ProjectIT-Enterprise: a Software Process Improvement Framework

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Abstract. Process descriptions represent high-level plans and do not contain information necessary for concrete software projects. Misalignments between processes and projects are caused by processes that are unrelated to daily practices or, hardly, mapped to project practices. We argue that software processes should emerge and evolve collaboratively within an organization. In this article we present a process and project authoring tool based on our vision for agile software process improvement.

Keywords: Software Process Improvement, Process Management, Project Management

1 Introduction

Standard Software Process Improvement (SPI) models impose that SPI practitioners focus on specific software process problems and ignore other problems more important to organizations, such as, not explaining the mechanisms of team's collaboration and how to react when facing existing problems. It is common that small and medium organizations have strong budget and schedule constraints, they tend to reject traditional SPI initiatives based on CMMI [1], ISO 9000 [2] or ISO/IEC 15504 [3], because the challenge to successfully carry out programs with these reference standards entails a substantial overhead. Although standard SPI models have been highly publicised and marketed, they are not being widely adopted. Therefore their influence in software organizations remains more at a theoretical than practical level [4].

Several surveys and studies [5,6] have emphasized that the majority of small organisations are not adopting standards such as CMMI. Another case is observed in Brazil where Brazilian software industry and universities are working cooperatively in implementing a successful SPI strategy that take into account software engineering best practices and aligned to Brazilian software organizations context [7].

We argue in our research that the emphasis in software process improvement should be stressed on communication, coordination, and collaboration within and among project teams in daily project activities, and consequently the effort in process improvement should be minimized and performed as natural as possible. Little attention had been paid to the effective implementation of SPI models which has resulted in limited success for many SPI programs. SPI managers want guidance on how to implement SPI activities, rather than what SPI activities do actually implement. Limited research has been carried out on exploring new approaches to effectively implement SPI programs. On this basis, we propose a new methodology, and a complementary tool (ProjectIT-Enterprise), to describe and improve software process based on organizations projects experience.

This paper is focused on the description of the ProjectIT-Enterprise, which is a Web based tool for process and project definition. Section 2 presents an overview of ProjectIT, in particular gives an overview of the set of tools that together compose the ProjectIT workbench. Section 3 describes how ProPAM (Process and Project Alignment Methodology) and ProjectIT-Enterprise tool are combined to work together in order to support process improvement. Finally, section 4 presents related work of other initiatives and section 5 concludes this work, justifying our perception that this proposal has innovative contributions for the community.

2 ProjectIT-Enterprise

The Information Systems Group of INESC-ID has been involved for some time in research projects in the area of software engineering. ProjectIT is an investigation initiative that reflects on this problematic area and it has the main goal to analyze, integrate and support best practices for managing and implementing IT projects [8]. The research, reported in this paper, has been performed within the context of ProjectIT initiative.

The initial definition of the ProjectIT initiative considered a set of guiding principles linked to development processes of information systems, namely: project and business alignment; clients and users involvement; plan and control just enough; facilitate communication based in visual models; architecture centred-development; promote reuse; software development based on models; and finally, simplicity at all levels [9].

The underlying investigation to this initiative has been rendered and validated with two complementary tools: ProjectIT-Enterprise and ProjectIT-Studio (see Fig. 1). **ProjectIT-Enterprise** is an integrated environment to support projects management and collaborative work, being classified as a Web CSCW (Computer-Supported Cooperative Work) tool. **ProjectIT-Studio** is a CASE (Computer-Aided Software Engineering) tool, with desktop interface, focused on the accomplishment of high productivity activities, associated to requirements specification and management, tests specification and management, models design and automatic code generation and software development [9].

This paper addresses many of the major research issues that had been integrated into ProjectIT-Enterprise, namely: process definition, process-project alignment and project management. ProjectIT-Enterprise intends to support mechanisms developed through this research in order to allow organizations to improve their processes.

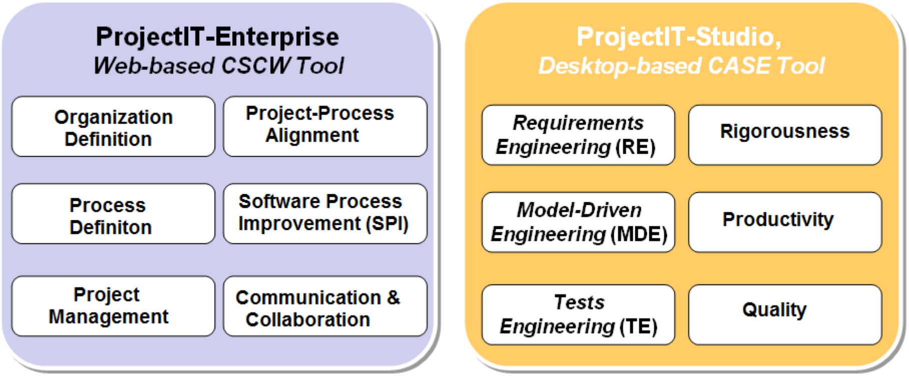


Fig. 1. ProjectIT-Enterprise and ProjectIT-Studio.

3 ProPAM – Process and Project Alignment

Process and project alignment methodology (ProPAM) is focused on the organization's need for communication, coordination, and collaboration within and among project teams. This methodology describes how the process and project are represented and how project teams acquire and use knowledge to improve their work. A key feature of ProPAM is the integration of SPI activities with software development activities. This way, authors considered project teams and projects themselves as the baseline for improvement. The following subsections present a brief overview of ProPAM's most important aspects and how ProjectIT-Enterprise supports SPI activities. Further details can be found in [10,11].

As Fig. 2 illustrates, ProPAM methodology includes activities that intend to develop as well as improve the software process of an organization (process level). Nevertheless, these SPI activities also include interaction between project managers and process managers as key to the success of SPI initiatives (project level). At project level, the methodology proposes to assist organizations in their daily effort to assess and manage problematic situations of specific projects, and develop and implement solutions to help managing these problems. Project level covers project information needed to systematically support or reject many process decisions. At process level, project feedback leads to process reviews and iterative process improvement. The dynamic interplay between these two levels (project level and process level) shows the synergy between the activities performed by project roles (project manager and team members) and the activities performed by process roles (process manager and process engineers) involved in SPI.

However, to manage the inherent complexity of these levels, ProPAM provides a method for formal process definition (stage 1) and improvement based on project experience (stage 2). Alignment lays the foundation for successful process definition efforts, as well as ensures the resulting improvements are synchronized with the goals of the organization. Data flow synchronization between these two levels minimizes uncertainty and the amount of unused data between working groups. Consequently, the ability to strategically relate information flows between these levels is essential to the success of these endeavours.

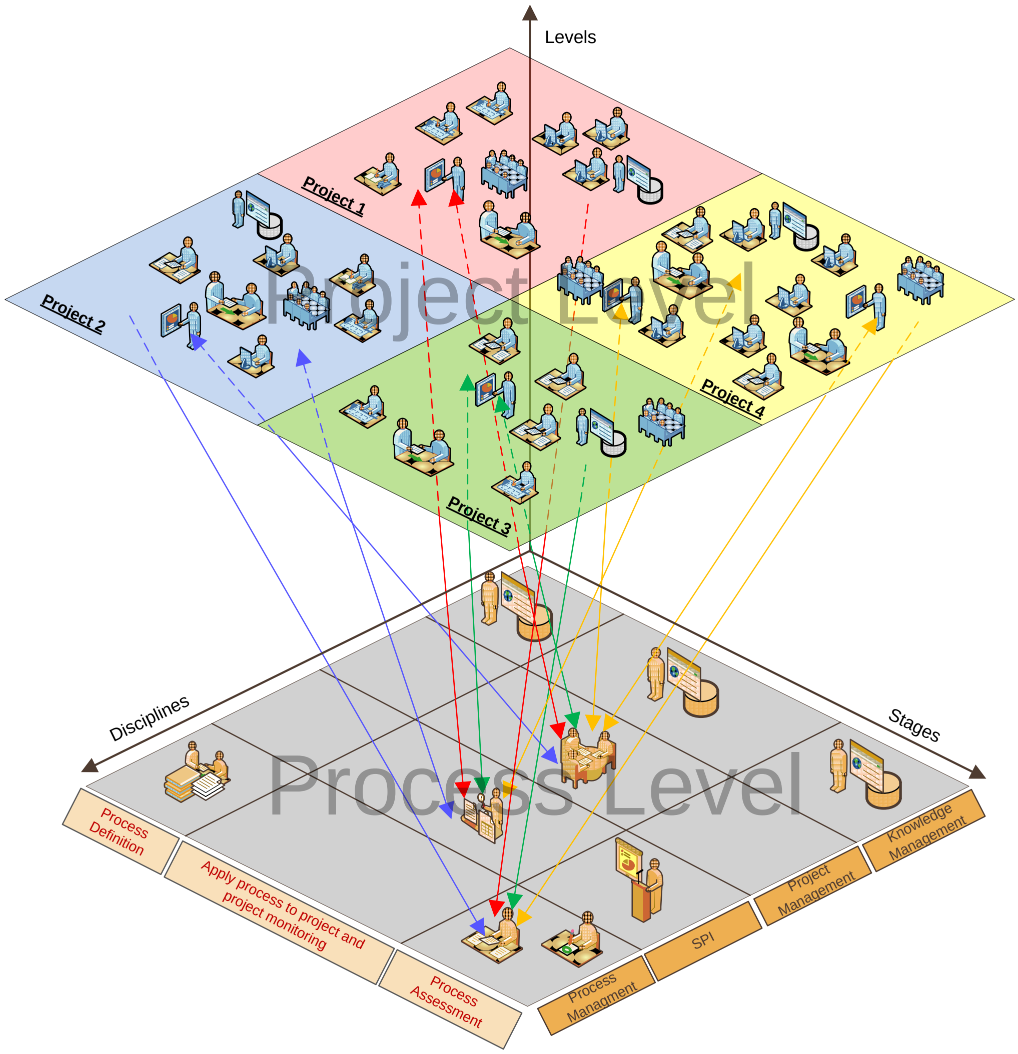


Fig. 2 Overview of process and project alignment methodology (ProPAM)

ProPAM is an iterative process improvement methodology organized into three stages: (1) process definition; (2) apply process to project(s) and monitoring; and (3) process assessment and refinement. The following subsections present an outline of these three stages.

Stage 1: Process Definition

The objective of this stage was to find out the organization's needs regarding SPI, analyze and understand problems with senior managers, and define the first version of the software development process. Initial process specification is performed through the application of the ProjectIT-Process metamodel shown in Fig. 3.

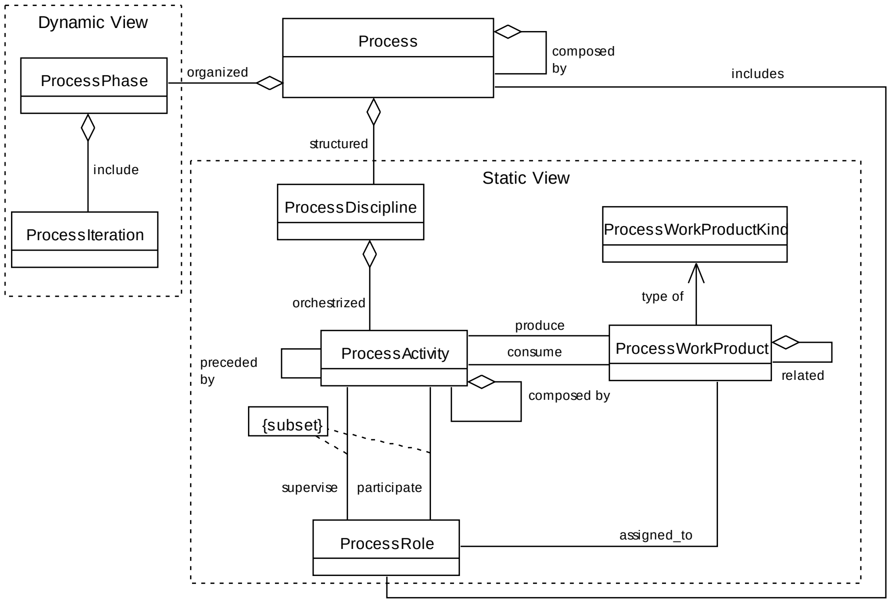
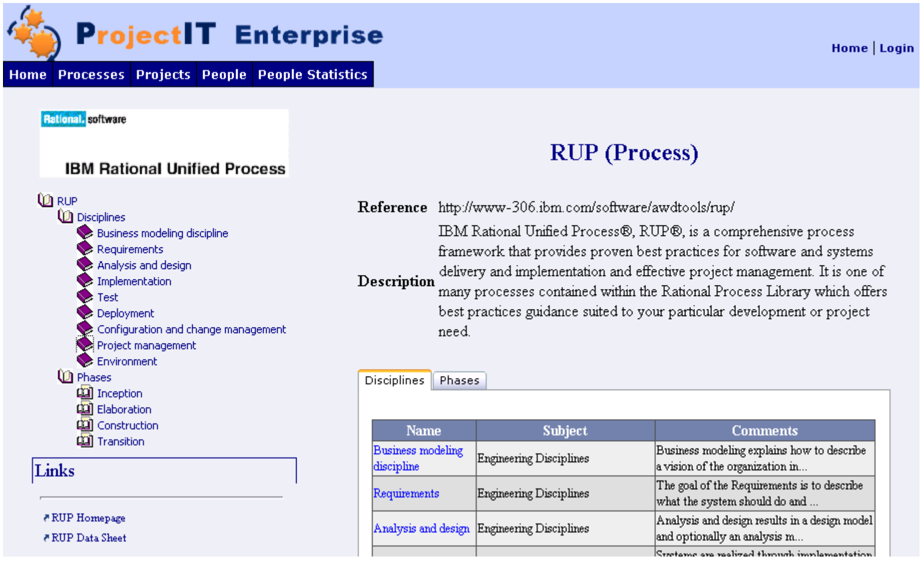


Fig. 3 ProjectIT-Process Metamodel

In this stage, the process manager finds current process practices to include in an initial process. Initial meetings with senior managers mainly covered questions about the organization's mission and goals. Also important was information retrieved through interviews and questionnaires. The organization also delivered several documents relevant for an initial development process definition. A kick-off meeting mainly covered a description of the collaboration process and a presentation of a process draft.

ProjectIT-Enterprise integrates process definition to support process manager in this initial phase dedicated to analyse and identify core activities performed by project teams. It allows describing supporting disciplines (in terms of activities, work products and roles) and supporting phases (in terms of number and size of iterations). Fig. 4 shows the Rational Unified Process (RUP) defined within this environment.

In this domain, ProjectIT-Process Metamodel defines a simple and user-oriented metamodel for software development processes, as well as its semantics. The metamodel specifies the modelling constructs and mechanisms that allow defining processes models like RUP, XP, Scrum, etc.



RUP (Process)

Reference http://www-306.ibm.com/software/awdtools/rup/

Description IBM Rational Unified Process®, RUP®, is a comprehensive process framework that provides proven best practices for software and systems delivery and implementation and effective project management. It is one of many processes contained within the Rational Process Library which offers best practices guidance suited to your particular development or project need.

Name	Subject	Comments
Business modeling discipline	Engineering Disciplines	Business modeling explains how to describe a vision of the organization in...
Requirements	Engineering Disciplines	The goal of the Requirements is to describe what the system should do and ...
Analysis and design	Engineering Disciplines	Analysis and design results in a design model and optionally an analysis m...
		Systems are realized through implementation

Fig. 4 Defining a process (RUP)

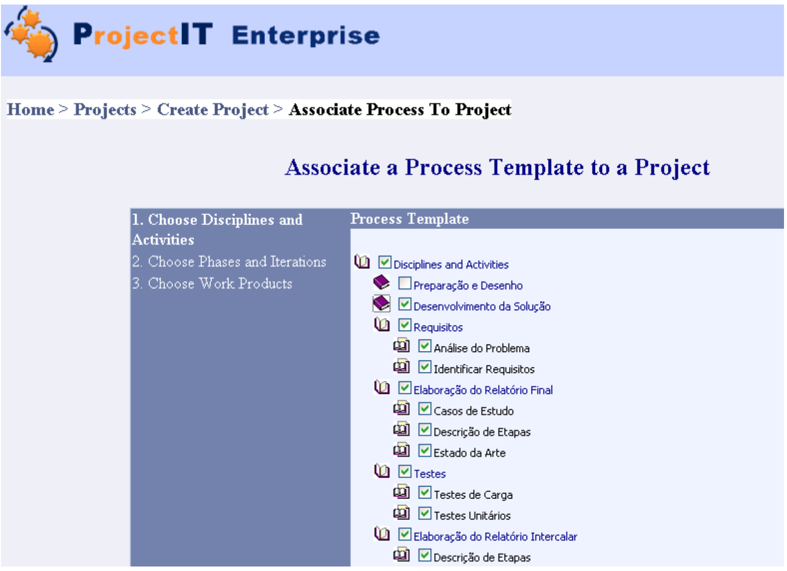
Stage 2: Apply Process to Projects and Project Control

Apply process to project(s) and monitoring stage involves planning and executing the project within the base process best practices. It also provides assurance that the project is progressing according to the base process or it reveals the need to take SPI actions because activities performed by team members are different from those specified in the process. The goal of this stage was to identify and solve problems with existing procedures, propose new practices to address these problems, and observe the application of new proposed practices. During this stage, project teams and the process manager will test and validate improvements against old project practices.

In this stage several activities are performed at the process and project level. At the project level, several projects will be under inspection to detect, introduce, and validate new software development practices. Then, these practices will be analyzed at the process level as candidates for future improvements in the base process. This stage follows a pattern of cyclic iterations that allows for detecting and validating new software engineering practices. At each iteration end, an SPI feedback meeting is held to review changes proposed by team members and to notify about the changes that will be applied from that point forward.

Initially, ProjectIT-Enterprise allows specification of projects based on process models (Fig. 5): monitoring projects; eliminating risk-prone software practices; proposing new software practices; testing, validating, and rejecting proposed practices; and preparing and coordinating iterations.

Considering a process that has a different set of process items (disciplines, activities, phases, work products, roles), the tool guide and shape a project using that template. A process template defines a set of activities that comprise best practice of how to achieve a certain goal.


ProjectIT Enterprise
Home > Projects > Create Project > Associate Process To Project

Associate a Process Template to a Project

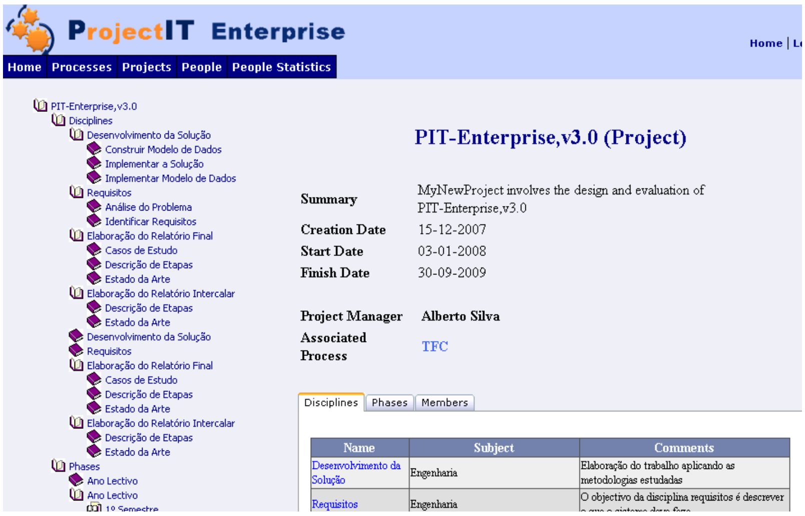
1. Choose Disciplines and Activities
2. Choose Phases and Iterations
3. Choose Work Products

Process Template

- ☑ Disciplines and Activities
  - □ Preparação e Desenho
  - ☑ Desenvolvimento da Solução
  - ☑ Requisitos
    - ☑ Análise do Problema
    - ☑ Identificar Requisitos
  - ☑ Elaboração do Relatório Final
    - ☑ Casos de Estudo
    - ☑ Descrição de Etapas
    - ☑ Estado da Arte
  - ☑ Testes
    - ☑ Testes de Carga
    - ☑ Testes Unitários
  - ☑ Elaboração do Relatório Intercalar
    - ☑ Descrição de Etapas

Fig. 5 Associate a Process Template to a Project

Fig. 6 presents a new project plan, generated after select one between several project templates. ProjectIT-Enterprise is flexible and allows the project plan to be modified by removing or adding activities, change activities order, planned man-hours, duration, roles, work products, etc.



- PIT-Enterprise,v3.0
  - Disciplines
    - Desenvolvimento da Solução
      - Construir Modelo de Dados
      - Implementar a Solução
      - Implementar Modelo de Dados
    - Requisitos
      - Análise do Problema
      - Identificar Requisitos
    - Elaboração do Relatório Final
      - Casos de Estudo
      - Descrição de Etapas
      - Estado da Arte
    - Elaboração do Relatório Intercalar
      - Descrição de Etapas
      - Estado da Arte
    - Desenvolvimento da Solução
    - Requisitos
    - Elaboração do Relatório Final
      - Casos de Estudo
      - Descrição de Etapas
      - Estado da Arte
    - Elaboração do Relatório Intercalar
      - Descrição de Etapas
      - Estado da Arte
  - Phases
    - Ano Lectivo
    - Ano Lectivo
      - 1º Semestre

PIT-Enterprise,v3.0 (Project)

Summary MyNewProject involves the design and evaluation of PIT-Enterprise,v3.0
Creation Date 15-12-2007
Start Date 03-01-2008
Finish Date 30-09-2009

Project Manager Alberto Silva
Associated Process TFC

Disciplines | Phases | Members

Name	Subject	Comments
Desenvolvimento da Solução	Engenharia	Elaboração do trabalho aplicando as metodologias estudadas
Requisitos	Engenharia	O objectivo da disciplina requisitos é descrever o que o sistema deve faze

Fig. 6 Project definition

Stage 3: Process Assessment and Refinement

This main goal of process assessment and refinement stage is to analyze the improvement opportunities identified in projects and validate the SPI actions accepted in previous meetings. This stage intends to analyze process data and interpret the results to provide support for decisions or corrective actions in the software development process. At the project level, collected data were analyzed, interpreted, and used by the project itself. At the process level, the process manager uses measurement data from projects to make conclusions about the changes purposed. This stage includes a final feedback meeting to discuss introduced practices.

Although not yet implemented in ProjectIT-Enterprise, our idea is to allow process version management. Primary focus of this capability is on tool support to better handle and manage the versions of evolving process definitions. However, the purpose of this paper is not to discuss an innovative solution for process version management.

The problem of evolving process management is related to the facility of comparing best practices proposed by each solution. The tool will operate on data that evolves over time and whose history is recorded through a version management tool. The versioning approach allows process innovation to be captured, assessed and reusable for future projects. In the context of this research, we conceive a model and respective mechanisms that allowed the alignment of projects and processes definition.

However, the initial ProjectIT-Process Metamodel (Fig. 3) only allows defining new processes without giving the appropriate support to analyse process that are improved versions of older ones. Fig. 7 describes a new proposal that introduces process version management in this metamodel. A process, which is either a composite process or a set of disciplines, includes the definition of its unique name and a process tree. A process is a root version, a revision or a variant. This means that a process must have a version number and a state (Transient, Released or Obsolete). Before describe details about process version elements, we must define the two types of process: (1) simple process and (2) composite process. A simple process comprises several disciplines and a composite process includes one or more other process (simple or composite). A new process version can be derived from an older version of the process by applying one or more modification operations (update, delete, referenced by a composite process, derived versions allowed, create projects and associated projects). Fig. 7 presents the main elements of the extended metamodel (modification and operation metaclasses).

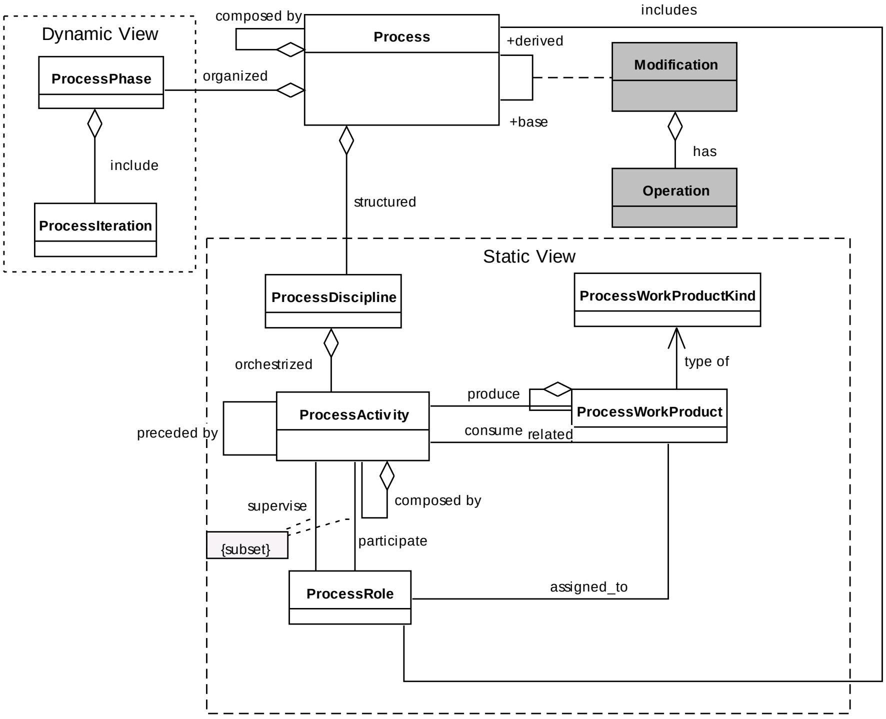


Fig. 7 PIT-ProcessM (revised approach with version management)

4 Related Work

The idea of providing a complete SPI support tool, throughout the entire life cycle is not new. Some of the most popular SPI tools are: Eclipse Process Framework Composer (EPC) [12], Rational Method Composer (RMC) [13], IRIS Process Author (IPA) [14] and Visual Studio Team System Process Editor (VSTSPE) [15].

However, many of these tools follow a traditional process principle, where processes are designed in a separated tool by a process team and then exported to a different environment to be used by project teams. It is a single directional form of communication, contradictory to principles presented in ProPAM.

On analysed SPI tools, IPA has the best support for collaboration through its Wiki features. However, these changes are not automatically propagated for the process repository. Concerning the other tools, EPC, RMC and VSTSPE only collect user feedback from a single entity, collaboration is not supported.

In order to improve process descriptions, it should be possible to comment on and annotate proposed changes by project teams. Agile communities today emphasize that would be naive and inefficient to always start project plans from scratch. For this reason, project teams today often consists of tailoring the contents of an existing process repository to the needs of a specific project settings.

Following the principles of ProPAM, ProjectIT-Enterprise adopts a bi-directional form of communication, between process team and project team. The lack of alignment between process and project(s) results from processes unrelated to project activities and failure in detecting project changes that improve processes.

The main difference between ProjectIT-Enterprise supporting ProPAM and other evaluated tools relays on the strong concept of "process and project alignment". Changes are detected in projects and previously are propagated to process descriptions creating a new process version. Actually, ProjectIT-Enterprise only supports process and project definition. More features need to be included in the near future, particularly a process version management infrastructure to evaluate SPI success.

Another problem in SPI tools is poor support to version management. When documenting improved process descriptions, a good version management system is important to trace differences between process versions.

IPA handles version tracing through exporting process descriptions to XML and previous store in external version control systems. XML descriptions can be re-imported into IPA as necessary. However, versions comparison is not possible. Other evaluated tools also rely on external version management systems.

5 Conclusions and Future Work

In this paper we introduce the ProjectIT research initiative, its main issues and challenges, and the importance of a collaborative framework for process management and improvement. In order to validate proposed ideas and contributions, we decide to develop a tool, called ProjectIT-Enterprise. Main intention is to meet the challenges of an industry that requires constant improvements in software development operations; we consider that an appropriate tool will overcome most of this problematic.

ProjectIT-Enterprise is a Web-based environment that provides collaborative features for process definition, project management as well as process and project alignment. ProjectIT-Enterprise currently supports the two most relevant and distinctive stages of ProPAM methodology: (1) process definition and (2) apply process to projects and project control. Results achieved until now show that it is possible to specify process based on project data in a more productive way, by adapting and integrating techniques such as modelling and models transformation.

ProjectIT-Enterprise is a tool that integrates process definition and project definition (based on previously defined processes). As opposite to evaluated tools, such as EPC, RMC, IPA and VSTSPE, where processes are designed in a specific environment and then exported by project management applications. Different tools for different teams prevent capturing new practices suggested by project teams and propagation to process descriptions after being accepted by process teams. In order to react to an industry that requires agility, quality and efficiency, it is imperative to design tools that provide a collaborative approach.

Another common problem in SPI is the assessment of proposed changes (new process version) to accept as a good solution. Although not yet implemented in ProjectIT-Enterprise, ProPAM methodology includes a stage dedicated to process assessment and refinement that provides some ideas on how to address process version management to evaluate SPI success. In the near future, we will take these ideas into account when integrating new functionalities in ProjectIT-Enterprise.

However, and in spite of the experiences already performed, at this stage of our research is important to continue validation and tuning the proposed approaches in more real projects. In conclusion, we believe that software process tools should move towards a new direction that includes deeper interaction between process and project teams in order to create and to improve processes really adopted by software development enterprises.

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