Week 7 – Proxy and Cloud Network

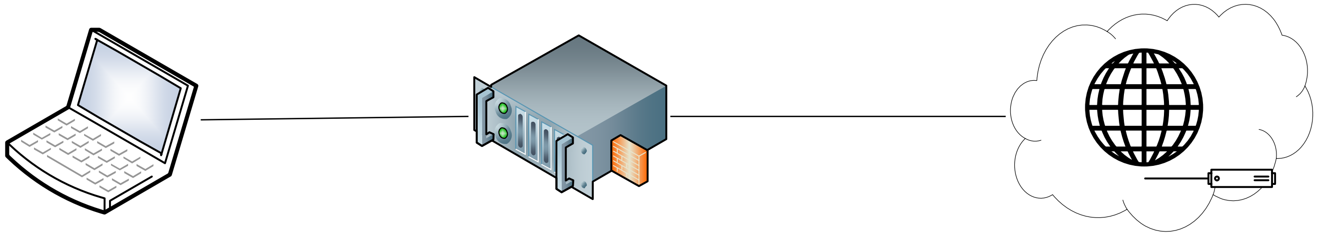
Dr Kiki Adhinugraha

Outline

- Reverse proxying with NGINX
- Universal JavaScript
- Networking in Cloud
- AWS Academy

Proxy

- A proxy server is a system or router that provides a gateway between users and the internet.
- It is a server, referred to as an “intermediary” because it goes between internal and the external networks.



https://www.youtube.com/watch?v=j9-Y0KWVJ1k

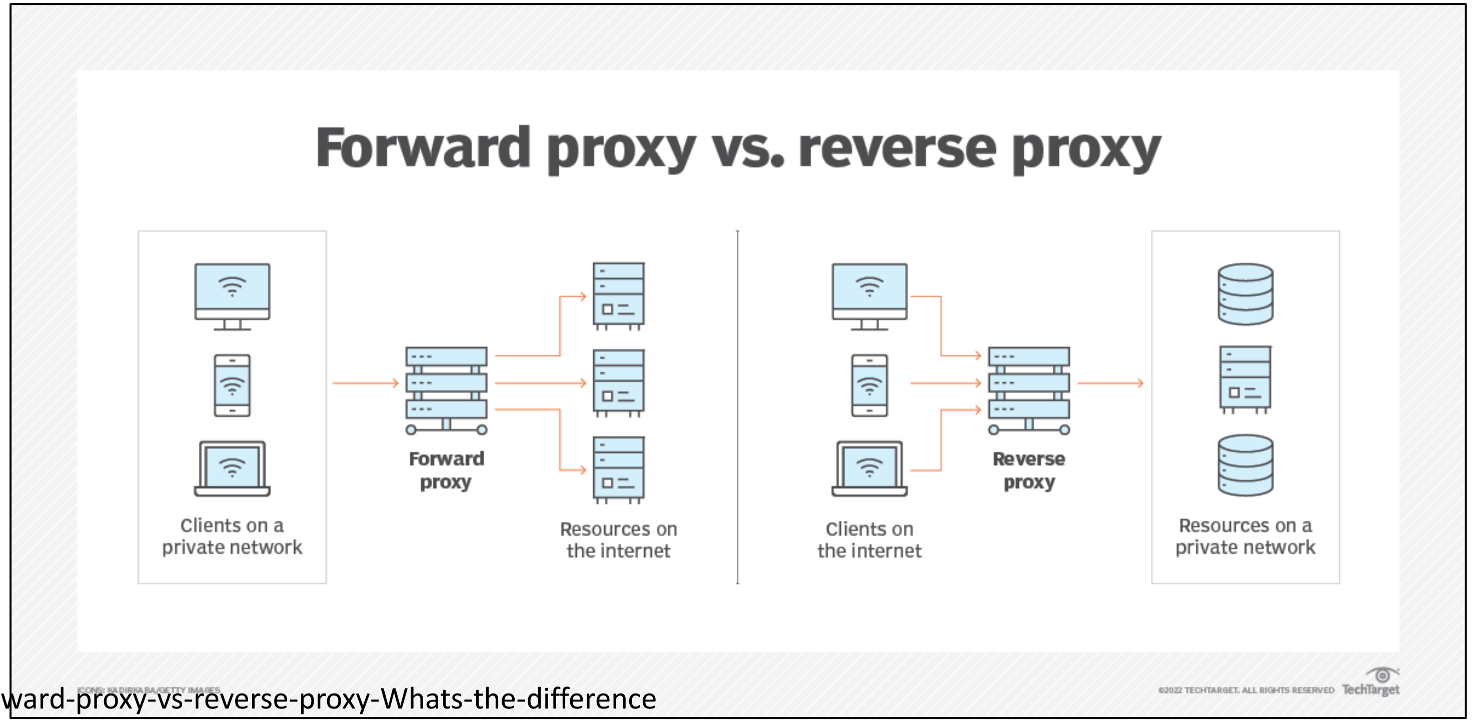
Proxy Type

Forward Proxy

- Protect the clients on a private network.
- It is the single point of exit for subnet users who want to access resources outside of their private network.

Reverse Proxy

- Protect the servers on its private network
- acts as a single point of entry for external systems to access resources on a private subnet.


Forward proxy vs. reverse proxy
Clients on a private network
Forward proxy
Resources on the internet
Clients on the internet
Reverse proxy
Resources on a private network
ICONS: KADIRKABA/GETTY IMAGES
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TechTarget

https://www.theserverside.com/feature/Forward-proxy-vs-reverse-proxy-Whats-the-difference

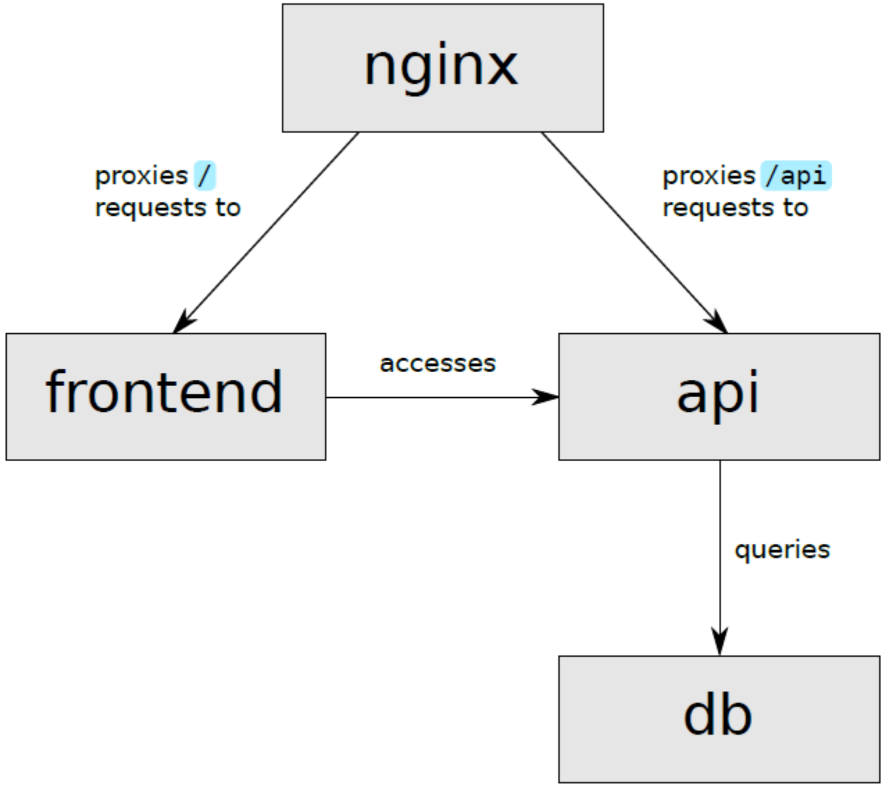
Reverse proxying with NGINX

- Consider you have a server with domain name www.example.com
- You have exposed the following ports:
  - Port 3001 for the API service
  - Port 3000 for the Frontend service
- However you want people to access both services via the default http port of 80.

- So you want people to access the different services via different paths:

- www.example.com:80/**api**
  - goes to the API service on port 3001

- www.example.com:80 /
  - goes to the Frontend service on port 3000



What is NGINX

- Pronounced as “Engine X”
- Open source web and reverse proxy server
- High performance HTTP, HTTPS, SMTP, IMAP, POP3 server
- Load balancing and HTTP caching
- Asynchronous event-driven architecture

Who use NGINX

WordPress

NETFLIX

Pinterest

HEROKU

GitHub

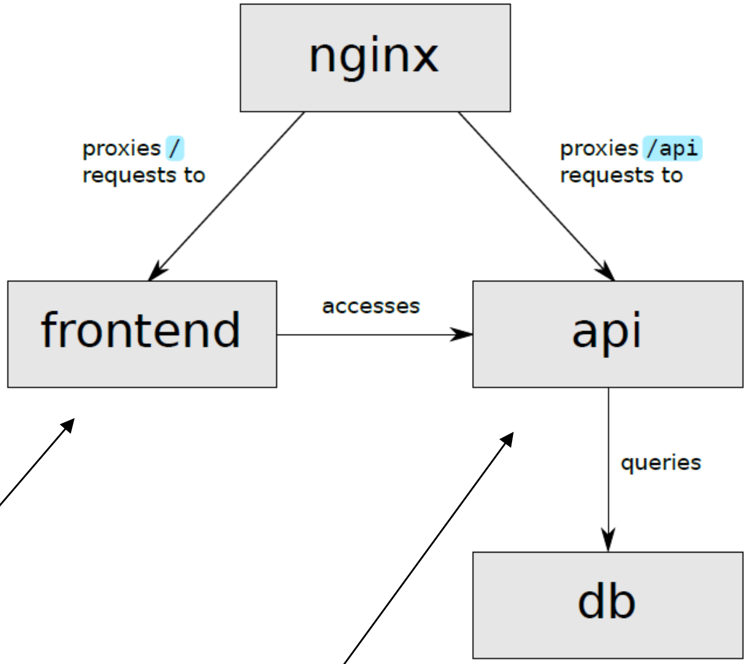
airbnb

And many more……
https://www.nginx.com/resources/wiki

Why use NGINX

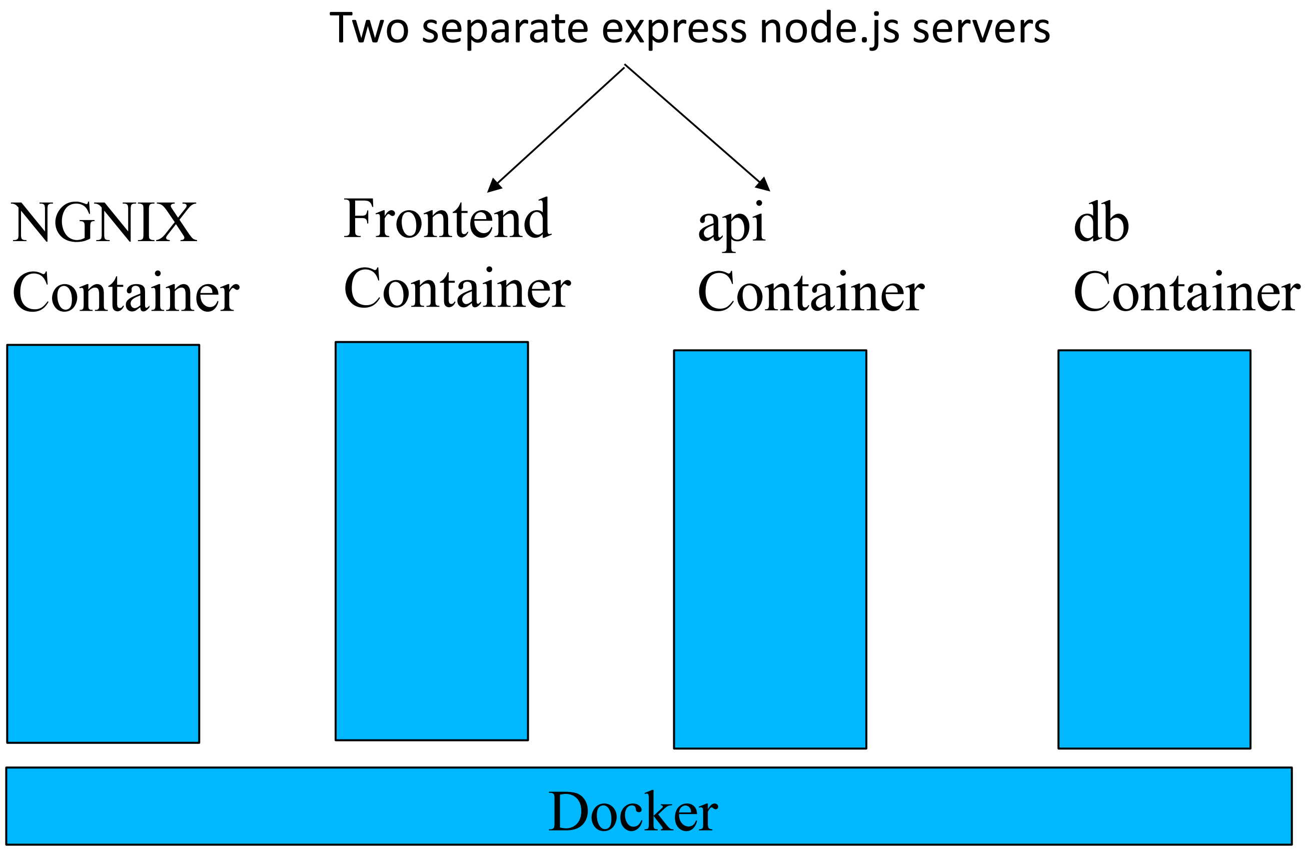
- Lightweight with small memory footprint
- Uses predictable memory under load
- Provides high level of concurrency
- Serves static content quickly
- Handles connections asynchronously
- Uses single thread

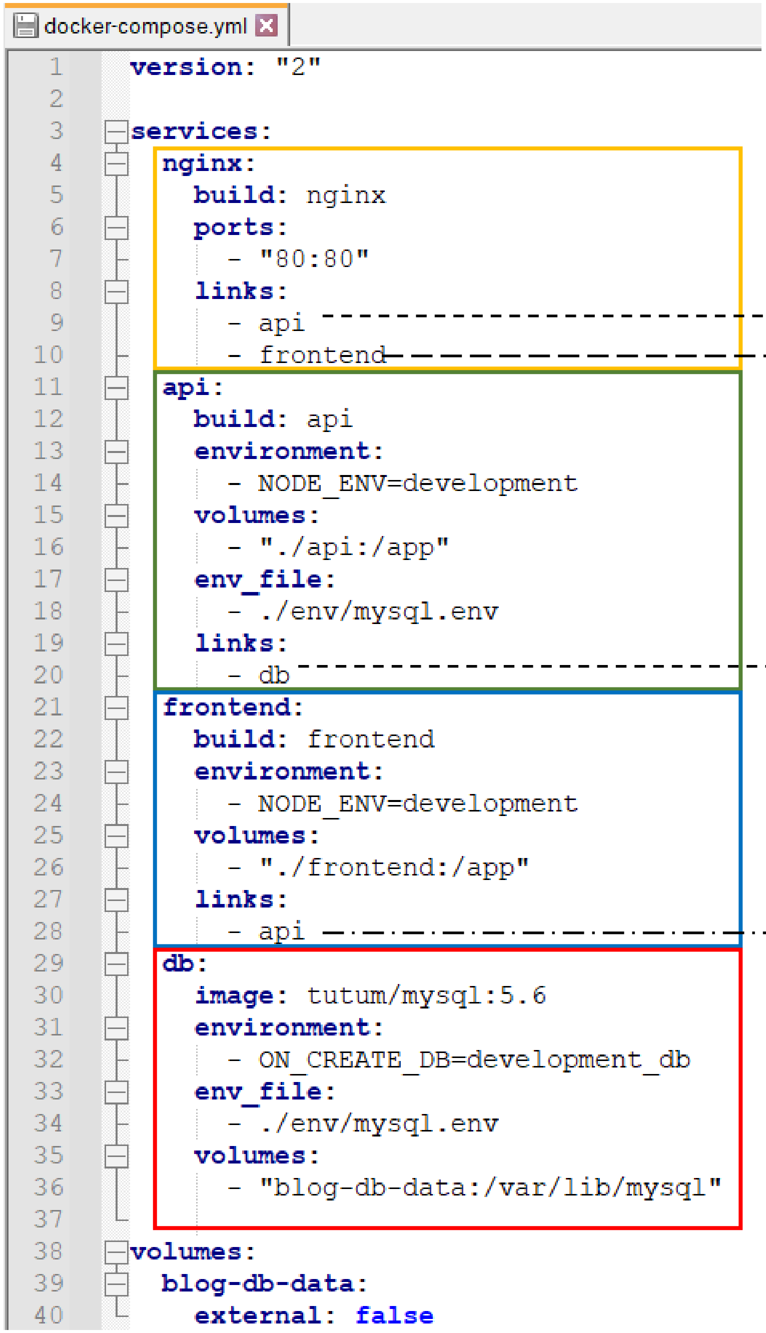
NGINX Configuration File



```
server {
  listen 80;
  location / {
    # Tell NGINX where to find the running service
    proxy_pass http://localhost:3000;
  }
  # Configure all requests in this subdirectory to be handled
  # by another service
  location /api/ {
    # This rewrite ensures that requests to the proxied
    # service are made relative to / rather than /api/
    rewrite /api/(.*) /$1 break;
    # Tell NGINX where to find the running service
    proxy_pass http://localhost:3001;
  }
```

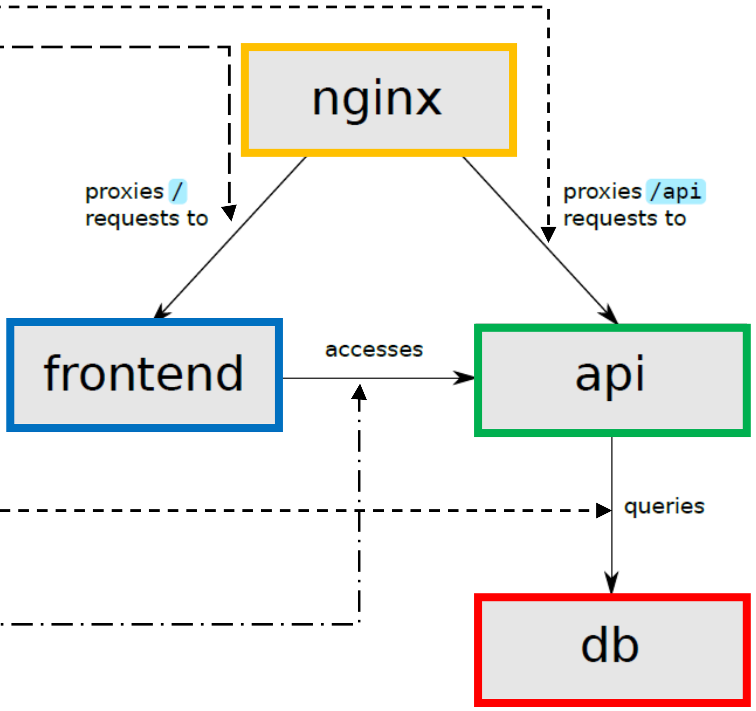
Docker Micro Services (Using 4 Containers)





docker-compose.yml

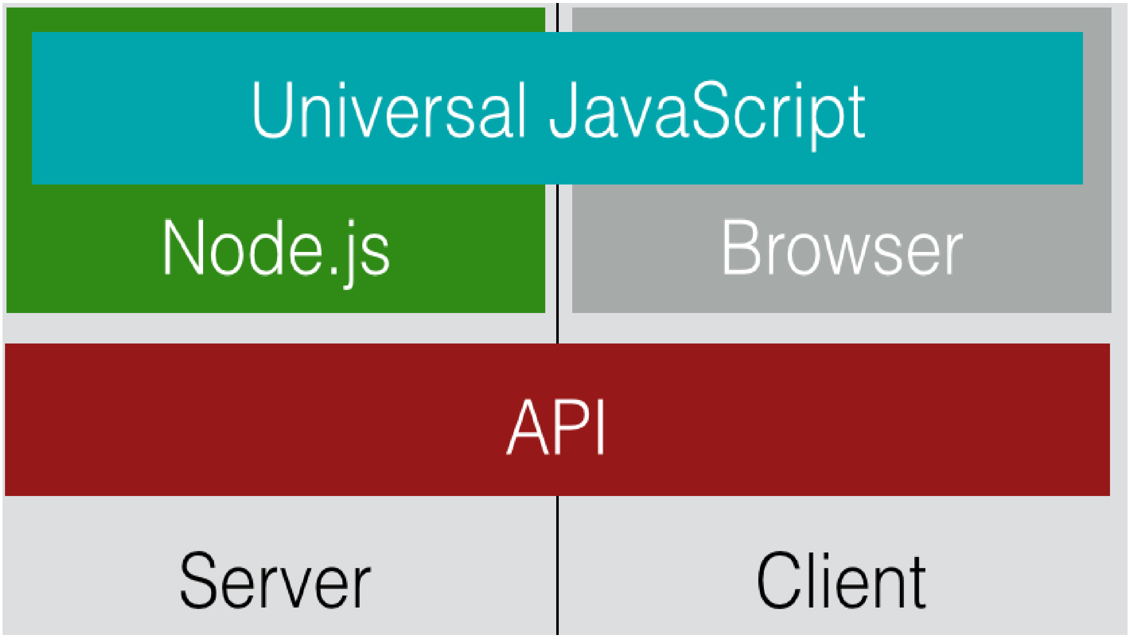
```yaml
version: "2"

services:
  nginx:
    build: nginx
    ports:
      - "80:80"
    links:
      - api
      - frontend
  api:
    build: api
    environment:
      - NODE_ENV=development
    volumes:
      - "./api:/app"
    env_file:
      - ./env/mysql.env
    links:
      - db
  frontend:
    build: frontend
    environment:
      - NODE_ENV=development
    volumes:
      - "./frontend:/app"
    links:
      - api
  db:
    image: tutum/mysql:5.6
    environment:
      - ON_CREATE_DB=development_db
    env_file:
      - ./env/mysql.env
    volumes:
      - "blog-db-data:/var/lib/mysql"

volumes:
  blog-db-data:
    external: false
```



- The "links" shows how the routing should work

Universal JavaScript (Server side rendering)

- React allows you to render your web page on the server.
- This is good for people who do not have JavaScript installed on their browser.
- It is also good for simple devices like mobile phones which maybe slow (server side rendering takes load off phone)
- For browsers that do not support JavaScript, universal JavaScript will generate a read only page
- But that is still better than just a blank or error page



Universal JavaScript

- NOT ONLY for Webs
  - Desktop applications
  - Mobile applications
  - Hardware
- "JavaScript-only" development
- Faster "perceived" load time
- Keep using React/JS paradigms also to generate "static" websites

Universal JavaScript

- **Universal Rendering**: Render the views of the application from the server (first request) and then in the browser (next requests)
- **Universal Routing:** Recognise the view associated to the current route from both the server and the browser.
- **Universal Data Retrieval:** Access data (and APIs) from both the server and the browser
- **Universal State Management:** Manage changes on the state tree both on the server and the client.

Universal JavaScript (Server side rendering)

A standard React app

```
Class MyApp extends React.Component { render() { …. }
}
ReactDOM.render(
   <MyApp />, document.getElementById(‘app’)
)
```

Server side when using universal JavaScript:

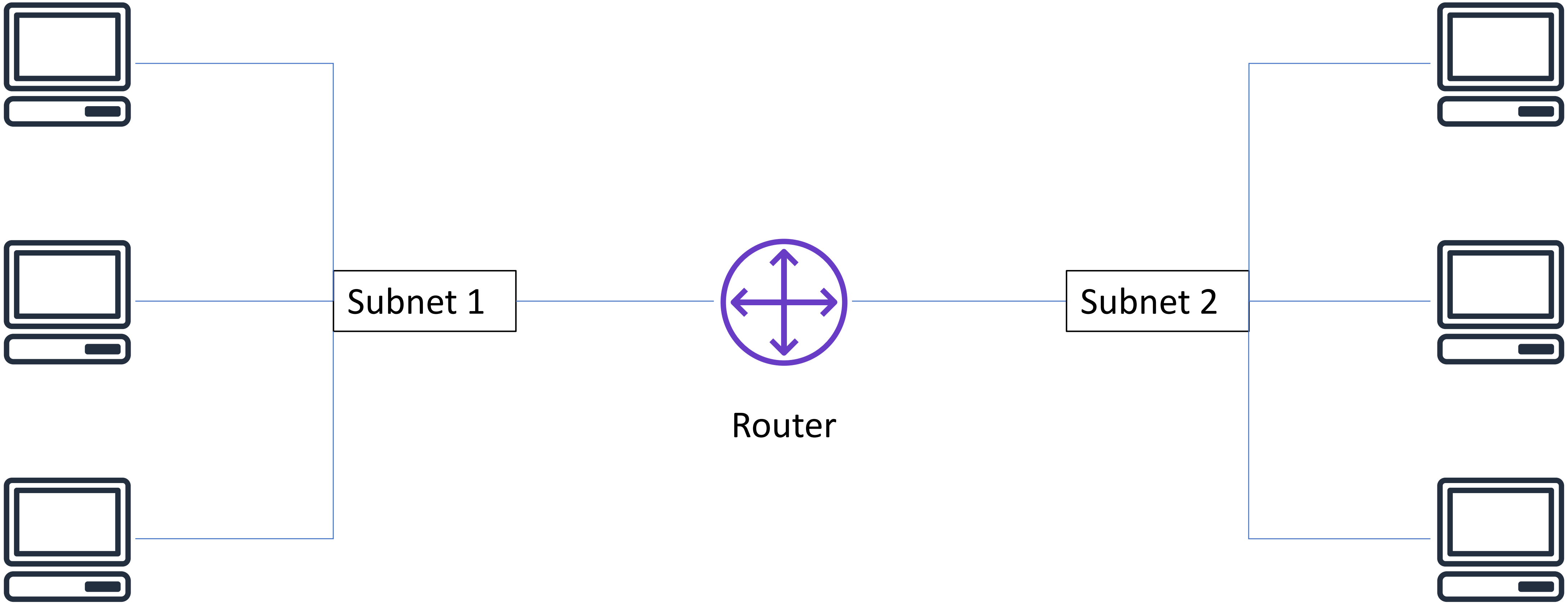
```
Class MyApp extends React.Component { render() { …. }
}
ReactDOM.renderToString(<MyApp />)
```

Node.js Integration

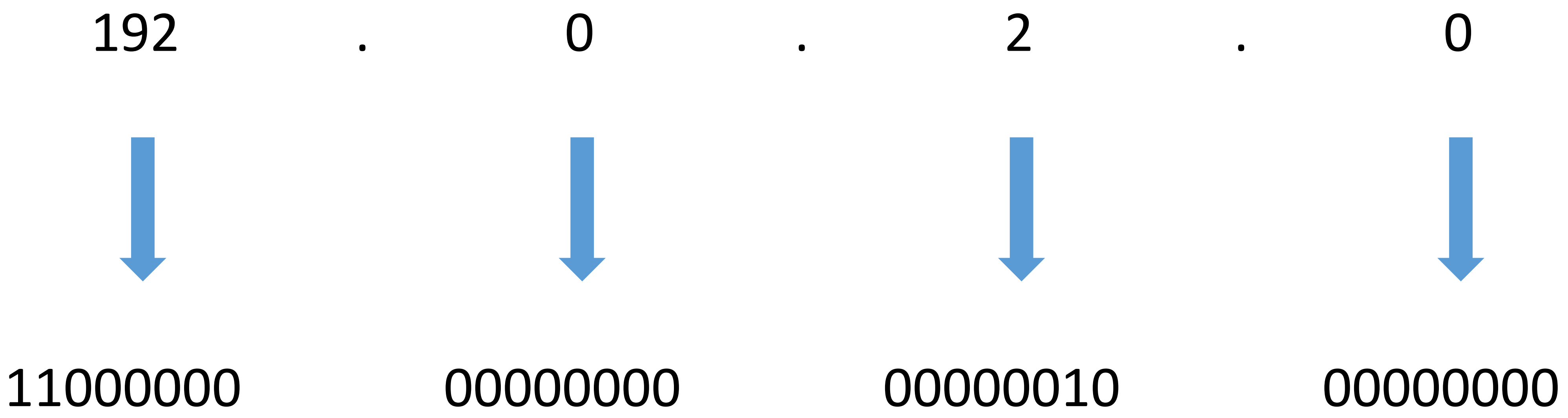
```
// some imports left out to save space
import React from ‘react’;
import MyApp from ‘./component’;
import { renderToString } from ‘react-dom/server’;

const app = express();

app.get('*', (req, res) => {
    const markup = renderToString(<MyApp />);
    res.render(‘index’, { markup });
});
```

Networking basics

Networks



IP addresses



192 . 0 . 2 . 0

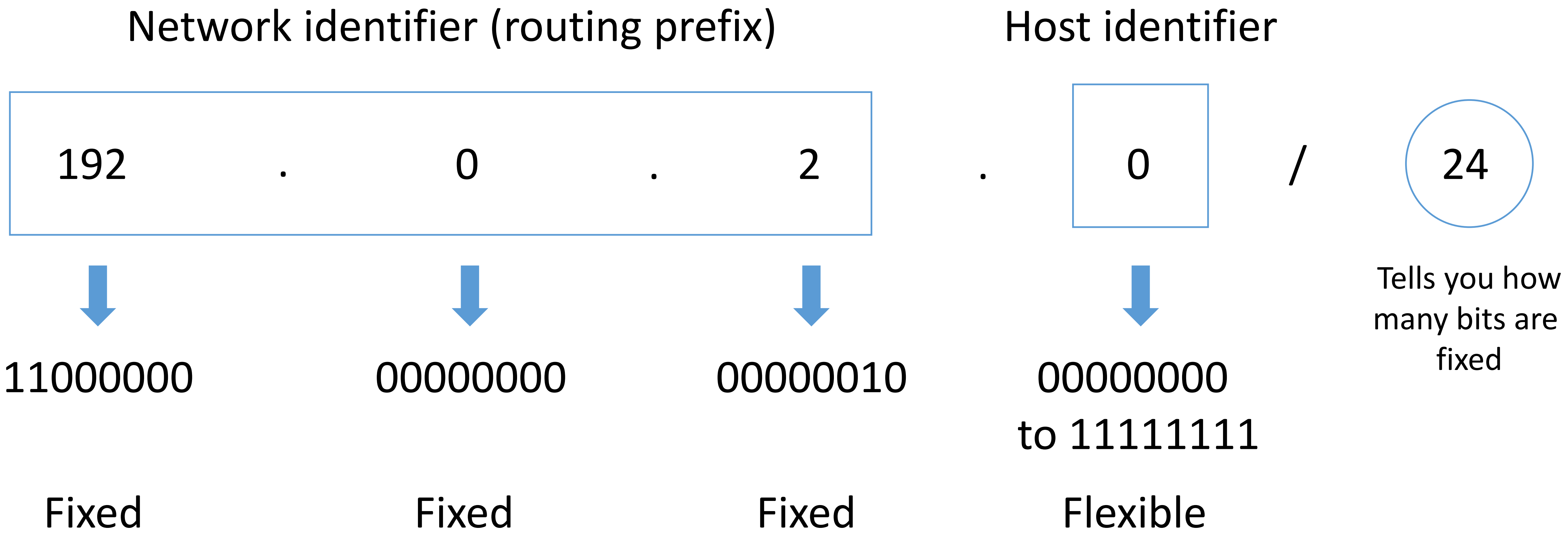
11000000 00000000 00000010 00000000

IPv4 and IPv6 addresses

IPv4 (32-bit) address: 192.0.2.0

IPv6 (128-bit) address: 2600:1f18:22ba:8c00:ba86:a05e:a5ba:00FF

Classless Inter-Domain Routing (CIDR)



Network identifier (routing prefix)

Host identifier

192 . 0 . 2 . 0 / 24

Tells you how many bits are fixed

11000000

Fixed

00000000

Fixed

00000010

Fixed

00000000 to 11111111

Flexible

CIDR Examples

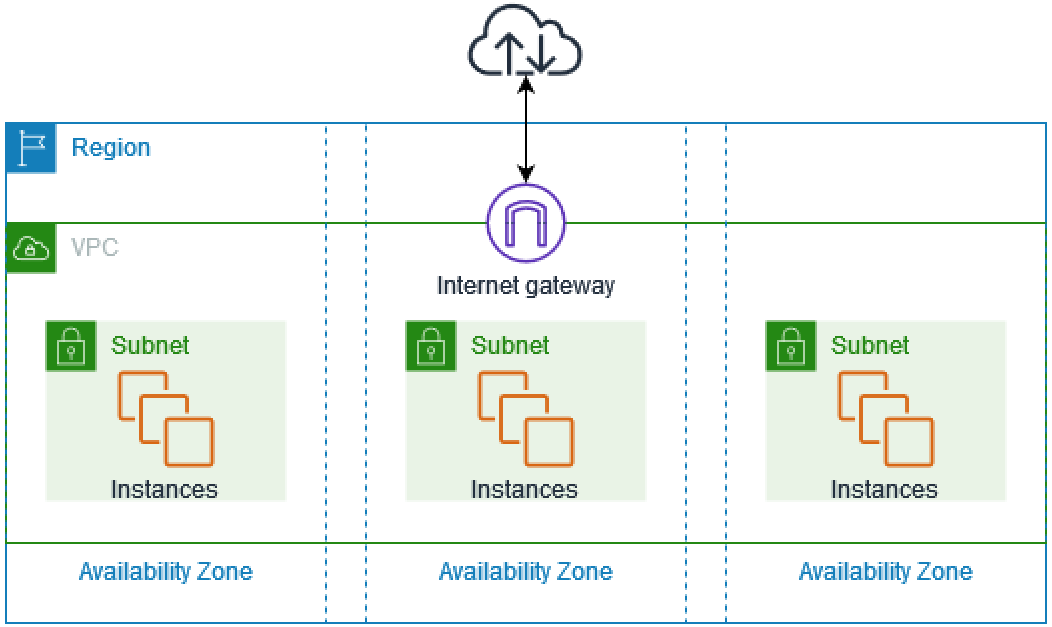
- IP address of 10.1.1.1 with Subnet of 255.0.0.0 = 10.1.1.1/8
  - Subnet mask in binary 11111111 00000000 00000000 00000000
- IP address of 10.1.1.1 with Subnet of 255.255.0.0 = 10.1.1.1/16
  - Subnet mask in binary 11111111 11111111 00000000 00000000
- IP address of 10.1.1.1 with Subnet of 255.255.255.0 = 10.1.1.1/24
  - Subnet mask in binary 11111111 11111111 11111111 00000000
- IP address of 192.168.1.50 with Subnet of 255.255.255.240 = 10.1.1.1/28
  - Subnet mask in binary 11111111 11111111 11111111 11110000

Virtual Private Clouds (VPC)

- A VPC is a virtual network that closely resembles a traditional network that you'd operate in your own data center. After you create a VPC, you can add subnets.
- In this example, we will refer to AWS VPC.
- Enables you to provision a logically isolated section of the AWS Cloud where you can launch AWS resources in a virtual network that you define
- Gives you control over your virtual networking resources, including:
  - Selection of IP address range
  - Creation of subnets
  - Configuration of route tables and network gateways
- Enables you to customize the network configuration for your VPC
- Enables you to use multiple layers of security

Virtual Private Cloud and subnets

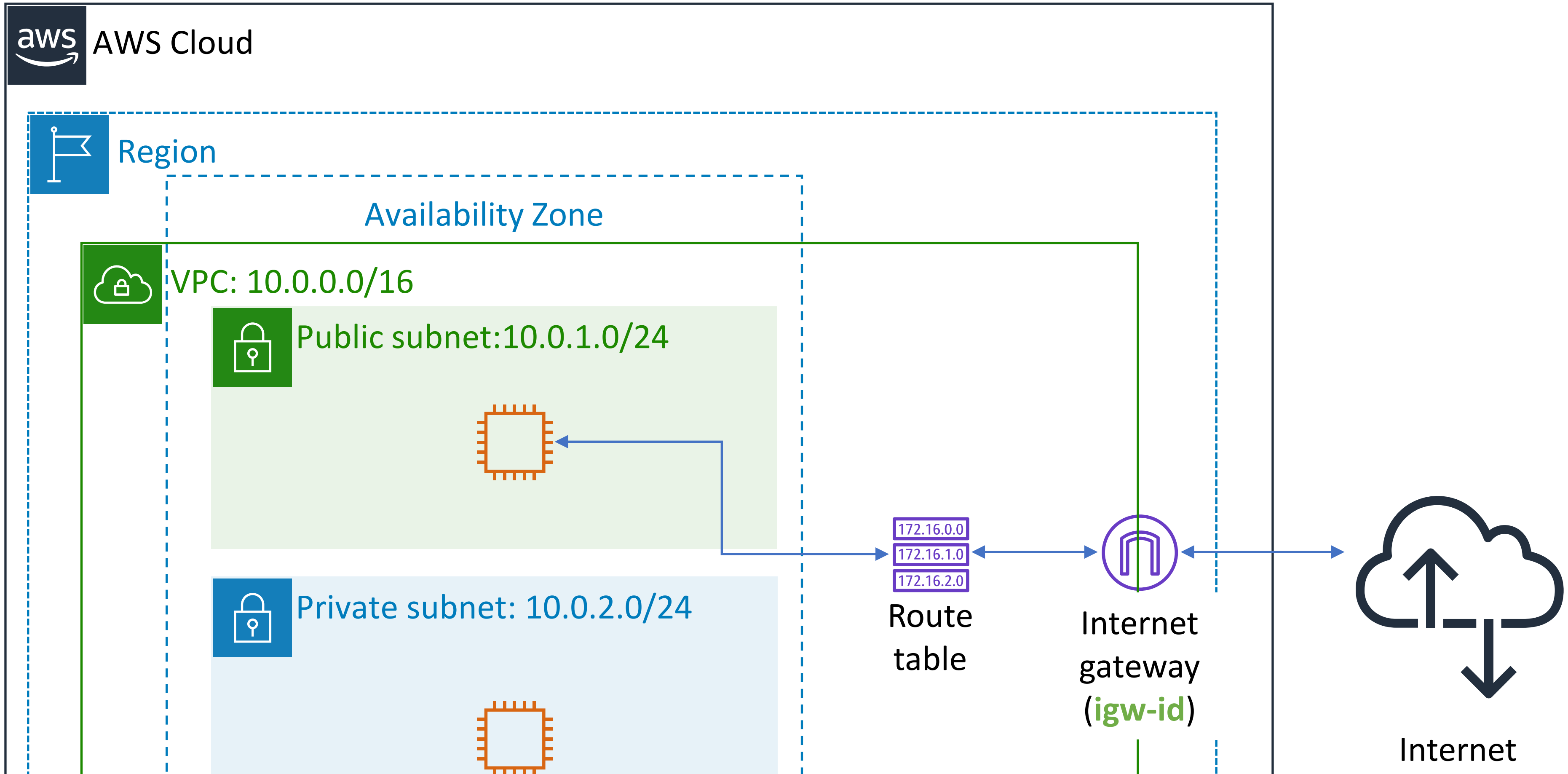
- VPCs:
  - Logically isolated from other VPCs
  - Dedicated to your AWS account
  - Belong to a single AWS Region and can span multiple Availability Zones
- Subnets:
  - Range of IP addresses that divide a VPC
  - Belong to a single Availability Zone
  - Classified as public or private



VPC networking implementation

Networking and Content Delivery

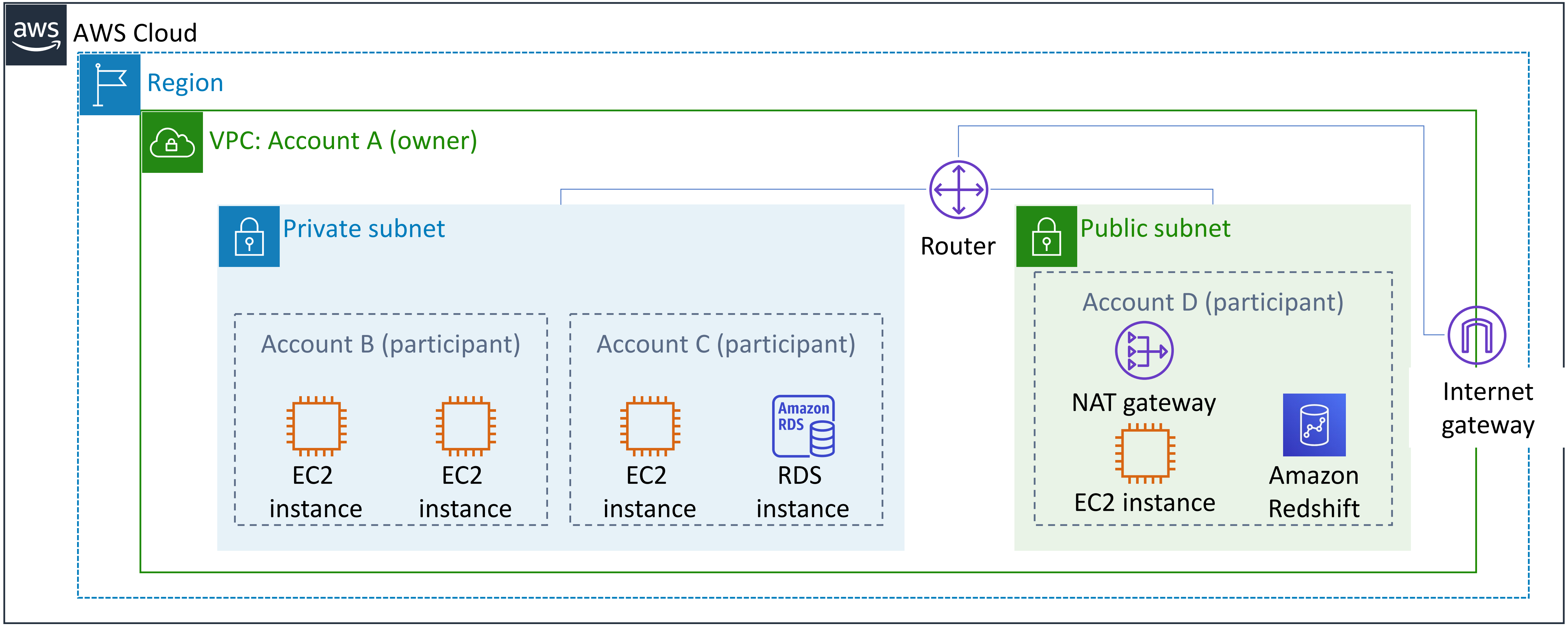
Internet gateway



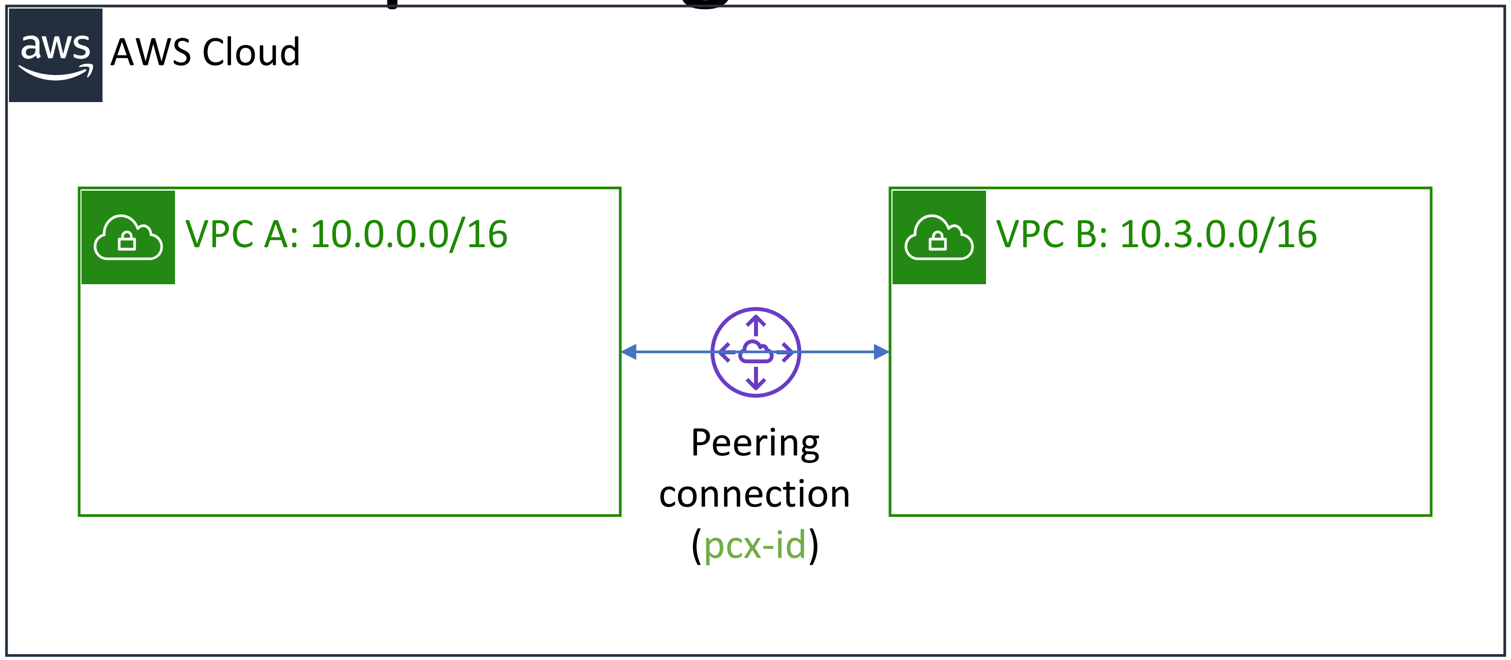
Public Subnet Route Table

Destination	**Target**
10.0.0.0/16	local
0.0.0.0/0	igw-id

VPC sharing


AWS Cloud
Region
VPC: Account A (owner)
Router
Private subnet
Public subnet
Account B (participant)
EC2 instance
EC2 instance
Account C (participant)
EC2 instance
Amazon RDS
RDS instance
Account D (participant)
NAT gateway
EC2 instance
Amazon Redshift
Internet gateway

VPC peering



AWS Cloud

VPC A: 10.0.0.0/16

VPC B: 10.3.0.0/16

Peering connection (pcx-id)

Route Table for VPC A

Destination	Target
10.0.0.0/16	local
10.3.0.0/16	pcx-id

Route Table for VPC B

Destination	Target
10.3.0.0/16	local
10.0.0.0/16	pcx-id

You can connect VPCs in your own AWS account, between AWS accounts, or between AWS Regions.

Restrictions:

- IP spaces cannot overlap.
- Transitive peering is not supported.
- You can only have one peering resource between the same two VPCs.

Introduction to AWS Academy

AWS Academy

- AWS Academy offers courses and learning resources that enable students to develop a range of skills in the AWS Cloud. Approved educators have access all AWS Academy courses and AWS Academy Learner Lab
- Developed by Amazon to enable the students to pursuit the certification in AWS Cloud technologies

AWS Specialisation

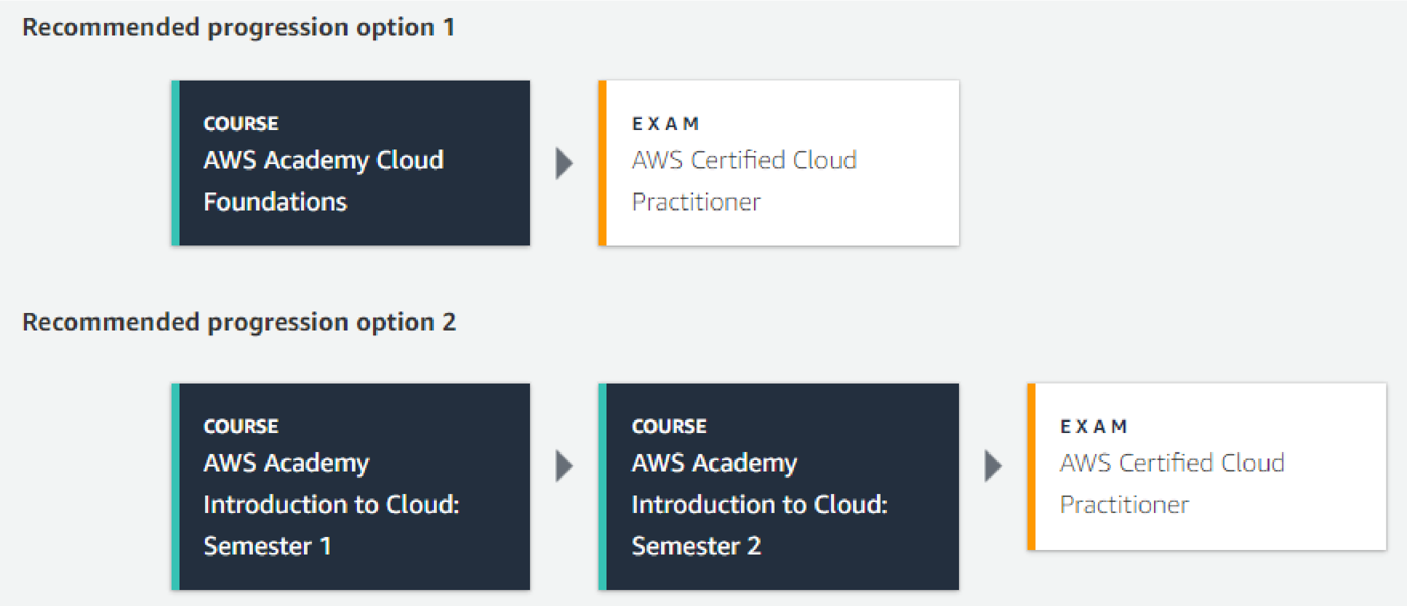
- Cloud Foundation
- Developing

CSE3CWA / CSE5006

- Architecting
- Operations
- Machine Learning
- Data
- Data Centers
- Security

AWS Academy Cloud Foundations

- This introductory course is intended for students who seek an overall understanding of cloud computing concepts, independent of specific technical roles. It provides a detailed overview of cloud concepts, AWS core services, security, architecture, pricing, and support.



Recommended progression option 1

COURSE
AWS Academy Cloud Foundations

EXAM
AWS Certified Cloud Practitioner

Recommended progression option 2

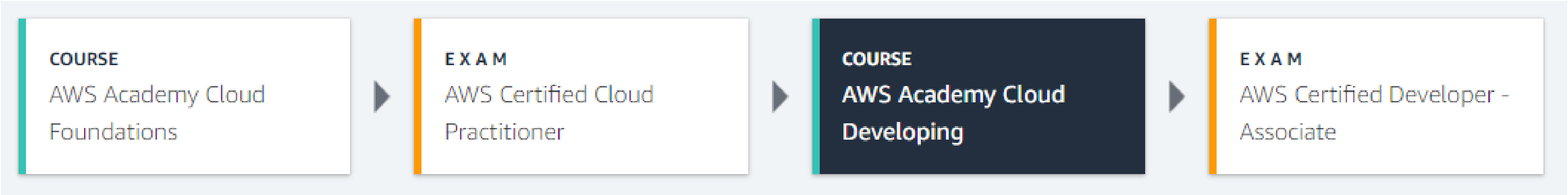
COURSE
AWS Academy Introduction to Cloud: Semester 1

COURSE
AWS Academy Introduction to Cloud: Semester 2

EXAM
AWS Certified Cloud Practitioner

AWS Academy Cloud Developing

- This intermediate-level course will help students gain technical expertise in development with cloud technologies. It will also help them prepare for the AWS Certified Developer - Associate certification exam.
- Upon completion, students will be able to develop with the AWS SDK and identify best practices for building and deploying applications in the AWS Cloud.



COURSE
AWS Academy Cloud Foundations

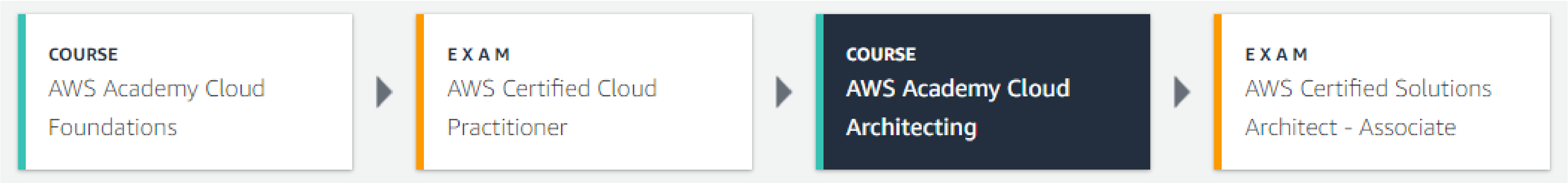
EXAM
AWS Certified Cloud Practitioner

COURSE
AWS Academy Cloud Developing

EXAM
AWS Certified Developer - Associate

AWS Academy Cloud Architecting

- This intermediate-level course covers the fundamentals of building IT infrastructure on AWS and helps students gain the skills they need to pursue the AWS Certified Solutions Architect – Associate certification.



COURSE
AWS Academy Cloud Foundations

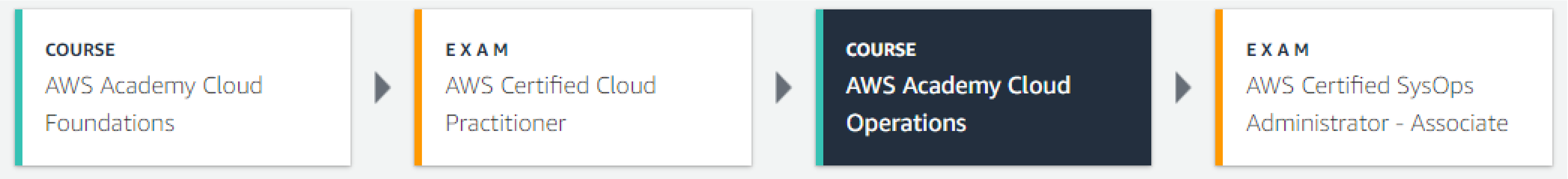
EXAM
AWS Certified Cloud Practitioner

COURSE
AWS Academy Cloud Architecting

EXAM
AWS Certified Solutions Architect - Associate

AWS Academy Cloud Operations

- This intermediate-level course will prepare students to pursue in-demand DevOps, support, and cloud operations roles at the entry level. It will also help them prepare for the AWS Certified SysOps Administrator – Associate exam.
- Through case studies, demonstrations, and hands-on activities, students will learn how to troubleshoot various scenarios and automate deployments of networks and systems on AWS.



COURSE
AWS Academy Cloud Foundations

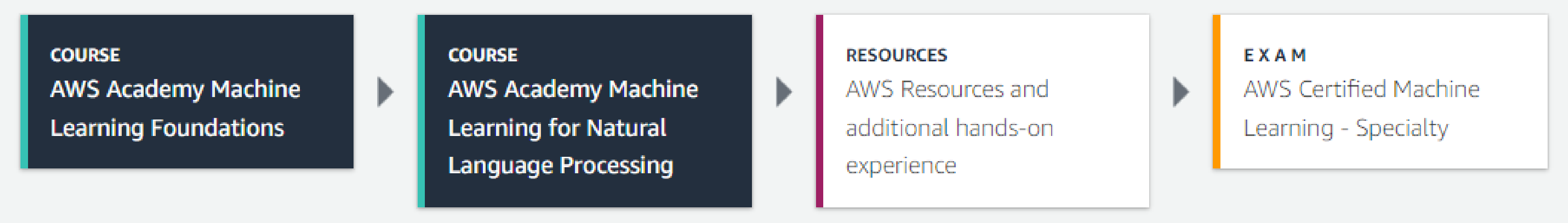
EXAM
AWS Certified Cloud Practitioner

COURSE
AWS Academy Cloud Operations

EXAM
AWS Certified SysOps Administrator - Associate

AWS Academy Machine Learning Foundations

- This introductory course introduces students to the concepts and terminology of artificial intelligence (AI) and machine learning (ML). By the end of this course, students will be able to select and apply ML services to resolve business problems. They will also be able to label, build, train, and deploy a custom ML model.



COURSE
AWS Academy Machine Learning Foundations

COURSE
AWS Academy Machine Learning for Natural Language Processing

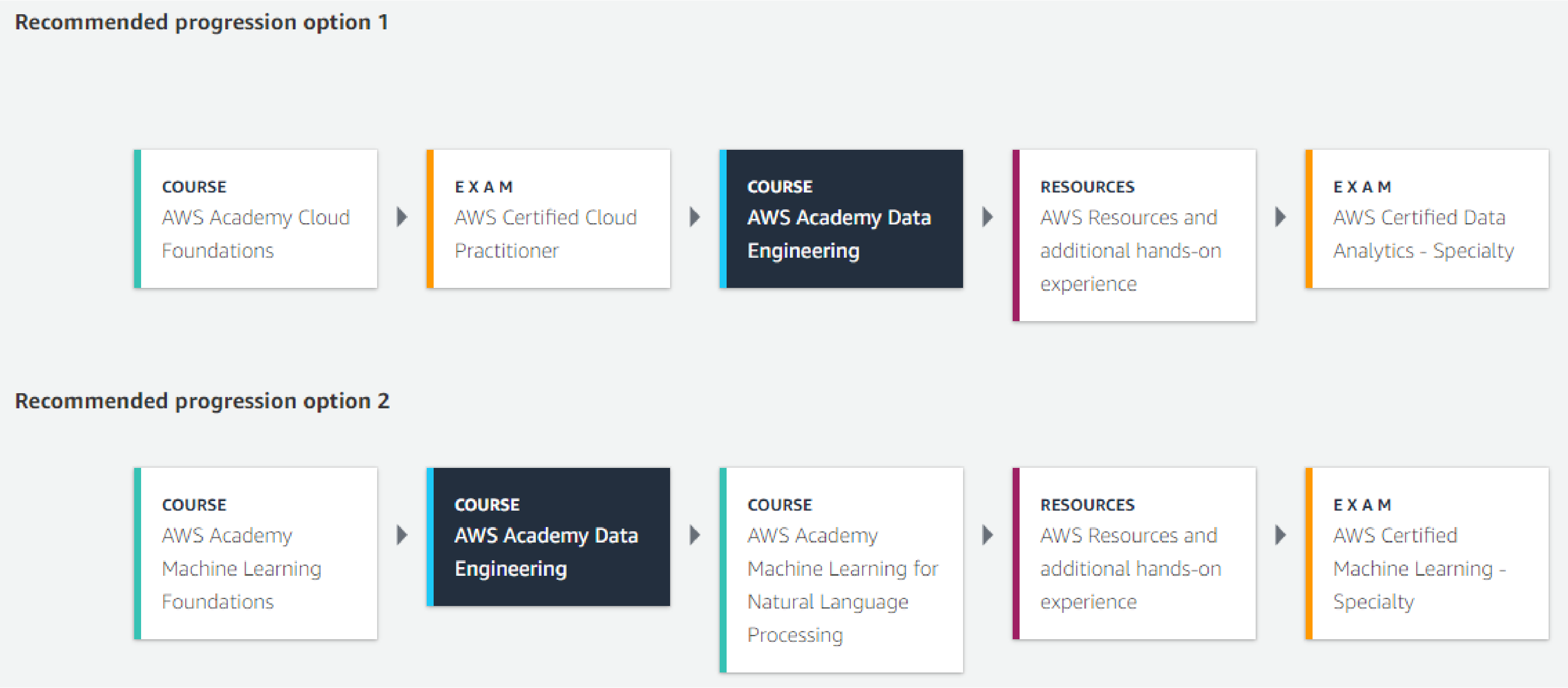
RESOURCES
AWS Resources and additional hands-on experience

EXAM
AWS Certified Machine Learning - Specialty

AWS Academy Data Engineering

- AWS Academy Data Engineering is designed to help students learn about and get hands-on practice with the tasks, tools, and strategies used to collect, store, prepare, analyze, and visualize data for use in analytics and machine learning applications.
- Throughout the course, students will explore use cases from real world applications that will enable them to make informed decisions while building the data pipeline for their particular application.

AWS Academy Data Engineering



Recommended progression option 1

- COURSE: AWS Academy Cloud Foundations
- EXAM: AWS Certified Cloud Practitioner
- COURSE: **AWS Academy Data Engineering**
- RESOURCES: AWS Resources and additional hands-on experience
- EXAM: AWS Certified Data Analytics - Specialty

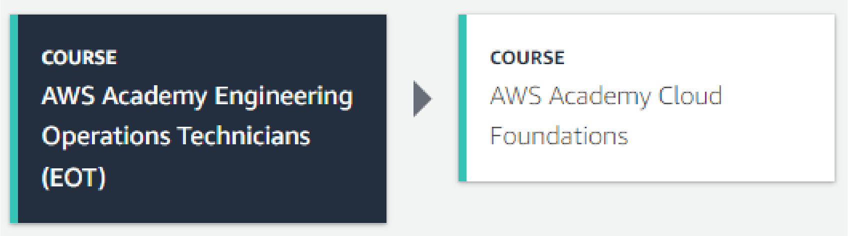
Recommended progression option 2

- COURSE: AWS Academy Machine Learning Foundations
- COURSE: **AWS Academy Data Engineering**
- COURSE: AWS Academy Machine Learning for Natural Language Processing
- RESOURCES: AWS Resources and additional hands-on experience
- EXAM: AWS Certified Machine Learning - Specialty

AWS Academy for Data Centers

Engineering Operations Technicians (EOT)

- This course provides an overview of the fundamental concepts and skills required for the Engineering Operations Technician role in a Data Center environment

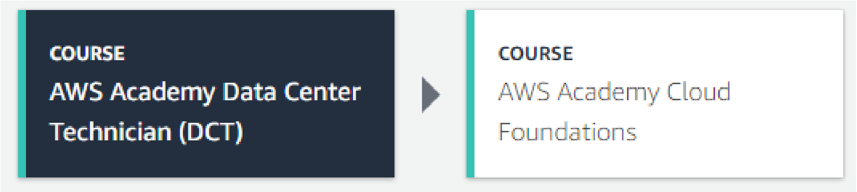


COURSE
AWS Academy Engineering Operations Technicians (EOT)

COURSE
AWS Academy Cloud Foundations

AWS Academy Data Center Technician (DCT)

- This course is designed to help students develop technical expertise in data center operations. Although this is a foundational course, students should possess a general knowledge of mechanical and electrical engineering concepts.

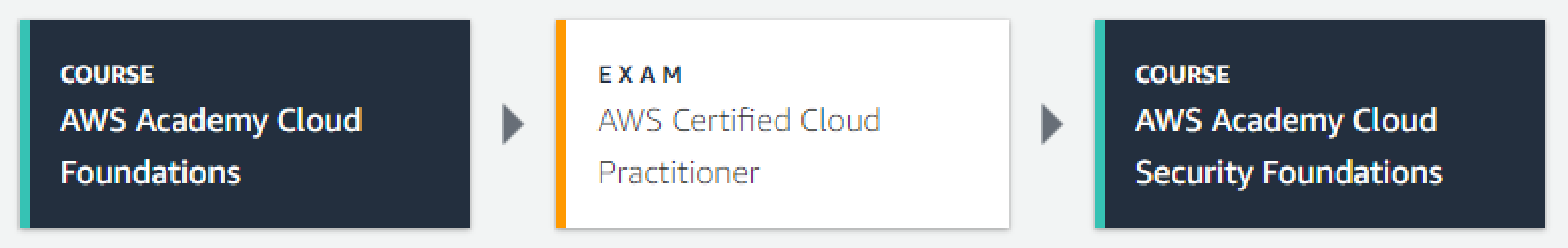


COURSE
AWS Academy Data Center Technician (DCT)

COURSE
AWS Academy Cloud Foundations

AWS Academy Cloud Security Foundations

- This course is designed to help students gain a foundational knowledge of cybersecurity principles and services for cloud computing through a guided hands-on approach. This course includes demonstrations, instructional guides, and real-life scenarios.



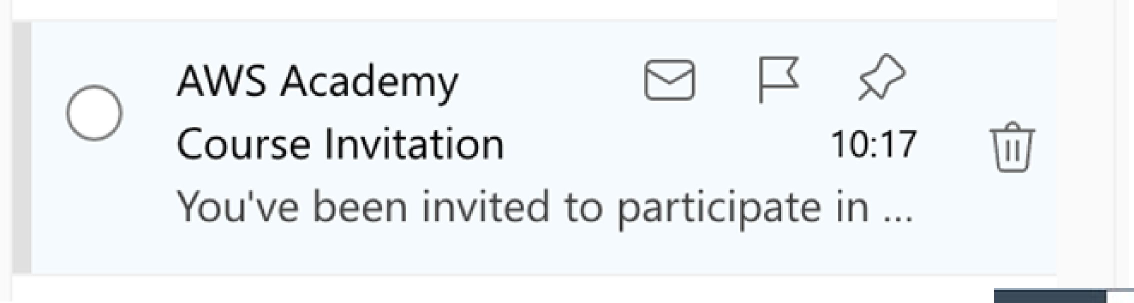
COURSE
AWS Academy Cloud Foundations

EXAM
AWS Certified Cloud Practitioner

COURSE
AWS Academy Cloud Security Foundations

Activate your account

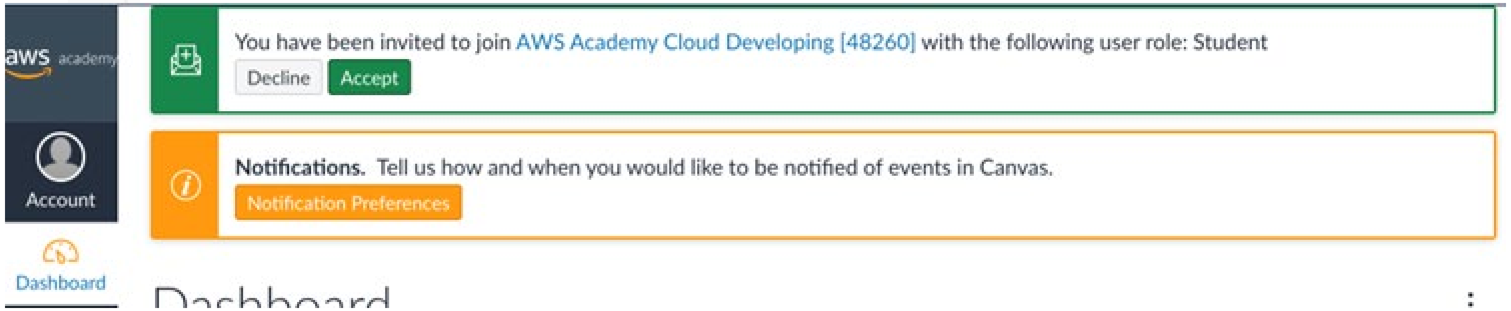
- Your lecturer will send you the invitation to access the AWS Academy system. Please check La Trobe's email for the invitation.
- If you haven't received the email, please contact your instance coordinator or subject coordinator as soon as possible.



AWS Academy

Course Invitation 10:17

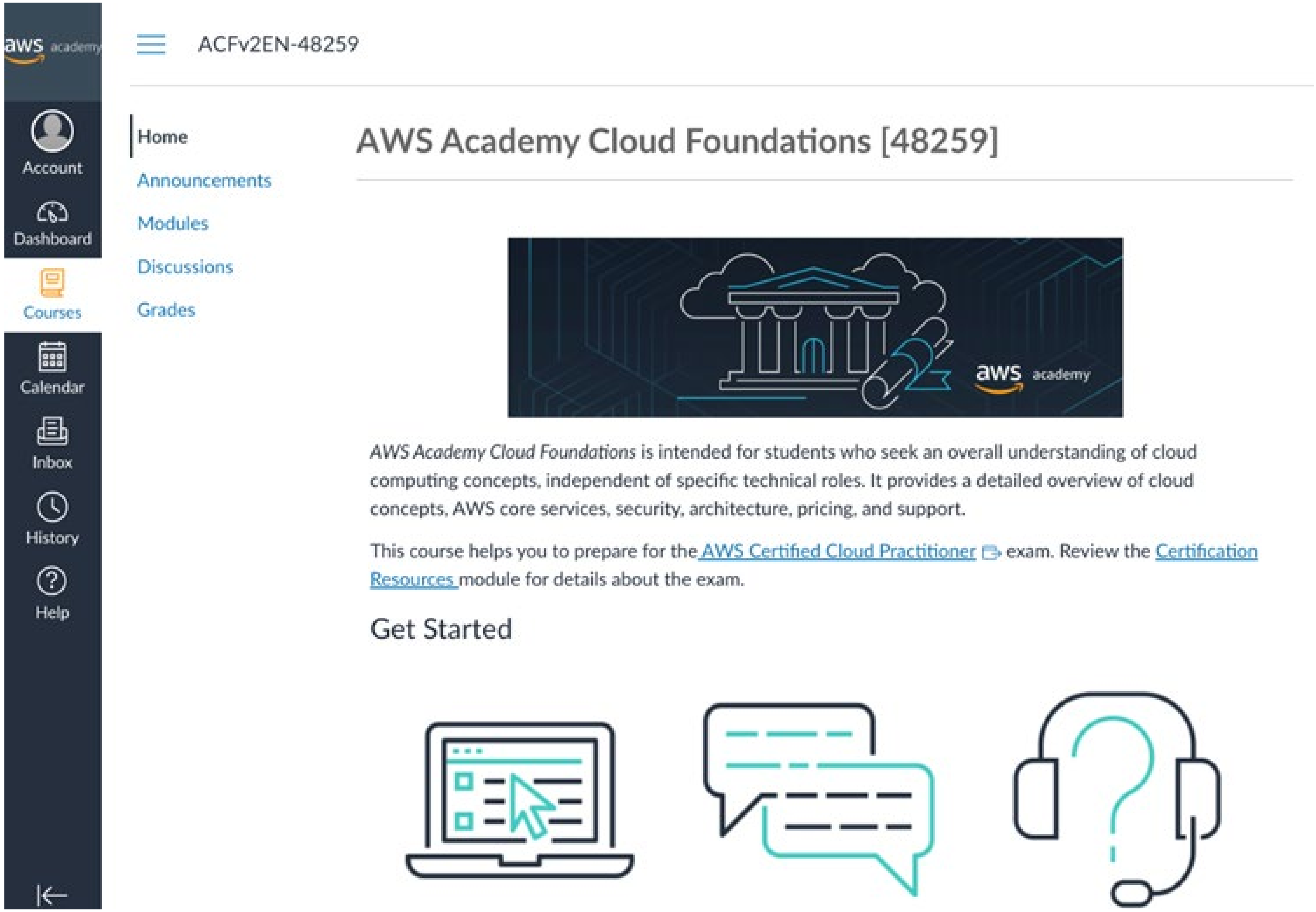
You've been invited to participate in ...



You have been invited to join AWS Academy Cloud Developing [48260] with the following user role: Student

Notifications. Tell us how and when you would like to be notified of events in Canvas.

AWS Academy Dashboard



AWS Academy Cloud Foundations [48259]

AWS Academy Cloud Foundations is intended for students who seek an overall understanding of cloud computing concepts, independent of specific technical roles. It provides a detailed overview of cloud concepts, AWS core services, security, architecture, pricing, and support.

This course helps you to prepare for the AWS Certified Cloud Practitioner exam. Review the Certification Resources module for details about the exam.

Get Started

AWS Academy Courses and Modules

- You will enrol into two different courses:
  - **AWS Academy Cloud Foundations**
  - **AWS Academy Cloud Developing**
- Your AWS Academy course completion **does not affect your final mark** in this subject.
- If you complete all of the modules and pass the quizzes in AWS Academy course, you will obtain **AWS badge**.

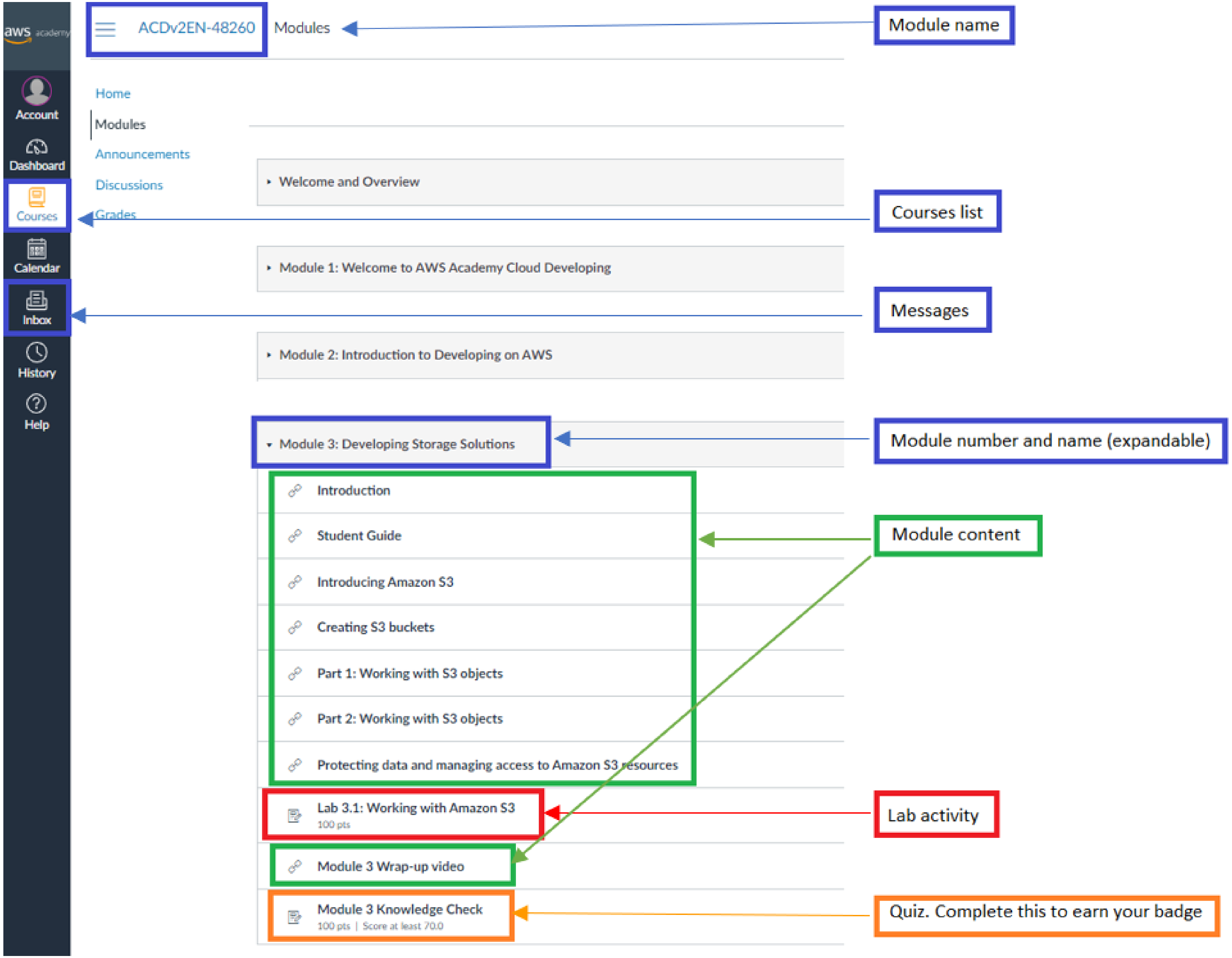
AWS Badge

- AWS Learning badges are credentials that offer these benefits:
  - AWS digital badges demonstrate your knowledge and skills for specific AWS Cloud topics, such as Object Storage
  - AWS digital badges are shareable on social networks to help you stand out to recruiters and prospective hiring managers
  - AWS digital badges are free to earn and share
- Note:

Your badges and completion certificates are not part of this subject assignments. They will not affect your final grade.

AWS Academy Environment

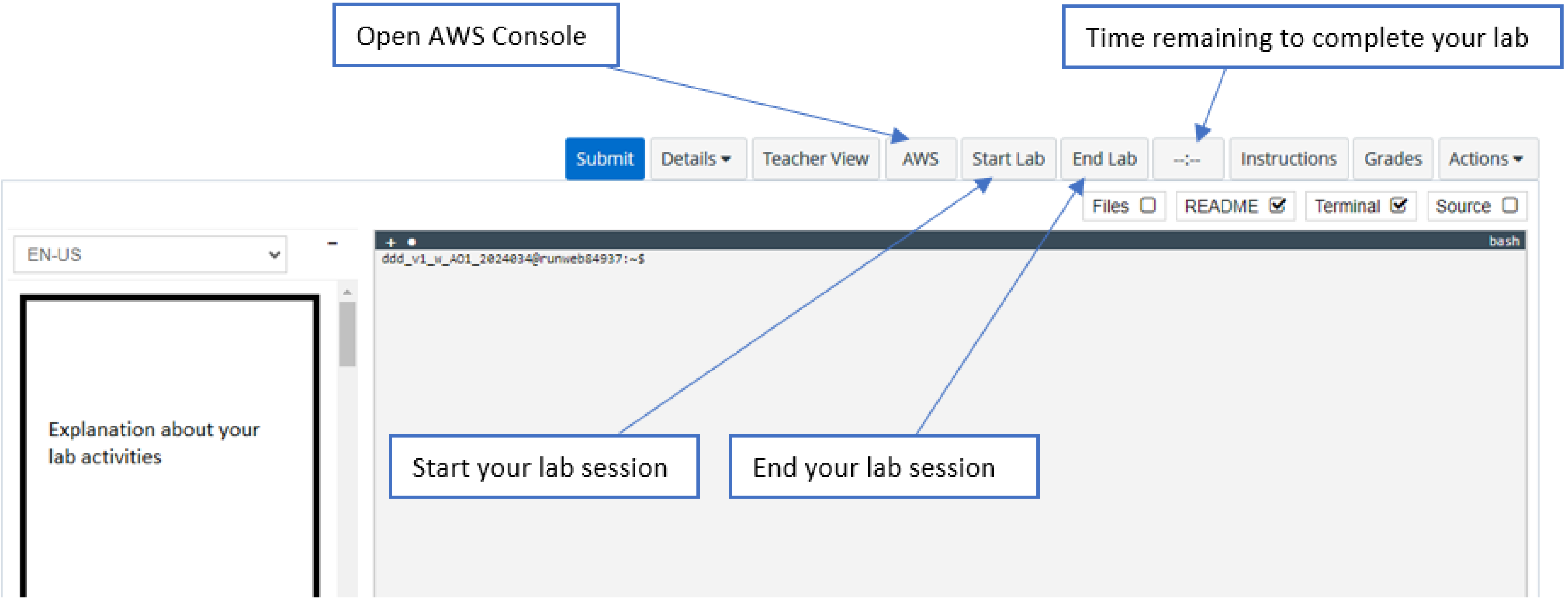
- Every week, we will discuss some specific modules
- Not all modules will be covered in this subject



- Welcome and Overview
- Module 1: Welcome to AWS Academy Cloud Developing
- Module 2: Introduction to Developing on AWS
- Module 3: Developing Storage Solutions
  - Introduction
  - Student Guide
  - Introducing Amazon S3
  - Creating S3 buckets
  - Part 1: Working with S3 objects
  - Part 2: Working with S3 objects
  - Protecting data and managing access to Amazon S3 resources
  - Lab 3.1: Working with Amazon S3
    100 pts
  - Module 3 Wrap-up video
  - Module 3 Knowledge Check
    100 pts | Score at least 70.0

AWS Academy Lab

- The lab is performed in AWS Workbench. You don't need to install anything in your system. Make sure you have updated your web browser to have the best experience in the lab activities.



```
ddd_v1_w_A01_2024034@runweb84937:~$
```

Open AWS Console

Time remaining to complete your lab

Explanation about your lab activities

Start your lab session

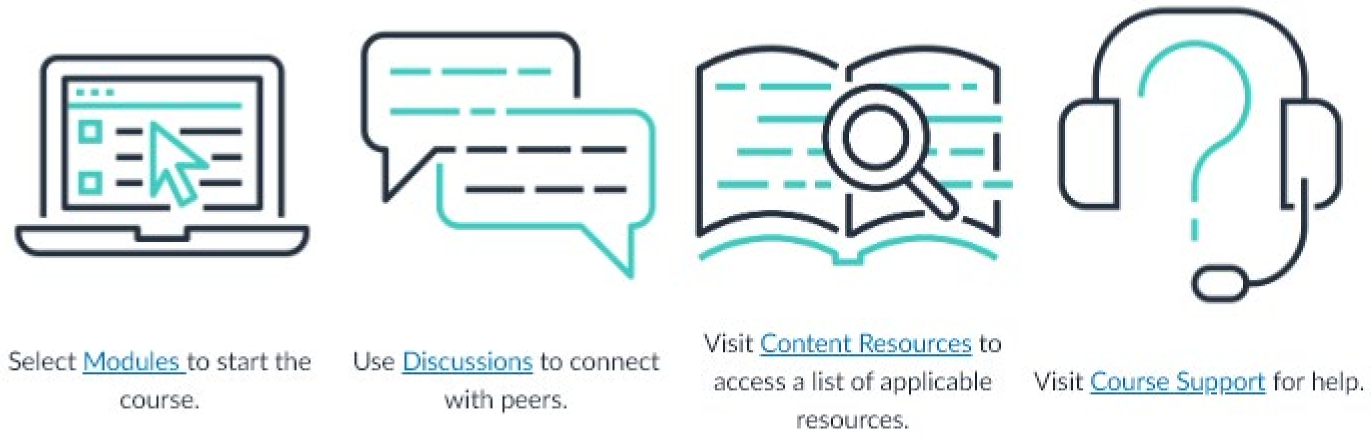
End your lab session

AWS Academy Lab

- When you click the "Start Lab" button, it may take several minutes before your lab environment is ready.
- You can only open the AWS Console if you have clicked the "Start Lab" button.
- You will get **a limited time** to use AWS services. You have to click “Start Lab” before using the service and click “End Lab” to stop the service. **Please note that any changes in the AWS service will be removed when you click “End Lab”.**
- The time will be reset when the lab session has ended. You need to wait around 5-10 minutes before you can re-start the lab again.
- Always pay attention to your remaining session time. **The lab will be terminated automatically when the time is up**.

Issues with AWS Academy

- If you have any issues with the AWS Academy account, please contact your instance or subject coordinator.
- You can also contact course support if you have any issues with the courses or content in AWS



Select Modules to start the course.

Use Discussions to connect with peers.

Visit Content Resources to access a list of applicable resources.

Visit Course Support for help.