

# Operational Planning, Re-planning and Risk Analysis for Software Releases

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**Abstract.** Software release planning takes place on strategic and operational levels. Strategic release planning aims at assigning features to subsequent releases such that technical, resource, risk and budget constraints are met. Operational release planning focuses on the realization of a single software release. Its purpose is to assign resources to feature development tasks such that total release duration is minimized under given process and project constraints. Re-planning becomes necessary on operational level due to addition or deletion of features during release development, or due to changes in the workforce. The allocation of resources to feature development tasks may depend on the accurate estimation of planning parameters such as feature size, developer productivity or development task dependencies. Risk analysis can help assess the vulnerability of a chosen release plan due to these dependencies. This paper presents a simulation-based approach to planning, re-planning and risk analysis of software releases on operational level. The core element of the approach is the process simulation model REPSIM-2 (Release Plan Simulator, Version 2). We describe the functionality of REPSIM-2 and illustrate its usefulness for planning, re-planning and risk analysis through application scenarios.

**Keywords:** software release planning, operational planning, process simulation, risk analysis.

## 1 Introduction

One of the key questions of incremental software development is to decide which features can be offered at which release. This decision depends on the customer needs, technological constraints, and the resources and time frame available to implement the features.

Software release planning takes place on strategic and operational levels. Strategic release planning aims at assigning features to subsequent releases such that technical, resource, risk and budget constraints are met. Once a strategic release plan has been generated, i.e., a decision has been made on which features are to be developed in which release, operational release planning focuses on the development of the identified features in a single software release. The purpose of operational release

planning is to assign resources to feature development tasks (e.g., design, implementation, and test) such that total release duration is minimized under given process and project constraints. Re-planning may become necessary on operational level for many reasons, for example, due to addition or deletion of features during release development, or due to changes in the workforce. The allocation of resources to feature development tasks may depend on the accurate estimation of planning parameters such as feature size, developer productivity or development task dependencies. Risk analysis can help assess the vulnerability of a chosen release plan due to these dependencies.

Good software release planning on both strategic and operational levels is extremely important [7]. A bad release plan may cause late delivery of high-value features, unsatisfied customers, budget overrun, and thus decreased competitiveness. Since many planning parameters and the features themselves are under continuous change [12], software release planning becomes a very dynamic task, and related decision-making problems are difficult to solve [6]. While satisfactory solutions for software release planning (and re-planning) on strategic level have recently been published in [3], [5], [10], more research is still needed to develop efficient and effective methods and tools in support of operational release planning.

The research presented in this paper focuses on a simulation model – REPSIM-2 (Release Plan Simulator, Version 2) – emphasizing on planning, re-planning, and risk analyses associated with operational release development plans of single releases. The presented simulation-based approach is applicable to any given solution to a specific strategic release planning problem. A solution to the strategic release planning problem, i.e., the assignment of features to subsequent releases, provides the following pieces of information for each individual release: number of features to be developed, number of task types needed to develop these features, number of developers available, estimates of the efforts needed per task type to develop a feature, estimates of the task type specific productivities of the available developers, and technical dependencies between subsequent task types. These pieces of information are needed to generate solutions to operational release planning and are referred to as problem parameters in the remainder of this paper. An introduction into existing methods supporting strategic release planning can be found in [11].

The remainder of this paper is structured as follows. Section 2 provides the motivation behind this research based on existing work performed in the area of software release planning. Section 3 describes the simulation model REPSIM-2. Section 4 illustrates the applicability and usefulness of REPSIM-2 with the help of a case example. Section 5 discusses achievements and limitations of REPSIM-2 and suggests directions for future research.

## 2 Related Work

Both optimization and simulation approaches have been proposed in the context of operational software release planning.

For example, OPTIMIZE<sub>RASORP</sub> (Optimize Resource Allocation for Software Release Planning) is an optimization approach that generates simultaneously feature allocation plans for subsequent releases and operational feature implementation plans