Grant Agreement N° 215483

Title:	*Collection of industrial best practices, scenarios and business cases*
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Identifier:	*Deliverable # CD-IA-2.2.2*
Type:	*Deliverable*
Version:	*1*
Date:	*27 March 2009*
Status:	*Final*
Class:	*External*

Management Summary

The current document aims at presenting the case studies that we have been collecting so far and we consider most relevant to S-Cube. In particular, we focus on five cases as they, collectively, touch all the main points of interest within S-Cube. To make all case studies comparable and easily understood, we have defined a case study description approach that leverages from the results achieved by NEXOF-RA and from the Requirements Engineering literature. The usage of such approach for revising and describing all cases has been very useful to highlight some weak aspects of the original descriptions and to identify those aspects in the case studies that cover the main points of interest for S-Cube.

The research leading to these results has received funding from the European Community's Seventh Framework Programme [FP7/2007-2013] under grant agreement n° 215483 (S-Cube).

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Chapter 1

Introduction

1.1 Context

The objective of S-Cube is to produce medium-term innovative research results in the area of service engineering. Being a network of excellence, S-Cube does not involve industrial partners. This can be seen as an obstacle to the grounding of results achieved by the network on the current best practices and problems of industry and to the actual experimentation of these results on a concrete basis. To overcome these issues, S-Cube is fostering links with innovative European large companies and SMEs to form long-term and productive collaborations. The purpose of workpackage WP-IA-2.2 is exactly to act as a driver for the creation of these links, and in particular:

- To identify alignment needs with industry in order to assess, on the one side, the industrial relevance of S-Cube and, on the other side, to gather new needs when they arise.
- To collect industrial best practices and guidelines for SBAs using the empirical evidence possibly provided by industrial partners.
- To foster and ensure the acceptance of Service-Based Applications (SBAs) by European industry, also including SMEs.

In concrete terms, the workpackage has started addressing these objectives by trying to collect from industry case studies, challenging problems to address, and best practices. Moreover, the workpackage has started collecting proposals for collaboration on specific problems, and for internships of S-Cube young researchers within industry. Finally, the workpackage has also planned to transfer to interested organizations the S-Cube results, and, more specifically, the application of the results on problems proposed by industry.

Clearly, in this interaction with industry, WP-IA-2.2 is acting as a mediator and is, in turn, interacting with all the other workpackages in the network. In particular, WP-IA-2.2 is gathering:

- From all research WPs the requirements and expectations for case studies as well as the concrete results and the application of these results to the case studies.
- From WP-IA-3.1 an overall integrated view of the S-Cube framework. Such a framework will be used to vehiculate to industry the main concepts and challenges S-Cube deals with.
- From the Spread of Excellence (SoE) activity new contacts and possibilities to showcase the results to industry.

1.2 Purpose of the document

The current document is consistently framed into the roadmap presented in Section 1.1 and aims at presenting the case studies we have been collecting so far and that we consider most relevant to S-Cube. In particular, we focus on five cases as they, collectively, touch all the main points of interest within S-Cube. These points will be discussed in more detail in the rest of the document and can be summarized as follows:

- The presence of business situations and, in particular, of Agile Service Networks.
- The need for negotiating, establishing, monitoring, enforcing Quality of Service aspects.
- The presence of actors with different characteristics.
- The presence of a distributed IT infrastructure.
- The possibility of having highly distributed and decentralized service compositions.
- The presence of highly changing requirements that lead to the need of adapting a SBA at various abstraction levels, from the business level down to the infrastructure.

In order to make all case studies comparable and easy to understand, we have defined a case study description approach that leverages from the results achieved by NEXOF-RA [1] and from the Requirements Engineering literature. The usage of such approach for revising and describing all cases has been very useful to highlight inconsistencies and to identify those aspects in the case studies that cover the points that we have listed above.

The term case studies has been used in the literature to mean either a specific problem or a problem together with a specific solution. In this document we refer to the first meaning as for the moment we are interested in gathering problems cases that we will then address with our specific S-Cube solutions. In the future steps of our work, if available, we could then use the solutions as benchmarks against which to compare our approaches.

1.3 Structure of the document

This document is structured as follows: Chapter 2 presents the main characteristics that we expect the case studies shoud have. Such characteristics are the ones that best highlight the most relevant aspects of S-Cube. Chapter 3 illustrates our methodology for case study description. Chapter 4 presents the case studies described according to the methodology and Chapter 5 discusses about how the case studies fulfill the main required characteristics. Finally, Chapter 6 draws the conclusion.

Chapter 2

Requirements for Case Studies

This chapter identifies the requirements that should be fulfilled by the industrial case studies in order to highlight those aspects that are considered important in the S-Cube project. Each of the identified requirements is strictly related to the Challenges of the S-Cube project itself, which are being collected by IA-3.1 and are going to be presented into the S-Cube white paper.

2.1 Description of business situations and presence of agile service networks

The next-generation of service-based applications will serve as a mean for developing mission-critical applications based on strategic technology capable of creating and executing cross-enterprise collaborative business processes, business-aware transactions and connecting the entire business value chains. With a process-managed business value chain, organizations can deploy, monitor and continuously update cross-enterprise functions within a mixed environment of people, content and systems. The next generation of service-based applications will essentially provide much more functionality and flexibility, enabling organizations to innovate value delivery systems that transcend the enterprise and extend to every external partner. The trend will be to move from a relatively static view of an organization to a much more dynamic, high-value one, where end-to-end business process interactions and trends are examined more closely to understand the business dynamics. Such collaborative, complex end-to-end service interactions give raise to the concept of Agile Service Networks (ASNs). ASNs describe those situations where the focus is not on product-centric industries, but rather on the possibility for various actors to be co-producers and co-innovators of services in a peer to peer way.

Agile Service Networks comprise large numbers of long-running, highly dynamic complex end-to-end service interactions reflecting asynchronous message flows that typically transcend several organizations and span geographical locations. The term complex end-to-end service interaction signifies a succession of automated business processes, which are involved in joint inter-company business conversations and transactions across a federation of cooperating organizations.

S-Cube is focusing on the above aspects and will provide a new coherent approach to model, execute, and monitor complex ASNs. Thus, the case studies we envisage should describe some business cases that involve various organizations that cooperate in a peer to peer way through complex business conversations and long-term transactions.

2.2 Need for negotiating, establishing, monitoring, enforcing QoS aspects

As illustrated before, more and more services will be provisioned in the context of short-term, volatile and thus highly dynamic relationships and processes involving service providers and requestors (also

called consumers) which are not known during design time. Thus, services will have to be enabled to collaborate in highly distributed environments, cutting across the boundaries of various organizations.

To provide the desired end-to-end quality of such globally distributed service-based applications, the dynamic agreement and assurance of quality becomes a key issue. This requires that not only quality aspects are negotiated and agreed, but also that these are checked during run-time in order to determine whether there is a need for adapting the service-based application or for re-negotiating the quality contracts.

Typically, a contract is a formal agreement between two or more parties to create mutual business relations or legal obligations. In electronic settings, contracts are composed of different parts, such as the definition of business partners, the specification of functional obligations, and quality, price, and penalties related with the object of the agreement.

In S-Cube approaches to define contracts, to monitor their fulfillment, and to predict potential problems will be studied. Thus, case studies requiring the establishment and management of contracts, will allow us to showcase the results of our work in this area.

2.3 Need for service consumers with various different characteristics

The analysis of the way humans can exploit service compositions and offer services themselves is an important aspect of S-Cube. In order to exercise the results of such analysis, we expect that case studies require:

- The existence of different types of roles that people can play.
- The presence of different individuals fulfilling the same roles and having different skills and abilities. For instance, we can imagine that users of different ages will have different preferences in the way they interact with the system.
- The need for different single and collaborative tasks within business processes.
- The presence of different organizational cultures that might influence qualities of business processes and service-based applications.

2.4 Need for distributed infrastructures

One of the objectives of S-Cube is to develop service-based solutions that are suitable to support the integration between distributed business organizations as well as pervasive computing applications. This results in the fact that the underlying software infrastructure we rely on is intrinsically distributed and composed of heterogeneous elements.

As a consequence, case studies that can fully benefit from the S-Cube results shall require such a distributed infrastructure. This would allow us to highlight the advantages of distributed and federated service repositories and of a communication backbone that enables the interaction between components on a fully decentralized basis.

2.5 Need for highly distributed service compositions

Service composition with a distributed logic enable an easy implementation of those interaction occurring within Agile Service Networks (ASNs) (see Section 2.1). In this setting, the mechanisms that implement ASNs should enable the composition of services without the need for a centralized orchestrator that manages such composition.

As a consequence, good case studies for S-Cube are those that provide situations where service compositions rely on services scattered among different organizations or different parts of the same

organization, and where it is appropriate to decentralize the service composition logic. Clearly, case studies with more limited requirements in terms of distribution of the composition logic would still be addressable, but they would not highlight the actual advantages offered by S-Cube in this area.

2.6 Highly changing requirements and adaptation at busines, composition, infrastructure levels

We envisage complex case studies where requirements change frequently and, thus, require countinous adaptation. Unpredictable changes might happen at different levels of service-based applications. For example, some applications might face changes at infrastructure level (e.g., highly changing network infrastructure), at composition level (by means of different services dinamically changing their availability or QoS aspects), and at business level (dynamic changes in the application requirements).

Case studies requiring changes at all these levels would allow us to show the adaptation and evolution mechanisms and methods that we plan to develop within S-Cube. Also, we could distinguish between those adaptation needs that are elicited during the design of the system and those that are completely unforeseen and need to be understood and handled on the fly while the system is running.

Chapter 3

Case study description format

3.1 Introduction

Case studies can be described in various ways depending on their purposes. For instance, they can describe a specific development or proof of concept using a specific technology, or they can simply describe an application case without offering a specific implementation solution. Of course, while in the first case the use case description contains also design, implementation, and even deployment and operation details, in the second case it should be implementation and technology agnostic. Since, of course, we are thinking of case studies supported by software, the description should focus on *what* espectations the software should address more than on *how* these should be addressed. In other terms, the description should be focusing on eliciting those *goals* and *assumptions* that the software should address.

In this chapter, we introduce a methodology for the description of case studies. We adapt the NEXOF-RA [1] methodology, and add a domain description. The whole description is composed of the following elements:

- A list of Business Goals and Domain Assumptions for the case study.
- A description of the Case Study Domain;
- A list of Scenario Descriptions;

In the following sections, we detail what we mean by domain and we describe the suggested templates for scenarios, business goals and domain assumptions.

3.2 Business Goals and Domain Assumptions Description

Business Goals and *Domain Assumptions* express the functionalities and the properties of the machine and of the environment in which it operates. While business goals state what the product has to do or what processing action is to take, domain assumptions report properties of the system, or restrictions on the design of the reference architecture. The following table should be used as a template for any single business goal and assumption description.

Table 3.1: Goal/Assumption Template Table

Field	Description
Unique ID	Give a unique ID for this goal/assumption.
Short Name	Give a short name for this goal/assumption.
Type	One of the following: Business Goals Domain Assumptions
Description	Specify the intention of the goal/assumption.
Rationale	Give a justification of the goal/assumption.
Involved Stakeholders	Stakeholders involved in the business goal/assumption
Supporting Materials	Give a pointer to documents that illustrate and explain this goal/assumption (in particular those of domain analysis).
Priority of accomplishment	One of the following: Must have: The system must implement this goal/assumption to be accepted. Should have: The system should implement this goal/assumption; some deviation from the goal/assumption as stated may be acceptable. Could have: The system should implement this goal/assumption, but may be accepted without it.
Tentative scheduling	Tentative scheduling of accomplishment. To be used only if the case study has to be implemented.

3.3 Domain Description

As suggested by Jackson and Zave [2], requirements engineering is concerned with phenomena occurring in the world, as opposed to phenomena occurring inside the system to be (the machine to be built). Figure 3.1 describes how phenomena are categorized by this approach. The set of phenomena occurring in the world together with the laws that regulate such world (e.g., physical laws, social rules, conventions that need to be respected, ...) define the application domain. Of course, if the machine needs to have an impact on the world, the two corresponding domains have to partially overlap. The phenomena that are at the intersection between the world and the machine are called *shared phenomena*. These can be either controlled by the world and observed by the machine, or, conversely, controlled by the machine and observed by the world. The study of such phenomena is particularly important in the requirements engineering phase since phenomena define the interface between the machine and the world. Thus, their definition is the main subject of the scenarios description activity that will be detailed in Section 3.4.

Of course, shared phenomena (and therefore scenarios) can be understood in the context of the world in which the machine will work and of the laws governing the world. Also, the boundaries between the world and the machine have to be clearly identified. In order to address these aspects we suggest to include in the case study domain description the following items:

- Introduce a glossary that defines the main terms of the world.
- In some complex case, the glossary alone is not enough as it does not highlight the relationships between the various terms nor their relative importance. Thus we need to build a model that highlights these aspects. Class diagrams are usually a good tool for this purpose since they allow the engineer to identify main entities as classes and to express several kinds of relationships between

these. Entity-relationship diagrams as well as semantic networks for our purposes have an expressive power that is similar to class diagrams and therefore can be used as well.

- Clearly describe any law that is relevant in the world. Such laws can be expressed in any form that is typical of the application domain that we are considering: matematics, logics, natural language, ...
- *Strategic Dependency Diagrams* (SDDs) [3] are used to model the dependencies between the different actors in the organisational context. They especially help to model user (roles) together with their relations. Dependency edges in the diagram link the actors with needs (dependers) to actors with the capability of meeting those needs (dependees). The needs are expressed in terms of goals (positioned on the edges).
- In addition to the Strategic Dependency Diagrams it can be useful to use the Context Diagrams (CDs) [4]. Figure 3.2 shows the notation of context diagrams. In a context diagram, any active entity on the case study to be modeled is represented as a box, while phenomena between agents are described by a directed arrow. Any source of the arc is the controller of the phenomenon, while any destination of the arc is the agent which monitors the phenomenon. A particular agent is the machine to be built, and, at this level of abstraction, the diagram should contain just an agent as the machine itself. Thus, shared phenomena are represented as arcs between the machine and an actor in the world. Both the SDDs and the CDs represent the agents/actors involved in the domain, but while the SDDs show the dependencies among them, the CDs put in evidence the relationship among them. Moreover differently from the previous diagrams, the CDs can be used when are clearly identified the boundaries between the machine and the world.

3.4 Scenario Description

As said in the previous section, scenarios are a way to describe world phenomena, and in particular the phenomena shared between the world and the machine. The shared phenomena have an operational flavour in the sense that they describe the steps that need to be followed by the machine and the world entities in order to accomplish a certain task.

Table 4.52 intuitively describes how scenarios should be detailed and described. The table has been an adaptation of what proposed in [1] and should be used as a template for any single scenario description.

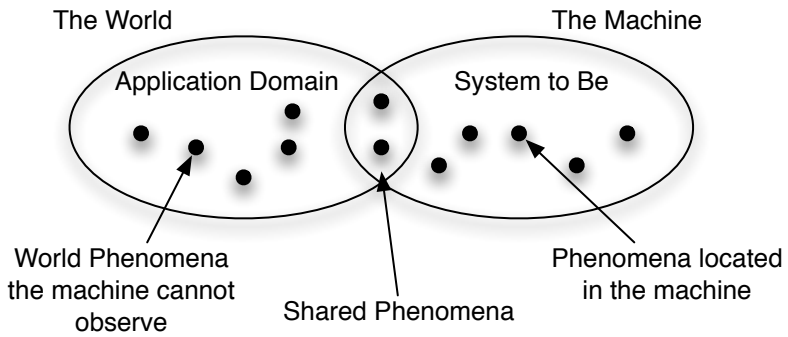


Figure 3.1: World, Machine and Shared Phenomena

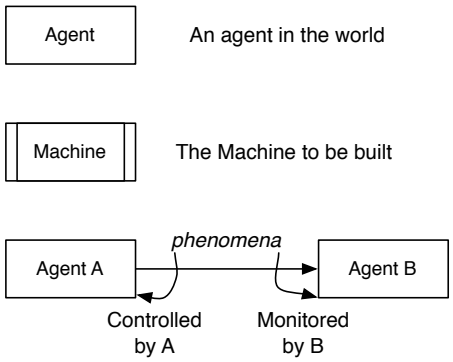


Figure 3.2: Context Diagram Notation

Table 3.2: Scenario Template Table

Field	Description
Unique ID	Give a unique ID for this scenario.
Short Name	Give a short name for this scenario
Related to	Specify the goal/assumption ID to which the scenario is related
Involved Actors	Specify the actors involved in the current scenario
Detailed Operational Description	Give a textual description of the scenario.
Problems and Challenges	Describe the specific problems that each scenario addresses or that consumers and providers face.
Additional Material	UML diagrams supporting the understanding of the scenario

3.5 Case study description life cycle

The three ingredients that we have identified in the previous sections as part of a case study description are not necessarily obtained through a sequential process that starts from the identification of the goals then moves to the analysis of domain, and, finally, to the description of scenarios. Instead, as in many other highly intellectual processes, it is more likely to proceed iteratively, starting from any of the three points and compiling them more or less in parallel. What we can do is to provide a non-exhaustive list of simple rules that allow us to understand when we can decide that our case study description has reached a reasonably good form:

- The terms used in the scenarios and in the identification of the business goals and of the assumptions are properly described in the glossary and they are related to the other terms in the domain model.
- The entities identified in the domain model are used in some scenario or in some business goals and domain assumptions description.
- All actors that have been identified in the scenarios appear also in the context diagram (and/or in the Strategic Dependency diagram) and viceversa.
- From each scenario there exist at least one related business goal and viceversa.
- Scenarios are not overlapping. Relationships are possible but they should be explicitly identified.
- Goals are not overlapping. Relationships are possible but they should be explicitly identified.

Chapter 4

Industrial Case Studies

This chapter will provide the description of five significant industrial case studies. The first one is focused on vineyard management and wine production (see Section 4.1) and has been offered by a well-known Italian wine production company called *Donnafugata* [5]. This case study is shared with the *Artdeco* project [6], partially founded by the Italian Ministery of Education.

The second case study is focused on a complex and geographically distributed supply chain in the automotive sector (see Section 4.2) and has been offered by researchers of the companies 360Fresh and IBM [7].

The remaining three case studies have been offered by the partners of the NEXOF-RA project [1] and concern the following areas:

- E-Health and, in particular, the management of Complex Diagnostic Workflows (see Section 4.3).
- Traffic Management (Section 4.4).
- E-Government (Section 4.5).

Every case study has been adapted to the description format previously described in Section 3. In particular, we had to elicit real business goals and domain assumptions from the case studies under examinations as they were not made explicit. In doing this work we have also identified some repetitions and inconsistencies that we have eliminated, as well as some implicit actors and some explicitly mentioned actors who did not have any specific role in the use cases description. Clearly, as we started from the NEXOF for describing scenarions, the case studies owned by this project where already partially described according to the format we wanted to apply. However, the definition of the application domain was left implicit and we have elicited it from the information collected within scenarios. Moreover, an in depth analyis of these case studies has allowed us to exclude some of the proposed requirements as they were too high level and applicable to any service-oriented application.

4.1 Wine Production Case Study

Context

The following case study illustrates a scenario, proposed by *Donnafugata*, related to the wine production. It involves a Wine Producer who wants to maximize his production in order to adapt it according to the monitored market needs. Other actors of the scenario are the Quality Manager, the Agronomist (i.e., an expert of a branch of agriculture which deals with field-crop production and soil management) and the Oenologist (i.e., an expert of wine and wine production). They have to observe the vineyard parameters and to react to critical conditions that may happen during the cultivation phase. Critical conditions may be represented by overcoming the threshold for some particular environmental parameter.

The case study also shows the processes involving the harvesting of the grapes and the logistics to deliver the product to retailers.

Business Goal and Domain Assumptions

In the following sections the Business Goals and the Domain Assumptions for the current case study will be reported.

Business Goals

Table 4.1: Business Goal WINERY-S-BG1

Field	Description
Unique ID	WINERY-S-BG1
Short Name	Observe[1] market needs and adapt production accordingly
Type	Business Goal
Description	Starting from the domain information, the system shall provide a way to infer critical conditions from the analysis of market needs. It shall react in an automatic way to those critical conditions, both selecting pre-defined reactions and inferring reactions from a knowledge base. Standard reactions are provided in the scenarios and in the domain sections.
Rationale	Maximize sales volume.
Involved Stakeholders	Quality Manager
Conflicts	None.
Supporting Materials	See Table 4.10
Priority of accomplishment	Must have.

Table 4.2: Business Goal WINERY-S-BG2

Field	Description
Unique ID	WINERY-S-BG2
Short Name	Observe vineyard cultivation and react to its evolution

[1] From now on, we substitute the term *monitor* used by our stakeholders with the term *observe* because monitor is used in the S-Cube project with a particular declination, that is, it has to do with activities that are performed outside the control of the specific system being monitored.

Type	Business Goal
Description	The system shall provide a way to infer critical conditions from observing vineyard parameters. It shall provide a way to react in an automatic way to those critical conditions, both from selecting predefined reactions and inferring reactions from a knowledge base. Notifications to the Quality Manager, Oenologist and Agronomist shall be included in such predefined reactions. Other standard reactions are provided in the scenarios and in the domain sections.
Rationale	Maximize sales volume and wine quality.
Involved Stakeholders	Quality Manager, Oenologist, Agronomist
Conflicts	None.
Supporting Materials	See Table 4.10
Priority of accomplishment	Must have.

Table 4.3: Business Goal WINERY-S-BG3

Field	Description
Unique ID	WINERY-S-BG3
Short Name	Observe maturation, fermentation and harvesting and react to their evolution
Type	Business Goal
Description	The infrastructure shall provide: a way to infer critical conditions from observing vineyard parameters; a way to react in an automatic way to those critical conditions, both from selecting predefined reactions and inferring reactions from a knowledge base. Notifications to the Quality Manager are included in such predefined reactions, especially if the critical conditions require manual interventions. Other standard reactions are provided in the description of the case study. Moreover, the Quality Manager shall be able to control quality parameters explicitly.
Rationale	Maximize sales volume and wine quality. In particular, this business goal handles the management of the critical conditions during phases following cultivation.
Involved Stakeholders	Quality Manager, Oenologist
Conflicts	None.
Supporting Materials	See Table 4.10
Priority of accomplishment	Must have.

Domain Assumptions

Table 4.4: Assumption WINERY-S-DA1

Field	Description
Unique ID	WINERY-S-DA1
Short Name	The system to be should be driven by a self-managing business process
Type	Domain assumption
Description	The overall business process must be designed such that it shall perform *self-management*, that is, it shall implement the so-called *MAPE* cycle, that adheres to the scenario related to this assumption. In the MAPE cycle, the execution of the business process is based on a paradigm that involves resource Monitoring, collected data Analysis, intervention Plan, and action Execution. In the case of the proposed scenario, monitoring comes from the physical infrastructure (see next assumption), and the remaining parts of the paradigm must be implemented by the self-managing business process, which permits to define intervention plans and action executions after a critical condition detection as required by the related scenario. In this approach, detection of market changes and reaction to these changes shall be implemented as a particular instance of the MAPE cycle within the autonomic infrastructure.
Rationale	See Description.
Involved Stakeholders	Quality Manager
Conflicts	None.
Supporting Materials	
Priority of accomplishment	Should have

Table 4.5: Assumption WINERY-S-DA2

Field	Description
Unique ID	WINERY-S-DA2
Short Name	Vineyard is equipped with a wireless sensor and actuator network.
Type	Domain assumption
Description	This assumption arises from the necessity of examining parameters of vineyards, which are spatially distributed among cultivation fields. This infrastructure can be seen at the business level from two possible points of view: by a *process manager* component of a workflow engine or from a *query layer* infrastructure that offers the ability of programming events generation to deploy directly into the sensor networks. Sensors are needed to observe quality attributes of grapes during the phases of the production process.
Rationale	A distribute Wireless Sensor Network (WSN) infrastructure shall be able to sense the environment of vineyards and collect data.
Involved Stakeholders	Quality Manager, Agronomist

Conflicts	
Supporting Materials	
Priority of accomplishment	Could have

Table 4.6: Assumption WINERY-S-DA3

Field	Description
Unique ID	WINERY-S-DA3
Short Name	Time between harvesting and processing should be limited
Type	Domain assumption
Description	This assumption is a very simple constraint on the business process, that requires that the time between harvesting and processing of the grapes must be limited, typically within one hour, or it must be related to specific requirements of a particular production.
Rationale	Maximize the quality of the final product.
Involved Stakeholders	Quality Manager
Conflicts	None.
Supporting Materials	
Priority of accomplishment	Must have

Table 4.7: Assumption WINERY-S-DA4

Field	Description
Unique ID	WINERY-S-DA4
Short Name	Logistic is supported through a RFID system.
Type	Domain assumption
Description	This assumption constrains the design of the physical and logical infrastructure for the observing and querying of temperature during the distribution phase. Moreover each bottle has associated a RFID, each pallet has associated a RFID data logger. In this case, since it is necessary to track and record the temperature information of moving packages, RFIDs and data loggers are suggested to be used. Moreover, to provide an uniform method for querying in such a physical architecture, a query layer for pervasive infrastructure should be used, such as PERLA. Finally, this infrastructure should be interfaced with the self-managing business process, in order to use it as a source for reacting to possible critical events regarding distribution.
Rationale	See Description.
Involved Stakeholders	Delivery Company, Retailer
Conflicts	None.

Supporting Materials	
Priority of accomplishment	Could have

Domain Analysis

Strategic Dependency Model and Context Diagram

Figure 4.1 illustrates the strategic dependency diagram of the case study. Agents are shown (in gray circles) and the dependencies among them. The diagram puts in evidence the business goals shared among the related actors: for example in the diagram we can note that the *Wine Producer* depends on the *Vineyard Operator* to maximize sales volume and the wine quality. Vineyard Operators may be agents such as Agronomist, Oenologist, Quality Manager and Wine Grower. Looking at the diagram, moreover, the *Wine Producer* depends on the *Retailer* to stipulate contract and on the *Market* to Manage Market Needs. While the ellipses on the edges linking two agents represent the goal they need to satisfy, the other shapes on the edges (such as Deliver Order and Schedule Delivery) reports the softgoals shared by the joined agents.

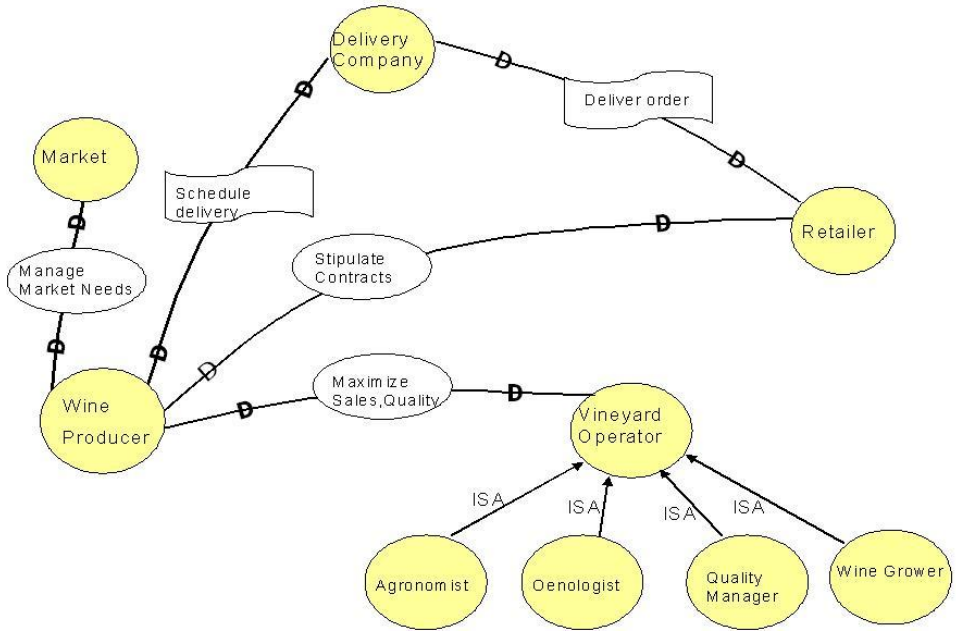


Figure 4.1: Strategic Dependency Diagram

Figure 4.2 illustrates the context diagram of the current case study. In the context diagram, all the actors that appear in the scenarios are agents.

Domain model

Figure 4.3 illustrates the domain model of the current case study. The model is represented using a UML notation. In particular the model shows the entities of the scenario, the actors and the relationship among them.

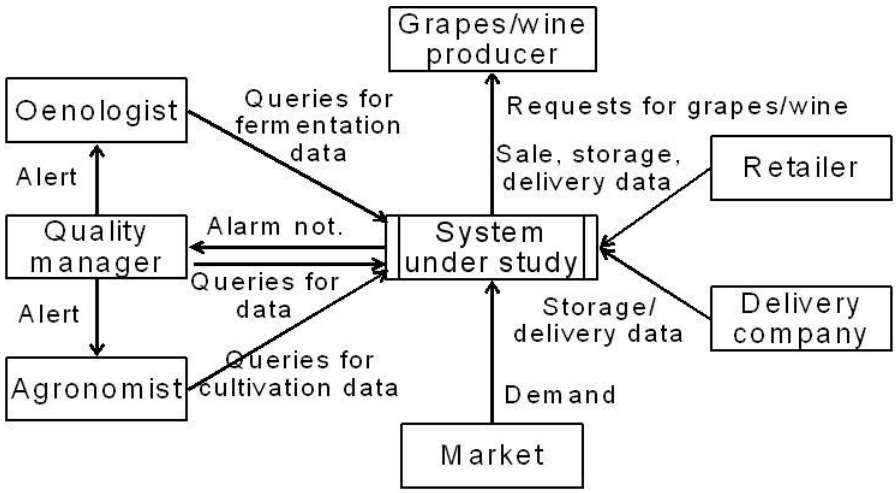
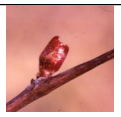


Figure 4.2: Context Diagram

Cultivation Phases and Word Glossary

Table 4.8: Cultivation Phases Glossary

Phase	Description	
Vegetative Rest	Interval of repose concerned with growth and development. The plants are leafless.	
Green Tips	Green tips are becoming to grow in the cottony tissue.	
Sprouting	The leaves are becoming visible as rosettes.	
Expanses Leaves	The leaves are broad and the axis of sprout is becoming visible.	
Visible Bunches	The first grapes are coming into sight. They present 4-6 expanses leaves and they are about 10 cm long.	
Separate Bunches	The rachides of the florescence are longer, while the flowers are still agglomerated.	

Separate flower buttons	The florescence presents a peculiar form. The flower buttons are clearly divided.	
Flowering	The flowers are opened and show the reproductive organs.	
Setting or “Migno-latura”	During this phase the flowers become fruits.	
Berries accretion	The berries are growing.	
Bunches closure	The bunches are increased in size and in this phase the riches are not visible.	
Veraison	The phase of the growing cycle where the grapes change color.	
Maturation	The color change is terminated.	

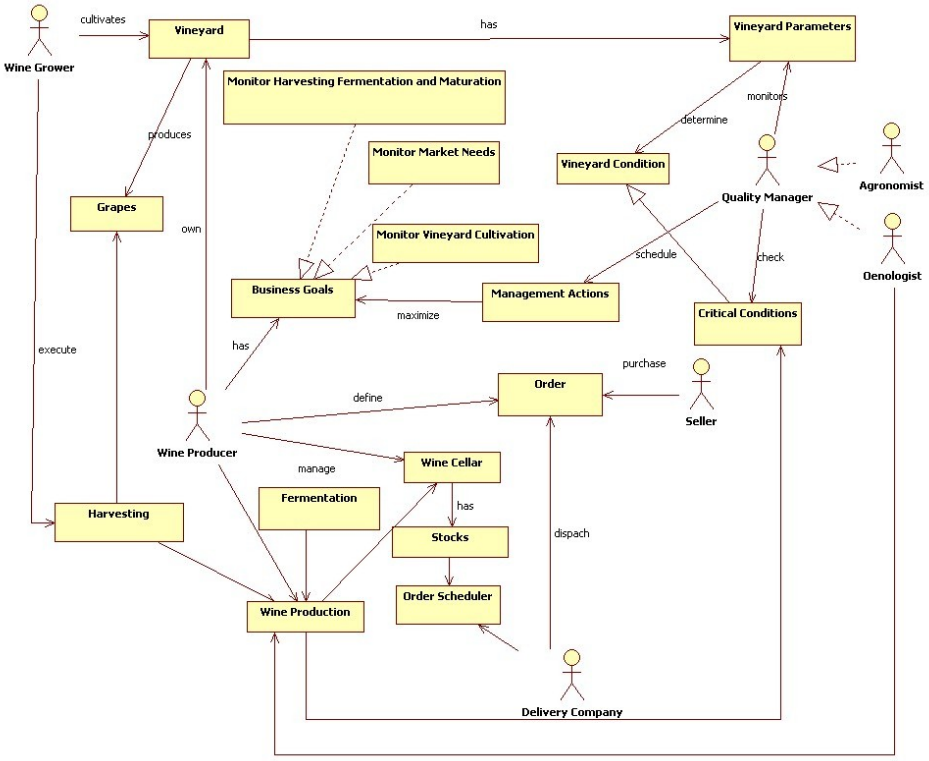


Figure 4.3: Domain Model

Table 4.9: Word Glossary

Word	Meaning	
Powdery mildew	It is a fungal disease. Powdery mildew diseases are caused by many different species of fungi. Infected plants display white powder-like spots on the leaves and stems. The lower leaves are the most affected, but the mildew can appear on any part of the plant that shows above the ground.	
Water Stress	It occurs when the demand for water exceeds the available amount during a certain period or when poor quality restricts its use.	

Critical Conditions and Management Actions

Table 4.10: Critical Conditions and Management Actions

Adversity	Phenological phase of vines	Temporal interval of observation	Interested environmental parameters	Critical thresholds and combinations	Possible actions
Frost	Vegetative rest	October-January	Temperature, wind speed	$T < 3$ °C	Critical alarm
Frost	Green tips	February	Temperature, wind speed	$T < 5$°C, wind $< 0,5$ m/s	Critical alarm
Frost	Sprouting	March	Temperature, wind speed, Light	$T < 5$°C, wind $< 0,5m/s$, Light < 100 lux	Critical alarm
Rime	Expanses leaves	March	Temperature, wind speed, Light, Hr	$T < 5$°C, wind < 0.5 m/s, Light $<$ 250 lux, Hr $> 75\%$	Critical alarm
Rime	Visible bunches	March	Temperature, Hr	$T < 5$°C, Hr $> 75\%$	Critical alarm
Heat, mildew, powdery mildew	Separated bunches	April	Temperature, wind speed, Hr, wind direction	$T > 30$ °C, $Hr > 75\%$, wind north or north-west sector$>$ 9 m/s, $T < 8$ °C	Specific interventions for fungal diseases based on sulphur and copper
Heat, mildew, powdery mildew	Separated flower buttons	May	Temperature, wind speed, Hr, wind direction	$T > 35$ °C, $Hr > 75\%$, wind north or north-west sector $>$ 9 m/s, $T < 8$ °C	Specific interventions for fungal diseases based on sulphur and copper
Heat, mildew, powdery mildew	Flowering	May	Temperature, wind speed, Hr, wind direction	$T > 35$ °C, $Hr > 75\%$, wind north or north-west sector$>$ 9 m/s, $T < 8$ °C	Specific interventions for fungal diseases based on sulphur and copper

Heat, mildew, powdery mildew	Mignolatura	May	Temperature, wind speed, Hr, wind direction	$T > 35$ °C, $Hr > 75\%$, wind north or north-west sector > 9 m/s, $T < 8$ °C	Specific interventions for fungal diseases based on sulphur and copper
Heat, mildew, powdery mildew	Berries accretion	June	Temperature, wind speed, Hr, wind direction	$T > 35$ °C, Hr $> 75\%$, wind north or north-west sector > 9 m/s, $T < 5$ °C	Specific interventions for fungal diseases based on sulphur and copper, irrigation in case of water stress
Heat, mildew, powdery mildew	Bunches closure	June	Temperature, wind speed, Hr, wind direction	$T > 35$ °C, Hr $> 75\%$, wind north or north-west sector > 9 m/s	Specific interventions for fungal diseases based on sulphur and copper, irrigation in case of water stress
Heat, mildew, powdery mildew	Veraison	June	Temperature, wind speed, Hr, wind direction	$T > 35$ °C, Hr $> 75\%$, wind north or north west sector > 9 m/s	Specific interventions for fungal diseases based on sulphur and copper, irrigation in case of water stress wind direction
Heat, mildew, powdery mildew	Maturation	August-September	Temperature, wind speed, Hr, wind direction	T > 35 °C, Hr $> 75\%$, wind north or north-west sector > 9 m/s	Specific interventions for fungal diseases based on sulphur and copper, irrigation in case of water stress

Scenarios

Figure 4.4 shows the general use-case diagram for the Vineyard case study.

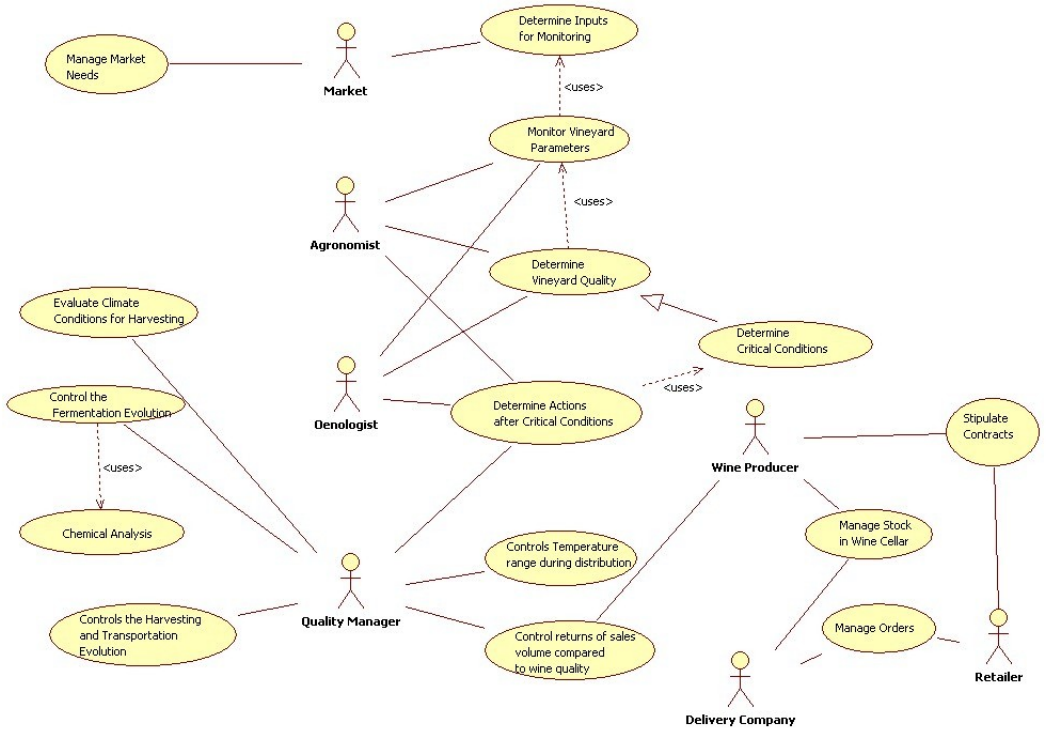


Figure 4.4: General Use Case Diagram

Table 4.11: Scenario WINERY-S-CH-1

Field	Description
Unique ID	WINERY-S-CH-1
Short Name	Cultivation Handling
Related to	WINERY-S-BG1, WINERY-S-BG2, WINERY-S-DA1, WINERY-S-DA2
Involved Actors	Three actors are involved in cultivation handling: the agronomist, the oenologist and the quality manager. Moreover, the market has some roles on determining which vineyard should be cultivated.

Detailed Operational Description	Cultivation handling is mainly performed by the agronomist and the oenologist. For each vineyard, the handling process implies the analysis of functional parameters such as *temperature*, *humidity*, *light*, *wind speed*, etc. in specific months of the year. The kind of vineyards to be cultivated are determined by information coming from the market, in the sense that using statistical data about sales of previous years, the enterprise infers which vineyards are more likely to be cultivated in order to produce the kind of wines that will maximize sales. The agronomist and oenologist determine the vineyard quality by analyzing gathered information. It may happen that those actors could detect critical conditions on which some recovery actions should be performed in order to react and prevent damages for the wine production. Critical conditions can involve some events on the environment (such as frost destroying the vineyard), or some other events involving the measurement of the quality versus its estimate coming from market information. The identification of the recovery actions is performed by the quality manager together with the oenologist and the agronomist. Actions include notifications and complex processes to be performed by different actors.
Problems and Challenges	The main problems arising with the described complex scenario involve: • handling the complex process of vineyard cultivation management; • identification of recovering actions; • automatization of observing vineyard parameters, detection of critical conditions and performing of recovery actions. • provide an automated way to infer an estimate of market needs;

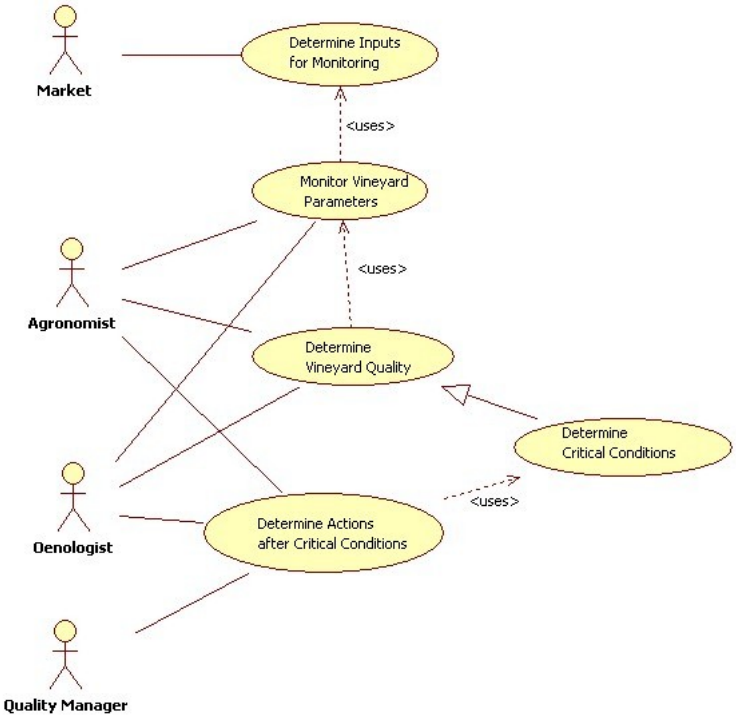
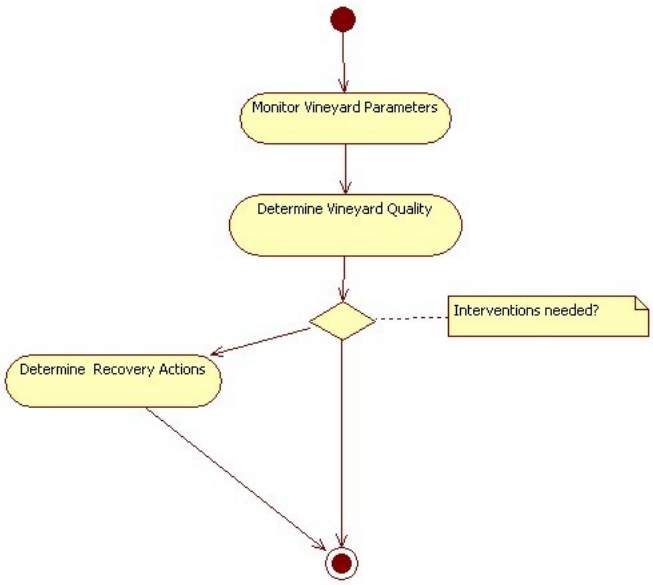
Additional Material	The following use case diagram summarizes the main functions to be offered during cultivation handling and their interactions with the main actors:  The following Activity Diagram shows the sequence of the activities to be done in the current scenario. 

Table 4.12: Scenario WINERY-S-CH-2

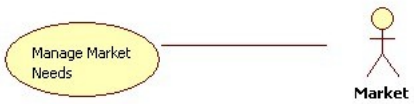
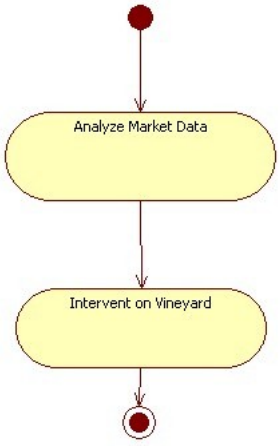
Field	Description
Unique ID	WINERY-S-CH-2
Short Name	Managing the Market Needs
Related to	WINERY-S-BG1, WINERY-S-BG2
Involved Actors	Market
Detailed Operational Description	Inputs derived from market needs must be properly managed. In this scenario, it must be possible for the information system to get forecasts for the current year, in terms of specific sales volume, together with wine kind and its quality. Thus, the information system of the enterprise should be able to infer the kind of grapes and consequently the vineyard to be cultivated. Moreover, from the observing vineyard parameters activity, it should be possible to estimate the quality of wine based on the health status of the vineyard (based also on the information gathered during all the production phases). During the management process, it must be possible to detect some critical conditions regarding the estimated wine quality. One of those condition is the following: ”the estimated Qs from the observing activity seems to be too much different from the quality Q desired from customers”; other conditions are more low level and they are related to specific vineyard conditions (see Section 4.1). A possible response action to these conditions is buying from other producers an amount of grapes automatically suggested by the observing system.
Problems and Challenges	The main problems arising with the described scenario involve, in particular: • proper detection (inference) of market needs; • proper identification of recovering and response actions;
Additional Material	The sub use case.  The corresponding activity diagram. 

Table 4.13: Scenario WINERY-S-HFM

Field	Description
Unique ID	WINERY-S-HFM
Short Name	Harvesting, Fermentation and Maturation
Related to	WINERY-S-DA1, WINERY-S-DA2, WINERY-S-BG3
Involved Actors	Quality Manager
Detailed Operational Description	In those three phases, the quality manager should be helped to control quality attributes to keep the wine production quality at the required level. The controlled phases are the following: • Harvesting; is a critical part of the wine production process. Usually, it is necessary to: – Minimize the interval between harvesting and grapes processing; – Evaluate climatic conditions for harvesting (depending on the particular kind of grapes or production, they may require specific climatic conditions); • Fermentation: – Chemical analysis (both "in loco" and in the lab) to monitor quality and avoid critical events, such as high concentration of acetic acid or presence of dangerous bacteria; those events must be properly communicated so that they can be properly managed by manual intervention; – acidity, humidity and temperature must be recorded in each cellar to monitor the quality of the produced wine. • In any transportation sub-phase, humidity and temperature must be observed.
Problems and Challenges	The main problems arising with the described complex scenario involve: • provide a distributed and secure infrastructure for observing critical parameters, both during fermentation and harvesting; • monitor critical parameters during any transportation phase; • minimize the time between harvesting and the grapes processing.

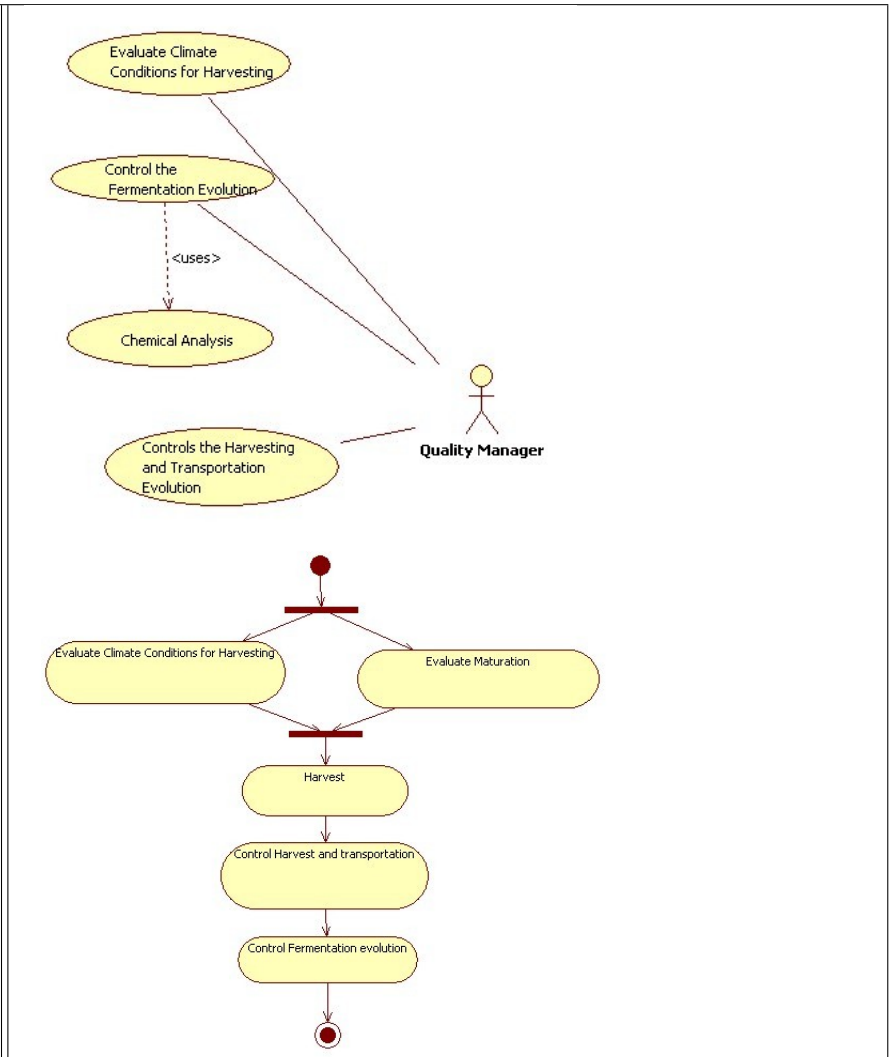
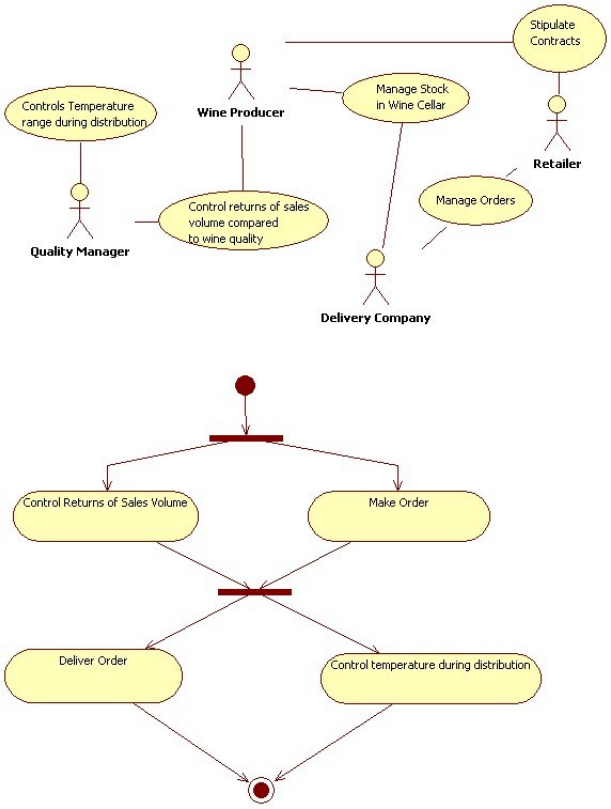
Additional Material	

Table 4.14: Scenario WINERY-S-DS

Field	Description
Unique ID	WINERY-S-DS
Short Name	Distribution and Sale
Related to	WINERY-S-BG3, WINERY-S-DA1, WINERY-S-DA4
Involved Actors	Quality Manager, Wine Producer, Delivery Company and Retailer
Detailed Operational Description	During the sales phase the Wine Producer interact with the Retailer to make orders. The orders will be delivered by the Delivery Company. During the sale phase, the quality manager is interested in the returns in order to compare them with the conditions of the product during all the life-cycle models. During the distribution phase, the quality manager must be able to assure that, starting from monitored values, the temperature variation meets some strict requirements (i.e., no wide fluctuations and it must be kept within a specific range).
Problems and Challenges	The main problems arising with the described scenario involve: • provide a distributed and secure infrastructure for observing critical parameters during distribution; • provide an infrastructure to track market information and predict changes in the market in a narrow time scale.
Additional Material	

4.2 Automotive (360Fresh and IBM)

Context

Automobile Incorporation (Auto Inc), located in South East Asia, is a local branch of a large enterprise in the automobile industry in Europe. Its incorporation comprises of a regional headquarter in Singapore, a manufacturing factory in Vietnam, several regional distribution and logistics provider, and several warehouses located in different countries in South East Asia. Auto Inc sells automobile products to retail customers in the surrounding countries.

The main business tasks of the manufacturing factory include importing and assembling CKD (Completely Knocked-Down) automobile body parts from the EU headquarter supplier, importing and assembling other parts (like wheels, brakes, seats, etc.) from regional suppliers, painting, integrating accessories (e.g. air conditioner, CD player, etc), testing and releasing the final products. Beside the mandatory CKD parts which must be imported from the overseas headquarter (from now on we will call them main sources), the other material and (semi-finished) products can be ordered from the regional suppliers in surrounding countries (from now on, we will call them local sources). This local sourcing strategy is indeed efficient regarding the reduction of costs and risks. Depending on the product specifications, the assembling, integrating and painting tasks use varying materials and products, and might be executed in disparate ways as well.

Different distribution logistics providers participate in the incorporation to provide the transportation of finished products from the manufacturing factory to the warehouses, and from the warehouses to the retail customers. The providers are selected according to the transportation routes and rules.

Figure 4.5 illustrates the global business scope of the service network in our scenario.

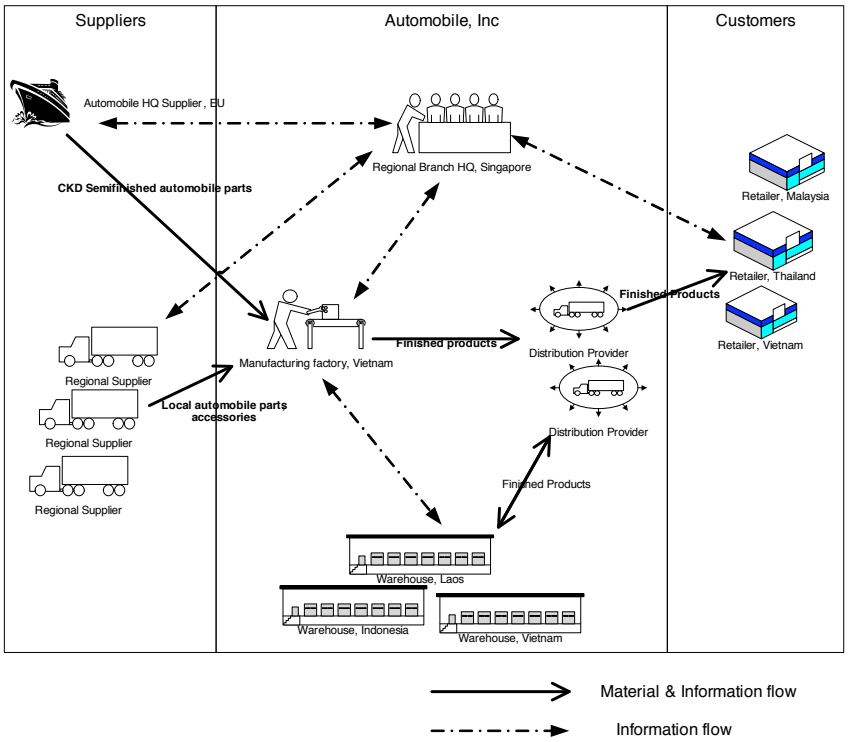


Figure 4.5: The business scope of our service network

Business Goals and Domain Assumptions

Business Goals

Table 4.15: Just in time production driven by financial and capacity plans

Field	Description
Unique ID	IBM_BG_01.
Short Name	Just in time production driven by financial and capacity plans
Type	Business Goal
Description	The production depends on customers' demands, but periodically updated financial and capacity plans should also control production and ensure that it is kept within the capacity of the organization.
Rationale	Just in time production may require significantly high and low picks in production in certain periods. These variations have to be clearly kept under control to ensure that the capacity of the organization is not over-exceeded.
Involved Stakeholders	Customers and Auto Inc headquarter
Supporting Materials	None.
Priority of accomplishment	Must have

Table 4.16: Optimize transportation

Field	Description
Unique ID	IBM_BG_02.
Short Name	Optimize transportation
Type	Business Goal
Description	Transportation has to be dependent on the highest possible order fulfillment
Rationale	The company wants to optimize the service offered by the distribution providers
Involved Stakeholders	Customers, Auto Inc headquarter, Distribution providers
Supporting Materials	None.
Priority of accomplishment	Must have

Table 4.17: Efficient material sourcing

Field	Description
Unique ID	IBM_BG_03.
Short Name	Efficient material sourcing
Type	Business Goal

Description	Source material has to be always sufficient for production. However, the duration of stocking has to be kept low, also depending on the sensitiveness of materials. Auto Inc has a local sourcing strategy and from time to time considers quite a lot of suppliers for selection. Criteria of the selection might be prices, performance, business relationships, business risks and rules, etc. The highly dynamic changes in tax and compliance rules, which are quite typical in South East Asia countries, may determine changes in the adopted criteria. Regarding the supplier performance, Auto Inc can predict the potential of not meeting the committed performance by detecting the late acknowledgements of orders or late shipment notifications.
Rationale	Material sourcing is a critical aspect of Auto Inc production. All possible ways to keep the performance of such aspect under control and to improve it is an essential aspect.
Involved Stakeholders	Auto Inc Headquarter, Auto Inc Manufactoring factory, Suppliers
Supporting Materials	None.
Priority of accomplishment	Must have

Table 4.18: All business partners form a value network

Field	Description
Unique ID	IBM_BG_04.
Short Name	All business partners form a value network
Type	Business Goal
Description	Suppliers can have themselves suppliers and can exploit distribution providers to send their products to Auto Inc. More in general, the case includes a high number of partners that collaborate in order to achieve a common goal, that is, the provision of cars to the final customers.
Rationale	The supply chain can be very complex given the geographical distribution of stakeholders and the complexity of the final product. Auto Inc wants to identify proper models that allow it to share responsibilities and competitive advantages with its partners.
Involved Stakeholders	Auto Inc Headquarter, Suppliers
Supporting Materials	None.
Priority of accomplishment	Must have

Domain Assumptions

Table 4.19: Adoption of SCOR and RosettaNet PIPs

Field	Description

Unique ID	IBM_DA_01.
Short Name	Adoption of SCOR and RosettaNet PIPs
Type	Domain Assumptions
Description	The case study scenario is constrained with following assumptions: • **Using Supply Chain Operation Reference Model (SCOR)**: Auto Inc requires the usage of the SCOR model [8] for building supply chains. This has been developed by the Supply Chain Council and provides the best-in-class blueprints and guidelines verified and approved from a large number of enterprises. • **Using RosettaNet Partner Interface Protocols (PIP) as the business protocol**: RosettaNet PIPs [9] have been jointly developed by several vertical large enterprises as an agreed business protocols for doing business in an unambiguous way. In our scenario, all participants within Auto Inc, the suppliers and customers agree on using RosettaNet PIPs as the common protocols.
Rationale	RosettaNet and PIP are well known standards in the area of supply chain. Their usage would increase the likehood that Auto Inc will be able to interact with a high number of stakeholders in the value network.
Involved Stakeholders	Customers, Suppliers, Distribution providers, Auto Inc. Headquarter, Auto Inc. Manufacturing factory, Auto Inc. EU Headquarter
Supporting Materials	None.
Priority of accomplishment	Should have

Table 4.20: Boundaries of the case study

Field	Description
Unique ID	IBM_DA_02.
Short Name	Boundaries of the case study
Type	Domain Assumptions
Description	The case study is limited to the management of everything that is triggered by a order process. On the contrary, the following aspects are considered to be out of scope: customer assist, customer relationship management, contract management, promotion and after-sale support, product return process.
Rationale	The company is modernizing its information system but would focus on a few aspects at a time as otherwise the required budget would be too high.
Involved Stakeholders	Customers, Suppliers, Distribution providers, Auto Inc. Headquarter, Auto Inc. Manufacturing factory, Auto Inc. EU Headquarter
Supporting Materials	None.
Priority of accomplishment	Should have.

Domain Analysis

Stategic Dependency Model and Context Diagram

Figure 4.6 summarizes the relationships between the various stakeholders as they have been identified in the business goals presented in Section 4.2.

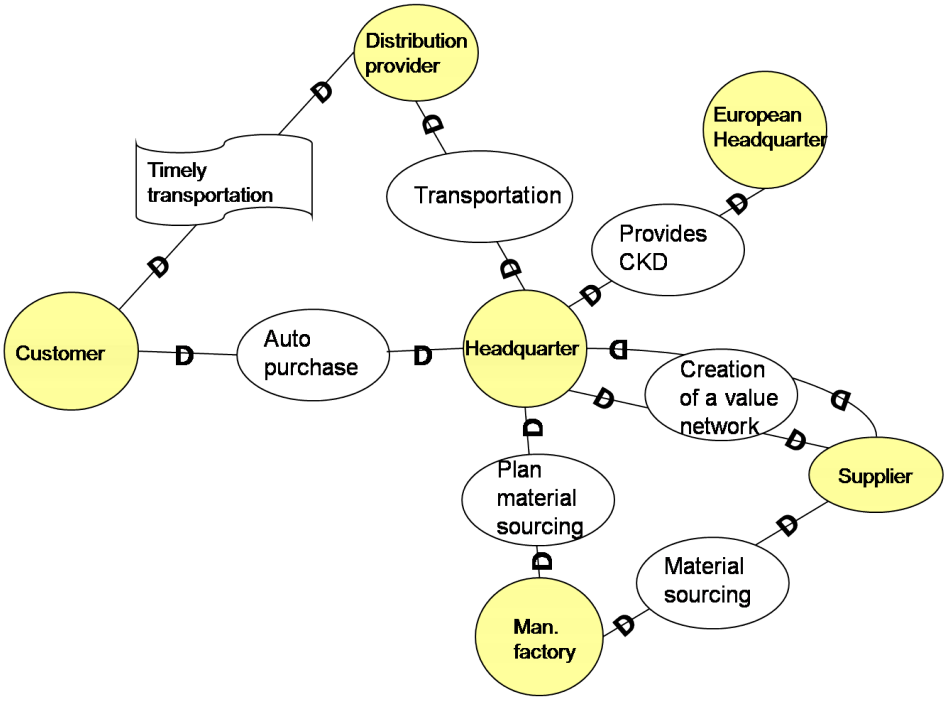


Figure 4.6: Strategic Dependency Model of the Automotive case study

Figure 4.7 highlights the role of a possible system-to-be supporting the supply chain with respect to the stakeholders.

Domain model

Figure 4.8 describes all main concepts in the case study application domain as well as the relationships among them. In particular, it highlights the fact that a car is composed of CKD (Completely Knocked-Down) parts plus some other parts that are provided by local suppliers. The car also includes accessories, again, acquired through local suppliers and requires the usage of various materials for the assembling and painting process.

Local suppliers are chosen according to their capacity and reputation. Compliance rules and risk can influence this choice as well. In particular, the following aspects are taken into account:

- The introduction of Government import rules prohibiting the import of particular kinds of goods from particular countries.
- The high dynamicity of tax rules in some countries, where they can change monthly or weekly.
- Variations in the Free Trading Zone (FTZ) of some country. These are zones where trading is tax-free. However, they could be changed frequently thus resulting in new regulations to be taken into account.

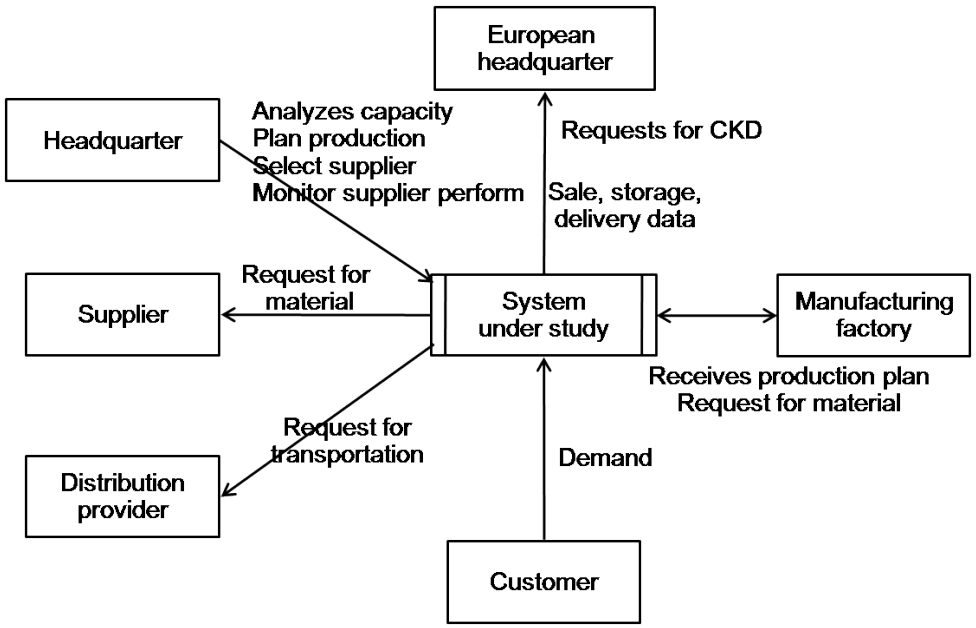


Figure 4.7: Context Diagram of the Automotive case study

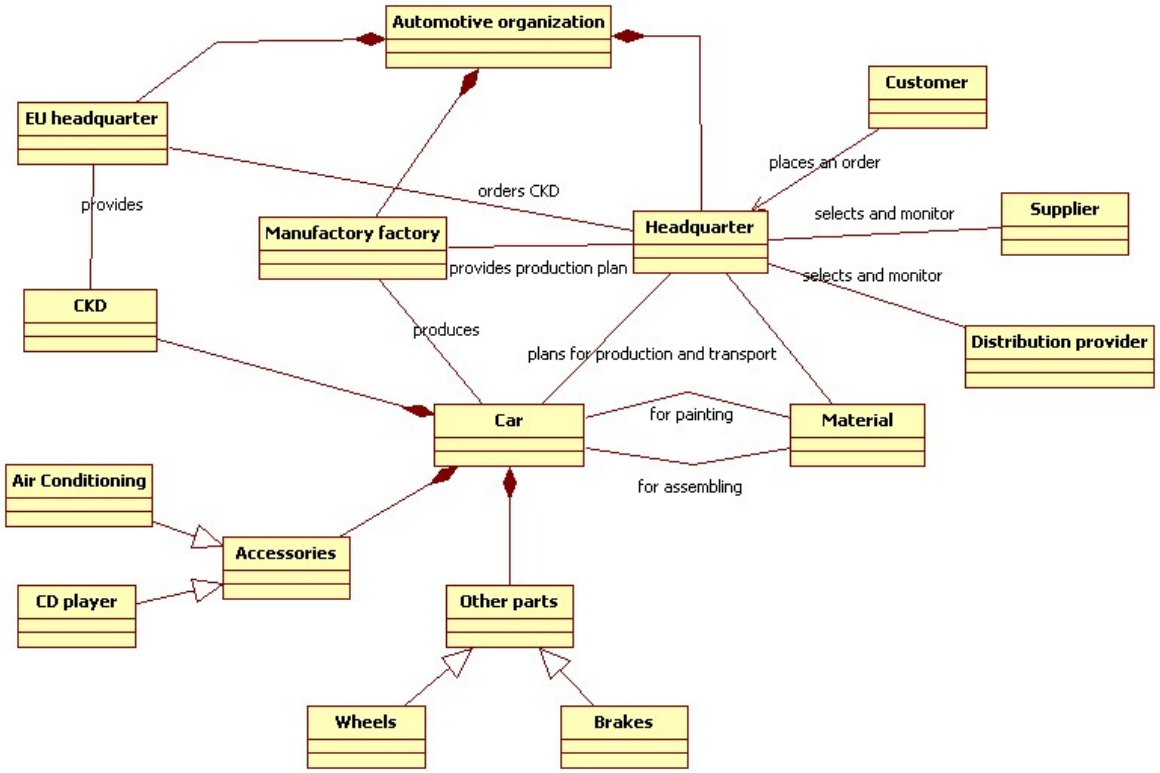


Figure 4.8: The domain model.

- The triggering of some internal rules that aim at protecting against critical situations. For instance, after 3 successive transactions with the same supplier, if the supplier does not reduce the price or introduce any new special offer, Auto Inc may want to consider to switch to other suppliers.

- The delay of delivery time due to bad weather, delay at border customs, etc.

Scenarios

Table 4.21: Main Supply Chain Process

Field	Description
Unique ID	IBM_SC_01
Short Name	Main Supply Chain Process
Related to	IBM_BG_01, IBM_BG_02, IBM_BG_03, IBM_BG_04
Involved Actors	Suppliers, all Auto Inc actors, Distribution providers, Retailers
Detailed Operational Description	The main supply chain process follows the steps that are detailed in Figure 4.9 and that can be summarized as follows: • *Planning*: it aligns resources to meet expected demand requirements. In the supply chain we distinguish between 3 kinds of planning processes, the sales and operations plans, the tactical plans, and the scheduling plan. These are detailed in the following scenario. • *Source-to-stock*: it aims at the execution of all concrete operations that are needed to acquire and stock parts and materials. • *Make-To-Stock*: it produces the final good and stocks it. • *Deliver-Stocked-Products*: it delivers the produced good to the customer. In order to perform these operations, the above steps rely on the business services that are shown in Figure 4.10.
Problems and Challenges	See the above description.
Additional Material	Figures 4.9 and 4.10

Table 4.22: Plan supply chain

Field	Description
Unique ID	IBM_SC_02
Short Name	Plan Supply Chain
Related to	IBM_BG_01
Involved Actors	all Auto Inc headquarter
Detailed Operational Description	Sales and operations plans are carried out monthly. Their foresight horizon is normally for the next 12 to 18 months. The headquarter analyzes the customer forecasts and sales performance in each region, and then releases a supply unit plan. This supply unit plan indicates how many products are planned for delivery in each warehouse in the next 12-18 months. However, because of the financial constraints and limited manufacturing capacity, the Enable Plan 10 process will constrain this supply unit plan and release the constrained plan to the next P4 process (see Figure 4.12).

Problems and Challenges	None.
Additional Material	Figure 4.12

Table 4.23: Tactical planning

Field	Description
Unique ID	IBM_SC_03
Short Name	Tactical planning
Related to	IBM_BG_01, IBM_BG_02, IBM_BG_03
Involved Actors	all Auto Inc headquarter
Detailed Operational Description	The tactical planning activities comprise Plan Deliver (P4), Plan Manufacturing (P3), and Plan Source (P2), which foresee the plans for the next 12- 14 weeks. Inputs for the P4 process are the constrained unit forecast from P1 and the unconfirmed sale orders from each region provided by the Deliver process D1. The P4 process decides then how many products should be delivered from each warehouse and informs the D1 process. As we see within the D1 process, the D1.3 step decides to fulfill the prioritized orders and postpone the other ones to the next round. The result of planning delivery in P4 process leads to the new replenishments orders for the warehouses, which will be sent to the manufacturing factory.
Problems and Challenges	None.
Additional Material	None

Table 4.24: Plan Manufacturing

Field	Description
Unique ID	IBM_SC_04
Short Name	Plan Manufacturing
Related to	IBM_BG_01, IBM_BG_03
Involved Actors	all Auto Inc headquarter
Detailed Operational Description	The Plan Make (P3) process takes into account these orders and the already scheduled production plan, and then decides how many products should be produced more for the near future. The result of this process is a new production plan that should be scheduled in the M1 process (Make-to-Stock). Last but not least in the planning phase, the P3 process must compensate the materials it consumed for the previous productions, by means of passing the material requirements to the Plan Source (P2) process. The P2 process considers these material requisitions with the already ordered material amounts, and then decides the volume of materials that should be sourced and stocked. The P2 process results in a scheduled material requisitions that will be fulfilled by the Source-To-Stock (S1) process.

Problems and Challenges	None.
Additional Material	None

Table 4.25: Schedule product delivery

Field	Description
Unique ID	IBM_SC_05
Short Name	Placing purchase orders and schedule products delivery
Related to	IBM_BG_03, IBM_BG_04
Involved Actors	Auto Inc manufactoring factory, Auto Inc EU headquarter, Supplier
Detailed Operational Description	The process described by this scenario is responsible for selecting suitable suppliers, purchasing goods, transferring products into materials, and, lastly, stocking materials. As we can see from Figure 4.11, the Auto Inc and its Headquarter supplier operate in the inventory replenishment strategy. This means that if there is a demand for main automobile parts, the purchasing department will send a notification of material release (PIP4D1) to the Headquarter and then receive an Advanced Notification of Shipment (ASN) (PIP3B2) to schedule the receipt. For other automobile parts and accessories, Auto Inc can place orders at the regional suppliers. The order placement is defined with the PIP3A4 and the acknowledgement should be sent back to Auto Inc with PIP3A4 as well. As soon as the products are ready for shipment, the suppliers will send an ASN (PIP3B2) to the Auto Inc. Figure 4.11 also points out at the role of some external business services. The interaction with them is needed for data management, performance measurement, and performance assessment. In particular, records of purchase and replenishment orders are used to analyze the statistical performance, or to keep track and detect the risks of the current orders. Some typical KPIs such as Order-To-Acknowledgement, Order-To-ASN, etc. are measured with the records. In particular, if the Order-To-Acknowledgement and Order-To-ASN are not received or returned too late, the process will schedule new material demand and place new supply order in order to ensure the amount of source materials in stock for future production. We assume that there is no need to cancel the old order in this case. Sources will still be imported excessively. Only the reputation of supplier will be deducted. The business services also provide the information needed to select the best suppliers to place purchase orders. In Figure 4.11, the selection criteria are based on the following elements:

	• *Prices and Availability*: which suppliers offer cheaper prices and larger availability will have more chance for collaborating. The Suppliers Management subprocess (ES10) maintains information about the current product catalogue (including prices and availability) of all suppliers, and hence can provide an ordered list based on price and availability. • *Reputation (based on statistical data of previous transactions)*: the performance, reliability, and quality are also important selection criteria. The Suppliers Management subpreocess (ES10) also maintains the statistical information about the suppliers and can provide a ranking list of the suppliers, based on performance, reliability and quality. • *Influences of compliance rules, risks*: In case Auto Inc must follow some external and internal compliance rules that some suppliers cannot hold, or the suppliers seem to yield too many risks, Auto Inc might have to choose other suppliers, even though they could be less efficient. The Risk Management subprocess (ES9) estimates the risk of importing goods from each supplier and provides also the ranking list of the suppliers.
Problems and Challenges	See the detailed operational description.
Additional Material	Figure 4.11

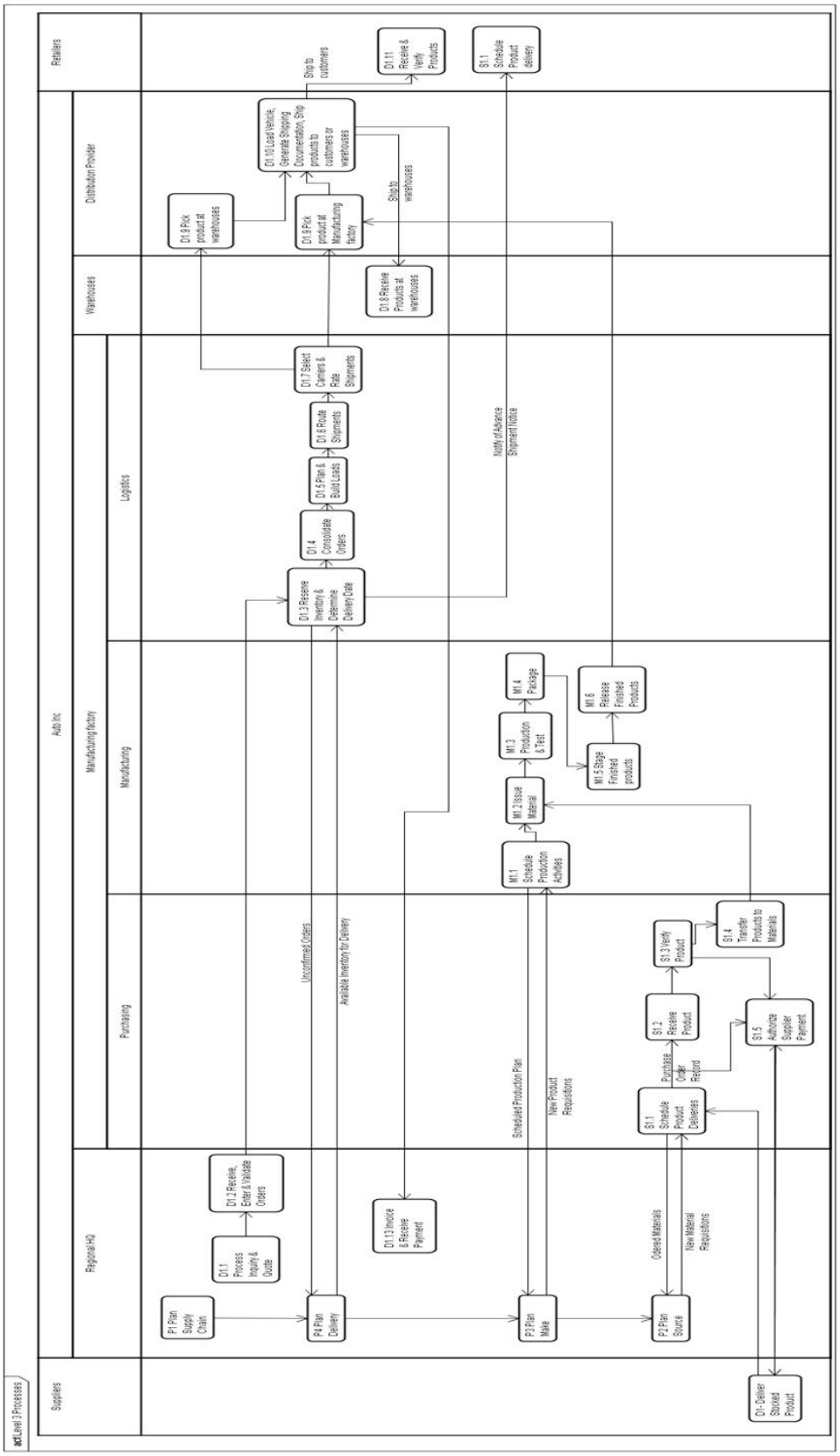


Figure 4.9: Execution processes in level 3

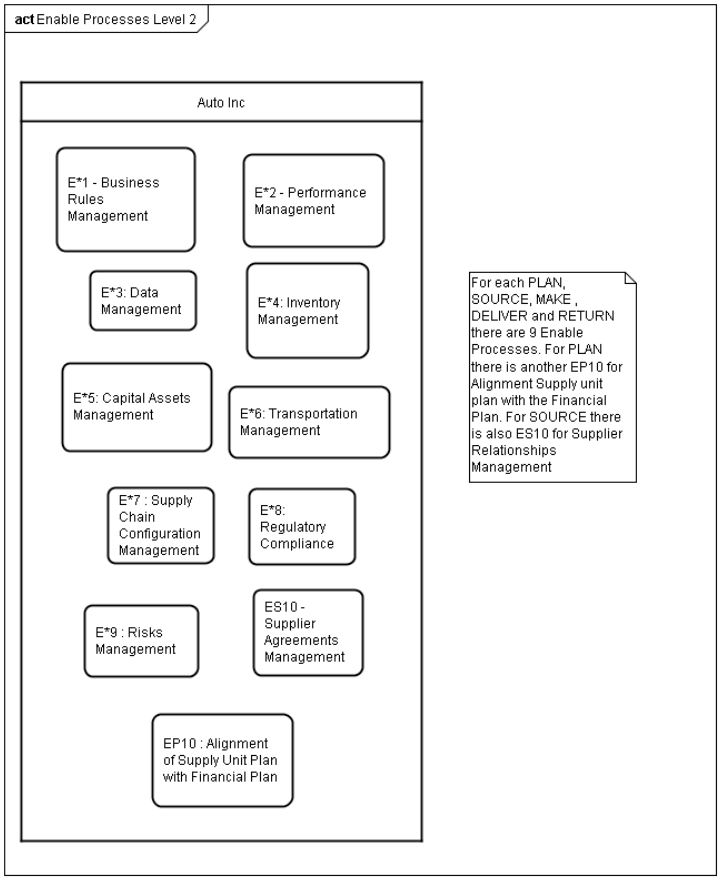


Figure 4.10: Enable Business Services

4.3 EHealth: Complex Diagnostic Workflow (Siemens/Thales)

Context

This case study describes the management of a complex diagnostic workflow in a EHealth environment. The case study has been derived from the EU Project NEXOF [1], and adapted to the different description format, methodology and case study requirements described previously in this document. The companies within NEXOF that proposed it are Siemens [10] and Thales [11].

The typical scenario of this case study essentially involves a consultation in a hospital, in a care centre or at a local doctor, where typical activities are carried out when the doctor examines the patient. Thereby, the overall focus is either on determining the patient's complete health status, which enables the doctor to recommend further actions, or on integrating useful services in the workflow once the complete health status is determined and the doctor is about to take diagnostic measures.

This case study becomes generally relevant due to the demographic change and to increasing costs, which enables IT-integrated healthcare (EHealth) to become more effective by using its resources more efficiently. Therefore, IT support is a critical factor in hospital workflows and diagnostic workflows. EHealth seeks to provide new kind of services and a better integration of new and existing ones, thus supporting the work of the overall healthcare staff. In particular, this case study takes the viewpoint of medical staff and the patient during a diagnostic workflow. It does not address administrative hospital workflows like patient admission, accounting and the like, though integration would be very reasonable. The actors involved in this case study are individuals including patients, doctors, experts and other medical staff, such as nurses, pharmacists, physical therapists. We also include the EHealth Organization

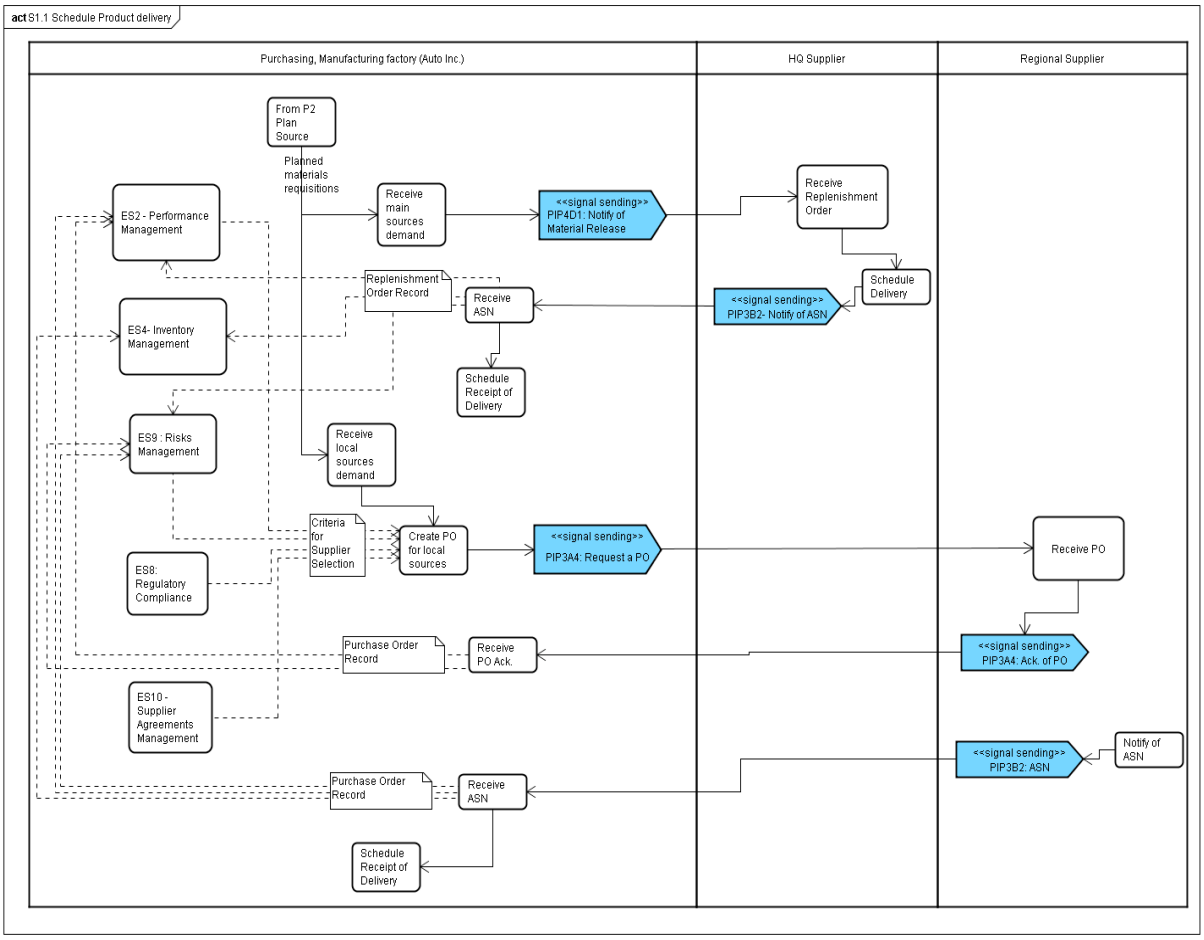


Figure 4.11: Placing purchase orders and schedule products delivery

as an actor, which represents hospitals including laboratories, pharmacies, nursing facilities and more generally, all health services and clearinghouses.

Business Goal and Domain Assumptions

In the following sections will be reported the Business Goals and the Domain Assumptions for the current case study.

Business Goals

Table 4.26: Ubiquitous and Immediate Access to Patient Data

Field	Description
Unique ID	EHEALTH_BG_01
Short Name	Ubiquitous and Immediate Access to Patient Data
Type	Business Goal

Description	The system shall be able to reduce the overall duration of healthcare activities through ubiquitous and immediate access to patient data. Patient data shall be recorded from any activity of the medical staff, that is, Doctors directly involved in the patient's diagnosis, but also staff persons performing only examinations or treatments prescribed by the Doctor. Moreover, any data coming from consultations of experts shall be recorded and made available. Patient data shall be ubiquitously available for the Doctor for further examinations.
Rationale	Improve the effectiveness and reliability of healthcare activities. Reduce costs of healthcare activities.
Involved Stakeholders	Doctors, Patients, Other Medical Staff
Conflicts	None
Supporting Materials	None
Priority of accomplishment	Must have

Table 4.27: Ubiquitous Access to Expert Consultancy

Field	Description
Unique ID	EHEALTH_BG_02
Short Name	Ubiquitous Access to Expert Consultancy
Type	Business Goals
Description	The system shall facilitate the ubiquitous access to expert consultancy whenever a doctor working for a diagnosis for a specific patient needs it. The system shall provide easy access to expert address books, facilitate phone calls and should even provide mechanism to automatically manage full collaborative environments for medical experts.
Rationale	Improve the effectiveness and reliability of healthcare activities. Reduce costs of healthcare activities.
Involved Stakeholders	Doctors, Experts
Conflicts	None
Supporting Materials	None
Priority of accomplishment	Must have

Table 4.28: Easier Planning of Examinations and Treatments

Field	Description
Unique ID	EHEALTH_BG_03
Short Name	Easier Planning of Examinations and Treatments
Type	Business Goals

Description	The system shall be able to improve the reliability of healthcare activities through easier planning of examinations, therapies and any kind of treatments. The system shall be able to prevent, avoid or reduce human errors by facilitating medical expert interactions.
Rationale	Improve the effectiveness, reliability and duration of healthcare activities. Reduce costs of healthcare activities.
Involved Stakeholders	Doctors, Patients, Other Medical Staff, EHealth Organization
Conflicts	None
Supporting Materials	None
Priority of accomplishment	Must have

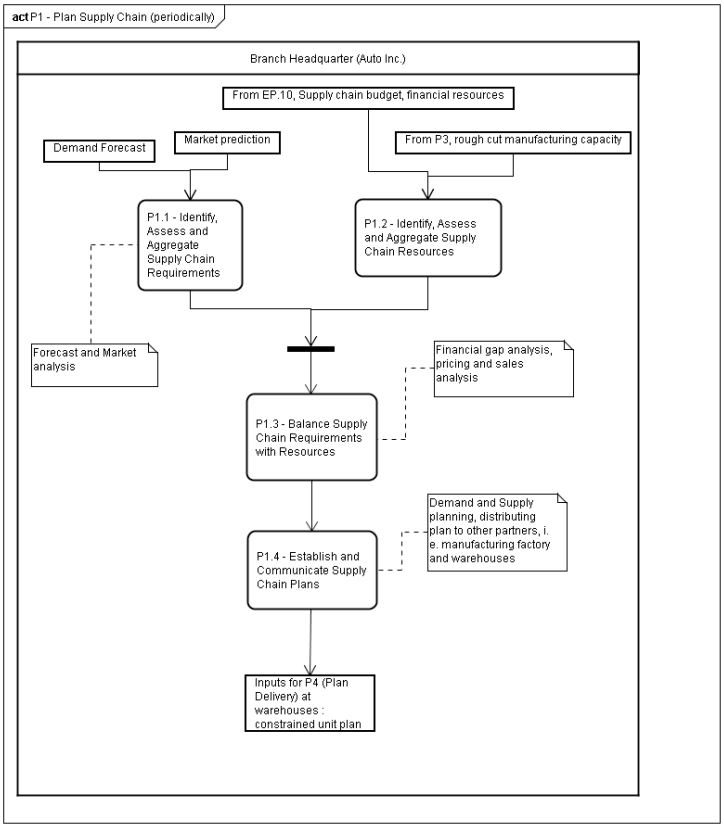


Figure 4.12: The P1 - Plan Supply Chain process

Domain Assumptions

Table 4.29: Device Integration and Vertical integration

Field	Description
Unique ID	EHEALTH_DA_01
Short Name	Device Integration and Vertical integration
Type	Domain Assumption

Description	The system shall consist of devices fully integrated in service-oriented architectures, that is, it shall be vertically integrated. For different kind of devices different embedded SOAs have to be developed including respective standards. The system shall provide a dependable device integration which will enable the data from different devices to be accessible in a dependable way. The complex diagnostic workflow system shall provide dependable access when the devices are used during a diagnosis or for monitoring a patient's health status, that is, after the health data is integrated into application specific workflows, it shall be accessible in a dependable way. In practice, there exist domain specific standards or best practices for device handling, such as the Microsoft Connected Health Framework (CHF) or the Eclipse OpenHealthFramework. Such standards are of great importance to the developers of applications for devices. These standards often contain domain specific information models and/or protocols and hence substantially facilitate the application development and interoperability.
Rationale	Enforce overall system integration, dependability and adaptability.
Involved Stakeholders	Doctors, Other Medical Staff
Conflicts	None
Supporting Materials	None
Priority of accomplishment	Could have

Table 4.30: Compliance to Health Privacy and Security requirements

Field	Description
Unique ID	EHEALTH_DA_02
Short Name	Compliance to Health Privacy and Security requirements
Type	Domain Assumptions
Description	The system should be compliant to security and privacy functions regarding treatments, services, workflows and individual services interactions. For example, in the Health domain the US-regulations are defined within the HealthPortability and Accounting Act (HIPAA) Privacy and Security rules. This standard covers all health stakeholders: individuals including doctors, nurses, pharmacists, physical therapists and organisations including hospitals, laboratories, pharmacies, nursing facilities and more generally, all health services and clearinghouses. The privacy and security rules require safeguarding all PHI (e.g. Protected Health Information).
Rationale	Effectively manage security and privacy policies, by relying on recognized standards in the world of healthcare. Without this requirement, a specific security and privacy policy will have to be defined.

Involved Stakeholders	Doctors, Patients, Other Medical Staff, EHealth Organization
Supporting Materials	Some documents that illustrate and explain this requirement: • http://www.hipaa.org/ • http://www.hhs.gov/ocr/hipaa/finalreg.html • http://privacyruleandresearch.nih.gov/resources.asp • http://www.hipaacomply.com/ • http://www.ioma.org/pdf/iomahipaahelp.pdf
Conflicts	None
Priority of accomplishment	Should have

Domain Analysis

Strategic Dependency Model and Context Diagram

Figure 4.13 illustrates the strategic dependency diagram of the case study. The diagram puts in evidence the business goals shared among the related actors. For example, in the diagram we can note that the *Doctor* makes a diagnosis for the *Patient*, and plans examinations and treatments which are managed by the *EHealth Organizations*. He/She can also request a consultancy to some experts. Moreover, the medical staff can monitor patient's data.

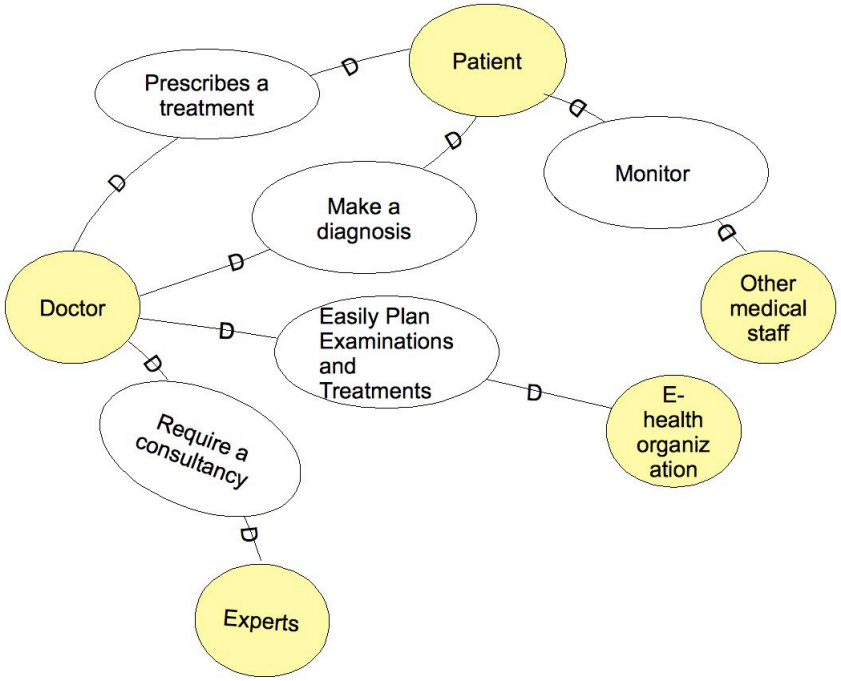


Figure 4.13: Strategic Dependency Diagram

Figure 4.14 illustrates the context diagram of the current case study. In the context diagram, all the actors that appear in the business goals and scenarios are agents.

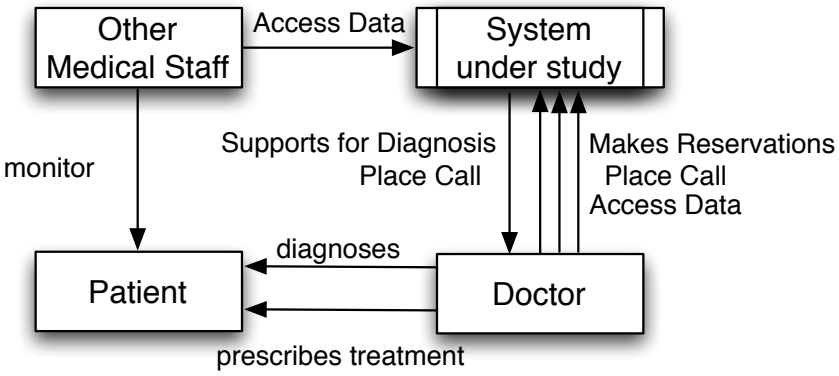


Figure 4.14: EHealth Context Diagram

Domain model

Figure 4.15 illustrates the domain model of the current case study. The model is represented using a UML notation. In particular the model shows the entities of the scenario, the actors and the relationship among them.

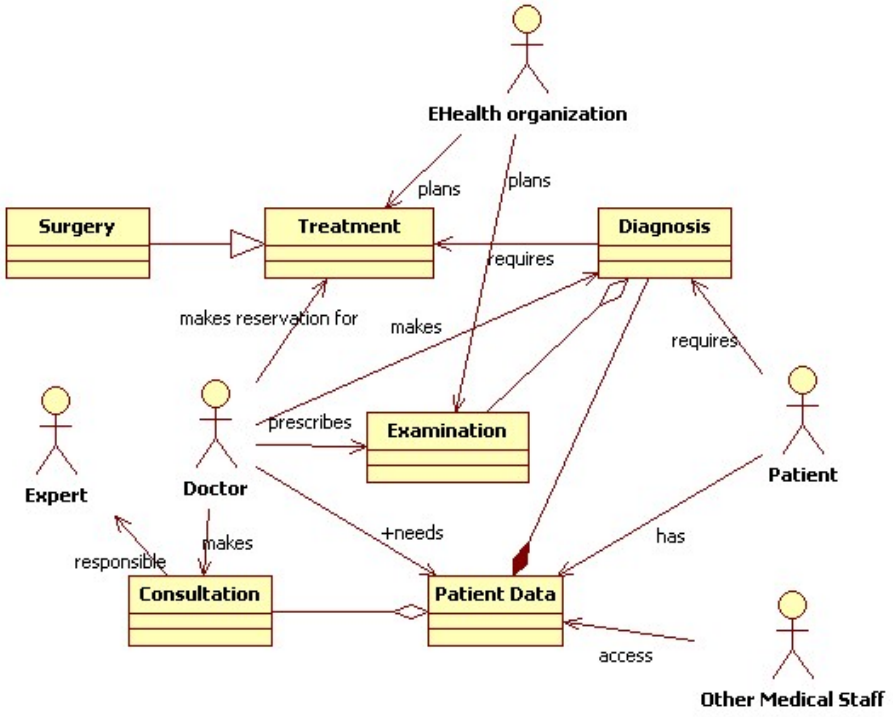


Figure 4.15: Domain Model

Scenarios

Figure 4.20 shows the general use-case diagram for the EHealth case study.

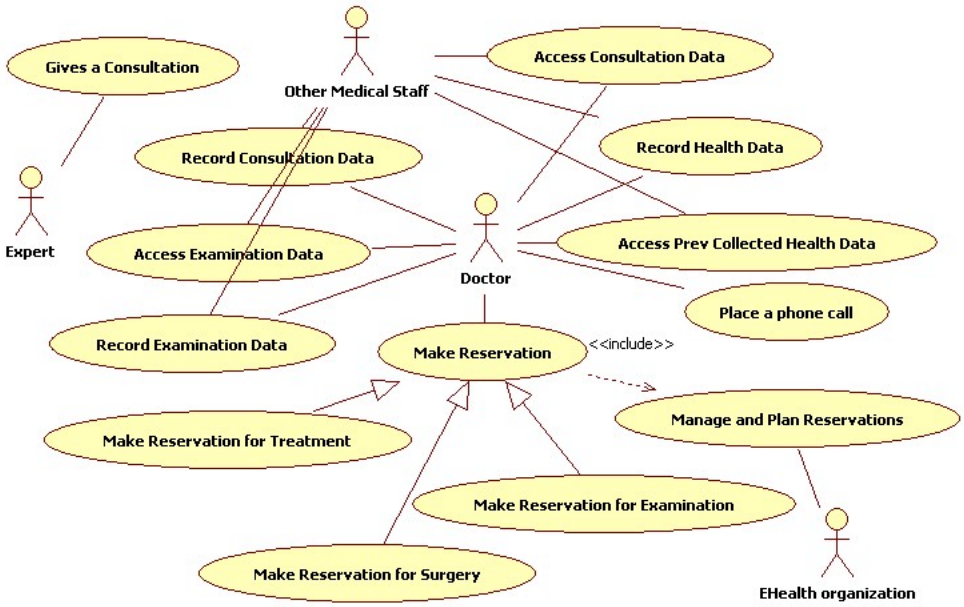


Figure 4.16: General Use Case Diagram for the EHealth Case Study

Table 4.31: EHealth: Accessing previously collected health data

Field	Description
Unique ID	EHEALTH_S_01
Short Name	EHealth: Accessing previously collected health data
Related to	EHEALTH_BG_01, EHEALTH_DA_02
Involved Actors	Doctor, Patient, Other Medical Staff
Detailed Operational Description	During the medical examination, the doctor or other medical staff may need access to the patient's previously recorded and now archived health data (that is, blood test results, X-ray images, etc.) which were either recorded in the same location or at a different place. For instance, this data might have been recorded at a different hospital (which possibly belongs to a different hospital chain).

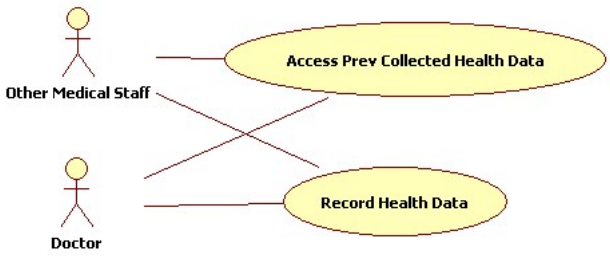
Problems and Challenges	The problems and challenges related to this scenario are the following: • Legal and technical issues with distributed and shared patient records • Integration across domains • Horizontal (enterprise information systems) and vertical integration (devices) • Platform heterogeneity, interoperability • HIPAA privacy and security compliance • Patient chart autorization access and protection • Procedure that maintain electronic protected health information to allow access only to those persons or programs that have been granted access rights • Emergency access procedure for obtaining necessary electronic protected health information during an emergency • Dependability, performance, security, and trust
Additional Material	Sub use case: 

Table 4.32: EHealth: Accessing present health data

Field	Description
Unique ID	EHEALTH_S_02
Short Name	EHealth: Accessing present health data
Related to	EHEALTH_BG_01, EHEALTH_DA_02
Involved Actors	Doctor, Other Medical Staff
Detailed Operational Description	The doctor also needs access to the data recorded online during the consultation by either the doctor himself or his assistants. He may, in addition, need data that was recorded shortly before the consultation, or that was collected in the hospital or at home during a long-term monitoring with a mobile diagnostic device like, for instance, an ambulatory blood pressure unit. It is even conceivable that the doctor would use diagnostic data received from nanobots (that is, agent-like devices of nanometre-size brought into a human body for diagnosis or even for therapy). In addition, whatever kind of data he is using, the doctor should be supported in his analysis by expert systems and databases.

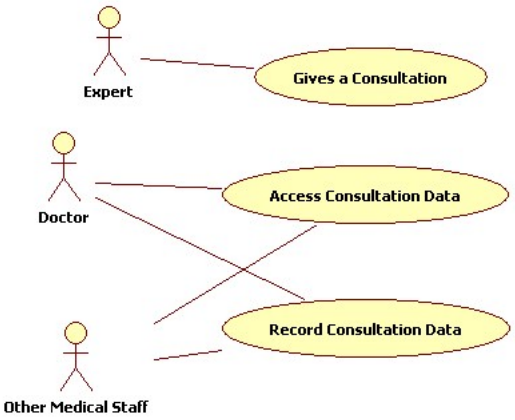
Problems and Challenges	The problems and challenges related to this scenario are the following: • Integrate on demand data from various devices • Store working sessions and allow to move sessions between devices • Integration of distributed workflows, distributed transactions, federated identities • Integration across domains • Horizontal (enterprise information systems) and vertical integration (devices) • Platform heterogeneity, interoperability • HIPAA privacy and security compliance • Use or disclosure of Protected Health information (PHI): Health • Mitigation procedures to address unauthorized user • Patient chart autorization access and protection • Dependability, performance, security, and trust
Additional Material	Sub use case: 

Table 4.33: EHealth: Accessing health data during examinations

Field	Description
Unique ID	EHEALTH_S_03
Short Name	EHealth: Accessing health data during examinations
Related to	EHEALTH_BG_01, EHEALTH_BG_04, EHEALTH_DA_02
Involved Actors	Doctor, Patient, Other Medical Staff

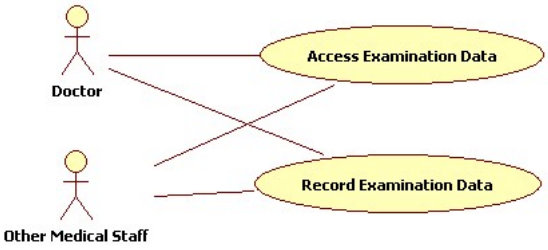
Detailed Operational Description	To reach a diagnosis during a complex examination, the doctor may need to use several devices in several locations. Typically, they are all in the same hospital, but also an external examination at the patient's home is conceivable. While the doctor is changing devices, they are still included in the same workflow. Its status should be stored when the examination with one device is finished and it should be retrieved when it is continued with another device. The devices could be a general-purpose handheld computer or a specific integrated device for medical diagnostics, for instance, an X-ray device.
Problems and Challenges	The problems and challenges related to this scenario are the following: • Integrate on demand data from various devices • Store working sessions and allow to move sessions between devices • Integration of distributed workflows, distributed transactions, federated identities • Integration across domains • Horizontal (enterprise information systems) and vertical integration (devices) • Platform heterogeneity, interoperability • HIPAA privacy and security compliance • Patient chart autorization access and protection • Emergency access procedure for obtaining necessary electronic protected health information during an emergency • Dependability, performance, security, and trust
Additional Material	Sub use-case: 

Table 4.34: EHealth: Placing a phone call

Field	Description
Unique ID	EHEALTH_S_04
Short Name	EHealth: Placing a phone call
Related to	EHEALTH_BG_02, EHEALTH_BG_05, EHEALTH_DA_02
Involved Actors	Doctor, Expert

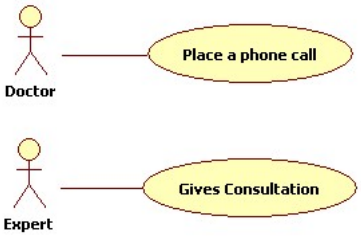
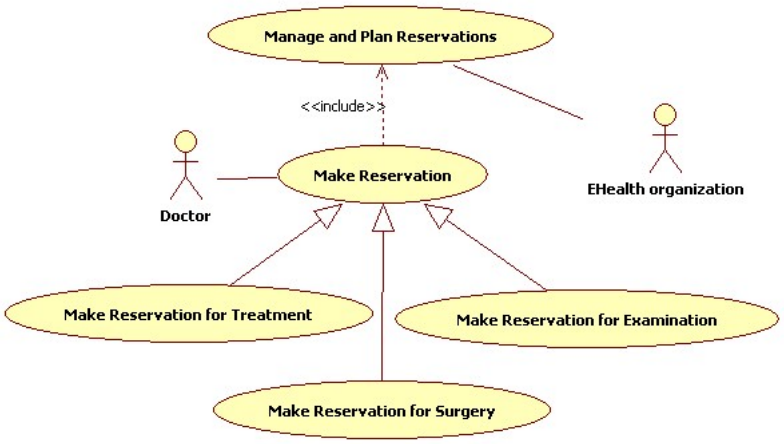
Detailed Operational Description	The doctor might need to call a colleague in for consultation or to evaluate a specific result. To this end, the doctor has access to directories and can place a phone call by one mouse-click from just the computer he uses at that moment. This feature may be taken a step further to collaborative environments and expert call centres.
Problems and Challenges	The problems and challenges related to this scenario are the following: • Legal and technical issues with distributed and shared patient records • Store working sessions and allow to move sessions between devices • Integrate external applications (telephony, reservation, external patient records) • Integration of distributed workflows, distributed transactions, federated identities • Integration across domains • Horizontal (enterprise information systems) and vertical integration (devices) • Platform heterogeneity, interoperability • Procedure that maintain electronic protected health information to allow access only to those persons or programs that have been granted access rights • Emergency access procedure for obtaining necessary electronic protected health information during an emergency • Dependability, performance, security, and trust
Additional Material	Sub use-case: 

Table 4.35: EHealth: Making Reservations for Treatments, Surgery or Examinations

Field	Description
Unique ID	EHEALTH_S_05
Short Name	EHealth: Complex Diagnostic Workflow
Related to	EHEALTH_BG_03, EHEALTH_DA_02
Involved Actors	Doctor, Other Medical Staff, EHealth Organization

Detailed Operational Description	If the doctor decides as a result of the medical examination that the patient needs additional treatment, he could easily reserve the necessary medical device or make the respective appointment (by, for instance, just clicking a button). There is no need to switch over to a reservation application or to call a responsible person.
Problems and Challenges	The problems and challenges related to this scenario are the following: • Store working sessions and allow to move sessions between devices • Integrate external applications (telephony, reservation, external patient records) • Integration of distributed workflows, distributed transactions, federated identities • Integration across domains • Horizontal (enterprise information systems) and vertical integration (devices) • Platform heterogeneity, interoperability • HIPAA privacy and security compliance • Procedure that maintain electronic protected health information to allow access only to those persons or programs that have been granted access rights • Emergency access procedure for obtaining necessary electronic protected health information during an emergency • Dependability, performance, security, and trust
Additional Material	Sub use-case: 

4.4 Traffic Management: Large Scale Emergency Handling (Siemens)

Context

This case study describes a traffic management system which is designed to manage normal situations as well as handle emergency cases. Such emergency case handling includes several different actions, such as the direction of rescue forces to the location of the accident as well as the management of traffic deviations. The actors involved in this case study are traffic managers, that is, the individuals accountable for entities controlling the traffic management system in a particular geographical area, generic rescue forces (e.g., police and ambulances), and citizens, such as motorists and pedestrians. The case study has been derived from the EU Project NEXOF [1], and adapted to the different description format and methodology described previously in this deliverable. The company within NEXOF that proposed it is Siemens [10].

Business Goal and Domain Assumptions

In the following sections will be reported the Business Goals and the Domain Assumptions for the current case study.

Business Goals

Table 4.36: Management of Normal Traffic Conditions

Field	Description
Unique ID	TRAFFIC_BG_01
Short Name	Management of Normal Traffic Conditions
Type	Business Goal
Description	The system shall regulate normal traffic conditions in order to optimize some parameters such as total noise, overall throughput, and air pollution. The system shall consider different perspectives with respect to his geographical zone of competence and the corresponding administrative powers of its owner entity. In particular, the system shalll consider different needs, such as the ones of pedestrians and motorists, and other factors like public events, school and working hours, holidays or public regulations which may alter traffic demand and needs during conditions that does not involve emergencies.
Rationale	Optimize traffic quality parameters and integrate stakeholders needs.
Involved Stakeholders	Traffic Managers, Citizens
Priority of accomplishment	Must have

Table 4.37: Management of Critical Traffic Conditions

Field	Description
Unique ID	TRAFFIC_BG_02
Short Name	Management of Critical Conditions in Traffic
Type	Business Goal

Description	The system shall react on different changed conditions in the traffic situation. For instance, the system shall properly react and be able to manage the case of traffic accidents and emergencies, as well as major road constructions or similar activities. In those situations, the system shall execute new control and management strategies. The traffic management system should then be able to identify the key necessities of the new situation, and then it shall retrieve an appropriate realization of the needed control mechanisms and adapt to the new strategies. The system shall also be designed such that it should be able to manage also unforeseen situations such as the ones determined by terrorist attacks. The thereby required reaction pattern of the system is not specific to the traffic management domain, but inherent to (at least partly) autonomously reacting systems. In case of a generic emergency, the traffic management system shall react quickly and change its strategies. This includes the reasonably fast selection of the right new strategy as well as the swift propagation of the new rules to the traffic control devices. This includes for example the rapid reconfiguration of traffic lights. Reconfiguration and adaptation process shall be performed by the system in a very short time in the case of emergency. Moreover, the system shall implement a reconfiguration and adaptation control process which has to come to a conclusive decision in a very short time and, in particular, does not fall into an "adaptation livelock", that is, that is does not try to perform again and again repeated adaptation steps without coming to a reasonable and stable new control structure in the requested time.
Rationale	Need to react autonomously on unexpected and unforeseen situations in a reasonable way.
Involved Stakeholders	Traffic Managers, Rescue forces, Citizens
Priority of accomplishment	Must have

Table 4.38: Integrity

Field	Description
Unique ID	TRAFFIC_BG_03
Short Name	Integrity
Type	Business Goal
Description	The system shall detect any attempt to jeopardize the traffic management system, that is, to override the decisions of the traffic management system from outside the system itself. The system shall also block any of those attempts or successfully self-repair itself. Examples of those attempts consist of manipulations of the sensors and the control devices, or the introduction of harmful strategies.

Rationale	Minimize the risk of manipulations of the traffic management system in a wrongful manner, which may result in a disastrous traffic situation with all its bad consequences, expecially in an emergency scenario.
Involved Stakeholders	Traffic Managers
Priority of accomplishment	Must have

Table 4.39: Traffic Management Systems Coordination

Field	Description
Unique ID	TRAFFIC_BG_04
Short Name	Traffic Management Systems Coordination
Type	Business Goal
Description	It is reasonable to expect that different traffic management systems are operating in different local areas (e.g., different cities) or managing traffic at different geographical dimensions (e.g., cities versus regions). Each of these has a correpsonding responsible government body, and a corresponding responsible individual. Coordination between these systems is needed because several of them generally deal with different strategies accordng to their geographical dimension and location, and according to the specific resposibilities and powers as defined by the responsible administrative entity. Those system shall be able to interact both during normal management as well as in the case of emergencies which involve more than a traffic system and their shared locations. This includes highways or roads connecting different cities. Coordination becomes critical when decisions must be taken at greater geographical levels. In those cases, each traffic management systems shall be able to integrate his process with the others involved in order to avoid inconsistent or contradictory decisions.
Rationale	Minimize the risk of contradictory decisions when traffic management systems have to interact.
Involved Stakeholders	Traffic Managers, Rescue forces
Priority of accomplishment	Must have

Domain Assumptions

Table 4.40: Assumption TRAFFIC_DA_01

Field	Description
Unique ID	TRAFFIC_DA_01
Short Name	Heterogeinity and Redundancy of Devices in Traffic Management Systems
Type	Domain assumption

Description	Every traffic management system may access distributed devices providing input on different interesting data sources, such as traffic density, car speed, air pollution, traffic light status, congestion indicators, etc. The devices used in the various traffic systems are rather heterogeneus and redundant, that is, they may perform the same or similar functions with different technologies.
Rationale	Independence and the lacking co-operation of the political institutions involved in the acquisition and maintenance of the respective traffic management systems, which results in heterogeinity and redundancy of devices.
Involved Stakeholders	Traffic Managers
Conflicts	None
Supporting Materials	None
Priority of accomplishment	Must have

Domain Analysis

Strategic Dependency Model and Context Diagram

Figure 4.17 illustrates the strategic dependency diagram of the case study. As in the previous case studies, the diagram puts in evidence the business goals shared among the related actors.

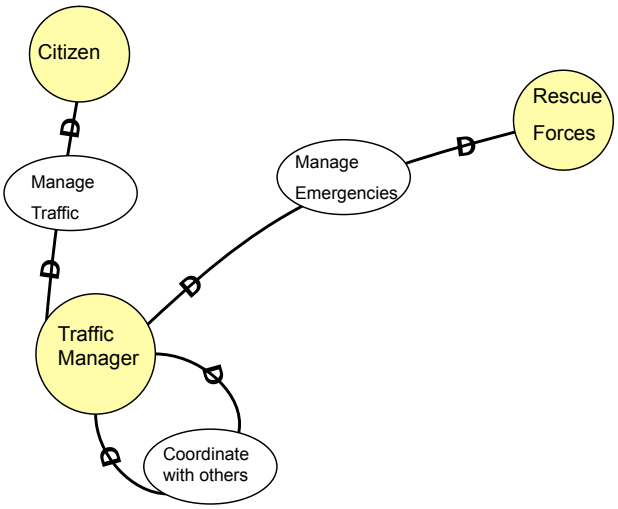


Figure 4.17: Strategic Dependency Diagram

Figure 4.18 illustrates the context diagram of the current case study. In the context diagram, all the actors that appear in the business goals and scenarios are agents.

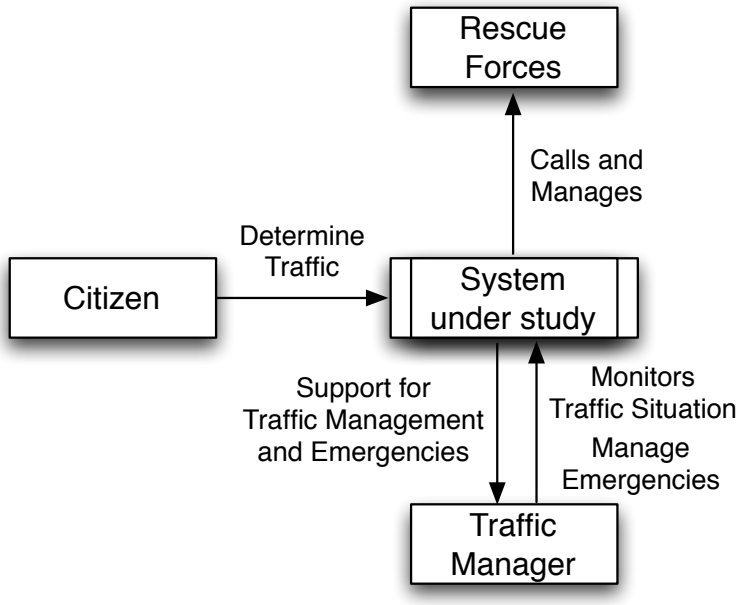


Figure 4.18: EHealth Context Diagram

Domain model

Figure 4.19 illustrates the domain model of the current case study.

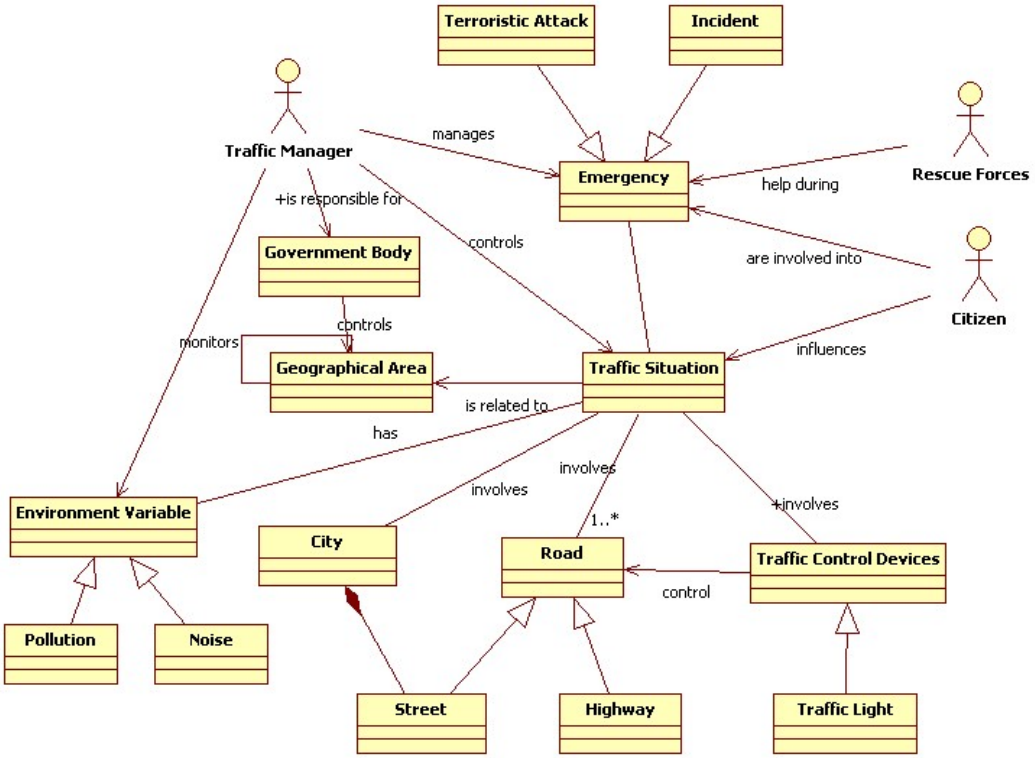


Figure 4.19: Domain Model

Scenarios

These scenarios describe the Traffic Management System and assume a large area with loosely coupled systems, operated by local authorities. Scenarios distinguishes between the *normal situation* and the *emergency case*. Figure 4.20 shows the general use-case diagram for the Traffic Management System case study.

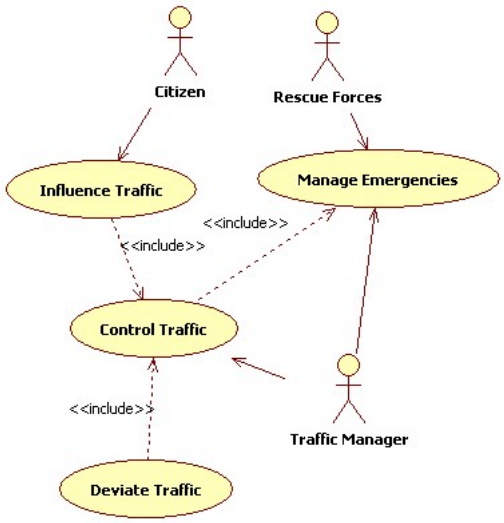


Figure 4.20: General Use Case Diagram for the Traffic Management System case study

Table 4.41: Traffic Management: Normal Situation

Field	Description
Unique ID	TRAFFIC_S_01
Short Name	Traffic Management: Normal Situation
Related to	TRAFFIC_BG_01, TRAFFIC_BG_03, TRAFFIC_BG_04, TRAFFIC_DA_01
Involved Actors	Traffic Managers, Citizens
Detailed Operational Description	In a certain area, various municipal and regional traffic systems are available and they guide long distance highways as well as village, township and city traffic. They are tailored to the respective local conditions, retrieved by devices scattered through the area, and depending on the time of the day. This means, that, according to the known and expectable traffic situations, they control and direct the traffic control devices, such as traffic lights, directions of multi-line highway lanes, lane and street closures, etc. During the normal situation, they also optimise throughput or other set parameters, such as air pollution or noise reduction. The local traffic control systems integrate the needs of pedestrians, bikers, car driver, etc. and take into account school hours or other factors, which alter traffic demand and needs.

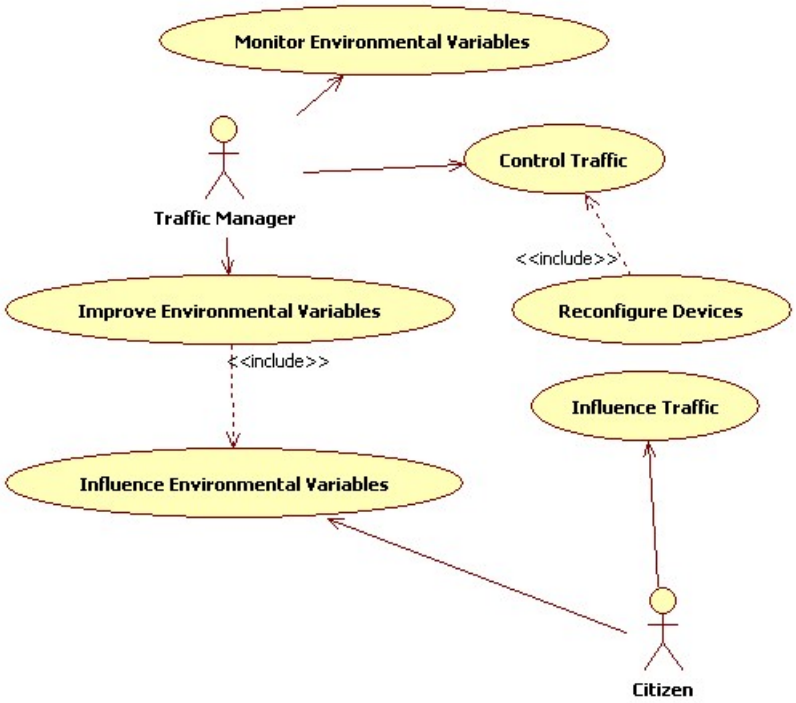
Problems and Challenges	Problems and challenges in this scenario are mainly related to business goals and domain assumptions, that is: • Integration of several traffic management systems with different strategies (cities, rural areas). • Integration of many heterogeneous devices (traffic control devices like semaphores, traffic monitoring devices, etc.). • Acquisition of adequate new strategies (control algorithms) in order to react upon an unexpected situation. • Constant evolution • Dependability, performance (emergency reactions), security and trust (in particular with respect to the acquisition of new strategies)
Additional Material	The following use case diagram describes the above scenario: 

Table 4.42: Traffic Management: Emergency Scenario

Field	Description
Unique ID	TRAFFIC_S_02
Short Name	Traffic Management: Normal Situation
Related to	TRAFFIC_BG_01, TRAFFIC_BG_02, TRAFFIC_BG_03, TRAFFIC_BG_04, TRAFFIC_DA_01
Involved Actors	Traffic Managers, Rescue Forces, Citizens

Detailed Operational Description	This scenario deals with the management of a critical and possible unexpected situation or emergency. An example of such a situation is a serious accident, where several actions must be performed. Typical actions to be performed during emergency are: • closing or limiting the traffic to / from the involved location (such as an highway); • rescue forces have to be directed to the location of the accident and their arrival has to be facilitated; • the traffic has to be deviated through places not intended for heavy traffic; • traffic management devices reconfiguration (e.g., traffic lights). Consequently, conflicting and unforeseen situations will occur. The control has to be reconfigured according to unplanned control patterns. Those unplanned patterns may have been already used at other locations, and thus they might be offered for re-use. Those available or retrievable control patterns have to be adapted to optimise the local situation, taking into account the changed conditions and the still remaining local settings. For example, a local theatre, for instance, could still close at the announced time notwithstanding the emergency situation. Deviation roads have to be selected accordingly. Signalling patterns, such as traffic light phases, have to be adapted in order to reduce stop & go traffic, that should also help to kept air pollution low, even if it's not critical during emergency situations. Decisions have to be integrated in order to keep "feature interactions" with undesirable results at bay. Those situations are, by definitions, those that are strictly goal directed and effective itself, but may result in a disaster if applied together.
Problems and Challenges	Problems and challenges in this scenario are mainly related to business goals and assumptions, that is: • Integration of several traffic management systems with different strategies (cities, rural areas). • Integration of many heterogeneous devices (traffic control devices like semaphores, traffic monitoring devices, etc.). • Acquisition of adequate new strategies (control algorithms) in order to react upon an unexpected situation. • Constant evolution • Dependability, performance (emergency reactions), security and trust (in particular with respect to the acquisition of new strategies)

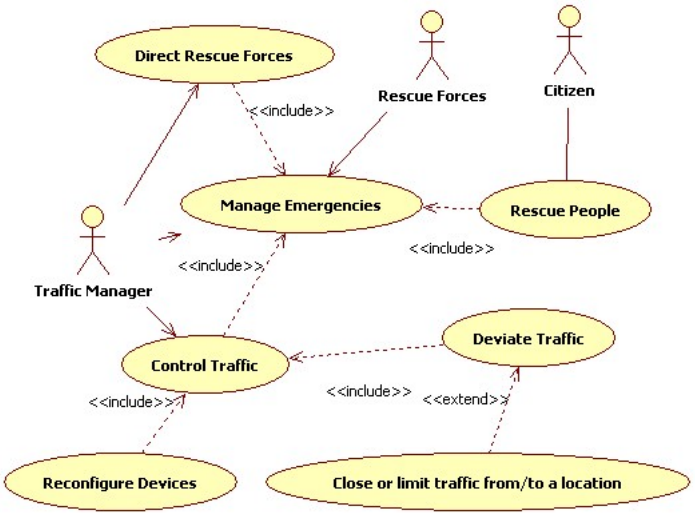
Additional Material	The following use case diagram describes the above scenario: 

Table 4.43: Traffic Management: Return to Normal Situation

Field	Description
Unique ID	TRAFFIC_S_03
Short Name	Traffic Management: Return to Normal Situation
Related to	TRAFFIC_BG_01, TRAFFIC_BG_02
Involved Actors	Traffic Managers, Citizens
Detailed Operational Description	After a complete emergency handling, there is probably a slow evolution back to the normal. If measures have to be taken immediately in the emergency case, it may need a slow and input-driven process to revert to the normal.
Problems and Challenges	Problems and challenges in this scenario: • Integration of several traffic management systems with different strategies (cities, rural areas). • Integration of many heterogeneous devices (traffic control devices like semaphores, traffic monitoring devices, etc.). • Constant evolution

4.5 E-Government (TIS/Engineering)

Context

Usually when a citizen needs some document from the public sector, he has to go to the appropriate department; often the time spent in queues, and the time spent to reach the right office is very long. E-Government is the process to make information technologies available to the government services in order to improve the relationships between citizens and their governments (public sector could be made open and transparent to the citizens). One of the services made available to the user, is the possibility to submit applications to require some service, and receive replies online. At any time during the day, from their locations citizens can access to the offered services and obtain all the needed information without spending any time in queues. In such a way, e-government is able to improve the efficiency of public sector, avoiding the time spent to reach different offices or waiting in queue, resulting in an improvement of the offered services and a better accessibility and transparency of the public services. Not only citizens may be the the users of the government application, but we can image that all the government agencies of a city could share data about the citizens and have the need to access to the services of the application, in order to make available, at any time, all the needed information. The case study is derived from the EU project NEXOF [1]. In particular, it has been proposed by Engineering Ingegneria Informatica [12] and TIS [13]. We have mapped it into the format proposed for S-Cube, retrieving the business goals and the scenarios needed for our description.

Business Goal and Domain Assumptions

In the following sections will be reported the Business Goals and the Domain Assumptions for the current case study.

Business Goals

Table 4.44: Statewide provision of online services

Field	Description
Unique ID	TIS_BG_1
Short Name	Statewide provision of online services for citizens, companies, government agencies
Type	Business Goal
Description	The infrastructure must be able to make services of the public sector available to all the users, such as citizens, companies or government agencies. Each user can access, from somewhere, to the services providing login information; after the login the user can have the possibility to forward requests of some documents or require any service.
Rationale	Essentially the rationale is the capability to make available the services offered by the public sector to citizens, companies and government agencies.
Involved Stakeholders	Users and Public Body
Priority of accomplishment	Should have

Table 4.45: Improve speed and efficacy of processes

Field	Description
Unique ID	TIS_BG_2
Short Name	Improve speed and efficacy of processes
Type	Business Goal
Description	The infrastructure must be able to serve quickly the user requests. When a citizen requires a service, replies are received online. Moreover if a fee must be paid, user could access, easily, the e-payment service. At the end of the process, the requested item (authenticated if required) , is available. The online interactions make the process very fast, improving the perceived quality and user satisfaction.
Rationale	The application of information technologies to the government process reduces the time to perform the task improving the efficiency.
Involved Stakeholders	User, Public Boby, Certifier service, E-payment service
Priority of accomplishment	Should have

Table 4.46: Provide a 24h per day availability of the services

Field	Description
Unique ID	TIS_BG_3
Short Name	Provide a 24h per day availability of the services
Type	Business Goal
Description	User may submit a request at any time and from anywhere, so service availability must be always guaranteed. User can access from anywhere in the world and can have a different time zone.
Rationale	The infrastructure must guarantee a 24x7 availability of the services.
Involved Stakeholder	User and Public Body
Priority of accomplishment	Should have

Table 4.47: Offer a good user experience and provide continuous feedbacks to users

Field	Description
Unique ID	TIS_BG_4
Short Name	Offer a good user experience and provide continuous feedbacks to users
Type	Business Goal

Description	The application must be easy to use, and of quick understanding guaranteeing usability and accessibility. The usability of an application is related to the interface, the navigability, the positioning of text and objects. The application should offer an interface highly intuitive; information should be displayed in a directly usable format. The users of the application can have different expertise: some user could be less able than others to interact with the application; moreover disabled users could access the application. Moreover the sequence of the task should be linear, the terminology understandable, time to load pages should not be long and users should be able to easily print their information. E-government application must provide continuous feedback to guide the user during the operations.
Rationale	The e-government application must be easy to use and guide users during his operations.
Involved Stakeholders	User, Public Body
Priority of accomplishment	Should have

Table 4.48: Guarantee confidentiality, integrity, authenticity, non-repudiation

Field	Description
Unique ID	TIS_BG_5
Short Name	Guarantee confidentiality, integrity, authenticity, non-repudiation
Type	Business Goal
Description	E-government application must guarantee the confidentiality of the information the user provided when a service is requested. Such applications act as an interface for data that is kept in a distributed way. This can occur because of legal restrictions that aim to ensure data privacy. If data is changed, distributed transaction support is needed. Data encryption must be guaranteed for data transfers from the citizen to the public administration, among administrative offices and from a public administration to the citizen. The transfer of this data has to be encrypted to prevent the access of unauthorized persons. Messages can be signed to certify the sender of the message. A citizen can prove that he or she has sent a message through the digital signature. It is possible to prove that the recipient really received the message and that the sender really sent the message. The transmission of a document is logged in a way that it proves that the sender submitted the message and that the receiver received it. Both parties get a confirmation of this.
Rationale	E-government applications frequently have to access, receive, or store data that contains personally identifiable information such as healthcare records, criminal justice investigations and proceedings, residence and geographic records, ethnicity, and so on. The originators of messages from citizens to public offices have to be guaranteed.
Involved Stakeholders	User, Public Body, Certifier service

Priority of accomplishment	Should have

Table 4.49: Guarantee that provided information is not used for a scope different than the one required by the user

Field	Description
Unique ID	TIS_BG_6
Short Name	Guarantee that provided information is not used for a scope different than the one required by the user
Type	Business Goals
Description	E-government application must guarantee the confidentiality of the information user provided when he requested a document. When a user requires a document, all his relevant personal information is needed, moreover if he have to pay a fee due to his request, he have to transmit information such as credit card number . It 's important to guarantee that transmitted data are not used for different scope than the one required by the user.
Rationale	When user perform a request of a document or a service, confidential data are transmitted; user must be guaranteed that data he communicated in the requests are not used for different scope.
Involved Stakeholders	User, Public Body and e-payment service
Priority of accomplishment	Should have

Domain Analysis

Strategic Dependency Model and Context Diagram

In the following figure (Figure 4.21) the strategic dependency diagram for the e-Government case study is reported. The diagram reports the dependency between User (a Citizen, a Government Agency or a Company) and Public Body to the satisfaction of the goal *Require service*; moreover User depends on the Certifier service to gain trust on the obtained output, while the Certifier service is needed by the Public Body to authenticate the service output. Moreover User needs the E-payment service to satisfy the softgoal *Charge Fee*.

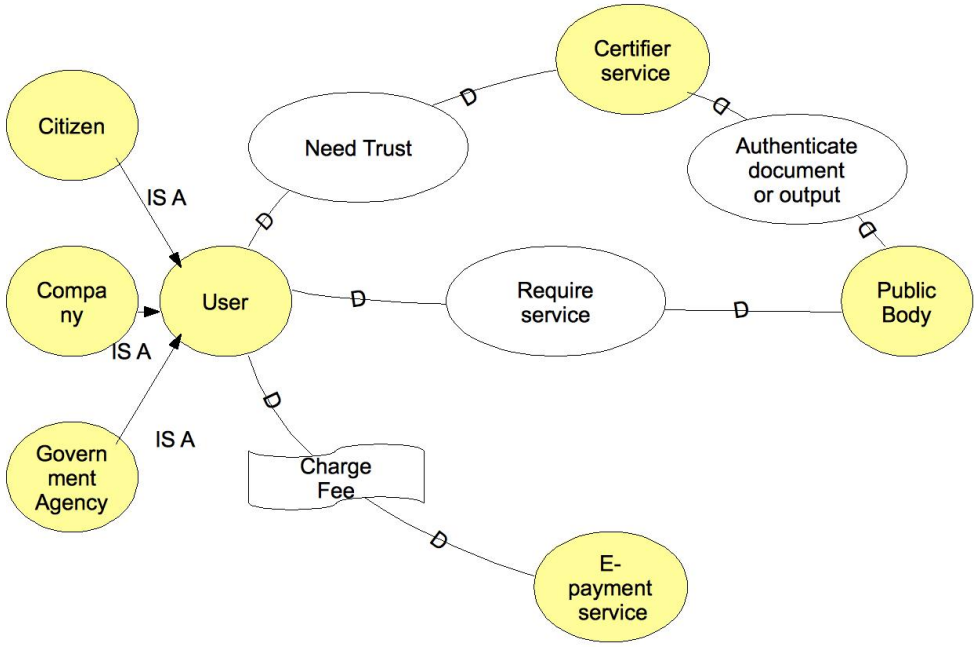


Figure 4.21: Strategic Dependency Diagram

The following figure (Figure 4.22) represent the context diagram of the e-government case study. In the Figure 4.23 the domain model of the e-Government is reported.

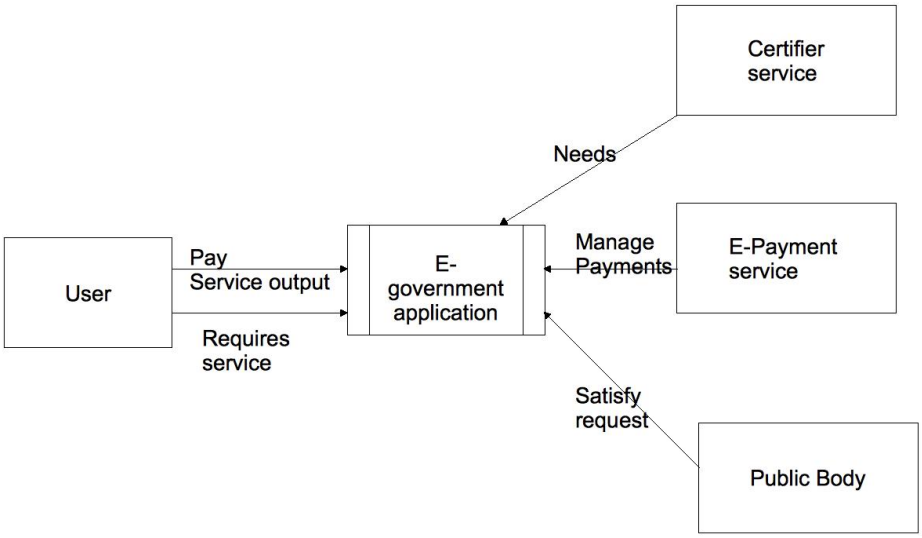


Figure 4.22: Context Diagram

Scenarios

In the Figure 4.24 the general use case diagram for the e-Government case study is reported.

Table 4.50: E-government scenario

Field	Description
Unique ID	TIS-ENG-1
Short Name	E-Government
Related to	TIS_BG_1, TIS_BG_2, TIS_BG_3, TIS_BG_4, TIS_BG_5, TIS_BG_6
Involved Actors	User, Public Body
Detailed Operational Description	This scenario describes the submission of applications to obtain subsidies from the province of Bolzano, Italy. In the e-government application the process is started by the user that, after the login, requires a service. So the user inserts the needed data to compile the form for the request (he could decide to compile the form from the scratch or updating preexistent data); submitted data is validated and used to obtain the requested document (or any other required output). If needed, the user pays the amount due (see the next scenario), and the document (authenticated if needed) is returned to the user. Actors involved in the scenario are the user of the application (citizen, companies or government agencies) and the public body.

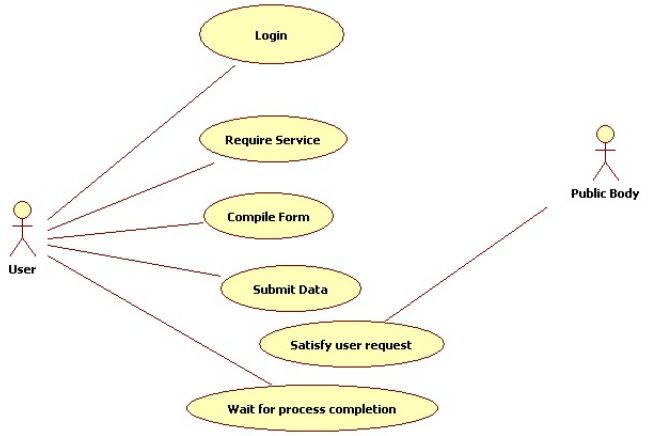
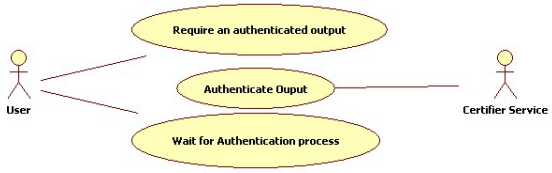
Problems and Challenges	When a user requires a document or a service he submits a lot of personal data. The confidentiality of the data must be guaranteed by the application, moreover the user must be assured that provided data are not used outside that transaction.
Additional Material	

Table 4.51: Payment of the requested service scenario

Field	Description
Unique ID	TIS-ENG-2
Short Name	E-Payment
Related to	TIS_BG_5, TIS_BG_6
Involved Actors	User, E-payment service
Detailed Operational Description	If the user needs to pay some fee to obtain the requested service, he must interact with the e-payment service. The user insert the needed data (usually credit card number) and wait for the completion of the process. The process requires the intervention of the e-payment service to check the inserted data.
Problems and Challenges	A mechanism of encryption of data must be guaranteed to protect the transmission of confidential data by intrusion.
Additional Material	

Table 4.52: Authentication of the output scenario

Field	Description
Unique ID	TIS-ENG-3

Short Name	Authentication of the output
Related to	TIS_BG_5, TIS_BG_6
Involved Actors	User, E-payment service
Detailed Operational Description	The user could require an authenticated output, so the application has to provide a mechanism to certify the output.
Problems and Challenges	A mechanism of digital signature must be provided to guarantee the authentication of the output.
Additional Material	

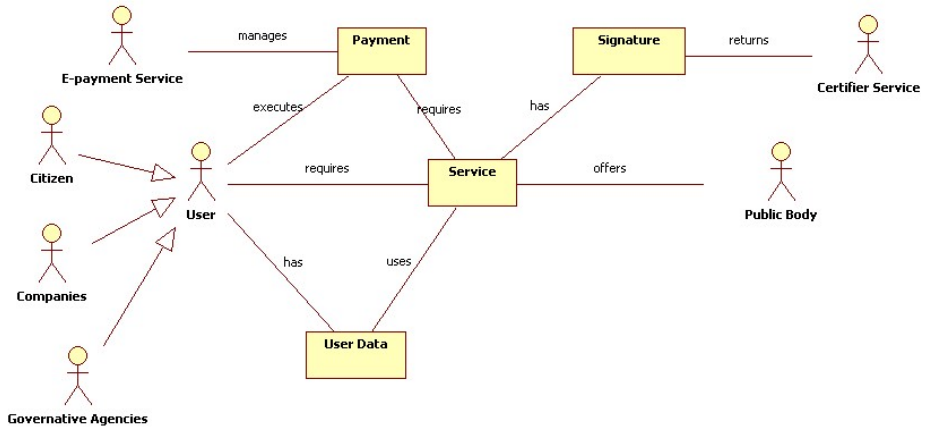


Figure 4.23: Domain Model

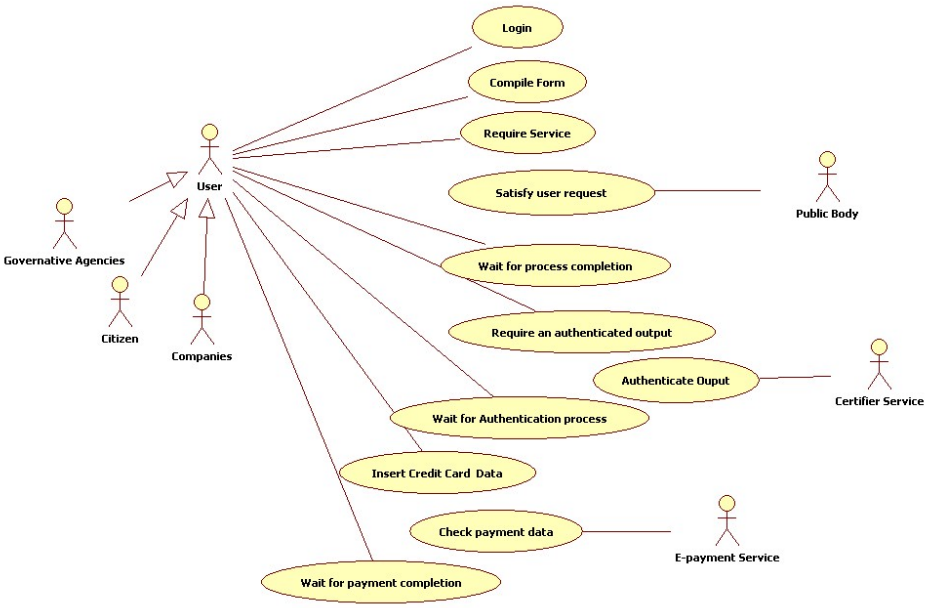


Figure 4.24: General Use Case diagram

Chapter 5

Discussion

Table 5.1 maps the case studies in Chapter 4 with requirements in Chapter 2.

Table 5.1: Case studies and their fullfillment of S-Cube requirements.

Requirement vs. case study	Wine production (Section 4.1)	Automotive (Section 4.2)	EHealth (Section 4.3)	Traffic Management (Section 4.4)	E-Government (Section 4.5)
Business situation and ASNs	Yes	Yes	No	No	Partially
QoS aspects	No	Partially	Yes	Yes	Partially
Service Consumers with various profiles	No	No	Yes	Yes	Yes
Distributed Infrastructure	Yes	Yes	Yes	Yes	Yes
Distributed Composition	Yes	Yes	No	No	No
Highly changing requirements	Yes	Partially	Yes	Yes	No

None of the case studies fullfills all requirements, but, all together, they address all of them. The first requirement on the presence of business situations that include Agile Service Networks is certainly fulfilled by the wine and the automotive case studies. Both cases, in fact, include a supply chain and require the interaction of the main organization with a number of other organizations. In some cases, such interaction is performed on a peer basis. For instance, in the wine case this happens when there is a need for covering some specific market opportunities or for addressing difficulties in cultivation and harvesting. Some business situations are also included in the e-government case study, in particular, for what concerns the interaction between the public body and the certifier service or the public body and the e-payment service. In these cases, however, the public body maintains always the role of the main actors and does not require any ASN. Finally the other case studies do not explicitly refer to business situations, even though they could be easily extended to deal with them.

Quality of Service appears to be explicitly considered in the e-health and in the traffic management scenarios as in both cases the reaction times in critical situations has to be very fast. QoS is also considered in the automotive and in the e-government case studies in the sense that some services are expected to be completed within a well specified time frame. Such time frame, however, is not necessarily short and usually can encompass a few days.

The ability to properly manage the interaction with consumers with different profiles in particularly relevant in the e-health case where the doctor has to have simple and fast mechanisms to access patient

information and to consult specialists while he/she is checking the patient. In this case, the user profile indicates the kind of devices being used by the operator and the situation in which he/she is working. In the traffic management case, different consumers, citizens, rescue force, and traffic manages have different profiles as they differ in the role they cover and in the kinds of actions they are allowed to take. Therefore, the system has to be able to provide the right set of operations and access rights to all of them. In the e-government case the need for offering different interaction paradigms is not explicilty mentioned, but it is implicit in the business goal TIS_BG_4 concerning the user experience. In order to offer a good user experience, in fact, it is not possible to assume that all citizens have the same requirements/needs. The user interface of the system will have to be adapted to the cultural background of the citizen, to his/her abilities or disabilities.

The presence of a distributed infrastructure is important in almost all cases. In the wine production case the system includes a wireless sensor network to monitor the situation in the vineyard as well as other sensors and RFID systems to support harversting, maturation, and logistic. Moreover, the system is able to interact with other external systems for monitoring and managing the fluctuation of market needs. In the automotive case the infrastructure is distributed as it includes the information systems of the various organizations involved in the case. In the e-health and in the traffic management cases the distribution is due to the usage of non-conventional devices by the operators. Finally, the e-government case does not explicitly indicate the need for distribution, but a few interaction with the payment and the certifier services are foreseen.

Distributed composition is required in two cases of wine and automotive in which we have in place some Agile Service Network.

Finally, highly changing requirements appear to be very important in the wine, e-health, and traffic management cases where unforeseen situations are typical of the considered application domains. The automotive and e-government cases are more stable, but in the automotive case the possibility for taxation rules and regulations to change overtime is explicitly mentioned. It should be noticed that even in the situations in which changing requirements are not foreseen at the application level, they could be needed at the level of the solution that is used to address the case. Clearly, at this stage, we cannot consider these situations yet.

Chapter 6

Conclusion

The main objective of this report is to describe in a uniform format some case studies that are representative of the panorama of service-based applications and could be used within S-Cube to experiment with the results that will be produced by the various research workpackages.

In order to achieve the goal of the report, we have identified the interesting characteristics that a case study should have to be of interest for S-Cube; of course, these characteristics are the ones that highlight aspects on which S-Cube is developing research results. Moreover, we have defined a description format for case studies and we have exploited it to revisit and disambiguate five case studies that have been gathered from industry. In the final part of the deliverable we have compared the case studies against the characteristics we consider important. The conclusion we have achieved that, all together, these cases cover all these characteristics, even though no one of them is able to cover all of them singularly.

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