

DEPARTMENT OF PHYSICS
UNIVERSITY OF LUCKNOW
LUCKNOW-226007

TENDER NO.: LU-Phy/HPC-01/2018 Dated: May 23, 2018
Tender /Bid invited
For purchase of High-Performance Computing (HPC) Cluster
required under DST-PURSE programme of the
Government of India
in the Department of Physics,
University of Lucknow, Lucknow- 226007

Non transferable



DEPARTMENT OF PHYSICS
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LUCKNOW-226007

TENDER NO. – LU-Phy/HPC-01 /2018 Dated: May 23, 2018.

Notice inviting tenders for High-Performance Computing (HPC) Cluster required under DST-PURSE programme of the Government of India, in the Department of Physics, University of Lucknow, Lucknow- 226007.

Sealed tenders are invited from registered, experienced and reputed firms under Two Bid system i. e. Technical Bid & Financial Bid for purchase of a High-Performance Computing Cluster required under DST-PURSE programme of the Government of India, in the Department of Physics, University of Lucknow, Lucknow.

1. Detailed description of items required along with specifications and qualification criteria.
(Please see Annexure I).
2. **Time Schedule:**
Date of uploading of Bid document: May 23, 2018
Last date and Time for receipt of Tenders: June 11, 2018 by 12 noon.
Date and time for opening of Bid: June 11 ; 3.00 p.m.
Place of Submission of Tender: Office of - The Head, Department of Physics,
University of Lucknow , Lucknow - 226007
3. **Cost of tender Form:** Rs 1000/- (One Thousand only) in the form of Bank draft of any Nationalized Bank in favour of Finance Officer, University of Lucknow payable at Lucknow, must be enclosed with tender form. Cost of tender form is Non-refundable.
4. Validity of Tender: 90 days from the date of opening of tender.
5. Interested firms may submit the documents completed in all respects along with Earnest Money Deposit (EMD) of Rs 20,000/- (Rupees twenty thousand only) in the name of Finance Officer, University of Lucknow, Lucknow – 226007 in the form of Bank Draft only, of any Nationalised Bank.
6. The University of Lucknow, reserves all rights to amend or withdraw any of the terms and conditions contained in the tender document or to reject any or all tenders without giving any notice or assigning any reason. The decision of University of Lucknow in this regard shall be final and binding on all.

**Head, Department of Physics
University of Lucknow
For REGISTRAR, University of Lucknow,
Lucknow- 226007**

TENDER FORM

The bidders should furnish the under mentioned information and also enclose copies of the respective documents as mentioned below failing which their bids will not be considered.

1. Name of the firm:
Full Address:
2. Name of the Proprietor:
3. Telephone / Mobile Number:
4. Bank Account Number:
(Please enclose proof)
5. Income Tax Permanent Account Number:
(Please enclose Photocopy)
6. G..S.T. Registration No.:
(Please enclose Photocopy)
7. Income Tax return for the past three years:
(Please enclose photocopies)
8. Firm deed & Registration of the Firm:
(Please enclose photocopy)
9. (a) Details of Demand Draft towards the cost of the Tender:
Draft No. Date: Amount: Rs 1000/-

Name of the issuing Bank:

(b) Details of Demand Draft towards the cost of Earnest Money Deposit (EMD):

Draft No. Date: Amount: Rs 20000/-

Name of the issuing Bank:

Demand Drafts should be drawn in favour of Finance Officer, University of Lucknow, Lucknow, payable at any Nationalized Bank at Lucknow. Tenders / Bids not accompanied by the requisite Demand drafts shall not be considered and shall be rejected.

Annexure I

High Performance Computing Cluster for Department of Physics, Lucknow University

I. PART1 – HPC Computation Infrastructure

1. Master/Login Node(s)

Qty: 1

Processor	: 2 x Intel Xeon Scalable processors (Formerly code named Skylake) with x86_64 architecture, each having 16-cores or higher, running @ 2.1GHz or higher. Must be capable of supporting memory running at 2666 MHz. Peak performance of each CPU should be 1075 GFLOPs or more (with turbo frequency and hyper-threading feature disabled)
Memory	: 192GB DDR4-2666 with ECC or higher in balanced configuration populating all memory channels. Must have free memory slots to upgrade further by adding memory modules (at least 16 DIMMs).
RAID	: Support for Hardware RAID6 with 2GB NV /flash backed cache
Disks	: 1 x 1TB NVMe SSD connected thru on board controller or AIC based 2 x 480GB MLC SATA SSDs as RAID1 160TB, 7200RPM SATA HDDs as RAID6. All disks must be hot-pluggable and enterprise/data centre grade and connected to RAID controller
Optical Disk	: DVDROM drive (internal only)
NIC	: 2 x 1Gigabit (RJ45) ports
Interconnect	: 1 x 100Gbps (or higher) low-latency interconnect (Mellanox EDR InfiniBand or Intel® Omni-Path) connected to PCIe 3.0 x16
Management	: Dedicated management port with KVM over LAN support enabled
Expansion	: 2 x free PCIe x16 expansion slots
Ports	: 1 Serial, 2 USB (3.0) or higher, 1 VGA
Form Factor	: Rack-mountable with rail-kit. 2U or lower
Power Supplies	: Hot-pluggable and N+N redundant, 80PLUS Platinum or better.

2. Compute Node(s)

Qty: 06 Nodes

Processor	: 2 x Intel Skylake procs with x86_64 architecture, each having 16-cores or higher, running @ 2.1GHz or higher. Must be capable of supporting memory running at 2666 MHz. Peak performance of each CPU should be 1075 GFLOPs or more (with turbo frequency and hyper-threading feature disabled)
Memory	: 2 nodes with 384GB and 4 nodes with 192GB DDR4-2666 with ECC or higher in balanced configuration populating all memory channels. Must have free memory slots to upgrade further by adding memory modules (at least 16 DIMMs)
Disks	: 1 x 480GB MLC SATA SSD
NIC	: 2 x 1Gigabit (RJ45) ports
Interconnect	: 1 x 100Gbps (or higher) low-latency interconnect (Mellanox EDR InfiniBand or Intel® Omni-Path) connected to PCIe 3.0 x16
Management	: Dedicated management port with KVM over LAN support enabled
Expansion	: 1 x free PCIe x16 expansion slot
Ports	: 2 USB (3.0) or higher, 1 VGA
Form Factor	: 1U Rack-mountable with rail-kit or Dense multi-node systems with maximum 2 nodes in 1U
Power Supplies	: hot-pluggable and N+N redundant, 80PLUS Titanium or better. Each set of 'N' Power supplies should be rated for supplying at least 500W to each individual System in the chassis

3. GPU Compute Node

Qty: 1 Node

Processor	: 2 x Intel Skylake procs with x86_64 architecture, each having 16-cores or higher, running @ 2.1GHz or higher. Must be capable of supporting memory running at 2666 MHz. Peak performance of each CPU should be 1075 GFLOPs or more (with turbo frequency and hyper-threading feature disabled)
GPU	: 2 x Nvidia Tesla V100 with 16GB
Memory	: 192 GB DDR4-2666 with ECC or higher in balanced configuration populating all memory channels.

Disks : 1 x 480GB MLC SATA SSD
All disks must be hot-pluggable and enterprise/datacentre grade
NIC : 2 x 1Gigabit (RJ45) ports
Interconnect : 1 x 100Gbps (or higher) low-latency interconnect (Mellanox EDR InfiniBand or Intel® Omni-Path) connected to PCIe 3.0 x16
Management : Dedicated management port with KVM over LAN support enabled
Form Factor : Rack-mountable with rail-kit. 2U or lower
Power Supplies : hot-pluggable and N+N redundant, 80PLUS Platinum or better.

NOTE:

- a) Bidders have to offer Total Linpack theoretical peak performance (CPU-CPU performance only) of at least 15 Tera Flops from 7 Nodes (Including all types of compute nodes part of HPC) and sustained performance must be 65% of peak performance. Performance of GPUs not part of it.
- b) STREAM 'TRIAD' (<http://www.cs.virginia.edu/stream/>), measuring sustainable memory bandwidth, benchmark report shall also be submitted along with the bid.
- c) Benchmark report for the performance of the cluster based on MAGMA (Matrix Algebra for GPU and Multicore Architectures) [<http://icl.utk.edu/magma/>] shall also be submitted along with the bid

II. PART 2 – HPC Communication Network Infrastructure

4. Communication Network

A. Primary Communication Network

Qty: 1 set

24-port or more, 100Gbps, Non-blocking, Switching Fabric (Mellanox EDR InfiniBand or Intel® Omni-Path) with embedded Subnet Manager for 24 devices or more and with redundant power supply/supplies. All cables required for connecting the devices quoted in this tender should be included/bundled.

B. Secondary Communication Network

Two 24-port OR **One** 48 port, Layer-2 internally / externally managed, Gigabit Ethernet Switch with rack-mounting kit. All cables required for connecting the devices quoted in this tender should be included/bundled.

5. KVM Switch/Console

Qty: 1 set

1 x KVM console with a 17" LED-backlit LCD monitor in a sliding housing, 1U rack-mountable

III. PART 3 - Software/Installation

6. OS : 64-bit Linux (CentOS/RHEL)

7. Job Scheduler: Job Scheduler with following features

- job monitoring and management
- Workload cum resource manager with policy-aware, resource-aware and topology-aware scheduling
- Advance reservation support
- Heterogeneous cluster support
- Multi-cluster support
- Pre-emptive and backfill scheduling support
- Application integration support
- Live reconfiguration capability
- GPU Aware scheduling

8. Libraries : OpenMPI, MVAPICH, Intel MPI, Blas 1,2,3, Lapack, Scalapac, Intel MKL, Intel DAAL

9. Compilers : GNU Compilers, Intel (C/C++/Fortran compilers),

Intel Parallel Studio XE Cluster Edition for Linux - 2 user floating license, with 3 years of support.

HPC Management: **Licensed Cluster Management software** with following features. License must be in the name of University of Lucknow. License copy to be issued as per academic licensing policy, in the name of Registrar, University of Lucknow.

- Cluster manager with provisioning, monitoring and reporting capabilities
- Support Package and Image based provisioning
- Support Disk and diskless cluster deployment both
- Intuitive web interface to manage and customize the cluster
- Customizing networks and compute node profiles
- Customizing compute nodes to max, up to changing kernel parameter
- Able to Push configuration changes and updates to the compute nodes without reinstalling and rebooting

10. Installation and Training: The vendor has to rack-mount all equipment with proper cabling and configure the system as a high-performance compute cluster. The vendor is required to run HPC and submit results as part of acceptance. The vendor will also be required to submit documentation with details about the installation and provide training (Minimum 4 days) on day to day operations and administration of HPC. One more refresher training (minimum 2 days) has to be provided in 6-12 months from the date of installation.

IV. PART4 – Cooling Solution Infrastructure

- The Data Centre to be equipped with the appropriate Inbuilt/self contained cooling system based racks. The inbuilt/self contained intelligent rack based cooling system should be able to remove high level of waste heat from server enclosures/rack and to provide uniform,& effective cooling for servers and similar IT equipment (switches etc.) installed with in racks as offered by bidder, it should be provided with appropriate refrigerant.
- It must offer N+N built in redundancy at the physical unit level to take care of minimum 7KW operating power load at any time.
- Indoor and Outdoor units (if any) shall be connected with proper piping work
- Outdoor Cooling Units (if any) have to be positioned out side the data centre. Bidders may visit the facility for better understanding before bidding.
- 32 A, Rack mount, vertical PDU with a combination of IEC C-13 and IEC C-19 sockets according to the IT equipment.
- The solution must have front door biometric access, rear door lock, smoke detection system with indicators, rodent control system, Fire Suppression Piping & Detection Sensor, Hooter/Sensor available for alarm purpose in case of any malfunctioning, IP Via Modbus enabled, double glass or toughened glass front panel
- Raw Power required to be fed to the cooling units will be provided by University of Lucknow**

V. PART 5 –

11. 42U Server Industrial Racks (Solution to be housed in either 1 or 2 racks at the max)

VI. PART 6 – Power Back Up Solution Infrastructure

- 10 KVA standalone, online double conversion, 3 phase UPS with full (N+N) redundancy, and One hour of Run-Time (power backup) on each UPS under full load.
- With industrial grade battery bank (dry and maintenance free). Sealed Maintenance free.
- SNMP control, high power factor (0.9 or more), high efficiency (0.92 or more), sine wave output.
- Only from globally reputed brands (APC, Emerson, and Eaton) with ISO 9001, 14001 certifications. CE compliant. OEM must have supplied UPS solution for Data Centres in India to at least at 3 Government Organisations. Required documentary evidence must be submitted.
- On site 3 year comprehensive warranty on UPS including batteries and support from the concerned OEM. Bidder must provide a letter from OEM regarding authorization provided and the explicit support at University of Lucknow at the time of installation and after sales service.

Note: Electrical system with essential high quality MCB and cables for UPS and Rack (input supply to rack units) will be set up by the University of Lucknow.

12. Comprehensive 3 Years Warranty for the complete Solution

13. Optional Item to be quoted: The University of Lucknow may desire to add more compute nodes or GPU nodes to the existing solution. Hence bidders must quote for standalone compute node and standalone GPU node, each having the above described configuration as an optional item. The University of Lucknow may decide upon the total additional nodes to be added at the time of order finalization.

Qualification Criteria:

- 1 Server OEM must have installed at least 5 HPC Clusters of the same size or greater, in terms of no. of nodes and minimum performance of 15TF with Infiniband /OPA Fabric in India, including at least 2 installations at Government Educational or Research Organisations during last 5 years. Documentary evidence (installation reports) to be provided. Server OEM must be listed in Top 500.org lists during last 2 years in at least three lists out of total four bi-yearly lists during the said ten
- 2 One OEM (Server OEM) can authorize only one SI/Bidder to quote their products
- 3 The bidder must be registered under the companies act 1956 or a registered firm. And have a registered office in India.
- 4 On Site support to be provided by the Bidder or the OEM. Declaration to be submitted along with the bid.
- 5 Bidder must not be blacklisted by any govt organisation in India; a notarised declaration must be submitted with the bid.
- 6 Valid and Duly Authorized Manufacturer Authorization Certificate from the respective OEMs in the name of Participating System Integrator/Bidder must be submitted at the time of submission of Bids. From Server, Storage, and Switch OEMs.
- 7 All the components of the server must be from the same OEM.
- 8 Regarding bench marks:
 - 8.1 Results should be submitted along with technical bid.
 - 8.2 Benchmarks are to be submitted for the proposed configuration only. If, exactly, the proposed configuration is not available then the benchmarks may be run on closest available configuration, and based on the result of closest available configuration benchmark results for proposed configuration may be submitted.
 - 8.3 Log files of the benchmark run in electronic format must be provided.
 - 8.4 All input files and output files along with the script must be provided.
 - 8.5 Complete Hardware and Software environment of the machines (cluster) on which the benchmarks were carried out must be provided.
 - 8.6 An undertaking that guarantees the reproduction of the benchmark reports on the proposed cluster in our premises after final installation must be provided. In case of failing to do so (with maximum deviation of 5% from the results submitted in the bid), the University reserves the right to deduct 10% money from the payment.
 - 8.7 A two step criterion will be used for technically qualifying the vendors:-
 - 8.7.1 Best performance of High performance LINPACK (on complete solution) benchmark.
 - 8.7.2 If 8.7.1 is satisfied, then other benchmarks shall be considered. Only those vendors whose benchmark results are within 25% of the best one will be qualified for the Financial Bid.

All documents stated above should be marked as Annexures 1 to 8 and submitted in serial order

General Terms and conditions:

- Quotations should be submitted in two separate sealed envelopes marked as 'Technical bid' and 'Financial bid' with the Tender Number written on it.
- Technical Bid should contain **item-wise compliance chart** clearly tabulated, for each of the 13 items and sub-items mentioned under the specifications. The compliance chart should be duly authenticated by an authorized person of the company.
- Financial bids for the product whose technical bid is not acceptable will not be opened.
- The delivery period should be specifically stated – preferably 4-10 weeks from the date of purchase order.
- Maximum educational discounts should be provided.
- Installation within 10 days after receiving the system at the University. The price should be inclusive of full installation on site with full functionality demonstration.