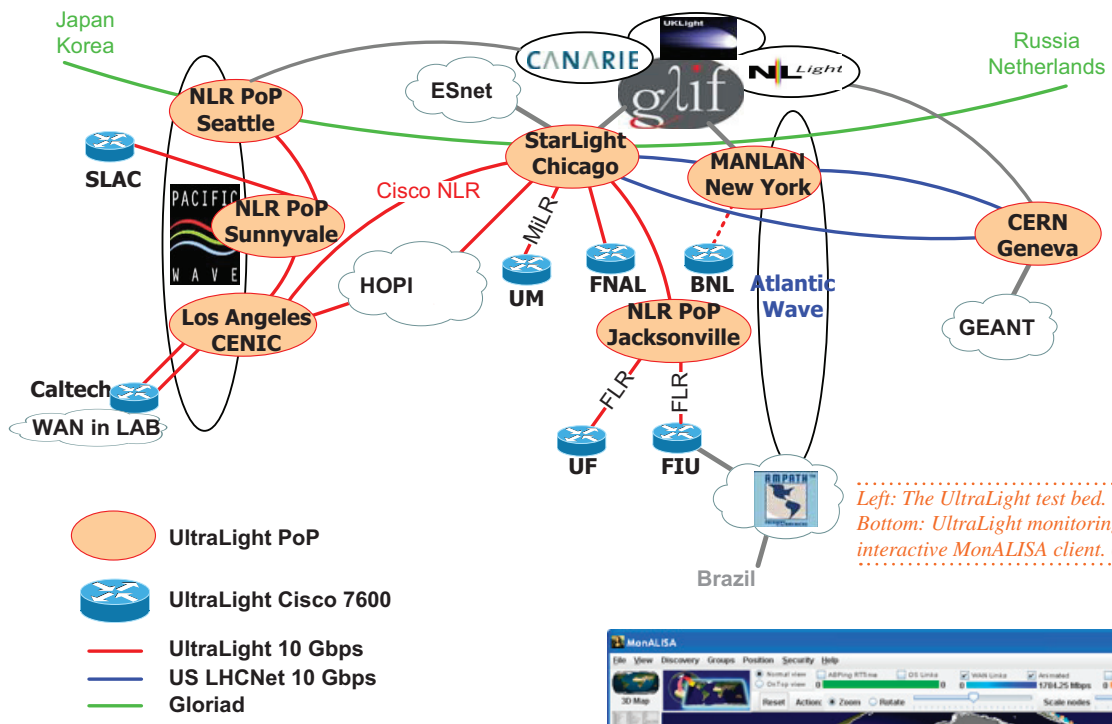
Networking and the Open Science Grid

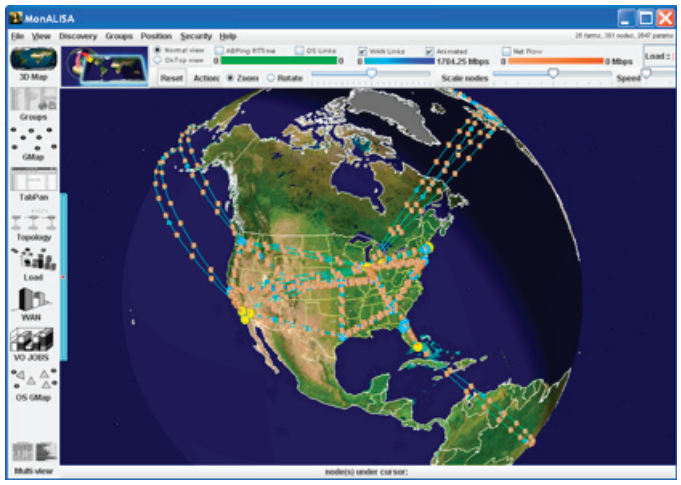
The Network as a Managed Resource

Distributed scientific collaborations and grids require high performance networks to interconnect their members and resources. The OSG intends to integrate the network as a managed resource along with storage and computing resources. The OSG vision is to provide a system that monitors and provides end-to-end throughput for priority tasks, including:

- A "path" construction service, where paths can have one of a few different priority levels as well as varying sizes (bandwidths)
- A network task director that decides if tasks are short enough and authorized to run in real time without queuing
- Queues for network tasks (transfers) of different lengths and levels of priority
- An end system agent that will help with switching between foreground, background and queuing choices
- A "best effort" network service for grid tasks that do not interface to the network management service.



Left: The UltraLight test bed. (Sylvain Ravot)
Bottom: UltraLight monitoring using the interactive MonALISA client. (Iosif Legrand)



Such a system would deliver an efficient, effective basis for grid computing and a responsive, robust infrastructure for e-science. Achieving it depends upon a number of NSF and U.S. Department of Energy network research initiatives, including UltraLight, Lambda Station, Terapaths and OSCARS. UltraLight focuses on building a managed network services infrastructure for collaborators in the Large Hadron Collider experiments, ranging from best-effort networks to optical point-to-point circuits. Intermediate cases will use protocols MPLS and QoS settings to provide dynamically constructed virtual circuits sized for the requesting application's needs. UltraLight also includes agent-based services and the end-to-end real-time monitoring required to deliver this infrastructure, and is optimizing disk-to-disk data movement to utilize 10 gigabit per second links.

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Networking and the Open Science Grid

ICFA-SCIC and the Digital Divide

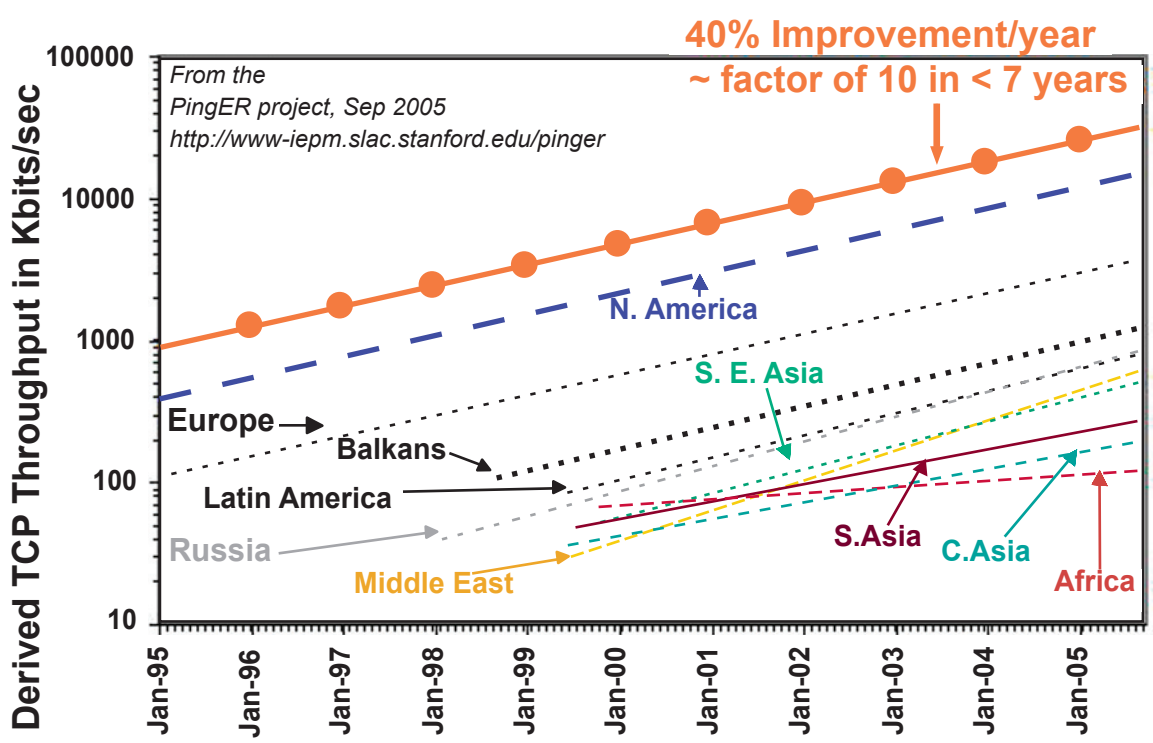
In an era of global collaborations and data-intensive grids, advanced networks are required to connect high-energy physics groups seamlessly, enabling them to collaborate throughout the life of their work. In the OSG, improving the data distribution capability among sites in all world regions is a key deliverable, enabling collaborative data analyses among university- and laboratory-based science groups worldwide. Such needs have led members of the physics community to become leading developers of wide area networks.

These physics developments have been paralleled by upgrades of national and continental network backbone infrastructures and key transoceanic links used for research and education in North America, Western Europe, Japan and Korea. As advances in the deployment and use of long range networks have accelerated, there is an increasing danger that the regions of Southeast Europe, Latin America, Russia, China, Central and South Asia, the Middle East and Africa will be left behind, separated from the rest of the world by a growing digital divide.

The Standing Committee on Inter-Regional Connectivity (SCIC), commissioned by the International Committee on Future Accelerators (ICFA) in 1998 to monitor the world's networks, track technology developments, provide roadmaps for future requirements, and identify connectivity problems, works to understand and mitigate or eliminate the digital divide as it affects high energy physics and other fields of collaborative science.

The SCIC Monitoring Working Group, in association with the Internet End-to-End Performance Monitoring project, has been tracking the digital divide over the past decade. Progress in the achievable network throughput in each world region and the multi-year gulf that separates regions have been demonstrated, showing that areas such as India and Africa are in danger of falling ever-farther behind.

TCP Throughput Measured From N. America to World Regions



(Les Cottrell)

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