporting end user service assembly:

1. to simplify access to service composition by domain-specific visual representations and metaphors embedded in a user-oriented design environment for service assembly;
2. to ensure the quality of the end user service assembly results by using formal service characteristics that support end users in choosing the appropriate services and avoiding mis-configurations; and
3. to stimulate innovation and expertise sharing among users by providing an infrastructure for supporting an open collaborative development process involving end users and professional developers.

The project is ambitious because of its vision and advanced research aspects, yet risks are outweighed by the potential advantages of opening up the consumption and reliable assembly of

services to millions of users who do not have programming background, and thus reducing overall service composition costs and time from weeks to days or even hours. This ambitious nature makes the project appropriate for EC funding, but we have also reduced the risk exposure of the overall project by identifying the two main risks and building our research and development strategy around them. The two main aspects are:

(a) the effort and cost of generating new domain-specific support could be too high; and

(b) automatic transformation from end-user views to machine views and back may prove unfeasible, requiring additional involvement by software specialists.

In the project, such risks are reduced through the introduction of an iterative innovation process which integrates experimental and conceptual research with software development to ensure an early evaluation of reachable results and goals, based on case studies and prototypes.

The result of the project will be a new service engineering approach, with associated development tools. The project is focusing on contributing to European research in the framework of the Challenge 1 of FP7, and in particular to the goals of point 1.2, towards the development of reliable and dependable quality services with a high degree of user involvement during the development life cycle. This relevance is explored further after describing the Aim and Objectives below.

B1.1.1 Aim and objectives

U-SAY aims to create the technology support needed to enable end users to create or modify service assemblies, thus fulfilling their needs as service consumers and creators. This will include:

- domain-specific user-friendly service assembly languages, supported by
- a user-oriented visual design environment including design assistance and critique; and
- a rich service description and discovery specification, which are embedded into
- a new method for collaborative software development including users and software developers.

Table 1 summarises the long-term impact goals of U-SAY, the top-level technical objectives to bring about these goals, and the scientific objectives to enable the development of the technical objectives.

B1.1.2 Measurability of Scientific and Technical Objectives

Success of the project will be measured across the different types of objectives Table 1 in a systematic manner, based on an explicit model of R&D innovation. The particular model chosen for U-SAY highlights the manner in which a scientific model or an experimental finding would underpin technical deliverables and the long-term impact on the users, each of them helping to achieve objectives classified as scientific, technological and long-term impact goals respectively. The dependencies between these components and the corresponding ways of measuring the success and quality of results are shown in Figure 3.

The informal model of Figure 3 is broken down into metrics and measures as detailed in Table 2.

Table 1. Derivation of U-SAY Objectives

Long-term End-user Objectives	Technical Objectives	Scientific Objectives
EO. 1 Simplify Access to Service Composition	TO.1.1. Develop a domain-independent application development framework for building Domain-oriented Service Assembly Design Environments (DODE-SAs)	SO.1.1.1. Develop effective support mechanisms for Service Assembly Design by non-programmers SO.1.1.2. Develop Appropriation Support Mechanisms for Collaborative Service Composition
	TO.1.2. Develop Domain-specific DODE-SAs	SO.1.2.1. Develop domain-optimised Service Composition Representations and Metaphors SO.1.2.2. Develop a Domain Customisation Method
EO.2 Ensure quality of end user service assembly results	TO.2.1. Develop assembly guidance and composition verification system TO.2.2. Develop a execution monitoring and feedback system	SO.2.1. Develop an Assembly Specification Language (ASL) for formal specification of service assemblies. SO.2.2. Create an automatic mechanism for compiling service designs into service search meta-data SO.2.3. Develop Formal Verification Mechanisms for Service Composition
EO.3. Expand the range of services available to end users	TO.3. Develop an extended design-driven service procurement engine	SO.3. Formulate extended service specification, including additional search meta-data regarding the following: • Architectural information; • QoS information; and • Community information
EO.4. Stimulate design innovation and expertise sharing among users	TO.4. Develop an infrastructure for design-oriented communication, collaboration and delegation between end users and between end users and professional developers	SO.4. Formulate collaborative design patterns and mechanisms

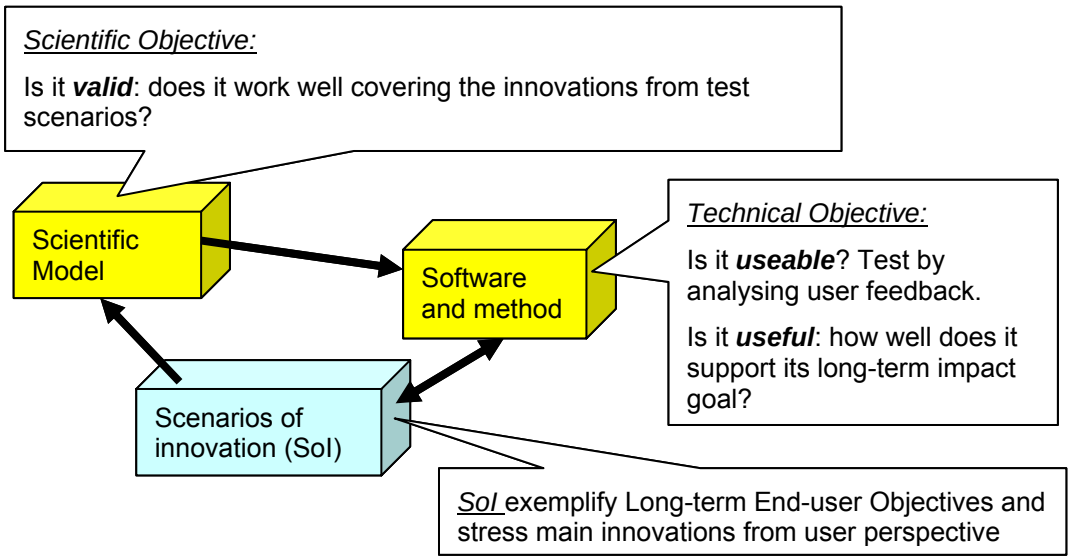

Figure 3. R&D Innovation Model in U-SAY

Table 2. Set of Key indicators for U-SAY

Metric	Measure	Method of measuring	Type of Objectives	
			S	T
Coverage of test scenarios	Percentage of target features covered	Reflection by WP leader, reported in WP Deliverable	✓	✓
Suitability for its corresponding Technical Obj	Expressed as a Scale (1..5)	Feedback by Software Developers	✓	
Suitability for its corresponding Long-Term End-User Objectives	Expressed as a Scale (1..5)	Feedback by Users		✓
Peer-acceptance of scientific results	Reviews of work submitted to peer-reviewed journals and top international conferences..	Number of acceptances & review scores reported in Dissemination Deliverable	✓	
Ease-of-use	Expressed as a Scale (1..5)	Usability testing using cognitive dimensions.		✓
Acceptance by the appropriate group of users	Expressed as a Scale (1..5)	Usability testing obtained during testing		✓
Dissemination	Number of target organisations aware of the U-SAY results.	Number in Dissemination Deliverable	✓	✓

B1.1.3 Relevance to the Objectives of the Call

U-SAY will provide several results matching the target outcomes described as items a) and b) in the objective ICT-2007.1.2:

Table 3. Relevance to the Objectives of the Call

Objective ICT-2007.1.2	**U-SAY contribution**
Target Outcome (a) ■ Service architectures, platforms, technologies, methods and tools that enable context awareness and discovery, advertising, personalisation and dynamic composition of services.	**U-SAY will** ■ provide a method, a technology and a tool to enable ➔ service discovery, consumption, and assembly on the basis of a platform for **domain oriented development environments** supporting visual metaphors ➔ a framework for the enrichment of services **by semantic metadata** on personal and community level
■ They should support flexible business models, provide for service management, and guarantee end-to-end quality of service.	■ provide technology support for flexible business models based on an ecosystem with the **user community interacting with the consulting and the software development community** to guarantee a certain quality of service
■ They will cater for multiple component technologies and support vendor independence. Opportunities for standardisation should be exploited.	■ enable the procurement of services developed using different component technologies and architectural styles; and propose a new **specification** for service description and discovery, WSDL and UDDI, which includes information about connectivity, quality of service and community-based information supporting the new joint user-developer development
Target Outcome (b) ■ Service/software engineering approaches development processes, product lifecycle and tools for dynamically composed systems with dependable quality of service and reliability properties and promoting new open development paradigms with a higher degree of involvement of joint user and development communities.	**U-SAY will** ■ provide an innovative service engineering approach using a collaborative process of joint user-developer service development and composition, allowing systems to be composed dynamically at the point of need with predictable dependability and reliability bringing a higher added value because of the opportunity to gain **design feedback** from the actual use of services via the end user community.

In addition, U-SAY will work towards all focal points of impact specified under Objective ICT-2007.1.2. It will provide a framework for dynamic construction of services with guaranteed properties which is open to a wide range of organisational profiles. It will also boost the productivity and reliability of software development by integrating requirement specification,

development and validation for complex service aggregates. Finally, it will open the possibility for SME competitiveness by providing new integration specifications, taking into account a variety of service properties and community-based development practices. Details of how U-SAY will deliver this impact are specified in Section B3 of this proposal.

B1.2 Progress beyond the State-of-the-Art

U-SAY research contributions focus on integrating models and techniques from three main research areas to achieve reliable and flexible service compositions by end users of services: End User Development, Collaborative Software Development and Service Composition, In the following, we discuss how the U-SAY project will contribute to the state of the art in those areas, and review related work on European level.

B1.2.1 End User Development in the Internet Age

End User Development

The idea that end users who are not trained programmers can modify or even develop their own software is in the core of the academic discipline of End User Development (EUD). The first EUD studies appeared as a result of the appearance of PCs at the workplaces. Some notable examples were concerned with the socio-technical dimension of EUD, for example Panko (1988) and Brancheau&Brown (1993) provide comprehensive early-days coverage of this aspect, with progress recently recapped by Powell&Moore (2002).

Representative recent selections of papers covering both the technology and the organizational dimension of End User Development can be found in special issues of the Communications of ACM (Sutcliffe&Mehandjiev 2004), Journal of Organizational and End User Computing (Mehandjiev&Sutcliffe, 2006); and the almanac of EUD published by Springer under their HCI Series (Lieberman,Paterno&Wulf *et al*., 2006). An example of a recent workshop in the area is (Scheidl, 2006).

Enabling technologies for EUD

The main enabling factor for EUD is accepted to be the balance between costs/risks and benefits of EUD practices (Mehandjiev, Sutcliffe&Lee, 2006b). Technology-based research efforts aim to redress the balance in favour of EUD by reducing the learning costs and improving the quality of the EUD results. The two main approaches influencing our work are Natural Programming and Domain-Oriented Design Environments.

Natural Programming (Myers, 2004) focuses on studying the approaches and representations which the target end users employ in their everyday problem-solving activities. The results are used to create “natural” programming languages and representations, often visual. This approach supersedes the naïve assumption made by early visual language researchers that visual representations are always better, and motivates the search for appropriate representation on a case-by-case basis. Combined with the discovery of the users’ real tasks, information needs, and vocabularies, the Natural Programming research explores how to design new user- and domain-

oriented languages (e.g., Pane, 2006); and how to build programming environments (Ko, 2005 and Coblenz, 2006).

Domain-oriented Design Environments (Fischer, 2003) see end user development as a design effort, and focus on providing knowledge-based support in terms of "artificial critics", "best practice" templates, explanation facilities, and syntax directed editors to support design and learning in a specific domain.

Both approaches produce end user development environments tuned to the needs of a specific sector of end users and to a specific application domain. This has been criticised as being too costly as an upfront investment (Ning, 1994) and for failing to support evolving user skills and verification of the quality of the resultant software (Sutcliffe, 1994). Software engineering approaches can be used to alleviate some of these concerns, for example Mehandjiev (1997) proposes an architecture enabling the integration and evolution of a distributed visual language for end user development. This can accommodate the evolving skills of end users, and can adapt the language and the environment to different domains using a modular approach and a canonical specification language. Similar architectural approaches can also be used to support collaborative modelling and development as illustrated in (Mehandjiev *et al*, 2001).

EUD for Web Services

The application of end user development principles for composing web services is currently at the phase of early efforts which do not benefit from mature theoretical support other than the one provided by earlier work on end user development of Web portals (Jahnke et al, 2006). The two best-known examples for composing web services are "mash-ups" (Hof, 2005) and "Yahoo! Pipes" (pipes.yahoo.com).

There is considerable interest in using these ideas for serious purposes (e.g., Jhingran, 2006, Floyd, 2007, Maximilien, 2006) , but the current "mash-up" technology is not tuned to the needs of end users, whilst Yahoo! Pipes is narrowly focused on information filtering as an application domain.

A number of ongoing and planned projects consider the creation of "lightweight service composition" interfaces, with optimism mirroring early EUD visions of managers dictating COBOL to their secretaries. Keeping in mind the technical complexity of Web Service compositions and the complexity inherent in realistic software systems (Brooks, 1986), success in this field is still some ways off.

Progress beyond the State-of-the-Art by U-SAY

U-SAY will approach the problem of user-driven service assembly in a manner which would address the main drawbacks of state-of-art approaches reviewed above.

Reusing effort across domains: We will address the concerns of reusing effort across domains by generalizing our findings from contextual inquiries in different target domains into domain-independent and domain-specific results. The domain-independent results will be combined with findings of the Domain Theory (Sutcliffe, 2002) to highlight reusable patterns of problem-oriented design structures and problem-solving tasks. These will form the core of a *domain-independent application framework and patterns repository*, which will be customisable to different application domains and different levels of user experience.

The framework will be customized to the needs of particular target domain using the domain-specific results from our contextual enquiry, and the customization steps will be generalized into transferable customization method, aiming to facilitate future adaptations of the framework.

Supporting quality of user-derived compositions: Our system will integrate the user-oriented design environment with formal mechanisms for verification of service compositions, allowing positive and negative feedback from the verification stage to propagate to the user environment, preventing users from attempting incorrect compositions.

Inherent complexity of assembling Web Services: The project will deliver empirically discovered and tested representations and metaphors which translate the technical problem of web service composition into task-oriented activities familiar to the target users. We will also develop collaborative development facilities, where less experienced users can contact more experienced ones or event software developers for help and ratings of design pattern, etc.

B1.2.2 Appropriation Support and Collaborative Design

Appropriation Support

The appropriation of technology is understood to be a creative process of the appropriator(s) which can even go beyond the rules and ideas associated by the developers of the software (Pipek, 2005a). A successful appropriation of information technology leads to new work practices, innovative business processes or modified organizational structures. Since the organizational environment typically changes during the process of appropriation and a successful appropriation of IT has an additional impact on work traditions, business processes or organizational structures, the requirements for IT are not stable during this process. Therefore, a design process that supports the appropriation of IT needs to deal with the dynamic evolution of requirements. The flexibility and openness to change of the social/organizational system has to be met by a flexibility and openness to change of the technological system. In addition, the system design has to be aware of the phenomena of open appropriation processes (De Sanctis & Poole, 1994; Orlikowski, 2000; Pipek, 2005a), in particular it should allow the unanticipated use of the software system (Robinson, 1993; Pekkola, 2003). The appropriation process is closely connected with the adaptation of systems to meet the local context, but cannot be reduced to it, as Dourish notes: *„Appropriation is the process by which people adopt and adapt technologies, fitting them into their working practices. It is similar to customisation, but concerns the adoption patterns of technology and the transformation of practice at a deeper level."* (Dourish, 2003).

Software engineering (SE) and human computer interaction (HCI) have developed different approaches which are meant to provide flexibility of technical artifacts to tackle these issues. For instance, software engineering methods of participatory design allow better understanding and reacting to the differentiation of needs within a field of application. While SE approaches focus on the design phase of IT, HCI approaches such as tailorability, end user programming or end user development (Kahler et al., 2000; Lieberman et al., 2006) provide technical flexibility for the use phase. Within the leeway provided by the design, non-professional programmers can modify these applications in use. However, both of these approaches are limited in the sense that they are either focusing on the design or the use phase of an application. User driven innovation and the concept of toolkits for mass customization (e.g. Piller, 2001; von Hippel, 2001) as well as new directions in Participatory Design (e.g. Bleek et al. 2002) have suggested tool support to bridge the gap

between the context of use and the design context. To support differentiated and dynamic appropriation processes efficiently, we need an infrastructure that provides flexibility, a smooth transition between design and use, and it has to be designed from the user's perspective taking the phenomena of appropriation seriously. Chalmers (Chalmers, 2004) presented different systems that are influenced by their usage history and could be taken as examples for systems that support collaborative appropriation:

- ***HIPPIE*** is a system which is based on the principle of context awareness. It was introduced by (Schiele et al., 2001) and is used to present information in a museum that could be adapted to different contexts. The context information is extracted from the recordings of the different information that users have viewed.
- ***Smart-Its Friends*** (Holmquist et al., 2001) is a system that monitors which objects a user used and which places he visited. In contrast to HIPPIE the system, Smart-Its Friends creates connections or unions between artifacts, based on usage histories.
- ***George Square*** (Goldberg et al., 1992; Chalmers, 2004) demonstrates how a usage history could be used to generate usage recommendations.
- ***Jimminy*** (Rhodes, 2003) serves as an example for a system that extends the model and the use context. It finds past usage periods in users' histories, who share some places and URLs, which have recently been viewed. Places and URLs of a usage period are selected and recommended to users.

The challenge that remains is how to apply these concepts of appropriation support to the user-driven creation of service assemblies.

Collaborative Design

Research in the area of participatory design show many different approaches of how designers and users can design a system collaboratively. Christiane Floyd recommended as early as the 1980s that software should be developed iteratively (Floyd, 1989). Since then, many methods from modern software engineering research and software distribution have extended evolutionary and participatory design (Bleek, 2002; Nichols, 2003; Ritterbruch, 2002). The approaches differ, for example, in their phase of use during the software lifecycle (Muller, 1997). Some approaches can be used before or while the system is being implemented, while others can be used after system is implemented. The U-SAY project involves both phases, because service assemblies are created during the use time of the system, but they involve the end user performing some implementation tasks. Increasingly, ethnographic methods such as contextual inquiry (Beyer, 1998) are being used to discover the target users' real tasks, needs and vocabulary. These are often augmented with studies in laboratories to try to understand the basic usability tradeoffs of various techniques. Put together, this generates new knowledge that can drive design, and allows design to be based on real data about the users' needs and characteristics. For example, a contextual inquiry study highlighted some properties of what makes code libraries and frameworks hard to use, which were refined and verified in laboratory studies (Ellis, 2007). Another study revealed that communication among programmers and discovering the design intent were significant barriers among programmers in the field (Ko, 2007).

Another approach we will use is called remote evaluation. It is similar to usability studies, but users are not given tasks. Instead, usability specialists track users' problems during their daily work. The approach should be used to complement classical usability studies. Hartson et al. (Hartson et al. 1996) recommend to use objective reports, which make the discussion of discrepancies between

users and designers needless. The term “remote” indicates that users and usability experts can work in different places, but also that they may be separated in time. Nichols et al. (Nichols 2002) describe another method for performing usability tests, called participatory usability. Users are requested to create a usability report, whenever they think that it is necessary. The tool for the creation of such reports is integrated into the application itself, making it easier for users to create the report. The report consists of two parts. The first part contains objective data from the program state and is generated automatically. The second part contains subjective data, which is entered by the user. After sending the report, the user is able to track it, to stay informed about whether the issue was already processed and if it will be fixed or not. Quite similar to the participatory usability approach are crash reporting tools. These tools are also integrated into the application and provide designers with objective information about the application in case of a crash. In contrast to the participatory usability approach, the decision of whether a report will be generated or not is done by the system and not by the user. Sometimes crash reporting tools provide a feedback channel to the users, providing them with web-links, email, etc. Usually these tools are used to increase the stability of an application and not to redesign it. The next approach is called e-prototyping. In this case, users participate in the design process because of their experiences in the use context, using the already implemented system. The approach is usually embedded in a participatory, evolutionary development process. The decision about whether a requested feature will be implemented is done within the development process and is not part of the e-prototyping approach.

In addition to these formal participatory design approaches, the open source development activities and the usage of Web 2.0 technologies shows how participatory design works in practical settings. In this case, there is no hard separation between the group of designers and the group of users. Every user can be a developer at the same time and vice versa. If users become developers, they have to face the same complexity of software development that all other developers have to face.

Progress beyond the State-of-the-Art by U-SAY

U-SAY will go beyond the State of the Art regarding the following issues:

- The existing body of research about Appropriation Support explored concepts and measures based on the paradigm of component-based systems. It was shown that in order to use component-based technology for redesigning software systems at use-time and in the use context, it is necessary to add metadata and management structures. U-SAY will transfer these concepts and experiences to the domain of Service-oriented Architectures.
- U-SAY will integrate the issues of articulation support (regarding all aspects of service assembly and service use) delegation support (for transparent delegation of composition tasks), historicity support (to trace earlier composition decisions) and re-design support (to address original service designers and assembly composers) into one concept to support user communities in assembling services in a sustainable way.
- U-SAY will develop visualizations and collaboration support to provide end users with a process-oriented perspective on a service assembly.
- U-SAY will demonstrate innovative strategies to embed appropriation support means (use communities, use recommender systems, etc.) into existing technological, organizational and social infrastructures based on service-oriented concepts.

- In terms of supporting collaborative development with joint user and developer participation, U-SAY will tie in with a new, less complex approach of collaborative design, which treats users and developers as equal partners, in contrast to classical participatory design approaches. U-SAY will provide end users with a domain-specific service assembly environment, using appropriate service composition representations and metaphors. The environment enables users to assemble services much in the same way that they know it from business process engineering. The created service assemblies could be used to adapt and extend existing programs or to create new programs.
- In comparison with open source development, the utilization of users' knowledge in process engineering decreases the complexity of developing programs. These user-driven assembly activities should furthermore be supported with communication, collaboration and delegation tools. These support tools serve two purposes. First, the assembly activities of users are in most cases collaborative activities, as studies have already proven. Second, the tools should support, like participatory design methods, the communication between users and programmers.

B1.2.3 Dynamic service composition and verification

Enhanced services

U-SAY will adopt an architectural style based on services adopting the service oriented approach. Several methodological approaches and systems have been proposed to support process-based service composition, by extending traditional process management system technology to distributed, Internet-based scenarios. In recent years, flexibility and adaptability have been studied as important properties in composed services.

In (Casati, 2001), a first proposal towards dynamic and adaptive composition of e-services is discussed. In SELFSERV (Benatallah, 2003), services can be composed and executed in a decentralized way. In (De Antonellis, 2006), a layered architecture for flexible e-service invocation is proposed based on a substitution mechanism. Moreover, for the more general use of mobile applications, it is important to be able to adapt these systems to the user at hand, thus making a case for simple user models to guide the adaptation. Banavar and Bernstein (2002) highlight the importance of semantic modelling in this respect.

Many adaptive mechanisms for workflows and service-based processes proposed in the literature are based on the analysis of processes at design-time to support the design of flexible processes and an optimal service selection. Meteor-S (Cardoso, 2003) and other semantic-based approaches (WSMO, 2007) explicitly define the service goal on which they perform both discovery and composition. While goal-based approaches open up the possibility of deriving service compositions at run time, their applicability in open WS-based applications is limited by the amount of knowledge available in the service definitions. In U-SAY, we aim to provide a design environment in which semantic information about services may be very limited and derived from service interfaces and user requirements. As mentioned above, we are not focusing on autonomic service behaviour with discovery and adaptation in an open world environment. However, some self-management properties are needed to control the correct execution of composed services (Papazoglou, 2005). With respect to self-healing mechanisms in this area, the U-SAY research will provide innovative contributions to monitor services at run time and to generate repair actions in case of failures.

Formal analysis of service compositions

Research on model checking web service compositions is quite recent, but has attracted considerable attention. An initial attempt is described in (Nakajima, 2002). Flows are described in WSFL (Leymann, 2001) and translated into Promela, the input language of the SPIN model checker (Holzmann, 1997). By following this approach, one can verify reachability, deadlock-freedom and application specific properties.

The Zing model checker (Andrews, 2004) is reported to check for errors in sets of web services, whose behaviour is described in BPEL. Kazhamiakin (2006) proposes a model of BPEL compositions based on a parametric definition of the communication infrastructure, in which the number of queues may be changed, to allow different levels of asynchrony. The authors also propose an algorithm for the verification, which identifies the simplest communication model for a specific composition and produces the corresponding input file for the SPIN and NuSMV (Cimatti, 2002) model checkers.

Nakajima (2005) proposes a method to extract the behavioural specification from a BPEL process and to analyze it by using the SPIN model checker. A finite-state automaton extended with variable annotations (definitions and updates) is used as an intermediate representation. This approach provides only a partial support for BPEL, which does not deal with fault/event handlers and compensation activities. The tool checks for deadlock freedom and verifies user-defined LTL properties.

In (Puyz, 2005), an operational semantics is provided for a subset of the BPEL language; this subset is then mapped onto a network of Timed Automata, which is verified in Uppaal (Bengtsson, 1995). Other authors use different computational models for verifying BPEL processes. Petri Nets are used in (Schlingloff, 2005), where a Petri Net semantics is provided for BPEL. The net resulting from the translation is then validated with the LoLA (Schmidt, 2000) model checking tool.

Process algebras are used in (Foster, 2003) and (Koshkina, 2003). In (Foster, 2003), web service compositions are verified against properties created from design specifications and implementation models. Specifications, in the form of Message Sequence Charts, and implementations, in the form of BPEL processes, are translated into the Finite State Process notation, which is the input language for the LTSA (Labelled Transition System Analyzer) model checker. In (Koshkina, 2003) a process algebra, the BPE-calculus, is used to abstract BPEL control flow. This calculus is used as input for a process algebra compiler to produce a front-end for the concurrency workbench (CWB), in which equivalence checking, pre-order checking and model checking of processes are performed.

The work described in (Huang, 2005) proposes model checking of composite web services expressed with OWL-S Web Ontology Language for Web Services), using an extended version of Blast (Henzinger, 2002) tuned to support OWL-S concurrency. Atomic web services are verified for predicate-bound properties.

There are many proposals for Architecture Description Languages (ADLs), including Rapide (Luckham, 1995), Wright (Allen, 1997), and Darwin (Magee, 1995). To model dynamic architectures, several approaches apply graph transformation (Baresi, 2002). Lemetayer (1996) describes architectures using graphs and the valid graphs of an architectural style using a graph grammar. Reconfiguration is described using conditional graph rewriting rules. By static type checking, the rewriting rules are proved to be consistent with the respective style. In comparison to our work, his graphs represent computational entities but no connectors, specifications, or other

resources. And, instead of a graph grammar, we use a declarative type graph to define the valid graphs of the architectural style.

Wermelinger and Fiadeiro (2002) provide an algebraic framework based on Category theory where architectures are represented as graphs of CommUnity programs and superpositions. The allowed ways to apply connectors to components is restricted by an architectural style, given as a type graph. Dynamic reconfiguration is specified by graph transformation rules over architecture instances. Both styles and rules are used for modelling domain-specific restrictions rather than the underlying platform as we do. Consequently, they do not deal with refinement relationships between different levels of platform abstraction.

In his Ph.D. thesis, Hirsch (2003) uses hypergraphs to represent architectures and hyperedge replacement grammars to define the valid architectures of an architectural style. Furthermore, he uses graph transformation rules to specify runtime interactions among components, reconfiguration, and mobility. Hypergraphs and rules are textually represented using the concept of syntactic judgements which enables formal type checking proofs. Similar to the other approaches, refinement relationships are not discussed.

Garlan (1996) stresses the fact that it is more powerful to have rules operating on styles rather than on style instances. He formalizes refinements as abstraction functions from the concrete to the abstract style. We use a similar approach to define the refinement relations. Also, he argues that no single definition of refinement can be provided, but that one should state what properties are preserved. In our case, we concentrate on the preservation of the dynamic semantics of reconfiguration and communication scenarios.

Progress beyond the State-of-the-Art by U-SAY

U-SAY research activities propose to enhance the service integration approach typical of FP6, where the focus is the composition of services, to a service-based composition of processes, based on process fragments and service choreography.

In addition, U-SAY approaches design from a user-oriented collaborative requirements approach, from which the process composition, adaptation and integration in complex BPEL processes are derived through automatic mapping and translation mechanisms from a user-oriented representation of the requirements. To guarantee the quality and reliability of the composition, formal analysis tools are applied, as discussed in the following.

U-SAY contributes to the actual verification of Web services compositions, and more generally to the validation of component-based systems, in different ways. It aims at fully exploiting the potential of model-checking techniques to validate the different aspects of these software systems. It also proposes the use of graph transformation systems to model their dynamic evolution. These two aspects require efficient model checking techniques and thus, we want to customize the behaviour of well-known model checkers (e.g., Bogor) to constrain the state space explosion by means of domain specific information. The peculiarities of the system under analysis can help differentiate states by using special-purpose policies and thus limiting the number of states that a conventional model checker would create. Besides this, we also support multi-paradigm validation by identifying the right formal methods/models to specify the aspect of interest and thus to validate it. Model checking is the primary verification means, but other verification approaches (e.g., Alloy, algebraic specifications, VDM, and so on) might be more appropriate to verify particular aspects.

Orthogonally, we also want to stress the idea of runtime validation, which clearly requires ad-hoc solutions to cope with the stringent time-related requirements. Some of the aspects listed above might be rethought to move from conventional off-line verification to the on-line check of running systems. Besides this, incremental, iterative, partial or simplified approaches could be the solution to obtain "significant" results in limited time.

B1.2.4 Related EU activities

The execution framework in U-SAY will be also based on research results from Politecnico di Milano in previous EU IP SECSE and FET-STREP WS-Diamond projects and the Italian MAIS and ArtDeco basic research projects, which contributed to the creation of an adaptive service framework. In particular, mechanisms for automatically augmenting processes with monitoring functionality have been proposed in (Baresi, 2007), and a design and execution environment with an advanced service registry, mediation tools for adaptation, optimization and negotiation have been proposed in (Bianchini 2006, Pernici 2006, Ardagna 2007, De Antonellis 2006). While existing methods and tools focus compositions of service operations, new research contributions of U-SAY will concern the composition of process fragments, coordinating several services.

MAIS functionality have also been adopted in the WS-Diamond to support service repair and self-healing functionality. In U-SAY, self-healing models developed in WS-Diamond will be adopted and extended to integrate them with the SECSE monitoring functionality and provide active feedback and support to users in case of failure.

The U-SAY proposal is coherent with the Strategic Research Agenda (SRA) of the European Technology Platform on Software and Services NESSI (the Networked European Software and Services Initiative).[1]. In particular, with regards to the vision of a Ubiquitous and invisible IT, U-SAY will focus on providing all users with a global, transparent tool in which they should only “perceive the functionality of solutions, rather than the complexity of the technology underneath”.

With respect to NESSI roadmap, U-SAY will contribute to service lifecycle management to support identification of components, location, negotiation and reservation, orchestration, configuration, operational management and in specifying common principles for defining unambiguous service level (SLA).

Several projects have been developed in FP6 in the service area. Among these, *Sensoria* focuses on global services that are context adaptive, personalisable, and may require hard and soft constraints on resources and performance. The project takes into account the fact that services have to be deployed on different, possibly interoperating, global computers, to provide novel and reusable service-oriented overlay computers. A formal approach to composition is provided, oriented more towards service programming rather than user-oriented design, and on proving formal properties of services (see below). Here, U-SAY will put a stronger emphasis on keeping service composition concepts understandable and manageable by end users.

The purpose of the *OPUCE (Open platform for user-centric service creation and execution)*[2] project is to bridge advances in networking, communication and information technology services towards a service environment. The project will produce an open service infrastructure to enable

[1] Further information available on http://www.nessi-europe.com

[2] OPUCE: Open Platform for User-centric service Creation and Execution, funded by FP6F6 IST, information available from http://www.opuce.tid.es/index.html, last accessed 19th March 2007

users to have easy service creation and deployment in heterogeneous environments and ambiances, allowing services to be accessed in a seamless way by a multitude of devices connected via different networks. OPUCE has emerged within the IP Communications innovation (ICi) initiative, which has brought together all major European players (telcos, vendors, SMEs and research organizations) in the field of Voice over IP/Next Generation Networks technologies with a special focus on innovation. The project shares with U-SAY the ambition to address end users in the configuration of the technologies they use, but it focuses on technological interoperability in Mobile Service Environments, and addresses a specific scenario for vertical service integration (levels: context, devices, network) whereas U-SAY addresses issues that emerge from considering large service networks on the same operational level.

The project *INCONTEXT (Interaction and context based technologies for collaborative teams)*[3] addresses similar problems to U-SAY, because it aims to develope a novel scientific approach focused on a new blend of human collaboration and service-oriented systems that explores two basic research strands: efficient and effective support for human interactions and collaboration in various teams through dynamically aggregated software services; and use of human-to-human or human-to-service interactions in applying intelligent mining and learning algorithms that can detect interaction patterns for proactive service aggregation. In contrast to inContext, U-SAY does not limit itself to automated service adaptation methods, but will also enable users to autonomously construct service assemblies by themselves, leaving design power in their hands.

The research project *CASCOM (Context-Aware Business Application Service Co-ordination in Mobile Computing Environments)*[4] will implement, validate, and test value-added support for business services for mobile workers and users across mobile and fixed networks. The vision of the CASCOM approach is that ubiquitous application services are flexibly co-ordinated and pervasively provided to the mobile users by intelligent agents in dynamically changing contexts of open, large-scale, pervasive environments. For end users, the CASCOM system provides easy and seamless access to semantic Web services anytime, anywhere, and using any device. The generic CASCOM intelligent peer-to-peer infrastructure includes efficient communication means, support for context-aware adaptation techniques, as well as dynamic and secure service discovery and composition planning. Again, this project addresses the technological provision of services on a mix of mobile devices, with a focus on the technological challenges to connect hardware and service infrastructure levels. U-SAY focuses on the process of assembling services by end users, and on possible support service infrastructures may offer here.

In several IP projects, semantic web services have been proposed (Fensel, 2002). In SUPER, there is an emphasis on business processes, in particular on modelling and managing process design. In ASG, semantic web services and BPM have also been studied, with a planning-based approach. SIMS has focused on collaborative services, semantic interfaces, and run time composition. Collaborative service modelling has been studied also in ATHENA, with research work on process models transformations with annotated processes, studying cross-organization business processes. The challenges for and activities of end users trying to compose their service networks were not in the focus of these projects, which targeted professional programmers.

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[3] INCONTEXT: Interaction and context based technologies for collaborative teams, funded by FP6 IST, information available from http://www.in-context.eu, last accessed 21st March 2007

[4] CASCOM - Context-aware Business Application Service Co-ordination in mobile Computing Environments. Home page. Available from http://www.ist-cascom.org, last accessed 20.03.2007

B1.3 S/T Methodology and Associated Work Plan

B1.3.1 Overall Strategy of the Workplan

Guiding principles

The U-SAY workplan is guided by the following principles:

- **Empirical grounding**: Since it is a primary goal of U-SAY to provide users with an assembly environment that corresponds to their domain-specific representation of services, the project needs a thorough empirical grounding. This includes field work to capture guiding scenarios and users' mental models of service compositions as well as a requirements analysis providing a taxonomy of services from a technical perspective. In terms of field work, we will solicit the requirements from two distinct application domains – process-based steel industry and event-based home energy -- and later expand the scope to the domain of service provision, to test the validity of our results beyond the original domains.
- **Concepts and mechanisms for service discovery and assembly**. Based on the requirements specified both at the user's level and at the technical level, concepts and mechanisms have to be developed that allow these two layers to be connected.
- **Design and development of domain-oriented development environments.** The implementation of these concepts and mechanisms will call for an architecture of domain-oriented developments environments (DODE-SAs) with certain domain-independent and certain domain-specific components. It is intended to separate domain independent components and domain specific component in the architecture. For both groups, a proper design of the components will need to be worked out. The design will be followed by the integrated development of functional prototypes for at least two different domains.
- **Prototype Validation.** Throughout the entire design and development phase, U-SAY will follow a user-centred approach, i.e., contact to the users will be maintained to receive feedback that allows for early adjustments as necessary. In addition to this continuous feedback, we will also have dedicated evaluation phases.
- **Iterative refinement.** To allow for a sound reconsideration of design and development after exposing a first functional prototype to user validation, a second design and development phase will follow to refine the achievements of the first phase based on the lessons learnt. The resulting second generation prototype will then be subject to a summative evaluation by users.
- **Domain diversity.** It is the goal of U-SAY to provide not only development environments for specific domains but also generic insight into the DODE-SA engineering process. For this reason, several application domains must be covered. In the first development cycle, applications for the process-based and the event-based domain are covered. This allows developing domain specific concepts. From these concepts a domain independent model and engineering process will be developed and verified within the service-based application domain.

Project phases

According to these principles, the U-SAY work plan structures the activities into five overall phases, cf. Figure 4

- **Phase I:** The first project phase (month 1-6) covers the elicitation of **requirements** as well as work on generic methods and designs, targeting two application domains: steel and home automation/energy.
- **Phase II:** The second phase (month 7-21) covers the **first iteration cycle**. In this cycle we will achieve basic concepts and mechanisms for service discovery and assembly. Detailed design of the domain-independent application framework and of the domain-specific customisations will be conducted, using analysis from the findings of the two application domains. Empty shell implementations of these components will be created by month 15. The empty shells will implement component interfaces, thus enabling correct interactions between components, but they will not implement internal logic. Each software component just receives input and in a hard coded fashion produces some output for other components to consume. This allows an early verification – and, if necessary, inexpensive adjustment – of the component interfaces. By the end of this phase, empty shells will be enriched by internal logic to achieve functional prototype at the end of this phase.
- **Phase III:** The results of the first iteration cycle will be evaluated in a **formative evaluation** phase (month 22-23).
- **Phase IV:** The evaluation results will be considered in the **second iteration cycle** (month 24-32), where the results of the first cycle will be revised to result in prototype DODE-SAs after the second cycle. For the purposes of validating our findings, our second iteration cycle will include a third application domain - the domain of service provision, exemplified by one of HP Italy Customer Care Centers.
- **Phase V:** The final phase the prototype DODE-SAs will be a **summative validation** according to the industrial requirements (month 33-36).

Within the iteration cycles we will strictly follow a test-driven approach to implement the evolutionary development of DODE-SA prototypes. Continuous integration of development results (based on a build server automatically executing [integration] tests) will ensure smooth development of DODE-SA prototypes.

Work package overview

To reach the U-SAY objectives as stated in section 1.1, the work will be broken down into the following set of work packages depicted in Figure 5.

WP 1: Project management

This work package contains activities related to scientific, technical and financial management of the U-SAY project.

WP 2: Requirements specification and analysis

This work package will derive empirically grounded requirements for domain-oriented development environments from the technical layer of services and the layer of appropriate user-interfaces. Implications for the design of DODE-SAs will be analysed.

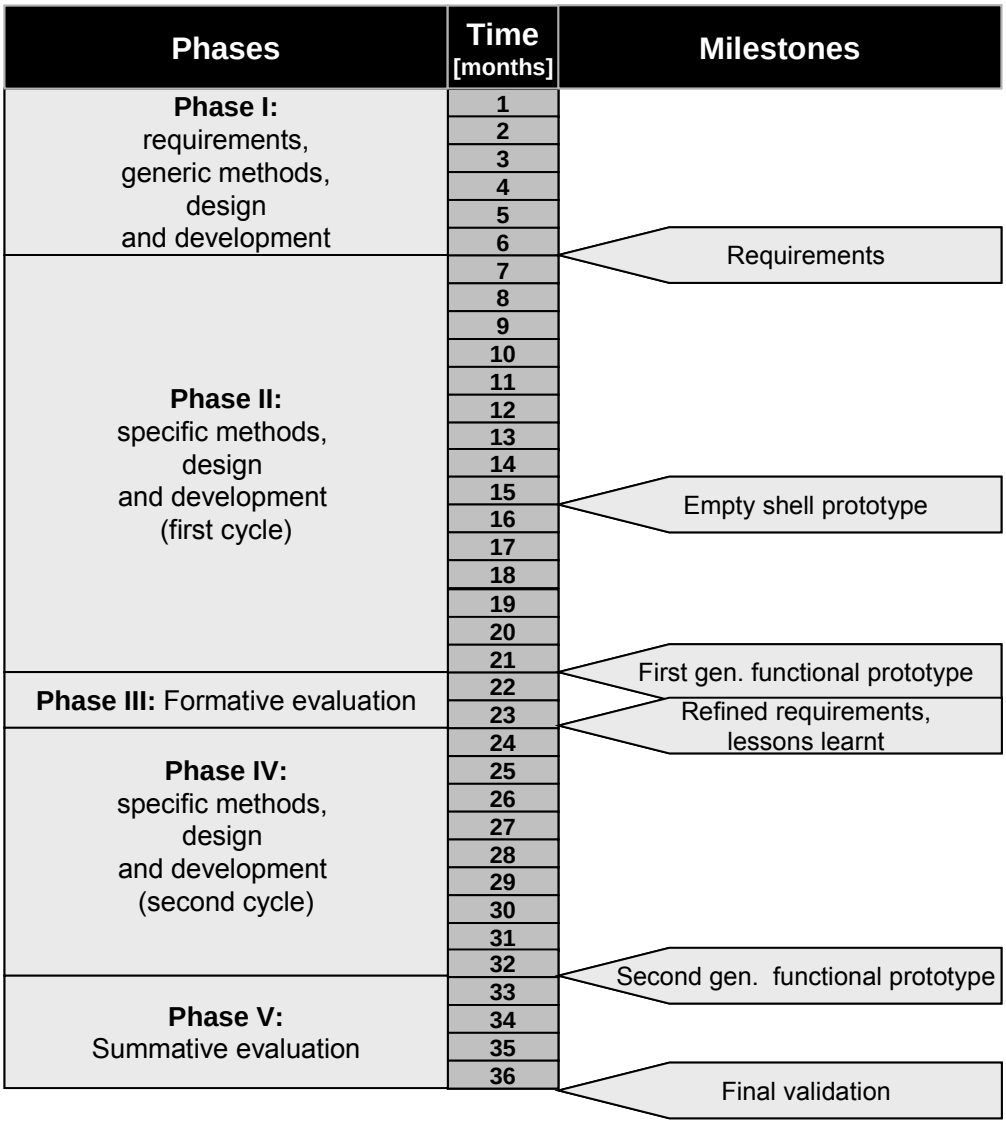


Figure 4. Project phases of U-SAY

WP 3: Service discovery and assembly

The results of WP 3 will enable the generation of an executable process from a service assembly defined in the end user design environment. The generation of an abstract and annotated process description as an enhanced service specification from a service assembly is a major goal.

WP 4: Domain-independent designs for DODE-SAs

In WP 4 all domain-independent components of DODE-SAs will be developed, major achievements will be the definition of integrated appropriation support mechanisms, the formalisation of appropriate problem-solving models and patterns, and the development of conceptual models of design assistance.

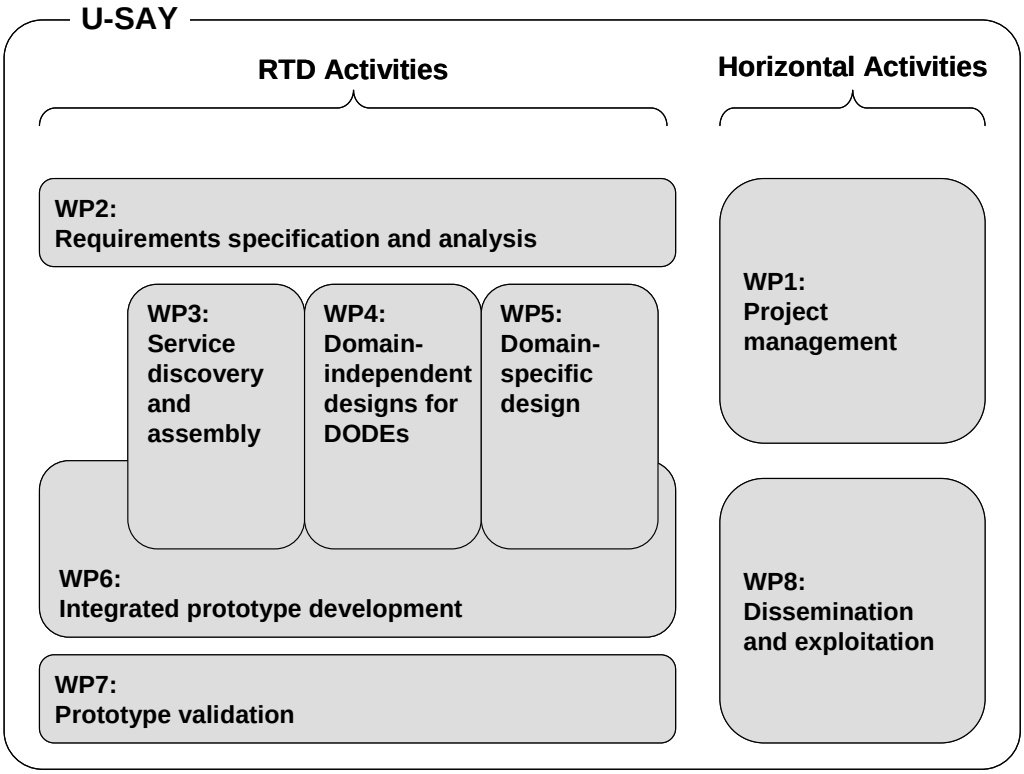


Figure 5: U-SAY work package structure

WP 5: Domain-specific design

In WP 5 we will analyse findings from scenario-driven requirements and the user feedback to mock-ups from WP 2, integrate this with existing findings on "natural programming," and develop domain-specific representations and metaphors.

WP 6: Integrated prototype development

Based on results from the WPs 3-5, we will develop the components for the prototype DODE-SAs realising the end-user scenarios from WP 2. We aim at ensuring the integrated development of the various components of the DODE-SAs into functional prototypes.

WP 7: Prototype validation

In WP 7 we will validate the DODE-SA prototypes on the basis of the industrial requirements from WP 2.

WP 8: Dissemination and exploitation

In WP 8 we conduct dissemination activities and elaborate detailed plans for the exploitation of the project results.

When describing the work packages in more detail on the following pages we will also show their relevance to achieve the identified project objectives.

Work plan details

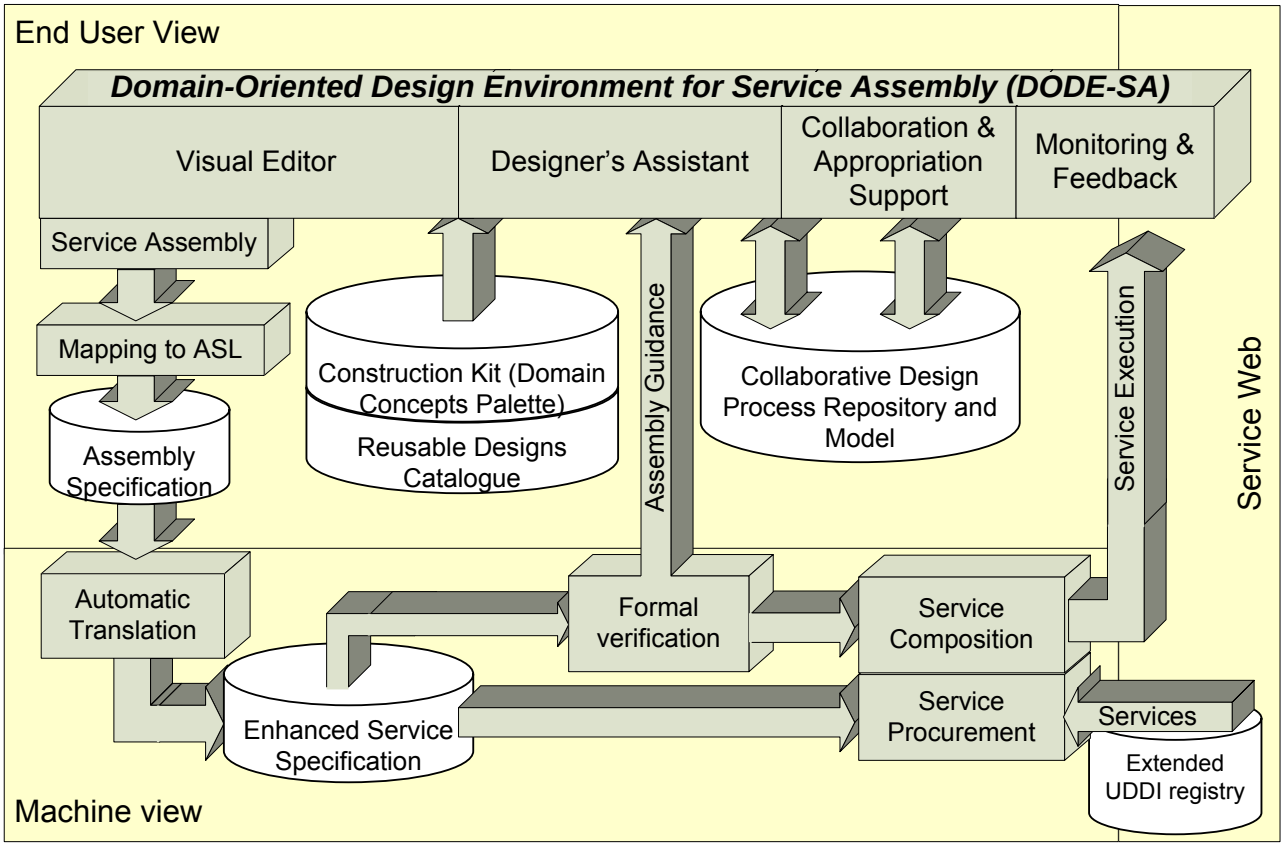


Figure 6: Main components of U-SAY architecture

This figure illustrates the connections between the following main components we will develop in the pursuit of our technical objectives:

Domain-oriented Design Environment for Service Assembly (DODE-SA)- this is the End User View of the system. Apart from the *Visual Editor,* it has *Designer's Assistant*, *Collaboration and Appropriation Support* module, and *Monitoring and Feedback* module, and is driven by the information in three repositories: *Domain Concepts Palette, Reusable Designs Catalogue,* and *Collaborative Design Repository*.

The **Designer's Assistant** is a general helper tasked with critiquing user designs, discovering similar designs and patterns, invoking formal verification module to provide assembly guidance and interfacing with the collaboration and appropriation support module to achieve the envisioned collaborative user-developer style of service assembly design. This is driven by the model of collaborative design processes and the associated instantiations stored in the Collaborative Design Repository and Model. It also invokes the simulation module to help users envision the interaction of the different services they are assembling together.

The **Visual Editor** module allows users to specify their desired service assemblies using a high-level domain-specific language and the domain-concepts palette provided by the Construction Kit repository. With the help of the Designer's Assistant, users can also retrieve appropriate partial solutions from the Reusable Designs Catalogue. The result of the module is a Service Assembly specification, which is then mapped to Assembly Specification Language by a domain-specific translator module. The Assembly Specification Language (**ASL**) is domain-independent language for service assembly, which provides all the necessary information for formal verification whilst still remaining at a sufficiently high abstraction level.

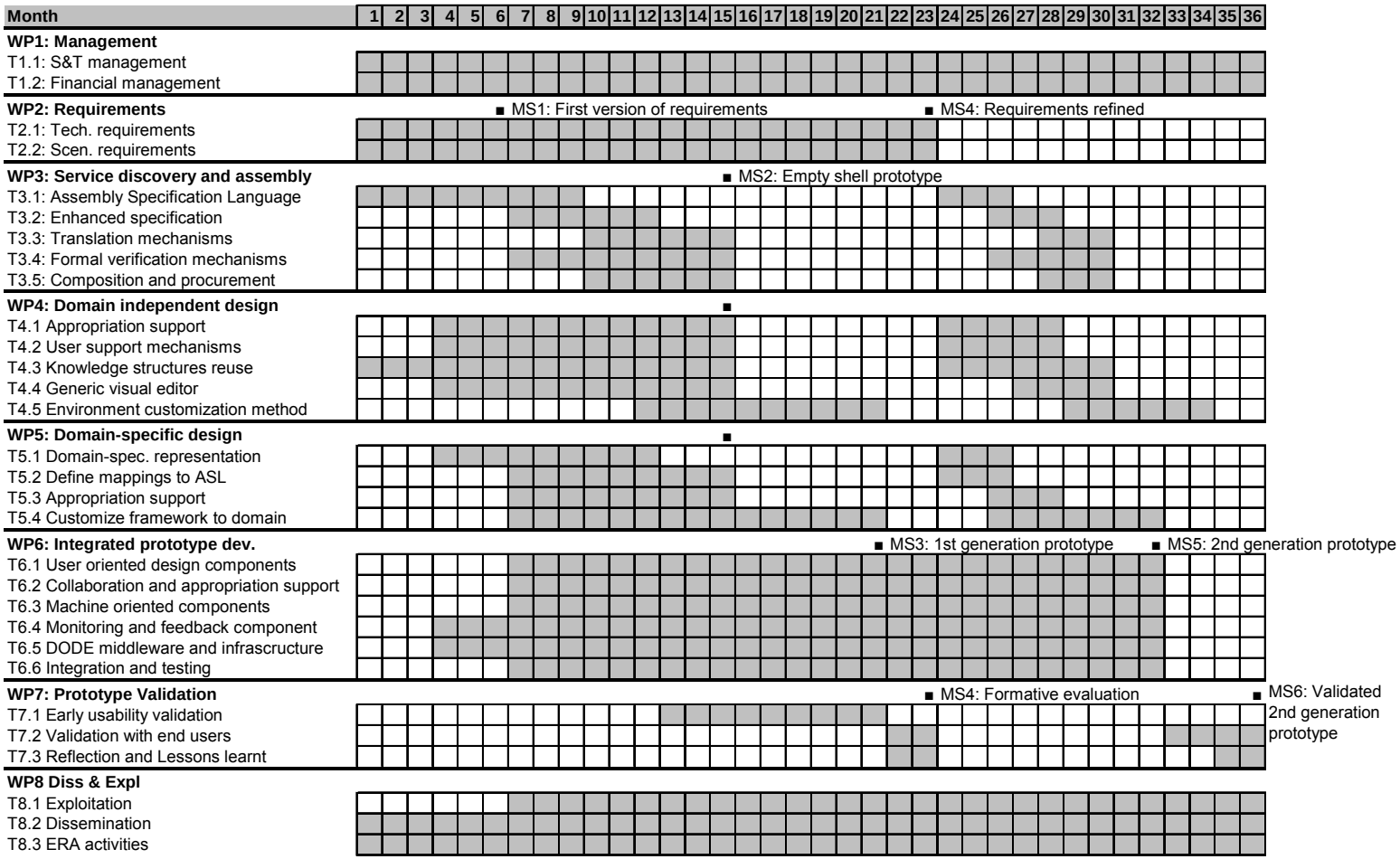
Still on the user side, the **Collaboration and Appropriation Support** module handles the community appropriation aspects of end user development, providing support for collaborative developer by end users and software developers, and allowing end users to share successful designs and feedback rankings. This is fed through the **Monitoring and Feedback** module, which is responsible for gathering service execution information to support the ranking and evaluation of services.

The **Automatic Translation** module takes a service assembly specification written in ASL and converts it into "enhanced service specification". This contains meta-data about service rankings, connection topologies and expected quality of service parameters, and contains sufficient level of detail to enable the operation of the **Formal Verification** and **Service Procurement** modules.

The **Formal Verification** module takes the enhanced service specification of the desired service assembly, and produces feedback about its correctness and validity. This feedback is propagated to the Designer's Assistant, which will present it to the user in an appropriate fashion. One mechanism we will explore is to provide continuous feedback through the physical metaphors of repulsion, preventing the component dropping action causing the verification error.

The results from the *Formal Verification* and *Service Procurement* modules are then passed to the **Service Composition** module which creates the appropriate Composite Service and enables its execution.

B1.3.2 Timing of Work packages and Tasks (Gantt Chart)



In WP 3, 4, 5, and 7 there are inactive time intervals between active intervals associated to the two iterative cycles of the project.

B1.3.3 Detailed Description of Work packages

Work package List

Work-package No	Work package title	Type of Activity	Lead partic no.	Lead partic short name	Person-months	Start month	End month
1	Project management	MGT	2	PF	24	1	36
2	Requirements specification and analysis	RTD	2	PF	65	1	23
3	Service discovery and assembly	RTD	5	PM	45	1	30
4	Domain-independent Designs for DODE-SAs	RTD	1	UM	70	1	34
5	Domain-specific design	RTD	4	US	70	4	32
6	Integrated prototype development	RTD	3	SAP	81	4	32
7	Prototype validation	RTD	6	HP	70	13	36
8	Dissemination and exploitation	RTD	3	SAP	28	1	36
	TOTAL				453		

Deliverables List

Del. No	Deliverable name	WP no.	Nature	Dissemi-nation level	Delivery date
D1.1 - D1.3	Periodic and final Management reports	1	R	CO	M12, M24, M36
D2.1.1 - D2.1.3	Service typology, specification and categorization – first, refined and final version	2	R	RE	M6, M12, M23
D2.2.1 - D2.2.3	Scenarios and requirements – first, refined and final version	2	R	RE	M6, M12, M23
D3.1.1, D3.1.2	Assembly Specification Language – first and refined version	3	R	RE	M9, M26
D3.2.1, D3.2.2	Enhanced service model and language specification and service specification meta-data – first and revised version	3	R	RE	M12, M26
D3.3.1, D3.3.2	Automatic translation mechanism - empty shell, revised module	3	P	PU	M15, M30
D3.4.1, D3.4.2	Formal verification mechanism - empty shell, revised version	3	P	PU	M15, M30
D3.5.1, D3.5.2	Composition module - empty shell, revised version	3	P	PU	M15, M30
D4.1.1, D4.1.2	Design of appropriation support mechanism - empty shell, revised module	4	P	PU	M15, M28
D4.2.1, D4.2.2	Designer's Assistant module - empty shell, revised module	4	P	PU	M15, M28
D4.3.1, D4.3.2	Reusable Designs Repository - first version, revised version	4	P	RE	M15, M30
D4.4.1, D4.4.2	Generic visual editor - empty shell, revised module	4	P	RE	M15, M30

D4.5.1, D4.5.2	DODE-SA customisation method - first version, revised version	4	R	RE	M21, M34
D5.1.1, D5.1.2	Specification of domain-specific representations and support mechanisms – first version, refined version	5	R	RE	M12, M26
D5.2.1	Empty Shell Demonstrator of Visual Editor and Designer's assistant modules	5	P	RE	M15
D5.2.2	Updated design of Translation Module and translation mechanisms	5	P	RE	M26
D5.3.1, D5.3.2	Domain specific appropriation support mechanisms – empty shell, revised module	5	P	PU	M15, M28
D5.4.1, D5.4.2	Domain specific framework customisation guide – first version, revised version	5	R	RE	M15, M28
D6.1, D6.2	First and second generation functional prototype	6	P	CO	M21, M32
D7.1	Report on Lab-based usability evaluation	7	R	CO	M21
D7.2	End user evaluation report	7	R	CO	M23
D7.3	Final Evaluation Report and lessons learned	7	R	RE	M36
D8.1	Public Web-Site about the aims and the progress of the project	8	R	PU	M3
D8.2	Web project documentation for consortium and the Commission's representative	8	R	RE	M6
D8.3.1, D8.3.1	Exploitation and Technology Implementation Plan – draft version, final version	8	R	CO	M24, M36
D8.4.1 – D8.4.3	Dissemination reports	8	R	CO	M12, M24, M36
D8.5	ERA contribution report	8	R	RE	M36

Work package Description

Work package number	1		**Start date/event:**		Month 1			
Work package title	Project management							
Activity type	MGT							
Participant number	1	2	3	4	5	6	7	8	9
Participant short name	UM	**PF**	SAP	US	PM	HP	VA	IP	EZ
Person month per partic.	7	11	3	1	1	1	-	-	-

Objectives

Guarantee the successful realisation and conclusion of the project. Implement and maintain an effective administrative and management infrastructure throughout all phases, including effective internal procedures, communication, reporting and meetings. Management of the project by objectives successfully in regards to time, quality, budget, legal and contractual issues. Efficient risk- and quality management.

Description of work

Task 1.1: Scientific, technical management

Administration of the Scientific and Technical content of the project, risk management and problem handling on management circle levels. Co-ordination of knowledge management on consortium level, harmonization of pre-existing know-how and installation of knowledge exchange mechanisms.

- Management of the consortium: legal, contractual, ethical and administrative matters.
- Managing the consortium agreement.
- Overall management and coordination of the project (including circles), ensuring that the project stays focused and that there is a good cooperation and coordination between all work packages.
- Update of the project plan in response to unforeseen events and realized risks (including update of sub-objectives, resource-allocation, milestones, performance indicators) ensuring to reach the overall objectives of the project and clear, common project vision even if sub-objectives are not reachable.
- Overseeing science and society issues.
- Continual risk management (identification, monitoring, reporting of risks, establishing and updating contingency plans: recovery plans and fallback strategies).
- Overlooking the promotion of gender equality in the project.
- Organizing meetings.

Task 1.2: Financial management

Handling of the financial aspects. Making sure that the budget constraints are obeyed. The central co-ordination and co-ordination on circle level contains in detail:

- Preparation of project management documentation for EC, including technical and financial reports.
- Performing day-to-day management as efficient administrative support, financial services, certified financial statements etc.
- Obtaining and checking of audit certificates.

Deliverable

D1.1: Periodic management report (progress, advances and delays in relation to the work program, and the overall project status; measures planned and management measures taken), (M12)

D1.2: Periodic management report (M24)

D1.3: Final management report (M36)

Work package number	2		**Start date/event:**		Month 1			
Work package title	Requirements specification and analysis							
Activity type	RTD							
Participant number	1	2	3	4	5	6	7	8	9
Participant short name	UM	**PF**	SAP	US	PM	HP	VA	IP	EZ
Person month per partic.	10	6	12	10	9	4	6	4	4

Objectives

Development environments designed for end users to bridge the gap between the technical layer of services and the layer of appropriate user interfaces. On the technical level, services are described by specifications of their interfaces and functionality which imposes constraints for possible topologies for assemblies. On the UI level, these technical aspects must be represented in a way appropriate for end users, i.e., taking into account domain specific mental models. This work package will derive empirically grounded requirements for domain-oriented development environments for service assembly (DODE-SAs) from both layers. Implications for the design of DODE-SAs will be analysed.

Description of work

Task 2.1: Technology-driven requirements (Leader: SAP; other partners: VA, HP, IP)

We will identify requirements for ASLs and DODE-SAs in a bottom-up approach analysing various service systems. Furthermore we will analyse and categorize the diversity of service types (such as granularity or functional characteristics).

SAP has based its recent Enterprise Resource Planning (ERP) solutions on platforms with service oriented architecture. In a first step, services of various granularities and characteristics in these platforms will be analysed and categorized since these services have standardized interfaces and data types which eliminate, for example, the complication of data conversions in assemblies.

Task 2.2: Scenario-driven requirements (Leader: US; other partners: PF, UM, PM, HP, VA, IP, EZ)

This task complements the technological requirements analysis of the WP with a top-down approach, to identify the requirements from different application domains, to allow us to extract similarities and differences between the domains. The first iteration of the task will work with two domains; the second iteration will add a third domain to validate the findings of the first iteration. For each domain, we will develop a domain-oriented scenario of innovation, illustrating the long-term impact goals of the project. The participating partners will be split in correspondence to the

scenarios. US, PF, UM and PM will participate in all three scenarios in dependence of their further objectives, while VA participates in scenario one (steel sector), IP and EZ participate in scenario two (energy sector) and HP participates in scenario three (service sector). The development of the scenarios is based on a broad empirical study in which we identify detailed requirements for the construction of DODE-SAs, as well as the working practices of our industrial partners in relation to the proposal objectives, which will be used for the definition of community and appropriation support mechanisms. One important part of the empirical study will be the execution of contextual inquiries to discover users' real tasks, information needs, and vocabularies. Besides these human-centric aspects we will also focus on the service-oriented architectures that are used and maintained in the companies. One aspect of this analysis is the usage of services within the IT-Infrastructure of the companies and another aspect is the creation and adaptation of the service assemblies. The results of our empirical study will make it possible to develop an appropriate prototype in WPs 3-6.

Deliverables

D2.1.1 Service typology, specification and categorization - first version (M6)

D2.1.2 Service typology, specification and categorization - refined version (M12)

D2.1.3 Service typology, specification and categorization - final version (M24)

D2.2.1 Scenarios and requirements - first version (M6)

D2.2.2 Scenarios and requirements - refined version (M12)

D2.2.3 Scenarios and requirements - final version (M24)

Contributions to achieving U-SAY objectives;

WP2 research activities contribute to the achievement of the following strategic objectives of the project:

All scientific and Technical Objectives are supported by this work package, by having the technical requirements and from the end-users elaborated and documented. These requirements will also be used later for the evaluation activities.

Work package number	3		**Start date/event:**		Month 1			
Work package title	Service discovery and assembly							
Activity type	RTD							
Participant number	1	2	3	4	5	6	7	8	9
Participant short name	UM	PF	SAP	US	**PM**	HP	VA	IP	EZ
Person month per partic.	6	4	6	4	21	4	-	-	-

Objectives

WP3 main goal is to enable the generation of an executable process from a service assembly defined in the end user design environment. In particular:

- Generate an abstract and annotated process description as an enhanced service specification from a service assembly
- Formal verification of enhanced service specifications
- Retrieve concrete services able to fulfil the requirements of enhanced service specification from the advanced service registry
- Negotiating of QoS and price for selected services for SLA and contracts.

Description of work:

Task 3.1: Assembly Specification Language (Leader: UM, other partners: PM, SAP)

The Assembly Specification Language (ASL) provides a formal basis for specifying user-oriented designs. The result of the visual design phase is a composition of components understandable at the user level, connected via different types of connectors. This description will be in general at a level of detail lower than the one needed for executable services that are composed in the machine view of the design process. A starting point will be UML notations and associated exchange formats like XMI and XPDL for process descriptions.

Task 3.2: Enhanced service specification with meta-data (Leader: US; other partners: UM, PF, PM, HP)

The aim of the task is to define an enhanced service specification language which describes the composed service at an abstract level, and includes information for architectural styles, semantic annotations, and meta-data that represent collaborative information. This abstract level is the basis for verification and for service composition and procurement.

The enhanced service specification includes global and local QoS constraints, security aspects, and semantic annotations (SAWSDL and possibly new W3C proposals), information identified on

the basis of the scenarios and empirical results of WP2, description of services from users' point of view, social tags (e.g. as demonstrated by Flickr), or examples.

Task 3.3: Translation mechanism (Leader: PM, other partners: UM)

Methods will be studied to transform service assemblies defined in the language developed in T3.1 to an enhanced service representations according to T3.2. The mechanisms will be based on clustering techniques on service assemblies, to identify characteristic patterns for which an enhanced service specification fragment is defined. Several fragments will be derived and composed according to composition rules driven also by context information. To support the translation and composition process, we will design a process registry to store enhanced process specification fragments and related meta-data, dependencies, and constraints.

Task 3.4: Formal verification mechanism (Leader: PM, other partners: UM)

We propose a formal framework for the analysis of service specifications. Such framework will be based on model-checking techniques and on the definition of suitable and special-purpose abstractions for the efficient analysis of these applications. The modularity of modern model-checkers (e.g., Bogor) allows for the ad-hoc tailoring of the state space generation and thus facilitates its analysis. Formal verification will also automatically generate monitoring information for service execution.

Task 3.5: Service composition and procurement (Leader: PM, other partners: HP, UM, PF)

In this task, algorithms for associating concrete executable services to the enhanced service specification will be developed, considering four main problems:

- service selection from enhanced service specifications, using an advanced UDDI registry
- Process optimization, selecting the best concrete services for the composition.
- Service procurement: methods to define an optimal SLA through negotiation and formulating a service contract.
- Service adaptation.

Deliverables

D3.1.1 Assembly Specification Language – first version (M9)

D3.1.2 Assembly Specification Language - revised version (M26)

D3.2. 1 Enhanced service model and language specification and service specification meta-data – first version (M12)

D3.2 .2 Enhanced service model and language specification and service specification meta-data - revised version (M28)

D3.3.1 Automatic translation mechanism - empty shell (M15)

D3.3.2 Automatic translation mechanism - revised module (M30)

D3.4.1 Formal verification mechanism - empty shell (M15)
D3.4.2 Formal verification mechanism - revised module (M30)
D3.5.1 Composition module - empty shell (M15)
D3.5.2 Composition module - revised version (M30)

Contributions to achieving U-SAY objectives:

Wp3 research activities contribute to the achievement of the following strategic objectives of the project:

SO.2.1. Develop an Assembly Specification Language (ASL) for formal specification of service assemblies, through tasks 3.1, whose goal is the development of the Assembly Description Language for an internal representation of user level requirements

SO.3. Formulate an extended service specification, developed in task 3.2, which defines the meta-data used in enhanced service compositions, including Architectural information, QoS information, and Community information, used as a basis for process composition and retrieval from the advances service registry

SO.2.2. Create an automatic mechanism for compiling service designs into service search meta-data, with task 3.3

SO.2.3. Develop Formal Verification Mechanisms for Service Composition, with task 3.4.

In addition, task 3.5 will provide the adaptivity and procurements mechanisms which allow the generation of an executable service composition from an enhanced service specification, and to generate SLA contracts to support and allow monitoring of service executions.

The main goal of WP3 is to guarantee the quality and reliability of the composition, with transformation, composition, adaptation, and formal analysis mechanisms.

Work package number	4		**Start date/event:**		Month 1			
Work package title	Domain-independent designs for DODE-SAs							
Activity type	RTD							
Participant number	1	2	3	4	5	6	7	8	9
Participant short name	**UM**	PF	SAP	US	PM	HP	VA	IP	EZ
Person month per partic.	22	8	21	10	9	-	-	-	-

Objectives

This work package will target the following objectives:

- Definition of integrated appropriation and collaboration support mechanisms for DODE-SAs, and the design of the appropriation and collaboration support module and infrastructure in the architecture;
- Definition of user support mechanisms as embedded in the Designer's Assistant module.
- Create a Reusable Designs Catalogue
- Design a Generic Visual Editor and integrate with Designer's Assistant blueprints
- Provide methodological guidance about how to customise the generic design blueprints into domain-specific environments

Description of work:

Task 4.1: Define appropriation support mechanisms for service compositions (Leader: US, other partners: SAP)

The proposed development of a DODE-SA that enables end users to develop service assemblies must also provide a stronger support for managing this flexibility. Keeping the tool interaction simple and providing good manuals is one strategy, but the adaptation and appropriation of tools is often more of a social activity than a problem of individual learning and use. Knowledge sharing and delegation structures often develop over time. End User Development methods can address the social aspects of computing by treating users as a '(virtual) community of tool/technology users', and by providing support for different appropriation activities that users can engage in to make use of a technology. Therefore we will define appropriation support mechanisms, supporting the development of service assemblies within the DODE-SA. Suitable mechanisms that cover these activities are:

- Articulation Support: Support for technology-related articulations (real and online)
- Historicity Support: Visualize appropriation as a process of emerging technologies and usages, e.g. by documenting earlier configuration decisions, providing retrievable storage of configuration and usage descriptions.
- Delegation Support: Support delegation patterns within configuration activities; provide

remote configuration facilities.
- (Re-) Design support: feedback to designers on the appropriation processes.

Task 4.2: User-support mechanisms (Leader: UM; other partners: US, PF, PM)

The task will analyse the results from WP2, seeking generalities between application domains, to formalise appropriate problem-solving models and patterns which are independent of the application domain. Based on these results, we will develop conceptual models of design assistance, and use these to design the Design Support Module. The task will produce an empty-shell prototype for this module.

Task 4.3: Knowledge structures reuse (Leader: UM; other partners: SAP)

The task will start by discovering commonalities in design patterns and models across the different user scenarios produced by WP2. It will compare the results with the knowledge structures of the Domain Theory (Sutcliffe, 2002) to formulate core knowledge structures. These structures will be used to design and prototype the Reusable Designs Catalogue.

Task 4.4: Generic visual editor (Leader: UM, other partners: PF, SAP)

To support the development of domain-specific visual representations and user-level service assembly languages, this task will design a Generic Visual Editor module, using an appropriate library integrated with the Eclipse IDE, and integrate the designs of the module with the blueprints for the Designer's Support module to enable highly interactive mode of service assembly.

T4.5: Environment customisation method (Leader: UM; other partners: SAP)

Provide methodological guidance about how to customise the generic application framework into domain-specific environments, given observations about domain-specific representations and design needs. This task will be based on reflections and experiences with the actual customisations, and will take into account how domain-independent concepts and reusable patterns can be specialised into domain-specific instances.

Deliverables

D4.1.1: Design of appropriation support mechanism - empty shell (M15)

D4.1.2: Design of appropriation support mechanisms - revised module (M28)

D4.2.1 Designer's Assistant module - empty shell (M15)

D4.2.2 Designer's Assistant module - revised module (M28)

D4.3.1 Reusable Designs Repository - first version (M15)

D4.3.2 Reusable Designs Repository - revised version (M30)

D4.4.1 Generic visual editor - empty shell (M15)
D4.4.2 Generic visual editor - revised module (M30)
D4.5.1 DODE-SA customisation method - first version (M21)
D4.5.2 DODE-SA customisation method - revised version (M34)

Contributions to achieving U-SAY objectives:

SO.1.1.1 Develop effective support mechanisms for Service Assembly Design by non-programmers., through Tasks 4.2., 4.3 and 4.4.

SO.1.1.2. Develop Appropriation Support mechanism for Collaborative Service Composition, through Task.4.1

SO1.2.2. Develop a Domain Customisation method through Task 4.5.

SO.4. Formulate Collaborative Design patterns and mechanisms, through Task 4.1.

TO.1.1. Develop a domain-independent Application Framework, through all Tasks in this WP.

Work package number	5		**Start date/event:**		Month 5			
Work package title	Domain-specific design							
Activity type	RTD							
Participant number	1	2	3	4	5	6	7	8	9
Participant short name	UM	PF	SAP	**US**	PM	HP	VA	IP	EZ
Person month per partic.	14	9	22	12	-	4	6	3	-

Objectives

This WP will develop the domain-specific parts of the user-oriented service assembly environment for each application area; it will:

- Systematically adapt the application framework developed on WP 4 to each of the three application domains
- Develop domain-specific representations, seed the reusable patterns, customise user support mechanisms and construct domain-specific designs, including representations and metaphors that allows using the DODE-SA in an easy way
- Provide the users with powerful interaction mechanisms based on ‘natural programming’.
- Provide a mapping model and translation mechanism between the domain-specific representations and the domain-independent assembly specification language (D3.1).
- Define and develop domain-specific specializations of appropriation support mechanisms that also address the informal handling of legacy systems

Description of work:

Task 5.1: Domain-specific representations and support mechanisms (Leader: UM; other partners: US, SAP)

We will apply findings from scenario-driven requirements and user feedback to the mock-ups to prepare preliminary suggestions for user-oriented representations for each of the target application areas. We will then compare this with existing theoretical models of "natural programming” and their supporting experimental findings, thus clarifying the boundary between domain-independent and domain-specific findings. Based on this, we will first develop domain-specific representations and metaphors, and this will be followed by the development of domain-specific mechanisms underpinning the designer’s assistant module, and the seeding of the reusable patterns repository. Iterative participatory design will be used to create the DODE-SA, so that end users will be shown early low-fidelity prototypes (e.g., paper prototypes), and the emerging implementation of the DODE-SA will be continuously refined and tested with users.

Task 5.2: Define mappings to ASL (Leader: UM; other partners: SAP)

We will first create conceptual mapping between the domain-independent assembly specification language (ASL – D3.1), and the domain-specific representations created by T5.1. (D5.1) Using the conceptual mapping, we will proceed to create an automatic translating module for each of our application domains (D5.2). To reduce programming effort and address the economic viability of domains-specific environments, we will be aiming to maximise the reuse between different domains.

Task 5.3: Domain specific appropriation support (Leader: US, other partners: PF, UM, SAP, VA, IP)

This task addresses the goal to leverage the general appropriation support mechanisms developed in Task 4.1 to specific domains. This comprises

- The design of representations and metaphors to allow deictic references to the technological, organisational and social context of a service architecture in the use scenarios
- The specialisation of means to support articulation, negotiation and delegation to involve all stakeholders and users in the use scenarios.
- The scenario-specific collection and integration of additional knowledge resources like documentation, manuals, help systems, etc.
- The development of strategies and tools to integrate appropriation support means of the framework with the infrastructure in the application fields efficiently. This includes appropriate historicity support.

The metadata structures provided for appropriation support from Task 4.1 will be filled with the appropriate data from the use scenarios. An appropriate interface to support local user communities and connect them to global communities will be provided.

Task 5.4: Customise framework to a specific application domain (Leader: SAP; other partners: HP, PF, UM, US, VA, IP)

This task will implement the domain customisation guidance of D.4.5 to systematically construct domain-specific designs for a DODE-SA. This will take into account the needs of the scenarios associated with each application domain.

Deliverables (brief description) and month of delivery

D5.1.1 Specification of domain-specific representations and support mechanisms – first version (M12)

D5.1.2 Specification of domain-specific representations and support mechanisms – final version (M26)

D5.2.1 Empty Shell Demonstrator of Visual Editor and Designer's assistant modules (M15)
D5.2.2. Updated design of Translation Module and translation mechanisms (M26)
D5.3.1 Domain specific appropriation support mechanisms – empty shell (M15)
D5.3.2 Domain specific appropriation support mechanisms - revised module (M28)
D5.4.1 Domain specific framework customisation guide – first version (M15)
D5.4.2 Domain specific framework customisation guide – revised version (M28)

Contributions to achieving U-SAY objectives;

WP5 research activities contribute to the achievement of the following strategic objectives of the project:

SO.1.1.1. Develop effective support mechanisms for Service Assembly Design by non-programmers, through task 5.1.

SO.1.1.2. Develop Appropriation Support Mechanisms for Collaborative Service Composition, which is achieved by task 5.3, where we will develop domain-specific appropriation support mechanisms.

SO.1.2.1. Develop domain-optimised Service Composition Representations and Metaphors, is addressed by task 5.1, where we will develop domain-specific representations.

SO.2.1. Develop an Assembly Specification Language (ASL) for formal specification of service assemblies. This objective is addressed by task 5.2 by the definition of mappings to the ASL.

The main goal of WP5 corresponds to TO.1.2. (Develop DODE-SA.)

Work package number	6		**Start date/event:**		Month 4			
Work package title	Integrated prototype development							
Activity type	RTD							
Participant number	1	2	3	4	5	6	7	8	9
Participant short name	UM	PF	**SAP**	US	PM	HP	VA	IP	EZ
Person month per partic.	10	12	26	6	4	12	6	5	-

Objectives

- Ensure the integrated development of the various components of the DODE-SA into functional prototypes realising the end-user scenarios from WP 2.

Description of work

Task 6.1: User oriented design components (Leader: SAP, other partners: US, IP, UM, VA)

Develop components handling the interaction between the user and the development environment, including the visual editor and the designer's assistant. Definition of acceptance and unit tests for these components. Definition of integration tests for relevant empty shells developed in WP 3-5.

Task 6.2: Collaboration and appropriation support components (Leader: SAP, other partners: UM, US)

Development of components providing mechanisms for collaborative development, including the connection to shared knowledge spaces such as Wikis or shared model repositories. Definition of acceptance and unit tests for these components. Definition of integration tests for relevant empty shells developed in WP 3-5.

Task 6.3: Machine oriented components (Leader: PF, other partners SAP, UM, PM)

Develop formal components underlying the interaction layer. These components would include an engine translating the assembly specification into the enhanced service specification as well as a formal verification engine. Definition of acceptance and unit tests for these components. Definition of integration tests for relevant empty shells developed in WP 3-5.

Task 6.4: Monitoring and feedback component (Leader: HP, US)

Development of the runtime components associated with the execution of services and their exposure to the web where they may be consumed by suitable runtime environments. Definition of acceptance and unit tests for these components. Definition of integration tests for relevant empty shells developed in WP 3-5.

Task 6.5: DODE-SA middleware and infrastructure (Leader: SAP, IP, HP)

Specification of interfaces between DODE-SA components. Development of integrating infrastructure for DODE-SA components. Definition of acceptance and unit tests for middleware and infrastructure. Definition of integration tests for relevant empty shells developed in WP 3-5.

Task 6.6: Integration and testing (Leader: PF, other partners: SAP, US, HP, IP, VA)

Definition and execution of integration tests for the software components developed in the previous tasks of this work package. Provision of soft- and hardware infrastructure for continuous integration (build server, bug tracking, and code versioning system).

Execution of unit tests for the individual software components, these unit tests have to be defined within the responsible tasks 6.1 - 5. Feedback of test results to tasks 6.1 - 6.5.

Deliverables

D6.1 First generation functional DODE-SA prototypes (M21)

D6.2 Second generation functional DODE-SA prototypes (M32)

Contributions to achieving U-SAY objectives;

The user-centred approach of U-SAY requires the development of functional prototypes that can be evaluated by end users under realistic circumstances. Integrated development is therefore a cross sectional activity that serves all technical objectives as stated in Table 1.

Work package number	7		**Start date/event:**		Month 13			
Work package title	Prototype validation							
Activity type	RTD							
Participant number	1	2	3	4	5	6	7	8	9
Participant short name	UM	PF	SAP	US	PM	**HP**	VA	IP	EZ
Person month per partic.	10	3	8	8	-	23	8	6	4

Objectives

Functional verification and usability validation according to the results of WP2**.**

Description of work

Task 7.1: Early usability validation - lab-based usability of prototype (Leader: UM, other partners: US)

The cooperative evaluation method (Monk et al 1993) will be used to diagnose operational problems with the user interfaces and combined with cognitive walkthrough techniques to analyse the users' mental model of the USAY DODE-SA and application composition process. This task will prepare evaluation material and diagnostic guides so that observed errors can be interpreted in terms of design problems by non expert as well as expert personnel. Lab based evaluations will be carried out on the DODE-SA - end user developer interfaces and the generated applications in a sample domain.

Task 7.2: Validation with end users - did the prototype meet their requirements (Leader: HP, other partners: IP, VA, EZ, PF, US, SAP)

This evaluation will involve end user software engineers with realistic tasks for composing applications using the USAY DODE-SA in one of the chosen application domains. The methods developed in task 7.1 will be applied, and complemented with evaluation workshops after testing to debrief participants and elicit further understanding about the reasons for operational problems and suggestions for design improvements. This cycle of evaluation will cover 3 interfaces (a) editors and configuration of the DODE-SA for a new application domain, (b) interfaces for application composition using the configured DODE-SA and (c) the generated application. The generated application will be evaluated with a different set of application end users (e.g. chemical engineers) to test whether the generated system achieves acceptable usability. Usability testing in this task will be carried out at the premises of the application domain partners.

Task 7.3: Reflection and lessons learnt (Leader: HP, other partners: UM, US, VA, IP, EZ)

This task will adopt a contextual evaluation approach in which the USAY system is used in realistic tasks in partner workplaces e.g. to generate application software and test operational use over a realistic time period (3-4 months) in the format of beta release/user acceptance testing. Use of the 3 interfaces will be investigated with ethnographic techniques to observe use, with follow up interviews to ascertain any remaining problems and suggestions for improvement. End users and software engineers will keep diaries to record critical incidents, and post notes to a Wiki site recording problems. Lessons learnt will be documented to feed into plans for future developments as well as preparing user manuals and management guidance for deployment of USAY software.

Deliverables

D7.1. Report on Lab-based usability evaluation (first cycle M21)

D7.2 End user evaluation report (first version - M23)

D7.3 Final Evaluation Report and lessons learned (final version - M36)

Contributions to achieving U-SAY objectives:

WP7 will contribute to enforce the user centricity of the overall project approach. The activities of this WP will ensure the usability of the DODE-SA with real world experiments, and will assess at the same time its usefulness from end-user perspective. WP7 will adopt an incremental and cyclic approach to ensure that feedback collected from end-users during evaluations will guide the other work packages. WP7 activities will contribute to address potential issues and to focus research and development efforts towards a concrete and relevant end-users expectations. The evaluations and reports produced by WP7 will support the objective SO.4: the analysis of the WP7 artifacts will help in formulating collaborative design patterns and mechanisms. Furthermore WP7 will help in testing and refining the design oriented infrastructure addressed by the objective TO.4. Finally, WP7 will contribute with its realistic experiments to stimulate the design innovation and expertise sharing among users, as addressed by project objective EO.4.

Work package number	8		**Start date/event:**		Month 1			
Work package title	Dissemination and exploitation							
Activity type	RTD							
Participant number	1	2	3	4	5	6	7	8	9
Participant short name	UM	PF	**SAP**	US	PM	HP	VA	IP	EZ
Person month per partic.	2	2	10	4	3	3	2	2	-

Objectives

The main goal of this task is to explore early on within U-SAY different ideas and strategies which will lead to effective industrialisation and exploitation of project results in the future. To this end, this work package has three major objectives:

- Gain early market feedback regarding the business potential
- Develop exploitation concept
- Identify, assess and verify exploitation of the expected research results

Description of work:

Task 8.1: Exploitation (Leader: SAP, other partners: VA, IP, EZ, PF, HP)

In order to provide a sound basis for the exploitation of the project results, the initial task is to perform a market overview on the potential impact of the expected research outcome. This market overview will be conducted by using experience and expertise from selected groups (e.g. development department, marketing specialists, or users). Complementary to this market overview, the second part of the preparatory work is to analyze the competitive environment and to prepare a report on the foreseen competitive advantage.

An exploitation opportunity identification to be updated throughout the project will ensure that the consortium does not lose sight of exploitation issues. This plan includes the identification of potential transfer targets within the individual organizations, the further monitoring of market developments, as well as the preparation of decisions if results of market overview or requirements of transfer targets require adjustments to the project. As a result of these application partners will create an individual exploitation plan incorporating the business / transfer opportunities for major innovations within their target markets/groups. In particular, SAP will explore the exploitation strategy into future product lines targeting the SME market. VA will establish an exploitation strategy for immediate deployment of service composition facilities across the VA group. This plan will also demonstrate how the output of the project will be usable by companies beyond the consortium in the future.

Task 8.2: Dissemination (Leader: UM, other partners: US, PM, PF, SAP, HP)

Dissemination in the **Scientific domain** will use traditional means like conferences and journal papers to transfer know-how to other European Scientists. Feedback gathered will be used to improve the scientific models and approaches for the second phase of conceptualization and development. Additional Scientific Dissemination is done within the ERA and Cluster Concertation Activities (see Task 8.3).

Dissemination in the **Business Domain** will be mainly based on the networks of individual partners (but see also T8.3).

Dissemination in the **Technical Domain** will be based on using concepts of the Open Source Community and NESSI technology platform (SAP and HP). Here mainly Software, accompanying documentation and User Manuals will be made available. To be able to reach the Open Source community also after the funded project phase in order to keep a sustainable community and to have an open source base for a future U-SAY product, the partners will either provide a web site that will be maintained for a longer period or a Open Source portal like sf.net will be used to provide the code, its documentation and user manual to the community. The publicly-available deliverables will be packaged together with the source code to be available also after the funded period of the project.

The U-SAY consortium will organize two dissemination workshops, one targeting the scientific and one targeting the technical community.

Task 8.3. ERA Contribution and Cluster Concertation Activities (Leader: UM other partners: US)

Project partners will participate in clustering activities, which seek to integrate EC-funded effort in the area of business networks, and to shape future work in the area. Existing links with European activities in the area of Services will be expanded in the direction of regional and national initiatives, seeking to develop a programme of coordinating and disseminating research results within relevant ERA activities, plus reflection on the cross-fertilisation between the project and related national and European projects.

Results will be reported in Deliverable D8.5.

Deliverables

D8.1 Public Web-Site about the aims and the progress of the project (M3)

D8.2 Web project documentation for consortium and the Commission's representative (M6)

D8.3.1 Exploitation and Technology Implementation Plan – draft version (M24)

D8.3.2 Exploitation and Technology Implementation Plan – final version (M36)

D8.4.1-3 Dissemination reports (M12, M24, M26)

D8.5 ERA contribution report (M36)

Summary of Staff Effort

Partic. No	Partic. Short name	WP1	WP2	WP3	WP4	WP5	WP6	WP7	WP8	Total person months
1	UM	7	10	6	22	14	10	10	2	81
2	PF	11	6	4	8	9	12	3	2	55
3	SAP	3	12	6	21	22	26	8	10	108
4	US	1	10	4	10	12	6	8	4	55
5	PM	1	9	21	9	0	4	0	3	47
6	HP	1	4	4	0	4	12	23	3	51
7	VA	0	6	0	0	6	6	8	2	28
8	IP	0	4	0	0	3	5	6	2	20
9	EZ	0	4	0	0	0	0	4	0	8
Total		24	65	45	70	70	81	70	28	453

B1.3.4 List of Milestones

Milestone number	Milestone Name	Work package involved	Expected date	Means of Verification
1	First version of requirements	WP 2	M6	Industrial partners agree on the requirements
2	Empty shell prototype	WP 3, 4, 5	M15	Successful execution of acceptance tests
3	First generation functional prototypes	WP 6	M21	Successful execution of acceptance tests
4	Formative evaluation, lessons learnt from first cycle, requirements refined	WP 2, 7	M23	End-users have evaluated the 1st prototype positively, according to requirements
5	Second generation functional prototype	WP 3 - 6	M32	Successful execution of acceptance tests
6	Validation of 2nd generation prototype	WP 7	M36	End-users have evaluated the 2nd prototype positively, according to refined requirements

B1.3.5 Graphical Representation of Work Packages and Tasks (Pert Diagram)

Figure 7 provides a graphical overview of the dependencies between the different workpackages, expressed as solid arrows linking the different workpackage rectangles. Our approach has two iterations and the feedback from the prototype development and validation activities of the first iteration to the theoretical and conceptual design workpackages of the second iteration is represented by a dashed line.

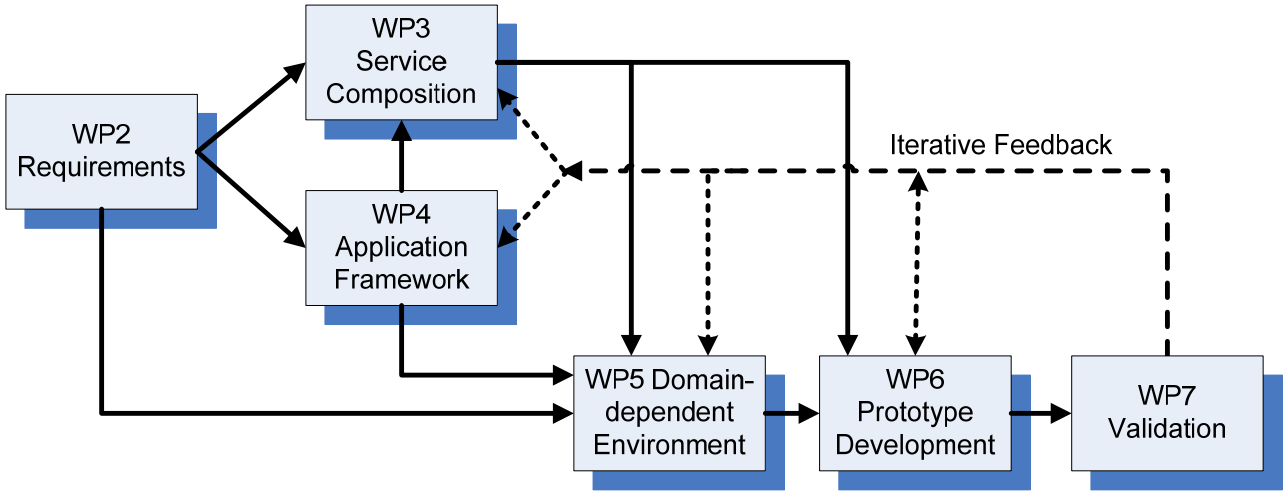


Figure 7: Graphical representation of work packages and their interdependencies

B1.3.6 Risk Management

The project manager takes care of the risk management within the management circle. The management circle will work out an early warning system, to assure that risks identified are monitored by the work package responsible partners, in order to allow early measure to take place to resolve potential risks.

In the following risks and contingency plans for the individual work packages are discussed.

WP1 - Project management:

Risk 1.1: Due to unexpected complexity a Partner's effort is higher than estimated

Contingency Plan 1.1:. The assumption of closed world applications, where the services to be integrated are developed using a common conceptual framework and agreed metadata and semantic annotations, will limit this risk.

Risk 1.2: Inter-work package dependencies: The above depicted inter-work package dependencies depicted on Figure 7 can pose a risk in the sense of that the results of a task are insufficient for the continuation of another task.

Contingency Plan 1.2: The participations of partners in the individual tasks has been developed in a way that allows individual partners to participate across work packages being able to bring forward the results of a task and bring backwards the requirements of the subsequent (dependent) task.

Risk 1.3: Too Ambitious goals

Contingency Plan 1.3: The used SCRUM method for software development requires involvements of all three partner types, the researchers, the software developers, and the end-users. This allows that at early stages potential risks are identified. . The SCRUM control mechanisms will uncover serious problems early. Additionally the empty shell prototype allows early identification of serious problems, leaving time within the project to bypass such problems.

WP2 - Requirements specification and analysis:

Risk 2.1: A construct required by the technical side can't be represented on the user side

Contingency Plan 2.1: To handle this risk, technical objective TO.2- Assembly guidance and composition verification system will support the end-users in a way that will support them in being able to provide the required "ASL" (Assembly Specification Language) output. The involvement of partners which have a high level of experiences in EUD (End User Development) lowers this risk.

Risk 2.2: A construct required by the user side can't be represented on the technical side

Contingency Plan 2.2: EUD provides standard methods and means to compose constructs required by users from smaller technical components.

Risk 2.3: The complexity of the end-user domain does not allow (with reasonable effort) to be described using formal technical descriptions

Contingency Plan 2.3: Experienced partners will guide end-users in selecting a problem of appropriate size. If at a later stage of the project it is recognised that the problem is too large, then either a more abstract scenario is derived from the original scenario, or a sub-part of the original scenario is selected for being used further in the project. How ever details of the cause will be documented to inform the exploitation of the project's results after the funded phase.

WP3 - Service discovery and assembly:

Risk 3.1: Automatic translation from end-user views expressed as assembly specifications into enhanced service specifications at machine view level fails

Contingency Plan 3.1: To cope with such risks, we assume that reusable designs and domain concepts contain structural and semantic information which can be used to drive the service specification composition. Services at the machine level will be developed as compositions of annotated BPEL process fragments, which will be available in correspondence to domain concepts and designs, and will be integrated during the translation phase. The assumption of closed world applications, where the services to be integrated are developed using a common conceptual framework and agreed metadata and semantic annotations, will reduce the complexity of this problem.

Risk 3.2: Providing feedback to the user after formal verification in terms of user level concepts fails

Contingency Plan 3.2: In addition, in case the translation cannot be fully automatised, we can insert some adjustment mechanisms through formal verification, pointing out inconsistent compositions during design, and after service selection, generating monitors and feedback mechanisms to support self-healing behaviour during execution.

WP4 - Domain-independent designs for DODE-SAs:

Risk 4.1: The design of the domain-independent application framework is technical and conceptual too complex, rendering some of more ambitious results and support mechanisms not feasible.

Contingency Plan 4.1: We would therefore start by exploring these complex areas with the highest risk, undertaking exploratory proof-of-concept prototyping of these areas early on in the project lifecycle. This will allow us to refine goals or re-deploy resources as appropriate. End-users are integrated in early stages of this project highlighting potential risks.

WP5 - Domain-specific design:

Risk 5.1: Misfit between domain-specific metaphors and representations. and the users' expectations.

Contingency Plan 5.1: Closely involve end users in the design process, to ensure the creation of appropriate representations. Task structure demonstrates a design in two improvement cycles. Task leaders maintain constant contact with the end users.

Risk 5.2: Incomplete integration of the specialized DODE-SA with traditional service infrastructures in the application domains

Contingency Plan 5.2: U-SAY employs a dual strategy that aims at either providing interfaces to existing infrastructures or providing means to describe and annotate ways to handle any inconsistencies.

Risk 5.3: Available Domains represent only a fraction of possible service environments

Contingency Plan 5.3: Choice of three quite diverse scenarios for requirements elicitation and evaluation already covers a number of service environments, and a continuous exchange of knowledge and experience between the researchers active in the scenarios will ensure that similarities and differences within the challenges encountered in different application domains will be discussed and addressed.

WP 6 - Integrated prototype development:

Risk 6.1: Significant delay/failure of component development or integration

Contingency Plan 6.1: The project is organized in two phases such that integration problems can be detected as early as possible. To establish early indicators of development and integration problems, the SCRUM methods of rapid application development will be implemented. This method allows breaks the development cycles into shorter sprint phases with defined intermediate objectives. The SCRUM control mechanisms will uncover serious problems. After each sprint phase the overall planning will be adjusted to optimize the results based on the actual current state. Should fundamental problems occur, they will become visible during the first development cycle. In the worst case where problems of development are an expression of misconception in WP 3, 4, and 5, the first development cycle might be terminated ahead of schedule to created time for an extension of the second development cycle that would have to start refinements at a lower level.

Risk 6.2: The technical complexity of a required legacy system requires too much effort for an interface to be implemented within the project's runtime.

Contingency Plan 6.2: Due to the advanced know-how and experiences of the involved software partners, this risk is limited. However if such a situation is encountered, first a web-service stub is considered, to cover the complexity of connecting to a legacy system. If this does not resolve the problem, a SQL database with provides the required information will be implemented, emulating the legacy system.

WP8 - Dissemination and exploitation

Risk 8.1: A scientific and technological breakthrough is achieved by a organisation outside the consortium

Contingency Plan 8.1: Continuous monitoring by the dissemination partners in the scientific community of results will limit this risk. The contributions to standard will also cover a main part of this activity.

B2. IMPLEMENTATION

B2.1 Management Structure and Procedures

The project management approach considered for U-SAY is based on management plans and techniques which have been used successfully for current and previous international research projects (e.g. MaBE, Plexus, CrossWork, SUDDEN).

The University of Manchester as the coordinating organisation has been involved in a number of European research projects focusing on high-tech hardware and software solutions for the producing industry as well as new management approaches. The coordinator Dr. Mehandjiev has been involved in several projects mainly in the GROWTH and in the IST program. The project management will be put into practice by Mr. Hämmerle from Profactor, who successfully managed the international research projects MaBE and CrossWork according to management principles which are the basis for U-SAY. Mr. Hämmerle has will also be supported by Profactor's Project Management Office. The primary aim of the management principles for U-SAY is to be capable of responding to the needs of an international research project without being intrusive or costly. The building-in of flexibility was one essential aspect while defining the management structure and procedures, which will be described in the following.

B2.1.1 Organisational structure

The organisational structure of U-SAY is separated into four different circles, cf. Figure 8. Led by the project coordinator the management circle is the supervisory body for project execution and the decision-making body in all relevant project matters. Members of the management circle are the coordinator, the project manager and representatives from the thematic circles' leading partners. Thematic circles will be established to deal with scientific, technological and industrial issues, respectively.

The University of Manchester is leading the scientific circle. The major task of this role is to synchronise the scientific research activities towards the achievement of the scientific objectives. SAP is leading the technological circle, synchronising the development activities which are necessary to transfer the requirements and the scientific results into a prototype DODE-SA. Profactor has the leading role within the industrial circle. The activities in this circle are focused on the gathering of requirements and the validation of project results. In the following we will further specify the responsibilities of the management circle.

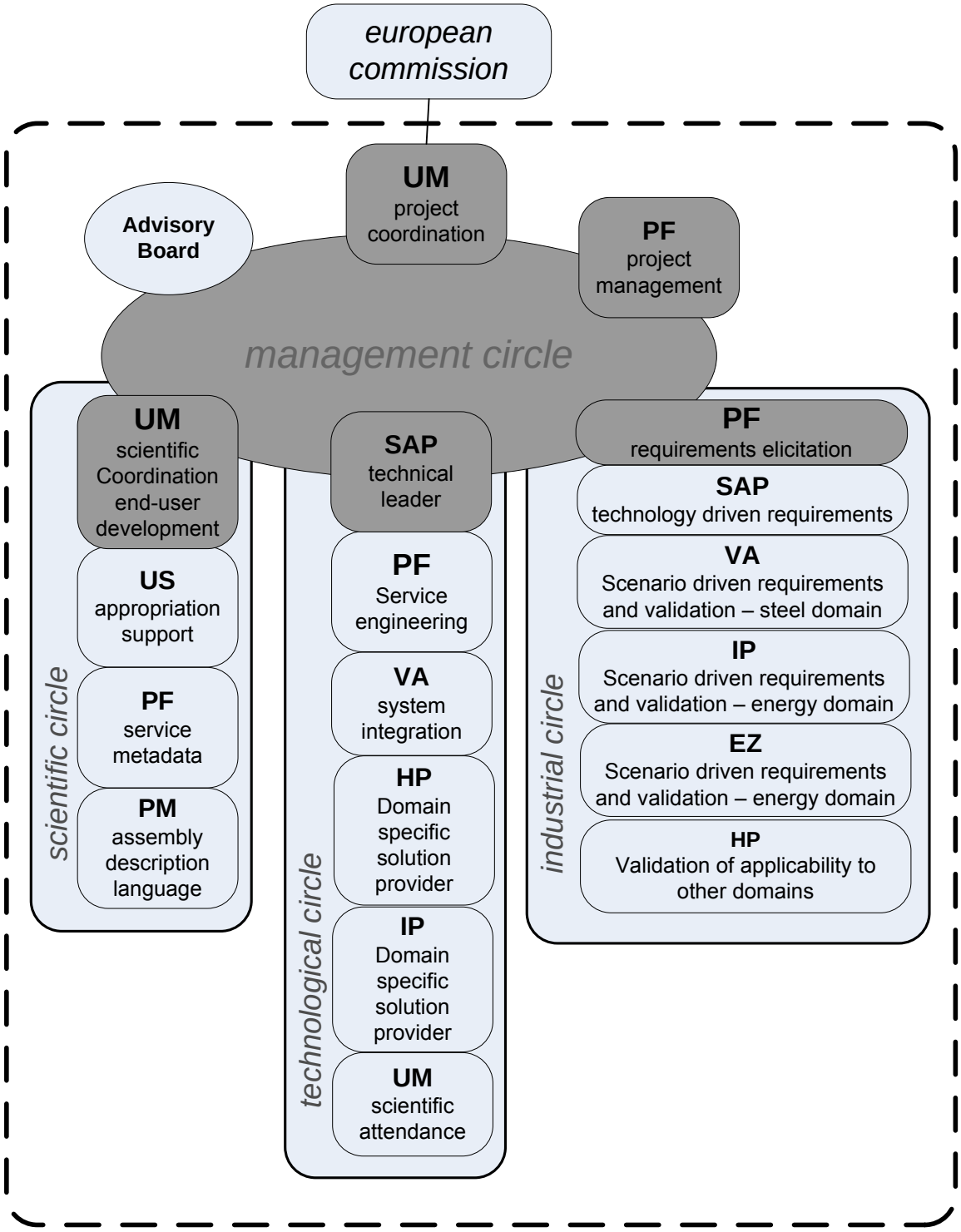


Figure 8. Management Structure

The management circle

The management circle will monitor and assess the progress of the project and make recommendations for appropriate amendments to the work plan as required. It will review the policy and strategies of exploitation and publicity, in particular with regard to the releasing of project information to the outside world. The management circle assumes overall responsibility for liaison between the project partners, for analysing and approving results, for proper administration of the project and for implementation of the provisions contained in the Consortium Agreement. In particular, the management circle shall be responsible for:

- supporting the coordinator and the project manager to fulfil the obligations towards the European Commission;
- ensuring that all work of the project meets functional requirements;
- representing the interests of the thematic circles (namely the scientific, technological, and industrial circle);
- agreeing press releases and joint publications by project partners with regard to U-SAY;
- agreeing on procedures and policies for dissemination of Knowledge from the project which is not to be used by the project partners;
- checking the progress of the project;
- co-ordinating the research and development teams;
- advising and directing the partners on the developments necessary for the Project,
- permit formal exchanges of information between the partners.

The management circle decides in cases of

- co-ordination, preparation and final approval of reports (technical, financial, etc.) prior to the submission to the European Commission,
- all budget-related matters,
- definition, allocation of tasks and changes in work sharing,
- the exclusion or penalisation of project-partners due to not adequate performance,
- the structure and restructuring of the project,
- the alteration of the Consortium Agreement, and
- the premature completion/ termination of the project.

For strategic decisions the management circle may consult the advisory board described at the end of Sec. B2.1.

B2.1.2 Meetings of the management circle

The management circle shall convene with the representatives of the project partners and the project coordinator's representative as chairperson. The management circle should meet at least quarterly in principle at the request of its chairman or at any other time when necessary at the request of 30 % of the project partners or at the request of one member of the management circle. Meetings shall be convened by the chairman with at least fifteen (15) calendar days prior notice with an agenda.

B2.1.3 Decision-making mechanisms

Decisions concerning normal running of the project and concerning strategy will be taken by the management board and will be reached unanimously. In cases where unanimous decisions are not possible, each partner will have one vote and a majority vote will be applied. Each partner has the

right to veto decisions that would seriously affect their work. The veto has to be written and has to make clear suggestions for alternative solutions. After carefully appraising the specific interest of this partner against the overall goals of the project, it will be the coordinator's decision whether the veto is granted.

If a partner leaves the project, the consortium will look for a partner with comparable expertise which is commonly accepted. Decision making will be further detailed in the Consortium Agreement.

Operative decisions: The responsibility of decision-making on the level of individual tasks in the workplan is clearly linked to the partner leading this task. In case of conflicts between task-level decisions it is the responsibility of the corresponding work package leader to decide.

Tactical decisions: If there are any relations to other research or development activities (across work packages), decision-making is done within the responsible thematic circle. The circle leader is coordinating this process and informs the project manager. If the decision making process influences objectives or activities of other circles - or if no satisfactory solutions can be found within the thematic circle - the responsibility for the decision making process goes up to the management circle, in which case the project manager coordinates the decision-making process.

Strategic decisions: If decision-making is concerning strategic objectives, the control flow goes up to the management circle in any case. The project manager is responsible for coordinating the decision-making process on strategic level.

B2.1.4 Rules of voting and decision making

If it comes to voting within the management circle or thematic circles, respectively, each member of the circle has one vote. All decisions will be taken by the majority vote of the circle members. In case of offline voting it is the majority of all circle members, in case of voting at circle meetings it is the majority of circle members present at the circle meeting. Management as well as thematic circle meetings shall constitute a quorum if at least seventy-five (75) percent of the circle members are present or duly represented by proxy. Any decision requiring a vote at a management or thematic circle meeting must be identified as such on the meeting agenda.

B2.1.5 The advisory board

The advisory board will provide scientific and technological consultancy to the management circle, but will not enjoy voting rights for decision-making. Members of the advisory board are prominent people from academics as well as from industry not active in the project. All of the following members have confirmed their participation in the U-SAY advisory board:

- **Len Bass** is a Senior Member of the Technical Staff of the Software Engineering Institute of Carnegie Mellon University. He works on the design and analysis of software architecture and supporting usability through software architecture, and participates in the High Dependability Computing Program. He has written two award-winning books in software architecture, and has been involved in the development of numerous production systems, including database systems and automotive systems. His contributions center on the use of scenarios and software architectural tactics to achieve quality attributes of resultant software systems.
- **Gerhard Fischer i**s full professor and director of the Center for LifeLong Learning and Design at the University of Colorado, Boulder. He is a recognized expert in end-user development and is the creator of the concept of a "domain-oriented design environment" (DODE) and "meta-design" as the evolutionary process of designing DODEs.

- **Jana Koehler** is manager of the Business Integration Technologies group in the Services and Software Department of the IBM Zurich Research Lab. The group works on model-driven technologies for Business-IT integration based on Service-Oriented Architectures. Jana Koehler built up this new research area that focuses on the intersection between services and software after joining IBM in Spring 2001. Prior to her work for IBM, she has been working at the German Research Center for AI, the International Computer Science Institute at Berkely, the University of Freiburg, and Schindler AG. Jana Koehler won several scientific and best-paper awards and was nominated full and associate professor in Computer Science.
- **Stefano De Panfilis**: is the Director of the Research & Development Laboratory of Gruppo Engineering, leading a team of about 100 resources in Italy and Europe. He is coordinating SeCSE (IST 6FP), which aims of implementing a platform to support Service-Centric Systems Engineering, with consortium including PM (CEFRIEL). He is also the person responsible for the Strategic Research Agenda of NESSI, the European Technology Platform on Software and Services, and his appointment as a member of the Strategic Advisory Board will ensure alignment between the work of U-SAY and the NESSI Research Agenda.
- **Boris De Ruyter** is a Principal Scientist from the Media Interaction Department Philips Research Europe. He has more than 11 years of experience in heading international and multi-disciplinary research projects. He works on user-system interaction research with Philips Research Labs since 1994. He is an author of multiple international publications and owns numerous patents, and one of the long-term supporters for End User Development in the domain of Home Entertainment and Automation, actively participating in the EUD-Net Network of Excellence.

B2.2 Individual Participants

The University of Manchester

The University of Manchester (UM)

The University of Manchester brings together the strengths of the Victoria University of Manchester and UMIST into a leading UK university with close links to industry. The School of Informatics has participated in a number of large EC- and EPSRC-funded research projects aiming to achieve user-friendly systems evolution, with more recent examples such as e-Utilities, EUD-Net, SaaS, MaBE, CrossWork, SUDDEN. The latter projects are concerned with intelligent service infrastructures. The SaaS (Software-as-a-Service) project was an early academic exploration of the concept of software provided as a service at the point of need, assembled from fine-grained sub-services for every instance of use. Its aim was to replicate the flexibility of service-based organisations in software. MaBE delivered software infrastructure framework for service composition and ontology evolution, whilst CrossWork explored the concept of emergent service composition using workflow technologies, and continued the work on aligning distributed ontologies using devolved ontological structures and formal concept analysis.

In the area of End User Development, the University of Manchester team has been a managing node of the EC-funded network of excellence on end user development (EUD-net), and guest editors of the Communications of ACM's special issue on End User Development, a recognition of their expertise in the area of task-specific models, visual representations and socio-economic models of end user development.

In U-SAY, UM will act as project coordinator and main scientific partner. UM's team has experience in running a multitude of RTD projects, including coordinating two STREPs under FP6. In the RTD activities, UM will lead WP 4, using its expertise in architectures and reusable knowledge structures underpinning DODEs to develop the generic application framework, and will also lead the natural programming aspects of contextual enquiries in WP2, the design of representations work in WP5 and the lab-based useability studies in WP6 to create and validate domain-specific languages and representations; It will also participate in the "downstreaming" activities in WP6 in collaboration with the technical partners on the project.

Key personnel available to the project

Dr. Nikolay Mehandjiev obtained a PhD for his work on User Enhanceability through Visual Programming, where he created a distributed visual language and environment to support end users in changing their workflow applications. He is currently a Senior Lecturer at the University of Manchester, with visiting positions at BT Labs (UK), UNSW (Australia), SAP Research (Germany) and Atos Origin (Spain). He researches ultra-flexible service-based software using multi-disciplinary approach based on software engineering principles. He has participated in a number of EC- and UK-funded projects, for example he lead the University of Manchester's participation in CrossWork, MaBE, SUDDEN and EUD_Net, and served as the project coordinator for SUDDEN and CrossWork.

Professor Alistair Sutcliffe (MA Cantab-Natural Sciences, PhD Wales) is Professor of Systems Engineering, and Director of the Centre for HCI Design, in the School of Informatics, University of Manchester, UK. He is the Founder and Chair of the IFIP TC-13 Working Group 13.2 on Methodology for User Centred Design. He was awarded the IFIP Silver Core in 1999 for leadership

in HCI, and is a member of IFIP Working Groups 8.1 and 2.9. He is a member of Editorial Boards for the International Journal for Human Computer Studies, the Journal of Automated Software Engineering, and the Requirements Engineering Journal. He has served as an invited plenary speaker at a number of conferences. Professor Sutcliffe investigates human-computer interaction (HCI) in knowledge representation, cognitive modelling, design methodologies for multimedia and VR systems, and visual HCI. He also researches into software engineering on issues including requirements engineering and analysis, software re-use, structured development methods and business process design. Industrial collaborators include ERA Technology and the Metropolitan Police, as well as Marconi Electronic and Naval Systems. He currently manages EPSRC projects ADVISES (E-science requirements analysis and visualisation) and ESRC/EPSRC Foresight project Developing Theory for Evolving Socio Technical Systems and was recently PI of EPSRC projects SIMP- Systems Integration for Major Projects, ISRE Immersive scenario based Requirements Engineering and CORK Corporate Knowledge Repository. His doctoral students work on design of visual HCI for information browsing and retrieval, and on architectures and models for re-usable user interfaces.

Professor Brad A. Myers is a Visiting Professor in the University of Manchester from Carnegie Mellon University where he is a Professor in the Human-Computer Interaction Institute in the School of Computer Science. He is an ACM Fellow, and a member of the CHI Academy, an honor bestowed on the principal leaders of the field. He is the principal investigator for the Pebbles Handheld Computer Project and the Natural Programming Project, and previously led the Amulet and Garnet projects. The Natural Programming Project has won four “Best Paper Awards” for new research on applying HCI to software development. Dr. Myers is the author or editor of over 300 publications, including the books "Creating User Interfaces by Demonstration" and "Languages for Developing User Interfaces," and he has been on the editorial board of five journals. He has been a consultant on user interface design and implementation to over 50 companies, and regularly teaches courses on user interface design and software. Myers received a PhD in computer science at the University of Toronto where he developed the Peridot user interface tool. He received the MS and BSc degrees from the Massachusetts Institute of Technology during which time he was a research intern at Xerox PARC. From 1980 until 1983, he worked at PERQ Systems Corporation. His research interests include user interface development systems, user interfaces, handheld computers, programming environments, programming language design, programming by example, visual programming, interaction techniques, and window management. He is a Senior Member of the IEEE, and also belongs to SIGCHI, ACM, the IEEE Computer Society, and Computer Professionals for Social Responsibility.

PROFACTOR (PF)

Profactor was founded in 1995 as a 100-percent subsidiary of the Vereinigung zur Förderung der Modernisierung der Produktionstechnologie in Österreich (Society for the Promotion of Modernisation of Manufacturing Technologies in Austria) (VPTÖ). The staff of seven scientists has since grown to over 100 in 2007.

PROFACTOR is as a non-profit company for manufacturing research and has been heavily involved in European and National research projects (e.g. the following ICT related projects: FLOCI-EE, Agentcities.NET, Agentlink, MaBE, CrossWork, SUDDEN, SENSE, OntoNet).

Profactor has established an internal Project Management Office for FP6. Profactor has experiences in managing a high number of STREPS and IP.

Profactor will be responsible for project management of U-SAY. In terms of research they will contribute to the elaboration of service specification metadata in WP 3, based on their expertise in

semantic technologies gained in the national RTD projects SENSE and OntoNet. With their expertise in modern software engineering approaches they will supervise the testing activities, guaranteeing smooth development of DODE-SA prototypes. With their expertise in industrial requirements elicitation, gained in numerous national and international RTD projects, they will lead WP 2 Requirements Specification and Analysis.

Key personnel available to the project

Martin Ankerl: DI(FH), obtained his degree in Software Engineering at the University Hagenberg in 2004. He has been working for Industrial Research Limited (Auckland, New Zealand), Joanneum Research (Graz, Austria), and joined Profactor in 2005 where he is working in the field of multi-agent systems. He has several publications in the field of multi-agent technologies and a strong background on modern software development techniques.

Roland Mungenast: DI (FH), obtained his degree in Software Engineering at the Upper Austrian University of Applied Sciences, Hagenberg in 2005. He has gained experiences as software engineer and web developer in several Austrian companies. Since 2004 he is focusing on ontology-based software systems and semantic web technologies. Since 2005 he is research associate at the multi-agents systems group at Profactor. He has been involved in several national and European research projects and he has made contributions to the JADE open source project.

Alexander Hämmerle: Received his Master degree in Physics in 1995 at the Technical University of Vienna. He joined the Multiagent systems group at Profactor in 1996. Since then numerous publications underpin his research in agent-based and complex systems. He has been involved in the international RTD projects HMS (Holonic Manufacturing Systems), Agentcities.NET, MaBE (Multiagent Business Environment) and CrossWork (Cross-organisational Workflow Formation and Enactment). In MaBE and CrossWork he has been responsible for project management.

SAP AG (SAP)

SAP has grown to become the world's leading provider of e-business software solutions. With 12 million users, 96,400 installations, and more than 1,500 partners, SAP is the world's largest inter-enterprise software company and the world's third-largest independent software supplier, overall. SAP solutions help enterprises of all sizes around the world to improve customer relationships, enhance partner collaboration and create efficiencies across their supply chains and business operations. SAP employs over 39,000 people in more than 50 countries.

SAP Research. SAP Research is the global technology research unit of SAP. The group significantly contributes to SAP's product portfolio and extends its leading position by identifying and shaping emerging IT trends through applied research and corporate venturing. In contrast to SAP's product groups, which work on new functions and releases, the researchers explore opportunities that haven't yet been developed into products. They track technological trends, evaluate the potential impact on SAP solutions and customers, and generate breakthrough technologies. The business model of SAP Research is based on co-innovation through collaborative research. In collaboration with leading universities, partners, customers, and SAP product groups, SAP Research oversees the development of promising ideas and prototypes into market-ready software for maximum customer value. SAP Research has been involved in several other EC-funded projects related to web services (e.g. DIP, ESFORS) and end user development (e.g. EUDISMES).

In U-SAY, SAP will be the leader of the technological circle. In WP2, SAP will lead the specification of technology-driven requirements, SAP leads the integrated prototype development in WP6 and

participates in the underlying research in WPs 3-5. In addition, SAP leads the dissemination and exploitation activities in WP8.

Key personnel available to the project

Dr. Jochen Rode holds a diploma in business & information technology as well as a masters and doctoral degree in computer science. He has a background in different fields ranging from networking and software engineering to web application development and human computer interaction. His dissertation was specifically devoted to application development by nonprogrammers and the design on an end-user development tool. Jochen joined SAP Research in 2005 as a Senior Researcher in the Software Engineering and Architecture program.

Dr. Stefan Scheidl is Senior Researcher in the same research program. He joined SAP in 2006 as the manager of internal and externally funded projects devoted to end user driven system adaptability. Stefan Scheidl received his PhD from the Ludwig-Maximilians University Munich in Theoretical Physics.

Michael Spahn joined SAP Research CEC Darmstadt in July 2006 as a research associate, where he is working in a project dedicated to end-user development tools for SMEs. Michael holds a diploma in business administration and computer science from the University of Technology Darmstadt. His thesis dealt with heuristic algorithms for the optimization of business processes in a Service oriented Architecture (SoA) with regard to Quality of Service (QoS). During and after his studies Michael worked for the E-Finance Lab Frankfurt am Main, where he focused on IT architectures and the optimization of business processes in the context of the industrialization of the financial industry. Besides his academic experiences Michael has been an IT freelancer for over 10 years.

UNIVERSITÄT SIEGEN ***The University of Siegen (US)***

The chair of Information Systems and New Media and the professorship for CSCW (IS&CSCW) at the University of Siegen is internationally well-known for research on Human-Computer Interaction (HCI), End User Development (EUD), user centred software engineering, appropriation support, service oriented architectures (SOA) and Computer Supported Cooperative Work (CSCW).. The research is focusing on flexible cooperation systems, which are supporting the interaction between users in social systems and actively support users' appropriation of the system. The design of these systems is of great economic and social importance, because of the increasing coupling of individuals and organisations. Examples of these systems are communication and cooperation systems, community systems and electronic workflows tools. The research group follows a practice-oriented approach of action research. It promotes an integrative model for Organization and Technology Development (OTD). Additionally, the research group maintains close ties with the research group on Human-Centered Computing at the Institute for Applied Information Technology of the Fraunhofer Society (FhG-FIT, Sankt Augustin). This group focuses on Information in Context, Usability Engineering Studies, Ubiquitous Computing and Ambient Technologies (e.g., in the FP6 project WearIT@Work)

The IS&CSCW will provide empirical studies, to define systems' requirements as well as expertise in EUD as well as extensive knowledge about appropriation support mechanisms and collaborative design support that are valuable for the prototype design. Furthermore IIS&CSCW will specify meta-data to support collaborative activities of end users.

Key personnel available to the project

Prof. Dr. Volker Wulf is full professor at the University of Siegen and a senior researcher at Fraunhofer Institute of Applied Information Technology (FhG-FIT). Moreover, he heads the Institute for Media Research of the University of Siegen and is deputy chairman at the International Institute for Socio-Informatics (IISI), Bonn. He studied computer science and business administration at the RWTH Aachen and the University of Paris VI, got a PhD at the University of Dortmund and a Habilitation Degree in computer science at the University of Hamburg. In 2006/2007 he spent his sabbatical (six months) at the University of Michigan in Ann Arbor and at the Stanford University. He has published more than 150 papers and 10 books. He is a leading researcher in the field of end-user development. Additional research foci: Computer Supported Cooperative Work, Computer Supported Cooperative Learning, Human Computer Interaction, User-centred Software-Engineering and Mobile Computing.

Prof. Dr. V. Pipek is assistant professor at the University of Siegen, where he coordinates several projects on EUD in SME and Mobile environments. He studied Computer Science and Economics at the University of Kaiserslautern, focussing on Database Systems and Artificial Intelligence. From 2003 to 2005 he was a guest researcher at the Laboratory of HCI and Group Technology at the University of Oulu, Finland, where he focussed on end-user development and appropriation support and received a PhD degree in Information Processing Science in 2005. He worked from 1997 to 2003 on several research projects at the Univerity of Bonn on user-centred and participatory design of collaborative applications in the fields of e- Government, e-Learning and Knowledge Management. Since 2004 he chairs to the board of trustees of the International Institute for Socio-Informatics (IISI), Bonn, to coordinate research efforts in social aspects of Information Technology.

Politecnico di Milano (PM)

The "Politecnico di Milano" is a Technical University in Italy, established in 1863, ranked as one of the most outstanding European universities in Engineering, Architecture, and Industrial Design, with approximately 42,000 students. PM participates in U-SAY with the Information Systems and the Software Engineering groups of the Department of Electronics and Information. The Information Systems group has a long research experience in information systems modelling and design methods and it developed in recent years a framework for adaptive web services for business applications (http://www.elet.polimi.it/upload/pernici/ws-research.html). The group has participated in many EU projects, among which FP6 FET-STREP project WS-Diamond on web service self-healability, FP5 WIDE on intelligent workflow systems and the FP5 Renoir network on Requirements Engineering. It lead a large Italian basic research project, MAIS, on Multichannel Adaptive Information Systems based on web services. The Software Engineering group is internationally recognized as one of the most competent research centers in requirements analysis, system design, middleware frameworks, software architectures, testing and validation, and service-centric systems. The group has been and is involved in many projects in these areas, in many cases in collaboration with the CEFRIEL research center. Among the others, we mention as related to this project: SeCSE, to support the development of service-centric systems, the national basic research project Artdeco, on enabling the creation of networked enterprises through the usage of adaptive, service-oriented infrastructures, UWA, on requirements analysis and design of complex and ubiquitous Web applications, MOTION, on developing and validating a distributed, multi-service eWork architecture to support distributed collaborations.

PM will contribute to U-SAY project mainly in Wp2 and Wp3, with research activities to provide an innovative requirement-level service assembly as a basis to generate, verify, and monitor enhanced web service compositions.

Key personnel available to the project

Barbara Pernici is full professor of Computer Engineering at Politecnico di Milano. She has a doctor in engineering degree (laurea) from Politecnico di Milano and a MS in Computer Science from Stanford University. Previously she was full professor at the University of Udine (1990-1993) and associate professor at Politecnico di Milano (1987-1990). Her research interests include workflow information systems design, adaptive information systems and web services, and data quality. She published more than 150 papers in international journals and conferences and edited 12 books. She co-chaired the international conference on Business Process Management (2004), the IFIP TC8 working conference on Mobile Information Systems (2004), the Conference on Cooperative Information Systems (COOPIS) in 2005, she will be general chair of the international conference on Business Process Management in 2008. She serves as elected chair of IFIP WG 8.1 (Information Systems Design and Evaluation) and second vice-chair of IFIP TC8 Information Systems.

Luciano Baresi is an associate professor at Politecnico di Milano, where he earned both his Laurea degree and a Ph.D. in Computer Science. Luciano was junior researcher at Cefriel (a research consortium between technical universities and industries in the Milan area) and visiting professor at University of Oregon at Eugene (USA) and University of Paderborn (Germany). His research interests are on software engineering topics, with special emphasis on software models, service-based applications, and dynamic software architectures. Luciano has published around 60 papers on the most important national and international journals and conferences, and a couple of books in Italian. He served as program co-chair of ICECCS 2002 (International Conference on Engineering Complex Computer Systems), FASE 2006 (Fundamental Aspects of Software Engineering), and ICWE 2007 (International Conference on Web Engineering). He was also workshops chair of ESEC'05 (European Software Engineering Conference).

Hewlett-Packard Italiana (HP)

Hewlett-Packard Italiana will be participating through its Italy Innovation Center (IIC) which is one of HP's European Innovation Centers. Since 1999, it is carrying on applied research, technology transfer and innovative solutions integration in leading edge areas. It can rely upon an excellence level team of researchers, consolidated skills and methodologies, and a physical infrastructure supporting project development and demonstration.

Main areas of expertise include:

- RFID technology based end-to-end solutions for logistics, manufacturing, e-health
- IT Governance and software lifecycle management
- Service Oriented Architectures
- Vertical solutions for front-office banking
- Vertical solutions for mobile users (e.g. in tourism and e-health)
- Mobile device centralized management
- Ad hoc wireless networking
- Open Source technologies

HP IIC has a consolidated presence and experience within the EU sponsored research and innovation programs. It is participating to about 20 projects in the previous framework programmes.

Key personnel available to the project

Dr. Marco Di Girolamo: Graduated in Electronics Engineering summa cum laude in November 1986. 20 years of working experience in R&D, IT and Consulting environments, in different Companies, both Italian and international. In HP since 1993, covered positions in R&D as Development Engineer (hardcopy devices), in Customer Care as Back-end Support Engineer for enterprise systems, and in IT Department as Service Delivery Manager for client computing. Since 2000, he is working in HPC&I Italy Innovation Center, where served as senior technology specialist, solution architect and project manager in different engagements, both internal and external. Since 2002, he is fulfilling the role of HP Italy European programs manager. In this position, he is coordinating and leading all HP Italy initiatives related to European innovation programs, including IST FP5, FP6 and eContent project participations.

Dr. Marco Luca Sbodio: Graduated in Computer Science in Politecnico di Torino (Italy) in May 1997. He has 10 years of working experience in the IT and Consulting environments in international companies. In HP since 2000, he has worked for several Italian and international customers in the development of distributed software systems, service delivery platforms, and Internet portals. Since 2003 he is part of HP IIC with the role of technology specialist and solution architect. Marco is also actively participating in European funded projects of FP6. His background is on distributed systems, service oriented architectures, knowledge representation and semantics. He's currently interested in the area of semantic web services, and in the possibilities offered by semantics to automate tasks such as discovery and composition of services in open environments.

voestalpine
EINEN SCHRITT VORAUS

voestalpine Informationstechnologie (VA)

voestalpine Informationstechnologie has developed from operative IT departments of several group companies. Since 1 January 2003 is a fully owned subsidiary of voestalpine AG and an independent company with roughly 320 employees.

Our core business is providing IT services to the entire voestalpine group of companies. Our portfolio is based on supporting our customers in optimising their business processes. With our IT expertise, we guarantee a high level of innovative power, a broad performance spectrum and assured quality standards.

The voestalpine group has changed from being a traditional steelmaker into a processing group. This is the result of a consistent strategy that has focussed on market niches and specialised orientation to customers as well as becoming a true market and technology leader. Innovation and the most modern technologies are our highest priorities and are indispensable success factors for our business.

- voestalpine Informationstechnologie has accompanied the rest of the group on this successful path
- As an international IT service organisation owned by voestalpine, we create a decisive advantage
- Our core business today is a decisive success factor for the voestalpine group of companies
- We employ dedicated and highly qualified staff members with an attractive workplace.

In U-SAY VA will provide industrial requirements and they will validate the resulting prototype from the point of view of the steel domain. Further more VA will be engaged in end-user specific aspects

of prototype development and they will install the prototype at the VA premises for validation. VA will disseminate the project results within the voestalpine group, thus preparing the path for exploitation within the voestalpine group.

Key personnel available to the project

Horst Baumgartner studied of Computer Sciences at the Johannes Kepler University at Linz, Austria. He was involved in international IT projects since 1984. Starting 1991 his work was dedicated to the pharmaceutical industry with focus on consulting and implementation of IT solutions using Databases, ERP-Systems, DMS, expert systems, data warehouses and web-technology. Since 2001 he coordinated the IT for knowledge management at the voestalpine Stahl GmbH. Since 2003 he is in charge of the department of Information- and Knowledge-Management at the voestalpine Informationstechnologie GmbH, providing the correspondent services to the voestalpine group.

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iPLON GmbH (IP)

iPLON GmbH was founded in 1997 by Victor Thamburaj and Dr.Carl Cordes as TLON. This was changed to iPLON In April 2007.

iPLON is focused on providing technology and know-how for the Automation (and Home Automation) sector, using intelligent decentralised systems and the InfraNet Technology pioneered by iPLON. Its main approach to development is Distributed Engineering / Model based engineering of distributed solutions.

iPLON is a Technology supplier on *turnkey* solutions including embedded Hardware, Software and Applications. It covers all stages of the product lifecycle from consulting, design, implementation, through to after sales services. iPLON also acts as system integrator for hardware sourced from major manufacturers.

iPLON is a pioneer and market leader in the Infranet Technology. In contrast to Internet, the Infranet's main goal is realizing a control task like controlling an HVAC equipment, energy saving devices or simplified maintenance. Experts believe that Infranet is the network of the future in market segments like:

- Industrial automation (Processing and discrete manufacturing)
- Transportation (e.g. elevator)
- Building Automation (e.g. lighting system, access control, heating an cooling)
- Home Automation
- Renewable Energy Monitoring systems
- Catering Industry (e.g. Coffee machines, money exchanger, vending machines, Point Of Sales systems, kitchen)
- Industrial Condition Monitoring Systems

With **over 15 Engineers and 10 years of experience** we have done Customer solutions in the fields of Industrial Process Automation, Catering Industry (Food and Beverages), Automatic Milking Parlours ,Building Automation ,Tank Stations and Renewable Energy Monitoring. iPLON has participated in a Joint Venture in Bangalore ,India, on the topic of Control technology solutions with Infranet and embedded UML

Key personnel available to the project

Victor Thamburaj received his B.Tech in Indian Institute of Technology Madras in Electrical Engineering in 1972. Since then, he has been working in the Electronics, embedded solutions and Networking systems. He is the founder of TLON GmbH / iPLON in 1997. He is also the co-founder of the Infranet Partners Organisation which is a European wide consortium of SMEs in the field of Distributed Networks solutions. He has experience in National and European Previous research Projects like MASS (No. 26065); IMCTPF (Esprit 25999); VORREITER.

energieZENTRUM (EZ)

Association for economic development, energieZENTRUM - energy division and energy agency of the district Schwäbisch Hall

The energieZENTRUM was founded in 2003 as the energy agency of the district of Schwäbisch Hall. The energieZENTRUM is a division of the WFG Schwäbisch Hall mbH, the association for business development Schwäbisch Hall.

The energieZENTRUM offers consulting programmes for private, commercial, business and municipal clients. The contents of these consultations are topics like energy efficiency, possible energy saving measures and trainings for employees. Since 2005 DAQ services for renewable energy plants are offered by the energieZENTRUM. Furthermore the energieZENTRUM offers concept development and concept implementations for both, communal and industrial clients.

As competence centre, the energieZENTRUM offers education schemes for biogas, biomass and renewable energy. Participants of these education schemes are endemic within the district of Schwäbisch Hall, Baden-Württemberg, Germany or the EU. Renewable energies are an important factor for the strengthening of the regional development. With the EU-Project CER^2, a network hub for improvement of competencies, information exchange and co-operation in the new central european economic region, the energieZENTRUM/WFG together with 14 other partners managed to provide essential stimuli for a sustained development in the energy sector.

The energieZENTRUM/WFG focuses on the following activities:

- Preparation of regional energy concepts, support of start-ups, establishing of networks for renewable energy and clusters for renewable energy and rational use of energy.
- Support of live long learning and advanced vocational training in fields of renewable energy.
- Quality assurance for RES/RUE trainings, systems and products.
- RES/RUE building technologies and eco-housings.
- Rational use of energy
- Local and peripheral energy production

Since 2005 the energieZENTRUM/WFG owns about 31 photovoltaic power plants with an installed peak power of about 1.25MW. These installations are monitored and managed by a LON based system with data exchange via GPRS/GSM. The results can be found at www.solaranlagen.wfgsha.de . In parallel, management and controlling algorithms/systems have been implemented through web technologies that allow a complete failure management and failure prediction for each individual power plant. In case of deviants from a predicted value, a chain of failure management is launched.

In U-SAY, energieZENTRUM and its will play the role of an end user for Home Automaton and acts as a multiplier due to its projects with about 20 commercial, 200 private and 10 municipal partners.

Key personnel available to the project

Sebastian C. Dürr received his Dipl. Ing. (FH) at the University Of Applied Sciences of Heilbronn/Künzelsau in “Technical Facility Management”/Gebäudesystemtechnik. Today he manages the energy division of the WFG Schwäbisch Hall mbH.

B2.3 Consortium as a whole

The project brings together a balanced consortium of four Technology Providers (SAP, Hewlett Packard,. Profactor and iPLON), three Universities (University of Manchester, University of Siegen and Politecnico di Milano) and two end users companies (voestalpine and EnergieZentrum) to cover the areas of expertise necessary for fulfilling the project plan and objectives. The approximate areas of expertise and responsibility are indicated in Figure 9, further details will be provided below.

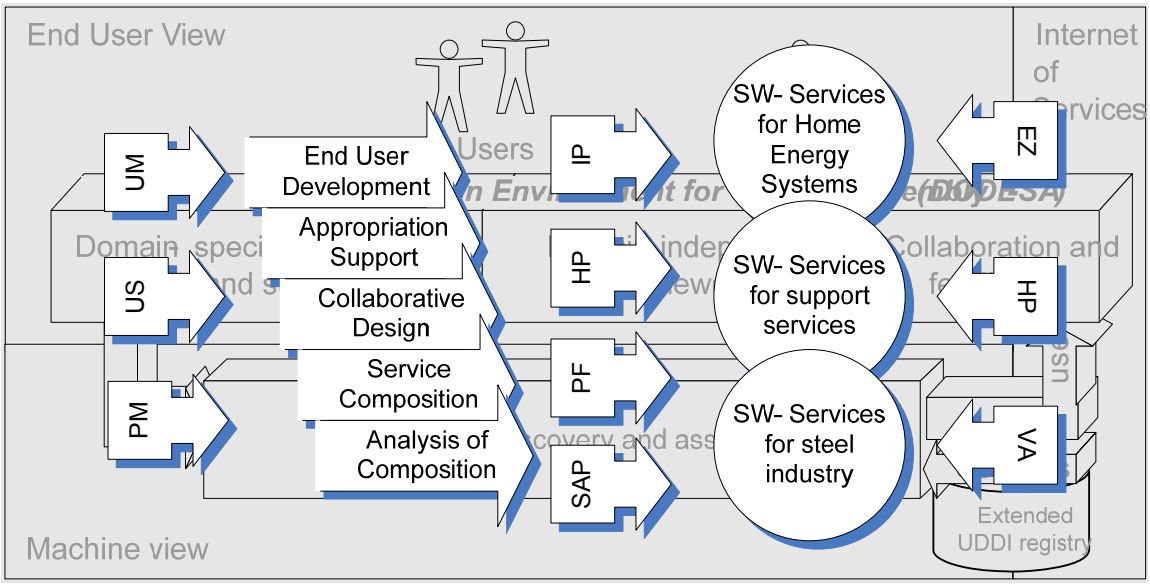

Figure 9. Consortium Overview

The University of Manchester will act as project coordinator and main scientific partner. The team has experience in running a multitude of RTD projects, including coordinating two STREPs under FP6. In the area of scientific contribution, UM will bring in expertise in three inter-related areas: (a) architectures and reusable knowledge structures underpinning DODEs; (b) natural programming, especially in using contextual enquiries and lab-based usability studies to create and validate domain-specific languages and representations; and (c) in software service architectures and descriptions. On the project UM will work with US to develop the generic application framework and the customisation methodology underpinning the DODE-SA, with the industrial end users to develop the domain-specific representations and validate prototypes; and with PM to develop the architectural assembly section of the system and integrate it with the Designer's Assistant module and reusable patterns repositories. New research results are expected in all these areas, results which will be validated by "downstreaming" them in collaboration with the technical partners in the course of the project.

Profactor will act as project manager and development partner, focusing on Requirements Elicitation activities, Service Description data, and Software Development. Profactor will especially support the VA use-case with their know-how and experience in the manufacturing industry. Profactor will also contribute with their know-how and experiences in Model-Driven Design environments developed in two national projects using semantic technologies (SEnSE, OntoNet). The software engineers of Profactor have long experiences with modern software development methods and especially with test-driven methods.

SAP will be the main technology provider. SAP will bring in technological experience as the world's leading provider of e-business software solutions. Its recent technology platforms are consequent realisations of the SOA paradigm. SAP will contribute a case study based on its best known SOA platform NetWeaver. SAP will actively participate in the research of this project to leverage this service infrastructure by DODE-SAs suitable for the needs and skills of end users from various business domains. SAP will pursue exploitation of U-SAY results to strengthen its offerings for the SME market which is of primary strategic relevance.

The University of Siegen has a long history in the fields of end-user development, usability and participatory design with end users. US will contribute its expertise in the areas of Requirements Elicitation, Appropriation Support Technology, and Usability Validation. More specifically, it will provide a component-based appropriation support toolkit that will serve as a basis for integrating functionality for integrating and supporting end users in service-oriented infrastructures. It supports user communities in sense-making and configuration processes regarding the use of software artifacts.

Politecnico di Milano brings internationally recognized expertise and prototype implementations of service composition and verification techniques, extended service descriptions and UDDI extensions. Its participation will allow U-SAY to reuse some of the results on adaptive service composition and quality of service developed in the EU FP6 Integrated Project SECSE, and in the EC FP6 FET-STREP project WS-Diamond. New research at PM will regard the discovery and composition of fragments of processes driven by user level assemblies and verification techniques on the composition loop with functional and architectural requirements, generating monitoring information to provide feedback to the users.

HP will have the dual role of Technology Provider and End User in the Customer Service domain. They will also play a key role in terms of exploitation planning and validation activities.

Voestalpine will also play the dual role of technology provider and end user for the Steel Manufacturing domain, also involved actively in the exploitation planning and validation activities.

iPLON will play a key role of technology provider and exploitation partner in relation to the Home Automation and Energy efficiency application domain.

EZ will play the role of end user for the Home Automation and Energy Efficiency domain.

B2.4 Resources to be committed

		Partner Number	1	2	3	4	5	6	7	8	9		
		Partner Name	University of Manchester	Profactor	SAP AG	University of Siegen	Politechnico di Milano	HP EIC	voestalpine AG	iPLON	energie-ZENTRUM		
		Short name	UM	PF	SAP	US	PM	HP	VA	IP	EZ		
		Country	UK	AT	DE	DE	IT	IT	AT	DE	DE		
		Type of Org.	ACA	SME	LE	ACA	ACA	LE	LE	SME	SME		
		Funding	75%	75%	50%	75%	75%	50%	50%	75%	75%		
Work package Title	**Lead**	**Type**										**Total**	
WP1. Project management	PF	MGT	7 PM	11 PM	3 PM	1 PM	1 PM	1 PM	PM	PM	PM	**24 PM**	
WP2. Requirements spec. and analysis	PF	RTD	10 PM	6 PM	12 PM	10 PM	9 PM	4 PM	6 PM	4 PM	4 PM	**65 PM**	
WP3. Service discovery and assembly	PM	RTD	6 PM	4 PM	6 PM	4 PM	21 PM	4 PM	0 PM	0 PM	0 PM	**45 PM**	
WP4. Domain-indep. designs for DODEs	UM	RTD	22 PM	8 PM	21 PM	10 PM	9 PM	0 PM	0 PM	0 PM	0 PM	**70 PM**	
WP5. Domain-specific design	US	RTD	14 PM	9 PM	22 PM	12 PM	0 PM	4 PM	6 PM	3 PM	0 PM	**70 PM**	
WP6. Integrated prototype development	SAP	RTD	10 PM	12 PM	26 PM	6 PM	4 PM	12 PM	6 PM	5 PM	0 PM	**81 PM**	
WP7. Prototype validation	HP	RTD	10 PM	3 PM	8 PM	8 PM	0 PM	23 PM	8 PM	6 PM	4 PM	**70 PM**	
WP8. Dissemination and exploitation	SAP	RTD	2 PM	2 PM	10 PM	4 PM	3 PM	3 PM	2 PM	2 PM	0 PM	**28 PM**	
Sum person-months per partner			**81 PM**	**55 PM**	**108 PM**	**55 PM**	**47 PM**	**51 PM**	**28 PM**	**20 PM**	**8 PM**	**453 PM**	**Total Person-months**
Sum non-management labour costs			€ 793.280	€ 582.120	€ 1.574.958	€ 571.968	€ 396.704	€ 798.000	€ 281.746	€ 195.008	€ 79.488	**€ 5.273.272**	Total non-mgmt. labour
Sum management costs			€ 75.040	€ 145.530	€ 44.999	€ 10.592	€ 8.624	€ 15.960	€ 0	€ 0	€ 0	**€ 300.745**	Total management costs
Equipment			€ 4.000			€ 4.000	€ 4.000					**€ 12.000**	Total equipment
Travel costs			€ 30.100	€ 20.100	€ 15.600	€ 20.100	€ 20.100	€ 15.600	€ 15.600	€ 15.600	€ 15.600	**€ 168.400**	Total travel costs
Audit costs (subcontracting)			€ 5.600	€ 3.000	€ 12.000	€ 5.000	€ 0	€ 5.000	€ 0	€ 0	€ 0	**€ 30.600**	Total audit costs
Consumables			€ 1.500	€ 1.500	€ 1.500	€ 1.500	€ 1.500	€ 1.500	€ 1.500	€ 1.500	€ 1.500	**€ 13.500**	Total consumables
Total costs per partner			**€ 930.880**	**€ 752.250**	**€ 1.649.057**	**€ 628.520**	**€ 446.288**	**€ 836.060**	**€ 298.846**	**€ 222.368**	**€ 106.848**	**€ 5.871.117**	**Total costs**
Total funding per partner			**€ 718.320**	**€ 601.320**	**€ 853.028**	**€ 475.288**	**€ 336.872**	**€ 428.510**	**€ 149.423**	**€ 166.776**	**€ 80.136**	**€ 3.809.673**	**Total Grant requested**

B2.4.1 Travel Costs

The overall financial plan considers the calculation of the average estimated travelling costs per partner. Ensuring the common view on the project of all the partners and coordination of work, it is necessary to organise at least two consortium meetings a year, a total of 6 meetings over the three years of the project. Technical and scientific synchronisation will be carried out in several national and bilateral work meetings. Joining conferences is a scientific dissemination activity and is mainly related to the research partners. All tables below are over the full duration of the project (3 years):

Research partners:

Destination / Purpose	no of trips	no of persons	cost per trip	total costs
European Project Meetings	6	2	1000,- €	12.000,- €
National and Bilateral Work Meetings	6	2	300,- €	3.600,- €
European Conferences	3	1	1.500,- €	4.500,- €
TOTAL				**20.100,- €**

Industrial partners:

Destination / Purpose	no of trips	no of persons	cost per trip	total costs
European Project Meetings	6	2	1000,- €	12.000,- €
National and Bilateral Work Meetings	6	2	300,- €	3.600,- €
TOTAL				**15.600,- €**

Travel costs for advisory board (added to UM budget):

We assume 5 members in the advisory board, furthermore we assume 2 meetings of the advisory board, one after the first milestone (month 6) and the other after the first iteration phase at month 24. We assume 1.000 ,- € per advisory board member trip, i.e. the total travel costs for advisory board meetings are 10.000,- €.

B2.4.2 Consumables and Equipment

Further related project costs are described in the tables below. We take into account computing hardware equipment for academic partners as well as software licences and dissemination material for all partners.

Academic partners:

Consumables per partner	No.	cost	total costs
Equipment (server/PC)	1	3.500,- €	3.500,- €
Notebook	1	1.500,- €	1.500,- €
Software licenses	1	500,- €	500,- €
Literature, dissemination material, etc.	5	200,- €	1.000,- €
Project costs per academic partner			**6.500,- €**

Industrial partners:

Consumables per partner	No.	cost	total costs
Software licenses	1	500,- €	500,- €
Dissemination material, etc.	5	200,- €	1.000,- €
Project costs per industrial partner			**1.500,- €**

B2.4.3 Sub-contracting

Subcontracting is foreseen for audits on cost statements. Audit costs vary between partners:

- US and HP: 2 audits, 2.500,- € each, resulting in 5.000,- € audit costs.
- SAP: 3 audits, 4.000,- € each, resulting in 12.000,- € audit costs.
- PF: 2 audits, 1.500,- € each, resulting in 3.000,- € audit costs.

Audit costs for UM will not be sub-contracted. All other partners will not have to deliver audit certificates, as they are under the threshold of 375.000,- € funding.

B3. IMPACT

B3.1 Expected Impacts Listed in the Work Programme

B3.1.1 Alignment of U-SAY with the overall ICT objectives

U-SAY is fully aligned with the overall strategic objective of the ICT programme to strengthen the competitiveness of European industry in meeting the demands of society and economy as derived from the renewed Lisbon strategy[5]. This is also background to the technology platforms established for the preparation of FP7.

In comparison to agriculture and industry, services represent a segment of the economy that has grown considerably in recent years and decades world wide. In highly developed regions including Europe and North America, services clearly represent the largest sector that further continues to grow, see Figure 10 below (from Paulsen, 2006).

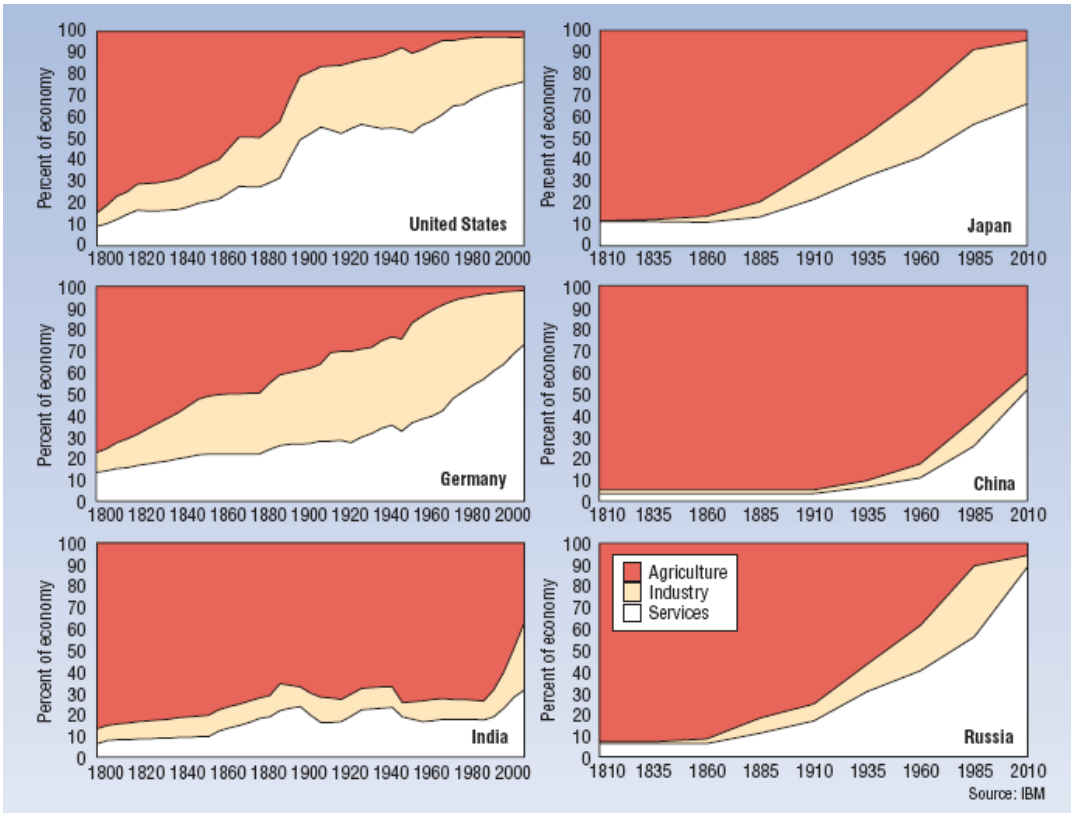

Figure 10: International evolution of agriculture, industry, and services (from Paulsen, 2006).

Information and communication technologies (ICT) are a central enabler for competitiveness of enterprises and efficiency of organisations in the industry and particularly in the service sector.

The need for a high degree of flexibility and adaptability of ICT solutions, driven by the accelerating dynamics of business and consumer requirements in a global competition, has fostered **service oriented architectures** (SOAs) with loosely coupled components interacting via service consumption ("services" in ICT represent encapsulated functionalities not to be confused with the economic sector). These service oriented architectures are the key enabler for a high degree of integrated infrastructures on application level as well as on business level.

[5] COM (2005) 24 [http://ec.europa.eu/growthandjobs/pdf/COM2005_024_en.pdf]

Enterprise resource planning (ERP) software is an example of ICT that specifically aims at supporting businesses to increase their efficiency and competitiveness. SAP as the world's leading provider of e-business software solutions has already introduced service enabled business process platforms. Although SOAs offer a high degree of flexibility, the adaptation of an ERP system to specific and / or dynamic business needs still requires considerable effort. This effort is a particular challenge for SMEs which typically have very limited IT resources and typically require the involvement of external consultants. For SMEs the adaptation process often is demanding time and budget to an undue amount.

U-SAY will foster web service based ICT and strengthen the industry and service sector by developing **user-centred service assembly technology** and opening it to a broad audience of users without specific programming skills from a variety of application domains. This approach will be particularly beneficial for SMEs which will be enabled to employ service assembly technology regardless of their limited IT resources.

The **needs of society** will be met not only indirectly via better service offerings by industries and SMEs but also directly by leveraging their power as service consumer, for example in the domain of home automation.

B3.1.2 Steps needed to bring about the expected impacts of Objective ICT-2007.1.2

U-SAY will address all three impact categories listed in the work programme by suitable steps:

Expected Impact – Improve competitiveness of enterprises and efficiency of organizations by	**U-SAY service assembly technology will**
■ Allowing the creation of dynamic services with guaranteed properties and new networked applications capable of interoperation across a wide variety of business domains and organisations of all sizes.	■ furnish a framework **integrating services from various application domains**, thereby increasing interoperability of service aggregates and **opening markets** ruled by highly dynamic services also to small organisations without specific know-how in service technology
■ Increased efficiency and productivity in software development and higher level of software reliability through novel service and software engineering tools and improved mastering of complex systems.	■ will realize an approach with a **seamlessly integrating requirement specification, development and validation** also for complex service aggregates. This will be done in conjunction with the ecosystem of collaborating user and development communities.
■ New opportunities, notably for SMEs, through open and standard platforms and interfaces for: software and service development; middleware for resource sharing; and next generation operating systems.	■ The U-SAY proposals for extended UDDI and WSDL standards and related metadata **enrichment middleware** will foster resource sharing and leverage **distributed computing** to a new level. These proposals will be integrated into the NESSI standardisation activities.

B3.1.3 European dimension

As stated in the beginning of Sec. B3.1, the growth of the service sector is a global phenomenon. The development of technological and business leadership in the service sector will therefore be reinforcement in the global competition. To strengthen Europe in this competition in the spirit of the Lisbon strategy, this leadership has to be developed in Europe. U-SAY expects to achieve the following impact:

- establish Europe as the prime area for software-services in industrial environments
- contributing to the establishment of service supporting infrastructures for a Single European Market

To specifically contribute to this goal, U-SAY has constituted a best-of-breed consortium of European partners with a world wide reputation in the key areas of end-user development, architectural description languages, service composition, validation, and procurement as well as innovative global players in industry with effective reach into the SME market. The scientific and technological quality of the U-SAY consortium can be achieved only by extravagating national borders.

Sec. B2.3 illuminates the composition of the consortium in more detail.

B3.1.4 Related national or international research activities.

An enhancement of the impact of U-SAY will arise from synergetic interaction with other research activities.

Related activities with U-SAY involvement: U-SAY partners have been or are involved in various research projects on a national or international level. Some of these projects have ended or will end soon. U-SAY immediately benefits from results and experiences generated in these former projects. Other projects significantly parallel U-SAY in time but complement U-SAY in terms of objectives and approaches. These projects include:

- **EUD-NET**: European Network of Excellence for End-User Development (FP5). Activity of UM and US (2002-2003). Backbone of network relationships between U-SAY and European EUD community.
- **EUSES**: End-Users Shaping Effective Software. Funded by National Science Foundation (USA). Activity of UM (subcontractor Carnegie Mellon University). Backbone of network relationships between U-SAY and American EUD community (2003-today).
- **EUDISMES**: “End-User Development in Small and Medium Enterprise Software Systems”. Project funded by the Federal Ministry of Education and Research. Activity of US and SAP (2005-tpday). Generated deep know-how on end-user development and its potential in the SME market.
- **Co-EUD**: Component-based End User Development. Project funded by the Federal Ministry of Education and Research . Activity of US (2006-today) This project will contribute results on providing collaboration means for end users in component-based architectures.
- **SECSE**: Service Centric Systems Engineering (FP6) Activity of PM (2004-today) Brings in methods, tool and techniques for system integrators and service providers.
- **WS-Diamond**: Web-Service Diagnosability, monitoring and diagnosis (FP6). Activity of PM (2005-today)

- **Tekne**: Towards Evolving Knowledge-based interNetworked Enterprise (funded by national Italian research program FIRB). Activity of PM (2006-today). Provides experience of service management for SMEs.
- **ArtDeco**: Adaptive Infrastructure for Decetralised Organisations. Funded by national Italian research program FIRB. Activity of PM (2006-today). Provides experience of adaptive service provisioning for networked enterprises.
- **THESEUS**. A lighthouse initiative of the German government, comprising several projects aiming to develop products, business models, and markets that will allow users and companies to access services, content, and knowledge around the clock and all over the world. Activity of SAP (2007-today). Has focus on business value networks, complementing the U-SAY focus on architectural foundation.
- **SEnSE**: The SENSE project deals with the development on an Engineering Support Environment which improves communication in product development processes. The scenarios targeted by the SENSE project are intelligent change management, engineering rationale detection and conflict resolution and redesign of existing products. A mechanism for engineering rationale detection and conflict resolution building on research in the area of Artificial Intelligence and Semantics will be developed.
- **OntoNet**: In OntoNet a framework for the systematic development of requirement profiles for potential collaboration partners is developed. Part of this framework is a tool which allows to implement domain specific ontologies without the requirement on the users to know how to handle formal ontologies.

Remark: "Activity of Partner" does not necessarily imply that this partner was participating as an organisation in a related project; it means that a person now being part of the partner's team has been/is active in the related project.

Related activities without U-SAY involvement: Mutually fertilising relationships to further ongoing projects with related objectives will be established as part of the dissemination activities outlined in section B3.2. A number of such projects already has been introduced in Section B1.2.

Alignment with NESSI: NESSI (Networked European Software and Services Initiative) is the European Technology Platform on Software and Services. We are aligned with the Strategic Research Agenda (SRA) of NESSI, and we would follow the developments of NESSI very closely to maximise the potential for cooperation in the area of dissemination and impact. This is naturally facilitated by the fact that two of the U-SAY consortium partners (SAP and HP) are NESSI Partners, sitting on the NESSI Strategic Board, and other three are NESSI members(UM, PM and PF), aligned with the Services Engineering and Services Sciences working groups of NESSI. Potential contribution of U-SAY results to the NESSI Open Framework will thus be considered in due course.

B3.1.5 Assumptions and external factors

A relevant driver to increase impact is given by standardization efforts. Standardisation bodies are independent entities from U-SAY Consortium, and could decide not to adopt U-SAY's outcomes or proposals. This can be mitigated by the fact that some of U-SAY partners are members in the reference bodies, so this could recommendations to be taken into some account, and considered in a positive light.

On a general level, market trends and expectations may change, and U-SAY approach could become unaligned with them. This does not seem very likely, since strategic objectives and technical grounds of U-SAY should be quite well-recognised by industry as something for which there is a real demand. Some market monitoring will give the consortium opportunity to react should this situation occur. These market monitoring activities are part of Task 8.1 "Exploitation".

Apart from this general assumption, the achievement of the impacts aspired by U-SAY does not depend on specific assumptions and external factors other than those covered by risk management as described in Sec. B1.3.5

B3.2 Dissemination and/or Exploitation of Project Results, and Management of Intellectual Property

Dissemination and exploitation are recognized as the key enabler for the success of the U-SAY project. Hence all partners are committed to the dissemination of research results and the exploitation of project results to create added value for Europe's economy and citizens.

B3.2.1 Dissemination

The main goal of dissemination activities is the transfer of information about service development, the U-SAY consortium and the specific project to every possible addressee thinkable. The dissemination shall create awareness and interactions between the consortium and an interested outside world. Interactions of interest for the U-SAY consortium are:

- Feedback of potential users and clients
- Business contacts and alliances
- Media awareness in the target markets
- Fulfilment of the obligation to furnish information to the European Union, the ICT-Departments and every potentially interested party.

Dissemination is done in task 8.2 under the responsibility of UM. All RTD partners (participating in the research and development activities beyond pure requirement and validation activities) will contribute to that task. A variety of levels and channels of dissemination will be addressed.

Dissemination levels

Dissemination within the partner organizations. Every participating organisation has to periodically report on its internal dissemination activities and plans to make sure they are known in the right parts in the organisation (e.g. business units) to have maximum impact. U-SAY will disseminate information internally on RTD progress emerging from the research project to ensure that every stakeholder is well informed and can use the latest developments. Training activities are part of internal dissemination. This internal dissemination is considered as a necessary precondition for the identification and realization of exploitation opportunities. Internal dissemination will be achieved by face to face discussions and/or presentation workshops with stakeholders within the organizations.

Dissemination within the project. The consortium is committed to establish a highly cooperative and open minded working culture that will foster the exchange and discussion of plans and preliminary results of ongoing work between the participating organisations. This dissemination within the consortium will take place on a continuous basis and not only via the exchange of deliverables and on the occasion of official project meetings. Such meetings will be organized in Task1.1 “Scientific, Technical Management” and will take place at least once a year. Continuous exchange will be initiated on an ad-hoc basis and take advantage of modern and cost efficient teleconferencing techniques.

Integration with EU research activities. Dissemination towards other, parallel running EU research projects is intended to achieve mutual exchange alignment. U-SAY will approach currently running projects such as S4ALL or OPUCE as well as upcoming projects, in particular the projects contributing to the NESSI Technology Platform. In this way, duplication of research work shall be avoided synergetic effects shall be unfolded wherever possible. To this end, the possibility

of organizing joint workshops will be explored. Furthermore, a representation on at least one of the regularly held ICT-congresses is planned.

Dissemination to academic audiences. Academic U-SAY partners will integrate project results, insights and related problems into lectures, courses and thesis definitions to provide topical training to academic audiences.

Dissemination to the public. The main mechanisms to be used for the dissemination work will be the publishing of papers in scientific journals, the participation in conferences and exhibitions and discussions within local, national and European and world wide interest groups.

Dissemination channels

Web site. US will establish a U-SAY Web site with internal and external areas as the central dissemination tool for easy and free access to all information concerning the project. All dissemination activities of partners and the feedback received will be collected and stored in the dissemination log file. A major part of dissemination is the production of the deliverables. For each deliverable (e.g., documents and software), the U-SAY consortium will decide whether it will be made publicly available via the U-SAY website.

Conferences. The targeted public dissemination channels include the following conferences with associated proceedings:

- the European Conference on Web services (ECOWS),
- the International Conference of Web Services (ICWS),
- the IEEE International Conference on Service-Oriented Computing and Applications (SOCA)
- the International Conference of Service Oriented Computing (ICSOC)
- the IEEE Conference on E-Commerce Technology (CEC)
- the IEEE Conference on Enterprise Computing, E-Commerce and E-Services (EEE)
- the IEEE Symposium on Visual Languages and Human-Centric Computing (VL/HCC) where a workshop dedicated to service assembly by end users shall be organised.
- the ACM Conference on Computer Supported Cooperative Work (CSCW)

Exhibitions and fairs. U-SAY partners from the industrial circle will participate in dissemination to technical and business audiences by contributing project presentations and demonstrations to selected exhibitions and fairs such as

- SAP's SAPPHIRE the one place where senior executives, business managers, and decision-makers can come together to explore how innovative business solutions foster long-term, profitable growth (http://www.sap.com/sapphire)
- SAP's TechEd as a premier educational event offering hands-on workshops and in-depth lectures on topical technological developments (http://www.sapteched.com/)
- CeBIT, the leading business event for the digital world (http://www.cebit.de/homepage_e)
- Hannover Industrial Fair (http://www.hannovermesse.de/homepage_e)
- LonWorld trade show and conference on energy and control (http://www.lonworldexpo.com/)

Journals. Case studies and research results will be published in international journals in the requirements engineering and software engineering areas, such as

- Human-Computer Interaction Journal (HCI)
- IEEE Software
- Journal of the Association for Information Systems (JAIS)

Training. Classroom training and individual thesis supervision will be chosen for the dissemination to academic audiences.

Specific dissemination activities

The project as a whole will organise two dissemination workshops. The first one in Milano (organised by PM) will be focused on scientific dissemination and will be organised at the start of year 2 of the project, to allow the presentation of conceptual results developed on work packages 3, 4 and 5, and the experimental results from work package 2.

The second dissemination workshop will take place in the area around Frankfurt and will be jointly organised by SAP and the other German partners. This will target the technical community but also advanced end users such as EZ and local government. The labour and other costs for organising both workshops have been considered in preparing the project workplan and partner's person-months allocation.

In addition, all project partners with RTD activities will participate in specific dissemination activities over and above the two workshops. The focus varies from partner to partner as follows.

UM dissemination focus. University of Manchester will pursue dissemination strategy through scientific publications and relevant course materials for its system modelling teaching modules. Publishing early concepts, interim designs and mature results from the project in well-known international conferences, wide-circulation professional society journals such as the Communications of ACM and respected archival journals such as TOSEM will be complemented by dissemination through our scientific networks in both the area of end user development and service engineering. Our system modelling education will benefit from U-SAY results in terms of case studies of service-based system modelling and simulation afforded by our application domains, and of the modelling languages developed on U-SAY. The case studies and research prototypes will also contribute to the education of our research students through close alignment between their projects and U-SAY research themes.

PF dissemination focus. As a research institute with industrial focus Profactor aims at two types of audiences in terms of disseminating U-SAY project results. On the one hand PF will contribute to relevant scientific publications (e.g. targeting innovations in semantic technologies) for dissemination to the scientific community. On the other hand PF will publish public project results to industry, thus widening the potential market for the exploitation of results. Prime target is the manufacturing industry in Austria, especially in the automotive domain, where PF organises educationally days frequently.

SAP dissemination focus. SAP will actively disseminate results into the organization, i.e. from participating unit SAP Research into the solution management and development units. Further more, it will realize the opportunities of contributing to scientific conferences and journals. In addition, SAP is committed to pilot a demonstration of the project results and prototype platforms on workshops, exhibitions and fairs with industrial focus such as SAPPHIRE and CEBIT.

US dissemination focus. The University of Siegen will pursue two directions within its dissemination strategy. The first direction is research publication activities, while teaching is considered as second direction. Extensive and up-to-date courses are essential for us to educate qualified scientist and employees for Europe's next generation ICT market. Therefore we will educate our students in seminars and project groups within the context of the U-SAY project, giving them the opportunity to get in touch with current research in the field of ICT. Furthermore we

will use the gathered experiences and results of the project to improve the course materials of our lectures. The U-SAY project will also contribute to our research activities in the field of End User Development, in which we are already one of Europe's leading universities. We will pursue the dissemination in this area by the publication of research results on well known international conferences as well as in international distinguished journals. This will increase our reputation in the field of End User Development and the reputation of the European Union as a global innovator.

PM dissemination focus. Politecnico di Milano dissemination strategy will be both in the direction of scientific publication and in advanced education. Publications will be in distinguished international conferences and journals in the information systems and services and in the software engineering areas. Advanced education will benefit from U-SAY results to develop the service-oriented area, in which a new curriculum is planned in the next years at Politecnico. Case studies and research prototypes will contribute to the education of master's level and PhD students. Thesis work at graduate and PhD level will also be developed within U-SAY.

HP dissemination focus. HP plans dissemination activities especially targeted to its internal, corporate business units and research Labs. Further plans include: participation in the largest HP technical dissemination events, e.g. the TechCon, through paper submissions and possibly direct presence; publication of knowledge briefs in HP's worldwide technical knowledge repositories.; participation in external events, targeting proper commercial areas like manufacturing industry, through paper submissions and workshop attendance. Special attention will be devoted to establish links with related EU-wide research initiatives. HP Italy plans to engage with its European representatives within the NESSI technological platform.

VA dissemination focus. voestalpine Informationstechnologie provides internal services and solutions along the value chain throughout the companies of the voestalpine group. Service development is driven by requirements-oriented analyses together with process engineers. Resulting process-designs and process-improvements are described in process management systems, enabling discussion of service decomposition and re-composition using IT-Tools. To introduce the power of service oriented architecture, business cases are opened to demonstrate SOA techniques. The SOA-deployment to processes and their adoption are done by the technical IT-units along the process chain together with the process responibles. Solutions and procedures are guided and maintained via the internal services of voestalpine Informationstechnologie and its associated group-internal communication channels.

IP dissemination focus. iPLON regularly participate in various trade shows providing a forum for the energy and regulation sectors, including the Hannover Industrial Fair and the LonWorld Exhibition. In this sector, iPLON is a member of several leading organisations (Infranet Partners as a European network of small companies specialising in Infranet solution, http://www.infranet-partners.com/; LonMark International as a global membership organisation of manufacturers, integrators and users of control systems, http://www.lonmark.org/). Dissemination to the members of these organisations is achieved via magazines and email newsletters.

B3.2.2 Exploitation

It is the principle of all exploitation activities to use research results to create value within all participating organizations from the industrial circle and thus to improve their competitive advantages. The exploitation of the U-Say initiative is focused on the establishment of end-user software service development and builds on the global trends in service-oriented business applications (SOBAs). Optimistically extrapolating the current development (see Figure 11) in the domain of SOBAs aiming at an increase of business agility to the future nourishes the expectation that the current state – where pure SOA platforms are available and composite applications can be developed by IT experts – can be matured to a state where next-generation applications are available, where new services and applications are available for easy configuration/development by business experts.

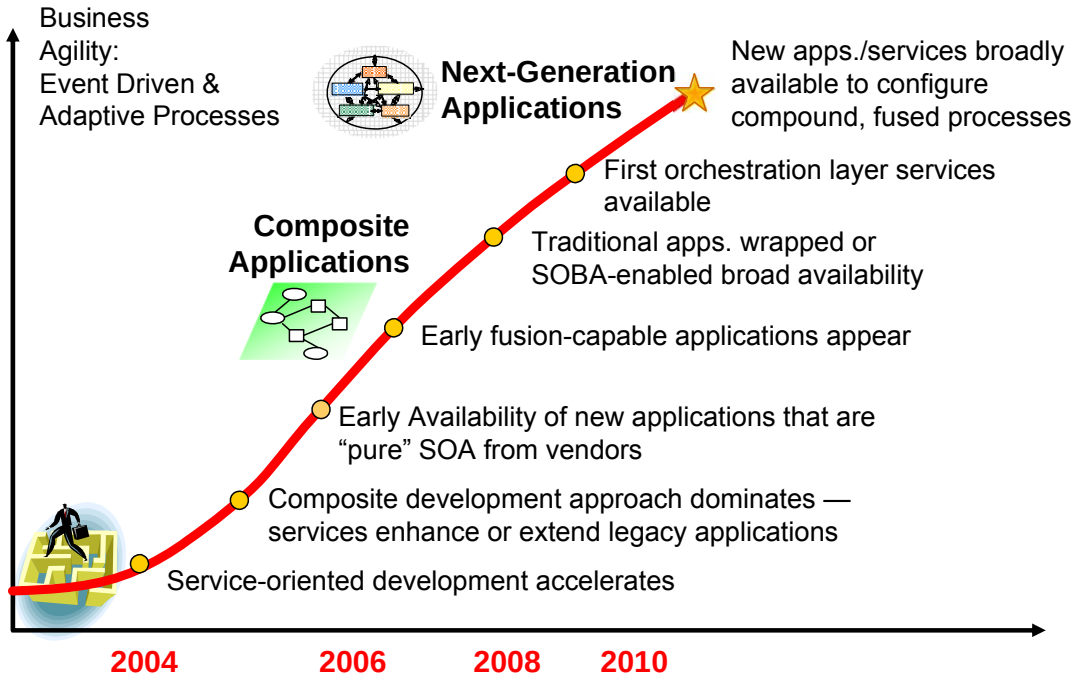

Figure 11: Expected trend of service oriented business applications (Gartner 2005)

Implementing an Enterprise Service Oriented Architecture (SOA) consequently, SAP has established the state of the art Business Process Platform. So the SAP platform allows a high flexible integration of external software components. SAP's long term strategy is to establish an Enterprise SOA Ecosystems with a clearly focus on collaboration with other software providers. Based on such SOA Ecosystems, the U-SAY is going to establish the user driven development of software services. Figure 12 illustrates the motivations and relations of exploiting U-Say results.

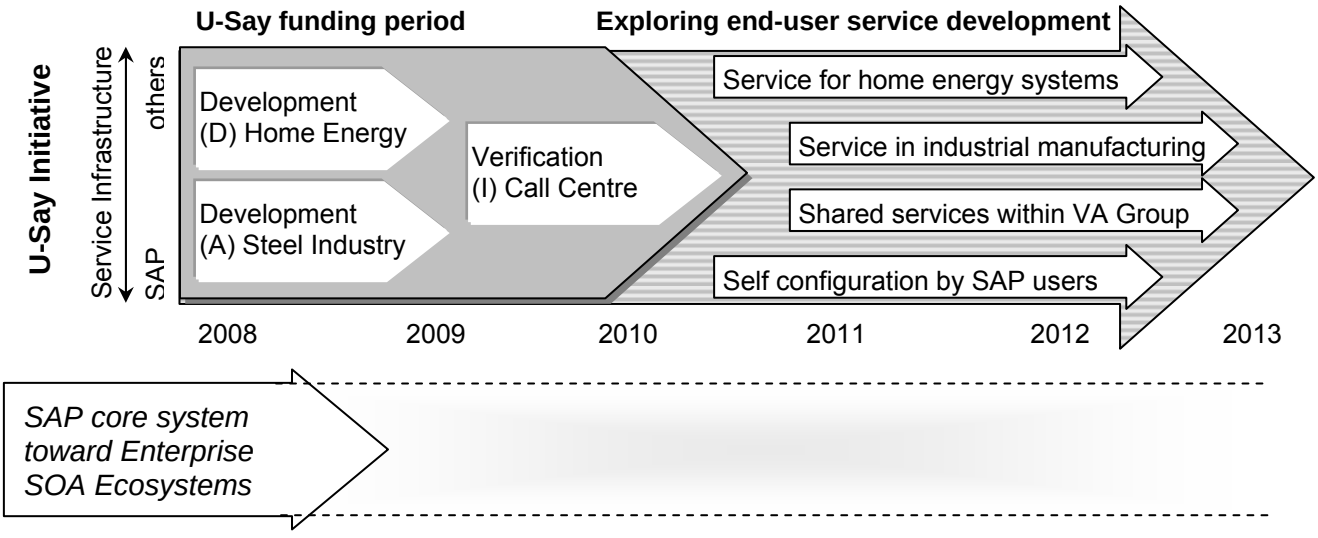

Figure 12: U-Say exploitation perspectives

Self configuration by SAP users

As mentioned above, the U-Say initiative is focused on the establishment of end-user software service development and builds on the global trends in service-oriented business applications (SOBAs). Enabling SOBAs will improve pure SOA platforms toward agility, next-generation business applications, where new services and applications are available for easy configuration/development by business experts. SAP's expectation in U-SAY is to provide a significant contribution in turning this extrapolation of a Service Oriented Business Process Platform into reality.

New products and services. Wherever possible, research results will be exploited for the internal development and support of new products and services. These products and services will lead to a competitive advantage of the participating organizations and will substantially contribute to the benefit of the targeted users. In order for the exploitation to be effective, an integrated approach will be necessary, combining experience and expertise from the development department and solution management, and the involvement of a user base, represented by the partner VA in particular as well as broader base which will be involved through dedicated surveys. An integral part of this exploitation approach is the identification of use cases which will serve as the validation point throughout the project – from customer requirements, to building the demonstrator through evaluation of the results.

SME market. Given the premise of such next-generation applications, U-SAY will support SAP in its strategic goal to strengthen the SME market on a global level.

Shared services within the voestalpine group

Within the **voestalpine** group the service-oriented paradigms of U-SAY can be applied to the areas of 1) design of a new production process or modification and upgrade of existing processes 2) simulating process behaviour under alternative boundary conditions and requirements and 3) combinations of these - design by simulation, process validation and online simulation to determine best control actions. The knowledge of process decomposition and service composition will lead to more versatile IT concepts allowing integrating different applications throughout the production planning processes.

Design and simulation of processes: In the years ahead new processes or modification and upgrade of existing processes will be applied at different companies of the voestalpine group. Existing SAP solutions as well as non-SAP solutions will be under investigation for improvement to gain more integrated decision- and value-chains. At the point of composition of new processes, service-orientation may lead to service-development from a small to larger scale, depending on the application and environment. Production-planning can be improved by simulation of processes or process steps, thus influencing and adopting the strategy and the services of a process.

Exploitation will be done by introducing key-concepts of the service orientation to different business cases (points 1 to 3) of production-aligned processes up to 2012. The existing diversity of applications in the area of production planning and production reporting can be simplified by moving towards an integrated SAP supported value chain. Voestalpine's motivation to use service orientation is to improve the process integration by unification of process steps and their associated master data. The resulting design provides more service based IT components leading to more overall-flexibility in the process design.

In the context of collaboration in the U-Say project, **PF** is interested in the usage and further development of U-SAY results (on conceptual as well as on prototype level) in future RTD and industrial projects on national and European level. In terms of commercial exploitation PF will contribute as technology developer to the further development of the resulting prototypes towards products which can be sold on the market. Target market for PF is the industrial manufacturing industry in Austria.

Exploitation: HP

HP Italy Innovation Center is part of HP Consulting & Integration. HP's mission is to provide customers with technological innovation tailored to improve their business efficiency and effectiveness. HP provides a large span of end-to-end horizontal and vertical solutions, based on leading edge technologies, and targeted to different specific markets (telecommunication, finance, manufacturing, public sector).

HP's wide presence in European innovation projects has proved quite effective to its business, since HP can exploit not only actual technological outcomes, but even, if not mostly, the acquired competencies and skills. For a Consulting & Integration business unit, that's something quite different from a product development division, people skills and competencies are the key and top tier asset HP needs to offer its customers to meet their needs.

In the U-SAY project, HP has still more rationales supporting exploitation. U-SAY is basically dealing with a service oriented world. HP is since long acting as a technological and business advisors, enabling customers to move into service oriented architectures and frameworks. U-SAY will impact the service domain from design and specification standpoint, so HP can enhance its SOA solution portfolio with U-SAY service assembly innovative capabilities. Moreover, U-SAY will impact the whole software development lifecycle, and HP believes that these technologies can empower the whole IT Governance product and solution suite HP is a leader vendor of, through customizations derived from the project's results.

Manufacturing testbed. Finally, the planned presence of an Italian testbed will give HP a straight exploitation path towards a specific domain, like complex data management. HP expects to provide a testbed in Italy, with a user coming from the manufacturing world, likely from the automotive manufacturing industry, or even from electrical equipment manufacturing. The application scenario is expected to tackle data organization and report generation.

Reporting scenario. A typical problem in large companies is the generation of reports for various purposes and users. Usually within a company there is a huge amount of data that need to be properly aggregated in order to present it in a meaningful way. Often the same data are aggregated in several ways to produce reports for different users, and to show different perspectives. In a Service Oriented Architecture (SOA), some services are information sources ("information production services" in contrast to "world transition services": the former produce some kind of information, whereas the latter have some effects on the state of the world). It could be interesting to provide a DODE-SA for end-users (not programmers) wishing to aggregate information sources (services) available within their enterprise to produce meaningful reports. This scenario seems to fit well with the Yahoo Pipes metaphor: the end-users would be able to use a simple, graphical formalism to construct processes that aggregate information sources with pipes, filters, etc. in order to build his own personalized report.

Service for home energy systems

IP and EZ work together to support the town of Wolpertshausen (Germany) and its neighboring villages to achieve 100% regenerative energy usage in a region with about 6000 inhabitants. This goal requires the employment of alternative energy sources such as photovoltaic systems and the employment of energy efficient appliances (lights, white goods) as well the control of the interplay between all components e.g. by home automation to optimize running times. In this project IP is a technology provider to energieZENTRUM, which acts as an advice centre serving this programme.

IP and EZ seek to exploit the results of U-SAY to support the following scenarios:

Home System Design – A first user of U-SAY technology can be a home owner willing to invest €10000 to get a more energy efficient home. At the design stage of his infrastructure, he would like to compose web services to create a customized planning and simulation tool that allows him to experiment with different approaches to increasing energy efficiency (e.g. photovoltaic vs. wind energy creation) and then with configurations of the implementation services (advice, supplying products, installation and maintenance services). The consumed

web services may include simulators for the alternative energy sources under consideration in combination, combined with web services specifying the local microclimate relevant for the expected energy yield, and simulators for the energy consumers in the household, and a service proposing optimized running time for these appliances.

Home System Configuration – The desired home system will be set up by an engineer from IP as an infranet, an infrastructure where all sensors, actuators, controllers, equipment and machines are connected via an intranet. These components offer services allowing their configuration from the office. In this context, an engineer from IP may act as a domain expert who develops a tailored control application with a graphical UI for the home owner. This engineer would not be programming in the traditional sense, he would be assembling hardware services. The home owner would strongly benefit from an integrated control application which is known (Nichols et al., 2006) to show significant ease-of-use improvements over the collection of independent control panels. U-SAY will make it easy for the engineer to assemble the UIs for the various services.

Home System Optimisation – Once a system is installed and running, home owners may want to use a graphical interface to obtain information about weather forecast, and specify energy optimisation logic. For example in cold weather the fridge might be set to run on lower temperature, or the washing machine might be scheduled to run at the time of the day when there are no clouds expected. This would involve service composition and programming application logic. This task has collaborative dimension both in terms of home owners seeking advice and best practice from their neighbours, but also collaborating with specialists from energieZENTRUM to optimise their rules. Also, home owners may interact with the original writers of the control software in IP to seek advice about control logic rules and device operation. This will implement a new joint mode of development.

B3.2.3 Management of IPR

During the proposal preparation the partners have agreed to a basic concept of a Consortium Cooperation Agreement (CCA) and how intellectual property rights will be handled. During the finalisation of the CCA foreground and background knowledge will be identified and access rules detailed. As a general rule, each partner will receive the rights for the results of its research activities. Jointly developed results will be IPR of the involved partners. All of the partners have the right to use any scientific results developed in U-SAY for the purpose of research during the project. To foster innovation and later exploitation, the RTD partners will grant the industrial partners (in return on license-fees or other means) the use-rights of those of the S+T results developed by the RTDs which the industrial partner requires to exploit its own results of U-SAY within own future products or services. These granted use rights are not exclusive, not transferable and limited to use in own products and services only - unless defined otherwise on bilateral contracts and cooperation agreements.

management of knowledge & IPRs		**pre-existing knowledge**	**research and development**	**merge (innovation) activities**	**product developm. (after the project)**
development of knowledge	planning of project	complementarily of partners	innovation activities	work-plan	exploitation plan
	execution of project	roles of partners	responsibilities	delivery/assembly	liability
	reporting	evaluation	deliverables	quality assurance	business plan
use of knowledge	internal use	preferential conditions	royalty-free base	royalty-free base	royalty-free base/ preferential cond.
	further development	preferential conditions	royalty-free base	royalty-free base/ preferential cond.	royalty-free base/ preferential cond.
	commercial use	preferential conditions	preferential conditions	preferential conditions	preferential cond./ market conditions

B4. ETHICAL ISSUES

The project contributes to the overall European goal of the information society by incorporating ethical considerations and policy evaluations in the different work packages. Within U-SAY it has to be guaranteed that ethical issues related to the project research are properly considered and any relevant conventions are respected. All participants in this project will conform to current legislation and regulations in the countries where the research will be carried out.

	Yes	Page
Informed Consent		
Does the proposal involve children?		
Does the proposal involve patients or persons not able to give consent?		
Does the proposal involve adult healthy volunteers?		
Does the proposal involve Human Genetic Material?		
Does the proposal involve Human biological samples?		
Does the proposal involve Human data collection?		
Research on Human embryo/foetus		
Does the proposal involve Human Embryos?		
Does the proposal involve Human Foetal Tissue /Cells?		
Does the proposal involve Human Embryonic Stem Cells?		
Privacy		
Does the proposal involve processing of genetic information or personal data (eg. health, sexual, ethnicity, political opinion, religious or philosophical conviction)		
Does the proposal involve tracking the location or observation of people?		
Research on Animals		
Does the proposal involve research on animals?		
Are those animals transgenic small laboratory animals?		
Are those animals transgenic farm animals?		
Are those animals cloned farm animals?		
Are those animals non-human primates?		
Research Involving Developing Countries		
Use of local resources (genetic, animal, plant etc)		
Benefit to local community (capacity building i.e. access to healthcare, education etc)		
Dual Use		
Research having direct military application		
Research having the potential for terrorist abuse		
ICT Implants		
Does the proposal involve clinical trials of ICT implants?		
I CONFIRM THAT NONE OF THE ABOVE ISSUES APPLY TO MY PROPOSAL	✓	

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