Cloud Services Architecting Practices

Course orientation on

Cloud Services Architecting Practices

Min-Yuh Day, Ph.D, Associate Professor

Institute of Information Management, National Taipei University

https://web.ntpu.edu.tw/~myday

2020-09-17
Tamkang University + AWS Academy

Accredited Instructor

Accredited Educator

AWS Certified Cloud Practitioner

AWS Certified Solutions Architect Associate
課程名稱：雲端服務架構實務
(Cloud Services Architecting Practices)

授課教師：戴敏育 (Min-Yuh Day)

開課系級：資管四P (TLMXB4P) (M2436) (2706)

開課資料：選修 單學期 2 學分
(2 Credits, Elective)

上課時間：週四 Thu 9, 10 (16:10-18:00)

上課地點：B216 (淡江大學淡水校園)

遠距非同步課程
課程簡介

• 雲端服務架構實務課程主要介紹：AWS 技術基礎和在 AWS 上建立架構。
• AWS 技術基礎介紹 AWS 產品、服務和常見解決方案。
• 在 AWS 上建立架構內容涵蓋在 AWS 上建置 IT 基礎架構的基礎。
• 解決方案架構師如何透過了解 AWS 服務來優化對 AWS 雲端的使用，及如何讓這些服務符合雲端解決方案。
• AWS 雲端最佳實務與建議的設計模式，協助學員思考在 AWS 上架構最佳 IT 解決方案的程序。
Course Introduction

• This course, **Cloud Services Architecting Practices**, introduces **AWS Technical Essentials** and **Architecting on AWS**.

• In **AWS Technical Essentials**, students will learn about AWS products, services, and common solutions.

• **Architecting on AWS** covers fundamentals of building IT infrastructure on the AWS platform.

• Students will learn how to optimize the AWS Cloud by understanding how AWS services fit into cloud-based solutions.

• In addition, students explore AWS Cloud best practices and design patterns for architecting optimal IT solutions on AWS.
課程目標

- 與 AWS 平台有關的術語和概念
- 瀏覽 AWS 管理主控台的方法
- AWS 安全措施和 AWS Identity and Access Management (IAM) 的關鍵概念
- 根據 AWS 架構原則和最佳實務做出架構決策
- 利用 AWS 服務，讓您的基礎設施可擴展、可靠且高度可用
Course Objective

• Terminology and concepts related to the AWS platform
• How to navigate the AWS Management Console
• Key concepts of AWS security measures and AWS Identity and Access Management (IAM)
• Make architectural decisions based on AWS architectural principles and best practices
• Leverage AWS services to make your infrastructure scalable, reliable, and highly available
週次 (Week)  日期 (Date)  內容 (Subject/Topics)
1  2020/09/17  Course orientation on Cloud Services Architecting Practices
2  2020/09/24  Introduction to Cloud computing and Amazon Web Services (AWS)
3  2020/10/01  中秋節 (Mid-Autumn Festival) 放假一天 (Day off)
4  2020/10/08  Cloud Economics and Billing, AWS Global Infrastructure
5  2020/10/15  AWS Cloud Security
6  2020/10/22  Networking and Content Delivery: Amazon VPC
課程大綱 (Syllabus)

週次 (Week)  日期 (Date)  內容 (Subject/Topics)
7  2020/10/29  Compute: Amazon EC2, Container services, AWS Lambda
8  2020/11/05  Storage: Amazon EBS, Amazon S3
9  2020/11/12  期中上機測驗
10  2020/11/19  期中考試週
11  2020/11/26  Databases: Amazon RDS, Amazon DynamoDB
12  2020/12/03  Cloud Architecture: AWS Well-Architected Framework, Automatic Scaling and Monitoring
週次 (Week)  日期 (Date)  內容 (Subject/Topics)
13  2020/12/10  AWS Academy Cloud Architecting (ACA)
14  2020/12/17  Designing the Network
15  2020/12/24  Designing for High Availability
16  2020/12/31  Designing for High Availability with Scaling
17  2021/01/07  期末上機測驗
18  2021/01/14  期末考試週
教學目標之教學方法與評量方法

• 教學方法
  • 講述、討論、發表、實作、體驗、模擬

• 評量方法
  • 測驗、討論、實作、報告
學期成績計算方式

• 期中評量：30.0％
• 期末評量：30.0％
• 平時評量：40.0％（課堂參與及報告討論表現）
教材課本與參考書籍

- 教材課本 (Textbook)
  - Slides
  - AWS Academy Cloud Foundations (AWS ACF), AWS Academy
  - AWS Academy Cloud Architecting (AWS ACA), AWS Academy
• 參考書籍 (References)
  • Ben Piper and David Clinton (2019), 
  • AWS Technical Essentials
    • [https://aws.amazon.com/training/course-descriptions/essentials/](https://aws.amazon.com/training/course-descriptions/essentials/)
  • Architecting on AWS
    • [https://aws.amazon.com/training/course-descriptions/architect/](https://aws.amazon.com/training/course-descriptions/architect/)
  • AWS Cloud Practitioner Essentials (Second Edition)
    • [https://aws.amazon.com/training/course-descriptions/cloud-practitioner-essentials/](https://aws.amazon.com/training/course-descriptions/cloud-practitioner-essentials/)
  • AWS Certified Cloud Practitioner
  • AWS Certified Solutions Architect – Associate
Available AWS Certifications

**Professional**
Two years of comprehensive experience designing, operating, and troubleshooting solutions using the AWS Cloud

**Associate**
One year of experience solving problems and implementing solutions using the AWS Cloud

**Foundational**
Six months of fundamental AWS Cloud and industry knowledge

https://aws.amazon.com/certification/
AWS Certified Cloud Practitioner

• This certification provides individuals in a larger variety of cloud and technology roles with a way to validate their AWS Cloud knowledge and enhance their professional credibility.

• This exam covers four domains, including cloud concepts, security, technology, and billing and pricing.

https://aws.amazon.com/certification/certified-cloud-practitioner/
AWS Certified Solutions Architect – Associate

• This certification validates your ability to effectively demonstrate knowledge of how to architect and deploy secure and robust applications on AWS technologies.

• This exam is for anyone with at least one year of hands-on experience designing available, cost-efficient, fault-tolerant, and scalable and distributed systems on AWS.

AWS Academy and Certifications

• **AWS Academy Cloud Foundations (ACF)**
  • **AWS Certified Cloud Practitioner (CLF-C01)** (2021/01)

• **AWS Academy Cloud Architecting (ACA)**
  • **AWS Certified Solutions Architect – Associate (SAA-C02)** (2021/05)

[https://aws.amazon.com/training/awsacademy/](https://aws.amazon.com/training/awsacademy/)
AWS Academy and Certifications

• AWS Academy **Cloud Foundations (ACF)**
  - **AWS Certified Cloud Practitioner (CLF-C01)** (2021/01)
  - AWS Cloud Practitioner Essentials (Second Edition)
    - [https://aws.amazon.com/training/course-descriptions/cloud-practitioner-essentials/](https://aws.amazon.com/training/course-descriptions/cloud-practitioner-essentials/)
  - AWS Technical Essentials
    - [https://aws.amazon.com/training/course-descriptions/essentials/](https://aws.amazon.com/training/course-descriptions/essentials/)

• AWS Academy **Cloud Architecting (ACA)**
  - **AWS Certified Solutions Architect – Associate (SAA-C02)** (2021/05)
    - Architecting on AWS
      - [https://aws.amazon.com/training/course-descriptions/architect/](https://aws.amazon.com/training/course-descriptions/architect/)

[https://aws.amazon.com/training/awsacademy/](https://aws.amazon.com/training/awsacademy/)
# AWS Certified Cloud Practitioner (CLF-C01)

<table>
<thead>
<tr>
<th>Domain</th>
<th>% of Examination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domain 1: Cloud Concepts</td>
<td>26%</td>
</tr>
<tr>
<td>Domain 2: Security and Compliance</td>
<td>25%</td>
</tr>
<tr>
<td>Domain 3: Technology</td>
<td>33%</td>
</tr>
<tr>
<td>Domain 4: Billing and Pricing</td>
<td>16%</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

## AWS Certified Solutions Architect – Associate (SAA-C02)

<table>
<thead>
<tr>
<th>Domain</th>
<th>% of Examination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domain 1: Design Resilient Architectures</td>
<td>30%</td>
</tr>
<tr>
<td>Domain 2: Design High-Performing Architectures</td>
<td>28%</td>
</tr>
<tr>
<td>Domain 3: Specify Secure Applications and Architectures</td>
<td>24%</td>
</tr>
<tr>
<td>Domain 4: Design Cost-Optimized Architectures</td>
<td>18%</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

AWS Certified Cloud Practitioner (CLF-C01)

Source: https://aws.amazon.com/certification/certified-cloud-practitioner/
AWS Certified Cloud Practitioner (CLF-C01)

• Domain 1: Cloud Concepts
  • 1.1 Define the AWS Cloud and its value proposition
  • 1.2 Identify aspects of AWS Cloud economics
  • 1.3 List the different cloud architecture design principles

Source: https://aws.amazon.com/certification/certified-cloud-practitioner/
AWS Certified Cloud Practitioner (CLF-C01)

• Domain 2: Security and Compliance
  • 2.1 Define the AWS shared responsibility model
  • 2.2 Define AWS Cloud security and compliance concepts
  • 2.3 Identify AWS access management capabilities
  • 2.4 Identify resources for security support

Source: https://aws.amazon.com/certification/certified-cloud-practitioner/
AWS Certified Cloud Practitioner (CLF-C01)

• Domain 3: Technology
  • 3.1 Define methods of deploying and operating in the AWS Cloud
  • 3.2 Define the AWS global infrastructure
  • 3.3 Identify the core AWS services
  • 3.4 Identify resources for technology support

Source: https://aws.amazon.com/certification/certified-cloud-practitioner/
• Domain 4: Billing and Pricing
  • 4.1 Compare and contrast the various pricing models for AWS
  • 4.2 Recognize the various account structures in relation to AWS billing and pricing
  • 4.3 Identify resources available for billing support

Source: https://aws.amazon.com/certification/certified-cloud-practitioner/
AWS Certified Solutions Architect – Associate (SAA-C02)

Source: https://aws.amazon.com/certification/certified-solutions-architect-associate
AWS Certified Solutions Architect – Associate (SAA-C02)

• Domain 1: Design Resilient Architectures
  • 1.1 Design a multi-tier architecture solution
  • 1.2 Design highly available and/or fault-tolerant architectures
  • 1.3 Design decoupling mechanisms using AWS services
  • 1.4 Choose appropriate resilient storage

Source: https://aws.amazon.com/certification/certified-solutions-architect-associate
• Domain 2: Design **High-Performing Architectures**
  
  • 2.1 Identify elastic and scalable compute solutions for a workload  
  • 2.2 Select high-performing and scalable storage solutions for a workload  
  • 2.3 Select high-performing networking solutions for a workload  
  • 2.4 Choose high-performing database solutions for a workload

• Domain 3: Design **Secure** Applications and Architectures
  
  • 3.1 Design secure access to AWS resources
  • 3.2 Design secure application tiers
  • 3.3 Select appropriate data security options

• Domain 4: Design Cost-Optimized Architectures
  • 4.1 Identify cost-effective storage solutions
  • 4.2 Identify cost-effective compute and database services
  • 4.3 Design cost-optimized network architectures

Source: https://aws.amazon.com/certification/certified-solutions-architect-associate
AWS Products and Services

Source: https://aws.amazon.com/
<table>
<thead>
<tr>
<th>Service</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Amazon EC2</strong></td>
<td>Virtual servers in the cloud</td>
</tr>
<tr>
<td><strong>Amazon Elastic Container Service</strong></td>
<td>Run and manage docker containers</td>
</tr>
<tr>
<td><strong>AWS Batch</strong></td>
<td>Run batch jobs at any scale</td>
</tr>
<tr>
<td><strong>AWS Lambda</strong></td>
<td>Run code without thinking about servers</td>
</tr>
<tr>
<td><strong>AWS Wavelength</strong></td>
<td>Deliver ultra-low latency applications for 5G devices</td>
</tr>
<tr>
<td><strong>Amazon EC2 Auto Scaling</strong></td>
<td>Scale compute capacity to meet demand</td>
</tr>
<tr>
<td><strong>Amazon Elastic Kubernetes Service</strong></td>
<td>Run managed Kubernetes on AWS</td>
</tr>
<tr>
<td><strong>AWS Elastic Beanstalk</strong></td>
<td>Run and manage web apps</td>
</tr>
<tr>
<td><strong>AWS Outposts</strong></td>
<td>Run AWS infrastructure on-premises</td>
</tr>
<tr>
<td><strong>VMware Cloud on AWS</strong></td>
<td>Build a hybrid cloud without custom hardware</td>
</tr>
<tr>
<td><strong>Amazon Elastic Container Registry</strong></td>
<td>Store and retrieve docker images</td>
</tr>
<tr>
<td><strong>Amazon Lightsail</strong></td>
<td>Launch and manage virtual private servers</td>
</tr>
<tr>
<td><strong>AWS Fargate</strong></td>
<td>Run containers without managing servers or clusters</td>
</tr>
<tr>
<td><strong>AWS Serverless Application Repository</strong></td>
<td>Discover, deploy, and publish serverless applications</td>
</tr>
</tbody>
</table>
AWS Database

- Amazon Aurora
  High Performance Managed Relational Database

- Amazon ElastiCache
  In-memory Caching System

- Amazon Quantum Ledger Database (QLDB)
  Fully managed ledger database

- Amazon Redshift
  Fast, Simple, Cost-effective Data Warehousing

- Amazon DynamoDB
  Managed NoSQL Database

- Amazon Managed Apache Cassandra Service
  Managed Cassandra-compatible database

- Amazon RDS
  Managed Relational Database Service for MySQL, PostgreSQL, Oracle, SQL Server, and MariaDB

- Amazon DocumentDB (with MongoDB compatibility)
  Fully managed document database

- Amazon Neptune
  Fully Managed Graph Database Service

- Amazon RDS on VMware
  Automate on-premises database management

- Amazon Timestream
  Fully managed time series database

- AWS Database Migration Service
  Migrate Databases with Minimal Downtime

Source: https://aws.amazon.com/
AWS Storage

Amazon Simple Storage Service (S3)
Scalable Storage in the Cloud

Amazon F5x for Lustre
High-performance file system integrated with S3

AWS Backup
Centralized backup across AWS services

Amazon Elastic Block Store (EBS)
EC2 block storage volumes

Amazon F5x for Windows File Server
Fully managed Windows native file system

AWS Snow Family
Physical devices to migrate data into and out of AWS

Amazon Elastic File System (EFS)
Fully managed file system for EC2

Amazon S3 Glacier
Low-cost Archive Storage in the Cloud

CloudEndure Disaster Recovery
Highly automated disaster recovery

AWS Storage Gateway
Hybrid Storage Integration

Source: https://aws.amazon.com/
### AWS Networking & Content Delivery

<table>
<thead>
<tr>
<th>Service</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amazon VPC</td>
<td>Isolated Cloud Resources</td>
</tr>
<tr>
<td>Amazon Route 53</td>
<td>Scalable Domain Name System</td>
</tr>
<tr>
<td>AWS Cloud Map</td>
<td>Application resource registry for microservices</td>
</tr>
<tr>
<td>AWS Transit Gateway</td>
<td>Easily scale VPC and account connections</td>
</tr>
<tr>
<td>Amazon API Gateway</td>
<td>Build, Deploy, and Manage APIs</td>
</tr>
<tr>
<td>AWS PrivateLink</td>
<td>Securely Access Services Hosted on AWS</td>
</tr>
<tr>
<td>AWS Direct Connect</td>
<td>Dedicated Network Connection to AWS</td>
</tr>
<tr>
<td>Elastic Load Balancing</td>
<td>Distribute incoming traffic across multiple targets</td>
</tr>
<tr>
<td>Amazon CloudFront</td>
<td>Global Content Delivery Network</td>
</tr>
<tr>
<td>AWS App Mesh</td>
<td>Monitor and control microservices</td>
</tr>
<tr>
<td>AWS Global Accelerator</td>
<td>Improve application availability and performance</td>
</tr>
</tbody>
</table>

Source: [https://aws.amazon.com/](https://aws.amazon.com/)
## AWS Cost Management

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AWS Cost Explorer</strong></td>
<td>Analyze Your AWS Cost and Usage</td>
</tr>
<tr>
<td><strong>Reserved Instance Reporting</strong></td>
<td>Dive Deeper into Your Reserved Instances (RIs)</td>
</tr>
<tr>
<td><strong>AWS Budgets</strong></td>
<td>Set Custom Cost and Usage Budgets</td>
</tr>
<tr>
<td><strong>Savings Plans</strong></td>
<td>Save up to 72% on compute usage with flexible pricing</td>
</tr>
<tr>
<td><strong>AWS Cost and Usage Report</strong></td>
<td>Access Comprehensive Cost and Usage Information</td>
</tr>
</tbody>
</table>

Source: [https://aws.amazon.com/](https://aws.amazon.com/)
AWS Services

- Amazon **EC2**
  - Virtual servers in the cloud
- Amazon **Simple Storage Service (S3)**
  - Scalable storage in the cloud
- Amazon **Aurora**
  - High performance managed relational database
- Amazon **DynamoDB**
  - Managed NoSQL database
- Amazon **RDS**
  - Managed relational database service for MySQL, PostgreSQL, Oracle, SQL Server, and MariaDB

Source: [https://aws.amazon.com/](https://aws.amazon.com/)
• **AWS Lambda**
  • Run code without thinking about servers

• **AWS Elastic Beanstalk**
  • Run and manage web apps

• **Amazon VPC**
  • Isolated cloud resources

• **Amazon Lightsail**
  • Launch and manage virtual private servers

• **Amazon SageMaker**
  • Build, train, and deploy machine learning models at scale

Source: [https://aws.amazon.com/](https://aws.amazon.com/)
Web Application with AWS Core Services
fb.com on AWS

AWS Application Services

AWS Security Services

AWS Serverless Airline Booking

Source: https://github.com/aws-samples/aws-serverless-airline-booking
UI/UX
- Quasar framework
- Vue.js
- AWS Amplify

Data/Lang
- Amazon DynamoDB
- Python
- Typescript
- JavaScript

API/Auth
- AWS AppSync
- Amazon API Gateway
- Amazon Cognito

Messaging
- Amazon SNS
- AWS Step Functions

Source: https://github.com/aws-samples/aws-serverless-airline-booking
AWS Serverless Airline Booking
High level infrastructure architecture

Source: https://github.com/aws-samples/aws-serverless-airline-booking
AWS Serverless Architecture

AWS Operational Responsibility Models

Source: Heitor Lessa (2019), How to build a full stack serverless airline ticketing web app, https://www.youtube.com/watch?v=MyoOeH1a2eg
Build
a
Serverless
Web Application
Build a Serverless Web Application

Overview

In this tutorial, you'll create a simple serverless web application that enables users to request unicorn rides from the Wild Rydes fleet. The application will present users with an HTML based user interface for indicating the location where they would like to be picked up and will interface on the backend with a RESTful web service to submit the request and dispatch a nearby unicorn. The application will also provide facilities for users to register with the service and log in before requesting rides.

Application Architecture

Source: https://aws.amazon.com/getting-started/projects/build-serverless-web-app-lambda-apigateway-s3-dynamodb-cognito/
Build a Serverless Web Application with Amazon S3, AWS Lambda, Amazon API Gateway, Amazon DynamoDB, and Amazon Cognito

Source: https://aws.amazon.com/getting-started/projects/build-serverless-web-app-lambda-apigateway-s3-dynamodb-cognito/
Build a Serverless Web Application with Amazon S3, AWS Lambda, Amazon API Gateway, Amazon DynamoDB, and Amazon Cognito

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Build a Serverless Web Application with Amazon S3, AWS Lambda, Amazon API Gateway, Amazon DynamoDB, and Amazon Cognito

Static Web Hosting
Amazon S3 hosts static web resources including HTML, CSS, JavaScript, and image files which are loaded in the user's browser.

Source: https://aws.amazon.com/getting-started/projects/build-serverless-web-app-lambda-apigateway-s3-dynamodb-cognito/
Build a Serverless Web Application with Amazon S3, AWS Lambda, Amazon API Gateway, Amazon DynamoDB, and Amazon Cognito

Source: https://aws.amazon.com/getting-started/projects/build-serverless-web-app-lambda-apigateway-s3-dynamodb-cognito/
Build a Serverless Web Application with Amazon S3, AWS Lambda, Amazon API Gateway, Amazon DynamoDB, and Amazon Cognito

2

User Management

Amazon Cognito provides user management and authentication functions to secure the backend API.

Source: https://aws.amazon.com/getting-started/projects/build-serverless-web-app-lambda-apigateway-s3-dynamodb-cognito/
Build a Serverless Web Application
with Amazon S3, AWS Lambda, Amazon API Gateway,
Amazon DynamoDB, and Amazon Cognito

Source: https://aws.amazon.com/getting-started/projects/build-serverless-web-app-lambda-apigateway-s3-dynamodb-cognito/
Serverless Backend

Amazon DynamoDB provides a persistence layer where data can be stored by the API's Lambda function.
Build a Serverless Web Application
with Amazon S3, AWS Lambda, Amazon API Gateway,
Amazon DynamoDB, and Amazon Cognito

Source: https://aws.amazon.com/getting-started/projects/build-serverless-web-app-lambda-apigateway-s3-dynamodb-cognito/
Build a Serverless Web Application with Amazon S3, AWS Lambda, Amazon API Gateway, Amazon DynamoDB, and Amazon Cognito

RESTful API
JavaScript executed in the browser sends and receives data from a public backend API built using Lambda and API Gateway.

Source: https://aws.amazon.com/getting-started/projects/build-serverless-web-app-lambda-apigateway-s3-dynamodb-cognito/
5 Terminate resources

Resource Cleanup

You will terminate an **Amazon S3** bucket, an **Amazon Cognito** User Pool, an **AWS Lambda** function, an **IAM** role, a **DynamoDB** table, a **REST API**, and a **CloudWatch** Log.

It is a best practice to **delete resources** you are no longer using to avoid unwanted charges.

Summary

• 雲端服務架構實務課程主要介紹：AWS 技術基礎和在 AWS 上建立架構。
• AWS 技術基礎介紹 AWS 產品、服務和常見解決方案。
• 在 AWS 上建立架構內容涵蓋在 AWS 上建置 IT 基礎架構的基礎。
• 解決方案架構師如何透過了解 AWS 服務來優化對 AWS 雲端的使用，及如何讓這些服務符合雲端解決方案。
• AWS 雲端最佳實務與建議的設計模式，協助學員思考在 AWS 上架構最佳 IT 解決方案的程序。
雲端服務架構實務
(Cloud Services Architecting Practices)

Contact Information

戴敏育 博士 (Min-Yuh Day, Ph.D.)
副教授 (Associate Professor)

國立台北大學 資訊管理研究所

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網址：http://web.ntpu.edu.tw/~myday/