University of Cincinnati

The University of Cincinnati is a major, comprehensive, state-supported public research and teaching university with an enrollment of more than 42,000 students. The University, classified as a “very high” research university by the Carnegie Commission and ranked as one of America’s top public research universities, is an institution with a rich history in discovery and innovation. Last year, UC and its research affiliates received $418 million in research funding, and the university is the largest employer in the Cincinnati region, with an economic impact of more than $3 billion.

University of Cincinnati Office of Information Technology (IT@UC)
The UC Office of Information Technology (IT@UC) is the university’s centralized IT services provider. IT@UC partners with students, faculty, and staff to deliver innovative and efficient real-world solutions that support the academic and research priorities of the university. IT@UC operates as an interdependent organization aligned to partner with IT colleagues across campus and provides services in strategic areas of focus including Business Operations, Client Services, E-Learning, Enterprise Shared Services, and IT Innovations & Partnerships.

UC Commodity Network
The University of Cincinnati Campus Core Network (UCNet) provides IPv4 and experimental IPv6 network connectivity for the main UC campus and three regional campuses. The core of the campus network is built on twenty-one Cisco 6500 series routers with dual gigabit fiber links providing interconnect between redundant core routers. UC has one external peer provided by OARnet, which is a shared connection for commodity Internet and Internet2 traffic. Current provisioning is 3.5 GB for commodity Internet and 800 mb for Internet2.

UCNet serves approximately 80 buildings throughout campus. Each floor of a building, serviced by its own vlan, is connected back to a distribution core router via dual fiber uplinks. UCNet currently supports over 1000 vlans, each a /24 IPv4 network and one /48 IPv6 network, which is still in an experimental stage.

UCNet is a centrally managed network, and the network infrastructure is designed to provide 100 Mbps Ethernet ports to the community and 100/1000 Mbps Ethernet ports to devices servicing the community at large, such as centrally located servers providing resources to the entire community.

UC Data Center
The UC Data Center, managed by IT@UC Enterprise Shared Services, provides 6700 square feet of managed space for core IT@UC systems, university research systems and UC co-locators. A Data Center Infrastructure Management (DCIM) system was recently added, bringing state-of-the-art management and monitoring to the data center. Other services provided include clean agent fire suppression (HALON) and dry-pipe sprinkler solution, in room enterprise UPS systems, and an Automatic Transfer Switch (ATS) connected to a backup diesel generator. The data centers internal network provides high-speed data transfers between enterprise storage and the university's core systems.

UC has entered into a partnership with the State of Ohio and established a secondary data center at the State of Ohio Computer Center (SOCC) in Columbus. Our SOCC data center, provides real-time synchronization with data storage systems in our primary data center, replication of data backups, and both active-active and active-standby hardware for critical business continuity and disaster recovery scenarios.
IT@UC Compute and Storage

The IT@UC Enterprise Shared Services division offers a variety of compute and storage resources to the UC community. Compute services include managed physical and virtual servers, data center hosting for co-locators, and hosting for applications and web services. Service administrators work with requestors to develop solutions to optimize the use of resources based on project requirements. Highly scalable, world-class enterprise storage includes 513 TB of total capacity disk storage, with various performance and backup levels offered based on the needs of the individual, group, or application.

Advanced Research Computing Center HPC Cluster

The University of Cincinnati’s Advanced Research Computing (ARC) initiative offers a readily accessible hybrid CPU/GPU computing cluster, supporting the next generation of computational and data science researchers while developing a highly competitive workforce.

This sustainable high-performance computing (HPC) infrastructure with technical support services, accelerates the time to discovery and enables sophisticated and increasingly realistic modeling, simulation and data analysis and will help to bridge users to the local, regional and national HPC ecosystem.

ARC resources support all disciplines, including healthcare, sciences, engineering and social sciences/humanities, in their quest to harness big data via analytics, modeling and simulation, visualization, artificial intelligence and machine learning.

The ARC initiative is a collaboration between the Office of Research, University of Cincinnati faculty, the Office of Information Technologies (UCIT) technical and research services teams, the College of Engineering and Applied Sciences (CEAS) technical staff, Indiana University Information Technology Service’s Chief HPC Systems Architect, and XSEDE Capabilities and Resource Integration (XCRI) HPC Systems Administration staff. This partnership is made possible as part of a long-term commitment by UC to create an environment to advance the University of Cincinnati’s leadership position in innovative research and impact.

HPC CLUSTER AVAILABLE HARDWARE/SOFTWARE

ARC is equipped with 50 teraFLOPS of peak CPU performance and 2 NVIDIA Tesla V100 GPU nodes (224 teraFLOPS deep learning peak performance) connected with high-performance 100 GB/s Omnipath (OPA) interconnect, a significant step forward in both bandwidth and latency.

Hardware – Pilot Cluster

- **50 teraFLOPS of peak CPU performance**
  - Intel Xeon Gold 6148 2.4G, 20C/40T, 192 GB RAM/node
  - Plans to increase it to 140 teraFLOPS peak CPU performance in the next year
- **224 teraFLOPS deep learning peak performance**
  - NVIDIA Tesla V100 32G Passive GPU
  - Plans to increase it to 896 teraFLOPS deep learning peak performance in the next year
- **ZFS Storage Node – 96TB raw storage**
- **100Gb/s Networking infrastructure fabric**
Hardware - Discovery Cluster

20x HPE ProLiant DL 385 Gen10 Plus Servers each with configured with:
  - 2x AMD EPYC 7452 CPUs (32 Cores, 2.3 GHz)
  - 256 GB RAM (16x 16 GB Dual Rank x8 DDR4-3200 DIMMS)
  - 1x HPE 960GB SATA 6G Read Intensive SFF SSD

2x HPE ProLiant DL 325 Gen10 Plus Servers each with configured with:
  - 1x AMD EPYC 7452 CPU (32 Cores, 2.3 GHz)
  - 256 GB RAM (16x 16 GB Dual Rank x8 DDR4-3200 DIMMS)
  - 2x HPE 960GB SATA 6G Read Intensive SFF SSD

1x Mellanox InfiniBand HDR 40-port QSFP56 Managed Back to Front Airflow Switch
11x Mellanox Split Cables HDR100

Software

- OpenHPC environment
- Warewulf cluster provisioning system and managed by the SLURM
- Singularity containers
- Developmental tools, including compilers, OpenMP, MPI, OpenMPI libraries for parallel code development, debuggers, and open source AI tools
- FLEXlm being installed so that individual researchers can easily maintain and use their software resources
- User login is based on UC/AD, so that user groups and easier access

IT@UC Research Computing Services Office

The IT@UC Research Computing Service strategic focus is to facilitate IT-enabled research and knowledge creation by connecting researchers with technical expertise, resources, training, and state-of-the-art IT services.

As an example, the Center for Simulations & Virtual Environments Research (UCSIM) provides technical and hardware expertise, programming, and modeling support for virtual and augmented reality research collaborations with the Cincinnati Children’s Hospital Medical Center TEAM VR Lab, the Air Force Research Lab Discovery Center, and the UC Center for Cognition, Action, and Perception.

The Research Computing Services office director actively collaborates with researchers, administration and industry partners by leading the IT Governance Research Computing Services topical committee.

IT Governance – Research & Development Topical Committee

The Research & Development topical committee is one of five committees that make up the IT Governance structure. All five committee chairs sit on the IT Council which is made up of major leadership of the university. The IT Governance structure is a part of the UC Integrated Decision-making process which is responsible for the identification and prioritization and funding recommendations for all UC initiatives.

The R&D committee membership includes the Office of Research’s Digital Futures Executive Director, Associate Deans of Research from major research colleges, computational researchers and faculty from UC’s College of Medicine, College of Engineering, College of Arts and Sciences, and Digital Humanities. Research IT staff who support HPC in the division of Biomedical Informatics, Cincinnati Children’s Medical Center High Performance Computing (HPC) center, and the College of Engineering
Mechanical and Aerospace HPC clusters represent their research partners’ cyberinfrastructure needs on the committee. Undergraduate and graduate student researchers from the STEM disciplines are important members as well, identifying and recommending the potential use of emerging technologies and trends.

**Office of Information Security**
The IT@UC Office of Information Security (IT@UC OIS) partners with the university community to foster a culture that supports the confidentiality, integrity, availability and accountability of the university’s academic and research objectives through the application of unified information security architecture with the necessary policies and procedures to ensure its viability.

Relevant Core Security functions include:

- Cybersecurity Education & Awareness
- Risk Management and Consulting

**OARnet**
The Ohio Academic Resources Network (OARnet) was created in 1987 by the Ohio Board of Regents, through legislation by the Ohio General Assembly. OARnet was founded to provide Ohio researchers "online" access to the high performance computing resources of the Ohio Supercomputer Center, established in Columbus earlier that same year. Today, the OARnet network consists of more than 1,850 miles of fiber-optic backbone, with more than 1,500 miles of it operating at ultrafast 100 Gbps speeds. The network blankets the state, providing connectivity to Ohio's colleges and universities, K-12 schools, public broadcasting stations, academic medical centers, government agencies, and partnering research organizations. Beyond being a nationally recognized statewide infrastructure, OARnet specializes in promoting efficiencies and shared services throughout Ohio's public institutions, providing worldwide connectivity through Internet2 tie-ins, and bridging dozens of international sites with high-definition telepresence.

**Unfunded Personnel**

Dr. Emily Kang, Assoc. Professor, Mathematics – Dr. Kang and her students will use the requested resources and work with the ARC team to identify training and education needs. Dr. Kang will evaluate the usefulness of the OSG resources for her team and share the outcomes with the IT R&D Committee members and the ARC Faculty Advisory Committee.

Dr. Sam Anand, Professor, Mechanical Engineering – The students in Dr. Anand’s lab will represent computational researchers who are currently using their workstations for computer simulations and modeling. They help define the needs of new HPC users who need assistance transferring their work from workstation to HPC level resources.

Dr. Amy Latessa, IT@UC Research Computing Services, Research Associate – Dr. Latessa manages all outreach, training and workforce development for the Advanced Research Computing center and the IT@UC Research Computing Services department. She will coordinate workshops, seminars and training sessions supporting the use of the HPC Cluster resources, focusing on training new users to take advantage of the resources.
P. Kurt Roberts, HPC System Admin, ARC and College of Medicine Environmental Health – As the ARC HPC System Admin and Facilitator, Kurt manages the ARC systems and assists users.

Larry Schartman, HPC System Admin, ARC and Mechanical Engineering – Larry is the senior HPC Systems Admin/Facilitator on the team and will provide expertise in operating the HPC clusters and helping new users use the systems.

NSF XSEDE XCRI Engineers/Team – the XCRI team will be available if the local staff need assistance installing or configuring the new resources. Their involvement should be limited because of the Installation Services being purchased as part of the acquisition.

IT@UC Enterprise Shared Services Cyberinfrastructure Team: Linux Server Admins, Storage Admins, Network Operations Center Engineers – The IT@UC ESS CI team will provide support as needed during the installation and configuration of the system, including the connectivity to the network.