

# Evolutionary Design of Complex Systems

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

### Quarterly Report Volume 1, Number 3

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# Technical Status Report

## 1. Ongoing Research and Development

### 1.1. Hyperware

A final alpha candidate for Chimera 2.0 was released on August 30th. This version has the ability to import and export hyperwebs which was a feature requested by Northrop after their experience with Chimera 1.0. This ability to store and read hyperwebs from external text files makes repairing a hyperweb database easier in the case of corruption, and also allows a minimal form of configuration management since the exported text files can be stored in a configuration management system such as RCS or Continuous. Also as a result of a Northrop request, all external dependencies of Chimera with 3rd party code has been removed as of this release. This was done since Northrop was not permitted under their contract to download or use binaries (i.e. Java class files) from sites other than UCI.

Ken Anderson participated in the Open Hypermedia Working Group 3.5 meeting which discussed and designed the next version of the Open Hypermedia Protocol (OHP). The OHP is an attempt to enable client interoperability with open hypermedia systems. In other words, you can have a client implement the OHP and then be able to obtain hypermedia services with any OHP-compliant hypermedia system. UCI is participating in this process because it has the potential to become an IETF standard for open hypermedia (similar to how WebDAV is defining a standard for Web-based authoring and versioning). Ken was there to contribute UCI's requirements into the discussion and to ensure that Chimera can become OHP-compliant in the future. The meeting was highly productive in that a component-based approach to specifying and implementing the OHP was adopted and service definitions were created using CORBA's Interface Definition Language. Component technologies, such as JavaBeans and CORBA, are now being evaluated as candidates as the component framework for OHP.

The WebDAV working group finished work on its requirements document, "Requirements for a Distributed Authoring and Versioning Protocol for the World Wide Web," and has submitted it to the Internet Engineering Steering Group (IESG) for publication as an Informational Request for Comments (RFC) [SVWD97].

The WebDAV working group also submitted 2 revisions of its protocol document, "Extensions for Distributed Authoring and Versioning on the World Wide Web." Work continues on this document as the working group converges on the final specification for performing distributed authoring and versioning on the Web [GWF+97].

Development has begun on a reference implementation of the WebDAV protocol. This implementation extends the existing Jigsaw java-based HTTP server with WebDAV functionality.

### 1.2. Software Architecture

During this quarter, research was conducted in comparing various approaches to runtime software evolution. Runtime software evolution is practical for mission-critical software systems as a means of alleviating the significant costs and risks associated with shutting down and restarting

these systems during upgrades. Included in our comparison, was UCI's architecture-based approach. The results have been submitted for publication [OMT97].

In this quarter we implemented a simple logistics system to demonstrate our dynamic architecture technology. Our logistics system, a cargo routing system, assists personnel in the task of routing cargo from a set of incoming ports to destination warehouses by way of transportation vehicles. The system is unique in that new system updates or bug fixes, provided by the application vendor, may be applied to the system during runtime. We demonstrate this concept by installing an automated planning component, which uses heuristics to suggest optimal cargo routing, during runtime. Without our dynamic architecture technology, system operators would have to stop the system, install the software update, and rerun the system. Our technology helps avoid costly downtime in mission-critical systems.

We have been revising the design and implementation of the Argo software architecture design environment to make it more efficient and flexible, and to ease integration with design tools implemented in Java. In addition, a survey of design critiquing systems is underway.

### 1.3. Process

#### 1.3.1. Process Support

We are currently exploring support and enriching the Endeavors execution model by including automated and constraint based execution of activities. We have segmented this task into two parts: First, integrating Endeavors with another rule based process system and second, by extending the existing Endeavors infrastructure for automation and constraint support. Many current Endeavors processes can immediately benefit from this functionality. For example, a time-constrained activity can allow Endeavors to automatically notify the participants of the activity that they are running out of time. This mechanism provides assurance to Process programmers and end users for certain process rules to be always enforced.

Endeavors is investigating alternative storage mechanisms to 1) Provide management and control of legacy data stores, 2) Generate process data that is manageable by third party tools 3) Optimize data storage and retrieval mechanisms 4) Allow for enhanced functionality provided by alternate storage mechanisms.

To achieve these goals, we are currently investigating and installing Mini SQL, Oracle, Informix, SimpleText JDBC, Object Store ODBMS and PSE using Object and Relational Database Management methods and techniques for alternative storage and distribution. So far, mSQL and Simple text databases have been installed and example tables created that show the feasibility of the relational database model as a storage mechanism. A Bug Tracking process that is currently being implemented in Endeavors will be one of the first processes to highlight some of the new features of the alternative storage mechanism.

The Endeavors HTTP server, the main mechanism used to provide distributed workflow, is being used and supported heavily under the JavaTrain and ADG process. The system has undergone several bug fixes and additional support for distributed processes. The server is now converted, tested, and executes under the JDK 1.1 environment.

Most of Endeavors has been converted to execute under the JDK/1.1 environment. The full con-

version of Endeavors will allow newer technologies to be integrated with Endeavors.

### 1.3.2. Active Agents

The EDEM redesign to allow generic monitoring of JavaBeans events has been extended to allow arbitrary, externally generated events to be passed to EDEM for processing.

We are continuing our survey of existing approaches/technologies/methodologies for collecting usage data.

## 2. Participants

### *Faculty:*

David Redmiles  
David S. Rosenblum  
Richard N. Taylor

### *Research Programmers:*

Clay Cover  
Arthur Hitomi  
Yuzo Kanomata  
Edwin Kraemer  
Kari Nies

### *Research Assistants:*

Ken Anderson  
Gregory Bolcer  
Roy Fielding  
David Hilbert  
Peter Kammer  
Michael Kantor  
Neno Medvidovic  
Peyman Oreizy  
Jason Robbins  
Shilpa Shukla  
James Whitehead

## 3. Notable Accomplishments and Technology Transition

### 3.1. Hyperware

A paper titled "A Critique of the Open Hypermedia Protocol." was accepted for publication in the Journal of Digital Information for the special issue on open hypermedia systems [ATW97]. This is an on-line journal located at <http://jodi.ecs.soton.ac.uk/>.

A final alpha candidate for Chimera 2.0 was released on August 30th.

A meeting of the WEBDAV Working Group was held on July 14-15, 1997 at the Orem, Utah cam-

pus of Novell. The purpose of this meeting was to provide a detailed review of the protocol specification, resolve open issues in the requirements document, and discuss the interim access control requirements draft. The meeting was attended by 26 people from Microsoft, Netscape, Novell, Xerox, Canon, Eastman Software, PC Docs, NTT Labs, and U.C. Irvine. Details of this meeting can be found at: <http://www.ics.uci.edu/~ejw/authoring/orem/>.

Another meeting of the WEBDAV Working Group was held August 11, 1997 at the Munich IETF general meeting. The purpose of this meeting was to introduce the design of the properties, collections, and namespace operations aspects of the protocol specification, draft-ietf-webdav-protocol-01.txt. Selected issues relating to properties and collections were presented and discussed. Over the duration of the meeting there were 54 attendees. Details of this meeting can be found at: <http://www.ics.uci.edu/~ejw/authoring/munich/>.

Finally, a design review meeting was held at the World Wide Web Consortium on September 10, 1997. The purpose of this review was to brief the staff of the W3C on the work performed to date on the WebDAV protocol, and to provide a forum for technical feedback.

### 3.2. Software Architecture

UCI's Architecture tools were demonstrated at the 2nd Annual EDCS Meeting in Seattle, WA. Demonstrations were given to many attendees and several EDCS PIs. We demonstrated UCI's architecture technology, specifically, techniques for upgrading long-running mission-critical software system during runtime. Our technology alleviates many of the costs and risks associated with shutting down and restarting these critical systems, without sacrificing system integrity.

Nenad Medvidovic presented a paper titled "A Framework for Classifying and Comparing Architecture Description Languages" at the Sixth European Software Engineering Conference together with Fifth ACM SIGSOFT Symposium on the Foundations of Software Engineering, [MT97-3].

The results of our comparison of runtime software evolution approaches were submitted to the 1998 International Conference on Software Engineering Conference in a paper entitled "Architecture-Based Runtime Software Evolution" [OMT97].

A paper entitled, "Architectural Domains: A Framework for Characterizing Architectural Description" was accepted to the USENIX Conference on Domain-Specific Languages. [NR97]

A paper entitled, "Adequate Testing of Component-Based Software" was released as a UCI Technical Report [Ros97].

A survey of GEF users was began on the GEF website ([www.ics.uci.edu/pub/arch/gef](http://www.ics.uci.edu/pub/arch/gef)).

A paper was submitted and accepted to the 1997 California Software Symposium [RRR97]. The content of the paper was an example of how a standard design notation, the Unified Modeling Language (UML), could be used to represent C2 architectural designs. For more on UML see [www.rational.com/uml](http://www.rational.com/uml).

A paper submitted to the International Journal of Automated Software Engineering was accepted and revised for final publication [RHR96-5].

A formal demonstration paper on the Argo software architecture design environment was accepted to the 1998 conference on Intelligent User Interfaces (IUI'98) [RHR97-2].

A paper was submitted to the 1998 International Conference on Software Engineering. The content of the paper was a discussion and examples of how a standard design notation, the Unified Modeling Language (UML), could be used to represent C2 and Wright architectural designs. The paper is still in review [RMRR97].

The Argo software architecture design environment was demonstrated at the 2nd Annual EDCS Meeting in Seattle, WA.

Tarak Goradia (tarak@scr.siemens.com) of Siemens Corporate Research expressed interest in using GEF and Argo for a commercial database design tool. Zoltan Gassmann (zga@fast.de) of the FAST research consortia expressed interest in using GEF and Argo for an object-oriented design tool. Howard Mullings (HMULLING@us.oracle.com) of Oracle expressed interest in using GEF for a commercial database design tool. Jack Park (jackpark@thinkalong.com) of ThinkAlong expressed interest in using Argo to develop a financial trading advisor application. Steve Bush (bushsf@crd.ge.com) of General Electric Corporate R&D expressed interest in using GEF for a network optimization application. Tom Maxwell (maxwell@kabir.cbl.cees.edu) of the University of Maryland Institute for Ecological Economics expressed interest in using GEF as a front end to a supercomputing and scientific visualization application.

### 3.3. Process

#### 3.3.1. Process Support

Arthur Hitomi visited Netscape to install Endeavors. Netscape is considering to use Endeavors as their core workflow technology. Endeavors was one of few technologies considered for integration of workflow into their next generation web browser.

A paper entitled “Supporting Distributed Workflow Using HTTP” was submitted for consideration for the International Conference on Software Engineering. This paper describes the use of HTTP to provide support from distribution in Endeavors [KBTH97].

Gregory Alan Bolcer compiled comprehensive comparison of 16 different Process/Workflow products in 70 categories in a condensed matrix form (see <http://www.ics.uci.edu/pub/endeavors/docs/ComparisonMatrix.pdf>). Some of the products compared includes Spade, Lotus Notes, and FileNet Visual Workflow.

The second phase of the Sun Microsystems’ Java Train training development system has been delivered as a beta proof of concept release. A series of collection forms have been designed and implemented sufficiently to allow a user with little training to develop a complete training course for Endeavors. Java Train can include visual aids such as gif graphics or Java Applets and create True false, Multiple Choice, and Match Word type “questions”. Courses are easily created and presented over the WWW through Endeavors.

The Second Phase of the Pacific Bell Applications Development Group (ADG) process has been delivered to Ray Licon of Pacific Bell. Licon presented the ADG using Endeavors in an executive meeting where he demonstrated how Endeavors creates, executes, and maintains workflow processes. The results of this meeting has initiated Endeavors to be used as the solution technology for the ADG organization, which authorizes all of Pacific Bell internal software development projects.

Shilpa Shukla (currently at Apple) with mentor Bonnie Nardi is considering implementing Apple's bug tracking system entirely in Endeavors.

Nancy Perry, research scientist from MCC, investigated Endeavors with two other workflow technologies for a presentation.

A. Winsor Brown is using Endeavors to implement the PSP. Brown will be presenting the PSP at the California Software Symposium by using Endeavors to map the PSP process and by integrating PSP tools.

### 3.3.2. Active Agents

EDEM was successfully integrated by Lockheed Martin C2 Integration Systems into the Global Transportation Network (GTN) demo scenario and demonstrated at the Second Annual EDCS Demo Days in Seattle. EDEM was also independently demonstrated at this meeting.

An EDEM demo paper was accepted to the 1998 Conference on Intelligent User Interfaces (IUI98) [HRR97-2].

An EDEM paper was submitted to the 1998 International Conference on Software Engineering (ICSE'98) [HR97].

An EDEM paper was submitted to the 1998 Conference on Autonomous Agents (Agents'98).

## 4. Progress on Inter/Intra Cluster Collaborations

### 4.1. Hyperware

Plans have been put into place to integrate Columbia's Rivendell Tool Server with Chimera 2.0 and to examine the potential use of Columbia's Pern Transaction Manager in the Chimera 2.0 hyperweb server. This integration and evaluation will be performed at the upcoming October EDCS DM cluster meeting at UCI.

### 4.2. Software Architecture

Demonstrated UCI's Architecture tools at the 2nd Annual EDCS Meeting in Seattle, WA. Demonstrations were given to attendees, and several EDCS PIs, including Lori Clarke (UMass) and Paul Hudak (Yale).

In mid-September the latest build of the ArchStudio tool suite was sent to Stephen Dai at Northrop Grumman (Greg Johnson manager). Northrop Grumman's B-2 simulation environment project is applying UCI's architecture technology as a means to facilitate tool integration and reconfiguration of their B-2 simulation environment. This would enable, for example, the swapping of two behaviorally equivalent software emulators, each of which models a complex component at different levels of abstraction, during a long-running simulation. Similarly, new visualization and debugging tools to be added to the environment.

During the EDCS Demo Days, Neno Medvidovic had a preliminary meeting with Don Batory

from the Architecture/Generation cluster to analyze the similarities and differences between our two technologies (GenVoca from UT Austin and C2 from UC Irvine) and assess the possibility of collaboration. A longer meeting is to follow in November.

### 4.3. Process

#### 4.3.1. Process Support

The ongoing research for exploring support for enriching Endeavors execution model to include automated and constraint based execution of activities will use Amber as the rule base language and system. Amber is the rule-based process engine developed by Gail Kaiser as part of the OzWeb project at Columbia University (Design Management cluster).

#### 4.3.2. Active Agents

Plans are currently underway with Lockheed Martin C2 Integration Systems to enhance EDEM to provide more advanced support for the GTN scenario. Contacts are Teri Paton and Lyn Uzzle (EDCS Integrators).

Technical plans and contractual negotiations are underway with Computing Services Support Solutions (CS3), regarding integration of EDEM with their FLEA/SoMoS System. Contact is K. Narayanaswamy (Rationale Capture cluster).

Discussions with CoGenTex are underway regarding a possible integration of EDEM with work they have been doing on intelligent and adaptive user interfaces. Contact is Michael White (Design Management cluster).

## 5. Publications

Kenneth M. Anderson, Richard N. Taylor, and E. James Whitehead, Jr. *A Critique of the Open Hypermedia Protocol*. To appear in the Journal of Digital Information for a special issue on open hypermedia systems. [ATW97]

David M. Hilbert, Jason E. Robbins, and David F. Redmiles. *EDEM: Intelligent Agents for Collecting Usage Data and Increasing User Involvement in Development*. To appear in the 1998 Conference on Intelligent User Interfaces. [HRR97-2]

Nenad Medvidovic, Richard N. Taylor. *A framework for classifying and comparing architecture description languages*. Proceedings of the Sixth European Software Engineering Conference, to be held in conjunction with the Fifth ACM SIGSOFT Symposium on the Foundations of Software Engineering (ESEC/FSE). Zurich, Switzerland, September 22-25, 1997. [MT97-3]

Nenad Medvidovic and David S. Rosenblum. *Architectural Domains: A Framework for Characterizing Architectural Description*. To Appear in the USENIX Conference on Domain-Specific Languages. [MR97]

Jason E. Robbins, David M. Hilbert, David F. Redmiles. *Extending design environments to software architecture design*. To appear in the International

Journal of Automated Software Engineering. [RHR96-5]

Jason E. Robbins, David M. Hilbert, and David F. Redmiles. *Software Architecture Critics in Argo*. To appear in the 1998 Conference on Intelligent User Interfaces. [RHR97-2]

David S. Rosenblum. *Adequate Testing of Component-Based Software*. Department of Information and Computer Science, University of California, Irvine, Technical Report 97-35, Sep. 1997. [Ros97]

Jason E. Robbins, David F. Redmiles, and David S. Rosenblum. *Integrating C2 with the Unified Modeling Language*. Proceedings of the 1997 California Software Symposium. [RRR97]

## 6. Travel

**Table 1: Project Meetings/Conferences and Attendance**

Meeting	Location	Dates	Attendees
Process/Workflow Technology Workshop	Nancy, France	July 5-12	RT
WebDAV Working Group Meeting	Novell Orem, Utah	July 14-15	JW
EDCS Annual meeting and Demo Days and Workshops	Seattle, WA	July 21-25	DR, DSR, RT, AH, KA, DH, MK, NM, PO
Meeting with Microsoft regarding WebDAV	Seattle, WA	July 25	JW
PC Meeting for the Automated SW Eng. Conf.	NASA/Ames	August 8	DR
WebDAV Working Group Meeting	Munich, Germany	August 11	JW
Software Engineering Symposium (panel participant)	Pittsburgh, PA	August 25-27	DR
Meeting with Netscape, Endeavors installation	Mountain View, CA	August 27	AH
Open Hypermedia Working Group	Aarhus, Denmark	Sept 7-11	KA
ICECCS'97	Villa Olmo, Italy	Sept 8-12	RT
Javastation Training Session at Sun Microsystems	Milpitas, CA	Sept 8-12	CC, AH, EK, KN

**Table 1: Project Meetings/Conferences and Attendance**

<b>Meeting</b>	<b>Location</b>	<b>Dates</b>	<b>Attendees</b>
WebDAV Design Review Meeting	W3 Consortium Cambridge, MA	Sept 10	JW
ESEC/FSE	Zurich, Switzerland	Sept 22-25	RT, NM

*\*Initials for attendees are based on the list of participants given on page 5.*

## **7. Near Term Plans**

### **7.1. Hyperware**

Work is beginning on developing a general plug-in mechanism to Chimera 2.0 servers. These plug-ins will be used to provide a configurable set of link traversal algorithms in the Chimera server and database consistency mechanisms in the hyperweb server. In addition, the ability to create links which span hyperwebs and websites will be implemented. Finally, we will begin work on allowing Java applets to provide an interface for as well as guide aspects of Chimera link traversals.

The WebDAV working group will continue to work on finalizing its protocol specification, and anticipates releasing several drafts in the upcoming quarter. The requirements document will also be released as an RFC during the fourth quarter. Work will also continue on the development of the WebDAV reference server implementation.

The next meeting of the WebDAV working group will be held in Washington, DC, at the December IETF meeting, during the week of December 8-12, 1997.

### **7.2. Software Architecture**

We will be furthering the development of UCI's architecture-based runtime software modification tools, including (1) a mechanism for supporting the incorporation of external analysis tools, and (2) a graphical user interface for configuring an evolving application which is appropriate for end-users.

In the near term, Neno Medvidovic and Peyman Oreizy will be attending the EDCS Architecture Cluster Workshop in Austin, Texas. Afterwards, Neno Medvidovic will be spending a couple of days with Don Batory's group at the University of Texas. He will also be investigating off-the-shelf component interconnection technologies for use as connectors in software architectures, specifically in the context of UCI's C2 style.

Work on software architecture environments will focus on applying the Argo infrastructure to the domain of object-oriented software architecture using the UML notation. Jason Robbins will continue a survey of design critiquing systems. Critiquing systems are knowledge-based software tools that support designers by giving advice about potential errors, incomplete parts of the design, the implications of design decisions, and possible design alternatives. The Argo design environment has a critiquing system as one of its major features.

## 7.3. Process

### 7.3.1. Process Support

Integration of Endeavors with the Rational Rose Java design tool is currently being considered.

Java Train will have more features to support distance learning and integration of third party tools. The conversion from the JDK/1.0.2 to JDK/1.1.4 is currently underway.

New user interfaces using the JDK/1.1 toolkit are currently being implemented to take advantage of new user interface features found within the new development toolkit. Additional new and updated user interfaces will also allow us to leverage some of the new process support functionality of the restructured architecture provided during the last quarter.

C2 will be integrated with Endeavors to become the main event mechanism.

### 7.3.2. Active Agents

In the following quarter David Hilbert is planning to complete his survey of existing approaches/technologies/methodologies for collecting usage data as well as the EDEM redesign.

We plan to work with several EDCS contractors at the upcoming October cross-cluster meeting. This includes Lockheed Martin C2 Integration Systems to provide enhancements to EDEM to further support the GTN scenario, Computing Services Support Solutions (CS3) to integrate EDEM with the FLEA/SoMoS system, and CoGenTex to integrate EDEM with their work on intelligent and adaptive user interfaces.

## References

- [ATW97] Kenneth M. Anderson, Richard N. Taylor, and E. James Whitehead, Jr. *A Critique of the Open Hypermedia Protocol*. To appear in the Journal of Digital Information for a special issue on open hypermedia systems.
- [GWF+97] Y.Y. Goland, E.J. Whitehead, Jr., A. Faizi, S. R. Carter, D. Jensen. *Extensions for Distributed Authoring and Versioning on the World Wide Web*. Internet-Draft, work-in-progress, <draft-ietf-webdav-protocol-03.txt>. ftp://ds.internic.net/internet-drafts/draft-ietf-webdav-protocol-03.txt
- [HR97] David M. Hilbert and David F. Redmiles. *An Approach to Large-Scale Collection of Application Usage Data Over the Internet*. Submitted to the 1998 International Conference on Software Engineering.
- [HR97-2] David M. Hilbert, David F. Redmiles. *Agents for Collecting Application Usage Data Over the Internet*. Submitted to the 1998 Autonomous Agents Conference (Agents'98).
- [HRR97-2] David M. Hilbert, Jason E. Robbins, and David F. Redmiles. *EDEM: Intelligent Agents for Collecting Usage Data and Increasing User Involvement in Development*. To appear in the 1998 Conference on Intelligent User Interfaces.
- [KBTH97] Peter J. Kammer, Gregory Alan Bolcer, Richard N. Taylor, and Arthur S. Hitomi. *Supporting Distributed Workflow Using HTTP*. Submitted to the 1998 International Conference on Software Engineering.
- [MR97] Nenad Medvidovic and David S. Rosenblum. *Architectural Domains: A Framework for Characterizing Architectural Description*. To appear in the USENIX Conference on Domain-Specific Languages.
- [MT97-2] Nenad Medvidovic and Richard N. Taylor. *Exploiting architectural style to develop a family of applications*. To appear in IEE Proceedings Software Engineering, England, 1996.
- [MT97-3] Nenad Medvidovic, Richard N. Taylor. *A framework for classifying and comparing architecture description languages*. Proceedings of the Sixth European Software Engineering Conference, to be held in conjunction with the Fifth ACM SIGSOFT Symposium on the Foundations of Software Engineering (ESEC/FSE). Zurich, Switzerland, September 22-25, 1997.
- [OMT97] Peyman Oreizy, Nenad Medvidovic, and Richard N. Taylor. *Architecture-Based Runtime Software*. Submitted to the 1998 International Conference on Software Engineering.
- [RHR96-5] Jason E. Robbins, David M. Hilbert, David F. Redmiles. *Extending design environments to software architecture design*. Submitted to the International Journal of Automated Software Engineering.
- [RHR97-2] Jason E. Robbins, David M. Hilbert, and David F. Redmiles. *Software Architecture Critics in Argo*. To appear in the 1998 Conference on Intelligent User Interfaces.
- [RMRR97] Jason E. Robbins, Nenad Medvidovic, David F. Redmiles, and David S. Rosenblum.

*Integrating Architecture Description Languages with a Standard Design Method.* Submitted to the 1998 International Conference on Software Engineering.

- [RRR97] Jason E. Robbins, David F. Redmiles, and David S. Rosenblum. *Integrating C2 with the Unified Modeling Language.* Proceedings of the 1997 California Software Symposium.
- [Ros97] David S. Rosenblum. *Adequate Testing of Component-Based Software.* Department of Information and Computer Science, University of California, Irvine, Technical Report 97-35, Sep. 1997.
- [SNR97] Shilpa V. Shukla, Bonnie A. Nardi, and David F. Redmiles. *Beta Blockers and Hot Potatoes: Redefining Artifacts in Sociotechnical Design.* Submitted to the 1998 Conference on Human Factors in Computing Systems (CHI'98).
- [SVWD97] J.A. Slein, F. Vitali, E.J. Whitehead, Jr., D.G. Durand. *Requirements for distributed authoring and versioning on the World Wide Web.* Internet-Draft, work-in-progress, <draft-ietf-webdav-requirements-03.txt>. <ftp://ds.internic.net/internet-drafts/draft-ietf-webdav-requirements-03.txt>