Connecting data centers on campus and beyond

University of Colorado Colorado Springs

Size: 12,000 students | Industry: Higher education | Location: Colorado Springs, Colorado

One of four campuses within the University of Colorado System, the University of Colorado Colorado Springs (UCCS) is one of the fastest-growing universities in the state. Enrolling roughly 12,000 students on campus and another 3,300 in online programs, UCCS offers 46 bachelor's, 22 master's, and five doctoral degree programs. For more information, visit uccs.edu.

Challenges

- Redesign the network, compute, and storage infrastructure of two data centers
- Increase automation and reduce manual tasks
- Implement a flexible network fabric that can be extended to additional sites

Solutions

- Application-centric, software-defined network
- Converged infrastructure

Results

- Logically connected two campus data centers
- Improved operational efficiency with configure-once-deploy-everywhere automation
- Established a network model for the National Cybersecurity Center and the entire University of Colorado System

For More Information

- Cisco® Application Centric Infrastructure (Cisco ACI™)
- Cisco Unified Computing System™ (Cisco UCS®)

Challenge: Practice what you teach

One of the courses Greg Williams teaches at UCCS is "Systems Administration and Security." The class provides an introduction to IT management and espouses several best practices: Work smarter, not harder; have a plan that covers both near- and long-term needs; spend ample time on the design before you start to build; avoid rigid, closed solutions and vendor lock-in; and focus heavily on the core to which everything else connects.

"I tell the students they must have a solid network," says Williams, whose primary role is the director of operations in the UCCS Office of Information Technology. "Without a solid network, everything else breaks down."

Three years after developing the curriculum, Williams had the opportunity to practice what he had been teaching. With six percent annual growth over the course of a decade—spanning admissions, academic programs, faculty, and campus infrastructure—the university's needs had surpassed the capabilities of its two primary data centers.

"We needed to refresh everything—core network, firewalls, compute, storage," Williams recalls. "We had an opportunity to change all of it, so we designed the data center infrastructure from scratch."

Following his own best practices, Williams sought to work smarter, not harder. He wanted to increase automation and reduce the manual tasks that can cause problems and confusion, especially when software updates and network changes are made. He wanted as much architectural flexibility as possible to optimize the security, management, and integration of the two data centers—and eventually others. And just as he advises his students, Williams wanted to build the data center infrastructure on the shoulders of a solid core network.

"We selected Cisco ACI," he explains, "because it gave us the flexibility to do everything we wanted to do. The other solutions we considered would have locked us into things or limited our capabilities."

"We're looking into a 100 GB ring and Cisco ACI for all Colorado University campuses. If we all have the same network architecture that is logically connected, we can improve resource sharing, policy federation, end-to-end automation, and disaster recovery."

Greg Williams
Director of Operations,
Office of Information Technology, UCCS

Boosting operational efficiency, automation

The industry's leading software-defined network solution, Cisco ACI has connected UCCS' two primary data centers via stretched fabric. Running the Intel® Xeon® processor-based Cisco UCS and Hitachi Vantara storage, the data centers possess roughly 200 VLANs, 350 switches, and 400 servers combined. Both data centers—and all of the components within them—are now managed collectively from a single console.

"Cisco ACI ties everything together and gives us one interface to manage it all," Williams says. "It's technology agnostic, so it can work with any hypervisor and any physical system underneath it."

The network fabric has dramatically improved operational efficiency, he adds. With full visibility of the network architecture and configure-once-deploy-everywhere automation, infrastructure changes and updates are not only faster, but also less risky.

"When you're manually managing hundreds of VLANs, it's easy to mess something up," Williams explains. "In the past, one mistake on a VLAN would take down the entire network, but with Cisco ACI, it's all automated. We've had no disruptions and zero downtime."

Increasing network security, resiliency

In addition to simplifying operational tasks, the network fabric is also improving the security and resiliency of UCCS' data centers. Using the segmentation capabilities and whitelist policy model of Cisco ACI, the university will soon separate its server subnets, housing subnets, and other endpoint groups. And it plans to bring additional workloads onto the fabric for security purposes.

"We'll be moving our PCI (payment card industry) system onto Cisco ACI," says Williams. "Because it supports financial data and transactions, the system needs to be fully segmented and secured."

UCCS also intends to integrate its network fabric with the F5 BIG-IP Application Delivery Controller and Palo Alto Networks next-generation firewalls. Doing so will provide additional control and resiliency, while extending the automation of Cisco ACI into the upper layers of the network.

"We want to use the segmentation and automation capabilities of Cisco ACI to create a multitenant environment and self-service portal for faculty members and students," says Williams. "They'll be able to provision an entire virtual environment—including servers, network, storage, firewalls, and load balancing—with a few clicks."

> "Cisco ACI ties everything together and gives us one interface to manage it all. It's technology agnostic, so it can work with any hypervisor and any physical system underneath it."
>
> **Greg Williams**
> Director of Operations, Office of Information Technology, UCCS

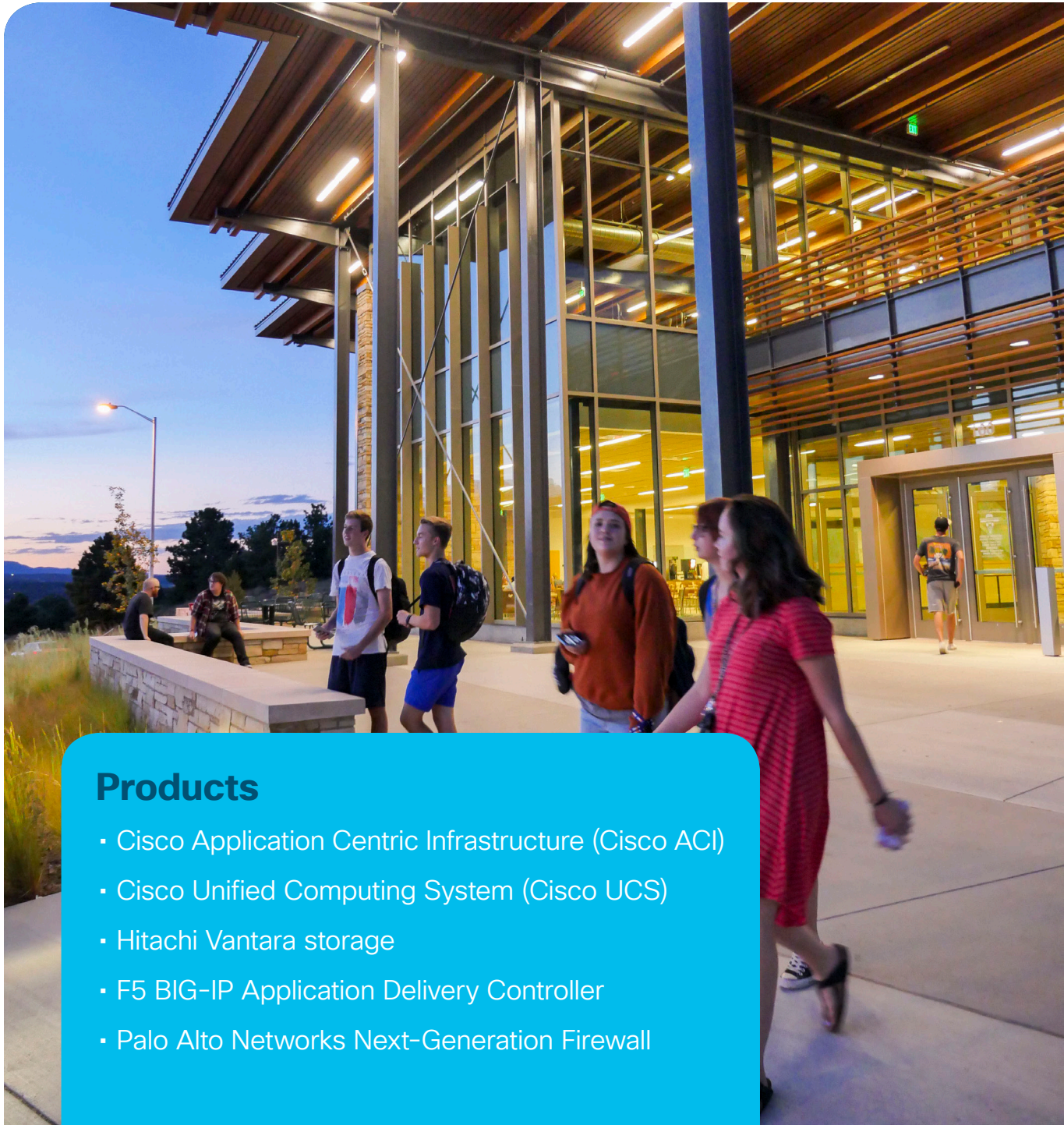
Looking ahead

The university is now planning to extend its network fabric—and the operational efficiency, automation, security, and resiliency it delivers—to additional sites. A data center dedicated to UCCS' College of Engineering and Applied Sciences will soon be retrofitted with Cisco ACI and connected to the core network.

The new National Cybersecurity Center (NCC), a research facility located 2.5 miles from the UCCS campus, will also receive a Cisco ACI network that will be connected to the university's data centers via dark fiber. In a unique partnership between the NCC, UCCS, and Cisco, the university will move its cybersecurity degree to the center and contract with businesses to develop specialized training programs and certifications.

Martin Wood, a UCCS vice chancellor who is leading the university's cybersecurity initiatives, has said the NCC is a research and training hub that is bringing together 14 colleges and universities in Colorado, Utah, and Wyoming. That's one reason why the entire University of Colorado System is evaluating Cisco ACI and its ability to securely connect multiple data centers.

"We're looking into a 100 GB ring and Cisco ACI for all Colorado University campuses," Williams says. "If we all have the same network architecture that is logically connected, we can improve resource sharing, policy federation, end-to-end automation, and disaster recovery."



Products

- Cisco Application Centric Infrastructure (Cisco ACI)
- Cisco Unified Computing System (Cisco UCS)
- Hitachi Vantara storage
- F5 BIG-IP Application Delivery Controller
- Palo Alto Networks Next-Generation Firewall