Customer
Case Study

# DTU Supercharges Life Science Research with VMware Cloud Technology

Founded in 1829, the Technical University of Denmark (DTU) is home to Computerome, the Danish national life science computing center. Computerome enables collaborative work between researchers, healthcare professionals and industry, processing sensitive health data in a secure, controlled environment.

## Industry

Education, Healthcare

## Strategic priorities

- Cloud Transformation

## VMware footprint

- VMware® Cloud Foundation™
- VMware NSX®
- VMware Professional Services

The Technical University of Denmark—DTU—is home to Computerome, the Danish national life science supercomputing center. One of the largest high performance computers in Scandinavia, Computerome supports collaboration between researchers, healthcare professionals and industry, and can process sensitive data in a highly secure environment. To create a more powerful, flexible system, DTU engaged VMware Professional Services to engineer the HPC as a virtual private cloud hosting smaller clouds in a secure, segmented network. Computerome allows researchers to analyze huge volumes of data to render medical treatments for cancer and other diseases more effective.

## A supercomputer for life science research

Computerome consists of 50,000 CPU cores, 20 petabytes of storage and 220 terabytes of memory, providing an aggregate peak performance exceeding 1,000 teraflops. The system maintains an extensive and continually growing library of over 4,000 software and scientific tools available to its users. "Computerome has both a clinical and a research function," says Peter Løngreen, director of Computerome. "The challenges of developing and deploying this system were to create a highly secure, flexible multi-tenant platform that can be utilized by both clinicians and researchers."

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## Virtualization creates a flexible HPC

Computerome built the first iteration of the HPC on a conventional, bare metal infrastructure. The system served multiple, concurrent workloads, demanding the reprovisioning of physical hardware nodes before each run. This time-consuming process required expert IT management, wasting hours of potential compute time. As research activity intensified, the labor of maintaining the system led to delays, slowing innovation. Resource intensive application management generated higher costs and contributed to siloed operations, with 80 percent of project budgets spent on infrastructure management.

Computerome needed a more flexible HPC capable of running more workloads with less direct intervention by IT staff. The institution needed to fully exploit the potential of the existing compute infrastructure without incurring exponentially higher costs. Engineers determined that virtualization of the HPC—a highly unusual move in the supercomputing sector—would enable Computerome to operate the HPC as a virtual private cloud running many smaller clouds in a secure, segmented network. Computerome would then be able to scale its operations to onboard, configure and commission new scientific projects more quickly.

"This was a new venture to combine two kinds of leading-edge technologies," says Løngreen. "We took a highly complex HPC cluster—one of the biggest in the world—and combined it with VMware private cloud technology. This had not been possible before."

## Using virtualization to create a high performance computing cloud

The Danish Technical University partnered with VMware to engineer a virtualized iteration of the HPC, expanding the Computerome product portfolio, to offer a computing system designed to operate as a virtual private cloud, running many smaller clouds in a secure, segmented network, while still offering traditional HPC capabilities. Virtualizing the HPC using VMware Cloud Foundation allows Computerome to scale its operations to onboard, configure and commission new scientific projects in hours, rather than days. The goal is for researchers to self-provision isolated virtual clouds in 10 to 15 minutes to enable more compute research, supporting projects that can generate lifesaving healthcare breakthroughs. VMware Cloud Foundation provides Computerome staff a single pane of glass for management and security, helping reduce costs for day-to-day operations, patching and maintenance. As a modular platform, VMware Cloud Foundation makes future upgrades and extensions of the Computerome product portfolio an easy task.

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## Analysis of personal data predicts the risks and benefits of cancer treatment

The solution runs many virtual instances on the HPC allowing Computerome to perform different tasks and disparate setups, simultaneously, operations that were impossible on the previous system. VMware Cloud Foundation helps Computerome users utilize data and combinations of patterns in a variety of different areas and applications, including helping make cancer treatment and surgery more predictable.

For example, Professor Ismail Gögenur and his research group from Zealand University Hospital use Computerome to develop new tailored therapy approaches for cancer patients after surgery. Researchers now have access to a secure private cloud environment where specially developed algorithms can process millions of data points from electronic patient records and relevant medical studies. The algorithms running on the supercomputer predict the risks and benefits of cancer treatment, functioning as a decision support tool to help healthcare professionals choose the best treatment for each patient.

"Computerome gives us an infrastructure to integrate tens of thousands of patients' data simultaneously and decide their treatment at an individual level," says Gögenur. "This is completely unique, and it gives us the huge advantage of being able to carry out this high quality research quickly."

## Securing sensitive scientific data in a virtualized HPC environment

Computerome now includes secure remote access for thousands of users, and hosts over 4,000 different tools for researchers, students and medical personnel. Among the primary concerns for the new Computerome system, security ranked high, especially for GDPR and encryption. Computerome hosts personally sensitive health data for precision medicine and research, requiring strict auditable compliance processes.

With a DKK 150 million investment in supercomputing resources expected to span a four-year period, the institution must be able to deliver more research results. Computerome can isolate research projects in a secure environment, utilizing network virtualization with VMware NSX. Providing micro-segmentation of data networks provides Computerome with completely separated research tasks in production, independent of a physical network provider.

"Computerome has an enormous volume of compute power so we can run jobs in parallel, allowing us to process thousands of samples at the same time and very quickly identify genes related to the disease," says Morten Olesen, professor, University of Copenhagen.

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## A secure private cloud helps predict, prevent—and find cures—for diseases

Computerome is a future-ready solution with enough compute power to facilitate giant steps in human genome research for years to come. Computerome can store massive quantities of data from millions of patient records, giving university researchers more accurate assessments of the causes and conditions associated with these diseases.

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With solutions from VMware, Computerome has launched a secure private cloud to support global collaboration in life science research to help predict, prevent—and find cures—for diseases. Computerome and DTU can now offer the life science sector the security and speed needed for research projects, which may lead to improvements in life science and healthcare.