

# Internet2 Network



"A key concept in the NSF's Cyberinfrastructure vision is that network capacity should be available as a schedulable, on-demand resource—just like a supercomputer or radio telescope is today. The idea is that researchers, scientists, artists, or faculty can tap into deep bandwidth resources whenever and wherever they need it. We believe the new Internet2 Dynamic Circuit Network which was developed through collaboration with our community, brings this important vision to fruition."

Rick Summerhill, CTO Internet2

<http://www.internet2.edu/network/dc/>



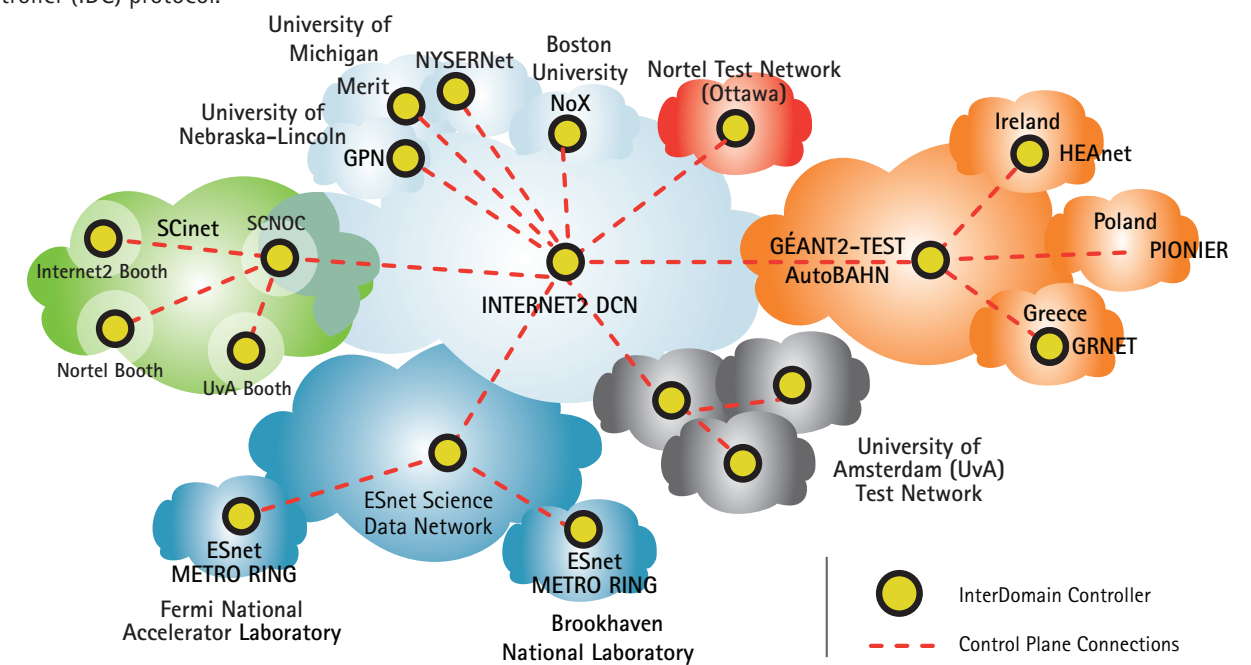
# Internet2 Demonstrations at SC07

## Internet2 Network



The Internet2 Dynamic Circuit (DC) Network is a revolutionary, optical circuit network that provides dedicated bandwidth for the most demanding applications. The Internet2 DC Network uses community-developed, standards-based technologies and protocols to provide on-demand, dedicated optical paths between endpoints. The Internet2 DC Network is currently being deployed and tested by multiple Internet2 Connectors.

At SC07, demonstrations highlight the interoperability of the Internet2 DC Network with other dynamic circuit networks in the United States and around the world. This interoperability is based on multiple, independent implementations of the Inter-Domain Controller (IDC) protocol.



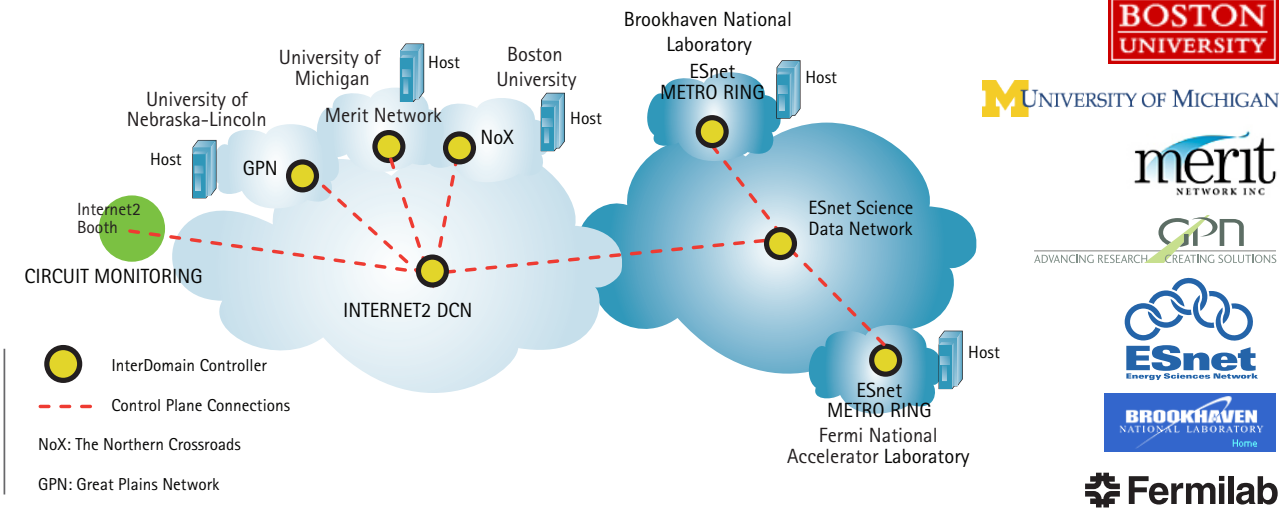
Networks involved in the inter-domain dynamic circuit network demonstrations at SC07 include:

- ESnet-Science Data Network in the United States
- GÉANT2-AutoBAHN in Europe
- Great Plains Network (GPN) in the United States
- GRNET in Greece
- HEAnet in Ireland
- Merit Network in the United States
- Northern Crossroads (NoX) in the United States
- Nortel Test Network in Canada via MAN LAN
- NYSERNet in the United States
- PIONIER in Poland
- University of Amsterdam via NetherLight

Applications using these dynamic circuit networks across multiple domains include:

- High Definition streaming video from HEAnet to the Internet2 SC booth
- File transfers from NYSERNet, GRNET and PIONIER to the Internet2 SC booth
- Large Hadron Collider data transfers: Fermilab to the University of Nebraska-Lincoln; Brookhaven Lab to the University of Michigan; Brookhaven Lab to Boston University
- CineGrid 1080p HD video transfer between University of Amsterdam and the Dutch Pavilion at SC07
- High Definition video streaming between Nortel's office in Ottawa, Canada and the Internet2 SC booth; Grid Applications requesting large data transfer using GridFTP

Large Hadron Collider Data Transfers from Fermilab to the University of Nebraska-Lincoln

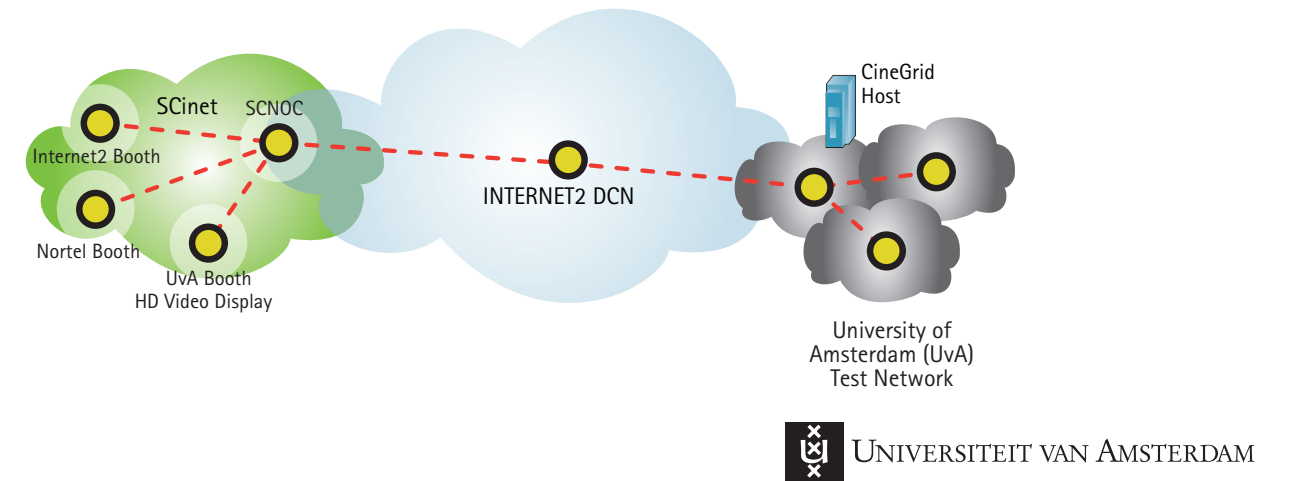


**Background:** CERN's Large Hadron Collider (LHC) experiment is scheduled to circulate the first beams in May 2008. First collisions at high energy are expected mid-year with results from the experiments soon after. This demonstration is in anticipation of LHC data-intensive demands on the network from the U.S. collaborators on this experiment: 2 U.S. national laboratories; 15 Tier 2 institutions; 68 Tier 3 institutions; and the 1500 U.S. researchers at Tier 4 locations.

**Application Class:** Large file transfers across multiple domains.

**Demonstration:** LHC file transfers between Fermilab, a Tier 1 national laboratory, and the University of Nebraska-Lincoln (UNL) a Tier 2 institution. The Fermilab developed LamdaStation interacts with the Internet2 DCN and invokes the dynamic circuit set up and graceful tear down. Circuits are provisioned based on reaching a certain threshold of traffic over the production IP network between Fermilab and UNL. Circuit performance will be monitored by perfSONAR. Additionally, dynamic circuit creation and file transfers between Brookhaven National Laboratory (BNL) and Boston University, and BNL and the University of Michigan will be demonstrated.

CineGrid HD Video Streaming between University of Amsterdam and the Dutch Pavilion at SC07

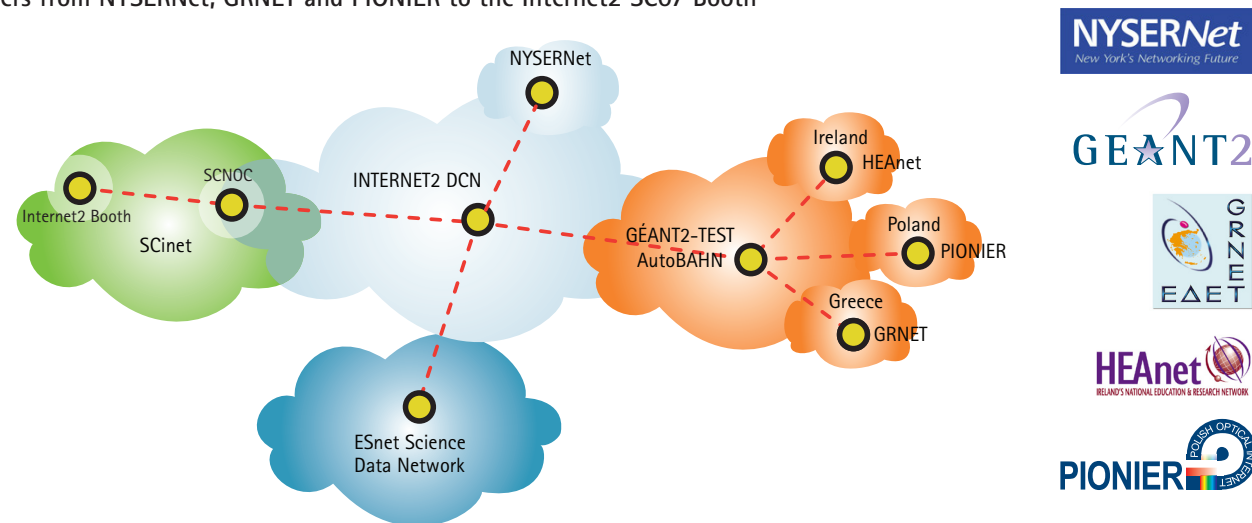


**Background:** The University of Amsterdam (UvA) is collaborating with Internet2 to develop inter-domain capabilities and experiment with inter-domain protocols. UvA will demonstrate the use of "tokens" implemented as a plug-in to the IDC code, as a way to authorize the use of dynamic circuits. A "token" is created during circuit reservation time and checked when the circuit is turned on.

**Application Class:** HD streaming video transfer across multiple domains.

**Demonstration:** For this demonstration UvA will link to the Internet2 DC Network with its own GE circuit connection across the Atlantic between NetherLight and MANLAN. In Amsterdam, UvA has three domains and each domain has two Ethernet switches. The demo will consist of a CineGrid 1080p HD video transfer across multiple domains from the University of Amsterdam to an HD display at the Dutch Pavilion at SC07. The circuit will be monitored at the Internet2 booth by perfSONAR.

High Definition Video Streaming from HEAnet to the Internet2 SC07 Booth  
File Transfers from NYSERNet, GRNET and PIONIER to the Internet2 SC07 Booth

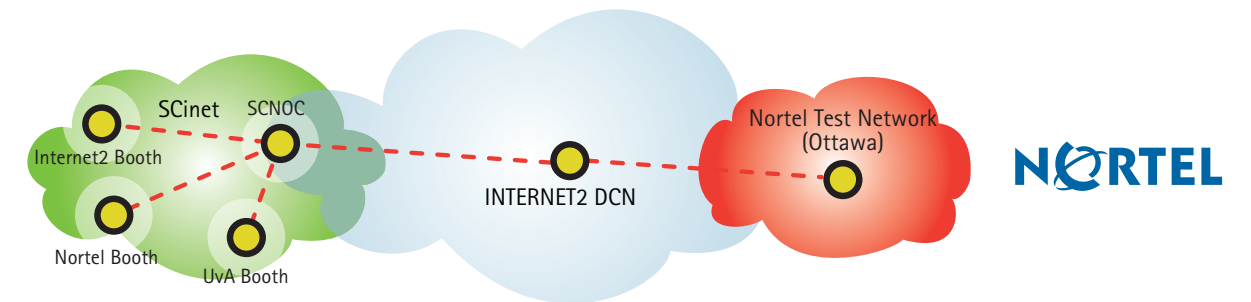


**Background:** Multi-domain interoperability is essential to broadening the reach of the Dynamic Circuit Network. Internet2 is working with collaborators in the U.S. and Europe to develop and test common aspects of Inter-Domain Controller software.

**Application Class:** High definition video streaming and large file transfers across multiple domains.

**Demonstration:** HD video streaming between Ireland (HEAnet) and the Internet2 booth and file transfers from New York, Poland, and Greece to the Internet2 booth. All dynamic circuits will be set up and torn down on-demand and monitored by perfSONAR.

High Definition Video Streaming and Grid Applications between Nortel's Labs in Ottawa, Canada and the Internet2 and Nortel Booth at SC07



**Background:** Nortel has a technology product named Dynamic Resource Allocation Controller (DRAC) to address next-generation networking concerns around an application-aware dynamic network. The Web-Services enabled DRAC software dynamically adjusts network resources to meet the changing demands of various applications according to priorities and constraints defined in its policy engine. Internet2 has been working in collaboration with Nortel to test their implementation of the Inter-Domain Control protocol on their DRAC domain controller and allow it to interoperate with Internet2 and ESNet.

**Application Class:** High Definition video transfer across multiple domains; Grid Applications requesting large data transfer using GridFTP.

**Demonstration:** Nortel has an optical connection to Internet2 at MANLAN via CANARIE. At Nortel Labs, the connection is terminated on their Metro Ethernet Routing Switch (MERS) 8600 and Optical Multiservice Edge (OME) 6500 optical platform. This demo shows the ability of the open source IDC implementation to interoperate with a commercial Network Domain Controller. It also highlights a proof point of Nortel's DRAC capabilities to participate in an inter-domain infrastructure, and establishing the usefulness of this protocol. The expectation is that Nortel (and other companies) will participate in ongoing development of the protocol and the deployment of global, dynamic, optical and Ethernet infrastructure.