

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

One of Chimera's goals is to support large scale distributed software engineering. In order to do this we have implemented the servers using Java byte-code in order to facilitate multiplatform use. We have addressed heterogeneity of data types and applications via our client integrations and API approach. This quarter's research has been spent investigating issues surrounding interoperability.

Our work involved work on porting Chimera to other platforms as well as supporting users experimenting with ports to other systems. Our work included refining our Linux port and tests of Chimera 2.0 on Windows 95, Windows 98, and Windows NT. From these tests, it was discovered that both Windows 95 and Windows 98 have incomplete Java Virtual Machine implementation available which limited the ability of Chimera 2.0 to be ported successfully onto these platforms. The tests have lead to further refinement of Chimera's servers and client applications on Linux and Windows NT.

In support of cross platform activities, a new client integration was completed and tested in-house. An integration with Adobe's Acrobat Reader for Unix based systems was completed using the plug-in capability of the software. An initial Windows implementation of the plug-in was begun this quarter as well.

Our experience gained from such activity was used to support a Linux based demonstration at the University of Colorado, and to our NT based demonstration at PACOM for the EDCS 1999 PI Dry Run Meeting in February.

These efforts support our work in linking heterogeneous applications (on now heterogeneous operating systems) within a distributed hypermedia network. Knowledge derived in our work can now be applied to tasks of deeper tool/application integrations using Chimera as the underlying information linking technology.

WebDAV work continued, with development work taking place to upgrade the WebDAV Explorer client to be fully compliant with the final WebDAV specification, RFC 2518, and to upgrade it to use the Java JDK 1.2 libraries. New WebDAV specifications were worked on as well, with UCI participation in the development of the Advanced Collections protocol (8 conference calls and 1 face to face meeting during the reporting period), and on the Versioning and Configuration Management protocol.

1.2. Software Architecture

Researchers attended the EDCS PI meeting in Honolulu, HI to give demos and discuss prospects for building an architecture workbench. We demoed UCI's integrated software architecture environment, ArchStudio, to two PACOM personnel. We discussed strategies for building an architecture workbench with other EDCS PIs.

A new version of Argo/UML was released with significant new functionality. New features include non-modal wizards that help designers correct the design problems identified by design critics and selection-action buttons that bring the appropriate toolbar buttons down into the main diagram editing area for faster and more convenient use.

We also conducted a user study of the “broom alignment tool” feature of Argo/UML. The study consisted of ten subjects who performed sample diagramming tasks using the broom alignment tool or standard alignment commands. The results of this study showed that the broom alignment tool required much less mouse movement and dragging, that users enjoyed using the broom tool, and that the short-term memory load required to use the broom was not significantly different from that of standard tools.

Jaya Vaidyanathan and Jason Robbins explored the use of HTML as a user interface prototyping medium. HTML is an attractive prototyping medium because many, high quality HTML editors are available and because the resulting prototypes emphasize elements of the design that is hard to express with paper prototypes, also HTML prototypes can be evaluated by remote subjects. An example user interface was prototyped and a prototyping method was outlined.

1.3. Process

Knowledge Depot has gained a new web based interface that has resulted in significant gains in usability over previous interfaces. It has also gained noticeably in speed. These two factors will make the system far more approachable to users, allowing us to better study the impact of the system on users.

2. Participants

Faculty:

David Redmiles
David S. Rosenblum
Richard N. Taylor
Kenneth M. Anderson (*University of Colorado at Boulder*)

Research Assistants:

Joe Feise
Roy Fielding
Michael Guntensdorfer
David Hilbert
Arthur Hitomi
Peter Kammer
Michael Kantor
Rohit Khare
Neno Medvidovic
Rema Natarajan
Peyman Oreizy
Jason Robbins
Shilpa Shukla
Doris Tonne

Jaya Vaidyanathan
James Whitehead

Research Programmers:

Clay Cover
Adam Gauthier
Yuzo Kanomata
Ed Kraemer
Kari Nies

3. Notable Accomplishments and Technology Transition

3.1. Hyperware

The WebDAV team took an important step to communicate the key results of the initial WebDAV activity to the broader academic community by submitting a conference paper to the European conference on Computer Supported Cooperative Work (ECSCW'99), which was accepted [WG99].

At the Hypertext'99 conference, held February 21-25, in Darmstadt, Germany, Jim Whitehead presented a tutorial on WebDAV titled "The Web as a Writable Collaborative Medium: An Introduction to the IETF WebDAV Standard," and also presented a talk on his paper, "Control Choices and Network Effects in Hypertext Systems"[Whi99]. At this conference, Ken Anderson also presented his paper entitled, "Data Scalability in Open Hypermedia Systems" [And99].

The WebDAV versioning and configuration management design team held a two-day meeting February 10-11, in Orem, Utah, hosted by Novell. The WebDAV Working Group held a meeting at 44th meeting of the Internet Engineering Task Force (IETF), March 17, Minneapolis, MN. The WebDAV versioning and configuration management design team also met in Minneapolis.

On February 10, the WebDAV Distributed Authoring Protocol standard was issued as Proposed Standard Request for Comments (RFC) 2518 [GW+99].

Several important technology transfer events for WebDAV culminated within the reporting period. Microsoft's Internet Explorer web browser, version 5, shipped with WebDAV support. On February 2, the WebDAV Resources web site (<http://www.webdav.org>) went live. This Web site is maintained by Greg Stein, an independent software developer, and is indicative of the growing support for this standard. A WebDAV module for the Apache Web server (the module is called "mod_dav") was released in beta form, as part of ongoing development. Zope, the "Z Object Publishing Environment" (<http://www.zope.org>), a product of Digital Creations, also announced their support for WebDAV during the reporting period. These are expected to be the first of many corporations announcing their support for the WebDAV standard.

Roy Fielding was invited to the Open Source and Community Licensing Summit in San Jose, California, on March 5th and gave a talk on the techniques for globally-distributed, collaborative software development used by the Apache project. The summit meeting was attended by the leaders of approximately twenty open source projects, six commercial Linux distributors, IBM, Hewlett Packard, Netscape, Sun Microsystems, SGI, Intel, Oracle, Informix, and a representative from the

White House.

Chimera was demoed to PACOM at the February PI Dry Run Meeting in Honolulu, Hawaii.

3.2. Software Architecture

Peyman Oreizy submitted a paper to the Seventh Symposium on the Foundations of Software Engineering (FSE-7) entitled “An Evaluation Framework for Comparing Approaches to Decentralized Software Evolution”. The paper describes a framework for comparing different approaches to software evolution by third-party developers [Ore99].

Two papers on Argo/UML were submitted and accepted this quarter. The paper entitled “Sweeping Away Disorder with the Broom Alignment Tool” by Jason Robbins, Michael Kantor, and David Redmiles was submitted and accepted to the 1999 Conference on Human Factors in Computing Systems (CHI’99) [RKR99]. Also, the paper “Cognitive support, UML Adherence, and XMI Interchange in Argo/UML” by Jason Robbins and David Redmiles was submitted and accepted to the 1999 Symposium on the Construction of Software Engineering Tools (CoSET’99) [RR99].

The paper “Using HTML to Create Early Prototypes” by Jaya Vaidyanathan, Jason Robbins, and David Redmiles was submitted and accepted to the 1999 Conference on Human Factors in Computing Systems(CHI’99) [VRR99].

3.3. Process

A paper entitled, “Techniques for Supporting Dynamic and Adaptive Workflow” by Peter Kammer, Greg Bolcer, Richard N. Taylor, and Mark Bergman was accepted for publication in the Journal of Computer Supported Cooperative Work [KBTB99].

A paper entitled, “Putting Words to Work: Integrating Conversation with Workflow Modeling” by Peter J. Kammer and David W. McDonald. was submitted to the European Conference of Computer Supported Cooperative Work (ECSCW’99) [KM99].

A paper entitled, “SWAP: Leveraging the Web to Manage Workflow.” by Gregory Alan Bolcer and Gail Kaiser appeared in IEEE Internet Computing [BK99].

A paper entitled, “Information Awareness Through Subscriptions” by Michael Kantor, David F. Redmiles, and Beatrix Zimmermann was submitted to CHI’99 [KRZ99].

4. Publications

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

Kenneth M. Anderson. *Data Scalability in Open Hypermedia Systems*. In Proceedings of the ACM Hypertext ‘99 Conference. [And99]

Gregory Alan Bolcer and Gail Kaiser. *SWAP: Leveraging the Web to Manage Workflow*. IEEE Internet Computing, vol. 3, no. 1, Jan-Feb, 1999. [BK99]

Peter Kammer, Greg Bolcer, Richard N. Taylor, and Mark Bergman. *Techniques for Supporting Dynamic and Adaptive Workflow*. To appear in the Journal of

Computer Supported Cooperative Work. [KBTB99]

Jason Robbins, Michael Kantor, and David Redmiles. *Sweeping Away Disorder with the Broom Alignment Tool*. To appear in Proceedings of the 1999 Conference on Human Factors in Computing Systems (CHI'99). [RKR99]

Jason Robbins and David Redmiles. *Cognitive support, UML Adherence, and XMI Interchange in Argo/UML*. To appear in Proceedings of the 1999 Symposium on the Construction of Software Engineering Tools (CoSET'99). [RR99]

Jaya Vaidyanathan, Jason Robbins, and David Redmiles. *Using HTML to Create Early Prototypes*. To appear in Proceedings of the 1999 Conference on Human Factors in Computing Systems(CHI'99). [VRR99]

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

E. James Whitehead, Jr. *Control Choices and Network Effects in Hypertext Systems*. In Proceedings of the ACM Hypertext '99 Conference, Darmstadt, Germany, February 21-25, 1999. [Whi99]

5. Travel

Table 1: Project Meetings/Conferences and Attendance

Meeting	Location	Dates	Attendees
International Conference on Intelligent User Interfaces, IUI'99	Redondo Beach, CA	Jan 5-8	DR, JV
EDCS PI Meeting	Honolulu, HI	Feb 1-3	DR, RT, YK, PO
WebDAV Versioning and Configuration Management design team meeting	Novell Orem, Utah	Feb 10-11	JW
Hypertext'99	Darmstadt, Germany	Feb 21-25	JW
Work Activities Coordination and Collaboration, WACC'99	San Francisco, CA	Feb 22-25	DR, GB, AH, MK, PK, SS
Sriram Sankar, Metamata, Inc. Talk at UCI	UC Irvine, CA	Mar 3-6	
O'Reilly & Associates Open Source and Community Licensing Summit	San Jose, CA	Mar 5	RF

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Meeting	Location	Dates	Attendees
44th Internet Engineering Task Force Meeting	Minneapolis, MN	Mar 15-18	RK, JW
NIST ADL Workshop	Gaithersburg, MD	Mar 24-25	RT
Software Program Managers Network	Fairfax, VA	Mar 26	RT

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

6. Near Term Plans

6.1. Hyperware

In support of Chimera's capability to link heterogeneous applications, the Chimera project at UCI will be integrating hypermedia features into more complex software tools. An integration with ARGO/UML is planned to be released and demoed for the June EDCS Demo Days.

In the next quarter, plans are to complete and release the WebDAV Explorer client to the public, and make its code available for open source development. Work on a second WebDAV client, the WebDAV Posties (a collaborative Post-It Note application), will also take place. A paper describing goals and preliminary work on the WebDAV Versioning and Configuration Management protocol will be written and submitted to the 9th Systems Configuration Management symposium (SCM-9). A presentation on WebDAV will be given at the Software Technology Conference (STC) on May 6th. Work will continue on the WebDAV Advanced Collections protocol, and the Versioning and Configuration Management protocol.

6.2. Software Architecture

In the coming months, we plan to integrate a number of software architecture-related technologies into TIIDE, The Irvine Integrated Development Environment, for demonstration at the EDCS Demo Days in Arlington, VA. The environment will include ArchStudio, our design environment and dynamic architecture tools, DRADEL, our specification-time architecture analysis and code generation tools, and Argo/UML, our component design tool based on UML.

Near-term efforts on the Argo/UML tool will focus on evaluating and documenting the tool's cognitive support features. In the next quarter, Jason Robbins will be working completing his dissertation and presenting some of the conference papers accepted this quarter. We will also prepare a demonstration of Argo/UML for EDCS Demo Days.

6.3. Process

We will be working on customizing Endeavors in such a way that it is easy to implement cross-organizational, cooperating workflow processes using Internet protocols such as SWAP and intermediate data formats such as XML. We plan to build a component that can be embedded in arbi-

trary software systems that allows remote automated workflow participation.

Ongoing research and development on Endeavors will also include mechanisms to leverage reactive workflow capabilities to support dynamic and ad hoc expression of work practice as it occurs, integrating these capabilities with existing work models.

During the next three months, the Knowledge Depot user interface will be further refined, the system will be integrated with a database capable of handling significantly larger quantities of data. Other changes to the system will include redesigning the server to better match the new user interface. We are currently getting our first group of serious users from a local software company, and will hopefully add more as time passes. This time period will also include a trip to Arlington for the EDCS demo days, a trip to New York to study users of the Lotus Notes version of the system, and a paper will be submitted to Group'99.

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- [And99] Kenneth M. Anderson. *Data Scalability in Open Hypermedia Systems*. To appear in Proceedings of the ACM Hypertext '99 Conference
- [BK99] Gregory Alan Bolcer and Gail Kaiser. *SWAP: Leveraging the Web to Manage Workflow*. IEEE Internet Computing, vol. 3, no. 1, Jan-Feb, 1999.
- [GW+99] Y. Goland, E. Whitehead, A. Faizi, S. Carter, and D. Jensen. *HTTP Extensions for Distributed Authoring -- WEBDAV*. Internet Proposed Standard Request for Comments 2518. February, 1999.
- [KBTB99] Peter Kammer, Greg Bolcer, Richard N. Taylor, and Mark Bergman. *Techniques for Supporting Dynamic and Adaptive Workflow*. To appear in the Journal of Computer Supported Cooperative Work.
- [KM99] Peter J. Kammer and David W. McDonald. *Putting Words to Work: Integrating Conversation with Workflow Modeling*. Submitted to the European Conference of Computer Supported Cooperative Work (ECSCW'99) to be held in Copenhagen, Denmark on September 12-16, 1999.
- [KRZ99] Michael Kantor, David F. Redmiles, and Beatrix Zimmermann. *Information Awareness Through Subscriptions*. Submitted to the 1999 Conference on Human Factors in Computing Systems(CHI'99).
- [Ore99] Peyman Oreizy. *An Evaluation Framework for Comparing Approaches to Decentralized Software Evolution*. Submitted to the Seventh Symposium on the Foundations of Software Engineering (FSE-7).
- [RKR99] Jason Robbins, Michael Kantor, and David Redmiles. *Sweeping Away Disorder with the Broom Alignment Tool*. To appear in Proceedings of the 1999 Conference on Human Factors in Computing Systems (CHI'99).
- [RR99] Jason Robbins and David Redmiles. *Cognitive support, UML Adherence, and XMI Interchange in Argo/UML*. To appear in Proceedings of the 1999 Symposium on the Construction of Software Engineering Tools (CoSET'99).
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- [Whi99] E. James Whitehead, Jr. *Control Choices and Network Effects in Hypertext Systems*. In Proceedings of the ACM Hypertext '99 Conference, Darmstadt, Germany, February 21-25, 1999, pp. 75-82.