



TU Delft

Solving the world's greatest challenges with data



High-quality education and research are at the heart of TU Delft, the oldest and largest public university in the Netherlands. TU Delft ranks among the top 10 engineering and technology universities in the world. More than 27,000 students and 6,500 employees who share a love of science, design, and technology are united by a common mission: to make an impact for a better society.

Challenge

The university sought a partner with expertise in HPC who could design, implement, and maintain the solution and who could advise research groups on how to make the most of the large HPC cluster.

Solution

- NetApp products E-Series EF-Series
- ThinkParQ's BeeGFS
- Fujitsu HPC cluster.

Outcomes

- 85% faster performance
- Nonstop availability
- The university aims to be operating in a completely sustainable manner by 2030
- Toward that goal, the infrastructure for the DelftBlue supercomputer is vastly more efficient than the previous solution.

“DelftBlue enables us, in a much easier way, to solve complex problems, including renewable energy, climate change, food production, and water conservation. All of this is now possible.”

Kees Vuik, Professor of Numerical Analysis, TU Delft, and Scientific Director, DHPC



#250
of the 500 fastest
supercomputers
in the world



Top 10
engineering
and technology
universities

“One of the exciting projects we are working on now is modeling how clouds affect global temperatures. How do clouds block sunshine? How do they retain heat?” explains Kees Vuik, professor of Numerical Analysis at TU Delft and scientific director of the Delft High Performance Computing Centre (DHPC). “This requires a lot of data from satellites—over 760TB of data for this one simulation alone. With our new supercomputer, students have the power to find the answers to these questions right here at TU Delft.”

Big challenges require big compute

“Our mission at TU Delft is to have an impact for a better society. And we all know that the challenges that we are facing are becoming more and more complex,” explains Tim van der Hagen, Rector Magnificus, TU Delft. “That’s why we need enormous computing power.”

In 2021, the university began work on an ambitious project to consolidate 15 small high-performance computing (HPC) clusters used by individual departments and research groups into one large cluster that could be available to all faculties and research groups at the university. TU Delft needed a solution that could surpass the speed, capacity, and functionality of its existing HPC solutions.

The university sought a partner with expertise in HPC who could design, implement, and maintain the solution and who could advise research groups on how to make the most of the large HPC cluster.

The right team

With deep HPC knowledge, Fujitsu was the ideal partner to design, build, and deliver a total solution for HPC. Since 1958, Fujitsu has focused specifically on building supercomputers. The team at TU Delft felt confident about Fujitsu’s products, solutions, consulting expertise, and partner ecosystem.

They knew that, with Fujitsu’s help, the computing capacity at TU Delft would dynamically adapt to the university’s current and future needs.

Fujitsu replaced the university’s 15 small, isolated heterogeneous HPC clusters with a single HPC cluster. The new cluster was suitable for hundreds of simultaneous users and disparate compute- and GPU-based research projects.

The result was the Delft High-Performance Computing (DHPC) Centre and the launch of DelftBlue, one of the fastest supercomputers in the world. DelftBlue consolidates HPC resources on campus to accelerate research and innovation into a range of fields, such as material science, fluid dynamics, quantum mechanics, design optimization, big data mining, and AI.

DelftBlue is built on a broad spectrum of Fujitsu compute- and GPU-based servers with 20,000 CPU cores in over 400 compute nodes. Fujitsu selected a high-speed parallel storage subsystem based on ThinkParQ BeeGFS and NetApp® high-performance E-Series and EF-Series storage systems. The solution is ideal for use cases featuring numerous small files that benefit from extra metadata performance and capacity. It’s also ideal for situations involving fewer large files that require more storage capacity and performance.



99.9999%

availability

NetApp's tight integration with ThinkParQ BeeGFS provides a cost-effective, easy-to-manage, and highly available HPC storage solution. NetApp and ThinkParQ's building-block architecture easily scales performance and capacity as needed.

The compute nodes and the storage system are interconnected with HDR100 InfiniBand technology for high-throughput, low-latency internode communication. To help the university get the most out of its investment, the Fujitsu solution includes a comprehensive training program on the effective use of supercomputing facilities.

The right architecture

With DelftBlue, TU Delft is leading with innovation and enabling research at the highest levels in Europe. The HPC solution provides TU Delft with a scalable building-block architecture that's fast and flexible.

85% faster performance

Speed was the main criterion for the project. Benchmark testing revealed that the Fujitsu and NetApp solution delivers 85% faster performance than the university's previous infrastructure. In fact, DelftBlue is now ranked 250 among the 500 fastest supercomputers in the world, with a speed of 2 petaflops (a million times a billion calculations per second).

Students and doctoral candidates no longer need to wait a long time for permission to test their models and methods on an external supercomputer. Because the system can support up to 800 simultaneous users, the resources are always available when they need them.

"Previously, with my own workstation, it took a lot of time to train and to test. Several hours—maybe several days. Now, with this supercomputing power, I can train more models—and more complicated and powerful models—simultaneously," says Shenglan Du, researcher in urban data science.

The flexibility to grow

Part of what makes the underlying infrastructure of DelftBlue so special is its flexibility: It can be nondisruptively scaled by adding metadata and data nodes. The solution automatically enables administrators of DelftBlue to respond to growing demand without disrupting existing users or having an adverse impact on performance. Because the architecture is based on standard building blocks, scaling improves performance predictably. Capacity can be added without downtime, so research can happen around the clock.

Nonstop availability

DelftBlue's data storage backbone supports business-critical applications with enterprise reliability in both architecture and software design. Fully redundant I/O paths, advanced data protection features, and extensive diagnostic capabilities enable the system to achieve greater than 99.9999% availability.

Industry:
Education

Location:
Netherlands

Website:
www.tudelft.nl

About the customer

TU Delft, the oldest and largest public university in the Netherlands, centers its focus on exceptional education and research. It holds a prominent position among the top 10 universities worldwide for engineering and technology. With over 27,000 students and 6,500 staff members who possess a passion for science, design, and technology, the university is driven by a shared purpose: to create a positive influence on society.



85%

faster performance

DelftBlue goes green

The world's ongoing climate challenges require innovative business and technical solutions. In addition to helping researchers drive innovations that will lead to a more sustainable future, the HPC solution itself contributes to the school's efforts to reduce its carbon footprint.

The university aims to be operating in a completely sustainable manner by 2030. That means that all campus activities will then be carbon neutral, circular, climate adaptive, and contributing to the quality of life for its users and for nature.

Toward that goal, the infrastructure for the DelftBlue supercomputer is vastly more efficient than the previous solution, which consisted of 15 independent computing clusters. DelftBlue's new single-cluster architecture is more efficient in terms of energy, space, and cost than running 15 instances. A single centralized cluster allows researchers to share data with minimal disruption and in near-real-time. Data center footprint, power consumption, and software management is streamlined to achieve economies of scale. The architecture improves resource utilization and enables the solution to be easily scaled and rightsized to minimize waste.

NetApp's new class of ultra-low-power storage systems also helps organizations like TU Delft respond to shareholder and regulatory demands. And NetApp is constantly improving these systems with a mission to have the lowest watts per user byte in the industry.

One solution, endless possibilities

Together with TU Delft, Fujitsu will ensure that the new system will make a substantial contribution to research and education at the university—and the world. Instead of complex or time-consuming experiments, researchers could run multiple, complex simulations without infrastructure limitations. With their new capabilities, they can also push further into new areas of research, such as AI, human society, and the effects of climate change.

"DelftBlue enables us, in a much easier way, to solve complex problems, including renewable energy, climate change, food production, and water conservation. All of this is now possible," says Vuik.

In collaboration with:



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