

One Grid Lights All: Multipurpose Photonic Grid for Multidisciplinary Collaborative Applications

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Supporting NC project:

ISOGA — Integrated Services Optical Grid Architecture for Emerging e-Science Collaborative Applications

Grid-based shared science “observatories” have been increasingly deployed by collaborative scientists to control remote instruments and to generate multi-gigabytes of 3D volumetric data objects that reside on distributed repositories accessible for correlation, simulation/analysis and visualization. For example, the BIRN (Biomedical Informatics Research Network), Earthscope and ORION (Ocean Research Interactive Observatory Network) have been deployed respectively as observatories for biologists, geoscientists and oceanographers. A Grid is a distributed virtual collection of networked computing, data, visualization and instrumentation resources that are shared and integrated via middleware into a virtual organization to provide collaborative capability to end users.

Grid applications have diverse computation, data storage and networking bandwidth and latency requirements. For the first generation best-effort Internet Grid, networking resources lack gigabit-rate transport capability to move gigabyte-size data objects between data and computing clusters in real-time interaction. To eliminate the networking resources bottleneck, the emerging second generation Lambda Grid employs optical circuits that send multiple lambda or wavelengths of light down a single length of optical fiber with each lambda capable of transporting data at 10 Gbps, with optional photonic multicast by splitting incoming light into multiple outputs. Unlike the Internet Grid, the Lambda Grid enables dedicated lightpaths of connecting lambdas to be reserved among laboratories, data resources, instruments and user access facilities; which make interactive visualization of remote gigabyte data objects as easy as the Web makes manipulating megabyte-size data objects.

The emerging Lambda Grid is optimal to support bandwidth-intensive data Grid applications with constant gigabit-rate traffic; but it is suboptimal to support multimedia access Grid applications with bursty and variable bit-rate traffic. This motivates the DOE National Collaboratories researchers to develop the third generation Multipurpose Lambda Grid to optimally support multidisciplinary Grid applications. A preliminary prototype of Multipurpose Lambda Grid enables researchers in the Electronic Visualization Laboratory in the University of Illinois at Chicago to engage in multimedia collaboration with their peers in Northwestern University and the University of Amsterdam, while visualizing gigabyte data objects from the federation of distributed computing clusters. A refined prototype of the Multipurpose Lambda Grid will be demonstrated at the iGrid 2005 symposium in San Diego, which will be driven by multidisciplinary Grid applications with diverse network bandwidth and latency requirements, and interactive visualization of variable size data objects such as biological microscopy and geological bathymetry.

