SYRACUSE UNIVERSITY

Institutional Commitment: Syracuse University is committed to providing state-of-the-art equipment necessary for its faculty to conduct advanced research, to generate novel technologies, and to make discoveries that positively impact society.

Computational Core Equipment

Computer clusters are housed in Syracuse University's Skytop and Machinery Hall data centers. Each data center provides water-cooled cooling racks, power, and networking for the clusters and our robust virtual private cloud at no cost to the research community. These data centers also house the enterprise computing resources, combining the research and administrative computing interests. The internal data center network is a mix of 10, 40, and 100 Gigabit connectivity, with redundant connections to all hosts and network components whenever possible. The data centers are connected to the campus network and each other via two bundles of geographically diverse, 144 strand fiber paths. These can be and have been used to provide direct connectivity between a PI's campus building and the hosted area in the primary data center.

Syracuse University's other research computing clusters:

- **OrangeGrid:** This cluster is comprised of roughly 70,000 cores for high-throughput computing (HTC). The computers in the grid are optimized to perform a large number of parallel jobs, providing high processing capacity over long periods of time. The grid utilizes a mixture of dedicated nodes (60,000 cores) and scavenged nodes (10,000 cores). HTCondor, developed with support from the National Science Foundation, manages the grid's workload.
  Scavenged worker nodes are managed by HTCondor Virtual Machine Coordinator (CVMC), an application developed by SU's Information Technology and Services department. These nodes are added to the grid by detecting when a desktop computer is idle, launching CVMC, deploying a custom virtual machine, and connecting it to HTCondor to receive work. The use of virtualization acts as a barrier that separates the researcher and their content from the user's information on the same computer.
- **Zest:** Zest is a 17,000 core High Performance Computing (HPC) cluster for campus researchers which supports tying together multiple compute nodes for research work that cannot be split into smaller components or fit within a single machine. To facilitate this, Zest compute elements are interconnected with InfiniBand to pass information between nodes with much lower latency than Ethernet. Zest utilizes the Slurm scheduler, which allows researchers to scale jobs within the cluster and groups the nodes together as needed by the current jobs.
- **SUrge:** This is a heterogeneous resource pool supporting computationally intensive research enhanced using Graphical Processing Units (GPUs). It is designed to be allocated as a stand-alone resource for smaller-scale work or for use in the OrangeGrid and Zest clusters. SUrge offers more than 250 GPUs, ranging from NVidia RTX 5000's to 80GB A100's.
- **Academic Virtual Hosting Environment (AVHE):** The AVHE provides a private compute cloud to the Syracuse University research community, lowering the entry bar for small to medium-sized research efforts. This private cloud uses virtualization to provide flexibility and hardware sharing to allow multiple researchers to operate on an underlying server and storage infrastructure. This lower bar of entry and flexibility provides an environment that supports both traditional and non-traditional computational research. Another use for the AVHE is building small to medium-sized clustered research computing environments, reducing the need for researchers to build and maintain physical clusters. Services within the AVHE include medium-scale storage for research data storage and archive. To date, this includes over 3 Petabytes of research data and output. The AVHE utilizes virtualization to provide high availability, which automatically migrates workloads to alternate resources in the case of physical server failure. Backup services within the AVHE are provided to all researchers.