

Chapter 5

Interoperability in Healthcare

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ABSTRACT

With the advancement of technology, patient information has been being computerized in order to facilitate the work of healthcare professionals and improve the quality of healthcare delivery. However, there are many heterogeneous information systems that need to communicate, sharing information and making it available when and where it is needed. To respond to this requirement the Agency for Integration, Diffusion, and Archiving of medical information (AIDA) was created, a multi-agent and service-based platform that ensures interoperability among healthcare information systems. In order to improve the performance of the platform, beyond the SWOT analysis performed, a system to prevent failures that may occur in the platform database and also in machines where the agents are executed was created. The system has been implemented in the Centro Hospitalar do Porto (one of the major Portuguese hospitals), and it is now possible to define critical workload periods of AIDA, improving high availability and load balancing. This is explored in this chapter.

INTRODUCTION

In healthcare, information systems have been growing, and consequently the volume, complexity and criticism of data become more and more difficult to manage. However, despite these systems contribute increasing the quality of healthcare

delivery, information sources are distributed, ubiquitous, heterogeneous, large and complex and the Health Information Systems (HIS) need to communicate in order to share information and to make it available at any place at any time. Data are stored in multiple independent structures. Therefore it emerges the need to create a global system

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that brings together all the islands of information shared between services. It is necessary to develop a solid and efficient process of integration and interoperation that must take into consideration scalability, flexibility, portability and security.

Several methodologies presently exist to implement interoperable information systems in healthcare; it results in several common communication architectures and mainstream standards such as Health Level 7 (HL7). However, several concerns regarding the distribution, fault tolerance, standards, communication and tightly bound systems still exist broadly throughout the healthcare area. The multi-agent paradigm has been an interesting technology in the area of *interoperability*; it addresses many of such limitations (Miranda et al., 2012; Miranda, Machado, Abelha, & Neves, 2013).

The homogeneity of clinical, medical and administrative systems is not possible due to financial and technical restrictions, as well as functional needs. The solution is to integrate, diffuse and archive this information under a dynamic framework, in order to share this knowledge with every information system that needs it. So *AIDA – Agency for Interoperation, diffusion and Archive of Medical Information* is presented. AIDA is an agency that supplies intelligent electronic workers called proactive agents, in charge of some tasks, such as communicating with the heterogeneous systems, sending and receiving information (e.g., medical or clinical reports, images, collections of data, prescriptions), managing and saving the information and answering to information requests (J Machado et al., 2010; Miranda, Duarte, Abelha, Machado, & Neves, 2010; Peixoto, Santos, Abelha, & Machado, 2012).

With the growing importance of HIS, databases became indispensable tools for day-to-day tasks in healthcare units. They store important and confidential information about patient's clinical status and about the other hospital services. Thus,

they must be permanently available, reliable and at high performance. In many healthcare units, fault tolerant systems are used. They ensure the availability, reliability and disaster recovery of data. However, these mechanisms do not allow the prediction or prevention of faults. In this context, the necessity of developing a *fault forecasting* system emerges. It is necessary to monitor database performance to verify the normal workload and adapt a forecasting model used in medicine into the database context. Based on percentiles a scale to represent the severity of situations was created (Silva et al., 2012).

The AIDA was implemented at Centro Hospitalar do Porto (CHP), in Portugal, and was subjected to Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis in order to ascertain what can be change to improve the system. This analysis can reveal what are the great strengths of the system as well as its major pitfalls. In addition, the opportunities than can be taken as advantages are highlighted and the key threats to the system are alerted (Pereira, Salazar, Abelha, & Machado, 2013).

The main goal of this chapter is to explain the importance of interoperability in the context of the quality healthcare delivery. In the background section a brief introduction about interoperability and its importance in the healthcare environment. The *intelligent agents* in interoperability section present a promising technology for interoperability implementation, namely the multi-agent technology. Combining the issues mentioned in the previous sections, a solution, the AIDA platform, is presented. In its section its architecture as well as its database is described. In order to improve AIDA performance, in the following sections fault forecasting systems are presented either from a database or from machines, which execute AIDA agents. The database, machines and agents' workload are also presented and discussed

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