

EU-IST Project IST-2004-026460 TAO  
TAO: Transitioning Applications to Ontologies



## D7.1 Case Study 2: Requirement analysis and application of TAO Methodology

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### **Synthesis Report**

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#### **Abstract**

This document outlines the results of requirement analysis and definition of transitioning scenarios to semantic technologies that have been carried out on the aircraft maintenance application of case study 2. In this work, a structured set of requirements is collected and exploited as a starting point to set up precise technical directions that will be followed in the re-engineering work. Main achievements are detailed specification and scope delimitation of the transitioning scenarios regarding ontology acquisition, semantic annotation, and process modelling.

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## **Executive Summary**

This document outlines the results of requirement analysis and definition of transitioning scenarios to semantic technologies that have been carried out on the aircraft maintenance application of case study 2. In this work, a structured set of requirements is collected and exploited as a starting point to set up precise technical directions that will be followed in the re-engineering work. Main achievements are detailed specification and scope delimitation of the transitioning scenarios regarding ontology acquisition, semantic annotation, and process modelling.

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**Task : T7.1**

## Outline of Requirement Analysis and Transitioning Scenarios

The application refactored in this case study is representative of the needs regarding knowledge-based services encountered in complex aeronautic information systems. The case study development focuses on providing semantic-based support to aircraft maintenance processes. More precisely, the goal we are pursuing is to show how maintenance legacy data repositories and business processes can be migrated into a semantic-powered SOA framework utilising TAO transitioning methodology and tools. The added value of the resulting service-based applications will be practically assessed in terms of knowledge reuse, interoperability, and increase of automation potential of both services and data exchanges. In the reengineered framework, ontology-based models of technical data and services are intended to be exploited to support highly interoperable exchanges between maintenance management systems and to provide standardised knowledge inputs for user mediated semantic annotation of technical publications.

Several identified requirements are related to the need for improved knowledge sharing as a way to strengthen interoperability. In the aeronautic sector, it is widely accepted that part of the solution to data interoperability lies in the use of business standards. Many effective standards defined by industry organisations are basically content-oriented and tailored to ensure semantic interoperability in automated processes. However, the lack of suitable representation languages has not allowed to make them fully exploitable for this purpose. Semantic languages are powerful devices that could enable to effectively exploit and improve existing business standards for better interoperability in software infrastructures. In this perspective, the proposed transitioning scenario demonstrates how in the complex aircraft maintenance domain a stratified reference model can be constructed through systematic reuse of widely accepted standards turned into ontologies and existing general-purpose ontologies. This upper reference model is intended to be reused and eventually specialised by all applications pertaining to this specific domain.

To implement such a stratification of domain and corporate knowledge, the representation framework should allow the definition of comprehensive models through progressive refinement of self-contained modules. Ontologies with their classification and modularisation capabilities appear to be good candidates to fulfill these requirements.

Another key problem addressed in this case study is the need for the assisted acquisition of semantic repositories from large collections of legacy data, including databases and unstructured documents. Ontology acquisition has been given a high priority in the case study development as we believe that a major obstacle to the adoption of semantic powered SOA is the acquisition effort required to elaborate the ontology-based repositories and to make them directly available for exploitation in service-based processes.

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As the main data source in the case study is a relational database, a significant effort will be devoted to ontology acquisition from semi-structured corporate repositories built on this widespread database model. We performed a detailed analysis of the legacy aircraft maintenance database to identify regular modelling patterns that can drive the definition of a semi-automated ontology learning method and tool. In the acquisition process defined in the transitioning scenario, both database mining and text mining are combined to generate bootstrap ontologies to be further refined in subsequent steps of the process.

A primary goal in this case study is to practically demonstrate how a large technical repository can be transitioned into an ontology-based and service oriented framework. Another important complementary goal is to show the benefits of the new repository, and more specifically to show how enhanced knowledge formalisation can help to provide the user with more automated services and to significantly improve interoperability in the maintenance processes. To fulfill these knowledge exploitation goals, two activities are revisited:

- Annotation of technical publications: this costly manual editing process is redesigned to take advantage of automated ontology-based annotation services included in the TAO suite.
- Process modelling for maintenance planning: A limited though representative scenario of maintenance planning is defined to be exploited as a practical framework for the evaluation of semantic-based SOA approaches and the identification of requirements for next generation of semantic web services.

The definition of the transitioning scenarios is intended to provide the major technical directions for prototype development on ontology acquisition and semantic annotation.