Course Description:

This course covers the architecture and enabling technologies of parallel and distributed computing systems and their innovative applications. We will cover scalable multiprocessors, distributed clusters, P2P networks, computational Grids, virtual machines, and Internet Clouds. Case studies include IBM BlueGene/L, Google search-engine, TeraGrid, e-Science, DataGrid, Gnutella, BitTorrent, content-delivery networks, VM Monitors, IBM BlueCloud, Amazon Elastic Clouds, Google Clouds, etc. The course aims to acquaint Master and Ph.D. students in computer science, electrical and computer engineering with state-of-the-art supercomputers and distributed computing systems for high-performance computing, e-commerce, and web-scale Internet applications.

Course Outline:

1. Advanced Processors and Interconnects (3 - 4 lectures)
   Multicore Processors and High-bandwidth Networks
2. Scalable Multiprocessors and Multicomputers (3 - 4 lectures)
   Distributed CC-NUMA and cluster Scalability.
3. Machine Virtualization for Distributed Computing (4 lectures)
   CPU, Memory, I/O, and System Virtualization.
4. Physical and Virtual Clusters: (4-5 lectures)
   Server clusters, high availability, and Disaster Recovery
5. Peer-to-Peer Computing Systems: (5 lectures)
   P2P systems, Overlay networks, and Content Distribution.
6. Computational Grids and Applications (2 - 3 lectures)
   National or global computing Grids and Applications
7. Internet Cloud Computing Platforms (4 - 5 lectures)
   Upgraded Web services and Elastic Supercomputing.

Prerequisite: EE 557 or equivalent background approved by the Instructor

Textbooks:


Grading Policy and Class Procedure:

1. The course work consists of three parts:
   - Survey Study Report (25%) due in the 7th week
   - Open Book/Note Mid-Term Exam (40%) to be scheduled at the 10th week
   - Final Research Project (Report/Presentation) (35%) due and scheduled at final week.

2. Depending on the size of the class, Survey Project and Final Project could be assigned either individually or two students to form a team. All project topics and team formation must be approved by the instructor at within the first two weeks of class.

3. Sample projects pursued in Spring 2009 include: multi-core microprocessors, high-bandwidth networks, physical and virtual clusters, virtual machine migration, disaster recovery, P2P networks, computational grids, network security, cloud computing platforms, datacenter architecture, data and copyright protection, reputation systems, trust management, and innovative Internet applications, etc.