Molhado: Object-Oriented Architectural Software Configuration Management

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Abstract

In this research demonstration, we describe Molhado, a research prototype of an architectural software configuration management (SCM) system that captures the evolution of system architecture, logical structures, and implementation source code in a natural and cohesive manner.

1 Introduction

The ability to manage architectural evolution is crucial to a successful software development and maintenance process. However, many SCM systems treat a software system as a “set of files”, and consistent configurations are defined implicitly as sets of file versions with a certain tag. This creates an impedance mismatch between the design domain (architecture level) and the SCM domain (file level).

2 A Tour of Molhado

To minimize the gap between software designs and SCM, our research produces Molhado, an architectural SCM system, in which the unplanned evolution of architecture and implementations are captured in a natural and cohesive manner. The key departure point of Molhado from other SCM systems is its object-oriented structure versioning framework, versus their file-oriented approaches. Molhado allows logical objects (components) to be versioned at both fine and coarse granularities. Its system model is also extensible to enable the definition of any new type of components. Architectural structure and elements are defined in accordance with this structure versioning framework and added into the system model to form an architectural system model. The tight integration of architectural and SCM concepts in our system model enables the version control and configuration management at both architecture and implementation levels via our product versioning SCM model. Molhado has been integrated into the Software Concordance (SC) development environment to provide several SCM supports.

Architectural SCM supports: A user can create a new project’s software architecture via either built-in tools or a description file written in xADL2.0. The user graphically manipulates the architecture and modifies properties, types, and constraints of architectural elements. To specify the implementations of architectural elements, the user can create new source code via built-in editors or import external programs into the system. The user is able to organize software artifacts into any logical structure depending on his chosen development paradigm. The user edits components via editors from SC, which supports program analyses, structural editing, hyperlinks, stylesheet-based presentations, and multimedia documentations. The user can capture the state of a project and commit changes at any time. While working on one version, the user is able to switch to work on other versions and any windows showing old versions (even uncaptured ones) are still available.

Fine-grained version control: Molhado can version any logical unit in a component. For example, it can capture the evolution of any syntactical unit in a Java program or any element in an XML or structured document. A set of structural comparison tools was developed to show differences between two arbitrary versions of a system’s hierarchical structure, of any component, and of any logical unit in both structural and line-oriented manners.

Versioned hypermedia traceability supports have been built on top of Molhado to improve software traceability at both architecture and implementation levels. Unlike HTML hyperlinks, in Molhado, traceability link networks are managed and versioned separately from component contents. Molhado not only supports versioning for traceability link networks but also for individual links.

Similar to software architecture, other development frameworks are also supported such as Web application development and UML-based OO development via the addition of new types of components and structures. To be compatible with commercial file-based SCM systems, Molhado provides supports for the logical document-directory organization of programs and documentations.