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## AWS ARCHITECTURE DESIGN, IMPLEMENTATION STEPS

### VPC CREATION

The screenshot shows the AWS VPC dashboard. In the top navigation bar, the account ID is 7763-0603-3623 and the region is United States (N. Virginia). The main section is titled "Your VPCs" with a sub-tab "VPCs". A table lists one VPC: "Tutoring-VPC" (vpc-0bf16727d18c41c3c), which is "Available". Below the table, a button "Create VPC" is visible. On the left sidebar, under "Virtual private cloud", there are several options like Subnets, Route tables, Internet gateways, Egress-only internet gateways, Carrier gateways, DHCP option sets, Elastic IPs, Managed prefix lists, and NAT gateways. At the bottom of the page, there are links for CloudShell, Feedback, Privacy, Terms, and Cookie preferences.

### ASSOCIATING IAM ROLE

The screenshot shows the AWS IAM Roles page. The top navigation bar shows the account ID 7763-0603-3623 and the region Global. The main section is titled "Roles (1/22)" with a sub-tab "Info". It displays two roles: "LabRole" (selected) and "RoleForLambdaModLabRole". Below the table, there is a section titled "Roles Anywhere" with a sub-tab "Info" and three options: "Access AWS from your non AWS workloads" (with X.509 Standard icon), "X.509 Standard", and "Temporary credentials". On the left sidebar, under "Access management", there are options like User groups, Users, Roles, Policies, Identity providers, Account settings, Root access management, and Temporary delegation requests. At the bottom of the page, there are links for CloudShell, Feedback, Privacy, Terms, and Cookie preferences.

## ENABLING DNS

The screenshot shows the 'Edit VPC settings' page for a VPC named 'CapstoneVPC'. Under the 'DNS settings' section, two checkboxes are checked: 'Enable DNS resolution' and 'Enable DNS hostnames'. A 'Save' button is visible at the bottom right.

The screenshot shows the 'Internet gateways' page. A new internet gateway named 'igw-Oaa3577f734c9bc7c / abc' has been created. A green banner at the top indicates it can now be attached to a VPC. The 'Actions' button is highlighted.

## MAKING SUBNETS

The screenshot shows the 'Subnets' page. A new subnet named 'Public Subnet 1' has been successfully created. It is listed in the table with details such as Subnet ID, State, VPC, Block Public, IPv4 CIDR, and IPv6 CIDR. A 'Create subnet' button is visible at the top right.

## MAKING TABLES IN DB

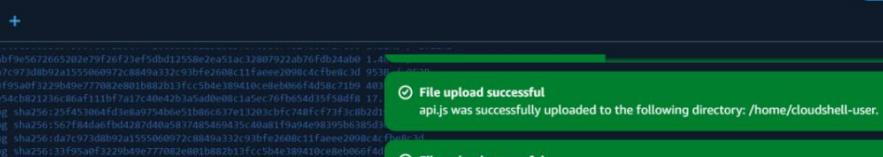
The screenshot shows the AWS DynamoDB 'Tables' page. On the left, a sidebar lists 'Dashboard', 'Tables' (selected), 'Explore items', 'PartiQL editor', 'Backups', 'Exports to S3', 'Imports from S3', 'Integrations', 'Reserved capacity', and 'Settings'. Below this is a section for 'DAX' with 'Clusters' and 'Subnet groups'. The main area displays a table titled 'Tables (1)'. The table has columns: Name, Status, Partition key, Sort key, Indexes, Replication Regions, Deletion protection, and Fav. One row is shown for 'TutorProfiles' with 'Active' status, 'TutorID (\$)' as the partition key, and 'Off' for deletion protection. A search bar at the top says 'Find tables' and filters by 'Any tag key'. The top right shows 'Last updated January 2, 2026, 01:20 (UTC+5:00)', 'Actions', 'Delete', and a 'Create table' button.

The screenshot shows the 'Create database' page for MySQL 8.0. It includes sections for 'Additional configuration', 'Database options' (initial database name 'info', DB parameter group 'default.mysql8.0', option group 'default.mysql8-0'), 'Backup' (enable automated backup checked), and 'Backup retention period' (set to 1 day). A note states that automated backups are supported for InnoDB storage engine only. The bottom section shows 'Backup window' settings.

## UPLOADING DATA ON REPO

The screenshot shows the 'Private repositories' page. A blue banner at the top says 'Managed signing now available' with a link to 'Configure image signing'. The main area shows a table for 'Private repositories (1)'. The table has columns: Repository name, URI, Created at, Tag immutability, and Encryption type. One repository, 'tutoring-repo', is listed with URI '776306033623.dkr.ecr.us-east-1.amazonaws.com/tutoring-repo', created on 'January 01, 2026, 23:42:49 (UTC+05)', tag immutability 'Mutable', and encryption type 'AES-256'. A search bar at the top says 'Search by repository substring'. The top right shows 'Actions' and a 'Create repository' button.

## CONTAINERIZATION AND PUSHING IMAGES INTO THEM



The screenshot shows a terminal window in AWS CloudShell with the following log output:

```
aws CloudShell us-east-1 Actions

[Alt+S] Ask Amazon Q [?] United States (N. Virginia) Account ID: 7763-0603-3625
voclabs/user@4455330-bcce25097@itu.edu.pk

>>> shuf25610abff95673665202e79126f23ef5bd15258e2e5a1c3280a922a76fd024ab0 1-4
>>> extracting sha256:25f45a008ec59a11bf7a1749a42b535ad0e1a5c76fb5d435f6df8 17
>>> extracting sha256:567f84daef4fd3ca9754be51986377e1293cbf749afcf75fc3b81d1
>>> extracting sha256:567f84daef4fd3ca9754be51987488560413cabb1f959a9e99105b5e385d3
>>> extracting sha256:d47c973dbd055504987279849a312c979fe260007729aee209084cfcbb0c4d
>>> extracting sha256:13195aef02290a9e777082e001bb8213fc954e309410ce8eb66f4d
>>> extracting sha256:a085c56sa0ebab957ecf253c74f16a6a55123de1f7c1ac74814ae
>>> extracting sha256:a0b9f9567265302e79f2f673efbd12558e2e51ac32807922ab76f
>>> extracting sha256:de54cb223c68e111bf7a1740e42b3a5ad0e08c1a5e77fbf654d3
> [2/2] COPY ./usr/share/nginx/html
>> exporting to image
>> exporting layers
>> writing image sha256:c0bd29ee1346687eed1573071a9f542afe2a0095f3fbfeaa023
>> naming to docker/library/tutoring-frontend

~$ docker images
REPOSITORY          TAG      IMAGE ID      CREATED        SIZE
tutoring-frontend  latest   c0bd29ee1346  32 seconds ago  53.7MB
~$ aws ecr get-login-password --region us-east-1 | docker login --username AWS --password-stdin
WARNING! Your password will be stored unencrypted in /home/cloudshell-user/.docker/config.json. Configure a credential helper to remove this warning. See https://docs.docker.com/engine/reference/commandline/login/#credentials-store

Login Succeeded
~$
```

The screenshot shows the AWS CloudShell interface. The user has run several Docker commands:

- Exporting layers for a tutorial frontend image.
- Writing the image to a local directory.
- Pushing the image to Amazon ECR.
- Logging in to ECR using AWS credentials.
- Checking for Docker command-line helpers.
- Uploading files (api.js, auth.js, groups.js, sessions.js, and tutoring.js) to the /home/cloudshell-user directory.

The CloudShell interface includes tabs for us-east-1 and eu-west-1, a search bar, and various AWS service icons. The right sidebar displays the uploaded files with success messages.

## AMAZON ECS FOR DEPLOYING APP

**Amazon Elastic Container Service**

- Express Mode
- Clusters
- Namespaces
- Task definitions**
- Account settings

Amazon ECR ↗

AWS Batch ↗

Documentation ↗

**Task roles - conditional**

**Task role** | Info A task IAM role allows containers in the task to make API requests to AWS services. You can create a task IAM role from the IAM console ↗.

LabRole

**Task execution role** | Info A task execution IAM role is used by the container agent to make AWS API requests on your behalf. If you don't already have a task execution IAM role created, we can create one for you.

LabRole

**Task placement - optional**

**Fault injection - optional**

**Container - 1** | Info

Container details

Essential container Remove

**Amazon Elastic Container Service**

- Express Mode
- Clusters
- Namespaces
- Task definitions**
- Account settings

Amazon ECR ↗

AWS Batch ↗

Documentation ↗

**tutoring-task:1**

Last updated January 2, 2026, 00:07 (UTC+5:00)

View task definition Deploy Actions Create new revision

<b>ARN</b> arn:aws:ecs:us-east-1:776306033623:task-definition/tutoring-task:1	<b>Status</b> ACTIVE	<b>Time created</b> January 2, 2026, 00:07 (UTC+5:00)	<b>App environment</b> Fargate
<b>Task role</b> LabRole ↗	<b>Task execution role</b> LabRole ↗	<b>Operating system/Architecture</b> Linux/X86_64	<b>Network mode</b> awsvpc
<b>Fault injection</b> Turned off			

**Developer Tools**

**CodeCommit**

Source • CodeCommit

- Getting started
- Repositories
- Code**
- Pull requests
- Commits
- Branches
- Git tags
- Settings
- Approval rule templates

Artifacts • CodeArtifact

Build • CodeBuild

Notify main Create pull request Clone URL

**tutoring-frontend-repo / buildspec.yml** | Info

```

1 version: 0.2
2 phases:
3   pre_build:
4     commands:
5       - aws ecr get-login-password --region us-east-1 | docker login --username AWS --password-stdin
6         <YOUR_ACCOUNT_ID>.dkr.ecr.us-east-1.amazonaws.com
7   build:
8     commands:
9       - docker build -t tutoring-frontend .
10      - docker tag tutoring-frontend:latest <YOUR_ACCOUNT_ID>.dkr.ecr.us-east-1.amazonaws.com/tutoring-
11        repo:latest
12      commands:
13        - docker push <YOUR_ACCOUNT_ID>.dkr.ecr.us-east-1.amazonaws.com/tutoring-repo:latest
14        - printf "[{"name":"Frontend","imageUri":"%s"}]" <YOUR_ACCOUNT_ID>.dkr.ecr.us-east-
15          1.amazonaws.com/tutoring-repo:latest > imagedefinitions.json
16      artifacts:
17        files: imagedefinitions.json
  
```

aws CloudShell us-east-1

```
$ docker push 776306033623.dkr.ecr.us-east-1.amazonaws.com/tutoring-repo:latest
The push refers to repository [776306033623.dkr.ecr.us-east-1.amazonaws.com/tutoring-repo]
c7507181170f: Pushed
e6fe11fa5b7f: Pushed
67ea0046e6d: Pushed
ed5fa8b595c7a: Pushed
8ae63eb1f3f: Pushed
b3e3d1bb64d: Pushed
48078b7e7300: Pushed
fd1e4ad7f74b: Pushed
7bb20c65675: Pushed
latest: digest: sha256:1e8976fc4af5857dcee30cc77019c5c9190e9dbfacb4d357bd89b68e905801e size: 2197
hint: Using 'master' as the name for the initial branch. This default branch name
hint: is subject to change. To configure the initial branch name to use in all
hint: of your new repositories, which will suppress this warning, call:
hint:
hint: git config --global init.defaultBranch <name>
hint:
hint: Names commonly chosen instead of 'master' are 'main', 'trunk' and
hint: 'development'. The just-created branch can be renamed via this command:
hint:
hint: git branch -m <name>
hint:
hint: Disable this message with "git config set advice.defaultBranchName false"
initialized empty Git repository in /home/cloudshell-user/.git/
~ $
```

**File upload successful**  
api.js was successfully uploaded to the following directory: /home/cloudshell-user.

**File upload successful**  
auth.js was successfully uploaded to the following directory: /home/cloudshell-user.

**File upload successful**  
groups.js was successfully uploaded to the following directory: /home/cloudshell-user.

**File upload successful**  
sessions.js was successfully uploaded to the following directory: /home/cloudshell-user.

**File upload successful**  
tutoring.js was successfully uploaded to the following directory: /home/cloudshell-user.

aws Amazon ECR Private registry Repositories

**Amazon Elastic Container Service**

- Private registry**
  - Repositories**
  - Features & Settings
- Public registry**
  - Repositories
  - Settings
- ECR public gallery
- Amazon ECS
- Amazon EKS

**Getting started**

**Private repositories (2)**

Repository name	URI	Created at	Tag immutability	Encryption type
tutoring-frontend	776306033623.dkr.ecr.us-east-1.amazonaws.com/tutoring-frontend	January 02, 2026, 01:24:48 (UTC+05)	Mutable	AES-256
tutoring-repo	776306033623.dkr.ecr.us-east-1.amazonaws.com/tutoring-repo	January 01, 2026, 23:42:49 (UTC+05)	Mutable	AES-256

View push commands Actions Create repository

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aws EC2 Target groups

**Network & Security**

- Security Groups
- Elastic IPs
- Placement Groups
- Key Pairs
- Network Interfaces

**Load Balancing**

- Load Balancers
- Target Groups**
- Trust Stores

**Auto Scaling**

- Auto Scaling Groups
- Settings

**Target groups (2)** Info | What's new?

Name	ARN	Port	Protocol	Target type	Lo
PeerBackend	arn:aws:elasticloadbalancing:us-east-1:776306033623:targetgroup/PeerBackend/5489544444444444	80	HTTP	Instance	
PeerApp	arn:aws:elasticloadbalancing:us-east-1:776306033623:targetgroup/PeerApp/5489544444444444	80	HTTP	Instance	

Actions Create target group

**0 target groups selected**

Select a target group above.

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Screenshot of the AWS EC2 Security Groups page showing a successful creation message and a list of five security groups.

**Security Groups (5) Info**

Name	Security group ID	Security group name	VPC ID	Description
-	sg-0206e52fde7873ca8	default	vpc-0bf16727d18c41c5c	default VPC security group
-	sg-012d17449826c426c	ALB_SG	vpc-073be7fef6ee2d2b2	alb
-	sg-002894f63502405e	launch-wizard-1	vpc-073be7fef6ee2d2b2	launch-wizard-1 created 2026
-	sg-0ad696a2df56921c	default	vpc-073be7fef6ee2d2b2	default VPC security group
-	sg-08d9d0625ed2f0b76	PeerAppSG	vpc-073be7fef6ee2d2b2	Peer

**Select a security group**

## LOAD TESTING FOR ALB

Screenshot of a terminal window showing the execution of a MySQL command to import data from a SQL file into a database.

```

bash -tp-10-0-1-87.ec2.i.x
 36
 37   name VARCHAR(255) NOT NULL,
 38   'address' VARCHAR(255) NOT NULL,
 39   city VARCHAR(255) NOT NULL,
 40   state VARCHAR(255) NOT NULL,
 41   zip VARCHAR(255) NOT NULL
 42
 43   protocol
 44   quick
 45   quote_max_column_width
 46   raw
 47   reconnect
 48   safe_updates
 49   i_an_a_dummy
 50   sanderson
 51   secure_auth
 52   select_limit 1000
 53   show_warnings
 54   silent_ignore
 55   socket
 56   ssl
 57   ssl_ca
 58   ssl_capath
 59   ssl_cert
 60   ssl_cipher
 61   ssl_key
 62   ssl_crl
 63   ssl_crlpath
 64   ssl_version
 65   ssl_verify_server_cert
 66   table
 67   unbuffered
 68   user
 69   vertical
 70
 71 voclabs:~/environment $ mysql -h capstoneedb.czpuu8s1uxz.us-east-1.rds.amazonaws.com -u nodeapp -p STUDENTS < data.sql
 72 Enter password:
 73 voclabs:~/environment $ 

```

AWS: profile default

Screenshot of the AWS Auto Scaling Groups page showing a successful scaling policy creation message.

**Scaling groups (0) Info**

Name	Launch template/configuration	Instances	Status	Desired capacity	Min	Max	Availability Zones	Create...
------	-------------------------------	-----------	--------	------------------	-----	-----	--------------------	-----------

**Scaling groups selected**

us-east-1.console.aws.amazon.com/cloud9/ide/dbf5668d493644fa85c649934dd2e648?region=us-east-1

```

File Edit Find View Go Run Tools Window Support Preview Run
Go Anything (Ctrl-P)
CapstoneIDE - mv
data.sql
README.md
WS: profile.default

Welcome | data.sql | bash -ip 10.0.1.87 ec2x | Immediate | 11 SQL Spaces 2 | Share | Settings | Help

Percentage of requests served within a certain time
50%   9 ms
90%   35 ms
95%   362 ms
99%   1918 ms
100%  2163 ms (longest request)

:1: 1 errors
vclabls:-/environment $ loadtest --rps 1000 < 500 -k http://capstonealb-1367864825.us-east-1.elb.amazonaws.com/
(node:786) [DEP0066] DeprecationWarning: The 'util._extend' API is deprecated. Please use Object.assign() instead.
(Use `node --trace-deprecation ...` to show where the warning was created)
Requests: 4099, requests per second: 1000, mean latency: 7.9 ms

Target URL: http://capstonealb-1367864825.us-east-1.elb.amazonaws.com/
Max time (s): 10
Target rps: 1000
Concurrent clients: 20
Agent: keepalive
Completed requests: 9999
Total errors: 0
Total time: 10.001 s
Mean latency: 5.6 ms
Effective rps: 1000

Percentage of requests served within a certain time
50%   2 ms
90%   36 ms
95%   25 ms
99%   38 ms
100%  233 ms (longest request)

vclabs:-/environment $

```

calculator.aws/#/estimate

aws pricing calculator

Feedback Language: English Contact Sales Create an AWS Account

Service Name	Status	Upfront cost	Monthly cost	Description	Region	Config Sum...
Amazon Virtual...	-	0.00 USD	73.00 USD	-	US East (N. Virg...)	Working days p...
Amazon EC2	-	0.00 USD	2.92 USD	-	US East (N. Virg...)	Tenancy (Share...
Amazon RDS fo...	-	0.00 USD	95.52 USD	-	US East (N. Virg...)	Storage amoun...
AWS Secrets Ma...	-	0.00 USD	0.40 USD	-	US East (N. Virg...)	Number of secr...
Elastic Load Bal...	-	0.00 USD	22.27 USD	-	US East (N. Virg...)	Number of Appl...

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us-east-1.console.aws.amazon.com/ec2/home?region=us-east-1#AutoScalingGroupDetails:id=CapstoneAutoScalingGroup1;view=activity

EC2 > Auto Scaling groups > CapstoneAutoScalingGroup1

Create notification

Activity history (3)

Status	Description	Cause	Start time	End time
Successful	Launching a new EC2 instance: i-0f205c294fc8a94cf	At 2025-11-24T07:35:57Z an instance was launched in response to an unhealthy instance needing to be replaced.	2025 November 24, 12:35:59 PM +05:00	2025 November 24, 12:36:00 PM +05:00
Successful	Terminating EC2 instance: i-04ae05dcbb2bb909	At 2025-11-24T07:35:57Z an instance was taken out of service in response to an EC2 health check indicating it has been terminated or stopped.	2025 November 24, 12:35:57 PM +05:00	2025 November 24, 12:41:11 PM +05:00
Successful	Launching a new EC2 instance: i-04ae05dcbb2bb909	At 2025-11-24T06:02:23Z a user request created an AutoScalingGroup changing the desired capacity from 0 to 1. At 2025-11-24T06:02:24Z an instance was started in response to a difference between desired and actual capacity, increasing the capacity from 0 to 1.	2025 November 24, 11:02:25 AM +05:00	2025 November 24, 11:02:31 AM +05:00

CloudWatch Feedback

