hyPACK-2013

Four-Days Technology Workshop *on*

Hybrid Computing - Coprocessors & Accelerators -

Power-Aware Computing & Performance of Application Kernels

Jointly Organized by

Centre for Development of Advanced Computing (C-DAC), Pune

Centre for Modelling & Simulation (CMSD), HPC Facility, University of Hyderabad,

Venue : CMSD, University of Hyderabad, Hyderabad

Dates : October 15 (Tuesday) – October 18 (Friday)

hyPACK-2013 : A Suite of programs on Power-aware Comp. & Performance of Apps.

The list of programs are developed based on NVML CUDA enabled NVIDIA GPU, using Power-off meters as external devices, NVIDIA CUDA ARM Processor tech. – Cram DevKit and Multi-Core ARM Processor Systems. The information of these codes are publicly available in NVIDIA Tech. documents, INTEL technical documents, ADM technical documents, ARM Processor Boston Systems, Texas Instruments DSP Processors, other research papers, technical documents, NVIDIA GPU Conferences, Workshops, Notes Material and especially recent webinars. This technical formation has been partially incorporated.

The in-house developed portal is used to display the power readings of Power-off meter in a tabular form, results in graph files and NVIDIA – NVML library calls output is processed through portal.

List of Modules – Power-aware Computing – Performance of Application Kernels

Module 1 : Using External Power-off Meter – Applications on Multi-Core Processor Systems
Module 2 : Using NVIDIA – NVML Library calls – To measure power Consumption our of complete GPU operations for Numerical Linear Algebra (NLA) & Application Kernels
Module 3 : NVIDIA CUDA enabled ARM Processor – carma DevKit - CUDA Programs on Numerical Computations (Dense Matrix Computations) & Application Kernels - OpenCL
Module 4 : Measure Power Consumption & Performance of Application Kernels on ARM Multi-Core Processor Systems – based on Shared Memory and Message Passing Programming
Module 5 : Measure total power Consumption of Hybrid Computing Platform with co-processors and Accelerators for Scientific Computing Kernels based on OpenCL /CUDA

1. **Module 1 : Using external Power-off Meter–Applications on Multi-core Processor Systems**
   - 1.1. Measure Power Consumption and Performance of Numerical Linear Algebra Kernels (DGEMM Solver and User developed Code with & with-out compiler Optimizations
   - 1.2. Measure Power Consumption and Performance of Numerical Linear Algebra code (Iterative Solver for Matrix System of Equations based on OpenMP implementation
   - 1.3. Measure Power Consumption and Performance of Partial Differential Equations (PDE) solver using Finite Difference Method (FDM) in an OpenMP environment
2. **Module -2: Using NVIDIA – NVML Lib. calls – To measure power Consumption out of GPU operations for Numerical Linear Algebra (NLA) & Application Kernels**
   - 2.1. Measure Power Consumption for basic GPU operations (Device Query, Driver, Data from Host-To-Device (H2D), Device-To-Host (D2H), Device-To-Host (D2D)
   - 2.2. Measure Power Consumption and Performance of Numerical Linear Algebra Kernels (CUBLAS Library and User developed CUDA Code with Compiler Optimizations
   - 2.3. Measure Power Consumption and Performance of Numerical Linear Algebra Code based on different memory types of CUDA enabled NVIDIA GPUs
   - 2.4. Measure Power Consumption and Performance of Numerical Linear Algebra Code based on different memory types of NVIDIA GPUs using OpenCL Environment
   - 2.5. Measure Power Consumption and Performance of Partial Differential Equations (PDE using Finite Difference Method (FDM) in CUDA on a Single GPU
   - 2.6. Measure Power Consumption and Performance of Partial Differential Equations on Multi GPU Accelerators in CUDA environment
   - 2.7. Measure Power Consumption and Performance of String Search Algorithms in an OpenCL environment
3. **Module 3 : NVIDIA CUDA enabled ARM Processor – carma DevKit - on Numerical Computations (Dense Matrix Computations) & Application Kernels – OpenCL**
   - 3.1. Measure Power Consumption and Performance of Numerical Linear Algebra Code based on different memory types of CUDA enabled NVIDIA GPUs
   - 3.2. Measure Power Consumption and Performance of Partial Differential Equation (PDE)) solver using Finite Difference Method (FDM) in CUDA
   - 3.3. Measure Power Consumption and Performance of String Search Algorithms in an OpenCL environment

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4. **Module 4 : Measure Power Consumption & Performance of Application Kernels on ARM Multi-Core Processor Systems – based on Shared Memory Programming**
   - 4.1. Measure Power Consumption and Performance of Numerical Linear Algebra (DGEMM Solver and User developed Code with & with-out compiler Optimizations
   - 4.2. Measure Power Consumption and Performance of Numerical Linear Algebra Code (Iterative Solver for Matrix System of Linear Eqs. based on OpenMP framework)
5. **Module 5 : Measure total power Consumption of Hybrid Computing Platforms with co-processors & Accelerators for Application Kernels based on MPI – CUDA/OpenCL**
   - 5.1. Measure Power Consumption and Performance of Numerical Linear Algebra Kernels and PDE Solver in an MPI and CUDA /OpenCL Environment