University of Macau
Faculty of Science and Technology
Computer and Information Science Department
SFTW451– Distributed Computer Systems
Syllabus
2nd Semester 2011/2012

Part A – Course Outline

Elective course in Computer Science

Catalog description:
(3-2) 4 hours credit. Architectures, Processes, Communication, Naming, Consistency and Replication, Security, and other topics. It is a senior-level elective course on distributed systems for computer and information science. Research papers in areas of distributed systems will be given for supplementary reading.

Course type:
Theoretical with substantial laboratory/practice content

Prerequisites:
SFTW330 Operating Systems II
SFTW331 Distributed Systems

Textbook(s) and other required material:
Distributed Systems: Principles and Paradigms, Second Edition, Andrew S. Tanenbaum, Maarten van Steen, Pearson Education, 2007. 0132392275; 9780132392273

References:
Computer Networking: A Top-Down Approach, James F. Kurose, Keith W. Ross, Addison-Wesley, Fifth Edition, 2010, 0136079679, 9780136079675

Major prerequisite by topic:
- LANs and WANs.
- Layered network architecture.
- Network protocols.
- Data communication techniques.

Course objectives:
- Present the key principles about distributed systems. [a, e]
- Relate principles to different approaches used in various distributed applications. [a, e, k]
- Expose students to the major challenges and research issues in this rapidly changing field. [a, e]
- Gain experience in the implementation of a distributed system project. [a, e, k]

Topics covered:
- **Introduction to Distributed Systems** (6 hours): An introduction of distributed systems, including cluster computing, grid computing, cloud computing, distributed information systems, distributed pervasive systems. Goals of distributed systems and the scalability problems.
- **Distributed Architectures** (6 hours): Architectural styles of distributed systems, including layered architectures, object-oriented architectures, data-centered architectures, event-based architectures. System architectures, which

include centralized architectures and decentralized architectures. Peer-to-peer systems, DHT-based systems, and example systems.

- **Virtualization, Clients, and Servers in Distributed Systems** (3 hours): virtualization techniques, architectures of virtual machines, threads in distributed systems, client-side software for distribution transparency, general design issues of servers, and server clusters.
- **Communication** (3 hours): Types of communication, remote procedure call, message-oriented communication, and stream-oriented communication.
- **Naming** (7 hours): Concept of names, identifiers, and addresses. Flat naming, home-based approaches, distributed hash tables, hierarchical approaches. Structured naming, name space, name resolution, the implementation of a name space, the Domain Name System. Attributed-based naming, directory services, hierarchical implementations, LDAP, decentralized implementations.
- **Consistency and Replication** (9 hours): Fundamentals of replication, data-centric consistency models, client-centric consistency models, replica management, primary-based protocols, replicated-write protocols, cache-coherence protocols, and protocols for implementing client-centric consistency.
- **Security in Distributed Systems** (8 hours): Fundamentals of distributed systems security, cryptography, authentication, message integrity, confidentiality, secure group communication, access control, firewalls, secure mobile code, and key management.

Class/laboratory schedule:

Timetabled work in hours per week			No of teaching weeks	Total hours	Total credits	No/Duration of exam papers
Lecture	Tutorial	Lab				
3	1	1	14	70	4	1 / 2 hours

Student study effort required:

Class contact:	
Lecture	42 hours
Tutorial & Lab	28 hours
Other study effort	
Self-study	10 hours
Homework	10 hours
Projects	28 hours
Total student study effort	118 hours

Student assessment:

Final assessment will be determined on the basis of:

Paper Reading Project	20%
Course Project	30%
Midterm Test	20%
Final Exam	30%

Course assessment:

The assessment of course objectives will be determined on the basis of:

- Projects, midterm test and final exam
- Course evaluation

Course outline:

Weeks	Topic	Course work

1, 2	Introduction to Distributed Systems Invited talk on Cloud Computing	Paper Reading Homework
3, 4	Distributed Architectures	
5	Virtualization, Clients, and Servers in Distributed Systems	Course Project
6	Communication	
7, 8, 9	Security in Distributed Systems Invited talk on Security	Midterm Test
9, 10, 11	Naming	
12, 13, 14	Consistency and Replication	

Contribution of course to meet the professional component:

This course provides students with an understanding of the principles, techniques, and practices relevant to the design and implementation of distributed systems.

Relationship to Computer Science program objectives and outcomes:

This course primarily contributes to Software Engineering program outcomes that develop student abilities to:
(a) an ability to apply knowledge of mathematics, science, and engineering.
(e) an ability to identify, formulate, and solve engineering problems.
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Relationship to Computer Science program criteria:

Criterion	DS	PF	AL	AR	OS	NC	PL	HC	GV	IS	IM	SP	SE	CN
Scale: 1 (highest) to 4 (lowest)					4	1								

Discrete Structures (DS), Programming Fundamentals (PF), Algorithms and Complexity (AL), Architecture and Organization (AR), Operating Systems (OS), Net-Centric Computing (NC), Programming Languages (PL), Human-Computer Interaction (HC), Graphics and Visual Computing (GV), Intelligent Systems (IS), Information Management (IM), Social and Professional Issues (SP), Software Engineering (SE), Computational Science (CN).

Course content distribution:

Percentage content for			
Mathematics	Science and engineering subjects	Complementary electives	**Total**
0%	100%	0%	100%

Coordinator:

Prof. Yiping Li

Persons who prepared this description:

Dr. Yan Zhuang, Dr. Simon Chi Chiu Fong

Part B General Course Information and Policies

2nd Semester 2011/2012

Instructor: Dr. Yan Zhuang
Office: N414
Office Hour: *To be announced*
Phone: 8397-4464
Email: syz@umac.mo

Time/Venue: *To be announced*

Grading Distribution:

Percentage Grade	Final Grade	Percentage Grade	Final Grade
100 - 93	A	92 - 88	A–
87 - 83	B+	82 - 78	B
77 - 73	B–	72 - 68	C+
67 - 63	C	62 - 58	C–
57 - 53	D+	52 - 50	D
below 50	F		

Comment:
The objectives of the lectures are to explain and to supplement the text material. Students are responsible for the assigned material whether or not it is covered in the lecture. You are encouraged to look at other sources (other texts, etc.) to complement the lectures and text.

Homework and Project Policy:
Reading research papers and doing project is of vital importance to help the students to master the concepts covered.

- Homework of research papers reading and course project are both of group assignments of 2-3 students per group.
- No late submission is accepted.
- Possible revision of homework/project grades may be discussed within one week from the grade announcement.

Note

- Attendance at both lectures and lab classes is strongly recommended.
- Check UMMoodle (http://ummoodle.umac.mo) for announcement, homework and lectures. Report any mistake on your grades within one week after announcement.
- No make-up test is given except for clear medical proof.
- Cheating is absolutely prohibited by the university.

Appendix:

Rubric for Program Outcomes

Rubric for (a)	5 (Excellent)	3 (Average)	1 (Poor)
Understand the theoretic background	Students understand theoretic background and the limitations of the respective applications.	Students have some confusion on some background or do not understand theoretic background completely.	Students do not understand the background or do not study at all.
Rubric for (e)	**5 (Excellent)**	**3 (Average)**	**1 (Poor)**
Modeling, problem formulation and problem solving	Students choose and properly apply the correct techniques.	Students model correctly but cannot select proper technique or model incorrectly but solve correctly accordingly.	Students at loss as to how to solve a problem.
Rubric for (k)	**5 (Excellent)**	**3 (Average)**	**1 (Poor)**
Use modern principles, skills, and tools in engineering practice	Student applies the principles, skills and tools to correctly model and analyze engineering problems, and understands the limitations.	Student applies the principles, skills and tools to analyze and implement engineering problems.	Student does not apply principles and tools correctly and/or does not correctly interpret the results.