Birla Institute of Technology & Science, Pilani
Pilani Campus
Computer Science and Information Systems Department
First Semester 2016-2017 Course Handout (Part II)

Date: 02/08/2016

In addition to part-I (General handout for all courses appended to the timetable) this portion gives further specific details regarding the course:

COURSE NO. : CS G623

ADVANCED OPERATING SYSTEMS

Instructor: **Chittaranjan Hota (hota@hyderabad.bits-pilani.ac.in)**
Co-Instructor: Lavika Goel (lavika.goel@pilani.bits-pilani.ac.in)

Scope and Objectives

Over the last two decades considerable amount of research has been done in "Distributed OS". The aim of this course is to introduce the design and implementation issues of Distributed OS. Distributed OS's work in an environment where we have independent machines (both hardware and software) connected with each other over a computer network. Distributed OSs have at their center the reasoning that you should use faster machines for more tasks that need speed, and slower ones for the tasks that don't. Also, central to the design of distributed OS's is making this design transparent to the user. A Distributed OS makes a Distributed System a virtual uniprocessor system. The distributed OS to be studied in this course is *microkernel* based. It's just that the user level processes that are separated from the kernel can run on remote machines. Few case studies like Sun NFS, V-System, Condor, Sprite, IVY, Vector Clocks, Causal ordering, Agreement protocols, Mutual Exclusion, Distributed file systems etc. shall be discussed and also implemented as part of the coding assignments.

TEXT BOOK

T1 M. Singhal & N. Shivaratri, "Advanced Concepts in Operating Systems: Distributed, Database and Multiprocessor Operating Systems", Tata McGraw Hill, 2001.

REFERENCE BOOKS

R1 Distributed Operating Systems – The Logical Design by A. Goscinski, AW
R2 Modern Operating Systems by A. S. Tanenbaum, PHI
R3 Distributed Systems-Concepts and Design by G. Coluris, AW

PLAN OF STUDY:

S.No.	Learning objectives	TOPIC	Ch. Ref (T1)	#Lec
1.	Will learn the usage of various Advanced OSs.	Overview of Advanced O.S: Design approaches, Why to study AOS? Types of Advanced OS.	Chapter 1	2
2.	Review of Computer networks.	Architecture: Motivation, Issues, Communication Networks, Communication Primitives.	Chapter 4	2
3.	Need of Logical clocks and how can they help solve the problem of non-availability of hardware clock synchronization approaches.	Theoretical Foundations: Limitations, Lamport's logical clock, vector clock, causal ordering, global state, Cuts.	Chapter 5	3

4.	Ways to serialize access to concurrent resource requests will be discussed using various approaches and their need to DS building.	Distributed Mutual Exclusion: Lamport, Recart-agrawala, and Maekawa's algorithms; Suzuki-kasami broadcast algorithm, and Raymond's tree based algorithm .	Chapter 6	3
5.	Few research papers on DME from various publications.	Recent Research on DME	IEEE/ACM	1
6.	Why deadlocks are seen as challenges in DS building? How to handle those without using shared variables like Semaphores as is done in Multi-user OS?	Distributed Deadlock Detection: Resource Vs. Communication deadlock, Strategies to handle deadlock, Ho-Ramamoorthy, Path-Pushing, Edge-Chasing, Diffusion Computation-based algorithms.	Chapter 7	3
7.	Importance of Consensus in DSs and different ways to implement those in a DS.	Agreement Protocols: System model, Classification of agreement problems, Solutions to Byzantine Agreement (BA) problems.	Chapter 8	3
8.	Few research papers on BA from various publications.	Recent Research on Consensus/ Agreement	IEEE/ACM	1
9.	How to access files from different machines running heterogeneous OSs in an transparent manner?	Distributed File Systems: Mechanisms for building DFSs, Design Issues, Sun DFS, Sprite DFS, and Hadoop DFS.	Chapter 9	3
10.	Few research papers on DFS from various publications.	Recent Research on DFS	IEEE/ACM	2
11.	Need of transferring a job from one machine to another and various ways of doing so will be learnt in this part.	Distributed Scheduling: Issues in Load Distribution, Components of a load distribution algorithm, Load Distribution Algorithms, V-system, Sprite, and Condor.	Chapter 11	3
12.	Few research papers on Distributed scheduling from various publications like Map reduce from Hadoop.	Recent Research on Distributed Scheduling	IEEE/ACM	2
13.	How to combine the storage power of several RAMs to realize a single RAM of larger size?	Distributed Shared Memory: Algorithms for implementing DSMs, Memory Coherence, and Coherence Protocols, IVY.	Chapter 10	3
14.	How to handle failures and different ways of recovering the distributed computations?	Recovery: Classification of failures, Synchronous and Asynchronous Check pointing and Recovery.	Chapter 12	3
15.	Why should we make our DS a fault tolerant and their impact?	Fault Tolerance: Commit Protocols, Voting Protocols, Failure Resilient Processes.	Chapter 13	3
16.	Access control mechanisms in DS will be studied.	Protection and Security: Access Matrix Model, Implementation of access matrix, Unix, and Amoeba..	Chapter 14	3

EVALUATION SCHEME:

Sl No.	Component & Nature	Duration	Weightage	Date and Time
1.	Assignment (TH)	*	20%	*
2.	Mid-semester Test	90 mins	25%	-
3.	Term paper presentation	30 mins	15%	*
4.	Comprehensive Exam (20% OB and 20% CB)	3 hrs	40%	14/12 AN

Coding Assignments for the course will be based on the design aspects of various components of Distributed Operating Systems like distributed middleware, agreement protocols, logical clock implementations, distributed file systems, distributed shared memory, and distributed scheduling or load balancing etc.

Note: All notices related to the course will be displayed on the CSIS Notice Board, and / or course website. Make ups shall be granted to genuine cases with a request for makeup reaching I/C on or before the test.

Chamber Consultation Hour: Will be announced in the class.