



HPC tailored to research needs with OpenStack cloud

With a centralized, open-source HPC model, the University of Kentucky offers academic researchers flexible compute resources while reducing licensing costs by up to 60 percent



Higher Education

United States

Business needs

The university sought a consolidated approach to sourcing large compute jobs that would save time and money yet still offer tailored solutions for researchers.

Solutions at a glance

- [OpenStack Cloud Solutions](#)
- [High-Performance Computing](#)
- [Networking](#)
 - [Dell EMC Networking S4820 and N2000 Series](#)
- [Servers](#)
 - [Dell EMC PowerEdge R730/730xd Rack Servers with Intel® Xeon® processors E5-2640](#)
 - [Dell EMC PowerEdge R630 Rack Servers](#)

Business results

- Consolidates HPC resources and expertise
- Tailors resources to workloads
- Delivers greater HPC flexibility and control
- Improves efficiency for both researchers and IT

Cuts licensing fees by up to

60%



Avoids potentially

millions

in infrastructure costs



Classic high-performance computing (HPC) involves batch processing the sub-tasks of computational problems through massively parallel computer architectures. But not all research projects need that.

In a peer-reviewed study, Cody Bumgardner, director of research computing at the University of Kentucky, found that more than 90 percent of workloads on the university's HPC platform don't use more than one cluster node, many not even a full core. "Most users want access to a more traditional virtual machine and smaller clusters for their applications, like Hadoop for data analytics," he says.

Flexible adaptability

"With classic HPC, they have to adapt their computational problems to its infrastructure. That's complex and time-consuming, taking them off their research and needing IT staff help. We adapt HPC to their problem instead."

Bumgardner also knew that this issue drove many departments to find their own solutions. Easiest was to tap turnkey, cloud-based resources from third parties. More complex was taking a build-your-own approach that involved big budgets and time from departmental administrative and research staffs as well as university IT.

"IT infrastructure islands were emerging, none very efficient or optimized," Bumgardner says. "Our researchers needed direct and on-demand access to tailored IT resources that they control but without the admin and management burden that control typically created before."

Planting the OpenStack seed

In 2012, Bumgardner attended a Dell EMC briefing on OpenStack. This seeded the idea of using an open-source platform for a private cloud that could offer HPC infrastructure as a service. "Our OpenStack journey started with Dell EMC," he says. "They've always connected us to the right people and experts, even if not driving sales."

Bumgardner proposed a private cloud to the university using OpenStack — the subject of a book he later wrote — and the proposal was accepted. Working with Dell EMC, he and his colleagues designed and deployed a private cloud for customizing HPC resources to researcher needs.

To start, they chose an OpenStack enterprise-grade solution co-engineered and integrated by Dell EMC and Red Hat. The cloud operates on a variety of Dell EMC gear, including:

- **Dell EMC PowerEdge R720 and R720xd rack servers** for controller, compute, storage and CEPH storage and monitor nodes. The compute nodes feature Intel® Xeon® processors E7, while the storage monitor nodes feature Intel Xeon processors E5-2650.
- **Dell EMC PowerEdge R630 rack server**, with Intel Xeon processors E5-2640, for deployment services.
- **Dell EMC Networking S4820 and N2000 Series switches** for ultra-low-latency connections to the management network and the internet.

"Researchers now use our Dell EMC OpenStack HPC platform, cutting cycle times from 30 days to just 12 hours."

Cody Bumgardner
Director, Research Computing
University of Kentucky

The HPC cloud can provide multi-tenancy and the use of virtualized machines and software containers. “Now, university researchers can get more flexibility and control over their compute resources using our OpenStack HPC platform from Dell EMC,” Bumgardner says. “Plus, we’ve helped reduce the university’s IT islands, saving money and staff time, thanks to the Dell EMC OpenStack solution.”

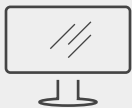
One big potential island could have been the university’s genomics project — Next-Generation Sequence Processing — for clinical diagnostics and both medical and non-medical research. “Instead of investing two years and potentially millions to build their own sequencing IT platform, researchers now use our Dell EMC OpenStack HPC platform, cutting cycle times from 30 days to just 12 hours,” Bumgardner says.

Another big benefit was the ability to deploy a software-defined infrastructure through OpenStack and Intel, helping to safely isolate clinical workloads. “Today, the resources used in clinical genomics processing are isolated from campus networks and appear as if they are sitting directly in a wet lab,” Bumgardner says. “We also reduced our licensing fees by up to 60 percent by taking the OpenStack route with Dell EMC,” he says.

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Cody Bumgardner
Director, Research Computing,
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