

Intradomain and Interdomain Circuit Reservations using OSCARS

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Summary

Two DOE Office of Science workshops⁺ in the past three years have clearly identified dynamically provisioned quality of service (QoS) paths as a science discipline driven network requirement. To address this, the ESnet On-Demand Secure Circuits and Advance Reservation System (OSCARS) is developing and deploying a prototype service that enables end-users to provision guaranteed bandwidth secure virtual circuits within the ESnet production network, and between ESnet and other domains.

The practice of modern science is increasingly dominated by large-scale science that is highly dependent on world wide collaborations of scientists and science resources. An example of this is the Large Hadron Collider (LHC) which is expected to come online in 2007. With the environment of science being inherently multi-domain, where data flows over several networks under different administrative controls, creating end-to-end guaranteed bandwidth paths poses unique challenges. To address these challenges, OSCARS was designed and engineered in collaboration with several like-minded projects such as the Bandwidth Reservation for User Work (BRUW)¹ from Internet2, Bandwidth on Demand (GN2-JRA3), Performance and Allocation Capacity for End-users (SA3-PACE) and Advance Multi-domain Provisioning System (AMPS)² from GEANT, TeraPaths³ from Brookhaven National Laboratory, and

Network QoS for Magnetic Fusion Research⁴ from General Atomics.

Software engineering

The OSCARS code base, which was co-developed with Internet2, underwent further refinement to make it more object-oriented and robust. In addition, database schemas were further normalized to optimize efficiency.

To promote interoperability with collaborative projects, OSCARS was coded to closely conform to the WS-I Basic Profile specifications which allow SOAP clients to be package and language agnostic.

Security

OSCARS presents an interactive Web interface for users within the ESnet domain and a Web Services API for programmatic use from within the domain or for reservation brokers in other domains. Connections to the Web interface are authenticated with a username, password

¹ BRUW: <http://discvenue.internet2.edu/wordpress>

² PACE: <http://pace.geant2.net>

³ TeraPaths: <http://www.atlasgrid.bnl.gov/terapaths>

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⁺ 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>)

⁴ Fusion QoS: <http://www.fusiongrid.org/network>

scheme. The Web Service connections are authenticated by XML signatures using a PKI certificate. OSCARS uses an authorization scheme based on the ROAM authorization service in use by the FusionGrid.⁵ It keeps all the user and resource information in a database, including all authorizations for use of the resources. Users who have registered with the OSCARS system are granted classes of privileges on an individual basis. Reservation requests coming from the reservation broker in another domain are made on the basis of an SLA agreement with the domain, rather than the specific user for whom the request is being made. The domain is authenticated by the certificate that was used to sign the request message.

Interdomain Reservations

Internet2: BRUW

On Apr 6, 2006, an interdomain guaranteed bandwidth path between Abilene and ESnet was dynamically negotiated and configured by the BRUW and OSCARS systems respectively. The unidirectional 25Mb/s guaranteed bandwidth path was configured between an Internet2 test host in Indianapolis, IN and an ESnet host in Sunnyvale, CA. The path consisted of two unidirectional MPLS Label Switched Paths (LSP's), one in Abilene, and the other in ESnet, "stitched" together at the Abilene-ESnet peering point in Chicago, IL.

Additional interoperability tests between Abilene and ESnet were done in June 2006 when both BRUW and OSCARS were

modified to utilize signed SOAP messages over SSL. The tests in April used unsigned SOAP messages over SSL to communication request information.

GEANT: AMPS

Collaborative efforts with GEANT included the deployment of the AMPS software within ESnet, and successfully testing of cross-domain AMPS communications between ESnet and GEANT.

A subset of the AMPS WSDL service description was adopted as the starting point for the OSCARS service description, because the AMPS description already included elements and operations commonly used in both intradomain and interdomain path setup.

BNL: TeraPaths

There was an extensive collaboration with BNL in refining the OSCARS service description to enable interoperability with TeraPaths. These refinements were instrumental in increasing the conformance with the WS-I Basic Profile.

Using the OSCARS service description, BNL was able to generate client stubs to allow TeraPaths to communicate directly with OSCARS to submit reservation requests.

In August 2006, the first successful interdomain bandwidth reservation between TeraPaths and OSCARS was executed.

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⁵ "ROAM: An Authorization Manager for Grids", J. R. Burruss, T. W. Fredian, M. R. Thompson, <http://www.fusiongrid.org/research/papers/burruss-jgc-2005-draft-final.pdf>