THE DEFENCE ACADEMY OF THE UNITED KINGDOM

Panasas® ActiveStor® Helps Power Nuclear Propulsion Research

The Nuclear Department at the Defence Academy of the United Kingdom, recently installed ActiveStor 11 to accelerate research. Leveraging PanFS, the integrated Panasas parallel file system to support a high performance Linux cluster, the academy performs Monte Carlo simulations of whole core reactor behaviors and runs deterministic models of radiation transport problems.

SUMMARY

CUSTOMER
The Defence Academy of the United Kingdom

INDUSTRY
Government

CHALLENGE

- To find an easy to use, powerful and scalable parallel storage solution to support a fast cluster

SOLUTION

- ActiveStor® 11
- PanFS® Parallel File System

RESULT

- Non-disruptive scaling of performance and capacity
- Single point of management for a single, scalable file system
- Elimination of traditional storage bottlenecks

The Defence Academy, part of the UK Ministry of Defence (MOD), provides research, education and training in support of the UK's Naval Nuclear Propulsion Programme. It possesses an extensive array of training and research resources, including high-fidelity reactor simulators, reactor plant models, and laboratories for radiation science, materials science and chemistry, all located within a secure facility.

THE CHALLENGE

The academy's Nuclear Department provides basic, corroborative and transformational research in reactor physics and engineering. Until recently, however, it did not possess the robust storage resources typically associated with this kind of work. It recently won budget authority to source a fast cluster and high performance storage for its computation-heavy research into shipboard nuclear reactor behavior and other high impact projects.

"We look at the basic physics underpinning neutronic behavior within the reactor core of seagoing nuclear propulsion systems and the related thermal hydraulics," said Dr. Kirk Atkinson, Senior Lecturer (Reactor Physics), Defence Academy of the United Kingdom Nuclear Department at the College of Management & Technology.

"Specifically, we run Monte Carlo simulations of whole core reactor scenarios using MONK, the MCNP code from Los Alamos National Laboratory (LANL), and more recently OpenMC from the Massachusetts Institute of Technology (MIT). We also use Imperial College London's EVENT and RADIANT (RADIAtion Non-oscillatory Transport) codes to perform deterministic modeling of radiation transport problems."

The current submarine-based reactors supplied by Rolls Royce are designed to last 25 years and, interestingly, never need refueling. The fuel in a seagoing reactor is typically more highly enriched (i.e., contains a higher concentration of uranium-235 vs. U238) than that used in land-based nuclear power plants. The result is a much smaller core, an important consideration for nuclear powered vessels.

THE PANASAS SOLUTION

"We recently won the opportunity to specify and acquire our fist high performance computing (HPC) cluster in support of basic research and educational directives," Atkinson said. "Our technology partner suggested a solution that included the blade-based Panasas ActiveStor® 11 with PanFS®, the fully integrated Panasas parallel file system."

"Based on the experience of colleagues at Rutherford Appleton Laboratory, I believed the ActiveStor parallel platform could be a good fit with the compute complex in our initial small cluster as well as with the expanded cluster we hope to implement next year. I had also been informed by colleagues that a Panasas ActiveStor configuration was in use at Los Alamos National Laboratory—not a bad reference in our line of work," Atkinson said.

The formal investigation and evaluation processes led the Nuclear Department to consider two solution alternatives, a 48TB ActiveStor 11 configuration, and a LUSTRE-based implementation. While LUSTRE was attractive from a technical standpoint, Atkinson was concerned about its complexity and the amount of time the department would have to spend doing system administration at the expense of science.

The initial compute side of the new deployment consisted of 66 CentOS-based compute nodes with dual core Intel processors. The team also specified dual Xeon Phi co-processor cards for 18 of those nodes. The theoretical, aggregate compute capacity approaches 50 teraflops, based on vendor claims. As for the storage component, the Nuclear Department needed to be able to easily scale both capacity and performance as their needs—and budget—grew; ActiveStor fit the bill.

THE RESULT

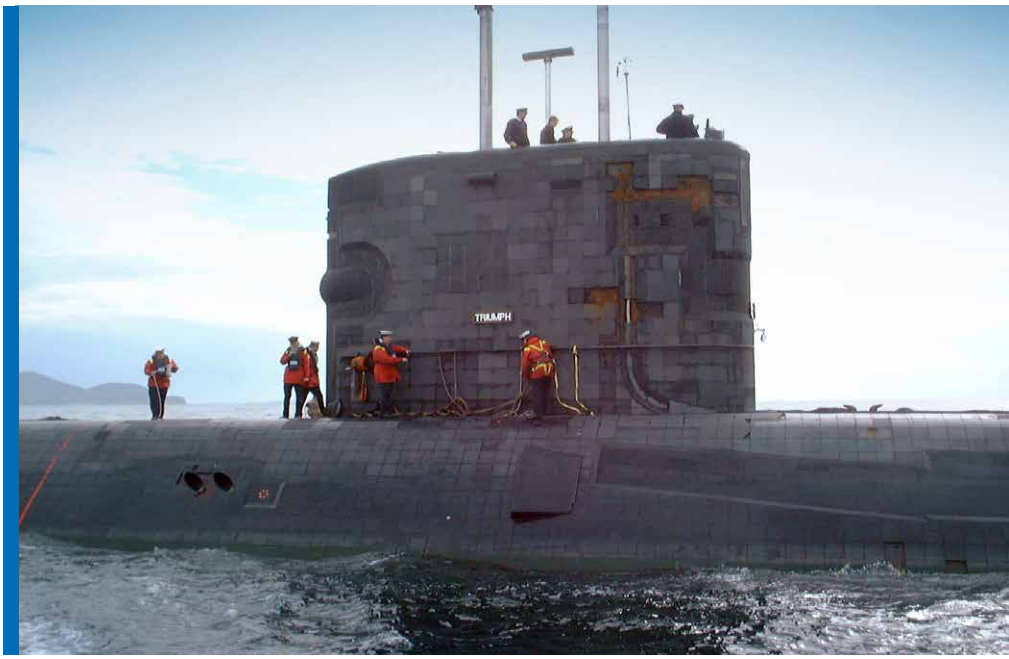
ActiveStor 11 simply and non-disruptively scales both capacity and performance by merely adding individual blades or entire racks to the overall system. It enables HPC cluster nodes to directly access a single, scalable file system in parallel at speeds up to 115GB/s. ActiveStor 11 can also scale to 6PB of raw capacity—all to eliminate traditional storage bottlenecks.

"We're still early in the process, but we have been very pleased thus far. The ActiveStor installation went very smoothly. We got to blinking lights very quickly. We're just coming on line now with our first HPC installation built around Panasas ActiveStor 11. As other aspects of the data center fit out, we expect continued success—very exciting," Atkinson said.

"When commissioning is complete we hope to get the kind of results that will let us double our current HPC compute and storage infrastructure." Right now we are steady on, maintaining course and speed with Panasas ActiveStor," Atkinson concluded.

Decision Criteria

"Performance, scalability, ease-of-use and simple management were critical decision criteria for us as we considered our storage options. When the cluster is fully commissioned, it will be drawn into a secure MOD environment. Coordinating outside service personnel would be difficult, and we wanted to minimize the system administration burden our scientists and instructors would have to carry," Atkinson said.



HMS Triumph

"We liked that ActiveStor provided a single point of management for a single, scalable file system. We like that capacity and performance planning, mount point management, and data load balancing across multiple pools of storage are all common administration problems easily solved by deploying Panasas storage."

Dr. Kirk Atkinson,
Senior Lecturer (Reactor Physics), Defence Academy of the United Kingdom Nuclear Department at the College of Management & Technology

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