A Stochastic Scheduling Model for Software Projects

Frank Padberg
Fakultät für Informatik
Universität Karlsruhe
Germany
padberg@ira.uka.de

Staff is the most valuable resource today in software development. In view of the shortage of software developers, it is more important than ever that software project managers plan and schedule their development projects in such a way that the developers are deployed as effectively as possible. Planning and scheduling a software project is extremely difficult though:

- The time needed to complete a particular software development activity is known only roughly. The time needed depends on technical factors such as the complexity of the piece of code to develop, but also on human factors such as the experience of the developers.
- Software is an immaterial product. Thus, tracking the actual progress of a software project is difficult, making it hard for a manager to tell when it's time to take controlling action such as reassigning tasks.
- It is typical for software projects that activities which run in parallel interfere with each other. Feedback between activities often leads to unanticipated rework and delays.

We present a scheduling model which is tailored to the dynamics of software projects. In the model, activity times are stochastic, resources are constrained and non-identical, and scheduling is preemptive. As opposed to other stochastic project scheduling models, the completion time of an activity explicitly depends on the amount of feedback received from concurrent activities. As a consequence, the completion time of an activity also depends on the scheduling strategy.

Technically, the model is a discrete-time Markov decision process. The corresponding stochastic optimization problem of minimizing the expected makespan can be solved using stochastic dynamic programming. We outline how to exploit simulation in order to cut down the computing time of the optimization algorithm. We also examine the link between our optimization problem and simulation-based optimization techniques in machine learning.