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TRƯỜNG ĐẠI HỌC KHOA HỌC TỰ NHIÊN, ĐHQG - HCM
KHOA CÔNG NGHỆ THÔNG TIN

Introduction to Cloud Computing

Lê Ngọc Sơn – Inson@fit.hcmus.edu.vn

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Introduction

- **Lecturers:**

- Lê Ngọc Sơn – Inson@fit.hcmus.edu.vn
- Chung Thùy Linh – ctlinh@fit.hcmus.edu.vn

- **Duration:**

- Theory : 45 Credit hours
- Practice : 30 Credit hours

Course Objectives

By the end of this course, students will be able to:

- **Understand the fundamentals of cloud computing**, including its definition, evolution, benefits, challenges, service models (IaaS, PaaS, SaaS), and deployment models (public, private, hybrid).
- **Analyze cloud architecture and virtualization technologies**, such as hypervisors, VMs, containers, and explore resource management, orchestration, autoscaling, and load balancing.
- **Leverage cloud services and applications**, including compute solutions (VMs, containers, serverless), cloud storage, cloud databases (NoSQL, relational), and networking with virtual private clouds (VPCs).
- **Explore big data and analytics in the cloud**, including data warehousing, data lakes, big data platforms, visualization tools, and introductory machine learning using cloud services.

Course Objectives

- **Understand and apply cloud-native technologies**, including microservices architecture, containerization with Docker, orchestration with Kubernetes, and monitoring with tools like Prometheus and Grafana.
- **Understand basic security on cloud environments**, including IAM, encryption, network security, and compliance with regulations like GDPR and HIPAA.
- **Monitor and optimize cloud performance and costs** using tools like AWS Cost Explorer, Azure Monitor, and other cloud-native monitoring solutions.
- **Apply knowledge through real-world case studies and practical exercises**, understanding how cloud solutions are deployed and managed across various industries.

Contents

- **Introduction to Cloud Computing**

- Definition and evolution of cloud computing
- Benefits and challenges of cloud adoption
- Cloud service models (IaaS, PaaS, SaaS)
- Deployment models (public, private, hybrid)
- Major cloud service providers (AWS, Azure, GCP, etc.)
- Case studies of cloud computing in various industries

- **Cloud Architecture and Virtualization**

- Cloud infrastructure and components
- Virtualization technologies: hypervisors, VMs, containers
- Resource management and orchestration
- High availability and scalability in the cloud: High availability and scalability: Autoscaling and load balancing
- Cloud monitoring and cost management tools (e.g., AWS Cost Explorer, Azure Monitor)

Contents

- **Cloud Services and Applications**

- Compute solutions: VMs, containers, and serverless computing
- Cloud storage solutions: Object (e.g., AWS S3), block (e.g., AWS EBS), and file storage (e.g., Azure Files).
- Cloud databases: NoSQL (e.g., DynamoDB), relational (e.g., RDS).
- Cloud networking and virtual private clouds (VPCs).
- Serverless computing basics
- Cloud application development and deployment models
- Case studies of cloud-based applications

- **Big Data and Analytics in the Cloud**

- Big data concepts and challenges: The 5Vs of Big Data (Volume, Velocity, Variety, Veracity, Value).
- Big data analytics platforms: AWS EMR, GCP BigQuery, Azure Synapse Analytics.
- Cloud-based data warehousing and data lakes
- Data visualization tools: AWS QuickSight, Power BI, GCP Looker Studio.
- Introduction to machine learning in cloud platforms: AWS SageMaker, Azure ML, GCP AI Platform.

Contents

- **Cloud-Native Technologies and Microservices Architecture**

- Cloud-Native Technologies Fundamentals
- Microservices architecture: Benefits, challenges, and use cases.
- Containerization and orchestration: Docker, Kubernetes.
- Cloud-native ecosystem tools: Service Meshes (Istio), monitoring tools (Prometheus, Grafana).

- **Cloud Security and Privacy**

- Cloud Security Fundamentals
- Security in Traditional vs. Cloud-Native Architectures
- Identity and Access Management (IAM)
- Data security and encryption strategies: At rest (e.g., AWS KMS), in transit (TLS).
- Network security: Firewalls (e.g., AWS WAF), VPNs, IDS/IPS.
- Compliance and privacy: GDPR, HIPAA, PCI DSS.

Projects

- **3 projects**
 - Project 1: Build a Scalable Web Application on Cloud
 - Project 2: Big Data Pipeline with Predictive Analytics / Cloud-Based Log Analytics and Business Intelligence System
 - Project 3 (Capstone Project): Deploy and Manage a Scalable Cloud-Native E-Commerce Platform
- Platform: AWS, Azure, Google Cloud
- Form groups of 2–3 students. Each group is required to create an account and provide credit card information during the registration process.



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Assessment

- Final exam: 40% (English quiz)
- Mid exam: 15% (English quiz)
- Exercises, group discussion: 5%
- Practice: 40%
 - Project 1: 10%
 - Project 2: 15%
 - Project 3: 15%