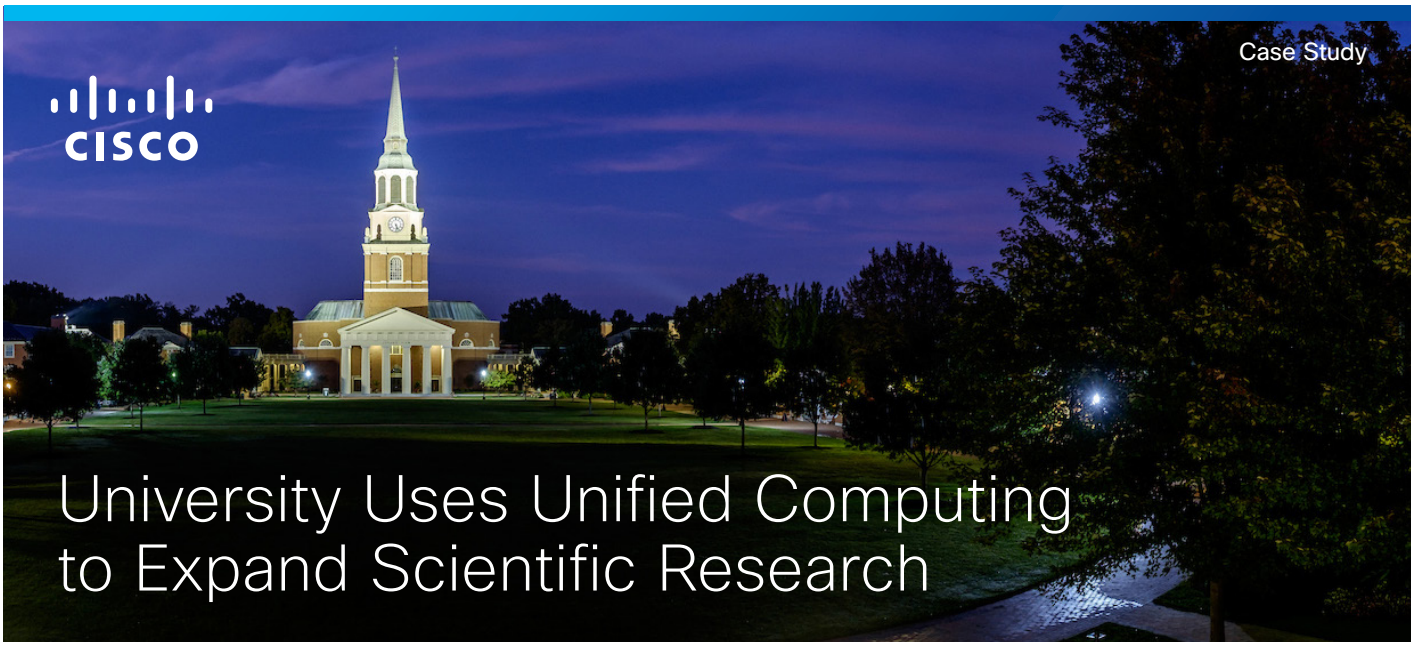

Case Study

University Uses Unified Computing to Expand Scientific Research

Executive Summary:

- **Customer Name:** Wake Forest University
- **Industry:** Higher Education
- **Location:** Winston-Salem, North Carolina
- **Number of Students:** 7700 (5000 undergraduates)

Solution:

- Supports advanced research through high performance computing
- Pushes out more jobs and obtains more resources without limitation
- Makes it easy for faculty and staff to customize instruction with new computational services

"We want to give our researchers the power to affect topics and issues at the forefront of today's research."

Greg Cook
Professor, Physics Department
Wake Forest University

Challenge

Since 1834, Wake Forest University has continuously innovated. It has advanced from a regional college to a top national research university while still using a liberal arts model of personal learning and societal contribution. Since Wake Forest strives to complement education with opportunity, it offers the best of both worlds for its students.

Wake Forest's concentration on science, technology, engineering, and mathematics (STEM) has gained significant momentum. For this reason, and many other factors related to growth, the university's Information Systems department began to meet new challenges.

More than 16 years ago Wake Forest began to use high performance computing (HPC) clusters–systems that use parallel processing to run advanced applications with heightened memory–to make scientific research more effective and farther reaching. In 2014, to further support the development of Wake Forest's HPC cluster, the university hired two system administrators: Adam Carlson and Damian Valles.

One of the HPC team's customers is Physics Professor Greg Cook, who uses the cluster to study numerical relativity, modeling collisions of neutron stars, and the release of gravitational waves from collisions of black-hole pairs–all pivotal elements of scientific research. Due to his concentration, Cook has used Wake Forest's HPC cluster since its inception, and is an original member of the Representative Committee (Repcom) of the HPC cluster. Repcom is a controlling board comprised of faculty members who have contributed funding to Wake Forest's HPC cluster as primary "customers."

"I've been working with HPC systems for more than 30 years and have closely watched them evolve," says Cook. "Since 1999, the HPC team's strategy was to start with a small cluster to support scientific research, and grow over the years, and Repcom fully supports that effort."

By the time Carlson and Valles were hired, the team knew it had to explore more advanced computing technologies to handle the sharing and dissemination of complex data. Wake Forest's goal has always been to use as powerful computers as possible to address difficult problems. However, while the school got by on existing hardware in the past, Wake Forest needed more flexibility within its HPC infrastructure, among other issues.

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Case Study

> "We want to make it easy for faculty to access the broad range of computational services we offer, and Cisco UCS helps us return on that vision."
>
> Adam Carlson
> HPC Systems Administrator
> Wake Forest University

> "We needed an advanced system to support physics research, not just technical needs."
>
> Greg Cook
> Professor, Physics Department
> Wake Forest University

"Our cluster started out in the physics department, not the IT department," says Cook. "We needed an advanced system to support physics research, not just technical needs."

Together, the computational faculty and the HPC team began to evaluate ways to help manage Wake Forest's cluster, which was growing and becoming increasingly more complex by the day.

Solution

In 2012, Wake Forest engaged with Cisco to test Cisco® Unified Computing System™ (Cisco UCS®)—a data center platform with computing hardware, virtualization support, switching fabric, and management software. It chose Cisco UCS for its capability to automate and simplify the configuration process for adding new hardware.

"Because our architecture is always changing, we needed to be conscious of slight variations, and that's where Cisco UCS had an advantage," says Carlson, referring to the HPC cluster's heterogeneous architecture. "As our cluster grows and changes, Cisco UCS has the ability to easily connect all of our systems at high network speeds."

After the testing phase, the HPC Team and Repcom unanimously agreed to adopt Cisco UCS, and the system was brought online when Carlson and Valles joined the university. Eventually, between 2014 and 2016, Wake Forest deployed four different processor architectures across Cisco UCS, and added more than 90 computing nodes and more than 2000 processing cores to the HPC cluster.

"The configuration process has been straightforward, quick and easy," says Valles.

Results

Wake Forest's HPC system is cleverly known as the Wake Forest **Distributed Environment for Academic Computing**, or DEAC, which is an abbreviation for the school's mascot: the Demon Deacon. One of the key benefits that Wake Forest has experienced with the updated HPC cluster is the higher availability this system gives to end-users. By communicating through the whole infrastructure, Cisco UCS helps users push more jobs and obtain more resources without limitation.

"Our vision has always been to expand instructional computational technology," says Carlson. "We want to make it easy for faculty to access the broad range of computational services we offer, and Cisco UCS helps us return on that vision."

Since using Cisco UCS, the user-base of Wake Forest's HPC cluster has grown steadily, and new disciplines–like biology, mathematics, and big data business analytics–have been launched on the HPC cluster. There are currently 18 applications on the HPC cluster in physics and chemistry, 10 general applications, six applications in biology, four applications for the medical school, one for computer science, and one for economics.

University Uses Unified Computing to Expand Scientific Research

Case Study

Product List

Network Management:

- Cisco Unified Computing System (UCS) Central

Sample HPC Applications:

- Biology:
  - ABySS
  - BWA (Burrows-Wheeler Aligner)
  - pBWA (parallel version)
  - Samtools
- Physics/Chemistry:
  - Ants
  - APT
  - Charmm
  - Cocoa
- Medical School:
  - MEME-Suite
  - LS-Dyna
  - SAS
  - MEAD
- General:
  - Intel compilers
  - GNU compilers
  - Maple
  - Mathematica

"The expansion of DEAC's user base could only occur once we grew our cluster quickly and easily," says Valles. "If we spent time adding hardware to try and stay afloat, this new expansion across the university could not have happened."

While the primary focus for the physics department was studying the different properties of materials and their applications, today its focus is energy amplification. This nuanced area of study helps researchers evaluate the storage of hydrogen in new ways, and helps cars to use fuel cells.

"In addition to aiding our academic community, within the physics department, we want to tackle advanced scientific problems," says Cook. "We want to give our researchers the power to affect topics and issues at the forefront of today's research. Thanks to Cisco UCS, we can now provide a stable, robust, and accessible resource that allows our research community to reach new heights."

Next Steps

The HPC team and Wake Forest's Chief Information Officer Mur Muchane have lofty goals for DEAC. In the coming years, they hope to grow the cluster and provide new services across campus.

"Expanding the capacity of the HPC cluster to support our researchers is essential to continuing scientific advancement, but will also help initiate a platform for all fields within liberal arts and humanities," says Muchane.

In addition to expansion, Carlson and Valles are testing new requirements for visualizing their research, and using Cisco UCS to on-board additional integrations.

"Ultimately, we want to support scientific research through education, training, hosted services, and computational resources," says Carlson. "With Cisco, we are fulfilling this mission thanks to high reliability, extended support, future scalability, and enhanced flexibility."

For More Information

To find out more about Cisco UCS, go to: **cisco.com/go/ucs**

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