

CPET 590 Topics in Cloud Computing Technologies
A Specialty Course
for
Purdue University's M.S. in Technology:
Information Technology/Advanced Computer Apps Track
Spring 2017

Course Description:

This course provides a detailed examination of distributed and cloud computing systems, enabling technologies and infrastructures; cloud architectures, interoperability, and standards; cloud computing service models, and use cases; enterprise, business, and government cloud strategies for optimizing computing resources.

Students are introduced to the concepts and issues of cloud computing and service models (IaaS, PaaS, and SaaS), service-oriented architectures (SOA), lease-or-buy evaluation and trade-off decision models, investing strategies and sustainable IT development; cloud computing programming and software environments, cloud applications in different industry sectors, and open issues including security, legal, ethical, and public policy.

The students are expected to study and present research papers and/or case studies from recent literature, to participate in class discussion actively, and complete a team-based, hands-on cloud application project with oral presentation and demonstration.

Instructor Information

Paul I-Hai Lin, Professor of Electrical and Computer Engineering Technology
Department of Computer, Electrical, and Information Technology
College of Engineering, Technology, and Computer Science
Indiana University-Purdue University Fort Wayne
2101 Coliseum Blvd E, Fort Wayne, IN 46805
Office: ET 205C Email: lin@ipfw.edu

Office Hours:

** Monday 1:00-3:00 PM, 6:00-7:00 PM
** Tuesday 11:00-12:00 Noon, 5:00-6:00 PM
** Wednesday 1:00-3:00 PM
** Thursday 11:00-12:00 Noon

Course Web site: <http://www.etcs.ipfw.edu/~lin>

Course Outcomes

Upon successful completion of this course, students will be expected to be able to

- 1) Be familiar with contemporary computing technologies: modern computing system hardware and software and technology trends, computer clusters, virtualization, data centers, service-oriented architectures (SOA), scalable distributed computing systems and services, cloud computing and business models, cloud security, networking traffic and management, other cloud-based IT technologies and applications.
- 2) Be familiar with IT project management techniques for private, public, and/or hybrid cloud computing projects including IaaS (infrastructure as a Service), SaaS (Software as a Service), PaaS (Platform as a Service) for delivering enterprise applications, platform or compute and storage cloud based "pas-as-you-go" services.
- 3) Apply proper methods for assessing the performance, total cost of ownership, the cloud computing services for enterprise and business organization.

- 4) Propose, design, document, implement, test cloud computing technology projects.
- 5) Prepare reports and make presentations for cloud computing projects
- 6) Develop critical analysis and strategic decision skills needed in management of cloud computing-based IT technologies

Disabilities Statement: If you have a disability and need assistance, special arrangements can be made to accommodate most needs. Contact the Director of Services for Students with Disabilities (Walb, room 113, telephone number 481-6658), as soon as possible to work out the details. Once the Director has provided you with a letter attesting to your needs for modification, bring the letter to me. For more information, please visit the web site for SSD at <http://new.ipfw.edu/disabilities/>

Class Activities and Course Assessment

- The class format will be 3 hour lecture/discussion/demo/case presentation each week
- Active students participation in presenting case studies, articles and papers from the recent literature are expected
- Student assignments include assignments on programming assignments, research questions, case studies, reading technical papers and/or articles and writing short summary for each paper.
- Hands-on term project: students will complete a final project working in groups of 2 students, present projects in class and complete a written project report.

Grading policy (Method of Evaluation or Assessment)

- Hw & reading assignments (from recent conference proceedings, magazines, and journals), summary reports, and presentations – 30%
- Exams & Quiz – 20%
- Cloud computing research and project proposal (mid-term) – 10%
- A hands-on cloud computing application project and written report – 30%
- Class Participation/Meeting/Discussion (attendance, class discussion, online collaboration activities, etc.) – 10%
 - Planned meeting dates/times: Wednesdays, 4:30 – to 5:30 PM on Feb. 1, 15; March 1, 22; April 12, 26

Grading Scale: A (90-100%), B (80 -89%), C (70-79%), D (60-69%), F (0-59%)

*No late assignment, reports, etc., will be accepted

*No makeup exam/quiz will be given.

Required Text:

K. Hwang, G. C. Fox, and J. J. Dongarra, *Distributed and Cloud Computing: from Parallel Processing to the Internet of Things*, Elsevier Inc., ISBN 978-0-12-385880-1, 2012.

Important Dates

- January 16, no class
- Spring break March 6-10

Tentative Topics of Discussion

1. Overview of Distributed and Cloud Computing System Models and Enabling Technologies

- Evolution of computer systems, scientific applications, and business-oriented (enterprise) information technologies for the past 30 years
- Scalable Internet-based computing
- Technologies for enabling network-based computing systems
- System models for distributed and cloud computing
- Software environments for distributed and cloud computing systems

- Performance, security, and energy efficiency considerations
- 2. Enterprise and Government IT Cloud Strategies**
 - Enterprise IT architectures, trends, interoperability and standards
 - Challenges: Green IT, sustainable IT, just-in-time and on-demand resource sharing, cost, streamlining, any-time & anywhere access, threat and business growth opportunities, service providers/consumers
 - Affected industry sectors: government services, healthcare services, educational services, e-Commerce and m-Commerce, mobile technologies, telecom services, research & development, supply chain management, marketing & sales, customer relationship management, advanced manufacturing, other cloud-based value-added services etc
 - Cloud computing industries and cloud ecosystem (PaaS, IaaS, SaaS, etc)
 - Possible cloud computing impacts, challenges and limitations: technological (data and system integration, interoperability) environmental, security, legal and policy related, operational, management, and scheduling factors,
 - Possible solutions: service oriented and cloud computing service models
 - Available products and service providers, and global players
 - Developing enterprise cloud strategies:
 - i. storage, compute, infrastructure, business intelligence
 - ii. Cloud development, adoption, implementation
 - iii. Remote and offshore
 - 3. Computer Clusters for Scalable Parallel Computing and Applications**
 - Building computer clusters for massive parallelism
 - Computer cluster and Massive Parallel Processing (MPP) architectures
 - Design principles of computer clusters
 - Cluster job and resource management
 - 4. Virtual Machines and Virtualization of Clusters and Data Centers**
 - Implementation levels of virtualization
 - Virtualization structures/tools and mechanisms
 - Virtualization of CPU, memory, and I/O devices
 - Virtual clusters and resource management
 - Virtualization for datacenter automation
 - 5. Cloud Platform Architecture over Virtualized Data Centers**
 - Cloud computing and service models
 - Data center design and interconnection networks
 - Architectural design of compute and storage clouds
 - Public cloud platforms: Google App Engine (GAE), Amazon Web Services (AWS), and Microsoft Azure
 - Inter-cloud resource management
 - Cloud security and trust management
 - 6. Service-Oriented Architecture (SOA) for Distributed Computing and Service-based Computing**
 - Service and SOA
 - Middleware
 - Portals and security gateways
 - Service discovery, registries, metadata, and databases
 - Workflow in SOA
 - 7. Cloud Programming and Software Environment**
 - Features of cloud and grid platforms
 - Parallel and distributed programming paradigms
 - Programming support for GAE (Google App Engine)
 - Programming on Amazon AWS
 - Programming Microsoft Azure
 - Emerging cloud software environments
 - 8. Other Advanced Topics**

References and Reading List - In addition to the required text, substantial reading will be required from professional periodicals, journals, articles, or via the Internet.

References (accessed through IPFW Library: e-journal)

- [1] IT Professional – Technology Solutions for the Enterprise, from IEEE Computer Society, <http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=6294> (full article access through IPFW Library e-journal)
- [2] IEEE Internet Computing, <http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=4236>
- [3] IEEE Computer, IEEE Computer Society, <http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=2> (full article access through IPFW Library e-journal)
- [4] IEEE Pervasive Computing, <http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=7756>
- [5] IEEE Software, <http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=52>
- [6] IEEE Multimedia, <http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=93>
- [7] IEEE Micro, <http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=40>
- [8] IEEE Intelligent Systems, <http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=9670>
- [9] IEEE Network, <http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=65>
- [10] IEEE Wireless Communications, <http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=7742>
- [11] IEEE Technology and Society Magazine, <http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=44>
- [12] IEEE Engineering Management Review, from IEEE Technology Management Council, <http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=46> (full article access through IPFW Library e-journal)
- [13] IET Information Security, <http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=4149673>
- [14] MIT Technology Review, (access through IPFW Library e-journal)
- [15] MIT Sloan Management Review, www.sloanreview.mit.edu
- [16] Harvard Business Review, (access through IPFW Library e-journal)
- [17] Harvard Management Update, (access through IPFW Library e-journal)
- [18] Business Week, <http://www.businessweek.com/index.html>
- [19] The Wall Street Journal, <http://online.wsj.com/public/us>
- [20] Forbes, <http://www.forbes.com/lists/>
- [21] Fortune, <http://money.cnn.com/magazines/fortune/>

IT Technologies

- [22] eWeek – Enterprise Technology News and Reviews, <http://www.eweek.com/>
- [23] Computer World, <http://www.computerworld.com/>
- [24] InfoWorld, <http://www.infoworld.com/>
- [25] Information Week, <http://www.informationweek.com/>
- [26] SearchSecurity, <http://searchsecurity.techtarget.com/>
- [27] Security, <http://www.securitymagazine.com/>
- [28] NetworkWorld, <http://www.networkworld.com/>
- [29] Health Management Technology, <http://www.healthmgttech.com/>
- [30] Federal Computer Week, <http://fcw.com/Home.aspx>
- [31] CRM Magazine, <http://www.destinationcrm.com/>
- [32] SOA World Magazine, <http://soa.sys-con.com/>
- [33] Supply Chain Management Review, <http://www.scmr.com/>
- [34] Smartphone & Pocket PC, <http://www.smartphonemag.com/>
- [35] Mobile Enterprise, <http://mobileenterprise.edgl.com/home>
- [36] IBM, <http://www.ibm.com/us/en/>
- [37] Oracle Magazine, <http://www.oracle.com/technetwork/oramag/magazine/home/index.html>
- [38] Visual Studio Magazine, <http://visualstudiomagazine.com/Home.aspx>
- [39] SQL Server Magazine, <http://www.sqlmag.com/>

Transactions/Journals

- [40] IEEE Transactions on Service Computing,
<http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=4629386>
- [41] IEEE Transactions on Network and Service Management,
<http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=4275028>
- [42] IEEE/ACM Transactions on Networking,
<http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=90>
- [43] IEEE Systems Journal, <http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=4267003>
- [44] Optical Communications and Networking,
<http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=4563700>
- [45] IEEE Transactions on Multimedia, <http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=6046>
- [46] IEEE Transactions on Wireless Communications,
<http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=7693>
- [47] IEEE Transactions on Mobile Computing,
<http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=7755>
- [48] IEEE Transactions on Knowledge and Data Engineering,
<http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=69>
- [49] IEEE Transactions on Parallel and Distributed Systems,
<http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=71>
- [50] IEEE Transactions on Software Engineering,
<http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=32>
- [51] IEEE Transactions on Engineering Management, from IEEE Technology Management Council,
<http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=17> (full access through IPFW Library e-journal)
- [52] IEEE Transactions on Industrial Informatics,
<http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=9424>
- [53] IEEE Transactions on Information Forensics and Security,
<http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=10206>
- [54] IEEE Transactions on Information Technology in Biomedicine,
<http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=4233>
- [55] IBM Journal of Research and Development,
<http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=5288520>