# MODERNIZED HPC INFRASTRUCTURE DELIVERS MORE SERVICES TO LARGER END-USER COMMUNITIES FOR LESS COST

**NIWA AND NESI CREATE NEXT-GENERATION CLUSTERED HPC ENVIRONMENT USING BRIGHT COMPUTING SOFTWARE**

**Bright** *Computing*

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### Bright Computing — Enabling NIWA and NeSI to supercharge New Zealand's science, research, and higher education initiatives

#### Objectives
- Create a flexible, extensible high-performance computing (HPC) environment
- Support new use cases such as artificial intelligence (AI) and deep learning
- Provide enhanced services to a diverse user population
- Move workloads to the cloud, as appropriate
- Ensure successful solution deployment by working with a partner experienced in HPC and cloud

#### Business results
- Streamlined management – utilizing Bright Cluster Manager to manage the physical hardware, coupled with Bright OpenStack to manage the virtual machine (VM) environment
- Increased focus on users and their requirements – leveraging the expertise and software of Bright Computing to deploy and manage both physical and Open Stack-based systems
- Hybrid Cloud Strategy - using Bright OpenStack as a gateway to both private and public clouds
- Simplify data center complexity – reducing the number of HPC systems in the data center footprint
- Reduced costs
  - Deploying fewer servers
  - Consuming less energy for power and cooling
  - Using less data center floor space

### MEETING ESCALATING HPC DEMANDS

Since 1992, the National Institute of Water and Atmospheric Research Ltd (NIWA) has worked at the forefront of some of the world's most critical environmental issues. Today, NIWA is considered New Zealand's leading environmental science and applied research service provider, specializing in atmospheric, freshwater, and marine research.

NeSI (the New Zealand eScience Infrastructure, https://www.nesi.org.nz) is a collaboration of four institutions, including NIWA, working together to provide high-performance computing (HPC), analytics data, and consultancy services to the science sector, government initiatives/agencies, and industry to tackle the world's largest problems.

When research sector HPC requirements threatened to exceed NIWA and NeSI's resource capacity, the time was right for a comprehensive, future-focused upgrade—one that included embracing OpenStack and cloud technologies. Rather than tackle the upgrade alone, NeSI turned to Cray and Bright Computing for the solution.

### DEFINING A UNIQUE STANDARDS-BASED SOLUTION

Far from a simple, single-location system, the new NIWA and NeSI systems needed to reside in two disparate locations—with the primary systems for residing in Wellington, and the backup system housed in Auckland. Additional system requirements included:

- Consolidating HPC investments into a single primary national HPC facility— including a large HPC cluster closely coupled to a Cray XC-class supercomputer located in Wellington, and a disaster recovery site in Auckland - to increase performance and reduce data center complexity
- Enhancing agility to evolve services as necessary over time
- Providing support for an increasing number of HPC use cases from research, scientific, and educational institutions
- Using OpenStack to manage an on-premises cloud environment
- Centralizing management of both physical and virtual machines
- Reducing overall cost and management

Cray—a leader in delivering HPC supercomputers and cluster systems that feature the latest in processing, networking, and cooling technologies—was selected for the hardware. Cray systems are highly customizable, and they are expressly designed to handle the most demanding range of scientific, research, simulation, analytics, and machine learning use cases.

To deliver robust cluster management with an integrated OpenStack platform, Cray partnered with Bright Computing. Armed with deep infrastructure knowledge and systems integration experience, Bright Computing was called upon to interpret NIWA and NeSI's system requirements and help NeSI build a hybrid HPC and private cloud infrastructure based on Bright Cluster Manager and Bright OpenStack.

## Putting the HPC system to work

In 2018, the NeSI/NIWA facility was commissioned to enable operational weather forecasting and climate simulations for NIWA staff and research computations for a wide range of leading-edge researchers from across New Zealand, including investigations into:

- Forecasting weather-related hazards
- Analyzing genetic information
- Understanding the systems driving our oceans
- Tracking New Zealand's freshwater resources
- Investigating New Zealand's seismic risk
- Building science algorithms and AI networks

To date, the Bright-managed clusters in the NeSI/NIWA facility have delivered the high levels of service and reliability necessary to handle these demanding workloads.

## DELIVERING A SCALABLE, EXTENDABLE HPC SOLUTION

Involving months of intense investigation, collaborative design, and solution realignment, Bright Computing and the combined Cray, NIWA, and NeSI teams brought the modernized NIWA and NeSI infrastructure online. The new infrastructure includes three clusters in part managed by Bright solutions—one cluster coupled to each of the Cray XC-class supercomputers and a third cluster for development, test, training, and education. With the advanced nature of requirements stretching the capabilities of Bright's solutions, the combined team identified novel solutions at critical stages of implementation, and the Bright team, in support of Cray, NIWA, and NeSI, delivered a fully operational, multi-site HPC infrastructure.

To ensure successful solution deployment, the Bright and Cray team followed a prescribed step-by-step process.

- The first step was to deploy the disaster recovery system (named "Kupe") at the University of Auckland's Tamaki Data Centre.
- Next, the engineers returned to NIWA's Wellington campus to decommission the previous supercomputer system ("FitzRoy"), and upgrade the data center to make it ready for the new Cray systems.
- With the data center upgraded at the Wellington campus, the team configured and deployed the Cray-XC ("Māui") and Cray-CS ("Mahuika") systems, integrated with Bright Cluster Manager and Bright OpenStack.
- After completing extensive testing, the distributed clustered environment was brought online, and research workloads were migrated to the new platform.

For complete details on the NeSI/NIWA HPC infrastructure, including the Cray CS and XC systems, please visit:

- https://www.nesi.org.nz/services/high-performance-computing/platforms
- https://support.nesi.org.nz/hc/en-gb/sections/360000034335-The-NeSI-High-Performance-Computers
- https://www.niwa.co.nz/our-services/high-performance-computing-facility/hpcf-fact-sheet

## PROVEN SYSTEM COMPONENTS

Building a flexible platform that could handle NeSI and NIWA's long-term HPC needs required careful consideration of the foundational elements—servers, storage, management, and memory—and how each element fits within the desired architecture. To that end, Bright suggested the following components for the three-cluster design.
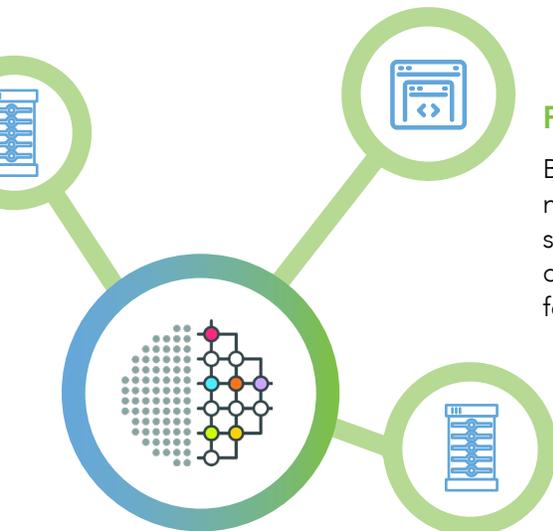
**Bright Cluster Manager**—Easy to deploy, operate, monitor, manage, and scale

For more than a decade, Bright has been building enterprise-grade cluster management software. Bright Cluster Manager has been successfully deployed in thousands of locations around the globe. Enterprises across industries choose Bright Cluster Manager because it:

- **Deploys easily**—Automatically installs workload manager, Spark, HPC, deep learning libraries, and more on the chosen Linux™ distribution.
- **Installs on bare metal**—With nothing to pre-install, users can start building a cluster from bare metal servers or VMs.
- **Provides comprehensive monitoring**—Monitor, visualize, and analyze a comprehensive set of hardware, software, job-based metrics, and workload accounting and reporting.
- **Includes two powerful user interfaces**—Provision, monitor, and manage clusters via a traditional command line interface or with the new web-based graphical user interface called Bright View.
- **Integrates hardware management**—Leverage powerful GPU and hardware accelerator management and monitoring capabilities to gain maximum control of an HPC cluster.
- **Optimizes the use of IT resources**—Allocate resources according to organizational policies, and prioritize workloads to meet business goals.
- **Supports containers**—Plug-and-play integration with Docker, Kubernetes, and Singularity enables containers to be orchestrated across a cluster.

**Bright OpenStack**—OpenStack made easy

For many organizations today, OpenStack is the solution of choice for building a private cloud. Bright Computing developed Bright OpenStack to enable turnkey deployment of OpenStack-based private clouds. Wizard-guided deployment starts at bare metal—enabling organizations to deploy physical and/or virtual resources, including compute, storage, network, and other services.

With Bright OpenStack, NeSI can administer its cloud as a single entity, provisioning the hardware, operating system, and cloud framework from a single interface. This way, NeSI can easily build a robust cloud—reliably—with the HPC resources they already have. And because Bright Cluster Manager is fully integrated with Bright OpenStack, the NIWA administrators can clearly understand and maintain the health of the multi-site infrastructure underpinning their cloud.

**Cray CS™ cluster supercomputers**

These Cray clustered supercomputers were designed to offer the widest possible choice of configurations. Cray® CS™ cluster supercomputers are highly scalable and modular platforms based on the latest Intel® Xeon® processing, co-processing, and accelerator technologies from Intel®, AMD, and NVIDIA®. Industry-standard server nodes and components have been optimized for HPC and tightly integrated with a comprehensive HPC software stack—creating a unified system that excels at capacity and supports data-intensive workloads. The Cray CS supercomputers offer:

- Flexible, scalable configurations
- Comprehensive manageability
- Built-in efficiency and reliability

## LOOKING TOWARD THE FUTURE

NeSI understands that increasingly demanding workloads are on the horizon—including artificial intelligence, deep learning, and more. Using Bright Cluster Manager and Bright OpenStack, NeSI's services will enable scientists, researchers, students, and developers to access and share the services from any location, using any device. This shared infrastructure will lead to more fully utilized national infrastructure resources, delivered at a lower cost per user.

## LEARN MORE

To learn more about Bright Computing software, solutions, and services, please visit brightcomputing.com. For information on the NeSI/NIWA HPC Facility, please visit https://www.nesi.org.nz/services/high-performance-computing/platforms and https://www.niwa.co.nz/our-services/high-performance-computing-facility

Tel: +31 20 491 9324
info@BrightComputing.com
www.brightcomputing.com

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