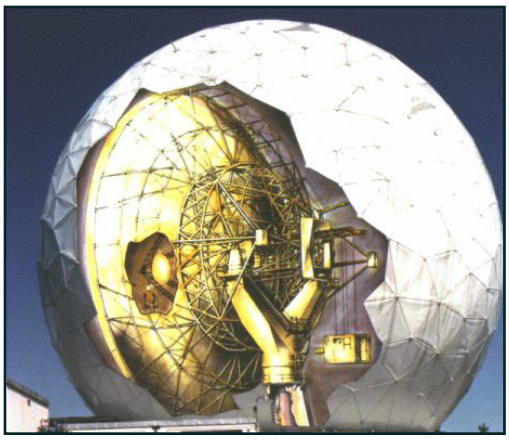
Internet2 Network

Internet2's Dynamic Circuit Network Case Study: The eVLBI Project



Courtesy of MIT Haystack Observatory

Very-Long-Baseline Interferometry (VLBI) involves high-resolution imaging of distant radio sources in the universe derived from radio telescopes located around the world. Signals received from telescopes in the US, Puerto Rico, Europe, Japan, Australia, South America, and other locations are carefully cross-correlated in the United States, Germany and elsewhere. The results allow detailed studies of the most distant objects and accurate measurements of the earth's motion in space.

The Problem

Over the past few decades FedEx has been hired to manually deliver data stored on tapes and disk packs from the telescope locations to the correlation research centers. Issues with this approach include the delay before all the data can be analyzed, and the impossibility of performing experiments requiring real-time adjustments to measurements being taken.

The Solution

MIT's Haystack Observatory is at the forefront of a global effort to use high-speed digital systems to efficiently process and transfer data for radio astronomy research. This effort is referred to as eVLBI, and its goal is that ultimately, huge bandwidths will be transmitted in real-time over advanced networks.

DCN and Universal Time Prediction

According to Chester Ruszczyk, Research Scientist at the MIT Haystack Observatory, one type of experiment that would greatly benefit from a DCN connection is known as an intensive experiment. The intensive experiment involves better earth-orientation predictions, particularly Universal Time (UT1), important for military and civilian navigation. These models adjust for the fact that the earth is not on a true 24 hour time period. Significantly, if scientists can process data for UT1 measurements within hours of an experiment, the uncertainty in the extrapolated UT1 prediction is reduced from 250 microseconds to just 25 microseconds.

Approximately one hour per day is the requirement for UT1 measurements, making this an ideal application for dedicated DCN connections that can be scheduled for a short period on a daily basis.

> *"Transfering large amounts of data in real time with sustainable data rates is the goal."*
>
> Chester Ruszczyk,
> Research Scientist
> MIT Haystack Observatory

Ruszczyk comments, "A DCN circuit allows one to be more aggressive with transport protocols. Transferring large amounts of data in real time with sustainable data rates is the goal. DCN will pave the way for improved prediction models for this type of experiment."

About DCN

To learn more about what DCN can do for your campus, read the back of this page and visit http://www.internet2.edu/network/dc/.

About the Internet2 Dynamic Circuit Network

Internet2's DCN is a revolutionary, optical circuit network for creating short-term circuits between end-users that require dedicated bandwidth, including reliable connections lasting from minutes to days.

Why Should I Use DCN?

DCN provides flexible bandwidth for the most demanding applications. This is particularly useful for projects such as the Large Hadron Collider and other big-science efforts that can stress out the campus backbone for short but schedulable periods.

How Does it Work?

An Internet2 member connects to the DCN through an Internet2 Connector. The DCN provides dynamic circuits across the Internet2 infrastructure to regional optical networks. This includes links to other national and global research networks like ESnet in the United States or GÉANT2 in Europe.

Seamlessly setting up optical circuits across independently operated networks requires the coordination of multiple administrative domains. Internet2's DCN uses control plane software to enable provisioning across domain boundaries with the appropriate authentication and authorization.

How do I Get Started?

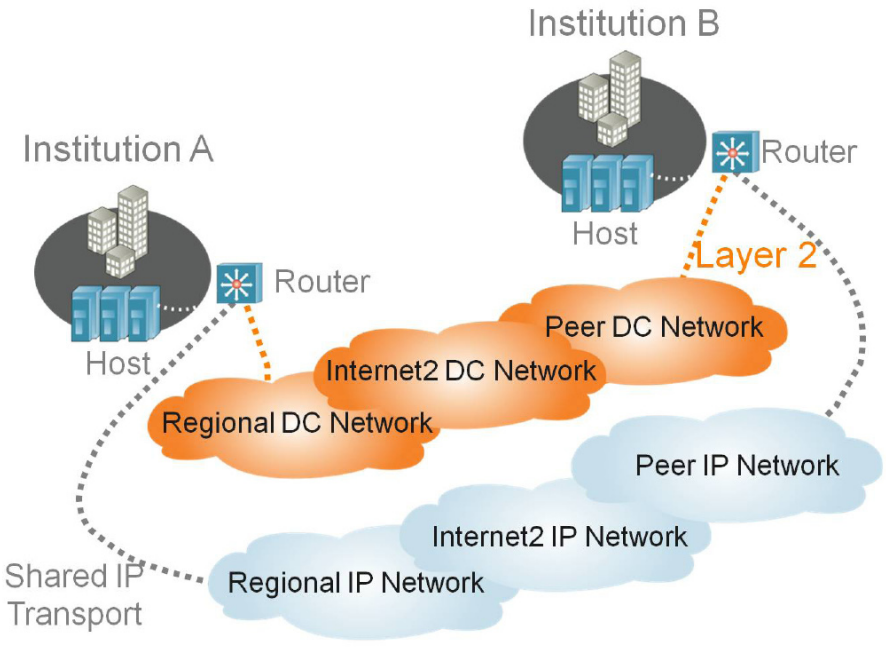
Researchers at Internet2 universities wishing to collaborate using the DCN should first contact their campus network organization for support. The campus network team can then determine if their institution has an appropriate connection to an Internet2 Connector, or other regional network. If the Internet2 Connector has not yet established a physical connection to the DCN, a request for that connection should be made to the connector.

Once a connection is established, a request should be sent to network@internet2.edu. An Internet2 project manager will be assigned, and will work with the connector and the Internet2 Network Operations Center (NOC) to implement the required network connections and implementation of the software to ensure delivery of the service.

Acknowledgments

Control plane software is under development through several on going projects, including the NSF-funded DRAGON project, the ESnet OSCARS program, and the GEANT2 AutoBAHN project. Other participants include the University of Southern California/Information Sciences Institute East (USC/ISI-East), Mid-Atlantic Crossroads (MAX), the University of Amsterdam, Nortel, and other regional and national networks.

Connecting to DCN



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