

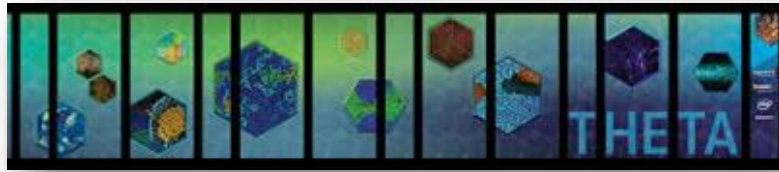
ORNL Pathways to Supercomputing Initiative for HBCUs/MSIs

Elijah MacCarthy, Veronica Melesse Vergara, John Holmen
System Acceptance & User Environment Group
Oak Ridge Leadership Computing Facility (OLCF)
Oak Ridge National Laboratory (ORNL)

Faculty Hackathon 2023 – October 22, 2023

ORNL is managed by UT-Battelle LLC for the US Department of Energy

We are one of the DOE's Office of Science computation user facilities



National Energy Research
Scientific Computing Center



- DOE is leader in open high-performance computing
- Provide the world's most powerful computational tools for open science
- Access is free to researchers who publish
- Boost US competitiveness
- Attract the best and brightest researchers

What is a Leadership Computing Facility (LCF)?

- Collaborative, multi-lab DOE initiative (2 centers / 2 architectures)
- Mission: Provide an ecosystem that enables capability computing opportunities to solve the most challenging problems.
- Administer and support two highly competitive user allocation programs
 - Innovative and Novel Computational Impact on Theory and Experiment (INCITE)
 - ASCR Leadership Computing Challenge (ALCC)
 - Computational allocations typically 100x larger than generally available in university, laboratory, and industrial (scientific and engineering) environments.

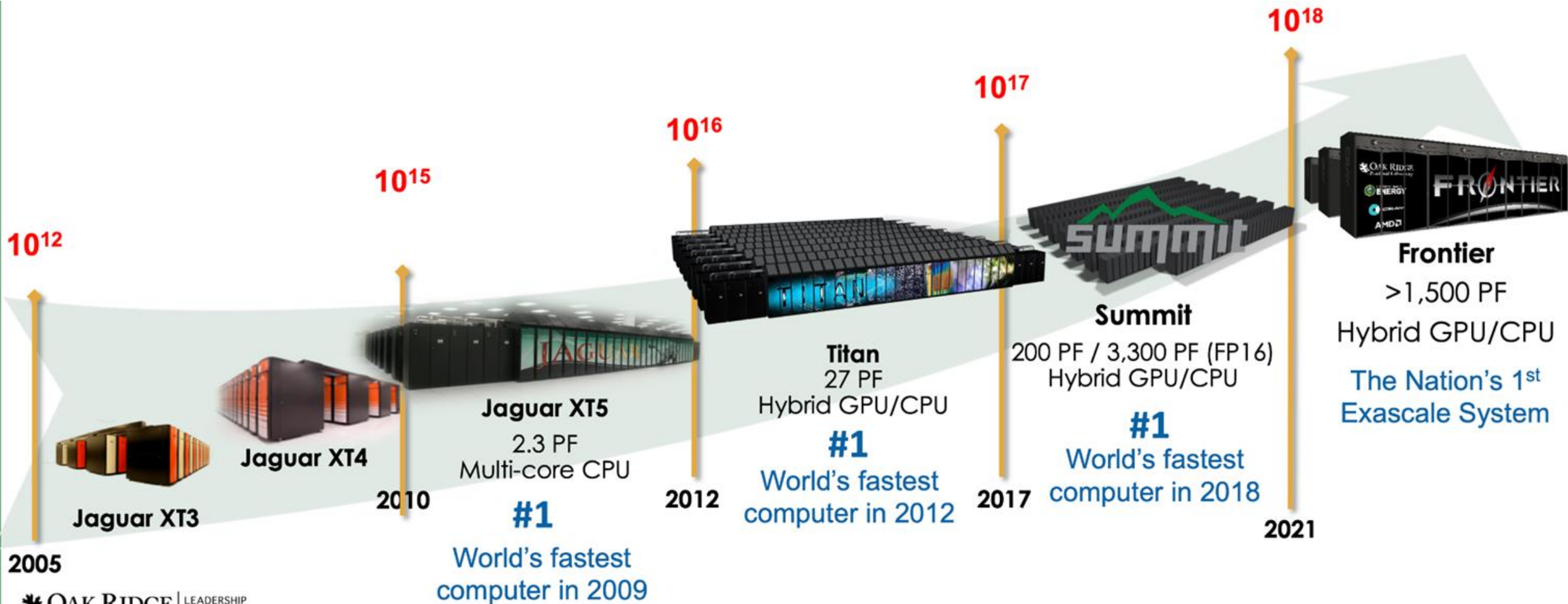


Resource Allocations at the OLCF

- Researchers across the globe are awarded computational resources at the OLCF for their projects.
- These projects should be one of a kind and those that cannot be supported by any other systems.
- The rationale behind this is to push barriers and for more scientific discoveries.
- As a result, the OLCF systems are highly competitive around the world.

The OLCF has Successfully Delivered Six Systems Since 2004

- Frontier is system number seven and provides an increased capability of over 5-10X Summit depending on the application.



OLCF IBM AC922 Summit Supercomputer

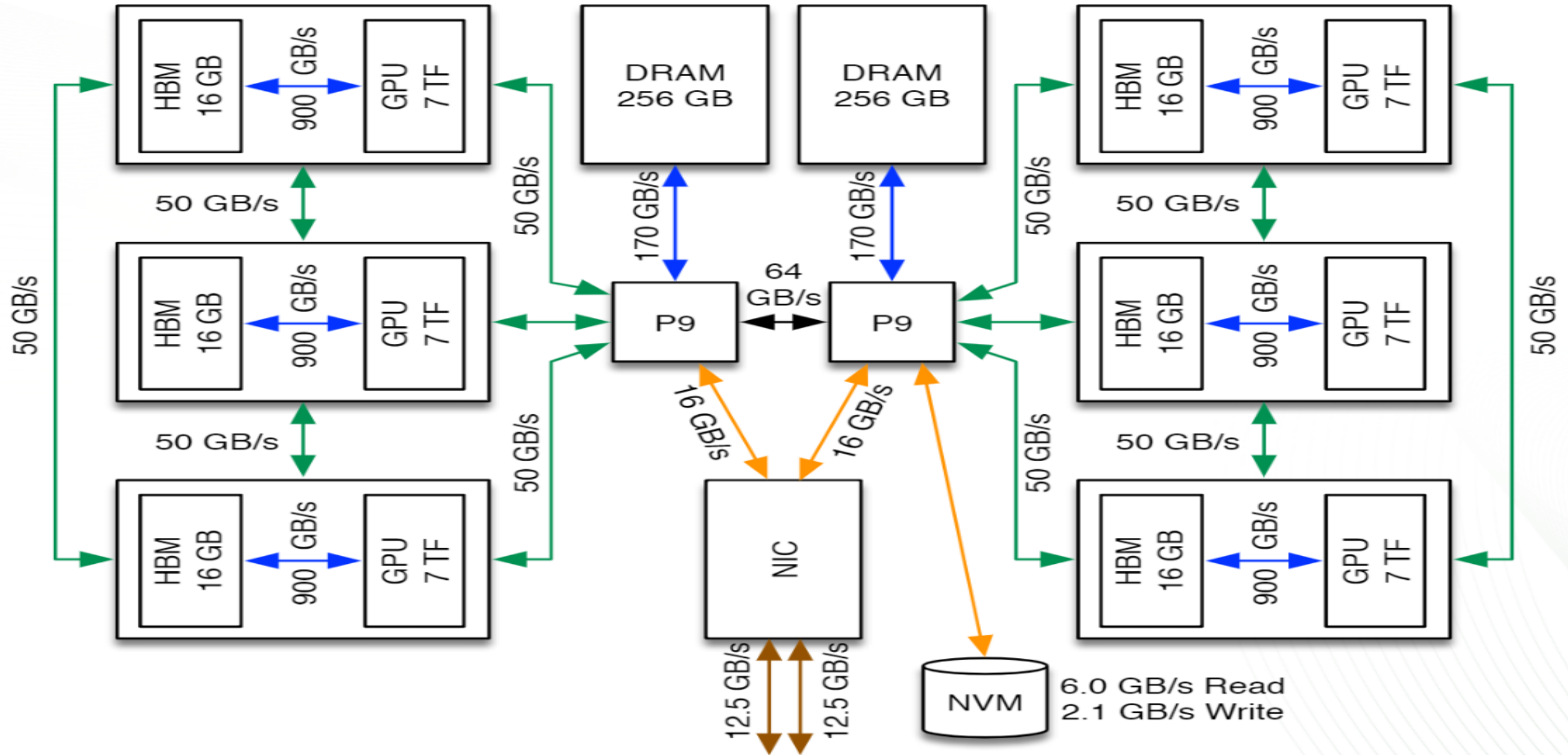
Specifications and Features

- Processor: IBM Power9™ (2/node)
- GPUs: 27,648 NVIDIA Volta V100s (6/node)
- Nodes: 4,608
- Node Performance: 42TF
- Memory/node: 512GB DDR4 + 96GB HBM2
- NV Memory/node: 1600GB
- Total System Memory: >10PB DDR4 + HBM + Non-volatile
- Interconnect Topology: Mellanox EDR 100G InfiniBand, Non-blocking Fat Tree
- Peak Power Consumption: 13MW

Screenshots of the TOP500 website and award certificates. The website shows the 'TOP 500 CERTIFICATE' for June 2018, ranking Summit as the number 1 system. It also displays the 'HPCG List for November 2019' and another 'TOP 500 CERTIFICATE' for Summit. The certificates mention 'Summit, an IBM Power CPU + NVIDIA Volta GV100 GPU System at DOE/SC/Oak Ridge National Laboratory' and 'Summit, an IBM Power System AC922 at the U.S. Department of Energy / SC / Oak Ridge National Laboratory, TN, USA'.

| Rank | System | Cores | Rmax (TFlop/s) | HPCG (TFlop/s) |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|----------------|----------------|
| 1 | Summit - IBM Power System AC922, IBM POWER9 22C 3.07GHz, NVIDIA Volta GV100, Dual-rail Mellanox EDR Infiniband, IBM DOE/SC/Oak Ridge National Laboratory | 2,414,592 | 148,600.0 | 2925.75 |

OLCF IBM AC922 Summit Supercomputer

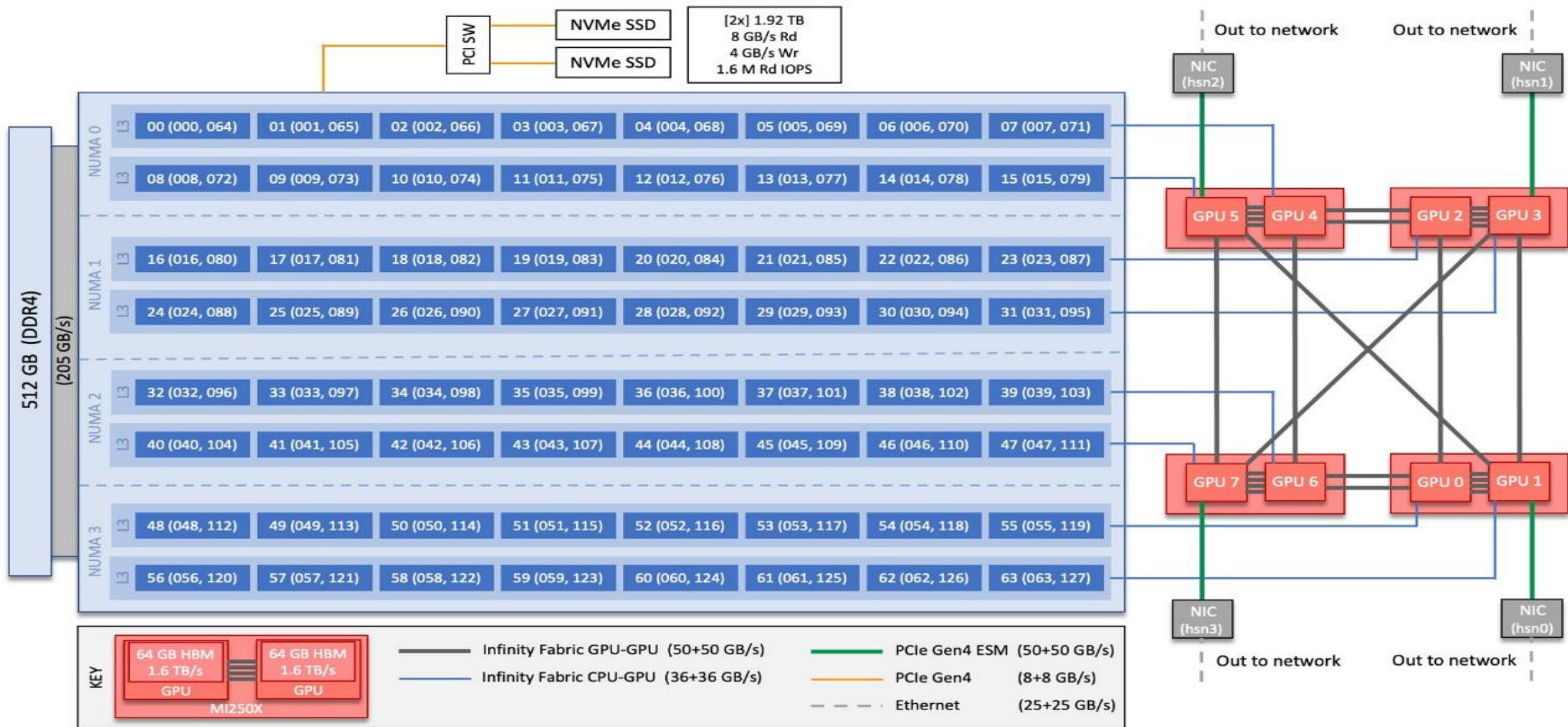


OLCF Cray Frontier Supercomputer(node architecture)

Specifications and Features

- Processor: AMD Optimized 3rd Gen EPYC (1/node)
- GPUs: 37,632 AMD MI250Xs on compute nodes (4/node)
- Nodes: 9,408 compute nodes.
- Memory/node: 512GB DDR4 + 64GB HBM2E
- NV Memory: 1.92TB (2/node)
- Total Storage: 716PB
- Interconnect Topology: Multiple Slingshot NICs providing 100 GB/s network bandwidth, Slingshot dragonfly network providing adaptive routing, congestion management and quality of service.
- Peak Power Consumption: 29MW

OLCF Cray EX Frontier Supercomputer (architecture)

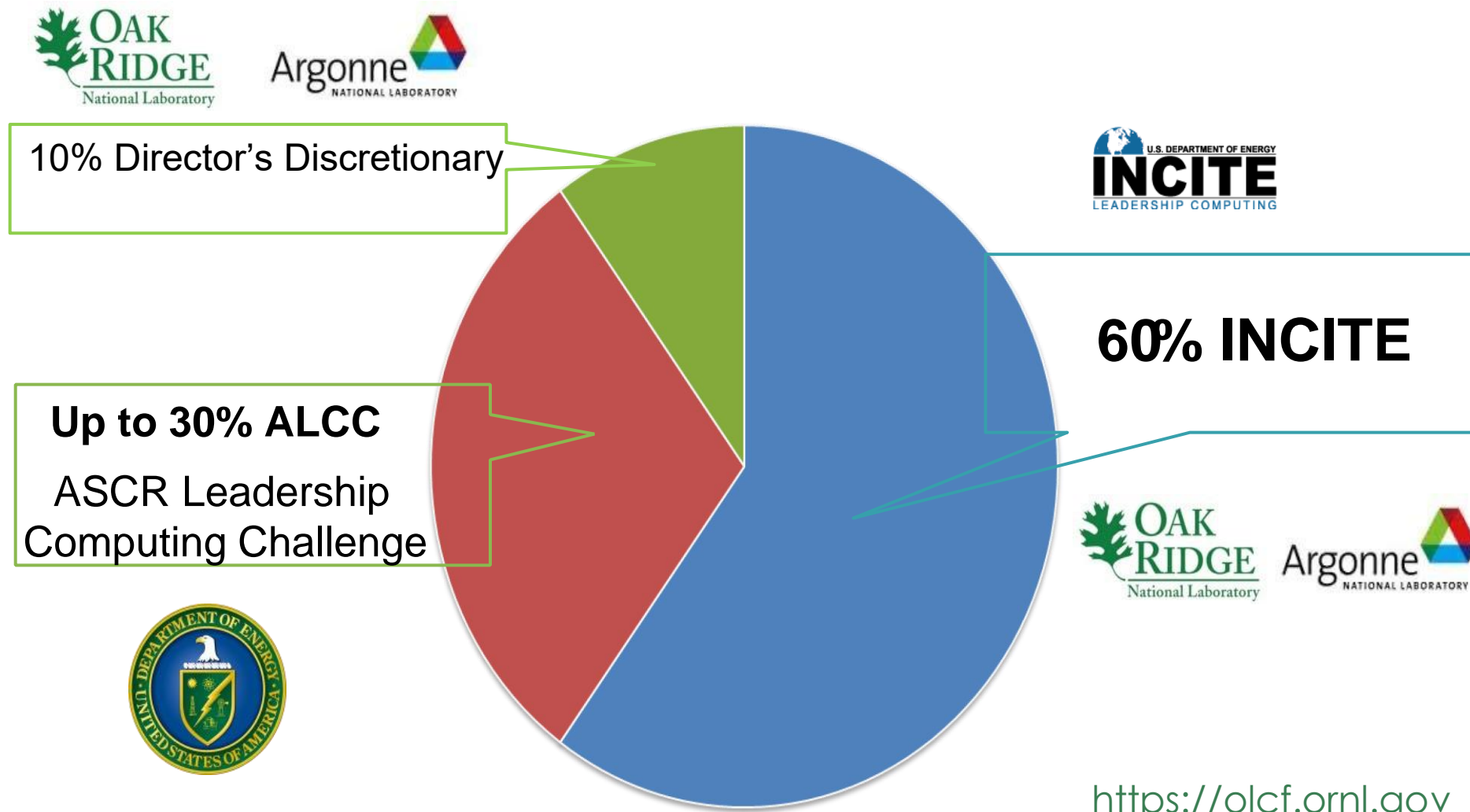


Background to OLCF Pathways Initiative

- High-Performance Computing has become an essential part to scientific research.
- It is important therefore to make available to researchers HPC resources that will facilitate their research efforts.
- As a result, the Oak Ridge Leadership Computing Facility (OLCF) aims to help build a vibrant and inclusive community of researchers in the area of theoretical and experimental science.



Primary User Programs for Access to LCF



OLCF Pathways Initiative

- The OLCF has invested in a series of programs and opportunities, including:
 - I. Computational resource allocations
 - II. Workshops, training events, and seminars
 - III. Internships
- This is to introduce scientists to the OLCF's leadership-class machines and to make resources on these machines available to researchers in HBCUs/MSIs and liberal art colleges.

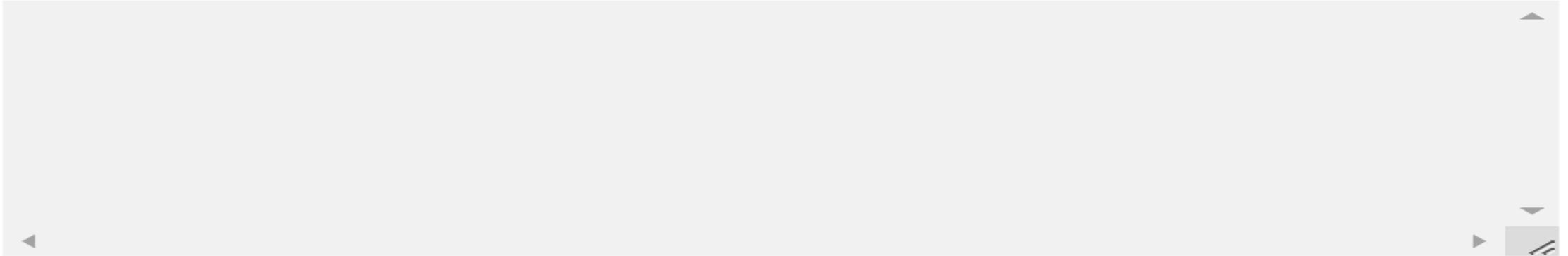
PSI: Research Resource Allocations

- This initiative launched by the Oak Ridge Leadership Computing Facility (OLCF) is to assist researchers and institutions currently underrepresented in high-performance computing (HPC).
- This is to equip these researchers with tools and resources needed to develop competitive allocation proposals and provide a pathway to the OLCF's user programs, including the Director's Discretionary, the Innovative and Novel Computational Impact on Theory and Experiment (INCITE), and the ASCR Leadership Computing Challenge (ALCC) programs.
- The initiative is open but not limited to community colleges, historically black colleges and universities, Hispanic-serving institutions, liberal arts colleges and small universities.
- Accepted applications are granted resources on the centers summit supercomputer as well as other resources and mentors to guide in the actual proposal.

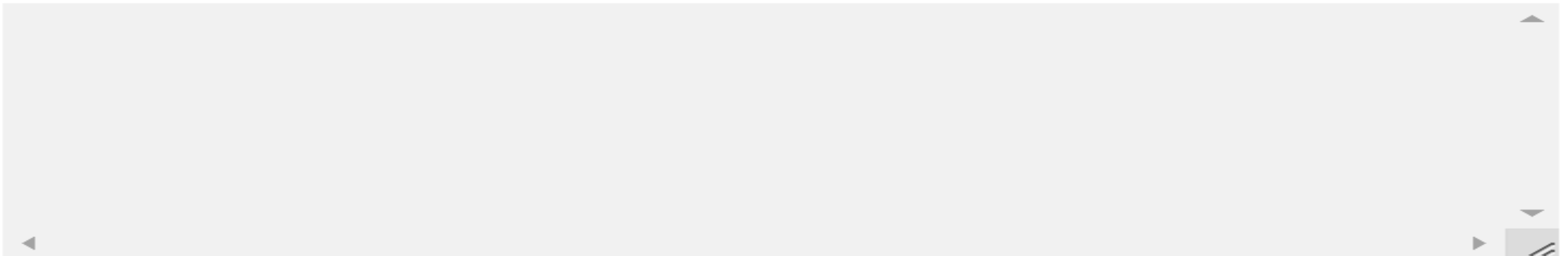
Completing the Interest Form for Pathways Initiative

How did you hear about the Pathways to Supercomputing Initiative? *(Required)*

Please briefly explain.



If selected, what computational experiments and scientific problems are you interested in tackling? Please explain the scientific background of your research. Please list any codes that you are interested in running and include a list of their dependencies. *(Required)*



Would you be interested in being contacted about the following?

Select all that apply.

Pathways to Supercomputing Internship Program

HPC Crash Course

- As part of the pathway's initiative, the OLCF has developed a virtual (2- or 3-day) crash course to expose students mainly from HBCUs/MSIs to high-performance computing (HPC).
- It covers the foundational skills needed to start learning about HPC (e.g., ssh, Linux command line, command-line text editors, introductory C programming) before moving on to the basics of HPC itself.
- The courses are hosted virtually on Zoom and make use of Slack for hands-on help during the exercises.
- The Hands-On HPC Crash Course is offered periodically throughout the year and also for specific audiences on demand.
- If you are interested in hosting a Hands-On HPC Crash Course at your institution or event, please submit an interest form.

Winter 2022 HPC Crash Course



Pathways to Computing Internship Program

- The Pathways to Computing Internship Program (PCIP) is another one of the ORNL pathways to supercomputing initiatives.
- This is a 10-week summer learning program for undergraduate students in computer science, computational science, and computational mathematics.
- Students are mentored by ORNL research and technical staff members and will be able to make contributions to projects in diverse computing areas, including computer science, high-performance computing, system administration, and more.
- The goal of the program is to improve opportunities and encourage applications from underrepresented groups in the computing field.

Pathways to Computing Internship Program



- For summer 2023 internships, offers have just been sent out.
- A total of 94 applications were received.
- 10 offers were sent out to the top candidates.
- A variety of topics from ML/AI, GPU Programming, Bioinformatics are being considered during Summer 2023.
- Students receive a weekly stipend of \$650 to \$750 paid biweekly.
- Up to \$1000 for travel expenses to Oak Ridge, TN.

Visiting Faculty Program (VFP)

- This is a DOE initiative for fulltime faculty from institutions historically marginalized in STEM research.
- It is a 10-weeks funded summer collaborative experience with a DOE National Laboratory, and it comes in two tracks.
- The VFP Research Collaboration track helps faculty from these institutions work with their counterparts in the DOE labs on STEM related research projects.
- VFP Teaching Initiative enables faculty to develop innovative course content, certificate programs, seminars and learning modules for their students.



How to Apply

- To submit an interest form for the HPC Crash Course and the Research Resource Allocations, go to: 
- To apply for the Pathways to Computing Internship Program (PCIP), please go to: 
- Other faculty and student opportunities/resources:
 - I. <https://education.ornl.gov/>
 - II. https://docs.olcf.ornl.gov/training/training_archive.html
 - III. <https://github.com/olcf/hands-on-with-Frontier->
 - IV. <https://github.com/olcf/hands-on-with-summit>

Summit here

Frontier here

Questions ?

maccarthyea@ornl.gov

