The CI Landscape: Systems, Service Providers, Technologies

—◇—

Jacob Fosso Tande,

The University of North Carolina at Greensboro,

Campus Champions Leadership Team,

Virtual Residency

June 28, 2022

Talk OUTLINE

◇

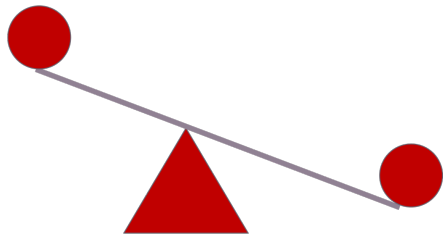|			
NSF/XSEDE →ACCESS Systems: Anvil, Bridges2, Expanse, Jetstream2, Frontera **Open Science Grid (OSG)**	**Science Gateways**	DOE National Labs: OLCF's Summit & Frontier and NERSC's Perlmutter & Cori	ESnet and EPOC
	Internet2	**International Orgs: GEANT, Compute Canada, PRACE**	**Tools: Globus, XDMod, Spack, Open OnDemand, ask.ci, etc**

Striking the Right Balance

Services and Systems are omitted because of:

1. Expanded landscape
2. Time
3. Where to find?

The following are omitted:

- NSF/ACCESS: Darwin, Rockfish, Open Storage Network(OSN), Stampede2, FASTER

- DOE National Lab resources such as the ALCF's Aurora & Polaris test bed.

- NIH resources such as BioWulf, Helix and Helixweb

- Cloud resources such as CloudBank, CloudLab, GENI, emulab and Chameleon.

- Commercial Cloud: Google Cloud, Azure, AWS, IBM cloud etc..

- Regional Networks and THE QUILT

Why Bother?

o You are from a resource limited institution.
o Your users have needs that are not present at your institution.
  o Extreme memory compute systems
  o Testbeds
  o Distributed data sharing (Open Storage Network)
o Demand surpasses offer
o Highly collaborative research projects:
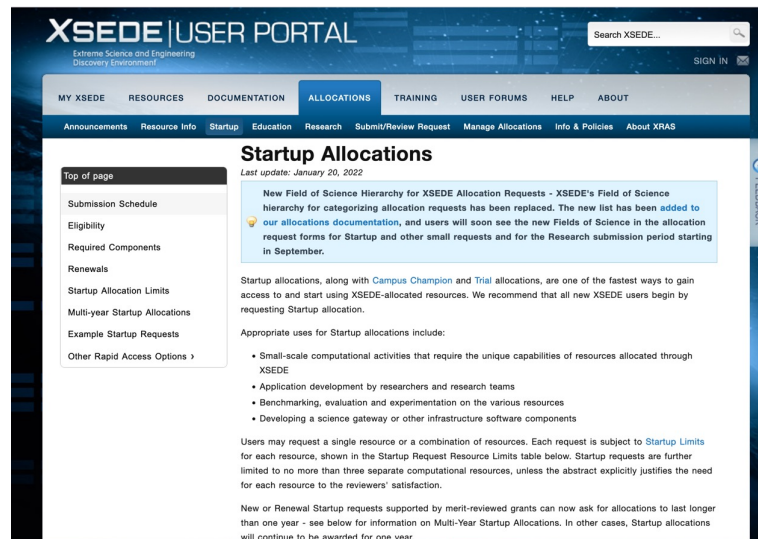 o IceCube project
  o Event Horizon Telescope Collaboration

What is more important? Knowing all about the systems and services or knowing where to find these systems and services?

NSF/XSEDE →ACCESS Systems
Startup Allocations

Why get a Startup Allocation?

- Small-scale computational activities that require the unique capabilities of resources allocated through XSEDE
- Application development by researchers and research teams
- Benchmarking, evaluation and experimentation.
- Developing a science gateway or other infrastructure software components

XSEDE | USER PORTAL
Extreme Science and Engineering Discovery Environment

Search XSEDE...

SIGN IN

MY XSEDE   RESOURCES   DOCUMENTATION   ALLOCATIONS   TRAINING   USER FORUMS   HELP   ABOUT

Announcements   Resource Info   Startup   Education   Research   Submit/Review Request   Manage Allocations   Info & Policies   About XRAS

Top of page

Submission Schedule
Eligibility
Required Components
Renewals
Startup Allocation Limits
Multi-year Startup Allocations
Example Startup Requests
Other Rapid Access Options ›

Startup Allocations
Last update: January 20, 2022

New Field of Science Hierarchy for XSEDE Allocation Requests - XSEDE's Field of Science hierarchy for categorizing allocation requests has been replaced. The new list has been added to our allocations documentation, and users will soon see the new Fields of Science in the allocation request forms for Startup and other small requests and for the Research submission period starting in September.

Startup allocations, along with Campus Champion and Trial allocations, are one of the fastest ways to gain access to and start using XSEDE-allocated resources. We recommend that all new XSEDE users begin by requesting Startup allocation.

Appropriate uses for Startup allocations include:

- Small-scale computational activities that require the unique capabilities of resources allocated through XSEDE
- Application development by researchers and research teams
- Benchmarking, evaluation and experimentation on the various resources
- Developing a science gateway or other infrastructure software components

Users may request a single resource or a combination of resources. Each request is subject to Startup Limits for each resource, shown in the Startup Request Resource Limits table below. Startup requests are further limited to no more than three separate computational resources, unless the abstract explicitly justifies the need for each resource to the reviewers' satisfaction.

New or Renewal Startup requests supported by merit-reviewed grants can now ask for allocations to last longer than one year - see below for information on Multi-Year Startup Allocations. In other cases, Startup allocations will continue to be awarded for one year.

FEEDBACK

NSF/XSEDE →ACCESS Systems

Startup Allocations

Share your thoughts in the chat: If you have/had a startup allocation, how do/would you use it?
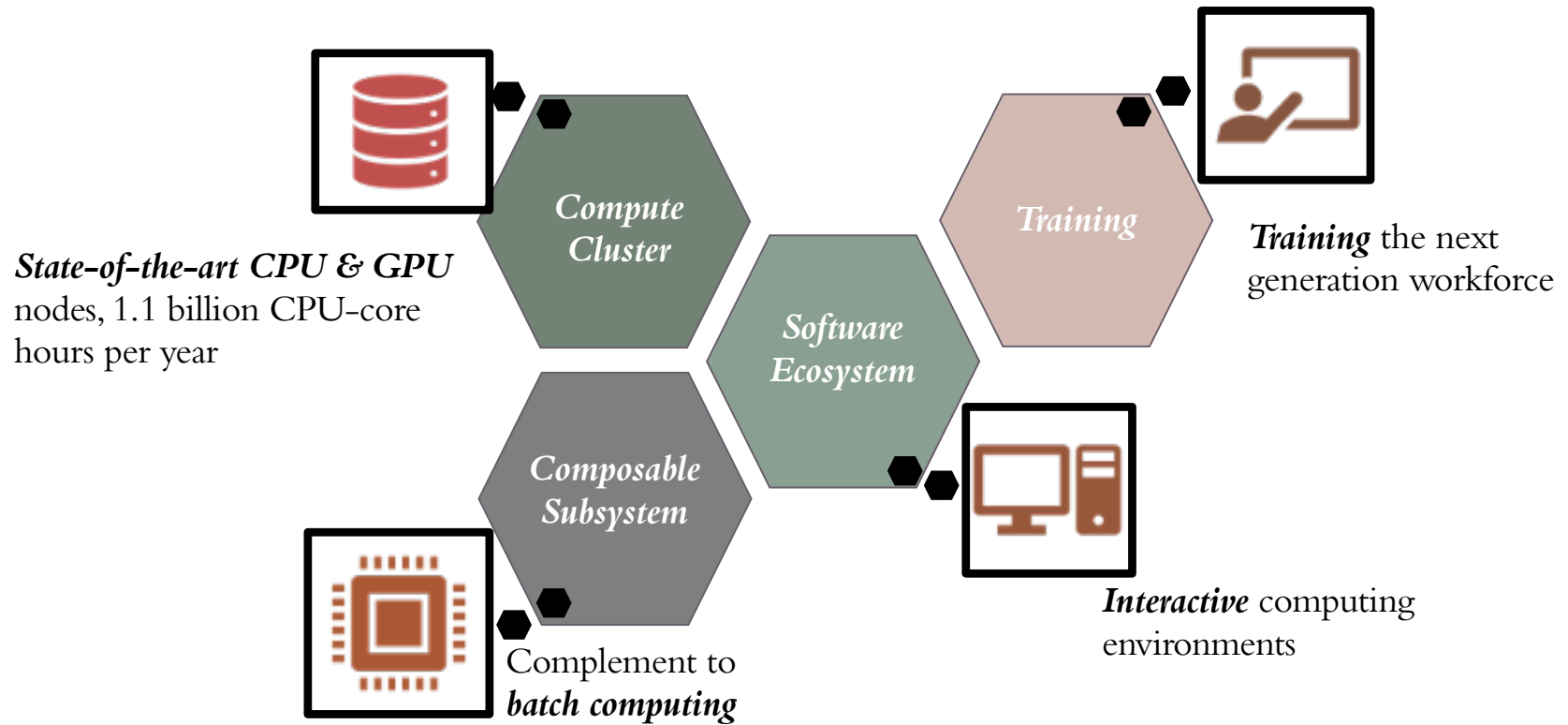
Anvil HPC

" … reflects the Purdue Boilermakers' strength and workmanlike focus on producing results …"

C a t e g o r y I : A National Composable Advanced Computational Resource for the Future of Science and Engineering

5-year Production Operations

Started Feb 2022

Anvil's Ecosystem

Compute Cluster

State-of-the-art CPU & GPU nodes, 1.1 billion CPU-core hours per year

Composable Subsystem

Complement to **batch computing**

Software Ecosystem

Training

Training the next generation workforce

Interactive computing environments

The Anvil System

- **1000 Compute Nodes**
- 128 core 3rd Gen AMD EPYC™ processors
- 5.1 PF peak performance

High – performance

GPU/Large-memory

- 16 nodes with 4 NVIDIA **A100 GPUs** each
- 32 large memory nodes with 1 TB of RAM

- **8 large memory** & storage nodes
- Kubernetes – Rancher for SciOps
- Cloud bursting to Azure

Composable subsystem

Storage

- **Multi-tier storage** (including archival & object storage)
- 10 PB of parallel file system, and 3 PB of all-flash storage
- Globus data transfer

The Anvil Software Stack

Programming Libraries and Compilers
- Various popular programming languages, GNU, Intel and AOCC compilers, message passing libraries
- Workflow and data management and analysis tools
- Debugging and profiling tools

Scientific Applications
- General purpose mathematics and statistics modeling tools, numerical libraries, visualization tools
- Broad application base with installs and modules from various science and engineering domains

Containers and Datasets
- Support for Singularity containerization and execution
- Efficient access to various databases (e.g., NCBI)

Bridges-2 HPC

Bridges-2

"PSC's newest supercomputer"

Provides transformative capability for rapidly evolving, computation–intensive and data–intensive research, creating opportunities for collaboration and convergence research.

Connecting new communities to advanced research computing.

More Science:	Approximately 3x larger than Bridges
Faster Computing:	Latest AMD EPYC processors
Faster Storage:	Fast flash array and tiered data management
Smarter Science:	Designed for Full System AI and data-centric computing
Scalable:	Interoperability with cloud and campus resources

Carnegie Mellon University

PSC

University of Pittsburgh

Bridge-2's Concepts

Bridges-2 core concepts:

- Converged HPC + AI + Data

- Custom fat tree Clos topology optimized for data-centric HPC, AI, and HPDA

- Heterogeneous node types for different aspects of workflows

- CPUs and AI-targeted GPUs

- 3 tiers of per-node RAM (256GB, 512GB, 4TB)

- Extremely flexible software environment

- Community data collections & Big Data as a Service

Innovations beyond Bridges:

- AMD EPYC 7742 CPUs: 64-core, 2.25–3.4 GHz

- AI scaling to 192 V100–32GB SXM2 GPUs

- 100TB, 9M IOPs flash array accelerates deep learning training, genomics, and other applications

- Mellanox HDR-200 InfiniBand doubles bandwidth &supports in-network MPI-Direct, RDMA, GPU Direct, SR-IOV, and data encryption

- Cray ClusterStor E1000 Storage System

- HPE DMF single namespace across disk and tape for data security and expandable archiving

Carnegie Mellon University   **PSC**   University of **Pittsburgh**

Bridge-2's Architecture

Users, XSEDE, campuses, instruments

Web Server Nodes (6)

Database Nodes (12)

Data Transfer Nodes (2)

Login Nodes 26)

Tape Backup and Archive
~8.6PB usable

Parallel File System
15PB usable
129 GB/s R, 142GB/s W

Flash Array
100TB, 9M IOPs
100 GB/s

Interconnect

Management Nodes (12)

RM Nodes(488)
2x AMD EPYC
7742 CPUs
256 GB RAM

LM Nodes(16)
2x AMD EPYC
7742 CPUs
512 GB RAM

EM Nodes(4)
4x Intel Xeon
Platinum 8160M CPUs,
4TB RAM

GPU Nodes (24)
8xNVIDIA V100-32
SXM-2, 2xIntel Xeon
Gold 6248,256GB HBM2,
512GB RAM

Carnegie Mellon University

PSC

University of **Pittsburgh**

Using Bridge-2

- Interactivity
- Popular languages and frameworks: Python, Anaconda, R, MATLAB, Java, Spark, Hadoop
- AI frameworks: TensorFlow, Caffe2, PyTorch, etc.
- Containers and virtual machines (VMs)
- Databases
- Gateways and distributed (web) services
- Large collection of applications and libraries

Expanse Scalable Compute Unit
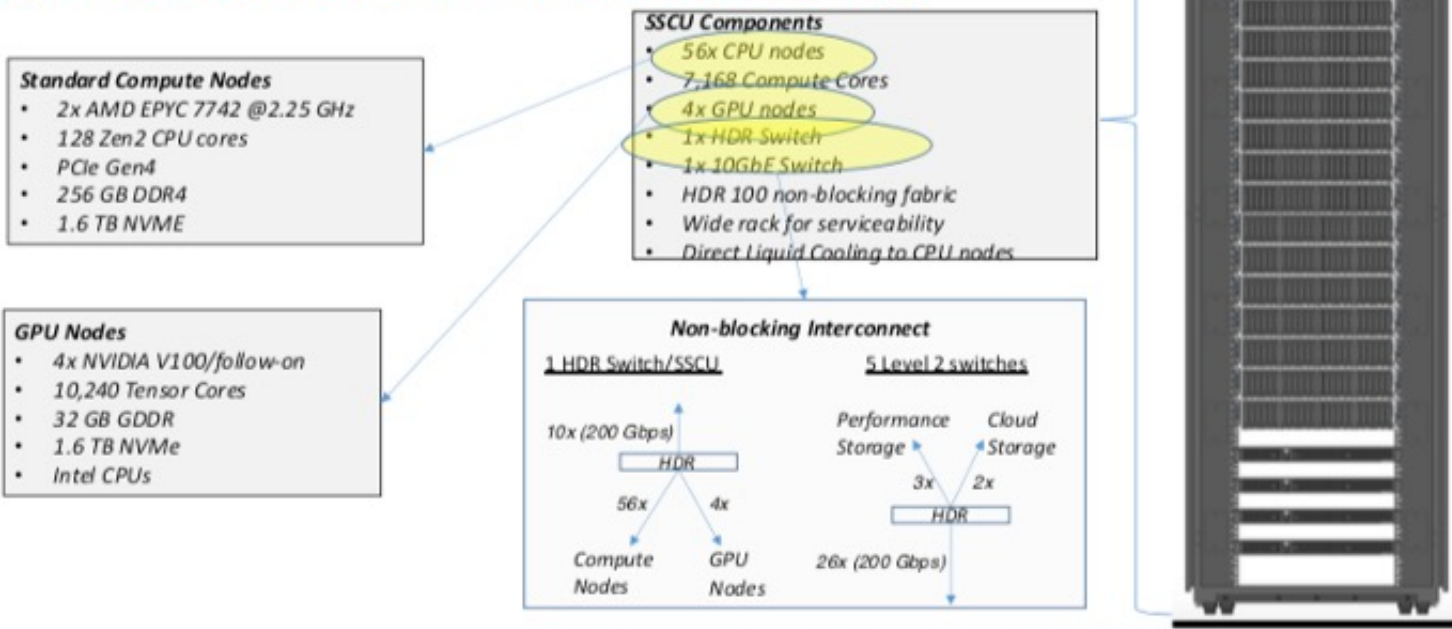
Expanse Connectivity Fabric
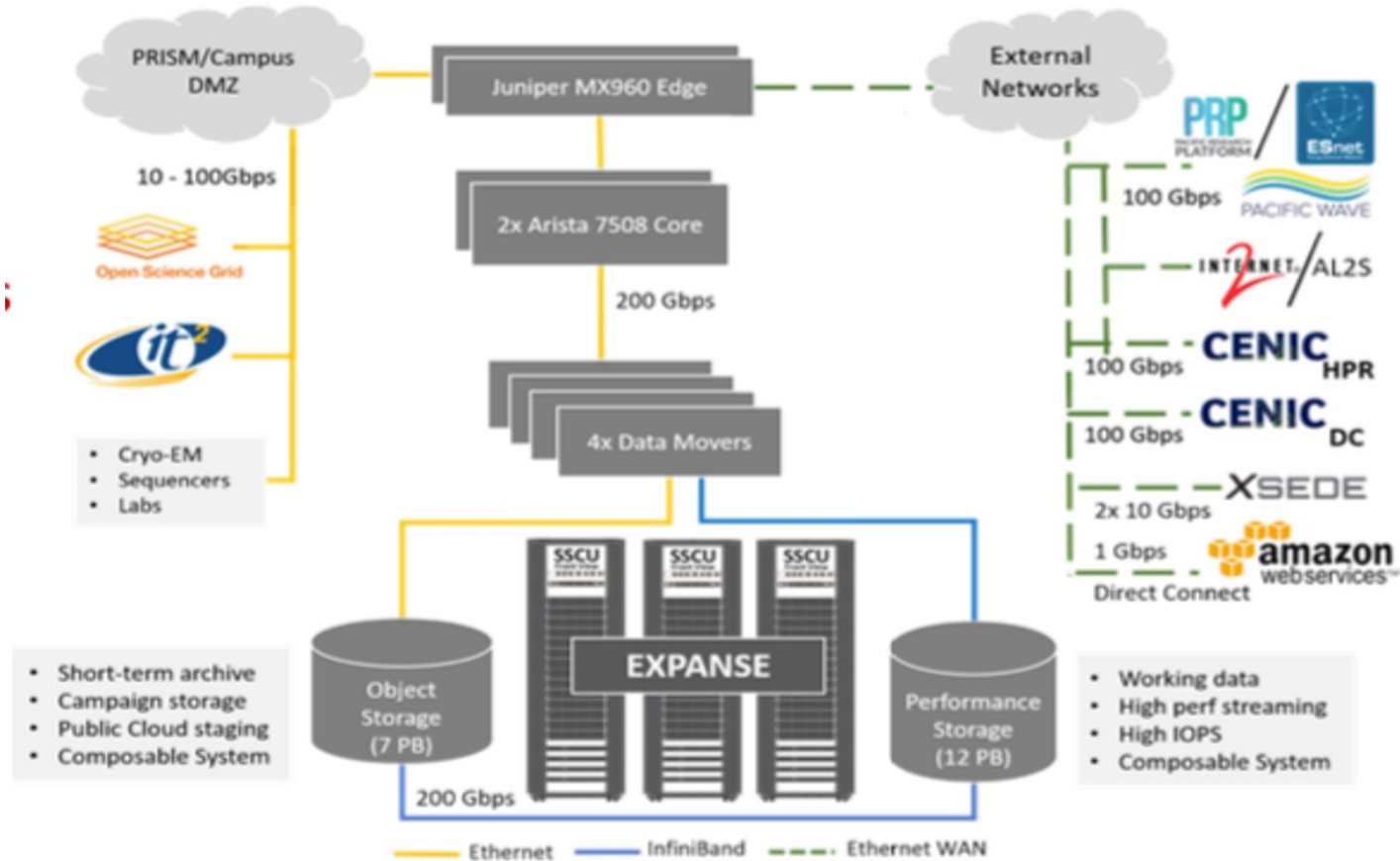
Expanse Composable Systems
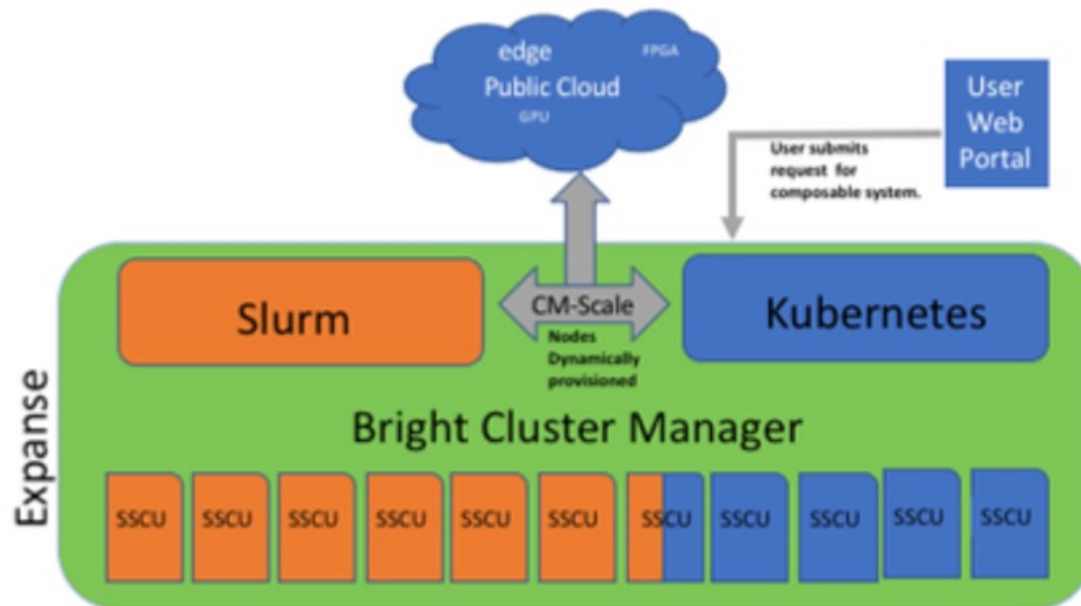
Bright Cluster Manager + Kubernetes
Requests for a composable system will
be part of an XRAC request

Composable Systems support complex, distributed, workflows – making Expanse part of a larger CI ecosystem. Advanced User Support resources is available to assist with projects

Expanse Cloud Bursting
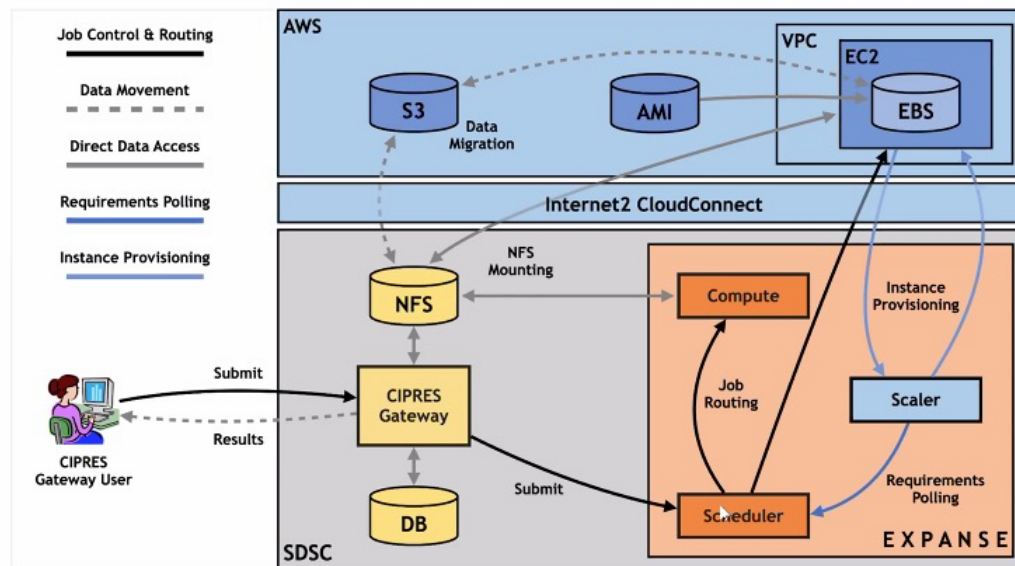
- Expanse supports integration with public clouds.
- Support for projects that share data, need access to novel technologies, and integrate cloud resources into workflows
- Users submit directly via Slurm, or as part of a composed system.
- Options for data movement: data in the cloud; remote mounting of file systems; cached filesystems (e.g., StashCache), and data transfer during the job.
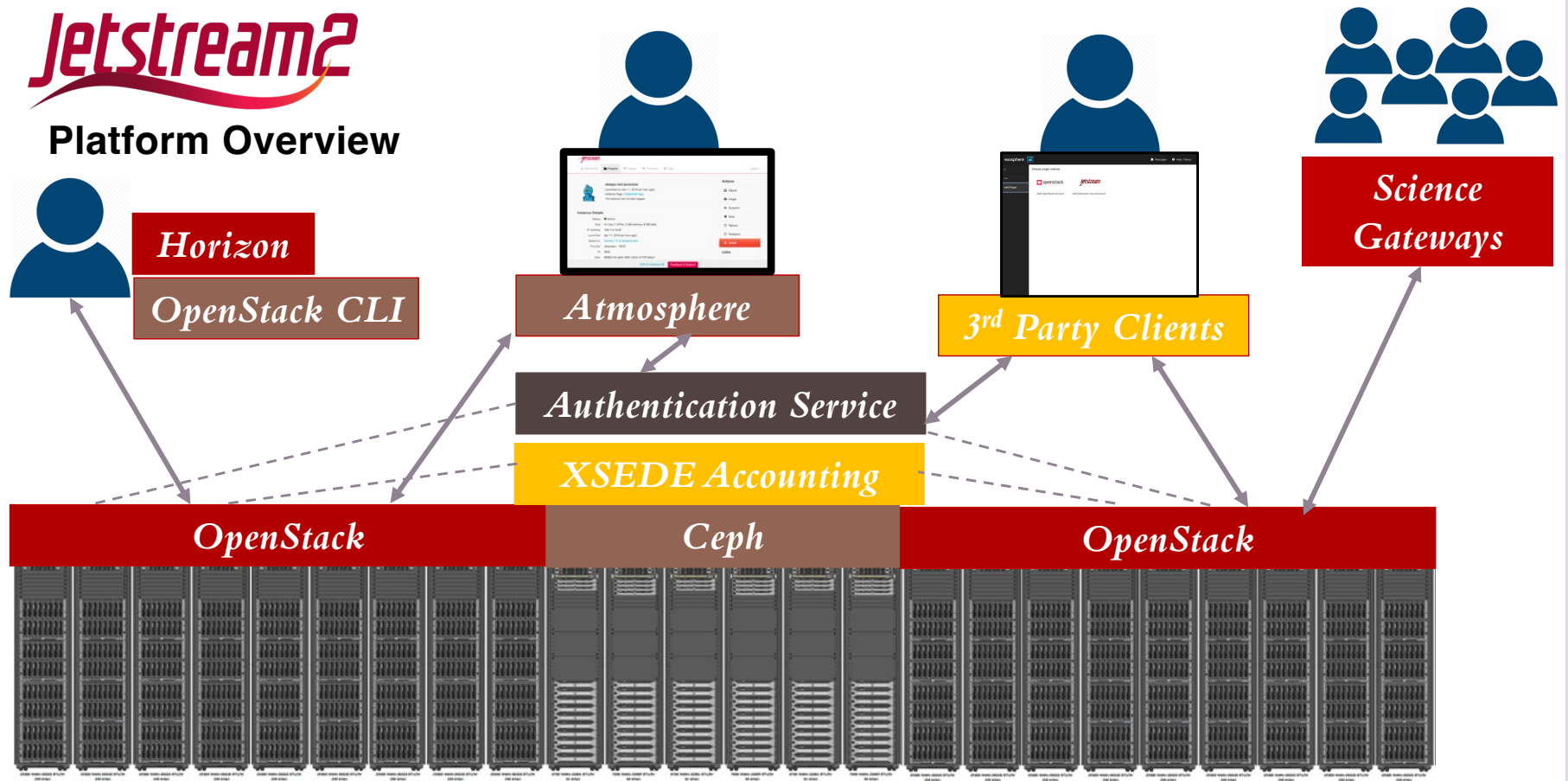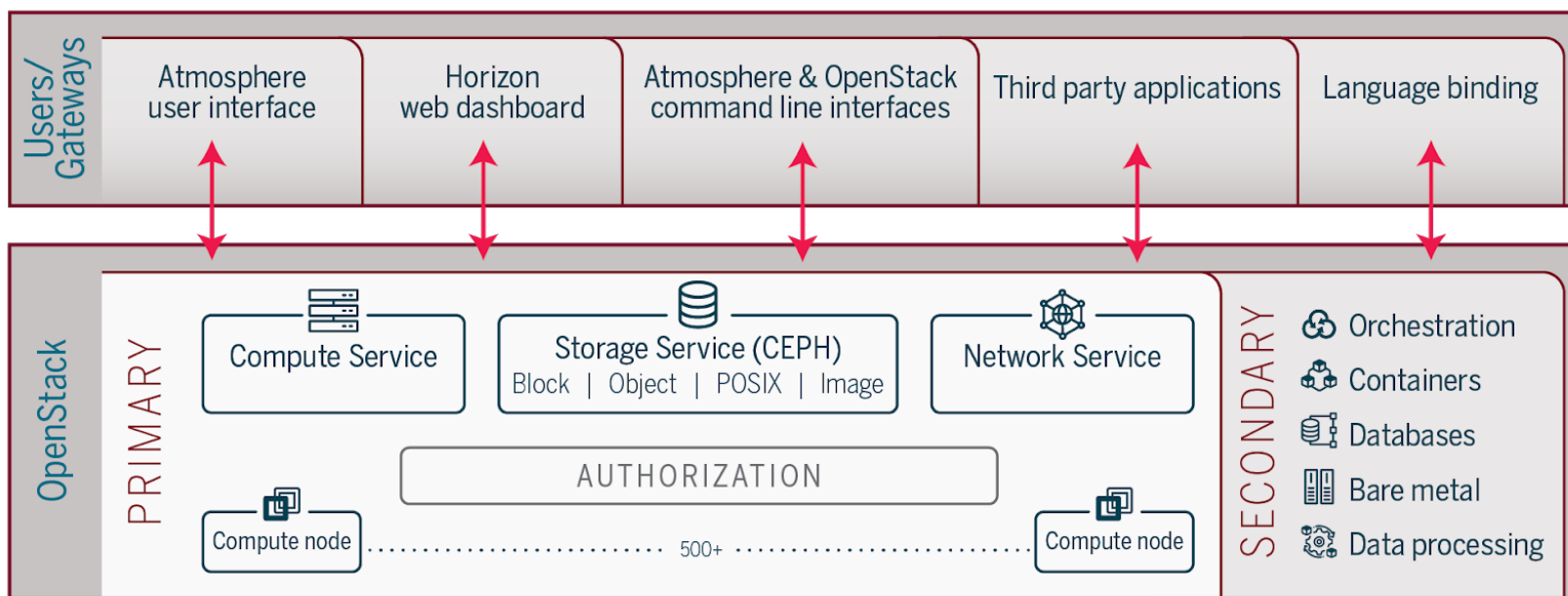
Figure 2: Conceptual and architectural diagram of the system environment

Jetstream2 Cloud

COMMERCIAL CLOUD

INTERNET 2®

UNIVERSITY OF HAWAI'I CYBERINFRASTRUCTURE

REGIONAL
COMPUTE
8 Nodes
1,024 Cores
4 TB RAM

STORAGE
869 TB

ACCELERATORS
2 Nodes
1 TB RAM
8 GPUs

ARIZONA STATE UNIVERSITY CYBERINFRASTRUCTURE

REGIONAL
COMPUTE
8 Nodes
1,024 Cores
4 TB RAM

STORAGE
869 TB

ACCELERATORS
2 Nodes
1 TB RAM
8 GPUs

XSEDEnet
Advanced Layer 2
Services (AL2S) platform

TACC CYBERINFRASTRUCTURE

COMPUTE
8 Nodes
1,024 Cores
4 TB RAM

REGIONAL
STORAGE
869 TB

ACCELERATORS
2 Nodes
1 TB RAM
8 GPUs

INDIANA UNIVERSITY CYBERINFRASTRUCTURE

PRIMARY
COMPUTE
416 Nodes
53,248 Cores
224 TB RAM

STORAGE
96 Nodes
15 PB

ACCELERATORS
90 Nodes
45 TB RAM
360 GPUs

CORNELL UNIVERSITY CYBERINFRASTRUCTURE

REGIONAL
COMPUTE
8 Nodes
1,024 Cores
4 TB RAM

STORAGE
869 TB

Jetstream2 Capabilities

Jetstream2

Jetstream2 IU - TG-CHE200061 (logged in as **jfossota@xsede.org**)

Create Instance

Name * | jfosso-test-vm ⊘

Image: Featured-Ubuntu20

Flavor

General-purpose

Name	CPUs	RAM	Root Disk	Ephemeral Disk
m3.tiny	1	3 GB	20 GB	none
m3.small	2	6 GB	20 GB	none
m3.quad	4	15 GB	20 GB	none
m3.medium	8	30 GB	60 GB	none
m3.large	16	60 GB	60 GB	none
m3.xl	32	125 GB	60 GB	none
m3.2xl	64	250 GB	60 GB	none

Large-memory ⓘ

Name	CPUs	RAM	Root Disk	Ephemeral Disk
r3.large	64	500 GB	60 GB	none
r3.xl	128	1,000 GB	60 GB	none

GPU ⓘ

Name	CPUs	RAM	Root Disk	Ephemeral Disk
g3.small	4	15 GB	60 GB	none
g3.medium	8	30 GB	60 GB	none
g3.large	16	60 GB	60 GB	none
g3.xl	32	125 GB	60 GB	none

Enhancing IaaS model of Jetstream:
- Improved orchestration support
- Elastic virtual clusters
- Federated JupyterHubs Commitment to >99% uptime
- Critical for science gateway hosting
- Hybrid-cloud support Revamped User Interface
- Unified instance management
- Multi-instance launch

- >57K cores of next-gen AMD EPYC processors
- >360 NVIDIA A100 GPUs will provide vGPUs via NVIDIA's MIG feature
- >18PB of storage (NVMe and disk hybrid)
- 100GbE Mellanox network

FRONTERA

Object	Frontera
Compute Node Type	Intel Xeon Platinum 8280 ("Cascade Lake")
Total Nodes	8,368
Cores/Node	56 (28 cores/socket with 2 sockets)
Hardware Threads/core	1
Clock Rate	2.7 GHz Max Turbo: 4.0 GHz
Memory	192 GB DDR4-2933
Peak Memory Bandwidth[6]	282 GB/s
L1 Cache	32 KB per core
L2 Cache	1 MB per core
L3 Cache	38.5 MB per socket
Local Storage (/tmp)	144 GB partition on 240 GB SSD

FRONTERA

System Architecture

SSH → Internet

Login Node (login1)	Login Node (login2)	Login Node (login3)
Resource Manager & Job Scheduler	Resource Manager & Job Scheduler	Resource Manager & Job Scheduler

Interconnect

Typical Compute Nodes

Compute Node | Compute Node | Compute Node

Specialized/Other Compute Nodes

Compute Node | Compute Node | Compute Node

Interconnect

File Systems to Store Data

$HOME | $WORK | $SCRATCH

The Mellanox InfiniBand interconnect ties all the components to each other and to the various high-performance storage systems.

The login nodes are configured similarly to the compute nodes

FRONTERA *Software Stack*
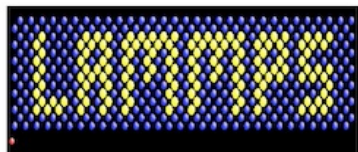
The above graphic displays just a small subset of supported applications available on Frontera. *Singularity* is available through the *tacc-singularity* module on Frontera. It cannot be built on the system but can be developed locally, then upload to Frontera.

NSF/XSEDE →ACCESS Systems

Efficient and Effective Use of Resources

Share your thoughts in the chat: state observed habits adopted by your users that have resulted in the wasteful usage of resources. What steps have you taken to reduce its occurrence?

The OSG Consortium

Open Science Pool (OSPool) provides researchers with **fair-share** access to computing and data capacity powered by **distributed high-throughput** computing (dHTC) technologies.

OSG All-Hands Meetings (AHM) provides the consortium stakeholders and the broader dHTC community with a venue to **share ideas and exchange information**.

OSG

Open Science Data Federation (OSDF) enables users and institutions to **share data files and storage capacity**, making them both accessible in dHTC environments such as the OSPool.

The OSPool

Core Hours by Facility
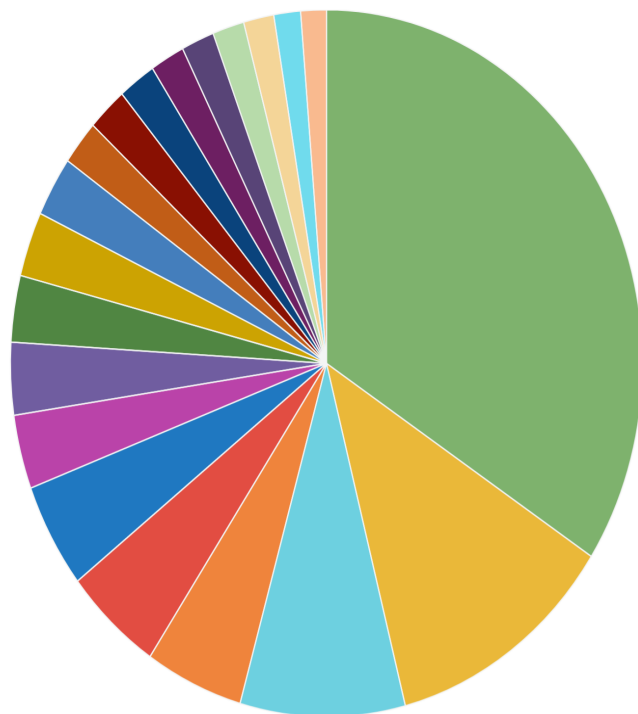
	total
Lancium	4 Mil
MWT2 ATLAS UC	1 Mil
Purdue Geddes	1 Mil
GP-ARGO	606 K
SU ITS	604 K
GLOW	582 K
FermiGrid	409 K
UConn-OSG	399 K
Texas Advanced Computing Center	367 K
UColorado_HEP	358 K
Pervasive Technology Institute	332 K
Rice-CRC	246 K
AGLT2	245 K
WTAMU_HPC	232 K
UTC - Epyc	212 K
Lehigh - Hawk	203 K
SIUE - CC	195 K
UIUC-ICC-SPT	187 K
BNL ATLAS Tier1	165 K
AMNH	158 K

Open to All

- Open to providers at all scales
  - from small colleges to large national labs
- Open to user communities at all scales
  - from individual students to large research communities
    - domain science specific and across many campuses
    - campus specific and across many domain sciences
- Open to any business model
  - sharing, allocations, purchasing
  - preemption is an essential part of operations

Core Hours by NSF Field of Science

Chemistry (15.28%)

Biological Sciences (12.23%)

Mathematics (1.32%)

Astronomy (21.92%)

Engineering (1.29%)

Physics (46.77%)

Computer Sciences (1.06%)
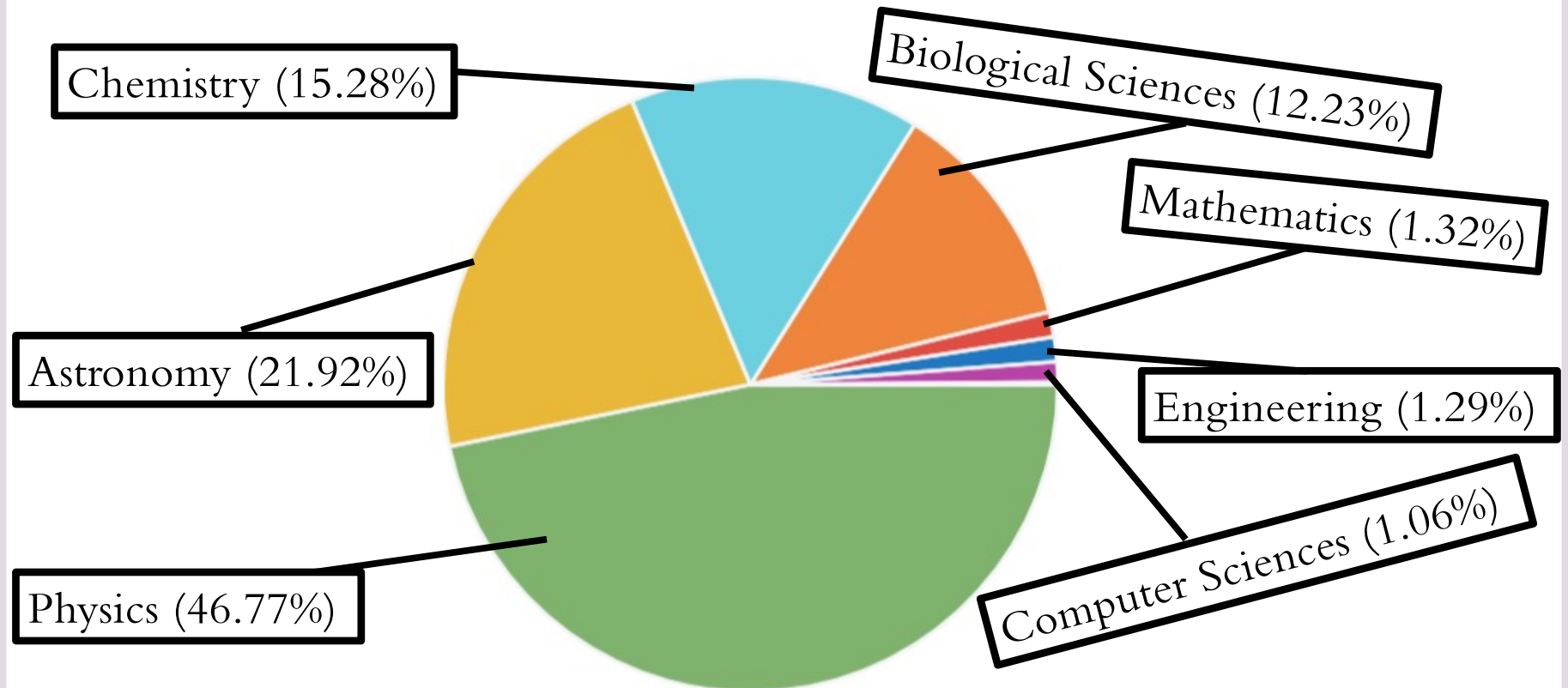
The OSG Consortium

Compute Resource Consolidation

Share your thoughts in the chat: have you consolidated compute resources on your campus? What are the benefits of such an initiative?

NSF/XSEDE → ACCESS Systems

Systems Information

❑ *Allocated Resources*: general description of the resource and its recommended use.

❑ *Non-Allocated Resources*: information about other resources in the XSEDE ecosystem

❑ *Allocation Requests*: general information about resources and allocation requests.

❑ *Link to information*: https://portal.xsede.org/allocations/resource-info

DOE National Labs: OLCF summit
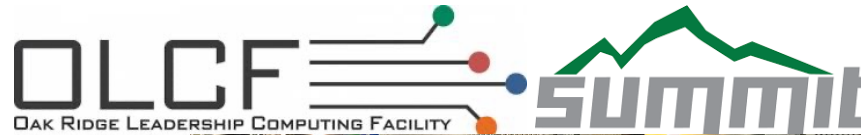
OLCF Summit Overview

The system includes:
- 4,608 nodes
- Dual–port Mellanox EDR InfiniBand network
- 250 PB IBM file system transferring data at 2.5 TB/s

Each node has:
- 2 IBM POWER9 processors
- 6 NVIDIA Tesla V100 GPUs
- 608 GB of fast memory (96 GB HBM2 + 512 GB DDR4)
- 1.6 TB of NV memory

System Performance:
- Peak of 200 Petaflops (FP64) for modeling & simulation
- Peak of 3.3 ExaOps (FP16) for data analytics and artificial intelligence

DOE National Labs: OLCF summit

Oak Ridge Leadership Computing Facility

Feature	Summit
Peak FLOPS	200 PF
Max possible Power	13 MW
Number of Nodes	4,608
Node performance	42 TF
Memory per Node	512 GB DDR4 + 96 GB HBM2
NV Memory per Node	1.6 TB
Total System Memory	2.8 PB + 7.4 PB NVM
System Interconnect	Dual Port EDR-IB (25 GB/s)
Interconnect Topology	Non-blocking Fat Tree
Bi-Section Bandwidth	115.2 TB/s
Processors om node	2 IBM POWER9™ 6 NVIDIA Volta™
File System	250 PB, 2.5 TB/s, GPFS

OLCF Summit Specs

DOE National Lab

OLCF — Oak Ridge Leadership Computing Facility

FRONTIER

OAK RIDGE NATIONAL LABORATORY'S FRONTIER SUPERCOMPUTER

- 74 HPE Cray EX cabinets
- 9,472 AMD EPYC CPUs, 37,888 AMD GPUs
- 700 petabytes of storage capacity, peak write speeds of 5 terabytes per second using Cray Clusterstor Storage System
- 90 miles of HPE Slingshot networking cables

Sources: May 30, 2022 Top500 release

TOP500

#1 ORNL's Frontier supercomputer is #1 on the TOP500.

1.1 exaflops of performance on the May 2022 Top500 list.

GREEN500

#1 ORNL's Frontier supercomputer is #1 on the GREEN500.

52.23 gigaflops/watt power efficiency.

HPL-AI

#1 ORNL's Frontier supercomputer is #1 on the HPL-AI list.

6.88 exaflops on the HPL-AI benchmark.

Press Release: The 59th edition of the TOP500 revealed the Frontier system to be the first true exascale machine with an HPL score of 1.102 Exaflop/s.

DOE National Lab

Feature	Frontier
Peak FLOPS	> 1.5 EF
Cabinets	> 100
Node	1 HPC and AI Optimized 3rd Gen AMD EPYC CPU 4 Purpose Built AMD Instinct 250X GPUs
CPU-GPU Interconnect	AMD Infinity Fabric
System Interconnect	Multiple Slingshot NICs providing 100 GB/s network bandwidth. Slingshot network which provides adaptive routing, congestion management and quality of service.
Storage	2-4x performance and capacity of Summit's I/O subsystem. Frontier will have near node storage like Summit.

OLCF Frontier Specs

NB: Summit has 250 PB, 2.5 TB/s, GPFS

DOE National Lab: NERSC Cori
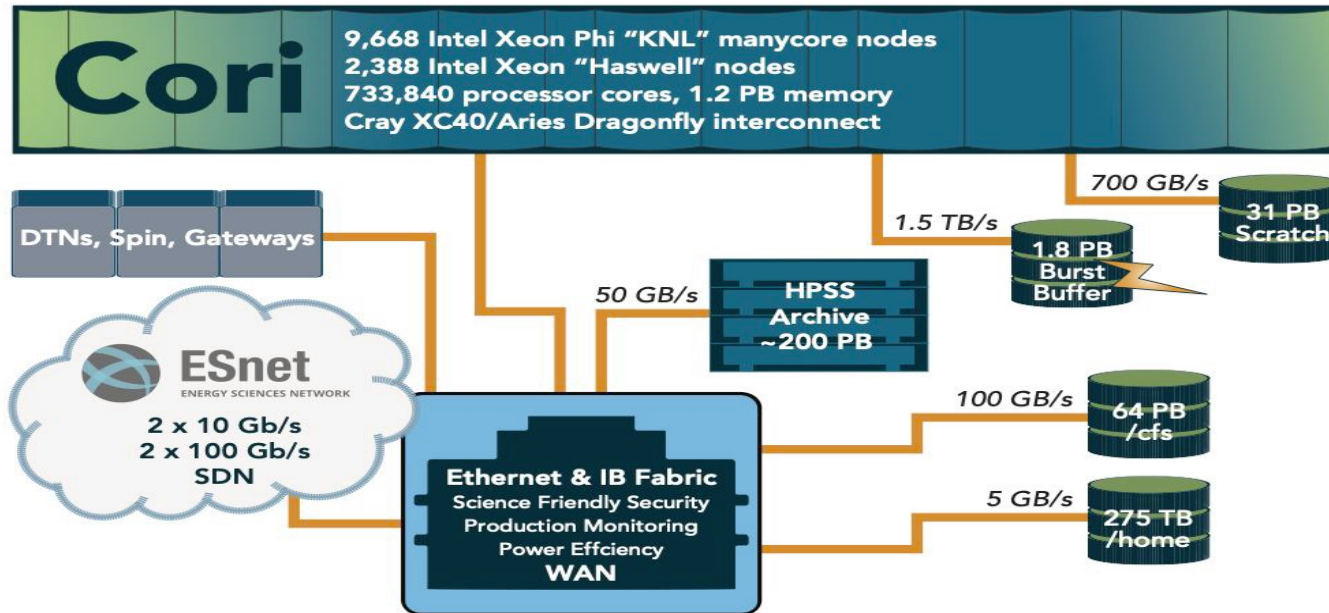
DOE National Lab: NERSC Cori

Chemistry & Materials Science Applications

Molpro
子专家
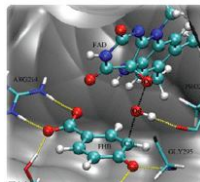
BerkeleyGW

NAMD
Scalable Molecular Dynamics

abinit.org

GAMESS

ab-initio
VASP
Vienna Package Simulation

WANNIER90

CPMD consortium page
CPMD

NWCHEM
HIGH-PERFORMANCE COMPUTATIONAL
CHEMISTRY SOFTWARE

More than 13.5 million lines of source code Compiled, Optimized, and Tested

LAMMPS

DOE National Lab: NERSC Perlmutter

A System Optimized for Science

- GPU-accelerated and CPU-only nodes meet the needs of large-scale simulation and data analysis from experimental facilities
- Cray "Slingshot" - High-performance, scalable, low-latency Ethernet compatible network
- Single-tier All-Flash Lustre based HPC file system, 6x Cori's bandwidth
- Dedicated login and high memory nodes to support complex workflows
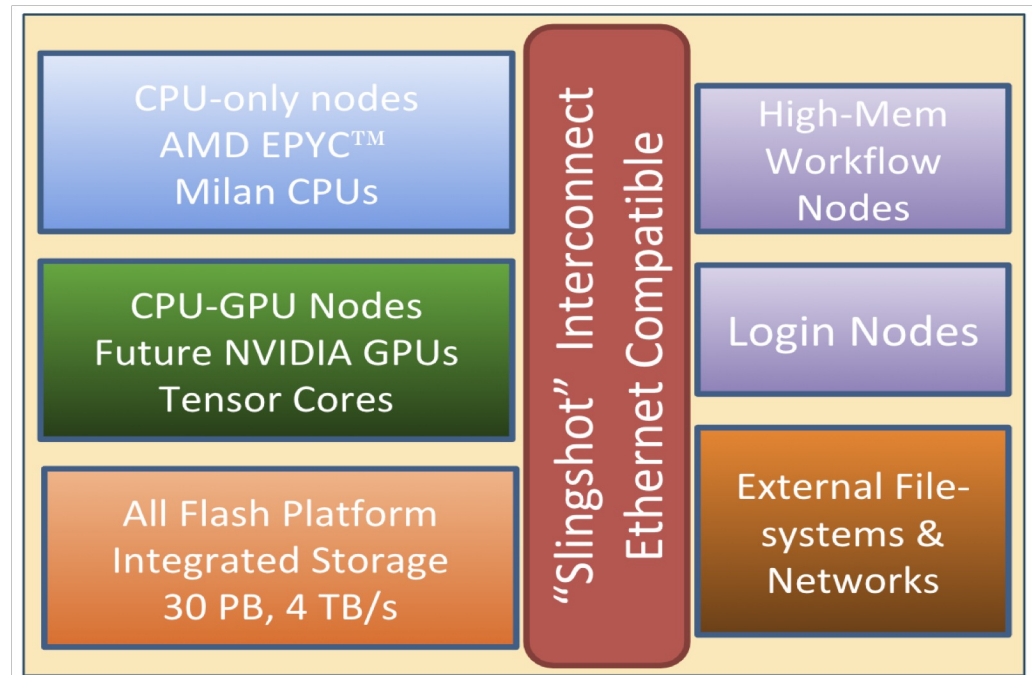
DOE National Lab: NERSC Perlmutter

A System Optimized for Science

- *Fast across many dimensions*
  - 4 TB/s sustained bandwidth
  - 7,000,000 IOPS
  - 3,200,000 file creates/sec
- *Usable for NERSC users*
  - 30 PB usable capacity
  - Familiar Lustre interfaces
  - New data movement capabilities
- *Optimized for NERSC data workloads*
  - NEW small-file I/O improvements
  - NEW features for high IOPS, nonsequential I/O

4.0 TB/s to Lustre
>10 TB/s overall

CPU + GPU Nodes

Logins, DTNs, Workflows

All-Flash Lustre Storage

Community FS
~ 200 PB, ~500 GB/s

Terabits/sec to
ESnet, ALS, ...
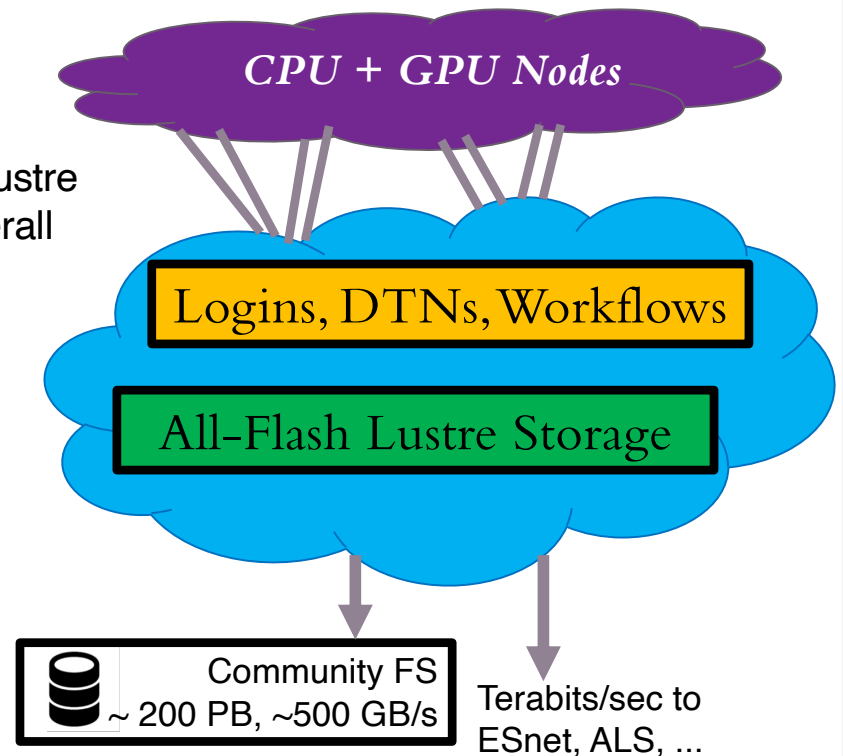
DOE National Lab

Share your thoughts in the chat: What are the similarities/differences between the DOE and XSEDE→ACCESS Systems?

DOE National Lab HPC Centers and Systems

- ***The National Renewable Energy Laboratory (NREL)***
  https://www.nrel.gov/hpc/
- ***Livermore Computing: HPC at LLNL*** https://hpc.llnl.gov/
- ***Los Alamos NL High Performance Computing***
  https://www.lanl.gov/org/ddste/aldsc/hpc/index.php
- ***Idaho NL HPC*** https://hpc.inl.gov/SitePages/Home.aspx
- ***Oak Ridge NL's Leadership Computing Facility***
  https://www.olcf.ornl.gov/
- ***Argonne NL's Leadership Computing Facility*** https://www.alcf.anl.gov/
- ***Sandia NL HPC*** https://hpc.sandia.gov/access/

Science Gateways

Science Gateways Catalog

Connect people and resources to accelerate discovery by empowering the science gateway community

FIND A GATEWAY	CATALOG	HELP/ABOUT

Total Entries: 632

FILTER BY: ∧

Category: Gateway ✕

GATEWAY (539)
SGCI CLIENT (34)
USED IN CLASSROOM (45)
PHYSICAL (264) ∨
LIFE (257) ∨
SOCIAL (83) ∨
APPLIED (157) ∨
INTERDISCIPLINARY (157) ∨
FORMAL (24) ∨
PHILOSOPHY (33) ∨

✕ Search   Sort by   A-Z

Arctos: Collaborative Collection Management Solution ⧉
http://arctos.database.museum/home.cfm

GATEWAY

Arctos is an ongoing effort to integrate access to specimen data, collection-management tools, and external resources on the internet.

Categories: Social, Anthropology, Archaeology, History

Contact Info: arctos.database@gmail.com

Tags: Arctos   museum collection

20th Century Reanalysis Project ⧉
http://portal.nersc.gov/project/20C_Reanalysis/

• **Science Gateways simplify access to computing resources by hiding infrastructure complexities.**

• **Science Gateways provide higher level user interface for XSEDE resources that are tailored to specific scientific communities. (https://www.xsede.org/ecosystem/science-gateways/gateways-listing)**

• **A Science Gateway is a community developed set of tools, applications, and data that are integrated via a portal or a suite of applications, usually in a graphical user interface, that is further customized to meet the needs of a specific community**

Science Gateways

Are you building websites that serve your discipline?

Do you wish you could connect with and learn from others, doing the same thing?
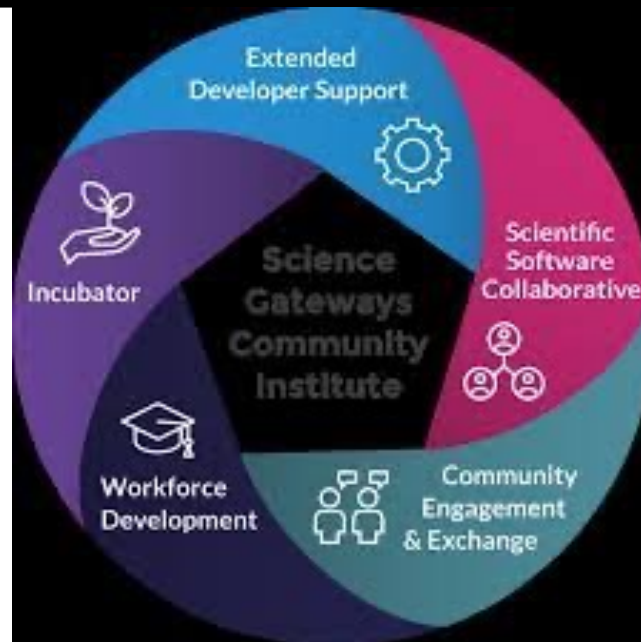
Science Gateways Listing

SGCI Catalog Summary

- GATEWAY (264)
- SGCI CLIENT (17)
- USED IN CLASSROOM (28)
- PHYSICAL (264) ⌄
- LIFE (89) ⌄
- SOCIAL (45) ⌄
- APPLIED (72) ⌄
- INTERDISCIPLINARY (73) ⌄
- FORMAL (18) ⌄
- PHILOSOPHY (26) ⌄

Apps ▾   Files ▾   Jobs ▾   Clusters ▾   Interactive Apps ▾   🗔 My Interactive Sessions   ❓ Help ▾   👤 Logged in as jfossota   ↪ Log Out
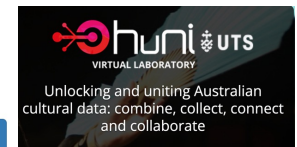
Pinned Apps A featured subset of all available apps

jupyter	Gromacs fast flexible free	R Studio	MATLAB
Jupyter Notebook	**Gromacs Desktop**	**RStudio Server (R-4.1.0)**	**MATLAB**
System Installed App	System Installed App	System Installed App	System Installed App
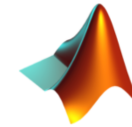
Welcome to OnDemand, a Data Science platform and portal to Longleaf

OnDemand provides a web-based interface to the Longleaf compute cluster with interactive apps such as Jupyter Notebooks, R Studio, Matlab, Stata, and more. These interactive apps allow you to work directly with your files on ITS-RC systems such as your home directory and `/proj`.

For any comments or questions, please contact us at research@unc.edu.

Science Gateways Example

Science Gateways Example

Apps ▾   Files ▾   Jobs ▾   Clusters ▾   Interactive Apps ▾   ▣ My Interactive Sessions   ❓ Help ▾   👤 Logged in as jfossota   ↪ Log Out

>_ Open in Terminal ›   ＋ New File   ▣ New Directory   ⬆ Upload   ⬇ Download   ▣ Copy/Move   🗑 Delete

Home Directory

/proj

/datacommons

/pine/scr/j/f/jfossota

↑   / nas / longleaf / home / jfossota /   ✎ Change directory   ▣ Copy path
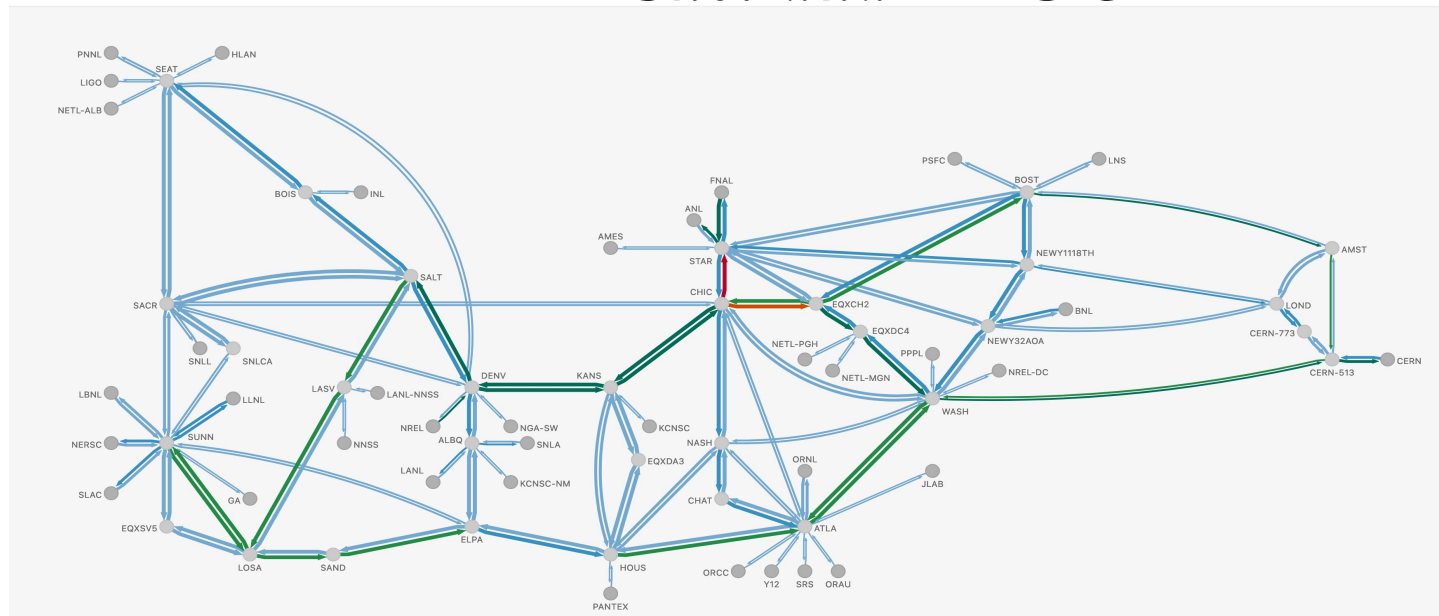
☐ Show Owner/Mode   ☐ Show Dotfiles   Filter: [   ]

Showing 12 of 41 rows - 0 rows selected

|	Type ↑↓	Name ↑↓		Size ↑↓	Modified at ↑↓
☐	📁	Desktop	⋮ ▾	-	4/13/2022 11:10:22 AM
☐	📁	DMTCP-Tutorial	⋮ ▾	-	10/13/2021 3:34:02 PM
☐	📁	dogwood	⋮ ▾	-	3/31/2020 7:14:47 AM
☐	📁	LleafClusterJobs	⋮ ▾	-	7/24/2020 1:53:28 PM
☐	📁	longleaf	⋮ ▾	-	3/31/2020 7:29:52 AM
☐	📁	Matlab_2019a_Tests	⋮ ▾	-	7/22/2020 11:09:49 AM

ESnet and EPOC

- **ESnet** is a **high–performance, unclassified network**
- Built to support scientific research.
- **Funded by the U.S. Department of Energy's Office of Science (SC)**
- Managed by Lawrence **Berkeley National Laboratory**.
- Provides services to more than **50 DOE research sites**
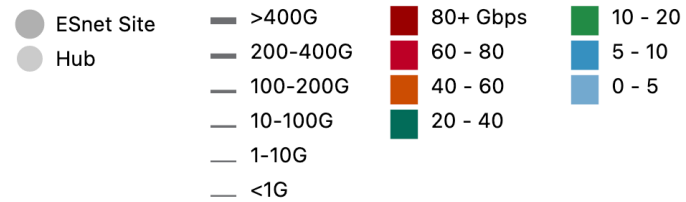
ESnet and EPOC

Esnet: Technical and Consulting Services

- The Science DMZ Architecture and Security
- Data Transfer Nodes
- perfSONAR
- Data transfer: Tools and Platforms
- Modern Research Data Portal.
- Network Requirements Gathering
- Collaboration
- Training Programs and Workshops
- Knowledge Base
- CI Engineering Lunch & Learn Series

https://www.es.net/science-engagement/technical-and-consulting-services/
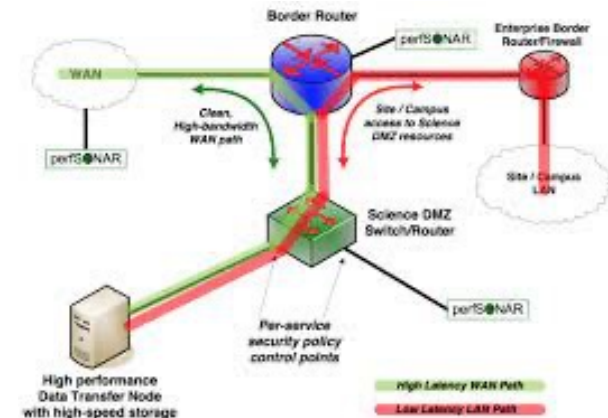
ESnet and EPOC

EPOC: Six Main Activities

- *Roadside Assistance and consultation* via a coordinated Operations Center to resolve network performance problems with end-to-end data transfers reactively;
- *Application Deep Dive* to work more closely with application communities to understand full workflows for diverse research teams in order to evaluate bottlenecks and potential capacity issues
- *Network Analysis* enabled by the *NetSage* monitoring suite to proactively discover and resolve performance issues
- The *Data Mobility Exhibition* and associated work with our simplified portal to check transfer times against known "good" end points
- *Provision of managed data services* via support through the IU GlobalNOC and our *Regional Network Partners*
- Coordinated Training to ensure effective use of network tools and science support

EPOC
Engagement and Performance
Operations Center

NSF CC* Specific Resources

Including EPOC in a Proposal

https://epoc.global/proposal-collaborations/

Internet2

About Internet2

- Internet2 is a community:
    - Higher education and Research institutions
    - Government entities, corperations and cultural organizations
- Cyberinfrastructure provider:
    - secure high-speed network, cloud solutions,
    - research support, services tailored for research and education
- Through InCommon provides:
    - Security and privacy,
    - IAM tools for research and education,
    - single sign-on (SSO) for access to cloud local services and roaming wi-fi
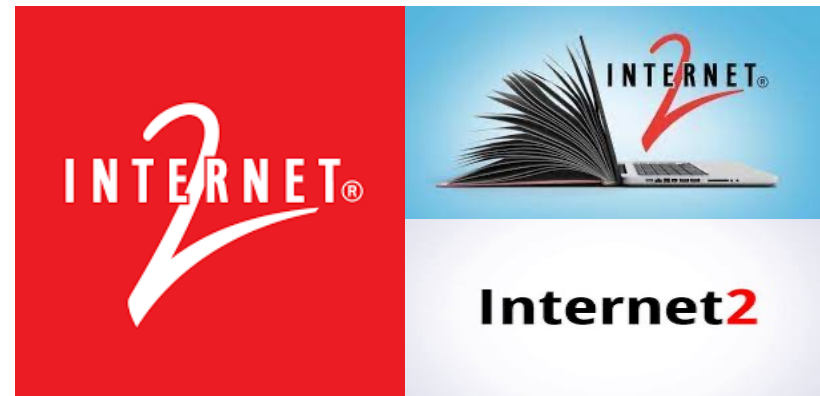
Internet2

BY THE NUMBERS

ADVANCING SCHOLARSHIP • ACCELERATING DISCOVERY

320+
HIGHER EDUCATION MEMBERS

950+
EDUROAM SUBSCRIBERS

350+
NET+ SUBSCRIBERS

1000+
INCOMMON PARTICIPANTS

80,000+
COMMUNITY ANCHOR INSTITUTIONS

50+
INDUSTRY MEMBERS

60
AFFILIATE & GOVERNMENT MEMBERS

100+
COUNTRIES & RESEARCH NETWORKS CONNECTIONS

750+
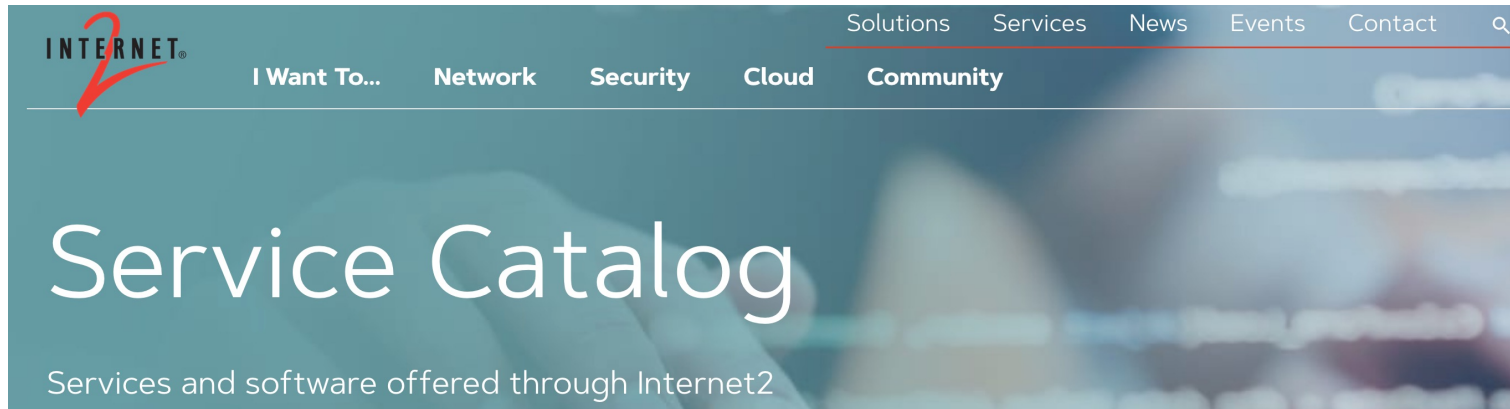NET+ CLOUD CONTRACTS

46
REGIONAL & STATE NETWORKS

800G+
WAVELENGTHS OF NETWORK CAPABILITY

32Tbps
CAPACITY PER LINK

Internet2

Service Catalog

Services and software offered through Internet2

| Solutions | Services | News | Events | Contact |

I Want To... Network Security Cloud Community

The Internet2 community works together to develop, vet, and provide services and software to meet the needs and requirements of research and education.

- *Cloud:* AWS, DocuSign, Duo Security, GCP, ServiceNow, Zoom, Splunk

- *InCommon:* COmanage, eduroam, InCommon Federation, Shibboleth

- *Network:*
  Cloud Connect: Extend your data center to the cloud using the combination of your regional network and the Internet2 high-speed national
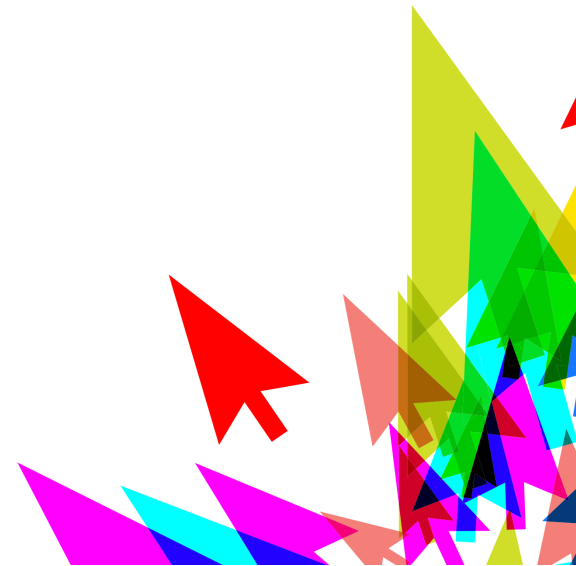
FRANÇAIS   ENGLISH

Bienvenue chez
calcul
canada

SERVICES ET EXPERTS

DÉCOUVREZ CALCUL CANADA

International Orgs: Compute Canada

Research Portal

Accessing Resources

Account Management

- Apply for an account
- Account Renewals
- Login to CCDB
- **Compute Canada CCV Submission Guide**
- User Roles to Access Resources and Services of the Compute Canada Federation

National Services

- Clusters
- Compute Canada Cloud
- Storage
- Data Movement (Globus)
- Humanities and Social Sciences
- Visualization

- Resource Allocation Competitions
- Rapid Access Service
- Available Resources for RAC 2022
- Technical Glossary
- Acknowledging Compute Canada

Technical Support

- Getting Help
- Training
- Documentation

International Orgs: GÉANT

Services

GÉANT develops and operates a range of connectivity, cloud, and identity services that ensure a safe and secure environment for researchers, educators, and students.

Community

The GÉANT Community Programme facilitates collaboration and knowledge sharing between NRENs, user organisations, R&E institutions, and the commercial sector.

Digital Inclusion

Data Growth

GÉANT

GÉANT is the collaboration of European National Research and Education Networks (NRENs). Together we deliver an information ecosystem of infrastructure and services to advance research, education, and innovation on a global scale.

+50%

Bringing fibre connectivity to more of European research and education

Network

Europe's essential terabit network for research and education interconnects Europe's NRENs and links them to over 100 countries in every region of the world.
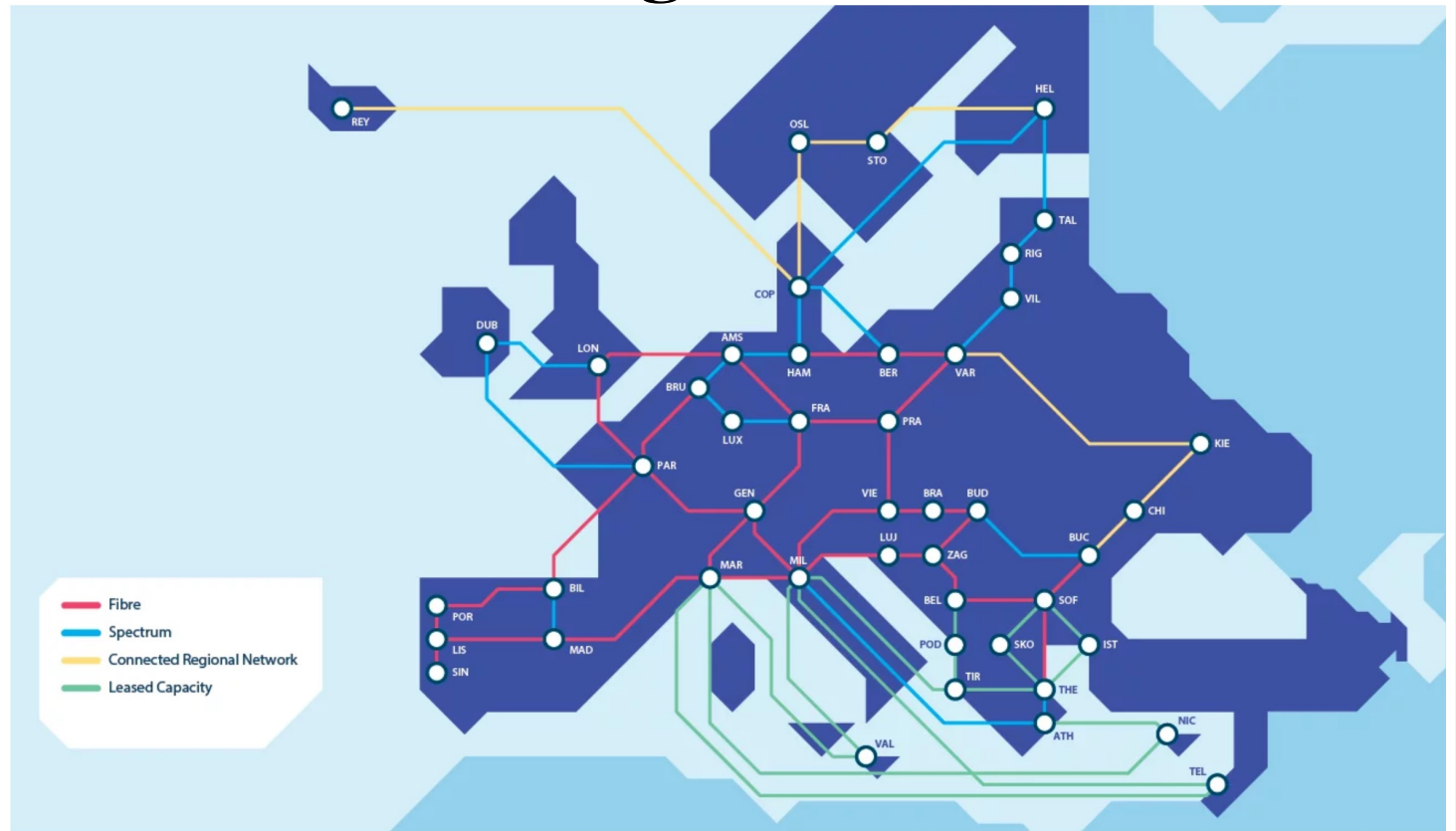
+30%

Average annual increase in network traffic over last five years

International Orgs: GÉANT

The GN4 Phase 3
Network project
(GN4–3N)

International Orgs:

PRACE — PARTNERSHIP FOR ADVANCED COMPUTING IN EUROPE

INFRASTRUCTURE SUPPORT

HPC IN EUROPE PORTAL

HPC

INDUSTRY & SMEs

TRAINING & SUPPORT

The mission of PRACE is to enable high-impact scientific discovery and engineering research and development across all disciplines to enhance European competitiveness for the benefit of society.

Cyberinfrastructure Tools

Share your thoughts in the chat:
What is a cyberinfrastructure tool?

Cyberinfrastructure Tools

ASK.CYBERINFRASTRUCTURE

Transfer your data.

OPEN
OnDemand

As a rule, tools can be characterized as devices that help scientists do what they know they must do.
Ref:https://www.ncbi.nlm.nih.gov/books/NBK25460/

fast
secure transfer
reliable

A → B

XDMoD
METRICS ON DEMAND

Grafana

Prometheus

Pegasus
Workflow Management System

jupyterhub

I Am Grateful For Your Attention. Thank You.