Fall 2005, Prof. Kai Hwang, University of Southern California

EE 657: Parallel and Distributed Computing

Class Hours: **Tu. Th. 2 – 3 : 20 pm ,** Class room **OHE 138**

Class No. 048-34098 R (Campus Students), 034-34099R (Remote Students)

(The class is still open for enrollment in Fall 2005, limited to 30 campus students and 10 remote students.
Contact Prof. Hwang at kaihwang@usc.edu , if you have any question to add into the class)

Course Description: *(Updated 2005 under a new title)*

The scope of this course has been significantly widened from *Parallel Processing* to *Parallel and Distributed Computing*, reflecting state of the art in supercomputing and networked computing. Professor Hwang will cover scalable multiprocessors, multicomputer clusters, Grid computing technologies, latency tolerance and multithreading, message passing and middleware, parallel programming, distributed supercomputing, Peer-to-Peer, and Grid applications.

Course Outline: *(Each topic roughly 2 weeks)*

1. **Shared-Memory Multiprocessor Architecture:**
   Symmetric MultiProcessor (SMP), CC-NUMA, and Distributed Shared Memory (DSM)
2. **Message-Passing Multicomputer Clusters:**
   PC clusters, workstation clusters, server farms, cluster of SMPs, availability support, single-system image, job management in clusters
3. **Grid Computing Infrastructure and Technologies:**
   Grid technologies, major Grid Projects, Globus, GridSim. Condor-G, Nimrod, GridSec, etc.
4. **Parallel Programming Models and Software Tools:**
   Shared-variable, message-passing, support for collective communication, Fast MPI, LAM, OpenMP, MPI, PVM, Condor, LSF, middleware, etc.
5. **Latency Tolerance and Multiprocessing Techniques:**
   Data pre-fetching, distributed coherent caches, latency hiding, Thread-level parallelism (TLP), etc.
6. **Cluster and Grid Computing Techniques and Applications:**
   SMP clusters, storage-area networks, distributed Supercomputing, e-Science, Business Grids, etc.
7. **Emerging New Technologies and Research Frontiers:**
   Grid and P2P Services, Wireless Grids, Network Security, Selfish Grids, and Trusted Computing, etc

Prerequisite: EE 557 or equivalent course approved by the instructor

Textbooks: *(Primarily use of lecture notes, PPT slides, and selected papers. Listed below are 3 references)*

1. K. Hwang and Z. Xu: ***Scalable Parallel Computing,*** McGraw-Hill, 1998, ISBN: 0-07-031798-4
2. F. Berman, G. Fox, and T. Hey (Editors), ***Grid Computing: Making The Global Infrastructure a Reality,*** John Wiley and Sons, 2003, ISBN: 0-470-85319-0
3. Foster and C. Kesselman (Editors), ***The GRID 2: Blueprint for New Computing Infrastructure***, Second Edition, Morgan Kaufmann, 2004, ISBN 1-55860-933-4

Grading Policy: *(Hard and creative work pays off eventually)*

1. **Selected Paper Reading and Evaluation (24 %) :** *Study recent papers from IEEE/ACM Conferences (IPDPS, ICDCS, HPDC, CCGrid, Cluster, SC, Infocom, etc) and major IEEE/ACM Journals or Magazines (JPDC, TPDS, TC, JGP, Internet Computing, ToN, etc.). The purpose is to inspire your own creative work. Students are required to submit individual study reports in every 3 weeks, two before and one after the mid-term exam.*
2. **Mid-term Written Exam (36 %):** *Test on all material covered up to the 10-th week in early November.*
3. **Final Project Report (30 %) and Presentation (10 %):** *The final project is a team effort on selected research topics, 2 – 3 students per team depending on the size of class. Both analytical studies and simulation experiments are encouraged on scalable multiprocessors, large cluster systems, and Grid computing applications. A high-quality technical report and formal project presentation are required for final evaluation or publication assessment.*