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Memorandum of Understanding
Investment-Based Participation in Cascades Computing Cluster for Filesystem Use

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This Memorandum of Understanding (MOU) contains provisions that guide the working relationship between the Virginia Tech researcher, referred to here as *The Faculty Partner*, and *Advanced Research Computing (ARC)* for use of the High-Performance Computing (HPC) filesystems through the Investment Computing Program over the five-year term of this MOU.

Term

This MOU is effective for a term of five years from the initial date of participation specified at the end of this MOU.

Definitions

- The Faculty Partner – Virginia Tech faculty member identified in this MOU
- Storage Service Unit (SSU) – One SSU provides 1 terabyte of available storage on the group filesystem for the duration of this MOU

Service Overview

The Faculty Partner is investing in storage capacity on the HPC filesystems managed by the Virginia Tech Division of Information Technology. By default, the maximum amount of storage available to the Faculty Partner is the same as for any user of the Cascades HPC cluster. Additional storage is available to the Faculty Partner for the duration of this MOU, with the per-terabyte cost associated with future investments determined based on future storage costs. The total initial investment by the Faculty Partner and the associated number SSUs is specified at the end of this MOU. The Faculty Partner will be able to use the HPC systems to compute on their data based on the level of service provided to general users.

Advanced Research Computing Responsibilities

- Use the Faculty Partner's investment to increase the capacity of the HPC filesystem
- Provide cluster infrastructure, including data center space, racks, power cooling, networking, and base storage
- Establish and maintain user accounts and job submission queues
- Maintain cluster system hardware, networking, storage, and software
- Provide system administration services and technical support
- Provide information regarding system maintenance outages and system status via email to all users of Cascades including the Faculty Partner

Faculty Partner Responsibilities

- Provide funding for priority to access computational resources as described in this MOU
- Ensure that data that must be protected by federal security or privacy laws (e.g. HIPAA, ITAR, classified information, etc.) is not stored on ARC systems unless an exception has been negotiated explicitly
- Accept responsibility for any data curation and retention costs associated with data stored on the HPC filesystems that must be supported beyond the five-year duration of this MOU
- Obtain an allocation on ARC's research computing systems so that data can be accessed and analyzed

- Request user accounts online using ARC's account request form[1]

Service Availability

Advanced Research Computing maintains clusters as a highly available 24/7 resource. Exceptions to these terms of service are as follows:

- Unplanned system outages due to issues with other aspects of the facility such as power, HVAC, network, or emergency maintenance to address computer security incidents may prevent use of the system in a timely manner, and
- Routine software and hardware maintenance of the system.

Planned maintenance windows will be announced at least one week in advance.

Acceptable Use Policies

The system is not intended for data protected by federal privacy and security laws and regulations (e.g. HIPAA, ITAR, classified, etc.) without special arrangement. It is the responsibility of the Faculty Partner, his/her research team, and IT staff to comply with all Virginia Tech and Commonwealth of Virginia policies and standards specified at: http://www.it.vt.edu/administration/policies.

Questions about information security can be directed to ARC by submitting a consultation request.[2]

Facilities

The HPC filesystems are housed at the Andrews Information System Building, 1700 Pratt Drive, Blacksburg, VA.

Support Process

All incident reporting should be submitted through the ticketing system supported through VT4Help, which is also accessible from the ARC website.[3] Advanced Research Computing will provide a response within one business day. Critical issues that disrupt large portions of the cluster or infrastructure will be addressed as quickly as possible.

Termination

Either party may terminate this MOU by providing written notification to the other party thirty (30) days in advance of termination. In the event of termination, all equipment will remain the property of ARC. The Faculty Partner may sell or transfer the remainder of his/her access to another Virginia Tech researcher. ARC will facilitate the transfer to the new partner.

Storage

Multiple types of storage are available. Support for protected data must be negotiated explicitly between the Faculty Partner and ARC. Details for the storage systems are available at: https://www.arc.vt.edu/storage/.

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[1] https://secure.hosting.vt.edu/www.arc.vt.edu/wp-admin/admin.php?page=account_request

[2] https://secure.hosting.vt.edu/www.arc.vt.edu/wp-admin/admin.php?page=consultation_request

[3] https://secure.hosting.vt.edu/www.arc.vt.edu/wp-admin/admin.php?page=help_request

Group Storage
Group storage is provided to each research group and is subject to a quota. The Faculty Partner may purchase additional high-performance storage for the life of the MOU, with the cost determined by the cost of storage to ARC.

Home Directories
Home directories are provided for each user of the cluster and are subject to a quota.

Scratch Storage
Scratch storage space is provided on Cascades on a parallel file system. Files in the scratch file system are subject to automatic purging.

Archival Storage
Long-term storage is available via the archival storage system which includes off-site backup.

Initial Date of Participation: MONTH DAY YEAR

Amount Invested: $XX,XXX

Resources Provided:

- Storage Service Units: 10 TB (Free), XX TB (Additional)

_____ Date: _____   _____Date: _____

Terry Herdman   NAME
Associate Vice President for   Faculty Partner
Advanced Research Computing   DEPARTMENT

_____ Date: _____   _____Date: _____

Scott Midkiff   NAME
Vice President for IT and CIO   Department Head
                                                 DEPARTMENT

Addendum A: Investment Computing Program Cost for Cascades Compute Nodes

Type:	**Type 1**	**Type 2**	**Type 3**
Function:	General-purpose compute node	Large memory compute node with GPU	Very Large memory compute node with local storage
Summary of Specifications:	• Two 16-core, 2.1 GHz Intel Broadwell processors (E5-2683v4) • 128 GB 2400-MHz memory • 1.8-TB 10K RPM SAS drive • Two 400 GB SSD • Infiniband interconnect • Dual 10G Ethernet	• Two 16-core, 2.1 GHz Intel Broadwell processors (E5-2683v4) • 512 GB 2400-MHz memory • Two 1.8-TB 10K RP SAS drives • Two 400 GB SSD • 2 TB NVMe PCIe • Infiniband interconnect • Dual 10G Ethernet • Two NVIDIA K80 GPU	• Four 18-core, 2.4 GHz Intel Broadwell processors (E7-8867v4) • 3 TB 2400-MHz memory • Six 1.8-TB 10K RPM SAS drives • Six 400 GB SSD • 2 TB NVMe PCIe • Infiniband interconnect • Dual 10G Ethernet
Exchange rate:	1.00	1.97	3.21
Node Cost:	$6,454	$12,688	$46,703
CSUs[1]/year per $50K[2]:	2,063,093	1,047,255	642,708
Cores equivalent for $50K[2]:	248	126	77

Notes:

1. A Compute Service Unit (CSU) provides access to one processor core for one hour on a Type 1 node
2. Annual CSUs available based on 95% utilization of the nodes, including fractional nodes, that could be purchased for $50,000.
3. Storage is available to the Faculty Partner for an investment of $100 for each terabyte of additional high-performance storage. This price is subject to change based on future costs for storage.