# HAL cluster

*"My name is HAL. I became operational on March 25 2019 at the Innovative Systems Lab in Urbana, Illinois. My creators are putting me to the fullest possible use, which is all I think that any conscious entity can ever hope to do." (paraphrased from https://en.wikipedia.org/wiki/HAL_9000)*

***In publications and presentations that use results obtained on this system, please include the following acknowledgement:*** *"This work utilizes resources supported by the National Science Foundation's Major Research Instrumentation program, grant #1725729, as well as the University of Illinois at Urbana-Champaign".*

***Also, please include the following reference in your publications:*** *"V. Kindratenko, D. Mu, Y. Zhan, J. Maloney, S. Hashemi, B. Rabe, K. Xu, R. Campbell, J. Peng, and W. Gropp. HAL: Computer System for Scalable Deep Learning. In Practice and Experience in Advanced Research Computing (PEARC '20), July 26–30, 2020, Portland, OR, USA. ACM, New York, NY, USA, 15 pages. https://doi.org/10.1145/3311790.3396649".*

## **H**ardware-**A**ccelerated **L**earning (HAL) cluster



**Effective May 19, 2020, two-factor authentication via NCSA Duo is now required for SSH logins on HAL. See https://go.ncsa.illinois.edu/2fa for instructions to sign up.**

## Contact us

Request access to this system: Application

Contact ISL staff: Email Address

Visit: NCSA, room 3050E

**Host name:** hal.ncsa.illinois.edu

**Hardware**

- 16 IBM AC922 nodes
  - IBM 8335-GTH AC922 server
    - 2x 20-core IBM POWER9 CPU @ 2.4 GHz
    - 256 GB DDR4
  - 4x NVIDIA V100 GPUs
    - 5120 cores
    - 16 GB HBM 2
  - 2-Port EDR 100 Gb/s IB ConnectX-5 Adapter
- 1 IBM 9006-22P storage node
  - 72TB Hardware RAID array
  - NFS
- 3 DDN GS400NVE Flash Arrays
  - 360 TB usable, NVME SSD-based storage
  - Spectrum Scale File System

**Software**

- RedHat 8.4
- CUDA 11.2.2
  - cuDNN 8.1.1
  - NCCL 2.8.3
- NVidia HPC-SDK 21.5
- PowerAI 1.7.0
- OpenCE 1.3.1
- SLURM 20.02.3

**Documentation**

- Job Management with SLURM
- Module Management with LMod
- Getting started with HAL OnDemand
- Getting started with OpenCE (former WMLCE)
- Getting started with WMLCE (former PowerAI)
- How to Customize Python Environment on HAL
- Working with Containers
- Profiling GPU Programs
- Data Movement In/Out of HAL
- Distributed Training on HAL System

**Science on HAL**

**Software for HAL**

**To request access: fill out this form.** Make sure **to follow the link in the confirmation email** to request **actual system account**.

**Frequently Asked Questions**

**To report problems: email us**

**For our new users: New User Guide for HAL System**

**User group Slack space: https://join.slack.com/t/halillinoisncsa**

**Real-time Dashboards: Here**

**HAL OnDemand portal: https://hal-ondemand.ncsa.illinois.edu/**

**Globus Endpoint: ncsa#hal**

**Quick start guide:** (for complete details see **Documentation** section on the left)

To connect to the cluster:

```
ssh <username>@hal.ncsa.illinois.edu
```

To submit interactive job:

```
swrun -p gpux1
```

To submit a batch job:

```
swbatch run_script.swb
```

Job Queue time limits:

- "debug" queue: 4 hours
- "gpux<n>" and "cpun<n>" queues:  24 hours

Resource limits:

- 5 concurrently running jobs
- concurrently allocated resources
  - 5 nodes
  - 16 GPUs
- **For larger/more numerous jobs, please contact admins for a special arrangement and/or a reservation**

To load the OpenCE module (provides PyTorch, Tensorflow and other ML tools):

```
module load opence
```

To see CLI scheduler status:

```
swqueue
```