

Evolutionary Design of Complex Systems

Open Technology for Software Evolution: Hyperware, Architecture, and Process

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Technical Status Report

1. Ongoing Research and Development

1.1. Hyperware

Work on WebDAV continued in the reporting period with progress on the Advanced Collections, Versioning and Configuration Management (Delta-V), and Searching (DASL) protocols. Support for WebDAV continued to grow. Sharemation <<http://www.sharemation.com/>> announced the availability of a WebDAV-compliant storage site, where it is possible for anyone to sign up for free 20 Meg of storage in under 5 minutes. This was a big step forward for WebDAV, since it means that anyone can quickly get access to a WebDAV server to try out the protocol.

The first Macintosh WebDAV client, called Goliath, was announced on September 11th. It provides a Finder-like interface to a remote WebDAV server. Red Hat announced that they are bundling the mod_dav WebDAV support module for Apache in with their Apache Commerce Server product.

Chimera 3.0 was released by the University of Colorado at Boulder. This release refined the server and data models underlying Chimera 2.0.

This quarter saw steady improvement of the WebDAV Explorer. This included a number of bug fixes to the early release which corrected misimplemented servers. WebDAV Explorer provides an open source client application which has allowed commercial and non-commercial vendors to model client behavior of the WebDAV protocol and also for use as a debugging tool for their own WebDAV client applications.

The WebDAV team has increased development of initial prototypes and industry partnerships in order to further refine the protocol and to provide support for further development of the protocol in the DASL and Delta-V working groups. To this end, work has begun with Unisys in an attempt to combine a legacy system with WebDAV capabilities.

1.2. Software Architecture

During this period, Peyman Oreizy continued research on decentralized software evolution. As an evaluation exercise, he componentized a small portion of the Mozilla Web browser -- the open-source version of Netscape's Communicator Web browser -- by adding several software connectors to its architecture. Exposing Mozilla's software architecture to third-party developers allows them to change its functionality in ways that were not previously possible.

1.3. Process

Endeavors has been researching integration strategies with the latest event based architectures and tools. Recent CSCW tools (used to support the end users for work) provide rich event based communications and can be used as the integration mechanism for workflow systems. Endeavors is continuing to leverage and study the semantics of these event mechanisms for discovering and integrating process into everyday tools. This approach, consistent with the Endeavors design philosophy, lowers the cost of adoption and through Endeavors allows for better automation and

analysis of work. New web-based reusable components as well as refinements to existing components have been made to the Endeavors web-based process library called e-lib (Endeavors library). These tools allow process managers to easily assign web pages as work activities and provide seamless integration of the WWW activities and resources with process.

The process group is surveying the technologies and approaches that support adapting changes to workflow for changing work environments and process requirements. This also suggests approaches that assist in discovering problems and avoiding conflicts between the system and environment before they occur. The approaches are drawn from the literature of the respective communities as well as insights based on the development of the Endeavors workflow support system.

This quarter we began enhancing the scalability of Knowledge Depot to greater numbers and types of users. The new design will also allow greater flexibility in specifying relevant information, as well as in clustering the information together within a single notification. This will enable studies within the Open Source community and with user groups on the University campus in determining the exact benefits and potential of this system.

2. Participants

Faculty:

David Redmiles
David S. Rosenblum
Richard N. Taylor

Research Assistants:

Joachim Feise
Roy Fielding
Michael Guntersdorfer
David Hilbert
Arthur Hitomi
Peter Kammer
Michael Kantor
Rohit Khare
Rema Natarajan
Peyman Oreizy
Jason Robbins
Shilpa Shukla
Doris Tonne
Jaya Vaidyanathan
James Whitehead

Research Programmers:

Yuzo Kanomata
Kari Nies

3. Notable Accomplishments and Technology Transition

3.1. Hyperware

On July 16, Jim Whitehead presented a full day tutorial on WebDAV at DataChannel's xDev Developer Days which was attended by approximately 30 participants representing a range of development organizations including Xerox, Documentum, Xythos, and many others.

The paper "WebDAV: A network protocol for remote collaborative authoring on the Web" was presented at the 1999 European Conference on Computer Supported Cooperative Work (ECSCW'99), September 12-16 [WG99], and "Goals for a Configuration Management Network Protocol" was presented at the Ninth Int'l Symposium on System Configuration Management, September 5-7 [Whi99-2]. Jim also presented an update on WebDAV at the Open Hypermedia Workshop 5.5, September 17-19, and a presentation on Web collaboration systems at 3rd Nordic Interactive Multimedia Research School, September 8-11.

3.2. Software Architecture

A paper entitled, "Coping with Application Inconsistency in Decentralized Software Evolution" by Peyman Oreizy and Richard N. Taylor was accepted and presented to the International Workshop on the Principles of Software Evolution (IWPSE-2) on July 16 in Fukuoka, Japan [OT99].

A paper entitled, "Modeling Software Architectures in the Unified Modeling Language" by was Nenad Medvidovic, David S. Rosenblum, Jason E. Robbins, and David F. Redmiles was submitted to ACM Transactions of Software Engineering and Methodology [MRRR99].

3.3. Process

The Course Syllabus Process (CSP) has been deployed at UCI for the start of the school year. The CSP lets end users systematically design a course syllabus by following a prescribed process using the Endeavors process engine. If necessary, any task of the CSP can be assigned and routed to different people. Professors and lectures at the Irvine campus now use the CSP for their courses.

Patricha Collins, Shilpa Shukla, and David Redmiles submitted a paper entitled, "Activity Theory and System Design: A View from the Trenches" to the Computer-supported Cooperative Work, special issue on Activity Theory and the Practice of Design [CSR99].

Michael Kantor, David Redmiles, and Beatrix Zimmermann submitted a paper entitled, "Supporting Awareness and Coordination Between Groups" to Submitted a paper to Computer Human Interaction (CHI'2000) [KRZ99]. This paper is accessible as UCI Technical Report UCI-ICS-99-46.

Michael Kantor presented a talk entitled, "Enhancing Awareness and Coordination through Subscriptions" at the UCI Institute for Software Research (ISR) sponsored Bay Area Roundtable on Organizational Memory and Project Awareness on September 10th.

4. Publications

Papers that have been published or accepted for publication this quarter.

Peyman Oreizy and Richard N. Taylor. *Coping with Application Inconsistency in*

Decentralized Software Evolution. In Proceedings of the International Workshop on the Principles of Software Evolution (IWPSE-2). [OT99]

E. James Whitehead, Jr., Yaron Y. Goland, *WebDAV: A network protocol for remote collaborative authoring on the Web.* In Proceedings of the Sixth European Conference on Computer Supported Cooperative Work (ECSCW'99). [WG99]

E. James Whitehead, Jr. *Goals for a Configuration Management Network Protocol.* In Proceedings of the Ninth International Symposium on System Configuration Management (SCM-9). [Whi99-2]

5. Travel

Table 1: Project Meetings/Conferences and Attendance

Meeting	Location	Dates	Attendees
IETF 45th Preliminary Proceedings	Oslo Norway	July 11-16	RK
IWPSE-2	Japan	July 16	PO
Meet with DARPA program manager and NSF visit	Washington, D.C.	July 24-27	
DARPA/NIST/NSF Workshop on Research Issues in Smart Computing Environments	Atlanta, GA	July 25-26	DSR
O'Reilly Open Source Convention	Monterey, CA	August 21-24	JR
Ninth International Symposium on System Configuration Management	Toulouse, France	Sept 5-7	JW
European Software Engineering Conference (ESEC/FSE'99)	Toulouse, France	Sept 6-10	DSR, RT, JW
1999 European Conference on Computer Supported Cooperative Work (ECSCW'99),	Copenhagen, Denmark	Sept 12-16	JW
Open Hypermedia Workshop 5.5	Esbjerg, Denmark	Sept 17-19	JW

**Initials for attendees are based on the list of participants given on page 4.*

6. Near Term Plan

6.1. Hyperware

The WebDAV project will continue to encourage adoption and awareness of the protocol. Work will continue on the WebDAV Advanced Collections, Versioning and Configuration Management (DeltaV), and Searching (DASL) protocols. Jim Whitehead and Rohit Khare plan on attending the November IETF meeting, in Washington, DC.

6.2. Software Architecture

In the next quarter, we plan to continue development on ArchStudio 2.0, our extensible, integrated software architecture development environment. We hope to augment its XML-based shared repository to support hypertext linking, to integrate additional off-the-shelf software development tools, and to experiment with a new componentized, extensible graphical front-end for the environment.

6.3. Process

Future work in process will be on: Strategies for integrating all types of end user process tools (including CSCW tools that support ad hoc work), evolving the Endeavors process libraries (e-lib) and enhancing workflow analysis tools such as RealityCheck.

Exceptions in workflow arise from inconsistencies with the actual process or unexpected occurrences. Endeavors will focus on handling these occurrences through mechanisms identified in the survey work for supporting adaptive changes.

During the next three months Michael Kantor will finish up development of the new version of Knowledge Depot mentioned above, and begin two experiments to determine the impact of the system. The first study will be done within the computer science department to see if emailed summaries of bboard postings results in junk mail or contributes to people's awareness of the issues around them. The second study will be of an Open Source software project to study the impact of Knowledge Depot on work groups that communicate primarily over email.

References

- [CSR99] Patricha Collins, Shilpa V. Shukla, and David F. Redmiles. *Activity Theory and System Design: A View from the Trenches*. Submitted to Computer-supported Cooperative Work, special issue on Activity Theory and the Practice of Design.
- [KRZ99] Michael Kantor, David F. Redmiles, and Beatrix Zimmermann. *Supporting Awareness and Coordination Between Groups*. Submitted to Computer Human Interaction (CHI'2000) to be held in The Hague, Netherlands, April 1-6, 2000.
- [MRRR99] Nenad Medvidovic, David S. Rosenblum, Jason E. Robbins, and David F. Redmiles. *Modeling Software Architectures in the Unified Modeling Language*. Submitted to ACM Transactions of Software Engineering and Methodology.
- [OT99] Peyman Oreizy and Richard N. Taylor. *Coping with Application Inconsistency in Decentralized Software Evolution*. In Proceedings of the International Workshop on the Principles of Software Evolution (IWPSE-2), Fukuoka, Japan, July 16, 1999.
- [WG99] E. James Whitehead, Jr., Yaron Y. Goland, *WebDAV: A network protocol for remote collaborative authoring on the Web*. In Proceedings of the Sixth European Conference on Computer Supported Cooperative Work (ECSCW'99), Copenhagen, Denmark, September 12-16, 1999, pp. 291-310.
- [Whi99-2] E. James Whitehead, Jr. *Goals for a Configuration Management Network Protocol*. In Proceedings of the Ninth International Symposium on System Configuration Management (SCM-9), LNCS 1675, Toulouse, France on September 5-7, 1999, pp. 186-204.