parcomp-NML-2004

Technical Programme *for*
Workshop on Practical aspects of Parallel Computing

Organized by
Centre for Development of Advanced Computing
at
National Metallurgical Laboratory (NML) , Jamshedpur

October 12-14, 2004

Day 1 : October 12, 2004 (Tuesday)

Time (Hrs)	Activity
0930 ~ 1000	**Inauguration and Overview of Workshop:** Summary of Parallel Computing workshop
1000 ~1100	**An overview of Parallel Computing and PARAM at NML:** Introduction to Parallel Computing, Why is Parallel Programming difficult? Scope of Parallel Computing, Application requirements, An overview of Parallel Computing -SIMD, MIMD Machines, Cluster Computing, Basic Communication Operations, An overview of PARAM Cluster at NML, Parallel Programming Environment on PARAM Cluster
1100 Hrs ~1115 Hrs Tea break	
1115 ~1200	**Parallel Programming Paradigms and Programming Models:** An overview of Parallel Programming Paradigms, Programmability Issues, Programming Models; Implicit Parallelism – Role of Compilers, Explicit Parallelism – Message Passing Programming (MPI); Shared Memory Programming (OpenMP, Pthreads); Data Parallel Programming (f90/f95/HPF)
1200~1245	**Explicit Parallelism**: **Message Passing Programming (MPI)**: Introduction, MPI Basics, features of MPI, Point-to-Point and Collective Communication library calls, Simple MPI programs
1300 Hrs ~ 1400 Hrs: Lunch Break; 1630 Hrs ~ 1645 Hrs: Tea Break	
1400~1830	**Hands-on Session on PARAM cluster:** Performance of selective FORTRAN/c programs on *uni-processor using compiler optimization features and code restructuring techniques on PARAM Cluster. Performance of parallel programs, Simple MPI Parallel programs using point-to-point and Collective Communications Library Calls*

Day 2: October 13, 2004 (Wednesday)

Time (Hrs)	Activity
0900~0945	**Performance – Using Compiler Techniques for Sequential /Parallel Codes:** Basic Compiler Techniques: What an Optimizing Compiler does to get maximum performance of your code? Compiler role in loop optimization techniques; Single processor optimization techniques - Optimization techniques to ease the memory access; Summary of performance of simple programs with/without compiler optimizations on PARAM Clusters
1000~1100	**Explicit Parallelism: Data Parallel Programming (f90/f95/HPF):** The Data-Parallel Model; The Fortran 90 Approach (Parallel Array Operations); High Performance Fortran (Data Mapping in HPF, Support for Data Parallelism); Fortran 95 Enhancements - Performance Issues on PARAM
1100 Hrs ~1115 Hrs: Tea break	
1115~1200	**Explicit Parallelism: Shared Memory Programming (OpenMP) :** (An Overview of Shared Memory Programming Model, OpenMP Constructs, Parallel for Loops, Critical Sections; Performance Improvements of Parallel programs, Examples, Advanced Features of OpenMP)
1200~1300	**Performance Metrics, Scalability and Speed Up Analysis: Types** of Performance requirements, Basic Performance and Workload Speed Metrics; Performance of Parallel Computers-Parallelism and interaction overheads; Overhead Quantification and measurement methods; Performance of parallel programs; Scalability and Theoretical Speed-up Analysis
1300 Hrs ~ 1400 Hrs: Lunch Break; 1630 Hrs ~ 1645 Hrs: Tea Break	
1400~1800	**Hands-on Session:** *Simple MPI Parallel programs, Performance of serial programs* for matrix computations using math libraries BLAS; *Parallel MPI Fortran 77/C/f90 programs* on vector-vector, matrix-vector and matrix-matrix multiplication algorithms; Solution of matrix system of linear equations by Direct/Iterative Methods*; Parallel Programs* using different MPI library calls; Performance issues of parallel programs on PARAM Cluster

Day 3: October 14, 2004 (Thursday)

Time (Hrs)	Activity
0900~1000	**Performance Visualization tools**: Performance Visualization tools for Parallel Programs; Demonstration of behavior of programs using Visualization tools on PARAM Cluster; MPI's Profiling Interface; Upshot – Performance Analysis Tools; Parallel Debuggers on PARAM Cluster
1000~1100	**Explicit Parallelism: Advanced Features of MPI and OpenMP :** Advanced Features of MPI : MPI advanced point-to-point communication; MPI Communication modes; MPI Collective Communication and Computations; MPI Derived Data types; Grouping data for Communication, Communication and Topologies; Cost of Message Passing Operations, MPI-2 Features
1100 Hrs ~1115 Hrs Tea break	
1115~1230	**An overview of Application and System Benchmarks**: Benchmarks Classification; Micro Benchmarks (LINPACK, LMBENCH, STREAM, P-COMS); Macro Benchmarks (NAS, PARKBENCH, STAP, SPEC, TCP Benchmarks); Performance Issues on PARAM Cluster
1230~1300	Open Session, Feedback and Conclusions
Lunch Break 1300 Hrs ~ 1400 Hrs; Tea Break: 1630 Hrs ~ 1645 Hrs	
1500 ~ 1800	**Hands-on Session:** *Simple MPI Parallel programs, Performance of serial programs* for matrix computations using math libraries BLAS; *Parallel MPI Fortran 77/C/f90 programs* on vector-vector, matrix-vector and matrix-matrix multiplication algorithms; Solution of matrix system of linear equations by Direct/Iterative Methods*; Performance of parallel programs* using combination of and MPI and OpenMP; *Demonstration of MPI parallel programs* using parallel visualization tools; *Demonstration of MPI parallel programs* to measure communication overheads using C-DAC developed P-COMS on PARAM Cluster; *Demonstration of Performance for selective application and system benchmarks (*NAS, ScaLAPACK, LINPACK) on PARAM Cluster