Development of an Electronic Health Record Application using a Multiple View Service Oriented Architecture

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INTRODUCTION

- Service-Oriented Architecture (SOA) has emerged as an architectural approach for developing distributed applications based on the concept of assembling services .
- A service is a capability of the business organization that is implemented and made available over the Internet so that other applications can access it.
- According to recent literature, SOA has been applied to develop applications in various domains (Soares and Franc¸a, 2016), including automotive industry (Kabir et al., 2014), serious games (Carvalhoet al., 2015), and learning platforms (Gonz´ alez et al.,2014).

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- SOA has also been considered for developing health applications (Monsieur et al., 2012) (Cho et al.,2010) (Traore et al., 2016) (Franc ¸a et al., 2016).
- One health application that is considered very complex not only to develop but also to operate and maintain is the Electronic Health Record (EHR), which refers to software systems that stores health information about patients in a digital format.
- EHRs are used by different health professional teams, including physicians, nurses, radiologists, pharmacists, laboratory technicians and radiographers.
- SOAhas been chosen as the architecture basis for developing the EHR in this project due to the necessity of integrating legacy systems in a public hospital.

BACKGROUND AND RELATED WORK

- According to ISO/TR 20514:2005 (ISO 20514:2005,2005), EHR means a repository of patient data in digital form, stored and exchanged securely, and accessible by multiple authorized users.
- EHR, as a complex software system, contains any health, clinical or medical record in electronic or digital format in the context of patient care.
- Our proposal in this paper is to present an EHR application developed under SOA paradigm using multiple views to describe the software architecture, as preconized by ISO/IEC/IEEE 42010.
- Models presented in these views are described by means of UML and SoaML (OMG, 2012) diagrams

A MOTIVATING CASE :

- The EHR system has been developed due to a demand from a public hospital.
- Three main constraints are considered in this EHR project.
- First, due to low budget for Information and Communication Technology in a public hospital, it is hard to apply resources for modernization of software applications.
- Second, lack of integration between current legacy systems makes duplication of data a common side effect. Most Hospital's legacy systems are not integrated and thus they do not meet many routine needs of hospital staff.
- There are many software systems for different purposes, including software to automate exams, to provide primary care, and also to register patient data.

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- Thus, data needs to be duplicated in two or more different systems.
- Finally, important business rules have not yet been implemented in existing software systems, as discovered after mapping all current business processes in the hospital.
- For instance, patients' data are registered in and maintained as hard copies.
- Daily, hundreds of patients are treated at the hospital and all data and evolution are noted in physical medical records.
- Therefore, this scenario causes a big impact regarding storage space of this large amount of physical records.
- Due to this the proposed solution is to use Service Oriented Architecture principles and techniques to gather all important information from legacy systems on services to be consumed by the EHR application.

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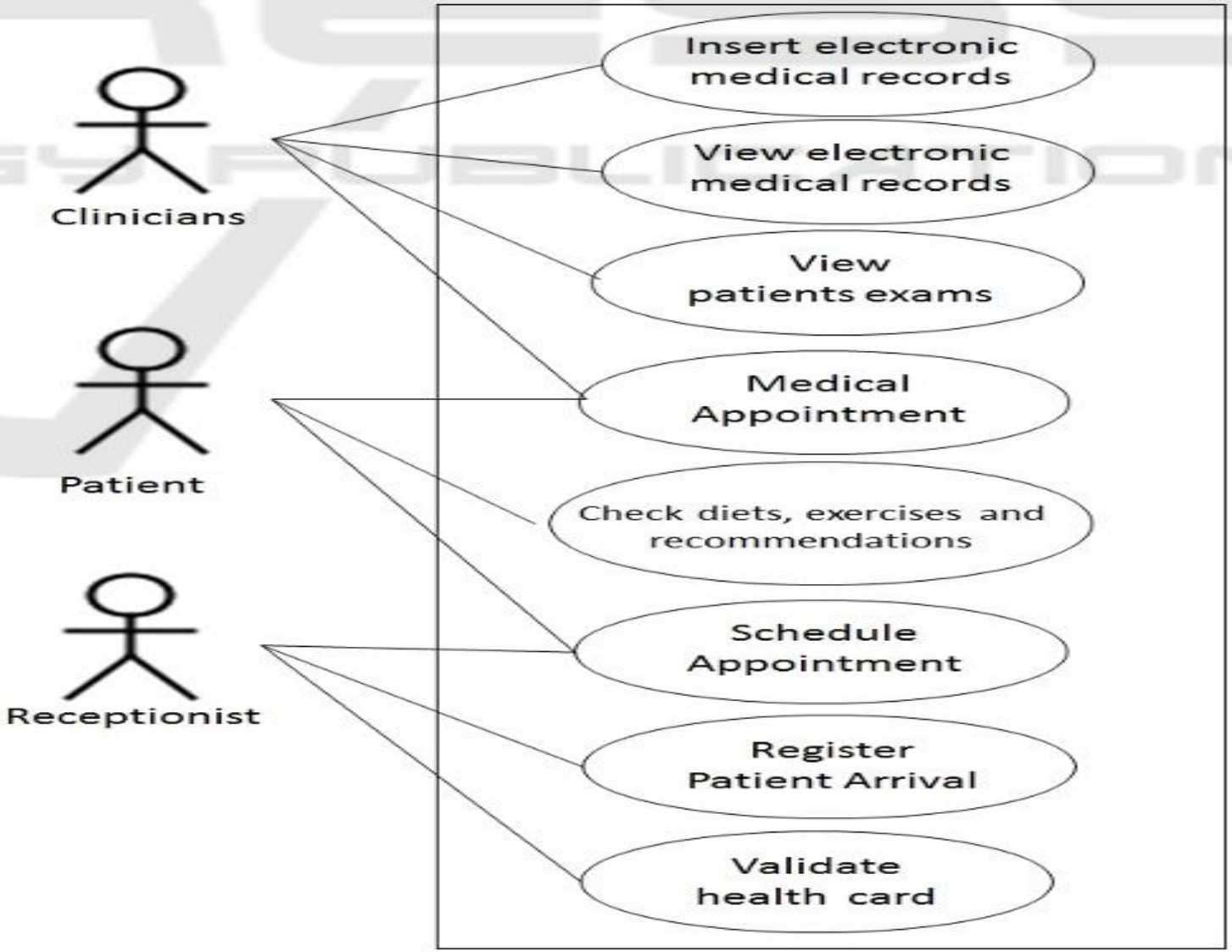
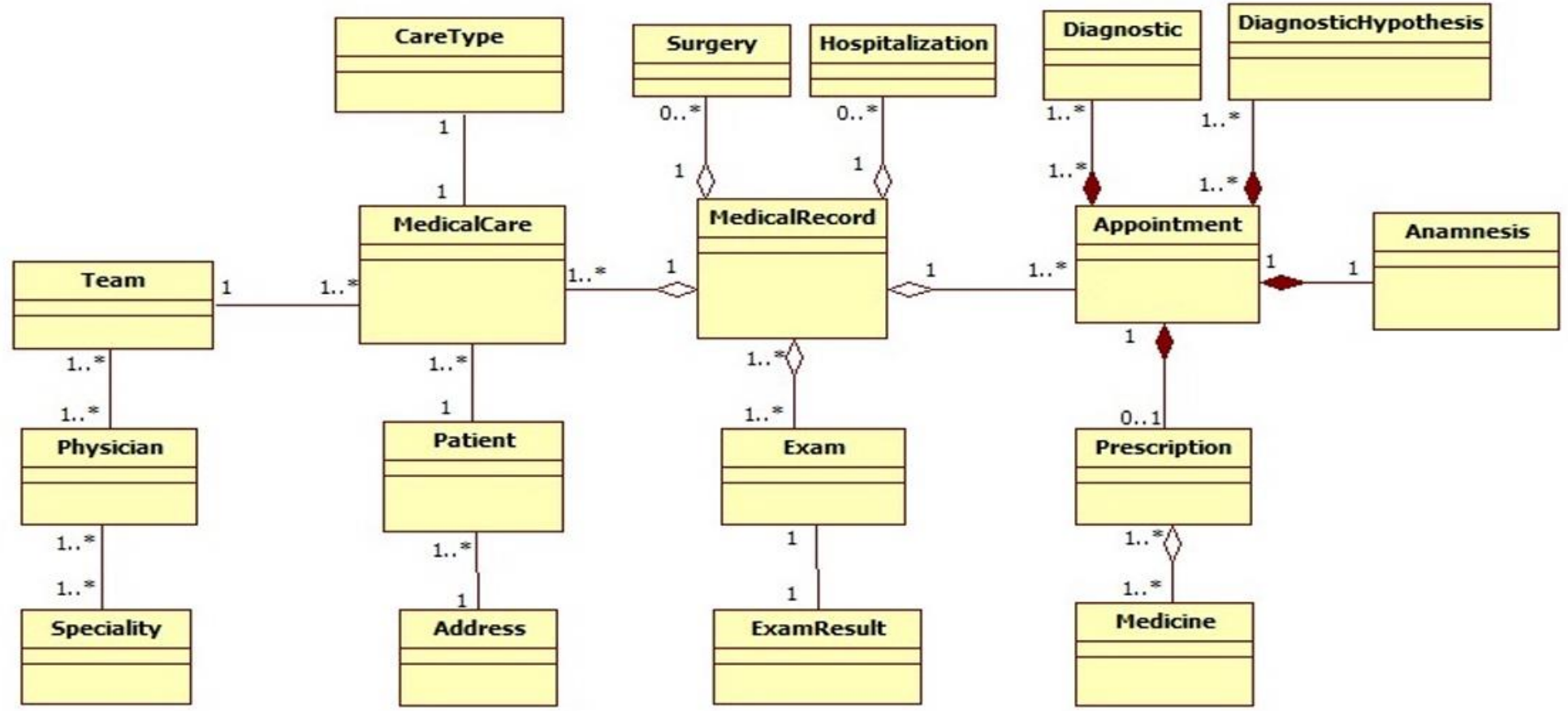
- The EHR application aims to store and provide medical records about patients in a public hospital.
- These patient data can be accessible by doctors, nurses, health professionals in general and also patients.
- Access to patient’s data can be realized by devices such as desktops, laptops, tablets and mobiles.

ARCHITECTURAL VIEWS :

- According to ISO/IEC/IEEE 42010 (ISO 42010:2011, 2011), an Architecture View refers to a work product expressing the architecture of a software system from the perspective of specific system concerns.
- This set of views is useful to describe the entire system for different stakeholders, including doctors, nurses, hospital managers and software developers, from different perspectives.


Clinicians
Patient
Receptionist
Insert electronic medical records
View electronic medical records
View patients exams
Medical Appointment
Check diets, exercises and recommendations
Schedule Appointment
Register Patient Arrival
Validate health card


CareType
Surgery
Hospitalization
Diagnostic
DiagnosticHypothesis
MedicalCare
MedicalRecord
Appointment
Anamnesis
Team
Physician
Patient
Exam
Prescription
Speciality
Address
ExamResult
Medicine

CONCLUSIONS

- This paper presents an architectural description using multiple views for an HER system based on SOA.
- The EHR application developed is a demand of a public hospital that has several legacy systems for different purposes.
- This paper describes part of the EHR architecture, which is applied to gather requirements by hospital stakeholders such as doctors, nurses, receptionist and health professionals in general.
- The proposed architecture has been proven to be extremely important to validate EHR scope by stakeholders because they could understand what would be developed.

- In addition, the proposed EHR architecture has been crucial for software developers. They clearly could understand through multiple scenarios, business processes, layers, and architectural decisions what should be implemented.
- As a conclusion of this after development of the EHR application using SOA,it is clear that investing time and effort documenting the software architecture is beneficial to the system development process.
- Multiple architectural views enable most stakeholders to understand the project scope, even if they are not expert in software development.