

**ATHENA – ADVANCED TECHNOLOGIES
FOR INTEROPERABILITY
OF HETEROGENEOUS ENTERPRISE NETWORKS
AND THEIR APPLICATIONS**

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Abstract: Organisations are engaging in more and more sophisticated business networks to improve collaboration. These business networks can range from more static relationships like Supply Chains to very dynamic networks like virtual organisations. A prerequisite to enable business networks is the interoperability of the participants systems and applications. ATHENA is an Integrated Project funded by the European Commission under Framework Programme 6 that addresses Interoperability of Enterprise Systems and Applications proposing a holistic approach. ATHENA will provide technical results like reference architectures, methodologies and infrastructures complemented by business results that provide ROI calculations and impact predictions for new technologies. This paper provides insights into ATHENA and how proposed approaches and expected results support business networks.

Keywords: Interoperability, Reference Architectures, Business Processes, Enterprise Modelling, Semantics, Services

1. INTRODUCTION

One of the trends in the global market is the increasing collaboration among enterprises during the entire product life cycle. This trend requires, that enterprise systems and applications need to be interoperable in order to achieve seamless business interaction across organisational boundaries, and realise networked organisations.

The European Commission considers the development of interoperability of enterprise applications and software as a strategic issue for European companies to strengthen their cooperation and gain competitiveness in the global market. In the context of the EU Framework Program 6 (FP 6) the integrated project ATHENA (Advanced Technologies for Interoperability of Heterogeneous Enterprise Networks and their Applications) has been funded [1]. It consists of a set of projects and is to lead to prototypes, technical specifications,

guidelines and best practices that form a common European repository of knowledge.

ATHENA takes a holistic approach to solving the Interoperability problem taking a technical as well as a business viewpoint into account. Previous activities in that space led to fragmented solutions addressing only part of the problem. From a standards viewpoint in the B2B space there is rather a proliferation than a lack of standards.

ATHENA itself is driven by industry scenarios and requirements. Industrial users in the consortium provide examples from aeronautics, automotive, telecommunications and the SME space. The approach of ATHENA is to go from the specific scenarios provided industrial users to generic requirements applicable to a whole industry. ATHENA looks at the scenarios provided by industrial users in detail and then tries to abstract to industry scenarios common for an industry by identifying commonalities and differences.

Currently users from the automotive, aerospace, telecommunication equipment and furniture industry are participating in ATHENA.

The main section of this document gives an introduction into ATHENA and discusses the research activities and the expected outcomes in detail.

2. ATHENA INTEGRATED PROJECT

The ATHENA IP (Integrated Project) [2] aims to enable interoperability by providing reference architectures, methods and infrastructure components. In ATHENA Research & Development will be executed in synergy and collaboration with Community Building: research will be guided by business requirements defined by a broad range of industrial sectors and integrated into Piloting and Technology Testing as well as Training. ATHENA consists of **three action lines** in which the activities will take place [3]. In Action Line A, the research and development activities will be carried out. Action Line B will take care of the community building whereas Action Line C will host all management activities [2]. Relations between the three action lines are shown figure 1.

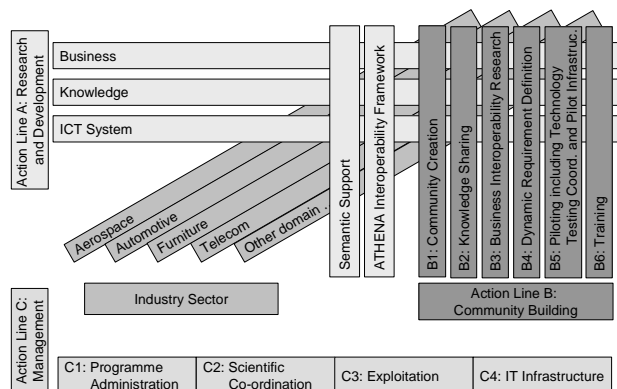


Fig.1 Interaction of ATHENA Action Lines

2.1 Approach

Scenarios play an important role in ATHENA as **sources of requirements** and for the **validation of results**. Scenarios represent the industrial sector-specific implementation of a process and capture industry-specific requirements of a given process. Industry-independent characteristics are described on the process level and are abstracted from the industry-specific scenarios. Scenarios used for validation of results need to be extended with business issues, software and infrastructure, and operational applications used in enterprises. Amongst other criteria, they will be selected based on their general relevance to current and future business paradigms, their general (i.e. industry-independent), industry specific and company-

specific characteristics, and their coverage of the anticipated ATHENA approach, methods, and tools. These criteria apply to scenarios provided by partners before the start of ATHENA and to future scenarios.

For each selected business scenario, the partners will provide **detailed descriptions**. These descriptions will be analysed and compared in order to identify commonalities and differences. The description will be based on a common methodology to capture user requirements.

One of the initial tasks (Dynamic Requirements Definition) in Action line B is to provide this methodology to users in order to be able to systematically capture user requirements.

The selection of processes and industries identified in the initial phase will be **extended** during the course of the project. At first, the scenarios of Supply Chain Management, Collaborative Product Development, e-Procurement and Portfolio Management will be investigated. Industrial requirements that are not fully covered by available scenarios will be anticipated through the Community Building Activities in Action Line B. This continuous process of identifying further industries and processes ensures that the quality of scenario selection will be maintained for the whole duration of ATHENA.

2.2 R&D projects

In Action Line A six research topics/projects were defined for the first stage of the IP. The definition of these R&D projects was based on the roadmaps elaborated by IDEAS (see Section 3.4):

- *Enterprise Modelling in the Context of Collaborative Enterprises* (A1) aims at developing methodologies for management and modelling of situated processes, flexible resource allocation and assignment. Furthermore, it investigates methodologies for work management and execution monitoring. For externalising the dynamic dependencies between participants and processes, methodologies of content based routing and collaborative processes will be developed. This project will enable scalable Enterprise Modelling methodologies and infrastructures, repository services and portal server services for “benefit driven Enterprise Modelling involvement”.

- *Cross-Organisational Business Processes* (A2) deals with modelling techniques to represent business processes from different organisations on a level that considers the privacy requirements of the involved partners. Such models will have two perspectives: an enterprise modelling perspective that assigns a process to its context in the enterprise, and a formal aspect to perform computational transformations in order to allow for re-use of a process in a cross-organisational environment. Such models need to be enriched

through ontological information and need to be executed through IT systems, such as workflow management systems. These systems need to be enabled to operate efficiently in an architectural environment that adapts to particular business scenarios.

- *Knowledge Support and Semantic Mediation Solutions* (A3) aim at the development of methods and tools for the semantic enabled enterprise, with a focus on supporting enterprise and application software interoperability. A key objective is to build an integrated software environment that is able to manage the semantics of different abstraction levels that can be found in an enterprise. Focus is to use formal semantics, organised in domain ontologies, to annotate the business processes and the software components in order to reconcile the mismatches that may be encountered in unanticipated cooperation activities.

- *Interoperability Framework and Services for Networked Enterprises* (A4) is concerned with the design and implementation of the infrastructure supporting interoperability in scenarios adopting the Integrated Paradigm (i.e. where there is a standard format for all constituent sub-systems) by enriching existing state-of-the-art interoperability architectures with enterprise semantics and models derived from the Enterprise Interoperability Infrastructures of the organisations involved. The project will provide methodologies and develop seamless and configurable inter-connection software components. The resulting toolset will be the basic set of software and engines that is to prepare any enterprise in the adoption and exploitation of interoperability support infrastructures.

- *Planned and Customisable Service-Oriented Architectures* (A5) is to develop the understanding, tools and infrastructures required for service-oriented architectures which can be achieved more easily through the planning and later customisation of solutions for better application to user scenario requirements. Although the project will consider available business services, an increasing emphasis will be given to the development of an environment for easier application development that natively provides better customisation.

- *Model-driven and Adaptive Interoperability Architectures* (A6) is to provide new and innovative solutions for the problem of sustaining interoperability through change and evolution, by providing dynamic and adaptive interoperability architecture approaches. The project aims to advance the state-of-the-art in this field by applying the principles of model-driven, platform independent architecture specifications, and dynamic and autonomous federated architecture approaches, including the usage of agent technologies.

2.3 Remarks

Though the programme as a whole adopts a holistic perspective on interoperability, there is an initial emphasis of individual projects on **individual building blocks** rather than on achieving solutions that address interoperability in a holistic manner. However, the individual results of the projects taken together will eventually be combined to an **integral solution**.

Four out of six initial research projects (projects A1, A2, A5, and A6) address relatively focused topics. Project A3 is rather **supportive** in its focus on semantic issues that will be evaluated and used by all other projects. Finally, project A4 integrates the results and methodologies reached in the other projects. This project is a first **reconciliation attempt** that will provide an integral solution resulting in the ATHENA Interoperability Framework.

Major impacting results from ATHENA could be stated as follows:

- A generic, common platform for Networked Organisations, integrated by an open Infrastructure.

- Interoperability services to assist enterprise designers, knowledge workers and system developers in composing and adapting executable solutions, reusing knowledge and software components.

- Specific platforms built to support the research projects, the communities, use-cases, scenarios, test-beds, training and learning facilities, and collaborative experimentation.

2.4 Research Environment

ATHENA builds on results and experience of the thematic network IDEAS - Interoperability Development of Enterprise Applications and Software [5]. Goal of IDEAS was the definition of a roadmap for Interoperability of Enterprise Systems and Applications [4]. This roadmap was used in ATHENA to define the R&D Projects described in the previous section.

Furthermore, besides ATHENA the European Commission approved a Network of Excellence addressing a similar problem space: INTEROP (Interoperability Research for Networked Enterprises Applications and Software) [6] aims at integrating expertise in relevant domains for sustainable structuration of European Research on Interoperability of Enterprise applications. ATHENA is closely related to INTEROP.

3. CONCLUSION

This paper presented the EU project ATHENA that addresses Interoperability of Enterprise Systems and Applications. Its holistic approach and the

individual research approaches and expected results were presented. Ongoing work focuses on research activities, building prototypes and applying them to pilot implementations.

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