Chapter 2.2
Web Service Design Concepts and Structures for Support of Highly Interconnected E-Health Infrastructures:
A Bottom-Up Approach

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ABSTRACT

In this chapter we present organizational aspects that appear when considering the case of interconnecting and integrating different compartments of a modern hospital. While the information and communication technologies provide advanced and powerful means for the creation of coherent information supply services, such as the Web service and ontology technologies, there is a lack of appropriate organizational metaphors that will enable the successful assimilation of these technologies, helping to aid in the improvement of critical cost parameters that concentrate a large part of the hospital's management resources, while also helping to improve the knowledge capital and the intangible and immaterial assets of any particular hospital, which are considered as the most essential and scarce resource. In this paper we presents a technology-based approach for solving interoperability problems at the service level, and we deliberately adopt a problem-solving approach that has successfully been adopted by the European IST Project ARTEMIS.

INTRODUCTION

What we more intensively experience is that the Web is moving from being a collection of pages toward a collection of services that interoperates through the Internet (Paolucci, Kawamura, Payne, & Sycara, 2002). According to the same source:

Web services provide a new model of the web in which sites exchange dynamic information on demand. This change is especially important for

the e-business community, because it provides an opportunity to conduct business faster and more efficiently. Indeed, the opportunity to manage supply chains dynamically to achieve the greatest advantage on the market is expected to create great value added and increase productivity. On the other hand, automatic management of supply chain opens new challenges: first, web services should be able to locate automatically other services that provide a solution to their problems, second, services should be able to interoperate to compose automatically complex services. In this paper we concentrate on the first problem: the location of web services on the basis of the capabilities that they provide.

In this chapter our concern is the application of some Web service design concepts and structures in order to support highly interconnected e-health infrastructures; though health for sure constitutes a special application domain with several idiosyncrasies and singular characteristics, there is a great extent of paradigms and analogies that can be drawn from the area of e-business and supply chain management.

We believe that our contribution by means of the work conducted under the European IST project ARTEMIS (ARTEMIS, 2004), which was lead by professor Asuman Dogac of the Middle East Technical University, constitutes a success story that can be followed to form the basis of several VE ventures in the area of e-health as well as in other business domains.

Currently, the majority of the interoperability problems of medical information systems are twofold (Bicer, Banu Laleci, Dogac, & Kabak 2005a; Bicer, Kilic, Dogac, & Banu Laleci, 2005b):

1. First there are multiple, incompatible, proprietary approaches to connecting disparate applications to clinical networks and information systems. As a result, for example it is not possible to integrate electronically the clinical patient records with critical emergency control information.
2. Secondly, when there are standards to achieve interoperability, there are more than one standard to represent the same information, which in turn creates an interoperability problem. For example, GEHR, CEN 13606 and openEHR are all standards for patient electronic health records.

The proposed model provides the most important entity of the healthcare industry, namely the hospital, with an ideal platform to achieve difficult organizational and technology integration problems. The proposed services as developed in our project ARTEMIS allow for seamless integration of disparate applications representing different and, at times, competing standards, thus allowing for a service to be invoked *on demand* pervasively by business processes, applications or people to fulfil a particular function. The latter forms the most important innovation of the presented work and a tangible contribution towards smarter hospitals that are capable to build dynamic information exchange and sharing infrastructures that might have the form of virtual enterprises. Though from a legal point of view there are many problems and difficulties, it is however important that such a goal will guide the investments in the health industry in Europe.

As will be further described, the innovation of our approach comes to the fact that our approach for design and management of services is implemented in a distributed service infrastructure according to a *preplanned usage of a multiple service actors' scheme*. The term distributed service infrastructure is used for description of an environment with the following characteristics:

1. It consists of a number of service flows that are executed using resources of several sites simultaneously.
2. That service flows communicate with each other by exchanging messages over a commonly agreed network of participants (in our case it is the network of the hospitals