

# C-DAC & IIT Madras Five-Day Technology Workshop Programme

*ON*

## Optimizing Performance of Parallel Programs on Emerging Multi-Core Processors and GPUs



**OPECG-2009**



**Venue : Indian Institute of Technology Madras**

**Dates : June 1-5, 2009**

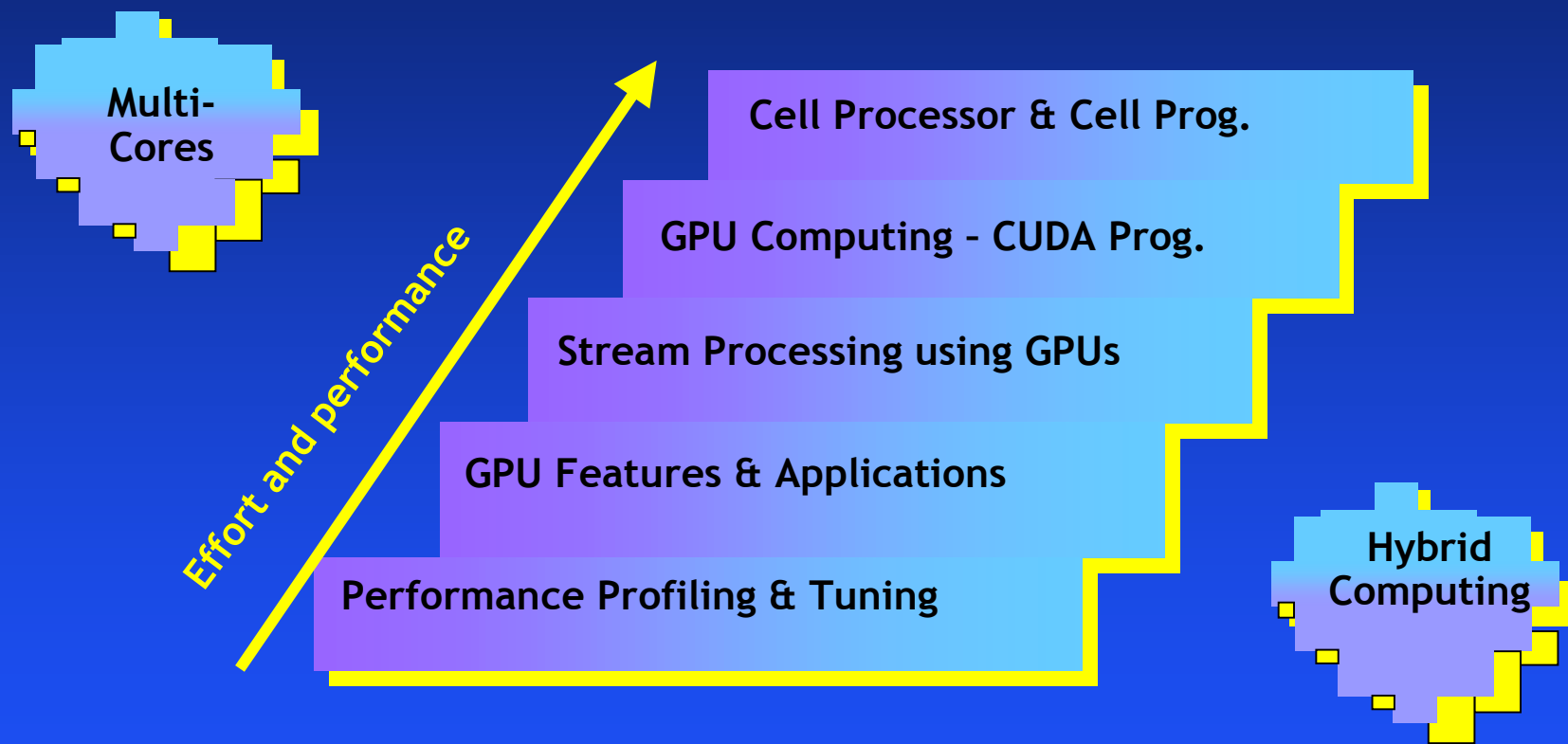


# OPECG 2009

- ❖ OPECG-2009 is 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, GPU Computing-CUDA Programming, GPGPUs – Stream computing)
  - Use Software Development tools (Intel) 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

# OPECG-2009

Enhance the performance of applications on emerging parallel processing platforms (Multi-Cores, GPGPUs, GPU Computing-CUDA,) as well as on Hybrid Adaptive Computing Hardware/ Software - Mixed Programming



Exposure to Hands-on Session various Platforms

Multi-Cores, GPGPUs-Stream computing, GPU Computing-CUDA

# OPECG-2009

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 - Pthreads (Part -I,II,III & IV)
  - An Overview of Multi-threading - OpenMP (Part -I, II, & III)
  - An Overview of Multi-threading - Intel Threading Building Blocks
- ❖ 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)

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

- GPUs : An Overview of GPU Computing
- GPUs : NVIDIA – GPU Computing – CUDA - Tesla 1060 System
- GPUs : AMD - Stream Computing
- GPUs : Open Computing Language (OpenCL)
- Hybrid Computing – Mixed Programming (MPI, Intel TBB, GPU)

# OPECG-2009

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 OPECG-2009. The sponsors provided partial financial assistance, access to their computing systems, use of their software in this technology workshop.



# OPECG-2009 : Hybrid Adaptive Computing (Hardware/ Software - Mixed Programming)



**OPECG-2009 : Hybrid Adaptive Computing  
(Hardware/ Software - Mixed Programming)**

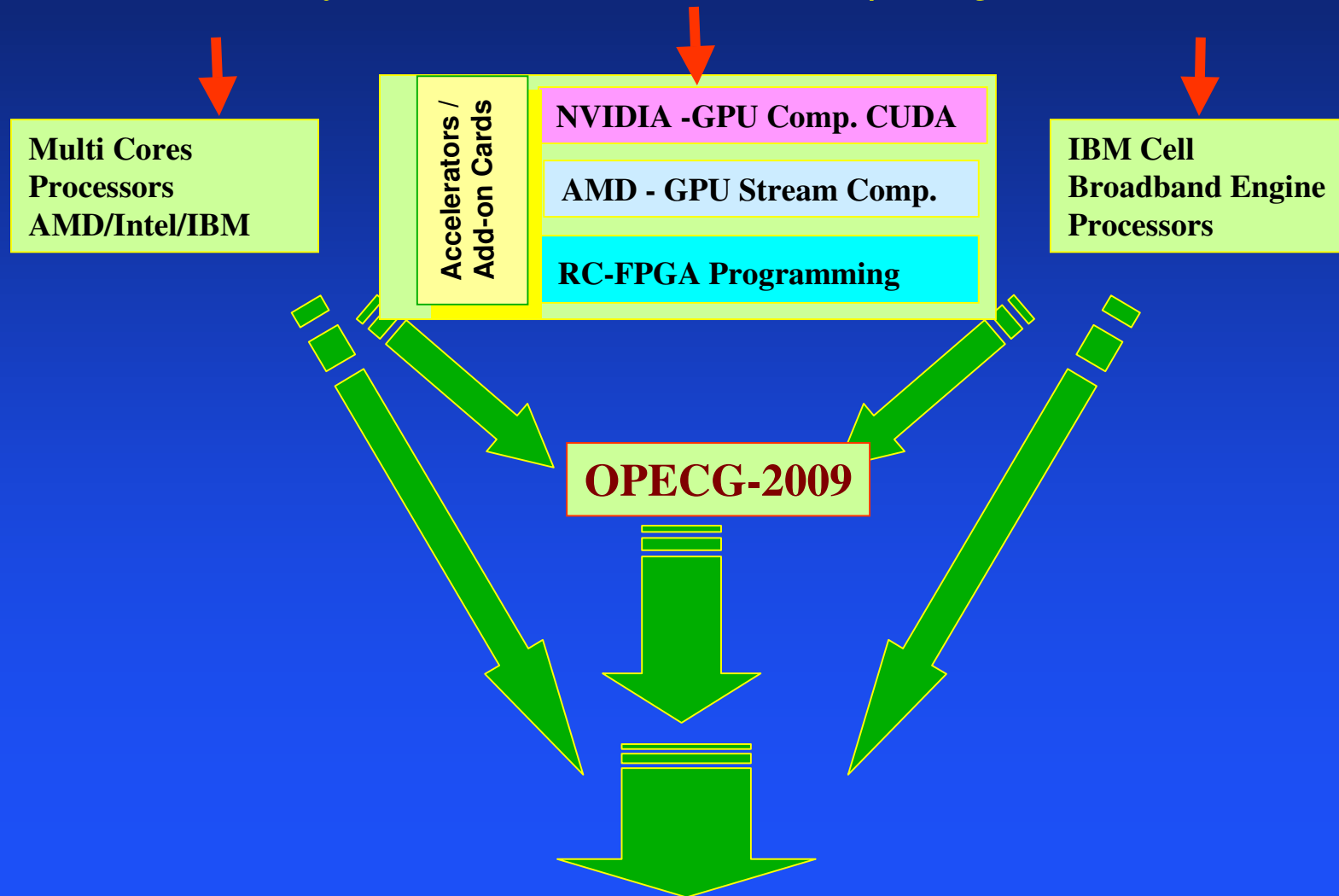
**Touch upon Current Trends**

**OPECG-2009 Lab** : Commodity Components can be used which brings *few* to *Many Teraflops* on your Desk top with Accelerators (GPUs - Number crunching Horse Power)

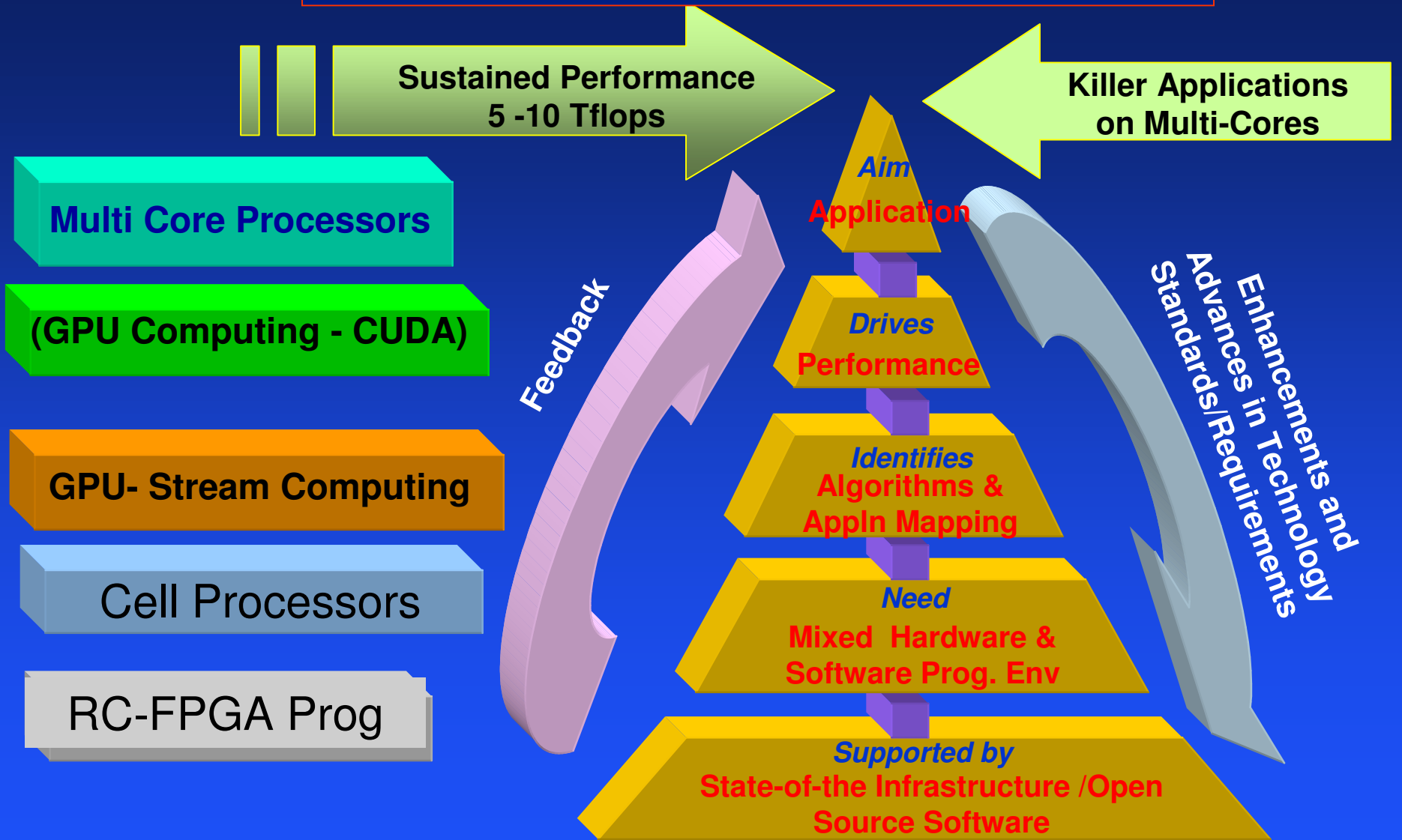
**OPECG-2009** : Programming Transactional Memory Efforts  
Open Computing Language (OpenCL)  
Hybrid Computing – Mixed Programming

# OPECG-2009

OPECG-2009 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

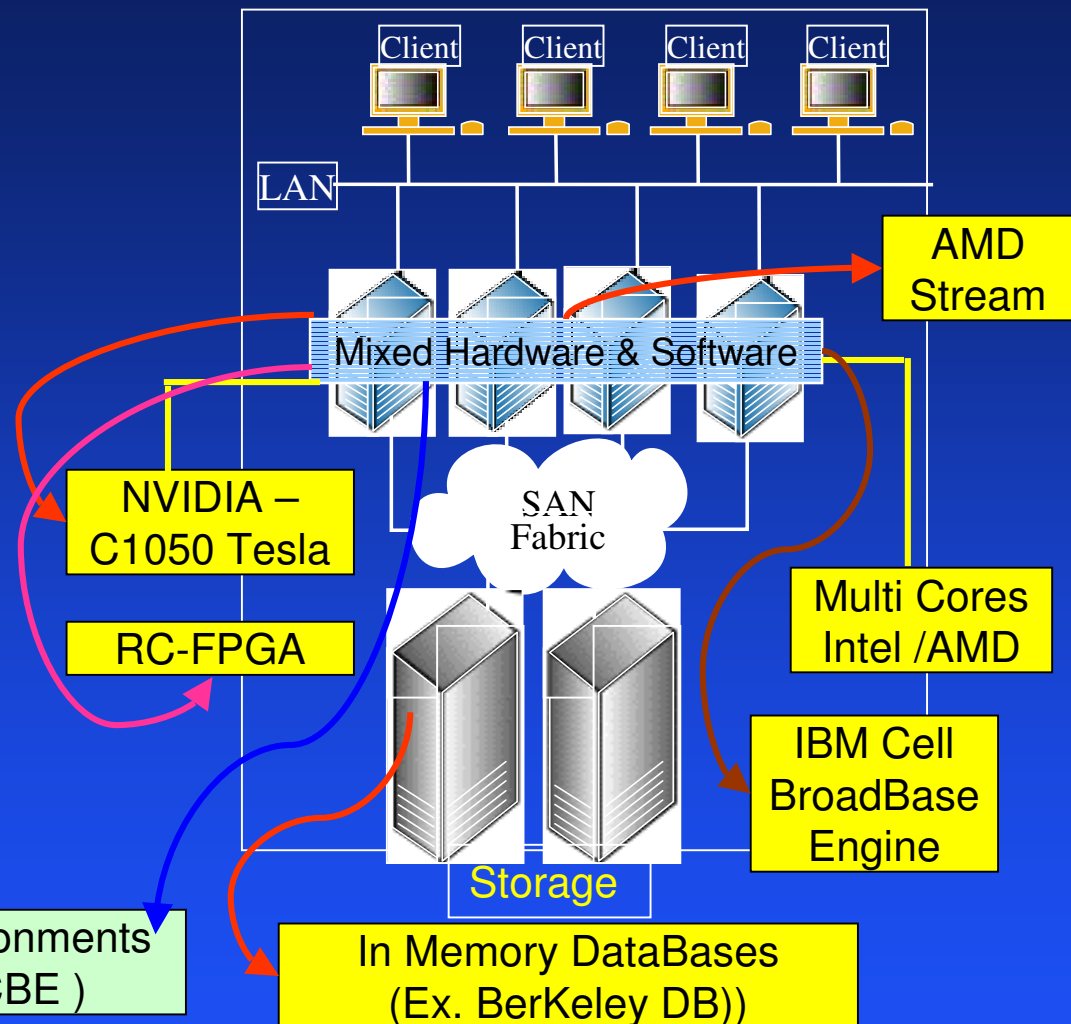


# OPECG-2009 : Hybrid Adaptive Computing (Hardware/ Software - Mixed Programming)



## OPECG-2009 : Hybrid Adaptive Computing (Hardware/ Software - Mixed Programming)

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



HPC Tools and Programming Environments  
(CUDA, Intel TBB, FPGA, IBM CBE )

Automatic Parallelizing Compilers & Parallel Debugging & New Programming Paradigms

**OPECG-2009 : Hybrid Adaptive Computing  
(Hardware/ Software - Mixed Programming)**

**OPECG-2009 : Mode 1 - Day 1**

- ❖ **An Overview of OPECG-2009** - Classroom Lectures /Hands-on
- ❖ **Class-room Lectures :**
  - An Overview of 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 & Performance Issues

**OPECG-2009 : Hybrid Adaptive Computing  
(Hardware / Software - Mixed Programming)**

**OPECG-2009 : Mode 1 - Day 2**

- ❖ Class-room Lectures :
  - Prog. on Multi-Core Processors : Part-I - Pthreads & OpenMP
  - Performance Enhancement through Software Multi-threading
  - Prog. on Multi-Core Processors : Part-I - Performance Issues - Memory Allocators
  - An Overview of Intel Threading Building Blocks (Intel TBB)
  
- ❖ Key-note Talk : Tuning & Performance - Tools on Multi-Core Processors; Speaker : Rama Kishan V, Intel
  
- ❖ Hands-on Session : Programming (MPI, OpenMP, Pthreads) Memory Allocators, Scalable I/O Performance; Intel Tools

**OPECG-2009 : Hybrid Adaptive Computing  
(Hardware/ Software - Mixed Programming)**

**OPECG-2009 : Mode 1 - Day 3**

- ❖ Class-room Lectures :
  - Programming on Multi -Core Processors : Part-I - Pthreads *versus* OpenMP *versus* Intel TBB
  - Prog. on Multi-Core Processors : MPI / Threading
  - Measuring Performance on Multi-Cores - Benchmarks
  - An Overview of Transactional Memory
- ❖ Keynote Talk (ACADEMIC):**Topic** : Performance of Compression Algorithms on Hybrid Computing Platforms (Multi-cores, GPUs / Cell Proc.)  
**Speaker:** Dr. Pallav Baruah, Sri Sathya Sai University, Anantapur, A.P.
- ❖ Key-note Talk : Fault Power Aware Speed up and Algorithm Based Transient Fault Tolerance in CMPs  
**Speaker:** Dr.Soumyendu Raha, SERC, IISc, Bangalore.
- ❖ Hands-on Session : Programming : Memory Allocators, Scalable I/O Performance - Intel Tools

## OPECG-2009 : Hybrid Adaptive Computing (Hardware/ Software - Mixed Programming)

### OPECG-2009 : Mode 2 - Day 4

- ❖ Class-room Lectures : An overview of GPU Computing / Hands-on Computing Systems with GPUs
- ❖ **Key-note Talk** : Implementing Regular and Irregular Operations on the GPU; **Speaker**: Prof. P.Narayanan, IIT, Hyderabad
- ❖ **Industry** : NVIDIA - High Performance Comp. based on GPGPU/ GPU Computing **Speaker**: Sanjiv Satoor, & Mr.Phani Kumar, NVIDIA
- ❖ **Hands-on Session** :
  - NVIDIA -Tesla C1060: 1 no. GeForce Cards : 3 no.
  - NVIDIA - Tesla S1070: System with 4 GPU's (Cluster)

## OPECG-2009 : Hybrid Adaptive Computing (Hardware/ Software - Mixed Programming)

### OPECG-2009 : Mode -2 Day 5

- ❖ Class-room Lectures : An overview of GPGPUs Stream Computing / An overview of Hybrid Computing; Hands-on Hybrid computing with GPUs
- ❖ Key-note Talk (INDUSTRY): Topic: AMD Stream Computing (*yet to Confirm*)
- ❖ Invited Talk : An overview of OpenCL /OpenGL computing Trends
- ❖ Key-note Talk (R&D): Topic: Performance Issues- Re-Configurable Comp. FPGA Prog; Speaker: Yogindra Abhyankar, C-DAC (*yet to Confirm*)
- ❖ Hands-on Session : AMD ATI Fire Stream 9250:1 no.
  - NVIDIA – Tesla C1060; Cluster Tesla S1060
  - Hybrid Computing – Multi-Core Processors, GPUs Lab

**Thank you**