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Review Article

The Need for System Analysis of a Pathology Process

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Abstract

For the analysis of processes, for improving them, for quality management and quality assurance, for integrating hardware and software components as well for education, training and communication between different domains' experts, analysis and modeling business process in a pathology department is certain. The authors underline the need for system analysis of a pathology process. Then, some methods for analysis and modeling are presented for the medical framework.

Keywords: Pathology process; Analysis and modeling; Medical framework

Introduction

There are many reasons for analysis and modeling a pathology process [1]. In fact, a business process analysis and modeling can improve the workflow in a department of pathology; the integration of new software and hardware components; the quality management; the communication with non-domain experts representing hospital units such as system administration and business administration; the educational and the training [2-4].

The general models are reusable and can be adapted to different levels of specialization up to a specific use case and a specific situation in a pathology department [5-7]. Then, the different steps of the pathology process are presented.

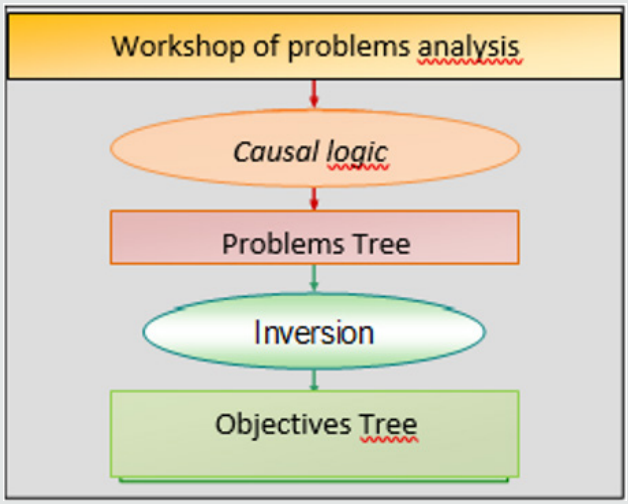
In this paper, a presentation of some methods of system analysis and modeling and a case of a pathology process are presented followed by an analysis of strengths and weaknesses. The application of the Objective Oriented Project Planning (OOPP) method is presented including necessary detailed representation of the pathology process.

Methods for Analysis and Modeling

In this part, the need for system analysis for the medical framework is presented. Then, we present in particular a method and a language for system analysis and modelling.

Presentation of the OOPP method

The OOPP method is presented as a communication device, an analysis and a project planning, anything its nature and its position [8]. It is made up of three essential phases (See Figure 1): 1st problem analysis phase; 2nd objective analysis phase and 3rd activity planning phase.



Figures 1: Methodology OOPP.

The problem analysis phase is extremely frequent that the conception and implementation of a project meets many difficult situations presented by a sponsor [9].

The approach used is federative because endorses the theory of organizing workshops bringing jointly diversity of capability domain. This is why the analysis of this state must be conducted

according to a structured methodology based on causal logic identifying its effects and causes.

The aims of the analysis phase are presented by the problems tree constituting a negative report, it allows an easy inversion (transform a negative state to a positive one) to make an Objectives Tree which represent the foundation of any action plan.

The causal logic of problem analysis is made to present "means-end" logic for developing the objectives tree.

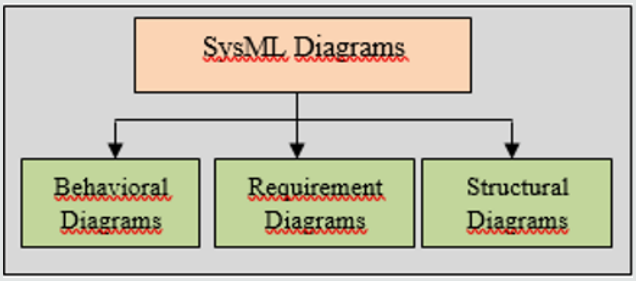
To study objective, result, activity or under activity, is arisen always we are confronted with the question: What is to be done to accomplish the analysed objective or accomplish the result that should achieve the identified activity?

The respond of this question is made by the decomposition of the analysis phase in the inferior levels. The OOPP method enables us, in addition to the determination of the diverse phases in the analysis of a project [10,11]: track its evolution, evaluate the project at its various phases; identify dysfunctions and deviations among performances and planning; study the causes, recognize the responsibility.

As a final point, the activity planning phase is represented by an activity matrix also known as activity planning scheme [12,13]. This matrix is composed of the activity sequence number, the activity code, the activity designation, the person in charge of the activity, the staff responsible for the activity, the objectively verifiable indicator (OVIs), the Source of verification (SOVs), the essential resources according to their category: infrastructure, human resources, equipment and consumables, logistics (energy, transport...) [14,15].

SysML language

SysML (System Modeling Language) is general purpose visual modeling language for systems engineering applications. SysML is defined as a dialect of UML standard, and supports the specification, analysis, design, verification and validation of a broad range of systems and systems-of-systems. These systems may include hardware, software, information, processes, personnel, and facilities. Figure 2 presents the SysML diagram architecture [16].



Figures 2: SysML 1.0 diagram architecture.

SysML offers systems engineer numerous noteworthy improvements over UML, which tends to be software-centric. These improvements consist of the following [17]:

I. SysML's semantics are more flexible and expressive. SysML reduces UML's software-centric restrictions and adds two new diagram types, requirement and parametric diagrams. The former can be used for requirements engineering; the latter can be used for performance analysis and quantitative analysis. Following these enhancements, SysML is able to model a wide range of systems, which may contain hardware, software, information, processes, personnel, and facilities.

II. SysML is a comparatively little language that is easier to learn and apply. Since SysML removes many of UML's software-centric constructs, the overall language measures smaller both in diagram types and total constructs.

III. SysML allocation tables support common kinds of allocations. Whereas UML provides only limited support for tabular notations, SysML furnishes flexible allocation tables that support requirements allocation, functional allocation, and structural allocation. This ability facilitates automated verification and validation and gap analysis.

SysML reuses seven of UML's fourteen diagrams, and adds two diagrams (requirement and parametric diagrams) for a total of nine diagram types. SysML also supports allocation tables, a tabular format that can be dynamically derived from SysML allocation relationships [18-20].

Case Study of a Pathology Process

The model of the pathology process that we propose means to represent the different activities of the pathology process of and to consider it like an information system. The number, the complexity and the interference of information exchange taken in the study of a model need a systemic approach defining the limits of the process (through establishing a communication between the outside environment) and identifying the principal activities and the parameters conditioning these activities.

The global objective of the model: General pathology process presented lead to an analysis of the different steps proceeded in the pathology process. A Tree of Objectives (Table 1) modelling the pathology process is presented after validation by the experts.

Table 1: Main process in pathology.

Code	Activity
OG1	General pathology process presented
OS1	Reception and recording assured
R1.1	Request sheet compliance check assured
R1.2	Creation of a case number assured
R1.3	Writing the case number on the request sheet assured
R1.4	Writing the case number on the sample assured
OS2	Gross exam assured
R2.1	Sample conformity check - request sheet assured
R2.2	Inspection assured
R2.3	Mesures realised
R2.4	Description of lesions assured

R2.5	Dissection and samples assured
R2.6	Placement of specimens in 'cassettes' labeled with identifying number
OS3	Automated tissu processioning
R3.1	Dehydration assured
R3.2	Clearing assured
R3.3	Infiltration with embedding agent assured
OS5	Sectionning assured
R5.2	Cutting sections assured
R5.2	Water bathing assured
OS6	Staining assured
R6.1	Staining slides assured
R6.2	Drying the slides assured
R6.3	Cover slipping assured
R6.3	Drying the slides assured
OS7	Microscopic examination assured
R7.1	Examination assured
R7.2	Writing the report assured
OS8	Siging out assured
R8.1	Writing the report in a computer assured
R8.2	Printing and signature of the report assured

Business process analysis and modeling in pathology is a quite serious communication process: the domain experts - pathologists, medical technical assistants, and secretaries have to clarify their work, related processes and outcome.

The model of the pathology process developed is complex. The OOPP method applied to this process has enabled, by its steps of analysis and planning, to understand better and better the description of this model and to facilitate after that the different expressions of relations constituting this model.

The OOPP analysis method allows answering pertinent questions conditioning all establishing project: what (result to achieve or activity to realise)? who (responsible and his collaborators)? how (resources)? when (time)? and where (place)?

The OOPP analysis method has many advantages that are cited: simplicity, adequacy to identify users' needs (Problems tree, Objectives tree, Activities planning), it can produce solutions at several levels of abstraction (OG, OS, Results, Activities…), the decomposition of activities in a modular, hierarchical and structured way facilitates the understanding of the problems studied and/or the results obtained, while improving communication.

However, this method has limitations: it only allows to deal with the static aspects of a system, evolution over time and execution of different activities is not modeled, OOPP does not distinguish the different types of flows in and out of an activity which can cause confusion when interpreting the model obtained, OOPP lacks semantics, analysis effort is focused on functions (neglecting consistency of the data), the difficulty in taking into account non-hierarchical interactions in complex systems...

Conclusion

The complexity of the pathology process and the important number of the information intervening in its constitution enables to elaborate a systemic method allowing the facilitating of system. We consider that informational resources are determining on the strategic level and on the communication one. The determination of these resources constitutes the base of all the information system. In fact, we reserve a particular importance to informational purpose and we consider all the parameters and all the functions like information that we must seize, treat and valorise. This information is evidently divided by the different activities taking into account their level. This kind of analysis enables to specify the information system in order to elaborate a management and conduct tools of projects; then the development of the data processing supports will be facilitated.

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