NETWORKING CASE STUDY:

Juniper Networks and MCI Build Next Generation Infrastructure to Support Future of DoD's Research and Engineering Community

CRA Reports

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IP Performance Improves by 500 Percent

Summary

Six months after initiating an ambitious project to transition the Defense Research & Engineering Network (DREN) to a next generation, Multi Protocol Label Switch (MPLS) based network, a contracting team made up of MCI and Juniper Networks completed an operational cutover of this nation-wide, 70+ site network -- 12 months ahead of schedule. The new infrastructure has elevated critical IP performance metrics by as much as 500 percent. Key success factors are:

- *A well managed collaborative effort from all participants in the DREN network – including local exchange carriers across the country.*
- *Stable, off-the-shelf M-series routers from Juniper Networks that provide ATM transport over MPLS and are easily integrated existing operations environments.*

Challenge

The Department of Defense invests billions of dollars every year to fund research and engineering projects that will improve the effectiveness of every branch of the military as they prepare for the next generation of threats.

Advances in war fighting technology between the first Gulf War and the current conflict in Iraq produced a quantum leap in the accuracy of weapons, the survivability of equipment and personnel, and the effectiveness of the war-fighter's ability to achieve his or her mission. This accomplishment is the byproduct of perhaps the largest collaborative technology and development initiative in human history, leveraging the efforts of scientists and engineers from academia, the private sector and government.

Today, that community is linked by a powerful and secure high-speed network that is on the cutting edge of communications technology.

The Defense Research & Engineering Network (DREN) operated by the High Performance Computing Modernization Program (HPCMP) Office in Arlington, VA, is DoD's recognized research and engineering network. DREN is a robust, high-capacity nation-wide network that provides connectivity among geographically dispersed High Performance Computing (HPC) user sites, HPC Centers, and other networks.

The community of interest that uses DREN puts advanced technology in the hands of U.S. forces more quickly, less expensively, and with greater certainty of success. For instance, many of today's weapons programs, such as the Joint Strike Fighter, Comanche Helicopter, Medium Tactical Vehicle Replacement, and the Javelin Missile program, have benefited through innovative materials, advanced design concepts, improved and faster modification programs, higher fidelity simulations, and more efficient tests that resulted from collaboration over DREN.

Because of the mission-critical role that it plays in developing and mastering new technologies, DREN was among the first federal agencies to transition from a native ATM networking environment to a Multi-Protocol Label Switching (MPLS) network that would improve the performance of Internet Protocol (IP) traffic, while preserving the performance and integrity of ATM transmissions

While traditional routed networks autonomously determine packet direction at each node, MPLS networks determine the entire path for a packet at entry by adding a short header or "label." Address lookup at subsequent hops is replaced by a label lookup and replacement or removal, much like ATM or Frame Relay. By integrating the operation into routers, this simple conceptual change enables networks to heal faster, scale bigger, distribute traffic more evenly, and accommodate non-IP protocols.

The new network was needed to support increasing demands for higher IP performance as that category of traffic becomes increasingly responsible for larger volumes and more diverse types of content (voice, data, and video) on the DREN network.

> *"We wanted to field a contractor team that was extremely competent and intelligent in leading edge networking technologies. We needed a team that could harness IP, protect our existing investment in ATM networking resources and enhance our overall effort to reduce latency and improve high capacity throughput over the entire WAN."* ***– Rodger Johnson, DREN Program Manager, OSD HPCMP***

Solution

After an exhaustive competitive bidding process, DREN tasked a contract team consisting of Ashburn, Va.-based MCI and Sunnyvale, Calif-based Juniper Networks, to provide the network services and routing technologies needed to rapidly deploy a next generation network based on (MPLS).

Work on implementing the new network build started in January of 2003, and six months later the network transition was completed. MCI initially deployed its MPLS-based infrastructure using Juniper routing equipment to securely connect approximately 80 different locations. The network has since been expanded to support over 100 sites today, with DREN officials reporting that IP performance – via higher throughput and reduced latency – has improved by a factor of 4 to 5 compared to how the IP traffic flowed over the previous native ATM network.

> *"We accomplished it in record time. We had initially planned to deploy the network over an 18 month period, but the contractor team was able to meet each of the critical milestones way ahead of schedule."* ***– DREN's Johnson***

In addition to securing significant performance gains, the DREN network infrastructure is positioned to support future integration of new optical switching and routing technologies that will extend the effective life of the network well into the foreseeable future.

DREN credits the rapid and successful deployment of the new network to a well managed collaborative effort between the High Performance Computing Modernization Program, DREN, Juniper and MCI. Also critical to the roll out was the active and

responsive involvement of the Local Exchange Carriers (LECs), each of which had to make resources and personnel available to the contract team to make the remote segments of the network compatible with IPv6.

Much of technical success can be attributed to the fact that Juniper was able to support the hybrid network – including support for ATM traffic – with a single chassis solution. This characteristic of the Juniper solution managed a significant amount of complexity that is associated with routing traffic in a hybrid network, and greatly simplified the deployment by reducing the amount of equipment and the number of devices that must be rolled out and maintained on the network.

> *"The architecture Juniper uses in its routing engine, and their overall chassis has exceeded our greatest expectations of what we thought we could do."* ***– DREN's Johnson***

Results

Incorporating the best operational capabilities of both the DoD and the commercial telecommunications infrastructure, the new DREN network provides long-haul network services for the DoD's computational scientific research, engineering, and testing communities.

Over 4,300 scientists and engineers at DoD and other government laboratories, test centers, universities, and industrial locations that use the HPCMP computing resources will have access to this enhanced network. Since its inception, DREN has been very active in transferring leading edge network and security technologies across DoD and other federal agencies.

The new MPLS-based DREN network has made it possible for the HPCMP Office to be among first networks to pilot DoD's transition to the next generation Internet Protocol version 6 (IPv6) in fiscal year 2004.

The deployment of the IPv6 network is simply the latest manifestation of DREN's commitment to providing its scientists and engineers with the networking resources necessary to equip the U.S. Military with the most advanced and effective war-fighting technology.