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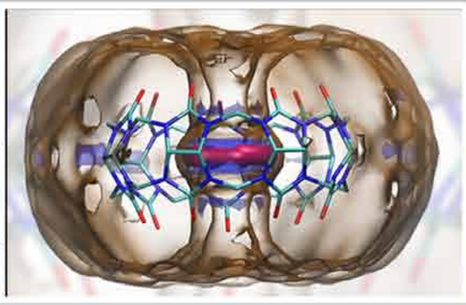
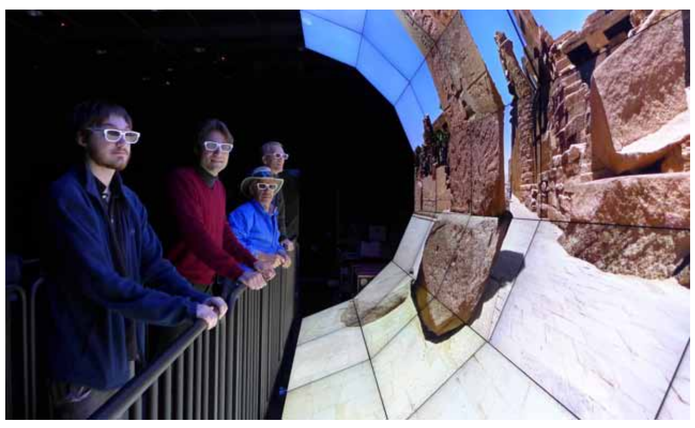



RCI Networking and Expertise Make WAVE(s) in Construction of Visualization Environment for Big Data

Falko Kuester
Associate Professor, Structural Engineering
Faculty-Affiliate, Computer Science and Engineering
Faculty-Affiliate, Calit2's Qualcomm Institute



"RCI helps to bring all the interdisciplinary talents together to collaborate on research."

Professor Kuester's research expertise is in visualization and virtual reality. His dream has always been the creation of novel collaborative research environments where local, national, or international scientists and engineers can come together and collaborate. He is the principal investigator of the NSF-Major Research Instrumentation-funded Scalable Omnipresence Environment (SCOPE) project, with Tom DeFanti, Tajana Rosing and Jurgen Schulze as co-principal investigators. SCOPE offers researchers an immersive 3D environment to collaborate on big data challenges, regardless of their locations. It has participants from 13 departments within UC San Diego, plus Jackson State University, and the University of Texas Medical Branch.

The SCOPE project completed the first prototype of its massively interconnected, high-tech display environment, called the Wide-Angle Virtual Environment (WAVE) in December 2013. RCI implementation partners ACT (Administrative Computing and Telecommunication) and the Qualcomm Institute (the UC San Diego division of the California Institute for Telecommunications and Information Technology, or Calit2) contributed to the construction of the WAVE by providing networking and technical expertise. Prof. Kuester and his colleagues can now work directly with big data researchers empowered by a dedicated, high-speed production network. He no longer needs to worry about network performance or bottlenecks as RCI has already done the design and optimization for him. Prof. Kuester feels that RCI has helped him move one step closer to achieve his dream:

"With the help from RCI, we are tackling new big data challenges over production networks that historically were simply out of reach."

The new WAVE is fittingly located in the WAVElab in the new Structural and Materials Engineering (SME) building. It is a video wall shaped like an ocean wave, and it's constructed as a 5x7 array of 55-inch 3D LCD monitors. The main idea is to provide people with a wide, 180-degree vertical view looking straight, 90 degrees down, 90 degrees up, and close to 180 degrees horizontal. As guests stand there wearing 3D glasses, they are able to see a full and realistic view of the environment around them.

To achieve this feat, the resolution of the wall requires billions of pixels to be rendered every second with datasets whose complexity is typically higher by orders of magnitude. It is unrealistic to replicate locally all the data because it is simply too large and difficult to synchronize. RCI helped to connect the WAVE to the dedicated Prism@UCSD network at 40 gigabits per second (Gbps), and the rest of the campus at 10 Gbps. Using an adaptive and progressive algorithm, Prof. Kuester and his colleagues can dynamically render an image with the required data points without having to load an entire database. They do not need to worry about cloning the data locally, and have no need for local data storage in the WAVE. All the data is flying through the network in real time, mediated by a flash memory-based storage "cloud" called FIONA (Flash I/O Network Appliance).

Several colleagues of Prof. Kuester are excited about the idea of connecting their respective instruments and databases through the Prism@UCSD network in order to make them available to their research communities. The effort is timely, given that ultra-high-resolution visualization and visual analytics require so much information and real-time processing that cloud-based approaches have become very desirable.

"We are hoping to expand RCI networking service."

The WAVE is an impressive demonstration that data can be acquired, processed, and visualized dynamically in distributed environments with tight timing constraints. The WAVE is already being used with very large collections of data for research areas including astronomy, biology, as well as archaeology and other fields of cultural heritage.

Prof. Kuester is working with his colleagues at UC San Diego to expand the reach of the WAVE by building the "big data freeway." According to Drs. Philip Papadopoulos (SDSC) and Larry Smarr (Calit2), the PI and co-PI of Prism@UCSD, the "big data freeway" will be soon upgraded to 80 Gbps in the next phase. Dr. Mike Norman, PI of the NSF-funded CHERuB (Configurable, High-speed, Extensible Research Bandwidth) project, is bringing 100 Gbps connection to the campus, and FIONA, the brainchild of Drs. DeFanti and Papadopoulos and funded by the Center for Integrated Access Networks (CIAN), can be easily scaled up in performance using the Rocks cluster software.

Enabled by extremely fast cloud storage devices and expanded high-speed networks, Prof. Kuester and his colleagues are "making WAVE(s)" where researchers and their communities are able to innovate and collaborate better and faster than ever.

For More Information

RCI resources, services, and pricing, please e-mail rci-info@ucsd.edu

Use a QR code reader to view the UC San Diego RCI website or visit rci.ucsd.edu

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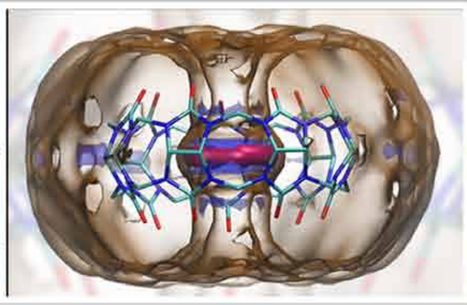
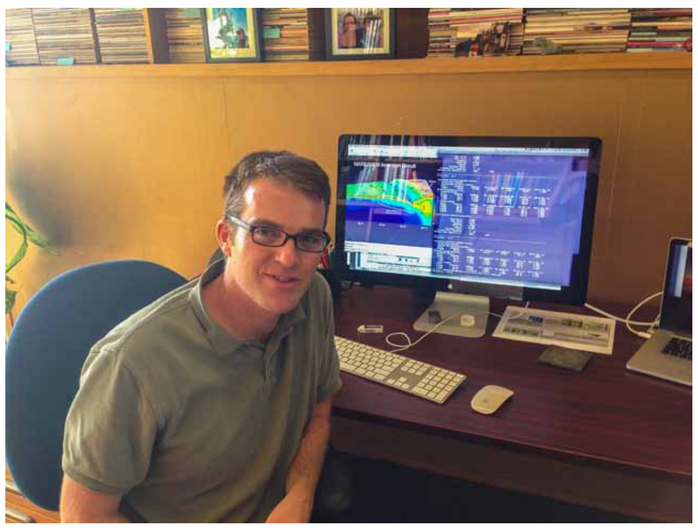



Imaging Seafloor Geology with Computational Electromagnetics on TSCC



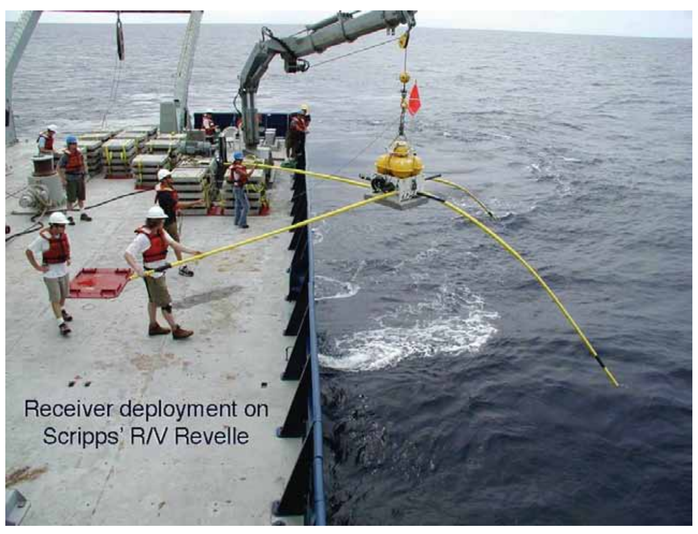
Kerry Key
Associate Professor, Marine Electromagnetics Laboratory
Scripps Institution of Oceanography, UC San Diego

"TSCC has been a huge eye-opener, giving me easy access to a powerful parallel computer."

Professor Kerry Key first got access to a parallel computer at UC San Diego (UCSD) 10 years ago, when he was a graduate student at Scripps Institution of Oceanography. His advisor bought a small cluster for their research program and Key was tasked with managing the system. However, without formal computer training, this task quickly became a huge time sink and disrupted his scientific research.

Four years ago, when Key was a postdoctoral scholar at UCSD, he received an email from the university's San Diego Supercomputer Center (SDSC) announcing the Triton Resource cluster.

After enrolling for a free trial account, Key found it to be a huge benefit, since he could focus on using the cluster for research while SDSC staff was responsible for managing the system. Key migrated to the new Triton Shared Compute Cluster (TSCC) rolled out earlier this year as part of the UCSD Research Cyberinfrastructure (RCI) program.

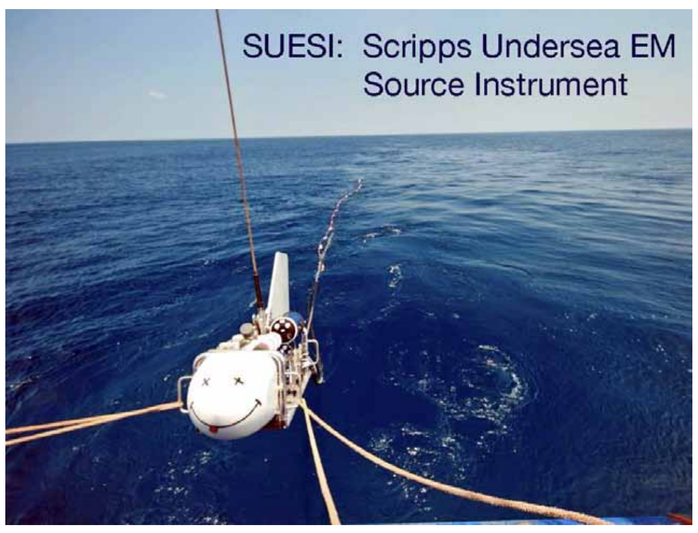

Receiver deployment on Scripps' R/V Revelle

"What we run overnight on TSCC would take almost a year if run on a desktop computer. It is just so dramatic how much work we can get done now."

Scientifically, Key's research focuses on using electromagnetic waves to study seafloor geology. Using one of Scripps' research vessels, Key's team deploys an array of electromagnetic receivers onto the seabed. A transmitter is then towed close to the seabed while broadcasting low- frequency electromagnetic waves that diffuse through the geology and are recorded by the receivers. This data is used to create and refine geological models of the targeted sea floor area.

These datasets can be overwhelming, with hundreds of thousands of transmitter positions. Using TSCC, researchers can model the datasets on hundreds of processors simultaneously, with each processor modeling a different transmitter. Using a desktop computer for this task would take thousands of times longer.

Key and his students recently submitted a research paper to Nature, which would have been unimaginable without relying on TSCC to expedite the modeling process.



"I can even do my supercomputing tasks remotely!"

As a busy researcher who travels frequently, TSCC lets Key log into TSCC remotely while on the road or at sea. He can launch jobs, track progress, and download results from TSCC at airports, research vessels, and hotels using a simple WiFi connection or even mobile devices. TSCC has transformed the way Key performs his research, while greatly improving his efficiency.

"SDSC provides solid support and quick response. I would recommend TSCC to my cost-conscious colleagues."

Key compared the TSCC node price with commercial offerings and found that for the same budget, he could get a much better deal from TSCC when taking into account the software, hardware, facility, and SDSC's support and expertise. TSCC researchers can enjoy these special rates because UC San Diego provides a subsidy to each faculty member using the RCI services. Key is happy to speak with anyone who is interested in learning more about the TSCC service for their own computing needs.

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