SPIKE
Secure Process-oriented Integrative Service Infrastructure for Networked Enterprises

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ICT in Support of the Networked Enterprise

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Abstract:
SPIKE will develop a software platform for the easy and fast setup of business alliances. The project targets two main organisational objectives: first, outsourcing parts of the value chain to business partners (and vice versa, offering such parts in form of services); second, enabling collaboration between members of participating organisations through ad-hoc created as well as predefined business processes. SPIKE will enable collaboration and cooperation between the networked enterprises.

The solution will encompass a semantically enriched service oriented infrastructure including a virtual semantic service bus for workflow control and handling and transformation of messages. At the enterprise interface level, we follow a collaborative process portal approach, capturing the user’s working context and seamlessly transmitting it to other applications and services according to the current workflow. This will also enable integration of legacy systems via tailored portlets and connectors. Special focus will be put on the security issues involved; the solution will include an easy-to-administer security infrastructure for the networked enterprise which will provide security services for service and workflow management.

The user partners will demonstrate the potential of SPIKE at the case of pilot deployments and use cases, i.e. a collaborative business alliance and two services ready for use in the networked enterprise. Because of its focus, the project will have an impact on organizations of all sizes that want to collaborate with each other. The base SPIKE components will be developed as an open source solution, with a special emphasis on easy adoption and cost feasibility. Where possible, we will build upon and enhance existing open source software. This way, SPIKE will have a special impact on SMEs. It will enable them to offer their services to potential new customers in a cost-saving and timely manner.
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</table>
Content

1 SPIKE – A PRESENTATION .................................................................................................................... 6
  1.1 SPIKE IN A NUTSHELL .................................................................................................................... 6
  1.2 WHY IS SPIKE NEEDED? .................................................................................................................. 7
  1.3 GOALS OF THE PROJECT ............................................................................................................. 8

2 MAIN CHARACTERISTICS OF THE PROJECT ................................................................................. 9
  2.1 SPIKE BRINGS BUSINESS OPPORTUNITIES ................................................................................. 9
  2.2 SPIKE TARGETS SHORT-TERM BUSINESS ALLIANCES .............................................................. 9
  2.3 SPIKE OFFERS SERVICES FOR INTRA- AND INTER-DOMAIN WORKFLOW ENACTMENT .......... 9
  2.4 TECHNICAL BUILDING BLOCKS ................................................................................................... 10
    2.4.1 Service-oriented Architectures, Enterprise Service Bus .............................................................. 10
    2.4.2 Semantic technologies ........................................................................................................... 10
    2.4.3 Business process management ............................................................................................... 11
    2.4.4 Portals, inter-portlet communication and context .................................................................... 11
    2.4.5 Security .................................................................................................................................. 11
    2.4.6 Identity management .............................................................................................................. 12
    2.4.7 Methodological guidelines ..................................................................................................... 12
  2.5 EXPLOITATION OF THE PROJECT’S RESULTS ........................................................................... 12

3 PROJECT ORGANISATION .................................................................................................................. 12

4 PILOTS AND APPLICATION CASES .................................................................................................. 13
  4.1 SOFTWARE PILOTS IN SPIKE ...................................................................................................... 13
  4.2 APPLICATION CASES .................................................................................................................. 13
    4.2.1 Case: Business alliances and identity management ................................................................. 14
    4.2.2 Case: Intra- and inter-organisational offering of technical documentation services ............. 14
Abbreviations used

<table>
<thead>
<tr>
<th>Abbreviation</th>
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1 SPIKE – a presentation

This document is an introduction to the SPIKE project. It presents the project’s goals, its main characteristics, the expected outcome and the project organisation. Further, the two application cases are briefly outlined.

The purpose of this document is to use it for the project’s dissemination. The document will be made available on the SPIKE website: www.spike-project.eu.

1.1 Spike in a nutshell

SPIKE stands for Secure Process-oriented Integrative Service Infrastructure for Networked Enterprises. The purpose of the SPIKE project is to develop a software service platform for the easy and fast start-up of virtual business alliances. This platform will:

- Enable outsourcing of parts of the value chain to business partners
- Simplify collaboration between the members of participating organisations through dynamically created and pre-defined business processes and workflows
- Achieve interoperability and integration between organisations of all sizes
- Offer generic solutions for inter-enterprise interoperability and collaboration through reference scenarios and guidelines for their use
- Have a special focus on security and trust.

The aim of SPIKE is to research and implement a system that will bring flexibility to the collaboration between networked enterprises. Using SPIKE, enterprises can gain business opportunities with previously inaccessible customers and partnering organisations.

To fully reach the desired goals, the platform developed will be easy to use, manage and integrate into the existing environment. The solution will encompass a semantically enriched service-oriented infrastructure including a virtual semantic service bus for workflow control, handling and transformation of messages. At the enterprise interface level, SPIKE will follow a collaborative process portal approach, capturing the user's working context and seamlessly transmitting it to other applications and services according to the current workflow. This will also enable integration of legacy systems via tailored portals and connectors.

Special focus will be put on security issues. The solution will include an easy-to-administer security infrastructure for the networked enterprise, which will provide security services for service and workflow management.

The potential of SPIKE will be shown in pilot deployments and use cases: a collaborative business alliance and two ready-for-use services in the networked enterprise.

Because of its focus, the project will have an impact on organisations of all sizes that wish to collaborate with each other. To the extent possible, SPIKE will build upon existing open source software to make it a cost feasible option for small and middle-sized enterprises (SME) as well. The base system and the infrastructure of the solution will be made available as open source software, which ensures low initial adoption cost. The deployment of open standards will reduce the lifecycle costs and provide a better return on investment (ROI) in the long run. This will open up business opportunities, especially for SMEs.
SPIKE is a collaborative project funded by the EC and the parties involved are:

- addIT Dienstleistungen GmbH & Co KG in Austria
- Citec Information Oy Ab in Finland
- Intersoft a.s. IS in Slovakia
- Infineon Technologies IT-Services GmbH in Austria
- IT Inkubator Ostbayern GmbH in Germany
- University of Kosice in Slovakia
- Universidad of Malaga in Spain
- University of Regensburg in Germany

The project is scheduled to end by the year 2010.

1.2 Why is SPIKE needed?

The pressures of global competition and the need for effectiveness and agility demand new approaches to business networking. Many organisations today are moving from fairly stable business networks to an open digital platform, where business is conducted across a rapidly formed network with anyone, who is located anywhere, despite different business processes and computer systems. Digital technologies play a fundamental role in these business networks. The technologies have facilitated improvements and fundamental changes in the ways in which organisations can interact with each other and they have introduced the possibility to form alliances to create new business opportunities.

The European Union has also set ambitious goals for a competitive Europe of the future. The targets regarding the information society and the digital economy are described in the action plan i2010, which demands “A European Information Society for growth and employment”. To this end, Europe needs “an open and competitive digital economy” wherein enterprises in particular need to address network and information security “more as an asset and an element of competitive advantage than as a “negative cost”.

SPIKE aims to lower the barriers for Europe’s enterprises to participate in the digital economy in a secure way and to open up new business opportunities. The underlying idea is that a global digital economy in all its facets would be of benefit for European SMEs in particular. However, it is the SMEs that face the most difficulties when adopting new technologies. This may be due to a lack of resources, professional competence, or the business risk of failed or missed technology adoption. This risk could be conceived as fatal, as it could threaten the financial existence of a smaller company.

Furthermore, a lack of suitable tools and technologies cause the SMEs to keep their eBusiness on a one-to-one basis. This means that an SME usually provides services for one large customer and that this single customer defines the process rules for the business services. Thus, SMEs are forced to align their processes to serve only one client, which makes them very dependent on their client’s success.

There have been various approaches encouraging companies to prepare for the digital economy in networked environments. Although these initiatives have been successful as a first step, there are still many obstacles for enterprises and especially for SMEs. Many SMEs face fierce competition due to the open markets and globalization. Often they cannot compete in direct production costs, but are successful with innovative business models, tight collaboration, and division of services (between sub-suppliers, partners, and subsidiaries).
There are several other EU-funded projects that deal with similar issues as SPIKE. SPIKE is needed to further develop and offer the following:

- Develop semantic processes and business processes
- Develop benefit for virtual organisations of all sizes and types
- Offer process and security support
- Offer support for short-term alliances
- Offer an open source solution.

Within the SPIKE project we will naturally study the project outputs of the related EU-funded projects and whenever possible use and benefit from these studies.

### 1.3 Goals of the project

The project’s main goals can be summarized on two levels: organisational objectives and realizing certain scientific and technological objectives.

The organisational objectives of the project are to allow for the secure and fast set-up and management of the networked enterprises through short-term and project-based business alliances. The goals for the platform are listed in section 1.1.

With respect to the needs of SMEs in particular, SPIKE will put an emphasis on pragmatism and financial feasibility of the developed solutions by building upon existing open source solutions. This will increase the chances for successful exploitation of the project’s results.

The science and technology objectives of the SPIKE project include the research, development, implementation and validation of the following components:

- Semantic service bus for registering, discovering and contracting services, as well as service message routing and processing capabilities
- Semantic business process management engine, which will handle customized reference processes, ad-hoc defined workflows and distributed processes built from generic process fragments
- Semantic transformation of service messages including user context information
- Information flow control between members of the alliance, that is, service message and user context filtering according to previously specified policies
- Security infrastructure for the networked enterprise in terms of attribute management, authentication, workflow and service access control, and auditing functionality
- Repositories for processes and ontologies supporting the networked enterprise
- Portal server extension for semantic context capturing and communication
- Portal-based interfaces and tools for user-friendly administration of alliances, ad-hoc workflow modelling and process handling, service management and security as well as user administration.

To increase the project impact and to facilitate the deployment process, the technical objectives will be complemented with the development of a methodological guideline on how to operate, run and dissolve a business alliance in general, and especially with the SPIKE system.
2 Main characteristics of the project

2.1 SPIKE brings business opportunities

SPIKE enables outsourcing of parts of the value chain to business partners. The system allows organisations to provide and use services and applications in a service-based architecture. Others can then utilize these resources by integrating them into their portal. Interoperability between heterogeneous domains will be ensured by semantic transformation of service messages and use of open standards.

SPIKE will create business opportunities especially for SMEs. The benefit for SMEs is that it will become easier to integrate services with larger supply chains. SMEs will be able to reach a larger amount of potential customers since the customer process and information requirements are no longer an obstacle. This has a strong impact on the competitiveness of the companies, as they will be able to make a more efficient use of their resources and can therefore better focus on development of their core competence. SMEs can, without big investments, turn their special ability into a service, which may be of value for an alliance or bought by other companies.

SPIKE addresses the specific needs of SMEs; the flexibility and scalability of SPIKE is the key aspect for the needs of modern innovative SMEs. SMEs feature unique business processes that pose their competitive advantage because of their specialisation, speed, and flexibility; SMEs require IT systems that particularly support these rather unstructured processes. Integrated standard software is usually not flexible enough to cope with this requirement. If systems are not customisable enough, the adaptation is very expensive, which makes them unsuitable for SMEs with a limited IT budget. SPIKE respects the fragile competitive advantages of SMEs deriving from specialisation and unique processes by not destroying or rearranging processes but rather adapting to them.

2.2 SPIKE targets short-term business alliances

A business network in SPIKE’s context is a virtual partnership of organisations that is designed to share the partners’ business services without restrictions such as the organisation’s size or structure. Short-term alliances are alliances that typically are project-based and last less than six months, which means that the partners might become competitors again later on, or they may even be competing in projects running in parallel. Partnerships of this kind are temporary nature, as is customary in rapidly changing business environments. The key challenges for the enterprises lie in forming alliances quickly and then having these partner organisations and the administrational ICT-effort (user management, access control, etc.) vanish as quickly as they entered.

Ad hoc process-oriented collaboration on the level of individual employees and on the level of working teams between partner organisations is a very important requirement. Traditional software environments are not flexible enough to support these requirements. Above all, they are unable to bridge semantic differences in concepts that are used by individual organisations and industrial domains.

2.3 SPIKE offers services for intra- and inter-domain workflow enactment

SPIKE enables both inter-enterprise and intra-enterprise collaboration. The system will enable collaboration and cooperation between enterprises by providing ad-hoc workflow and process functionality. In SPIKE business alliances will be created on the basis of web service interaction, which guarantees secure and coordinated interactions across enterprise boundaries. All members of the alliance can offer their services through standard interfaces, which enable exposition of any functionality that can be covered by such service interfaces.

Workflows and tasks can be defined at the user’s discretion or started from reference models. The workflows and tasks can also be saved for later re-use. The portlets of the collaborative applications and
the workflow portlet will be connected via the semantic portal platform enabling process-oriented work based on semantic context integration. Through this capturing, communication, and transformation of the current collaboration contexts and service messages (local as well as remote), it is possible to ensure operation across heterogeneous domains.

2.4 Technical building blocks

SPIKE has to be very flexible and advanced to provide all the planned features. The approach is the annotation of content through utilization of taxonomies and ontologies. SPIKE will provide collaboration facilities by ad-hoc workflow and process definition and management functionality. The interoperability and the collaboration functionality can be used for inter-enterprise as well as for intra-enterprise collaboration.

SPIKE will consist of the following technical building blocks:

- Service-oriented architecture, enterprise service bus
- Semantic technologies
- Business process management
- Portals, inter-portlet-communication and context
- Security Infrastructure for the networked enterprises
- Identity management
- Methodological guidelines

2.4.1 Service-oriented Architectures, Enterprise Service Bus

The term service-oriented architecture (SOA) refers to the design specifics of a large-scale networked system. SOA means using components in combination with loose coupling and decoupled message flow control. The central component is the service: a software instance on a (remote) node, which can be accessed via standardised interfaces that are described in XML. Services can be used atomically or can be chained to form aggregate process flows. The most common way to implement a service-oriented architecture approach nowadays is to apply web services technology.

The integration of technical and business components as well as services using a SOA requires an infrastructure that can connect any components or services, regardless of their location, messaging protocol, and message format. Such a concept is called an Enterprise Service Bus (ESB). Within the ESB, services are combined into complex architectures via an event-driven and standards-based messaging engine. The service bus will be used for registering, discovering and contracting services as well as service message routing and processing capabilities.

2.4.2 Semantic technologies

The semantic web offers the opportunity for providing, finding, and processing information via the Internet. The semantic web uses ontologies to describe information sources, provide common shared vocabularies, and enable semantic interoperability when communicating information and knowledge.

All current ESB implementations have one thing in common: they show that a deeper understanding of the semantics of the underlying services is required. The problem today is finding the best matching service for a particular requirement, especially when considering context aspects. Future ESB solutions, like the one the SPIKE project is envisioning, have to have extended semantic functionality to achieve two of the main objectives of an ESB: (1) the automated selection of the most suitable service for the
next task in the workflow and (2) automated semantic transformation of service messages in order to achieve interoperability between heterogeneous domains.

2.4.3 Business process management

Workflow and business process management

Workflow is the automation of a business process, in whole or part, during which documents, information or tasks are passed from one participant (human or machine) to another for action, according to a set of process. In SPIKE, information flow control will be possible between members of the alliance, i.e. service message and user context filtering according to previously specified policies.

Semantic business process management

The semantic business process management engine handles customized reference processes; these are ad-hoc defined workflows and distributed processes built from generic process fragments. The main focus in SPIKE will be on the management of inter-organisational collaborative business processes, which can suffer from consistency issues, when composing process fragments from different parties. SPIKE will try to overcome this issue using a semantic composition and validation approach.

Process orchestration and choreography

The coordination of web service interaction during modelling is called choreography, whereas flow control at runtime of a complex workflow is known as orchestration. A whole family of technologies has evolved that are intended to take care of these difficult modelling and execution tasks.

As of now, choreography and orchestration implementations are static and hard-coded. This hinders re-usability of services, so it is vital to develop mechanisms for flexible mapping of choreographies to orchestrated services. This will need further development as it will be done in SPIKE for semantic description matching, message transformation and processing during run-time for both process fragments and processes composed from them.

2.4.4 Portals, inter-portlet communication and context

Portals have become the de-facto standard for web application delivery today. In fact, analysts have predicted that portals will become the next generation desktop environment. Technically, a portal combines multiple web applications (as so-called portlets) to one single portal webpage.

The SPIKE system will have portal-based interfaces and tools for user-friendly administration of alliances, ad-hoc workflow modelling and process handling, service management and security as well as user administration. The portal server extension is used for semantic context capturing and communication.

The SPIKE approach is to provide a generic, context-based portlet integration method by capturing the user context and annotating the portlet mark-up using semantic web technologies. Further, SPIKE will bind the context to a workflow instance, instead of only to user-sessions, which means that context-aware collaboration between multiple parties will be possible. There are existing solutions, but they are not appropriate for SPIKE, as they do not consider the semantics of the inter-portlet communication, nor are they suitable for portlets that are provided as third party components.

2.4.5 Security

SPIKE will have a special focus on the security issues involved. The solution will include an easy-to-administer security infrastructure, which will provide security services for service and workflow management of the networked enterprise. The security infrastructure for the networked enterprise
includes attribute management, authentication, workflow and service access control and an auditing functionality.

SPIKE will support large virtual organisations; therefore special care has to be taken to assure that the underlying security model is able to support a possibly very large number of users and objects. The security of sensitive business data is also endangered by the flow of context and message data between organisations. Thus, it is also required that a message and context filtering capability dealing with this issue is researched.

2.4.6 Identity management

The emerging demand for sharing identity information between organisations - among other factors driven by short-term alliances - results in a greater need for standardized data exchange channels. When different organisations work together on specific projects, identity management is one of the most challenging areas. The secure and efficient administration of numerous personal attributes, which make up digital identities, is one of the key requirements here.

There are many different vendors who are currently enhancing their existing identity management products, but there are still several security issues, which remain unsolved. There is, for example, a need for enforcing a strict and controlled synchronisation of identity information among the partners’ user repositories. SPIKE will tackle this issue as well.

2.4.7 Methodological guidelines

To increase the project impact and to facilitate the deployment process, the technical objectives will be complemented with the development of a methodological guideline on how to operate, run and dissolve a business alliance in general and especially with the SPIKE system. Among the components of this guide will be the integration of SPIKE into a given IT infrastructure and the realization of adaptive organisational processes needed for forming alliances.

2.5 Exploitation of the project’s results

All exploitation activities will be based on the SPIKE modules, which will be available free-of-charge. The platform providers will develop services based upon this open source technical infrastructure. The main exploitation areas of SPIKE are in consulting, customisation of business processes, custom development of integration processes and user interfaces for legacy applications. Moreover, semantic annotations or setting up the technical infrastructure are additional fields of exploitation.

The collaboration and service integration markets can be seen as the main markets for SPIKE and its exploitation, as SPIKE addresses intra- and inter-organisational alliances by supporting the partners in setting up the collaboration platform, as well as collaboration processes and integration services.

SPIKE will bring a competitive advantage to companies and organisations of all sizes, helping them to develop and adapt new business models that distinguish their offerings from those of their competitors. Many companies today see their future business success depending more on adapting their business processes or how the organisation operates than on what their organisation actually does. Business model innovation is replacing product innovation as the major driver for competitiveness.

3 Project organisation

AddIT Dienstleistungen GmbH & Co KG (AIT) contributes to the project with the definition of user requirements, business cases for pilot projects, and testing/accepting the implemented platform and the identity management service and business alliance case with Infineon Technologies IT-Services (INF). The company is also involved with the exploitation and requirements engineering for various application domains.
Citec Information Oy Ab pilots the project development results with the Information Hotel concept and coordinates the dissemination and exploitation activities of the project. Citec Information will also provide the project with the needed documentation and training material for the software and the interfaces developed throughout the project.

Infineon Technologies IT-Services (INF) contributes requirements and scenarios and test cases for testing the prototype(s) and provides the test environment. Infineon Technologies also take on quality management tasks. Infineon collaborates with a partner enterprise (AIT) to develop a generic identity management service for business alliances and contributes to the requirements engineering and exploitation.

Intersoft a.s is involved with the service bus and portal development. Intersoft is responsible for the semantic modelling in SPIKE and for contributing to other aspects of the project (for example with the exploitation).

IT Inkubator Ostbayern GmbH contributes user requirements for pilot trials and use plans, as well as providing market analysis, and investigating the potential positioning of SPIKE on the market and the exploitation possibilities. The company is also responsible for raising public awareness and creating and maintaining the project website and different marketing materials.

University of Kosice is responsible for functional specification and overall architecture design and the system integration. They also contribute to semantic modelling, the infrastructure and the portal interface.

University of Malaga is the partner responsible for the security of SPIKE. They also contribute to the architecture design and infrastructure.

University of Regensburg (UR) is the coordinator of the project, which means that UR is responsible for the overall project management and the quality strategy. UR is also responsible for the SPIKE portal, research and software development, for the design and development of the service bus and the portal interface and for contributing to the security of the system.

4 Pilots and application cases

4.1 Software pilots in SPIKE

The evaluation of the platform created in the project will be done using the following cases as software pilots:

- Forming a business alliance with portal-based user interfaces to legacy applications and a workflow concept
- Management of user identities in the networked enterprise
- Documentation service in support of intra-enterprise product development
- Information Hotel for documentation services involving multiple participants.

4.2 Application cases

In the following cases, sample scenarios are described in which the SPIKE infrastructure can deliver a clear added value.
4.2.1 Case: Business alliances and identity management

Identity federation is the main application area for SPIKE at Infineon Technologies IT-Services (INF) and addIT Dienstleistungen (AIT). SPIKE aims to reduce organisational and technical overhead, such as introducing a quick and straightforward implementation of a collaboration infrastructure. This opens up new and more business opportunities to INF and AIT enabling them to offering their services more efficiently to customers from outside the Infineon and Siemens (AIT) groups. These companies plan to use the outcome of the project as a non-open product for setting up and managing identity federations between them and their partners.

SPIKE will enable generic portal-based user interfaces to legacy applications for alliance members and provide generic identity management services to administrate users of networked enterprises. In the SPIKE project, two targets will be pursued. First, a fully automated process involving portal-based user interfaces to legacy applications will be developed. Second, an identity management service that is generic enough for deployment in any business alliance setting will be designed.

4.2.2 Case: Intra- and inter-organisational offering of technical documentation services

Citec Information will pilot an intra- and inter-organisational offering of technical documentation services. The goal of this pilot is to enable close collaboration and communication between all involved partners in the documentation process. In this case, the SPIKE infrastructure will be deployed to aid the documentation service providers in communicating with other actors in the project and help them in accessing, refining and disseminating relevant project information throughout the product development organisation. This part of the case will have the character of intra-organisational cooperation.

Citec Information will be focusing on the novel semantic data transformation functionality of SPIKE, trying to make collaboration more flexible in terms of faster and easier exchange of differing data formats. The SPIKE infrastructure is also expected to create new business opportunities for technical documentation service providers. Based on the tight integration of documentation service providers into the information processes of product development organisations – enabled by the SPIKE system - new opportunities and a significant added value for the product development organisation itself will be possible. With the Information Hotel approach, Citec will provide the interface for the seamless flow of information between all involved parties.

While SPIKE provides the missing links for intra-organisational cooperation, it can be extended to inter-organisational business as well. This SPIKE-based approach will deliver a solution (called Information Hotel), which will unify and define methods and technology for the collaboration processes, so that documentation services can be offered under involvement of multiple parties. The Information Hotel will provide services for secure knowledge and content management between collaborating parties. This solution will lower the documentation costs on both sides, shorten the time-to-market for all parties and improve the quality of the documentation. The Information Hotel can be virtual (each party owning their own parts) or hosted, where Citec Information or another collaborator could host the environment. This case will be an example for the inter-organisational solution of SPIKE technology possibilities.