

How to Connect: Internet2's Dynamic Circuit Network

The Internet2 Network

The Internet2 Network is a high performance, hybrid optical and packet network infrastructure that provides advanced capabilities to the U.S. research and education community. The infrastructure supports an enhanced IP Network and a Dynamic Circuit Network (DCN).

DCN is a switching service that creates short-term circuits between end-users that require dedicated bandwidth, including reliable connections lasting from minutes to days.

Internet2's Dynamic Circuit Network

The DCN enables users to create point-to-point circuits across the Internet2 infrastructure using control plane software that automates the set up and tear down of the circuits. The Internet2 DCN is currently deployed throughout the United States in a preliminary operational mode. A number of Connectors and member organizations have also deployed DCN infrastructure; some are using it for live traffic while others are using it to experiment and develop applications. Internet2 encourages Connectors and members to explore DCN's unique capabilities during 2008. The goal for this year is to exercise the current capabilities and enhance control capabilities to fit the needs of users to request circuits on-demand or as a schedulable resource.

An Internet2 member connects to the DCN through an Internet2 Connector. The Connector's physical connection to the Internet2 infrastructure may be used both for the DCN and for longer-term point-to-point static circuits provided through WaveCo. Connection to the DCN provides dynamic circuits across the Internet2 infrastructure to regional optical networks that are Internet2 Connectors, and to other national and global research networks like ESnet in the United States or GEANT2 in Europe.

Seamlessly setting-up optical circuits across independently operated networks requires the coordination of multiple administrative domains. This is achieved through control plane

software enabling provisioning across domain boundaries with the appropriate authentication and authorization. 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. There is also active collaboration on developing the interdomain protocol within GLIF and a working group is forming at OGF to consider standardizing Dynamic Circuit control protocols.

The Internet2 DCN currently uses an open source version of DCN Control Software which has been called the DCN Software Suite. This suite includes the DRAGON-developed control plane software as well as the ESnet/Internet2 OSCARS software. This software is used to control the Internet2 DCN and is also available as open source to other institutions to use in creating their own DCN.

How to connect to DCN?

Internet2 Connectors

To connect to the DCN, current Internet2 IP Connectors should send a request to network@internet2.edu. An Internet2 project manager will be assigned to this request, and 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.

Internet2 Universities

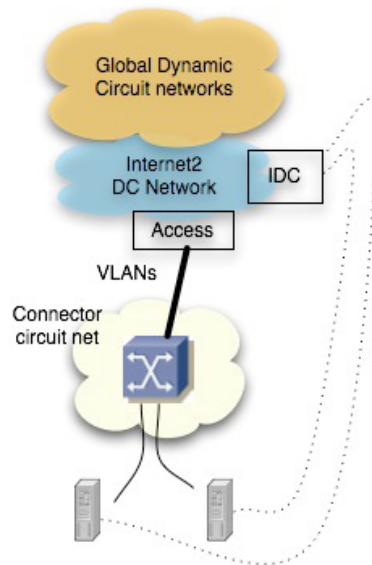
Researchers at Internet2 universities wishing to collaborate using the DCN should first contact their campus network organization for support. The campus network team can then determine if their institution has an appropriate connection to an Internet2 Connector, or other regional network. If their Internet2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

Initial Connections to DCN

A Connector, setting up the ability to use the Internet2 DCN may use several approaches. One scenario is a two-step approach in which the Connector first makes a data connection to DCN and uses it to configure static connections from its users to DCN. The second step is for the Connector to implement its own DCN domain. The connector then dynamically switches different users to the Internet2 DCN. Other implementation sequences may be appropriate for some Connectors. These examples provide basic descriptions of these stages. The Internet2 Network Operations Center and Internet2 staff will provide one-on-one consultation to help make a successful connection. Through partnership with regional networks and members, Internet2 has also created a series of workshops to help educate its members on DCN best practices, set-up processes, and associated technologies.

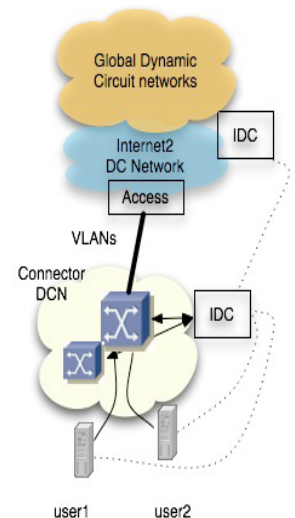
Connecting to DCN: Step 1

In Stage 1, Connectors must generally have an Ethernet switch that connects to the Internet2 dynamic switching platform, in the Internet2 Point of Presence (PoP). The Ethernet switch is used by the Connector to create a Virtual Local Area Network (VLAN) connection from the user on campus to the Internet2 DCN interface. The user requests dynamic circuits from the Internet2 DCN, the dynamic circuit starts at the edge of the Internet2 network. As demand on campus or additional campuses for the DCN service grows, the Connector adds users by establishing additional VLAN connections through the Ethernet switch from each user to DCN. These additional sites also use the Internet2 IDC to enable the service.



Connecting to DCN: Step 2

In stage 2, as the population in a single region or campus expands, regional networks or campuses may consider establishing local or regional dynamic circuit networks. The DCN Software Suite provides the necessary tools to initiate this process. The stage 2 figure shows a Connector that has created its own DCN and is a full participant in the Global Dynamic Circuit community. In this case the data connections are the same as in stage 1, but now the user requests dynamic circuits from the Connector IDC rather than the Internet2 IDC.



Connecting to DCN: An Example

This diagram shows a high-level view of how a DCN connection might be made between two sites in the United States. This demonstrates how regional networks connect users on campuses to the Internet2 DCN and to partner DCNs like ESnet or GÉANT. In this scenario, a researcher at Institution A does high-bandwidth (multi-Gbps) transfers to and from Institution B. Rather than congesting the IP network between Institutions A and B with these large periodic data flows, a short-term, dedicated, dynamic circuit is established across the DCN domains to handle this specific traffic. The data is dynamically switched from the shared IP path onto the dedicated circuit, a multi-Gbps path devoted to this application.

