

University of Tennessee

High Performance Computing and Storage Infrastructure Facilities September 2026

1. Overview

The University of Tennessee (UT) has advanced high performance and scientific computing over the last two decades by progressively provisioning substantial computing resources for the community. With professional support from the High Performance & Scientific Computing (HPSC) group in the Office of Innovative Technology (OIT) at the University of Tennessee, Knoxville (UTK), the current high-performance-computing (HPC) resources encompass four Infrastructure for Scientific Applications and Advanced Computing (ISAAC) clusters, where ISAAC Oak Ridge Innovation (ISAAC-ORI) and the ISAAC Next Generation (ISAAC-NG) clusters are for open science research, while the ISAAC Secure Enclave (ISAAC-SIP and ISAAC-CMMC) clusters are for research involved in regulated data including Protected Health Information and/or Controlled Unclassified Information. The HPC resources also feature the high-performance parallel file system for staged data storage, tape library for archived data storage, high speed networking bandwidth with connection to several core research facilities for data transfer and data storage [1].

2. Data Center Facilities

The ISAAC related resources are housed in two data centers: one located in the University of Tennessee Oak Ridge Innovation Institute (UTORII) campus and the other one located in the University of Tennessee Knoxville campus at the Kingston Pike Building (KPB). The UTORII data center has a 2,000 square-foot computer room with 364kW power, 64kW of battery backup, redundant cooling provided by chilled water, and is home to ISAAC-ORI resources. The KPB data center is approximately 2,200 square-foot and houses ISAAC-NG and the ISAAC Secure Enclave resources and is equipped with 400kW redundant UPS power and backup generator, a 300ton water chiller, and a FM200 fire suppression system, situated on the 2 feet raised floor.

3. HPC Computing and Storage Resources

The University provides support for acquisition of computational and storage resources for use by university researchers at any University of Tennessee campus. Additionally, faculty researchers can invest in private condos as part of the ISAAC resources to support their specific lines of research either funded by research awards, internal department, college funding, and/or faculty start-up funds. Along with the details of ISAAC resources described in this section, the following table gives an overview of the resources available as of September 2026.

Hardware item	ISAAC-NG	ISAAC-ORI	ISAAC-SIP	ISAAC-CMMC	AI-Tennessee
Nodes	259	72	15 - 49	51	8
Cores	18,312	4,953	2,384	2,448	512
Max RAM/Node	2 TB	1 TB	192 GB	192 GB	1 TB
GPUs	44	1	2	2	32
Storage (PB)	5.3	1	1.7	2	5.3 (shared)

3.1 ISAAC-NG

The ISAAC-NG cluster has been in production since 2021 with all new infrastructure, compute nodes, GPU nodes, and high-performance data storage systems. The computing capabilities of ISAAC-NG have continued to expand over the last several years, with the addition of new hardware and infrastructure under the support from both university investment and faculty research funding. As of September 2026, ISAAC-NG features a total of over 18,000 CPU cores, over 5 petabytes of high-performance data storage capacity, and high-speed internet connection to several core research facilities. For open science research, the ISAAC-NG cluster offers a diverse range of compute nodes suitable for a variety of computational needs, including:

- A. **High-Performance Compute Nodes:** The compute nodes on ISAAC-NG feature modern Intel processors (Cascade Lake Refresh, Ice Lake, Sapphire Rapids, and Skylake) and AMD processors (Bergamo, Genoa, Milan, and Rome). All the compute nodes are interconnected via high-speed network (EDR/HDR/NDR InfiniBand), enabling efficient communication and scalable parallel processing for large-scale workflows. The compute nodes on ISAAC-NG are available in a wide range of configurations, with 32 to 224 cores per node and memory capacities ranging from 128 GB to 2 TB RAM, ensuring ample capacity for computationally intensive analyses.
- B. **GPU-Accelerated Computing:** ISAAC-NG includes more than 30 GPU computing nodes equipped with NVIDIA Tesla V100S, T4, A40, A16, L40, and H100 GPUs dedicated for GPU-accelerated computing. These resources are critical for accelerating demanding artificial intelligence and machine learning applications.
- C. **NVME Scratch Space:** Certain GPU nodes are equipped with fast NVME scratch space (up to 47 TB), providing high-performance temporary storage for data-intensive computations.
- D. **Large Memory Nodes:** ISAAC-NG provides nine “big-mem” computing nodes with up to 2 TB of RAM, offering the extensive memory capacity required for large-scale data integration and analysis.
- E. **High-Speed Interconnect:** The ISAAC-NG infrastructure supports high-speed network (EDR/HDR/NDR) connections to lab instruments campus-wide, enabling real-time data collection and analysis.
- F. **Dedicated resources for AI research.** The University of Tennessee has an AI Tennessee Initiative that is providing research seed funds and equipment funds to support AI research across the University led by University of Tennessee, Knoxville. In July 2023, the AI Tennessee Initiative project provided funding for \$1M in AI compute resources for research that could make use of up to four NVIDIA H100 Hopper GPUs for AI applications. Around the same time, the NSF awarded an NSF MRSEC award to University of Tennessee, Knoxville for the Center for Advanced Materials and Manufacturing (CAMM) (NSF award 2399083) which also has need for employing AI research. The network in place is an HDR InfiniBand network designed for access to the ISAAC-NG Lustre storage.

The table below shows the computing resources available on ISAAC-NG (as of September 2026).

Node Type	CPU/GPU/RAM	Nodes	Cores/Node	Mem/Node
Emerald Rapids	Intel Gold 6548Y+	6	64	256 GB
Sapphire Rapids Bigmem	Intel Gold 6438M	2	64	2 TB
Cascade Lake Refresh	Intel Gold 6248R	118	48	192 GB
Cascade Lake 4xNVIDIA Tesla V100S	Intel Gold 6148	1	40	400 GB

Node Type	CPU/GPU/RAM	Nodes	Cores/Node	Mem/Node
Cascade Lake Refresh 2xNVIDIA Tesla V100S	Intel Gold 6248R V100S GPU – 32 GB	6	48	192 GB
Cascade Lake Refresh 4xT4 GPU	Intel Gold 6248R NVIDIA T4 GPU	1	48	192 GB
Cascade Lake Refresh 2xV100S GPU	Intel Gold 6248R V100S GPU – 32 GB	9	48	768 GB
Cascade Lake Refresh 1xV100S GPU	Intel Gold 6248R V100S GPU – 32 GB	1	48	192 GB
Cascadelake Refresh Bigmem	Intel Gold 6248R	4	48	1.5 TB
Icelake	Intel Gold 6348	38	56	256 GB
Icelake Platinum 4xA40 GPU 56 TB NVME scratch space	Intel Platinum 8358 A40 GPU – 48 GB	1	64	1TB RAM + 1.7TB NVME
Icelake Platinum	Intel Platinum 8358	2	64	256 GB
Icelake 2xA16 GPU	Intel Gold 6348 A16 GPU – 16 GB	3	56	256 GB
Icelake Bigmem	Intel Gold 6348	3	56	2 TB
Sapphire Rapids	Intel Gold 6438M	5	64	512 GB
Sapphire Rapids 2xL40 GPU	Intel Platinum 8462Y+ L40 GPU – 48 GB	1	64	768 GB
Sapphire Rapids 4x H100 GPU 47 TB NVME scratch space	Intel Platinum 8462Y+ H100 GPU –80 GB	10	64	1 TB
Sky Lake	Intel Gold 6148	8	40	192 GB
AMD Bergamo	AMD EPYC 9754	2	256	1 TB
AMD Bergamo	AMD EPYC 9734	20	224	1 TB
AMD Genoa	AMD EPYC 9534	2	128	512 GB
AMD Genoa	AMD EPYC 9534	4	128	756 GB
AMD Genoa	AMD EPYC 9534	1	128	1.5 TB
AMD Genoa	AMD EPYC 9334	1	64	1 TB
AMD Milan	AMD EPYC 7713	7	128	512 GB
AMD Milan	AMD EPYC 7763	1	64	256 GB
AMD Rome	AMD EPYC 7542	1	32	128 GB

3. 2 ISAAC-ORI

The ISAAC-ORI cluster is the combination of several existing separate compute clusters into one centrally managed cluster. As of September 2026, the cluster features a balanced set of computing resources, including 72 compute nodes (collectively over 5000 CPU cores) with InfiniBand interconnections, a Lustre parallel file system with 2.7 petabytes of high-performance storage capacity, two high-performance data transfer nodes, and 100-gigabit network connectivity to Internet2.

3. 3 ISAAC Secure Enclave resources

The University supports research in fields that may have need to process sensitive information which may have regulatory compliance requirements for confidentiality, integrity and availability of the information. Such research may be in medical, social sciences, engineering, and/or other

fields requesting computational support for processing sensitive information including, but not limited to, Protected Health Information (PHI), Controlled Unclassified Information (CUI), and human studies research under the jurisdiction of applicable University of Tennessee and other organizations Institutional Review Boards (IRB).

The ISAAC secure enclave (ISAAC-SIP and ISAAC-CMMC) clusters are configured as separate resources from the other ISAAC clusters. The clusters have over 50 compute nodes with over 2000 CPU cores and 1.7 petabytes of data storage capacity via Lustre file system. Each of the ISAAC secure enclave clusters has a written and approved cybersecurity plan developed by the professional staff with experience in implementing HIPAA or CUI security rule (via NIST 800-53 and/or NIST 800-171 requirements). In addition to traditionally physical computing resources, the secure enclave also provides access to standalone Windows/Linux virtual machines that are accessible remotely via Citrix and virtual desktop interface. Access to the Secure Enclave cluster is via SSH accessed also via Citrix.

3. 4 Virtual Machines

Infrastructure is available to provide Virtual Machines (VM) that can either be Windows or Linux. The access to the VMs is provided remotely via Citrix with controls in place to prevent files or even copy/paste buffers from being used between the workstation accessing the virtual environment and the actual VM. Each of the research projects can request one or more VMs, specify the host configuration (CPU, memory, and storage), and specify the users who can have access to the VMs including external collaborators when combined with UT sponsored NetIDs.

3. 5 High-Performance Data Transfer Nodes

HPSC currently supports multiple data transfer nodes for high-performance data transfer between ISAAC resources and external computer systems supporting Globus and SCP file transfer protocols. Currently, ISAAC-ORI has two data transfer nodes each with 10 Gb network connectivity and FDR InfiniBand access to Lustre haven storage resources. ISAAC-NG also has two data transfer nodes, each with 40Gb network connectivity and HDR InfiniBand access to the Lustre storage resources.

In order for the Secure Enclave to comply with the PHI and CUI related regulations, the data transfer infrastructure is split between the VM environment and the compute cluster environment. The VM environment data transfer node is provisioned on the VMware infrastructure with 10Gb network connectivity and provides secured authenticated data transfer via Globus to the VM environments only. The compute cluster data transfer node is a Secure Enclave HPC infrastructure node, with 40Gb network connectivity, and HDR InfiniBand access to the SIP Lustre filesystem.

3. 6 LTO-9 Tape Based Archival Storage

The University has purchased an archival storage system, named UT-StorR and in production since July/2024, with a six petabyte tape archival robot based on LTO-9 tape technology, an 800 terabyte Lustre parallel file system based storage landing pad, HPE's Data Management Framework made up of servers and software, and the Globus research data management for data movement and sharing to form a hierarchical storage management environment for high capacity long term archival storage for the University for data storage, management, and sharing needs.

4. HPC user supports

Under the HPSC leadership, the team consists of one senior HPC system administrator, one HPC system architecture, one HPC system administrator, one account/project manager, three HPC research scientists, and two security analysts. The team includes five PhD by training from STEM fields and expertise in performing advanced scientific computing with over 30 first/corresponding

authored publications on peer-review journals and international conferences including *Physical Review Letters*; *Chemical Physics Letters*; *Applied and Environmental Science*; *Parallel and Symbolic Computations*, etc. The team has a proven track record of user assistance across the UT community for scientific computing on ISAAC resources, including:

- A. **User Support & Professional Training:** The HPSC team addresses user support requests daily via ticket system and provides prompt assistance regarding HPC system usage, scientific programming, and performance optimization and target cluster. In addition, the team provides ongoing opportunities for HPC professionals every semester through a range of activities, including workshops, specialized training programs, instructional classes, and symposia, consistently ensuring researchers effectively navigate advanced computational environments.
- B. **Research Software Administration and Optimization:** The HPSC team supports more than 100 scientific computing software packages deployed on ISAAC, including software auditing, license management, software optimization and installation, CPU/GPU benchmarking and testing. The group also support the container-based applications and the development of new workflows for scientific computing on the cluster.
- C. **Research Facilitation:** The team has years of professional experience in delivering on-time guidance for resolving research computational problems on ISAAC. Since 2020, the team has supported over 400 projects across multiple UT campuses (Knoxville, Chattanooga, Space Institute, Health Science Center, etc.) for research and education on ISAAC resources, directly accelerating scholarly output and student learning across campus.
- D. **Regulated Research Computing Enablement:** The HPSC team has established two dedicated secure enclave clusters to provide researchers with the specialized computing power and comprehensive safeguards needed to meet rigorous regulatory standards and compliance requirements. Working with university stakeholders and external auditors, the team's security personnel also ensure the operational delivery of secure research computing environments for researchers by safeguarding research assets, managing incident response workflows, and driving end-to-end cybersecurity governance, risk assessment, and compliance assurance.
- E. **Core research facility support:** The HPSC team has continued to support the UT core research facility for massive data storage and scientific computing on ISAAC since 2021 and the team is currently supporting multiple core research facility centers. For example, with the close work between the HPSC team and the Genomics Core staff, the massive datasets generated from the Genomics Core instruments (e.g. Illumina NovaSeq) are now automatically saved to the ISAAC-NG Lustre file system. When needed, the data can be converted from BCL to FASTQ format once the instrument run is complete, eliminating the need and use of Illumina BaseSpace in the cloud. Access to this data can be made available to all collaborators who need the DNA sequence data.
- F. **Proposal Support:** The team also has an established history of bridging ISAAC computing resources with national supercomputing facilities, helping ISAAC users develop competitive proposals to secure external resources for extremely large-scale computations and simulations. Over the past five years, the team has provided assistance for the development of more than a dozen research proposals. Furthermore, acting as the PIs/Co-PIs, members of the HPSC team have submitted two Major Research Instrumentation (MRI) proposals and seven additional research proposal to national funding agencies, collectively bringing in over \$700,000 external funding for the university.

[1]. More details about the high-performance computing and storage resources can be found at the HPSC website: <https://oit.utk.edu/hpsc/> (accessed on September/28/2026)