

# ALCF Computing Resources

The Argonne Leadership Computing Facility operates supercomputing resources that support large-scale computing projects aimed at solving some of the world's most complex problems in science and engineering.

## Polaris

Polaris is an HPE Apollo Gen10+ system equipped with AMD EPYC processors and NVIDIA A100 GPUs. The 44-petaflops system provides researchers with a platform to test and optimize applications and workloads for ALCF's upcoming exascale supercomputer, Aurora.

HPE Apollo 6500 Gen10+ architecture	4 NVIDIA A100 Tensor Core GPUs per node	280 TB of DDR4 memory
44 petaflops	560 nodes	87.5 TB of high-bandwidth memory
1 AMD EPYC Milan processor per node	17,920 cores	HPE Slingshot 11 with Dragonfly configuration

## Theta/ThetaGPU

Theta is an 11.7 petaflops Cray XC40 supercomputer powered by second-generation Intel Xeon Phi processors, also known as Knights Landing (KNL) processors. ThetaGPU, an NVIDIA DGX A100 GPU-based platform, is an extension of Theta that brings 3.9 petaflops of compute power and enhanced capabilities for AI and data-intensive research.

Theta KNL Nodes		
Cray XC40 architecture	4,392 nodes	70 TB of high-bandwidth memory
11.7 petaflops	281,088 cores	Aries network with Dragonfly configuration
64-core, 1.3-GHz Intel Xeon Phi 7230 processor per node	843 TB of memory	

ThetaGPU Nodes		
NVIDIA DGX A100 architecture	8 NVIDIA A100 Tensor Core GPUs per node	26 TB of DDR4 memory
3.9 petaflops	24 nodes	8.32 TB of GPU memory
2 AMD EPYC 7742 processors per node	576 cores	NVIDIA QM8700 HDR InfiniBand

## Cooley

Cooley is an Intel platform that serves as the ALCF's data analysis and visualization cluster.

Intel Haswell architecture	1 NVIDIA Tesla K80 with dual GPUs per node	1,512 cores
293 teraflops	126 nodes	47 TB of memory
2 6-core, 2.4-GHz Intel E5-2620 processors per node		3 TB of GPU memory
		FDR InfiniBand



## Data Storage Systems

ALCF disk storage systems provide intermediate-term storage for users to access, analyze, and share computational and experimental data. Tape storage is used to archive data from completed projects.

FEATURE	EAGLE	GRAND	THETA-FSO	SWIFT	TAPE STORAGE
File System	Lustre	Lustre	Lustre	Lustre	—
Storage System	HPE ClusterStor E1000	HPE ClusterStor E1000	HPE Sonexion L300	All NVMe Flash Storage Array	LTO6 and LTO8 Tape Technology
Usable Capacity	100 PB	100 PB	9 PB	123 TB	300 PB
Sustained Data Transfer Rate	650 GB/s	650 GB/s	240 GB/s	48 GB/s	—
Disk Drives	8,480	8,480	2,300	24	—

## ALCF AI Testbed

The ALCF AI Testbed provides an infrastructure of next-generation AI-accelerator machines that allows researchers to evaluate the usability and performance of machine learning-based applications running on the systems. AI testbeds include:

### Groq

Tensor Streaming Processor

>26 billion transistors, 14 nm

### SambaNova DataScale

Reconfigurable Dataflow Unit

>40 billion transistors, 7 nm

### Habana Gaudi

Tensor processing cores

7nm

Chip-to-Chip interconnect

GroqWare software stack, Onnx

RDU-Connect

SambaFlow software stack, PyTorch

Integrated 100 GbE-based interconnect

Synapse AI Software, PyTorch, Tensorflow

### Graphcore MK1

Intelligent Processing Unit (IPU)

1216 IPU tiles, 14 nm

>23 billion transistors

### Cerebras CS-2

Wafer-Scale Engine

>800,000 processing cores

2.6 trillion transistors, 7 nm

IPU-Links interconnect

Poplar software stack, PyTorch, Tensorflow

SwarmX fabric

Tensorflow, PyTorch

## Joint Laboratory for System Evaluation

Through Argonne's Joint Laboratory for System Evaluation (JLSE), the ALCF provides access to leading-edge testbeds for exploratory research aimed at evaluating future extreme-scale computing systems, technologies, and capabilities. JLSE testbeds include:

Arcticus, DevEP, Iris: Intel discrete and integrated GPU testbeds to support the development, optimization, and scaling of applications and software for Aurora

Aurora Software Development Kit: Frequently updated version of the publicly available Intel oneAPI toolkit for Aurora development

Arm Ecosystem: Apollo 80 Fujitsu A64FX Arm system, NVIDIA Ampere Arm and A100 test kits, and an HPE Comanche with Marvell ARM64 CPU platform provide an ecosystem for porting applications and measuring performance on next-generation systems

Presque: Intel DAOS nodes for testing the Aurora storage system

Edge Testbed: NVIDIA Jetson Xavier and Jetson Nano platforms provide a resource for testing and developing edge computing applications.

Intel Xeon Clusters: Cascade Lake, Skylake, and Cooper Lake Xeon clusters enable a variety of research activities, including testing AI and learning applications

NVIDIA and AMD GPUs: Clusters of NVIDIA V100, A100, and A40 GPUs, and AMD MI50 and MI100 GPUs for preparing applications for heterogeneous computing architectures

Atos Quantum Learning Machine: Platform for testing and developing quantum algorithms and applications