Brief about New HPC Facility- A Background Document

Introduction:

One of the primary goals of Earth System Science Organization (ESSO) of Ministry of Earth Sciences (MoES) is to develop and improve capability to forecast weather, and climate and hazard related phenomena and to explore Ocean Resources for societal, economic and environmental benefits. To achieve this objective, the ESSO has been providing weather/climate related services on land and ocean through its various constituent units by adopting the latest technology for development of science, improving the telecommunication network for effective communication and dissemination and capacity building through training. The recent improvements in weather and climate forecast (e.g. Phailin Cyclone Forecast, Uttarakhand Heavy rainfall event, and long range prediction of seasonal mean monsoon rainfall) were done using moderate resolution dynamical numerical models. To produce the forecasts using these models requires data assimilation & integration of the models to the future. For all these High Performance Computers (HPC) is a crucial requirement. For this purpose MoES had setup HPC at its organizations in 2009 with a total capacity of 115 TF as a part of a strategic plan for long term augmentation of HPC resources at MoES Institutes

The future improvement of weather prediction relies upon incorporating greater number of detailed physical processes into these models, and increase resolution of these models. Which becomes possible as computer speed increases and as a result ESSO will be able to provide more accurate and finer resolution forecasts to the user community. In order to achieve these HPC resources at ESSO Institutes needs to be augmented with additional capacity. Recently ESSO has procured 1.15 Peta Flops HPC system to be setup at two of its Institutes (Indian Institute of TRopical Meteorology (IITM), Pune and National Center for Medium Range Weather Forecast(NCMRWF), Noida) and the resources setup at these two institutes will be utilized by other MoES institutes as well.

HPC installation at IITM will be inaugurated will be inaugurated at the hands of **Dr. Shailesh Nayak,** honorable Secretary of the Ministry of Earth Science (MoES), Chairman, Earth System Science Organization (ESSO), Chairman, Earth Commission on 28 February 2014 at 9 am. The newly augmented HPC installation at IITM is named "AADITYA" (means SUN) to signify the major source of energy that drives our climate system.

Details of the HPC System

The Aaditya HPC is a Highly Parallel Supercomputing System built on IBM System X technology. The compute performance is more than 790 Tera Flops with Intel Sandy bridge Processors. There are 2384 compute Nodes with each node have 2 number of 8 core Processors (Intel Xeon E5-2670 2.6GHz cache 20MB) and the Memory is 4 GB DDR3 per core and 64 GB per node. The total RAM/Memory of the cluster is more than 150 Tera bytes.

The System is having a 6 Peta bytes disk based storage solution built on IBM GSS technology with read and write performance of about 100 Gigabytes per second and the Tape Storage

solution is based on Tivoli Storage 3500 tape library (Two Libraries) with Tivoli Storage Manager for automatic backup and restore and HSM functionalities. The Tape Library is scalable up to 100 Petabytes just by adding LTO6 Tape cartridges.

The compute, storage, master nodes and utility servers are connected over multiple Infiniband FDR switches for Inter Process Communication. The nodes are connected to the switches in a Fully Non-Blocking FAT Tree topology and is capable of delivering 56 Gbps end to end bandwidth.

The Operating environment is with Red Hat Enterprise Linux as Operating System, GPFS as the cluster Parallel file system, IBM XCAT as cluster administration and Management tool, UFM (Mellanox Unified Fabric Manager) for Fabric Management, Platform Load sharing facility (LSF) as the job scheduler and all other software, such as compilers, debuggers, profilers, MPI libraries, development environment are based on Intel Cluster Studio and IBM Parallel and Scientific Computation Environment.

Objective of this new HPC System:

a) enable simulations for improved weather, climate and ocean forecast and help in providing reliable weather and climate services to the end users such as farmers, fishermen and other stakeholders in the government and neighboring countries.
b) boost research in weather and climate forecasting as well as monitoring and predicting air pollution.
c) help in implementing the innovative programs of the Ministry in providing near accurate weather, climate and ocean forecast.
d) Allow India to take part in the IPCC Assessment report using an Indian Model.

Highlights:

Advantages for Research Institutes:

- Ministry of Earth Science (MoES) is launching HPC System (790 TF) at IITM. All Institutes under MoES will be benefited.

- Another HPC system will be very soon installed at NCMRWF and start functioning. Both the systems IITM + NCMRWF, will be of 1.15 Peta Flop system

- This HPC facility will help the Institute to setup an Indian Model for Weather and Climate Prediction by 2017 on mission mode. The system will be useful for 1) improving weather predictions and provide finer resolution and accurate forecasts 2) providing seasonal and extended range rainfall prediction of active/break cycles of Monsoon Prediction, 3) air quality forecasting, 4) climate projections, 5) development of Earth System Model (ESM) which is a Global Model, embedded with Bio/Geo/Atmosphere/ Ice/ Boundary layer / Cryosphere.

- This will be the National Facility in connection with various Universities/ Institutes through National Knowledge Network (NKN) linkage.

- Energy Efficient system: The Energy consumption for the existing (70.2 TF) one as well as for this new HPC (790 TF) will be almost the same.

- HPC at IITM Pune will be holding the 1st position in India for the most powerful High Performance Computing System.

- Lightening activity for the complete Maharashtra state will be monitored and networked through HPC.

Who will be the beneficiaries:

- Farmers, fishermen, common man, stakeholders in the government
- Researchers at IITM, Institutes under Ministry of Earth Sciences, Universities, Indian and Foreign Institutes

Other details available at: http://www.tropmet.res.in/static_page.php?page_id=134

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