News

Press Releases
Event Announcements
CCT Weekly
Grants and Funding
Student News
Archived News

TeraGrid: Paying it Forward in the Wake of Disaster

(Source: HPCwire)

While reports vary, some estimate the total cost of Japan's March 11, 2011, earthquake and tsunami at 25 trillion yen, or 330 billion U.S. dollars, making it the most costly natural disaster on record. This is more than three times the size of the second most expensive natural disaster, also an earthquake, and also in Japan in 1995. More than 26,000 are dead or missing and an estimated 400,000 are homeless. Nearly a quarter of Japan's total geography has been altered.

The process of loss assessment, clean-up and rebuilding has begun. One month after the original 9.0 magnitude event, 408 aftershocks greater than 5.0 intensity had occurred and are expected to continue for as long as ten years. Progress, albeit slow at first, is stalled or even reversed with each new tremor.

Damage to their nuclear power facilities may have an impact on the ocean and atmosphere far beyond Japanese shores. A fractured power grid and rolling blackouts have adversely affected essential services that rely on digital resources. Current predictions estimate a ~9 GW national power deficiency this coming summer due to the earthquake and damage to the Fukushima Daiichi facility; this deficiency will force prioritization of essential services, such as health care, security, transportation, education and basic services like air conditioning and elevators in the skyscrapers of metropolitan Tokyo and elsewhere. Some think it could take years before all of their computing resources are back online, and that may be prolonged as spending is prioritized for more urgent needs.

In addition to the humanitarian crisis, Japan's industrial and research communities have been affected which has global impact. Many of the products we use in our daily lives come from factories that were destroyed. Japan's intellectual contribution to the global research community has been interrupted as the systems many relied on to do their work were demolished. Much collaboration between Japanese and U.S. research groups across all domains of science has ground to a halt.

Japan, a very important U.S. economic partner, clearly has need for costly short and long-term assistance. Fluctuations in its economy have a noticeable impact on the U.S. in a variety of ways. Yet, with the recent threat of a government shut-down, the U.S. is dealing with its own financial crisis, making it difficult for Americans to help.

What can we do?

The National Science Foundation's (NSF) TeraGrid is the world's most comprehensive cyberinfrastructure in support of open scientific research. The people who support and use this resource form an unparalleled, multidisciplinary fraternity of innovators and problem solvers. Some have offered solutions that will help in the short-term, and all recognize the need for a more coordinated long-term effort. Following are a few ways the TeraGrid community has begun to help -- gestures that have minimal impact on the U.S. research community while proving to be beneficial to researchers in Japan in the wake of this global tragedy. Hopefully, the examples will inspire additional innovation:

1. The Keeneland Project at Georgia Tech (GT) has collaborated closely with Tokyo Tech over the past two years on developing innovative computer architectures and software that use graphic processors. Georgia Tech's Keeneland Initial Delivery system's combination of architecture and software is nearly identical to Tokyo Tech's TSUBAME2.0. Currently in preproduction mode, the Keeneland team is working with a select group of Keeneland early adopters to develop programming tools and libraries for applications on GPUs. As a result of the disaster, Keeneland team is exploring ways to provide cycles and storage from Keeneland to our colleagues at Tokyo Tech; Japanese researchers will be able to continue their important work during summer, when the demand for power will exceed the available supply, and, consequently, lead to the temporary shutdown of TSUBAME2.0.

2. Indiana University (IU) provided assistance to the international emergency response community via the U.S. National Aeronautics and Space Administration (NASA)-funded E-DECIDER and QuakeSim projects in the weeks following the disaster. IU staff assisted with the creation of Level 0 satellite data products for the International Charter which provides a unified system of space data acquisition and delivery to those affected by natural or man-made disasters. IU also made a global analysis image from the very coarse grained (250 m resolution) MODIS (NASA MODIS Rapid Response System) satellite data that revealed the tsunami inundation area by using change-detection algorithms that compared before and after images. Early analysis showed damage more than three kilometers inland in places, which was later confirmed with higher resolution images. Earthquakes are an inevitable threat to many areas of the U.S., not just the West Coast. The Great Central U. S. Shakeout is attempting to highlight this danger and help emergency responders, public health officials, government agencies, and the general public prepare. Understanding the recent major earthquakes in Haiti, Chile and Japan is a worthy humanitarian goal that will directly benefit United States citizens.

3. A Louisiana State University professor is collaborating with Japanese colleagues from the University of Massachusetts, Woods Hole Oceanographic Institution and others on a large scale tsunami simulation. With help from volunteers, they quickly prepared an extremely accurate global ocean model, using six different observations that were provided by Japanese collaborators.

LSU and the Louisiana Optical Network Initiative helped in the hours following Hurricane Katrina, by providing the National Oceanic and Atmospheric Administration with emergency access to its high-speed, high-bandwidth networking connections so they could share and transfer critical data quickly from New Orleans. This gesture helped first-responders provide rapid aid.

4. San Diego Supercomputer Center is providing cycles and storage on its Triton and Data Oasis resources to colleagues from the National Institute of Advanced Industrial Science and Technology and Tokyo Institute of Technology. These resources have enabled researchers to continue their Global Earth Observation Grid activities, including generation of ground motion maps and analyzing satellite data related to the disaster (some results at disaster.geogrid.org were generated with Triton).

5. The Texas Advanced Computing Center (TACC) regularly provides a portion of its supercomputer cycles for emergency applications. For example, TACC helped in the months following the Deep Horizons oil rig explosion by donating 6.5 million service units on Ranger to generate a simulation of the anticipated path of the oil spill. This drastically benefited mitigation efforts.

Just recently, Lonestar4 cycles were provided to Japanese researchers from the University of Tokyo, and additional Japanese schools, to model the March 2011 earthquake and tsunami, and the route taken by radioactive content from the Fukushima Daiichi nuclear plant that was dispersed in the ocean and atmosphere.

Recognizing TACC's impact, Dell contributed technology to further expand the organizations efforts to support emergency response efforts. The TACC and Dell teams have since worked to bring together U.S. and Japanese universities in the wake of the earthquake and tsunami.

TeraGrid Forum Chair John Towns is pleased with the immediate response from TeraGrid partners so far, and hopes to see more. "We will work together to develop a more organized and integrated plan to assist Japanese researchers while minimizing the impact to the

resources needed by the U.S. research community," he said. "All requests for TeraGrid resources and services are received via TeraGrid's Partnerships Online Proposal System (POPS). Urgent requests are always considered separate and apart from our regular quarterly process," he added.

The NSF encourages the community to apply for funds that will enable more support through the NSF RAPID grant program. RAPID grants are typically around $50,000, up to $200,000 for the most relevant projects. The program funds urgent proposals that address the availability of or access to data, facilities, or specialized equipment, including quick-response research on natural or anthropogenic disasters and similar unanticipated events. Applications will be accepted via NSF Fastlane through April 29, 2011.

"This isn't the first time our TeraGrid family took the initiative to help in a crisis," said NSF's Barry Schneider, TeraGrid program director. "Hopefully their efforts will help Japanese researchers return to some sense of normality, allow the world to gain a better understanding of earthquakes and tsunamis in general, and prevent future loss. It's a great example of how the U.S. investment in science contributes to global scientific, social, and economic progress," he added.

For more information about TeraGrid, visit www.teragrid.org.
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