Education Consortium Eases Members' Network Congestion

New Jersey Research and Education Network implements next-gen routing architecture to enhance service delivery.

Executive Summary

New Jersey Research and Education Network (NJEDge.Net)

- **Industry:** Education
- **Location:** Newark, New Jersey
- **Number of Employees:** 19

CHALLENGE

- Balance member traffic and enhance network performance
- Deliver network technology support services and maximize institutional decision making
- High operational expenditures for members operating Border Gateway Protocol (BGP)
- Provide Internet edge access link load balancing for multihomed sites with disparate providers, infrastructures, and user and application traffic flows.

SOLUTION

- Integrate advanced routing technology into NJEDge.Net's existing network architecture
- Connect membership to the new technology to enable accurate multihomed ingress traffic load balancing

RESULTS

- Immediately load balanced ingress traffic to mulithomed members
- Reduced members' operational expenditures for manually managing traffic load distribution
- Lowered members' capital expenditures by decreasing need for future hardware purchases

Challenge

In 1997, the Commission on Higher Education created a technology task force to investigate into Looking to the New Millennium: New Jersey's Plan for Higher Education, the state's first long-range plan which would serve as a guide for planning and policy development by institutions and the state. US$5 million of New Jersey's Higher Education Technology Infrastructure Fund was set aside to aid the creation of a single broadband network utility to support the collaborative efforts of colleges and universities in the state. In 2000, the task force established NJEDge.Net (The New Jersey Research and Education Network), with the Presidents' Council Executive Board serving as the board of directors, to assist with the statewide network and governance structure.

NJEDge.Net is a nonprofit consortium that supports 62 New Jersey educational institutions in their teaching, learning, research and development, and mission by providing collaborative resources, networked information services, and consultations. Understanding that broadband connectivity is critical to delivering core missions of the higher education community, NJEDge.Net built a state-of-the-art network in 2003 to better deliver support services to its members and execute on New Jersey's Looking to the New Millennium higher education plan.

After building its broadband network, NJEDge.Net encountered members' other operational challenges; specifically NJEDge.Net's members were mulithomed to diverse Internet Service Providers (ISPs), and the majority of them had issues balancing ingress network traffic among the ISPs in the multi-homing links they purchased. Members were incurring complexity from managing Border Gateway Protocol (BGP) at the Internet edge, and their various providers service limited traffic-balancing support among the links, often leaving the members to regulate the links themselves following infrastructure installation, routinely using complicated BGP policies. James Stankiewicz, director of Internet engineering at NJEDge.Net, comments on members' frustrations: "Our members were paying for bandwidth that they weren't even using. No matter what they tried, they just could not get a balance of traffic among their providers."

The inability to balance ingress traffic was a drain on members' time and funds, and inhibited NJEDge.Net's ability to deliver critical technology consultative services and best use practices to institutions throughout New Jersey. Stankiewicz recalls one NJEDge.Net member, "...told me he was paying a premium for Internet service amounts between all his providers, and still was not able to get the traffic to balance." NJEDge.Net needed a solution that would balance members' traffic despite their varying techno-political networks and enable the consortium to deliver services that supported the state's commitment to furthering education.

Education Consortium Eases Members' Network Congestion

New Jersey Research and Education Network implements next-gen routing architecture to enhance service delivery.

"Using LISP has enhanced our offering to our members... We introduced this technology, and it has noticeably relieved pressure on our membership."

James Stankiewicz
Director of Internet Engineering, NJEDge.Net

Solution

In 2011, Stankiewicz met with Cisco to explore Locator/ID Separation Protocol (LISP) technology as a potential solution. LISP is a state-of-the-art routing architecture that decouples location and identity of IP addresses, yielding many benefits. Cisco is leading the development of LISP within the Internet Engineering Task Force (IETF) and has included it within IOS, IOS-XE, and NX-OS releases since December 2009. LISP separates IP addresses into two namespaces: Endpoint Identifiers (EIDs), which are assigned to end-hosts (networks within a site), and Routing Locators (RLOCs), which are assigned to devices (primarily routers) that make up the global routing system.

For enterprises, including K-12 and higher education institutions, one of the benefits of implementing the LISP approach is that traffic destined to a site is automatically and accurately distributed across all available access links in accordance with the ingress policy specified by the site. That is, LISP simplifies traffic engineering capabilities and enables managing bandwidth in a simple and cost-effective way. There is no need to run, configure, or maintain BGP, as the technology guarantees load balancing of ingress traffic flows regardless of the provider.

Stankiewicz describes the moment that he and his team decided to officially engage Cisco: "Cisco worked with us to test the technology live, and in action. After viewing the technology first-hand, we realized that LISP running on Cisco routers worked as expected." LISP integrated flawlessly into NJEDge.Net's existing network architecture with no changes required to topology or hardware. LISP also integrated flawlessly with member site Cisco routers.

Results

For the majority of New Jersey educational institutions, balancing their traffic is a major frustration. NJEDge.Net can initiate direct connection with the school and can also provide an alternate to achieve load balancing without BGP and the complexity that comes with it. "Using LISP," Stankiewicz says, "has enhanced our offering to our members. I can't tell you how phenomenal it's been. We introduced this technology, and it has noticeably relieved pressure on our membership."

For example, before LISP, Rider University in Lawrenceville was in a difficult position with balancing their traffic. Despite working with ISPs that gave pointers on how to balance traffic, the traffic flow was not optimized. The school worked with NJEDge.Net and integrated LISP within the school in less than a day. The end result was balanced traffic and increased performance within a matter of hours.

Education Consortium Eases Members' Network Congestion

New Jersey Research and Education Network implements next-gen routing architecture to enhance service delivery.

Product List

Cisco LISP capabilities are currently supported on a range of Cisco IOS, NX-OS and IOS-XR routing platforms through Early Deployment (ED) software releases and mainline releases.

ROUTING AND SWITCHING

- Cisco ISR 800, 1800, 1900, 2800, 2900, 3800, 3900 Series
- Cisco ASR 1000 Series
- Cisco Nexus® 7000 Series
- Cisco ASR 9000 (Q4 CY2012)
- CRS Series (Q4 CY2012)

Another member, Monmouth University, had similar conditions as the aforementioned University. The difference with Monmouth University was that there was no direct connection to NJEDge.Net. Monmouth University was using two different ISPs. After many failed attempts to balance traffic, Monmouth inquired about NJEDge.Net's ability to load-balance their traffic. As soon as LISP was implemented, their load balance problems were resolved. Eric Joyce, Director of Infrastructure Operations at Monmouth University, indicated: "We are quite pleased with the results of switching over to LISP routing. Using BGP, we would at most ever average 130-140MB of our 200MB of bandwidth. Even with the use of prepends or more specific routes, we could never achieve an equal balance."

Beyond performance improvements, LISP has resulted in enormous cost savings for NJEDge.Net's community. Generally, NJEDge.Net members move through cyclical equipment refreshes; whenever a member's hardware ceased to support the amount of routes needed for multi-home connections on the router, they would be need to purchase new hardware with additional memory, costing on average US$28,000. Because LISP is incrementally deployable on existing routers with only a software upgrade, NJEDge.Net members no longer have to completely upgrade their equipment and buy new routers just to support BGP and Internet routing table scaling. Now members can purchase smaller, simpler devices for their routing needs by integrating LISP technology, resulting in an average of $11,000 in savings spread over the lifetime of a box (approximately seven years). Stankiewicz comments on these benefits: "All connected members of our consortium can benefit in the same way. Every member that has integrated LISP is happy that they have a solution that truly works for them."

Next Steps

Since January 2012, NJEDge.Net has signed on five additional members to integrate LISP, and eight more members are at the implementation planning stages. NJEDge.Net's Board of Trustees meets on a quarterly basis, and it is anticipated that an increasing number of members will integrate LISP as each meeting convenes. Because LISP also provides highly scalable network virtualization, smooth IPv6 migration, and host mobility support, NJEDge.Net is also looking into leveraging LISP for data center mobility, including disaster recovery strategies.

For More Information

To learn more about Cisco LISP, go to http://lisp.cisco.com and http://www.cisco.com/go/lisp.

Education Consortium Eases Members' Network Congestion

New Jersey Research and Education Network implements next-gen routing architecture to enhance service delivery.

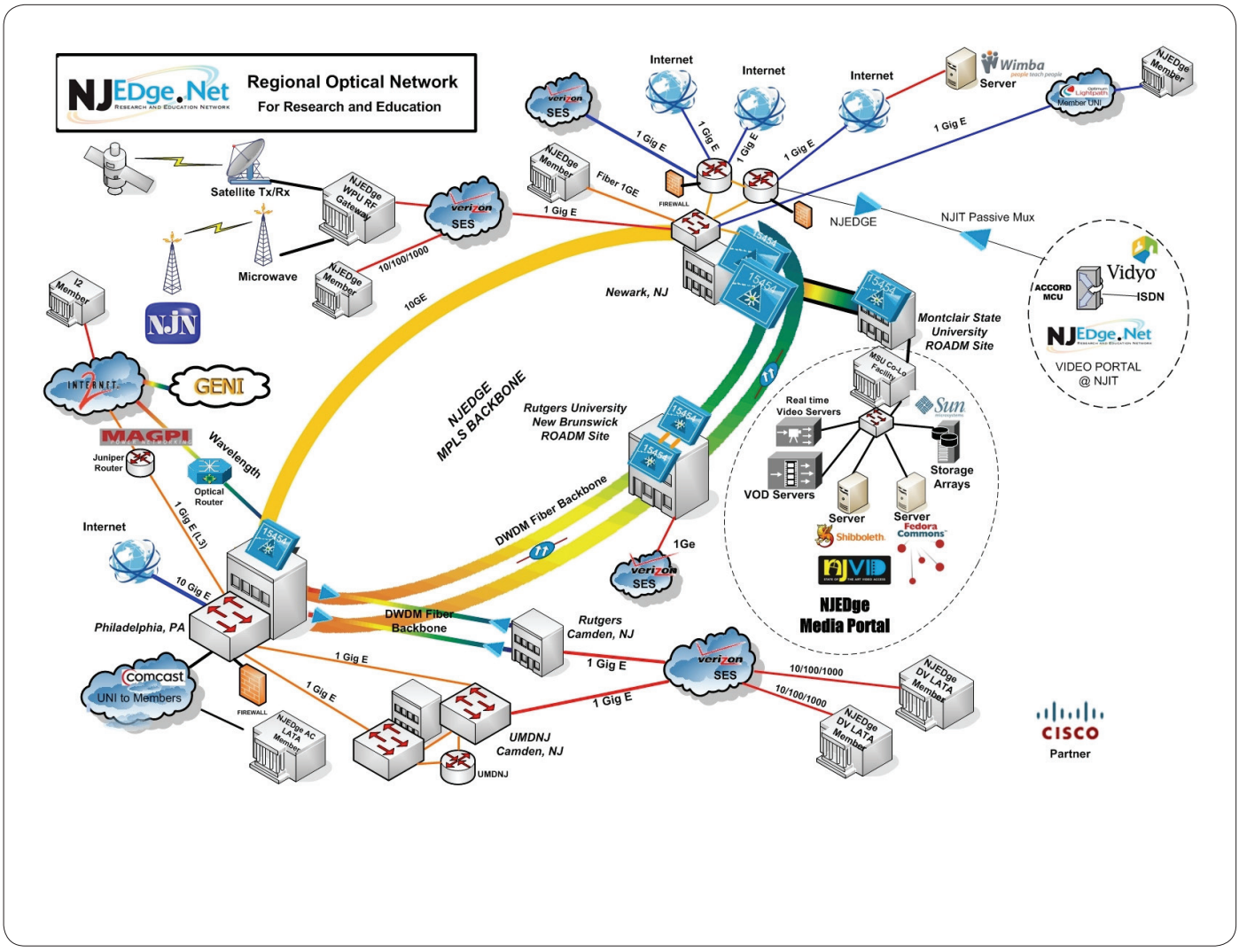

Figure 1.
NJEDge Regional Optical Research Network-Public Diagram