AMPLE
Aspect–Oriented, Model–Driven, Product Line Engineering

Specific Targeted Research Project: IST- 33710

Requirement specifications for industrial case studies

Abstract

This deliverable and its attached supplemental documents contain the requirement specifications for a subset of the case studies described in D5.1. The subset will be chosen according to the evaluation criteria developed in D5.1.

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1 Introduction

Requirements are important in all project-efforts; the requirements denote the first artefacts of a project that lead to the project goal. In general, dealing with requirements can be separated into the development and the management of requirements. The former generates the input for architecture design and includes the elicitation of requirements, their analysis, and finally their specification. To begin the elicitation, a scope for the requirements must be defined. This scope is dependent on the desired system and must identify what necessary and unnecessary system characteristics are. Then, requirements are collected in different ways, for example, surveys are possible. It is also necessary in the beginning phase to establish a common understanding among the stakeholders. In projects that involve multiple parties, the elicitation also involves the negotiation of requirements, for example, between client and developers.

This document intends to serve as input for the AMPLE project consortium collecting requirements from three case study descriptions that were submitted by each of the industry partners in the project: SAP, Holos and Siemens. These three project partners have case studies from the business fields to provide realistic and real-world input to the AMPLE research project. These requirements target the product line infrastructure as part of a product line engineering process.

The following sections will describe an overview on the case studies for a set of supplemental document for this case study:

- SAP Case “Sales Scenario”
    - Market Requirements Document: Sales Scenario (Aggregated Description)
    - Sales Scenario Requirements Specification “Customer Order Management”
    - Sales Scenario Requirements Specification “Payment”
    - Sales Scenario Requirements Specification “Product Management”
- Holos Case “Space Weather”
    - Description of the Space Environment Support System (SESS)
    - Description of the Space Environment Information System (SEIS)
- Siemens Case “Smart Home”
    - Requirements from the EU-Funded ePerSpace project
    - Requirements from application case “Totally Integrated Home”
    - Requirements from the application case “siemens@home”

The following overview will start with a case study from SAP, which covers the sales scenario of a customer-relationship-management application. Then, the subsequent part will present the case study from Holos which presents two very similar applications and thus show a clear potential for the establishment of a product line. As a third case study, the smart home case from Siemens is presented. Subsequently, this document presents a summary on the requirements derived from these three case study sections.

2 SAP Case Study

The case study presented by SAP describes a software-product line in context of business applications. Considering this large application domain indicates that different applications are relevant in such case study, for example, product life cycle management (PLM), supply chain management (SCM) or supplier relationship management (SRM), only to mention only a few.

The case study chooses the customer relationship management (CRM) as focus. In addition, the case study combines these with different subsets of the aforementioned applications. It has to be stated, that not an entire CRM system is considered, but parts that seem to be relevant and meaningful enough to integrate into a variability-driven context and adjusted them to the focus of the project. For this case study, SAP has submitted four requirements specification documents: “Market Requirements Document” describing three particular areas, and three “Requirement Specifications” describing three areas in the sales scenario. The three documents cover the following areas:

- **Customer Order Management:** The Portfolio Case “Customer Order Management” entails the Market Requirements: Sales Processing, Quotation, Pricing Strategy, Approval Process, Availability Check, Credit Check, Returns.
- **Payment:** The Portfolio Case “Payment” manages receipts of incoming and outgoing payments. Upon creation of a binding sales order, “Payment” is activated automatically. Depending on the method of payment offered by the system and selected by the customer, an automatic debit transfer from the customer’s account can be triggered (Payment Card) or an invoicing document can be attached to the delivery (Cash On Delivery). A third payment option (Invoicing) is possible and allows an invoicing document to be send to the customer with the possibility of later settlement.
- **Product Management:** The Portfolio Case “Payment” manages receipts of incoming and outgoing payments. Upon creation of a binding sales order, “Payment” is activated automatically. Depending on the method of payment offered by the system and selected by the customer, an automatic debit transfer from the customer’s account can be triggered (Payment Card) or an invoicing document can be attached to the delivery (Cash On Delivery). A third payment option (Invoicing) is possible and allows an invoicing document to be send to the customer with the possibility of later settlement.

The presented case is called sales scenario, in order to clearly distinguish from CRM as such. It represents an aggregation of the documents mentioned above. The entire example is based on explanations of Buck-Emden and Zencke in [BZ04].

2.1 Requirements Documents Overview

The key message for the sales scenario is "management is all". Its core concept is the acquisition and exploitation of business process data (i.e., the holistic management). Central storage and access controlled retrieval shall be provided. It is irrelevant for the example, whether data is only stored and the system provides only a user interface for I/O, or if other communication channels are used to communicate directly or indirectly with other parties involved in a business process (printing invoices, quotations, etc. is considered indirect communication in this regard).

The Sales Scenario focuses on sales processes of enterprises selling one or more products. This involves different things, ranging from opportunity management (currently not in the feature model) to quotations to customers, sales order and invoice processing. The supplemental documents provide the following information:

- One "**Market Requirements Document**": This document describes the three scenarios of the case study from a functional perspective. It lists a summary, the context, the business value and involved roles for the scenarios. Each of the scenarios is described in further detail by separate requirement specifications (see below).
- Three "Sales Scenario Requirements Specification" documents:
    - "**Customer Order Management**": This document refines in a systematic way the business context and scope, explains involved roles and the detailed software requirements of this scenario. The customer order management covers the creation of quotation, availability checks, the credit worthiness etc.
    - "**Payment**": The requirements specification for the payment scenario has the same structure as the document introduced above. The payment scenario covers the processing of different payment methods, such as payment by credit card or payment by invoice.
    - "**Product Management**": The product management scenario covers functionality that is required in conjunction with sales, such as the management of a warehouse or the tracking of stock items.

All these three documents provide identification numbers for particular requirements in order to allow tracking of requirements among the documents.

3 Holos Case Study – Space Weather Decision Support System (SWDSS)

The SWDSS case study presented by Holos describes a software-product line in the context of providing real-time information about space weather conditions/events and spacecraft onboard measurements for a set of products denoted - Clients Tools.

3.1 The Case Study Domain

All externally retrieved data (space weather and spacecraft data) and internally generated data (such as triggered alarms, occurrences of single event upsets and time series data forecasting) are collected and integrated and the Data Processing Module (DPM), which is responsible for the retrieving, extraction, transformation and loading of all relevant data (available on External Data Service Providers or generated at request, by the components in the Forecasting Module). The Data Integration Module (DIM) manages all information, establishing the communication between DPM and Client Tools.

The Client Tools - the principal human machine interface with the users, used by the Flight Control Team and others interested parties, are capable to support different application scenarios such as:

- **Monitoring Tool** – near real-time visualization of ongoing Space Weather and Spacecraft conditions;
- **Reporting and Analysis Tool** – historical data visualization and correlation analysis (including automatic report design, generation and browsing) using state-of-art Online Analytical Processing (OLAP) client/server technology;
- **Alarm Engine** – is responsible for the analysis the real-time data stored in the DIM and evaluates it according to a set of alarm rules that identify Spacecraft or Space Weather anomalous conditions.

With these tools the whole system increase awareness and understanding of space weather and its effects on spacecraft performance. All together, it should lead to operations that are more efficient and possibly to a quality increase of services as well as improving the safety of the payloads.

3.2 Requirements Documents Overview

The initial requirements defined for SWDSS are based on previous project requirements documents, and encompasses three main functionalities for the system:

- **DPM (Data Processing Module) and DIM (Data Integration Module)** – the first one is responsible for all file retrieval, parameter extraction and further transformations applied to all identified data and validation mechanisms ensuring that all online and offline availability constraints are met; the second one acts as the system's supporting infrastructure database, providing integrated data services to the SWDSS user applications, using three types of multi-purpose databases;

- **Clients Tools (Monitoring Tool, Reporting and Analysis Tool)** - the SWDSS system comprises two main client tools, witch take advantage of both the collected real time and historical data.
- **Alarm Engine** – service that analyse real-time data stored in the DIM and evaluates a set of alarm rules to identify Spacecraft or Space Weather anomalous conditions. The alarms to be evaluated are defined by the users using the Alarm Editor tool. When the Alarm Engine identifies an alarm, it stores it in the DIM so it can be accessible to the Monitoring tool.

All these three documents provide information numbers for particular requirements in order to allow tracking of requirements among the documents. The next task in the SWDSS is to summarize and extend the initial requirements defined to ensure each product line (Client tool) is well characterized.

4 Siemens Case Study

The case study submitted by Siemens comes from the area of building technology: The product is a so called “smart home”. A smart home is a building for living equipped with a set of electrical sensors and actuators in order to allow for an intelligent sensing and controlling of the building’s elements: the windows, the heaters, the light, etc.

4.1 The Case Study Domain

In the homes of European citizens you typically find a wide range of electrical and electronic devices: home equipment like lights, thermostats, electrical blinds, fire and glass break sensors, white goods like washing machine, dryer and dishwasher, entertainment equipment like TV, radio and devices to play music or films, communication devices like (smart) phones and PCs. As an orientation, the basic key entities in this domain are:

- a House,
- a House has several Floors,
- a Floor consists Rooms,
- a Room consists of several Controlled Devices,
- each House is equipped with a Smart Home Service Platform,
- each House consists of Remote Control GUI Devices (inside house) and 3rd party services or devices.

The goal of projects in the Smart Home domain is to network those devices and enable the inhabitants of a home to monitor and control the status from some kind of GUI. A rudimental solution allows controlling devices from certain technical areas inside the house and executes home centric applications. A more ambitious solution integrates more kinds of devices and includes an external platform to enable remote access and services from other providers. Tasks like billing, logging and platform management are involved in this case.

4.2 Requirements Documents Overview

Referring to the case study smart home, Siemens has created a number of requirement documents that cover three main applications of the smart home. The first application targets the family life in the future (the ePerSpace project) and thus, provides a very personal view on how to benefit from a smart home. The second requirement document discusses applications enabled by a networked infrastructure (serve@home). As a consequence, described scenarios focus on communication and information services, such as ordering a taxi, or getting weather information. The third document lists requirements from a scenario that focuses on a strong integration between the components (Totally Integrated Home). Such scenario allows for combining different services with different devices and thus leads to new applications.

Each of the requirements documents is available in two document versions: one version presents a comprehensive overview and is thus preferred for reference purposes (“Original Requirements Documents”). The other version is a shortened version focussing on the requirements part of the documents allows for a quick introduction of the scenarios.

4.2.1 Original Requirements Documents

Requirements from the ePerSpace EU-project.

These requirements were derived from the EC-funded ePerSpace project (IST No. 506775), in particular from the Deliverable 1.1 which describes these scenarios in detail. The scenarios introduced by the ePerSpace project describe a day in the life of the fictitious van Epers family. The van Epers family are ePerSpace users and can make use of services provided by the system both at home and elsewhere.

Requirements from the "serve@home" case study.

The case study covers the remote control of home appliances. It allows retrieval of status information from devices like washing machines, dryers, and dish washers, as well as modification of the settings and control, i.e. to turn them on and off or to start programs. In serve@home, the home appliances are connected through powerline-based network to a gateway. They can be controlled with a mobile phone or a Tablet-PC. Additionally, the user is automatically notified about events. Such events are typical household appliance events, like the end of a washing cycle or the opening of the freezer door. The Figure 2.1 shows the main components of the serve@home architecture which are the home appliances networked via power line, the gateway as central element and the interaction devices connected to it via wireless technologies.

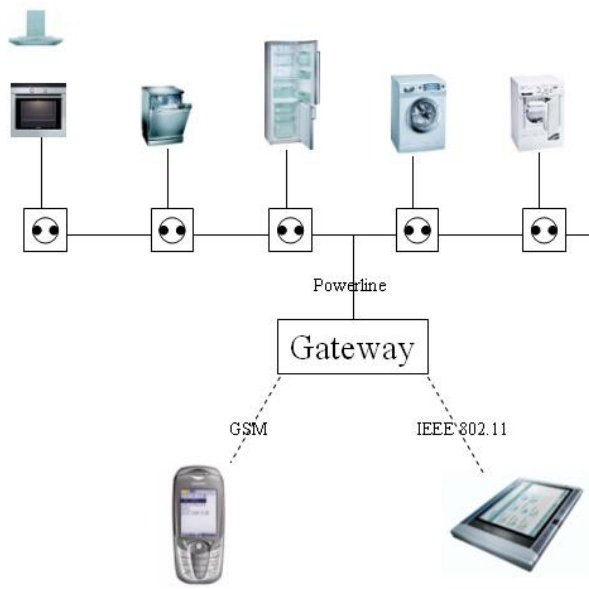

Figure 1 serve@home Base Architecture

Requirements from a specific case study "Totally Integrated Home".

The third supplemental document lists requirements from a Siemens internal document on a Totally Integrated Home platform. The document itself is confidential. General requirements are extracted to support the process of domain description. For the case study the Totally Integrated Home is treated as one existing application.

4.2.2 Condensed Requirements Documents

The above three requirements documents cover huge areas of the home automation domain. To be able to connect the tooling provided by AMPLE requirements engineering with the actual implemented slice of the home automation domain, a number of requirements documents were produced that fit the scope that can be implemented as a case study in WP5.

ePerSpace

This requirements document descries scenarios that are written in the same style as the ePerSpace scenarios. They reflect what is going to be implemented in the Smart Home demonstrator. The first scenario describes a day in the life of the van Epers family. The van Epers family are ePerSpace users and can make use of services provided by the system both at home and elsewhere. The scenario describes what happens when the van Epers family leaves for and is on vacation. Here the focus is on security features provided by smart home.

serve@home

This document describes requirements a building architect has to a smart home system. The included scenarios are based on domain knowledge and were created to allow mining commonalities and variations from this document together with the other shortened requirements documents.

Totally Integrated Home

This document is a short version of the Totally Integrated Home description. It concentrates on the main use cases and non functional requirements like security, and several operational requirements.

5 Tool, Technology and Process Requirements

This section lists requirements towards the tools, technologies and processes used and developed in the context of AMPLE. The requirements are divided into four main parts:

- The first part covers all requirements about the transformation infrastructure,
- The second part deals with required technologies and standards ,
- The third part covers requirements about modelling languages, specifications and the creation and management of models,
- The fourth part considers requirements that are orthogonally aligned, and thus, called „special“,
- The fifth part targets requirements that focus on the realisation of particular case studies. However, these requirements have clear implications on the product line engineering.

The presented requirements listed here do only cover the product line engineering as this is subject to the AMPLE project. For example, if the smart home case requires the support for light switches, this is not subject of the discussion. The remaining requirements with their referring case study/party are:

1. Transformations:

- Configurable transformations in order to support adaptation of transformation depending on the configured DSL (Siemens),
- Definition of own DSLs possible (obviously) (SAP, Siemens),
- Support of variable process models / updates in process models (SAP),
- Support of AO instead of „Common Language Crosscutter“. (Siemens),
- Integration of UI generation while considering their usability (SAP).

2. Infrastructure

- Use of open source technology whenever possible (SAP),
- Reuse proven solutions for frameworks, tools and project know-how (SAP),
- Incorporate Eclipse as rich client (SAP, and, although it has not been mentioned specifically, Siemens, as well),
- Support for Java (SAP, Siemens) as the main language for the implementation,
- Support for OSGi (Siemens), or potentially JEE with Seam and Spring frameworks (SAP),
- Support of different hard- and software platforms – as a proposal this can be realised by AO Templates (Siemens).

3. Modelling Facilities:

- Distinguish between platform independent and platform specific models and provide a clear separation between both,

- Support of multiple Viewpoints, for example, a data view point and also an architectural viewpoint. (Siemens),
- Use of feature models for configuration of model editors as a part of the product line infrastructure (Siemens),
- Setup product line infrastructure for already established/ existing software products (Holos),
- Integrate modelling and transformation infrastructure to existing and already developed software (Holos),
- Support for crosscutting concerns such as the implications of a feature from business logic to user interface level (SAP),
- Support for roles in the domain (Siemens, SAP). Although roles are also a concept referring to the use of the systems as describes by the case studies, the roles are also important in the context of product lines. The product line engineering infrastructure gets so complex, so that the clarification of roles in the engineering efforts is required (SAP, Siemens),
- Prefer to weave aspects at model level instead of weaving at code level (SAP),
- Using AO for putting cross cutting concerns into separate modules (SAP).

4. Special features:

- Traceability from requirements to artefacts / code (SAP),
- Traceability from code to requirements (SAP),
- Integration of traceability into modelling infrastructure (SAP),
- Checking for unanticipated features using AO techniques (SAP),
- Configurable Binding Time of features: optional features can be bound at design time, at compile time or during run time. Ideal would be to have the binding time as configuration setting to the extent of technical limitations (SAP).

5. Case Study Adoption:

- Use of mock objects for transformation (Siemens),
- Ignore non-functional requirements (Siemens) In addition, remain on focus on functional requirements is an according requirement by SAP,
- Allow for extension strategy with the introduction of product lines when considering that the AMPLE techniques are applied to existing products (Holos),
- Avoid fixed binding to existing backend business systems (SAP),
- Present a rich adoption of AMPLE technologies and concepts (SAP).

Table of Figures

Figure 1 SEIS Architecture .... **Fehler! Textmarke nicht definiert.**
Figure 2 serve@home Base Architecture 10

References

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