Developing Multimedia Applications with the WinWin Spiral Model

Barry Boehm, Alex Egyed, USC-Center for Software Engineering
Julie Kwan, USC University Libraries
Ray Madachy, USC-CSE and Litton Data Systems

Abstract

Fifteen teams recently used the WinWin Spiral Model to perform the system engineering and architecting of a set of multimedia applications for the USC Library Information Systems. Six of the applications were then developed into an Initial Operational Capability. The teams consisted of USC graduate students in computer science. The applications involved extensions of USC’s UNIX-based, text-oriented, client-server Library Information System to provide access to various multimedia archives (films, videos, photos, maps, manuscripts, etc.).

Each of the teams produced results which were on schedule and (with one exception) satisfactory to their various Library clients. This paper summarizes the WinWin Spiral Model approach taken by the teams, the experiences of the teams in dealing with project challenges, and the major lessons learned in applying the Model. Overall, the WinWin Spiral Model provided sufficient flexibility and discipline to produce successful results, but several improvements were identified to increase its cost-effectiveness and range of applicability.

1. Introduction

At the last two International Conferences on Software Engineering, three of the six keynote addresses identified negotiation techniques as the most critical success factor in improving the outcome of software projects. Tom DeMarco stated that “how the requirements were negotiated is far more important than how the requirements were specified” [DeMarco, 1996]. In discussing “Death March” projects, Ed Yourdon stated that “Negotiation is the best way to avoid Death March projects,” [Yourdon, 1997]. Mark Weiser concluded that “Problems with reaching agreement were more critical to his projects’ success than such factors as tools, process maturity, and design methods” [Weiser, 1997].

At the USC Center for Software Engineering, we have been developing a negotiation-based approach to software system requirements engineering, architecting, development, and management. It is based on three primary foundations:

- Theory W, a management theory and approach. It is based on making winners of all of the system’s key stakeholders as a necessary and sufficient condition for project success [Boehm-Ross, 1989].
- The WinWin Spiral Model, an extension to the Spiral Model of the software process. It is described further below.
The WinWin groupware tool for facilitating distributed stakeholders' negotiation of mutually satisfactory (WinWin) system specifications [Boehm et al., 1995; Horowitz et al., 1997].

2. The WinWin Spiral Model

The original spiral model [Boehm, 1988] uses a cyclic approach to develop increasingly detailed elaborations of a software system's definition, culminating in incremental releases of the system's operational capability. Each cycle involves four main activities:

- Elaborate the system or subsystem's product and process objectives, constraints, and alternatives.
- Evaluate the alternatives with respect to the objectives and constraints. Identify and resolve major sources of product and process risk.
- Elaborate the definition of the product and process.
- Plan the next cycle, and update the life-cycle plan, including partition of the system into subsystems to be addressed in parallel cycles. This can include a plan to terminate the project if it is too risky or infeasible. Secure the management's commitment to proceed as planned.

The Spiral Model has been extensively elaborated (e.g., SPC, 1994), and successfully applied in numerous projects (e.g., [Royce, 1990], [Frazier-Bailey, 1996]). However, some common difficulties have led to some further extensions to the model.

One difficulty involves answering the question, "Where do the elaborated objectives, constraints, and alternatives come from?" The WinWin Spiral Model resolves this difficulty by adding three activities to the front of each spiral cycle, as illustrated in Figure 1 [Boehm-Bose, 1994].

- Identify the system or subsystem's key stakeholders.
- Identify the stakeholders' win conditions for the system or subsystem.
- Negotiate win-win reconciliations of the stakeholders' win conditions.

**Figure 1. The WinWin Spiral Model**

1. Identify next-level Stakeholders
2. Identify Stakeholders' win conditions
3. Reconcile win conditions. Establish next level objectives, constraints, alternatives
4. Evaluate product and process alternatives. Resolve Risks
5. Define next level of product and process - including partitions
6. Validate product and process definitions
7. Review, commitment