DELL EMC

intel

A NEW ‘FRONTERA’

National supercomputing center pushes forward with its mission to arm researchers with leading-edge high performance computing resources.

TACC
TEXAS ADVANCED COMPUTING CENTER

High performance computing | United States

Business needs

Researchers around the country turn to the Texas Advanced Computing Center for access to HPC systems that accelerate discovery.

Solutions at a glance

- Dell EMC PowerEdge servers
- Intel® Xeon® Scalable Processors
- Intel® Optane™ DC Persistent Memory

Business results

- Driving discoveries to advance science and society
- Solving bigger and harder computational problems

Fueled by a $60 million award from the National Science Foundation (NSF)

Frontera has **16K +** Intel Xeon processors

The nation’s **fastest** academic supercomputer

Debuted as the world’s fifth **most powerful** high performance computing system

Enabling breakthrough discoveries

The Texas Advanced Computing Center (TACC) at The University of Texas at Austin is one of the world's leading supercomputing centers. The center designs and deploys some of the world's most powerful advanced computing systems and innovative software solutions to help tens of thousands of researchers answer complex questions. With the high performance computing and artificial intelligence technologies available through TACC, researchers from across the United States are making breakthrough discoveries that advance science and society.

To fulfill its mission, TACC is always in the process of designing and deploying next-generation HPC systems that will enable researchers to solve ever-larger and ever-harder problems. That's the case today as TACC researchers capitalize on a new supercomputer, called Frontera, designed to open new frontiers in scientific research.

Efforts at TACC show the benefits of applying high performance computing and artificial intelligence to a range of research challenges.

The Frontera supercomputer

Frontera — the Spanish word for "frontier" — is driving important advances in all fields of science, from astrophysics to zoology. Some of the projects that run on Frontera include analyses of particle collisions from the Large Hadron Collider, global climate modeling, improved hurricane forecasting and multi-messenger astronomy.

Fueled by a $60 million award from the National Science Foundation (NSF), Frontera debuted on the TOP500 list in June 2019 as the nation's fastest academic supercomputer and the world's fifth most powerful high-performance computing system.[1] With a peak-performance rating of 38.7 petaFLOPS, the supercomputer is about twice as powerful as TACC's Stampede2 system, which is currently the 19th fastest supercomputer in the world.

Dell EMC provided the primary computing system for Frontera, based on Dell EMC PowerEdge™ C6420 servers. The system has more than 8,000 two-socket nodes, more than 16,000 Intel Xeon Scalable Processors, 448,448 cores.[2] With its ability to run a variety of HPC and AI workloads required by TACC's vast user community, the Intel Xeon Scalable Processor was a clear choice. In addition, Frontera incorporates several technical innovations, including Intel Optane DC Persistent Memory for some large-memory nodes, CoolIT Systems high- density Direct Contact Liquid Cooling and a high performance Mellanox HDR 200 Gb/s InfiniBand interconnect.

Tommy Minyard, director of advanced computing systems at TACC, notes that Frontera is the next generation of a leadership-class computing system that the NSF has funded.

"We knew we needed a system to be able to support the high-end researchers and the more advanced technologies that are coming," Minyard says. "And so we proposed Frontera, with more than 8,000 nodes of very high-speed, high-end hardware from Dell EMC and Intel, with a lot of memory in those nodes.

With Frontera, our researchers can tackle some of the biggest challenges for high performance computing and push the boundaries of what the science can do."

1 TOP500 List – June 2019.

2 Intel case study, "Texas Advanced Computing Center Installs Frontera for Massive Scale Computing," August 2019.

DELL EMC

The Frontera supercomputer is aptly named. "Frontera" alludes to "Science the Endless Frontier," the title of a 1945 report to President Harry Truman that led to the creation of the National Science Foundation. In conveying the report to the president, the author, Vannevar Bush, noted: ***"Scientific progress is one essential key to our security as a nation, to our better health, to more jobs, to a higher standard of living, and to our cultural progress."***[3]

Building on earlier successes

In choosing Dell EMC for the new Frontera system, TACC builds on a long-running relationship with Dell EMC.

"Frontera represents the third Top-10 and fifth Top-25 system we have deployed in partnership with Dell EMC," says Dan Stanzione, executive director of TACC. "The success we have had together reflects our close collaboration and a deep relationship, with attention to every detail, that lets us repeatedly deploy at the cutting edge of technology on-time and on-budget. With this new machine, we will further push the frontiers of science, offering researchers an instrument with capabilities they have never had before."[4]

Earlier Dell EMC systems at TACC include the Stampede2 supercomputer, launched in the fall of 2017, and Wrangler, which came online in 2013.

Stampede2

Stampede2 is the previous flagship supercomputer at TACC. A strategic national resource funded by NSF, Stampede2 continues to provide HPC capabilities to thousands of researchers across the United States. Stampede2 powers a wide range of applications, from large-scale simulations and data analyses using thousands of processors simultaneously to smaller computations.

Stampede2 is an 18-petaflop system that builds on the successes of the original Stampede cluster. It features 4,200 Intel® Knights Landing (KNL) nodes — the second generation of processors based on Intel's Many Integrated Core (MIC) architecture — and 1,736 Intel® Xeon® Skylake nodes.

The Stampede2 cluster was deployed by TACC in conjunction with Dell, Intel and others, and is operated by a team of cyberinfrastructure experts at TACC, UT Austin, Clemson University, Cornell University, the University of Colorado at Boulder, Indiana University and Ohio State University.

Wrangler

Wrangler, designed for data-intensive high-performance computing, is the most powerful data analysis system allocated in the Extreme Science and Engineering Discovery Environment (XSEDE). The system is built to handle large-scale data transfer, analytics and sharing, and provides flexible support for a wide range of software stacks and workflows. Its scalable design allows for ongoing growth in the number of users and data applications.

Dell EMC provided the technologies that make up the core of Wrangler. These technologies include Dell EMC rack-scale flash storage technology to help ensure speed and performance and to enable real-time analytics at scale.

Funded by a grant from the NSF, Wrangler is the result of the collaborative efforts of Indiana University, TACC and the University of Chicago.

HPC for everyone

In its work to make supercomputing resources available to researchers around the country, TACC is democratizing HPC. TACC is there to meet the needs of the wide range of researchers who require HPC and AI systems for their research, from those running tightly coupled simulations across thousands of nodes to those who simply need more computational power than they can get on a desktop system.

3 National Science Foundation, "Science, The Endless Frontier," July 1945

4 Dell EMC news release, "Dell EMC Gains High Performance Computing Momentum and Expands Portfolio," November 13, 2018.

"We have a little bit of everybody using the center," Minyard says. "Traditionally, high performance computing has been a tool for scientists and engineers, but nowadays we are seeing that everybody can take advantage of HPC. We see computational biologists and life scientists — folks who have not traditionally been high performance computing users — using our systems now. We are even getting a lot of non-traditional users — including science and humanities, arts, and business folks — using our computing platforms to get their research and science done."

While some of the research initiatives supported by TACC could be called basic science, others are focused on solving problems that are right here, right now. That's the case with DesignSafe, a web-based research platform for the natural hazards research community that allows scientists and engineers to manage, analyze and understand critical information about natural hazards — from earthquakes and tornados to hurricanes and sinkholes.

Supported by grants from NSF and developed at TACC in collaboration with partners at The University of Texas at Austin, Rice University and Florida Institute of Technology, DesignSafe is advancing research that will help prevent natural hazard events from becoming societal disasters. This means helping engineers build safer structures in the future to withstand natural hazards and enabling emergency responders to better target their efforts.

Working with Dell EMC

TACC's long-running relationship with Dell EMC began in 2003, when TACC deployed its first system, a 500-node cluster.

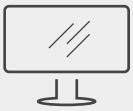
"We have had a history of partnering with Dell to deploy these systems," Minyard says. "The Dell team provides a lot of hardware in a very cost-effective manner, and then works with us to help us engineer the platforms to deploy and operate them. Our partnership with Dell EMC has been very good."

Minyard notes that engineers from Dell EMC regularly visit TACC, troubleshoot problems that come up, and make sure new systems are ready to go live. TACC personnel, in turn, often visit the Dell EMC HPC and AI Innovation Lab to get a close-up look at new and emerging technologies.

"It is a challenge to build these large-scale systems. We are lucky that we can partner with Dell EMC and have the team in town here in Austin," he says. "We have been able to leverage that relationship over many years to go from a small 500-node system that was about a thousand cores to systems that now have several hundred thousand cores, and are some of the fastest computers in the world."

Intel Inside®. Powerful Solution Outside.

TACC
TEXAS ADVANCED COMPUTING CENTER



Learn more about Dell EMC advanced computing

Unlock the value of data with artificial intelligence

Share this story

DELL EMC

intel