A Virtual Organization Modeling Approach for Home Care Services

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Abstract. We follow a Virtual Organization (VO) approach for Requirements Engineering (RE) to define and describe the collaborative models needed in a French home care scenario. We use the Intentional level of abstraction for building the models to define the alliance, collaboration and objectives. In this level we identify the intra, inter and extra relationships between the organizations. The approach is illustrated in the context of a French regional project looking for innovative ideas for the care of fragile people within legal, medical, technical and volunteering concerns. Our goal is to facilitate iterative modeling taking into account all organizations' points of view and manage complexity with a top-down refinement.

Keywords: virtual organizations, collaboration modeling, eCare.

1 Introduction

In most countries there is a concern to satisfy not only the health of their population but also their social needs as part of an integral heal. This trend is related to the improvement of health, life expectancy and the change of people's traditional patterns (e.g., demographic, social, epidemiological, science and technology innovation, attitudes and expectations among other political priorities) [9]. Health care Information Systems (IS) in general and home care for the frail in particular involve a myriad of actors to facilitate an autonomous life at home. On the one hand, the collaboration between these actors (sometimes competing between them) is a complex task that requires the integration and coordination of skills and resources. On the other hand, designing the IS supporting collaboration is a challenge. Therefore, modeling was chosen as a reliable RE elicitation technique to "facilitate communication, uncover missing information, organize information gathered from other elicitation techniques, and uncover inconsistencies"[2].

Well known RE modeling approaches have evolved, matured and are source of many publications such as i*, KAOS, Map, scenarios and e^3value [4]. Some works use business process to express changes during the business process life cycle (i* [3]), to determine goal satisfaction (KAOS [1]), to capture goal achievement variability (Map [8]) and to identify value objects (e^3value [10]). Although they explore actor's relationships and allow refinement, must of them were originally conceived for one organization and offer partial models and analysis.

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Frail people's home care can be addressed throughout a Virtual Organization (VO) approach as defined in [6]: "an alliance for integrating competences and resources from several independent real companies, that are geographically dispersed. This integration is possible throughout the layout of an information system infrastructure to satisfy customer's requirements, or to seize a business opportunity without having to form a new legal entity".

In this paper, we present the development of Intentional models based on the 360° VisiOn [6] for VOs a comparative analysis of model based approaches can be found in [7]. This proposal aims to define the VO requirements taking into account each organization with different specialties and competences and the set of organizations committed to work together by sharing a common objective. It consists in exploring, assembling and visualizing the information that defines requirements of different people. The analysis of the Intentional models is useful to set a common language to the different participants and backgrounds.

We instantiate the 360° VisiOn models using a case study of the InnoServ project to guide frail people's home care service modeling. The ongoing project involves private, public and volunteer health care service providers and researchers from the French Rhône-Alpes region. The team is concerned about legal, medical, technical and social matters. The objective of the project is to offer innovative services for frail people to allow the person to stay as long as possible at home in a secure environment, avoid unnecessary hospitalizations or specialized home services after hospitalization, and break people's isolation and improve their quality of life and care.

The paper is structured accordingly. Section 2 gives an overview of the 360° VisiOn framework. Section 3 illustrates the approach with the InnoServ project and Section 4 summarizes our proposal, discusses our findings and prospects for future study.

2 Overview of the 360° VisiOn

The 360° VisiOn proposes a framework for eliciting VO's requirements from a horizontal and a vertical view. The former analyzes the *Intentional* (actors in a service, common and individual goals and collaboration), *Organizational* (the BP to be performed by each actor according to the objectives) and *Operational* (the IS's implementation based on the BP) levels. The latter analyzes three dimensions: *intra-organizational* (participant organizations internals), *inter-organizational* (participant organizations relationships) and *extra-organizational* (external environment relationships). The horizontal and vertical characterization is composed of a set of aspects formalized in UML diagrams [5]:

- *Alliance Identification* of the agreement (e.g., the duration based on time or a project), the actors involved (e.g., stakeholders, users, organizations) and the services offered (the general output expected from these actors and their role in the service).
- *Collaboration Willingness* characterizes actor's compromises in terms of the availability to the relationship (priority, time), the investments willing to be made (financial and material assets, organizational, human and relational capital), the elements to be coordinated (people, process) and the regulation (the expected behavior to assure actors' good performance).

– *Common Objective* characterizes the shared goal and the directions to be followed for achieving it. The latter could answer customer's needs (e.g., integral services), satisfy companies' objectives (to share costs, benefits, to create more effective processes), make new business (new markets, new products or services) or confront difficulties (absence of knowledge).

3 The 360° VisiOn Intentional Models in InnoServ

To guide the collaboration modeling process in the team (with varied actors and concerns), we use the 360° VisiOn models for visualizing, analyzing and exploring the diverse stakeholders scattered in the French health care service. In this section we describe some of the models used so far.

The *Alliance Identification* is implemented in a software tool prototype [5]. The Inter view starts at a macro level with the *Groups of Organizations* providing the health care service *Take Care of Fragile People* described as "organization and implementation of the services required by a fragile person in order to ease his/her everyday life". Guided by the 360° VisiOn the groups, relationships and group decomposition were identified in three participative sessions and four iterations with all project members:

– *Fragile People* are chronic or occasional patients, elderly, disable and momentary prevented people needing help to continue living at home.
– *Non-professional Caregivers* are unpaid neighbors, family, friends and volunteer associations engaged to help fragile people.
– *Health Professionals* are individuals and certified institutions working in physical or mental health with knowledge and specialized expertise to maintain or improve the health care of individuals.
– *Health Care Service Providers* are private or public organizations (offering devices and equipments to overcome physical barriers and limitations) and laboratories (performing medical analysis or imaging to diagnose and treat disease).
– *Non Health Care Service Providers* are organizations offering services that help simplify fragile people's daily lives while providing tax benefits, like personal assistance (e.g., food), home maintenance (e.g., housework).
– *Social Professionals* are nonprofit institutions helping patients to cope with financial difficulties, state health suppliers agreements, encourage prevention.
– *Indirect Service Providers* facilitate the work of the various actors in the health care field with materials (e.g., medical and ambulatory equipment) and services (e.g., mobile health).
– *State & Local Authorities* are tutorships and regulators of health legislations which gradually delegate government actions to the regions.

The relationships in the French health care system are defined by: *regulation* (representing organizational behavior control through laws and regulations), *coordination* (synchronizing, monitoring, planning and implementing processes), *execution* (carrying out the planned tasks defined in the processes) and *prescription* (giving medical prescriptions or non-medical recommendations).

Each *Group of Organizations* was decomposed giving a total of 45 organizations, e.g., *Indirect Service Providers* are Support Equipment Suppliers, Support Service Providers and Research and Development Labs; *Non-professional Caregivers* are Neighbors, Family, Friends and Volunteer Associations.

Four scenarios glimpsed during the first year of the project (homecoming, toilet, Alzheimer's and diabetes disease) we first illustrate our proposal with the former. The homecoming scenario is described as follows: "Mrs. Dubois is a widow woman in her late 80's. She lives alone in a small village in the mountains, she had being autonomous and independent so far. She was taken to the hospital emergency services due to a fall while at home. After several examinations she was diagnosed with distal femur fracture and had to stay in the hospital for three days. Since the accident she had considerable lost autonomy. In addition, she has always faced economic difficulties and does not have relatives to take care of her. Returning home becomes complicated". Based on the general decomposed model, 35 organizations were considered to participate in this scenario with an average of 2 relationships (one organization has four relationships) representing the service in an *Alliance Identification* decomposed model.

From this model, *Collaboration Willingness* representations were developed for defining: first the *engagement* to allocate investments (e.g., *State & Local Authorities* provide 80% of the money needed in the service). Second, the *coordination* of processes (e.g., hospital discharge, treatment proposal, refunding), describing where, when and how the communication is done (e.g., hospital discharge starts locally, is event-triggered by the hospital doctor, requires mobile access and data is transmitted to the medical record). And third, establishing *trust* with process regulations (e.g., private medical information exchange) and penalization in case of nonfulfillment (e.g., violation of access consent to private information).

One of the *Common Objectives* is to provide a "quality homecoming service". Regarding the intra objectives we can cite "optimize homecoming costs"(from the *State & Local Authorities*); "encourage social participation"(from the General Council). The expected *benefit* of an objective represents the foreseen goal yield (e.g., "maximize caregivers visits"). In turn, goals can emerge from *opportunities* (conjectural circumstance that facilitates objective achievement like "increment of social volunteers") or *problems* (a difficulty that can justify the objective like "rise of isolated people in the region").

4 Conclusions and Future Work

In this paper we reported on an approach for VOs modeling in the French health care domain which provides information about the problem space and handles the complexity linked to the numerous organizations involved in the service. The main contribution of the 360° VisiOn is to delimit the analysis at an intra, inter and extra dimensions to explore and analyze more alternatives, while other RE modeling approaches offer at best, two dimensions. It is important to consider these dimensions when exploring collaboration due to the different needs of organization's internals, organizations providing a service and environmental organizations.

We also described some of the models for the identification of actors, collaboration and objectives. Models have helped to establish a common language and facilitate

communication among project members helping to organize information from a top-down approach in a iterative way. Some innovative ideas have started to emerge from the alliance identification models which are currently validated, full validation for collaboration willingness and common objectives models is left as future works. A bottom-up approach based on business processes is being developed with other InnoServ partners, we are planning to analyze the impact of both approaches in the project.

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