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International Journal of Project Management 32 (2014) 229 – 241

International Journal of Project Management

www.elsevier.com/locate/ijproman

Managing complex project process models with a process architecture framework

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Received 29 October 2012; received in revised form 22 May 2013; accepted 23 May 2013

Abstract

Especially in large, complex projects, various aspects of process (activity network) information reside in separate models and diagrams that can become unsynchronized over time. Prior research has introduced the concept of a process architecture framework (PAF), which provides a solution by tying all the models and diagrams together in a single, rich process model with many views, where each view presents a subset of model information. This paper advances that work by (1) proposing an expandable PAF structure that organizes 27+ new and existing views, (2) suggesting examples of three new views that align well with specific concerns of users, and (3) presenting insights to guide the development of new views. Thus, this paper takes further steps towards the development of a PAF that provides at once both simplicity and completeness for project managers and other users of process models and project management information systems.

Keywords: Process modeling; Process views; Process architecture framework; Project management information systems; Complexity management; Decision support

1. Introduction

Especially in large, complex projects (such as those for the design and development of complex products or services), various aspects of process (activity network) information often reside in separate models and diagrams such as Gantt charts, network diagrams, resource assignment matrices, risk management plans, compliance databases, lessons learned databases, and role and responsibility lists, to name but a few. Because they are built and maintained by different individuals and teams, these models can become unsynchronized over the course of a project. Although some projects have sophisticated information systems to manage many aspects of their process information, even these systems do not yet meet the needs of many users inside and outside the project. Because of these shortcomings, such users many construct their own diagrams, models, spreadsheets, reporting templates, and tracking systems for process information. However, the present danger is that the various models—which contain a great deal of overlapping information—will fall out of synchronization because of their development by disparate organizational units with different information, assumptions, and concerns. For example, a project manager might use a software tool to plan and schedule work, but the list of activities in that tool may fall out of sync with a list of risk management activities kept by designated risk manager, or a list of evidences of process compliance may become disconnected from a standard process kept by process auditors or assessors.

One way to address these issues is to consolidate all of the information about the work done in a project (a project's process information) into a single, rich model with varied *views* (Browning, 2009). A view extracts and displays a subset of a model's attributes and assumptions with an arrangement of symbols, tables, graphs, or other diagrams or depictions (Browning and Ramasesh, 2007). Fig. 1 shows an example of three common views drawn from the information in a single, more complex model of a process. Whereas a complex process model might contain some information that only a few types of users care about—such as how an activity is performed on other projects, when its documentation was last updated, who

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0263-7863/$36.00
http://dx.doi.org/10.1016/j.ijproman.2013.05.008

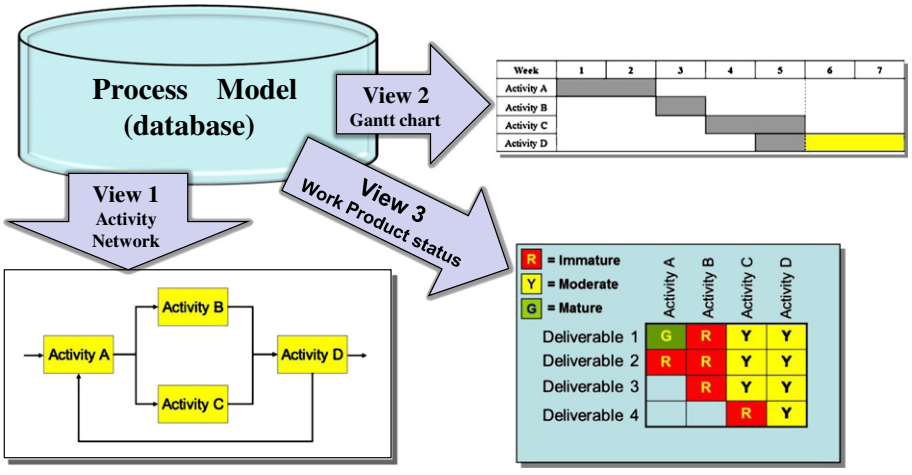

Fig. 1. An example of three views extracted from a single, richer model of a process.

"owns" it, etc.—a particular user will usually only need a small subset of those data to address a specific concern. A scheduler, for example, might care only about the activity's predecessors, duration, and alternative modes (such as opportunities for crashing) and might therefore prefer the Gantt chart and network diagram views. A project manager might care more about the status of activities and deliverables, using views two and three in Fig. 1. By extracting different views from the process model, it is possible to provide each of these users with a customized filter that shows them the subset of the model they need. From their own perspective, each is working with his or her own model, but, behind the scenes, all are in fact using a single, common model and therefore "drawing from the same well." Thus, a view offers a particular lens or portal through which to build and/or access certain aspects of a rich process model—a model whose immensity would otherwise cause "information overload" for most users. The use of views from a single model enables the integration and synchronization of the vast amount of information useful for describing, documenting, and managing project work. Management tools such as Microsoft Project® provide a basic form of this capability by allowing a user to toggle back and forth among Gantt chart, network diagram, and tabular views of project activities and resources. In such tools, the data reside in a database, not in any of the particular views, which are reconstructed each time they are accessed by pulling the latest information from the database. However, users do not interact directly with the database. Instead, they input and output data through one or more of the available views. Some users prefer to work in the tabular data entry mode (although each of the available tables only accesses a subset of the database's elements) while others prefer to click on visual elements and pull up dialog windows for data entry. This multi-view approach can be generalized and extended to a much greater portion of project management information, starting with the process (activity network), through the use of a *process architecture framework* (PAF), an organized collection of views of a complex process model.

A PAF is helpful both for assimilating and disseminating the information in a complex process model. Using a synchronous portfolio of PAF views has the potential to greatly enhance project managers' capabilities and prevent unwanted surprises due to data disconnects. But which views should a PAF provide? That depends on who uses process information ("stakeholders") and what concerns they have. Each view in a PAF might seek to align with a particular concern (or category of concerns) by displaying all of the process model data relevant to that concern while excluding irrelevant information. However, a recent study (Browning, 2010b) of both literature and practice found substantial misalignment between 28 concerns and 15 views in terms of 56 information attributes in process models (Table 1).[1] Most problematically, a variety of key concerns from five types of users[2] were not well supported by *any* of the 15 common views examined! Hence, additional and better views of process model information would seem to be needed. Improved views can be a significant driver of innovation in system design (Alexander, 1964; Keller et al., 2005, 2006b; Schätz et al., 2002; Simon, 1996; Zachman, 1987), product development decisions (Krishnan and Ulrich, 2001), and decision support systems in general (Basu et al., 1997), so it is logical to infer that they could be beneficial to project managers and stakeholders as well.

Since earlier work (Browning, 2009) provides theoretical motivation and grounding for PAFs, as well as extensive literature review, this paper merely contributes a step forward in PAF development by proposing an organizational structure for

[1] Although the term "purpose" was used in prior literature on PAFs, this paper uses the term "concern" (synonymous in this context) for greater consistency with ISO 42010 (ISO, 2011). Note that ISO 42010 uses the term "stakeholder" for any user with a concern and distinguishes a "viewpoint" as containing the specifications for a "view." This paper does not emphasize the term "stakeholder" because of its wider meaning in project management (i.e., project stakeholders), nor does it delve into distinctions between viewpoints and views. Nevertheless, the terminology and approach in this paper are not inconsistent with ISO 42010.

[2] These users (stakeholders) were project managers and team leaders; owners of (multi-project) standard processes; project planners and schedulers; engineers, designers, and other team members; and process auditors, assessors, and appraisers.