Revisiting the P&P Pattern with Explicit Meta-Models

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Introduction. It has been known, since a long time, that there is some kind of structural correspondence between algorithm and data. In this work, we try to generalize the structural similarities between procedural knowledge and data knowledge, into a more general correspondence scheme between process and product. In many situations (i.e. with SADT datagrams and actigrams), people have developed asymmetric views of the universe, giving more weight to product or more weight to process. The UML for example is a rather product-oriented proposal while most workflow systems are on the process side. This paper discusses the relations between product and process meta-models. The importance of the subject will first be established. The practical interest of this conceptual investigation is to understand more precisely the state of affairs in the new landscape of applied model engineering. The possibilities we have, of explicit representation of meta-models in modern technologies like the MOF-based OMG model architecture, now allow the study to be made on more precise grounds.

Summary of the presentation. Our objective, in this presentation, is manifold. We first show how the new landscape of software modeling has radically changed in the recent period, with the arrival of the three OMG recommendations: UML, MOF and XMI. We mention that a similar evolution is under way, within the Microsoft software circles (OIS, RTIM, and XIF). We then state that this is just a new occurrence of the classical process and product (P&P) recurrent pattern (or algorithm and data). We discuss the peculiarities of this evolution and particularly its newest aspects. Both process and product meta-models are now explicitly specified. Furthermore, they are expressed in terms of a common meta-meta-model (the MOF or Meta-Object Facility at OMG [3] and the RTIM or Repository Type Information Model within Microsoft circles [2]). Many undergoing industrial efforts are now engaged in this direction, for example the workflow initiative [5] or the Software Process Engineering work [4]. The last part of the paper, leading to the conclusion, will show that these new ideas in the domain of software engineering, can be applied as well to the domain of system engineering. Some illustrations, in the area of enterprise modeling, will help to show how straightforward the adaptation could be.

The P&P recurrent pattern. The relation between process and product is a recurrent theme in computer science. To the best of our knowledge, there has never been a systematic study on the subject. Many contributions however suggest strong structural correspondence between process and product models, and several authors have pro-

vided empirical evidence of this in the last decades. These discoveries were usually made on the occasion of establishing guiding rules[1] or applied model elaboration. In [6] for example, when most people were still working on Structured Programming, N. Wirth noticed that *"... structuring considerations of program and data are often closely related. Hence, it is only natural to subject also the specification of data to a process of stepwise refinement. Moreover, this process is naturally carried out simultaneously with the refinement of the program"*.

Conclusion. The arrival to maturity of object technologies has allowed the idea of model-based software development to find its way to practicality. The OMG (Object Management Group) is now centering its activities not only on one interoperability bus, but on two different ones: the classical CORBA software bus (for code interoperability) and the emerging MOF (Meta-Object Facility) knowledge bus (for model interoperability). The consensus on UML (Unified Modeling Language) has been instrumental in this transition from code-oriented to model-oriented software production techniques. An essential role is played by the concept of meta-model in new software organizations like the OMG meta-model stack architecture or the Microsoft OIS (Object Information System). The concept of a MOF (Meta-Object Facility) has progressively emerged in the last ten years from the work of different communities like IRDS, CDIF, etc. [1]. Recent advances in model engineering now allow a more precise discussion of models, based on explicit representation of meta-models. The various artifacts, present or not in UML, can be explicitly represented (Use Cases, Scenarios, CRC cards, Tests, Architectural items or any other kind of workproduct).

All these results bear wider applicability than in the field of software engineering. The P&P pattern is not new in system engineering, but its application may lead to important improvements if combined with the use of explicit meta-models. The P&P pattern states that we can explore alternatively the product definition space and the process definition space. Progress made on one path will be readily applicable to the other one, and switching between product and process analysis becomes natural.

References

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[1] At a time when "design pattern" was not yet such a buzzword.