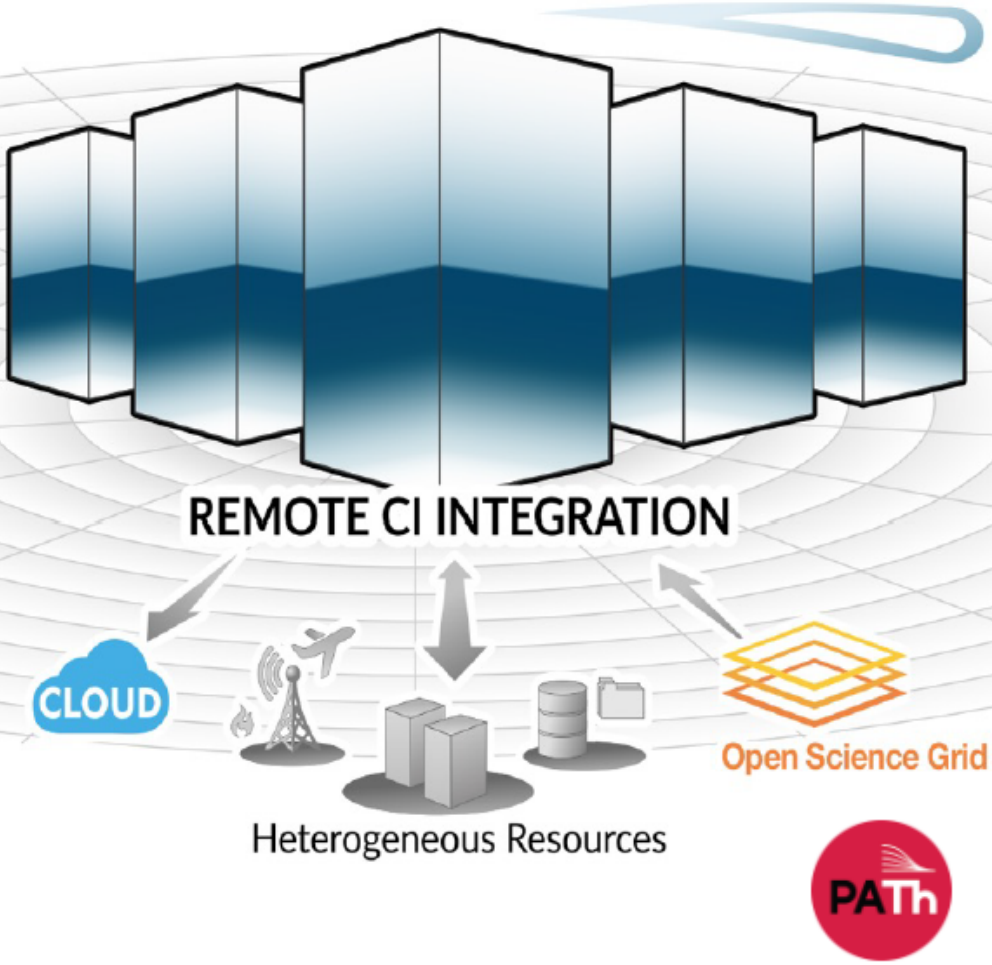
EXPANSE

COMPUTING WITHOUT BOUNDARIES
5 PETAFLOP/S HPC and DATA RESOURCE

HPC RESOURCE
13 Scalable Compute Units
728 Standard Compute Nodes
52 GPU Nodes: 208 GPUs
4 Large Memory Nodes

DATA CENTRIC ARCHITECTURE
12PB Perf. Storage: 140GB/s, 200k IOPS
Fast I/O Node-Local NVMe Storage
7PB Ceph Object Storage
High-Performance R&E Networking

AMD EPYC Rome (zen2) CPUs
NVIDIA V100 GPUs



LONG-TAIL SCIENCE
Multi-Messenger Astronomy
Genomics
Earth Science
Social Science

INNOVATIVE OPERATIONS
Composable Systems
High-Throughput Computing
Science Gateways
Interactive Computing
Containerized Computing
Cloud Bursting

Expanse policies

Expanse was built to serve the long tail of science, supporting researchers with small-to-medium sized jobs. The operating policies reflect this vision.

- Maximum allocation for individual PI is 15M core-hours and 75K GPU hours
- Science Gateways can request up to 30M core-hours
- Maximum job size is 4,096 cores
- Minimum job size is one CPU/GPU when running in shared partition
- Most jobs are limited to 48 hours, but when using preempt partition can run up to 7 days. Longer jobs are also possible by request and approved on a case-by-case basis
- Expanse is well-suited for Science Gateways; currently supports CIPRES (phylogenetics), I-TASSER (protein structure prediction), NSG (neuroscience), and others

Texas A&M HPRC: FASTER System Description Designed for Multi-GPU Workloads

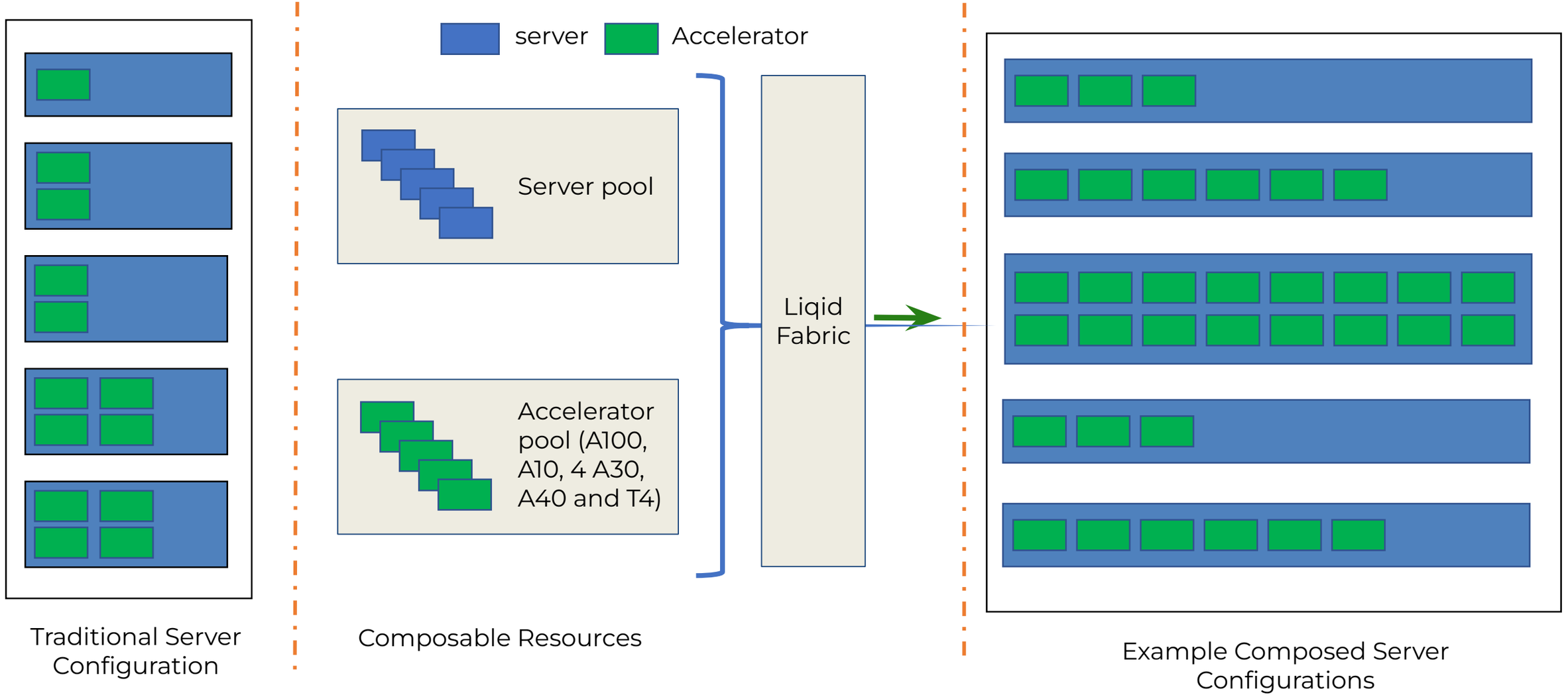
FASTER (Fostering Accelerated Sciences Transformation Education and Research) is a 180-node Intel cluster from Dell with an InfiniBand HDR-100 interconnect and Liquid PCIe Gen4 for composing the GPUs. NVIDIA A100, A10, A30, A40 and T4 GPUs are available. The 180 compute nodes are based on the Intel Ice Lake processor.

Node Type			
	Login	**Compute**	**Large Memory**
Quantity	3 (2 for TAMU, 1 for ACCESS)	180	1
CPU	2 32-core (64 cores) Intel Xeon 8352Y	2 32-core (64 cores) Intel Xeon 8352Y	2 32-core (64 cores) Intel Xeon 8352Y
Memory	256 GB	256 GB	1 TB
Additional Cluster Specifications			
Disk Space	3.84 TB NVMe (local, /tmp) 5PB DDN Lustre (global)		
Composable Accelerators	**GPU**: 200 T4 16GB; 40 A100 40GB; 10 A10 24GB; 4 A30 24GB; 8 A40 48GB		
Interconnect	Mellanox HDR100 InfiniBand (MPI and storage) Liqid PCIe Gen4 (resource composability)		

https://hprc.tamu.edu/kb/Quick-Start/FASTER/

Texas A&M HPRC: FASTER System Description

Unlike a traditional HPC system, FASTER compute nodes can be composed with one or more GPUs using Liqid to fit the need of the research workflow as illustrated below.



FASTER Allocation Description

1 SU = 1 core hour

GPU jobs on FASTER are charged in addition to the SU charge for core hours as shown in the table to the right.

Additional details can be found on the Texas A&M High Performance Research Computing Account Management System kb page

Effective GPU	SU charge per one hour (wall_time)
A10	128
A30	128
A40	128
A100	128
T4	64

OOKAMI

Stony Brook University

Ookami - www.stonybrook.edu/ookami

Available:
~750k node hours / year
~36 mil core hours / year

Node	
Processor	Fujitsu A64FX
#Cores	48
Peak DP	2.76 TOP/s
Memory	32GB@**1TB/s**
System	
#Nodes	176
Peak DP	486 TOP/s
Peak INT8	3886 TOP/s
Memory	5.6 TB
Disk	0.8 PB Lustre
Comms	IB HDR-100

Best suited for well vectorized and threaded applications

Ookami - www.stonybrook.edu/ookami

Available software:

- OpenFOAM
- QuantumEspresso
- Lammps
- Namd
- Siesta
- Python
- R
- Octave
- Kokkos
- Jupyter
- Julia
- Gromacs
- Go
- Chapel
- …. And many more

  (if users need something specific,

  it can be installed on request)

Anvil System Update – AARC, Mar 2024

PURDUE UNIVERSITY

NSF

Resource Overview

Node Type	Node Spec	Number of Nodes
CPU	AMD EPYC 7763, 128 cores, 256GB memory	1000
Large Memory	AMD EPYC 7763, 128 cores, 1TB memory	32
GPU	AMD EPYC 7763, 4 NVIDIA A100 (40GB) GPUs, 512 GB memory	16 (total of 64 GPUs)

https://www.rcac.purdue.edu/knowledge/anvil/architecture

Ideal Applications

- CPU
  - Most popular MPI-based codes should scale well on Anvil's CPU nodes
  - Due to its capacity, users should be able to get access to a large number of nodes easily
  - Wide queue on Anvil enables use of up to 56 nodes, custom QoS and reservations are also supported
- GPU
  - Popular Python based ML frameworks are supported
  - Popular libraries (PyTorch, TensorFlow, Keras, etc.) are distributed via the module system and NVIDIA's NGC containers
  - GPU subsystem is smaller, so large GPU requests are probably better served on other resources

Resource Availability for this AARC

Resource Type	Service Units Available
Anvil CPU	400M
Anvil GPU	200K

- Anvil service unit calculation
  - 1 CPU SU = 1 CPU core hour
  - 1 GPU SU = 1 GPU hour

https://www.rcac.purdue.edu/knowledge/anvil/run/accounting

NCSA's Delta

- Delta is currently the largest GPU resource in the NSF ACCESS portfolio with over 800 Ampere generation GPUs.
- Delta's GPUs along with a modest CPU node partition make Delta an ideal platform for AI/ML based research as well as GPU accelerated simulation.
- Delta is working to improve access to HPC resources by deploying/supporting the latest easy to use interfaces including OpenOndemand, Science Gateways, VSCode, etc as well as addressing accessibility issues throughout.

Delta Hardware Overview

RESOURCE COUNTS

CPU NODES	124 x CPU Nodes w/ 256GB RAM 8 x CPU Utility Nodes
GPU NODES	100 x 64-Bit x 4 GPU w/ 256GB RAM 100 x 32-Bit x 4 GPU w/ 256GB RAM 5 + 1 x 8 GPU & 2TB memory
STORAGE	7 PB HDD (Lustre) 3 PB SSD (non-POSIX)
Network	HPE Slingshot – 200Gb per node

SYSTEM TOTALS

CPUs	476 x AMD EPYC 7763 64 core “Milan”
GPUs	440 x NVIDIA A100 (40GB) 400 x NVIDIA A40 (48GB) 8 x AMD MI100
PERF	10 PF double-precision 100 PF single-precision 200 PF tensor

Hewlett Packard Enterprise

ddn

NVIDIA

AMD

Bridges-2 Configuration

- Compute
  - RM (Regular Memory Nodes)
    - 488 nodes with 256GB RAM
    - 16 nodes with 512GB RAM
      - Each with two AMD EPYC 7742 CPUs
        - With 64 cores per CPU
  - EM (Extreme Memory Nodes)
    - 4TB RAM
    - 4 Intel “Cascade Lake” processors per node
      - 24 cores per CPU
  - GPU
    - 24 nodes
      - with 8 NVIDIA 32GB V100 GPUs per node and 512GB total RAM
    - 9 nodes
      - with 8 NVIDIA 16GB V100 GPUs per node and 192GB total RAM
    - 1x DGX-2
      - 16 V100 GPUs within node
- Storage
    - 15PB disc
    - 7PB tape

Carnegie Mellon University PSC PITTSBURGH SUPERCOMPUTING CENTER University of Pittsburgh

Name	*Jetstream2*
Institution	*Indiana University*
Resource	*Persistent and on-demand cloud services with CPU, GPU, and large memory resources*
Technology	*AMD EPYC3 Milan CPUs + NVIDIA A100 GPUs*
Interfaces	*Exosphere GUI (general usage)* *CACAO GUI (K8s and Terraform)* *Horizon GUI* *CLI + SDK*
Support mechanisms	*ACCESS Ticketing, Contact Form, Community Forum* *https://docs.jetstream-cloud.org/* *help@jetstream-cloud.org*
Website	*https://jetstream-cloud.org/*

Highlights

- On-demand, interactive computing or persistent cloud services
- Focus on ease of use
- Since June 2022, 3500 users directly on JS2 and 203,000 via science gateways