# HiPerGator Facilities

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Although the Administration provides for much of the UFIT Research Computing infrastructure, it is still dependent upon faculty research funds for equipment purchases. Without faculty funding, UFIT Research Computing cannot purchase clusters, networking equipment, or storage. Therefore, if you intend to utilize UFIT Research Computing facilities, it is extremely important that you request funding for the center in your grant proposals. The information here is intended to help you as you prepare a budget for your research proposals.

Your proposal can include direct funding for HPC resources in two categories that leverage the investments made by the University in the HPC infrastructure. These categories are hardware and staff consulting services. A proposal can include either hardware, staff support, or both.

Your proposal can list UFIT Research Computing and its resources under the “Facilities, Equipment and Instrumentation” by inserting the text provided in the facilities document. You can augment the text with further descriptions of other facilities used by your project, such as, for example, available NMR instruments and facilities on campus.

## UFIT Research Computing

In 2011, University made a 5-year commitment to build out the facility into a comprehensive cyber infrastructure for research computing, creating the department of Research Computing as a part of UF Information Technology. The commitment from the University has been renewed because of the success in supporting research computing activities of the faculty, their students, and collaborators. UF Research Computing has grown to a staff of 23 FTE, supporting the work of over 500 faculty-led research groups, with over 5,000 users, of which 500 are active every week.

Further details on UF Research Computing can be found at <https://it.ufl.edu/resources/researcher-resources/> and <http://www.rc.ufl.edu>.

## Network infrastructure and Florida Lambda Rail (FLR) regional network

The computer systems are located in the University of Florida data center. The machine room is connected to other campus resources by the 400 Gigabit per second campus network and Science DMZ. The network connects HiPerGator to the FLR, from which Internet2, ES.net and other national and international research networks are accessible.

The Florida Lambda Rail (FLR) provides the underlying fiber optic network and network connectivity between these institutions and many others. The FLR backbone completed the upgrade to 400 Gbps in April 2023. The University of Florida is connected to this backbone with two full speed of 200 Gbps links, to be upgraded to 400 Gbps by Dec 2023. UF has had a 400 Gbps path to the Internet2 backbone since Feb 2022 (<https://flrnet.org>).

Universities in the state of Florida joined forces in the Sunshine State Education & Research Computing Alliance (SSERCA), a part of FLR, to share expertise in research facilitation and to support collaborations among researchers in the state of Florida and with researchers everuwhere (<http://sserca.org>).

## High-performance computing and big-data analytics

UFIT Research Computing operates HiPerGator, UF’s supercomputer, a cluster-based system with a combined capacity of about 70,000 cores in multi-core servers since May 2021. In 2021, HiPerGator AI was taken into production. It is an NIVIDIA DGX A100 SuperPOD donated by alumnus Chris Malachowsky and NVIDIA. It has 17,000 cores and 1,120 NVDIDIA Ampere A100 GPUs with 80 GB or RAM. The HiPerGator systems are connected by an integrated InfiniBand fabric. HiPerGator systems shares over 25 PetaBytes of distributed storage via the Lustre parallel file system. In addition, UF houses about 3.2 PB of storage for the High Energy Physics collaboration of the Compact Muon Solenoid (CMS) experiment. In addition to HiPerGataor AI, HiPerGator 3.0 includes, and 560 NVIDIA GeForce RTX 2080ti and 48 NVIDIA Quadro RTX 6000 GPUs for simulation, machine learning (ML), deep learning (DL), artificial intelligence (AI), and simulation and modeling, available for exploratory and production research, as well as for training and teaching.

The peak performance of HiPerGator 3.0 is around 1 Pflops, that of HiPerGator AI is 17.2 Pflops, which places it at #38 on the top500 list and #14 of the green500 list of Nov 2022. The AI operation performance of HiPerGator AI is 0.7 Eflops.

## Restricted data storage, analysis, computing, and development

Research projects may involve storing and processing restricted data, including intellectual property (IP), protected health information (PHI), Controlled Unclassified Information (CUI) regulated by Health Insurance Portability and Accountability Act (HIPAA), International Trade in Arms Regulation (ITAR), Export Administration Regulation (EAR), Family Educational Rights and Privacy Act (FERPA).

On Apr 17, 2023, HiPerGator officially met the HITRUST CSF v9.6 risk-based, 2-year (r2) certification criteria, so that researchers can use the full power of HiPerGator for work with PHI and FERPA data. This certification will be renewed every 2 years.

For ITRA/EAR projects, a special enclave environment on the HiPerGator platform <https://www.rc.ufl.edu/documentation/hipergator-rv/>. The HiPerGator-RV/ResVault system is approved for NIST 800-53 “moderate” and NIST 800-171 since Dec 2017.

## Services

Further details on the services, including the subsidized and the full-cost-recovery price, can be found at the Research Computing web site <https://www.rc.ufl.edu> under Services.

Support for proposal development can be found under Get Support -> Proposal Support.

## Virtual network environments

By the end of 2014, the campus network infrastructure was upgraded to support virtual network environments. These virtual environments enable extending physical networks beyond their physical boundaries that traditionally coincide with individual buildings. There are three physical networks:

1. The Academic network,
2. The Health network that allows protected health information to be stored and accessed,
3. The Campus Research Network or Science DMZ connecting HPC resources with data generating instruments.

With the virtual network environments, it is possible to connect instruments in any enabled building to the Science DMZ virtual environment, even if the instrument resides in a building that is served by the physical Health network. Similarly, researchers can choose to be connected to the Academic virtual network even if their offices are in a Health network building. The virtual environments allow deployment of the correct policies and security measures on a fine-grained scale to meet the needs of the activities of the people using the network. Further virtual network environments include

1. Administrative virtual network environment, with a level of security in between academic and health.
2. Industrial building control network environment will allow separating traffic for monitoring and controlling building systems from the networks used by the occupants of the buildings.
3. Payment Card Industry virtual environment.
4. ITAR virtual environment to connect that compliant data storage and processing system ResVault in a compliant and secure way to some of the engineering labs where the restricted data is used to create and test export-controlled devices.

## Space, Power and Cooling

The funding model for Research Computing includes the commitment from the Provost, the VP for Research, and the VP and CIO to provide for machine-room facilities with electrical power and cooling and professional staff. The University has a substantial investment in research computing infrastructure including a data center completed in 2013 on the East Campus that provides 10,000 sq. ft. of machine room space, of which 5,000 sq. ft. is dedicated to house HiPerGator.

## Staffing

The University pays the salaries of the 23 highly qualified staff members, including several with a PhD or master’s degree in science or engineering. Staff members, in addition to sharing in the system design, installation, and administration duties, provide application support and consulting services to faculty members, their research associates, and their graduate students. This support ranges from assistance with job flow management and installation of open-source software to teaching students how to improve the MPI performance of their programs.

## Training and Outreach

UFIT Research Computing provides advanced support and training to the user community. Many training materials are now available online. The schedule can be found at <https://help.rc.ufl.edu/doc/Training>.

In addition, user feedback meetings are held as well as periodic training workshops are organized every semester. In 2022 over 60 courses leveraged HiPerGator.