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Use case and UML Scenarios Engineering for Building B2B E-commerce

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ABSTRACT

Recently, the enterprise information system is a central element of the functioning of an organization, its development uses Unified Modeling Language (UML). In this article we present two main contributions: The first relates to the application of the use case and UML scenarios approach to B2B systems. Based on the engineering of use cases and UML scenarios, we present our vision to develop Business-to-Business (B2B) systems as an activity process derived from formal specifications from the engineering of use cases and UML scenarios. We use a set of algorithms and tools developed to make all activities of the proposed process automatic. In the second contribution we describe how to use the use case diagrams and UML scenarios to analyze static and dynamic requirements by supporting B2B interactions with the intention of developing a B2B e-commerce system.

Key words: UML, Use case, Scenario engineering, B2B, Enterprise.

1. INTRODUCTION

E-commerce refers to any form of business transaction conducted online (online shopping...etc.). It is the ability to conduct commercial transactions using the Internet or other computer networks such as electronic data interchange and involving an exchange of ownership of the good or service ordered. E-commerce has grown in popularity tremendously over the past few decades and is in a way replacing tradition.

E-commerce is classified into four distinct categories: Business-to-Consumer (B2C), Business-to-Business (B2B) Business-to-Administration (B2A), and Consumer-to-Administration (C2A) [1].

B2B electronic commerce builds upon inter-company business processes that cross the borders of enterprises. B2B interaction is the exchange of information, service or goods and money between business parties. For example, of B2B interaction is: (i) the interaction between buyer and supplier and (ii) the service exchange between service consumer and service provider using electronic techniques and tools.

To ensure software quality and reduce costs, the developer must be able to resolve design issues in the early stages of software development. Recently, use case diagram and UML scenarios have become popular techniques for requirements elicitation, specification building, reading and producing design documents.

B2B interaction can be described by UML model using use case and UML scenarios engineering [2,3]. The two parts of business are the objects of collaboration and interaction: their roles are similar to those of classes of objects. The exchanged entities (information, goods, service) are described as messages of UML sequence diagrams.

The use of UML scenarios and use cases (service of system), mutually, has been described in several works. They allow partial descriptions of the treated system. UML is more precise in the definition of these different terms. A use case is a generic description of an entire transaction involving several objects of the system. A scenario shows a particular series of interactions among objects in a single execution of a use case of a system (execution instance of a use case or service of system). Scenarios can be viewed in two different ways through sequence diagrams or communication diagrams UML.

This paper is organized as follows. Section 2 gives a brief overview of the scenario and the UML diagrams relevant for our work. Section proposes our approach and methodology. The last section is a summary and concludes this paper.

2. UML SCENARIOS

In recent years, researchers have paid great attention to UML scenarios and used them in different fields: human-machine interaction, generation of specifications, object-oriented analysis and design, etc. More specifically, scenarios were seen as a promising technique for requirements engineering. In this section, we present a brief overview on the use of UML scenarios and diagrams relevant to our work.

2.1 Scenario aspects

The evolution of the scenarios is due to several aspects. Indeed, their interpretations depend on the context and purpose of use, and on the method by which they were acquired or generated. In [4], the authors defined a scenario as "composed of one or several actions, the combination of actions in a scenario describes a unique path leading from initial to final states of agents". They also proposed, during a survey, a classification of scenarios according to four aspects: the form, contents, the goal and the cycle of development (Figure 1)

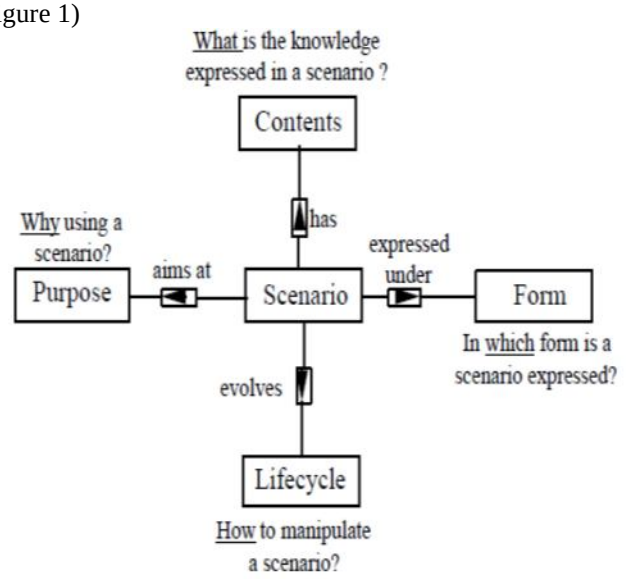

Figure 1: Aspects of scenarios (four views)

The main function of the form view is to give the form of a scenario. In which form is a scenario expressed? formally or informally described, in a static, animated or interactive form. The content view focuses on the knowledge expressed in a scenario. This knowledge can have several types: for example, describing the functions of a system or describing a larger view in which the functionality is integrated into a larger business process with various stakeholders and related resources. The purpose view is intended to present the role of a scenario within the requirements engineering process for systems development. The lifecycle view suggests to considers scenarios as artefacts existing and evolving in time through the execution of operations during the requirements engineering process.

2.2 UML diagrams

UML is a pictogram-based graphical modeling language designed to provide a standardized method for visualizing the design of a system. It is commonly used in software development and object-oriented design. UML framework offers a modeling standard, to represent the software architecture. It consists of different types of diagrams. In this section, we discuss the UML diagrams that are relevant to our approach: use case diagrams and sequence (scenario) diagrams.

2.3 Use case Diagram

Use cases are coherent units that express the different interactions between the system and external actors. A use case diagram captures the behavior of a system, subsystem, class, or component as an outside user sees it [2,5]. They model the needs of these users at a very high level of abstraction. UML defines a set of relationships between use cases by allowing them to interact and exchange services [5]. An example of a use case diagram is given in Figure 2.

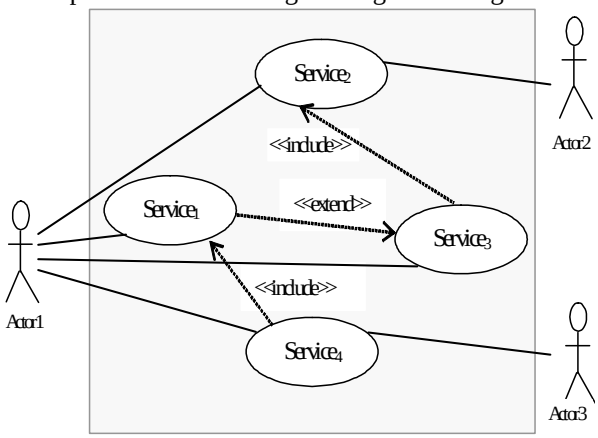

Figure 2: Example of use case diagram manipulate services (uses case)

2.4 Sequence Diagram

In the context of this work, we have adopted the use of the sequence diagram through their wide use in different fields. Sequence diagrams are the graphical representation of interactions between actors and the system in chronological order, which is a major advantage in understanding synchronization and interaction problems. It describes objects by their lifelines and shows the messages they exchange in the temporal sequence. However, it does not capture associations between objects (Figure 3.).

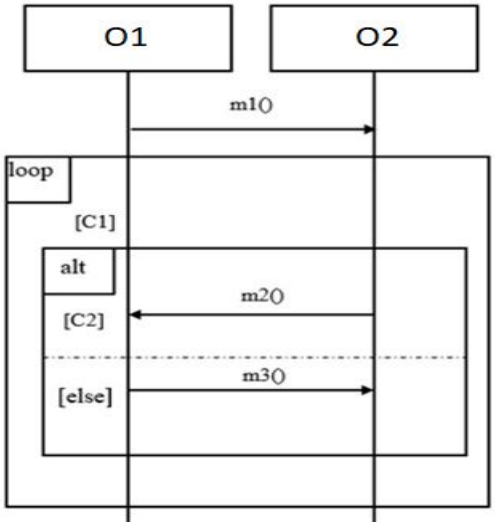

Figure 3: Example of a SequenceD.

3. SCENARIOS ENGINEERING IN B2B SYSTEMS

The scenarios are very successful in software engineering, this is due to their use in all phases of the development cycle of computer systems from the requirements acquisition to testing activities [2,4].

UML is widely used to model most aspects of a business information system, namely static and dynamic. In this context several problems can be overcome. In this section, we provide an overview of the iterative process that derives a formal specification of the B2B system from the engineering of use cases and scenarios.

3.1 Business Interaction Model (BIM)

A Business Interaction Model (BIM) is a collaborative and efficient working method requiring the commitment of all stakeholders. It's a quick way to develop a strategic vision for a business. BIM enables the sharing of reliable information throughout the development life of a system. It presents a high-level view of the collaboration between all stakeholders in a project, either through data exchange, or by allowing intervention on a single model (for example, service provider or consumer). The strong point of this model is to describe the business functions they perform or the services they provide, the communication and exchange of goods (facilitates and accelerates communication), services and information between political borders. while performing these business functions and providing services.

BIM can be described using use case and sequence diagram of UML framework by collaboration and interaction objects. The exchanged entities (information, use case, goods, service, etc.) are described as sequenced messages of sequence diagram UML. Figure 4 shows an example of a BIM sequence diagram in UML. In this example we consider two objects: " Enterprise A (EA)" which plays the role of a buyer and " Enterprise B (EB)" plays that of a seller. When these objects interact with each other, they exchange information (order, ACK order), money and goods. UML sequence diagrams that describe BIM are very abstract. Usually, they cannot be directly used in software implementation.

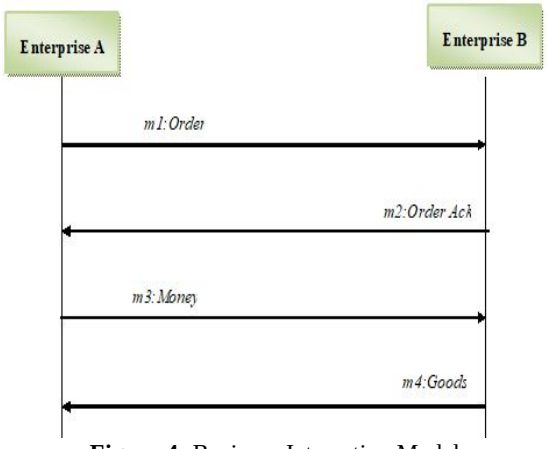

Figure 4: Business Interaction Model

Using UML scenario engineering, one can develop, build and rigorously refine the final interaction model. In the sections at the bottom we will discuss those activities that are part of the Business-to-Business transaction [6].

3.2 B2B Transaction

Recently, E-commerce |14,15] uses internet-worked computers to build, create and transform business relationships between systems. Indeed, web applications provide business solutions that improve the quality of goods and services, increase the speed of service delivery and reduce the cost of business operations. A B2B transaction gives and manages a request whether commercial or service, placed by the opposing commercial party (for example the buyer or the consumer), and consists of two most important parts: the interaction and the part Implementation.

i. The interaction part is the external part which has the function of implementing the developed business interaction model. The main components of this part are some interaction activities to receive the requests and provide the answers. This part is visible by the opposite commercial part [3].

ii. The implemented part is the internal part which houses some commercial activities. These activities deal with handling incoming requests. In ecommerce jargon, this part is considered a business process or business workflow. This part is hidden from the opposing commercial part.

3.3 UML Scenario in B2B

Before, B2B model transactions were an embarrassment full of complications and misunderstanding. This model is mainly based on old telecommunications systems like telephony and fax to handle orders, track shipments and also collect money. In fact, the slowness and the very long duration of the treatments are two major drawbacks of this type of system. Lately, with the advent of Internet services and e-commerce, most companies have developed and improved their B2B system. B2B e-commerce systems allow online business owners to implement a streamlined, highly efficient, fast, and cost-effective (beneficial) ordering process, ultimately impacting sales and bottom line [3].

The continuous growth and change of these B2B e-commerce systems allows them to keep abreast of the latest trends regarding the e-commerce process. Therefore, this factor is very significant in the success of a business strategy. The success of an online business is essentially based on the number of visitors a site receives, and also on the number of those visitors who become customers. The design of

e-commerce systems is done in such a way that a pre-qualified visitor comes to a site, they can easily convert to a customer. In B2B systems, several Information Systems (ISi) interact with each other to achieve a scenario. In figure 5, the objects are prefixed with the name of ISi where they evolve.

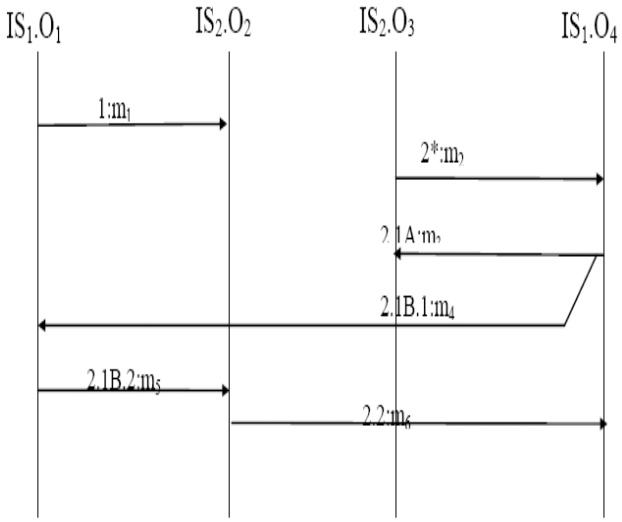

Figure 5: Sequence diagram for information systems

In a sequence diagram, we discover all messages that are exchanged in a business process and their order. It can be extracted from use case diagram. The B2B standards should specify the sequence of exchanged messages.

3.4 Scenarios Abstraction/Refinement

In UML framework, we can describe a system partially and globally. The partial descriptions of the system are entrusted to the scenarios while the overall description of a given service (use case) of the system or the description of the entire system is obtained via an integration, merger or composition operation. Several articles have addressed the principle of integration [7,8].

UML Scenarios engineering using use case diagrams model the user requirements and their interactions with the system at a very high level of abstraction. They are very useful for early requirements analysis for effective systems development.

We can also visualize the scenarios at different levels of detail: IS level where objects of an IS are hidden behind it, object level which is the detailed level, or any set of objects [9]. The abstraction/refinement operator has been developed for this purpose. This operator offers the possibility to visualize a scenario at different levels of detail. Through further elaboration, the B2B standards should specify the sequence of exchanged messages of UML scenarios. Figure 6 shows an example where all objects of the IS2 is hidden.

5. CONCLUSION

Lately, the use case diagram and scenarios are seen as more usable and reassuring techniques for eliciting requirements and creating specifications. In this work, we have presented a new methodoly that produces a global description or specification of a given service (information, use case) of the system or the whole system.

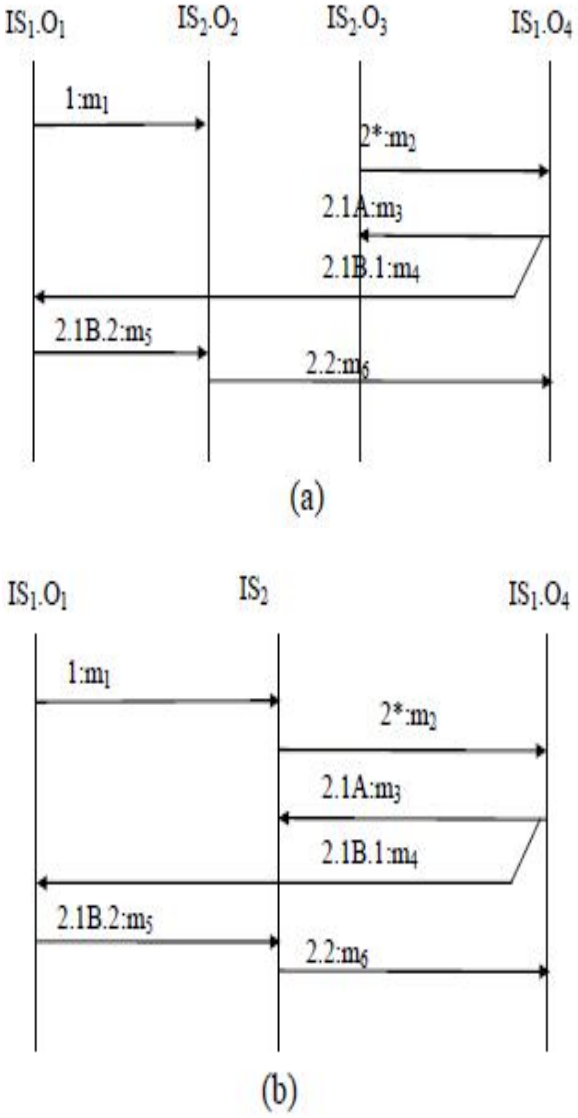

Figure 6: (a) Detailed view, (b) Corresponding abstract view where objects of IS2 were hidden

We proposed how to using use case and sequence diagrams in e-Commerce services. As a case study, we chose the scenario for building B2B ecommerce systems. We presented the use of the use case and the scenario approach in B2B systems: how several information systems ISi interacts between then to realize a scenario. In the approach proposed, we can take a unified model of interaction that gives a unique syntax to take interactions at different levels (use cases, scenarios UML, messages, etc.)

As future work, we plan on building a B2B e-commerce system using UML Behavioral Diagrams (activity and state diagrams). Also continuing work will further improve the expansion ability of our approach by introducing and implementing the merging of UML scenarios using combined fragments of sequence diagrams [1,10]. Moreover, comparative experiments of similar approaches can also be performed in the future [9,11,12, 13].

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