

# AWS re:Invent

NOV. 28 – DEC. 2, 2022 | LAS VEGAS, NV

# Build your first graph application with Amazon Neptune

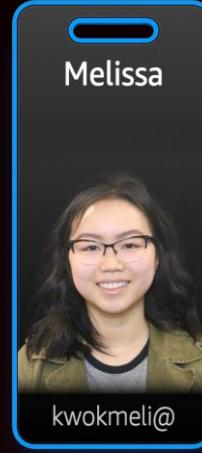
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Amazon Neptune, AWS

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Amazon Neptune, AWS

# Meet the team



# Agenda

- What are we building?
- Graph fundamentals
- Let's build!

# What are we building?



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# Travel agency

You've just inherited a travel agency that helps vacationers decide on travel routes.

Vacation consultants for the travel agency provide customers with a set of routes that take them from one destination to another, sometimes including extra cities along the way and limiting routes based on total distances.



# The challenge

Today, the consultants use a relational database to help them plan routes. So, queries that need to find different paths from Austin to Auckland, for example, look a little like this:

```
select a.code ,r.dist, a2.code, r2.dist,a3.code,  
r2.dist+r.dist as total from airports a  
join routes r on a.id = r."from"  
join airports a2 on a2.id = r."to"  
join routes r2 on a2.id = r2."from"  
join airports a3 on a3.id = r2."to"  
where a.code = 'AUS'  
and a3.code = 'AKL'  
order by total asc  
limit 4
```

id	label	code	city
3	airport	AUS	Austin
8	airport	DFW	Dallas
13	airport	LAX	Los Angeles
23	airport	SFO	San Francisco
63	airport	AKL	Auckland

routes table			
id	from	to	dist
1010	3	8	190
1054	3	13	1230
1123	3	23	1500
1189	13	63	6512
1189	23	63	6525

Actually, this query doesn't give you variable length paths, only one-stop routes...

# The challenge

This is the real SQL query using Common Table Expressions (CTE)

```
WITH RECURSIVE graphtraversal AS (
    SELECT e.src, e.dest, 1 as depth, concat_ws('->',n1.iata,n2.iata) as path
    FROM airports n1
    INNER JOIN routes e ON n1.id = e.src  INNER JOIN airports n2 ON n2.id =
e.dest
    WHERE n1.iata = 'AUS'
    UNION
    SELECT r.src, p.dest, r.depth + 1 as depth, concat_ws('->', r.path,
n.iata)
    FROM graphtraversal r INNER JOIN routes p ON p.src = r.dest
        INNER JOIN airports n ON p.dest = n.id
    WHERE r.depth < 4
)
SELECT r.depth as total_hops, r.dest as destination, r.path
FROM graphtraversal r INNER JOIN airports n ON r.dest = n.id
WHERE n.iata = 'AKL';
```

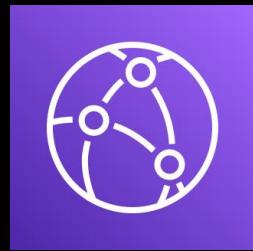
# The objective

Your consultants are tired of writing and managing long, complex SQL queries.

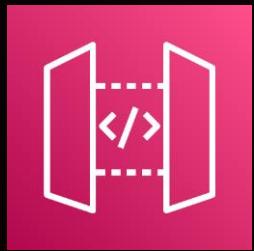
You've just learned about graph databases and believe they will be a better fit for the highly connected air routes data your consultants work with and the types of queries that they write.

So you decide to create a web application that is backed by Amazon Neptune.

# AWS services you will be using today



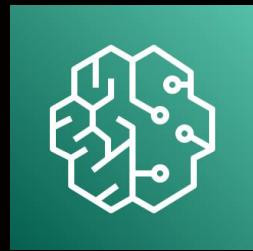
Amazon CloudFront



Amazon API Gateway



AWS Lambda



Amazon  
SageMaker



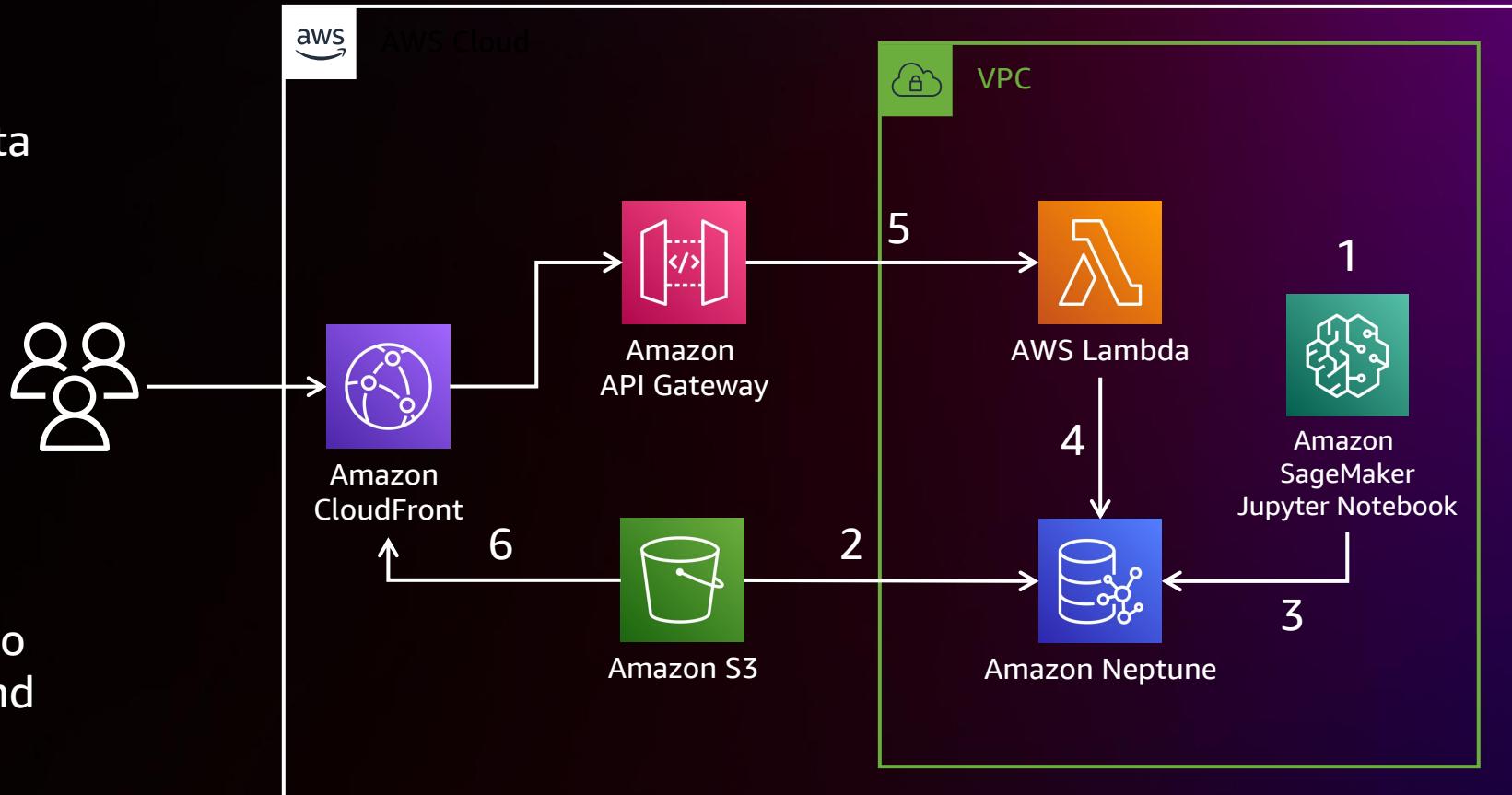
Amazon Neptune



Amazon S3

# The architecture

1. Extract and transform the data
2. Bulk load the data
3. Design your queries
4. Configure AWS Lambda to submit queries
5. Configure Amazon API Gateway to add a “front door” to your back end from the front end
6. Layer on the front end



# Graph fundamentals



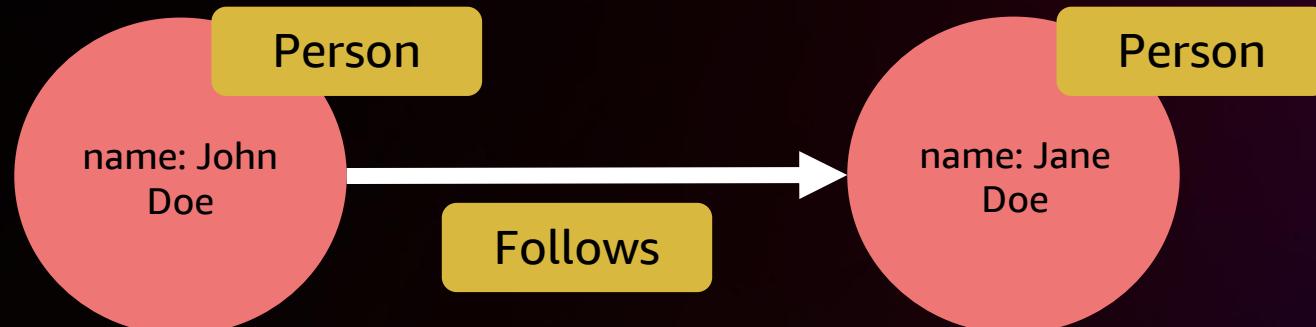
# What is a graph?

- Graphs are purpose-built to store and navigate relationships
- Nodes represent real-world objects
- Edges store relationships between objects



# What is a property graph?

- Each node or edge is like a “container” that can hold properties and label(s)
- Labels are used for categorizing types of entities
- Properties are used to specify attributes of a particular instance of a node or edge type



# Why use a graph?



**Social networking**



**Recommendations**



**Knowledge graphs**



**Fraud detection**



**Life sciences**



**Network and IT operations**

These use cases all:

- Have a highly connected data domain
- Navigate (variably) connected structures
- Filter or compute results based on the strength, weight, or quality of relationships

# Let's build!



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# Getting started with this workshop

- As a participant, you will have access to an AWS account with pre-provisioned infrastructure and IAM policies needed to complete this workshop.
- The AWS account will only be available for the duration of this workshop. You will lose access to the account thereafter.
- The pre-provisioned infrastructure will be deployed to a specific region. Check your workshop content to determine whether other regions will be used.
- Be sure to review the terms and conditions of the event. Do not upload any personal or confidential information in the account.

# Step 1: Sign in via your preferred method

<https://catalog.us-east-1.prod.workshops.aws/join>

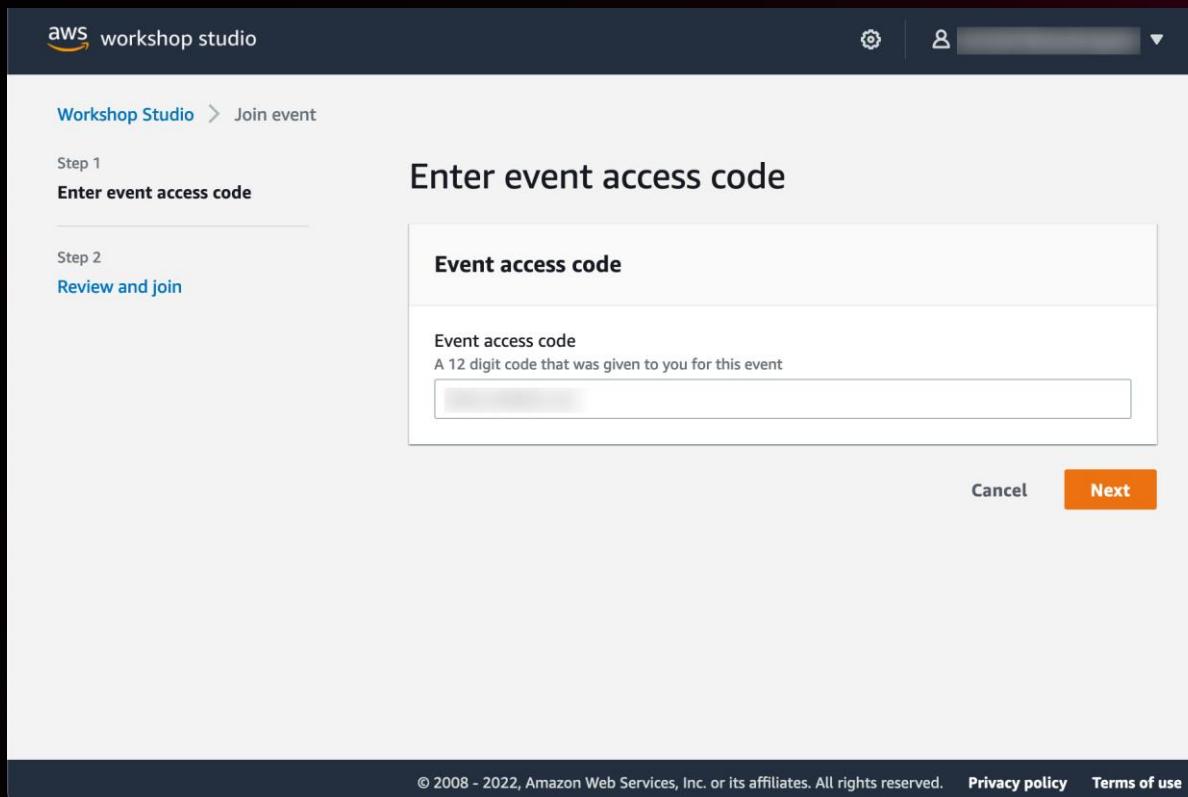
Or shortened: <https://s12d.com/dat205>



A screenshot of the AWS Workshop Studio sign-in interface. The top navigation bar includes the AWS logo and the text "workshop studio". Below the navigation, the text "Workshop Studio &gt; Sign in" is displayed. The main content area is titled "Sign in" and contains the sub-instruction "Choose a preferred sign-in method". Three sign-in options are listed in boxes: "Email one-time password (OTP)" (highlighted in orange), "Login with Amazon" (with a sub-instruction "Login with your Amazon.com retail account"), and "Amazon employee" (with a sub-instruction "Login with your Amazon Corporate account. Only for Amazon Employees"). The bottom of the page features a dark footer bar with the text "© 2008 - 2022, Amazon Web Services, Inc. or its affiliates. All rights reserved." and links for "Privacy policy" and "Terms of use".

# Step 2: Enter event access code

Enter the 12-digit event access code. If you were given a one-click join link, you can skip this step.



# Step 3: Review terms and join event

The screenshot shows the 'Review and join' step of the AWS Workshop Studio 'Join event' process. The page is titled 'Review and join' and displays 'Event details' and 'Terms and Conditions'.

**Event details**

Name	Start time	Duration	Level
AWS General Immersion Day	9/23/2022 01:13 AM	12 hours	-

**Description**  
AWS General Immersion Day

**Terms and Conditions**  
Read and accept before joining the event

1. By using AWS Workshop Studio for the relevant event, you agree to the AWS Event Terms and Conditions and the AWS Acceptable Use Policy. You acknowledge and agree that are using an AWS-owned account that you can only access for the duration of the relevant event. If you find residual resources or materials in the AWS-owned account, you will make us aware and cease use of the account. AWS reserves the right to terminate the account and delete the contents at any time.  
2. You will not: (a) process or run any operation on any data other than test data sets or lab-approved materials by AWS, and (b) copy, import, export or otherwise create derivative works of materials provided by AWS, including but not limited to, data sets.  
3. AWS is under no obligation to enable the transmission of your materials through Event Engine and may, in its discretion, edit, block, refuse to post, or remove your materials at any time.  
4. Your use of AWS Workshop Studio will comply with these terms and all applicable laws, and your access to AWS Workshop Studio will immediately and automatically terminate if you do not comply with any of these terms or conditions.

I agree with the Terms and Conditions

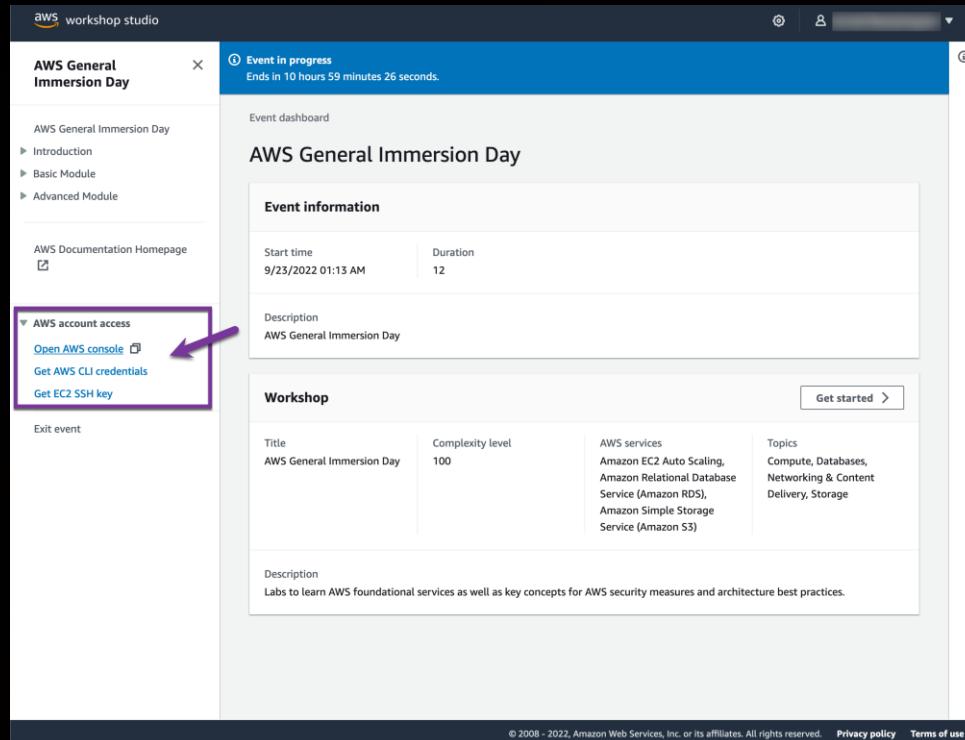
Cancel Previous **Join event**

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# Step 4: Access AWS account

Access the AWS Console or generate AWS CLI credentials as needed.



AWS General Immersion Day

Event in progress  
Ends in 10 hours 59 minutes 26 seconds.

Event dashboard

**AWS General Immersion Day**

**Event information**

Start time	9/23/2022 01:13 AM	Duration	12
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Description  
AWS General Immersion Day

**Workshop**

Title	AWS General Immersion Day	Complexity level	100
AWS services	Amazon EC2 Auto Scaling, Amazon Relational Database Service (Amazon RDS), Amazon Simple Storage Service (Amazon S3)		
Topics	Compute, Databases, Networking & Content Delivery, Storage		

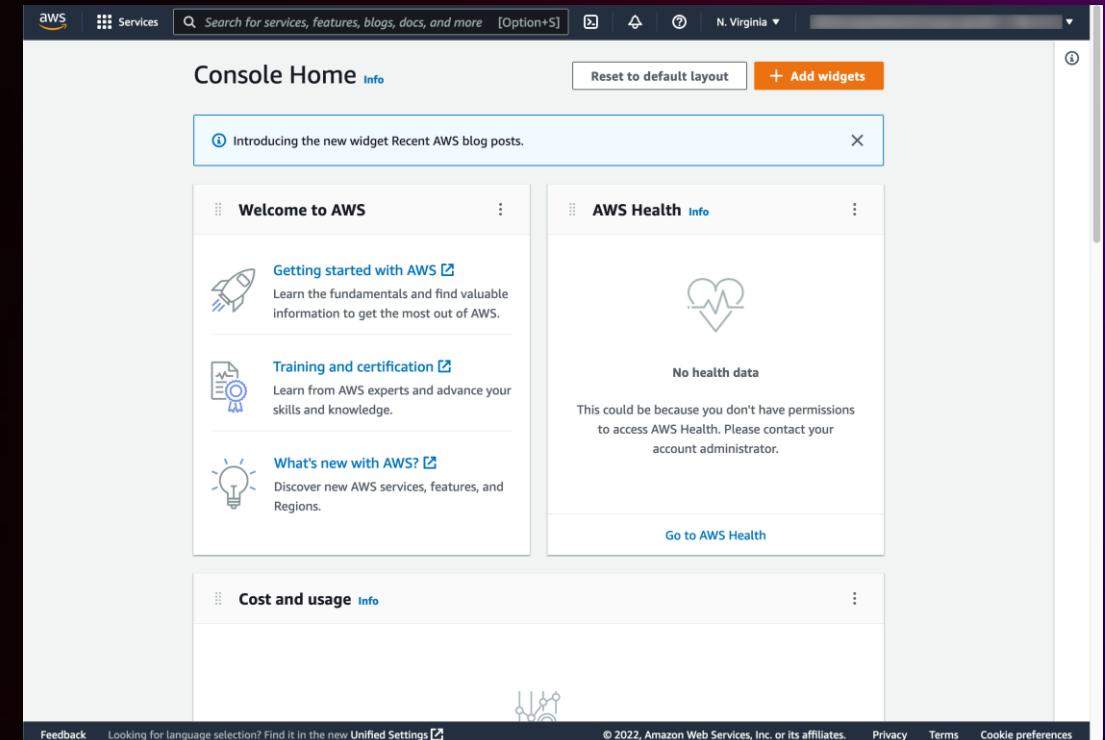
**Description**  
Labs to learn AWS foundational services as well as key concepts for AWS security measures and architecture best practices.

**AWS account access**

- Open AWS console
- Get AWS CLI credentials
- Get EC2 SSH key

Exit event

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Search for services, features, blogs, docs, and more [Option+S]

Console Home

Introducing the new widget Recent AWS blog posts.

Welcome to AWS

- Getting started with AWS
- Training and certification
- What's new with AWS?

AWS Health

No health data

This could be because you don't have permissions to access AWS Health. Please contact your account administrator.

Go to AWS Health

Cost and usage

Feedback Looking for language selection? Find it in the new Unified Settings

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# Step 5: Get started with the workshop

AWS workshop studio

**AWS General Immersion Day**

Event in progress  
Ends in 10 hours 59 minutes 26 seconds.

Event dashboard

## AWS General Immersion Day

**Event information**

Start time	Duration
9/23/2022 01:13 AM	12

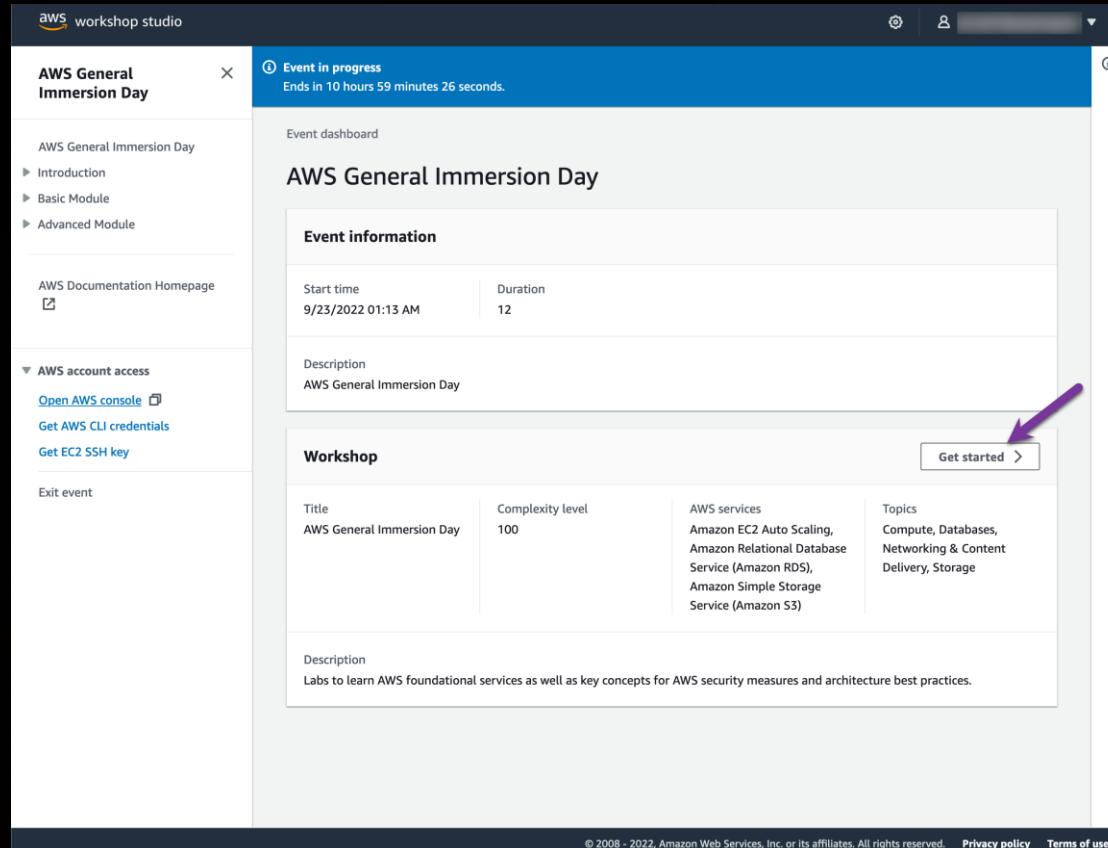
Description  
AWS General Immersion Day

**Workshop**

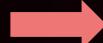
Title	Complexity level	AWS services	Topics
AWS General Immersion Day	100	Amazon EC2 Auto Scaling, Amazon Relational Database Service (Amazon RDS), Amazon Simple Storage Service (Amazon S3)	Compute, Databases, Networking & Content Delivery, Storage

Description  
Labs to learn AWS foundational services as well as key concepts for AWS security measures and architecture best practices.

**Get started >**



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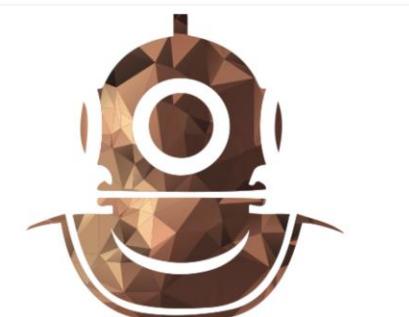
AWS workshop studio

**AWS General Immersion Day**

Event in progress  
Ends in 10 hours 57 minutes 12 seconds.

Event dashboard > AWS General Immersion Day

## AWS General Immersion Day



**IMMERSION DAYS**

In this General Immersion Day workshop, through a mix of service explanation and hands-on labs led by AWS, you will learn about AWS foundational services as well as key concepts for AWS security measures and architecture best practices.

The hands-on labs are largely divided into **basic** and **advanced** modules.

In basic modules, you can learn various features of each AWS foundational service. In advanced modules, you can learn how to connect each service organically to create architecture like 3-tier web application.

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# Thank you!

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