

OpenQuake Social Networking for EarthCube

Category

This letter of intent expresses our interest in an EAGER grant in EarthCube's "New Capability" category. As a collaborative research effort involving Indiana University (IU), the University of California Davis (UC Davis), and the University of Southern California (USC), we will explore the development of social networking and information management tools to improve the ability of earthquake researchers to discover and share data and undertake collaborative research. This is in line with EarthCube's general goals and specifically "Category N" capabilities (<http://earthcube.ning.com/page/capabilities>).

Scientific Motivation

We have re-examined aspects of our QuakeSim science gateway (<http://www.quakesim.org/>) and its services in light of both recent technology developments and experience from its use during recent serious earthquakes in Haiti (2010), Chile (2010), and Japan (2011). Highlights of particularly relevant technology developments include the rise in importance of lightweight clients (smart phones, tablets), rich Web 2.0 collaborative sites, data sharing and exchange techniques (e.g., structured tagging, ontologies) and Cloud back-ends supporting, e.g., Software as a Service. Further, open source (community) approaches to software development have blossomed. Recent disasters have emphasized the requirement for essentially real-time response. This was presumably always a requirement but only recently have Internet-interfaced cloud resources made it clearly possible. Another important feature of Earthquake response is that the scientific capabilities of the gateway should leverage and help related disaster response resources, which continue to expand in number and functionality. This suggests that commercial and open source assistance, motivated by societal reasons, should be readily available. Looking at portal support for crises and emergency response planning, there are many features that are common both to different modalities of disasters and indeed to military command and control systems. Such basic features include collaborative tools, including sharing of real time data from sensors and webcams, with information supported on Web-based GIS (Geographic Information Systems).

Furthermore, major Internet companies ("giants"), particularly Google and Microsoft, have collected a remarkable amount of information relevant to crises. This varies from collections of scholarly papers (e.g., on earthquake forecasting) to lists of "all" geo-located entities in the world (at some level of abstraction). Examples of Web 2.0 resources dedicated to last year's tragic earthquake in Japan include <http://japan.person-finder.appspot.com/> (now deactivated) and <http://www.google.com/crisisresponse/japanquake2011.html>.

We have re-evaluated QuakeSim in light of the above ideas and identified the features of the next generation portal, which we call the OpenQuake Infomall; this is to emphasize the role of community contributions, extending ideas such the myGrid team's myExperiment. The OpenQuake Infomall will support the electronic exchange of data and tools of relevance to Earthquake response and science. It will be open so that it motivates people to contribute new data and tools in an interoperable fashion. OpenQuake will support and establish the needed interface standards to promote this. The OpenQuake Infomall effort will collaborate with the Internet "giants" so that their data and base tools in GIS/collaboration areas are exploited. It will focus on gaps in the commodity offerings and put its efforts into filling these. Areas of clear importance include specialized data not compiled commercially (such as fault and sensor data); simulation and data mining tools; support for user workspaces to organize (connections to) data and tools for the specific needs of a user; and further customizations of base tools to the needs of OpenQuake. An example is the scholarly literature searches customized to particular earthquake regions and features. OpenQuake will offer a convenient web-based workflow engine allowing

quick analyses on demand in the cloud with a powerful visualization front end. Other tools include data mining/analysis and portals to simulations such as those forecasting aftershocks. Both data archives and links to real time data will be supported.

Proposed Pilot Project

We specifically propose here a short feasibility investigation of the use of social networking and associated technologies to enable collaboration among scientists (researchers and practitioners) via-a-vis earthquakes. This will have two aspects: (1) exploring new results through intuitive composition of data and execution services, and (2) sharing the results through collaboration. The former is a prominent need we have seen in many projects: scientists need to combine results from many different online capabilities in novel ways. Unfortunately, developing sophisticated user interfaces may take too long if every task is delegated over time to a Web development team. This is also akin to mashup development or workflow composition, but tools in this area are not known for their ease of use.

Inspired by general sites like ifttt.com ("If This Then That"), we believe it is possible to create much simpler user interfaces for constructing workflow recipes that can also be integrated with popular online services such as Twitter for notification. We will prototype a site like Flickr or Youtube where both data (links) and tools can be uploaded and accessed. At the simplest the user will then be able to supply a data entry to a tool entry and save results as another entry in data space. As of course data (and tools) will be large, they will be stored on backend clouds with Amazon, Azure, and Dropbox as possibilities. This facility will be prototyped on FutureGrid.

The sharing of both specific results and general recipes motivates the second part of our feasibility study: social networking for scientists. We believe that existing social networks (particularly Ning (as used in Earthcube), Google+ and Facebook) can be leveraged to create an overlay social network that can deliver more specialized services and effective collaboration. Our team's e-Humanities effort (<http://e-humanity.org/>) illustrates some of these ideas for a different domain. We will also look at lessons from the well-known NanoHub portal

Results of Research

Our prototype could have broad impact on many science fields by enabling community activities and providing an easy to use interface to the many relatively simple tasks seen in some applications. Use of a cloud back-end supports naturally the "long tail of science". Further our work has special value in the Earthquake field where events involve both scientists and the broad community impacted by the natural disaster.

Team Members

The proposal team will consist of Andrea Donnellan (USC/JPL), Geoffrey Fox (IU), Dennis McLeod (USC), Marlon Pierce (IU), and John Rundle (UC Davis). The team has collaborated for the past decade on the NASA-funded QuakeSim effort (quakesim.org) and possesses a broad mixture of expertise in geophysics, complex systems, data and knowledge management, Web 2.0 development, and cyberinfrastructure.