National Institution Improves Network to Support Visitors and Science

Smithsonian dark fiber optical network connects museums, offices, and research facilities.

Executive Summary

Smithsonian Institution

- **Industry:** Museum and Research Institution
- **Location:** Headquartered in Washington, D.C.
- **Number of Employees:** 7,000

CHALLENGE

- Increasing network demands driven by high-bandwidth applications, such as video for the baby panda cam at the national zoo and the digitization of museum collections
- Increasing need for access to Smithsonian resources by institutes of higher learning
- Rising circuit costs, long lead times for changes, and limited equipment space and power in 100+ year-old buildings

NETWORK SOLUTION

- Cisco Optical Networking System Multiservice Transport Platform

RESULTS

- New levels of network performance and reliability, with better than 99.999 percent availability
- Reduced latency from more than 20 milliseconds to less than 20 microseconds, a 1,000-fold improvement
- Annual savings on circuit charges of approximately US$100,000 per year using DWDM and leased fiber paths that allow the addition of devices and services as needed

The Panda Cub at the National Zoo

Challenge

Millions of people are familiar with the wonderful museums along the National Mall in Washington, D.C. But what many people do not realize is that the Smithsonian Institution is much more than its impressive collections of art and artifacts. It is a major contributor to research and education that is helping to unlock the mysteries of the universe, better understand our biodiverse planet, value world cultures, and improve our understanding of the American experience.

Founded in 1846, the Smithsonian Institution is the world's largest museum and research complex, consisting of 19 museums and galleries with more than 137 million objects, artworks and specimens; the National Zoological Park; and nine research facilities. In addition, the Institution encompasses 40 other facilities on the East Coast, from Florida to New York, and 181 affiliate museums across the country.

The Institution's mission is to increase and disperse knowledge and its vision is to help shape the future by preserving our heritage, discovering new knowledge, and sharing resources with the world. Technology plays a major role in helping the Institution fulfill its mission: from digitizing its collections, to creating interactive web-based learning experiences for visitors and students, to facilitating its genomic research efforts.

In 2012, there were more than 30 million visits to Smithsonian museums and the National Zoo, more than 100 million website visitors, and more than 8 million digitized records available online. The Zoo's Panda Cam alone has received more than 1 million clicks by people watching the new baby panda in action.

Between museum visitors sending pictures via the Wi-Fi network, 7,000 employees sharing large files via email, researchers transferring digital images, and Panda Cam watchers, the Institution's 1 Gbps Ethernet network was under tremendous strain and suffering from repeated congestion, at times running at 95 percent capacity.

Meanwhile, other Smithsonian research endeavors required network support as well. These programs included genomics research (mapping the genomes of the animal and plant kingdoms), astrophysics, environmental research on the Chesapeake Bay and the Florida Coast, tropical research in Florida, Air and Space Museum video support to NASA, and the digitization (2-D and 3-D) of the Smithsonian's vast collections. As these programs and their technologies advanced, they required far more bandwidth than the legacy network could handle.

"People keep building more and more apps. That's wonderful, but they aren't worth anything if your network can't handle it," says Martin Beckman, director of IT Operations for the Smithsonian Institution. Continually adding leased carrier circuits to accommodate the growing traffic was expensive and inefficient, so Beckman and his team began to implement an optical network.

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Martin Beckman, Director, IT Operations, Smithsonian Institution

Network Solution

The Smithsonian Optical Network (SON) uses dense wavelength-division multiplexing (DWDM), which employs multiple light wavelengths to transmit signals over a single optical fiber. DWDM maximizes the use of installed fiber cable and allows new services to be quickly and easily provisioned over existing infrastructure.

The SON includes a series of Cisco® Optical Networking System Multiservice Transport Platform Multiplexers that allow up to 40 optical wavelengths to traverse a single pair of fiber that can transport 4 Terabits with minimal operational complexity and near-zero excess latency. Using amplifiers to extend the optical signal, the SON is able to connect the core network routers in downtown Washington, D.C. to a data center 30 miles away in Herndon, Va., in addition to locations in Suitland and Landover, Md. Through an interconnection partner, the Institution also has direct access to the Internet and Internet2, an advanced networking consortium led by the research and education community.

The Institution's legacy core network 1 Gbps Ethernet links were upgraded to dual 40 Gbps paths diversely routed across the SON architecture, connecting four high-performance core routers, two at the Herndon data center and two at the National Mall. Connections to other facilities, including all the museums, have each been upgraded to redundant 10 Gbps fiber links.

In 2014, the network will undergo additional improvements when the 40 Gbps services are upgraded to diversely routed 200-400 Gbps services. The Institution is also moving all its IP phones to 1 Gbps and upgrading its PCs to take advantage of the new capabilities, such as streaming and transferring video or 3-D images, made possible by the SON.

Results

The SON is yielding tremendous benefits, including new levels of network performance and resiliency. Capacity has greatly increased, and latency has greatly decreased, providing visitors, employees, and researchers with more network throughput for their images and files. Increased bandwidth was especially welcomed by the throngs of people who regularly watch the new baby panda via webcam.

Whereas the legacy network experienced more than 600 circuit drops in six months, the symmetry of the core optical network provides better than 99.999 percent availability to the Institution enterprise overall and makes the network more resilient. And latency on the core backbone network has been reduced from more than 20 milliseconds (20 thousandths of a second) to less than 20 microseconds (20 millionths of a second).

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Martin Beckman, Director, IT Operations, Smithsonian Institution

Product List

Network Management

- Cisco Unified Computing System™ (UCS®) Manager

Optical Products

- Cisco ONS 15454 MSTP

Routing and Switching

- Cisco Nexus® 7009 switches
- Cisco Nexus 7004 switches
- Cisco Nexus 5548 FCOE switches
- Cisco Catalyst® 6506e routers

Voice and IP Communications

- Cisco 7900 series phones
- Cisco wireless 3502 access points

"The backbone has been bullet-proof, as I expected it would be, and that is due in no small part to the help from Cisco directly and the leading value-added reseller, WWT," says Beckman.

Leasing fiber has proven to be extremely affordable for the Institution, which estimates annual savings on circuit charges at approximately US$100,000 per year. Instead of leasing fixed circuits, flexible add/drop modules allow individual fiber channels to be dropped and inserted along a route as needed. And an open-architecture system allows a variety of devices to be connected, such as IP routers and optical switches. As Beckman says, "It's the backbone that makes the magic happen. Once you have optical fiber, you're only limited by your imagination."

For More Information

To find out more about Cisco networking solutions, go to: http://www.cisco.com/go/networkfabric.