

Improving Engineering

Luigi Benedicenti

Faculty of Engineering
University of Regina
Regina SK S4S 0A2

+1-306-585-4701

Luigi.Benedicenti@uregina.ca

Giancarlo Succi

Department of Electrical &
Computer Engineering
The University of Calgary
2500 University Dr. N.W.
Calgary, AB Canada T2N 1N4

+1 403 220 8357

Giancarlo.Succi@enel.ucalgary.ca

Tullio Vernazza

DIST – Università di Genova
Via Opera Pia 13
16145 Genova Italy

+39-10-3532793

Tullio.Vernazza@dist.unige.it

ABSTRACT

We present an experience report on the adoption of a modeling toolkit, Pescarenico, in an Italian firm: Engineering ingegneria Informatica, the largest software developer component of the Engineering group. The modeling toolkit comprises a process modeling methodology, a metric set, and a graphic computer tool.

The process modeling methodology is the foundation of the modeling scheme. The metric set shows the weak points in the process, and thus the required detail level of the model. The graphic computer tool is a visual interface that transforms the model in a concrete set of diagrams ready for dissemination inside a firm.

The novelty of Pescarenico is in the integration of the tools and the broader aspects involved (communication, technology transfer, and process control) without the semantical “Kitchen Sink” effect of a single unified process language. Moreover, the different abstraction levels are easily tailorable depending on the target audience.

These advantages have resulted in a better understanding of Pescarenico and its faster acceptance in the firm.

Keywords

Software process modeling, object oriented modeling, Activity Based Costing, Balanced Scorecard.

1 INTRODUCTION

This paper is an experience report of the application of a process modeling toolkit, Pescarenico, in an Italian company.

Pescarenico is a process modeling toolkit that comprises a process modeling methodology, a metric set, and a graphic environment tool. It has been developed in the University, and as such it required modifications and tailoring to suit it to the industrial environment.

This paper introduces the three components of the toolkit, then presents the results of its application based on a subprocess of the firm, and draws some conclusions.

2 THE TOOLKIT

Pescarenico is an object-oriented process modeling toolkit that results from the synergy of three separate props: a methodology, a graphic tool, and a metrics system.

The methodology, Gertrude [5], is the foundation of the modeling process. It defines the primitives of the process, the relations among them, and the modeling procedures. By separating the abstract modeling from the actual modeling process we obtain clarity. It is based on OMT [6, 3].

Gertrude handles four types of objects, namely, activities, people, roles, and infrastructures.

The approach we follow in modeling is bottom-up. Starting from the information collected via interviews, we build use cases, and then we build object diagrams. Eventually, we refine the model until it converges to a stable version that realistically depicts the firm.

Gertrude uses two model languages: the internal language, and the external language. The internal language is used by people who develop the model. The external language is used by the users of the model: project managers, resource owners, top managers, employees. These people should not study the whole methodology to understand the model. The distinction between internal and external languages is required to enforce information hiding.

Gertrude uses Activity Based Costing (ABC) to collect on line data from the process. ABC is an accounting technique. Innes and Mitchell [2] provide a good introduction to ABC. Basically, it breaks down costs into activities, as opposed to functional departments. This is particularly fitting for the software production process, since activity decomposition is naturally supported.

Gertrude requires the employees to record every activity on ABC forms. This is useful for managers to get information about the cost and time the activities require. Moreover, ABC forms have a direct relevance to modeling: they provide a feedback from the employees when the employees perform the activities. The collection of ABC forms uncovers features of the activities that may be not initially evident.

The metric system is driven by Kaplan's Balanced Scorecard [4]. The Balanced Scorecard is a unifying method for choosing the metrics to be collected in order to show a uniform and complete picture of a business organization. This picture, often called vision, shows the weak and the strong points of a firm, and makes it possible to concentrate on real objectives, thus focusing the modeling process. The Balanced Scorecard is a method of its own, but its coupling with a process modeling environment complements it perfectly.

The graphic tool, Egidio, is a graphic computer-aided design tool that allows translating the postulated model in actual diagrams. The diagrams are easily modifiable in case of process changes. Moreover, the tool automatically produces reports on the diagram (such as the thrashing matrix) and the forms for cost collection. It is currently implemented in Visual Basic and runs on the Windows platforms.

The synergic union of different entities under a single system scores many advantages:

- The interfaces between the entities are well defined and known
- The approach to modeling is a global approach driven by the company's strategy and objectives
- Technology transfer is made simple with graphic diagrams that show the process internals
- Each instrument focuses on a single task, thus avoiding the confusion arising from semantic richness overload ("kitchen sink" effect)
- Gertrude, the Balanced Scorecard, and Egidio work on the same basic entities. Gertrude defines them, Egidio represents them, and the Balanced Scorecard measures them

3 A SAMPLE APPLICATION OF PESCARENICO

Pescarenico is currently the modeling methodology employed in a pilot project undertaken by an Italian software firm. The firm prefers to remain anonymous. Preliminary, meetings with the top management of the firm established the framework for the project. In particular, the meetings defined the individuals that would participate to the project, their responsibilities, and the activities to perform. The authors take part into the modeling group, which is responsible for the modeling activities and the

resulting deliverables. The modeling group includes a set of firm's managers trained in Gertrude who provide a bridge between the firm's process and the methodology. The managers also play the role of promoters of the project within the firm.

The case study we consider here regards the uploading of

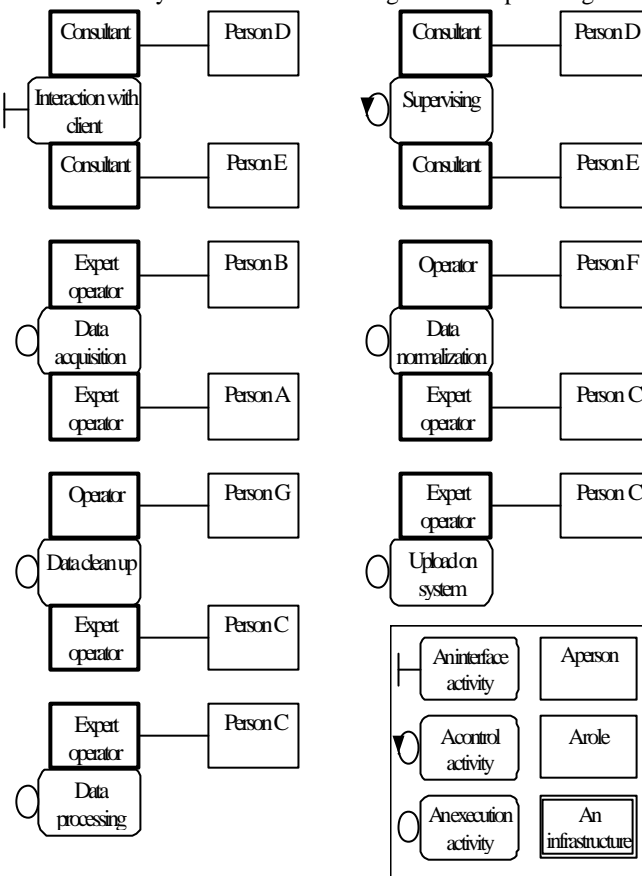


Figure 1: Activities Roles People Diagram

data in an information system. This process is a service offered by the firm as a part of the installation of the information systems the firm develops for municipalities. The top management has assessed that this process is actually highly reused and is likely to be standardized as a result of the modeling. The presented process was the first one the modeling group had to cope with. The analysis of this case presents many aspects worth noting, especially problems, that were not faced in modeling subsequent processes, when larger experience had been gained.

Interviews are the main tool to collect information in the early stages of the methodology. Gertrude requires interviews to the key people of the process. Usually key people are those who perform interface activities (which interact with external clients and thus have a very client-oriented view of the process) and those who perform

control activities (which control the execution of other activities and thus have an all-comprising view of the process). In our case we did not know *a priori* who the key people were so we divided all the participants in groups and made group interviews. Eventually, when most diagrams were stable, we switched to individual interviews and communications.

The use case of the considered process can be shortly stated as follows. The firm must set up a new information system it has delivered to its client by loading and processing an initial set of data. The data are taken from a legacy system the client had before the installation of the new information system. The legacy system can be in any format and it is usually a set of loosely interconnected data bases. The process mainly consists of a sequence of batch activities:

- Data acquisition: the firm imports the data from the legacy system.
- Data normalization: the firm merges the acquired data and converts them in a consistent format. This activity manages the syntax of the data.
- Data clean up: the firm resolves inconsistencies and provides missing data. This activity manages the semantics of the data.
- Upload on system: the firm stores the normalized and

cooperate and integrate with the external environment:

- Interaction with client: the firm manages the exchange of input and output with the client. Moreover it asks the client a policy for the data normalization.
- Supervising: the firm ensures an adequate distribution of resources over the activities.

The use case is graphically formalized in an ARP (Activities, roles, people) snapshot which depicts the activities, the roles, the people, and the relations between them in a synthetic form.

We use different drawing elements to represent activities, roles, and people (See figure 1 inner box). The box denoting a person should contain the actual name of the person. Throughout our case study we omit people's name and other details about the firm we have been asked to keep confidential.

The dynamics of the process are effectively captured in an AID (Activity Interaction Diagram) which uses arrows to represent interactions between the activities. Each activity has an associated vertical line and time is considered moving downward along the lines.

The ARP snapshot and the AID played an important role in the case study. As a matter of fact the employees acknowledged these diagrams as one of the most effective

Table 1: Sample ABC form

Name: Person C								
Department: external installations					Week: 7 July 1997 / 13 July 1997			
	Mon.	Tue.	Wed.	Thu.	Fri.	Sat.	Sun.	Total
Data normaliz.	0	0	0	0	0	0	0	0
Data clean-up	0	0	0	0	0	0	0	0
Upload on system	8	8	5	2	8	0	0	31
Data processing	0	0	1	8	1	0	0	10
Other	0	0	0	0	0	0	0	0
Idle	0	0	2	0	1	0	0	3
Total	8	8	8	10	10	0	0	44

cleaned up data in the new information system.

- Data processing: the information system processes the data to derive new data.

These batch activities need special activities to properly

response from the modelers: putting the information in this graphical form improves the interaction between the employees and the modelers. Although the employees were not modeling experts, looking at the diagrams forced them to consider the information they gave from a new perspective. Egidio was the tool that enabled this profitable

interaction. The first impact of the diagrams on the employees produced instability in the descriptions but we think it also helped a deeper analysis of the process. Eventually, when most hypothesis had been sorted out, the model reached a stable version that was refined in subsequent phases without dramatic changes. Most effort was necessary to delimit the activities because many factors, like sharing of common human resources and overlap in time, made the activities hard to distinguish.

But the most important diagram the firm required to understand the requirement of the activities in terms of people and roles is the ARP (Activities, roles, people) diagram (Figure 1). The ARP diagram is composed of a set of sub-diagrams. Each sub-diagram focuses on a specific activity. Each activity is connected to the set of roles it requires to be performed. Each role is connected to the person who plays it.

Although the dynamics and the interactions are not represented, the ARP diagram was useful for the firm's human resource manager to plan, in the short term, the allocation of people to activities, to detect possible overloads and to tailor the activities to the skills of the people involved.

Actually, along with the ARP diagram, we gave the human resource manager a thrashing matrix which depicts the current allocation of people to activities in a more synthetic form. This kind of matrix is easier to understand than an ARP diagram, especially if the person who uses it is not an expert in object orientation, but conveys the same information.

According to Gertrude, we used the ABC forms to validate the model. Up to now we have been collecting ABC forms for two months. Table 1 shows a sample ABC form filled in by Person C. From the modeling point of view, the ABC forms are a feedback from the employees and we used them to determine whether the identified set of activities in the model was correct. The forms have an *other* line where the employees can report activities that were not captured during the modeling. The modeler must examine the suggested new activities and, if they actually contribute to clarify the model, must include them in the model. The modeler must also tune the model if the set of identified activities is confusing for the employees. In our application of Pescarenico we actually had to change the model because of the data from the ABC forms: in the beginning the activity *data clean up* was split in *automatic clean up* and *manual clean up*. Eventually, by observing the ABC forms, we discovered that the two activities were performed in conjunction: they were so tightly related that it was not necessary to keep them apart. Grouping the two activities in a single *data clean up* activities also produces simpler and more understandable ABC forms for the employees. Moreover, the ABC forms provided a basis for the human resource manager to analyze the time spent on

each activity in past and current projects. This information was not available before the application of Pescarenico.

4 CONCLUSIONS AND FUTURE WORK

We have presented our experience in the application of a methodology developed in the University. Pescarenico has sustained the load of a real business process.

Pescarenico has performed well and has delivered the expected advantages in terms of process understandability, visualization, technology transfer, and abstraction.

We wish to enhance Pescarenico with process reengineering and reuse techniques. We also wish to build a tool to compare the costs coming from Pescarenico with the costs coming from the accounting department.

Pescarenico is based on OMT. It is our intention to expand it for UML, which is now becoming the new standard for object oriented modeling.

We plan to enlarge Egidio for distributed modeling. This will follow a port of it in Java.

REFERENCES

- [1] Bandinelli, S., A. Fuggetta, and C. Ghezzi. Software Processes as Real Time Systems: A case study using High-Level Petri nets. Proceedings of the International Phoenix conference on Computers and Communications. Arizona, April 1992
- [2] Innes, J., F. Mitchell. I costi di struttura - Metodologie di analisi e di gestione. Egea, 1994.
- [3] Jacobson, I., M. Ericsson, and A. Jacobson. The object advantage - business process reengineering with object technology. ACM Press, 1995.
- [4] Kaplan, R. S., and D. P. Norton. The Balanced Scorecard - Measures that Drive Performances. Harvard Business Review. January - February 1992, pp. 71-79.
- [5] G. Succi, F. Benedicenti, P. Predonzani, T. Vernazza. Standardizing the Reuse of Software Processes. ACM StandardView, ACM Press. Vol 5, No 2, June 1997
- [6] Rumbaugh, J., M. Blaha, W. Premerlani, F. Eddy, and W. Lorenzen. Object-Oriented Modeling and Design. Prentice-Hall, Englewood Cliffs, NJ., 1991