Birla Institute of Technology & Science, Pilani
Hyderabad Campus

FIRST SEMESTER 2021 - 2022

Course Handout Part II

Date: 11.08.2021

In addition to part-I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course No. : CS G527
Course Title : Cloud Computing
Instructor-in-Charge : Dr. Subhrakanta Panda

Description : Review of Distributed computing - Concurrency, message passing, connectivity and failure models, replication. Computing Infrastructure - Processing Power, Storage aggregation, I/O & Communication, Clusters and Data Centers. Resource modeling and virtualization - CPU virtualization, memory and storage virtualization, virtualized networks. Services - Service models and service contracts; Programming on the cloud. Cloud Applications - Software on the Cloud and Infrastructure Services. Cloud infrastructure - Private vs. Public Clouds, Resource scaling and Resource provisioning. Quality of Service - Performance models, scalability, Performance measurement and enhancement techniques. Security issues - Data/ Storage Security, Resource Access Control, Process Isolation and Control, Service Policies and Privacy Issues.

Scope and Objective of the Course:

Cloud computing is a key distributed systems paradigm that has grown popular in the last few years. Cloud technologies are pervasive and act as the de-facto infrastructure for HPC applications. This course aims to teach the students both the fundamental concepts of how and why cloud systems work, as well as the cloud technologies that manifest these concepts like virtualization. Various cloud service models and cloud deployment models will be discussed. Case studies on open source cloud environments like Openstack, OpenNebula, Eucalyptus, Microsoft Azure and Amazon EC2 will help the students get the necessary hands-on exposure.

Course Outcome:

The expected outcomes of this course are as follows:

- Students will develop a good understanding of the different architectural as well as the design perspectives of cloud deployment and service models.
- Students to gain hands-on exposure to AWS, Google App Engine, etc., and other open source platforms like Cloudsim.
- Develop understanding of different cloud virtualizations and have hands on implementation.
- To be able to understand and analyze SLAs in cloud systems and its QoS models.
- To be able to analyze and design admission control algorithms.
- To be able to analyze and design scheduling algorithms.
- Analyze the threat models and security challenges in cloud.
- Solve problems through Map-Reduce applications.

Textbooks:

1. Dinkar Sitaram and Geetha Manjunath, “Moving to the Cloud”, Syngress (Elsevier) Pub, 2011.
2. Rajkumar Buyya, James Broburg & Anderzej M.G, “Cloud Computing – Principles and Paradigms”, John Wiley Pub, 2011.

Reference books

1. Barrie Sosinsky, “Cloud Computing Bible”, Wiley-India, 2010.
2. Nikos Antonopoulos and Lee Gillam, “Cloud Computing: Principles, Systems and Applications”, Springer, 2012.
3. Ronald L. Krutz, Russell Dean Vines, “Cloud Security: A Comprehensive Guide to Secure Cloud Computing”, Wiley-India, 2010.
4. Rajkumar Buyya, Christian Vecchiola et.al., “Mastering Cloud Computing”, Mc Graw Hill Education, 1st edition, 2013.
5. Arshdeep Bahga and Vijay Madisetti, “Cloud Computing: A Hands-on Approach”, Universities press (India), 2014.
6. Dan C. Marinescu, “Cloud Computing: Theory and Practice”, Elsevier, 2013.

Course Plan:

L No.	Learning objectives	Topics to be covered	Chapter No.
1-2	Understand different computing models	Overview of various computational paradigms like cluster computing, grid computing etc.	T1 Ch 1. R1 Ch 1. T1 Ch 2
3-4	Introduction to cloud computing	Motivation for Cloud Computing; Introduction to Cloud Computing environment (NIST model), History of Cloud Computing, Cloud Computing architecture: service model, Cloud Computing architecture: deployment model, benefits, challenges, and risks;	T1 Ch 1. T1 Ch 2. R1 Ch 2. NIST Doc. 800-146.
5-6	Cloud computing architecture: Deployment model	Public, Private, Community, Hybrid, Federated Clouds	T1 Ch 1. T2. Ch 1. T2. Ch 6.
7-10	Cloud virtualization	Introduction to cloud virtualization, types of Virtualization, practical aspects of Virtualization; Virtual Machine monitors/hypervisors; VM Life Cycle management; Virtualization of CPU, Storage, I/O, and Network;	T1 Ch 9. R1 Ch 3. T2 Ch 5.
11-12	Cloud computing architecture: IaaS	Introduction to IaaS; Software stack; Delivery model, Scope of control; Management; IaaS benefits and issues;	T1 Ch 2. R2
13-20	AWS	Reference Model of AWS, Region Vs Availability zones, AWS infrastructure service: Amazon Elastic Compute Cloud (Amazon EC2) Infrastructure Services, Amazon Web Services: Amazon S3, Amazon Glacier, Amazon EBS, AWS Import/Export Amazon RDS, Amazon DynamoDB, Amazon AWS Demo Amazon Cloud Services - CloudFront, Elastic Load Balancer, Elastic Block Storage; Openstack	T1 Ch 2.
21-23	Containers	Cloud orchestration technologies, Dockers - Elements, Images, Files, Containers	Open Sources
24-26	Cloud computing architecture: PaaS	Introduction to PaaS; Software stack; Dependency; Delivery model; Scope of control; IaaS benefits and issues; Traditional packaged Platform Vs PaaS; GAE, Microsoft Azure/OpenNebula/Eucalyptus	T1 Ch 3. R2
27-30	Cloud computing architecture: SaaS	Introduction to SaaS; Dependency; Portability; Pros and Cons of SaaS model; Applications of SaaS; Traditional packaged Software Vs SaaS;	T1 Ch 4. T2 Ch 9.

			R1 Ch 10.
31-34	Service Level Agreements (SLAs)	Service Level Agreements: Lifecycle and Management; Automated Policy-Based Management; Admission control mechanisms	T1 Ch 8. T2 Ch 16.
35-36	Quality of Service (QoS)	QoS model, parameter, measurement, and enhancement; Resource management; Failure detection and recovery.	T2, R4, R5.
37-40	Cloud security issues and threat models	Infrastructure Security: Network level security, Host level security, Application level security; Data security and Storage: Data privacy and security Issues; Identity and Access Management; Access Control; Authentication in cloud computing	T1 Ch 7. T2 Ch 23. R3.
41-42	Cloud Storage Systems	Introduction to Distributed File Systems, Case Study HDFS: Hadoop components and understanding MapReduce.	R6, Ch 8.

Evaluation Scheme:

Sl. No.	Component	Duration	Weightage (%)	Date & Time	Nature of Component
1	Mid-Semester	90 mins	30	As per Timetable	Closed Book
	Assignments 3 Nos. (1 Assignment before Mid-Semester.)		30	TBA	Open Book/Take Home
2	Term Paper Presentation (TPP)		10	TBA	Open Book
6	Comprehensive	120 mins	30	As per Timetable	Open Book

Consultation Hour: To be announced in the class.
Notices: Notices regarding the course will be put up on the CMS.
Make-up Policy: No makeup for TPP and Assignment components. For any other genuine reasons other than medical, prior approval from the IC is mandatory. Requests coming after the test will not be honored. (please refer to the guidelines by AUGSD/AGSRD in this regard)**.** The above mentioned rules will be followed very strictly.

Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

INSTRUCTOR-IN-CHARGE
CSG527