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GuiMarket specification using the *Unified Modeling Language*

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Abstract

GuiMarket is an e-Marketplace of health care, social care services developed as a pilot project in a Northern Portuguese Municipality, with the main objective of improving the well-being of elderly people and people with special needs staying at home, or their caregivers. This paper makes a brief introduction of this platform, explains its overall implementation and operation using an IDEF0 (Integration DEFinition) diagram, and presents the specification of the main services of the e-Marketplace using UML (Unified Modeling Language).

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Keywords: GuiMarket; electronic marketplace; health care; social care; helth care services; social care services; UML; IDEF; IDEF0; 3. Information Systems modeling.

1. Introduction

Changes in population age structure, consequence of declining fertility rates in recent decades, together with recent increases in life expectancy, may exert a significant influence on economic growth[1]. This demographic trend

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has led to increased health care spending and a higher demand for care and assistance services, threatening existing public health and welfare systems[2].

Several studies indicate that as far as possible health care and social care services should desirably be provided at the user's home[3-6]. It is argued that the existence of a network of health care, social care and professional services providers, working articulately with an underlying effective management and intermediation service can be a powerful tool and result in improving the quality of life for people with special needs (elderly and permanently or temporarily disabled people) and to the population in general[7].

In 2010 the authors were invited by a Portuguese Municipality (Guimarães) to study the development of an ICT-based solution for improving well-being of elderly people and people with special needs staying at home. The authors suggested an e-Marketplace – *GuiMarket* – for care and assistance services, to support the above-mentioned network of health care, social care and professional services providers. *GuiMarket* pilot project was developed envisaging people with special needs (elderly or with temporary or permanent disabilities), their caregivers, their family and institutions[8-11].

The paper introduces the *GuiMarket* project in section 2, followed by a brief reference to the specification techniques used to model the system in section 3. Then follows the overall functional specification using an IDEF0 diagram in section 4, and section 5 includes specification aspects to understand some of the most relevant processes of *GuiMarket* operation.

2. *GuiMarket*: an e-Marketplace of health and social care services

We are currently witnessing an attempt to use in the health and social care sectors some solutions already in use by the business sector, to optimize processes of product sourcing and supply chain improvement, such as the several well-succeeded "last generation" e-Marketplaces (e.g. www.broadlane.com, www.Med2med.com, www.labx.com, www.saniline.com), and many others referred by directories like *eMarketServices*, available online at http://www.emarketservices.com[12-16].

Modern organizations face many pressures from the ever changing external economic, technological, social and political environments[24] and, in this context, Information Technology (IT) and Information Systems (IS) play an extremely important role being present in almost every aspect of business[28,29]. In fact, IT is a core asset[32], being the backbone of today's organizations[34,35]: internal and external IT capabilities enhance firm performance[25]. IT/IS enable organizations to make significant improvements[26] as, for instance, to reduce operational costs[30]. Particularly, Internet has changed the way companies perform in the market[31]. In recent years the World Wide Web (WWW) has shown a continuous expansion, concerning size and used technologies, being today fundamental for conducting business[27]. A good example of that evolution and impact is the Web 2.0, which has "hit" businesses all over the world, stimulating collaboration between persons and companies[33].

Offer and demand are usually matched under several different circumstances, from unregulated search to oriented search, from simple intermediation mechanisms to the market mechanism, all of them with the possibility of being either manually performed or automated. E-Marketplaces implement the concept of 'market' and were developed to bring together large numbers of buyers and sellers expanding the choices available to buyers, and giving sellers new opportunities and access to new customers (buyers), simultaneously reducing transaction costs for all participants[17].

GuiMarket is a marketplace of healthcare and social care resource providers to facilitate the matching between users looking for service providers and individuals/institutions offering their resources, in a context of geographical proximity. The authors' objective was to test if a network of health care, social care and professional services providers, working articulately with an underlying effective management and intermediation service, based on an e-Marketplace, could be a powerful tool and contribute to the well-being of people with special needs, namely elderly people, and simultaneously to support their caregivers[18-21].

Offer and demand sides of *GuiMarket* are systematized in table 1.

Table 1. Offer and Demand in an e-Marketplace of health and social care services[22]

Demand	*Individuals*	The service is designed having in mind firstly individuals with special needs, elder or disabled, but it is accessible to all population of the Municipality. Currently a significant number of these targeted users cannot access these technologies, but that task can be performed by their caregivers, relatives, neighbours or friends; alternatively, they can use a call centre service where an operator mediates the search and selection tasks.
	Organizations	In a perspective of complementarities to the services they offer, or as demanders of services provided by the other classes of providers represented in the e-marketplace.
Offer	*Individuals and enterprises*	Individuals and enterprises certified to provide social care, health care or home specific services, such as gerontology services, transportation, plumbing, catering, cleaning, transportation, home assistance, or therapists.
	Organizations	Certified entities of the social network of services and care providers, the health care network.

The main activities of search and selection of resources providers using *GuiMarket* are the following ones:

- *Request*: Request involves the specification of the required service. This can be done navigating through the market of resources providers (or more narrowed sets of providers called focused markets), or for complex situations, using a chat facility with the "broker" of the market, when the service specification is not immediate and requires "knowledge" about the required service.
- *Search and Selection*: Search, negotiation and selection consist of several steps: the identification of potential resources providers, separation of eligible providers, negotiation among these to identify the candidate providers (according to availability, price, conditions to provide the service), and finally the selection of the most suitable. Negotiation is a feature that is possible for certain classes of professional services (request for quotations is the most usual). When it is not needed negotiation, selection is made from the services directory or catalogue. For complex situations, the final selection can be controlled by the broker or in interaction with him.
- *Contractualization*: An automated contractualization by which the user and the provider agree on the conditions to be respected in the service to be provided.

3. Information Systems modeling

There are several ways to model a system, from process centred to data centred models. In this paper it is used an IDEF (Integration DEFinition) to present the overall process architecture, complemented by a more detailed UML specification of services.

IDEF refers to a family of modeling languages in the field of systems and software engineering. They cover a wide range of uses, from functional modeling to data, simulation, object-oriented analysis/design and knowledge acquisition. The most-widely recognized and used components of the IDEF family is IDEF0, a function modeling methodology which offers a functional modeling language for the analysis, development, re-engineering, and integration of information systems; business processes; or software engineering analysis.

IDEF diagrams illustrate the structural relations between two processes and the entities present in the system. The processes (represented as boxes) transform the inputs into outputs (respectively the left and the right arrows of a process), using the mechanisms for the transformation (the bottom arrows of a process) and constrained by control information or conditions under which the transformation occurs (the top arrows).

Unified Modeling Language (UML®) is the OMG's (Object Management Group) most-used specification that enable model not only application structure, behavior, and architecture, but also business process and data structure[23].

4. IDEF0 representation of *GuiMarket*

The overall functioning of *GuiMarket* is represented by an IDEF0 diagram in Fig. 1. It consists of the creation and management of the market of resources (*GuiMarket* database) (Process A.1.), as the environment to support

search, negotiation, selection and contractualization of resources providers (Process A.2.) that, after the conclusion of the service, are evaluated (Process A.3.). It was used the WorkFlow Modeler™ by Meta Software Corporation.

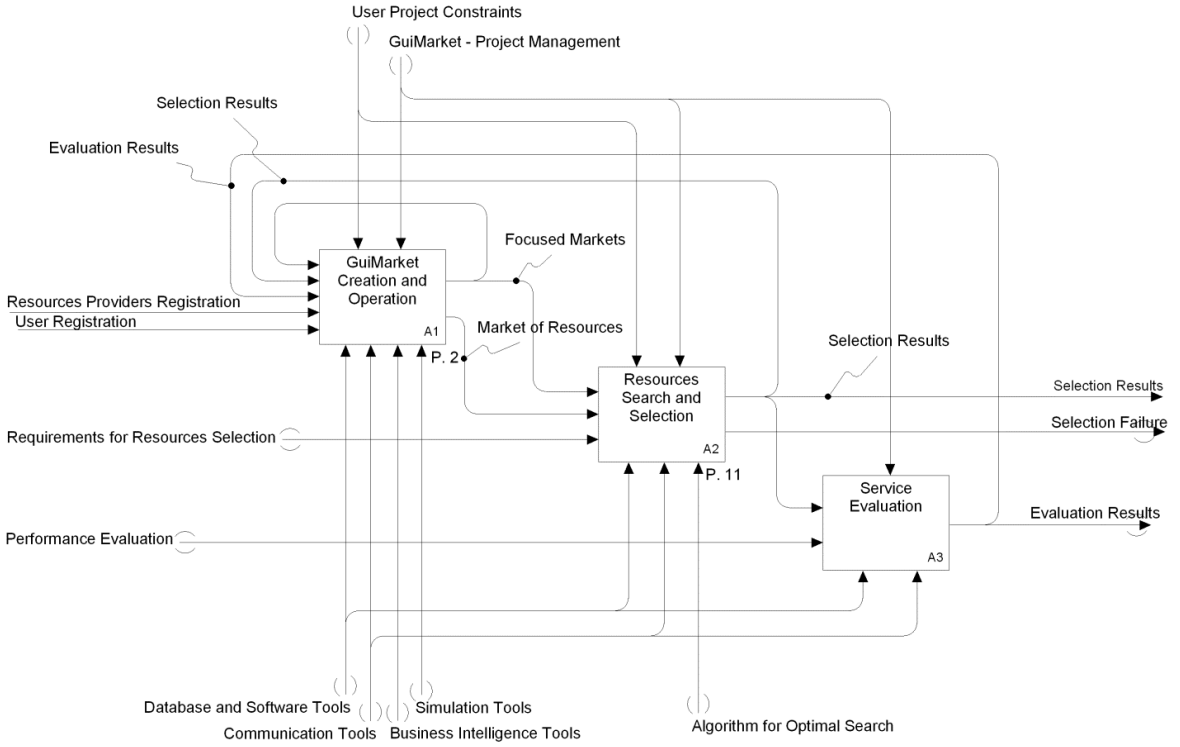

Fig. 1. IDEF0 representation of the global process for the *GuiMarket* creation and maintenance, the resources providers search and selection and the final evaluation of the service provided.

5. Functional specification using UML

This section includes the representation of actors, a package diagram and some relevant use case diagrams. For the UML diagrams the 5th version of *StarUML* tool was used.

5.1. Main actors

Electronic Marketplaces were developed to bring together buyers and sellers and automating transactions, expanding the choices available to buyers, and *giving* sellers access to new customers. So, naturally customer and supplier are two main classes of actors, which together with the manager, the prescriber and the system manager form the group of registered users.

- *GuiMarket* manager: Considering the type of services offered and the need to ensure a high standard of quality and reliability of the services, the *GuiMarket* manager is a vital actor. He is responsible for creating new service categories (either requested by users or by providers), confirming that the new providers are legally allowed to offer the service, benchmarking the quality of providers based on user feedback (including discriminating useful feedback), and ensuring that the system is functional (quickly acting whenever there are problems). Aside from these logistic tasks, the manager has two critical roles in the growth and sustainability of the business: (1) communicate with users along time in order to identify new possible areas of activity and also implement modifications to improve the usability of the portal; and (2) use the necessary traditional communication

mechanisms to allow people access to the market without the use of the portal (management of a supporting call centre). The later allows all types of interaction with the market, including the personal and direct contact such as in any traditional business.

- Customer: according to Table 1, the *demand* side of this e-Marketplace consists of both individuals and organizations that use the service to search for resources providers (suppliers) regarding the satisfaction of their needs.
- Supplier: as explained in Table 1, suppliers represent the *offer* side of *GuiMarket*, which can also be individuals and organizations.
- Prescriber: it is the person that prescribes; in this e-Marketplace the prescriber acts as enabler of access of a customer to a given service and/or defines the service that the supplier is required to provide.
- System manager: corresponds to the traditional computer systems and network administrator.

The main actors of *GuiMarket* are represented in Figure 2.

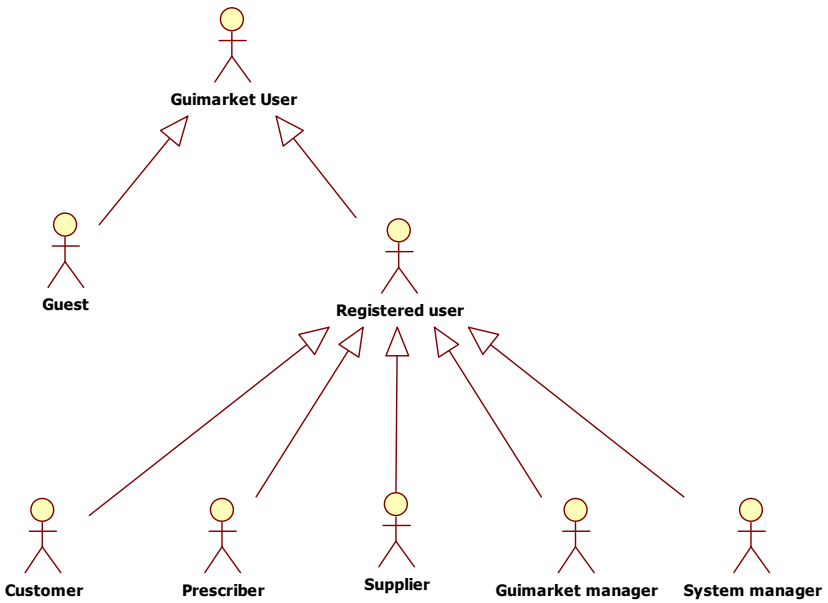

Fig. 2. Main actors

5.2. Package Diagram

The set of functionalities of the system was organized in the packages “Authentication and profile management”, “GuiMarket information”, “Information about services”, “Orders and tracking”, “Orders management”, “Catalogue management” and “Backoffice management”. The actors’ interaction with the system processes are represented in the package diagram of Fig. 3.

5.3. Use case diagrams

Some packages are detailed in this section by use-cases diagrams. Figures 4 to 7 represent the use case diagrams of packages P2 - Information about services, P3 - Orders and tracking, P4 - Orders management and P5 - Catalogue management, respectively.

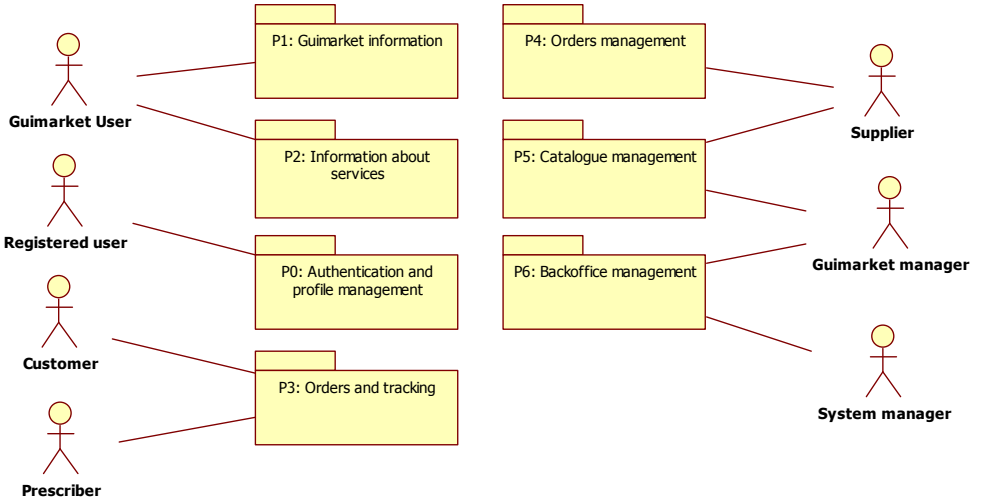

Fig. 3. Packages diagram

Package P2: Information about services

All the users (actor *GuiMarket* User) are able to search, browse and list services, view highlighted services, view service details and view information about services and providers (Fig. 4).

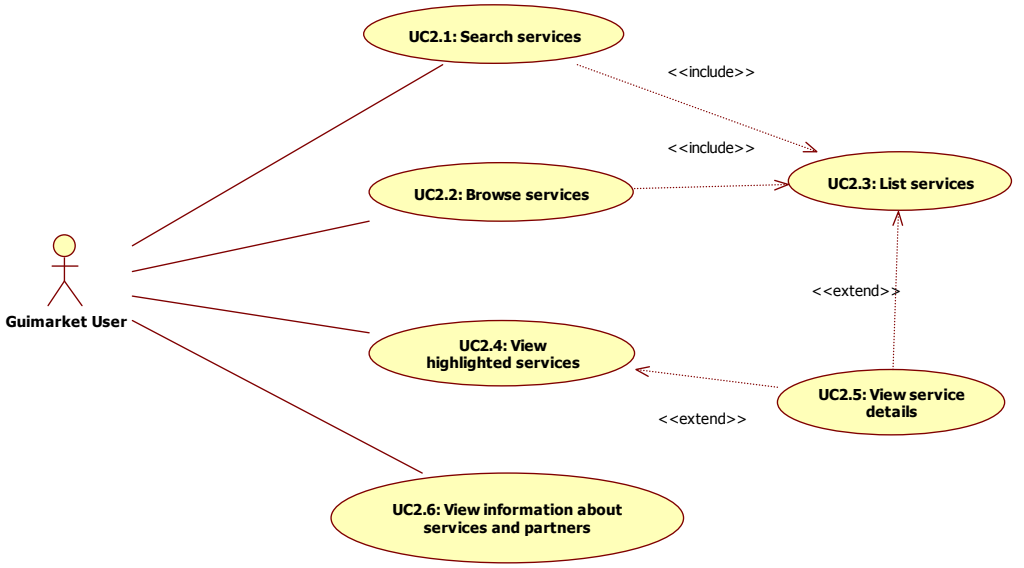

Fig. 4. Use case diagram – P2: Information about services

Package P3: Orders and tracking

Both customers and prescribers are able to order services, track and cancel orders, view orders history, comment services and suggest new services (Fig. 5).

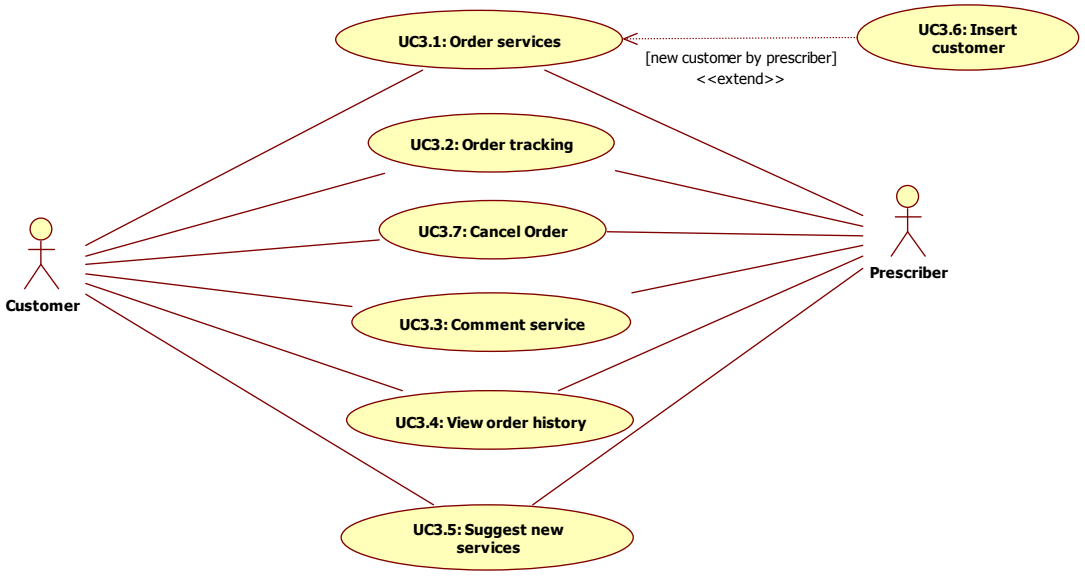

Fig. 5. Use case diagram – P3: Orders and tracking

Package P4: Orders management

Concerning the orders management package, the supplier is able to receive notifications about new orders, list orders, view orders history and details, edit orders and delete orders, as specified in Fig. 6.

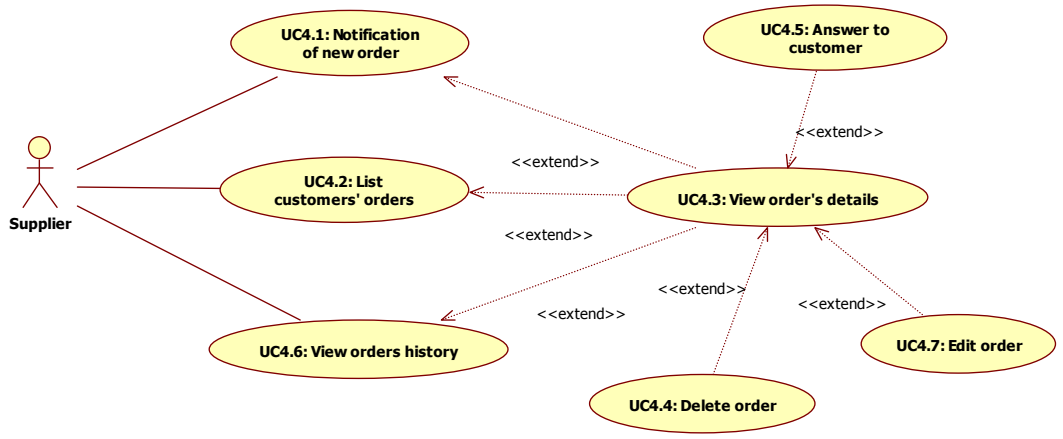

Fig. 6. Use case diagram – P4: Orders management

Package P5: Catalogue management

Concerning the orders management package, the supplier is able to insert new services and define services delivery terms, browse, edit and remove his services, and view comments left about his services. In turn, the *GuiMarket* manager can highlight services, edit and manage the catalogue, manage new services suggestions and manage comments concerning the services. Package P5 is represented in Fig. 7.

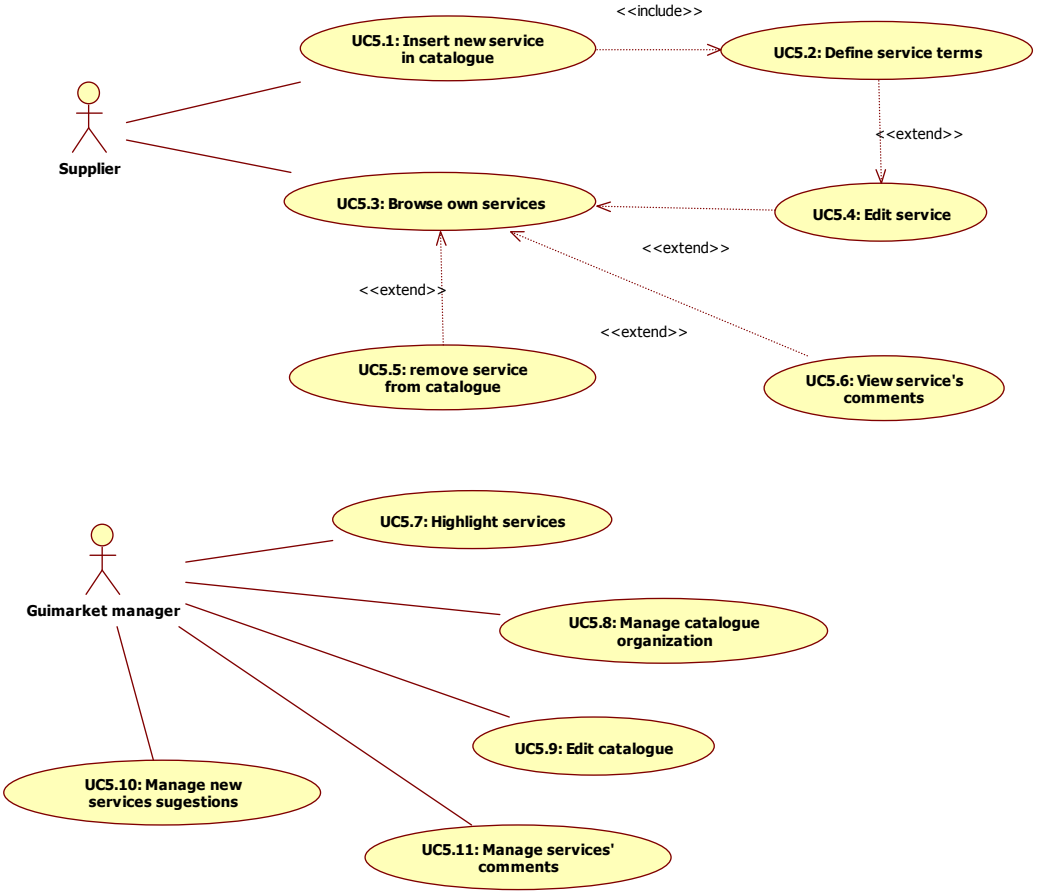

Fig. 7. Use case diagram – P5: Catalogue management

6. Conclusions

This paper presents the overall operation of *GuiMarket*, an e-Marketplace of Health and Social care services, using both IDEF0 for an overall process-oriented of the system and UML for the representation of actors and main use-cases. Only the most relevant aspects were included. For a complete understanding of the service implementation we recommend the authors' references cited along the text. As future work it will be made a complete specification of the system, covering the structural and behavioral perspectives.

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