

# Development of HPC aware manpower under NSM

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# Outline

- About NSM
  - Major Activities
- HPC aware Manpower development activities
  - Goals
  - Means to achieve goals
  - Training Activities
  - HPC nodal centres
- PARAM Shavak, a platform for manpower development

# About the Mission

- 7 year Mission
- Being jointly Executed by MeitY and DST, Govt. of India
- Implementing agencies : C-DAC and IISc
- Four activities
  - Infrastructure Development
  - Development of Supercomputing applications
  - HPC Research and Development leading to Exascale computing readiness
  - HPC aware manpower development

# Infrastructure Development

- Deployment of a number of supercomputing systems of different sizes and scales
  - Entry Level Supercomputers
  - Midrange Supercomputers
  - Large Supercomputers
- Systems will be deployed using
  - Build Approach
  - Buy Approach

# System Deployment

- Six systems to be deployed by April 2019
- Using Build Approach
  - 1.3 PetaFlop System at IIT-KGP
  - 650 TeraFlop Systems at IIT-BHU and IISER-Pune
- Using Buy Approach
  - 1.3 PetaFlop System at IIT-K
  - 650 TeraFlop Systems at JNCAR and IIT-HYB

# Build Approach

- Optimized architecture and system design
- Customization of open source software - OpenHPC
- Collaboration with industry partners
- Most of the subsystems are envisaged to be designed and manufactured in India
- 3 Phase approach
  - Phase I: Assembly of Systems
  - Phase II: Manufacturing of System
  - Phase III: Design and Manufacturing of systems

# Supercomputing Applications

## Objectives

- Design of scalable algorithms and software
- Explore compatibility of algorithms, software and tools with different hardware accelerators
- Deploy existing programs and tools from different laboratories in the country
- Conceptualize HPC based research problems in various scientific and engineering discipline

# Applications Areas

- Personalized and Predictive Medicine
- Drug Discovery Platform
- Climate, Weather and Disaster Prediction
- Materials and Computational Chemistry
- Geophysics and Oil Exploration
- CFD for Engineering Applications
- Astronomy and Computational Physics



# HPC R&D Areas

- Next generation system architectures and prototypes
- Programming paradigm for Exascale computing
- Scalable Algorithm developments
- Power optimization technologies
- Exploring next generation Data centre technologies
- R&D for high speed network scalable for Exascale supercomputers
- Special purpose machines – e.g. for Bio-informatics
- Silicon photonics

# Development of HPC aware Manpower

# Goals of HRD Activities

- To generate enough human resources that can take-up and spearhead supercomputing activities in the country, through development of ecosystem.
- To develop at least 20,000 number of HPC aware experts and professionals
  - To be done by a planned collaboration between academia, R&D organizations and the industry

# Means to achieve Goals

- Curriculum development and content creation
- Train the trainer model for multiplicative effect
- Training modes
  - Classroom
  - e-learning
  - Blended
- Emphasis on
  - Hands-on training
  - Providing training to CS and non-CS students

# Means to achieve Goals (Contd.)

- Collaborations with universities and academic institutes for delivering courses
  - Setting up of HPC nodal centers
- Providing access to state-of-art hardware platforms for training, accessible from all over the country
- Provide fellowships to PhD students to attract talent
  - Working closely with Ministry of HRD

# Training Activities

- Design of model syllabus for HPC courses
  - For CS students
  - For non-CS students
  - Freely available for institutes for adaption
- Facilitating training programs across India
  - Short term (1-2 weeks) /Workshops
  - Medium term (6 months)
  - Long term (Formal education courses)

# Short Term Courses

- Intended for
  - Faculties
  - Researchers
  - Domain Experts
  - Industry Professionals
- 1-4 week duration
- Introductory and advanced topics
- Faculty Development Programs, “Think Parallel” workshops, Hackathon
- Access to 100TF system at C-DAC for participants post training

# Think Parallel Workshop

- A comprehensive workshop providing the right blend of fundamental and advanced concepts and practical hands-on experience of the state-of-the-art parallel computing technologies

## Topics

- Advanced Computer Architectures
- Parallel Programming : Design & Paradigms
- OpenMP, Message Passing Interface (MPI)
- Accelerator Programming Overview
- Performance Analysis & Debugging Parallel Programs
- Parallel Application Case Studies
- Emerging trends in parallel computing



# Medium Term Courses

- Intended for
  - Graduate Students
  - Industry professionals
- 6 month duration
- Course Topics
  - Parallel Programming
  - System Administration
- Fifth batch of PG Diploma in HPC System Administration is in progress at C-DAC

# Long Term Courses

- Intended to run as formal course in Educational Institutes
  - Subjects/Electives in UG curriculum (for CS and Domain)
  - PG degree courses in Data Science/HPC/AI
  - Topics for Research Scholars
- IIT-Bombay has conducted two undergraduate courses, one for CS students and one for non-CS students

# Activities of HPC Nodal Centres

- Undertaking activities which meet the goals set by NSM-EG-HRD,
- Spreading awareness about HPC to encourage use of HPC
- Conducting faculty development programs and refresher courses
- Generating content which can be used from a MOOC platform like NPTEL and SWAYAM
- Hosting resources for use of HPC community
- Conducting technology update workshops

# Planned Activities (continued)

- Conducting HPC workshops
  - targeted towards specific audience
  - on a thematic area
  - For providing technology updates
- Updating Curriculum
- Provide consultation and expertise to research organizations, Industries, SMEs
- Organize Seminars, Conference and HPC awareness programs in region

# Programs Conducted

- HPC Awareness Workshop (1 day)
- HPC add-on Course (1 day)
- Think Parallel Workshop (5 day)
- OpenACC Hackathon
- Faculty Development program (5 day)
- PG Diploma in HPC System Administration (6 month)
- UG course at IITB (1 semester)

# PARAM Shavak

- A platform for Manpower Development
- Ready-to-use Supercomputer-in-a-box solution
- Affordable solution for academic, scientific and research institutions
- Three Models
  - PARAM Shavak HPC System
  - PARAM Shavak DL GPU
    - For Deep Learning
  - PARAM Shavak VR System
    - For Virtual Reality



# Some Recent Activities

# OpenACC Hackathon



- 5 day event
- 32 participants

14 teams  
24 mentors



# HPC Training



Thank you

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