Internet2 applications enable collaboration among people and shared, interactive access to information and resources in ways not possible on today's Internet. Interactive collaboration, real-time access to remote resources, shared virtual reality, and large-scale, multi-site computation and data mining are examples of just some of the high-performance networking applications that researchers at Internet2 member universities are developing and using today.

Remote Instrumentation

The Gemini Observatory
Association of Universities for Research in Astronomy

http://www.gemini.edu/

The Gemini Observatory is the result of a multi-national project to build twin 8.1 meter astronomical telescopes in Hawaii and Chile, making the skies in both the northern and southern hemispheres fully accessible to astronomers. High-performance networks enable these mountaintop telescopes to be operated remotely, in real-time, by astronomers in sea level-based control rooms. The high-performance connection also allows scientists to collaborate via videoconferencing, and will enable the observatories to share more of their findings with the public through techniques such as virtual observatory tours and live video to museums, planetaria and classrooms worldwide. Eventually, astronomers with access to Internet2 high-performance networks, in conjunction with international network partners, will be able to 'observe' using the Gemini telescopes from authorized remote sites, without having to travel to Hawaii or Chile.

The nanoManipulator
University of North Carolina at Chapel Hill

http://www.cs.unc.edu/Research/nano/

The nanoManipulator is an interface to scanning probe microscopes (SPM) allowing users to see, feel, and manipulate samples ranging in size from DNA to single atoms. The nanoManipulator allows the user to control the SPM, view interactive 3D visualizations of the data, and feel the shape of the sample through a force-feedback device. A nanoManipulator can be used collaboratively by scientists in a "virtual laboratory" environment that allows remote access to a shared microscope and previously collected data. During collaboration, the nanoManipulator transfers video and system control data—all having different bandwidth, loss, and latency (delay) requirements. In contrast to some applications that have "bursty" bandwidth demands, the typical scientific experiment using the nanoManipulator lasts for many hours, creating a long-lived high demand on the network.

Interactive Collaboration

The Access Grid
Argonne National Laboratory

http://www.accessgrid.org/

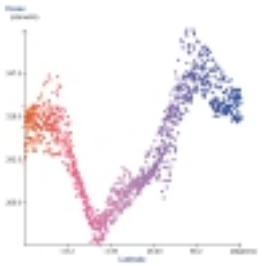
Large-scale scientific and technical collaborations often involve group-to-group interactions with multiple teams working together. The goal of the Access Grid project is to explore and support the requirements of group-to-group interactions across the computational grid. The Access Grid consists of large-format multimedia display, presentation, and interaction software environments; interfaces to grid middleware; and interfaces to remote visualization environments. Access Grid nodes are "designed spaces" that support the high-end audio/video technology needed to provide a compelling and productive collaborative experience. By providing access to these resources, the Access Grid supports large-scale distributed meetings, seminars, lectures, tutorials, and training.

Distributed Computing

National Scalable Cluster Project

University of Illinois at Chicago
University of Pennsylvania

http://www.ncdm.uic.edu/
http://nscp.upenn.edu/



The National Scalable Cluster Project (NSCP) has pioneered the application of cluster computing and high performance wide area networks to a variety of problems in data mining and data intensive computing. Using a testbed called the Terabyte Challenge, the NSCP develops the next-generation tools and standards to manage and mine massive (terabyte to petabyte) collections of data, specifically those that are geographically distributed. The Terabyte Challenge has been used as an Interoperability testbed for the development of the Predictive Model Markup Language (PMML) and has also been used in the development of DataSpace, an infrastructure to explore and mine remote, distributed data in real-time. Shown here is a graphical representation of climate data obtained using the DataSpace Transfer Protocol (DSTP). In this plot of ozone (an attribute) versus latitude (Universal Correlation Key) we are able to see the distribution globally.

Grid Physics Network

University of Chicago
University of Florida

http://www.griphyn.org/

The Grid Physics Network (GriPhyN) collaboration is a team of experimental physicists and information technology researchers who are implementing the first petabyte-scale computational environments for data intensive science. Using Internet2 high-performance networks, GriPhyN will allow geographically dispersed extraction of complex scientific information from massive datasets, provide access to large-scale computational resources, and enable collaboration among worldwide scientific communities. GriPhyN will initially give scientists access to the vast amounts of data that will flow from four large-scale physics and astronomy experiments. GriPhyN will be capable of storing 10 petabytes of data. In addition to the Abilene network, other high-performance networks, including ESnet, NREN, I-WIRE, and international connections through STAR TAP and StarLight, will be used to share data throughout this globally distributed community of scientists.

Networked Virtual Reality

Virtual Harlem

University of Missouri – Columbia
Central Missouri State University
University of Illinois at Chicago

http://www.evl.uic.edu/cavern/harlem/

Virtual Harlem is a virtual reality environment originally developed in collaboration with University of Missouri-Columbia to supplement African American literature courses at Central Missouri State University. Students are able to step through a virtual 'portal' to the 1925–1935 New York Harlem Renaissance to navigate the city streets, interact with key figures, and listen to music written and popularized during the era. More recently, the University of Illinois at Chicago's Electronic Visualization Laboratory translated the Harlem experience to a fully immersive CAVE environment, establishing an experimental testbed for a diverse group of educators and researchers. Virtual Harlem has also been deployed as the educational component of a Harlem, New York project to bring high-speed networking to five community technology centers offering under-served communities access to hardware and software.

TIDE2

University of Illinois at Chicago

http://www.evl.uic.edu/cavern/TIDE/

Image courtesy of the Electronic Visualization Laboratory, University of Illinois at Chicago

Tele-Immersive Data Explorer 2 (TIDE2) is a tele-immersion tool that allows distantly located scientists to query and visualize large, multi-dimensional datasets. It features out-of-core memory management and playback tools, and is supported by CAVERNsoft, a cross-platform tele-immersion toolkit for the Grid developed at the University of Illinois at Chicago's Electronic Visualization Laboratory. TIDE2 is designed to be a reusable framework to facilitate the construction of other domain-specific data exploration applications challenged with the problem of having to visualize massive datasets.