Operating Room Planning

Agent based system analysis and design

By Eric Neher and Pascal Büttiker



Version 1.0

March 2013

**Summary**

Für Interessierte, die sich innerhalb kurzer Zeit einen Überblick über den Inhalt eines Berichts verschaffen wollen, ist das Summary (eine halbe bis anderthalb A4-Seiten das geeignete Mittel. Die Zusammenfassung soll die folgenden fünf Aspekte beleuchten: Problemstellung, Problemlösungen, allenfalls mit Varianten, Hauptergebnisse, Schlussfolgerungen und Vorschläge für das weitere Vorgehen. Die Zusammenfassung entscheidet – zusammen mit dem Inhaltsverzeichnis – ob die Leserin, der Leser den Text eingehend studiert oder gleich beiseitelegt.

**Table of Content**

[1 Introduction 4](#_Toc350183870)

[2 Purpose of Agent System 4](#_Toc350183871)

[3 Agent Architecture 5](#_Toc350183872)

[4 GAIA Methodology 6](#_Toc350183873)

[4.1 Introduction 6](#_Toc350183874)

[4.2 Vision 6](#_Toc350183875)

[4.3 Requirements 6](#_Toc350183876)

[4.4 Subdivision of System into Sub-Organizations 6](#_Toc350183877)

[5 Agent Interaction 8](#_Toc350183878)

[6 Agent Communication 8](#_Toc350183879)

[7 Register of Illustrations 9](#_Toc350183880)

[8 Bibliography 9](#_Toc350183881)

[9 Appendix 1 – Operating Room Planning 10](#_Toc350183882)

[9.1 Introduction 10](#_Toc350183883)

[9.2 Operating Room Planning 10](#_Toc350183884)

# Introduction

The aim of this report is to present an analysis and design of an agent based system which is capable of handling the “Operating room planning” problem.

# Purpose of Agent System

The Operating Room Planning (ORP) problem describes a dynamic environment in which clients in general share a common goal: getting well as soon as possible. Survival is one of the strongest instincts of a human which means that a client, who finds himself trapped in an environment such as the ORP describes, his desires are pretty straightforward and normally don’t change. In contrast, his believes and intentions may change. Unfortunately, once a client falls into the “emergency” category within the ORP environment, his believes and intentions become irrelevant.

The problem of the ORP which has to be solved is therefore not managing the individual wishes or handle the clients differently because of their distinction in believe. It is about live and death and how latest can be minimalized, which becomes more and more difficult due to increasing demand. Health care is a huge building which requires several administrative instances and since there are numerous clients and just limited resources a clever client management system is inevitable.

Each client has its own health status and his own path of welfare it has to go through. In order to achieve the ORP goal, maximize the success rate of surgeries and minimalize the cost, a very simple but effective method has to be applied: Prioritization.

A surgery has to be considered failed, if clients

The facts that the client status may change at any time and the health of a human, as well as the applied medical measurements are everything else than predictable, makes the environment dynamic.

Therefore, the systems prioritization of its clients, the planned procedure as a result of analysis and grading may change anytime. The requirements Additionally to need of

# Agent Architecture

# GAIA Methodology

## Introduction

Regarding the GAIA Methodology we consider the following steps as most relevant:

* Subdivision of System
* Environmental Model
* Organizational Rules
* Agent Model
* Service Model

In the following paragraphs we will discuss the Operation Room Planning problem within the above defined topics of the GAIA Methodology. In addition, we will first describe the requirements of the system. Although the requirement elaboration and elicitation process is not included in GAIA it is essential to have solid knowledge about them.

## Vision

The vision of approaching the Operating Room Planning problem with an agent based system is to optimize surgery scheduling in order to improve surgery efficiency, minimize peak demands and save costs.

## Requirements

* The system needs to be able to do long term planning
* The system needs to be able to do short term planning
* The system has to adjust the planning in case of sudden changes of patients state

## Subdivision of System into Sub-Organizations

* Patient
  + Non-emergency case
  + Emergency case
* Departments
  + Surgery Waiting List System
* Operation Room Planner
* Surgeon Manager
  + Surgeon Teams
* Operating Room Manager
* Postoperative Manager

## Environmental Model

The environmental model of the ORP consists of an information system in which patients get prioritized based on their health stats.

## Preliminary roles:

* Short term planer
* Long term planer
* Operating Room manager – provides information about

## Organizational Rules

# Agent Interaction

# Agent Communication

# Register of Illustrations

[Abbildung 1: Logo FHNW (Quelle) **Fehler Textmarke nicht definiert.**](#_Toc305602880)

# Bibliography

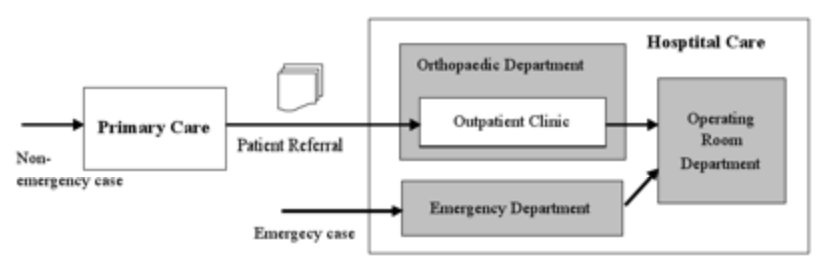
# Appendix 1 – Operating Room Planning

## Introduction

Most countries today, try to adjust to increasing demand and cost for healthcare services. One of the most expensive areas in healthcare is surgery, which necessitates many expensive resources in terms of staff, equipment, and medical resources. Generally, these resources have to be managed and divided between several departments within the hospital, e.g., orthopaedics, gynaecology and general surgery, in order to meet the total surgery demand.

## Operating Room Planning

The operating room planning includes both short term planning and long term planning, i.e., emergency cases and non-emergency cases. Non-emergency cases are described as elective cases and are commonly referred from primary care to a specified department within the hospital care. Before surgery is decided, the patient generally meets the surgeon at the outpatient clinic, i.e., the hospital care. Emergency cases commonly enter the Operating room department passing through the Emergency department as illustrated in Figure 2. However, there are exceptions to this rule; for instance, an elective patient admitted to an inpatient ward can suddenly become an emergency surgery case due to unexpected complications.



In general, the elective surgery process starts at primary care. The patient is then referred to specialist care for an outpatient appointment. If surgery is decided, the patient is then put on hold for surgery. In reality, the *surgery waiting list* system consists of two waiting lists; one, waiting to meet the surgeon specialist at the outpatient appointment, and one, waiting to be scheduled for surgery after the appointment. Moreover, there is one surgery waiting list system representing each of the operating departments and which are separately managed, i.e., one waiting list system at the Department of Orthopaedics (as depicted in Figure 2), another one at the Department of General Surgery and at the Department of Gynaecology, and so on. Consequently, the allocation of operating room resources affects every surgery waiting list system. In addition, the Operating room department also has to consider a variety of postoperative resources when planning. After surgery, the patients are monitored in a postoperative ward for circulation and respiration, but also for assistance with analgesic before being transferred to the ward or directly discharged. In addition, some patients will need postoperative intensive care and consequently have to be transferred to the Intensive care unit, (ICU) after surgery.