Modeling surgical pavilions and a unit of anesthesia on a Chilean hospital using Specification and Description Language (SDL)

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Abstract

This work addresses the problem of formal modeling of the processes related to the surgical pavilions and an anesthesia unit on a Chilean hospital. To perform this modeling we used Specification and Description Language (SDL).

The model was successful in:

- document and understand the tacit knowledge of the unit and
- facilitate the simulation.

1. Introduction

The high cost of operation, complexity, scarce resources and high demand of the anesthesia units and surgical pavilions (UAPQ), permanently pose challenges to improve them. Their optimization requires the specification and documentation of each of the processes. The best way is modeling. Models are increasingly used to solve real life problems. They can describe the functioning of processes, facilitating the understanding of the system. Respect to the stages of modeling, a simplified version of the model development process is presented in Figure 1. The problem is the system (actual or proposed), the conceptual model is the logic-mathematical representation of the system and computerized model is the conceptual model implemented using a computer application (Sargent 2007).

In this paper we focus in the definition of the model (formal definition) that helps to solve some of the aforementioned problems reinforcing the idea that a model by itself is a product (Brade 2000).

This formal definition allows quasi automatic translation into several computerized simulation systems.

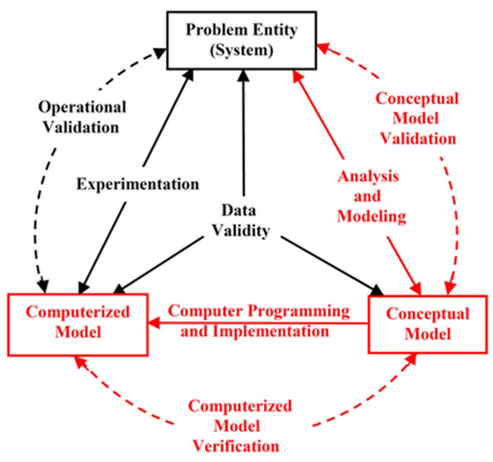


Figure 1. Simplified version of the Modeling Process (Sargent 2007)

A simulation of a part of the model is presented to evaluate the process of the model validation. The study was developed in the Hospital Dr. Gustavo Fricke (Chile).

4. Data validation

The next step is to feed the model with validated data. In order to do this we collected information of the last 5 years from the UAPQ database. We performed a validation process of the existing records. They were tested also for goodness of fit. These will be used for future simulations.

5. Discussion

The study allowed the creation of an unambiguous documentation and a full understanding of the UAPQ processes by clinical and administrative staff.

The information channels, the signals, the directionality and hierarchy between different processes have been defined. This complete definition of the system features and the modular structure of the language allows a clear identification of relations between different system elements. The modular model definition allows continuing different research lines, such as continue simulating the UAPQ processes or studying the optimization of some of their processes.

2. Methods

With the participation and supervision of UAPQ hospital staff, the components of the system were studied.

Modeling was performed using the Specification and Description Language (SDL), using Microsoft Visio® to represent the diagrams. Simulation was conducted over the SDLPS simulation engine.

3. Modeling the UAPQ

The designed model has the following agents: the system, 10 blocks and 50 processes.

The environment of the UAPQ has 3 components: (i) The clinical services, (ii) the emergency units and (iii) the support units. Communication between these entities is done through 102 channels using 126 different signal types. The modeling is presented in Figure 2.

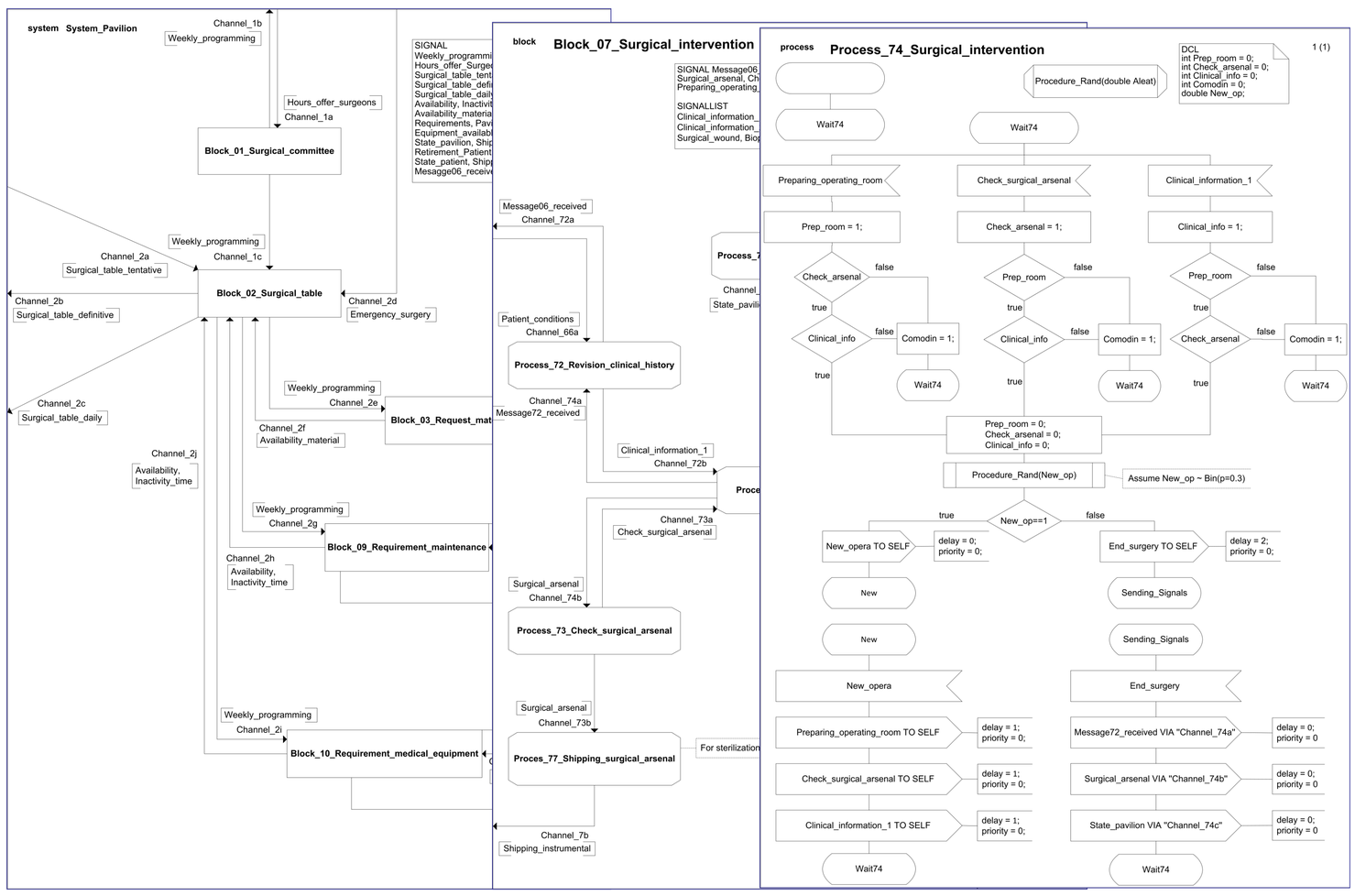
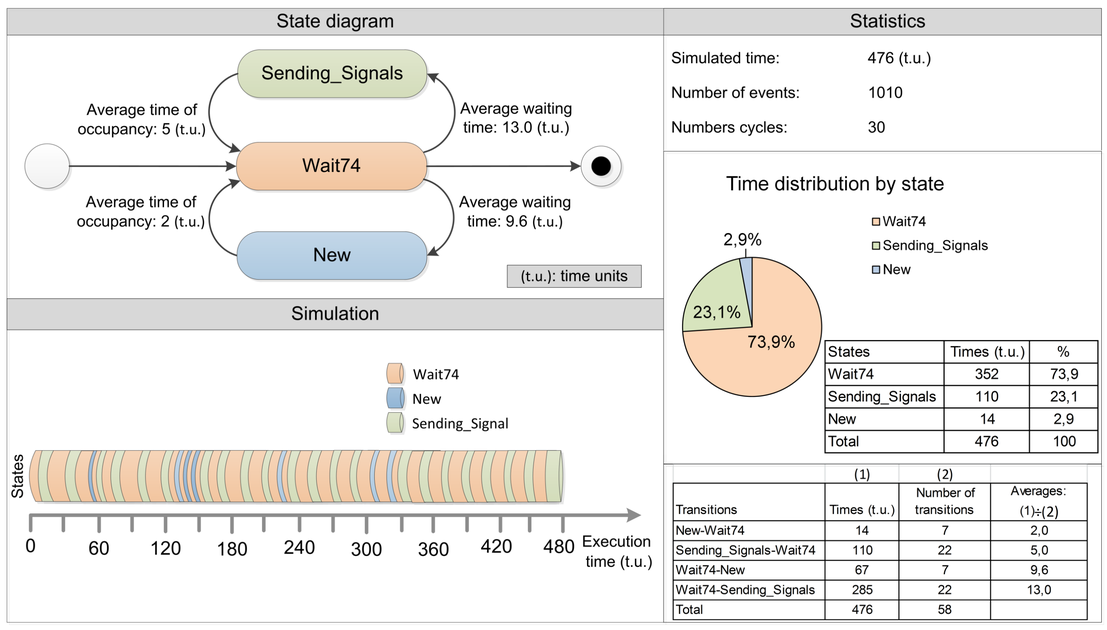


Figure 2: Modeling the UAPQ

Since SDL allows a modular specification of the system, we decided to start specifying and simulating the processes related to the surgical interventions. The results of the simulation of the Process 74 “Surgical intervention” is show in Figure 3.



States	Times (t.u.)	%
Wait74	352	73,9
Sending_Signals	110	23,1
New	14	2,9
Total	476	100

Transitions	(1) Times (t.u.)	(2) Number of transitions	Averages: (1)÷(2)
New-Wait74	14	7	2,0
Sending_Signals-Wait74	110	22	5,0
Wait74-New	67	7	9,6
Wait74-Sending_Signals	285	22	13,0
Total	476	58	

Figure 3: Results of the Simulation Process 74 - Surgical intervention

6. Bibliography

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