The OptIPuter and Its Applications

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The NSF-funded OptIPuter project [see www.optiputer.net and special issue of Future Generation Computer Systems (FGCS), Volume 25, Issue 2, February 2009] has been exploring for the last six years how user-controlled 10Gbps dedicated lightpaths (lambdas) can provide direct access to global data repositories, scientific instruments, and computational resources from the researchers' Linux clusters in their campus laboratories. These clusters are reconfigured as "OptIPortals," providing the end users with local scalable visualization, computing, and storage. Using the 10Gbps lightpaths available over the National Lambda Rail (NLR) and the Global Lambda Integrated Facility (GLIF), this new distributed architecture creates an end-to-end "OptIPlatform" for data-intensive research (Figure 1).

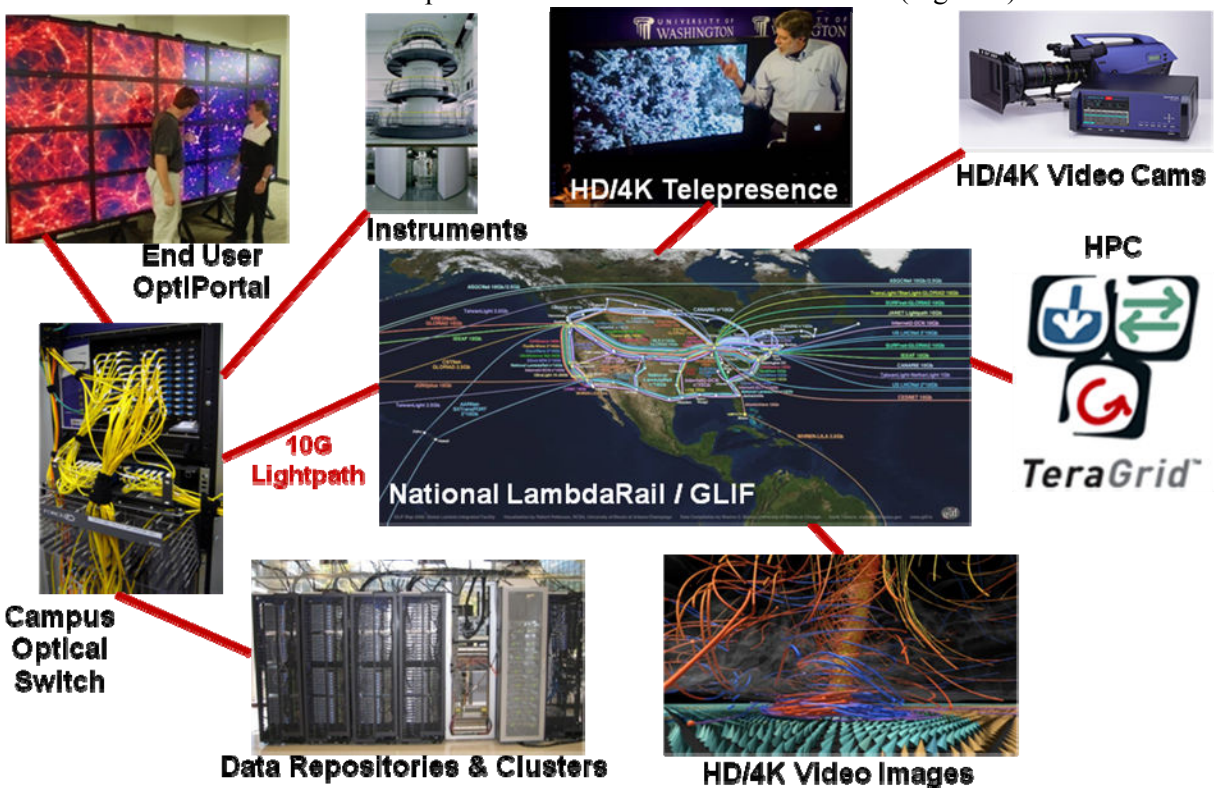


Figure 1. The components of the national to global scale end-to-end OptIPlatform



As of today, research centers around the world have deployed over 50 OptIPortals (see FGCS for images of some of these) and in many cases connected them using 10Gbps lightpaths. This user-configurable OptIPlatform opens new frontiers for collaborative research in data mining, genomics, neurosciences, earth sciences, ocean observing, and space exploration.

Figure 2. Prof. Armbrust at the Univ. of Washington (UW) shows diatom micrographs on her OptIPortal to Smarr in the Calit2@UCSD auditorium.

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Specifically, the Gordon and Betty Moore Foundation-funded microbial metagenomics CAMERA project (see FGCS article) has worked with UW's Moore Investigator Prof. E. Virginia Armbrust to establish an OptIPortal in her lab and to connect it to Calit@UCSD via uncompressed High Definition video (iHDTV) using 1.5 Gbps over a dedicated 10G lambda between UW and UCSD. More recently, the NASA Ames Lunar Science Institute in Mountain View, CA has established an OptIPortal and linked it to the Calit2@UCSD HiPerSpace OptIPortal via compressed HD. This enables showing large scale lunar images on either wall, under control of either end of the collaboratory.



Figure 3. Photo taken at NASA Lunar Science Institute of HD-coupled OptIPortals. The "virtual handshake" is between NASA's Laurence Edwards and Calit2's CGLX developer Kai-Uwe Doerr (standing in front of Calit2 HiPerSpace).

The OptIPuter team at the University of Illinois at Chicago (UIC) Electronic Visualization Laboratory (EVL) has developed Scalable Adaptive Graphics Environment (SAGE) VisualCasting (see FGCS article), which uses multiple 10Gbps lambdas to create a Global collaboratory by distributing HD video and ultra-high-resolution visualizations in real time to multiple sites. VisualCasting does not require multicast, a network-centric technology that requires network engineering at all sites prior to working. Instead, Visualcasting uses commodity clusters (SAGE Bridges) to broadcast real-time ultra-high-resolution content to multiple sites. Many applications will make use of this powerful new OptIPlanet Collaboratory in 2009.



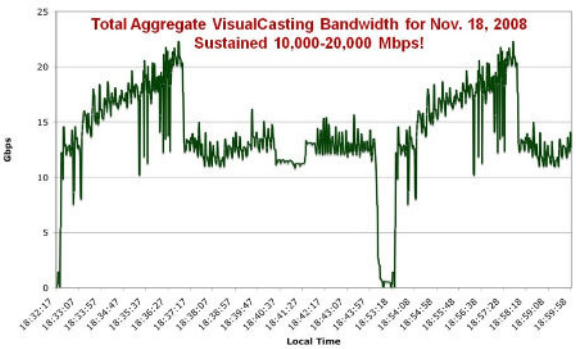


Figure 4. Photo of a demonstration of EVL's VisualCasting at Calit2@UCSD for the CENIC CalREN-XD/HPR Workshop (Sept. 15-16, 2008) in which EVL director Jason Leigh interacts with EVL and University of Michigan researchers. The graph shows the sustained bandwidth of 10-20 Gbps during a VisualCasting demonstration at Supercomputing '08 in Austin, Texas.

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