

Project Title: ESnet On-demand Secure Circuits and Advance Reservation System (OSCARS)
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Institution: ESnet

Number: Graduate Students: 1
Number of PhD Students: 0
Number of PostDoc Fellows: 0
Project Website (if available): www.es.net/oscars

With the Large Hadron Collider (LHC) expected to come online in 2007, demand for guaranteed high-bandwidth connectivity for huge data transfers is becoming urgent. Such service is also identified as important by many other DOE Office of Science mission areas in the reports of several science networking requirements workshops¹, and such service will be important to the ITER project when it comes online a decade from now.

The default characteristics of the Internet today do not provide a user any service guarantees. There is neither the assurance that a packet will be delivered to its destination, nor any transport predictability (such as latency and jitter) when the packet is in transit. With the advent of service sensitive applications to support DOE's science (such as remote controlled experiments, time constrained massive data transfers, distributed (Grid based) analysis of massive scientific data sets, etc.) the capability of on-demand, dynamically provisioned bandwidth assignment will provide predictable high bandwidth and/or low latency paths (virtual circuits) to high-impact science applications in a way that lets the science collaborations manage bandwidth as a predictable service as is currently done with computing resources.

The ESnet On-Demand Secure Circuits and Advance Reservation System (OSCARS) is developing and deploying a prototype service that enables on-demand provisioning of guaranteed bandwidth, secure virtual circuits within the ESnet production network. Further, with most of the large-scale science of the Office of Science being collaborations with the US and international research and education community, inter-domain interoperability is critical, and so the service is being developed in collaboration with the US and European research and education networking community in order to ensure end-to-end quality of service.

The major research activities of OSCARS center around three main issues.

1. Setup, use, and teardown of virtual circuits: Utilizing standardized protocols or mechanisms to manage circuits helps facilitate deployment over non-homogenous networks.
2. Appropriately allocating bandwidth on a shared network: Authentication and authorization schemes must effectively address security and usage policy concerns in regards to who may provision circuits, and when they may be provisioned.
3. Inter-domain interoperability: For a circuit service to be effective, it must be end-to-end. In order for inter-domain circuits to be successful, interoperability must occur on three levels; data-plane (the flowing of traffic from one domain to another e.g. layer 1, 2, 3), control-

¹ See "High Performance Network Planning Workshop," August 2002 (<http://www.doecollaboratory.org/meetings/hpnpw>) and "DOE Science Networking Roadmap Meeting," June 2003 (<http://www.es.net/hypertext/welcome/pr/Roadmap/index.html>)

plane (the setting up of circuits e.g. circuit-stitching, RSVP-TE), and management-plane (the security and usage policies.)

To facilitate technology transfer, OSCARS is being developed with a service-oriented architecture. Its components are compossible and replaceable, and they communicate via standards-based mechanisms. Each component of OSCARS – the web-based interface, the authentication, authorization and accounting server (AAA), and the bandwidth reservation and path setup system – handle communication via well-defined interfaces. Each may be used with or replaced by with another component that uses the same interface definition.

In order to ensure that the new network services interoperate among DOE Labs and universities and other research institutions, the new services are being developed in close cooperation with Internet2/Abilene and the US research and education network community, and with Dante/GEANT and the European research and education network community. This work is also in collaboration with the DOE funded UltraScienceNet, network research project.

In the past year, ESnet has successfully demonstrated that an end-user can provision circuits within ESnet (through a simple web-interface), and effectively obtain the required bandwidth. To date we have create 21 accounts for OSCARS beta users, collaborators, and developers, and have processed more than a hundred reservation requests.