Tejaswi: Hybrid High-Performance Computing Facility at CUSAT

Powering Innovation, Accelerating Discovery

Overview

High-Performance Computing (HPC) has been a critical part of academic research and innovation for decades. HPC helps scientists, engineers, inventors, and other researchers solve significant, complex problems in less time and cost less than conventional computing. In the traditional HPC community, scientists tend to focus on simulation and modeling, mostly consuming the number-crunching capability of the hardware. Whereas in the modern AI community, data scientists try to build models that try to learn directly from massive datasets. Thus HPC and the data-driven AI communities are converging as they are arguably running the same types of data and compute-intensive workloads on the hardware. Although much research is happening in the industry to have an integrated platform, many organizations currently use a hybrid architecture to deal with modern compute-intensive and massive data workloads.

Through Kerala Infrastructure Investment Fund Board (KIIFB), the State Government has sanctioned a DPR of 'Procurement of Laboratory Equipments for developing Cochin University of Science and Technology into an International Centre of Excellence in Academics & Research' with a total outlay of INR 142.24 Crore. An amount of INR 21.00 Crore is earmarked for setting up a centralized High-Performance Computing Facility to meet the state-of-art research work for the academic community. KITCO Ltd, Cochin is the consultant for implementing the above project.

Goals

The overall goal is to set up a hybrid HPC Cluster, and AI Infrastructure installed and maintained at Cochin University of Science and Technology (CUSAT), including a Data Centre facility as a turnkey solution. The facility will be open to all researchers of the state and industry players participating in collaborative projects. The specific goals are as follows.

1. To set up a first-of-its-kind hybrid HPC platform in the state
2. To meet the requirements of computing, data-intensive, modeling & simulation workloads of researchers in the state.
3. To place the state at the forefront of the AI revolution
4. To cultivate synergy among industry players and academic researchers

Specifications

A state-of-the-art hybrid high-performance computing cluster with the most modern compute and storage architectures and Tier-3 data center facilities.

Technical Specifications

The highlights of the HPC facility are as follows.

- CPU Computing capacity: 350 TFLOPS sustained performance
- Compute cores: above 6500 nos.
- Compute Memory: above 25 Terabytes
- GPU Capacity: 1.2 peta FLOPS
- Storage Capacity: 2 petaBytes
- Datacenter: 3-Tier

The detailed specification is given in Annexure 1.

Financial Specifications

An allocation of 25.81 Crores is given for the development of a High-Performance Computer as a common Facility, under the KIIFB sub-project (HED006-02). The allocation includes procurement and installation of the facility, inclusive of taxes.

Location Specifications

The facility is housed in the Computer Center of the University providing access to the CUSAT community through network infrastructure. The facility is also intended for use by outside communities including public and private institutions, industry and individuals.

Technical Committee

A technical evaluation committee was constituted by the University. The structure of the committee is as follows.

1. Dr. Santhosh Kumar G, Professor, and Honorary Director, Centre for Information Resource Management,CUSAT (Coordinator)
2. 2. Dr. Anil Shaji, Professor, IISER, TVM

3. Dr. Unnikrishnan C, Assistant Professor, Department of CSE, IIT, Palakkad
4. Dr. Jayaraj PB, Dept.of Computer Science, NIT, Calicut
5. Dr. Abhilash S, Professor, Department of Atmospheric Sciences, CUSAT
6. Dr. Sabu M. K., Professor, Department of Computer Applications, CUSAT
7. Dr. V. Sivanandan Achari, Professor, School of Environmental Studies, CUSAT
8. Sri. Vinodkumar P.P., Associate Professor , School of Engineering, CUSAT
9. Dr. Praveen C S, Assistant Professor, International School of Photonics, CUSAT
10. Dr. Mohamed Ameen P, Assistant Professor, International School of Photonics, CUSAT
11. Dr. Jayasree E, Professor, Department of Applied Chemistry, CUSAT

Funding

The entire project is funded by the state government through KIIFB. A budget of 25.81 Cr was allotted. Tendering Process

I. Tendering of the HPC requirement

Through etenders website (Tender ID: 2021_CUSAT_437498_4), the tendering process with extensions, 5 bidders participated in the bidding process. A decision on this was made during Sept 2023.

II. Tender Award

There were 5 bids and after technical review, StarOneIT Solutions, Thiruvananthapuram, Kerala was awarded the tender for an amount of 25.80 Cr. The Purchase order was issued during July 2024

Milestones

- Project retendering: July 2022
- Award of Project: July 2024
- Completion & Commissioning: October 2025

Conclusion

The proposed facility is a prestigious project for Cochin University and the State of Kerala. The HPC facility is one of the first of its kind in the state with hybrid compute power catering to the needs of the computing community at large.

APPENDIX - I

TECHNICAL SPECIFICATIONS

CPU Servers

HPE Compute nodes DL 360 G10+ with 256 GB/ node (102 nodes)

Hardware: Intel Ice Lake 8358, 32 C

HPL Performance RPeak / RMax: 543 TF / 350 TF

Software: Redhat, HPE Cluster, Intel OneAPI, Altair PBS

AI/ML Workload

HPE Apollo 6500 Gen10 Plus System

HPE Apollo 6500 Gen10 Plus System accelerates performance with NVIDIA® HGX A100 Tensor Core GPUs and AMD Instinct™ MI100 with Infinity Fabric™ accelerators to take on some of the most complex HPC and AI workloads. This purpose-built platform provides enhanced performance with premier graphics processing units (GPU), fast GPU interconnect, high-bandwidth fabric, and configurable GPU topology, providing rock-solid reliability, availability, and serviceability (RAS). Configure with single or dual processor options for a better balance of processor cores, memory, and I/O. Improve system flexibility with 8 GPUs and a broad selection of operating systems and options, all within a customized design to reduce costs, improve reliability, and provide leading serviceability.

Expected AI performance with mixed precision: 1.2 PFLOPS

Cluster Manager

HPE Performance Cluster Manager 1 Node

Scheduler

Altair PBS Pro

Parallel Storage

DDN 2 PB parallel storage system of with read and write throughput of 20 GBps

Networking

Infiniband Switches: 6 Nos

Management Switches: 4 Nos

KVM Console: 1

Data Centre

Racks: 4 x 42U Racks with closed loop cooling system

Chillers: 2 x 60 TR Scroll Chillers with additional Liquid Cooling Packages (LCPs).

Diesel Generator: 320 KVA

Benchmarking

The proposed HPC solution has to be benchmarked (CPU Only) on the following:

● High Performance LINPACK (HPL)

Note: The 350 TFLOPS Sustained performance of the HPC (CPU only) solution should be proved on HPL to give approval for commissioning.

The proposed HPC solution has to be benchmarked (CPU / GPU) on the following:

● Weather Research and Forecasting Model (WRF)

● Regional Climate Model (REGCM4)

● Groningen Machine for Chemical Simulations

(GROMACS)

● Large Scale Atomic/Molecular Massively Parallel Simulator (LAMMPS)

● Quantum Open Source Package for Research in Electronics Structure, Simulation and Optimisation (Quantum Espresso)

Standard Operating Procedures (SOP) for the High Performance Computing Facility at the Cochin University of Science and Technology

General

1. High Performance Computing (HPC) applications have become synonymous with Artificial Intelligence Applications in general and with machine learning and deep learning in particular. Today most of the modern HPC implementations are built with these workloads in mind. To cater to the diverse needs of research and development in the University, a hybrid HPC with CPU load and AI/ML loads.
2. The HPC facility was procured from the state government funding through KIIFB
3. Centre for Information Resources Management (CIRM) has been given the responsibility of monitoring and managing the facility.

Aim

4. The aim of this SOP is to lay down the procedures for the access and utilization of the HPC facility

Purpose of the HPC facility

5. To advance cutting-edge research by catering to the requirements of high-performance workloads of scientific and engineering domains and also focus on data-driven research in the fields of Science and Technology, and also to enhance the knowledge in niche fields of AI, ML, and DL
6. This facility will be utilized as follows
    a. Provide access to high performance computing facilities as well as AI/ML facilities to the faculty, researchers and the students of this University on a chargeable basis
    b. Provide access to faculty, researchers and the students outside the University on a chargeable / mutual benefit basis
    c. Provide access to the Private companies on a chargeable / mutual benefit basis

Allocation and User Account Policies

7. User Accounts: A “User Account” is associated with an individual user of resources. User accounts may be associated with more than one project. All project members are eligible to request user accounts. Users are granted user accounts at their request, if eligible, and agree to all HPC policies including the Appropriate Use Policy (AUP). AUP agreements expire one (1) year after they become active or when the contractual arrangement between the user’s employer and University ends, whichever is sooner. Users are responsible for moving their data before their account enters the retired state.
8. Project Allocation: A “Project” is work that is associated with an allocation of resources (compute time and/or storage). Project allocations have an allocation period. Project allocations may be renewed through the resource allocation request process. A project has a principal investigator (PI), Lead, Alternate Lead, and project members
    a. A project is in the Active state once the project has been awarded an allocation and the date is within the specified allocation period. While a project is in the Active state:

        (i) Project jobs run at normal priority until usage exceeds allocation.

        (ii) Project jobs run at very low priority after usage exceeds allocation.

    b. A project enters the Expired state once the date is after the end of the allocation period or if the project PI leaves the project and no new PI is identified. While a project is in the Expired state:

        (i) Project members are responsible for moving project data off of the systems.

        (ii) Users may continue to log in to HPC systems for a period of 2 months after the project enters the Expired state to move relevant data off of HPC primary storage (primarily /projects/<project_id>) to another storage location.

        (iii) Users may continue to log in to MSS (Mass Storage System) for a period of 1 month after the project enters the Expired state to move or remove data.

9. A project enters the *Ended* state 15 months after the project enters the *Expired* state or if all user accounts associated with the project are in the *Retired* state. When a project enters the *Ended* state:
    a. User access to project data is disabled.
    b. We reserve the right to delete project data from /projects/<project id>) and MSS (Mass Storage System).

Appropriate Use Policy

10. To meet the smooth running of the facility for the above purpose, following policies are to be followed by the user
    a. HPC users are accountable for their actions. Violations of policy, procedure, and security rules may result in applicable administrative sanctions or legal actions.
    b. HPC resources are to be used only for activities authorized by the University. The request for use must be sanctioned by the University before allocation of any resources
    c. HPC resources for personal or private benefit are prohibited. The use of HPC resources to support illegal, fraudulent, or malicious activities is also prohibited.
    d. The University makes no express or implied warranty with respect to the use of HPC resources. Neither CIRM nor University shall be liable in the event of any HPC system failure or loss of data.
    e. A user identifier (username) and an associated password are required of all HPC users. Individuals who have an assigned user identifier are responsible for protecting the associated password. HPC users are not permitted to share their accounts with others.
    f. HPC users are responsible for protecting data files and acknowledge and understand that University's HPC security control implementation is sufficient for research data access and storage.
    g. HPC users must ensure that when using HPC resources that all software is acquired and used according to appropriate licensing. Possession, use, or transmission of illegally obtained software on HPC resources is prohibited. HPC users shall not copy, store or transfer copyrighted software or data using HPC resources, except as expressly permitted by the copyright owner

h. University reserves the right to remove any data at any time and/or transfer data to other individuals (such as Principal Investigators working on a same or similar project) after a user account is deleted or a user no longer has a business association with University. University does not guarantee that data files are protected against destruction.
i. HPC users have no explicit or implicit expectation of privacy. CIRM retains the right to actively monitor all HPC resources, activities on the systems and networks and to access any file without prior knowledge or consent of HPC users, senders, or recipients. CIRM may retain copies of any network traffic, computer files, or messages indefinitely without the user's prior knowledge or consent. CIRM may, at its discretion, share information gathered through monitoring with the University, other incident response organizations, and local, state, central, and international law enforcement organizations.

11. To receive access credentials, you must apply through https://caif.cusat.ac.in. After receiving the application, the CIRM will review it and contact you to inform you on the following steps. You will have to sign a User Agreement.

General guidelines for using HPC

12. Please refer to the Appendix II for details

Technical Support

13. Technical support is provided to all HPC cluster users. The support includes assistance in preparing jobs, installing application software, briefing on the work with the cluster, and consulting. In some areas (such as computational chemistry), we can also provide scientific support by helping to choose the most appropriate simulation tool for your problem or to create a simulation model.

    HPC user support e-mail: hpc-support@cusat.ac.in

    Security incidents should be reported to e-mail: hpc-incident@cusat.ac.in

HPC Access Charges

14. All users will be charged for the use of HPC facilities. The rates are fixed by the appropriate bodies of the University. The current rates are appended in Appendix II

Contact

Centre for Information Resource Management (CIRM)
Cochin University of Science and Technology
Cochin - 682 022

EMail: cirm@cusat.ac.in

Appendix II

TEJASWI HYBRID HPC Facility Usage Policy and Usage Fee Structure is approved by the Committee under the Category: TEJASWI USER CATEGORIES & FEE STRUCTURE available in the CAIF Portal

1. **Introduction:** The CUSAT HPC Facility [TEJASWI] provides high performance computing resources to support advanced research in AI, Machine Learning, and Scientific Simulation. To ensure sustainable operation and equitable access, the following usage guidelines and fee structures apply.

2. **User Categories and Fee Structure:** The hourly rate is calculated per user type.

GPU CHARGES

OEM	GPU TYPE	Instance Type	GPU Cards/ Instance	GPU Memory	Cat. 01 [Price/ Hour] Rs.	Cat. 02[Price/ Hour] Rs	Cat. 03[Price/ Hour] Rs.	Cat. 04[Price/ Hour] Rs.	
Nvidia	A100 80 GB	A100.80 GB	1	80	90	113	135	180	
Nvidia	A100 80 GB	A100.80 GB	2	2 x 80	180	225	270	360	
Nvidia	A100 80 GB	A100.80 GB	8	8 x 80	720	900	1080	1440	
CPU CHARGES									
OEM	**CPU Type**	**Instance Type**	**CPU Cards/ instance**	**Memory**	**HDD**	**Cat. 01 [Price/ Hour] Rs.**	**Cat. 02[Price/ Hour] Rs**	**Cat. 03[Price/ Hour] Rs.**	**Cat. 04[Price/ Hour] Rs.**
Intel	Xeon	Skylake 32vCPUs	2	256 GB	960 GB	40	50	60	80

Cat. 01. Faculty and students of CUSAT (Base Fee Referred to as X)/ SLAB I: CUSAT

Cat. 02. Other Academic Institutions (X+X/4)/ SLAB II: Other Education Institutions

Cat. 03. Government Organisations (X+X/2)/ SLAB III: Government Organisations

Cat. 04. Industries (2 X)/ SLAB IV: Industries

3. **Allocation & Quota :**
   - **Maximum Session Duration:** 48 hours per job (exceptions granted for long – running training upon request/ as per booking)

- **Storage Quote:** Each user is allocated **960 GB** of storage space per CPU/GPU node. For 8 Node AI/ML, storage can be extended up to 15TB. Data must be removed to external storage within five days of job completion.

4. **Operational Guidelines:**
   - **Job scheduling:** All jobs must be submitted via a **Workload Manager.** Running heavy processes on login nodes is strictly prohibited.
   - **Fair Use:** Users **must not** monopolize resources. Large-scale jobs (utilizing > 4 GPUs simultaneously) require prior administrative approval.
   - **Acknowledgement:** Any publication resulting from the use of this facility must include an acknowledgement: "**The Authors acknowledge the Tejaswi Hybrid HPC Facility at Cochin University of Science and Technology (CUSAT) for providing the computational resources in this study**."

5. **Security & Ethics:**
   - **Access:** User accounts are personal and non-transferable.
   - **Usage:** The facility must be used for academic/research purposes only. Commercial software must have a valid licence provided by the user unless globally available on the cluster.
   - **Compliance:** Users must adhere to the university's IT security policy.

Note: Usage Charges are as on 02/02/2026. The charges are subject to revision.