The Computerworld Honors Program

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Final Copy of Case Study

Year:
2013

Status:
Laureate

Organization Name:
George E. Brown, Jr. Network for Earthquake Engineering Simulation Network (NEES)

Organization URL:
www.nees.org

Project Name:
NEEShub

Please select the category in which you are submitting your entry.
Collaboration

Please provide an overview of the nominated project. Describe the problem it was intended to solve, the technology or approach used, how it was innovative and any technical or other challenges that had to be overcome for successful implementation and adoption. (In 300 words or less.)

NEEShub, a sophisticated software platform funded by the National Science Foundation (Award Number CMMI-0927178), is intended for Earthquake Engineering research, collaboration, and education. NEEShub is based on the Hubzero platform developed at Purdue University. Collaboration is critical to the advancement of the field of Earthquake Engineering, however, collaboration is hindered by the fact that the community is geographically dispersed. By providing a powerful Internet-accessible system designed to store and utilize research project data and computational tools, NEEShub allows the fruits of groundbreaking research to be shared among researchers, students,

practitioners, and the public. NEEShub is powered by a leading edge, heterogeneous hardware environment that relies heavily on server-level virtualization. NEEShub also provides seamless access to multiple High Performance Computing (HPC) venues including XSEDE and OSG for the creation and use of community developed and contributed computational tools. The Project Warehouse, one of the most comprehensive sources of Earthquake Engineering research data in the world, is used to collect and display NEES experimental and computational research data/results. NEEShub provides a unique, efficient tool environment in which users are not required to download, install, or configure software. Tool developers install and configure tools within a secure environment, which then allows NEEShub users to use the tools within a web browser. The ingenious use of virtualization among multiple operating systems allows NEEShub to transparently work for both Linux and Windows tools from a web browser. NEEShub also provides features specifically intended to support geographically dispersed teams. The Groups functionality is a dropbox-like mechanism for shared, web-accessible storage. A tool-sharing feature allows multiple users to view tool interaction and execution of another user. NEEShub combines these and other features to offer an innovative collaboration environment supporting Earthquake Engineering researchers, students, and practitioners around the world.

When was this project implemented or last updated? (Please specify month and year.) Has it incorporated new technologies and/or other innovations since its initial deployment? (In 300 words or less.)

The initial implementation of NEEShub took place in August 2009. Since that initial implementation, NEEShub has incorporated and continues to incorporate new technologies and other innovations by following a bi-annual release schedule. The most recent NEEShub release took place in November 2012; the next release is planned for June 2013. In February 2011 the Databases feature was added. Databases provide a unique collection of Earthquake Engineering research data vetted by professional communities, and connected to original sources. Collectively, they enable impactful data to be highlighted, searched, and analyzed in multiple formats. In June 2012, Data Object Identifiers (DOIs) were added for Experiment level research data. DOIs are unique character strings used to permanently identify electronic data, files, or documents for the purpose of long-term data curation and accessibility. The DOI enhancement established Earthquake Engineering research data sets as citable resources, which has a potentially great impact on the NEES community. DOIs also provide a way to give proper credit to researchers and to demonstrate the researchers' contribution to the community. As another aspect of collaboration, each NEEShub release is driven by a proven, repeatable development process. The development process is initiated with user-contributed requirements gathered from multiple sources. The primary source of user requirements is a NEEShub

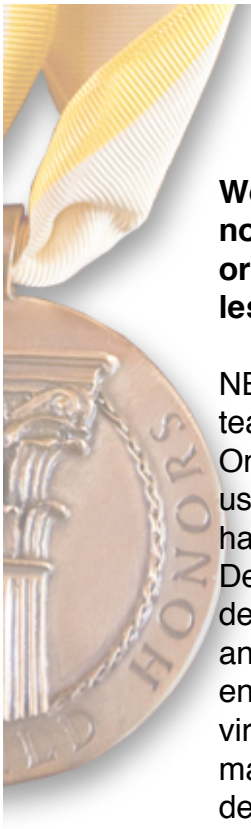
feature called the Wish List. User requirements are also collected through interviews, surveys, and usability studies.

Is implementation of the project complete? If no, please describe the project's phases and which phase the project is now in. (In 300 words or less.)

Although the initial implementation of the project was completed in August 2009, NEEShub will continue to be enhanced with new functionality and technology by following a twice-yearly release schedule until September 30, 2014. The next major release is scheduled for June 2013.

Please provide at least one example of how the technology project has benefited a specific individual or organization. Feel free to include personal quotes from individuals who have directly benefited from the work. (In 300 words or less.)

As previously mentioned, NEEShub provides seamless access to a variety of High Performance Computing (HPC) venues. Numerous faculty and students use these HPC venues to run batch jobs for one of the more popular Earthquake Engineering computational tools, OpenSees. In the past, faculty and students would have had to obtain individual logons and withstand cumbersome learning curves for each of the HPC venues. NEEShub has removed those obstacles with the implementation of the batchsubmit command. Batchsubmit allows NEEShub users to specify the venue on which to run their job along with the appropriate executable file and associated parameters. NEEShub securely submits the job to the venue, monitors its execution, and returns the job results to an abundant storage area with NEEShub. The use of batchsubmit is growing at a rapid pace since its November 2011 implementation. It provides users with impressive compute capability without the traditional overhead of accessing or using HPC venues. For example, a group of engineering students from the University of British Columbia have capitalized on the availability of HPC venues through NEEShub, using OpenSees through the batchsubmit command to run large-scale numeric simulations and parametric studies. According to their advisor, this research would not have been possible without NEEShub: "NEEShub is an amazing resource for running large analyses with OpenSees. We couldn't do it without NEEShub." – Professor Ken Elwood, University of British Columbia.



Would this project be considered an innovation, a best practice or other notable advancement that could be adopted by or tailored for other organizations and uses? If yes, please describe that here. (In 300 words or less.)

NEEShub would be considered an example of best practice. The NEEScomm IT team supports NEEShub from both operational and development perspectives. One of the foundational practices followed since the inception of the project is the use of virtualization through VMware. NEEScomm IT made optimal use of its hardware by instantiating numerous virtual servers on top of a series of high-end Dell servers. This practice has allowed each developer to have his/her own development environment, thus isolating one developer's changes from another's. It has also allowed for nearly identical hardware configurations across environments, which minimizes testing variability. Finally, the speed at which virtualized servers can be created compared to actual servers is orders of magnitude less, resulting in a much faster and more dynamic overall development process. Another example of a NEEShub best practice is embedding a user within the IT team. Although the NEEScomm IT team consists primarily of software professionals, it also contains a dedicated Earthquake Engineer. This embedding approach facilitates a highly efficient two-way knowledge transfer. The software professionals are constantly exposed to Earthquake Engineering needs and terminology. Additionally, the Earthquake Engineer is exposed to IT processes and terminology, allowing him to communicate and interact more effectively with others in the NEES community.