AMRITA VISHWA VIDYAPEETHAM
AMRITA SCHOOL OF ENGINEERING, COIMBATORE
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
Academic year: 2020 - 2021 , 6th Semester, B.Tech CSE

15CSE337   **Cloud Computing and Services**   **3-0-3-3**

Preamble:

Cloud Computing plays a pivotal role in the industry for application development, deployment, storage and all other application management scenarios. This course introduces the basic principles of cloud computing, cloud native application development and deployment, containerization principles, micro-services and application scaling. It will also equip the students to understand major industry players in the public cloud domain for application development and deployment. Finally, the course will introduce what it takes to build a private cloud.

Syllabus

Unit 1:
Distributed Computing Taxonomy – Cluster, Grid, P2P, Utility, Cloud, Edge, Fog computing paradigms; Introduction to Cloud Computing – Cloud delivery models (XaaS), Cloud deployment models (Private, Public, Hybrid); Characteristics of Cloud, Major use cases of Cloud; disadvantages and best practices; Major public cloud players in the market; Security Issues and Challenges; Cloud Native application development – Introduction to JavaScript Cloud native development, Using maps and directions APIs in your application
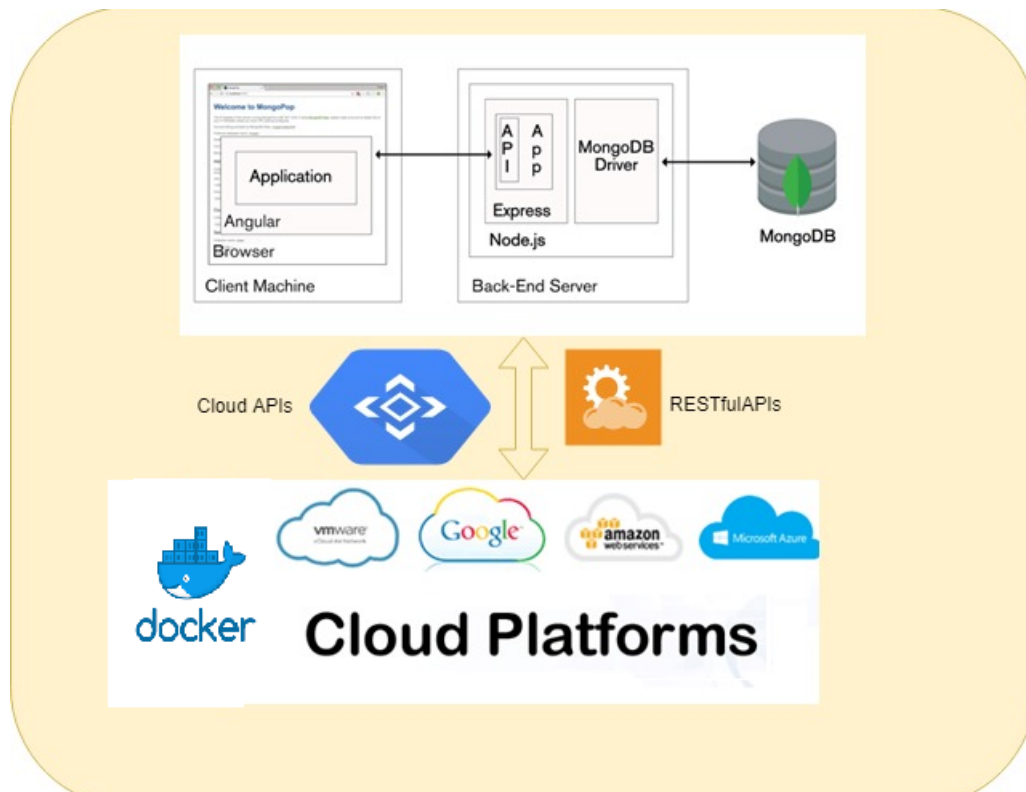
Unit 2:
Public Cloud – Using public cloud for infrastructure management (compute and storage services), Web application deployment using public cloud services, and Deploying container images in public cloud, deploy a monolithic application to a container, then decouple the application into Micro-services without any downtime and manage this application using public cloud services; Private Cloud – Case study on setting up private cloud using open stack and deploying container applications in it

Unit 3:
Virtualization – Basics, Cloud vs Virtualization, Types of virtualization, Hypervisor types; Containers – Introduction to dockers and containers, containerization vs virtualization, docker architecture, Use cases, Learn how to build container images, Operations on container images; Kubernetes – Need for orchestration, container orchestration methods, Introduction to Kubernetes, Kubernetes architecture, using YAML file, Running Kubernetes via minikube;

Microservice – Introduction, Microservice architecture, Design patterns for Microservices, Microservices using containerization and scaling them through Kubernetes.

Text Books:

1. Mastering cloud computing, Rajkumar Buyya et.al., McGraw Hill Education, 2013
2. Docker: Up & Running: Shipping Reliable Containers in Production, Sean P. Kane, Karl Matthias, O'Reilly, 2018

References:

1. Microservices and Containers, Parminder Singh Kocher, Addison Wesley, 2018.
2. Learning AWS: Design, build, and deploy responsive applications using AWS, Aurobindo Sarkar, Amit Shah, Packt, Second edition, 2018.
3. Docker on Amazon Web Services, Justin Menga, Packt, 2018.
4. OpenStack Administration with Ansible, Walter Bentley, Packt, 2016.

Course outcomes

COs	Course Outcome Description	BTL
CO1	Understand the basic principles of cloud computing	L2
CO2	Learn how Cloud Native application development happens	L3
CO3	Apply cloud native application development for containerization and container orchestration	L3
CO4	Distinguish different types of cloud services – Delivery models, Deployment models	L4
CO5	Implement different solution approaches in Cloud – containers in public cloud, setting up private cloud and convert monolithic applications to containers	L3

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	-	3	2
CO2	2	2	3	1	-	-	-	-	-	-	-	-	3	2
CO3	2	2	2	2	-	-	-	-	-	-	-	-	3	2
CO4	3	2	2	2	-	-	-	-	-	-	-	-	3	2
CO5	2	2	2	2	-	-	-	-	-	-	-	-	3	2

Concept Map

Evaluation Pattern

Components	Type	Weightage	Marks
Quiz	Internal	20	20
Assignments/Tutorials	Internal	10	10
Lab Evaluation	Internal	40	40
Online exam	External	30	15
Viva	External		15

Course Plan

Lecture No(s)	Topics	Keywords	Objectives	Content Preparation
1	Use cases, Challenges in existing computing model	Overview of cloud Applications and use cases	To understand the need for Cloud Computing	Dr.R.Gowtham
2	Basics of Cloud Computing	Definition, usage scenarios and applications, benefits of cloud, types of clouds, multi-tenancy, elasticity, resiliency, data center	To understand the basics of Cloud Computing and its related terms.	Dr.R.Gowtham
3	Cloud Computing Services	Cloud Delivery Models - Infrastructure as a Service, Platform as a Service, Software as a Service; Cloud Deployment Models – Public, Private, Hybrid Community	To learn about various types of services in cloud computing	Dr.R.Gowtham
4-5	JavaScript Cloud native development – Client side	Overview of JavaScript, Client side JavaScript	To develop and deploy cloud applications	Dr.R.Karthi
6-7	JavaScript Cloud native development - server-side	server-side JavaScript in Node.js platform using Express.js framework	To develop and deploy an cloud applications using a MERN stack	Dr.R.Karthi
7 - 10	Public Cloud Infrastructure	EC2 - launching linux and windows instances	To learn On demand public cloud Services	Dr.R.Gowtham

11 - 13	Public Cloud Infrastructure	S3	To learn On demand public cloud Services	Dr.R.Karthi
14 - 16	Public Cloud Infrastructure	RDS - Mysql	To learn On demand public cloud Services	Dr.R.Gowtham
17 - 21	Public Cloud – Beyond infrastructure	Elastic Beanstalk, Lamda	Use on-demand computing resource offered by public cloud in terms of function-as-a-service	Dr.R.Karthi and Dr.R.Gowtham
22 - 23	Virtualization	Basics, Cloud vs Virtualization, Virtualization in Cloud Computing, Types of virtualization	To understand how cloud helps in providing Resource Isolation, Resource sharing, Aggregation of resources, and Dynamical resource	Dr.R.Gowtham
24 - 28	Containerization	Docker, Docker-Images, Pull and Push Images	Containers – Introduction to dockers and containers, containerization vs virtualization, docker architecture, Use cases, Learn how to build container images, Operations on container images;	Dr.R.Karthi and Dr.R.Gowtham
29 - 30	Container Orchestration	Kubernetes	To design our own cluster and Manage Containers with an Isolated and Secure App Platform.	Dr.R.Gowtham
31- 32	Containers in Public Cloud	ECS, ECR	To use fully-managed Docker container services extended by public cloud	Dr.R.Karthi

CO – PO Mapping – Justification

Engineering Graduates will be able to:

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

CO1	2	Apply the basics to understand the different services in computing.
CO2	2	Understand how web services impacts the cloud computing.
CO3	2	Understand various APIs used in cloud computing.
CO4	3	Design an application to deploy into the cloud
CO5	2	Apply full stack development technologies to develop web applications.

2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

CO1	1	Identify the need for different cloud services associated with various applications.
CO2	2	Write a web service call to invoke the services
CO3	2	How the APIs implementation was carried out to integrate the cloud platforms.
CO4	2	Design the application solution model
CO5	2	Implement full stack development technologies to develop web applications.

3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

CO2	3	Design the various web services to incorporate few problems in different domains.
CO3	2	Apply Google/AWS APIs to demonstrate various domains.
CO4	2	Design an application using Dockers, AWS and Google Clouds.
CO5	3	Design MEAN stack applications.

4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

CO2	1	Analysis the cloud paradigms.
CO3	2	Study on the impact of the various API calls into cloud platforms.
CO4	2	Review the usage of the different service provides.
CO5	2	How single page application impacts web application is explored.

5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

   -NA-

6. The engineer and society: Apply reasoning informed by the contextual knowledge to Assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

   -NA-

7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

   -NA-

8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

   -NA-

9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

   -NA-

10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

    -NA-

11. Project management and finance: Demonstrate knowledge and understanding of engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

    -NA-

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

    -NA-

Faculty Members

Name	Designation	Email id
Dr.R.Gowtham	Assistant Professor (SG)	r_gowtham@cb.amrita.edu
Dr. R.karthi	Associate Professor	r_karthi@ch.amrita.edu