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The ASG Consortium has 22 partners

The vision of the Integrated Project and Technical Reference Architecture ASG and SOA

The main goal of ASG is to develop an open service platform that consists of a set of concepts, languages and tools that are generic and therefore domain-independent in a way, where it can adapt to different kinds of application realms, business needs or service scenarios. In order to provide a broad range of solutions, tailoring towards a specific application area primarily requires the definition or provision of a domain-specific ontology that describes the concepts and their relationships in that particular domain. Once provisioning has been taken care of, the platform will be able to access and handle all services that rely on that ontology. Service providers will be encouraged to use already existing ontologies or to provide new ones in order to integrate their services. ASG will thereby provide support in the development of ontologies and the integration of services. Service providers can also extend the use of service-oriented usage scenarios and a prototype will allow the adaptability of the platform towards specific application scenarios to be formally proved and demonstrated.

Adaptive Behaviour

Through use of the ASG platform, every service will be accessed and handled in an adaptive way. This means that the platform is able to adapt to runtime changes in the service environment such as the failure of a service or the registration of new services. In the end the platform attempts to reach a defined user goal as long as the service landscape allows for it. For example, in case of a service failure the platform attempts to substitute or re-build this service automatically by using semantically equivalent services that are available in the current service landscape. This type of automation is inherent in almost every feature of the platform from service discovery to invocation and represents a distinct advantage over traditional manual construction methods carried out at design time.

More User-centric Services

The philosophy of ASG is to be as user-centric as possible. This means that ASG will develop and provide technologies that ease service consumption and service provision in addition to providing much richer functionality by services being more responsive and valuable as compared to traditional services today. Additionally, this user-centric philosophy implies putting more control in the hands of the user, for example in terms of consuming a service. The best way in which this can be achieved is to allow the user to specify preferences and constraints, which will have an impact upon the quality of a service that needs to be fulfilled when a user goal is reached. The user is therefore able to choose levels of quality from a wide range of service-related aspects such as maximal cost or response time.

The ASG Consortium is a part of the Sixth Framework Programme Information Society Technology with the strategic objective "Open development platforms for software and services" and was launched in September 2004 with a lifetime of two years.

Dr. Dominik Kuropka, Hasso Plattner Institute, Germany (ASG Scientific Coordinator)

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“IT’s all about services”

In the interconnected world of the Web, users are able to take advantage of services on a broad range of functionality such as searching, ordering, making reservations or retrieving any kind of information. In the future services will provide far more functionality to users in using a wide range of different service components and by applying complex processes in the form of service-oriented applications. Such service applications will have their runtime environments within a worldwide network and be powerful through dynamic performance capabilities in which many flexible service components are available. Reliability, easy service creation and composition as well as service maintenance take on a new meaning when a service is created not from one source, but also from a network of service providers. The integrated project Adaptive Service Grid tackles such challenges by developing an open platform for adaptive and flexible service discovery, creation, composition and enactment. Positioned in the field of service-oriented architectures (SOA), ASG attempts to raise SOA technology to a new level, by incorporating and applying concepts drawn from the latest technologies such as semantic web services, grid technology, agent-based negotiation or model-driven service creation.

The ASG open service platform-generic and domain-specific

The vision of the Integrated Project Adaptive Service Grid is to provide the next level of service provision and delivery by developing concepts, languages and tools for an open architecture for adaptive service discovery, creation, composition and enactment. Furthermore, the platform will stimulate business use by adding functionalities and procedures in order to respect quality of service parameter defined by users.

"Over the last few years, the service-oriented paradigm has gained massive interest from industry and also from academia. SOA is predicted to have a massive impact on how we build software systems, and current developments in software industries affirm this. What makes SOA attractive is the loose coupling of individual services to larger applications, and this is exactly where ASG comes into the picture. We are providing a platform which allows seamless integration of heterogeneous external services, on-demand creation of service compositions and reliable service provision."

Prof. Dr. Ryszard Kowalczyk, Swinburne University of Technology, Australia (Work Component Leader “Adaptive Process Management” and Member of the ASG Scientific Board)
**DEVELOPING USAGE SCENARIOS FOR BUSINESS**

**Usage Scenarios**

Alongside the participation of major European research institutes, the ASG project has the designation of a strong involvement of industry-based partners ranging from big companies to small and medium-sized enterprises. The ASG project aims to have great impact on relevant industry and businesses, and will exploit and demonstrate its technical developments in a variety of application areas. Although the ASG platform intends to cover a wide range of application possibilities, the targeted industry domains are exemplary in the domains of telecommunications, telematics and enhanced enterprise IT. Additionally, the field of E-Government will also be targeted. As demonstration of potential applicability of the ASG platform in its current development, several candidates of usage scenarios will be developed. These scenarios will serve as a base to open the door for business and industrial exploitation. In order to achieve this the project has a dedicated Work Component “Usability and Demonstration” which concentrates on the design and development of such scenarios.

**Demonstration Scenario “Attraction Booking Service”**

In order to proof the feasibility and applicability of the concepts and technologies developed within ASG and to demonstrate their technical advancements, the project has selected one usage scenario that will be implemented by the platform prototype. This scenario, designed by the industrial partners of the telecommunications industry, presents a location-based mobile service called the “Attraction booking service”. This service can be regarded as a part of a larger service platform providing different kinds of tourist services for a mobile end user. The goal of the attraction booking service is to provide customers with information about attractions in the proximity of the customer’s current location. Additionally the customer is able to perform certain actions based on this information, for example retrieve event details, book, pay, or get route descriptions. The customer uses a mobile device, such as a PDA or mobile phone, to obtain this information. A sample situation where this service might be useful is where a tourist visits a foreign city and wants to book a cultural event for the evening.

**ASG’s explorative research methodology**

In order to ensure business exploitation of ASG outcomes and results, ASG adopts an explorative approach where research is tightly interwoven with business-oriented usage scenarios and prototype development. As the ASG project has quite a range of industrial partners it is crucial for them that results of the project can directly be transformed into real-world business scenarios. Therefore, research efforts from the ASG research work components are strongly related to business requirements defined by the industrial partners, iteratively integrating novel findings, concepts and techniques into a running explorative prototype enables the ASG project on one hand to validate and refine research results and on the other to provide industrial partners with concrete solutions. The explorative research methodology of ASG takes advantage in the “Attraction Booking Scenario” which was selected for demonstration purposes by the platform prototype.

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The ASG platform will perform and support a service delivery lifecycle that enables provision and consumption of complex services based on new computing and web technologies. The main enabling concept is that ASG will use semantic information about services to fulfill user requests. A service in ASG is thus not only syntactically (the technical interface to invoke a service) described but also semantically. These semantics are represented by semantic service specifications, which include functional and non-functional properties and rely on ontologies from various industrial domains. ASG components can make use of this information for what a service does in addition to how it does it.

Quality of service, which covers a broad range of non-functional aspects of services such as cost, response time, duration, performance, availability, and many others, is a very important requirement of both business and individual users. By incorporating quality of service in the composition and provision processes, ASG enables user-centric delivery of new and enhanced services where the users have more choice and in-creased control over service quality they receive. The quality-assured provision of services in ASG also enables user-centric delivery of new and enhanced services where the users have more choice and the in-

ASG distinguishes between two types of Services: basic and composed services. A service composition can be thereby regarded as a combined set of services that yield another service reflecting more complex workflows or service processes. In the planning sub-cycle, the ASG platform analyses the current service landscape by discovering and com-

AG is able to negotiate with service providers to find the best solution for user preferences (Quality of Service parameters) provided together with a user’s request. To make this possible ASG, separa-

Enactment sub-cycle

During the enactment of a planned service composition, every individual negotiated service implementation is involved using the ASG Grid service infrastructure that further provides access to service implementa-

Registration & Deployment

ASG follows an approach that provides openness for the widest possible range of service providers and service developers that want to register their services in the ASG platform or intend to create or develop new ASG compliant services. A tool chain based on model-driven approach will support the creation and generation of new ASG services with the help of pre-existing service specification templates. This, in turn, will allow easier integration and enrichment of external services with semantic metadata in order to make them ASG compliant. In this way, every standardized web service can be registered in the platform and deployed within its grid-based infrastructure.
"The ASG reference architecture defines the required building blocks of a semantic web service environment. This includes the definition of clearly defined responsibilities and interfaces, data types and collaborations. Further a reference implementation of each building block will be provided. Since the ASG reference architecture relies on standards it can be tailored towards different domains such as telecommunication as well as IT landscapes."

Klaus Jank, Siemens AG, Corporate Technology Software & Engineering, Germany (ASG Chief Architect)

"The prototype development stream of the project helps us to iteratively validate the findings of the scientific work components. Many research projects remain on a more theoretical level. ASG goes one step beyond by always integrating the newest scientific approaches into a running system to prove their practical benefits. Thus, we do not have just one initial prototype but iteratively release a running prototype implementation of the ASG reference architecture within short time periods. The prototype implements parts of user requirements and thereby allows our industrial partners exposing the adaptability features of the platform."

Guido Laures, Hasso Plattner Institut, Germany (ASG Technical Lead)
ASG takes advantage of the latest research issues within areas such as Web Services, the Semantic Web, Grid technologies, as well as Agent-based Negotiation or Model-driven service creation. One aim of the integrated project is to unite these by utilizing and evaluating their main concepts and methods for further development and extension.

### THE TECHNOLOGIES

#### Service-Oriented Architectures (SOA)

The main technological paradigm in which ASG is positioned is Service-Oriented Architecture, where services are the primary focus as compared to data, objects or applications. This paradigm is based on web service technology and is currently proliferating due to internet technologies and established, well-accepted standards such as SOAP, WSDL, and UDDI. SOA technology attempts to provide interoperability in heterogeneous environments by connecting and integrating applications across enterprise and technology boundaries. This is possible because services are able to hide the underlying functional complexity and technology platform. That's why SOA platforms primarily intend to improve the development of applications in highly distributed infrastructures. In contrast to state-of-the-art SOA, there is no a priori notion of objects with which to be addressed. These challenges are mainly about latent automation possibilities that simplify processes and tasks related to services such as building service applications faster, finding appropriate services more easily, simplifying service specification and creation or enabling easier negotiation of contracts for consuming a commercial service. In addition, in terms of the composition of services that yield another service (also called service orchestration), the programmer has currently to do this manually at design time. The challenge here is to automate this process at runtime. This is one of the areas where ASG plays a major role, by enhancing through developing concepts, languages and tools for an open service platform that attempts to overcome current SOA weaknesses processes services, service composition or automatic service negotiation.

#### Semantic Web

The semantic web is widely proclaimed to be the next generation of the current web in which information is given a well defined meaning. The Internet is currently a huge information space that is used by humans or manual intervention. In order to make this data also interpretable by machines semantic metadata needs to be added in a machine processable way in order to enable reasoning about this semantic information by software programs. This could, in turn, shift the internet into a web of applications and services where machine-to-machine and human-to-machine communication would be more effective. Ontologies are a core enabling concept for the semantic web that define the vocabulary of a particular domain in order to communicate in the same "language". An ontology describes a shared conceptualization of a specific domain by describing its concepts and the relationships between them. ASG explores and uses semantic web technologies for further development to enrich existing web services with semantic metadata or to create new semantically rich services. By using such concepts ASG will be able to discover or compose services in an automatic and flexible way. ASG will also give support in the development and specification of domain-specific ontologies.

#### Grid Technology

The term Grid technology is most typically interpreted as sharing computer power and data storage over the internet in order to use resources co-operatively. Powerful Grids are used across corporate and organisational boundaries by incorporating and sharing resources of all parties into a virtual organisation. The usage of grid technology in the underlying ASG infrastructure allows high scalability, reliability and will provide high performance for task fulfilment. User-specific Quality of Service parameters can therefore be respected. ASG uses the Grid paradigm in the sense of service grids, where services are deployed and executed in the Grid infrastructure. It therefore adopts the Grid idea that the actual binding of a resource for the execution of a service is delayed until execution time. This facilitates a flexible and adaptive approach for efficient resource usage.

#### Agent Technology

Agent technology, originally a part of the field of artificial intelligence, allows software programs to act more intelligently by taking over tasks that are too tedious, complex or protracted to be carried out by a human. These software programs, also called agents, act on behalf of a user and the preferences it specifies. In the context of semantic web technologies agents could reason about semantic specifications of services with regard to relevant domain ontologies. In ASG, Agent technology is used to automate the task of negotiating service level agreements which define a contract between a service consumer and a service provider. The ASG platform holds a mediating position where this task is kicked to the end-user.
The new FP7-instrument integrated project guarantees best conditions to disseminate research results directly to the potential user groups by driving the generated knowledge in a way that it can be received by all interested parties and feedback on research work.

Business sessions, conferences or workshops will mainly focus on business-oriented technologies.

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addresses the questions of platform-independent service execution and monitoring, as well as standardisation and adaption and, in particular, for the development of monitoring products and systems.

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The Business Process Technology research group at the Hasso Plattner Institute for IT Systems Engineering at the University of Potsdam is responsible for the development of a service composition sub-project, responsible for scientific progress in ASG. Our main area of research is the development of a service composition sub-project, responsible for scientific progress in ASG.

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The 'Operating Systems and Middleware Group' at Hasso Plattner Institute (HPI) for Software Systems Engineering focuses on research and teaching in the areas of computer systems, operating systems, computer architecture, and network protocols. The group is involved in the development of new technologies and methodologies for building scalable, reliable, and secure distributed systems.

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Swinburne University of Technology, Australia
Swinburne University of Technology in Melbourne, Australia is a large multi-
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Erik Libilov is a former Senior Research Scientist at Norsk MD with more than 30 years of experience in different fields within Computer and Communication Science. From 1972 – 1988 he was a research scientist at NDEE (Norwegian Defense Research Establishment) working with different kind of computer communication projects. NDEE had close relation to USA DOD. Therefore he became early involved in the DARPAETT (later Internet) project (1974) entering with a stay as International Fellow at IRSI, Menlo Park, California (1976). Libilov was later involved in ISD and CCITT standardization of the MHS (Message Handling System) developed by CCITT as specified in the X.408 Recommendations. As a Peace researcher he participated in the foundation of the ASG consortium and contributed to the Project Proposal. He has also actively participated the ASG project in the C-7 work component, and since start-up in August 2004 he has worked in C-7 and still continue to do that throughout the duration of the project. Among experiences he has that are of relevance of the ASG project are his international standardization work on Web Services and Agent Technology, in addition to tele-conferencing and panel-convening services. Particularly he has participated in several international projects like the E1Y OU/ASTRANT project and standardization work within the ISO and his work on the Open Service Architecture (OSA).

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Larry Libilov, Norway

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generates scalability and high quality access to dis- cern its benefits. The experience with Semantic Web and Peer-to- Peer systems is brought into the development of the disin-stitutionalized Web Service Registry. The P2P-to-Peer sys- tems generates scalability and high quality access to dis- cern its benefits. The experience with Semantic Web and Peer-to-