

Introduction

In these slides we want to cover the following:

- A high-level overview of a cluster and its components
- Resources offered by the CoSTAR cluster



Cluster Basics

What is a Computer Cluster?

A cluster is a collection of interconnected computers (nodes) that operate as a single unified system.



Cluster Basics

Benefits of Using and Operating Clusters

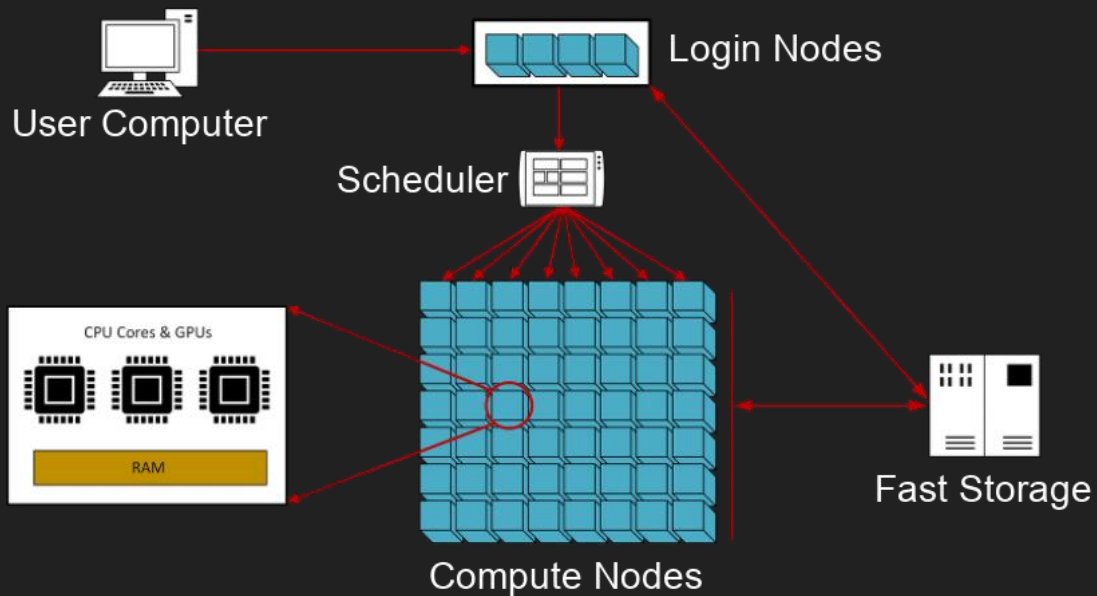
- **Efficient Resource Sharing:** Fairly distributes computational resources among multiple users.
- **Scalability:** Users can split and distribute tasks across multiple nodes.
- **High Throughput:** A cluster can minimise idle time of expensive resources by dynamically allocating and backfilling tasks.
- **Centralised Management:** Facilitates easy management of software and system maintenance.



Cluster Architecture

Core Cluster Components

- **Login Node:** Entry point where users log in and submit jobs.
- **Compute Nodes:** Perform computations assigned by the scheduler.
- **Fast Storage:** Includes user home directories and shared scratch storage.
- **High-speed InfiniBand Network** which connects nodes and storage.



CoSTAR Cluster – Purpose & Mission

- **CoSTAR National Lab:** A High-Performance Computing (HPC) facility focused on advanced AI training, generative modeling, and creative tech workloads, operated by the University of Surrey.
- **Built for Innovation:** Purpose-built for computationally intensive projects across academic disciplines and fledgling UK creative/AI startups.
- **Smart Resource Orchestration:** Dynamically allocates compute resources, high-speed memory, and crucially 100 NVIDIA H200 GPUs via the Slurm Workload Manager.
- **Equitable Access:** Utilises a Fairshare & Allocation system to balance queue priorities and track custom project GPU-hour budgets.



CoSTAR Cluster – Key Resources & Capabilities

- **100 x NVIDIA H200 GPUs (141 GB HBM3e):**
Elite hardware acceleration across 13 nodes, purpose-built for massive AI training and large-scale generative modelling.
- **1,568 Total CPU Cores & 35 TB+ RAM:**
High-memory architecture featuring up to 3 TB of RAM per node.
Note: 8 CPU cores per node are dedicated to guarantee maximum storage I/O performance, leaving up to 120 cores per standard node available for Slurm jobs
- **True Multi-Node Scaling (MPI Enabled):**
Connected via ultra-low-latency Mellanox InfiniBand NDR (400 Gb/s). Unlike legacy AI systems, CoSTAR fully supports massive distributed workloads across multiple nodes simultaneously
- **Operating System:** Rocky Linux 9.6

