# **UVM VACC Cluster Specs**

## **The Vermont Advanced Computing Center (VACC)**

The Vermont Advanced Computing Center (<https://www.uvm.edu/vacc>) is a University of Vermont (UVM) core facility created in 2006 that facilitates discovery by providing rapid access to large-scale advanced computing infrastructure while oﬀering responsive technical support to researchers.

As of March 2022, the VACC provides three clusters: BlackDiamond, Bluemoon, and DeepGreen.

### **BlackDiamond Specs**

BlackDiamond is a high-performance computing cluster made possible by a gift from microchip manufacturer AMD. This cluster is built using AMD's 2nd Gen AMD EPYC processor, which pushes the boundaries for x86 performance, efficiency, security features, and overall system throughput.

#### **HARDWARE**

6 GPU nodes, each with:

* 1 AMD EPYC 7642 48-core processor
* 8 AMD Radeon Instinct MI50 Accelerators (32GB)
* 512GB DDR4-3200MHz RAM
* NVME via RDMA storage

#### **SOFTWARE**

* Operating System: RedHat Enterprise Linux 7.9 (64-bit) with the GNU compilers (gcc, f77)
* Resources Manager: Slurm v20.11.8
* Package Manager: Spack v0.11
* ROCm 4.3

### **Bluemoon Specs**

Bluemoon is a 300 node, 4004 core, high-performance computing cluster modeled after national supercomputing centers. This cluster supports large-scale computation, low-latency networking for MPI workloads, large memory systems, and high-performance parallel ﬁlesystems.

#### **HARDWARE**

* 32 dual-processor, 12-core (Intel E5-2650 v4) Dell PowerEdge R430 nodes, with 64GB RAM each, 10Gb Ethernet-connected
* 8 dual-processor, 12-core (Intel E5-2650 v4) Dell PowerEdge R430 nodes, with 256GB RAM each, 10Gb Ethernet-connected
* 9 dual-processor, 20 core (Intel 6230), PowerEdge R440, with 10GB RAM, 10Gb Ethernet-connected
* 3 dual-processor, 10-core (Intel E5-2650 v3) Dell PowerEdge R630 nodes, with 256GB RAM each, Ethernet-connected
* 38 dual-processor, 128-core AMD Epyc 7763 PowerEdge R6525 nodes, with 1TB RAM each. Mixed use: Infiniband connected 100Gb/s (2X HDR) for file access as well as MPI communication along with 10/25Gb Ethernet
* 1 dual-processor, 64-core EPYC 7543 PowerEdge R7525 node, with 4TB RAM. Infiniband connected 100 Gb/s (2X HDR) for file access, 10/25Gb Ethernet
* Infiniband: 8 dual-processor, 160-core (Intel E5-2650 v3) Dell PowerEdge R630 nodes, with 64GB RAM each, Inﬁniband 4XFDR (56Gb)-connected
* Infiniband: 32 dual-processor, 640-core (Intel E5-2650 v3) Dell PowerEdge R630 nodes, with 64GB RAM each, Inﬁniband 4XFDR (56Gb)-connected
* Infiniband: 22 dual-processor, 252-core (Intel E5-2630) IBM dx360m4 nodes, with 32GB RAM each, Inﬁniband 4XFDR (56Gb)-connected
* 2 dual-processor, 12-core (Intel E5-2650 v4) Dell R730, with 1TB RAM
* 1 dual-processor, 8-core (Intel E7-8837) IBM x3690 x5, with 512GB RAM
* 2 dual-processor, 12-core (Intel E5-2650 v4) Dell R730 GPU nodes, each with 2 Nvidia Tesla P100 GPUs. (Each GPU has 3584 CUDA cores and 16GB RAM)
* 2 I/O nodes (Dell R430s, 10Gb Ethernet-connected) along with 2 I/O nodes (IBM x3655s, 10Gb Ethernet-connected) connected to:
  + 1 IBM DS4800 providing 260TB of raw storage to GPFS (roughly 197TB usable)
  + 1 IBM DS4700 providing 104TB of raw storage (roughly 76TB usable)
  + 1 IBM DCS3850 providing 240TB of raw storage to GPFS (roughly 164TB usable)
  + 1 Dell MD3460 providing 357.5TB of raw storage to GPFS (roughly 260.5TB usable), and 43TB of solid-state disk to GPFS (for fast random-access data and metadata, roughly 27.5TB usable)
  + 1 IBM V3700 providing 10TB of solid-state disk to GPFS (for fast random- access data and metadata)
* 2 Flash-storage GPFS Metadata nodes (IBM x3655s, 10Gb Ethernet-connected)

#### **SOFTWARE**

* Operating System: RedHat Enterprise Linux 7.9 (64-bit) with the GNU compilers (gcc, f77)
* Resources Manager: Slurm v20.11.8
* Package Manager: Spack v0.11

**DeepGreen Specs**

DeepGreen is a massively parallel cluster deployed in Summer 2019 with 80 GPUs capable of over 8 petaﬂops of mixed-precision calculations based on the NVIDIA Tesla V100 architecture. Its hybrid design can expedite high-throughput artiﬁcial intelligence and machine learning workﬂows, and its extreme parallelism will forge new and transformative research pipelines.

#### **HARDWARE**

* 10 GPU nodes (Penguin Relion XE4118GTS) each with:
  + 2 Intel(R) Xeon(R) Gold 6130 CPU @ 2.10GHz (2x 16 cores, 22M cache)
  + 768GB RAM (256GB for GPFS pagepool)
  + 8 NVIDIA Tesla V100s with 32GB RAM
  + 4 2-lane HDR (100Gb/s, so 400Gb/s/node) Inﬁniband links to QM8700 switch
  + 2 NVMe nodes, each with 64TB NVMe devices (8x8TB), replicated to provide 64TB/gpfs3 ﬁlesystem
* Mellanox QM8700 switch running at HDR speeds

#### **SOFTWARE**

* Operating System: RedHat Enterprise Linux 7.9 (64-bit) with the GNU compilers (gcc, f77)
* Resources Manager: Slurm v20.11.8
* Package Manager: Spack v0.11
* CUDA 11.4