



Welcome





C-DAC Five Days Technology Workshop

ON

**Heterogeneous Computing –
Many Core / Multi GPU
Performance Algorithms, Application Kernels**

HeMPa-2011

Venue : CMSD, University of Hyderabad

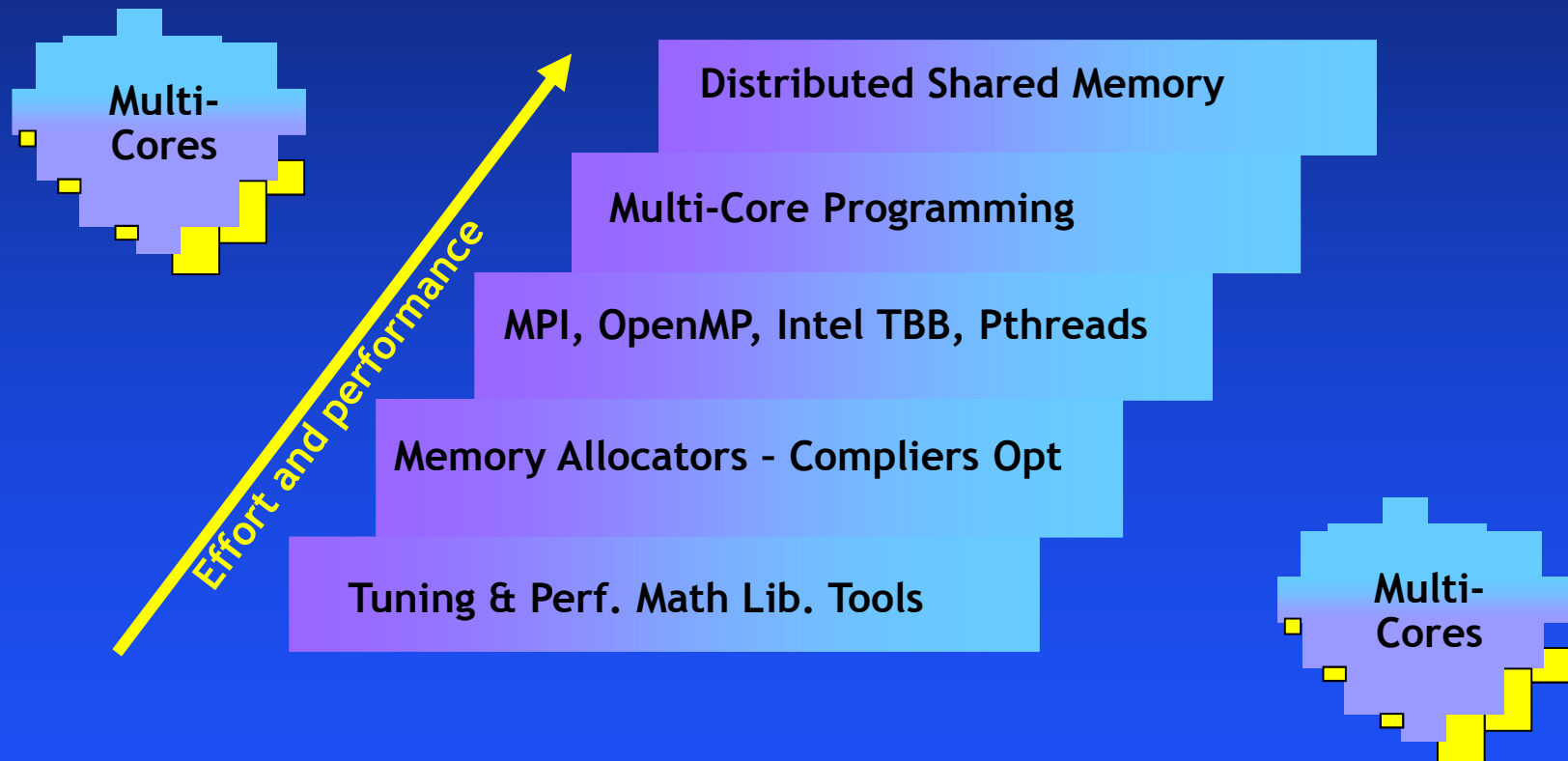
Date: October 17-21, 2011

HeMPa-2011

- ❖ Aimed to understand emerging parallel processing technology platforms, focusing on various programming paradigms & rich set of tools from end-users point of view
- ❖ One of our Objective is to make strong foundation to enhance the performance of applications on emerging parallel processing platforms (Multi-Core Processors, Partitioned Global Address Space (PGAS) Models; GPU Computing-CUDA Programming, GPGPUs – OpenCL; HPC GPU Cluster)
 - Use Software Development tools to understand performance bottleneck issues of programs
- ❖ Most importantly, Hybrid Adaptive Computing Hardware/ Software - Mixed Programming & Transactional Memory on Multi-Core Processors will be taken up as new initiatives

HeMPa-2011 (Mode-1 : Multi-cores)

Enhance the performance of applications on emerging parallel processing platforms (Multi-Cores, Distributed Shared Memory (PGAS) GPGPUs, GPU Comp.-CUDA, /OpenCL) Hybrid Prog.- HPC GPU Cluster

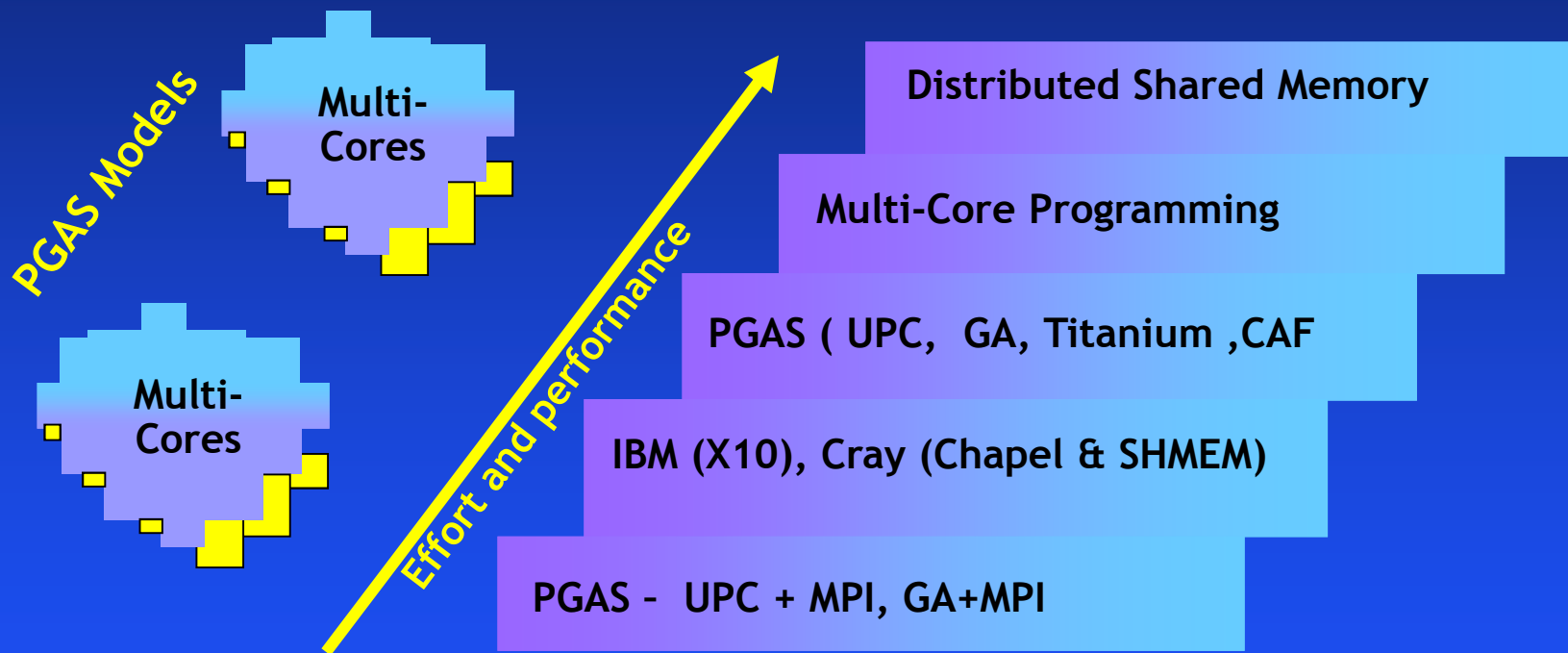


Exposure to Hands-on Session various Platforms

Multi-Cores – software Threading – Tuning & Performance

HeMPa-2011 (Mode-1 : PGAS)

Enhance the performance of applications on emerging parallel processing platforms (Multi-Cores, Distributed Shared Memory (PGAS) GPGPUs, GPU Comp.-CUDA, /OpenCL) Hybrid Prog.- HPC GPU Cluster

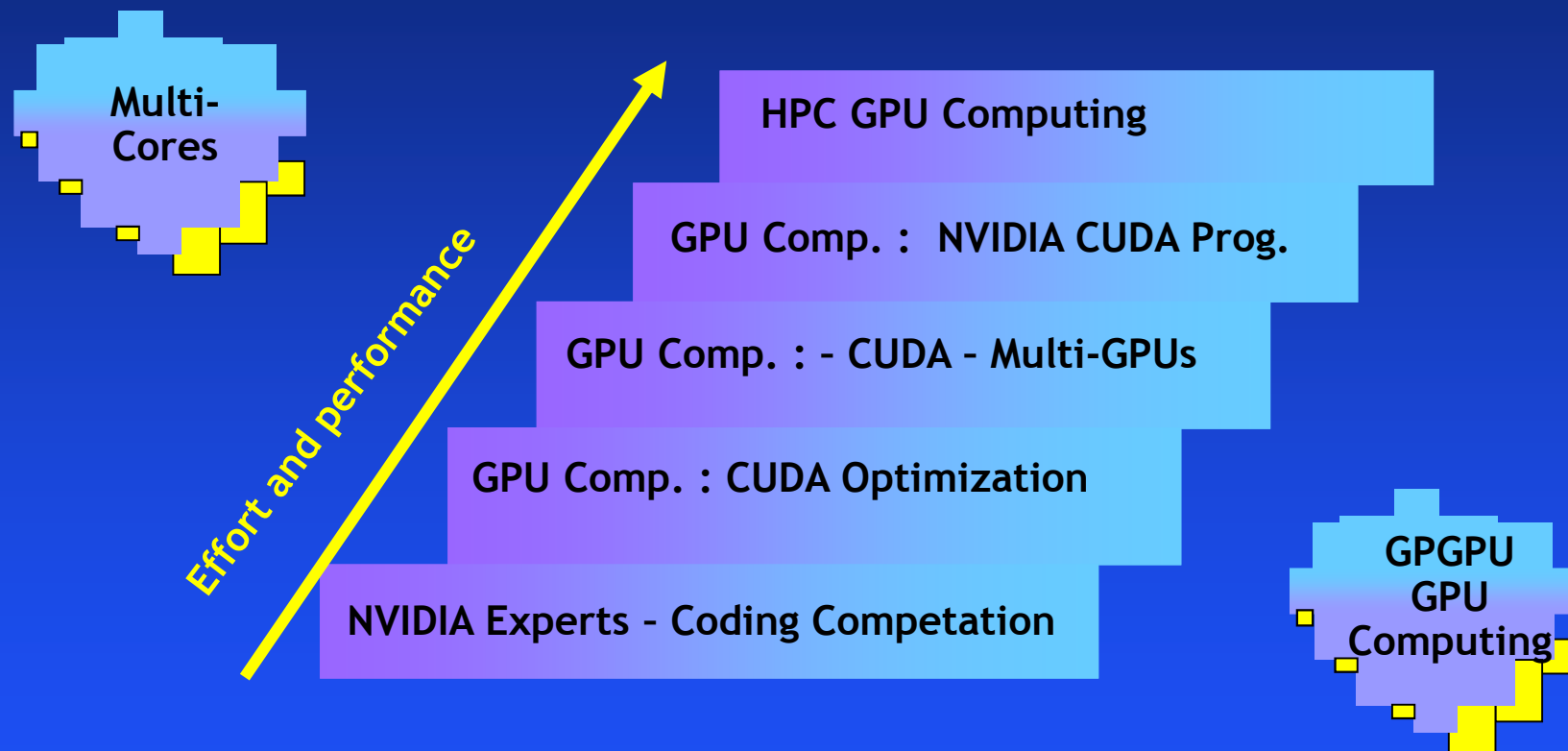


Exposure to Hands-on Session various Platforms

Multi-Cores, PGAS Programming Models – GPU -OpenCL

HeMPa-2011 (Mode-2 – GPGPUs)

Enhance the performance of applications on emerging parallel processing platforms (Multi-Cores, Distributed Shared Memory (PGAS) GPGPUs, GPU Comp.-CUDA, /OpenCL) Hybrid Prog.- HPC GPU Cluster

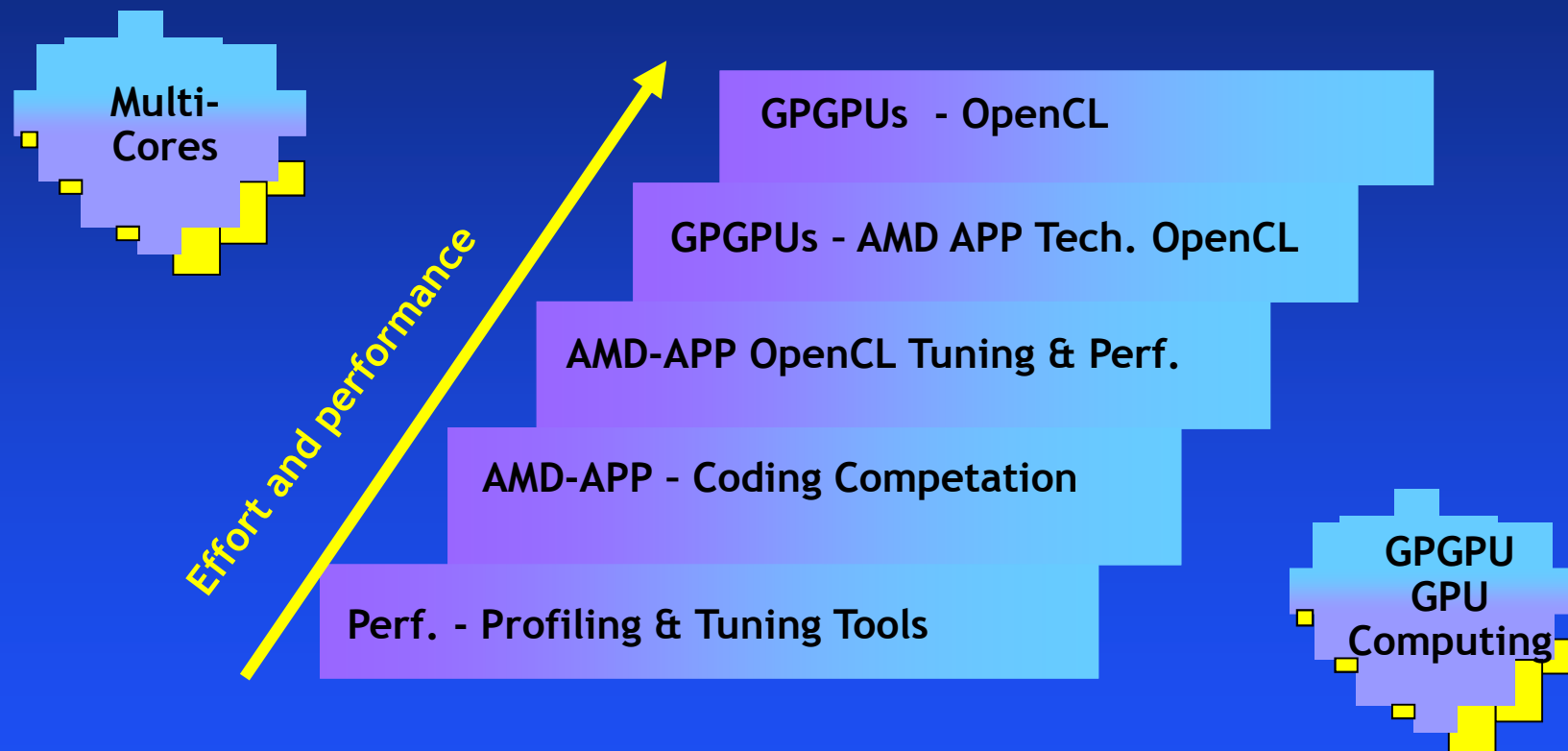


Exposure to Hands-on Session various Platforms

Multi-Cores, GPGPUs-AMD APP Tech – OpenCL , GPU Computing-CUDA

HeMPa-2011 (Mode-2 – GPGPUs)

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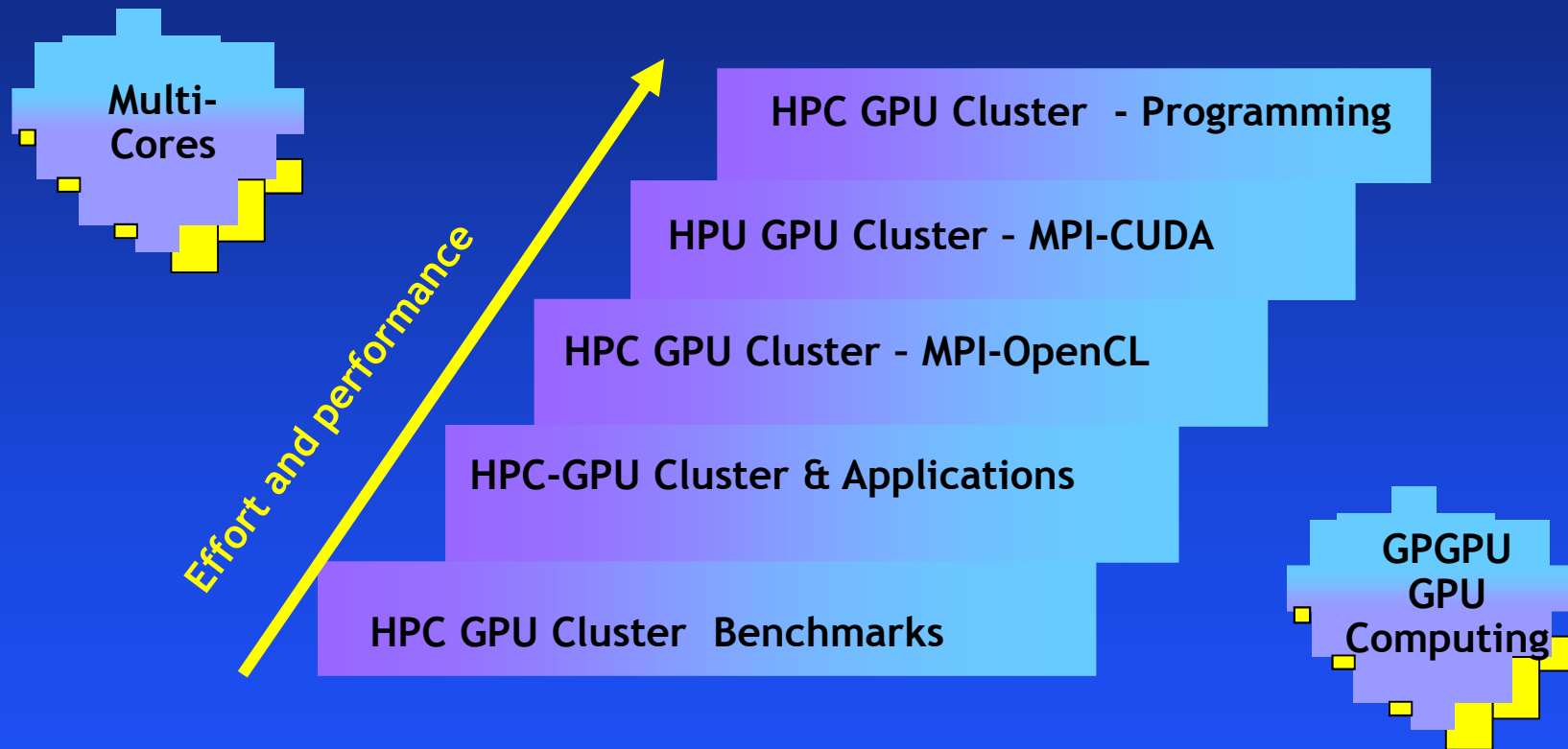


Exposure to Hands-on Session various Platforms

Multi-Cores, GPGPUs-AMD APP Tech – OpenCL , GPU Computing-CUDA

HeMPa-2011 (Mode-2 – HPC GPU Cluster)

Enhance the performance of applications on emerging parallel processing platforms (Multi-Cores, Distributed Shared Memory (PGAS) GPGPUs, GPU Comp.-CUDA, /OpenCL) Hybrid Prog.- HPC GPU Cluster



Exposure to Hands-on Session various Platforms

Multi-Cores, GPGPUs-AMD APP Tech – OpenCL , GPU Computing-CUDA

HeMPa-2011 (Mode-1: Multi-Core)

An overview of Hybrid Adaptive Computing Hardware/ Software - Mixed Programming with Hands-on Session & Keynote talks from Industry/Academic/Res. Develop. Organizations and Demonstration

Hands-on Session : Quad Core Systems (6)

- ❖ Multi-Core: Introduction & Challenges in Applications
- ❖ Multi-Core : An Overview of Architecture (Part -I, & II)
- ❖ Multi-Core:
 - An Overview of Multi-threading - OpenMP (Part -I, II, & III)
 - An Overview of Multi-threading - Intel Threading Building Blocks
 - **An Overview of Multi-threading - Pthreads (Part -I,II,III & IV)**
- ❖ Multi-Core : Tools, Debuggers, Libraries (Part-I, & II)
- ❖ Multi-Core : Tuning & Performance (Part -I, & II)
- ❖ Multi-Core : Prog. Env. & Application & Algorithms Design (Part -I & II)
- ❖ Multi-Core : Programming Environment (MPI 1.0/2.0 Part - I II,III, & IV)
- ❖ Multi-Core : Benchmarks (Part- I, II, & III)

HeMPa-2011 (Mode-1: PGAS)

An overview of Hybrid Adaptive Computing Hardware/ Software - Mixed Programming with Hands-on Session & Keynote talks from Industry/Academic/Res. Develop. Organizations and Demonstration

Hands-on Session : Quad Core Systems (6)

- ❖ An Overview of Distributed Memory Programming, Shared Memory Programming
- ❖ Distributed Shared Memory Programming - Programming Aspects
- ❖ Partitioned Global Address Space – (PGAS) Memory Model
 - Earlier Developments
- ❖ PGAS - Unified Parallel C (UPC) & MPI
- ❖ PGAS - X10 (IBM)
- ❖ PGAS - Global Arrays (GA) & MPI
- ❖ PGAS -Titanium (Java Tech.)
- ❖ PGAS – CAF & MPI
- ❖ PGAS - Chapel (Cray)

HeMPa-2011 (Mode-2: GPGPUs)

An overview of Hybrid Adaptive Computing (HPC GPU Cluster) Hardware/ Software - Mixed Programming with Hands-on Session & Keynote talks from Industry/Academic/Res. Develop. Organizations and Demonstration

Hands-on Session – GPUs / Hybrid Computing Systems (4-6)

- GPUs : An Overview of GPU Computing
- GPUs : NVIDIA – GPU Comp. – CUDA – Fermis
- GPUs : AMD – APP Tech OpenCL
- GPUs : Open Computing Language (OpenCL)
- HPC GPU Cluster Hybrid Computing – Mixed Programming (MPI, OpenMP, Intel TBB, GPU – CUDA)
- HPC GPU Cluster Hybrid Computing – Mixed Programming (MPI, OpenMP, Intel TBB, GPU – OpeCL)

HeMPa-2011 : Hybrid Prog. - HPC GPU Cluster (Hardware/ Software - Mixed Programming)

An overview of Hybrid Adaptive Computing Hardware/ Software - Mixed Programming with Hands-on Session & Keynote talks from Industry/Academic/Res. Develop. Organizations and Demonstration

Sponsors : The IT companies and government organisations partial sponsors for HeMPa-2011. The sponsors provided partial financial assistance, access to their computing systems, use of their software in this technology workshop.



HeMPa-2011 : Hybrid Prog. - HPC GPU Cluster (Hardware/ Software - Mixed Programming)



HeMPa-2011 : Hybrid Prog. - HPC GPU Cluster (Hardware/ Software - Mixed Programming)

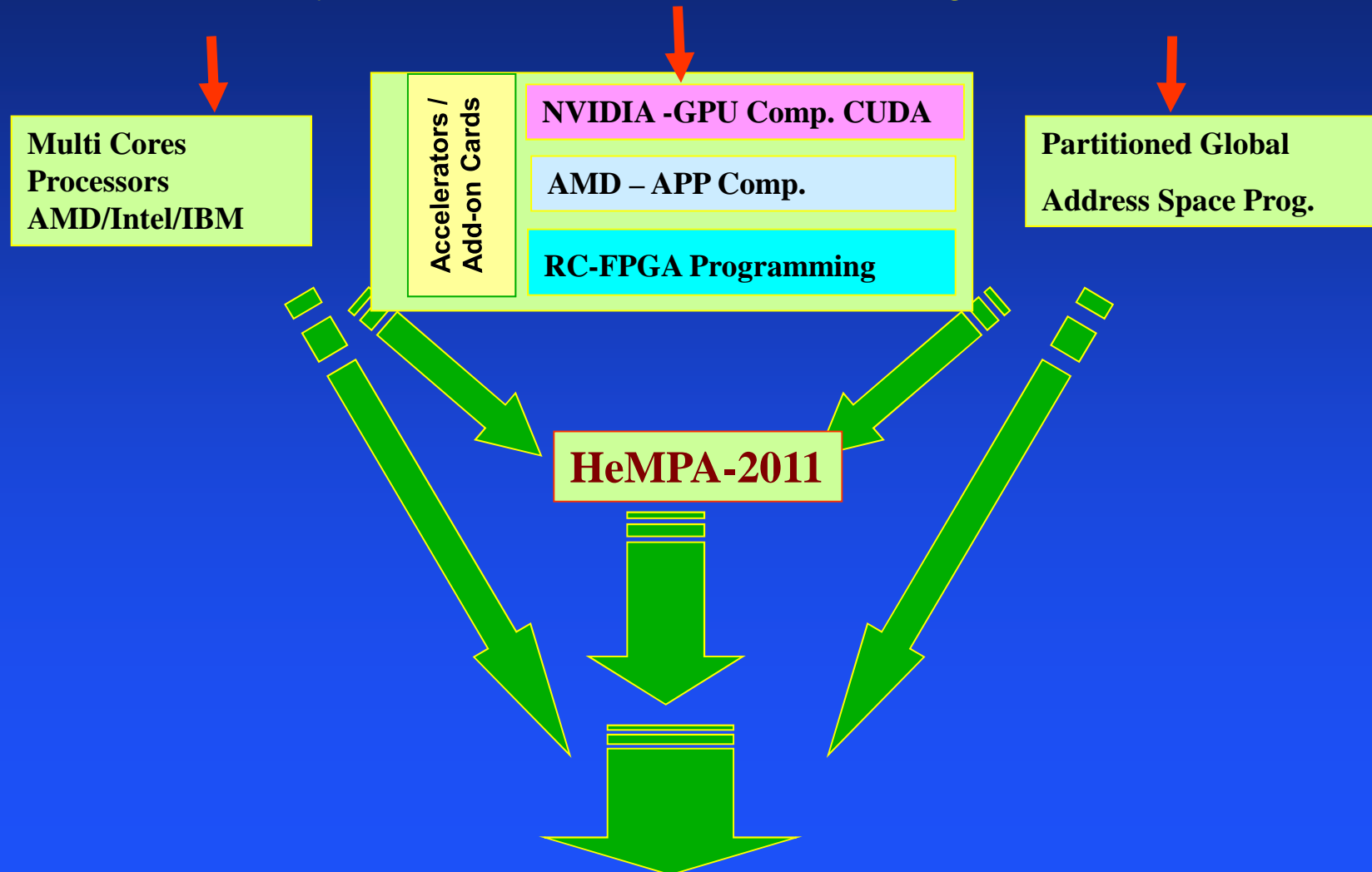
Touch upon Current Trends

HeMPa-2011 Lab : Commodity Components can be used which brings *few* to *Many Teraflops* on your Desk top with Accelerators (GPUs - Number Crunching Horse Power)

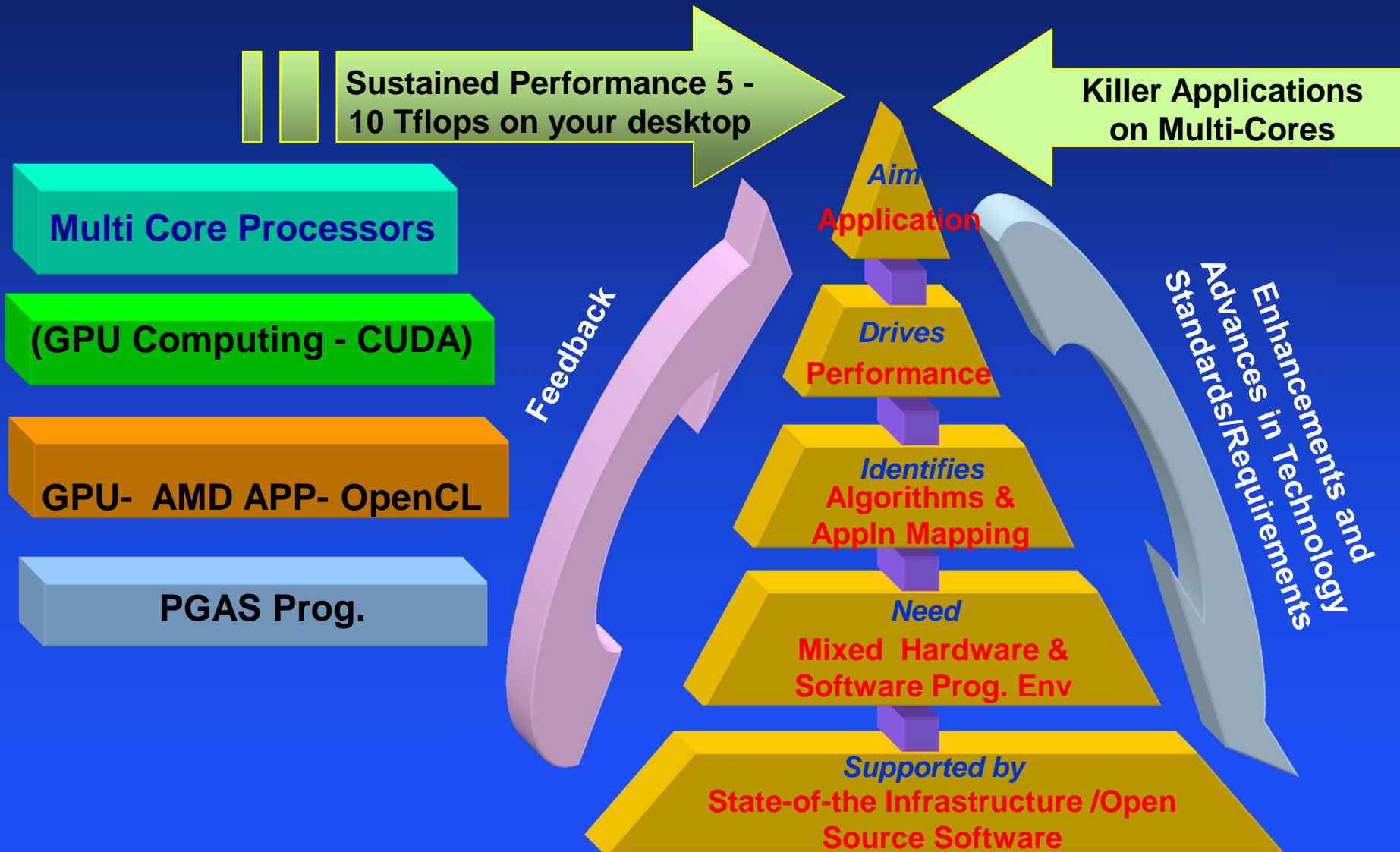
HeMPa-2011 : Open Computing Language (OpenCL)
Hybrid Computing – Mixed Programming

HeMPa-2011

HeMPa-2011 covers an overview of Hybrid Adaptive Computing
Hardware/ Software - Mixed Prog. with Hands-on Session & Keynote
talks from Industry / Academic / Res. Develop. Org. and Demonstration

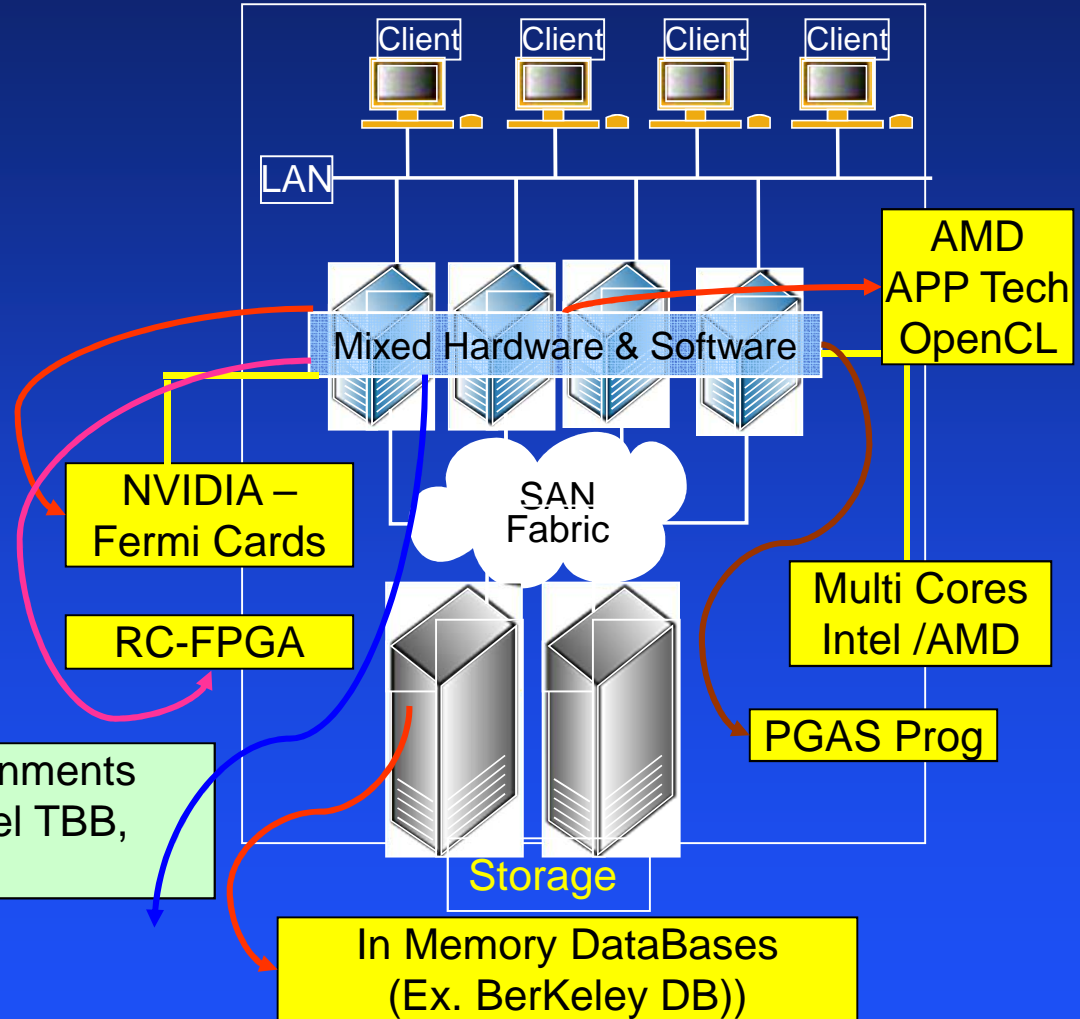


HeMPa-2011 : Hybrid Prog. - HPC GPU Cluster (Hardware/ Software - Mixed Programming)



HeMPa-2011 : Hybrid Prog. - HPC GPU Cluster (Hardware/ Software - Mixed Programming)

- Multi -node hybrid Adaptive Cluster (HPC GPU Cluster) for Hands-on Session
- Efficient Mapping of Algorithms on suitable Architectures
- Economics – Easily Migration & Adoption



HPC Tools and Programming Environments
(OpenCL, CUDA, MPI/OpenMP/ Intel TBB,
RC-FPGA,)

Automatic Parallelizing Compilers & Parallel Debugging & New Programming Paradigms

HeMPa-2011 : Hybrid Prog. - HPC GPU Cluster (Hardware/ Software - Mixed Programming)

HemPa-2011 : Mode 1 - Day 1

- ❖ **An Overview of HeMPa-2011** - Classroom Lectures /Hands-on
- ❖ **Class-room Lectures :**
 - Multi-core Architectures – Hardware and Software
 - Prog. on Multi-Core Processors : Part-I - Pthreads & OpenMP
 - Performance Enhancement through Software Multi-threading
- ❖ **Hands-on Session :** Programming : Pthreads, Open MP, Intel TBB, MPI, Mixed Programming - Performance Issues

HeMPa-2011 : Hybrid Prog. - HPC GPU Cluster (Hardware/ Software - Mixed Programming)

HeMPa-2011 : Mode 1 - Day 1 (Multi-Core)

- ❖ **Class-room Lectures** : An Overview of Prog. on Multi-Core Processors :- Pthreads & OpenMP, Intel Threading Building Blocks (Intel TBB) ,MPI; Performance Enhancement through Software Multi-threading Performance Issues - Memory Allocators & Benchmarks
- ❖ **Key-note Talk (Industry)** : Multi-Cores: An Overview current Trends
Speaker : VCV.Rao C-DAC, Pune & Malladi, Rama K V” Intel , Bengaluru
- ❖ **Invited Talk (Academic)** : An Overview of Message Passing Interface (MPI)
Speaker : Prof. Rajeev Wankar, Dept. of Comp. Sc, UoHYD
- ❖ **Invited Talks** : C-DAC Speakers
- ❖ **Hands-on Session** : Programming (MPI, OpenMP, Intel TBB , Pthreads) Memory Allocators, Scalable I/O Performance; Intel Tools, Benchmarks, Mixed Prog. & Compiler Optimisations

HeMPa-2011 : Hybrid Prog. - HPC GPU Cluster (Hardware/ Software - Mixed Programming)

HeMPa-2011 : Mode 1 - Day 2 (PGAS)

- ❖ **Lecture** : An Overview of Distributed Shared Memory Programming - Programming Aspects ; Partitioned Global Address Space – (PGAS) Memory Model (UPC, X10, Global Arrays, Titanium, CAF, Cray)
- ❖ **Key-note Talk (Academic) : Global Arrays & Topology aware Alg.**
Speaker : “Sudheer Kumar , DMACS , Sri Sathya Sai Inst. of Higher Learning, Prashanti Nilayam, Andhra Pradesh
- ❖ **Key-note Talk (Industry): PGAS- Chapel**
Speaker : Cray
- Key-note Talks (Academia & RD) : PGAS-UPC Speakers** : VCV.Rao (C-DAC) & T Keshav Rao (Dept. of Comp; Sc, NITW)
- ❖ **Hands-on Session** : Programming (MPI, OpenMP, Intel TBB , Pthreads) and PGAS Memory Model

HeMPa-2011 : Hybrid Prog. - HPC GPU Cluster (Hardware/ Software - Mixed Programming)

- ❖ **HeMPa-2011 : Mode 2 - Day 3 (GPGPUs)**
- ❖ **Lecture** : An overview of GPU Comp. / Hands-on Comp. Systems with GPUs – CUDA enabled NVIDIA GPUs /OpenCL
Speaker : Nisha Agarwal, C-DAC, Pune

NVIDIA CUDA Code Competition Announcement

- ❖ **Invited Talk** : An overview of CUDA enabled NVIDIA GPUs Speaker : Nisha Agarwal /VCV.Rao (in collaboration with NVIDIA)
- ❖ **Invited Talk** : Implementing Edge Detection Algorithms on CUDA enabled NVIDIA GPU - **Speaker**: Mr. Raghu Chandra, IIIT-Allhabad
- ❖ **Key-note (Industry)** : NVIDIA - High Performance Comp. based on GPU Comp., **Speakers** : VCV.Rao /Nisha Agarwal
- ❖ **Hands-on Session** : NVIDIA – Fermi – Multi-GPU & – HPC GPU Cluster

HeMPa-2011 : Hybrid Prog. - HPC GPU Cluster (Hardware/ Software - Mixed Programming)

HeMPa-2011 : Mode -2 Day 4 (GPGPUs)

- ❖ **Classroom Lecture** : An overview of GPGPUs AMD-APP Tech. / An overview of Hybrid Computing; Hands-on HPC GPU Cluster
- ❖ **Key-note Talks (INDUSTRY)**: Topic: AMD APP – OpenCL by Jayaprakash Velu, AMD Bengaluru
- ❖ **Key-note Talks (INDUSTRY)**: Topic: AMD APP – OpenCL by G.E.Naganna, VizExperts (AMD), Bengaluru

AMD-APP Code Competition Announcement

- ❖ **Key-note Talk (Academic)**: GPU assisted Numerical computation of stochastic dynamics – Application trends – Optimization of Power and Speed by Prof. Soumyendu Raha, SERC, IISc, Bangalore
- ❖ **Invited Talk** : Applications – Implementation of String Search Algorithms
Speaker : Samrit Maity, C-DAC
- ❖ **Hands-on Session : AMD-APP Tech.** AMD ATI Fire Stream 9250 /9350 & HPC GPU Cluster - GPUs Lab

HeMPa-2011 : Hybrid Prog. - HPC GPU Cluster (Hardware/ Software - Mixed Programming)

HeMPa-2011 : Mode -2 Day 4-5 (GPGPUs)

- ❖ Invited Lecture : :An Overview of AMD Fusion : Programming and Performance Issues by VCV.Rao, C-DAC, Pune & Jayaprakash Velu, AMD Bengaluru)
- ❖ Classroom Lecture Topic: An Overview OpenCL Code Walk-through on HPC GPU Cluster – Prog, on host-CPU and device-GPU – Nisha /Sonia
- ❖ Key-note Talks (INDUSTRY): Topic: Tuning & Performance of OpenCL Prog. on AMD GPUs by G.E.Naganna, / Naresh Reddy VizExperts (AMD), Bengaluru
- ❖ Key-note Talk (Academic): Data Integrity & Security algorithms on HPC GPU Cluster; by: Prof. Pallav Baruah, DMACS, Sri Sathya Sai Institute of Higher Learning, SSSU, Prashanti Nilyam, A.PI
- ❖ Hands-on Session : AMD-APP TechAMD ATI 9230 9240 /AMD FirePro V5900 /AMD FirePro V7900 – HPC GPU Cluster

HeMPa-2011 : Hybrid Prog. - HPC GPU Cluster (Hardware/ Software - Mixed Programming)

HeMPa-2011 : Mode -2 Day 5 (HPC-GPU Cluster with AMD-APP GPUs

- ❖ **Key-note Talks (INDUSTRY):** Topic: AMD- Fusion – Prog. & Performance Issues - VCV.Rao, C-DAC, Pune & Jayaprakash Velu, AMD, Bengaluru
- ❖ **Key-note Talks (INDUSTRY):** Topic: Tuning and Performance of OpenCL Programs on AMD based on OpenCL by G.E.Naganna, VizExperts (AMD), Bengaluru
- ❖ **Keynote Talk (Academic):** Topic : Performance of Security of algorithms on HPC GPGPU Cluster
Speaker: Dr. Pallav Baruah, Sri Sathya Sai University, Anantapur, A.P.
- ❖ **Hands-on Session :** Laboratory Session using different programming on host-cpu and OpenCL Device GPU.

AMD ATI 9230 9240 /AMD FirePro V5900 /AMD FirePro V7900

- HPC GPU Cluster (NVIDIA /AMD GPUs)

Thank you