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USING COLLABORATIVE TOOLS IN NEESGRID

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SUMMARY

The CHEF collaboration toolkit allows the development of rich web-based collaborative applications such as a course management system or small group-collaboration. The CHEF environment uses portal technology from the Jakarta Jetspeed project to allow separate collaborative components to be assembled together in different ways depending on the needs of the collaborative application. In addition the portal framework allows new functionality to be easily added to a collaborative application while making use of the existing tools. The current applications of the CHEF framework include the CourseTools course management system (ctng.ummu.umich.edu), a national structural engineering collaboratory (www.neesgrid.org), and the National Middleware Initiative grid portal toolkit (www.ogce.org).

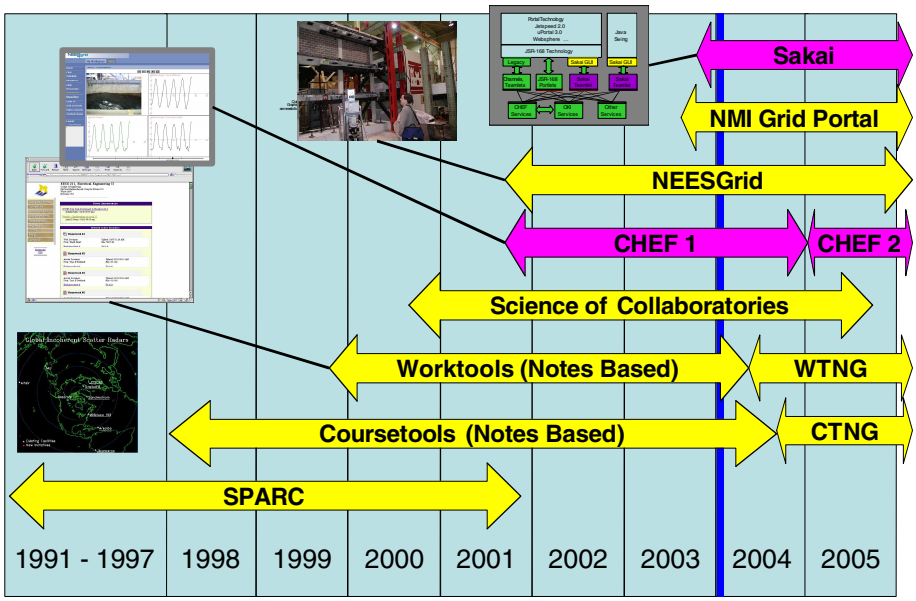
INTRODUCTION

The CHEF collaborative toolkit [CHEF] springs from the notion that there is a great deal of overlap in functionality between various collaborative activities ranging from course management systems, small group collaboration, and group-enabled scientific problem solving environments. Each of these

environments often has a number of features: announcements, mailing list, shared discussion, shared calendar, chat, and shared document repository, and notification and tracking of events. To these core tools each distinct collaborative environment adds specific tools such as grading software, shared data analysis software or data visualization software to create the collaborative environment for a particular application. Over the years many different tools have been developed for particular collaborative needs. Unfortunately by the time most of these environments are mature, they have become specialized around their original scope and difficult to reuse for purposes beyond their original intent. The only real tools that provide core collaborative functionality in an extensible framework are Microsoft Outlook and Lotus Notes. While these are popular and solve many core problems, they are proprietary and difficult to extend – especially in an environment where it is important to support a wide range of desktops including Linux. The CHEF toolkit fills this niche and provides an application agnostic extensible toolkit that is browser-based, written in JAVA, and available with an open source license. The CHEF environment uses portal technology from the Jakarta Jetspeed[Jetspeed] project to allow separate collaborative components to be assembled together in different ways depending on the needs of the collaborative application. In addition the portal framework allows new functionality to be easily added to build a collaborative application while making use of the existing tools. By providing an environment that can satisfy the needs of teachers, learners, and research, we hope to enable the creation of environments that enhance the connection between teaching and research. The current applications of the CHEF framework include the CourseTools[CTNG] course management system (ctng.ummu.umich.edu), a national structural engineering collaboratory [NEESgrid], and the National Middleware Initiative grid portal toolkit [NMI]. The CHEF software is production-quality and available for download and deployment. The next generation of CHEF [Sakai] is a partnership between the uPortal [uPortal] project and a number of universities to provide a complete OKI[OKI] compliant and JSR-168 [JSR168] compliant collaboration-enabled portal framework and a complete course management system.

PREVIOUS WORK

There has been a significant amount of work on collaborative activities at the University of Michigan ranging from the development of collaborative software, to the application and study of other collaborative environments. Part of the strength of the approach is that the activity is cross-disciplinary, involving the resources and talents of the Media Union, School of Information, and the IT staff at the University of Michigan.



The early collaborative work centered on developing a software infrastructure for the Space Physics and Aeronomy Collaboratory (SPARC). The SPARC project was focused on tools to support person-to-person collaboration, instrument sharing, data collection, data storage, and data viewing. The nature of space physics is that instruments are scattered around the world - often in remote locations. The collaboratory was highly successful and ran for over ten years.

Separately, the University of Michigan developed its own course management system based on Lotus Notes called CourseTools [Ctools]. CourseTools was introduced in 1999 and was highly successful with over 80% of the students in at Michigan using the system in any given semester.

In 2000, the CourseTools software was slightly altered to change terminology from courses and instructors to groups and collaborators and named WorkTools [Wtools]. Users could create a WorkTools group with the sponsorship of a UM staff member. The groups were hosted at the University of Michigan at no charge. The idea was to foster cross-institutional small group collaboration - typically in a research setting. WorkTools proved very popular and as of 2004, there are over 2000 WorkTools sites with over 3000 users who use the system in any given month.

The success of WorkTools as a slightly refocused course-management system proved the notion that small-group collaboration and course-oriented collaboration were closely related and that it would be possible to use common software that solves both problems.

The CHEF project was started to develop a set of web based collaboration tools in JAVA using open-source and commodity components to the extend possible. CHEF chose a number of foundational technologies including: Jakarta-Tomcat[Tomcat], Jakarta-Jetspeed, Jakarta-Velocity[Velocity], and Jakarta-Turbine[Turbine]. CHEF chose a model-view controller approach where the presentation is separated from tool logic that is also separated from persistence issues. CHEF development started in 2001 and was deployed at Michigan in production use in the Fall of 2003.

A along with the Globus[Globus] toolkit, the CHEF software was one of the founding technologies for the NEESGrid project. The George E. Brown Jr. Network for Earthquake Engineering Simulation [NEES]

project is a multi-year project designed to develop world-class experimental and simulation capabilities for the structural engineering field. The NEESGrid project is developing a collaborative toolset for person-to-person collaboration, multi-site experimentation using Grid technologies, remote telepresense, and data analysis, storage, and archiving capabilities.

The Sakai project is a Mellon-Foundation funded effort which will produce a standards-based implementation of a collaborative toolkit based on the best practices of the OnCourse[OnCourse] toolkit at Indiana University, Stellar[Stellar] software at MIT, CourseWork[CourseWork] software at Stanford and CourseTools at the University of Michigan. The Sakai project will be deployed using the uPortal enterprise portal system. Sakai will operate as a stand-alone collaborative system or as part of an Enterprise portal. The four core partners will spend a year developing a common solution (Sakai) after which it will replace the locally developed collaboration software at the four institutions. In addition, there are over 20 partner institutions that are working towards adopting Sakai as well. Sakai is informed by a number of efforts including the Open Knowledge Initiative (OKI), the JISC[JISC] learning management effort in the UK, and a number of standards organizations including IEEE[IEEE] and IMS[IMS].

COLLABORATIVE TOOLS IN CHEF

The core to the CHEF software is the common collaborative tool set. These tools are the ones that are generic across multiple collaborative domains. CHEF fundamentally operates on groups of users (called sites). Each CHEF site can have any number of "tools" activated for that site. By using a different mix of tools, the site owner(s) can configure each group/site for its particular purpose.

The core collaborative tools include:

- Announcements
- Chat
- Threaded Discussion
- Calendar
- Schedule
- E-Mail Archive
- Resources including access via WebDav
- Worksite Setup
- Profile
- Notifications / Subscriptions

CHEF provides implicit access control and scoping for each of these tools operating within a group. So each group has their own dedicated chat, resource, or schedule space.

The above figure shows the CHEF resources tool. This user is a member of several groups. As the person navigates between groups, they are presented the collection of tools chosen by the person who maintains the particular site/group.

Learning Management Tools in CHEF and Sakai
In addition, there are several tools that are unique to a learning management system application:

- Assignments
- Drop Box

The Sakai project will extend the toolkit in a number of ways. Some of the new tools under consideration include:

- A testing and assessment tool which is compliant with the IMS QTI specification
- A grade book tool that is integrated across the other grade oriented applications
- An extended profile tool
- A SCORM compliant content presentation system

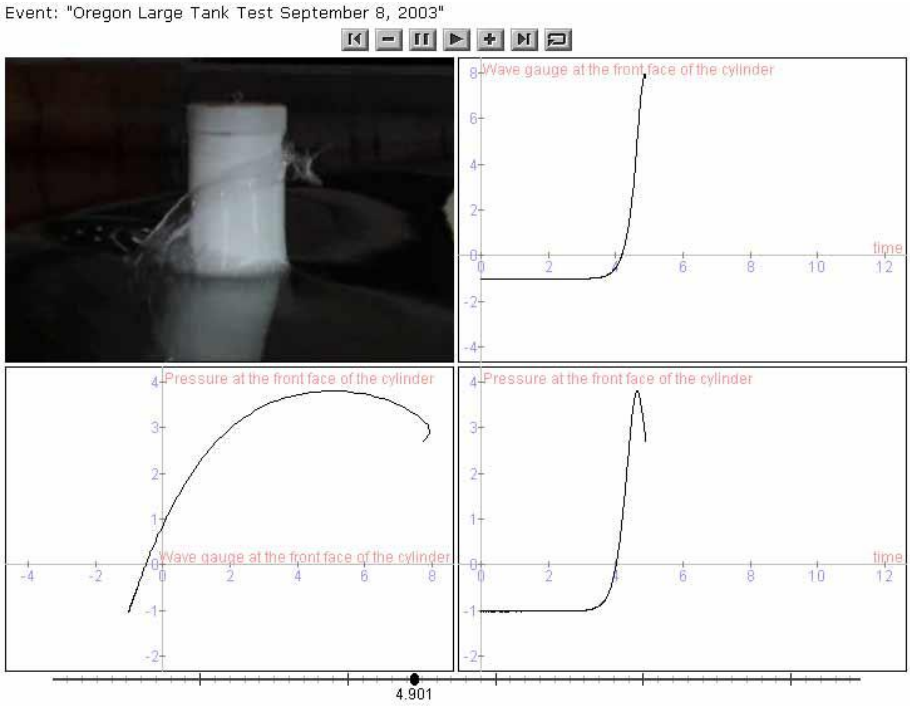
By the end of the Sakai project, the tool set will be comparable to most commercial learning management systems.

NEES and NMI Grid Portal Tool Set
The NEES and NMI Grid portal efforts add a number of specific tools to the CHEF environment to produces a collaborative problem solving environment using Grid technology. These extensions include:

- Authentication and Credential Management
- Grid file transfer [Extreme]
- Grid job submission and monitoring
- Grid system monitoring [GPIR]
- Data and metadata Repository
- Data display and visualization capabilities

- Support for streaming data using Data Turbine [RBNB]
- Support for video and data synchronization for both live and offline activities
- Metadata-enabled Electronic Notebook [SAM]

These tools are deployed along with the collaborative tools to produce the particular problem-solving environment as needed.



This figure shows a combined display of experimental data synchronized with video showing the results of an experiment in the wave basin at Oregon State University.

A NEES USAGE SCENARIO

This scenario demonstrates the use of a number of NEESgrid collaborative capabilities to execute an experiment.

A number of researchers meet in a small group session at an Earthquake Engineering site to talk about ways to explore a beam-column interaction under descriptive loads. The group decides to apply for a small grant to collaboratively pursue this work that will use the facilities at several sites.

While at the meeting, set up a CHEF group of the people who have attended the meeting. During the meeting, they use the CHEF resource facility to upload a number of different papers and presentations that they each have which provide background information for the work that they are going to undertake. They all join the group and automatically have an archived e-mail list and threaded discussion group. They also post the minutes of the meeting to the CHEF resources tool as well as an outline for the proposal.

After the meeting, they develop the proposal collaboratively using their private e-mail list and exchanging new versions using the CHEF resources tool. Part of the way through, they add another collaborator and

by adding the person to the CHEF group that person can catch up on all of the E-Mail discussion and has immediate access to all of the documents.

The night before the proposal is due there is still a few more things that have not been solved in the proposal, so a message goes out to the list that they will have an all-hands chat. Because not everyone uses chat and the members with IM all use different services, they find that the CHEF web-based chat is quite useful and right before midnight the proposal is successfully submitted.

Once the proposal is submitted, work begins at the two experimental sites which will participate in the effort. Several new groups are formed, using the NEES software installed at each site. One group is focused on specimen building while another group will develop the simulation part of pseudo-dynamic experiment. The groups use the E-Mail, chat, and resources tool to exchange diagrams, software elements, and other documents. As the specimen is built, the electronic notebook is used to maintain a log of the activities including pictures, text, test results, calibrations, etc.

The software team begins to develop the simulation for the structure. They initially write a single application to simulate the entire structure. The results of the simulation are loaded into the data repository and using the metadata browser, the data viewer can be pointed at these files for joint visualization by the members of the simulation group and for validation by the senior investigators.

Once the monolithic simulation is determined to work appropriately, it is decomposed into three components and the NTCP (NEES Tele-operation and Control Protocol) is used to allow the three sub-components to exchange information and to allow the simulations of the three sub-components to exchange data. Again the data repository and viewers are used to validate the results and the make sure that the data from the three sources can be integrated together and viewed together.

Since there will be several time-lapse photograph sequences for this experiment, the simulation controller software is configured to trigger the photographs to be taken and stored for each time-step. This allows the entire operation to be tested with the time-lapse photography before any specimens are constructed.

Once the specimens are constructed the actual experiment takes place. The experiment takes a number of hours. As the experiment progresses, the NEES tele-presence tools are used to monitor the audio, video and data as the experiment is progressing. These tools provide a TIVO-like capability, which allow users to move back and forth to view accumulated data as well as watch the experiment live. In addition to the triggered data channels at the end of each time-step, there is a while series of continuous data being monitored by the sensors and cameras in case anything interesting happens such as a catastrophic failure.

Several trials of the experiment are run with extensive discussion and analysis between each trail as to ways in which parameters for the upcoming trials would change. CHEF is used to capture the discussions, diagrams, notes and other data about the experiment.

Once each trial is completed, the investigators produce a visualization of the data including video and data channels that can be easily and directly viewed by people both within and outside the project team.

As part of the publication of the results of the effort, the entire data and metadata for the experiment (notebooks, chats, discussions, documents, data files, visualizations, metadata, etc) is collected and sent to the central NEES repository for long term storage and curation.

CONCLUSION

The CHEF project has demonstrated the ability to use a common tool set across a very wide range of applications ranging from an enterprise-wide course management system to a problem-solving environment for distributed researchers.

The NEESGrid project uses this collaborative toolkit coupled with Grid technology and a set of specially developed components to deploy a problem solving environment for Earthquake engineers.

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[GPIR] GPIR - Grid Portals Information Repository - University of Texas at Austin - tacc.utexas.edu/projects/gpir

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[IMS] The IMS Global Learning Consortium, Inc. - www.imsproject.org

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[JISC] The Joint Informations Systems Committe - e-Learning Programme - www.jisc.ac.uk/index.cfm?name=programme_elearning

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[NEESgrid] The George E. Brown Jr. Network for Earthquake Engineering Simulation System Integration - www.neesgrid.org

[NMI] National Middleware Infrastructure - Grid Portal - www.ogce.org

[OKI] Open Knowledge Initiative - Massachusetts Institute of Technology - web.mit.edu/oki/

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[Velocity] - Jakarta Velocity Template Engine - jakarta.apache.org/velocity/

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