

Toward a Business Continuity Plan for Home-Care Systems

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Abstract—Demographic changes in recent years have contributed to a shift in care models, with the development of home-care as a new alternative to traditional hospitalization. On the other hand, our society is increasingly influenced by modern Information and Communication Technology (ICT). The health care has greatly benefited from these technological advances. However, the use of these technologies for real life application may pose problems resulting in system failure, which might have significant impacts on patient safety and on the ability to deliver high-quality care services. Thus, continuity of service remains a critical area of concern for home-care. Appropriate means must then be taken to ensure an efficient, robust and advanced home-care system. In this context, we propose an approach based on Business Continuity Management (BCM) to ensure the ability to operate in spite of unforeseen events and to quickly recover from any type of business interruption. This paper provides a framework for BCM and its key concepts. Then, we describe a generic methodological approach for introducing BCM to home-care; outlining key issues to be considered.

Keywords—Continuity in eHealth Care; Safety; Detection emergency situations

I. INTRODUCTION

Demographic changes, especially a rapid ageing of the population and a growing segment of people with chronic illnesses and physical disabilities [1][2], in addition to the increasing costs in the healthcare sector [3][4], are having a growing and profound impact on the health care system [5]. These changes lead to a need for new care delivery mechanisms and structures [5][6].

As a result, many countries tried different alternatives. One of these new initiatives is the home-care [8]. In the recent years, we are noting an increasing demand for home-care services; in France, as it mentioned in [9], between 2005 and 2009, the number of persons under home-care increased by 120%, the number of hospitalization days in home-care raised by 119% and the number of patients increased 148%.

In Canada too, home-care organizations are growing rapidly. It is even the most rapidly expanding sector of the Canadian health care delivery system [8]. Indeed, finding ways to deliver high quality health care adapted to the needs

of these patients is a major challenge for health care system [9]. In response to this challenge, there is a considerable international interest in exploiting the Information and Communication Technology (ICT) solutions to enhance the quality and safety of Health Care, in general, and home-care in particular [10].

These trends are strong incentives for e-Health research. The European Union has undertaken a number of research projects to assist the elderly [1], proposing solutions to the issues of mobility (I2HOME), communication (SHARE-it), remote monitoring (CAALYX, eCAALYX), timely access to patient specific information (COGKNOW, EasyLine+) [1], and involving patients more actively in their own care process (Copolintha).

Nowadays, the introduction of new technology in practice is confronted with some problems resulting in system failure [4][7], which lead to unexpected and possibly harmful effects [11], such as delay in appointments, problems with data transmission of patients' records, etc.

The projects we have mentioned, and even others using information and communication technologies in the health sector, have largely dealt with the benefits of their solutions to enhance the delivery of health care services. However, they did not consider constraints and challenges faced in using ICT effectively in the health sector. No plans were proposed in case of failure of their solution, such as solutions to face a power outage, a unavailability of the system or even when the patient does not know how to use the device, etc.

As ICT becomes more integrated with health programs and activities, the impact of ICT outage on the system remains a critical area of concern. This should be taken into consideration when designing the system in order to ensure business continuity. Appropriate recommendations must then be taken to ensure an efficient, robust and advanced health care system.

However, while there is a growing focus in literature to discuss telemedicine applications for home-care [4][7][10][11][12][13], less attention has been paid to take into consideration organizational business interruptions, and issues involved in the use of telemedicine applications for daily delivery of home-care services.

We propose the development of a Business Continuity Management methodology (BCM) for home-care organizations to ensure the ability to operate in spite of unforeseen events and quickly recovering from any type of business interruption.

It's the purpose of the BCM, which is supposed to investigate actions to put in place in case of unavailability of the system. The BCM is then an appropriate approach for such critical need for these new systems based on the use of new technologies.

The present work carried out in the framework of a regional research project "SySO", supported by the French region Midi-Pyrénées, aiming at supporting continuity of home-care under technical or organizational failure; this project is linked to a national project "Plas'O'Soins"[30], funded by the French Agency for Research (ANR) intending to develop a software platform to improve coordination between different care providers in home-care.

This paper is organized into three main sections. First, we review relevant concepts related to Business Continuity Management (BCM). Second, we outline the characteristics of home-care processes. We present then a methodology to introduce BCM to home-care field. Finally, we offer conclusions and future research.

II. BUSINESS CONTINUITY MANAGEMENT

It is vital to accept that disruptive events will continue to happen despite our best efforts to mitigate risks. Organizations are increasingly concerned with their ability to continue serving their customers in spite of those incidents [14].

The present section carries out a brief review of literature on Business Continuity Management key concepts.

A. Business Continuity Management concepts

The British Standard BS25999, published by the British Standard Institute (BSI) [15], defines BCM as a "holistic process that identifies potential threats to an organization and the impacts to business operations,..., it provides a framework for building organizational resilience with the capability for an effective response that safeguards the interests of key stakeholders, and value-creating activities,..."

Most of the relevant literature advocates that BCM is a decision-making process [14]; it includes the concepts of business resilience, long term performance, and value preservation [15][16].

BCM aims to offer an "uninterrupted availability" of all key activities and resources [17]. It incorporates treatments and controls to continue essential business processes, once an outage event has occurred [18].

Zambon [19] and Cerullo [20] articulate that the purpose of BCM is also to recover operations within a "predefined time", and to reduce the "time required" to restore conditions to a state of business as usual.



Figure 1. Business Continuity Management Lifecycle (BS25999-1:2006).

B. BCM Lifecycle

Until recently, no widely agreed methodology was available to implement BCM. The standard BS25999 has changed this situation providing guidelines to understand, develop and implement a BCM: The Business Continuity Institute's Good Practice Guidelines [21].

The BCM life-cycle as it is proposed in BS25999 [21], Figure 1, integrates a four-stage process. It takes an organization through:

- An initial understanding of the organization by the identification of activities and resources supporting key processes of the organization,
- Determining BCM strategy, a description of what the plan is trying to achieve and how to make it work;
- Developing and implementing a BCM response: based on a Business Impact Analysis, to evaluate the impact of the disruption of the core processes previously identified; and determining the incident response structure, preparing and agreeing the content of the contingency plans, and developing the plans,
- Exercising and testing of the plans, the management of the plan through training, rehearsals, and reviews, to ensure the plan stays effective and up to date.

A further review of the literature provides us with some common inclusions compliant with the BS25999 BCM life-cycle. Some researchers [18][20][22] suggest that BCM should address three interdependent objectives:

- Business impact analysis (BIA): Identify major risks and impacts of business interruption,
- Business continuity plan development: Develop a plan to mitigate or reduce the impact of the identified risks,
- Exercising, testing and updating of the plan.

They also state that the primary output from the BCM process is a Business Continuity Plan (BCP), which is a set of procedures and documents describing a sequence of actions, and people responsible for carrying them out, to resume business processes following a disruption [23][24].

However, as we noted, as it is also mentioned in different guides and papers [18][19][21], there is no standard format for BCP; therefore each organization needs to assess its own requirements.

C. BCM in Health Care

1) Traditional Hospitalization

BCM within the health care context is in its infancy [14], but, today, most health care administrators recognize that BCP is not solely about planning for a sudden influx of patients, but also about planning for disasters that harm their IT systems and physical facilities [25].

As the Health Care system employs more digital technology to improve the quality of care, organizations are becoming increasingly concerned with their ability to continue serving their patients in spite of unforeseen events [14][20].

However, managing business continuity in health care environment is more sensitive [26], since Health sector is very sensitive to any kind of interruption that would impact their operations, their ability to help people and the vast amounts of data they require.

2) Home-care

Home-care is increasingly common in care delivery systems; it plays an important role as a mechanism for integration and coordination between health care actors [5]. Like other organizations, home-care organizations are vulnerable to internal and external events and risks that can interrupt their business operations and ability to accomplish their primary and critical missions.

The home-care process is a collaborative process [13][27] connecting an important number of technical and human resources, that involve multidisciplinary care providers [28] (doctors, nurses, case managers, physiotherapists, occupational therapists, dieticians, social workers, physicians, etc.) and personnel who provide a range of basic activities to support daily living for patients (home health aide, personal care worker, home health attendant, and home support worker), regional public units for funding, patients and their relatives [8].

This multidisciplinary collaboration is both indispensable and complicated [26]. In addition, the deployment of such a process takes place in a specific context: a very dynamic and uncertain environment [27].

In order to coordinate this complex cooperative process, it is crucial for it to be supported by telemedicine applications, as shown in Figure 2. The platform that we propose to develop in the Plas'O'Soins project offers a package of services such as coordinating the activities of home-care caregivers, facilitating communication between them, managing activities schedule, etc.

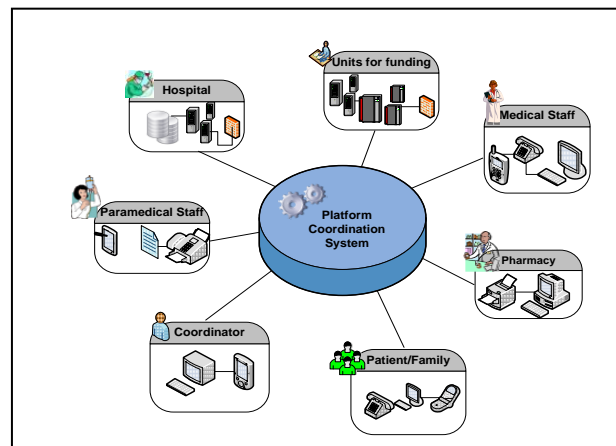


Figure 2. Home-care ecosystem.

This imposes that home-care organizations should adapt their business to include a response to both organizational and technical dysfunctions. Then, home-care organizations need not only to be able to manage the disruption caused by such incidents, but also to have plans to deliver their care services to patients 24/7.

Our aim is to define a BCM methodology and adapt it to the particularities of the Home care processes.

III. PROPOSED BCM APPROACH IN HOME-CARE

The proposed Business Continuity Plans that we found in literature are a set of procedures and documents in a text format, determining how the organization will keep functioning after a disruptive event until the restoration of interrupted activities within a predetermined time. That means, for example, that solutions and a list of people who need to be informed as a priority are all part of the plan.

Our aim is to formalize a Business Continuity Plan (BCP), following a model-centered approach, in order to provide a BCP model for home-care.

In this section, we present steps and considerations to model and formalize a BCP for home-care organizations, which will improve their chances of continuing operations during or after disruptive events.

1) The method

We stay compliant with the BCM lifecycle proposed by the BS25999 standard, and we model each of the different steps:

1. **Organization Modeling:** to describe how the home-care is organized, to represent process related concepts, actors and their roles, and data flows, so that the current processes may be analyzed. For this we choose a process oriented modeling approach to design and model home-care existing processes and the exchanged data. So to be able to analyze the processes, different views are required: organizational view, data view, and business process view. For these reasons ARIS software (Architecture of Integrated Information System) [31] was retained.

2. **Business Continuity Plan Modeling:** to develop a BCP model we will start by developing a BCP meta-model, defining BCP main related concepts, and BCP elements. Then, to support continuity of care under technical and organizational failure, and to ensure the resilience and robustness the system and keep it operational 24/7; the BCP model that we propose will be defined based on the organizational and technical models of home-care organizations.

The home-care sector depends on an important number of regulatory requirements and crucial business processes have time constraints, since we can't represent everything with events, to generate an appropriate response to anomalies based on organizations' business policies, best practices and regulatory requirements, we have to elicit business rules adequately. The anomaly detection process, could then be modeled using Complex Event Processing (CEP) concepts [29].

The CEP is a strategic technology especially effective in situations involving numerous factors that interact in variable ways [29]. It allows applications to identify complex sequences of events, events that are an abstraction of two or more events, like event A is followed by B, then by C. These complex patterns of events can have temporal constraints (within 5 hours) or spatial constraints (within 5 miles).

3. Exercising: Anomaly Treatment Process

BCP shows how to continue doing business until recovery is accomplished. Thus, we need to analyze the anomalies. Based on the organizational model, and the BCP model, we will define how these models evolve in response to anomalies. The principle phases of the anomaly treatment process that we propose are depicted in Figure 3.

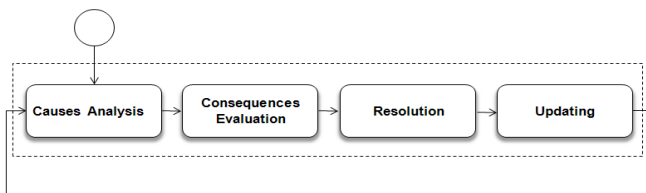


Figure 3. Anomaly Treatment Process.

- Phase 1: ‘Cause Analysis’ holds identifying the failure and analyzing its potential causes. The sources of anomalies may be hardware or software failure, technical problems or organizational dysfunctions, due to a drift of a business rule, a processes that has failed to complete or disruptive events occurring on devices.
- Phase 2: ‘Consequence Evaluation’ focuses on the impact of the outage including both the likelihood and consequence; it involves also assessing the severity of impacts that are likely to occur from the failure. For this we need firstly to identify relevant impact criticality criteria to set the priorities. This impact evaluation defines the maximum acceptable

outage for each key business process and sets the recovery priorities for the activities and resources underpinning them.

- Phase 3: ‘Resolution’ In this phase, we propose a number of treatments form the BCP to ensure the business continuity after the outage has occurred.
- Phase 4: Finally, the BCP should be dynamic, evolving as the business environment changes and its dependency on advanced technology changes, thus a BCP ‘update’ phase after an interruption is imperative, we may add new solutions , new consequences, new causes, or new anomalies ...

IV. CONCLUSIONS AND PERSPECTIVES

Discontinuities are inevitable in complex systems such as our home-care system. If they are not identified and treated, they contribute to decreases in patient safety.

Ensuring business resilience has proven to be increasingly challenging as the home-care field employs more ICT applications and all signs for the future point to even more reliance on digital data.

In this position paper, we presented a framework for a Business Continuity Management approach to ensure the permanence of key processes in home-care system supported by an e-platform.

To provide a level of preparedness in order to respond, manage and recover from disruptive events so that a return to 'business as usual' status is achieved in the shortest possible timeframe; the Business Continuity Plan for home-care organizations that we propose helps detecting the outage and restoring operations as soon as possible.

Our ongoing work is to achieve a formal description of the BCP, following an approach grounded in Model-Driven Engineering (MDE). This formal description will be based on a combination of several models, e.g., Complex Event Processing rules, Business Rules, Temporal Logics, as well as organizational models, such as Role maps or Business Process models. These complementary approaches will provide the ability to react to event as they occur, and will offer an effective decision management solution.

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