# Evolution of High-Performance Computing Environment (HPCE) Clusters at the Computer Center -I

### LEO Cluster (2007–2010) : Early High-Performance Computing in HPCE



**Storage Configuration:** 

• Utilizes the filesystem from the SNP

• A user quota of 2 GB is set for each user

• Quotas help manage storage allocation

machine of the SGI Altix 350 server

effectively and ensure fair usage

HPC at IIT Madras has step into Cluster Computing significantly with a full setup of

### System Configuration:

#### **Head Node:**

- Server: 1 × HP Proliant DL360 Server
- Processor: Intel® Xeon® CPU E7330 @ 2.40 GHz (Core 2 Quad, 8 CPUs)
- Storage: 160 GB Hard Disk (with mirroring)

#### **Compute Nodes:**

- Total Nodes: 14
- Server: HP Proliant DL140 Servers
- Processor: Intel® Xeon® CPU E7330 @ 2.40 GHz
- Storage: 250 GB SATA Hard Disk

#### Software Stack Text File Editor Parallel Computing ✓ Gnu compilers 4.5.4 <u>Frameworks</u> ✓ Gvim/ VI editor ✓ openmpi ✓ Javac 1.7.0 ✓ mpich ✓ Gedit ✓ Python 2.7/2.7.3 ✓ Intel-mpi ✓ Cmake 2.8.10.1 ✓ Perl 5.10.0 Scientific Libraries Research Software Package ✓ FFTW -3.3.2 ✓ Ansys/Fluent 13,14,14.5 ✓ HDF5 ✓ MKL ✓ Abaqus 6.10,6.11,6.12 ✓ GNU Scientific Library ✓ BLAS ✓ Mathematica 8,9 ✓ Matlab 2013a,2013b ✓ LAPACK ✓ Gaussian 09 version A.02 ✓ LAPACK++ Open Source Software Interpreters and Runtime **Environments** ✓ NAMD 2.9 ✓ Java 1.7.0 ✓ Gromacs 4.0.7,4.5.5 ✓ Python 2.7/2.7.3 ✓ OpenFoam2.1.1 ✓ Numpy 1.6.1 ✓ LAMMPS (parallel) Debugger ✓ Gnu gdb ✓ Intel idb Visualization Software ✓ Gnuplot 4.0

## GPU Cluster LIBRA (2012–2017) : Advancing HPC with GPU Technology



A GPU cluster is a computer cluster in which each node is equipped with a Graphics Processing Unit (GPU). By harnessing the computational power of modern GPUs via General-Purpose Computing on Graphics Processing Units (GPGPU), very fast calculations can be performed with a GPU cluster.

HPC at IIT Madras has strengthened its GPU power significantly with a full setup of

- 1 Head Node on HP Proliant DL380 G7 servers with Dual Processors, Six-Core Intel Xeon 5670 series processors with 24GB RAM and 146gb of SAS Hard disk.
- 8 nodes based on HP Proliant SL390s server of Dual processor, Six-core, Intel Xeon X5675
   Processors with 3 Telsa M2070 GPU card and 146gb of SAS Hard disk in each node
- Achieves a performance of 6TFLOPS

### **Key features of M2070:**

- Tesla M2070 is a professional GPU by NVIDIA, launched on July 25th, 2011.
- Designed for high-performance computing (HPC) and scientific simulations.
- 448 CUDA cores, 6 GB memory.



### Super Cluster VEGA (2008–2012): Supercomputing Advancements in HPCE



**Storage Configuration:** 

backups.

NAS Storage Rack – 30 TB of

storage and a Tape Library

• HP SFS Parallel File System –

racks, employing RAID-5 and

offering a licensed storage

capacity of 80 TB.

the Clusters

Distributed over three separate

• The SFS storage is shared by both

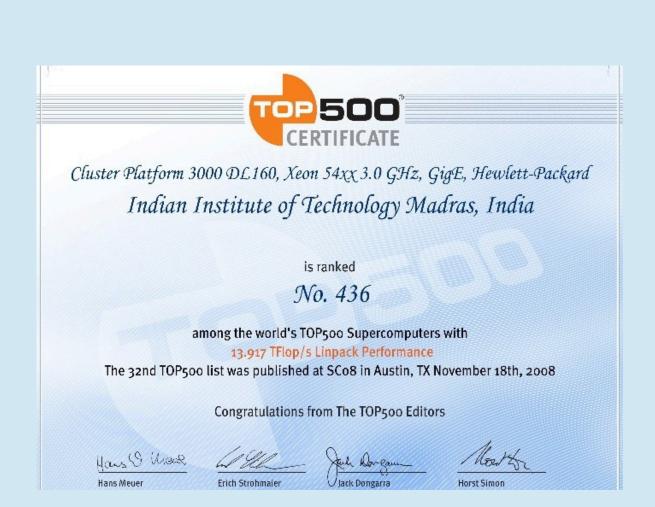
containing 48 tapes for automated

### Performance:

- 13.96 TFLOPS
- Ranked 436<sup>th</sup> in the world

### **System Configuration:**

- 256 nodes
- 128 nodes connected via InfiniBand (IB)
- 128 nodes connected via Gigabit (GB)
- Each node is equipped with one head node
- HP Proliant DL160 G5 servers with Quad-core Intel Xeon processors with Dual Processor, Quad-core Intel E5472
- Memory: 16 GB RAM
- Storage: 250 GB SATA Hard Disk



### GNR Cluster (2013–2020) : Specialized Computing in High-Performance Environments



This cluster is named after the scientist Prof. G N Ramachandran.

HPC at IIT Madras currently has introduced a cluster for the B.Techs and beginners with a setup of

- 1 Head Node on Super micro servers with Dual Processors, Eight-Core Intel Xeon Ivy bridge E5-2650v2 series processors with 4 X 8GB RAM and 500 GB of SATA Hard disk.
- 16 compute nodes based on super micro server with Dual processor, Eight-core Intel Xeon Ivy Bridge E5-2650v2 series Processors with 4 X 8 GB RAM and 500 GB of SATA Hard disk in each node.
- 14TB of shared storage.

