Chapter 19

Towards a Middleware Based on SOA for Ubiquitous Care of Non-Communicable Diseases

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ABSTRACT

According to World Health Organization, the treatment of non-communicable diseases needs more than patient engagement to help control the diseases. Community and health organizations support is also desirable for controlling them. This work details the UDuctor middleware, which was designed for supporting ubiquitous non-communicable disease care, and so, helping the integration between patient and community resources. The UDuctor middleware gives a step forward in relation to other architectures for ubiquitous applications by integrating patients, community resources and community members through a peer-to-peer network. Each peer runs a RESTful based middleware, which enables messaging, resource sharing, context subscription and notification, and location between other UDuctor peers. The middleware implementation was employed in two solutions and tested in three experiments. The results are promising and show feasibility for the application of the middleware in real life situations.

INTRODUCTION

Approximately 25 years ago, Mark Weiser (Weiser, 1991) introduced the concept of Ubiquitous Computing (ubicomp) predicting a world where computing devices would be present in objects, environments and human beings themselves. These devices would interact naturally with the users without being noticed. Ten years after, Mahadev Satyanarayanan reinforced the concept through an article that became a classic (Satyanarayanan, 2001). More recent articles have discussed general aspects and trends of ubicomp (Caceres & Friday, 2011). In addition, the improvement and integration of technologies, such as context-aware computing, adaptive systems, profile management and recommender systems
have increasingly allowed the realization of the vision introduced by Weiser (1991) and Satyanarayanan (2001). In this sense, ubiquitous computing has found application in a diverse range of knowledge areas, such as, health, commerce, competence management, learning, logistics, accessibility and games. This chapter will discuss a research effort dedicated to create a middleware based on SOA for ubiquitous care of Non-communicable Diseases (NCDs), which is part of a large computational model called UDuctor.

This chapter is organized as follows. The Background section gives insights about the basis of UDuctor middleware. Next, we explain the UDuctor model and, particularly, its service oriented middleware. Section “Solution and Recommendations” details the applications which run the middleware, their evaluations and results. Section “Future Research Directions” shows possible topics that must be addressed by the UDuctor middleware in the near future. Finally, section “Conclusion” gives final remarks about this chapter.

BACKGROUND

The application of ubiquitous computing in health is called u-Health or pervasive health, which can be applied in hospital routine management, patients monitoring, or well-being. Non-communicable diseases care can also benefit from u-Health technologies, once their treatment is continuous, demanding patients to always be aware of their condition and to follow the treatment planned by the doctor. Furthermore, patients of NCDs should be engaged in the treatment, because some activities are performed daily by themselves and depend on their habits and lifestyle (Vianna & Barbosa, 2014).

The NCDs are part of the chronic conditions group which involves other kinds of health problems, such as, long-term mental disorders, HIV/AIDS and tuberculosis. Altogether, those conditions share some characteristics once they demand lifestyle changes, requires long term health management, and may be caused by unhealthy behaviours like “tobacco use, prolonged and unhealthy nutrition, physical inactivity, excessive alcohol use, unsafe sexual practices, and unmanaged psychosocial stress”. The rapid growth of chronic conditions cases resulted in the creation of models to support their management (Wagner et al., 2001; World Health Organization, 2002). “The Chronic Care Model” (CCM) (Wagner et al., 2001; Improving Chronic Illness Care, 2016) and “Innovative Care for Chronic Conditions” (World Health Organization, 2002) are examples of these models.

The CCM goal is to act as a “guide to quality improvement and disease management activities” (Wagner et al., 2001). It describes practices that help to improve the interactions between patients and health providers. Thus, for patients acquire the skills and confidence required to manage their conditions, they need to cooperate with the practice team, giving information and assessments as a way to help the optimization of their care. Innovative Care for Chronic Conditions (ICCC) is a World Health Organization initiative to create a model that can be usable in the care of many chronic conditions, like, HIV, tuberculosis, heart diseases, diabetes and long term mental disease. The ICCC splits its components in three levels (micro, meso and macro) on the assumption that to succeed the chronic care model must comprehend every level from the patient to government, which is responsible for health policies creation.

There is a strong integration between communities and health organizations in both models, in order to the patient obtain success in his chronic condition care. Patients, communities and health organizations must be updated about chronic care practices, so as they must be informed about policies and project that may help in care and control of chronic conditions.