

# **PROJECT REPORT**

On

## **Edu Cloud – Trainer-Student Secure File Portal**

Submitted as part of the requirements for successful  
completion of the course

by

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**Project Title:**

EduCloud – Cloud-Based Learning & Assignment Management System

**Domain:**

Cloud Computing / AWS Architecture

**Prepared By:**

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## **Abstract:**

EduCloud is a cloud-based platform designed to manage study material distribution and assignment submission in an educational environment. The system leverages Amazon Web Services (AWS) to provide a secure, scalable, and highly available solution for students and trainers. The project focuses on real-world cloud architecture practices including VPC design, Auto Scaling, Load Balancing, S3 storage, CloudFront distribution, IAM security, and automation using AWS Lambda. EduCloud ensures controlled access, efficient content delivery, and automated notifications while following best practices in cloud security and cost optimization.

## **Introduction:**

With the increasing adoption of cloud technologies in education, there is a need for platforms that are secure, scalable, and easily accessible. Traditional systems struggle with scalability, manual handling of assignments, and inefficient content delivery

EduCloud addresses these challenges by:

- Centralizing content storage using Amazon S3
- Automating workflows using AWS Lambda
- Improving performance using CloudFront CDN
- Ensuring high availability using ALB and Auto Scaling

This project demonstrates the practical implementation of cloud infrastructure rather than focusing only on application development.

## **Objectives:**

The main objectives of the EduCloud project are:

- Design a secure and scalable cloud architecture
- Implement role-based access for students and trainers
- Enable secure upload and storage of materials and assignments
- Automate notifications for uploads
- Ensure high availability and fault tolerance
- Apply AWS best practices for networking and security

## **System Architecture Overview:**

EduCloud follows a **multi-tier cloud architecture**:

### **Key Components**

- **CloudFront:** Content delivery for frontend pages
- **Application Load Balancer (ALB):** Traffic distribution
- **Auto Scaling Group (ASG):** Dynamic EC2 scaling
- **Amazon EC2:** Application servers
- **Amazon S3:** Storage for materials and assignments
- **AWS Lambda:** Automation and notifications
- **Amazon RDS:** Metadata storage
- **VPC:** Network isolation and security

The architecture separates public-facing components from private backend services, ensuring controlled access and improved security.

## **VPC & Network Design:**

### **VPC Structure**

- CIDR Block: 10.0.0.0/16

### **Routing**

- Public Subnets → Internet Gateway
- Private Subnets → NAT Gateway
- This design prevents direct internet access to backend resources.

## **Frontend Design:**

The frontend consists of static HTML pages served through CloudFront.

### **Pages**

1. index.html – Landing page and navigation
2. upload.html – Trainer material upload
3. submit\_assignment.html – Student assignment submission

## US East (N. Virginia)

The screenshot shows the AWS Console Home page. At the top right, the region is set to "United States (N. Virginia)". The left sidebar lists recently visited services: VPC, EC2, Lambda, S3, CloudFront, Billing and Cost Management, and AWS Global View. Below this is a "Welcome to AWS" section with a rocket icon and links to "Getting started with AWS". To the right is the "AWS Health" info section showing 0 open issues over the past 7 days. Further right is the "Cost and usage" info section showing credits remaining of \$119.88 USD with 110 days remaining until May 08, 2026. The main content area displays a "Select Region" dropdown set to "us-east-1 (Current Region)". A large table lists AWS regions categorized by continent: United States (N. Virginia, us-east-1), Asia Pacific (Hyderabad, Mumbai, Osaka, Seoul, Singapore, Sydney, Tokyo), Canada (Central, ca-central-1), Europe (Frankfurt, Ireland, London, Paris, Stockholm), and South America (Sao Paulo). At the bottom right, there are links for "Manage Regions" and "Manage Local Zones". The footer includes copyright information and links for CloudShell, Feedback, and Console Mobile App.

## VPC

The screenshot shows the AWS VPC dashboard. The left sidebar has sections for "Virtual private cloud" (Your VPCs, Subnets, Route tables, Internet gateways, Egress-only internet gateways, Carrier gateways, DHCP option sets, Elastic IPs, Managed prefix lists, NAT gateways, Peering connections, Route servers) and "Security" (Network ACLs, Security groups). The main content area is titled "Your VPCs" and shows a table with one entry: "vpc-0aa6535aa0afc45e" which is "Available". There is a "Create VPC" button at the top right of the table. Below the table, a message says "Select a VPC above". The footer includes copyright information and links for CloudShell, Feedback, and Console Mobile App.

Create VPC form filled out

The screenshot shows the 'Create VPC' configuration page. Under 'VPC settings', 'Resources to create' is set to 'VPC only'. A 'Name tag - optional' field contains 'EduCloudVPC'. Under 'IPv4 CIDR block', 'IPv4 CIDR manual input' is selected, with '10.0.0.0/16' entered. Under 'IPv6 CIDR block', 'No IPv6 CIDR block' is selected. Under 'Tenancy', 'default' is chosen. At the bottom, there are links for 'cloudShell', 'Feedback', and 'Console Mobile App', along with copyright information for 2026 and links for 'Privacy', 'Terms', and 'Cookie preferences'.

## Educloud VPC

The screenshot shows the 'Details' tab for the VPC 'vpc-0fdcc429bf867a8c3 / EduCloudVPC'. Key details include:

VPC ID	State	Block Public Access	DNS hostnames
vpc-0fdcc429bf867a8c3	Available	Off	Disabled
DNS resolution	Tenancy	DHCP option set	Main route table
Enabled	default	dhcp-05f7d58cd4da6d3a0	rtb-04f7ea627337b1c79
Main network ACL	Default VPC	IPv4 CIDR	IPv6 pool
acl-0fb2b2b5394482ea08	No	10.0.0.0/16	-
IPv6 CIDR (Network border group)	Network Address Usage metrics	Route 53 Resolver DNS Firewall rule groups	Owner ID
-	Disabled	-	139749347006
Encryption control ID	Encryption control mode		
-	-		

Below the details, the 'Resource map' tab is active, showing four sections: 'VPC' (Your AWS virtual network), 'Subnets (0)' (Subnets within this VPC), 'Route tables (1)' (Route network traffic to resources), and 'Network Connect' (Connections to other networks). There is also a 'Show all details' link.

**VPC Created**

The screenshot shows the AWS VPC dashboard with a green success message at the top: "You successfully created vpc-0fddc429bf867a8c3 / EduCloudVPC". The main table lists two VPCs:

Name	VPC ID	State	Encryption control ...	Encryption control ...	Block Public... (radio button)	IPv4 CIDR
vpc-0aa653aad0afc45e	vpc-0aa653aad0afc45e	Available	-	-	Off	172.31.0.0/16
EduCloudVPC	vpc-0fddc429bf867a8c3	Available	-	-	Off	10.0.0.0/16

Below the table, there's a note: "Select a VPC above". The URL in the address bar is <https://us-east-1.console.aws.amazon.com/console/home?region=us-east-1>.

## internet gateway

The screenshot shows the AWS Internet Gateways dashboard with a green success message: "The following internet gateway was created: igw-0beb6c561a76efa93 - EduCloud-IGW. You can now attach to a VPC to enable the VPC to communicate with the internet." The main card displays the details of the created internet gateway:

Internet gateway ID	State	VPC ID	Owner
igw-0beb6c561a76efa93	Detached	-	Owner 139749347006

Below the card, there's a section for "Tags (1)":

Key	Value
Name	EduCloud-IGW

The URL in the address bar is <https://us-east-1.console.aws.amazon.com/vpc/internet-gateways?region=us-east-1>.

## Internet Gateway Attached to VPC

The screenshot shows the AWS VPC Internet Gateways page. A green success message at the top states: "Internet gateway igw-0beb6c561a76efa93 successfully attached to vpc-0fdcc429bf867a8c3". The main card displays the Internet gateway details: ID (igw-0beb6c561a76efa93), State (Attached), VPC ID (vpc-0fdcc429bf867a8c3 | EduCloudVPC), and Owner (139749347006). It also shows a single tag named "Name" with the value "EduCloud-IGW". The left sidebar includes sections for Virtual private cloud (Your VPCs, Subnets, Route tables, Internet gateways, Carrier gateways, DHCP option sets, Elastic IPs, Managed prefix lists, NAT gateways, Peering connections, Route servers) and Security (Network ACLs, Security groups, PrivateLink and Lattice).

## Subnets

The screenshot shows the AWS Subnets creation page. The title is "Create subnet". Under "Subnet settings", it says "Specify the CIDR blocks and Availability Zone for the subnet." The "Subnet 1 of" section shows a single subnet named "Public-Subnet-ALB" with an availability zone of "United States (N. Virginia) / use1-az1 (us-east-1a)". The "IPv4 VPC CIDR block" is set to "10.0.0.0/16". In the "Tags - optional" section, a tag named "Name" is added with the value "Public-Subnet-ALB". The URL in the address bar is <https://us-east-1.console.aws.amazon.com/console/home?region=us-east-1>.

aws [Alt+S] United States (N. Virginia) MyAWSAccount

VPC > Subnets > Create subnet

### Subnet 3 of 3

**Subnet name**  
Create a tag with a key of 'Name' and a value that you specify.  
  
The name can be up to 256 characters long.

**Availability Zone** Info  
Choose the zone in which your subnet will reside, or let Amazon choose one for you.

**IPv4 VPC CIDR block** Info  
Choose the VPC's IPv4 CIDR block for the subnet. The subnet's IPv4 CIDR must lie within this block.

**IPv4 subnet CIDR block**  
 256 IPs

**Tags - optional**

Key	Value - optional
<input type="text" value="Name"/>	<input type="text" value="Private-Subnet-Database"/>

Add new tag  
You can add 49 more tags.  
Remove

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VPC > Subnets > Create subnet

### Subnet 2 of 3

**Subnet name**  
Create a tag with a key of 'Name' and a value that you specify.  
  
The name can be up to 256 characters long.

**Availability Zone** Info  
Choose the zone in which your subnet will reside, or let Amazon choose one for you.

**IPv4 VPC CIDR block** Info  
Choose the VPC's IPv4 CIDR block for the subnet. The subnet's IPv4 CIDR must lie within this block.

**IPv4 subnet CIDR block**  
 256 IPs

**Tags - optional**

Key	Value - optional
<input type="text" value="Name"/>	<input type="text" value="Private-Subnet-Servers"/>

Add new tag  
You can add 49 more tags.  
Remove

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VPC > Subnets

### VPC dashboard

AWS Global View L

Filter by VPC

Subnets (3) Info Last updated less than a minute ago Actions Create subnet

Find subnets by attribute or tag

Subnet ID : subnet-0f562fa9e3915cb77 Subnet ID : subnet-08caf5f194329fb7f Subnet ID : subnet-0e098a62fb665c59 Show more (+) Clear filters

Name	Subnet ID	State	VPC	Block Public	IPv4 CIDR	IPv6 CIDR
Private-Subnet-Servers	subnet-08caf5f194329fb7f	Available	vpc-0fddc429bf867a8c3   Edu...	Off	10.0.2.0/24	-
Private-Subnet-Database	subnet-0e098a62fb665c59	Available	vpc-0fddc429bf867a8c3   Edu...	Off	10.0.3.0/24	-
Public-Subnet-ALB	subnet-0f562fa9e3915cb77	Available	vpc-0fddc429bf867a8c3   Edu...	Off	10.0.1.0/24	-

Select a subnet

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## Auto-assign IP enabled for public subnet

The screenshot shows the 'Edit subnet settings' page for a subnet named 'Public-Subnet-ALB'. Under the 'Auto-assign IP settings' section, the 'Enable auto-assign public IPv4 address' checkbox is checked. The 'Resource-based name (RBN) settings' section shows the 'IP name' option selected for hostname type.

## NAT gateway

The screenshot shows the 'Create NAT gateway' page. Under 'NAT gateway settings', the 'Name - optional' field contains 'EduCloud-NAT'. The 'Availability mode' section has the 'Zonal' option selected, which is highlighted with a blue border. The 'Subnet' section shows 'subnet-0f562fa9e3915cb77 (Public-Subnet-ALB)' selected. The 'Connectivity type' section has the 'Public' option selected. The 'Elastic IP allocation ID' field contains 'eipalloc-0b1d29f83ba195f26', and the 'Allocate Elastic IP' button is visible.

## Status Available

The screenshot shows the AWS VPC NAT gateway details page for the gateway `nat-00ab4c4f7244fd78f`. The gateway is named `EduCloud-NAT`. Key details include:

- Details:**
  - NAT gateway ID: `nat-00ab4c4f7244fd78f`
  - NAT gateway ARN: `arn:aws:ec2:us-east-1:139749347006:natgateway/nat-00ab4c4f7244fd78f`
  - VPC: `vpc-0fdc429bf867a8c3 | EduCloudVPC`
- Connectivity type:** Public
- State:** Available
- Primary public IPv4 address:** `52.70.125.66`
- Subnet:** `subnet-0f562fa9e3915cb77 / Public-Subnet-ALB`
- Created:** Tuesday, January 20, 2026 at 11:06:45 GMT +:30
- State message:** Info
- Primary network interface ID:** `eni-02c66be85a6a85749`
- Deleted:** -

Below the details, there are tabs for **Secondary IPv4 addresses**, **Monitoring**, and **Tags**. The **Secondary IPv4 addresses** tab shows a search bar and a message stating "Secondary IPv4 addresses are not available for this nat gateway." There is also a button to "Edit secondary IPv4 address associations".

## PUBLIC ROUTE TABLE

The screenshot shows the AWS VPC route table details page for the route table `rtb-0bbdad5d0f03df892`. A success message indicates "Route table rtb-0bbdad5d0f03df892 | Public-Route-Table was created successfully." Key details include:

- Details:**
  - Route table ID: `rtb-0bbdad5d0f03df892`
  - Main: No
  - VPC: `vpc-0fdc429bf867a8c3 | EduCloudVPC`
  - Owner ID: `139749347006`
- Routes:** (1)
  - Destination: `10.0.0.0/16`
  - Target: local
  - Status: Active
  - Propagated: No
  - Route Origin: Create Route Table

Below the routes, there are tabs for **Subnet associations**, **Edge associations**, **Route propagation**, and **Tags**. There is also a "Edit routes" button.

Route table rtb-0bbdad5d0f03df892 | Public-Route-Table was created successfully.

Name	Route table ID	Explicit subnet associations	Edge associations	Main	VPC
rtb-04f7ea627337b1c79	-	-	-	Yes	vpc-0fddc429bf867a8c3   Edu...
<b>Public-Route-Table</b>	<b>rtb-0bbdad5d0f03df892</b>	-	-	No	vpc-0fddc429bf867a8c3   Edu...

**rtb-0bbdad5d0f03df892 / Public-Route-Table**

- Details
- Routes**
- Subnet associations
- Edge associations
- Route propagation
- Tags

**Routes (1)**

Destination	Target	Status	Propagated	Route Origin
10.0.0.0/16	local	Active	No	Create Route Table

Edit routes

Destination	Target	Status	Propagated	Route Origin
10.0.0.0/16	local	Active	No	CreateRouteTable
0.0.0.0/0	Internet Gateway	-	No	CreateRoute
	igw-0beb6c561a76efa93	-		
	Use: "igw-0beb6c561a76efa93"	-		
	igw-0beb6c561a76efa93 (EduCloud-IGW)	-		

Add route

Cancel Preview Save changes

## Public Route Table with IGW route

Updated routes for rtb-0bbdad5d0f03df892 / Public-Route-Table successfully

**rtb-0bbdad5d0f03df892 / Public-Route-Table**

- Actions

**Details**

Route table ID	Main	Explicit subnet associations	Edge associations
rtb-0bbdad5d0f03df892	No	-	-
VPC	Owner ID		
vpc-0fddc429bf867a8c3   EduCloudVPC	139749347006		

**Routes (2)**

Destination	Target	Status	Propagated	Route Origin
0.0.0.0/0	igw-0beb6c561a76efa93	Active	No	Create Route
10.0.0.0/16	local	Active	No	Create Route Table

## Public subnet associated

**Edit subnet associations**

Change which subnets are associated with this route table.

**Available subnets (1/3)**

Name	Subnet ID	IPv4 CIDR	IPv6 CIDR	Route table ID
Private-Subnet-Servers	subnet-08caf5f194329fb7f	10.0.2.0/24	-	Main (rtb-04f7ea627337b1c79)
Private-Subnet-Database	subnet-0e098a62fb665c59	10.0.3.0/24	-	Main (rtb-04f7ea627337b1c79)
<input checked="" type="checkbox"/> Public-Subnet-ALB	subnet-0f562fa9e3915cb77	10.0.1.0/24	-	Main (rtb-04f7ea627337b1c79)

**Selected subnets**

subnet-0f562fa9e3915cb77 / Public-Subnet-ALB
--

**Actions**: Cancel | Save associations

**VPC dashboard**

You have successfully updated subnet associations for rtb-0bbdad5d0f03df892 / Public-Route-Table.

**rtb-0bbdad5d0f03df892 / Public-Route-Table**

**Details**

Route table ID: rtb-0bbdad5d0f03df892	Main: No	Explicit subnet associations: subnet-0f562fa9e3915cb77 / Public-Subnet-ALB
VPC: vpc-0fdcd429bf867a8c3   EduCloudVPC	Owner ID: 139749347006	Edge associations: -

**Routes** (2)

Destination	Target	Status	Propagated	Route Origin
0.0.0.0/0	igw-0beb6c561a76efa93	Active	No	Create Route
10.0.0.0/16	local	Active	No	Create Route Table

## Private-Route-Table

**VPC dashboard**

Route table rtb-00a5444b7e40c444c | Private-Route-Table was created successfully.

**rtb-00a5444b7e40c444c / Private-Route-Table**

**Details**

Route table ID: rtb-00a5444b7e40c444c	Main: No	Explicit subnet associations: -
VPC: vpc-0fdcd429bf867a8c3   EduCloudVPC	Owner ID: 139749347006	Edge associations: -

**Routes** (1)

Destination	Target	Status	Propagated	Route Origin
10.0.0.0/16	local	Active	No	Create Route Table

## Both private subnets associated

The screenshot shows the 'Edit subnet associations' page for a specific route table. In the 'Available subnets' section, two subnets are listed: 'Private-Subnet-Servers' and 'Private-Subnet-Database'. Both have checkboxes checked, indicating they are selected for association. In the 'Selected subnets' section, the same two subnets are listed with their respective subnet IDs. At the bottom right, there are 'Cancel' and 'Save associations' buttons.

The screenshot shows the 'rtb-00a5444b7e40c444c / Private-Route-Table' details page. A green success message at the top states: 'You have successfully updated subnet associations for rtb-00a5444b7e40c444c / Private-Route-Table.' The 'Details' tab is selected, showing the route table ID, VPC, and explicit subnet associations (2 subnets). The 'Routes' tab is active, displaying one route entry: Destination 10.0.0.0/16, Target local, Status Active, Propagated No, and Route Origin CreateRouteTable. At the bottom right, there are 'Actions' and 'Edit routes' buttons.

The screenshot shows the 'Edit routes' page for the same route table. It lists several route entries. One entry has a destination of 10.0.0.0/16, target 'local', status 'Active', propagated 'No', and route origin 'CreateRouteTable'. Another entry has a destination of 0.0.0.0/0, target 'NAT Gateway', status 'Active', propagated 'No', and route origin 'CreateRoute'. There are buttons for 'Add route', 'Remove', 'Preview', and 'Save changes' at the bottom right.

## Default security Groups

The screenshot shows the AWS VPC Security Groups page. On the left, there's a navigation sidebar with options like VPC dashboard, Virtual private cloud, and Security. The main area displays a table of security groups:

Name	Security group ID	Security group name	VPC ID	Description
-	sg-05ca4d1e70710ad9b	default	vpc-0aa6535aad0afc45e	default VPC security group
-	sg-065a43c9f20f91531	default	vpc-0fdc429bf867a8c3	default VPC security group

At the bottom, there's a section titled "Select a security group".

## ALB SECURITY GROUP (Public Load Balancer)

The screenshot shows the AWS VPC Security Groups page for a specific security group named "sg-0505e52b098b2911a - EduCloud-ALB-SG". A green success message at the top says "Security group (sg-0505e52b098b2911a | EduCloud-ALB-SG) was created successfully". The main area shows the security group details:

Security group name EduCloud-ALB-SG	Security group ID sg-0505e52b098b2911a	Description Security group for Application Load Balance	VPC ID vpc-0fdc429bf867a8c3
Owner 139749347006	Inbound rules count 2 Permission entries	Outbound rules count 1 Permission entry	

Below this, there are tabs for Inbound rules, Outbound rules, Sharing, VPC associations, and Tags. The Inbound rules section shows two rules:

Name	Security group rule...	IP version	Type	Protocol	Port range	Source
-	sgr-e1280d685bf909ad	IPv4	HTTPS	TCP	443	0.0.0.0/0
-	sgr-0a5265a27df0fb356	IPv4	HTTP	TCP	80	0.0.0.0/0

## WEBSERVER SECURITY GROUP

The screenshot shows the 'Create security group' page in the AWS VPC console. The 'Inbound rules' section is displayed, listing six rules:

Type	Protocol	Port range	Source	Description
HTTP	TCP	80	Custom (sg-0505e52b098b2911a)	Allow HTTP from Load Balancer only
SSH	TCP	22	My IP (49.207.213.15/32)	Allow SSH from my IP (temporary)
HTTPS	TCP	443	Custom (sg-0505e52b098b2911a)	Allow HTTPS from Load Balancer
NFS	TCP	2049	My IP (49.207.213.15/32)	Allow NFS from trainer workstation
Custom TCP	TCP	21	Anywhere (0.0.0.0/0)	Allow FTP control connection

At the bottom left is a 'Add rule' button.

The screenshot shows the 'Details' page for the security group 'sg-0834453f1ae82fe95 | EduCloud-WebServer-SG'. A green banner at the top indicates it was created successfully.

**Details:**

Security group name	Security group ID	Description	VPC ID
EduCloud-WebServer-SG	sg-0834453f1ae82fe95	Security group for EC2 web servers	vpc-0fdcdc429bf867a8c3

**Inbound rules (6):**

Name	Security group rule...	IP version	Type	Protocol	Port range	Source
-	sgr-08da6f9b4a5a1854d	IPv4	NFS	TCP	2049	49.207.213.15/32
-	sgr-0507f4fd5c999791b	-	HTTP	TCP	80	sg-0505e52b098b2911a
-	sgr-07e9d1783e92f4105	IPv4	SSH	TCP	22	49.207.213.15/32
-	sgr-0fcac1cab0d4242d49	IPv4	Custom TCP	TCP	40000 - 40100	0.0.0.0/0

# RDS SECURITY GROUP

The screenshot shows the 'Create security group' page in the AWS VPC console. In the 'Basic details' section, the security group name is 'EduCloud-RDS-SG' and the description is 'Security group for RDS MySQL database'. The VPC is set to 'vpc-0fdc429bf867a8c3 (EduCloudVPC)'. In the 'Inbound rules' section, there is one rule: 'Allow MySQL from web servers only' (sg-0834453f1ae82fe95). The rule is defined with MySQL/Aurora as the type, TCP as the protocol, port range 3306, and a custom source. The description is 'Allow MySQL from web servers only'. The screenshot also shows the AWS navigation bar at the top.

The screenshot shows the 'Security Groups' page in the AWS VPC console. A success message indicates that the security group 'sg-0b3b45a8c3fab07e | EduCloud-RDS-SG' was created successfully. The main card displays the security group details: name 'EduCloud-RDS-SG', ID 'sg-0b3b45a8c3fab07e', owner '139749347006', and a single inbound rule entry. The 'Inbound rules' tab is selected, showing the rule 'Allow MySQL from web servers only' with the same details as the previous screenshot. The left sidebar shows the VPC dashboard and other network-related services like Subnets, Route tables, Internet gateways, Egress-only internet gateways, Carrier gateways, DHCP option sets, Elastic IPs, Managed prefix lists, NAT gateways, Peering connections, and Route servers. The AWS navigation bar is visible at the bottom.

## BASTION SECURITY GROUP

The screenshot shows the 'Create security group' page in the AWS VPC console. In the 'Basic details' section, the security group name is set to 'EduCloud-Bastion-SG'. The description is 'Security group for Bastion Host (SSH jump server)'. Under 'VPC Info', it is associated with 'vpc-0fddc429bf867a8c3 (EduCloudVPC)'. The 'Inbound rules' section contains one rule: 'Allow SSH from my workstation only' (description), which is configured for 'SSH' (Protocol), 'TCP' (Port range), port 22, and source 'My IP' (49.207.213.15/32). A note says 'Allow SSH from my workstation only'. At the bottom, there is a success message: 'Security group (sg-0b994c65798e79150 | EduCloud-Bastion-SG) was created successfully'.

## Security Group Configuration

The screenshot shows the 'Security Groups' page in the AWS VPC console. It lists six security groups: 'EduCloud-Bastion-SG', 'EduCloud-RDS-SG', 'EduCloud-WebServer-SG', 'default', 'sg-065a43c9f20f91531', and 'EduCloud-ALB-SG'. The table includes columns for Name, Security group ID, Security group name, VPC ID, and Description. A success message at the top states: 'Security group (sg-0b994c65798e79150 | EduCloud-Bastion-SG) was created successfully'. The left sidebar shows navigation links for Virtual private cloud, Security, and PrivateLink and Lattice.

## **SECURITY BEST PRACTICES IMPLEMENTED**

### **Principle of Least Privilege:**

- RDS only accessible from WebServers (not from internet)
- WebServers only accept HTTP from Load Balancer
- SSH only from Bastion or specific IP

### **Defense in Depth:**

- Multiple layers: ALB → WebServer → Database
- Each layer has its own security group

### **Segmentation:**

- Public resources (ALB) separate from private (WebServer, RDS)
- Database completely isolated from internet

### **Source Restriction:**

- SSH limited to known IPs
- NFS limited to trainer workstation
- Database only from application servers

The screenshot shows the AWS IAM Dashboard. On the left, a sidebar navigation includes 'Identity and Access Management (IAM)', 'Dashboard', 'Access Management' (User groups, Users, Roles, Policies, Identity providers, Account settings, Root access management), 'Temporary delegation requests', 'Access reports' (Access Analyzer, Resource analysis, Unused access, Analyzer settings, Credential report, Organization activity), and links to 'cloudShell', 'Feedback', and 'Console Mobile App'. The main content area features a 'Security recommendations' section with two items: 'Root user has MFA' (Having multi-factor authentication (MFA) for the root user improves security for this account.) and 'Root user has no active access keys' (Using access keys attached to an IAM user instead of the root user improves security.). Below this is an 'IAM resources' summary table:

User groups	Users	Roles	Policies	Identity providers
0	0	3	0	0

The 'What's new' section indicates 'AWS IAM enables identity federation to external services using JSON Web Tokens (JWTs). 2 months ago'. To the right, there are sections for 'AWS Account' (Account ID: 139749347006, Account Alias: Create, Sign-in URL: https://139749347006.siginn.aws.amazon.com/console), 'Quick Links' (My security credentials, Manage your access keys, multi-factor authentication (MFA) and other credentials), and 'Tools' (Policy simulator). The bottom of the page includes copyright information (© 2026, Amazon Web Services, Inc. or its affiliates.) and links for Privacy, Terms, and Cookie preferences.

## TRAINER GROUP

The screenshot shows the 'User groups' page under the 'Access Management' section. The sidebar is identical to the previous dashboard screenshot. The main area displays a success message: 'TrainerGroup user group created.' Below this is a table of user groups:

Group name	Users	Permissions	Creation time
TrainerGroup	0	Defined	Now

At the bottom, there are links for 'View group', 'Delete', and 'Create group'. The footer includes standard copyright and link information.

The screenshot shows the 'TrainerGroup' details page. The top header includes 'TrainerGroup' and 'Delete' buttons. The 'Summary' section provides basic information: User group name (TrainerGroup), Creation time (January 20, 2026, 12:15 (UTC+05:30)), and ARN (arn:aws:iam::139749347006:group/TrainerGroup). Below this are tabs for 'Users', 'Permissions' (selected), and 'Access Advisor'. The 'Permissions policies' section shows 2 managed policies: 'AmazonS3ReadOnlyAccess' and 'CloudWatchReadOnlyAccess', both listed as 'AWS managed' with 2 attached entities each. Buttons for 'Simulate', 'Remove', and 'Add permissions' are available. A 'Filter by Type' dropdown is also present.

## STUDENT GROUP

The screenshot shows the AWS IAM User Groups page. A green banner at the top indicates "StudentGroup user group created." The main table displays two groups: "StudentGroup" (selected) and "TrainerGroup". Both groups have 0 users and 0 permissions defined. The "StudentGroup" was created "Now" and the "TrainerGroup" was created "1 minute ago".

Group name	Users	Permissions	Creation time
StudentGroup	0	Defined	Now
TrainerGroup	0	Defined	1 minute ago

The screenshot shows the "StudentGroup" details page. The "Summary" section shows the group name "StudentGroup" and creation time "January 20, 2026, 12:17 (UTC+05:30)". The ARN is listed as "arn:aws:iam::139749347006:group/StudentGroup". The "Permissions" tab is selected, showing one attached policy: "AmazonS3ReadOnlyAccess" (AWS managed). Other tabs include "Users" and "Access Advisor".

## SUPPORT GROUP

The screenshot shows the AWS IAM User Groups page. A green banner at the top indicates "SupportGroup user group created." The main table displays three groups: "StudentGroup", "SupportGroup" (selected), and "TrainerGroup". All three groups have 0 users and 0 permissions defined. The "SupportGroup" was created "Now" and the "TrainerGroup" was created "2 minutes ago".

Group name	Users	Permissions	Creation time
StudentGroup	0	Defined	Now
SupportGroup	0	Defined	Now
TrainerGroup	0	Defined	2 minutes ago

**SupportGroup** Info

**Summary**

User group name: SupportGroup

Creation time: January 20, 2026, 12:18 (UTC+05:30)

ARN: arn:aws:iam::139749347006:group/SupportGroup

**Permissions** (2) Info

You can attach up to 10 managed policies.

**Filter by Type**

Policy name	Type	Attached entities
CloudWatchReadOnlyAccess	AWS managed	2
ViewOnlyAccess	AWS managed - job function	1

**Actions:** Delete, Edit, Simulate, Remove, Add permissions

## TRAINER USERS

### Trainer1

**User created successfully**

You can view and download the user's password and email instructions for signing in to the AWS Management Console.

**Retrieve password**

Specify user details

Console sign-in details

Console sign-in URL: <https://139749347006.signin.aws.amazon.com/console>

User name: trainer1

Console password: [Show](#)

**Actions:** Email sign-in instructions, Download .csv file, Return to users list

### Console sign-in URL

<https://139749347006.signin.aws.amazon.com/console>

### User name

trainer1

### Console password

Trainer1@EduCloud2026!

## Trainer2

The screenshot shows the 'Create user' process in the AWS IAM console. Step 4, 'Retrieve password', is selected. A green success message box at the top says 'User created successfully'. Below it, instructions state: 'You can view and download the user's password and email instructions for signing in to the AWS Management Console.' A 'View user' button is present. To the left, a vertical navigation bar lists steps: Step 1 (Specify user details), Step 2 (Set permissions), Step 3 (Review and create), and Step 4 (Retrieve password). On the right, under 'Console sign-in details', the URL is https://139749347006.signin.aws.amazon.com/console, the user name is trainer2, and the console password is shown as a masked string. Buttons for 'Email sign-in instructions', 'Download .csv file', and 'Return to users list' are available.

### Console sign-in URL

<https://139749347006.signin.aws.amazon.com/console>

### User name

trainer2

### Console password

Trainer2@EduCloud2026!

The screenshot shows the 'Users' page in the AWS IAM console. The sidebar includes sections for Identity and Access Management (IAM), Access Management (User groups, Users, Roles, Policies, Identity providers, Account settings, Root access management, Temporary delegation requests), Access reports (Access Analyzer, Resource analysis, Unused access, Analyzer settings, Credential report, Organization activity), CloudShell, Feedback, and Console Mobile App. The main area displays a table of users:

User name	Path	Groups	Last activity	MFA	Password age	Console last sign-in	Access key ID
trainer1	/	1	-	-	4 minutes	-	-
trainer2	/	1	-	-	1 minute	-	-

Buttons for 'Delete' and 'Create user' are visible above the table. The bottom of the screen shows standard AWS footer links: © 2026, Amazon Web Services, Inc. or its affiliates., Privacy, Terms, and Cookie preferences.

## STUDENT USERS

### Student1

The screenshot shows the AWS Management Console with the IAM service selected. A green success banner at the top states "User created successfully" and provides instructions to view and download the user's password and email instructions. Below the banner, a navigation menu lists steps: Step 1 (Specify user details), Step 2 (Set permissions), Step 3 (Review and create), and Step 4 (Retrieve password), with Step 4 currently selected. The main content area displays "Retrieve password" instructions, including a "Console sign-in details" section with a "Console sign-in URL" (https://139749347006.signin.aws.amazon.com/console), "User name" (student1), and "Console password" (redacted). A "Show" link is available for the password. At the bottom right are "Cancel", "Download .csv file", and "Return to users list" buttons. The footer includes links for CloudShell, Feedback, and Console Mobile App, along with copyright information and links for Privacy, Terms, and Cookie preferences.

### Console sign-in URL

<https://139749347006.signin.aws.amazon.com/console>

### User name

student1

### Console password

Student1@EduCloud2026!

## Student2

The screenshot shows the AWS IAM 'Create user' success page for 'student2'. A green header bar indicates 'User created successfully'. Below it, a message says 'You can view and download the user's password and email instructions for signing in to the AWS Management Console.' A 'View user' button is present. On the left, a vertical navigation menu lists steps: Step 1 (Specify user details), Step 2 (Set permissions), Step 3 (Review and create), and Step 4 (Retrieve password), with Step 4 currently selected. The main content area is titled 'Retrieve password' and contains 'Console sign-in details' with a 'Console sign-in URL' (https://139749347006.signin.aws.amazon.com/console), 'User name' (student2), and 'Console password' (\*\*\*\*\*). A 'Show' link is next to the password field. Buttons for 'Cancel', 'Download .csv file', and 'Return to users list' are at the bottom.

### Console sign-in URL

<https://139749347006.signin.aws.amazon.com/console>

### User name

student2

### Console password

Student3@EduCloud2026!

## Student3

The screenshot shows the AWS IAM 'Create user' success page for 'student3'. A green header bar indicates 'User created successfully'. Below it, a message says 'You can view and download the user's password and email instructions for signing in to the AWS Management Console.' A 'View user' button is present. On the left, a vertical navigation menu lists steps: Step 1 (Specify user details), Step 2 (Set permissions), Step 3 (Review and create), and Step 4 (Retrieve password), with Step 4 currently selected. The main content area is titled 'Retrieve password' and contains 'Console sign-in details' with a 'Console sign-in URL' (https://139749347006.signin.aws.amazon.com/console), 'User name' (student3), and 'Console password' (\*\*\*\*\*). A 'Show' link is next to the password field. Buttons for 'Cancel', 'Download .csv file', and 'Return to users list' are at the bottom.

## Console sign-in URL

<https://139749347006.signin.aws.amazon.com/console>

### User name

student3

### Console password

Student3@EduCloud2026!

The screenshot shows the AWS IAM Users page. At the top, a green success message box displays "User created successfully" and "You can view and download the user's password and email instructions for signing in to the AWS Management Console." Below this, a "View user" button is visible. The main area is titled "Users (5)" with an "Info" link. It contains a search bar and a table with the following data:

User name	Path	Groups	Last activity	MFA	Password age	Console last sign-in	Access key ID
student1	/	1	-	-	5 minutes	-	-
student2	/	1	-	-	3 minutes	-	-
student3	/	1	-	-	1 minute	-	-
trainer1	/	1	-	-	12 minutes	-	-
trainer2	/	1	-	-	9 minutes	-	-

## SUPPORT USER

The screenshot shows the "Create user" wizard on the "Retrieve password" step. The left sidebar lists steps: Step 1 (Specify user details), Step 2 (Set permissions), Step 3 (Review and create), and Step 4 (Retrieve password), with Step 4 currently selected. The main area displays "Console sign-in details" including the "Console sign-in URL" (https://139749347006.signin.aws.amazon.com/console), "User name" (support1), and "Console password" (redacted). Buttons for "Email sign-in instructions" and "Download .csv file" are also present.

## Console sign-in URL

<https://139749347006.signin.aws.amazon.com/console>

### User name

support1

### Console password

Support1@EduCloud2026!

Users (6) <small>Info</small>										
An IAM user is an identity with long-term credentials that is used to interact with AWS in an account.										
	User name	Path	Group	Last activity	MFA	Password age	Console last sign-in	Access key ID		
<input type="checkbox"/>	<a href="#">student1</a>	/	1	-	-	8 minutes	-	-		
<input type="checkbox"/>	<a href="#">student2</a>	/	1	-	-	6 minutes	-	-		
<input type="checkbox"/>	<a href="#">student3</a>	/	1	-	-	4 minutes	-	-		
<input type="checkbox"/>	<a href="#">support1</a>	/	1	-	-	1 minute	-	-		
<input type="checkbox"/>	<a href="#">trainer1</a>	/	1	-	-	15 minutes	-	-		
<input type="checkbox"/>	<a href="#">trainer2</a>	/	1	-	-	12 minutes	-	-		

## Custom policy created

The screenshot shows the AWS IAM Policies page. A green banner at the top indicates that the policy 'EduCloud-Trainer-S3-Policy' has been created. The main table lists one policy:

Policy name	Type	Used as	Description
EduCloud-Trainer-S3-Policy	Customer managed	None	Allows trainers to upload materials to ...

The left sidebar shows the navigation menu for IAM, with 'Policies' selected. Other options like 'User groups', 'Roles', and 'Access reports' are also visible.

## Create policy

```
{  
    "Version": "2012-10-17",  
    "Statement": [  
        {  
            "Sid": "AllowS3ListBuckets",  
            "Effect": "Allow",  
            "Action": [  
                "s3>ListAllMyBuckets",  
                "s3:GetBucketLocation"  
            ],  
            "Resource": "*"  
        },  
        {  
            "Sid": "AllowS3MaterialsUpload",  
            "Effect": "Allow",  
            "Action": [  
                "s3:PutObject",  
                "s3:PutObjectAcl",  
                "s3:GetObject",  
                "s3:GetObjectVersion",  
                "s3>DeleteObject",  
                "s3>ListBucket"  
            ],  
            "Resource": [  
                "arn:aws:s3:::educloud-materials",  
                "arn:aws:s3:::educloud-materials/*"  
            ]  
        },  
        {  
            "Sid": "AllowS3MaterialsFolderAccess",  
            "Effect": "Allow",  
            "Action": [  
                "s3:PutObject",  
                "s3:GetObject",  
            ]  
        }  
    ]  
}
```

```

    "s3:DeleteObject"
],
"Resource": "arn:aws:s3:::educloud-materials/materials/*"
}
]
}

```

## ATTACH CUSTOM POLICY TO TRAINER GROUP

The screenshot shows the AWS IAM User Groups interface. The left sidebar is collapsed. The main area shows the 'TrainerGroup' user group details. The 'Permissions' tab is selected. A green banner at the top says 'Policies attached to this user group.' Below it, the 'Summary' section shows the group was created on January 20, 2026, at 12:15 (UTC+05:30). The ARN is listed as arn:aws:iam:139749347006:group/TrainerGroup. The 'Permissions policies' section lists three policies: AmazonS3ReadOnlyAccess, CloudWatchReadOnlyAccess, and EduCloud-Trainer-S3-Policy. There are buttons for 'Simulate', 'Remove', and 'Add permissions'.

## EC2 ROLE

The screenshot shows the AWS IAM Roles interface. The left sidebar is collapsed. The main area shows the 'Create role' process. Step 2, 'Add permissions', is selected. Step 3, 'Name, review, and create', is shown below. The 'Role details' section includes a 'Role name' field set to 'EduCloud-EC2-Role' and a 'Description' field containing 'IAM role for EC2 instances to access S3, RDS, and CloudWatch'. The 'Step 1: Select trusted entities' section shows a trust policy with the following JSON code:

```

1 - [
2 -   {
3 -     "Version": "2012-10-17",
4 -     "Statement": [
5 -       {
6 -         "Effect": "Allow",
7 -         "Action": [
8 -           "sts:AssumeRole"
9 -         ],
10 -        "Principal": [
11 -          {
12 -            "Service": [
13 -              "ec2.amazonaws.com"
14 -            ]
15 -          }
16 -        ]
17 -      }
18 -    ]
19 -  }
20 - ]

```

Step 2: Add permissions		
Permissions policy summary		
Policy name	Type	Attached as
<a href="#">AmazonRDSFullAccess</a>	AWS managed	Permissions policy
<a href="#">AmazonS3FullAccess</a>	AWS managed	Permissions policy
<a href="#">AmazonSSMManagedInstanceCore</a>	AWS managed	Permissions policy
<a href="#">CloudWatchAgentServerPolicy</a>	AWS managed	Permissions policy

## IAM role for EC2 instances to access S3, RDS, and CloudWatch

The screenshot shows the AWS IAM Roles page. A green banner at the top indicates 'Role EduCloud-EC2-Role created.' The main area displays a table of roles:

Role name	Trusted entities	Last activity
<a href="#">AWSServiceRoleForResourceExplorer</a>	AWS Service: resource-explorer-2 [S]	21 minutes ago
<a href="#">AWSServiceRoleForSupport</a>	AWS Service: support [Service-Linker]	-
<a href="#">AWSServiceRoleForTrustedAdvisor</a>	AWS Service: trustedadvisor [Service-Linker]	-
<b>EduCloud-EC2-Role</b>	AWS Service: ec2	-

Below the table, there are sections for 'Roles Anywhere' and 'Temporary credentials'.

## EduCloud-Lambda-Role

The screenshot shows the 'Name, review, and create' step of the IAM role creation wizard. The 'Step 1: Select trusted entities' section is active. The 'Trust policy' field contains the following JSON policy:

```

1: {
2:   "Version": "2012-10-17",
3:   "Statement": [
4:     {
5:       "Effect": "Allow",
6:       "Action": "sts:AssumeRole"
7:     }
  ]
}
  
```

## IAM role for Lambda functions to access S3, RDS, SNS, and VPC

Step 2: Add permissions

Permissions policy summary

Policy name	Type	Attached as
<a href="#">AmazonS3FullAccess</a>	AWS managed	Permissions policy
<a href="#">AmazonSNSFullAccess</a>	AWS managed	Permissions policy
<a href="#">AWSLambdaBasicExecutionRole</a>	AWS managed	Permissions policy
<a href="#">AWSLambdaVPCAccessExecutionRole</a>	AWS managed	Permissions policy

Identity and Access Management (IAM)

Roles (1/5) [Info](#)

Role name	Trusted entities	Last activity
<a href="#">AWSServiceRoleForResourceExplorer</a>	AWS Service: resource-explorer-2	24 minutes ago
<a href="#">AWSServiceRoleForSupport</a>	AWS Service: support (Service-Linker)	-
<a href="#">AWSServiceRoleForTrustedAdvisor</a>	AWS Service: trustedadvisor (Service)	-
<a href="#">EduCloud-EC2-Role</a>	AWS Service: ec2	-
<b>EduCloud-Lambda-Role</b>	AWS Service: lambda	-

Roles Anywhere [Info](#)

X.509 Standard

Temporary credentials

## S3 ARCHITECTURE

### PRIMARY S3 BUCKET

Storage

## Amazon S3

Store and retrieve any amount of data from anywhere

Amazon S3 is an object storage service that offers industry-leading scalability, data availability, security, and performance.

Create a bucket

Every object in S3 is stored in a bucket. To upload files and folders to S3, you'll need to create a bucket where the objects will be stored.

Create bucket

How it works

Introduction to Amazon S3 | Amazon Web Services

Pricing

With S3, there are no minimum fees. You only pay for what you use. Prices are based on the location of your S3 bucket.

Estimate your monthly bill using the [AWS Simple Monthly Calculator](#).

View pricing details

Resources

User guide

API reference

### Bucket name and region

**Create bucket** [Info](#)

Buckets are containers for data stored in S3.

**General configuration**

**AWS Region**  
US East (N. Virginia) us-east-1

**Bucket type** [Info](#)

General purpose  
Recommended for most use cases and access patterns. General purpose buckets are the original S3 bucket type. They allow a mix of storage classes that redundantly store objects across multiple Availability Zones.

Directory  
Recommended for low-latency use cases. These buckets use only the S3 Express One Zone storage class, which provides faster processing of data within a single Availability Zone.

**Bucket name** [Info](#)  
educloud-materials-Mdnihal01fe27

Bucket names must be 3 to 63 characters and unique within the global namespace. Bucket names must also begin and end with a letter or number. Valid characters are a-z, 0-9, periods (.), and hyphens (-). [Learn more](#)

**Copy settings from existing bucket - optional**  
Only the bucket settings in the following configuration are copied.

**Choose bucket**

Format: s3://bucket/prefix

## Bucket created confirmation

**aws** [\[Alt+S\]](#) [Search](#)

Amazon S3 > Buckets

**Successfully created bucket "educloud-materials-mdnihal01fe27"**  
To upload files and folders, or to configure additional bucket settings, choose [View details](#).

**General purpose buckets** [All AWS Regions](#) **Directory buckets**

Name	AWS Region	Creation date
educloud-materials-mdnihal01fe27	US East (N. Virginia) us-east-1	January 20, 2026, 14:56:45 (UTC+05:30)

**Account snapshot** [Info](#) [View dashboard](#)  
Updated daily  
Storage Lens provides visibility into storage usage and activity trends.

**External access summary** [Info](#)  
Updated daily  
External access findings help you identify bucket permissions that allow public access or access from other AWS accounts.

## CREATED BACKUP BUCKET - US West (Oregon) us-west-2

**Create bucket** [Info](#)

Buckets are containers for data stored in S3.

**General configuration**

**AWS Region**  
US West (Oregon) us-west-2

**Bucket type** [Info](#)

General purpose  
Recommended for most use cases and access patterns. General purpose buckets are the original S3 bucket type. They allow a mix of storage classes that redundantly store objects across multiple Availability Zones.

Directory  
Recommended for low-latency use cases. These buckets use only the S3 Express One Zone storage class, which provides faster processing of data within a single Availability Zone.

**Bucket name** [Info](#)  
educloud-materials-backup-mdnihal01fe27

Bucket names must be 3 to 63 characters and unique within the global namespace. Bucket names must also begin and end with a letter or number. Valid characters are a-z, 0-9, periods (.), and hyphens (-). [Learn more](#)

**Copy settings from existing bucket - optional**  
Only the bucket settings in the following configuration are copied.

**Choose bucket**

Format: s3://bucket/prefix

## Backup bucket created in us-west-2

Successfully created bucket "educloud-materials-backup-mdnihal01fe27"  
To upload files and folders, or to configure additional bucket settings, choose [View details](#).

General purpose buckets All AWS Regions Directory buckets

General purpose buckets (2) [Info](#)

Buckets are containers for data stored in S3.

Name	AWS Region	Creation date
educloud-materials-backup-mdnihal01fe27	US West (Oregon) us-west-2	January 20, 2026, 15:12:33 (UTC+05:30)
educloud-materials-mdnihal01fe27	US East (N. Virginia) us-east-1	January 20, 2026, 14:56:45 (UTC+05:30)

Copy ARN Empty Delete Create bucket

Account snapshot [Info](#) [View dashboard](#)  
Updated daily  
Storage Lens provides visibility into storage usage and activity trends.

External access summary [Info](#)  
Updated daily  
External access findings help you identify bucket permissions that allow public access or access from other AWS accounts.

## Lifecycle rule details

### Create lifecycle rule [Info](#)

#### Lifecycle rule configuration

Lifecycle rule name  
Archive-Old-Materials-To-Glacier  
Up to 255 characters

Choose a rule scope  
 Limit the scope of this rule using one or more filters  
 Apply to all objects in the bucket

**⚠️ Apply to all objects in the bucket**  
If you want the rule to apply to specific objects, you must use a filter to identify those objects. Choose "Limit the scope of this rule using one or more filters". [Learn more ↗](#)

I acknowledge that this rule will apply to all objects in the bucket.

#### Lifecycle rule actions

Choose the actions you want this rule to perform.

Transition current versions of objects between storage classes  
This action will move current versions.

Transition noncurrent versions of objects between storage classes  
This action will move noncurrent versions.

Expire current versions of objects

Permanently delete noncurrent versions of objects

Delete expired object delete markers or incomplete multipart uploads  
These actions are not supported when filtering by object tags or object size.

**⚠️ Transitions are charged per request**  
For a lifecycle transition action, each request corresponds to an object transition. For details on lifecycle transition pricing, see requests pricing info on the Storage & requests tab of the [Amazon S3 pricing page ↗](#).

I acknowledge that this lifecycle rule will incur a transition cost per request.

**ⓘ By default, objects less than 128KB will not transition across any storage class**  
We don't recommend transitioning objects less than 128 KB because the transition costs can outweigh the storage savings. If your use case requires transitioning objects less than 128 KB, specify a minimum object size filter for each applicable lifecycle rule with a transition action.

#### Lifecycle rule actions

Choose the actions you want this rule to perform.

Transition current versions of objects between storage classes  
This action will move current versions.

Transition noncurrent versions of objects between storage classes  
This action will move noncurrent versions.

Expire current versions of objects

Permanently delete noncurrent versions of objects

Delete expired object delete markers or incomplete multipart uploads  
These actions are not supported when filtering by object tags or object size.

**⚠️ Transitions are charged per request**  
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I acknowledge that this lifecycle rule will incur a transition cost per request.

**ⓘ By default, objects less than 128KB will not transition across any storage class**  
We don't recommend transitioning objects less than 128 KB because the transition costs can outweigh the storage savings. If your use case requires transitioning objects less than 128 KB, specify a minimum object size filter for each applicable lifecycle rule with a transition action.

**Transition current versions of objects between storage classes**

Choose transitions to move current versions of objects between storage classes based on your use case scenario and performance access requirements. These transitions start from when the objects are created and are consecutively applied. [Learn more ↗](#)

**Choose storage class transitions**

Glacier Flexible Retrieval (formerly Glacier)	Days after object creation	90	<a href="#">Remove</a>
---	----------------------------	----	------------------------

[Add transition](#)

**Transition noncurrent versions of objects between storage classes**

Choose transitions to move noncurrent versions of objects between storage classes based on your use case scenario and performance access requirements. These transitions start from when the objects become noncurrent and are consecutively applied. [Learn more ↗](#)

**Choose storage class transitions**

Glacier Flexible Retrieval (formerly Glacier)	Days after objects become noncurrent	30	<a href="#">Remove</a>
---	--------------------------------------	----	------------------------

**Number of newer versions to retain - Optional**

Number of versions  
Can be 1 to 100 versions. All other noncurrent versions will be moved.

[Add transition](#)

**Expire current versions of objects**

For version-enabled buckets, Amazon S3 adds a delete marker and the current version of an object is retained as a noncurrent version. For non-versioned buckets, Amazon S3 permanently removes the object. [Learn more ↗](#)

**Days after object creation**

365
-----

**Review transition and expiration actions**

Current version actions	Noncurrent versions actions
<b>Day 0</b>	<b>Day 0</b>
• Objects uploaded	• Objects become noncurrent
↓	↓
<b>Day 90</b>	<b>Day 30</b>
• Objects move to Glacier Flexible Retrieval (formerly Glacier)	• 0 newest noncurrent versions are retained
↓	• All other noncurrent versions move to Glacier Flexible Retrieval (formerly Glacier)
<b>Day 365</b>	
• Objects expire	

## Lifecycle rule created

The rule "Archive-Old-Materials-To-Glacier" has been successfully added and the lifecycle configuration has been updated. It may take some time for the configuration to be updated. Refresh the lifecycle rules list if changes to the configuration aren't displayed.

**Lifecycle configuration**

To manage your objects so that they are stored cost effectively throughout their lifecycle, configure their lifecycle. A lifecycle configuration is a set of rules that define actions that Amazon S3 applies to a group of objects. Lifecycle rules run once per day.

**Default minimum object size for transitions**

All storage classes 120K

**Lifecycle rules (1)**

Use lifecycle rules to define actions you want Amazon S3 to take during an object's lifetime such as transitioning objects to another storage class, archiving them, or deleting them after a specified period of time. [Learn more ↗](#)

View details	Edit	Delete	Actions ▾	Create lifecycle rule		
<a href="#">Find lifecycle rules by name</a>						
Lifecycle rule name	Status	Scope	Current version actions	Noncurrent versions actions	Expired object delete ...	Incomplete multipart u...
Archive-Old-Materials-To-Glacier	Enabled	Entire bucket	Transition to Glacier Flexible Ret	Transition to Glacier Flexible Ret	-	-

## CROSS-REGION REPLICATION

## Custom policy for the replication

{

"Version": "2012-10-17",

"Statement": []

{

"Effect": "Allow",

"Action": [

"s3:GetReplicationConfiguration",

"s3>ListBucket"

】，

"Resource": [

"arn:aws:s3:::educloud-materials-mdnihal01fe27"

]

},

"Effect": "Allow",

"Action": [

"s3:GetObjectVersionForReplication",

"s3:GetObjectVersionAcl",

"s3:GetObjectVersionTagging"

],

"Resource": [

"arn:aws:s3:::educloud-materials-mdnihal01fe27/\*"

]

},

{

"Effect": "Allow",

"Action": [

```

    "s3:ReplicateObject",
    "s3:ReplicateDelete",
    "s3:ReplicateTags"
],
{
  "Resource": [
    "arn:aws:s3:::educloud-materials-mdnihal01fe27/*"
  ]
}
]
}

```

## Custom Policy attached to the replication role

The screenshot shows the AWS IAM Policies page. The left sidebar is titled 'Identity and Access Management (IAM)' and includes sections for Dashboard, Access Management (User groups, Users, Roles, Policies), and Access reports (Access Analyzer, Unused access, Analyzer settings, Credential report, Organization activity). The main content area is titled 'Policies (1/1443)' and contains a table with one row. The table has columns for Policy name, Type, Used as, and Description. The single policy listed is 'S3-Replication-Policy', which is a 'Customer managed' policy used as a 'Permissions policy'. A search bar at the top right is set to 'S3-Replication-Policy'. The bottom of the page includes standard AWS footer links: CloudShell, Feedback, Console Mobile App, © 2026, Amazon Web Services, Inc. or its affiliates., Privacy, Terms, and Cookie preferences.

Policy name	Type	Used as	Description
S3-Replication-Policy	Customer managed	Permissions policy (1)	-

## S3 replication role

Step 1  
 Select trusted entity  
Step 2  
 Add permissions  
Step 3  
 Name, review, and create

## Name, review, and create

**Role details**

**Role name**  
Enter a meaningful name to identify this role.  
  
Maximum 64 characters. Use alphanumeric and "+-,.\_-" characters.

**Description**  
Add a short explanation for this role.  
  
Maximum 1000 characters. Use letters (A-Z and a-z), numbers (0-9), tabs, new lines, or any of the following characters: - + . @ / [ ] { } % ^ & \_

**Step 1: Select trusted entities**

**Trust policy**

```

1 - | {
2 - |   "Version": "2012-10-17",
3 - |   "Statement": [
4 - |     {
5 - |       "Effect": "Allow",
6 - |       "Principal": {
7 - |         "Service": "s3.amazonaws.com"
8 - |       }
9 - |     }
10 - |   ]
11 - | }
12 - |

```

The screenshot shows the AWS IAM 'Create role' wizard at Step 1: 'Add permissions'. The left sidebar lists steps: 'Select trusted entity', 'Add permissions' (which is selected and highlighted in blue), 'Name, review, and create'. The main area is titled 'Add permissions' with a 'Permissions policies (1/1112)' section. A search bar contains 'S3-Replication-Policy'. A filter dropdown says 'All types' with '1 match'. Below the search bar, two policies are listed: 'Policy name' (selected) and 'S3-Replication-Policy' (Customer managed). At the bottom, there's an optional 'Set permissions boundary' section and navigation buttons for 'Cancel', 'Previous', and 'Next'.

The screenshot shows the AWS IAM Roles page. At the top, a green banner indicates that a role named "S3-Replication-Role" has been created. The main table lists six roles, each with a checkbox, role name, trusted entities, and last activity. The "S3-Replication-Role" is the most recent entry. Below the table, there's a section titled "Roles Anywhere" with a "Manage" button, and another section titled "Access AWS from your non AWS workloads" with a "X.509 Standard" sub-section.

Role name	Trusted entities	Last activity
AWSServiceRoleForResourceExplorer	AWS Service: resource-explorer-2 (Service-Link)	33 minutes ago
AWSServiceRoleForSupport	AWS Service: support (Service-Link)	-
AWSServiceRoleForTrustedAdvisor	AWS Service: trustedadvisor (Service-Link)	-
EduCloud-EC2-Role	AWS Service: ec2	-
EduCloud-Lambda-Role	AWS Service: lambda	-
S3-Replication-Role	AWS Service: s3	-

## Replication rule created

The screenshot shows the AWS S3 Replication rules configuration page. A new replication rule has been created:

Replication rule name	Status	Priority
Replicate-To-Backup-Bucket	Enabled	0

**Source bucket:**

- Source bucket name: educloud-materials-mdnihil01fe27
- Scope: Entire bucket
- Prefix: -
- Tags: -

**Destination:**

- Destination bucket name: educloud-materials-backup-mdnihil01fe27
- Storage class: Same as source
- Object ownership: Same as source
- Destination Region: US West (Oregon) us-west-2

**Encryption:**

- KMS-encrypted objects (SSE-KMS or DSSE-KMS): Do not replicate
- AWS KMS key for encrypting destination objects: -

**Actions:** View details, Edit rule, Delete, Actions, Create replication rule.

## CONFIGURE CORS FOR WEB ACCESS

### CORS Configuration

[

{

  "AllowedHeaders": [

    "\*"

  ],

  "AllowedMethods": [

    "GET",

    "HEAD",

    "PUT",

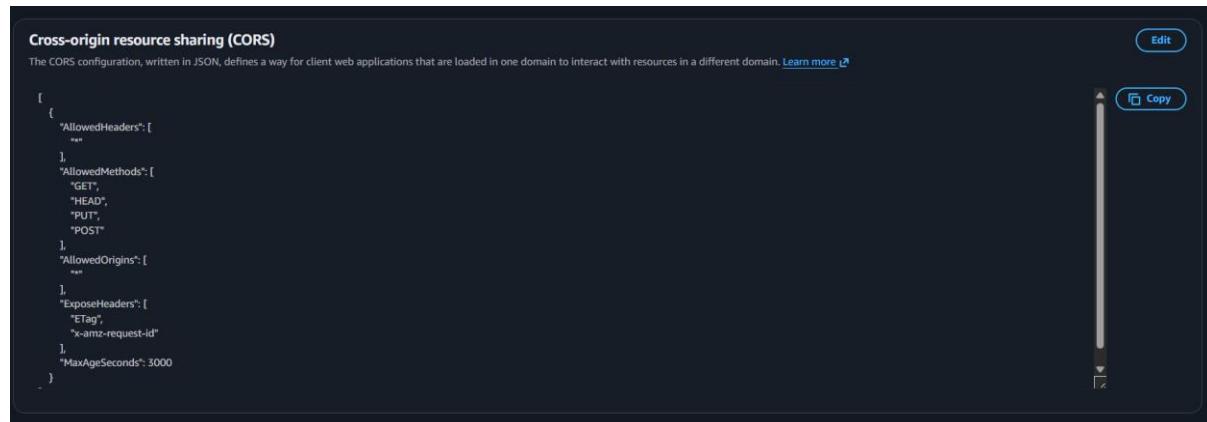
    "POST"

  ],

```

    "AllowedOrigins": [
        "*"
    ],
    "ExposeHeaders": [
        "ETag",
        "x-amz-request-id"
    ],
    "MaxAgeSeconds": 3000
}
]

```



## CONFIGURE BUCKET POLICY (FOR CLOUDFRONT)

```

{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Sid": "AllowCloudFrontServicePrincipal",
            "Effect": "Allow",
            "Principal": {
                "Service": "cloudfront.amazonaws.com"
            },
            "Action": "s3:GetObject",
            "Resource": "arn:aws:s3:::educloud-materials-YOURNAME/*",
        }
    ]
}

```

```

    "Condition": {
        "StringEquals": {
            "AWS:SourceArn": "arn:aws:cloudfront::ACCOUNT-ID:distribution/DISTRIBUTION-ID"
        }
    }
}
]
}

```

## ENABLE SERVER ACCESS LOGGING

The screenshot shows the AWS S3 Bucket Properties page for a bucket named 'educloud-materials-mdnihil01fe27'. A green success message at the top states 'Successfully edited server access logging.' Below it, the 'Server access logging' section is visible, showing that logging is enabled and pointing to CloudWatch for health checks. The 'Log object key format' is set to 'logs/[YYYY]-[MM]-[DD]-[hh]-[mm]-[ss]-[UniqueString]'. The 'AWS CloudTrail data events' section indicates that CloudTrail data events can be viewed and configured. The 'Event notifications (0)' section shows no notifications are currently configured, with a 'Create event notification' button available.

## CONFIGURE S3 EVENT NOTIFICATIONS (FOR LAMBDA )

The screenshot shows the AWS S3 Bucket Properties page for the same bucket. The 'Event notifications (0)' section is still empty, with a note about using CloudTrail for object-level operations. Below it, the 'Amazon EventBridge' section is present, showing that notifications are off. It includes a note about using EventBridge for event-driven applications and a link to pricing information.

## File upload material folder (test)

The screenshot shows the AWS S3 console interface. The top navigation bar includes the AWS logo, a search bar with 'iam', and a 'Copy Amazon Q' button. The account information 'MyAWSAccount (1397-4934-7006)' and region 'United States (N. Virginia)' are displayed. The main content area shows a bucket named 'educloud-materials-mdnihal01fe27' with a 'materials/' folder selected. A table titled 'Objects (1)' lists one item: 'server1 (1).pem' (Type: pem, Size: 1.6 KB, Storage class: Standard). The table has columns for Name, Type, Version ID, Last modified, Size, and Storage class. Buttons for Actions, Create folder, and Upload are visible at the top of the table.

## File upload Multiple versions showing (test)

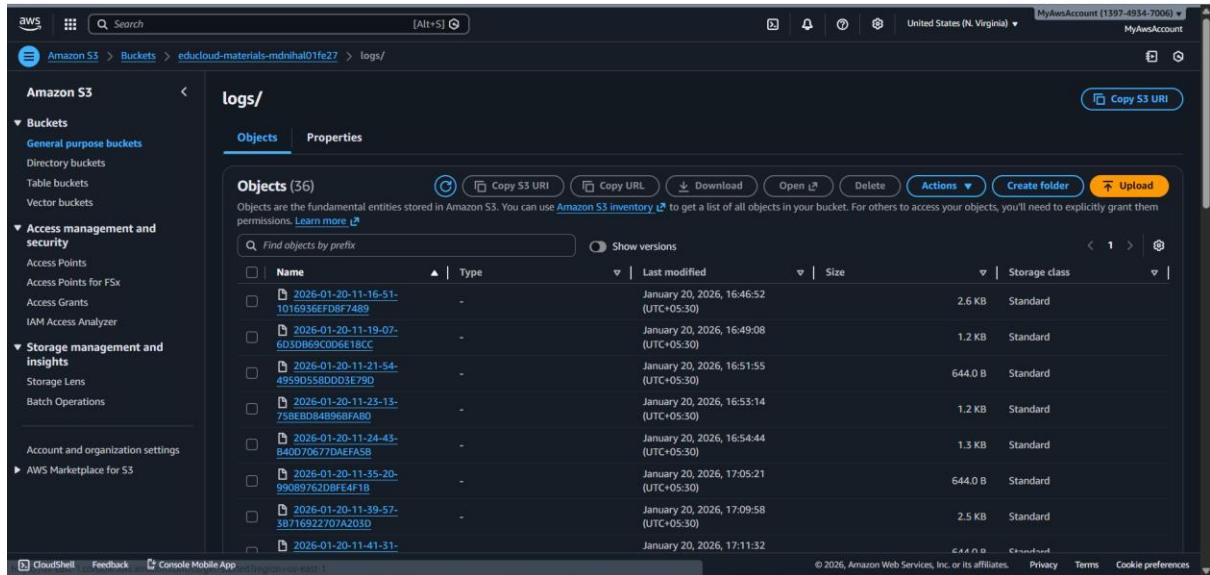
The screenshot shows the AWS S3 console interface, identical to the previous one but with a different file name. The table titled 'Objects (2)' now lists two items: 'server1 (1).pem' and 'L server1 (1).pem'. Both files are of type 'pem' and have a size of 1.6 KB, stored in the 'Standard' storage class. The first file was last modified on January 20, 2026, at 18:33:28 (UTC+05:30), and the second file was last modified on January 20, 2026, at 18:32:52 (UTC+05:30). The table columns are identical to the first screenshot.

## File replicated to backup bucket

The screenshot shows the AWS S3 console interface. On the left, there's a navigation sidebar with sections like 'Amazon S3', 'Buckets', 'Access management and security', 'Storage management and insights', and 'Account and organization settings'. The main area displays the properties of an object named 'server1 (1).pem' in a bucket named 'educloud-materials-mdnihal01fe27'. The object was last modified on January 20, 2026, at 18:47:22 (UTC+05:30). It has a size of 1.6 KB and is of type pem. The key is 'materials/server1 (1).pem'. To the right, there are sections for 'Object management overview', 'Bucket properties' (including Bucket Versioning), 'Management configurations' (with 'Replication status' showing 'COMPLETED'), and 'Expiration rule' (with a note about the object being noncurrent and a delete marker being generated). The URL for the object is https://educloud-materials-mdnihal01fe27.s3.us-east-1.amazonaws.com/materials/server1+(1).pem.

This screenshot shows the AWS S3 console with a different bucket selected: 'educloud-materials-backup-mdnihal01fe27'. The left sidebar remains the same. The main area shows a single object named 'server1 (1).pem' listed under the 'Objects' tab. The object was last modified on January 20, 2026, at 18:47:22 (UTC+05:30) and has a size of 1.6 KB. The storage class is Standard. There are buttons for 'Actions' (including Copy S3 URI, Copy URL, Download, Open, Delete, and Actions dropdown), 'Create folder', and 'Upload'. A search bar at the top allows finding objects by prefix. The table view shows columns for Name, Type, Last modified, Size, and Storage class. The 'Actions' column contains a small icon for each object entry.

## Server Access logging



The screenshot shows the Amazon S3 console interface. On the left, the navigation pane is open with the following sections visible:

- Buckets
  - General purpose buckets
  - Directory buckets
  - Table buckets
  - Vector buckets
- Access management and security
  - Access Points
  - Access Points for FSx
  - Access Grants
  - IAM Access Analyzer
- Storage management and insights
  - Storage Lens
  - Batch Operations
- Account and organization settings
  - AWS Marketplace for S3

The main content area displays the contents of the 'logs/' folder in a bucket named 'edulcloud-materials-mdnrahal01fe27'. The table lists 36 objects, all of which are log files. The columns include Name, Type, Last modified, Size, and Storage class. All objects are of type '-' (log file) and have a storage class of Standard. The last modified date for most objects is January 20, 2026, with times ranging from 16:46:52 to 17:11:52 UTC+05:30.

## WHAT IS SERVER ACCESS LOGGING?

Server Access Logging records every request made to your S3 bucket:

- Who accessed it
- What files they viewed/downloaded
- When it happened
- What operation (GET, PUT, DELETE, etc.)
- HTTP status code (success/failure)

### IP address of requester

### BENEFITS:

#### 1. Security Auditing

- Track unauthorized access attempts
- Monitor who's accessing sensitive files
- Detect unusual activity patterns

#### 2. Compliance

- Required for many regulations (HIPAA, PCI-DSS, SOX)
- Provides audit trail for investigations

#### 3. Usage Analytics

- Which files are most popular
- Peak usage times

- Student engagement metrics

**Primary Bucket (us-east-1):**

educloud-materials- mdnihal01fe27 created

Versioning enabled

Encryption (SSE-S3) enabled

4 folders created (materials, assignments, logs, backups)

Test file uploaded successfully

**Backup Bucket (us-west-2):**

educloud-materials-backup-mdnihal01fe27 created

Versioning enabled

Encryption enabled

**Configuration:**

Lifecycle rule created (Glacier after 90 days)

Cross-region replication configured and working

CORS configuration added

IAM replication role created

Server access logging enabled (optional)

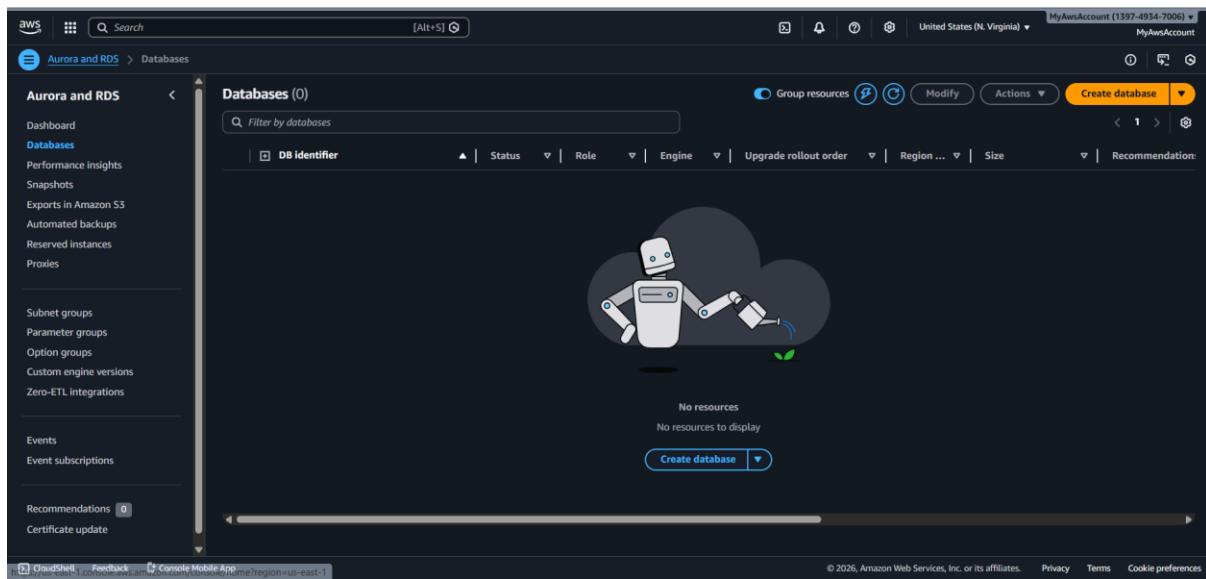
**Testing:**

Test file uploaded

Multiple versions visible

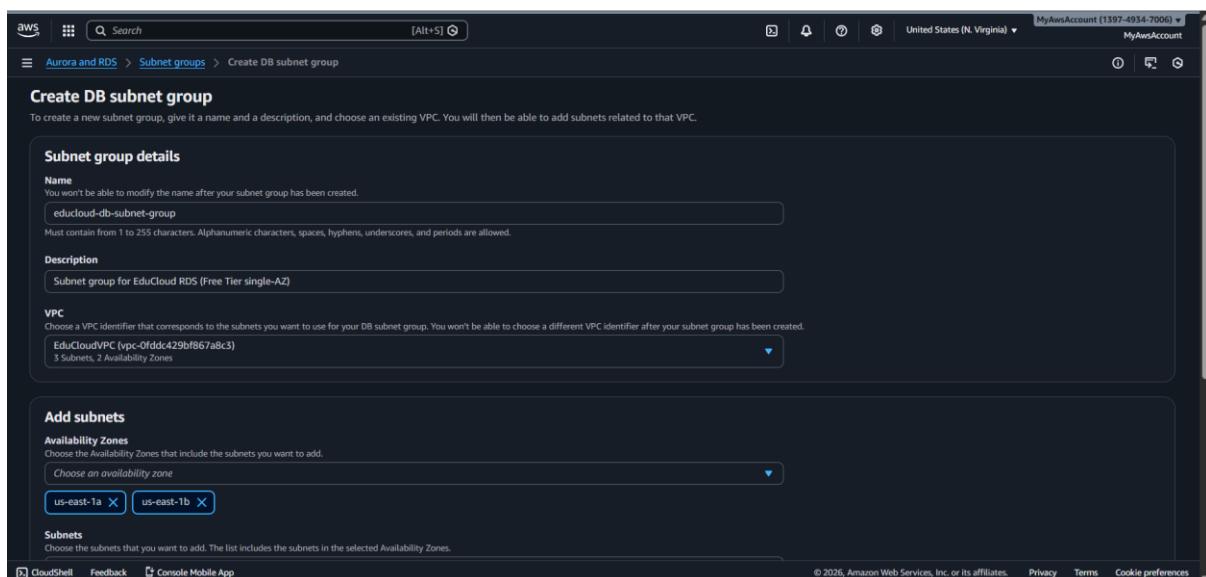
File replicated to backup bucket

## RDS MYSQL DATABASE SETUP



The screenshot shows the AWS RDS MySQL Database Setup page. The left sidebar includes options like Dashboard, Databases (selected), Performance insights, Snapshots, Exports in Amazon S3, Automated backups, Reserved instances, Proxies, Subnet groups, Parameter groups, Option groups, Custom engine versions, Zero-ETL Integrations, Events, Event subscriptions, and Recommendations. The main area displays a "Databases (0)" section with a search bar and filters for DB identifier, Status, Role, Engine, Upgrade rollout order, Region, Size, and Recommendation. A central illustration of a robot working on a cloud is present, along with a message stating "No resources" and "No resources to display". A prominent "Create database" button is at the bottom.

## CREATE DB SUBNET GROUP



The screenshot shows the "Create DB subnet group" wizard. It starts with a brief description: "To create a new subnet group, give it a name and a description, and choose an existing VPC. You will then be able to add subnets related to that VPC." The "Subnet group details" step is shown, where the user has entered "educlead-db-subnet-group" for the Name and "Subnet group for EduCloud RDS (Free Tier single-AZ)" for the Description. Under the VPC section, "EduCloudVPC (vpc-0fddc429bf867a8c5)" is selected, which contains 3 Subnets, 2 Availability Zones. The "Add subnets" step follows, where "us-east-1a" and "us-east-1b" are chosen from the Availability Zones dropdown. The "Subnets" section lists the subnets available in these zones. The bottom of the screen shows standard AWS navigation links: CloudShell, Feedback, Console Mobile App, and Copyright information.

The screenshot shows the 'Create DB subnet group' page in the AWS RDS console. Under 'Add subnets', 'Availability Zones' section, 'us-east-1a' and 'us-east-1b' are selected. In the 'Subnets' section, 'Private-Subnet-Servers' and 'Private-Subnet-Database' are selected. A note at the bottom states: 'For Multi-AZ DB clusters, you must select 3 subnets in 3 different Availability Zones.' The 'Subnets selected (2)' table lists the chosen subnets:

Availability zone	Subnet name	Subnet ID	CIDR block
us-east-1a	Private-Subnet-Servers	subnet-08caf5f194329fb7f	10.0.2.0/24
us-east-1b	Private-Subnet-Database	subnet-0e098a62fb665c59	10.0.3.0/24

At the bottom right are 'Cancel' and 'Create' buttons.

The screenshot shows the 'Subnet groups' list page in the AWS RDS console. A success message at the top says: 'Successfully created educloud-db-subnet-group. View subnet group'. The table lists the subnet group:

Name	Description	Status	VPC
educloud-db-subnet-group	Subnet group for EduCloud RDS (Free Tier single-AZ)	Complete	vpc-0fdde429bf867a8c3

## DB instance identifier

educloud-mysql-db

## Master username

Admin

## Master password

Mdnihal2000

## Endpoint

educloud-mysql-db.c6n4sgm4gf6o.us-east-1.rds.amazonaws.com

The screenshot shows the AWS RDS Databases page. On the left, there's a sidebar with options like Dashboard, Databases (which is selected), Performance insights, Snapshots, Exports in Amazon S3, Automated backups, Reserved instances, Proxies, Subnet groups, Parameter groups, Option groups, Custom engine versions, Zero-ETL integrations, Events, Event subscriptions, Recommendations (0), and Certificate update. The main area is titled 'Databases (1)' and lists a single database: 'educlead-mysql-db'. The details for this database are: Status: Available, Instance: MySQL Co..., Engine: SECOND, Region ...: us-east-1b, Size: db.t4g.micro. There are buttons for Group resources, Modify, Actions, and Create database.

This screenshot shows the detailed view for the 'educlead-mysql-db' database. The top navigation bar includes the AWS logo, search bar, and account information. The main summary section shows the DB identifier as 'educlead-mysql-db', Status as 'Available', CPU usage at 6.58%, and other details like Role (Instance), Engine (MySQL Community), and Region & AZ (us-east-1b). Below this, the 'Connectivity & security' tab is selected, showing the Endpoint (educlead-mysql-db.c6n4sgm4gf6o.us-east-1.rds.amazonaws.com), Port (3306), Networking (Availability Zone: us-east-1b, VPC: EduCloudVPC), and Security (VPC security groups: EduCloud-RDS-SG (sg-0b3b45a8c3fab07e) - Active, Publicly accessible: No, Certificate authority: rds-ca-ssl2048-g1, Certificate authority date: May 26, 2061, 05:04 (UTC+05:30), DB instance certificate expiration date: Never). Other tabs include Monitoring, Logs & events, Configuration, Zero-ETL integrations, Maintenance & backups, Data migrations, and Tags.

**RDS database is correctly configured for security - it's private and not accessible from the internet!**

**Allowed connection only from the Web-server-sg**

## Server Information

### Connection Error

Error invoking remote method 'DB\_CONNECT': Error: connect ETIMEDOUT

#### Name

#### Database Type

 SSL

#### Server Address



#### User

#### Password

#### Initial Database/Keyspace

#### Initial Schema

#### URI

 SSH Tunnel Filter

## LAUNCH EC2 INSTANCE

The screenshot shows the 'Launch an instance' step in the AWS EC2 wizard. The top navigation bar includes 'vpc', 'Ask Amazon Q', 'United States (N. Virginia)', and 'MyAWSAccount'. A message at the top says, 'It seems like you may be new to launching instances in EC2. Take a walkthrough to learn about EC2, how to launch instances and about best practices' with 'Take a walkthrough' and 'Do not show me this message again' buttons.

**Launch an instance** Info

Amazon EC2 allows you to create virtual machines, or instances, that run on the AWS Cloud. Quickly get started by following the simple steps below.

**Name and tags** Info

Name: EduCloud-WebServer-1

**Application and OS Images (Amazon Machine Image)** Info

An AMI contains the operating system, application server, and applications for your instance. If you don't see a suitable AMI below, use the search field or choose [Browse more AMIs](#).

**Quick Start**

Amazon Linux  macOS  Ubuntu  Windows  Red Hat  SUSE Linux  Debian

**Summary**

Number of instances:

Software Image (AMI): [Amazon Linux 2023 AMI 2023.10... \(read more\)](#)

Virtual server type (instance type): t3.micro

Firewall (security group): New security group

Storage (volumes): 1 volume(s) - 8 GiB

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Screenshot of the AWS EC2 Instances Launch wizard, Step 1: Application and OS Images (Amazon Machine Image).

The page shows a search bar for "Search our full catalog including 1000s of application and OS images". Below it is a "Quick Start" section with icons for various AMIs: Amazon Linux, macOS, Ubuntu, Windows, Red Hat, SUSE Linux, and Debian.

**Amazon Machine Image (AMI)**

Amazon Linux 2023 kernel-6.1 AMI  
ami-07ff62358b87c7116 (64-bit (x86), uefi-preferred) / ami-059afa9e3a9c7af0c (64-bit (Arm), uefi)  
Virtualization: hvm ENA enabled: true Root device type: ebs

Free tier eligible

**Description**

Amazon Linux 2023 (kernel-6.1) is a modern, general purpose Linux-based OS that comes with 5 years of long term support. It is optimized for AWS and designed to provide a secure, stable and high-performance execution environment to develop and run your cloud applications.

Amazon Linux 2023 AMI 2023.10.20260105.0 x86\_64 HVM kernel-6.1

Architecture	Boot mode	AMI ID	Publish Date	Username	Verified provider
64-bit (x86)	uefi-preferred	ami-07ff62358b87c7116	2026-01-02	ec2-user	Verified provider

Screenshot of the AWS EC2 Instances Launch wizard, Step 2: Instance type.

The page shows the "Instance type" section with a dropdown menu showing "t3.micro". Other options include "All generations" and a "Compare instance types" link.

**t3.micro**

Family: t3 2 vCPU 1 GiB Memory Current generation: true  
On-Demand Ubuntu Pro base pricing: 0.0139 USD per Hour On-Demand SUSE base pricing: 0.0104 USD per Hour  
On-Demand Linux base pricing: 0.0104 USD per Hour On-Demand RHEL base pricing: 0.0392 USD per Hour  
On-Demand Windows base pricing: 0.0196 USD per Hour

Free tier eligible

Additional costs apply for AMIs with pre-installed software

**Key pair (login)**

You can use a key pair to securely connect to your instance. Ensure that you have access to the selected key pair before you launch the instance.

**Key pair name - required**

EduCloud-KeyPair

Create new key pair

**VPC - required** | Info  
vpc-0fddc429bf867a8c3 (EduCloudVPC)  
10.0.0.0/16

**Subnet** | Info  
subnet-08caf5f194329fb7f  
VPC: vpc-0fddc429bf867a8c3 Owner: 139749347006 Availability Zone: us-east-1a (use1-az1)  
Zone type: Availability Zone IP addresses available: 251 CIDR: 10.0.2.0/24

**Create new subnet**

**Auto-assign public IP** | Info  
Disable

**Firewall (security groups)** | Info  
A security group is a set of firewall rules that control the traffic for your instance. Add rules to allow specific traffic to reach your instance.  
 Create security group  Select existing security group

**EduCloud-WebServer-SG sg-0834453f1ae82fe95**  
VPC: vpc-0fddc429bf867a8c3

**Common security groups** | Info  
Select security groups

**Compare security group rules**

**Advanced network configuration**

## Launch success message

**Instance summary for i-0688bc64d500b3be2 (EduCloud-WebServer-1)** | Info  
Updated less than a minute ago

Instance ID	i-0688bc64d500b3be2	Public IPv4 address	-
IPv6 address	-	Private IPv4 address	10.0.2.223
Hostname type	IP name: ip-10-0-2-223.ec2.internal	Public DNS	-
Answer private resource DNS name	-	Elastic IP addresses	-
Auto-assigned IP address	-	AWS Compute Optimizer finding	<input type="radio"/> Opt-in to AWS Compute Optimizer for recommendations.   Learn more
IAM Role	EduCloud-EC2-Role	Subnet ID	subnet-08caf5f194329fb7f (Private-Subnet-Servers)
IMDSv2	Required	Instance ARN	arn:aws:ec2:us-east-1:139749347006:instance/i-0688bc64d500b3be2
Operator	-	Auto Scaling Group name	-

**Details** Status and alarms Monitoring Security Networking Storage Tags

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## Instance running with 2/2 status checks

The screenshot shows the AWS EC2 Instances page. On the left, there's a navigation sidebar with options like Dashboard, EC2 Global View, Events, Instances (selected), Instance Types, Launch Templates, Spot Requests, Savings Plans, Reserved Instances, Dedicated Hosts, Capacity Reservations, Capacity Manager, Images, AMIs, AMI Catalog, Elastic Block Store, Volumes, Snapshots, Lifecycle Manager, and Network & Security. The main content area displays 'Instances (1/1) Info' for 'EduCloud-WebServer-1'. The instance ID is i-0688bc64d500b3be2, it's in the 'Running' state, has an 't3.micro' instance type, and is initializing. It's located in the 'us-east-1a' availability zone. The Public IPv4 address is 10.0.2.223. The Private IP DNS name is ip-10-0-2-223.ec2.internal. The instance summary table also shows the Public IPv4 address, Instance state (Running), Private IP DNS name, Instance type (t3.micro), and Elastic IP addresses.

## BASTION HOST ARCHITECTURE

EduCloud-WebServer-SG to allow ssh only from the bastion host(jump server)

The screenshot shows the AWS VPC Security Groups page. The left sidebar includes options for gateways, security groups (selected), and various networking services. The main content area shows the details for the security group sg-0834453f1ae82fe95, which is named 'EduCloud-WebServer-SG'. It has a security group ID of sg-0834453f1ae82fe95, an owner of 139749347006, and a VPC ID of vpc-0fddc429bf867a8c3. The inbound rules tab is selected, displaying six entries. The first five entries are for NFS, HTTP, SSH, Custom TCP (port 40000-40100), and Custom TCP (port 21). The last entry is for TCP port 2049 with a source range of 49.207.213.15/32. The Outbound rules tab shows one permission entry.

## EduCloud-Bastion-SG only allow ssh from the system's ip from the local machine

The screenshot shows the AWS VPC Security Groups console. The security group named "EduCloud-Bastion-SG" is selected. The "Inbound rules" tab is active, displaying two rules:

Name	Security group rule...	IP version	Type	Protocol	Port range	Source
-	sgr-0d4968c721a63ea7e	IPv4	SSH	TCP	22	49.207.213.15/32
-	sgr-02008ae86f39d44cd	-	SSH	TCP	22	sg-0834453f1ae82fe9...

## LAUNCHING BASTION HOST

The screenshot shows the "Launch an instance" wizard in the AWS EC2 Instances console. The "Quick Start" tab is selected. The configuration includes:

- Name and tags**: Name is set to "EduCloud-Bastion".
- Application and OS Images (Amazon Machine Image)**: An Amazon Linux 2023 AMI is selected.
- Summary**: Shows 1 instance, t3.micro instance type, and 1 volume(s) - 8 GiB storage.
- Launch instance** button is visible.

aws | Q vpc | Ask Amazon Q X

EC2 > Instances > Launch an instance

**Amazon Machine Image (AMI)**

Amazon Linux 2023 kernel-6.1 AMI  
ami-07ff62358b87c7116 (64-bit (x86), uefi-preferred) / ami-059afa9e3a9c7af0c (64-bit (Arm), uefi)  
Virtualization: hvm ENA enabled: true Root device type: ebs

Free tier eligible ▾

**Description**

Amazon Linux 2023 (kernel-6.1) is a modern, general purpose Linux-based OS that comes with 5 years of long term support. It is optimized for AWS and designed to provide a secure, stable and high-performance execution environment to develop and run your cloud applications.

Amazon Linux 2023 AMI 2023.10.20260105.0 x86\_64 HVM kernel-6.1

Architecture	Boot mode	AMI ID	Publish Date	Username	Verified provider
64-bit (x86) ▾	uefi-preferred	ami-07ff62358b87c7116	2026-01-02	ec2-user	Verified provider

**Instance type** Info | Get advice

**Instance type**

t3.micro  
Family: t3 2 vCPU 1 GB Memory Current generation: true  
On-Demand Ubuntu Pro base pricing: 0.0139 USD per Hour On-Demand SUSE base pricing: 0.0104 USD per Hour  
On-Demand Linux base pricing: 0.0104 USD per Hour On-Demand RHEL base pricing: 0.0392 USD per Hour  
On-Demand Windows base pricing: 0.0196 USD per Hour

Free tier eligible ▾

All generations

Compare instance types

**Additional costs apply for AMIs with pre-installed software**

**Key pair (login)** Info

You can use a key pair to securely connect to your instance. Ensure that you have access to the selected key pair before you launch the instance.

aws | Q vpc | Ask Amazon Q X

EC2 > Instances > Launch an instance

**Network settings** Info

**VPC - required** | Info

vpc-0fddc429bf867a8c3 (EduCloudVPC)  
10.0.0.0/16

**Subnet** | Info

subnet-0f562fa9e3915cb77  
Public-Subnet-ALB  
VPC: vpc-0fddc429bf867a8c3 Owner: 139749347006 Availability Zone: us-east-1a (use1-az1)  
Zone type: Availability Zone IP addresses available: 251 CIDR: 10.0.1.0/24

**Create new subnet** ↗

**Auto-assign public IP** | Info

Enable

**Firewall (security groups)** | Info

A security group is a set of firewall rules that control the traffic for your instance. Add rules to allow specific traffic to reach your instance.

Create security group  Select existing security group

**Common security groups** | Info

Select security groups

EduCloud-Bastion-SG sg-0b994c65798e79150 X  
VPC: vpc-0fddc429bf867a8c3

Compare security group rules ↗

Security groups that you add or remove here will be added to or removed from all your network interfaces.

**Advanced network configuration**

**Configure storage** Info

Advanced

CloudShell Feedback Console Mobile App

## SSH to bastion host via system's IP in security group use Myip instead custom ip

The screenshot shows the AWS CloudShell interface with a terminal window. The terminal session is connected to the instance i-0b3feae601901d1c (EduCloud-Bastion). The user has run several commands to verify connectivity and permissions:

```
cwBLAPTOP-RB8E0TUV MINGW64 ~
$ cd downloads
cwBLAPTOP-RB8E0TUV MINGW64 ~/downloads
$ chmod 400 webserver.pem
cwBLAPTOP-RB8E0TUV MINGW64 ~/downloads
$ ssh -i webserver.pem ec2-user@44.214.44.196
The authenticity of host '44.214.44.196 (44.214.44.196)' can't be established.
ED25519 key fingerprint is SHA256:b6ZHT42gy40/X6GUUm+Zqfw6bnrtskkkbh040eH10.
This key is not known by any other names.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '44.214.44.196' (ED25519) to the list of known hosts.
ec2-user@44.214.44.196: Permission denied (publickey,gssapi-keyex,gssapi-with-mic).
cwBLAPTOP-RB8E0TUV MINGW64 ~/downloads
$ ssh -i EduCloud-KeyPair.pem ec2-user@44.214.44.196
Warning: Identity file EduCloud-KeyPair not accessible: No such file or directory.
ec2-user@44.214.44.196: Permission denied (publickey,gssapi-keyex,gssapi-with-mic).
cwBLAPTOP-RB8E0TUV MINGW64 ~/downloads
$ ssh -i EduCloud-KeyPair.ec2-user@44.214.44.196
Amazon Linux 2023
https://aws.amazon.com/linux/amazon-linux-2023
[ec2-user@ip-10-0-1-81 ~]$ sudo su
[root@ip-10-0-1-81 ec2-user]#
```

## BASTION CONNECTIVITY

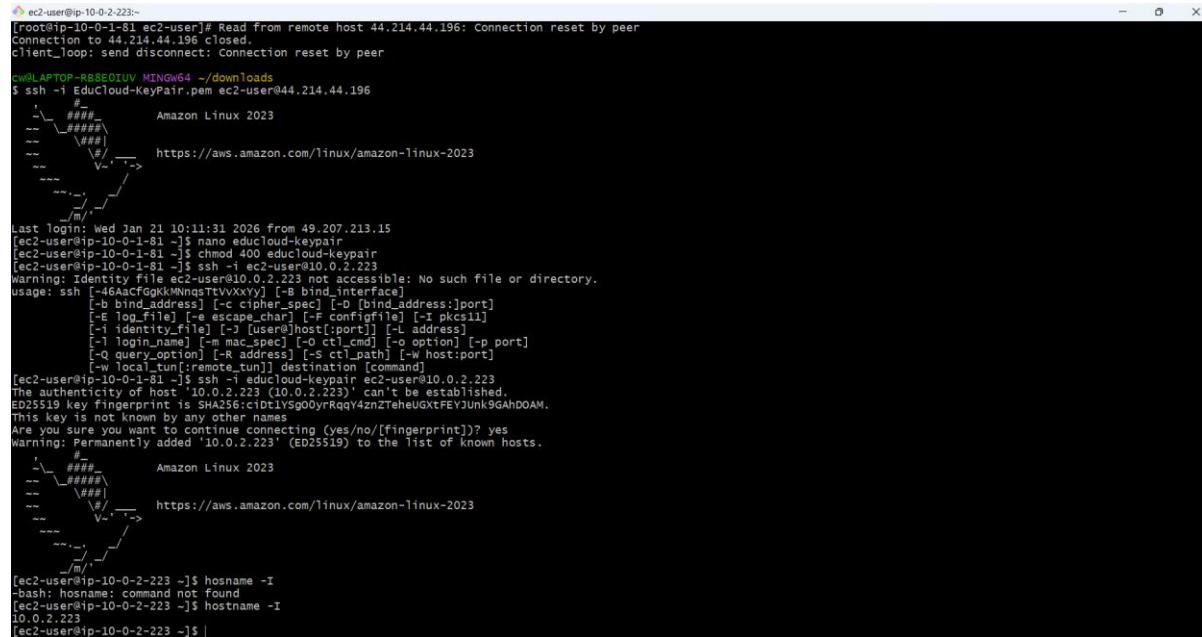
Ping google.com working because if NAT and ping EduCloud-WebServer-1 working because in same VPC

The screenshot shows the AWS CloudShell interface with a terminal window. The user has run a ping command to test connectivity to the internet and another to a specific instance within the VPC:

```
[root@ip-10-0-1-81 ec2-user]# ping -c 3 google.com
PING google.com (142.251.111.138) 56(84) bytes of data.
64 bytes from bk-in-f138.1e100.net (142.251.111.138): icmp_seq=1 ttl=106 time=1.91 ms
64 bytes from bk-in-f138.1e100.net (142.251.111.138): icmp_seq=2 ttl=106 time=1.94 ms
64 bytes from bk-in-f138.1e100.net (142.251.111.138): icmp_seq=3 ttl=106 time=1.98 ms
--- google.com ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2003ms
rtt min/avg/max/mdev = 1.909/1.940/1.976/0.027 ms
[root@ip-10-0-1-81 ec2-user]#
[root@ip-10-0-1-81 ec2-user]# ping -c 3 10.0.2.223
PING 10.0.2.223 (10.0.2.223) 56(84) bytes of data.
64 bytes from 10.0.2.223: icmp_seq=1 ttl=127 time=0.202 ms
64 bytes from 10.0.2.223: icmp_seq=2 ttl=127 time=0.226 ms
64 bytes from 10.0.2.223: icmp_seq=3 ttl=127 time=0.225 ms
--- 10.0.2.223 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2109ms
rtt min/avg/max/mdev = 0.202/0.217/0.226/0.011 ms
[root@ip-10-0-1-81 ec2-user]#
```

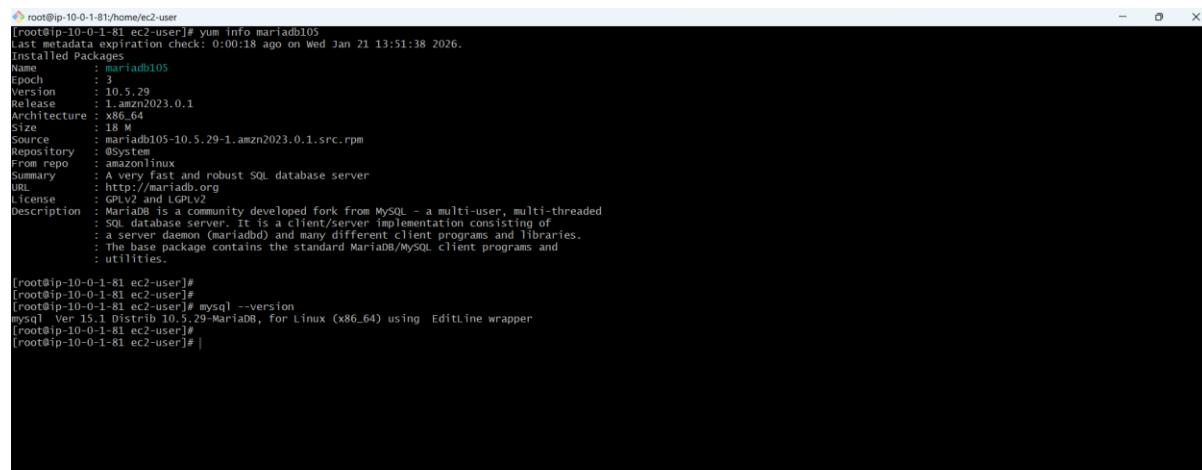
## SSH FROM BASTION TO PRIVATE EC2 (JUMP)

Two way ssh from local machine for myip only → bastion host and from bastion host (only from my system not from others) → Private-webserver-1 (allowed only for the bastion host not from others)



```
[root@ip-10-0-1-81 ec2-user]# Read from remote host 44.214.44.196: Connection reset by peer
Connection to 44.214.44.196 closed.
client_loop: send disconnect: Connection reset by peer
cw@LAPTOP-RB88E0IUV MINGW64 ~/Downloads
$ ssh -i /root/.ssh/EdulCloud-keyPair.pem ec2-user@44.214.44.196
Last login: Wed Jan 21 10:11:31 2026 from 49.207.213.15
[ec2-user@ip-10-0-1-81 ~]$ nano edulcloud-keypair
[ec2-user@ip-10-0-1-81 ~]$ chmod 400 edulcloud-keypair
[ec2-user@ip-10-0-1-81 ~]$ ssh -i ec2-user@ip-10.0.2.223
Warning: Identity file /root/.ssh/EdulCloud-keypair: No such file or directory.
usage: ssh [-46AcGgKMNngstvVxxxy] [-B bind_interface]
           [-b bind_address] [-c cipher_spec] [-D [bind_address]:port]
           [-E log_file] [-e escape_char] [-F configfile] [-f pkcs11]
           [-i identity_file] [-L local_address:[port]:remote_address]
           [-l login_name] [-m mac_spec] [-O ctl_cmd] [-o option]
           [-Q query_option] [-R address] [-S ctl_path] [-w host:port]
           [-w local_tun[:remote_tun]] destination [command]
[ec2-user@ip-10-0-1-81 ~]$ ssh -i edulcloud-keypair ec2-user@10.0.2.223
The authenticity of host '10.0.2.223 (10.0.2.223)' can't be established.
ED25519 key fingerprint is SHA256:c1btLYSg0OyRQqY4znZtHeuGxtFEYJunk9GAhDOAM.
This key is not known by any other names
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '10.0.2.223' (ED25519) to the list of known hosts.
[ec2-user@ip-10-0-2-223 ~]$ hostname -I
-bash: hostname: command not found
[ec2-user@ip-10-0-2-223 ~]$ hostname -I
10.0.2.223
[ec2-user@ip-10-0-2-223 ~]$
```

Connect to private-webserver-1 via jump server with the help of NAT for the internet inbound connection installed mariadb105



```
[root@ip-10-0-1-81 /home/ec2-user]
[root@ip-10-0-1-81 ec2-user]# yum info mariadb105
Last metadata expiration check: 0:00:18 ago on Wed Jan 21 13:51:38 2026.
Installed Packages
Name        : mariadb105
Version     : 10.5.29
Release    : 1.aenz2023.0.1
Architecture: x86_64
Size        : 18 M
Source      : mariadb105-10.5.29-1.amzn2023.0.1.src.rpm
Repository  : @System
From repo   : amazonlinux
Summary     : A very fast and robust SQL database server
URL        : http://mariadb.org
License     : GPLV2 and LGPLV2
Description : MariaDB is a community developed fork from MySQL - a multi-user, multi-threaded
              SQL database server. It is a client/server implementation consisting of
              a server daemon (mariadb) and many different client programs and libraries.
              The base package contains the standard MariaDB/MySQL client programs and
              utilities.

[root@ip-10-0-1-81 ec2-user]#
[root@ip-10-0-1-81 ec2-user]# mysql --version
mysql Ver 15.1 Distrib 10.5.29-MariaDB, for Linux (x86_64) using EditLine wrapper
[root@ip-10-0-1-81 ec2-user]#
[root@ip-10-0-1-81 ec2-user]# |
```

Successfully connected RDS Data base with private-webserver-1 rds allow traffic only from

## Private-webserver-1

SHOW DATABASE;

To list created db and the time of creation of rds ie educloud\_db

Pwd:Mdnihal2000

```
ec2-user@ip-10-0-2-223:~$ mysql -h educloud-mysql-db.c6n4sgm4gf6o.us-east-1.rds.amazonaws.com -u admin -p
Enter password:
Welcome to the MariaDB monitor.  Commands end with ; or \g.
Your MySQL connection id is 15
Server version: 8.0.43 Source distribution

Copyright (c) 2000, 2018, Oracle, MariaDB Corporation Ab and others.

Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.

MySQL [(none)]> showdb
-> SHOW DATABASES;
[1]+  Stopped                  mysql -h educloud-mysql-db.c6n4sgm4gf6o.us-east-1.rds.amazonaws.com -u admin -p
[ec2-user@ip-10-0-2-223 ~]$ mysql -h educloud-mysql-db.c6n4sgm4gf6o.us-east-1.rds.amazonaws.com -u admin -p
Enter password:
ERROR 1045 (28000): Access denied for user 'admin'@'10.0.2.223' (using password: YES)
[ec2-user@ip-10-0-2-223 ~]$ mysql -h educloud-mysql-db.c6n4sgm4gf6o.us-east-1.rds.amazonaws.com -u admin -p
Enter password:
Welcome to the MariaDB monitor.  Commands end with ; or \g.
Your MySQL connection id is 18
Server version: 8.0.43 Source distribution

Copyright (c) 2000, 2018, Oracle, MariaDB Corporation Ab and others.

Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.

MySQL [(none)]> SHOW DATABASES;
+-----+
| Database |
+-----+
| educloud_db |
| information_schema |
| mysql |
| performance_schema |
| sys |
+-----+
5 rows in set (0.030 sec)

MySQL [(none)]> |
```

## CREATE & ATTACH EBS VOLUME

EBS volume created (20GB, Available)

The screenshot shows the AWS EC2 Volumes page. A success message at the top indicates "Successfully created volume vol-0b2eb68cc79c52e2c." The main table displays three volumes:

Name	Volume ID	Type	Size	IOPS	Throughput	Snapshot ID	Source volume ID	Created
	vol-064f8b5f4551c658d	gp3	8 GiB	3000	125	snap-04fa8e9...	-	2026/01/21 15:15:15
EduCloud-WebServer-Storage	vol-0b2eb68cc79c52e2c	gp3	20 GiB	3000	125	-	-	2026/01/22 15:05:15
	vol-04625d8f925c05f64	gp3	8 GiB	3000	125	snap-04fa8e9...	-	2026/01/21 14:15:15

Below the table, a "Snapshot summary" section shows "0 / 2" recently backed up volumes. The status bar at the bottom right indicates "Data Lifecycle Manager default policy for EBS Snapshots status" and "No default policy set up | Create policy".

## Volume attached to WebServer

The screenshot shows the AWS EC2 Volumes page. A specific volume, "vol-0b2eb68cc79c52e2c (EduCloud-WebServer-Storage)", is selected. The volume details are as follows:

Details	Size	Type	Status check
Volume ID: vol-0b2eb68cc79c52e2c (EduCloud-WebServer-Storage)	20 GiB	gp3	Okay
AWS Compute Optimizer finding: Opt-in to AWS Compute Optimizer for recommendations.	Volume state: In-use	IOPS: 3000	Throughput: 125
Fast snapshot restored: No	Availability Zone: us-east-1a (us-east-1a)	Created: Thu Jan 22 2026 15:05:08 GMT+0530 (India Standard Time)	Multi-Attach enabled: No
Attached resources: i-0688bc64d500b3be2 (EduCloud-WebServer-1); /dev/sdf (attached)	Outposts ARN: -	Managed: false	Operator: -

Below the main table, there are sections for "Source" (Snapshot ID: -; Source volume ID: -) and "Encryption" (Encryption: Not encrypted; KMS key ID: -; KMS key alias: -; KMS key ARN: -). At the bottom, there are tabs for "Status checks", "Monitoring", and "Tags".

### Attached resources

i-0688bc64d500b3be2 (EduCloud-WebServer-1):  
/dev/sdf (attached)

## output showing 20GB nvme1n1 disk

```
ec2-user@ip-10-0-2-223:~$ hostname -I
10.0.1.81
[ec2-user@ip-10-0-1-81 ~]$ ls
educloud-keypair
[ec2-user@ip-10-0-1-81 ~]$ ssh -i educloud-keypair ec2-user@10.0.2.223
#
Amazon Linux 2023
# https://aws.amazon.com/linux/amazon-linux-2023
Last login: Wed Jan 21 14:09:38 2026 from 10.0.1.81
[ec2-user@ip-10-0-2-223 ~]$ ls
[ec2-user@ip-10-0-2-223 ~]$ lsblk
NAME      MAJ:MIN RM  SIZE RO TYPE MOUNTPOINTS
nvme0n1    259:0   0   8G  0 disk
└─nvme0n1p1 259:2   0   8G  0 part /
└─nvme0n1p27 259:3   0   1M  0 part
└─nvme0n1p28 259:4   0  10M  0 part /boot/efi
nvme1n1    259:1   0  20G  0 disk
[ec2-user@ip-10-0-2-223 ~]$ |
```

## no filesystem

```
[root@ip-10-0-2-223:/home/ec2-user]$ lsblk
NAME      MAJ:MIN RM SIZE RO TYPE MOUNTPOINTS
nvme0n1    259:0   0   8G  0 disk
└─nvme0n1p1 259:2   0   8G  0 part /
└─nvme0n1p127 259:3   0   1M  0 part
└─nvme0n1p128 259:4   0 10M  0 part /boot/efi
nvme1n1    259:1   0 20G  0 disk
[root@ip-10-0-2-223 ~]$ 
[root@ip-10-0-2-223 ~]$ 
[root@ip-10-0-2-223 ~]$ sudo su
[root@ip-10-0-2-223 ec2-user]# file -s /dev/nvme1n1
/dev/nvme1n1: data
[root@ip-10-0-2-223 ec2-user]#
```

Disk formatted successfully

```
[root@ip-10-0-2-223:/home/ec2-user]$ lsblk
NAME      MAJ:MIN RM SIZE RO TYPE MOUNTPOINTS
nvme0n1    259:0   0   8G  0 disk
└─nvme0n1p1 259:2   0   8G  0 part /
└─nvme0n1p127 259:3   0   1M  0 part
└─nvme0n1p128 259:4   0 10M  0 part /boot/efi
nvme1n1    259:1   0 20G  0 disk
[root@ip-10-0-2-223 ~]$ 
[root@ip-10-0-2-223 ~]$ 
[root@ip-10-0-2-223 ~]$ sudo su
[root@ip-10-0-2-223 ec2-user]# file -s /dev/nvme1n1
/dev/nvme1n1: data
[root@ip-10-0-2-223 ec2-user]# file -s /dev/nvme1n1
/dev/nvme1n1: data
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# mkfs.xfs /dev/nvme1n1
meta-data=/dev/nvme1n1          isize=512    agcount=16, agsize=327680 blks
                                = sectsz=512   attr=2, projid32bit=1
                                =         crc=1   finobt=1, sparse=1, rmapbt=0
                                =         reflink=1  bigtime=1 inobtcount=1 nrext64=0
                                =         exchange=0
data     =         bsize=4096   blocks=5242880, imaxpct=25
          =         sunit=1   swidth=1 blks
naming   =version 2           bsize=4096   ascii-ci=0, ftype=1, parent=0
log      =internal log        bsize=4096   blocks=16384, version=2
          =         sectsz=512  sunit=1 blks, lazy-count=1
realtime =none                extsz=4096   blocks=0, rtextents=0
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# file -s /dev/nvme1n1
/dev/nvme1n1: SGI XFS filesystem data (blksz 4096, inosz 512, v2 dirs)
[root@ip-10-0-2-223 ec2-user]#
```

## CREATED MOUNT POINT

```
root@ip-10-0-2-223:~# sudo mkdir -p /mnt/educloud-data
root@ip-10-0-2-223:~# ls -ld /mnt/educloud-data
drwxr-xr-x. 2 root root 6 Jan 22 09:52 /mnt/educloud-data
root@ip-10-0-2-223:~#
```

## MOUNTED THE DISK

### 20GB disk mounted

```
root@ip-10-0-2-223:~# sudo mkdir -p /mnt/educloud-data
root@ip-10-0-2-223:~# ls -ld /mnt/educloud-data
drwxr-xr-x. 2 root root 6 Jan 22 09:52 /mnt/educloud-data
root@ip-10-0-2-223:~# sudo mount /dev/nvme1n1 /mnt/educloud-data
root@ip-10-0-2-223:~# df -hT /mnt/educloud-data
Filesystem      Type  Size  Used  Avail Use% Mounted on
/dev/nvme1n1    xfs   20G  176M  20G   1% /mnt/educloud-data
root@ip-10-0-2-223:~#
```

## CONFIGURED AUTO-MOUNT ON REBOOT /etc/fstab

```
[root@ip-10-0-2-223:home/ec2-user]#
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# sudo blkid /dev/nvme0n1
/dev/nvme0n1: UUID='5cffeffb-9385-44c6-898f-a8d84840e9ac' BLOCK_SIZE="512" TYPE="xfs"
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# sudo cp /etc/fstab /etc/fstab.backup
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# sudo nano /etc/fstab
[root@ip-10-0-2-223 ec2-user]# sudo nano /etc/fstab
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# cat /etc/fstab
#
UUID=497419d5-2417-43e6-927d-6777766bb648      /          xfs    defaults,noatime 1  1
UUID=A1F2-F73A        /boot/efi      vfat   defaults,noatime,uid=0,gid=0,umask=0077,shortname=winnt,x-systemd.automount 0 2
UUID=5cffeffb-9385-44c6-898f-a8d84840e9ac  /mnt/educloud-data  xfs    defaults,nofail 0  2
[root@ip-10-0-2-223 ec2-user]# |
```

## CREATE DIRECTORIES FOR PROJECT

```
[root@ip-10-0-2-223:home/ec2-user]#
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# sudo mkdir -p /mnt/educloud-data/materials
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# sudo mkdir -p /mnt/educloud-data/assignments
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# sudo mkdir -p /mnt/educloud-data/logs
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# sudo mkdir -p /mnt/educloud-data/training_data
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# sudo mkdir -p /mnt/educloud-data/sensitive_data
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# sudo mkdir -p /mnt/educloud-data/backups
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# tree -L 2 /mnt/educloud-data
bash: tree: command not found
[root@ip-10-0-2-223 ec2-user]# ls -la /mnt/educloud-data/
total 0
drwxr-xr-x. 8 root root 112 Jan 22 10:04 .
drwxr-xr-x. 3 root root 27 Jan 22 09:52 ..
drwxr-xr-x. 2 root root 6 Jan 22 10:03 assignments
drwxr-xr-x. 2 root root 6 Jan 22 10:04 backups
drwxr-xr-x. 2 root root 6 Jan 22 10:04 logs
drwxr-xr-x. 2 root root 6 Jan 22 10:03 materials
drwxr-xr-x. 2 root root 6 Jan 22 10:04 sensitive_data
drwxr-xr-x. 2 root root 6 Jan 22 10:04 training_data
[root@ip-10-0-2-223 ec2-user]#
```

## Set proper ownership and permissions

```
root@ip-10-0-2-223:~# sudo chown -R root:root /mnt/educloud-data
root@ip-10-0-2-223:~# sudo chmod 755 /mnt/educloud-data
root@ip-10-0-2-223:~# ls -ld /mnt/educloud-data/
drwxr-xr-x. 8 root root 112 Jan 22 10:04 /mnt/educloud-data/
root@ip-10-0-2-223:~# |
```

## Initial permissions for subdirectories

```
root@ip-10-0-2-223:~# sudo chown -R root:root /mnt/educloud-data
root@ip-10-0-2-223:~# sudo chmod 755 /mnt/educloud-data
root@ip-10-0-2-223:~# ls -ld /mnt/educloud-data/
drwxr-xr-x. 8 root root 112 Jan 22 10:04 /mnt/educloud-data/
root@ip-10-0-2-223:~# sudo chmod 755 /mnt/educloud-data/materials
root@ip-10-0-2-223:~# sudo chmod 755 /mnt/educloud-data/assignments
root@ip-10-0-2-223:~# sudo chmod 755 /mnt/educloud-data/logs
root@ip-10-0-2-223:~# sudo chmod 755 /mnt/educloud-data/training_data
root@ip-10-0-2-223:~# sudo chmod 700 /mnt/educloud-data/sensitive_data
root@ip-10-0-2-223:~# sudo chmod 755 /mnt/educloud-data/backups
root@ip-10-0-2-223:~# ls -la /mnt/educloud-data/
total 0
drwxr-xr-x. 8 root root 112 Jan 22 10:04 .
drwxr-xr-x. 3 root root 27 Jan 22 09:52 ..
drwxr-xr-x. 2 root root 6 Jan 22 10:03 assignments
drwxr-xr-x. 2 root root 6 Jan 22 10:04 backups
drwxr-x---. 2 root root 6 Jan 22 10:04 logs
drwxr-xr-x. 2 root root 6 Jan 22 10:03 materials
drwx-----. 2 root root 6 Jan 22 10:04 sensitive_data
drwxr-xr-x. 2 root root 6 Jan 22 10:04 training_data
root@ip-10-0-2-223:~# |
```

## VOLUME DETAILS:

Device: /dev/xvdf

Size: 20 GB

Filesystem: XFS

Mount Point: /mnt/educloud-data

```
ec2-user@ip-10-0-2-223:~$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ mount | grep educloud-data /dev/nvme0n1 on /mnt/educloud-data type xfs (rw,relatime,seclabel,attr2,inode64,logbufs=8,logbsize=32k,sunit=8,swidth=8,noquota) [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ df -h /mnt/educloud-data Filesystem Size Used Avail Use% Mounted on /dev/nvme0n1 20G 176M 20G 1% /mnt/educloud-data [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ ls -la /mnt/educloud-data/ total 4 drwxr-xr-x. 8 root root 133 Jan 22 10:18 . drwxr-xr-x. 3 root root 27 Jan 22 09:52 .. drwxr-xr-x. 2 root root 6 Jan 22 10:03 assignments drwxr-xr-x. 2 root root 6 Jan 22 10:04 backups drwxr-xr-x. 2 root root 6 Jan 22 10:04 logs drwxr-xr-x. 2 root root 6 Jan 22 10:03 materials drwx----- 2 root root 6 Jan 22 10:04 sensitive_data -rw-r--r--. 1 root root 35 Jan 22 10:19 test-file.txt drwxr-xr-x. 2 root root 6 Jan 22 10:04 training_data [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ ls -l /materials /assignments /logs lrwxrwxrwx. 1 root root 30 Jan 22 10:09 /assignments -> /mnt/educloud-data/assignments lrwxrwxrwx. 1 root root 23 Jan 22 10:10 /logs -> /mnt/educloud-data/logs lrwxrwxrwx. 1 root root 28 Jan 22 10:09 /materials -> /mnt/educloud-data/materials [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$
```

## SOFTWARE INSTALLATION & SYSTEM UPDATE

### APACHE WEB SERVER

```
root@ip-10-0-2-223:/home/ec2-user# [root@ip-10-0-2-223 ec2-user]# [root@ip-10-0-2-223 ec2-user]# [root@ip-10-0-2-223 ec2-user]# httpd -v Server version: Apache/2.4.66 (Amazon Linux) Server built: Dec 5 2025 00:00:00 [root@ip-10-0-2-223 ec2-user]# [root@ip-10-0-2-223 ec2-user]# |
```

## INSTALL MySQL CLIENT

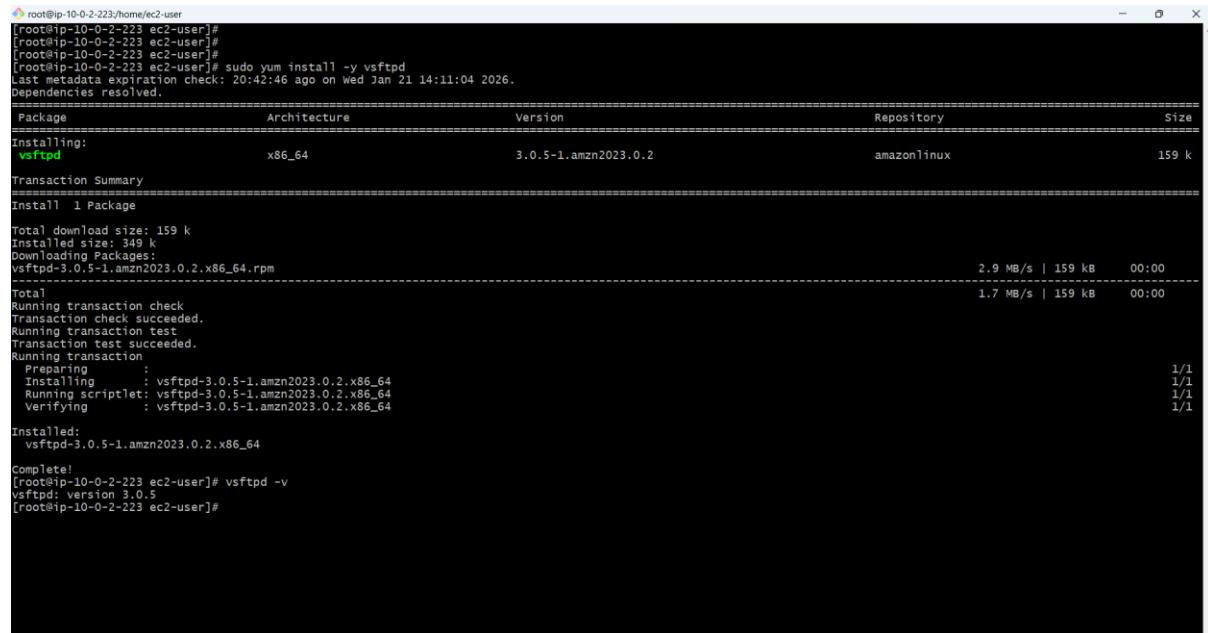
```
root@ip-10-0-2-223:/home/ec2-user#
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# mysql --version
mysql Ver 15.1 Distrib 10.5.29-MariaDB, for Linux (x86_64) using EditLine wrapper
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# |
```

## INSTALL FILE SHARING & STORAGE TOOLS

### INSTALL NFS UTILITIES

```
root@ip-10-0-2-223:/home/ec2-user#
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# sudo yum install -y nfs-utils
Last metadata expiration check: 20:41:48 ago on Wed Jan 21 14:11:04 2026.
Package nfs-utils-1:2.5.4-2.rc3.amzn2023.0.3.x86_64 is already installed.
Dependencies resolved.
Nothing to do.
Complete!
[root@ip-10-0-2-223 ec2-user]# |
```

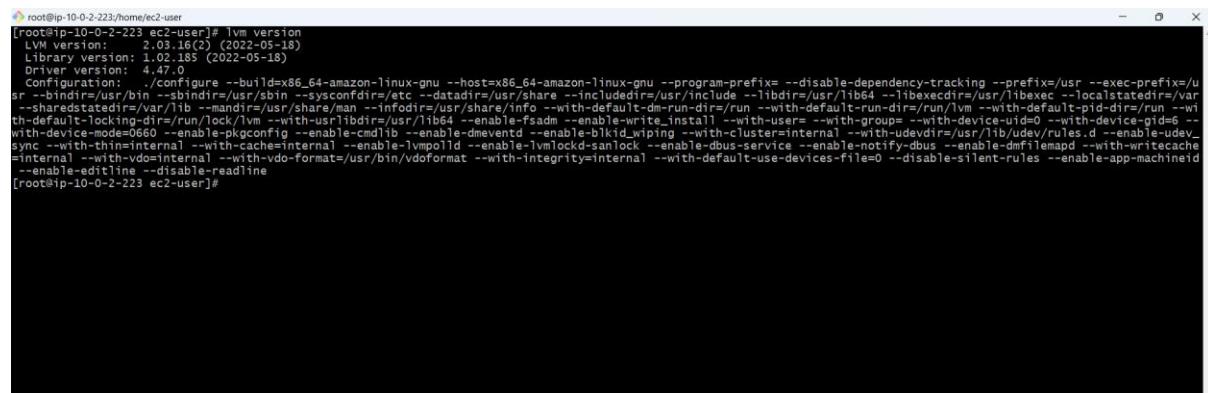
## INSTALL FTP SERVER (vsftpd)



```
[root@ip-10-0-2-223 ~]# sudo yum install -y vsftpd
Last metadata expiration check: 20:42:46 ago on Wed Jan 21 14:11:04 2026.
Dependencies resolved.
=====
| Package           | Architecture | Version      | Repository | Size | |
|=====             |=====         |=====        |=====       |===== |
| Installing:     | vsftpd       | x86_64      | 3.0.5-1.amzn2023.0.2 | amazonlinux | 159 k |
| Transaction summary |           |
| Total 1 Package |           |
| Total download size: 159 k |           |
| Installed size: 349 k |           |
| Downloading Packages: |           |
| vsftpd-3.0.5-1.amzn2023.0.2.x86_64.rpm |           | | | |
|---|---|---|---|---|
| Total |           |           |           |           |
| Running transaction check |           |           |           |           |
| Transaction check succeeded. |           |           |           |           |
| Running transaction test |           |           |           |           |
| Transaction test succeeded. |           |           |           |           |
| Running transaction |           |           |           |           |
|   Preparing : |           |           |           |           |
|     Installing : vsftpd-3.0.5-1.amzn2023.0.2.x86_64 |           |           |
|     Running scriptlet: vsftpd-3.0.5-1.amzn2023.0.2.x86_64 |           |           |
|     Verify: : vsftpd-3.0.5-1.amzn2023.0.2.x86_64 |           |           |
|-----|-----|-----|-----|-----|
| Installed: |           |           |           |           |
| vsftpd-3.0.5-1.amzn2023.0.2.x86_64 |           |           |           |           |
|-----|-----|-----|-----|-----|
| Complete! |           |           |           |           |
| [root@ip-10-0-2-223 ~]# vsftpd -v
vsftpd: version 3.0.5
[root@ip-10-0-2-223 ~]#
```

## INSTALL STORAGE MANAGEMENT TOOLS

### INSTALL LVM TOOLS



```
[root@ip-10-0-2-223 ~]# lvm version
LVM version: 2.03.16(2) (2022-05-18)
Library version: 1.02.185 (2022-05-18)
Driver version: 4.47.0
Configuration: ./configure --build=x86_64-amazon-linux-gnu --host=x86_64-amazon-linux-gnu --program-prefix= --disable-dependency-tracking --prefix=/usr --exec-prefix=/usr
--bindir=/usr/bin --sbindir=/usr/sbin --sysconfdir=/etc --datadir=/usr/share --includedir=/usr/include --libdir=/usr/lib64 --libexecdir=/usr/libexec --localstatedir=/var
--sharedstatedir=/var/lib --mandir=/usr/share/man --infodir=/usr/share/info --with-default-dm-run-dir=/run --with-default-run-dir=/run/lvm --with-default-pid-dir=/run --wi
th-default-locking-dir=/run/lock/lvm --with-usrlibdir=/usr/lib64 --enable-fsadm --enable-write_install --with-user= --with-group= --with-device-uid=0 --with-device-gid=6 --
with-device-mode=0660 --enable-pkgconfig --enable-cmdlib --enable-blkid_wiping --with-cluster=internal --with-udevdir=/usr/lib/udev/rules.d --enable-udev_
sync --with-thin=internal --with-cache=internal --enable-lvmpoold --enable-lvmetad-sanlock --enable-dbus-service --enable-notify-dbus --enable-dmfilempd --with-writecache
=internal --with-thin=internal --with-vdo-format=/usr/bin/vdoformat --with-integrity=internal --with-default-use-devices-file=0 --enable-silent-rules --enable-app-machineid
--enable-editline --disable-readline
[root@ip-10-0-2-223 ~]#
```

## INSTALL ENCRYPTION TOOLS

```
root@ip-10-0-2-223:/home/ec2-user
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# cryptsetup --version
cryptsetup 2.6.1 f1ags: UDEV BLKID KEYRING FIPS KERNEL_CAPI PWQUALITY
[root@ip-10-0-2-223 ec2-user]# |
```

## INSTALL ACL & UTILITIES

```
root@ip-10-0-2-223:/home/ec2-user
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# sudo yum install -y acl
Last metadata expiration check: 20:46:07 ago on Wed Jan 21 14:11:04 2026.
Package acl-2.3.1-2.amzn2023.0.2.x86_64 is already installed.
Dependencies resolved.
Nothing to do.
Complete!
[root@ip-10-0-2-223 ec2-user]# rpm -qa | grep acl
libacl1-2.3.1-2.amzn2023.0.2.x86_64
acl-2.3.1-2.amzn2023.0.2.x86_64
[root@ip-10-0-2-223 ec2-user]#
```

## INSTALL UTILITY TOOLS

```
root@ip-10-0-2-223:/home/ec2-user
[root@ip-10-0-2-223 ec2-user]# vim --version | head -1
VIM - Vi IMproved 9.1 (2024 Jan 02, compiled Aug 01 2025 00:00:00)
[root@ip-10-0-2-223 ec2-user]# tar --version | head -1
tar (GNU tar) 1.34
[root@ip-10-0-2-223 ec2-user]# tree --version
tree v1.8.0 (c) 1996 - 2018 by Steve Baker, Thomas Moore, Francesc Rocher, Florian Sesser, Kyosuke Tokoro
[root@ip-10-0-2-223 ec2-user]#
```

## START & ENABLE SERVICES

### START APACHE WEB SERVER

```
[root@ip-10-0-2-223 ~]# 
[root@ip-10-0-2-223 ~]# 
[root@ip-10-0-2-223 ~]# sudo systemctl start httpd
[root@ip-10-0-2-223 ~]# 3
bash: 3: command not found
[root@ip-10-0-2-223 ~]# 
[root@ip-10-0-2-223 ~]# sudo systemctl enable httpd
Created symlink /etc/systemd/system/multi-user.target.wants/httpd.service → /usr/lib/systemd/system/httpd.service.
[root@ip-10-0-2-223 ~]# 
[root@ip-10-0-2-223 ~]# 
[root@ip-10-0-2-223 ~]# sudo systemctl status httpd
● httpd.service - The Apache HTTP Server
   Loaded: loaded (/usr/lib/systemd/system/httpd.service; enabled; preset: disabled)
   Drop-In: /usr/lib/systemd/system/httpd.service.d
             └─php-fpm.conf
     Active: active (running) since Thu 2026-01-22 11:01:32 UTC; 23s ago
       Docs: man:httpd.service(8)
   Main PID: 6366 (httpd)
     Status: "Total requests: 0; Idle/Busy workers 100/0;Requests/sec: 0; Bytes served/sec: 0 B/sec"
      Tasks: 177 (limit: 1067)
     Memory: 13.4M
        CPU: 75ms
       CGroup: /system.slice/httpd.service
                 ├─6366 /usr/sbin/httpd -DFOREGROUND
                 ├─6391 /usr/sbin/httpd -DFOREGROUND
                 ├─6392 /usr/sbin/httpd -DFOREGROUND
                 ├─6393 /usr/sbin/httpd -DFOREGROUND
                 └─6394 /usr/sbin/httpd -DFOREGROUND

Jan 22 11:01:32 ip-10-0-2-223.ec2.internal systemd[1]: Starting httpd.service - The Apache HTTP Server...
Jan 22 11:01:32 ip-10-0-2-223.ec2.internal systemd[1]: Started httpd.service - The Apache HTTP Server.
Jan 22 11:01:32 ip-10-0-2-223.ec2.internal httpd[6366]: Server configured, listening on: port 80
[root@ip-10-0-2-223 ~]#
```

### START NFS SERVER

```
[root@ip-10-0-2-223 ~]# 
[root@ip-10-0-2-223 ~]# 
[root@ip-10-0-2-223 ~]# sudo systemctl start nfs-server
[root@ip-10-0-2-223 ~]# 
[root@ip-10-0-2-223 ~]# sudo systemctl enable nfs-server
Created symlink /etc/systemd/system/multi-user.target.wants/nfs-server.service → /usr/lib/systemd/system/nfs-server.service.
[root@ip-10-0-2-223 ~]# 
[root@ip-10-0-2-223 ~]# 
[root@ip-10-0-2-223 ~]# sudo systemctl status nfs-server
● nfs-server.service - NFS server and services
   Loaded: loaded (/usr/lib/systemd/system/nfs-server.service; enabled; preset: disabled)
   Active: active (exited) since Thu 2026-01-22 11:03:17 UTC; 16s ago
     Main PID: 6731 (code=exited, status=0/SUCCESS)
        CPU: 23ms

Jan 22 11:03:17 ip-10-0-2-223.ec2.internal systemd[1]: Starting nfs-server.service - NFS server and services...
Jan 22 11:03:17 ip-10-0-2-223.ec2.internal rpc.nfsd[6714]: rpc.nfsd: Unable to request RDMA services: Protocol not supported
Jan 22 11:03:17 ip-10-0-2-223.ec2.internal systemd[1]: Finished nfs-server.service - NFS server and services.
[root@ip-10-0-2-223 ~]# 
[root@ip-10-0-2-223 ~]#
```

## START FTP SERVER

```
root@ip-10-0-2-223:/home/ec2-user
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# sudo systemctl start vsftpd
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# sudo systemctl enable vsftpd
Created symlink /etc/systemd/system/multi-user.target.wants/vsftpd.service → /usr/lib/systemd/system/vsftpd.service.
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# sudo systemctl status vsftpd
● vsftpd.service - Vsftpd ftp daemon
   Loaded: loaded (/usr/lib/systemd/system/vsftpd.service; enabled; preset: disabled)
   Active: active (running) since Thu 2026-01-22 11:04:17 UTC; 22s ago
     Main PID: 6835 (vsftpd)
       Tasks: 1 (limit: 1067)
      Memory: 752.0K
        CPU: 3ms
       CGroup: /system.slice/vsftpd.service
               └─6835 /usr/sbin/vsftpd /etc/vsftpd/vsftpd.conf

Jan 22 11:04:17 ip-10-0-2-223.ec2.internal systemd[1]: Starting vsftpd.service - Vsftpd ftp daemon...
Jan 22 11:04:17 ip-10-0-2-223.ec2.internal systemd[1]: Started vsftpd.service - Vsftpd ftp daemon.
[root@ip-10-0-2-223 ec2-user]#
```

## STRESS TOOL

```
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ sudo yum install -y stress
Last metadata expiration check: 21:06:09 ago on Wed Jan 21 14:11:04 2026.
Dependencies resolved.
=====
| Package           | Architecture | Version | Repository | | |
| ======            | ======       | ======  | ======      |
| Installing:      | stress       | x86_64   | 1.0.7-2.amzn2023.0.1 | amazonlinux | Size |
| ======            | ======       | ======  | ======      |
| Transaction Summary |
| ======            |              |          |             |
| Install 1 Package |
| Total download size: 34 k
| Installed size: 68 k
| Downloading Packages:
| stress-1.0.7-2.amzn2023.0.1.x86_64.rpm
| 
| Total
| Running transaction check
| Transaction check succeeded.
| Running transaction test
| Transaction test succeeded.
| Running transaction
|   Preparing
|   Installing : stress-1.0.7-2.amzn2023.0.1.x86_64
|   Running scriptlet: stress-1.0.7-2.amzn2023.0.1.x86_64
|   Verifying   : stress-1.0.7-2.amzn2023.0.1.x86_64
| 
| Installed:
|   stress-1.0.7-2.amzn2023.0.1.x86_64
| 
| Complete!
[ec2-user@ip-10-0-2-223 ~]$ stress --version
stress 1.0.7
[ec2-user@ip-10-0-2-223 ~]$ |
```

## INSTALLED SOFTWARE SUMMARY

**Complete data base connection test manually and via php script Configured Security group, IAM Roles**

```

[ec2-user@ip-10-0-2-223 ~]$ sudo cp /etc/php.ini /etc/php.ini.backup
[ec2-user@ip-10-0-2-223 ~]$ sudo sed -i 's/upload_max_filesize = 2M/upload_max_filesize = 100M/' /etc/php.ini
[ec2-user@ip-10-0-2-223 ~]$ sudo sed -i 's/post_max_size = 8M/post_max_size = 100M/' /etc/php.ini
[ec2-user@ip-10-0-2-223 ~]$ sudo sed -i 's/max_execution_time = 30/max_execution_time = 300/' /etc/php.ini
[ec2-user@ip-10-0-2-223 ~]$ sudo sed -i 's/memory_limit = 128M/memory_limit = 256M/' /etc/php.ini
[ec2-user@ip-10-0-2-223 ~]$ grep -E 'upload_max_filesize|post_max_size|max_execution_time|memory_limit' /etc/php.ini | grep -v '^;'

max_execution_time = 300
memory_limit = 256M
post_max_size = 100M
upload_max_filesize = 100M
[ec2-user@ip-10-0-2-223 ~]$ sudo systemctl restart httpd
[ec2-user@ip-10-0-2-223 ~]$ sudo systemctl status httpd
● httpd.service - The Apache HTTP Server
    Loaded: loaded (/usr/lib/systemd/system/httpd.service; enabled; preset: disabled)
      Drop-In: /usr/lib/systemd/system/httpd.service.d
        └─php-fpm.conf
     Active: active (running) since Thu 2026-01-22 14:16:08 UTC; 13s ago
       Docs: man:httpd(8)
   Main PID: 15943 (httpd)
     Status: "Total requests: 0; Idle/Busy workers 100/0;Requests/sec: 0; Bytes served/sec: 0 B/sec"
       Tasks: 177 (limit: 1067)
      Memory: 13.4M
         CPU: 66ms
      CGroup: /system.slice/httpd.service
              ├─15943 /usr/sbin/httpd -DFOREGROUND
              ├─15944 /usr/sbin/httpd -DFOREGROUND
              ├─15945 /usr/sbin/httpd -DFOREGROUND
              ├─15946 /usr/sbin/httpd -DFOREGROUND
              └─15947 /usr/sbin/httpd -DFOREGROUND

Jan 22 14:16:08 ip-10-0-2-223.ec2.internal systemd[1]: Starting httpd.service - The Apache HTTP Server...
Jan 22 14:16:08 ip-10-0-2-223.ec2.internal systemd[1]: Started httpd.service - The Apache HTTP Server.
Jan 22 14:16:08 ip-10-0-2-223.ec2.internal httpd[15943]: Server configured, listening on port 80
[ec2-user@ip-10-0-2-223 ~]$

```

Full LAMP stack (Linux, Apache, MySQL client, PHP)

NFS server ready (configure in Task 16)

FTP server ready (configure in Task 17)

LVM tools ready (use in Task 13)

Encryption tools ready (use in Task 14)

All services running and enabled

Complete software inventory

## PASSWORD POLICY CONFIGURATION

**Security requirement for multi-user system where trainers, students, and support staff have different access levels**

### 1.BACKUP EXISTING CONFIGURATION:

```

ec2-user@ip-10-0-2-223:~]
[ec2-user@ip-10-0-2-223 ~]$ ls
[ec2-user@ip-10-0-2-223 ~]$
[ec2-user@ip-10-0-2-223 ~]$
[ec2-user@ip-10-0-2-223 ~]$ sudo cp /etc/login.defs /etc/login.defs.backup
[ec2-user@ip-10-0-2-223 ~]$
[ec2-user@ip-10-0-2-223 ~]$ sudo cp /etc/pam.d/password-auth /etc/pam.d/password-auth.backup
[ec2-user@ip-10-0-2-223 ~]$
[ec2-user@ip-10-0-2-223 ~]$ sudo cp /etc/pam.d/system-auth /etc/pam.d/system-auth.backup
[ec2-user@ip-10-0-2-223 ~]$
[ec2-user@ip-10-0-2-223 ~]$ ls -la /etc/*.backup /etc/pam.d/*.backup
-rw-r--r--. 1 root root 217 Jan 22 09:57 /etc/fstab.backup
-rw-r--r--. 1 root root 8402 Jan 23 05:14 /etc/login.defs.backup
-rw-r--r--. 1 root root 663 Jan 23 05:14 /etc/pam.d/password-auth.backup
-rw-r--r--. 1 root root 663 Jan 23 05:14 /etc/pam.d/system-auth.backup
-rw-r--r--. 1 root root 62987 Jan 22 14:15 /etc/php.ini.backup
[ec2-user@ip-10-0-2-223 ~]$
[ec2-user@ip-10-0-2-223 ~]$

```

## CONFIGURING PASSWORD EXPIRY (30 DAYS)

Edit `/etc/login.defs` to set password aging policies

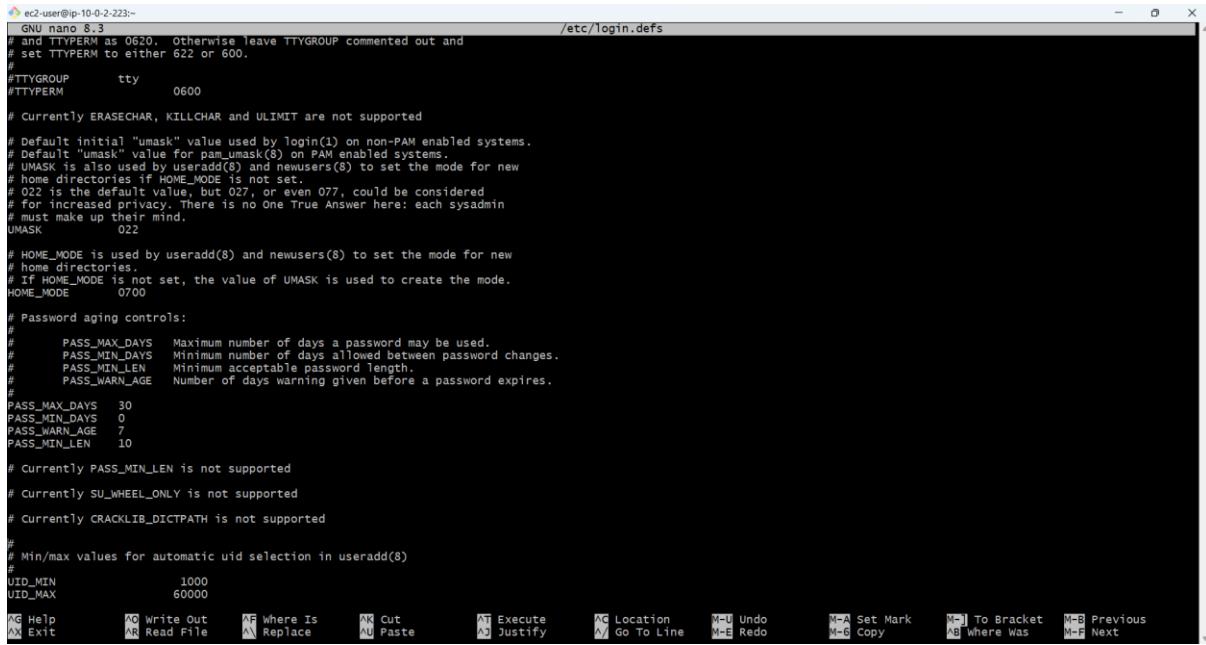
ORIGINAL VALUES

```

ec2-user@ip-10-0-2-223:~]
GNU nano 8.3          /etc/login.defs
#
#TIGROUP      tty      0600
#
# Currently ERASECHAR, KILLCHAR and ULIMIT are not supported
#
# Default initial "umask" value used by login(1) on non-PAM enabled systems.
# Default "umask" value for pam_umask(8) on PAM enabled systems.
# UMASK is also used by useradd(8) and newusers(8) to set the mode for new
# home directories if HOME_MODE is not set.
# 022 is the default value, but 027, or even 077, could be considered
# for increased privacy. There is no One True Answer here: each sysadmin
# must make up their mind.
#UMASK          022
#
# HOME_MODE is used by useradd(8) and newusers(8) to set the mode for new
# home directories.
# If HOME_MODE is not set, the value of UMASK is used to create the mode.
#HOME_MODE        0700
#
# Password aging controls:
#
# PASS_MAX_DAYS Maximum number of days a password may be used.
# PASS_MIN_DAYS Minimum number of days allowed between password changes.
# PASS_MIN_LEN Minimum acceptable password length.
# PASS_WARN_AGE Number of days warning given before a password expires.
#
PASS_MAX_DAYS    99999
PASS_MIN_DAYS   0
PASS_WARN_AGE    7
#
# Currently PASS_MIN_LEN is not supported
#
# Currently SU_WHEEL_ONLY is not supported
#
# Currently CRACKLIB_DICTPATH is not supported
#
#
# Min/max values for automatic uid selection in useradd(8)
#
#UID_MIN          1000
#UID_MAX          60000
#
# System accounts
#SYS_UID_MIN     201
#SYS_UID_MAX     999

```

CHANGED TO:



```

ec2-user@ip-10-0-2-223:~$ nano /etc/login.defs
# and TTYPERM as 0620. Otherwise leave TTYGROUP commented out and
# set TTYPERM to either 622 or 600.
#
#TTYGROUP      tty      0600
#TTYPERM      0600

# Currently ERASECHAR, KILLCHAR and ULIMIT are not supported

# Default initial "umask" value used by login(1) on non-PAM enabled systems.
# Default "umask" value for pam_umask($) on PAM enabled systems.
# UMASK is also used by useradd($) and newusers($) to set the mode for new
# home directories if HOME_MODE is not set.
# 022 is the default value, but 027, or even 077, could be considered
# for increased privacy. There is no One True Answer here: each sysadmin
# must make up their mind.
UMASK      022

# HOME_MODE is used by useradd($) and newusers($) to set the mode for new
# home directories.
# If HOME_MODE is not set, the value of UMASK is used to create the mode.
HOME_MODE      0700

# Password aging controls:
#
# PASS_MAX_DAYS   Maximum number of days a password may be used.
# PASS_MIN_DAYS   Minimum number of days allowed between password changes.
# PASS_MIN_LEN    Minimum acceptable password length.
# PASS_WARN_AGE   Number of days warning given before a password expires.
#
PASS_MAX_DAYS  30
PASS_MIN_DAYS  0
PASS_WARN_AGE   7
PASS_MIN_LEN   10

# Currently PASS_MIN_LEN is not supported

# Currently SU_WHEEL_ONLY is not supported

# Currently CRACKLIB_DICTPATH is not supported

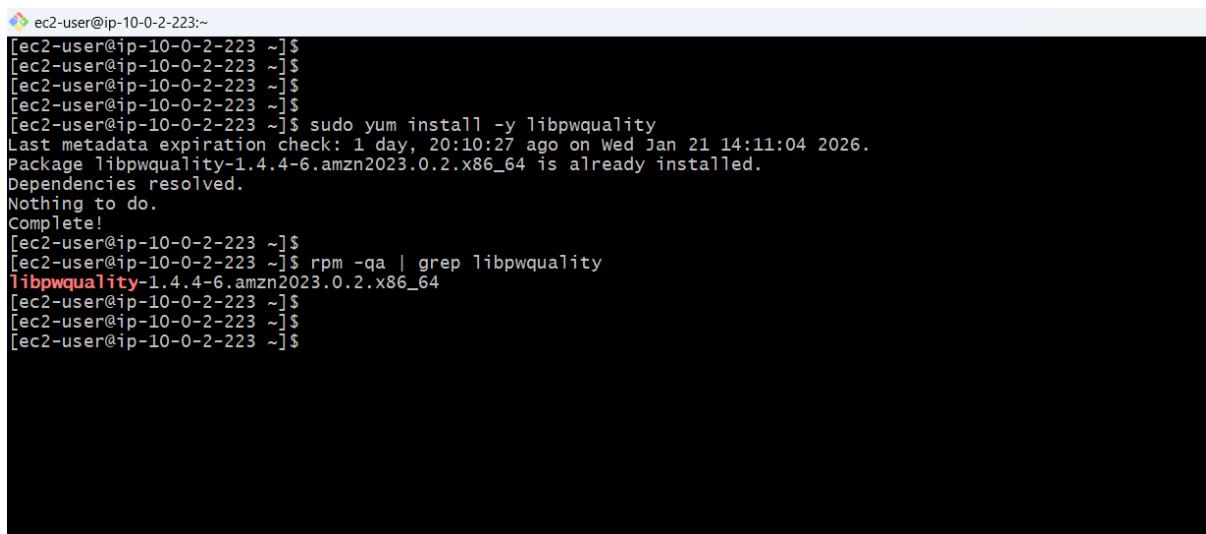
#
# Min/max values for automatic uid selection in useradd($)
#
UID_MIN          1000
UID_MAX          60000

AG Help           AX Exit           AO Write Out        AF Where Is        AK Cut            AU Paste          AI Execute        AC Location       M-U Undo         M-E Redo         M-A Set Mark     M-B To Bracket   M-B Where Was    M-B Previous    M-F Next
AR Read File      AR Replace

```

## CONFIGURE PASSWORD COMPLEXITY

### INSTALLED PASSWORD QUALITY LIBRARY



```

[ec2-user@ip-10-0-2-223 ~]$ sudo yum install -y libpwquality
Last metadata expiration check: 1 day, 20:10:27 ago on Wed Jan 21 14:11:04 2026.
Package libpwquality-1.4.4-6.amzn2023.0.2.x86_64 is already installed.
Dependencies resolved.
Nothing to do.
Complete!
[ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ rpm -qa | grep libpwquality
libpwquality-1.4.4-6.amzn2023.0.2.x86_64
[ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$
```

## CONFIGURE PASSWORD COMPLEXITY REQUIREMENTS

**At least 1 uppercase, 1 digit, 1 special character**

**password requisite pam\_pwquality.so try\_first\_pass local\_users\_only retry=3  
minlen=10 uccredit=-1 dcredit=-1 ocredit=-1 lcredit=-1**

- minlen=10 → Minimum 10 characters
- uccredit=-1 → At least 1 uppercase letter (U)
- dcredit=-1 → At least 1 digit (D)
- ocredit=-1 → At least 1 special character (O = other)

- lccredit=-1 → At least 1 lowercase letter (L)
- retry=3 → Allow 3 attempts to set password

```
ec2-user@ip-10-0-2-223:~$ nano /etc/pam.d/password-auth
#%PAM-1.0
auth    required    pam_env.so
auth    sufficient  pam_unix.so try_first_pass nullok
auth    required    pam_deny.so

account  required   pam_unix.so

password requisite pam_pwquality.so try_first_pass local_users_only retry=3 minlen=10 ucredit=-1 dcredit=-1 ocredit=-1 lccredit=-1
password sufficient pam_unix.so try_first_pass use_authtok nullok sha512 shadow
password required   pam_deny.so

session  optional   pam_keyinit.so revoke
session  required   pam_limits.so
session  optional   pam_systemd.so
session  [success=1 default=ignore] pam_succeed_if.so service in crond quiet use_uid
session  required   pam_unix.so
```

**Change in both the lines**

```
ec2-user@ip-10-0-2-223:~$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ sudo nano /etc/pam.d/password-auth [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ sudo nano /etc/pam.d/system-auth [ec2-user@ip-10-0-2-223 ~]$ |
```

## CREATE PASSWORD QUALITY CONFIG FILE

**sudo nano /etc/security/pwquality.conf**

```
ec2-user@ip-10-0-2-223:~$ nano /etc/security/pwquality.conf
# gecoscheck = 0
#
# Whether to check for the words from the cracklib dictionary.
# The check is enabled if the value is not 0.
# dictcheck = 1
#
# Whether to check if it contains the user name in some form.
# The check is enabled if the value is not 0.
# usercheck = 1
#
# Length of substrings from the username to check for in the password
# The check is enabled if the value is greater than 0 and usercheck is enabled.
# usersubstr = 0
#
# Whether the check is enforced by the PAM module and possibly other
# applications.
# The new password is rejected if it fails the check and the value is not 0.
# enforcing = 1
#
# Path to the cracklib dictionaries. Default is to use the cracklib default.
# dictpath =
#
# Prompt user at most N times before returning with error. The default is 1.
# retry = 3
#
# Enforces pwquality checks on the root user password.
# Enabled if the option is present.
# enforce_for_root
#
# Skip testing the password quality for users that are not present in the
# /etc/passwd file.
# Enabled if the option is present.
# local_users_only
#
# EduCloud Password Policy Configuration
minlen = 10          # Minimum password length
dcredit = -1          # At least 1 digit
ucredit = -1          # At least 1 uppercase
lccredit = -1         # At least 1 lowercase
ocredit = -1          # At least 1 special character
minclass = 3          # At least 3 different character classes
maxrepeat = 2          # Maximum 2 repeated characters
difok = 3             # At least 3 different characters from old password
```

## Password quality check

Password:12345678

Password: abcdefghij

Password: ABCDEFGH12

```
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$ sudo nano /etc/security/pwquality.conf  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$ sudo useradd testuser1  
[ec2-user@ip-10-0-2-223 ~]$ id testuser1  
uid=1001(testuser1) gid=1001(testuser1) groups=1001(testuser1)  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$ echo "Testing weak password policy..."  
Testing weak password policy...  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$ sudo passwd testuser1  
Changing password for user testuser1.  
New password:  
BAD PASSWORD: The password contains less than 1 uppercase letters  
Retype new password:  
Sorry, passwords do not match.  
New password:  
BAD PASSWORD: The password contains less than 1 digits  
Retype new password:  
Sorry, passwords do not match.  
New password:  
BAD PASSWORD: The password contains less than 1 lowercase letters  
Retype new password:  
Sorry, passwords do not match.  
passwd: Have exhausted maximum number of retries for service  
[ec2-user@ip-10-0-2-223 ~]$ |
```

```
[ec2-user@ip-10-0-2-223 ~]  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$ sudo passwd testuser1  
Changing password for user testuser1.  
New password:  
BAD PASSWORD: The password contains less than 1 non-alphanumeric characters  
Retype new password:
```

## VALID PASSWORD

Password:TestUser@2026

```
[ec2-user@ip-10-0-2-223 ~]  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$ sudo passwd testuser1  
Changing password for user testuser1.  
New password:  
Retype new password:  
passwd: all authentication tokens updated successfully.  
[ec2-user@ip-10-0-2-223 ~]$ |
```

## Enforced Policy:

Maximum number of days between password change: 30

Number of days of warning before password expires: 7

```
ec2-user@ip-10-0-2-223:~  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$ sudo chage -l testuser1  
Last password change : Jan 23, 2026  
Password expires : Feb 22, 2026  
Password inactive : never  
Account expires : never  
Minimum number of days between password change : 0  
Maximum number of days between password change : 30  
Number of days of warning before password expires : 7  
[ec2-user@ip-10-0-2-223 ~]$ |
```

## MANUALLY SET PASSWORD EXPIRY

```
ec2-user@ip-10-0-2-223:~  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$ sudo chage -d 0 testuser1  
[ec2-user@ip-10-0-2-223 ~]$ sudo chage -l testuser1  
Last password change : password must be changed  
Password expires : password must be changed  
Password inactive : password must be changed  
Account expires : never  
Minimum number of days between password change : 0  
Maximum number of days between password change : 30  
Number of days of warning before password expires : 7  
[ec2-user@ip-10-0-2-223 ~]$ sudo passwd testuser1  
Changing password for user testuser1.  
New password:  
Retype new password:  
passwd: all authentication tokens updated successfully.  
[ec2-user@ip-10-0-2-223 ~]$ |
```

```
ec2-user@ip-10-0-2-223:~  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$ sudo chage -d 0 testuser1  
[ec2-user@ip-10-0-2-223 ~]$ sudo chage -l testuser1  
Last password change : password must be changed  
Password expires : password must be changed  
Password inactive : password must be changed  
Account expires : never  
Minimum number of days between password change : 0  
Maximum number of days between password change : 30  
Number of days of warning before password expires : 7  
[ec2-user@ip-10-0-2-223 ~]$ sudo passwd testuser1  
Changing password for user testuser1.  
New password:  
Retype new password:  
passwd: all authentication tokens updated successfully.  
[ec2-user@ip-10-0-2-223 ~]$ sudo chage -l testuser1  
Last password change : Jan 23, 2026  
Password expires : Feb 22, 2026  
Password inactive : never  
Account expires : never  
Minimum number of days between password change : 0  
Maximum number of days between password change : 30  
Number of days of warning before password expires : 7  
[ec2-user@ip-10-0-2-223 ~]$ |
```

## PASSWORD POLICY DOCUMENT

Maximum password age: 30 days (PASS\_MAX\_DAYS)

Minimum password age: 0 days (PASS\_MIN\_DAYS)

Minimum password length: 10 characters (PASS\_MIN\_LEN)

Password expiry warning: 7 days (PASS\_WARN\_AGE)

## **PASSWORD COMPLEXITY REQUIREMENTS:**

Minimum length: 10 characters

At least 1 uppercase letter (A-Z)

At least 1 lowercase letter (a-z)

At least 1 digit (0-9)

At least 1 special character (!@#\$%^&\*)

At least 3 different character classes

Maximum 2 repeated consecutive characters

At least 3 different characters from old password

## **Configuration Files:**

- /etc/pam.d/password-auth

- /etc/pam.d/system-auth

- /etc/security/pwquality.conf

## **VALID PASSWORD EXAMPLES:**

TestUser@2026 (10 chars, U, l, d, special)

Student#Pass123 (14 chars, U, l, d, special)

Trainer\$2026Abc (14 chars, U, l, d, special)

Support!Login99 (14 chars, U, l, d, special)

## **INVALID PASSWORD EXAMPLES:**

password123 (no uppercase, no special char)

PASSWORD123 (no lowercase, no special char)

Password (too short, no digit, no special char)

Pass@123 (too short - only 8 chars)

12345678910 (no letters, no special char)

## **FORCING PASSWORD CHANGE ON FIRST LOGIN:**

---

Command: sudo chage -d 0 <username> Example: sudo chage -d 0 student1

## LINUX USERS & GROUPS CREATION

### CREATED THREE GROUPS

```
ec2-user@ip-10-0-2-223:~$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ sudo groupadd trainers [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ sudo groupadd students [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ sudo groupadd support [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ cat /etc/group | grep -E 'trainers|students|support' trainers:x:1002: students:x:1003: support:x:1004: [ec2-user@ip-10-0-2-223 ~]$ tail /etc/groups tail: cannot open '/etc/groups' for reading: No such file or directory [ec2-user@ip-10-0-2-223 ~]$ tail /etc/group rpcuser:x:29: tcpdump:x:72: screen:x:84: ec2-user:x:1000: apache:x:48: nginx:x:992: testuser1:x:1001: trainers:x:1002: students:x:1003: support:x:1004: [ec2-user@ip-10-0-2-223 ~]$ |
```

### CREATED TRAINER USERS

```
ec2-user@ip-10-0-2-223:~$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ sudo useradd -m -g trainers -c "Trainer One - EduCloud" trainer1 [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ sudo useradd -m -g trainers -c "Trainer Two - EduCloud" trainer2 [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ id trainer1 uid=1002(trainer1) gid=1002(trainers) groups=1002(trainers) [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ trainer2 -bash: trainer2: command not found [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ trainer2 -bash: trainer2: command not found [ec2-user@ip-10-0-2-223 ~]$ id trainer2 uid=1003(trainer2) gid=1002(trainers) groups=1002(trainers) [ec2-user@ip-10-0-2-223 ~]$ |
```

### CREATE STUDENT USERS

```
ec2-user@ip-10-0-2-223:~  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$ sudo useradd -m -g students -c "Student One - EduCloud" student1  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$ sudo useradd -m -g students -c "Student Two - EduCloud" student2  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$ sudo useradd -m -g students -c "Student Three - EduCloud" student3  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$ id student1  
uid=1004(student1) gid=1003(students) groups=1003(students)  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$ id student2  
uid=1005(student2) gid=1003(students) groups=1003(students)  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$ id student3  
uid=1006(student3) gid=1003(students) groups=1003(students)  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$ |
```

## CREATED SUPPORT USER

```
ec2-user@ip-10-0-2-223:~  
[ec2-user@ip-10-0-2-223 ~]$ ls  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$ sudo useradd -m -g support -c "Support Staff - EduCloud" support1  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$ id support1  
uid=1007(support1) gid=1004(support) groups=1004(support)  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$
```

## All users created

```
ec2-user@ip-10-0-2-223:~  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$ cat /etc/passwd | grep -E 'trainer|student|support'  
trainer1:x:1002:1002:Trainer One - EduCloud:/home/trainer1:/bin/bash  
trainer2:x:1003:1002:Trainer Two - EduCloud:/home/trainer2:/bin/bash  
student1:x:1004:1003:Student One - EduCloud:/home/student1:/bin/bash  
student2:x:1005:1003:Student Two - EduCloud:/home/student2:/bin/bash  
student3:x:1006:1003:Student Three - EduCloud:/home/student3:/bin/bash  
support1:x:1007:1004:Support Staff - EduCloud:/home/support1:/bin/bash  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$ ls -la /home  
total 0  
drwxr-xr-x. 10 root      root     135 Jan 23 12:01 .  
dr-xr-xr-x. 18 root      root     285 Jan 22 10:10 ..  
drwx-----  3 ec2-user   ec2-user  133 Jan 23 05:12 ec2-user  
drwx-----  2 student1  students  62 Jan 23 12:00 student1  
drwx-----  2 student2  students  62 Jan 23 12:00 student2  
drwx-----  2 student3  students  62 Jan 23 12:00 student3  
drwx-----  2 support1  support   62 Jan 23 12:01 support1  
drwx-----  2 testuser1  testuser1 62 Jan 23 10:32 testuser1  
drwx-----  2 trainer1   trainers  62 Jan 23 11:57 trainer1  
drwx-----  2 trainer2   trainers  62 Jan 23 11:57 trainer2  
[ec2-user@ip-10-0-2-223 ~]$ |
```

## SET PASSWORDS

## SET PASSWORDS FOR TRAINERS

Trainer1

```
ec2-user@ip-10-0-2-223:~$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ sudo passwd trainer1 Changing password for user trainer1. New password: Retype new password: passwd: all authentication tokens updated successfully. [ec2-user@ip-10-0-2-223 ~]$
```

**Password:** Trainer@2026

Tried including trainer name in the password

```
ec2-user@ip-10-0-2-223:~$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ sudo passwd trainer2 Changing password for user trainer2. New password: BAD PASSWORD: The password contains the user name in some form Retype new password: [ec2-user@ip-10-0-2-223 ~]$ |
```

Trainer2

```
ec2-user@ip-10-0-2-223:~$ [ec2-user@ip-10-0-2-223 ~]$ sudo passwd trainer2 Changing password for user trainer2. New password: Retype new password: passwd: all authentication tokens updated successfully. [ec2-user@ip-10-0-2-223 ~]$ |
```

**Password:** Trainertwo@2026

## SET PASSWORDS FOR STUDENTS

Student1

```
ec2-user@ip-10-0-2-223:~  
[ec2-user@ip-10-0-2-223 ~]$ sudo passwd student1  
Changing password for user student1.  
New password:  
Retype new password:  
Sorry, passwords do not match.  
New password:  
Retype new password:  
passwd: all authentication tokens updated successfully.  
[ec2-user@ip-10-0-2-223 ~]$ |
```

Password:EduCLoud@123

```
root@ip-10-0-2-24:/home/ec2-user  
[root@ip-10-0-2-24 ec2-user]# lftp -u student1 10.0.2.223  
Password:  
Interrupt  
[root@ip-10-0-2-24 ec2-user]# lftp -u student1 10.0.2.223  
Password:  
lftp student1@10.0.2.223:> ls  
ls: Fatal error: Certificate verification: Not trusted (F5:62:81:A6:E0:6C:AB:2E:7C:60:FB:59:42:EE:09:5E:AA:A0:8F:AB)  
lftp student1@10.0.2.223:> ls  
ls: Fatal error: Certificate verification: Not trusted (F5:62:81:A6:E0:6C:AB:2E:7C:60:FB:59:42:EE:09:5E:AA:A0:8F:AB)  
lftp student1@10.0.2.223:> ls  
ls: Fatal error: Certificate verification: Not trusted (F5:62:81:A6:E0:6C:AB:2E:7C:60:FB:59:42:EE:09:5E:AA:A0:8F:AB)  
lftp student1@10.0.2.223:> ls  
ls: Fatal error: Certificate verification: Not trusted (F5:62:81:A6:E0:6C:AB:2E:7C:60:FB:59:42:EE:09:5E:AA:A0:8F:AB)  
lftp student1@10.0.2.223:> ls  
ls: Fatal error: Certificate verification: Not trusted (F5:62:81:A6:E0:6C:AB:2E:7C:60:FB:59:42:EE:09:5E:AA:A0:8F:AB)  
lftp student1@10.0.2.223:> bye  
[root@ip-10-0-2-24 ec2-user]#  
[root@ip-10-0-2-24 ec2-user]# cat > ~/.lftpvc << 'EOF'  
set ftp:ssl-allow false  
set ssl:verify-certificate no  
EOF  
[root@ip-10-0-2-24 ec2-user]# lftp -u student1 10.0.2.223  
Password:  
lftp student1@10.0.2.223:> pwd  
ftp://student1@10.0.2.223  
lftp student1@10.0.2.223:> ls  
ls: Login failed: 530 Non-anonymous sessions must use encryption.  
lftp student1@10.0.2.223:> bye  
[root@ip-10-0-2-24 ec2-user]# |
```

## Student2

```
ec2-user@ip-10-0-2-223:~  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$ sudo passwd student2  
Changing password for user student2.  
New password:  
Retype new password:  
passwd: all authentication tokens updated successfully.  
[ec2-user@ip-10-0-2-223 ~]$ |
```

Password: Learning#456

## Student3

```
ec2-user@ip-10-0-2-223:~  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$ sudo passwd student3  
Changing password for user student3.  
New password:  
Retype new password:  
passwd: all authentication tokens updated successfully.  
[ec2-user@ip-10-0-2-223 ~]$
```

Password:Scholer\$789

## SET PASSWORD FOR SUPPORT

### Support

```
ec2-user@ip-10-0-2-223:~  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$ sudo passwd support1  
Changing password for user support1.  
New password:  
Retype new password:  
passwd: all authentication tokens updated successfully.  
[ec2-user@ip-10-0-2-223 ~]$
```

Password:HelpDesk\$99

## PASSWORD AGING POLICY LIST

```
ec2-user@ip-10-0-2-223:~  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$ sudo chage -l trainer1  
Last password change : Jan 23, 2026  
Password expires : Feb 22, 2026  
Password inactive : never  
Account expires : never  
Minimum number of days between password change : 0  
Maximum number of days between password change : 30  
Number of days of warning before password expires : 7  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$ sudo chage -l trainer2  
Last password change : Jan 23, 2026  
Password expires : Feb 22, 2026  
Password inactive : never  
Account expires : never  
Minimum number of days between password change : 0  
Maximum number of days between password change : 30  
Number of days of warning before password expires : 7  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$ sudo chage -l trainer3  
chage: user 'trainer3' does not exist in /etc/passwd  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$ sudo chage -l student1  
chage: user 'student1' does not exist in /etc/passwd  
[ec2-user@ip-10-0-2-223 ~]$ sudo chage -l student1  
Last password change : Jan 23, 2026  
Password expires : Feb 22, 2026  
Password inactive : never  
Account expires : never  
Minimum number of days between password change : 0  
Maximum number of days between password change : 30  
Number of days of warning before password expires : 7  
[ec2-user@ip-10-0-2-223 ~]$ sudo chage -l student2  
Last password change : Jan 23, 2026  
Password expires : Feb 22, 2026  
Password inactive : never  
Account expires : never  
Minimum number of days between password change : 0  
Maximum number of days between password change : 30  
Number of days of warning before password expires : 7  
[ec2-user@ip-10-0-2-223 ~]$ sudo chage -l student3  
Last password change : Jan 23, 2026  
Password expires : Feb 22, 2026  
Password inactive : never  
Account expires : never  
Minimum number of days between password change : 0  
Maximum number of days between password change : 30  
Number of days of warning before password expires : 7  
[ec2-user@ip-10-0-2-223 ~]$
```

**TRAINERS (trainer1, trainer2):**

- Upload study materials to /materials (via NFS)
- Read/Write access to /materials - Read-only access to /assignments
- Read/Write access to /logs
- Can manage student records in RDS
- Can trigger backups to S3
- Access to encrypted /sensitive\_data (LUKS)

**STUDENTS (student1, student2, student3):**

- Download materials from /materials (read-only via NFS)
- Upload assignments to /assignments (via FTP)
- Read/Write access to /assignments
- No access to /logs
- No access to /sensitive\_data
- Can view own records in RDS

**SUPPORT (support1): -**

Monitor system logs in /logs (read-only)

- Upload logs and backups to S3
- Read-only access to /logs
- CloudWatch monitoring access
- No access to /materials or /assignments
- No access to /sensitive\_data

**All 6 users created successfully**

All users assigned to correct groups

All passwords meet complexity requirements

Password aging configured (30 days)

User login tested (trainer1, student1)

Password change on first login tested

Home directories created with proper permissions

## CREATED MAIN PROJECT DIRECTORIES

```
ec2-user@ip-10-0-2-223:~$ ls -lah /mnt/educloud-data/
total 4.0K
drwxr-xr-x. 8 root root 133 Jan 22 10:18 .
drwxr-xr-x. 3 root root 27 Jan 22 09:52 ..
drwxr-xr-x. 2 root root 6 Jan 22 10:03 assignments
drwxr-xr-x. 2 root root 6 Jan 22 10:04 backups
drwxr-x---. 2 root root 6 Jan 22 10:04 logs
drwxr-xr-x. 2 root root 6 Jan 22 10:03 materials
drwxr----. 2 root root 6 Jan 22 10:04 sensitive_data
-rw-r--r--. 1 root root 35 Jan 22 10:19 test-file.txt
drwxr-xr-x. 2 root root 6 Jan 22 10:04 training_data
[ec2-user@ip-10-0-2-223 ~]$ |
```

## SET OWNERSHIP FOR /materials

Trainers upload study materials here

```
ec2-user@ip-10-0-2-223:~$ sudo chown root:trainers /mnt/educloud-data/materials
[ec2-user@ip-10-0-2-223 ~]$ ls -ld /mnt/educloud-data/materials
drwxr-xr-x. 2 root trainers 6 Jan 22 10:03 /mnt/educloud-data/materials
[ec2-user@ip-10-0-2-223 ~]$
```

Owner: root (administrative control)

Group: trainers (trainers can write files)

## SET OWNERSHIP FOR /assignments

Students submit assignments here

```
ec2-user@ip-10-0-2-223:~$ sudo chown root:students /mnt/educloud-data/assignments
[ec2-user@ip-10-0-2-223 ~]$ ls -ld /mnt/educloud-data/assignments
drwxr-xr-x. 2 root students 6 Jan 22 10:03 /mnt/educloud-data/assignments
[ec2-user@ip-10-0-2-223 ~]$
```

## SET OWNERSHIP FOR /logs

System and application logs

```
ec2-user@ip-10-0-2-223:~  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$ sudo chown root:support /mnt/educloud-data/logs  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$ ls -ld /mnt/educloud-data/logs  
drwxr-x---. 2 root support 6 Jan 22 10:04 /mnt/educloud-data/logs  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$
```

## SET OWNERSHIP FOR /training\_data (FOR LVM)

Will be used for LVM

```
ec2-user@ip-10-0-2-223:~  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$ sudo chown root:root /mnt/educloud-data/training_data  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$ ls -ld /mnt/educloud-data/training_data  
drwxr-xr-x. 2 root root 6 Jan 22 10:04 /mnt/educloud-data/training_data  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$ |
```

## SET OWNERSHIP FOR /sensitive\_data (FOR LUKS)

Will be encrypted with LUKS (trainers only)

```
ec2-user@ip-10-0-2-223:~  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$ sudo chown root:trainers /mnt/educloud-data/sensitive_data  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$ ls -ld /mnt/educloud-data/sensitive_data  
drwx-----. 2 root trainers 6 Jan 22 10:04 /mnt/educloud-data/sensitive_data  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$
```

## SET BASIC PERMISSIONS

### SET PERMISSIONS FOR /materials

Trainers = Read/Write, Students = Read-only

### SET PERMISSIONS FOR /assignments

Students = Read/Write, Trainers = Read-only

### SET PERMISSIONS FOR /logs

Support = Read-only, Trainers = Read/Write, Students = No access

## **SET PERMISSIONS FOR /training\_data**

755 permissions (accessible to all for LVM )

## **SET PERMISSIONS FOR /sensitive\_data**

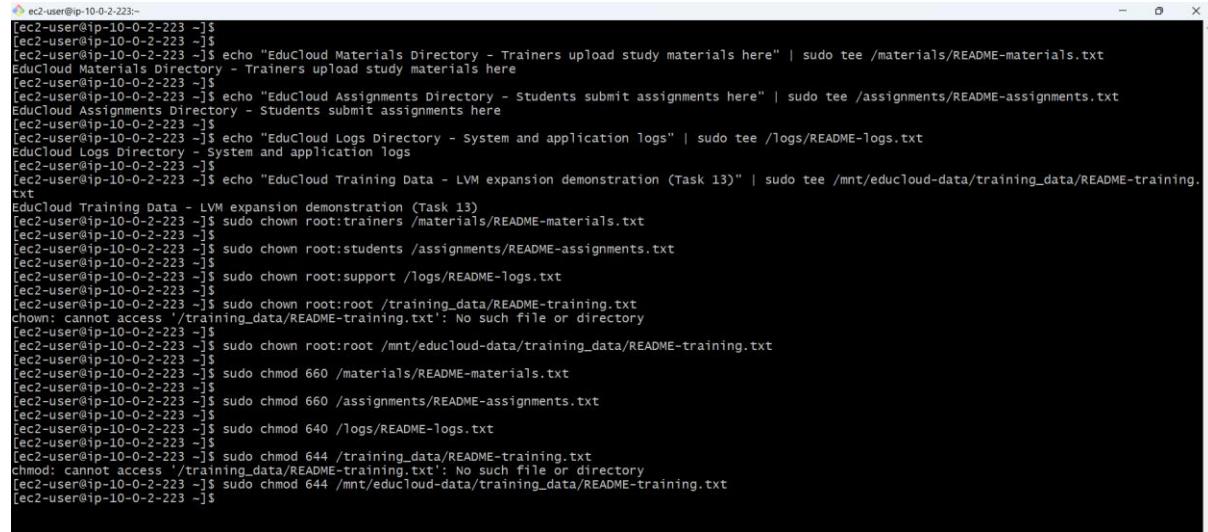
Trainers only

```
ec2-user@ip-10-0-2-223:~$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ sudo chmod 770 /mnt/educloud-data/materials [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ ls -ld /mnt/educloud-data/materials drwxrwx--- 2 root trainers 6 Jan 22 10:03 /mnt/educloud-data/materials [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ sudo chmod 770 /mnt/educloud-data/assignments [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ ls -ld /mnt/educloud-data/assignments drwxrwx--- 2 root students 6 Jan 22 10:03 /mnt/educloud-data/assignments [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ sudo chmod 750 /mnt/educloud-data/logs [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ ls -ld /mnt/educloud-data/logs drwxr-x--- 2 root support 6 Jan 22 10:04 /mnt/educloud-data/logs [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ sudo chmod 755 /mnt/educloud-data/training_data [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ ls -ld /mnt/educloud-data/training_data drwxr-xr-x 2 root root 6 Jan 22 10:04 /mnt/educloud-data/training_data [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ sudo chmod 700 /mnt/educloud-data/sensitive_data [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ ls -ld /mnt/educloud-data/sensitive_data drwx----- 2 root trainers 6 Jan 22 10:04 /mnt/educloud-data/sensitive_data [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ |
```

```
ec2-user@ip-10-0-2-223:~$ [ec2-user@ip-10-0-2-223 ~]$ tree -L 1 -pugD /mnt/educloud-data/ /mnt/educloud-data/ ├── [drwxrwx--- root students Jan 22 10:03] assignments └── [drwxr-xr-x root root Jan 22 10:04] backups └── [drwxr-x--- root support Jan 22 10:04] logs └── [drwxrwx--- root trainers Jan 22 10:03] materials └── [drwx----- root trainers Jan 22 10:04] sensitive_data └── [-rw-r--r-- root root Jan 22 10:19] test-file.txt └── [drwxr-xr-x root root Jan 22 10:04] training_data 6 directories, 1 file [ec2-user@ip-10-0-2-223 ~]$ ls -lah /mnt/educloud-data/ total 4.0K drwxr-xr-x. 8 root root 133 Jan 22 10:18 . drwxr-xr-x. 3 root root 27 Jan 22 09:52 .. drwxrwx---. 2 root students 6 Jan 22 10:03 assignments drwxr-xr-x. 2 root root 6 Jan 22 10:04 backups drwxr-x---. 2 root support 6 Jan 22 10:04 logs drwxrwx---. 2 root trainers 6 Jan 22 10:03 materials drwx-----. 2 root trainers 6 Jan 22 10:04 sensitive_data -rw-r--r--. 1 root root 35 Jan 22 10:19 test-file.txt drwxr-xr-x. 2 root root 6 Jan 22 10:04 training_data [ec2-user@ip-10-0-2-223 ~]$
```

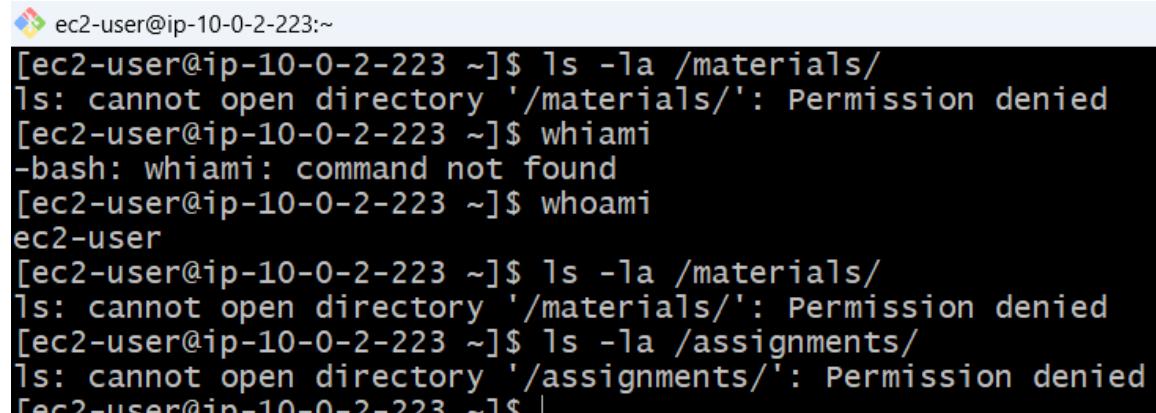
## **CREATING TEST FILES IN DIRECTORIES TO CHECK THE TEST ACCES FRPOM THE DIFFERENT USER**

Adding test content to the test file and setting proper ownership to the files and also giving proper permission



```
[ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ echo "EduCloud Materials Directory - Trainers upload study materials here" | sudo tee /materials/README-materials.txt EduCloud Materials Directory - Trainers upload study materials here [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ echo "EduCloud Assignments Directory - Students submit assignments here" | sudo tee /assignments/README-assignments.txt EduCloud Assignments Directory - Students submit assignments here [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ echo "EduCloud Logs Directory - System and application logs" | sudo tee /logs/README-logs.txt EduCloud Logs Directory - System and application logs [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ echo "EduCloud Training Data - LVM expansion demonstration (Task 13)" | sudo tee /mnt/educloud-data/training_data/README-training.txt EduCloud Training Data - LVM expansion demonstration (Task 13) [ec2-user@ip-10-0-2-223 ~]$ sudo chown root:trainers /materials/README-materials.txt [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ sudo chown root:students /assignments/README-assignments.txt [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ sudo chown root:support /logs/README-logs.txt [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ sudo chown root:root /training_data/README-training.txt chown: cannot access '/training_data/README-training.txt': No such file or directory [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ sudo chown root:root /mnt/educloud-data/training_data/README-training.txt [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ sudo chmod 660 /materials/README-materials.txt [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ sudo chmod 660 /assignments/README-assignments.txt [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ sudo chmod 640 /logs/README-logs.txt [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ sudo chmod 644 /training_data/README-training.txt chmod: cannot access '/training_data/README-training.txt': No such file or directory [ec2-user@ip-10-0-2-223 ~]$ sudo chmod 644 /mnt/educloud-data/training_data/README-training.txt [ec2-user@ip-10-0-2-223 ~]$
```

No access to ec2-user only student, trainer and support these group member have the permission



```
[ec2-user@ip-10-0-2-223 ~]$ ls -la /materials/ ls: cannot open directory '/materials/': Permission denied [ec2-user@ip-10-0-2-223 ~]$ whami -bash: whami: command not found [ec2-user@ip-10-0-2-223 ~]$ whoami ec2-user [ec2-user@ip-10-0-2-223 ~]$ ls -la /materials/ ls: cannot open directory '/materials/': Permission denied [ec2-user@ip-10-0-2-223 ~]$ ls -la /assignments/ ls: cannot open directory '/assignments/': Permission denied [ec2-user@ip-10-0-2-223 ~]$ |
```

## TEST ACCESS WITH DIFFERENT USERS

### TEST TRAINER ACCESS

```
trainer1@ip-10-0-2-223:/materials
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ sudo su - trainer1
[trainer1@ip-10-0-2-223 ~]$ whoami
trainer1
[trainer1@ip-10-0-2-223 ~]$ cd /materials
[trainer1@ip-10-0-2-223 materials]$ 
[trainer1@ip-10-0-2-223 materials]$ cat README-materials.txt
EduCloud Materials Directory - Trainers upload study materials here
[trainer1@ip-10-0-2-223 materials]$ 
[trainer1@ip-10-0-2-223 materials]$ ls -la
total 4
drwxrwx---. 2 root trainers 34 Jan 23 14:04 .
drwxr-xr-x. 8 root root 133 Jan 22 10:18 ..
-rw-rw----. 1 root trainers 68 Jan 23 14:08 README-materials.txt
[trainer1@ip-10-0-2-223 materials]$
```

**Access test after proper ACL..... To be continued**

## TEST SUPPORT ACCESS

All behaviours working as expected

```
support1@ip-10-0-2-223:/logs
[student1@ip-10-0-2-223 ~]$ exit
logout
[ec2-user@ip-10-0-2-223 ~]$ sudo su - support1
Last login: Fri Jan 23 12:21:08 UTC 2026 on pts/4
[support1@ip-10-0-2-223 ~]$ 
[support1@ip-10-0-2-223 ~]$ cd /logs
[support1@ip-10-0-2-223 logs]$ 
[support1@ip-10-0-2-223 logs]$ ls -la
total 4
drwxr-x---. 2 root support 29 Jan 23 14:05 .
drwxr-xr-x. 8 root root 133 Jan 22 10:18 ..
-rw-r-----. 1 root support 54 Jan 23 14:08 README-logs.txt
[support1@ip-10-0-2-223 logs]$ 
[support1@ip-10-0-2-223 logs]$ cat README-logs.txt
EduCloud Logs Directory - System and application logs
[support1@ip-10-0-2-223 logs]$ 
[support1@ip-10-0-2-223 logs]$ echo "Test" > test-support.txt
-bash: test-support.txt: Permission denied
[support1@ip-10-0-2-223 logs]$ 
[support1@ip-10-0-2-223 logs]$ cd /materials
-bash: cd: /materials: Permission denied
[support1@ip-10-0-2-223 logs]$ 
[support1@ip-10-0-2-223 logs]$ cd /assignments
-bash: cd: /assignments: Permission denied
[support1@ip-10-0-2-223 logs]$ |
```

## FILE PERMISSIONS & ACLs CONFIGURATION

### CONFIGURING ACLs FOR /materials

Trainers = Read/Write, Students = Read-only

Current ACL

```
ec2-user@ip-10-0-2-223:~  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$ ls -ld /materials  
lrwxrwxrwx. 1 root root 28 Jan 22 10:09 /materials -> /mnt/educloud-data/materials  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$ getfacl //materials  
getfacl: Removing leading '/' from absolute path names  
# file: materials  
# owner: root  
# group: trainers  
user::rwx  
group::rwx  
other::---  
[ec2-user@ip-10-0-2-223 ~]$ |
```

## ADD ACL FOR STUDENTS (READ-ONLY)

```
ec2-user@ip-10-0-2-223:~  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$ sudo setfacl -m g:students:r /materials  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$ getfacl /materials  
getfacl: Removing leading '/' from absolute path names  
# file: materials  
# owner: root  
# group: trainers  
user::rwx  
group::rwx  
group:students:r-x  
mask::rwx  
other::---  
[ec2-user@ip-10-0-2-223 ~]$
```

ACL added to /materials for students read only

```
ec2-user@ip-10-0-2-223:~  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$ sudo setfacl -m g:students:r /materials  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$ getfacl /materials  
getfacl: Removing leading '/' from absolute path names  
# file: materials  
# owner: root  
# group: trainers  
user::rwx  
group::rwx  
group:students:r-x  
mask::rwx  
other::---  
  
[ec2-user@ip-10-0-2-223 ~]$ ls -ld /materials  
lrwxrwxrwx. 1 root root 28 Jan 22 10:09 /materials -> /mnt/educloud-data/materials  
[ec2-user@ip-10-0-2-223 ~]$ ls -ld /mnt/educloud-data/materials  
drwxrwx---+ 2 root trainers 34 Jan 23 14:04 /mnt/educloud-data/materials  
[ec2-user@ip-10-0-2-223 ~]$
```

## SET DEFAULT ACL ON /materials

Default ACLs ensure new files inherit the same permissions:

```
ec2-user@ip-10-0-2-223:~$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ sudo setfacl -d -m g:students:rwx /materials [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ sudo setfacl -d -m g:trainers:rwx /materials [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ getfacl /materials getfacl: Removing leading '/' from absolute path names # file: materials # owner: root # group: trainees user::rwx group::rwx group:students:r-x mask::rwx other::--- default:user::rwx default:group::rwx default:group:trainers:rwx default:group:students:r-x default:mask::rwx default:other::--- [ec2-user@ip-10-0-2-223 ~]$ |
```

```
trainer1@ip-10-0-2-223:/materials:~$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ whoami ec2-user [ec2-user@ip-10-0-2-223 ~]$ sudo su - trainer1 Last login: Fri Jan 23 14:16:00 UTC 2026 on pts/2 [trainer1@ip-10-0-2-223 ~]$ [trainer1@ip-10-0-2-223 ~]$ cd /materials [trainer1@ip-10-0-2-223 materials]$ [trainer1@ip-10-0-2-223 materials]$ ls -la total 4 drwxrwx---+ 2 root trainers 34 Jan 23 14:04 . drwxr-xr-x. 8 root root 133 Jan 22 10:18 .. -rw-rw----. 1 root trainers 68 Jan 23 14:08 README-materials.txt [trainer1@ip-10-0-2-223 materials]$ cat lecture1.pdf cat: lecture1.pdf: No such file or directory [trainer1@ip-10-0-2-223 materials]$ cat README-materials.txt EduCloud Materials Directory - Trainers upload study materials here [trainer1@ip-10-0-2-223 materials]$
```

New file created in materials inherits r-w for in /materials

```

 trainer1@ip-10-0-2-223:/materials
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ whoami
ec2-user
[ec2-user@ip-10-0-2-223 ~]$ sudo su - trainer1
Last login: Fri Jan 23 14:16:00 UTC 2026 on pts/2
[trainer1@ip-10-0-2-223 ~]$ 
[trainer1@ip-10-0-2-223 ~]$ cd /materials
[trainer1@ip-10-0-2-223 materials]$ 
[trainer1@ip-10-0-2-223 materials]$ ls -la
total 4
drwxrwx---+ 2 root trainers 34 Jan 23 14:04 .
drwxr-xr-x. 8 root root 133 Jan 22 10:18 ..
-rw-rw----. 1 root trainers 68 Jan 23 14:08 README-materials.txt
[trainer1@ip-10-0-2-223 materials]$ cat lecture1.pdf
cat: lecture1.pdf: No such file or directory
[trainer1@ip-10-0-2-223 materials]$ cat README-materials.txt
EduCloud Materials Directory - Trainers upload study materials here
[trainer1@ip-10-0-2-223 materials]$ echo "New material by trainer1" > lecture1.pdf
[trainer1@ip-10-0-2-223 materials]$ 
[trainer1@ip-10-0-2-223 materials]$ cat lecture1.pdf
New material by trainer1
[trainer1@ip-10-0-2-223 materials]$ 
[trainer1@ip-10-0-2-223 materials]$ getfacl lecture1.pdf
# file: lecture1.pdf
# owner: trainer1
# group: trainers
user::rw-
group::rwx          #effective:rwx-
group:trainers:rwx   #effective:rwx-
group:students:r-x   #effective:r-- 
mask::rw-
other::---
```

## **write access denied for student to create files in materials**

```

 student1@ip-10-0-2-223:/materials
[trainer1@ip-10-0-2-223 materials]$ exit
logout
[ec2-user@ip-10-0-2-223 ~]$ sudo su - student1
Last login: Fri Jan 23 14:19:43 UTC 2026 on pts/2
[student1@ip-10-0-2-223 ~]$ 
[student1@ip-10-0-2-223 ~]$ cd /materials
[student1@ip-10-0-2-223 materials]$ 
[student1@ip-10-0-2-223 materials]$ ls -la
total 8
drwxrwx---+ 2 root     trainers 54 Jan 23 15:24 .
drwxr-xr-x. 8 root     root    133 Jan 22 10:18 ..
-rw-rw----. 1 root     trainers 68 Jan 23 14:08 README-materials.txt
-rw-rw----+ 1 trainer1 trainers 25 Jan 23 15:24 lecture1.pdf
[student1@ip-10-0-2-223 materials]$ 
[student1@ip-10-0-2-223 materials]$ 
[student1@ip-10-0-2-223 materials]$ cat lecture1.pdf
New material by trainer1
[student1@ip-10-0-2-223 materials]$ 
[student1@ip-10-0-2-223 materials]$ echo "Test" > test.txt
-bash: test.txt: Permission denied
[student1@ip-10-0-2-223 materials]$
```

## **CONFIGURE ACLs FOR /assignments**

**Students = Read/Write, Trainers = Read-only**

Give trainers group read and execute permissions

```
[ec2-user@ip-10-0-2-223:~]$  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$ sudo setfacl -m g:trainers:rx /assignments  
[ec2-user@ip-10-0-2-223 ~]$ getfacl /assignments  
getfacl: Removing leading '/' from absolute path names  
# file: assignments  
# owner: root  
# group: students  
user::rwx  
group::rwx  
group:trainers:r-x  
mask::rwx  
other::---  
  
[ec2-user@ip-10-0-2-223 ~]$
```

## SET DEFAULT ACL ON /assignments

```
[ec2-user@ip-10-0-2-223:~]$  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$ sudo setfacl -d -m g:trainers:rx /assignments  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$ sudo setfacl -d -m g:students:rwx /assignments  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$ getfacl /assignments  
getfacl: Removing leading '/' from absolute path names  
# file: assignments  
# owner: root  
# group: students  
user::rwx  
group::rwx  
group:trainers:r-x  
mask::rwx  
other::---  
default:user::rwx  
default:group::rwx  
default:group:trainers:r-x  
default:group:students:rwx  
default:mask::rwx  
default:other::---  
  
[ec2-user@ip-10-0-2-223 ~]$ |
```

## TEST /assignments ACCESS

```
student1@ip-10-0-2-223:~]$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ sudo su - student1 Last login: Fri Jan 23 15:31:13 UTC 2026 on pts/7 [student1@ip-10-0-2-223 ~]$ [student1@ip-10-0-2-223 ~]$ cd /assignments [student1@ip-10-0-2-223 assignments]$ [student1@ip-10-0-2-223 assignments]$ [student1@ip-10-0-2-223 assignments]$ echo "Assignment submission by student1" > assignment1.tar.gz [student1@ip-10-0-2-223 assignments]$ [student1@ip-10-0-2-223 assignments]$ ls -la total 8 drwxrwx---+ 2 root students 62 Jan 23 15:39 . drwxr-xr-x. 8 root root 133 Jan 22 10:18 .. -rw-rw----. 1 root students 66 Jan 23 14:08 README-assignments.txt -rw-rw----+ 1 student1 students 34 Jan 23 15:39 assignment1.tar.gz [student1@ip-10-0-2-223 assignments]$ [student1@ip-10-0-2-223 assignments]$ cat assignment1.tar.gz Assignment submission by student1 [student1@ip-10-0-2-223 assignments]$ [student1@ip-10-0-2-223 assignments]$ |
```

## Trainer rest on assignment and materials

Trainers can read /assignments but cannot write

```
trainer1@ip-10-0-2-223:~]$ cd /assignments [trainer1@ip-10-0-2-223 assignments]$ [trainer1@ip-10-0-2-223 assignments]$ ls -la total 8 drwxrwx---+ 2 root students 62 Jan 23 15:39 . drwxr-xr-x. 8 root root 133 Jan 22 10:18 .. -rw-rw----. 1 root students 66 Jan 23 14:08 README-assignments.txt -rw-rw----+ 1 student1 students 34 Jan 23 15:39 assignment1.tar.gz [trainer1@ip-10-0-2-223 assignments]$ [trainer1@ip-10-0-2-223 assignments]$ cat assignment1.tar.gz Assignment submission by student1 [trainer1@ip-10-0-2-223 assignments]$ [trainer1@ip-10-0-2-223 assignments]$ echo "Grading" > grades.txt -bash: grades.txt: Permission denied [trainer1@ip-10-0-2-223 assignments]$ [trainer1@ip-10-0-2-223 assignments]$ |
```

## CONFIGURE ACLs FOR /logs

Support = Read-only, Trainers = Read/Write, Students = No access

### ADD ACL FOR TRAINERS (READ/WRITE) ON /logs

trainers group read, write, and execute permissions

Support group already has r-x from basic permissions

```
ec2-user@ip-10-0-2-223:~  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$ sudo setfacl -m g:trainers:rwx /logs  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$ getfacl /logs  
getfacl: Removing leading '/' from absolute path names  
# file: logs  
# owner: root  
# group: support  
user::rwx  
group::r-x  
group:trainers:rwx  
mask::rwx  
other::---  
  
[ec2-user@ip-10-0-2-223 ~]$
```

## SET DEFAULT ACL ON /logs

```
ec2-user@ip-10-0-2-223:~  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$ sudo setfacl -d -m g:trainers:rwx /logs  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$ sudo setfacl -d -m g:support:rwx /logs  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$ getfacl /logs  
getfacl: Removing leading '/' from absolute path names  
# file: logs  
# owner: root  
# group: support  
user::rwx  
group::r-x  
group:trainers:rwx  
mask::rwx  
other::---  
default:user::rwx  
default:group::r-x  
default:group:trainers:rwx  
default:group:support:r-x  
default:mask::rwx  
default:other::---  
  
[ec2-user@ip-10-0-2-223 ~]$
```

## TEST /logs ACCESS

trainers group read, write, and execute permissions

**Trainer**

```
trainer1@ip-10-0-2-223:~  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$ sudo su - trainer1  
Last login: Fri Jan 23 15:40:20 UTC 2026 on pts/7  
[trainer1@ip-10-0-2-223 ~]$  
[trainer1@ip-10-0-2-223 ~]$ echo "Application log entry by trainer1" > app.log  
[trainer1@ip-10-0-2-223 ~]$  
[trainer1@ip-10-0-2-223 ~]$ ls -la  
total 20  
drwx----- 2 trainer1 trainners 98 Jan 23 15:47 .  
drwxr-xr-x 10 root root 135 Jan 23 12:01 ..  
-rw----- 1 trainer1 trainners 385 Jan 23 15:44 .bash_history  
-rw-r--r-- 1 trainer1 trainners 18 Jan 28 2023 .bash_logout  
-rw-r--r-- 1 trainer1 trainners 141 Jan 28 2023 .bash_profile  
-rw-r--r-- 1 trainer1 trainners 492 Jan 28 2023 .bashrc  
-rw-r--r-- 1 trainer1 trainners 34 Jan 23 15:47 app.log  
[trainer1@ip-10-0-2-223 ~]$  
[trainer1@ip-10-0-2-223 ~]$ cat app.log  
Application log entry by trainer1  
[trainer1@ip-10-0-2-223 ~]$  
[trainer1@ip-10-0-2-223 ~]$
```

### /logs access control working correctly

```
support1@ip-10-0-2-223:/logs  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$ sudo su - support1  
Last login: Fri Jan 23 15:49:28 UTC 2026 on pts/7  
[support1@ip-10-0-2-223 ~]$  
[support1@ip-10-0-2-223 ~]$ cd /logs  
[support1@ip-10-0-2-223 logs]$  
[support1@ip-10-0-2-223 logs]$ ls -la  
total 8  
drwxrwx---+ 2 root support 44 Jan 23 15:50 .  
drwxr-xr-x 8 root root 133 Jan 22 10:18 ..  
-rw-r---- 1 root support 54 Jan 23 14:08 README-logs.txt  
-rw-rw----+ 1 trainer1 trainners 34 Jan 23 15:50 app.log  
[support1@ip-10-0-2-223 logs]$  
[support1@ip-10-0-2-223 logs]$ cat app.log  
Application log entry by trainer1  
[support1@ip-10-0-2-223 logs]$  
[support1@ip-10-0-2-223 logs]$  
[support1@ip-10-0-2-223 logs]$ echo "Test" > test.log  
-bash: test.log: Permission denied  
[support1@ip-10-0-2-223 logs]$
```

### Complete ACL configuration summary

```

support1@ip-10-0-2-223:~/logs$ 
[support1@ip-10-0-2-223 logs]$ 
[support1@ip-10-0-2-223 logs]$ getfacl /materials
getfacl: Removing leading '/' from absolute path names
# file: materials
# owner: root
# group: trainers
user::rwx
group::rwx
group:students:r-x
mask::rwx
other::---
default:user::rwx
default:group::rwx
default:group:trainers:rwx
default:group:students:r-x
default:mask::rwx
default:other::---

[support1@ip-10-0-2-223 logs]$ getfacl /assignments
getfacl: Removing leading '/' from absolute path names
# file: assignments
# owner: root
# group: students
user::rwx
group::rwx
group:trainers:r-x
mask::rwx
other::---
default:user::rwx
default:group::rwx
default:group:trainers:r-x
default:group:students:rwx
default:mask::rwx
default:other::---

[support1@ip-10-0-2-223 logs]$ getfacl /logs
getfacl: Removing leading '/' from absolute path names
# file: logs
# owner: root
# group: support
user::rwx
group::r-x
group:trainers:rwx
mask::rwx
other::---
default:user::rwx
default:group::r-x
default:group:trainers:rwx

```

## TEST FILES CREATION AND VERIFY INHERITANCE

### /materials

#### **students:r-x inherited**

```

trainer1@ip-10-0-2-223:~/materials$ 
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ sudo su - trainer1
Last login: Fri Jan 23 15:50:18 UTC 2026 on pts/7
[trainer1@ip-10-0-2-223 ~]$ 
[trainer1@ip-10-0-2-223 ~]$ cd /materials
[trainer1@ip-10-0-2-223 materials]$ 
[trainer1@ip-10-0-2-223 materials]$ echo "Test inheritance" > test-inheritance.txt
[trainer1@ip-10-0-2-223 materials]$ 
[trainer1@ip-10-0-2-223 materials]$ ls
README-materials.txt lecture1.pdf test-inheritance.txt
[trainer1@ip-10-0-2-223 materials]$ getfacl test-inheritance.txt
# file: test-inheritance.txt
# owner: trainer1
# group: trainers
user::rw-
group::rwx          #effective:rw-
group:trainers:rwx   #effective:rw-
group:students:r-x   #effective:r--
mask::rw-
other::---

[trainer1@ip-10-0-2-223 materials]$ |

```

Test file creation as student1 in /assignments

trainers: r-x inherited

```
student1@ip-10-0-2-223:~/assignments$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ sudo su - student1 Last login: Fri Jan 23 15:38:59 UTC 2026 on pts/7 [student1@ip-10-0-2-223 ~]$ [student1@ip-10-0-2-223 ~]$ cd /assignments [student1@ip-10-0-2-223 assignments]$ [student1@ip-10-0-2-223 assignments]$ [student1@ip-10-0-2-223 assignments]$ echo "Test inheritance" > test-inheritance.txt [student1@ip-10-0-2-223 assignments]$ [student1@ip-10-0-2-223 assignments]$ [student1@ip-10-0-2-223 assignments]$ getfacl test-inheritance.txt # file: test-inheritance.txt # owner: student1 # group: students user::rw- group::rwx #effective:rwx group:trainers:r-x #effective:r-- group:students:rwx #effective:rwx mask::rw- other::--- [student1@ip-10-0-2-223 assignments]$ |
```

## LVM STORAGE SETUP

### CURRENT STORAGE

```
ec2-user@ip-10-0-2-223:~$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ lsblk NAME MAJ:MIN RM SIZE RO TYPE MOUNTPOINTS nvmeOn1 259:0 0 8G 0 disk |-nvmeOn1p1 259:2 0 8G 0 part / |-nvmeOn1p127 259:3 0 1M 0 part |-nvmeOn1p128 259:4 0 10M 0 part /boot/efi nvmeIn1 259:1 0 20G 0 disk /mnt/educloud-data [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ df -h /mnt/educloud-data Filesystem Size Used Avail Use% Mounted on /dev/nvmeIn1 20G 176M 20G 1% /mnt/educloud-data [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ |
```

### BACKUP ALL DATA

**Backup all data preserves permissions**

```

 ec2-user@ip-10-0-2-223:~$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ sudo mkdir -p /backup-educloud [ec2-user@ip-10-0-2-223 ~]$ sudo rsync -av /mnt/educloud-data/ /backup-educloud/ sending incremental file list ./. test-file.txt assignments/ assignments/README-assignments.txt assignments/assignment1.tar.gz assignments/test-inheritance.txt backups/ logs/ logs/README-logs.txt logs/app.log materials/ materials/README-materials.txt materials/lecture1.pdf materials/test-inheritance.txt sensitive_data/ training_data/ training_data/README-training.txt sent 1,572 bytes received 241 bytes 3,626.00 bytes/sec total size is 413 speedup is 0.23 [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ ls -la /backup-educloud/ total 20 drwxr-xr-x. 8 root root 133 Jan 22 10:18 . dr-xr-xr-x. 19 root root 16384 Jan 24 06:15 .. drwxrwx---. 2 root students 90 Jan 23 15:59 assignments drwxr-xr-x. 2 root root 6 Jan 22 10:04 backups drwxrwx---. 2 root support 44 Jan 23 15:50 logs drwxrwx---. 2 root trainers 82 Jan 23 15:56 materials drwx-----. 2 root trainers 6 Jan 22 10:04 sensitive_data -rw-r--r--. 1 root root 35 Jan 22 10:19 test-file.txt drwxr-xr-x. 2 root root 33 Jan 23 14:07 training_data [ec2-user@ip-10-0-2-223 ~]$
```

## Fstab backup

### REMOVE EXISTING FSTAB ENTRY

```

 ec2-user@ip-10-0-2-223:~$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ sudo cp /etc/fstab /etc/fstab.backup-before-lvm [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ cat /etc/fstab # UUID=497419d5-2417-43e6-927d-6777766bb648 / xfs defaults,noatime 1 1 UUID=A1F2-F73A /boot/efi vfat defaults,noatime,uid=0,gid=0,umask=0077,shortname=winnt,x-systemd.automount 0 2 UUID=5cffeffb-9385-44c6-898f-a8d84840e9ac /mnt/educloud-data xfs defaults,nofail 0 2 [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ sudo nano /etc/fstab [ec2-user@ip-10-0-2-223 ~]$ sudo nano /etc/fstab [ec2-user@ip-10-0-2-223 ~]$ cat /etc/fstab # UUID=497419d5-2417-43e6-927d-6777766bb648 / xfs defaults,noatime 1 1 UUID=A1F2-F73A /boot/efi vfat defaults,noatime,uid=0,gid=0,umask=0077,shortname=winnt,x-systemd.automount 0 2 #UUID=5cffeffb-9385-44c6-898f-a8d84840e9ac /mnt/educloud-data xfs defaults,nofail 0 2 [ec2-user@ip-10-0-2-223 ~]$ |
```

### UNMOUNT THE DISK

```

ec2-user@ip-10-0-2-223:~ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ df -h | grep educloud-data /dev/nvme1n1 20G 176M 20G 1% /mnt/educloud-data [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ lsblk NAME MAJ:MIN RM SIZE RO TYPE MOUNTPOINTS nvme0n1 259:0 0 8G 0 disk |nvme0n1p1 259:2 0 8G 0 part / |nvme0n1p127 259:3 0 1M 0 part |nvme0n1p128 259:4 0 10M 0 part /boot/efi nvme1n1 259:1 0 20G 0 disk /mnt/educloud-data [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ sudo umount /mnt/educloud-data [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ df -h | grep educloud-data [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ lsblk NAME MAJ:MIN RM SIZE RO TYPE MOUNTPOINTS nvme0n1 259:0 0 8G 0 disk |nvme0n1p1 259:2 0 8G 0 part / |nvme0n1p127 259:3 0 1M 0 part |nvme0n1p128 259:4 0 10M 0 part /boot/efi nvme1n1 259:1 0 20G 0 disk [ec2-user@ip-10-0-2-223 ~]$ |

```

## REPARTITIONING THE DISK

```

ec2-user@ip-10-0-2-223:~ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ sudo fdisk /dev/nvme1n1 Welcome to fdisk (util-linux 2.37.4). Changes will remain in memory only, until you decide to write them. Be careful before using the write command. The device contains 'xfs' signature and it will be removed by a write command. See fdisk(8) man page and --wipe option for more details. Device does not contain a recognized partition table. Created a new DOS disklabel with disk identifier 0xc7b884f0. Command (m for help): n Partition type p primary (0 primary, 0 extended, 4 free) e extended (container for logical partitions) Select (default p): p Partition number (1-4, default 1): 1 First sector (2048-41943039, default 2048): Last sector, +/-sectors or +/-size{K,M,G,T,P} (2048-41943039, default 41943039): +10G Created a new partition 1 of type 'Linux' and of size 10 GiB. Command (m for help): n Partition type p primary (1 primary, 0 extended, 3 free) e extended (container for logical partitions) Select (default p): p Partition number (2-4, default 2): 2 First sector (20973568-41943039, default 20973568): Last sector, +/-sectors or +/-size{K,M,G,T,P} (20973568-41943039, default 41943039): Created a new partition 2 of type 'Linux' and of size 10 GiB. Command (m for help): p Disk /dev/nvme1n1: 20 GiB, 21474836480 bytes, 41943040 sectors Disk model: Amazon Elastic Block Store Units: sectors of 1 .. 512 = 512 bytes Sector size (logical/physical): 512 bytes / 512 bytes I/O size (minimum/optimal): 4096 bytes / 4096 bytes DiskLabel type: dos Disk identifier: 0xc7b884f0 Device Boot Start End Sectors Size Id Type /dev/nvme1n1p1 2048 20973567 20971520 10G 83 Linux /dev/nvme1n1p2 20973568 41943039 20969472 10G 83 Linux Command (m for help): |

```

```
[ec2-user@ip-10-0-2-223:~]$ lsblk
NAME      MAJ:MIN RM  SIZE RO TYPE MOUNTPOINTS
nvme0n1    259:0   0   8G  0 disk 
└─nvme0n1p1 259:2   0   8G  0 part /
└─nvme0n1p127 259:3   0   1M  0 part 
└─nvme0n1p128 259:4   0  10M  0 part /boot/efi
nvme1n1    259:1   0  20G  0 disk 
└─nvme1n1p1 259:7   0  10G  0 part 
└─nvme1n1p2 259:8   0  10G  0 part 
[ec2-user@ip-10-0-2-223 ~]$ |
```

## FORMAT AND RESTORE DATA PARTITION

### FORMATING FIRST PARTITION 10GB FOR OLD DATA

```
[ec2-user@ip-10-0-2-223:~]$ 
[ec2-user@ip-10-0-2-223:~]$ 
[ec2-user@ip-10-0-2-223:~]$ sudo mkfs.xfs /dev/nvme1n1p1
meta-data=/dev/nvme1n1p1             isize=512    agcount=16, agsize=163840 blks
                                    =           sectsz=512  attr=2, projid32bit=1
                                    =           crc=1     finobt=1, sparse=1, rmapbt=0
                                    =           reflink=1 bigtime=1 inobtcount=1 nrext64=0
data        =           bsize=4096   blocks=2621440, imaxpct=25
            =           sunit=1    swidth=1 blks
naming      =version 2              bsize=4096   ascii-ci=0, ftype=1, parent=0
log         =internal log          bsize=4096   blocks=16384, version=2
            =           sectsz=512  sunit=1 blks, lazy-count=1
realtime    =none                  extsz=4096   blocks=0, rtextents=0
[ec2-user@ip-10-0-2-223:~]$ file -s /dev/nvme1n1p1
/dev/nvme1n1p1: no read permission
[ec2-user@ip-10-0-2-223:~]$ sudo file -s /dev/nvme1n1p1
/dev/nvme1n1p1: SGI XFS filesystem data (blksz 4096, inosz 512, v2 dirs)
[ec2-user@ip-10-0-2-223:~]$
```

### MOUNTED DATA TO PARTITION

#### 10GB Partition for Educloud data

```
[ec2-user@ip-10-0-2-223:~]$ 
[ec2-user@ip-10-0-2-223:~]$ 
[ec2-user@ip-10-0-2-223:~]$ 
[ec2-user@ip-10-0-2-223:~]$ sudo mount /dev/nvme1n1p1 /mnt/educloud-data
[ec2-user@ip-10-0-2-223:~]$ 
[ec2-user@ip-10-0-2-223:~]$ df -h /mnt/educloud-data
Filesystem      Size  Used Avail Use% Mounted on
/dev/nvme1n1p1  10G  104M  9.9G   2% /mnt/educloud-data
[ec2-user@ip-10-0-2-223:~]$
```

### RESTORED DATA

```

 ec2-user@ip-10-0-2-223:~ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ sudo rsync -av /backup-educloud/ /mnt/educloud-data/ sending incremental file list / test-file.txt assignments/ assignments/README-assignments.txt assignments/assignments.tar.gz assignments/test-inheritance.txt backups/ logs/ logs/README-logs.txt logs/app.log materials/ materials/README-materials.txt materials/lecture1.pdf materials/test-inheritance.txt sensitive_data/ training_data/ training_data/README-training.txt sent 1,574 bytes received 241 bytes 3,630.00 bytes/sec total size is 413 speedup is 0.23 [ec2-user@ip-10-0-2-223 ~]$ ls -la /mnt/educloud-data/ total 4 drwxr-xr-x  8 root root   133 Jan 22 10:18 . drwxr-xr-x  3 root root    27 Jan 22 09:52 .. drwxrwx---  2 root students  90 Jan 23 15:59 assignments drwxr-xr-x  2 root root     6 Jan 22 10:04 backups drwxrwx---  2 root root    44 Jan 23 15:50 backup drwxr-xr-x  2 root trainers  82 Jan 23 15:56 materials drwxrwx---  2 root trainers  6 Jan 22 10:04 sensitive_data -rw-r--r--  1 root root   35 Jan 22 10:19 test-file.txt drwxr-xr-x  2 root root   33 Jan 23 14:07 training_data [ec2-user@ip-10-0-2-223 ~]$ ls -la /materials/

```

## Data restored to 10GB partition

```

 ec2-user@ip-10-0-2-223:~ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ df -h /mnt/educloud-data Filesystem      Size  Used Avail Use% Mounted on /dev/nvme1n1p1   10G  105M  9.9G   2% /mnt/educloud-data [ec2-user@ip-10-0-2-223 ~]$ |

```

## UPDATING FSTAB FOR DATA PARTITION

/mnt/educloud-data is attached to the new partition 10GB

Removed backup to free space

```

 ec2-user@ip-10-0-2-223:~ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ sudo blkid /dev/nvme1n1p1 /dev/nvme1n1p1: UUID="08c06783-cd31-41ca-8beb-7fa12a97c3f5" BLOCK_SIZE="512" TYPE="xfs" PARTUUID="c7b884f0-01" [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ sudo nano /etc/fstab [ec2-user@ip-10-0-2-223 ~]$ sudo nano /etc/fstab [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ sudo umount /mnt/educloud-data [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ sudo mount -a [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ df -h /mnt/educloud-data Filesystem      Size  Used Avail Use% Mounted on /dev/nvme1n1p1   10G  105M  9.9G   2% /mnt/educloud-data [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ sudo rm -rf /backup-educloud/ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ ls -la /backup-educloud/ ls: cannot access '/backup-educloud/': No such file or directory [ec2-user@ip-10-0-2-223 ~]$ 

```

## CREATE PHYSICAL VOLUME

Creating Physical Volume on partition 2

Creating Volume Group named "training\_vg" with 10GB capacity

Volume Group created (10GB)

```
ec2-user@ip-10-0-2-223 ~]$ sudo pvcreate /dev/nvme1n1p2
Physical volume "/dev/nvme1n1p2" successfully created.
[ec2-user@ip-10-0-2-223 ~]$ sudo pvdisk /dev/nvme1n1p2
"/dev/sdf2" is a new physical volume of "<10.00 GiB"
--- NEW Physical volume ---
PV Name           /dev/sdf2
VG Name
PV Size          <10.00 GiB
Allocatable      NO
PE Size          0
Total PE         0
Free PE          0
Allocated PE     0
PV UUID          ZOpmXa-3ZRF-E98R-055I-MG4i-8w1C-jjF1aM

[ec2-user@ip-10-0-2-223 ~]$ sudo pvs
PV             VG Fmt Attr PSize  PFree
/dev/sdf2      lvm2 ---  <10.00g <10.00g
[ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ sudo vgcreate training_vg /dev/nvme1n1p2
Volume group "training_vg" successfully created
[ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ vfdisk
-bash: vfdisk: command not found
[ec2-user@ip-10-0-2-223 ~]$ vgdisplay
WARNING: Running as a non-root user. Functionality may be unavailable.
/run/lock/lvm/P_global:aux: open failed: Permission denied
[ec2-user@ip-10-0-2-223 ~]$ sudo vgdisplay
--- Volume group ---
VG Name          training_vg
System ID
Format          lvm2
Metadata Areas  1
Metadata Sequence No 1
VG Access       read/write
VG Status       resizable
MAX LV          0
Cur LV          0
Open LV          0
Max PV          0
Cur PV          1
Act PV          1
VG Size         <10.00 GiB
PE Size          4.00 MiB
```

```
root@ip-10-0-2-223:/home/ec2-user
```

```
[ec2-user@ip-10-0-2-223 ~]$ sudo su
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# pvs
PV             VG Fmt Attr PSize  PFree
/dev/sdf2      training_vg lvm2 a--  <10.00g <10.00g
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# vgs
VG             #PV #LV #SN Attr   VSize   VFree
training_vg    1   0   0 wz--n- <10.00g <10.00g
[root@ip-10-0-2-223 ec2-user]# |
```

## CREATE LOGICAL VOLUME (5GB)

Created 5GB Logical Volume

## Logical volume "training\_lv"

```
root@ip-10-0-2-223:~# [root@ip-10-0-2-223 ~]# [root@ip-10-0-2-223 ~]# [root@ip-10-0-2-223 ~]# [root@ip-10-0-2-223 ~]# [root@ip-10-0-2-223 ~]# sudo lvcreate -L 5G -n training_lv training_vg Logical volume "training_lv" created. [root@ip-10-0-2-223 ~]# [root@ip-10-0-2-223 ~]# sudo lvdisk /dev/training_vg/training_lv --- Logical volume --- LV Path          /dev/training_vg/training_lv LV Name         training_lv VG Name         training_vg LV UUID          hSnL0K-TzxY-7wbU-iARw-ng4L-HUgc-MIjy25 LV Write Access  read/write LV Creation host, time ip-10-0-2-223.ec2.internal, 2026-01-24 06:51:22 +0000 LV Status       available # open          0 LV Size        5.00 GiB Current LE     1280 Segments       1 Allocation      inherit Read ahead sectors auto - currently set to 256 Block device   253:0 [root@ip-10-0-2-223 ~]# |
```

## Partition structure

```
root@ip-10-0-2-223:~# [root@ip-10-0-2-223 ~]# [root@ip-10-0-2-223 ~]# [root@ip-10-0-2-223 ~]# [root@ip-10-0-2-223 ~]# lsblk NAME           MAJ:MIN RM  SIZE RO TYPE MOUNTPOINTS nvme0n1          259:0    0   8G  0 disk nvme0n1p1        259:2    0   8G  0 part / nvme0n1p127      259:3    0   1M  0 part nvme0n1p128      259:4    0  10M  0 part /boot/efi nvme1n1          259:1    0  20G  0 disk nvme1n1p1        259:7    0  10G  0 part /mnt/educloud-data nvme1n1p2        259:8    0  10G  0 part └─training_vg-training_lv 253:0    0   5G  0 lvm [root@ip-10-0-2-223 ~]#
```

## FORMATING AND MOUNTING LVM VOLUME

### FORMATING LOGICAL VOLUME

**5GB LVM volume is mounted!**

```

 ec2-user@ip-10-0-2-223:~  

[ec2-user@ip-10-0-2-223 ~]$  

[ec2-user@ip-10-0-2-223 ~]$  

[ec2-user@ip-10-0-2-223 ~]$  

[ec2-user@ip-10-0-2-223 ~]$  

[ec2-user@ip-10-0-2-223 ~]$  

[ec2-user@ip-10-0-2-223 ~]$ df -h /mnt/educloud-data/training_data  

Filesystem Size Used Avail Use% Mounted on  

/dev/mapper/training_vg-training_lv 4.9G 24K 4.6G 1% /mnt/educloud-data/training_data  

[ec2-user@ip-10-0-2-223 ~]$  

[ec2-user@ip-10-0-2-223 ~]$  

[ec2-user@ip-10-0-2-223 ~]$
```

## **CONFIGURE AUTO-MOUNT /etc/fstab for new mount /training\_data auto-mount**

```

 ec2-user@ip-10-0-2-223:~  

[ec2-user@ip-10-0-2-223 ~]$  

[ec2-user@ip-10-0-2-223 ~]$  

[ec2-user@ip-10-0-2-223 ~]$  

[ec2-user@ip-10-0-2-223 ~]$  

[ec2-user@ip-10-0-2-223 ~]$ df -h /mnt/educloud-data/training_data  

Filesystem Size Used Avail Use% Mounted on  

/dev/mapper/training_vg-training_lv 4.9G 24K 4.6G 1% /mnt/educloud-data/training_data  

[ec2-user@ip-10-0-2-223 ~]$  

[ec2-user@ip-10-0-2-223 ~]$  

[ec2-user@ip-10-0-2-223 ~]$ echo "/dev/training_vg/training_lv /training_data ext4 defaults,nofail 0 2" | sudo tee -a /etc/fstab  

/dev/training_vg/training_lv /training_data ext4 defaults,nofail 0 2  

[ec2-user@ip-10-0-2-223 ~]$  

[ec2-user@ip-10-0-2-223 ~]$ cat /etc/fstab | grep training_data  

/dev/training_vg/training_lv /training_data ext4 defaults,nofail 0 2  

[ec2-user@ip-10-0-2-223 ~]$  

[ec2-user@ip-10-0-2-223 ~]$ cat /etc/fstab  

#  

UUID=497419d5-2417-43e6-927d-6777766bb648 / xfs defaults,noatime 1 1  

UUID=A1F2-F73A /boot/efi vfat defaults,noatime,uid=0,gid=0,umask=077,shortname=winnt,x-systemd.automount 0 2  

UUID=08c06783-cd31-41ca-8beb-7fa12a97c3f5 /mnt/educloud-data xfs defaults,nofail 0 2  

/dev/training_vg/training_lv /training_data ext4 defaults,nofail 0 2  

[ec2-user@ip-10-0-2-223 ~]$ cat /etc/fstab  

#  

UUID=497419d5-2417-43e6-927d-6777766bb648 / xfs defaults,noatime 1 1  

UUID=A1F2-F73A /boot/efi vfat defaults,noatime,uid=0,gid=0,umask=077,shortname=winnt,x-systemd.automount 0 2  

UUID=08c06783-cd31-41ca-8beb-7fa12a97c3f5 /mnt/educloud-data xfs defaults,nofail 0 2  

/dev/training_vg/training_lv /training_data ext4 defaults,nofail 0 2  

[ec2-user@ip-10-0-2-223 ~]$ |
```

## **DISK USAGE**

### **Pushed some demo file to track the usage**

```

 ec2-user@ip-10-0-2-223:~  

[ec2-user@ip-10-0-2-223 ~]$  

[ec2-user@ip-10-0-2-223 ~]$  

[ec2-user@ip-10-0-2-223 ~]$  

[ec2-user@ip-10-0-2-223 ~]$ for i in {1..10}; do  

    echo "Student $i assignment data for LVM demonstration" | sudo tee /training_data/student-assignments/assignment-$i.txt  

done  

Student 1 assignment data for LVM demonstration  

Student 2 assignment data for LVM demonstration  

Student 3 assignment data for LVM demonstration  

Student 4 assignment data for LVM demonstration  

Student 5 assignment data for LVM demonstration  

Student 6 assignment data for LVM demonstration  

Student 7 assignment data for LVM demonstration  

Student 8 assignment data for LVM demonstration  

Student 9 assignment data for LVM demonstration  

Student 10 assignment data for LVM demonstration  

[ec2-user@ip-10-0-2-223 ~]$ ls -la /training_data/*  

-rw-r--r--. 1 root root 99 Jan 24 09:03 /training_data/README.txt  

/training_data/course-data:  

total 0  

drwxr-xr-x. 2 root root 6 Jan 24 09:02 .  

drwxr-xr-x. 4 root root 70 Jan 24 09:03 ..  

/training_data/student-assignments:  

total 56  

drwxr-xr-x. 2 root root 16384 Jan 24 09:03 .  

drwxr-xr-x. 4 root root 70 Jan 24 09:03 ..  

-rw-r--r--. 1 root root 48 Jan 24 09:03 assignment-1.txt  

-rw-r--r--. 1 root root 49 Jan 24 09:03 assignment-10.txt  

-rw-r--r--. 1 root root 48 Jan 24 09:03 assignment-2.txt  

-rw-r--r--. 1 root root 48 Jan 24 09:03 assignment-3.txt  

-rw-r--r--. 1 root root 48 Jan 24 09:03 assignment-4.txt  

-rw-r--r--. 1 root root 48 Jan 24 09:03 assignment-5.txt  

-rw-r--r--. 1 root root 48 Jan 24 09:03 assignment-6.txt  

-rw-r--r--. 1 root root 48 Jan 24 09:03 assignment-7.txt  

-rw-r--r--. 1 root root 48 Jan 24 09:03 assignment-8.txt  

-rw-r--r--. 1 root root 48 Jan 24 09:03 assignment-9.txt  

[ec2-user@ip-10-0-2-223 ~]$ |
```

## Current usage

```
ec2-user@ip-10-0-2-223:~$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ df -h /training_data Filesystem Size Used Avail Use% Mounted on /dev/nvme0n1p1 8.0G 1.9G 6.2G 23% / [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ |
```

## FILLED DISK TO 80% CAPACITY

Create large file to fill disk to 80%+

created 3.8GB file

```
sudo dd if=/dev/zero of=/training_data/large-dataset.img bs=1M count=3800
```

## DISK TO 80% CAPACITY

```
ec2-user@ip-10-0-2-223:~$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ df -h /training_data Filesystem Size Used Avail Use% Mounted on /dev/mapper/training_vg-training_lv 4.9G 24K 4.6G 1% /training_data [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ sudo dd if=/dev/zero of=/training_data/large-dataset.img bs=1M count=3800 3800+0 records in 3800+0 records out 3984588800 bytes (4.0 GB, 3.7 GiB) copied, 28.5413 s, 140 MB/s [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ df -h /training_data Filesystem Size Used Avail Use% Mounted on /dev/mapper/training_vg-training_lv 4.9G 3.8G 884M 82% /training_data [ec2-user@ip-10-0-2-223 ~]$ |
```

/training\_data at 84% capacity

```
ec2-user@ip-10-0-2-223:~$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ ls -lh /training_data/ total 3.8G -rw-r--r--. 1 root root 3.8G Jan 24 09:16 large-dataset.img drwx----- 2 root root 16K Jan 24 08:51 lost+found [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ sudo vgs VG #PV #LV #SN Attr VSize VFree training_vg 1 1 0 wz--n- <10.00g <5.00g [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ sudo lvs LV VG Attr LSize Pool Origin Data% Meta% Move Log Cpy%Sync Convert training_lv training_vg -wi-ao--- 5.00g [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$
```

**5gb in vg**

```

 ec2-user@ip-10-0-2-223:~ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ lsblk NAME MAJ:MIN RM SIZE RO TYPE MOUNTPOINTS nvme0n1 259:0 0 8G 0 disk |---nvme0n1p1 259:2 0 8G 0 part / |---nvme0n1p127 259:3 0 1M 0 part |---nvme0n1p128 259:4 0 10M 0 part /boot/efi nvme1n1 259:1 0 20G 0 disk |---nvme1n1p1 259:7 0 10G 0 part /mnt/educloud-data |---nvme1n1p2 259:8 0 10G 0 part |---training_vg-training_lv 253:0 0 5G 0 lvm /training_data [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ df -h /training_data Filesystem Size Used Avail Use% Mounted on /dev/mapper/training_vg-training_lv 4.9G 3.8G 884M 82% /training_data [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ sudo vgs VG #PV #LV #SN Attr VSize VFree training_vg 1 1 0 wz--n- <10.00g <5.00g [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ sudo lvs LV VG Attr LSize Pool Origin Data% Meta% Move Log Cpy%Sync Convert training_lv training_vg -wi-ao---- 5.00g [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ |

```

## EXTENDED LOGICAL VOLUME TO 10GB

```

 ec2-user@ip-10-0-2-223:~ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ sudo lvextend -L 10G /dev/training_vg/training_lv Insufficient free space: 1280 extents needed, but only 1279 available [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ sudo vgs VG #PV #LV #SN Attr VSize VFree training_vg 1 1 0 wz--n- <10.00g <5.00g [ec2-user@ip-10-0-2-223 ~]$ sudo pvs PV VG Fmt Attr PSize PFree /dev/sdf2 training_vg lvm2 a-- <10.00g <5.00g [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ sudo lvextend -l +100%FREE /dev/training_vg/training_lv Size of logical volume training_vg/training_lv changed from 5.00 GiB (1280 extents) to <10.00 GiB (2559 extents). Logical volume training_vg/training_lv successfully resized. [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ sudo resize2fs /dev/training_vg/training_lv resize2fs 1.46.5 (30-Dec-2021) Filesystem at /dev/training_vg/training_lv is mounted on /training_data; on-line resizing required old_desc_blocks = 1, new_desc_blocks = 2 The filesystem on /dev/training_vg/training_lv is now 2620416 (4k) blocks long. [ec2-user@ip-10-0-2-223 ~]$ df -h /training_data Filesystem Size Used Avail Use% Mounted on /dev/mapper/training_vg-training_lv 9.8G 3.8G 5.6G 40% /training_data [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ sudo lvs LV VG Attr LSize Pool Origin Data% Meta% Move Log Cpy%Sync Convert training_lv training_vg -wi-ao---- <10.00g [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ |

```

**~10gb**

```

[ec2-user@ip-10-0-2-223:~]
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ df -h
Filesystem           Size   Used  Avail Use% Mounted on
/dev/tmpfs            4.0M    0    4.0M  0% /dev
tmpfs                459M    0    459M  0% /dev/shm
tmpfs                184M  496K  183M  1% /run
/dev/nvme0n1p1        8.0G  1.9G  6.2G  23% /
tmpfs                459M    0    459M  0% /tmp
/dev/nvme0n1p128      10M   1.3M  8.7M  13% /boot/efi
tmpfs                92M    0    92M  0% /run/user/1000
/dev/nvme1n1p1        10G  105M  9.9G  2% /mnt/educloud-data
/dev/mapper/training_vg-training_lv  9.8G  3.8G  5.6G  40% /training_data
[ec2-user@ip-10-0-2-223 ~]$ 
```

## ALL DATA PRESERVED AS IT IS BEFORE EXPANSION

### DATA INTEGRITY

```

[ec2-user@ip-10-0-2-223:~]
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ sudo lvs
  LV       VG     Attr       LSize   Pool Origin Data%  Meta%  Move Log Cpy%Sync Convert
  training_lv training_vg -wi-ao---- <10.00g
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ ls -la /training_data/
total 3891240
drwxr-xr-x. 3 root root    4096 Jan 24 09:16 .
dr-xr-xr-x. 19 root root   16384 Jan 24 09:02 ..
-rw-r--r--. 1 root root 3984588800 Jan 24 09:16 large-dataset.img
drwx-----. 2 root root   16384 Jan 24 08:51 lost+found
[ec2-user@ip-10-0-2-223 ~]$ ls -lh /training_data/large-dataset.img
-rw-r--r--. 1 root root 3.8G Jan 24 09:16 /training_data/large-dataset.img
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ find /training_data -type f | wc -l
find: '/training_data/lost+found': Permission denied
1
[ec2-user@ip-10-0-2-223 ~]$ sudo find /training_data -type f | wc -l
1
[ec2-user@ip-10-0-2-223 ~]$ 
```

```

[ec2-user@ip-10-0-2-223:~]
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ sudo pvs
  PV       VG     Fmt Attr PSize   PFree
  /dev/sdf2  training_vg lvm2 a--  <10.00g    0
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ sudo vgs
-bash: suod: command not found
[ec2-user@ip-10-0-2-223 ~]$ sudo vgs
  VG       #PV #LV #SN Attr   VSize   VFree
  training_vg  1   1   0 wz--n- <10.00g    0
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ sudo lvs
  LV       VG     Attr       LSize   Pool Origin Data%  Meta%  Move Log Cpy%Sync Convert
  training_lv training_vg -wi-ao---- <10.00g
[ec2-user@ip-10-0-2-223 ~]$ 
```

### Disk Repartitioning:

Data backed up successfully

20GB disk repartitioned into 10GB + 10GB

Data restored to 10GB partition

Fstab updated for data partition

**Physical Volume (PV):**

PV 10GB size

**Volume Group (VG):**

Initial free space: 10GB

**Logical Volume (LV):**

LV "training\_lv" created at 5GB

**VG free space: 5GB after LV creation**

Mounted to /training\_data

Test data created to fill the disk with 80%

**Disk filled to 80%+**

**LVM Expansion:**

LV extended from 5GB to 10GB

Filesystem resized online

No unmount during expansion

All data preserved

Post-expansion shows ~42% usage

**LUKS ENCRYPTION SETUP**

/sensitive\_data partition (2GB) with LUKS encryption for trainer-only access

**INITIAL CHECK**

```

[ec2-user@ip-10-0-2-223:~]$ lsblk
NAME          MAJ:MIN RM  SIZE RO TYPE MOUNTPOINTS
nvme0n1        259:0    0   8G  0 disk
└─nvme0n1p1    259:2    0   8G  0 part /
└─nvme0n1p27   259:3    0   1M  0 part
└─nvme0n1p28   259:4    0 10M  0 part /boot/efi
nvme1n1        259:1    0 20G  0 disk
└─nvme1n1p1    259:7    0 10G  0 part /mnt/educloud-data
└─nvme1n1p2    259:8    0 10G  0 part
  └─training_vg-training_lv 253:0    0 10G  0 lvm  /training_data
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ sudo fdisk -l /dev/nvme1n1
Disk /dev/nvme1n1: 20 GiB, 21474836480 bytes, 41943040 sectors
Disk model: Amazon Elastic Block Store
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 4096 bytes / 4096 bytes
Disklabel type: dos
Disk identifier: 0xc7b884f0

Device      Boot   Start   End Sectors Size Id Type
/dev/nvme1n1p1        2048 20973567 20971520 10G 83 Linux
/dev/nvme1n1p2        20973568 41943039 20969472 10G 83 Linux
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ ls -la /sensitive_data/
ls: cannot access '/sensitive_data/': No such file or directory
[ec2-user@ip-10-0-2-223 ~]$ ls -ld /mnt/educloud-data/sensitive_data/
drwx-----. 2 root trainers 6 Jan 22 10:04 /mnt/educloud-data/sensitive_data/
[ec2-user@ip-10-0-2-223 ~]$ ls -la /sensitive_data
ls: cannot access '/sensitive_data': No such file or directory
[ec2-user@ip-10-0-2-223 ~]$ ls -la /mnt/educloud-data/sensitive_data/
ls: cannot open directory '/mnt/educloud-data/sensitive_data/': Permission denied
[ec2-user@ip-10-0-2-223 ~]$ sudo ls -la /mnt/educloud-data/sensitive_data/
total 0
drwx-----. 2 root trainers 6 Jan 22 10:04 .
drwxr-xr-x. 8 root root 133 Jan 22 10:18 ..
[ec2-user@ip-10-0-2-223 ~]$ |

```

## Current Disk Layout

### Available Space on nvme1n1

/sensitive\_data Directory

### cryptsetup Installed

```

[ec2-user@ip-10-0-2-223:~]$ 
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ sudo df -h /mnt/educloud-data/sensitive_data/
Filesystem      Size  Used Avail Use% Mounted on
/dev/nvme1n1p1  10G  105M  9.9G   2% /mnt/educloud-data
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ which cryptsetup
/usr/sbin/cryptsetup
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ rpm -qa | grep cryptsetup
cryptsetup-libs-2.6.1-1.amzn2023.0.1.x86_64
cryptsetup-2.6.1-1.amzn2023.0.1.x86_64
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ cryptsetup --version
cryptsetup 2.6.1 flags: UDEV BLKID KEYRING FIPS KERNEL_CAPI PWQUALITY
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ D

```

taking backup of the file if there is any data present already

## verifying backup

### unmounting if mounted before

```
[ec2-user@ip-10-0-2-223:~]$  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$ sudo mkdir -p /tmp/sensitive_backup  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$ sudo cp -rp /mnt/educloud-data/sensitive_data/* /tmp/sensitive_backup/ 2>/dev/null || echo "No files to backup"  
No files to backup  
[ec2-user@ip-10-0-2-223 ~]$ ls -la /tmp/sensitive_backup/  
total 0  
drwxr-xr-x. 2 root root 40 Jan 24 12:20 .  
drwxrwxrwt 14 root root 280 Jan 24 12:20 ..  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$ sudo umount /sensitive_data 2>/dev/null || echo "Not mounted"  
Not mounted  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$
```

## Creating 2GB Partition

### Check LVM Usage

```
[ec2-user@ip-10-0-2-223:~]$ lsblk  
NAME MAJ:MIN RM SIZE RO TYPE MOUNTPOINTS  
nvme0n1 259:0 0 8G 0 disk  
└─nvme0n1p1 259:2 0 8G 0 part /  
└─nvme0n1p127 259:3 0 1M 0 part  
└─nvme0n1p128 259:4 0 10M 0 part /boot/efi  
nvme1n1 259:1 0 20G 0 disk  
└─nvme1n1p1 259:7 0 10G 0 part /mnt/educloud-data  
└─nvme1n1p2 259:8 0 10G 0 part  
└─training_vg-training_lv 253:0 0 10G 0 lvm /training_data  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$ df -h /training_data/  
Filesystem Size Used Avail Use% Mounted on  
/dev/mapper/training_vg-training_lv 9.8G 3.8G 5.6G 40% /training_data  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$ sudo du -sh /training_data/*  
3.8G /training_data/large-dataset.img  
16K /training_data/lost+found  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$ ^C  
[ec2-user@ip-10-0-2-223 ~]$
```

## VG/LV/PV Status

```
[ec2-user@ip-10-0-2-223:~]$  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$ sudo vgs  
  VG #PV #LV #SN Attr  VSize  VFree  
 training_vg 1 1 0 wz--n- <10.00g  0  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$ sudo lvs  
  LV VG Attr  LSize  Pool Origin Data%  Meta%  Move Log Cpy%Sync Convert  
  training_lv training_vg -wi-ao---- <10.00g  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$ sudo pvs  
  PV VG Fmt Attr PSize  PFree  
  /dev/sdf2 training_vg lvm2 a-- <10.00g  0  
[ec2-user@ip-10-0-2-223 ~]$  
[ec2-user@ip-10-0-2-223 ~]$ |
```

## Backing up Training Data

```
ec2-user@ip-10-0-2-223:~$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ sudo mkdir -p /tmp/training_backup [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ sudo tar czf /tmp/training_backup/training_data_backup.tar.gz /training_data/ tar: Removing leading '/' from member names [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ ls -lh /tmp/training_backup/ total 3.7M -rw-r--r--. 1 root root 3.7M Jan 24 13:16 training_data_backup.tar.gz [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ |
```

## Unmount /training\_data

### Check Filesystem

### Resize Filesystem to 8GB

### Shrink Logical Volume to 8GB

```
ec2-user@ip-10-0-2-223:~$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ sudo umount /training_data [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ sudo e2fsck -f /dev/training_vg/training_lv e2fsck 1.46.5 (30-Dec-2021) Pass 1: Checking inodes, blocks, and sizes Pass 2: Checking directory structure Pass 3: Checking directory connectivity Pass 4: Checking reference counts Pass 5: Checking group summary information /dev/training_vg/training_lv: 12/655360 files (0.0% non-contiguous), 1036080/2620416 blocks [ec2-user@ip-10-0-2-223 ~]$ sudo file -s /dev/training_vg/training_lv /dev/training_vg/training_lv: symbolic link to ../dm-0 [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ sudo file -s /dev/training_vg/training_lv /dev/training_vg/training_lv: symbolic link to ../dm-0 [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ sudo resize2fs /dev/training_vg/training_lv 7.5G resize2fs 1.46.5 (30-Dec-2021) resize2fs: Invalid new size: 7.5G [ec2-user@ip-10-0-2-223 ~]$ sudo resize2fs /dev/training_vg/training_lv 8G resize2fs 1.46.5 (30-Dec-2021) Resizing the filesystem on /dev/training_vg/training_lv to 2097152 (4k) blocks. The filesystem on /dev/training_vg/training_lv is now 2097152 (4k) blocks long. [ec2-user@ip-10-0-2-223 ~]$ sudo lvreduce -L 8G /dev/training_vg/training_lv WARNING: Reducing active logical volume to 8.00 GiB. THIS MAY DESTROY YOUR DATA (filesystem etc.) Do you really want to reduce training_vg/training_lv? [y/n]: yes Size of logical volume training_vg/training_lv changed from <10.00 GiB (2559 extents) to 8.00 GiB (2048 extents). Logical volume training_vg/training_lv successfully resized. [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ sudo lvs LV VG Attr LSize Pool Origin Data% Meta% Move Log Cpy%Sync Convert training_lv training_vg -wi-a---- 8.00g [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ |
```

```

ec2-user@ip-10-0-2-223:~$ sudo pvdisplay /dev/nvme1n1p2
--- Physical volume ---
PV Name           /dev/sdf2
VG Name           training_vg
PV Size           <10.00 GiB / not usable 3.00 MiB
Allocatable       yes
PE Size           4.00 MiB
Total PE          2559
Free PE           511
Allocated PE      2048
PV UUID           Z0pmXa-3ZRF-E98R-055I-MG4i-8w1C-jjFIaM

[ec2-user@ip-10-0-2-223 ~]$ sudo vgs
VG #PV #LV #SN Attr VSize VFree
training_vg 1 1 0 wz--n- <10.00g <2.00g
[ec2-user@ip-10-0-2-223 ~]$ sudo vgreduce --removemissing training_vg
Volume group "training_vg" is already consistent.
[ec2-user@ip-10-0-2-223 ~]$ sudo vgs
VG #PV #LV #SN Attr VSize VFree
training_vg 1 1 0 wz--n- <10.00g <2.00g
[ec2-user@ip-10-0-2-223 ~]$ sudo pvresize --setphysicalvolumesize 8G /dev/nvme1n1p2
/dev/sdf2: Requested size 8.00 GiB is less than real size <10.00 GiB. Proceed? [y/n]: yes
WARNING: /dev/sdf2: Pretending size is 16777216 not 20969472 sectors.
/dev/sdf2: cannot resize to 2047 extents as 2048 are allocated.
0 physical volume(s) resized or updated / 1 physical volume(s) not resized
[ec2-user@ip-10-0-2-223 ~]$ sudo pvs -o+pv_used
PV VG Fmt Attr PSize PFree Used
/dev/sdf2 training_vg lvm2 a-- <10.00g <2.00g 8.00g
[ec2-user@ip-10-0-2-223 ~]$ sudo pvs
PV VG Fmt Attr PSize PFree
/dev/sdf2 training_vg lvm2 a-- <10.00g <2.00g
[ec2-user@ip-10-0-2-223 ~]$ sudo pvresize --setphysicalvolumesize 8.1G /dev/nvme1n1p2
/dev/sdf2: Requested size <8.10 GiB is less than real size <10.00 GiB. Proceed? [y/n]: yes
WARNING: /dev/sdf2: Pretending size is 16986931 not 20969472 sectors.
Physical volume "/dev/sdf2" changed
1 physical volume(s) resized or updated / 0 physical volume(s) not resized
[ec2-user@ip-10-0-2-223 ~]$ sudo pvs
PV VG Fmt Attr PSize PFree
/dev/sdf2 training_vg lvm2 a-- <8.10g 100.00m
[ec2-user@ip-10-0-2-223 ~]$ sudo pvdisplay /dev/nvme1n1p2
--- Physical volume ---
PV Name           /dev/sdf2
VG Name           training_vg
PV Size           <8.10 GiB / not usable <1.40 MiB
Allocatable       yes
PE Size           4.00 MiB

```

## Pvs,lvs,vgs

```

ec2-user@ip-10-0-2-223:~$ sudo pvs
PV VG Fmt Attr PSize PFree
/dev/sdf2 training_vg lvm2 a-- <8.10g 100.00m
[ec2-user@ip-10-0-2-223 ~]$ sudo vgs
VG #PV #LV #SN Attr VSize VFree
training_vg 1 1 0 wz--n- <8.10g 100.00m
[ec2-user@ip-10-0-2-223 ~]$ sudo lvs
LV VG Attr LSize Pool Origin Data% Meta% Move Log Cpy%Sync Convert
training_lv training_vg -wi-a---- 8.00g
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ 

```

## Remounted /training\_data

```

[ec2-user@ip-10-0-2-223:~]
[ec2-user@ip-10-0-2-223 ~]$ ls -la /dev/training_vg/training_lv
[ec2-user@ip-10-0-2-223 ~]$ lrwxrwxrwx. 1 root root 7 Jan 24 13:22 /dev/training_vg/training_lv -> ../../dm-0
[ec2-user@ip-10-0-2-223 ~]$ sudo mount /dev/training_vg/training_lv /training_data
[ec2-user@ip-10-0-2-223 ~]$ df -h /training_data
Filesystem           Size  Used Avail Use% Mounted on
/dev/mapper/training_vg-training_lv  7.8G  3.8G  3.7G  51% /training_data
[ec2-user@ip-10-0-2-223 ~]$ sudo ls -la /training_data/
total 3891240
drwxr-xr-x. 3 root root      4096 Jan 24 09:16 .
dr-xr-xr-x. 19 root root     16384 Jan 24 09:02 ..
-rw-r--r--. 1 root root 3984588800 Jan 24 09:16 large-dataset.img
drwx-----. 2 root root     16384 Jan 24 08:51 lost+found
[ec2-user@ip-10-0-2-223 ~]$
```

**Before:**

**p2: sectors 20973568 to 41943039 (10GB)**

**After:**

**text**

**p2: sectors 20973568 to ~37748735 (8GB)**

**for p3:**

**FREE: sectors ~37748736 to 41943039 (2GB) ← Available for p3!**

```

This disk is currently in use - repartitioning is probably a bad idea.
It's recommended to unmount all file systems, and swapoff all swap
partitions on this disk.

Command (m for help): d
Partition number (1,2, default 2): 2
Partition 2 has been deleted.

Command (m for help): n
Partition type
  p  primary (1 primary, 0 extended, 3 free)
  e  extended (container for logical partitions)
Select (default p): p
Partition number (2-4, default 2):
First sector (20973568-41943039, default 20973568):
Last sector or +/sectors or +/-size{K,M,G,T,P} (20973568-41943039, default 41943039): +8.5G

Created a new partition 2 of type 'Linux' and of size 8.5 GiB.
Partition #2 contains a LVM2_member signature.

Do you want to remove the signature? [Y]es/[N]o: N

Command (m for help): t
Partition number (1,2, default 2): 2
Hex code or alias (type L to list all): 8e
Changed type of partition 'Linux' to 'Linux LVM'.

Command (m for help): p
Disk /dev/nvme1n1: 20 GiB, 21474836480 bytes, 41943040 sectors
Disk model: Amazon Elastic Block Store
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 4096 bytes / 4096 bytes
Disklabel type: dos
Disk identifier: 0xc7b884f0

Device      Boot   Start   End Sectors  Size Id Type
/dev/nvme1n1p1    2048 20973567 20971520 10G 83 Linux
/dev/nvme1n1p2  20973568 38799359 17825792 8.5G 8e Linux LVM

Command (m for help): w
The partition table has been altered.
Syncing disks.

[ec2-user@ip-10-0-2-223 ~]$
```

```

ec2-user@ip-10-0-2-223:~]
[ec2-user@ip-10-0-2-223 ~]$ sudo partprobe /dev/nvme1n1
[ec2-user@ip-10-0-2-223 ~]$ sudo partx /dev/nvme1n1
NR      START      END      SECTORS SIZE NAME  UUID
1       2048     20973567  20971520  10G   c7b884f0-01
2      20973568  36597759  15624192  7.5G   c7b884f0-02
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ lsblk
NAME      MAJ:MIN RM  SIZE RO TYPE MOUNTPOINTS
nvme0n1    259:0   0   8G  0 disk
└─nvme0n1p1 259:2   0   8G  0 part /
└─nvme0n1p127 259:3   0   1M  0 part
└─nvme0n1p128 259:4   0  10M  0 part /boot/efi
nvme1n1    259:1   0  20G  0 disk
└─nvme1n1p1 259:7   0  10G  0 part /mnt/educloud-data
└─nvme1n1p2 259:8   0  7.5G 0 part
[ec2-user@ip-10-0-2-223 ~]|

```

## Resized P2 pv, vg, lv

```

ec2-user@ip-10-0-2-223:~]
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ sudo pvs
WARNING: Device /dev/sdf2 has size of 15624192 sectors which is smaller than corresponding PV size of 16984883 sectors. Was device resized?
WARNING: One or more devices used as PVs in VG training_vg have changed sizes.
PV /dev/sdf2 VG training_vg   lvm2 [<8.10 GiB / 100.00 MiB free]
  Total: 1 [<8.10 GiB] / in use: 1 [<8.10 GiB] / in no VG: 0 [0 ]
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ sudo vchange -ay training_vg
WARNING: Device /dev/sdf2 has size of 15624192 sectors which is smaller than corresponding PV size of 16984883 sectors. Was device resized?
WARNING: One or more devices used as PVs in VG training_vg have changed sizes.
device-mapper: reload ioctl on (253:0) failed: Invalid argument
 0 logical volume(s) in volume group "training_vg" now active
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ sudo lv
WARNING: Device /dev/sdf2 has size of 15624192 sectors which is smaller than corresponding PV size of 16984883 sectors. Was device resized?
WARNING: One or more devices used as PVs in VG training_vg have changed sizes.
LV      VG      Attr  LSize Pool Origin Data%  Meta%  Move Log Cpy%Sync Convert
  training_lv training_vg -wi-a----- 8.00g
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ sudo pvs
WARNING: Device /dev/sdf2 has size of 15624192 sectors which is smaller than corresponding PV size of 16984883 sectors. Was device resized?
WARNING: One or more devices used as PVs in VG training_vg have changed sizes.
PV   VG      Fmt Attr PSize PFree
/dev/sdf2 training_vg lvm2 a-- <8.10g 100.00m
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ sudo vgs
WARNING: Device /dev/sdf2 has size of 15624192 sectors which is smaller than corresponding PV size of 16984883 sectors. Was device resized?
WARNING: One or more devices used as PVs in VG training_vg have changed sizes.
VG #PV #LVM #SN Attr  VSzie VFree
  training_vg 1 1 0 wz--n- <8.10g 100.00m
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ 

```

```

ec2-user@ip-10-0-2-223:~]
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ sudo partprobe /dev/nvme1n1
[ec2-user@ip-10-0-2-223 ~]$ sudo partprobe /dev/nvme1n1
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ sudo pvs
PV      VG      Fmt Attr PSize PFree
/dev/sdf2 training_vg lvm2 a-- <8.10g 100.00m
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ sudo pvresize /dev/nvme1n1p2
Physical volume "/dev/sdf2" changed
  1 physical volume(s) resized or updated / 0 physical volume(s) not resized
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ sudo pvs
PV      VG      Fmt Attr PSize PFree
/dev/sdf2 training_vg lvm2 a-- <8.50g 508.00m
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ sudo vgchange -ay training_vg
  1 logical volume(s) in volume group "training_vg" now active
[ec2-user@ip-10-0-2-223 ~]$ sudo lvs
  LV      VG      Attr  LSize Pool Origin Data%  Meta%  Move Log Cpy%Sync Convert
  training_lv training_vg -wi-a----- 8.00g
[ec2-user@ip-10-0-2-223 ~]$ ls -la /dev/mapper/
total 0
drwxr-xr-x. 2 root root     80 Jan 24 18:09 .
drwxr-xr-x. 15 root root   3260 Jan 24 18:09 ..
crw-----. 1 root root 10, 236 Jan 24 05:13 control
lrwxrwxrwx. 1 root root      7 Jan 24 18:09 training_vg-training_lv -> ../dm-0
[ec2-user@ip-10-0-2-223 ~]$ 

```

## Mounted training data, verified data integrity

```
ec2-user@ip-10-0-2-223:~$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ sudo mount /dev/training_vg/training_lv /training_data [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ df -h /training_data Filesystem Size Used Avail Use% Mounted on /dev/mapper/training_vg-training_lv 7.8G 3.8G 3.7G 51% /training_data [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ sudo ls -la /training_data/ total 3891240 drwxr-xr-x. 3 root root 4096 Jan 24 09:16 . dr-xr-xr-x. 19 root root 16384 Jan 24 09:02 .. -rw-r--r--. 1 root root 3984588800 Jan 24 09:16 large-dataset.img drwx-----. 2 root root 16384 Jan 24 08:51 lost+found [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ lsblk NAME MAJ:MIN RM SIZE RO TYPE MOUNTPOINTS nvmeOn1 259:0 0 8G 0 disk |└nvmeOn1p1 259:2 0 8G 0 part / |└nvmeOn1p127 259:3 0 1M 0 part |└nvmeOn1p128 259:4 0 10M 0 part /boot/efi nvmeIn1 259:1 0 20G 0 disk |└nvmeIn1p1 259:7 0 10G 0 part /mnt/educloud-data |└nvmeIn1p2 259:8 0 8.5G 0 part └└training_vg-training_lv 253:0 0 8G 0 lvm /training_data [ec2-user@ip-10-0-2-223 ~]$
```

## Create Partition 3 (2GB for LUKS)

```
Welcome to fdisk (util-linux 2.37.4). Changes will remain in memory only, until you decide to write them. Be careful before using the write command. This disk is currently in use - repartitioning is probably a bad idea. It's recommended to umount all file systems, and swapoff all swap partitions on this disk. Command (m for help): p Disk /dev/nvmeIn1n: 20 GiB, 21474836480 bytes, 41943040 sectors Disk model: Amazon Elastic Block Store Units: sectors of 1 * 512 = 512 bytes Sector size (logical/physical): 512 bytes / 512 bytes I/O size (minimum/optimal): 4096 bytes / 4096 bytes Disklabel type: dos Disk identifier: 0xc7b884f0 Device Boot Start End Sectors Size Id Type /dev/nvmeIn1p1 2048 20973567 20971520 10G 83 Linux /dev/nvmeIn1p2 20973568 38799359 17825792 8.5G 8e Linux LVM Command (m for help): n Partition type: p primary (2 primary, 0 extended, 2 free) e extended (container for logical partitions) Select (default p): p Partition number (3,4, default 3): First sector (38799360-41943039, default 38799360): Last sector, +/-sectors or +/size(K,M,G,T,P) (38799360-41943039, default 41943039): Created a new partition 3 of type 'Linux' and of size 1.5 GiB. Command (m for help): p Disk /dev/nvmeIn1n: 20 GiB, 21474836480 bytes, 41943040 sectors Disk model: Amazon Elastic Block Store Units: sectors of 1 * 512 = 512 bytes Sector size (logical/physical): 512 bytes / 512 bytes I/O size (minimum/optimal): 4096 bytes / 4096 bytes Disklabel type: dos Disk identifier: 0xc7b884f0 Device Boot Start End Sectors Size Id Type /dev/nvmeIn1p1 2048 20973567 20971520 10G 83 Linux /dev/nvmeIn1p2 20973568 38799359 17825792 8.5G 8e Linux LVM /dev/nvmeIn1p3 38799360 41943039 3143680 1.5G 83 Linux Command (m for help): w
```

```

ec2-user@ip-10-0-2-223:~ [ec2-user@ip-10-0-2-223 ~]$ sudo partprobe /dev/nvme1n1
[ec2-user@ip-10-0-2-223 ~]$ lsblk
NAME          MAJ:MIN RM  SIZE RO TYPE MOUNTPOINTS
nvme0n1        259:0   0    8G  0 disk
└─nvme0n1p1    259:2   0    8G  0 part /
  └─nvme0n1p127 259:3   0    1M  0 part
  └─nvme0n1p128 259:4   0   10M  0 part /boot/efi
nvme1n1        259:1   0   20G  0 disk
└─nvme1n1p3    259:5   0   1.5G 0 part
  └─nvme1n1p1   259:7   0   10G  0 part /mnt/educloud-data
  └─nvme1n1p2   259:8   0   8.5G 0 part
    └─training_vg-training_lv 253:0   0    8G  0 lvm  /training_data
[ec2-user@ip-10-0-2-223 ~]$ sudo fdisk -l /dev/nvme1n1 | grep nvme1n1p
/dev/nvme1n1p1      2048 20973567 20971520  10G 83 Linux
/dev/nvme1n1p2      20973568 38799359 17825792  8.5G 8e Linux LVM
/dev/nvme1n1p3      38799360 41943039 3143680  1.5G 83 Linux
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ 

```

## Why 1.5gb not 5gb

**Original Plan:** 10GB + 8GB + 2GB = 20GB

**Reality:** 10GB + 8.5GB + 1.5GB = 20GB

Why 8.5GB for p2? Because: - LVM needs 8.1GB minimum (metadata says so) - 8.0GB partition = only 7.5GB usable (overhead) - 8.5GB partition = 8.1GB usable - Extra 0.5GB needed for LVM to fit comfortably

**BEFOR:**

**P1 -> Sector: 2048 → 20973567**

**P2 -> Sector: 20973568 → 41943039**

**after**

**P1sectors: 2048 → 20973567**

**P2 sectors: 20973568 → 38799359**

**P3 sectors: 38799360 → 41943039**

**Result: 20GB - 10GB - 8.5GB = 1.5GB left for p3**

**uppercase 'yes': YES**

**passphrase: Trainer@2026!Secure**

**Verify passphrase: Trainer@2026!Secure**

**Partition is LUKS encrypted**

```

 ec2-user@ip-10-0-2-223:~ [ec2-user@ip-10-0-2-223 ~]$ sudo fdisk -l /dev/nvmein1 | grep nvmeInlp3 /dev/nvmeInlp3 259:0 16777216 8G 0 disk [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ sudo cryptsetup luksFormat /dev/nvmeInlp3
WARNING!
=====
This will overwrite data on /dev/nvmeInlp3 irreversibly.

Are you sure? (Type 'yes' in capital letters): YES
Enter passphrase for /dev/nvmeInlp3:
Verify passphrase:
[ec2-user@ip-10-0-2-223 ~]$ lsblk
NAME MAJ:MIN RM SIZE RO TYPE MOUNTPOINTS
nvme0n1 259:0 0 8G 0 disk
└─nvme0nlp1 259:2 0 8G 0 part /
└─nvme0nlp127 259:3 0 1M 0 part
└─nvme0nlp128 259:4 0 10M 0 part /boot/efi
nvmeInlp1 259:1 0 20G 0 disk
└─nvmeInlp3 259:5 0 1.5G 0 part
└─nvmeInlp1 259:7 0 10G 0 part /mnt/educloud-data
└─nvmeInlp2 259:8 0 8.5G 0 part
└─training_vg-training_lv 253:0 0 8G 0 lvm /training_data
[ec2-user@ip-10-0-2-223 ~]$ sudo cryptsetup luksDump /dev/nvmeInlp3 | head -20
LUKS header information
Version: 2
Epoch: 3
Metadata area: 16384 [bytes]
Keyslots area: 16744448 [bytes]
UUID: c2f8b757-0c8e-4c06-9dca-15fe59bb4aa0
Label: (no label)
Subsystem: (no subsystem)
Flags: (no flags)

Data segments:
 0: crypt
    offset: 16777216 [bytes]
    length: (whole device)
    cipher: aes-xts-plain64
    sector: 512 [bytes]

Keyslots:
 0: luks2
    Key: 512 bits
[ec2-user@ip-10-0-2-223 ~]$ sudo cryptsetup isLuks /dev/nvmeInlp3 && echo "Partition is LUKS encrypted"
Partition is LUKS encrypted
[ec2-user@ip-10-0-2-223 ~]$
```

## Mounting /sensitive\_data

```

 ec2-user@ip-10-0-2-223:~ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ sudo mount /dev/mapper/sensitive_crypt /mnt [ec2-user@ip-10-0-2-223 ~]$ sudo umount /dev/mapper/sensitive_crypt /mnt umount: /mnt: not mounted.
[ec2-user@ip-10-0-2-223 ~]$ lsblk
NAME MAJ:MIN RM SIZE RO TYPE MOUNTPOINTS
nvme0n1 259:0 0 8G 0 disk
└─nvme0nlp1 259:2 0 8G 0 part /
└─nvme0nlp127 259:3 0 1M 0 part
└─nvme0nlp128 259:4 0 10M 0 part /boot/efi
nvmeInlp1 259:1 0 20G 0 disk
└─nvmeInlp3 259:5 0 1.5G 0 part
└─sensitive_crypt 253:1 0 1.5G 0 crypt
└─nvmeInlp1 259:7 0 10G 0 part /mnt/educloud-data
└─nvmeInlp2 259:8 0 8.5G 0 part
└─training_vg-training_lv 253:0 0 8G 0 lvm /training_data
[ec2-user@ip-10-0-2-223 ~]$ sudo umount /dev/mapper/sensitive_crypt /mnt/educloud-data/sensitive_data/
umount: /dev/mapper/sensitive_crypt: not mounted.
umount: /mnt/educloud-data/sensitive_data/: not mounted.
[ec2-user@ip-10-0-2-223 ~]$ sudo mount /dev/mapper/sensitive_crypt /mnt/educloud-data/sensitive_data/
[ec2-user@ip-10-0-2-223 ~]$ lsblk
NAME MAJ:MIN RM SIZE RO TYPE MOUNTPOINTS
nvme0n1 259:0 0 8G 0 disk
└─nvme0nlp1 259:2 0 8G 0 part /
└─nvme0nlp127 259:3 0 1M 0 part
└─nvme0nlp128 259:4 0 10M 0 part /boot/efi
nvmeInlp1 259:1 0 20G 0 disk
└─nvmeInlp3 259:5 0 1.5G 0 part
└─sensitive_crypt 253:1 0 1.5G 0 crypt /mnt/educloud-data/sensitive_data
└─nvmeInlp1 259:7 0 10G 0 part /mnt/educloud-data
└─nvmeInlp2 259:8 0 8.5G 0 part
└─training_vg-training_lv 253:0 0 8G 0 lvm /training_data
[ec2-user@ip-10-0-2-223 ~]$
```

## Opening LUKS Partition

```

[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ sudo cryptsetup luksOpen /dev/nvme1n1p3 sensitive_crypt
Enter passphrase for /dev/nvme1n1p3:
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ ls -la /dev/mapper/sensitive_crypt
lrwxrwxrwx. 1 root root 7 Jan 24 18:41 /dev/mapper/sensitive_crypt -> ../dm-1
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ lsblk | grep sensitive_crypt
| sensitive_crypt      253:1    0  1.5G  0 crypt
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ sudo mkfs.ext4 /dev/mapper/sensitive_crypt
mke2fs 1.46.5 (30-Dec-2021)
Creating filesystem with 388864 4k blocks and 97344 inodes
Filesystem UUID: 491e1128-1c3a-4517-b9b0-6e896e2366aa
Superblock backups stored on blocks:
            32768, 98304, 163840, 229376, 294912

Allocating group tables: done
Writing inode tables: done
Creating journal (8192 blocks): done
Writing superblocks and filesystem accounting information: done

[ec2-user@ip-10-0-2-223 ~]$ sudo blkid /dev/mapper/sensitive_crypt
/dev/mapper/sensitive_crypt: UUID="491e1128-1c3a-4517-b9b0-6e896e2366aa" BLOCK_SIZE="4096" TYPE="ext4"
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ 

```

## Trainer-Only Permissions (Root Access Only)

```

[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ sudo mkdir -p /sensitive_data/exams
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ sudo mkdir -p /sensitive_data/grades
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ sudo mkdir -p /sensitive_data/student-records
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ echo "Confidential Exam Answers - Final 2026" | sudo tee /sensitive_data/exams/final-answers.txt
Confidential Exam Answers - Final 2026
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ echo "Student Grades - Confidential" | sudo tee /sensitive_data/grades/class-grades.txt
Student Grades - Confidential
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ echo "Student Personal Records - DO NOT SHARE" | sudo tee /sensitive_data/student-records/records.txt
Student Personal Records - DO NOT SHARE
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ echo "Salary: Trainer = Rs.80,000/month" | sudo tee /sensitive_data/payroll.txt
Salary: Trainer = Rs.80,000/month
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ sudo chown -R root:root /sensitive_data/
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ sudo chmod 700 /sensitive_data/
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ sudo chmod -R 600 /sensitive_data/exams/
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ sudo chmod -R 600 /sensitive_data/grades/
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ sudo chmod -R 600 /sensitive_data/student-records/
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ 

```

## Test Root Access

Attempts read as ec2-user: Permission denied

Reads as root (should work)

```

 ec2-user@ip-10-0-2-223:~  

[ec2-user@ip-10-0-2-223 ~]$  

[ec2-user@ip-10-0-2-223 ~]$ ls -ld /sensitive_data/  

drwx----- 5 root root 75 Jan 24 19:00 /sensitive_data/  

[ec2-user@ip-10-0-2-223 ~]$  

[ec2-user@ip-10-0-2-223 ~]$ cat /sensitive_data/exams/final-answers.txt  

cat: /sensitive_data/exams/final-answers.txt: Permission denied  

[ec2-user@ip-10-0-2-223 ~]$  

[ec2-user@ip-10-0-2-223 ~]$  

[ec2-user@ip-10-0-2-223 ~]$ sudo cat /sensitive_data/exams/final-answers.txt  

Confidential Exam Answers - Final 2026  

[ec2-user@ip-10-0-2-223 ~]$  

[ec2-user@ip-10-0-2-223 ~]$ sudo cat /sensitive_data/grades/class-grades.txt  

Student Grades - Confidential  

[ec2-user@ip-10-0-2-223 ~]$  

[ec2-user@ip-10-0-2-223 ~]$ sudo cat /sensitive_data/payroll.txt  

Salary: Trainer = Rs.80,000/month  

[ec2-user@ip-10-0-2-223 ~]$  

[ec2-user@ip-10-0-2-223 ~]$
```

## LUKS Encryption Active

```

 ec2-user@ip-10-0-2-223:~  

[ec2-user@ip-10-0-2-223 ~]$  

[ec2-user@ip-10-0-2-223 ~]$  

[ec2-user@ip-10-0-2-223 ~]$ sudo cryptsetup isLuks /dev/nvme1n1p3 && echo "partition is LUKS encrypted"  

partition is LUKS encrypted  

[ec2-user@ip-10-0-2-223 ~]$ sudo cryptsetup status sensitive_crypt  

/dev/mapper/sensitive_crypt is active and is in use.  

  type:      LUKS2  

  cipher:    aes-xts-plain64  

  keysize:   512 bits  

  key location: keyring  

  device:   /dev/nvme1n1p3  

  sector size: 512  

  offset:   32768 sectors  

  size:     3110912 sectors  

  mode:    read/write  

[ec2-user@ip-10-0-2-223 ~]$
```

## Encrypted partition mounted and status

```

 ec2-user@ip-10-0-2-223:~  

[ec2-user@ip-10-0-2-223 ~]$ sudo cryptsetup status sensitive_crypt  

/dev/mapper/sensitive_crypt is active.  

  type:      LUKS2  

  cipher:    aes-xts-plain64  

  keysize:   512 bits  

  key location: keyring  

  device:   /dev/nvme1n1p3  

  sector size: 512  

  offset:   32768 sectors  

  size:     3110912 sectors  

  mode:    read/write  

[ec2-user@ip-10-0-2-223 ~]$ df -h  

Filesystem      Size  Used Avail Use% Mounted on  

/dev/tmpfs        4.0M   4.0M    0  100% /dev/shm  

tmpfs           184M  504K  183M   1% /run  

/dev/nvme0n1p1    8.0G  1.9G  6.2G  23% /  

tmpfs           459M   0  459M   0% /tmp  

/dev/nvme0n1p12   10M   1.3M  8.7M  13% /boot/efi  

/dev/nvme1n1p1    10G  105M  9.9G  2% /mnt/educloud-data  

/dev/mapper/training_vg-training_lv  7.8G  3.6G  3.1G  47% /training_data  

tmpfs            92M   0  92M   0% /run/user/1000  

[ec2-user@ip-10-0-2-223 ~]$ lsblk  

NAME    MAJ:MIN RM  SIZE RO TYPE MOUNTPOINTS  

nvme0n1       259:0    0   8G  0 disk  

└─nvme0n1p1    259:5    0   8G  0 part /  

nvme0n1p127   259:6    0   1M  0 part  

nvme0n1p128   259:7    0   10G 0 part /boot/efi  

nvme1n1       259:1    0  20G  0 disk  

└─nvme1n1p1    259:2    0   10G 0 part /mnt/educloud-data  

nvme1n1p2       259:3    0   8.5G 0 part  

└─training_vg-training_lv  253:0    0   8G  0 lvm /training_data  

nvme1n1p3       253:1    0   1.5G 0 part  

└─sensitive_crypt  253:1    0   1.5G 0 crypt  

[ec2-user@ip-10-0-2-223 ~]$  

[ec2-user@ip-10-0-2-223 ~]$ sudo mount /dev/mapper/sensitive_crypt /sensitive_data  

[ec2-user@ip-10-0-2-223 ~]$  

[ec2-user@ip-10-0-2-223 ~]$ lsblk  

NAME    MAJ:MIN RM  SIZE RO TYPE MOUNTPOINTS  

nvme0n1       259:0    0   8G  0 disk  

└─nvme0n1p1    259:5    0   8G  0 part /  

nvme0n1p127   259:6    0   1M  0 part  

nvme0n1p128   259:7    0   10G 0 part /boot/efi  

nvme1n1       259:1    0  20G  0 disk  

└─nvme1n1p1    259:2    0   10G 0 part /mnt/educloud-data  

nvme1n1p2       259:3    0   8.5G 0 part  

└─training_vg-training_lv  253:0    0   8G  0 lvm /training_data  

nvme1n1p3       253:1    0   1.5G 0 part  

└─sensitive_crypt  253:1    0   1.5G 0 crypt /sensitive_data  

[ec2-user@ip-10-0-2-223 ~]$ ls -lh /sensitive_data/  

Filesystem      Size  Used Avail Use% Mounted on  

/dev/mapper/sensitive_crypt  1.5G  24K  1.4G   1% /sensitive_data  

[ec2-user@ip-10-0-2-223 ~]$ sudo ls -la /sensitive_data/  

total 36  

drwxr-xr-x.  3 root root 4096 Jan 24 18:42 .  

drwxr-xr-x. 20 root root 16384 Jan 24 19:00 ..  

drwxr-xr-x.  2 root root 16384 Jan 24 18:42 lost+found  

[ec2-user@ip-10-0-2-223 ~]$
```

## Unmounted sensitive data

```
ec2-user@ip-10-0-2-223:~]$ 
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ sudo umount /sensitive_data
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ lsblk
NAME          MAJ:MIN RM  SIZE RO TYPE  MOUNTPOINTS
nvme0n1        259:0   0    8G  0 disk
└─nvme0n1p1    259:5   0    8G  0 part  /
  └─nvme0n1p127 259:6   0    1M  0 part
    └─nvme0n1p128 259:7   0   10M 0 part  /boot/efi
nvme1n1        259:1   0   20G  0 disk
└─nvme1n1p1    259:2   0   10G  0 part  /mnt/educloud-data
  └─nvme1n1p2    259:3   0   8.5G 0 part
    └─training_vg-training_lv 253:0   0    8G  0 lvm   /training_data
  └─nvme1n1p3    259:4   0   1.5G 0 part
    └─sensitive_crypt 253:1   0   1.5G 0 crypt
[ec2-user@ip-10-0-2-223 ~]$ |
```

## Closed partition

### Status inactive

```
ec2-user@ip-10-0-2-223:~]$ 
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ sudo cryptsetup luksClose sensitive_crypt
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ ls -la /dev/mapper/ | grep sensitive
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ df -h | grep sensitive
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ sudo cryptsetup status sensitive_crypt
/dev/mapper/sensitive_crypt is inactive.
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ |
```

## Mounted again /sensitive\_data, status active,

```

[ec2-user@ip-10-0-2-223:~]
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ sudo cryptsetup luksOpen /dev/nvme1n1p3 sensitive_crypt
Enter passphrase for /dev/nvme1n1p3:
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ ls -la /dev/mapper/sensitive_crypt
lrwxrwxrwx. 1 root root 7 Jan 26 10:16 /dev/mapper/sensitive_crypt -> ../../dm-1
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ sudo cryptsetup status sensitive_crypt
/dev/mapper/sensitive_crypt is active.
    type:      LUKS2
    cipher:    aes-xts-plain64
    keysize:   512 bits
    key location: keyring
    device:   /dev/nvme1n1p3
    sector size: 512
    offset:   32768 sectors
    size:     3110912 sectors
    mode:    read/write
[ec2-user@ip-10-0-2-223 ~]$ sudo mount /dev/mapper/sensitive_crypt /sensitive_data
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ df -h /sensitive_data
Filesystem           Size  Used Avail Use% Mounted on
/dev/mapper/sensitive_crypt  1.5G  24K  1.4G  1% /sensitive_data
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ lsblk
NAME    MAJ:MIN RM  SIZE RO TYPE MOUNTPOINTS
nvme0n1  259:0   0   8G  0 disk
└─nvme0n1p1  259:5   0   8G  0 part /
└─nvme0n1p127 259:6   0   1M  0 part
└─nvme0n1p128 259:7   0   10M 0 part /boot/efi
nvme1n1  259:1   0   20G 0 disk
└─nvme1n1p1  259:2   0   10G 0 part /mnt/educloud-data
└─nvme1n1p2  259:3   0   8.5G 0 part
└─training_lv 253:0   0   8G  0 lvm   /training_data
└─nvme1n1p3  259:4   0   1.5G 0 part
└─sensitive_crypt 253:1   0   1.5G 0 crypt /sensitive_data
[ec2-user@ip-10-0-2-223 ~]$ 
```

**Script for mount/luksclose: /usr/local/bin/mount-sensitive.sh**

**Script for unmount: /usr/local/bin/umount-sensitive.sh**

## **UNLOCK & MOUNT (Open Encrypted Partition)**

Step 1: Unlock the encrypted partition

```
sudo cryptsetup luksOpen /dev/nvme1n1p3 sensitive_crypt
```

Enter passphrase: Trainer@2026!Secure

Step 2: Mount the decrypted device

```
sudo mount /dev/mapper/sensitive_crypt /sensitive_data
```

Step 3: Verify mounted

```
df -h /sensitive_data
```

## **UMOUNT & LOCK (Close Encrypted Partition)**

Step 1: Unmount the filesystem

```
sudo umount /sensitive_data
```

Step 2: Lock the encrypted partition

```
sudo cryptsetup luksClose sensitive_crypt
```

Step 3: Verify closed

```
sudo cryptsetup status sensitive_crypt
```

# Should show: inactive

## RDS MYSQL DATABASE SCHEMA SETUP

### Install MySQL Client & Connect to RDS

```
ec2-user@ip-10-0-2-223:~ [ec2-user@ip-10-0-2-223 ~]$ mysql --version
mysql Ver 15.1 Distrib 10.5.29-MariaDB, for Linux (x86_64) using EditLine wrapper
[ec2-user@ip-10-0-2-223 ~]$
[ec2-user@ip-10-0-2-223 ~]$
```

**Created educloud\_db default while creating rds database**

```
ec2-user@ip-10-0-2-223:~ [ec2-user@ip-10-0-2-223 ~]$ mysql --version
mysql Ver 15.1 Distrib 10.5.29-MariaDB, for Linux (x86_64) using EditLine wrapper
[ec2-user@ip-10-0-2-223 ~]$
[ec2-user@ip-10-0-2-223 ~]$ which mysql
/usr/bin/mysql
[ec2-user@ip-10-0-2-223 ~]$ mysql -h educloud-mysql-db.c6n4sgm4gf6o.us-east-1.rds.amazonaws.com -P 3306 -u admin -p
Enter password:
Welcome to the MariaDB monitor. Commands end with ; or \g.
Your MySQL connection id is 15
Server version: 8.0.43 Source distribution

Copyright (c) 2000, 2018, Oracle, MariaDB Corporation Ab and others.

Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.

MySQL [(none)]> SHOW DATABASES;
ERROR 1064 (42000): You have an error in your SQL syntax; check the manual that corresponds to your MySQL server version for the right syntax to use near 'DAT
ABASE' at line 1
MySQL [(none)]> SHOW DATABASES;
+-----+
| Database |
+-----+
| educloud_db |
| information_schema |
| mysql |
| performance_schema |
| sys |
+-----+
5 rows in set (0.023 sec)

MySQL [(none)]> USE educloud_db;
Database changed
MySQL [educloud_db]> SELECT DATABASE();
+-----+
| DATABASE() |
+-----+
| educloud_db |
+-----+
1 row in set (0.001 sec)

MySQL [educloud_db]>
```

## Creating Students Table

### students table

```
ec2-user@ip-10-0-2-223:~$ MySQL [(none)]> SHOW DATABASES;
+-----+
| Database |
+-----+
| educloud_db |
| information_schema |
| mysql |
| performance_schema |
| sys |
+-----+
5 rows in set (0.022 sec)

MySQL [(none)]> USE educloud_db;
Database changed
MySQL [educloud_db]> SELECT DATABASE();
+-----+
| DATABASE() |
+-----+
| educloud_db |
+-----+
1 row in set (0.001 sec)

MySQL [educloud_db]> CREATE TABLE students (
    ->     id INT AUTO_INCREMENT PRIMARY KEY,
    ->     name VARCHAR(100) NOT NULL,
    ->     email VARCHAR(100) UNIQUE NOT NULL,
    ->     student_group VARCHAR(50) NOT NULL,
    ->     created_at TIMESTAMP DEFAULT CURRENT_TIMESTAMP
    -> );
Query OK, 0 rows affected (0.053 sec)

MySQL [educloud_db]> DESCRIBE students;
+-----+-----+-----+-----+-----+
| Field | Type | Null | Key | Default | Extra |
+-----+-----+-----+-----+-----+
| id   | int  | NO  | PRI | NULL    | auto_increment
| name | varchar(100) | NO  |     | NULL    |
| email | varchar(100) | NO  | UNI | NULL    |
| student_group | varchar(50) | NO  |     | NULL    |
| created_at | timestamp | YES |     | CURRENT_TIMESTAMP | DEFAULT_GENERATED
+-----+-----+-----+-----+-----+
5 rows in set (0.010 sec)

MySQL [educloud_db]> |
```

## Creating Trainers Table

### trainers table

```
MySQL [educloud_db]> CREATE TABLE trainers (
    ->     id INT AUTO_INCREMENT PRIMARY KEY,
    ->     name VARCHAR(100) NOT NULL,
    ->     email VARCHAR(100) UNIQUE NOT NULL,
    ->     subject VARCHAR(100) NOT NULL,
    ->     created_at TIMESTAMP DEFAULT CURRENT_TIMESTAMP
    -> );
Query OK, 0 rows affected (0.044 sec)

MySQL [educloud_db]> DESCRIBE trainers;
+-----+-----+-----+-----+-----+
| Field | Type | Null | Key | Default | Extra |
+-----+-----+-----+-----+-----+
| id   | int  | NO  | PRI | NULL    | auto_increment
| name | varchar(100) | NO  |     | NULL    |
| email | varchar(100) | NO  | UNI | NULL    |
| subject | varchar(100) | NO  |     | NULL    |
| created_at | timestamp | YES |     | CURRENT_TIMESTAMP | DEFAULT_GENERATED
+-----+-----+-----+-----+-----+
5 rows in set (0.004 sec)
```

## Creating Uploads Table

### uploads table

```

MySQL [educloud_db]> CREATE TABLE uploads (
->     id INT AUTO_INCREMENT PRIMARY KEY,
->     filename VARCHAR(255) NOT NULL,
->     uploader VARCHAR(100) NOT NULL,
->     upload_timestamp TIMESTAMP DEFAULT CURRENT_TIMESTAMP,
->     file_size VARCHAR(20),
->     file_type VARCHAR(50)
-> );
Query OK, 0 rows affected (0.035 sec)

MySQL [educloud_db]> DESCRIBE uploads;
+-----+-----+-----+-----+-----+-----+
| Field | Type | Null | Key | Default | Extra |
+-----+-----+-----+-----+-----+-----+
| id   | int  | NO   | PRI | NULL    | auto_increment |
| filename | varchar(255) | NO | NULL | NULL |
| uploader | varchar(100) | NO | NULL | NULL |
| upload_timestamp | timestamp | YES | | CURRENT_TIMESTAMP | DEFAULT_GENERATED |
| file_size | varchar(20) | YES | | NULL |
| file_type | varchar(50) | YES | | NULL |
+-----+-----+-----+-----+-----+-----+
6 rows in set (0.003 sec)

MySQL [educloud_db]>

```

## all tables in database

```

ec2-user@ip-10-0-2-223:~
MySQL [educloud_db]> SHOW TABLES;
+-----+
| Tables_in_educloud_db |
+-----+
| students
| trainers
| uploads
+-----+
3 rows in set (0.002 sec)

MySQL [educloud_db]> |

```

## Inserting Sample Data – Students

```

ec2-user@ip-10-0-2-223:~
MySQL [educloud_db]> INSERT INTO students (name, email, student_group) VALUES
-> ('Rajesh Kumar', 'student1@educloud.com', 'students'),
-> ('Priya Sharma', 'student2@educloud.com', 'students'),
-> ('Amit Patel', 'student3@educloud.com', 'students'),
-> ('Sneha Reddy', 'student4@educloud.com', 'students'),
-> ('Vikram Singh', 'student5@educloud.com', 'students');
Query OK, 5 rows affected (0.005 sec)
Records: 5 Duplicates: 0 Warnings: 0

MySQL [educloud_db]> SELECT * FROM students;
+-----+-----+-----+-----+
| id | name      | email            | student_group | created_at   |
+-----+-----+-----+-----+
| 1 | Rajesh Kumar | student1@educloud.com | students | 2026-01-27 07:14:16 |
| 2 | Priya Sharma | student2@educloud.com | students | 2026-01-27 07:14:16 |
| 3 | Amit Patel   | student3@educloud.com | students | 2026-01-27 07:14:16 |
| 4 | Sneha Reddy  | student4@educloud.com | students | 2026-01-27 07:14:16 |
| 5 | Vikram Singh | student5@educloud.com | students | 2026-01-27 07:14:16 |
+-----+-----+-----+-----+
5 rows in set (0.001 sec)

MySQL [educloud_db]> |

```

## Inserting Sample Data – Trainers

### Inserting 3 trainers

```
ec2-user@ip-10-0-2-223:~  
MySQL [educloud_db]> INSERT INTO trainers (name, email, subject) VALUES  
-> ('Dr. Anand Kumar', 'trainer1@educloud.com', 'Linux System Administration'),  
('Prof. Meera Joshi', 'trainer2@educloud.com', 'AWS Cloud Solutions'),  
('Mr. Karthik Rao', 'trainer3@educloud.com', 'DevOps & Automation');  
('Prof. Meera Joshi', 'trainer2@educloud.com', 'AWS Cloud Solutions'),  
-> ('Mr. Karthik Rao', 'trainer3@educloud.com', 'DevOps & Automation');  
Query OK, 3 rows affected (0.005 sec)  
Records: 3 Duplicates: 0 Warnings: 0  
  
MySQL [educloud_db]> SELECT * FROM trainers;  
+----+----+----+----+  
| id | name | email | subject | created_at |  
+----+----+----+----+  
| 1 | Dr. Anand Kumar | trainer1@educloud.com | Linux System Administration | 2026-01-27 07:15:45 |  
| 2 | Prof. Meera Joshi | trainer2@educloud.com | AWS Cloud Solutions | 2026-01-27 07:15:45 |  
| 3 | Mr. Karthik Rao | trainer3@educloud.com | DevOps & Automation | 2026-01-27 07:15:45 |  
+----+----+----+----+  
3 rows in set (0.001 sec)  
  
MySQL [educloud_db]> SELECT name, subject FROM trainers WHERE email = 'trainer1@educloud.com';  
+----+----+  
| name | subject |  
+----+----+  
| Dr. Anand Kumar | Linux System Administration |  
+----+----+  
1 row in set (0.001 sec)  
  
MySQL [educloud_db]> |
```

## Inserting Sample Data – Uploads

### Insert upload records

```
ec2-user@ip-10-0-2-223:~  
MySQL [educloud_db]> INSERT INTO uploads (filename, uploader, file_size, file_type) VALUES  
-> ('linux_basics_week1.pdf', 'trainer1', '12MB', 'PDF'),  
-> ('aws_vpc_tutorial.pdf', 'trainer2', '8MB', 'PDF'),  
-> ('assignment1.tar.gz', 'student1', '25MB', 'Archive'),  
-> ('docker_intro.pdf', 'trainer3', '15MB', 'PDF'),  
-> ('assignment2.tar.gz', 'student2', '18MB', 'Archive'),  
-> ('kubernetes_guide.pdf', 'trainer2', '22MB', 'PDF'),  
-> ('assignment3.tar.gz', 'student3', '30MB', 'Archive');  
Query OK, 7 rows affected (0.007 sec)  
Records: 7 Duplicates: 0 Warnings: 0  
  
MySQL [educloud_db]> SELECT * FROM uploads;  
+----+----+----+----+  
| id | filename | uploader | upload_timestamp | file_size | file_type |  
+----+----+----+----+  
| 1 | linux_basics_week1.pdf | trainer1 | 2026-01-27 07:17:28 | 12MB | PDF |  
| 2 | aws_vpc_tutorial.pdf | trainer2 | 2026-01-27 07:17:28 | 8MB | PDF |  
| 3 | assignment1.tar.gz | student1 | 2026-01-27 07:17:28 | 25MB | Archive |  
| 4 | docker_intro.pdf | trainer3 | 2026-01-27 07:17:28 | 15MB | PDF |  
| 5 | assignment2.tar.gz | student2 | 2026-01-27 07:17:28 | 18MB | Archive |  
| 6 | kubernetes_guide.pdf | trainer2 | 2026-01-27 07:17:28 | 22MB | PDF |  
| 7 | assignment3.tar.gz | student3 | 2026-01-27 07:17:28 | 30MB | Archive |  
+----+----+----+----+  
7 rows in set (0.001 sec)  
  
MySQL [educloud_db]> SELECT * FROM uploads WHERE uploader LIKE 'trainer%';  
+----+----+----+----+  
| id | filename | uploader | upload_timestamp | file_size | file_type |  
+----+----+----+----+  
| 1 | linux_basics_week1.pdf | trainer1 | 2026-01-27 07:17:28 | 12MB | PDF |  
| 2 | aws_vpc_tutorial.pdf | trainer2 | 2026-01-27 07:17:28 | 8MB | PDF |  
| 4 | docker_intro.pdf | trainer3 | 2026-01-27 07:17:28 | 15MB | PDF |  
| 6 | kubernetes_guide.pdf | trainer2 | 2026-01-27 07:17:28 | 22MB | PDF |  
+----+----+----+----+  
4 rows in set (0.001 sec)  
  
MySQL [educloud_db]> |
```

## Count uploads per uploader, recent uploads (last 7 entries), students with their email group

```
ec2-user@ip-10-0-2-223:~  
MySQL [educloud_db]> SELECT filename, uploader, upload_timestamp  
-> FROM uploads  
-> ORDER BY upload_timestamp DESC  
-> LIMIT 7;  
+-----+-----+-----+  
| filename | uploader | upload_timestamp |  
+-----+-----+-----+  
| linux_basics_week1.pdf | trainer1 | 2026-01-27 07:17:28 |  
| aws_vpc_tutorial.pdf | trainer2 | 2026-01-27 07:17:28 |  
| assignment1.tar.gz | student1 | 2026-01-27 07:17:28 |  
| docker_intro.pdf | trainer3 | 2026-01-27 07:17:28 |  
| assignment2.tar.gz | student2 | 2026-01-27 07:17:28 |  
| kubernetes_guide.pdf | trainer2 | 2026-01-27 07:17:28 |  
| assignment3.tar.gz | student3 | 2026-01-27 07:17:28 |  
+-----+-----+-----+  
7 rows in set (0.001 sec)  
  
MySQL [educloud_db]> SELECT id, name, email, student_group  
-> FROM students  
-> ORDER BY name;  
+-----+-----+-----+  
| id | name | email | student_group |  
+-----+-----+-----+  
| 3 | Amit Patel | student3@educloud.com | students |  
| 2 | Priya Sharma | student2@educloud.com | students |  
| 1 | Rajesh Kumar | student1@educloud.com | students |  
| 4 | Sneha Reddy | student4@educloud.com | students |  
| 5 | Vikram Singh | student5@educloud.com | students |  
+-----+-----+-----+  
5 rows in set (0.002 sec)  
  
MySQL [educloud_db]>  
MySQL [educloud_db]> SELECT name, subject  
-> FROM trainers  
-> ORDER BY subject;  
+-----+-----+  
| name | subject |  
+-----+-----+  
| Prof. Meera Joshi | AWS Cloud Solutions |  
| Mr. Karthik Rao | DevOps & Automation |  
| Dr. Anand Kumar | Linux System Administration |  
+-----+-----+
```

**db layer access control, INSERT, UPDATE, SELECT to trainers**

**Created trainer user (full access)**

**Created student user (read-only), only SELECT to students**

**Create support user (logs monitoring), Grant SELECT to support**

```

ec2-user@ip-10-0-2-223:~$ MySQL [educloud_db]> CREATE USER 'trainer_user'@'%' IDENTIFIED BY 'Trainer@2026!Pass';
Query OK, 0 rows affected (0.012 sec)

MySQL [educloud_db]> GRANT SELECT, INSERT, UPDATE ON educloud_db.* TO 'trainer_user'@'%';
Query OK, 0 rows affected (0.007 sec)

MySQL [educloud_db]> CREATE USER 'student_user'@'%' IDENTIFIED BY 'Student@2026!Pass';
Query OK, 0 rows affected (0.009 sec)

MySQL [educloud_db]> GRANT SELECT ON educloud_db.students TO 'student_user'@'%';
Query OK, 0 rows affected (0.005 sec)

MySQL [educloud_db]> GRANT SELECT ON educloud_db.uploads TO 'student_user'@'%';
Query OK, 0 rows affected (0.005 sec)

MySQL [educloud_db]> Display all 762 possibilities? (y or n)
MySQL [educloud_db]>
Display all 762 possibilities? (y or n)
MySQL [educloud_db]> CREATE USER 'support_user'@'%' IDENTIFIED BY 'Support@2026!Pass';
Query OK, 0 rows affected (0.006 sec)

MySQL [educloud_db]> GRANT SELECT ON educloud_db.uploads TO 'support_user'@'%';
Query OK, 0 rows affected (0.005 sec)

MySQL [educloud_db]> FLUSH PRIVILEGES;
Query OK, 0 rows affected (0.005 sec)

MySQL [educloud_db]> SELECT user, host FROM mysql.user WHERE user IN ('trainer_user', 'student_user', 'support_user');
+-----+-----+
| user | host |
+-----+-----+
| student_user | % |
| support_user | % |
| trainer_user | % |
+-----+-----+
3 rows in set (0.001 sec)

MySQL [educloud_db]> |

```

## Testing with trainer user, INSERT, UPDATE, SELECT

```

ec2-user@ip-10-0-2-223:~$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ mysql -h educloud-mysql-db.c6n4sgm4gf6o.us-east-1.rds.amazonaws.com -P 3306 -u trainer_user -p
Enter password:
Welcome to the MariaDB monitor.  Commands end with ; or \g.
Your MySQL connection id is 31
Server version: 8.0.43 Source distribution

Copyright (c) 2000, 2018, Oracle, MariaDB Corporation Ab and others.

Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.

MySQL [(none)]> USE educloud_db;
Reading table information for completion of table and column names
You can turn off this feature to get a quicker startup with -A

Database changed
MySQL [educloud_db]> INSERT INTO students (name, email, student_group) VALUES
-> ('Test Student', 'test.student@educloud.com', 'students');
Query OK, 1 row affected (0.005 sec)

MySQL [educloud_db]> SELECT * FROM students WHERE email = 'test.student@educloud.com';
+-----+-----+-----+-----+
| id | name | email | student_group | created_at |
+-----+-----+-----+-----+
| 6 | Test Student | test.student@educloud.com | students | 2026-01-27 07:32:25 |
+-----+-----+-----+-----+
1 row in set (0.001 sec)

MySQL [educloud_db]> UPDATE students SET student_group = 'advanced_students'
-> WHERE email = 'test.student@educloud.com';
Query OK, 1 row affected (0.007 sec)
Rows matched: 1 Changed: 1 Warnings: 0

MySQL [educloud_db]> SELECT * FROM students WHERE email = 'test.student@educloud.com';
+-----+-----+-----+-----+
| id | name | email | student_group | created_at |
+-----+-----+-----+-----+
| 6 | Test Student | test.student@educloud.com | advanced_students | 2026-01-27 07:32:25 |
+-----+-----+-----+-----+
1 row in set (0.001 sec)

MySQL [educloud_db]> |

```

## Test Student User Access (Read-Only)

```

ec2-user@ip-10-0-2-223:~$ MySQL [educloud_db]> EXIT;
Bye
[ec2-user@ip-10-0-2-223 ~]$ mysql -h educloud-mysql-db.c6n4sgm4gf6o.us-east-1.rds.amazonaws.com -P 3306 -u student_user -p
Enter password:
Welcome to the MariaDB monitor.  Commands end with ; or \g.
Your MySQL connection id is 33
Server version: 8.0.43 Source distribution

Copyright (c) 2000, 2018, Oracle, MariaDB Corporation Ab and others.

Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.

MySQL [(none)]> USE educloud_db;
Reading table information for completion of table and column names
You can turn off this feature to get a quicker startup with -A

Database changed
MySQL [educloud_db]> SELECT * FROM students;
+----+-----+-----+-----+-----+
| id | name | email | student_group | created_at |
+----+-----+-----+-----+-----+
| 1 | Rajesh Kumar | student1@educloud.com | students | 2026-01-27 07:14:16 |
| 2 | Priya Sharma | student2@educloud.com | students | 2026-01-27 07:14:16 |
| 3 | Amit Patel | student3@educloud.com | students | 2026-01-27 07:14:16 |
| 4 | Sneha Reddy | student4@educloud.com | students | 2026-01-27 07:14:16 |
| 5 | Vikram Singh | student5@educloud.com | students | 2026-01-27 07:14:16 |
| 6 | Test Student | test.student@educloud.com | advanced_students | 2026-01-27 07:32:25 |
+----+-----+-----+-----+-----+
6 rows in set (0.001 sec)

MySQL [educloud_db]> INSERT INTO students (name, email, student_group) VALUES
-> ('Unauthorized', 'hack@test.com', 'students');
ERROR 1142 (42000): INSERT command denied to user 'student_user'@'10.0.2.223' for table 'students'
MySQL [educloud_db]> UPDATE students SET name = 'Hacked' WHERE id = 1;
ERROR 1142 (42000): UPDATE command denied to user 'student_user'@'10.0.2.223' for table 'students'
MySQL [educloud_db]> DELETE FROM students WHERE id = 1;
ERROR 1142 (42000): DELETE command denied to user 'student_user'@'10.0.2.223' for table 'students'
MySQL [educloud_db]> |

```

```

ec2-user@ip-10-0-2-223:~$ MySQL [educloud_db]>
MySQL [educloud_db]> SELECT * FROM students WHERE email = 'student1@educloud.com';
+----+-----+-----+-----+
| id | name | email | student_group | created_at |
+----+-----+-----+-----+
| 1 | Rajesh Kumar | student1@educloud.com | students | 2026-01-27 07:14:16 |
+----+-----+-----+-----+
1 row in set (0.001 sec)

MySQL [educloud_db]> SELECT * FROM uploads WHERE uploader = 'student1';
+----+-----+-----+-----+-----+
| id | filename | uploader | upload_timestamp | file_size | file_type |
+----+-----+-----+-----+-----+
| 3 | assignment1.tar.gz | student1 | 2026-01-27 07:17:28 | 25MB | Archive |
+----+-----+-----+-----+-----+
1 row in set (0.001 sec)

MySQL [educloud_db]> SELECT * FROM trainers;
ERROR 1142 (42000): SELECT command denied to user 'student_user'@'10.0.2.223' for table 'trainers'
MySQL [educloud_db]> |

```

## Admin User - Full Database Operations

```

ec2-user@ip-10-0-2-223:~$ MySQL [educloud_db]> SHOW FULL TABLES FROM educloud_db;
+-----+-----+
| Tables_in_educloud_db | Table_type |
+-----+-----+
| students | BASE TABLE |
| trainers | BASE TABLE |
| uploads | BASE TABLE |
+-----+-----+
3 rows in set (0.002 sec)

MySQL [educloud_db]> |

```

### **Created indexing on email for the performance**

```
ec2-user@ip-10-0-2-223:~$ MySQL [educloud_db]> CREATE VIEW student_uploads_view AS
->     SELECT
->         s.name AS student_name,
->         s.email,
->         u.filename,
->         u.upload_timestamp
->     FROM students s
->     LEFT JOIN uploads u ON s.name = CONCAT('student', s.id)
->     WHERE u.uploader LIKE 'student%';
Query OK, 0 rows affected (0.070 sec)

MySQL [educloud_db]> SELECT * FROM student_uploads_view;
Empty set (0.026 sec)

MySQL [educloud_db]> CREATE INDEX idx_student_email ON students(email);
Query OK, 0 rows affected (0.130 sec)
Records: 0 Duplicates: 0 Warnings: 0

MySQL [educloud_db]> CREATE INDEX idx_trainer_email ON trainers(email);
Query OK, 0 rows affected (0.058 sec)
Records: 0 Duplicates: 0 Warnings: 0

MySQL [educloud_db]> CREATE INDEX idx_uploader ON uploads(uploader);
Query OK, 0 rows affected (0.060 sec)
Records: 0 Duplicates: 0 Warnings: 0

MySQL [educloud_db]> |
```

```

ec2-user@ip-10-0-2-223:~$ MySQL [educloud_db]> exit
Bye
[ec2-user@ip-10-0-2-223 ~]$ mysql -h educloud-mysql-db.c6n4sgm4gf6o.us-east-1.rds.amazonaws.com -P 3306 -u admin -p
Enter password:
Welcome to the MariaDB monitor.  Commands end with ; or \g.
Your MySQL connection id is 50
Server version: 8.0.43 Source distribution

Copyright (c) 2000, 2018, Oracle, MariaDB Corporation Ab and others.

Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.

MySQL [(none)]> SHOW INDEX FROM students;
ERROR 1046 (3D000): No database selected
MySQL [(none)]> USE educloud_db;
Reading table information for completion of table and column names
You can turn off this feature to get a quicker startup with -A

Database changed
MySQL [educloud_db]> SHOW INDEX FROM students;
+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
| Table | Non_unique | Key_name   | Seq_in_index | Column_name | Collation | Cardinality | Sub_part | Packed | Null | Index_type | Comment | Index_C |
| Table | Non_unique | Key_name   | Seq_in_index | Column_name | Collation | Cardinality | Sub_part | Packed | Null | Index_type | Comment | Index_C |
+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
| students |          0 | PRIMARY    |            1 | id          | A           |        5 |       NULL |       NULL | BTREE   |          |          |
| students |          0 | NULL       |            1 | email       | A           |        5 |       NULL |       NULL | BTREE   |          |          |
| students |          1 | YES        |            1 | idx_student_email | A           |        6 |       NULL |       NULL | BTREE   |          |          |
| students |          1 | NULL       |            1 | email       | A           |        6 |       NULL |       NULL | BTREE   |          |          |
+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
3 rows in set (0.033 sec)

MySQL [educloud_db]>
```

## NFS SERVER SETUP

```
root@ip-10-0-2-223:/home/ec2-user
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# getent group trainers
trainers:x:1002:
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# getent group students
students:x:1003:
[root@ip-10-0-2-223 ec2-user]# id trainer1
uid=1002(trainer1) gid=1002(trainers) groups=1002(trainers)
[root@ip-10-0-2-223 ec2-user]# id student1
uid=1004(student1) gid=1003(students) groups=1003(students)
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# systemctl status nfs-server
● nfs-server.service - NFS server and services
   Loaded: loaded (/usr/lib/systemd/system/nfs-server.service; enabled; preset: disabled)
     Active: active (exited) since Tue 2026-01-27 06:18:38 UTC; 4h 37min ago
       Process: 1895 ExecStartPre=/usr/sbin/exportfs -r (code=exited, status=0/SUCCESS)
      Process: 1896 ExecStart=/usr/sbin/rpc.nfsd (code=exited, status=0/SUCCESS)
      Process: 1914 ExecStart=/bin/sh -c if systemctl -q is-active gssproxy; then systemctl reload gssproxy ; fi (code=exited, status=0/SUCCESS)
        Main PID: 1914 (code=exited, status=0/SUCCESS)
          CPU: 32ms

Jan 27 06:18:38 ip-10-0-2-223.ec2.internal systemd[1]: Starting nfs-server.service - NFS server and services...
Jan 27 06:18:38 ip-10-0-2-223.ec2.internal rpc.nfsd[1896]: rpc.nfsd: Unable to request RDMA services: Protocol not supported
Jan 27 06:18:38 ip-10-0-2-223.ec2.internal systemd[1]: Finished nfs-server.service - NFS server and services.
[root@ip-10-0-2-223 ec2-user]#
```

## Configure NFS Exports

### Backup original exports file

```
root@ip-10-0-2-223:/home/ec2-user
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# sudo cp /etc/exports /etc/exports.backup.$(date +%F)
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# ls -la /etc/exports*
-rw-r--r--. 1 root root 0 Jun 23 2020 /etc/exports
-rw-r--r--. 1 root root 0 Jan 27 10:58 /etc/exports.backup.2026-01-27

/etc/exports.d:
total 16
drwxr-xr-x. 2 root root 6 Feb 1 2023 .
drwxr-xr-x. 86 root root 16384 Jan 27 10:58 ..
[root@ip-10-0-2-223 ec2-user]#
```

### Creating simple NFS export configuration

```
GNU nano 8.3
# NFS Export Configuration for EduCloud Materials
# Export /materials directory to entire VPC
/materials 10.0.0.0/16(rw,sync,no_root_squash)
```

### proper permissions on /materials

# Set permissions: owner=rwx, group=rwx, others=no access

# This allows trainers to write, but we'll control read via file permissions

```

root@ip-10-0-2-223:/home/ec2-user
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# sudo vim /etc/exports

[1]+  Stopped                  sudo vim /etc/exports
[root@ip-10-0-2-223 ec2-user]# sudo nano /etc/exports
[root@ip-10-0-2-223 ec2-user]# sudo cat /etc/exports
# NFS Export Configuration for EduCloud Materials
# Export /materials directory to entire VPC

/materials 10.0.0.0/16(rw,sync,no_root_squash)

[root@ip-10-0-2-223 ec2-user]# sudo chown root:trainers /materials
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# sudo chmod 755 /materials
[root@ip-10-0-2-223 ec2-user]#

```

```

root@ip-10-0-2-223:/home/ec2-user
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# ls -ld /materials
lrwxrwxrwx. 1 root root 28 Jan 22 10:09 /materials -> /mnt/educloud-data/materials
[root@ip-10-0-2-223 ec2-user]# ls -ld /mnt/educloud-data/materials
drwxr-xr-x. 2 root trainers 82 Jan 23 15:56 /mnt/educloud-data/materials
[root@ip-10-0-2-223 ec2-user]#

```

## Services running, exports are active

```

root@ip-10-0-2-223:/home/ec2-user
[root@ip-10-0-2-223 ec2-user]# sudo systemctl start nfs-server
[root@ip-10-0-2-223 ec2-user]# sudo systemctl status nfs-server
sudo: systemctl: command not found
[root@ip-10-0-2-223 ec2-user]# sudo systemctl status nfs-server
● nfs-server.service - NFS server and services
   Loaded: Loaded (/usr/lib/systemd/system/nfs-server.service; enabled; preset: disabled)
     Active: active (exited) since Tue 2026-01-27 06:18:38 UTC; 4h 47min ago
       Process: 1895 ExecStartPre=/usr/sbin/exportfs -r (code=exited, status=0/SUCCESS)
      Process: 1896 ExecStart=/usr/sbin/rpc.nfsd (code=exited, status=0/SUCCESS)
      Process: 1914 ExecStart=/bin/sh -c if systemctl -q is-active gssproxy; then systemctl reload gssproxy ; fi (code=exited, status=0/SUCCESS)
     Main PID: 1914 (Code=exited, status=0/SUCCESS)
        CPU: 32ms

Jan 27 06:18:38 ip-10-0-2-223.ec2.internal systemd[1]: Starting nfs-server.service - NFS server and services...
Jan 27 06:18:38 ip-10-0-2-223.ec2.internal rpc.nfsd[1896]: rpc.nfsd: Unable to request RDMA services: Protocol not supported
Jan 27 06:18:38 ip-10-0-2-223.ec2.internal systemd[1]: Finished nfs-server.service - NFS server and services.
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# sudo systemctl status rpcbind | grep Active
  Active: active (running) since Tue 2026-01-27 06:18:38 UTC; 4h 47min ago
[root@ip-10-0-2-223 ec2-user]# sudo systemctl status nfs-server | grep Active
  Active: active (exited) since Tue 2026-01-27 06:18:38 UTC; 4h 47min ago
[root@ip-10-0-2-223 ec2-user]# sudo exportfs -arv
exporting 10.0.0.0/16:/mnt/educloud-data/materials
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]#

```

## Testing with local test mount point /mnt/nfs-local-test

```

root@ip-10-0-2-223:/home/ec2-user
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# sudo mount -t nfs 10.0.2.223:/materials /mnt/nfs-local-test
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# df -h | grep materials
10.0.2.223:/materials 10G 104M 9.9G 2% /mnt/nfs-local-test
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# mount | grep nfs
nfsd on /proc/fs/nfs type nfsd (rw,relatime)
sunrpc on /var/lib/nfs/rpc_pipefs type rpc_pipefs (rw,relatime)
10.0.2.223:/materials on /mnt/nfs-local-test type nfs (rw,relatime,vers=3,rsize=131072,wsize=131072,namelen=255,hard,proto=tcp,timeo=600,retrans=2,sec=sys,mountaddr=10.0.2.223,mountvers=3,mountport=20048,mountproto=udp,local_lock=none,addr=10.0.2.223)
[root@ip-10-0-2-223 ec2-user]# ^C
[root@ip-10-0-2-223 ec2-user]# ls -la /mnt/nfs-local-test
total 12
drwxr-xr-x. 2 root      trainers 82 Jan 23 15:56 .
drwxr-xr-x. 4 root      root    49 Jan 27 11:12 ..
-rw-rw----. 1 root      trainers 68 Jan 23 14:08 README-materials.txt
-rw-rw----. 1 trainer1  trainers 25 Jan 23 15:24 lecture1.pdf
-rw-rw----. 1 trainer1  trainers 17 Jan 23 15:56 test-inheritance.txt
[root@ip-10-0-2-223 ec2-user]#

```

## Testing write access as trainer

```

tracer1@ip-10-0-2-223:~#
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# sudo su - trainer1
Last login: Tue Jan 27 11:22:39 UTC 2026 on pts/3
[trainer1@ip-10-0-2-223 ~]$ echo "NFS Test - Uploaded by trainer1 on $(date)" > /materials/nfs-test.txt
cat /materials/nfs-test.txt
NFS Test - Uploaded by trainer1 on Tue Jan 27 11:25:55 UTC 2026
[trainer1@ip-10-0-2-223 ~]$ cat /mnt/nfs-local-test/nfs-test.txt
NFS Test - Uploaded by trainer1 on Tue Jan 27 11:25:55 UTC 2026
[trainer1@ip-10-0-2-223 ~]$ cat /materials/nfs-test.txt
NFS Test - Uploaded by trainer1 on Tue Jan 27 11:25:55 UTC 2026
[trainer1@ip-10-0-2-223 ~]$
```

## Create Sample Training Materials

```

tracer1@ip-10-0-2-223:/materials
[trainer1@ip-10-0-2-223 materials]$ tree /materials/
/materiels/
├── README-materials.txt
└── lecture1.pdf
  ├── nfs-test.txt
  └── test-inheritance.txt
  └── week1_linux_basics
    ├── commands_cheatsheet.txt
    └── linux_intro.txt
  └── week2_aws_basics
    └── aws_intro.txt

2 directories, 7 files
[trainer1@ip-10-0-2-223 materials]$ ls -R /materials
/materiels:
README-materials.txt  lecture1.pdf  nfs-test.txt  test-inheritance.txt  week1_linux_basics  week2_aws_basics

/materiels/week1_linux_basics:
commands_cheatsheet.txt  linux_intro.txt

/materiels/week2_aws_basics:
aws_intro.txt
[trainer1@ip-10-0-2-223 materials]$ ls -lah /materials/
total 16K
drwxrwx---. 4 root     trainers 152 Jan 27 13:14 .
drwxr-xr-x. 8 root     root    133 Jan 22 10:18 ..
-rw-rw----. 1 root     trainers  68 Jan 23 14:08 README-materials.txt
-rw-rw----. 1 trainer1 trainers  25 Jan 23 15:24 lecture1.pdf
-rw-r--r--. 1 trainer1 trainers  64 Jan 27 11:25 nfs-test.txt
-rw-rw----. 1 trainer1 trainers  17 Jan 23 15:56 test-inheritance.txt
drwxr-xr-x. 2 trainer1 trainers  60 Jan 27 13:14 week1_linux_basics
drwxr-xr-x. 2 trainer1 trainers  27 Jan 27 13:14 week2_aws_basics
[trainer1@ip-10-0-2-223 materials]$ ls -lah /materials/week1_linux_basics/
total 8.0K
drwxr-xr-x. 2 trainer1 trainers  60 Jan 27 13:14 .
drwxrwx---. 4 root     trainers 152 Jan 27 13:14 ..
-rw-r--r--. 1 trainer1 trainers 1.5K Jan 27 13:14 commands_cheatsheet.txt
-rw-r--r--. 1 trainer1 trainers 2.0K Jan 27 13:14 linux_intro.txt
[trainer1@ip-10-0-2-223 materials]$ ls -lah /materials/week2_aws_basics/
total 4.0K
drwxr-xr-x. 2 trainer1 trainers  27 Jan 27 13:14 .
drwxrwx---. 4 root     trainers 152 Jan 27 13:14 ..
-rw-r--r--. 1 trainer1 trainers 1.7K Jan 27 13:14 aws_intro.txt
[trainer1@ip-10-0-2-223 materials]$ |
```

## Student read only enforced

```

ec2-user@ip-10-0-2-223:~
[student1@ip-10-0-2-223 ~]$ 
[student1@ip-10-0-2-223 ~]$ 
[student1@ip-10-0-2-223 ~]$ 
[student1@ip-10-0-2-223 ~]$ touch /materials/student-test.txt
touch: cannot touch '/materials/student-test.txt': Permission denied
[student1@ip-10-0-2-223 ~]$ 
[student1@ip-10-0-2-223 ~]$ echo "Student edit attempt" >> /materials/week1_linux_basics/linux_intro.txt
-bash: /materials/week1_linux_basics/linux_intro.txt: Permission denied
[student1@ip-10-0-2-223 ~]$ 
[student1@ip-10-0-2-223 ~]$ rm /materials/week1_linux_basics/commands_cheatsheet.txt
rm: remove write-protected regular file '/materials/week1_linux_basics/commands_cheatsheet.txt'?
[student1@ip-10-0-2-223 ~]$ exit
Logout
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ |
```

## NFS server configuration

```

ec2-user@ip-10-0-2-223:~ [ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ sudo exportfs -v
/mnt/educloud-data/materials
    10.0.0.0/16(sync,wdelay,hide,no_subtree_check,sec=sys,rw,secure,no_root_squash,no_all_squash)
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ sudo systemctl status nfs-server --no-pager
● nfs-server.service - NFS server and services
   Loaded: loaded (/usr/lib/systemd/system/nfs-server.service; enabled; preset: disabled)
   Active: active (exited) since Tue 2026-01-27 06:18:38 UTC; 7h ago
     Process: 1895 ExecStartPre=/usr/sbin/exportfs -r (code=exited, status=0/SUCCESS)
    Process: 1896 ExecStart=/usr/sbin/rpc.nfsd (code=exited, status=0/SUCCESS)
    Process: 1914 ExecStart=/bin/sh -c if systemctl -q is-active gssproxy; then systemctl reload gssproxy ; fi (code=exited, status=0/SUCCESS)
   Main PID: 1914 (code=exited, status=0/SUCCESS)
      CPU: 32ms

Jan 27 06:18:38 ip-10-0-2-223.ec2.internal systemd[1]: Starting nfs-server.service - NFS server and services...
Jan 27 06:18:38 ip-10-0-2-223.ec2.internal rpc.nfsd[1896]: rpc.nfsd: Unable to request RDMA services: Protocol not supported
Jan 27 06:18:38 ip-10-0-2-223.ec2.internal systemd[1]: Finished nfs-server.service - NFS server and services.
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ sudo ss -tuln | grep 2049
tcp  LISTEN  0      64          0.0.0.0:2049  0.0.0.0:*
tcp  LISTEN  0      64          [::]:2049  [::]:*
[ec2-user@ip-10-0-2-223 ~]$ 

```

## Nfs-test-server

```

root@ip-10-0-2-24:/home/ec2-user [ec2-user@ip-10-0-2-24 ~]$ sudo su
[root@ip-10-0-2-24 ec2-user]# yum update
Amazon Linux 2023 repository
Amazon Linux 2023 Kernel Livepatch repository
Dependencies resolved.
Nothing to do.
Complete!
[root@ip-10-0-2-24 ec2-user]# sudo yum install nfs-utils -y
Last metadata expiration check: 0:00:24 ago on Tue Jan 27 13:53:34 2026.
Package nfs-utils-1:2.5.4-2.rc3.amzn2023.0.3.x86_64 is already installed.
Dependencies resolved.
Nothing to do.
Complete!
[root@ip-10-0-2-24 ec2-user]# which mount.nfs
/usr/sbin/mount.nfs
[root@ip-10-0-2-24 ec2-user]#
[root@ip-10-0-2-24 ec2-user]# sudo mkdir -p /mnt/educloud-materials
[root@ip-10-0-2-24 ec2-user]#
[root@ip-10-0-2-24 ec2-user]# ls -ld /mnt/educloud-materials
drwxr-xr-x. 2 root root 6 Jan 27 13:54 /mnt/educloud-materials
[root@ip-10-0-2-24 ec2-user]#
[root@ip-10-0-2-24 ec2-user]# sudo mount -t nfs 10.0.2.223:/materials /mnt/educloud-materials
Created symlink /run/systemd/system/remote-fs.target.wants/rpc-statd.service → /usr/lib/systemd/system/rpc-statd.service.
mount.nfs: mounting 10.0.2.223:/materials failed, reason given by server: No such file or directory
[root@ip-10-0-2-24 ec2-user]#
[root@ip-10-0-2-24 ec2-user]# df -h | grep materials
[root@ip-10-0-2-24 ec2-user]#
[root@ip-10-0-2-24 ec2-user]# mount | grep nfs
sunrpc on /var/lib/nfs/rpc_pipefs type rpc_pipefs (rw,relatime)
[root@ip-10-0-2-24 ec2-user]#
[root@ip-10-0-2-24 ec2-user]# sudo groupadd -g 1003 students
[root@ip-10-0-2-24 ec2-user]#
[root@ip-10-0-2-24 ec2-user]# sudo useradd -u 1004 -g students -m student1
[root@ip-10-0-2-24 ec2-user]#
[root@ip-10-0-2-24 ec2-user]# sudo passwd student1
Changing password for user student1.
New password:
[root@ip-10-0-2-24 ec2-user]#

```

## Student1 pwd:Stud1@2026

### Client-side nfs testing, file mounted successfully from client

```

root@ip-10-0-2-24:/home/ec2-user [root@ip-10-0-2-24 ~]$ sudo mount -t nfs 10.0.2.223:/mnt/educloud-data/materials /mnt/educloud-materials -o vers=4
[root@ip-10-0-2-24 ec2-user]#
[root@ip-10-0-2-24 ec2-user]# df -h | grep materials
10.0.2.223:/mnt/educloud-data/materials 10G 104M 9.9G  2% /mnt/educloud-materials
[root@ip-10-0-2-24 ec2-user]#
[root@ip-10-0-2-24 ec2-user]# mount | grep materials
10.0.2.223:/mnt/educloud-data/materials on /mnt/educloud-materials type nfs4 (rw,relatime,vers=4.2,rsize=131072,wsize=131072,namlen=255,hard,proto=tcp,timeo=600,retrans=2,sec=sys,clientaddr=10.0.2.24,local_lock=none,addr=10.0.2.223)
[root@ip-10-0-2-24 ec2-user]#
[root@ip-10-0-2-24 ec2-user]# ls -la /mnt/educloud-materials/
total 16
drwxr-xr-x. 4 root 1002 152 Jan 27 13:14 .
drwxr-xr-x. 3 root root 32 Jan 27 13:54 ..
-rw-rw----. 1 root 1002 68 Jan 23 14:08 README-materials.txt
-rw-rw----. 1 1002 1002 25 Jan 23 15:24 lecture1.pdf
-rw-r--r--. 1 1002 1002 64 Jan 27 11:25 nfs-test.txt
-rw-rw----. 1 1002 1002 17 Jan 23 15:56 test-inheritance.txt
drwxr-xr-x. 2 1002 1002 60 Jan 27 13:14 week1_linux_basics
drwxr-xr-x. 2 1002 1002 27 Jan 27 13:14 week2_aws_basics
[root@ip-10-0-2-24 ec2-user]#
[root@ip-10-0-2-24 ec2-user]#

```

### Student login in client and accessing mounted file from server /mnt/educloud-data/materials/\*

```

root@ip-10-0-2-24:/home/ec2-user#
[root@ip-10-0-2-24 ec2-user]# 
[root@ip-10-0-2-24 ec2-user]# 
[root@ip-10-0-2-24 ec2-user]# 
[root@ip-10-0-2-24 ec2-user]# sudo su - student
su: user student does not exist or the user entry does not contain all the required fields
[root@ip-10-0-2-24 ec2-user]# sudo su - student1
Last login: Tue Jan 27 13:58:05 UTC 2026 on pts/2
[student1@ip-10-0-2-24 ~]$ 
[student1@ip-10-0-2-24 ~]$ ls -la /mnt/educloud-materials/
total 16
drwxr-xr-x. 4 root 1002 152 Jan 27 13:14 .
drwxr-xr-x. 3 root root 32 Jan 27 13:54 ..
-rw-rw----. 1 root 1002 68 Jan 23 14:08 README-materials.txt
-rw-rw----. 1 1002 1002 25 Jan 23 15:24 lecture1.pdf
-rw-r--r--. 1 1002 1002 64 Jan 27 11:25 nfs-test.txt
-rw-rw----. 1 1002 1002 17 Jan 23 15:56 test-inheritance.txt
drwxr-xr-x. 2 1002 1002 60 Jan 27 13:14 week1_linux_basics
drwxr-xr-x. 2 1002 1002 27 Jan 27 13:14 week2_aws_basics
[student1@ip-10-0-2-24 ~]$ 
[student1@ip-10-0-2-24 ~]$ cat /mnt/educloud-materials/sample.txt
cat: /mnt/educloud-materials/sample.txt: No such file or directory
[student1@ip-10-0-2-24 ~]$ cat /mnt/educloud-materials/nfs-test.txt
NFS Test - Uploaded by trainer1 on Tue Jan 27 11:25:55 UTC 2026
[student1@ip-10-0-2-24 ~]$ 
[student1@ip-10-0-2-24 ~]$ 
[student1@ip-10-0-2-24 ~]$ exit
Logout
[root@ip-10-0-2-24 ec2-user]# |

```

## Write for the student is permission denied

```

student1@ip-10-0-2-24:/home/ec2-user#
[ec2-user@ip-10-0-2-24 ~]$ sudo su
[root@ip-10-0-2-24 ec2-user]# su student1
[student1@ip-10-0-2-24 ec2-user]$
[student1@ip-10-0-2-24 ec2-user]$ touch /mnt/educloud-materials/test_student.txt
touch: cannot touch '/mnt/educloud-materials/test_student.txt': Permission denied
[student1@ip-10-0-2-24 ec2-user]$
[student1@ip-10-0-2-24 ec2-user]$
[student1@ip-10-0-2-24 ec2-user]$

```

## train@2026

### trainers write on mounted

```

trainer@ip-10-0-2-24:~
[root@ip-10-0-2-24 ec2-user]#
[root@ip-10-0-2-24 ec2-user]#
[root@ip-10-0-2-24 ec2-user]#
[root@ip-10-0-2-24 ec2-user]#
[root@ip-10-0-2-24 ec2-user]# sudo mount -t nfs 10.0.2.223:/mnt/educloud-data/materials /mnt/educloud-materials -o vers=4
[root@ip-10-0-2-24 ec2-user]#
[root@ip-10-0-2-24 ec2-user]# ls -ld /mnt/educloud-materials/
drwxrwsr-x. 4 root trainers 152 Jan 27 13:14 /mnt/educloud-materials/
[root@ip-10-0-2-24 ec2-user]#
[root@ip-10-0-2-24 ec2-user]# sudo su - trainer
Last login: Tue Jan 27 17:15:55 UTC 2026 on pts/7
[trainer@ip-10-0-2-24 ~]$
[trainer@ip-10-0-2-24 ~]$ echo "Trainer works now" > /mnt/educloud-materials/trainer_works.txt
[trainer@ip-10-0-2-24 ~]$ 
[trainer@ip-10-0-2-24 ~]$ 
[trainer@ip-10-0-2-24 ~]$ ls -ld /mnt/educloud-materials/trainer_works.txt
-rw-r--r--. 1 trainer trainers 18 Jan 27 17:22 /mnt/educloud-materials/trainer_works.txt
[trainer@ip-10-0-2-24 ~]$ cat /mnt/educloud-materials/trainer_works.txt
Trainer works now
[trainer@ip-10-0-2-24 ~]$ 

```

## Create mount point sudo mkdir -p /mnt/educloud-materials

**sudo mount -t nfs 10.0.2.223:/mnt/educloud-data/materials /mnt/educloud-materials -o vers=4**

**df -h | grep materials**

**FTP Server Setup with vsftpd**

```

root@ip-10-0-2-223:~# vsftpd -v
vsftpd: version 3.0.5
[root@ip-10-0-2-223 ~]# 
[root@ip-10-0-2-223 ~]# sudo systemctl status vsftpd
● vsftpd.service - Vsftpd ftp daemon
   Loaded: loaded (/usr/lib/systemd/system/vsftpd.service; enabled; preset: disabled)
   Active: active (running) since Wed 2026-01-28 04:52:17 UTC; 7min ago
     Process: 1861 ExecStart=/usr/sbin/vsftpd /etc/vsftpd/vsftpd.conf (code=exited, status=0/SUCCESS)
    Main PID: 1863 (vsftpd)
      Tasks: 1 (limit: 1067)
     Memory: 940.0K
        CPU: 5ms
       CGroup: /system.slice/vsftpd.service
               └─1863 /usr/sbin/vsftpd /etc/vsftpd/vsftpd.conf

Jan 28 04:52:17 ip-10-0-2-223.ec2.internal systemd[1]: Starting vsftpd.service - Vsftpd ftp daemon...
Jan 28 04:52:17 ip-10-0-2-223.ec2.internal systemd[1]: Started vsftpd.service - Vsftpd ftp daemon.
[root@ip-10-0-2-223 ~]#

```

These permission for chroot jail user restricting user from accessing each other

Each student will be locked to their own directory (chroot jail)

allows students to write files in their directory

```

ec2-user@ip-10-0-2-223:~$ 
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ sudo chmod 700 /mnt/educloud-data/assignments/student1
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ sudo chown root:root /mnt/educloud-data/assignments
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ sudo chmod 755 /mnt/educloud-data/assignments
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ sudo chown student1:students /mnt/educloud-data/assignments/student1
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ sudo chown student2:students /mnt/educloud-data/assignments/student2
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ sudo chown student3:students /mnt/educloud-data/assignments/student3
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ sudo chmod 700 /mnt/educloud-data/assignments/student1
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ sudo chmod 700 /mnt/educloud-data/assignments/student2
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ sudo chmod 700 /mnt/educloud-data/assignments/student3
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ ls -la /mnt/educloud-data/assignments/
total 12
drwxr-xr-x. 5 root      root      138 Jan 28 05:48 .
drwxr-xr-x. 8 root      root      133 Jan 22 10:18 ..
-rw-rw----. 1 root      students  66 Jan 23 14:08 README-assignments.txt
-rw-rw----. 1 student1 students  34 Jan 23 15:39 assignment1.tar.gz
drwx-----. 2 student1 students  6 Jan 28 05:48 student1
drwx-----. 2 student2 students  6 Jan 28 05:48 student2
drwx-----. 2 student3 students  6 Jan 28 05:48 student3
-rw-rw----. 1 student1 students  17 Jan 23 15:59 test-inheritance.txt
[ec2-user@ip-10-0-2-223 ~]$ |

```

Backing up of vsftpd.conf file before changed

```

 ec2-user@ip-10-0-2-223:~  

[ec2-user@ip-10-0-2-223 ~]$  

[ec2-user@ip-10-0-2-223 ~]$  

[ec2-user@ip-10-0-2-223 ~]$  

[ec2-user@ip-10-0-2-223 ~]$  

[ec2-user@ip-10-0-2-223 ~]$  

[ec2-user@ip-10-0-2-223 ~]$ sudo cp /etc/vsftpd/vsftpd.conf /etc/vsftpd/vsftpd.conf.backup  

[ec2-user@ip-10-0-2-223 ~]$  

[ec2-user@ip-10-0-2-223 ~]$ ls -la /etc/vsftpd/  

total 44  

drwxr-xr-x. 2 root root 114 Jan 28 05:56 .  

drwxr-xr-x. 86 root root 16384 Jan 27 17:40 ..  

-rw-----. 1 root root 125 Feb 2 2023 ftpusers  

-rw-----. 1 root root 361 Feb 2 2023 user_list  

-rw-----. 1 root root 5039 Feb 2 2023 vsftpd.conf  

-rw-----. 1 root root 5039 Jan 28 05:56 vsftpd.conf.backup  

-rwxr--r--. 1 root root 352 Feb 2 2023 vsftpd_conf_migrate.sh  

[ec2-user@ip-10-0-2-223 ~]$ |

```

## SSL/TLS Certificate for Encryption

TLS enabled, uploads restricted to /assignments.

### Generated a self signed certificate

Generate self-signed SSL certificate valid for 365 days # -x509: Create self-signed certificate (not CA-signed) # -nodes: No password protection (for automated services) # -days 365: Valid for 1 year # -newkey rsa:2048: Generate 2048-bit RSA key pair # -keyout: Where to save private key # -out: Where to save public certificate # -subj: Certificate details (Country, State, City, Organization, Common Name)

```

 ec2-user@ip-10-0-2-223:~  

[ec2-user@ip-10-0-2-223 ~]$  

[ec2-user@ip-10-0-2-223 ~]$  

[ec2-user@ip-10-0-2-223 ~]$ sudo mkdir -p /etc/ssl/private  

[ec2-user@ip-10-0-2-223 ~]$  

[ec2-user@ip-10-0-2-223 ~]$ sudo openssl req -x509 -nodes -days 365 -newkey rsa:2048 \  

  -keyout /etc/ssl/private/vsftpd.key \  

  -out /etc/ssl/certs/vsftpd.crt \  

  -subj '/C=IN/ST=karnataka/L=Bengaluru/O=EduCloud/OU=IT/CN=10.0.2.223/emailAddress=admin@educloud.local'  

-----  

...  

-----  

[ec2-user@ip-10-0-2-223 ~]$ sudo chmod 600 /etc/ssl/private/vsftpd.key  

[ec2-user@ip-10-0-2-223 ~]$ ls -la /etc/ssl/private/vsftpd.key  

-rw----- 1 root root 1704 Jan 28 05:59 /etc/ssl/private/vsftpd.key  

[ec2-user@ip-10-0-2-223 ~]$  

[ec2-user@ip-10-0-2-223 ~]$ ls -la /etc/ssl/certs/vsftpd.crt  

-rw-r--r-- 1 root root 1448 Jan 28 05:59 /etc/ssl/certs/vsftpd.crt  

[ec2-user@ip-10-0-2-223 ~]$  

[ec2-user@ip-10-0-2-223 ~]$ sudo openssl x509 -in /etc/ssl/certs/vsftpd.crt -text -noout | head -20  

Certificate:  

  Data:  

    Version: 3 (0x2)  

    Serial Number:  

      63:6f:a7:f3:5a:f5:77:c9:e9:b8:97:cd:e0:55:a5:bb:07:25:bf:03  

    Signature Algorithm: sha256WithRSAEncryption  

    Issuer: C=IN, ST=karnataka, L=Bengaluru, O=EduCloud, OU=IT, CN=10.0.2.223, emailAddress=admin@educloud.local  

    Validity  

      Not Before: Jan 28 05:59:06 2026 GMT  

      Not After : Jan 28 05:59:06 2027 GMT  

    Subject: C=IN, ST=karnataka, L=Bengaluru, O=EduCloud, OU=IT, CN=10.0.2.223, emailAddress=admin@educloud.local  

    Subject Public Key Info:  

      Public Key Algorithm: rsaEncryption  

      Public-Key: (2048 bit)  

        Modulus:  

          00:c2:8b:96:3a:ef:87:6c:82:03:02:b6:99:12:bc:  

          46:94:63:b8:81:7b:86:4d:ac:51:25:8e:15:83:49:  

          c1:48:8c:1e:67:d2:62:8a:cb:p3:31:8c:4c:40:6e:  

          61:b4:dd:75:22:67:e2:85:80:de:85:4e:e3:41:6c:  

          f4:01:32:f4:ab:e7:la:52:87:6b:53:ce:f4:7d:c:  

[ec2-user@ip-10-0-2-223 ~]$ |

```

Changing student home directories to point to their assignment folders

This ensures they land in correct directory when they login via FTP

home directory for student1

Set home directory for student2

home directory for student3

```

 ec2-user@ip-10-0-2-223:~$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ sudo usermod -d /mnt/educloud-data/assignments/student1 student1 [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ sudo usermod -d /mnt/educloud-data/assignments/student2 student2 [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ sudo usermod -d /mnt/educloud-data/assignments/student3 student3 [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ cat /etc/passwd | grep student student1:x:1004:1003:Student One - EduCloud:/mnt/educloud-data/assignments/student1:/bin/bash student2:x:1005:1003:Student Two - EduCloud:/mnt/educloud-data/assignments/student2:/bin/bash student3:x:1006:1003:Student Three - EduCloud:/mnt/educloud-data/assignments/student3:/bin/bash [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ id student1 uid=1004(student1) gid=1003(students) groups=1003(students) [ec2-user@ip-10-0-2-223 ~]$ |

```

Clinet ftp student1 login

```

 root@ip-10-0-2-24:/home/ec2-user [root@ip-10-0-2-24 ec2-user]# lftp -u student1 10.0.2.223 Password: lftp student1@10.0.2.223:~> ls -rw-rw---- 1 0 1003 66 Jan 23 14:08 README-assignments.txt -rw-rw---- 1 1004 1003 34 Jan 23 15:39 assignment1.tar.gz drwx----- 2 1004 1003 6 Jan 28 05:48 student1 drwx----- 2 1005 1003 6 Jan 28 05:48 student2 drwx----- 2 1006 1003 6 Jan 28 05:48 student3 -rw-rw---- 1 1004 1003 17 Jan 23 15:59 test-inheritance.txt lftp student1@10.0.2.223:/> |

```

```

 root@ip-10-0-2-24:/home/ec2-user [root@ip-10-0-2-24 ec2-user]# lftp -u student1 10.0.2.223 Password: lftp student1@10.0.2.223:~> ls -rw-rw---- 1 0 1003 66 Jan 23 14:08 README-assignments.txt -rw-rw---- 1 1004 1003 34 Jan 23 15:39 assignment1.tar.gz drwx----- 2 1004 1003 6 Jan 28 05:48 student1 drwx----- 2 1005 1003 6 Jan 28 05:48 student2 drwx----- 2 1006 1003 6 Jan 28 05:48 student3 -rw-rw---- 1 1004 1003 17 Jan 23 15:59 test-inheritance.txt lftp student1@10.0.2.223:/> cd /student1 lftp student1@10.0.2.223:/student1> pwd ftp://student1@10.0.2.223/student1 lftp student1@10.0.2.223:/student1> echo "Math Assignment" > math_hw.txt lftp student1@10.0.2.223:/student1> echo "Science Project" > science_proj.txt lftp student1@10.0.2.223:/student1> tar -czf math_assignment.tar.gz math_hw.txt Unknown command 'tar'. lftp student1@10.0.2.223:/student1> !tar -czf math_assignment.tar.gz math_hw.txt lftp student1@10.0.2.223:/student1> !tar -czf science_assignment.tar.gz science_proj.txt lftp student1@10.0.2.223:/student1> mput math_assignment.tar.gz science_assignment.tar.gz 286 bytes transferred Total 2 files transferred lftp student1@10.0.2.223:/student1> ls -la drwx----- 2 1004 1003 69 Jan 28 07:32 . drwxr-xr-x 5 0 0 138 Jan 28 05:48 .. -rw-r--r-- 1 1004 1003 143 Jan 28 07:32 math_assignment.tar.gz -rw-r--r-- 1 1004 1003 143 Jan 28 07:32 science_assignment.tar.gz lftp student1@10.0.2.223:/student1> !ls -lh downloaded_assignment.tar.gz ls: cannot access 'downloaded_assignment.tar.gz': No such file or directory lftp student1@10.0.2.223:/student1> !ls -lh assignment1.tar.gz ls: cannot access 'assignment1.tar.gz': No such file or directory lftp student1@10.0.2.223:/student1> lftp student1@10.0.2.223:/student1>

```

```

root@ip-10-0-2-24:~# lftp -u student1 10.0.2.223
Password:
lftp student1@10.0.2.223:~> pwd
ftp://student1@10.0.2.223
lftp student1@10.0.2.223:~> ls
-rw-rw--- 1 0 1003 66 Jan 23 14:08 README-assignments.txt
-rw-rw--- 1 1004 1003 34 Jan 23 15:39 assignment1.tar.gz
drwx----- 2 1004 1003 69 Jan 28 07:32 student1
drwx----- 2 1005 1003 6 Jan 28 05:48 student2
drwx----- 2 1006 1003 6 Jan 28 05:48 student3
-rw-rw--- 1 1004 1003 17 Jan 23 15:59 test-inheritance.txt
lftp student1@10.0.2.223:/> get assignment1.tar.gz
34 bytes transferred
lftp student1@10.0.2.223:/> ls
-rw-rw--- 1 0 1003 66 Jan 23 14:08 README-assignments.txt
-rw-rw--- 1 1004 1003 34 Jan 23 15:39 assignment1.tar.gz
drwx----- 2 1004 1003 69 Jan 28 07:32 student1
drwx----- 2 1005 1003 6 Jan 28 05:48 student2
drwx----- 2 1006 1003 6 Jan 28 05:48 student3
-rw-rw--- 1 1004 1003 17 Jan 23 15:59 test-inheritance.txt
lftp student1@10.0.2.223:/> cd /student1
lftp student1@10.0.2.223:/student1> ls
-rw-r--r-- 1 1004 1003 143 Jan 28 07:32 math_assignment.tar.gz
-rw-r--r-- 1 1004 1003 143 Jan 28 07:32 science_assignment.tar.gz
lftp student1@10.0.2.223:/student1>

```

file uploads/downloads work, isolation is enforced, and the core EduCloud assignment system is functional

## final working

### Client student

```

student1@ip-10-0-2-24:~# 
student1@ip-10-0-2-24:~# 
student1@ip-10-0-2-24:~# 
student1@ip-10-0-2-24:~# su -student1
su: need to execute /etc/sudoers: No such file or directory
student1@ip-10-0-2-24:~# su student1
Last login: Tue Jan 27 15:32:05 UTC 2026 on pts/4
[student1@ip-10-0-2-24 ~]$ 
[student1@ip-10-0-2-24 ~]$ mkdir ~/final-project
[student1@ip-10-0-2-24 ~]$ 
[student1@ip-10-0-2-24 ~]$ cd ~/final-project
[student1@ip-10-0-2-24 final-project]$ 
[student1@ip-10-0-2-24 final-project]$ echo "Project Report" > report.txt
[student1@ip-10-0-2-24 final-project]$ 
[student1@ip-10-0-2-24 final-project]$ echo "<h1>hello world</h1>" > code.py
[student1@ip-10-0-2-24 final-project]$ 
[student1@ip-10-0-2-24 final-project]$ cd ~
[student1@ip-10-0-2-24 ~]$ 
[student1@ip-10-0-2-24 ~]$ czip final-project-submission.tar.gz final-project/
-bash: -czip: command not found
[student1@ip-10-0-2-24 ~]$ 
[student1@ip-10-0-2-24 ~]$ tar -czf final-project-submission.tar.gz final-project/
[student1@ip-10-0-2-24 ~]$ 
[student1@ip-10-0-2-24 ~]$ ls -lh final-project-submission.tar.gz
-rw-r--r-- 1 student1 students 233 Feb 2 07:39 final-project-submission.tar.gz
[student1@ip-10-0-2-24 ~]$ 
[student1@ip-10-0-2-24 ~]$ lftp -u student1 10.0.2.223
Password:
lftp student1@10.0.2.223:> cd student1
lftp student1@10.0.2.223:/student1> ls
-rw-r--r-- 1 1004 1003 143 Jan 28 07:32 math_assignment.tar.gz
-rw-r--r-- 1 1004 1003 143 Jan 28 07:32 science_assignment.tar.gz
lftp student1@10.0.2.223:/student1> put final-project-submission.tar.gz
233 bytes transferred
lftp student1@10.0.2.223:/student1> ls
-rw-r--r-- 1 1004 1003 233 Feb 02 07:41 final-project-submission.tar.gz
-rw-r--r-- 1 1004 1003 143 Jan 28 07:32 math_assignment.tar.gz
-rw-r--r-- 1 1004 1003 143 Jan 28 07:32 science_assignment.tar.gz
lftp student1@10.0.2.223:/student1>

```

### Server

```

root@ip-10-0-2-223:/home/ec2-user
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ exit
logout
Connection to 10.0.2.24 closed.
[root@ip-10-0-1-81 ec2-user]# ssh -i educloud-keypair ec2-user@10.0.2.223
A newer release of "Amazon Linux" is available.
Version 2023.10.20260120:
Run '/usr/bin/dnf check-release-update' for full release and version update info
      #_
      ##_#
      #####_
      /###\_
      /##\_
      /#\_
      /#\_
      V-->
      /_/
      /_/
      /_/
Last login: Mon Feb  2 12:50:52 2026 from 10.0.1.81
[ec2-user@ip-10-0-2-223 ~]$ sudo su
[root@ip-10-0-2-223 ec2-user]# ls -la /assignments/
total 120
drwxrws---  5 root    students 138 Jan 28 11:18 .
drwxr-xr-x  8 root    root     133 Jan 22 15:48 ..
-rw-rw----  1 root    students 66 Jan 23 19:38 README-assignments.txt
-rw-rw----  1 student1 students 34 Jan 23 21:09 assignment1.tar.gz
drwxr-sr-x  2 student1 students 129 Feb  2 13:11 student1
drwxr-sr-x  2 student2 students  6 Jan 28 11:18 student2
drwxr-sr-x  2 student3 students  6 Jan 28 11:18 student3
-rw-rw----  1 student1 students 17 Jan 23 21:29 test-inheritance.txt
[root@ip-10-0-2-223 ec2-user]# ls -la /assignments/student1
total 20
drwxrws--- 2 student1 students 129 Feb  2 13:11 .
drwxrws--- 5 root    students 138 Jan 28 11:18 ..
-rw-rw----  1 student1 students 46 Jan 28 15:56 .bash_history
-rw-r--r--  1 student1 students 233 Feb  2 13:11 final-project-submission.tar.gz
-rw-r--r--  1 student1 students 143 Jan 28 13:02 math_assignment.tar.gz
-rw-r--r--  1 student1 students 143 Jan 28 13:02 science_assignment.tar.gz
[root@ip-10-0-2-223 ec2-user]#

```

## AWS CLI - Test S3 Access from EC2

### Listing bucket

```

ec2-user@ip-10-0-2-223:~$ aws --version
aws-cli/2.32.22 Python/3.9.25 Linux/6.1.159-181.297.amzn2023.x86_64 source/x86_64.amzn.2023
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ aws configure list
NAME          : VALUE                      : TYPE          : LOCATION
profile        : <not set>                  : None         : None
access_key    : ****JZIE****                 : iam-role    :
secret_key    : ****Ghdu****                : iam-role    :
region        : us-east-1                  : imds        :
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ aws s3 ls
2026-01-20 09:42:33 educloud-materials-backup-mdnihal01fe27
2026-01-20 09:26:45 educloud-materials-mdnihal01fe27
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ echo "Test upload from WebServer EC2 instance" > /tmp/test-upload.txt
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ echo "Date: $(date)" >> /tmp/test-upload.txt
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ echo "Hostname: $(hostname)" >> /tmp/test-upload.txt
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ cat /tmp/test-upload.txt
Test upload from WebServer EC2 instance
Date: Wed Jan 28 08:20:29 UTC 2026
Hostname: ip-10-0-2-223.ec2.internal
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ 

```

### IAM Role attached to s3 access from ec2

**Instances (1/3) Info**

Find Instance by attribute or tag (case-sensitive)

All states ▾

Instance state = running X Clear filters

Name	Instance ID	Instance state	Instance type	Status check	Alarm status	Availability Zone	Public IPv4 DNS
EduCloud-WebServer-1	i-0688bc64d500b3be2	Running	t3.micro	3/3 checks passed	View alarms +	us-east-1a	-
EduCloud-Bastion	i-0b3feae601901d1c	Running	t3.micro	3/3 checks passed	View alarms +	us-east-1a	ec2-52-3-231-76.comp...
NFS-Client-Test	i-01d680f35d897c073	Running	t3.micro	3/3 checks passed	View alarms +	us-east-1a	-

**i-0688bc64d500b3be2 (EduCloud-WebServer-1)**

Details | Status and alarms | Monitoring | **Security** | Networking | Storage | Tags

**Security details**

IAM Role: EduCloud-EC2-Role

Owner ID: 139749347006

Launch time: Wed Jan 28 2026 10:22:06 GMT+0530 (India Standard Time)

Security groups: sg-0834453f1ae82fe95 (EduCloud-WebServer-SG)

**Inbound rules**

## S3 upload from ec2 cli

```
ec2-user@ip-10-0-2-223:~$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ cat /tmp/test-upload.txt Test upload from WebServer EC2 instance Date: Wed Jan 28 08:20:29 UTC 2026 Hostname: ip-10-0-2-223.ec2.internal [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ aws s3 ls 2026-01-20 09:42:33 educloud-materials-backup-mdnihal01fe27 2026-01-20 09:26:45 educloud-materials-mdnihal01fe27 [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ aws s3 cp /tmp/test-upload.txt s3://educloud-materials-mdnihal01fe27/test-cli/upload: ../../tmp/test-upload.txt to s3://educloud-materials-mdnihal01fe27/test-cli/test-upload.txt [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ aws s3 ls s3://educloud-materials-mdnihal01fe27/test-cli/ 2026-01-28 08:23:33 112 test-upload.txt [ec2-user@ip-10-0-2-223 ~]$ |
```

aws Search [Alt+S]

Amazon S3 > Buckets > educloud-materials-backup-mdnihal01fe27

MyAWSAccount (139749347006) ▾ MyAWSAccount

Objects (3) Actions ▾ Create folder Upload

Objects are the fundamental entities stored in Amazon S3. You can use [Amazon S3 inventory](#) to get a list of all objects in your bucket. For others to access your objects, you'll need to explicitly grant them permissions. [Learn more](#)

Show versions

Name	Type	Last modified	Size	Storage class
logs/	Folder	-	-	-
materials/	Folder	-	-	-
test-cli/	Folder	-	-	-

Amazon S3

- Buckets
  - General purpose buckets
    - Directory buckets
    - Table buckets
    - Vector buckets
- Access management and security
  - Access Points for FSx
  - Access Grants
  - IAM Access Analyzer
- Storage management and insights
  - Storage Lens
  - Batch Operations
- Account and organization settings
- AWS Marketplace for S3

CloudShell Feedback Console Mobile App

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## S3 Download

```
[ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ aws s3 cp s3://edcloud-materials-mdnihal01fe27/test-cli/test-upload.txt /tmp/test-download.txt download: s3://edcloud-materials-mdnihal01fe27/test-cli/test-upload.txt to ../../tmp/test-download.txt [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ cat /tmp/test-download.txt Test upload from WebServer EC2 instance Date: Wed Jan 28 08:20:29 UTC 2026 Hostname: ip-10-0-2-223.ec2.internal [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$
```

**Created 5 file and pushed across s3 at once for batch upload**

```
[ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ mkdir -p /tmp/educloud-test
for i in {1..5}; do
    echo "Test file $i - $(date)" > /tmp/educloud-test/file$i.txt
done
[ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ ls -lh /tmp/educloud-test/
total 20K
-rw-r--r-- 1 ec2-user ec2-user 43 Jan 28 08:27 file1.txt
-rw-r--r-- 1 ec2-user ec2-user 43 Jan 28 08:27 file2.txt
-rw-r--r-- 1 ec2-user ec2-user 43 Jan 28 08:27 file3.txt
-rw-r--r-- 1 ec2-user ec2-user 43 Jan 28 08:27 file4.txt
-rw-r--r-- 1 ec2-user ec2-user 43 Jan 28 08:27 file5.txt
[ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ aws s3 sync /tmp/educloud-test/ s3://educloud-materials-mdnihal01fe27/test-cli/batch/
upload: ../../tmp/educloud-test/file1.txt to s3://educloud-materials-mdnihal01fe27/test-cli/batch/file1.txt
upload: ../../tmp/educloud-test/file4.txt to s3://educloud-materials-mdnihal01fe27/test-cli/batch/file4.txt
upload: ../../tmp/educloud-test/file3.txt to s3://educloud-materials-mdnihal01fe27/test-cli/batch/file3.txt
upload: ../../tmp/educloud-test/file2.txt to s3://educloud-materials-mdnihal01fe27/test-cli/batch/file2.txt
upload: ../../tmp/educloud-test/file5.txt to s3://educloud-materials-mdnihal01fe27/test-cli/batch/file5.txt
[ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ aws s3 ls s3://educloud-materials-mdnihal01fe27/test-cli/batch/
2026-01-28 08:27:46        43 file1.txt
2026-01-28 08:27:46        43 file2.txt
2026-01-28 08:27:46        43 file3.txt
2026-01-28 08:27:46        43 file4.txt
2026-01-28 08:27:46        43 file5.txt
[ec2-user@ip-10-0-2-223 ~]$ |
```

## AWS CLI Installed (v2)

## IAM Role Attached (EduCloud-EC2-Role)

## S3 List Access Working

## S3 Upload Working

S3 Download Working

## S3 Sync Working

## Presigned URLs Working

## Automation Scripts used later for the cron jobs

### backup-materials.sh

```
root@ip-10-0-2-223:~# ls -ld /opt/educloud/scripts/backup-materials.sh
-rw-r--r--. 1 root root 2158 Jan 28 09:39 /opt/educloud/scripts/backup-materials.sh
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# ls -ld /var/log/educloud/
drwxr-xr-x. 2 root root 6 Jan 28 09:39 /var/log/educloud/
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# chmod +x /opt/educloud/scripts/backup-materials.sh
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# ls -lh /opt/educloud/scripts/backup-materials.sh
-rwxr-xr-x. 1 root root 2.2K Jan 28 09:39 /opt/educloud/scripts/backup-materials.sh
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]#
```

### upload-logs.sh Script

```
root@ip-10-0-2-223:~# ls -ld /opt/educloud/scripts/upload-logs.sh
-rw-r--r--. 1 root root 2519 Jan 28 09:42 /opt/educloud/scripts/upload-logs.sh
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# chmod +x /opt/educloud/scripts/upload-logs.sh
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# ls -lh /opt/educloud/scripts/upload-logs.sh
-rwxr-xr-x. 1 root root 2.5K Jan 28 09:42 /opt/educloud/scripts/upload-logs.sh
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# |
```

### archive-assignments.sh Script

```
root@ip-10-0-2-223:~# ls -ld /opt/educloud/scripts/archive-assignments.sh
-rw-r--r--. 1 root root 2930 Jan 28 09:43 /opt/educloud/scripts/archive-assignments.sh
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# chmod +x /opt/educloud/scripts/archive-assignments.sh
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# ls -lh /opt/educloud/scripts/archive-assignments.sh
-rwxr-xr-x. 1 root root 2.9K Jan 28 09:43 /opt/educloud/scripts/archive-assignments.sh
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# |
```

## Permissions

```

root@ip-10-0-2-223:/home/ec2-user
[root@ip-10-0-2-223 ec2-user]# 
[root@ip-10-0-2-223 ec2-user]# 
[root@ip-10-0-2-223 ec2-user]# 
[root@ip-10-0-2-223 ec2-user]# 
[root@ip-10-0-2-223 ec2-user]# chown -R ec2-user:ec2-user /opt/educloud
[root@ip-10-0-2-223 ec2-user]# 
[root@ip-10-0-2-223 ec2-user]# chmod 755 /opt/educloud
[root@ip-10-0-2-223 ec2-user]# 
[root@ip-10-0-2-223 ec2-user]# chmod 755 /opt/educloud/scripts
[root@ip-10-0-2-223 ec2-user]# 
[root@ip-10-0-2-223 ec2-user]# chmod 750 /opt/educloud/scripts/*.sh
[root@ip-10-0-2-223 ec2-user]# 
[root@ip-10-0-2-223 ec2-user]# chmod 755 /var/log/educloud
[root@ip-10-0-2-223 ec2-user]# 
[root@ip-10-0-2-223 ec2-user]# chown ec2-user:ec2-user /var/log/educloud
[root@ip-10-0-2-223 ec2-user]# 
[root@ip-10-0-2-223 ec2-user]# ls -lh /opt/educloud/scripts/
total 12K
-rwxr-x---. 1 ec2-user ec2-user 2.9K Jan 28 09:43 archive-assignments.sh
-rwxr-x---. 1 ec2-user ec2-user 2.2K Jan 28 09:39 backup-materials.sh
-rwxr-x---. 1 ec2-user ec2-user 2.5K Jan 28 09:42 upload-logs.sh
[root@ip-10-0-2-223 ec2-user]# 
[root@ip-10-0-2-223 ec2-user]# ls -ld /var/log/educloud/
drwxr-xr-x. 2 ec2-user ec2-user 6 Jan 28 09:39 /var/log/educloud/
[root@ip-10-0-2-223 ec2-user]# 
[root@ip-10-0-2-223 ec2-user]# 

```

## Testing scripts (backup)

```

root@ip-10-0-2-223:/home/ec2-user
[root@ip-10-0-2-223 ec2-user]# 
[root@ip-10-0-2-223 ec2-user]# 
[root@ip-10-0-2-223 ec2-user]# 
[root@ip-10-0-2-223 ec2-user]# 
[root@ip-10-0-2-223 ec2-user]# chown -R ec2-user:ec2-user /opt/educloud
[root@ip-10-0-2-223 ec2-user]# 
[root@ip-10-0-2-223 ec2-user]# chmod 755 /opt/educloud
[root@ip-10-0-2-223 ec2-user]# 
[root@ip-10-0-2-223 ec2-user]# chmod 755 /opt/educloud/scripts
[root@ip-10-0-2-223 ec2-user]# 
[root@ip-10-0-2-223 ec2-user]# chmod 750 /opt/educloud/scripts/*.sh
[root@ip-10-0-2-223 ec2-user]# 
[root@ip-10-0-2-223 ec2-user]# chmod 755 /var/log/educloud
[root@ip-10-0-2-223 ec2-user]# 
[root@ip-10-0-2-223 ec2-user]# chown ec2-user:ec2-user /var/log/educloud
[root@ip-10-0-2-223 ec2-user]# 
[root@ip-10-0-2-223 ec2-user]# ls -lh /opt/educloud/scripts/
total 12K
-rwxr-x---. 1 ec2-user ec2-user 2.9K Jan 28 09:43 archive-assignments.sh
-rwxr-x---. 1 ec2-user ec2-user 2.2K Jan 28 09:39 backup-materials.sh
-rwxr-x---. 1 ec2-user ec2-user 2.5K Jan 28 09:42 upload-logs.sh
[root@ip-10-0-2-223 ec2-user]# 
[root@ip-10-0-2-223 ec2-user]# ls -ld /var/log/educloud/
drwxr-xr-x. 2 ec2-user ec2-user 6 Jan 28 09:39 /var/log/educloud/
[root@ip-10-0-2-223 ec2-user]# 
[root@ip-10-0-2-223 ec2-user]# echo "Training Material - Cloud Computing Basics - $(date)" > /mnt/educloud-data/materials/test-material.txt
[root@ip-10-0-2-223 ec2-user]# 
[root@ip-10-0-2-223 ec2-user]# echo "Content: AWS EC2, S3, VPC" >> /mnt/educloud-data/materials/test-material.txt
[root@ip-10-0-2-223 ec2-user]# 
[root@ip-10-0-2-223 ec2-user]# cat /mnt/educloud-data/materials/test-material.txt
Training Material - Cloud Computing Basics - Wed Jan 28 09:47:03 UTC 2026
Content: AWS EC2, S3, VPC
[root@ip-10-0-2-223 ec2-user]# 
[root@ip-10-0-2-223 ec2-user]# ls -lh /mnt/educloud-data/materials/
total 24K
-rw-rw----. 1 root trainers 68 Jan 23 14:08 README-materials.txt
-rw-rw----. 1 trainer1 trainers 25 Jan 23 15:24 lecture1.pdf
-rw-rw----. 1 trainer1 trainers 64 Jan 27 11:25 nfs-test.txt
-rw-rw----. 1 trainer1 trainers 20 Jan 27 15:57 test-inheritance.txt
-rw-rw----. 1 root trainers 100 Jan 28 10:47 test-inheritance2.txt
-rw-rw----. 1 trainer1 trainers 18 Jan 27 17:22 trainer-workshop.txt
drwxrwxr-x. 2 trainer1 trainers 60 Jan 27 13:14 week1_linux_basics
drwxrwxr-x. 2 trainer1 trainers 27 Jan 27 13:14 week2_aws_basics
[root@ip-10-0-2-223 ec2-user]# 

```

```

[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ cat /var/log/educloud/backup.log
[2026-01-28 09:48:37] =====
[2026-01-28 09:48:37] Starting materials backup
[2026-01-28 09:48:37] Source: /mnt/educloud-data/materials
[2026-01-28 09:48:37] Destination: s3://educloud-materials-mdnihal0ife27/backups/materials-20260128-094837/
[2026-01-28 09:48:37] =====
[2026-01-28 09:49:31] ERROR: Aws authentication failed
[2026-01-28 10:10:12] =====
[2026-01-28 10:10:12] Starting materials backup
[2026-01-28 10:10:12] Source: /mnt/educloud-data/materials
[2026-01-28 10:10:12] Destination: s3://educloud-materials-mdnihal0ife27/backups/materials-20260128-101012/
[2026-01-28 10:10:12] =====
[2026-01-28 10:10:12] Files backup: 9
[2026-01-28 10:10:12] Total size: 40K
[2026-01-28 10:10:12] Starting S3 sync...
upload: ../../educloud-data/materials/lecture1.pdf to s3://educloud-materials-mdnihal0ife27/backups/materials-20260128-101012/lecture1.pdf
upload: ../../mnt/educloud-data/materials/README-materials.txt to s3://educloud-materials-mdnihal0ife27/backups/materials-20260128-101012/README-materials.txt
upload: ../../mnt/educloud-data/materials/test-inheritance.txt to s3://educloud-materials-mdnihal0ife27/backups/materials-20260128-101012/test-inheritance.txt
upload: ../../mnt/educloud-data/materials/trainer_works.txt to s3://educloud-materials-mdnihal0ife27/backups/materials-20260128-101012/trainer_works.txt
upload: ../../mnt/educloud-data/materials/week1_linux_basics/linux_intro.txt to s3://educloud-materials-mdnihal0ife27/backups/materials-20260128-101012/week1_linux_basics/linux_intro.txt
upload: ../../mnt/educloud-data/materials/nfs-test.txt to s3://educloud-materials-mdnihal0ife27/backups/materials-20260128-101012/nfs-test.txt
upload: ../../mnt/educloud-data/materials/week2_aws_basics/aws_intro.txt to s3://educloud-materials-mdnihal0ife27/backups/materials-20260128-101012/week2_aws_basics/aws_intro.txt
upload: ../../mnt/educloud-data/materials/test-material.txt to s3://educloud-materials-mdnihal0ife27/backups/materials-20260128-101012/test-material.txt
upload: ../../mnt/educloud-data/materials/week1_linux_basics/commands_cheatsheet.txt to s3://educloud-materials-mdnihal0ife27/backups/materials-20260128-101012/week1_linux_basics/commands_cheatsheet.txt
[2026-01-28 10:10:14] [?] SUCCESS: Backup completed in 1 seconds
[2026-01-28 10:10:14] Files backed up: 9
[2026-01-28 10:10:14] Backup process completed
[2026-01-28 10:10:14] =====
[ec2-user@ip-10-0-2-223 ~]$ 

```

## Logs /var/log/educloud/backup.log

```

[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ 
[ec2-user@ip-10-0-2-223 ~]$ sudo ./opt/educloud/scripts/backup-materials.sh
[2026-01-28 10:10:12] =====
[2026-01-28 10:10:12] Starting materials backup
[2026-01-28 10:10:12] =====
[2026-01-28 10:10:12] Destination: s3://educloud-materials-mdnihal0ife27/backups/materials-20260128-101012/
[2026-01-28 10:10:12] =====
[2026-01-28 10:10:12] Files to backup: 9
[2026-01-28 10:10:12] Total size: 40K
[2026-01-28 10:10:12] Starting S3 sync...
upload: ../../educloud-data/materials/lecture1.pdf to s3://educloud-materials-mdnihal0ife27/backups/materials-20260128-101012/lecture1.pdf
upload: ../../mnt/educloud-data/materials/README-materials.txt to s3://educloud-materials-mdnihal0ife27/backups/materials-20260128-101012/README-materials.txt
upload: ../../mnt/educloud-data/materials/test-inheritance.txt to s3://educloud-materials-mdnihal0ife27/backups/materials-20260128-101012/test-inheritance.txt
upload: ../../mnt/educloud-data/materials/trainer_works.txt to s3://educloud-materials-mdnihal0ife27/backups/materials-20260128-101012/trainer_works.txt
upload: ../../mnt/educloud-data/materials/week1_linux_basics/linux_intro.txt to s3://educloud-materials-mdnihal0ife27/backups/materials-20260128-101012/week1_linux_basics/linux_intro.txt
upload: ../../mnt/educloud-data/materials/nfs-test.txt to s3://educloud-materials-mdnihal0ife27/backups/materials-20260128-101012/nfs-test.txt
upload: ../../mnt/educloud-data/materials/week2_aws_basics/aws_intro.txt to s3://educloud-materials-mdnihal0ife27/backups/materials-20260128-101012/week2_aws_basics/aws_intro.txt
upload: ../../mnt/educloud-data/materials/test-material.txt to s3://educloud-materials-mdnihal0ife27/backups/materials-20260128-101012/test-material.txt
upload: ../../mnt/educloud-data/materials/week1_linux_basics/commands_cheatsheet.txt to s3://educloud-materials-mdnihal0ife27/backups/materials-20260128-101012/week1_linux_basics/commands_cheatsheet.txt
[2026-01-28 10:10:13] [?] SUCCESS: Backup completed in 1 seconds
[2026-01-28 10:10:14] Files backed up: 9
[2026-01-28 10:10:14] Backup process completed
[2026-01-28 10:10:14] =====
[ec2-user@ip-10-0-2-223 ~]$ 

```

## Test archive-assignments.sh Script

Created old sample data by student

```

root@ip-10-0-2-223:/mnt/educloud-data/assignments/student1
[root@ip-10-0-2-223 ec2-user]# cd /mnt/educloud-data/assignments/student1
[root@ip-10-0-2-223 student1]# sudo -u student1 whoami
student1
[root@ip-10-0-2-223 student1]# echo "Old assignment - $(date -d '35 days ago')" > /mnt/educloud-data/assignments/student1/old-assignment.txt
[root@ip-10-0-2-223 student1]# touch -d '35 days ago' /mnt/educloud-data/assignments/student1/old-assignment.txt
[root@ip-10-0-2-223 student1]#
[root@ip-10-0-2-223 student1]# ls -lh /mnt/educloud-data/assignments/student1/old-assignment.txt
-rw-r--r--. 1 root root 46 Dec 24 10:31 /mnt/educloud-data/assignments/student1/old-assignment.txt
[root@ip-10-0-2-223 student1]#
[root@ip-10-0-2-223 student1]#

```

## File archived

```

root@ip-10-0-2-223:~/.aws/credentials
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# /opt/educloud/scripts/archive-assignments.sh 30
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# Starting assignment archival
[root@ip-10-0-2-223 ec2-user]# Source: /mnt/educloud-data/assignments
[root@ip-10-0-2-223 ec2-user]# Archive threshold: 30 days
[root@ip-10-0-2-223 ec2-user]# =====
[root@ip-10-0-2-223 ec2-user]# Processing: student1
[root@ip-10-0-2-223 ec2-user]# Archiving: old-assignment.txt (46 bytes)
upload: ./mnt/educloud-data/assignments/student1/old-assignment.txt to s3://educloud-materials-mdnihal01fe27/archives/assignments/student1/20260128/old-assignment.txt
[root@ip-10-0-2-223 ec2-user]# Archived and removed: old-assignment.txt
[root@ip-10-0-2-223 ec2-user]# Processing: student2
[root@ip-10-0-2-223 ec2-user]# Processing: student3
[root@ip-10-0-2-223 ec2-user]# =====
[root@ip-10-0-2-223 ec2-user]# ARCHIVAL SUMMARY
[root@ip-10-0-2-223 ec2-user]# Total files found: 1
[root@ip-10-0-2-223 ec2-user]# Successfully archived: 1
[root@ip-10-0-2-223 ec2-user]# Failed: 0
[root@ip-10-0-2-223 ec2-user]# =====
[root@ip-10-0-2-223 ec2-user]# Current disk usage:
Filesystem      Size  Used Avail Use% Mounted on
/dev/xvdb1p1   10G  10M  9.9G  2% /mnt/educloud-data
[root@ip-10-0-2-223 ec2-user]# Archive process completed
[root@ip-10-0-2-223 ec2-user]# aws s3 ls s3://educloud-materials-mdnihal01fe27/archives/assignments/
2026-01-28 10:33:28    46 archives/assignments/student1/20260128/old-assignment.txt
[root@ip-10-0-2-223 ec2-user]#

```

Can be accessed via - `s3://educloud-materials-mdnihal01fe27/archives/assignments/student1/20260128/old-assignment.txt`

Stored in glacier deep archive

Created VPC endpoint gateway for the communication between ec2 s3 without nat

The screenshot shows the AWS VPC console interface. In the top navigation bar, the URL is `us-east-1.console.aws.amazon.com/vpcconsole/home?region=us-east-1#EndpointDetailsvcEndpointId=vpce-01dbe95b913350c2a`. The main content area displays a green success message: `Successfully created VPC endpoint vpce-01dbe95b913350c2a`. Below this, the `vpce-01dbe95b913350c2a / educloud-s3-endpoint` details are shown in a card format. The card includes fields for Endpoint ID (`vpce-01dbe95b913350c2a`), Status (Available), Creation time (Wednesday, January 28, 2026 at 16:16:30 GMT+5:30), and Endpoint type (Gateway). It also lists the Service name (`com.amazonaws.us-east-1.s3`), Service region (us-east-1), and Private DNS names enabled (No). The `Route tables` tab is selected, showing one route table named `Private-Route-Table` associated with the endpoint. The bottom right corner of the page has links for `CloudShell`, `Feedback`, and `Console Mobile App`.

## Adding Cron Job Entries

Verify Scripts exist

```
root@ip-10-0-2-223:/home/ec2-user
[ro...t@ip-10-0-2-223 ec2-user]#
[ro...t@ip-10-0-2-223 ec2-user]#
[ro...t@ip-10-0-2-223 ec2-user]#
[ro...t@ip-10-0-2-223 ec2-user]# crontab -e
no crontab for root - using an empty one
crontab: installing new crontab
[ro...t@ip-10-0-2-223 ec2-user]#
[ro...t@ip-10-0-2-223 ec2-user]# ls -ld /opt/educloud/scripts/backup-materials.sh
-rwxr-x---. 1 ec2-user ec2-user 2158 Jan 28 09:39 /opt/educloud/scripts/backup-materials.sh
[ro...t@ip-10-0-2-223 ec2-user]#
[ro...t@ip-10-0-2-223 ec2-user]# ls -ld /opt/educloud/scripts/upload-logs.sh
-rwxr-x---. 1 ec2-user ec2-user 2519 Jan 28 09:42 /opt/educloud/scripts/upload-logs.sh
[ro...t@ip-10-0-2-223 ec2-user]#
[ro...t@ip-10-0-2-223 ec2-user]# ls -ld /opt/educloud/scripts/archive-assignments.sh
-rwxr-x---. 1 ec2-user ec2-user 2930 Jan 28 09:43 /opt/educloud/scripts/archive-assignments.sh
[ro...t@ip-10-0-2-223 ec2-user]# |
```

## Required Users Exist

```
ec2-user@ip-10-0-2-223:~
[ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ getent passwd trainer1
trainer1:x:1002:1002:Trainer One - EduCloud:/home/trainer1:/bin/bash
[ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ getent passwd trainer2
trainer2:x:1003:1002:Trainer Two - EduCloud:/home/trainer2:/bin/bash
[ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ getent passwd support1
support1:x:1007:1004:Support Staff - EduCloud:/home/support1:/bin/bash
[ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ getent group trainers
trainers:x:1002:
[ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ getent group support
support:x:1004:
[ec2-user@ip-10-0-2-223 ~]$
```

## Cron for trainer1 (Daily Backup at 11:00 PM)

```
trainer1@ip-10-0-2-223:~
[ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ [ec2-user@ip-10-0-2-223 ~]$ su - trainer1
Password:
[ec2-user@ip-10-0-2-223 ~]$ sudo su - trainer1
Last login: Tue Jan 27 18:43:04 IST 2026 on pts/5
[trainer1@ip-10-0-2-223 ~]$ [trainer1@ip-10-0-2-223 ~]$ [trainer1@ip-10-0-2-223 ~]$ whoami
trainer1
[trainer1@ip-10-0-2-223 ~]$ crontab -e
no crontab for trainer1 - using an empty one
crontab: installing new crontab
[trainer1@ip-10-0-2-223 ~]$ crontab -l
#backup materials daily at 11:00 PM
0 23 * * * /opt/educloud/scripts/backup-materials.sh >> /var/log/educloud/trainer1-backup.log 2>&1
[trainer1@ip-10-0-2-223 ~]$
```

## Cron for support1 (Logs Every Sunday 6:00 PM)

```

support1@ip-10-0-2-223:~#
[ec2-user@ip-10-0-2-223 ~]$
[ec2-user@ip-10-0-2-223 ~]$
[ec2-user@ip-10-0-2-223 ~]$
[ec2-user@ip-10-0-2-223 ~]$ sudo su - support1
Last login: Fri Jan 23 21:20:58 IST 2026 on pts/7
Last failed login: Wed Jan 28 18:05:34 IST 2026 on pts/11
There was 1 failed login attempt since the last successful login.
[support1@ip-10-0-2-223 ~]$ whoami
support1
[support1@ip-10-0-2-223 ~]$ crontab -e
no crontab for support1 - using an empty one
crontab: installing new crontab
[support1@ip-10-0-2-223 ~]$ crontab -l
#upload logs every Sunday at 6:00 PM

0 18 * * 0 /opt/educloud/scripts/upload-logs.sh >> /var/log/educloud/support1-logs.log 2>&1
[support1@ip-10-0-2-223 ~]$ |

```

## Cron for trainer2 (Monthly Archive on 1st at 12:30 AM)

```

trainer2@ip-10-0-2-223:~#
[ec2-user@ip-10-0-2-223 ~]$
[ec2-user@ip-10-0-2-223 ~]$
[ec2-user@ip-10-0-2-223 ~]$
[ec2-user@ip-10-0-2-223 ~]$
[ec2-user@ip-10-0-2-223 ~]$
[ec2-user@ip-10-0-2-223 ~]$ sudo su - trainer2
[trainer2@ip-10-0-2-223 ~]$
[trainer2@ip-10-0-2-223 ~]$ whoami
trainer2
[trainer2@ip-10-0-2-223 ~]$
[trainer2@ip-10-0-2-223 ~]$ pwd
/home/trainer2
[trainer2@ip-10-0-2-223 ~]$
[trainer2@ip-10-0-2-223 ~]$ crontab -e
no crontab for trainer2 - using an empty one
crontab: installing new crontab
[trainer2@ip-10-0-2-223 ~]$ crontab -l
#rotate assignments monthly on 1st at 12:30 AM

30 0 1 * * /opt/educloud/scripts/archive-assignments.sh 90 >> /var/log/educloud/trainer2-archive.log 2>&1
[trainer2@ip-10-0-2-223 ~]$ |

```

## Proper Script Execution Permissions to Users

```

root@ip-10-0-2-223:/home/ec2-user#
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# chmod 755 /opt/educloud/scripts/backup-materials.sh
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# chmod 755 /opt/educloud/scripts/upload-logs.sh
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# chmod 755 /opt/educloud/scripts/archive-assignments.sh
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# chmod 777 /var/log/educloud
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# touch /var/log/educloud/trainer1-backup.log
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# touch /var/log/educloud/support1-logs.log
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# touch /var/log/educloud/trainer2-archive.log
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# chown trainer1:trainers /var/log/educloud/trainer1-backup.log
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# chown support1:support /var/log/educloud/support1-logs.log
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# chown trainer2:trainers /var/log/educloud/trainer2-archive.log
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# chmod 644 /var/log/educloud/*.log
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# |

```

## Cron jobs log files

```

root@ip-10-0-2-223:/home/ec2-user
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# ls -lh /var/log/educloud/
total 20K
-rw-r--r--. 1 root      root      1.3K Jan 28 19:15 archive.log
-rw-r--r--. 1 root      root      3.6K Jan 28 19:15 backup.log
-rw-r--r--. 1 root      root      0 Jan 28 19:15 logs.log
-rw-r--r--. 1 support1 support    0 Jan 28 18:11 support1-logs.log
-rw-r--r--. 1 ec2-user   ec2-user   59 Jan 28 15:45 test.log
-rw-r--r--. 1 trainer1  trainers  1.5K Jan 28 18:59 trainer1-backup.log
-rw-r--r--. 1 trainer2  trainers  0 Jan 28 18:11 trainer2-archive.log
-rw-r--r--. 1 ec2-user   ec2-user  934 Jan 28 15:45 upload-logs.log
[root@ip-10-0-2-223 ec2-user]#

```

## All users crontab

```

root@ip-10-0-2-223:/home/ec2-user
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# crontab -u trainer1 -l
#backup materials daily at 11:00 PM
0 23 * * * /opt/educloud/scripts/backup-materials.sh >> /var/log/educloud/trainer1-backup.log 2>&1
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# crontab -u support1 -l
#upload logs every Sunday at 6:00 PM
0 18 * * 0 /opt/educloud/scripts/upload-logs.sh >> /var/log/educloud/support1-logs.log 2>&1
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# crontab -u trainer2 -l
#rotate assignments monthly on 1st at 12:30 AM
30 0 1 * * /opt/educloud/scripts/archive-assignments.sh 90 >> /var/log/educloud/trainer2-archive.log 2>&1
[root@ip-10-0-2-223 ec2-user]#

```

## Crontab root user

```

root@ip-10-0-2-223:/home/ec2-user
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# crontab -e
crontab: installing new crontab
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# crontab -l
# EduCloud Automation - Scheduled by trainer1, support1, trainer2
# Runs as root for AWS IAM role access

# trainer1's job: Backup /materials daily at 11:00 PM IST
0 23 * * * /opt/educloud/scripts/backup-materials.sh >> /var/log/educloud/backup.log 2>&1

# support1's job: Upload /logs every Sunday at 6:00 PM IST
0 18 * * 0 /opt/educloud/scripts/upload-logs.sh >> /var/log/educloud/logs.log 2>&1

# trainer2's job: Archive assignments monthly on 1st at 12:30 AM IST
30 0 1 * * /opt/educloud/scripts/archive-assignments.sh 90 >> /var/log/educloud/archive.log 2>&1

# Cleanup old cron logs (monthly on 1st at 5:00 AM)
0 5 1 * * find /var/log/educloud -name "*.log" -mtime +30 -delete 2>&1

[root@ip-10-0-2-223 ec2-user]#

```

## Manual test after the crontab setup back ups working fine

```
root@ip-10-0-2-223:~# tail -f /var/log/educloud/backup.log
[2026-01-28 19:52:45] [S] SUCCESS: Backup completed in 1 seconds
[2026-01-28 19:52:45] [S] SUCCESS: Backup completed in 1 seconds
[2026-01-28 19:52:45] Files backed up: 9
[2026-01-28 19:52:45] Files backed up: 9
[2026-01-28 19:52:45] Backup process completed
[2026-01-28 19:52:45] Backup process completed
[2026-01-28 19:52:45] =====
[2026-01-28 19:52:45]
```

## Trainers archive old course materials into .tar.gz weekly

```
root@ip-10-0-2-223:~# chmod +x /opt/educloud/scripts/sync-materials-to-s3.sh
[root@ip-10-0-2-223 ec2-user]# touch /var/log/educloud/sync-materials.log
[root@ip-10-0-2-223 ec2-user]# chmod 644 /var/log/educloud/sync-materials.log
[root@ip-10-0-2-223 ec2-user]# crontab -e
crontab: installing new crontab
"/tmp/crontab.D4E4QXQ":2: bad minute
Invalid crontab file, can't install.
Do you want to retry the same edit? (Y/N) y
crontab: installing new crontab
[root@ip-10-0-2-223 ec2-user]# crontab -l
* * * * * /opt/educloud/scripts/backup-materials.sh >> /var/log/educloud/backup.log 2>&1
# 1. Backup materials daily at 2 AM (to s3://backups/)
0 2 * * * /opt/educloud/scripts/backup-materials.sh >> /var/log/educloud/backup.log 2>&1
# 2. Upload logs every Sunday at 6 PM
0 18 * * 0 /opt/educloud/scripts/upload-logs.sh >> /var/log/educloud/logs.log 2>&1
# 3. Archive old assignments monthly at 12:30 AM on 1st
0 0 1 * * /opt/educloud/scripts/archive-assignments.sh 90 >> /var/log/educloud/archive.log 2>&1
# 4. Cleanup old log files every Sunday at 1 AM
0 1 * * 0 find /var/log/educloud -name "*.log" -mtime +30 -delete 2>&1
# 5. Archive old materials every Sunday at 2 AM (to s3://archives/)
0 2 * * 0 /opt/educloud/scripts/archive-old-materials.sh 90 >> /var/log/educloud/archive-materials.log 2>&1
# 6. NEW: Sync materials to s3 daily at 11 PM (to s3://materials/ for CloudFront)
0 23 * * * /opt/educloud/scripts/sync-materials-to-s3.sh >> /var/log/educloud/sync-materials.log 2>&1

[root@ip-10-0-2-223 ec2-user]#
```

## Sync Materials to S3 Script

```

root@ip-10-0-2-223:~/home/ec2-user#
[root@ip-10-0-2-223 ec2-user]# 
[root@ip-10-0-2-223 ec2-user]# 
[root@ip-10-0-2-223 ec2-user]# /opt/educloud/scripts/sync-materials-to-s3.sh
[2026-01-28 21:06:48] Starting materials sync to S3
[2026-01-28 21:06:48] Source: /mnt/educloud-data/materials
[2026-01-28 21:06:48] Destination: s3://educloud-materials-mdnihil0ife27/materials
[2026-01-28 21:06:48] =====
[2026-01-28 21:06:48] Total files to sync: 9
upload: ../../mnt/educloud-data/materials/README-materials.txt to s3://educloud-materials-mdnihil0ife27/materials/README-materials.txt
delete: s3://educloud-materials-mdnihil0ife27/materials/server1 (1).pem
upload: ../../mnt/educloud-data/materials/nfs-test.txt to s3://educloud-materials-mdnihil0ife27/materials/test-inheritance.txt
upload: ../../mnt/educloud-data/materials/test-material.txt to s3://educloud-materials-mdnihil0ife27/materials/test-material.txt
upload: ../../mnt/educloud-data/materials/trainer_works.txt to s3://educloud-materials-mdnihil0ife27/materials/trainer_works.txt
upload: ../../mnt/educloud-data/materials/week1_linux_basics/commands_cheatsheet.txt to s3://educloud-materials-mdnihil0ife27/materials/week1_linux_basics/commands_cheatsheet.txt
upload: ../../mnt/educloud-data/materials/week2_aws_basics/aws_intro.txt to s3://educloud-materials-mdnihil0ife27/materials/week2_aws_basics/aws_intro.txt
upload: ../../mnt/educloud-data/materials/week1_linux_basics/linux_intro.txt to s3://educloud-materials-mdnihil0ife27/materials/week1_linux_basics/linux_intro.txt
upload: [2026-01-28 21:06:49] [+] SUCCESS: Materials synced to S3
[2026-01-28 21:06:50] Files in S3: 10
[2026-01-28 21:06:50] Sync process completed
[2026-01-28 21:06:50] =====
[root@ip-10-0-2-223 ec2-user]# tail -f /var/log/educloud/sync-materials.log
upload: ../../mnt/educloud-data/materials/test-material.txt to s3://educloud-materials-mdnihil0ife27/materials/test-material.txt
upload: ../../mnt/educloud-data/materials/trainer_works.txt to s3://educloud-materials-mdnihil0ife27/materials/trainer_works.txt
upload: ../../mnt/educloud-data/materials/week1_linux_basics/commands_cheatsheet.txt to s3://educloud-materials-mdnihil0ife27/materials/week1_linux_basics/commands_cheatsheet.txt
upload: ../../mnt/educloud-data/materials/week2_aws_basics/aws_intro.txt to s3://educloud-materials-mdnihil0ife27/materials/week2_aws_basics/aws_intro.txt
upload: ../../mnt/educloud-data/materials/week1_linux_basics/linux_intro.txt to s3://educloud-materials-mdnihil0ife27/materials/week1_linux_basics/linux_intro.txt
upload: [2026-01-28 21:06:49] [+] SUCCESS: Materials synced to S3
[2026-01-28 21:06:50] Files in S3: 10
[2026-01-28 21:06:50] Sync process completed
[2026-01-28 21:06:50] =====

```

Amazon S3

Buckets

General purpose buckets

- Directory buckets
- Table buckets
- Vector buckets

Access management and security

- Access Points
- Access Points for FSx
- Access Grants
- IAM Access Analyzer

Storage management and insights

- Storage Lens
- Batch Operations

Account and organization settings

AWS Marketplace for S3

Objects (9)

Name	Type	Last modified	Size	Storage class
lecture1.pdf	pdf	(UTC+05:30)	25.0 B	Standard
nfs-test.txt	txt	January 28, 2026, 21:06:50 (UTC+05:30)	64.0 B	Standard
README-materials.txt	txt	January 28, 2026, 21:06:50 (UTC+05:30)	68.0 B	Standard
server1 (1).pem	pem	January 20, 2026, 18:47:22 (UTC+05:30)	1.6 KB	Standard
test-inheritance.txt	txt	January 28, 2026, 21:06:50 (UTC+05:30)	17.0 B	Standard
test-material.txt	txt	January 28, 2026, 21:06:50 (UTC+05:30)	100.0 B	Standard
trainer_works.txt	txt	January 28, 2026, 21:06:50 (UTC+05:30)	18.0 B	Standard
week1_linux_basics/	Folder	-	-	-
week2_aws_basics/	Folder	-	-	-

## Apache Configuration with your HTML pages

```

root@ip-10-0-2-223:~# rpm -q httpd
httpd-2.4.66-1.amzn2023.0.1.x86_64
root@ip-10-0-2-223:~# systemctl status httpd
● httpd.service - The Apache HTTP Server
   Loaded: loaded (/usr/lib/systemd/system/httpd.service; enabled; preset: disabled)
   Drop-In: /usr/lib/systemd/system/httpd.service.d
             └─php-fpm.conf
     Active: active (running) since Thu 2026-01-29 10:28:46 IST; 23min ago
       Docs: man:httpd.service(8)
     Main PID: 1533 (httpd)
      Status: "Total requests: 0; Idle/Busy workers 100/0;Requests/sec: 0; Bytes served/sec: 0 B/sec"
        Tasks: 177 (limit: 1067)
       Memory: 18.2M
          CPU: 1.408s
      CGroup: /system.slice/httpd.service
              ├─1533 /usr/sbin/httpd -DFOREGROUND
              ├─1536 /usr/sbin/httpd -DFOREGROUND
              ├─1537 /usr/sbin/httpd -DFOREGROUND
              ├─1538 /usr/sbin/httpd -DFOREGROUND
              └─1539 /usr/sbin/httpd -DFOREGROUND

Jan 29 10:28:46 ip-10-0-2-223.ec2.internal systemd[1]: Starting httpd.service - The Apache HTTP Server...
Jan 29 10:28:46 ip-10-0-2-223.ec2.internal systemd[1]: Started httpd.service - The Apache HTTP Server.
Jan 29 10:28:46 ip-10-0-2-223.ec2.internal httpd[1533]: Server configured, listening on: port 80
[root@ip-10-0-2-223 ec2-user]#

```

## Directory structure

```

root@ip-10-0-2-223:~# cd /var/www/html/
root@ip-10-0-2-223:~# pwd
/var/www/html
root@ip-10-0-2-223:~# mkdir -p /var/www/html/architecture
root@ip-10-0-2-223:~# mkdir -p /var/www/html/student-portal
root@ip-10-0-2-223:~# mkdir -p /var/www/html/assets/videos
root@ip-10-0-2-223:~# tree /var/www/html/ -L 2
/var/www/html/
├── architecture
├── assets
│   └── videos
├── dbtest.php
└── index.html
├── info.php
└── student-portal

4 directories, 3 files
[root@ip-10-0-2-223 html]#

```

## Ami configured from the educloud-webserver-1

Screenshot of the AWS EC2 AMI Catalog page showing the details of the AMI 'ami-000a1b5c0635ba38c'.

**Image summary for ami-000a1b5c0635ba38c (EduCloud-WebServer-Golden-Image)**

AMI ID	ami-000a1b5c0635ba38c	Image type	machine	Platform details	Linux/UNIX	Root device type	EBS
AMI name	EduCloud-WebServer-Golden-Image	Owner account ID	159749347006	Architecture	x86_64	Usage operation	RunInstances
Root device name	/dev/xvda	Status	Available	Source	159749347006/EduCloud-WebServer-Golden-Image	Virtualization type	hvm
Boot mode	uefi-preferred	State reason	-	Creation date	2026-01-29T07:00:33.000Z	Kernel ID	-
Description	Configured web server with Apache, NFS, Cron jobs, users, and scripts for EduCloud platform portal	Product codes	-	RAM disk ID	-	Deprecation time	-
Last launched time	-	Block devices	/dev/xvda=snap-036b8e9ae4c5d45f7:8:true:gp /dev/sdf=snap-0804290ffd23a4415:20:false:gp	Deregistration protection	Disabled	Allowed image	-
Source AMI ID	ami-07ff62358b87c7116	Source AMI Region	us-east-1				

**Permissions** | **Storage** | **My AMI usage** | **AMI Ancestry - new** | **Tags**

**Image share permission:** Private. This image is only shared with account IDs, organizations, or OUs that you have specified.

## Create Launch Template

Screenshot of the 'Create launch template' wizard.

**Create launch template**

Creating a launch template allows you to create a saved instance configuration that can be reused, shared and launched at a later time. Templates can have multiple versions.

**Launch template name and description**

Launch template name - required: EduCloud-WebServer-Template

Must be unique to this account. Max 128 chars. No spaces or special characters like '&', '&', '@'.

Template version description: Web server with Apache, users, cron jobs

Max 255 chars

Auto Scaling guidance: Info. Select this if you intend to use this template with EC2 Auto Scaling.  Provide guidance to help me set up a template that I can use with EC2 Auto Scaling

**Template tags**

Key: Name, Value: EduCloud-WebServer-Template, Add new tag

You can add up to 49 more tags.

**Source template**

**Summary**

Software Image (AMI): Configured web server with Apa...read more ami-000a1b5c0635ba38c

Virtual server type (instance type): t3.micro

Firewall (security group): EduCloud-WebServer-SG

Storage (volumes): 2 volume(s) - 28 GiB

**Create launch template**

Screenshot of the 'Create launch template' wizard.

**Launch template contents**

Specify the details of your launch template below. Leaving a field blank will result in the field not being included in the launch template.

**Application and OS Images (Amazon Machine Image) - required**

An AMI contains the operating system, application server, and applications for your instance. If you don't see a suitable AMI below, use the search field or choose Browse more AMIs.

Search our full catalog including 1000s of application and OS images

Recents | **My AMIs** | Quick Start

Owned by me | Shared with me

Browse more AMIs

**Amazon Machine Image (AMI)**

EduCloud-WebServer-Golden-Image  
ami-000a1b5c0635ba38c  
2026-01-29T07:00:33.000Z Virtualization: hvm ENA enabled: true Root device type: ebs Boot mode: uefi-preferred

**Description**

Configured web server with Apache, NFS, Cron jobs, users, and scripts for EduCloud platform portal

**Architecture** x86\_64 | **AMI ID** ami-000a1b5c0635ba38c

**Summary**

Software Image (AMI): Configured web server with Apa...read more ami-000a1b5c0635ba38c

Virtual server type (instance type): t3.micro

Firewall (security group): EduCloud-WebServer-SG

Storage (volumes): 2 volume(s) - 28 GiB

**Create launch template**

**Instance type**

t3.micro  
Family: t3 - 2vCPU | 1 GB Memory | Current generation true | On-Demand (Ubuntu Pro base pricing: 0.0159 USD per Hour)  
On-Demand SUSE base pricing: 0.0104 USD per Hour | On-Demand Linux base pricing: 0.0104 USD per Hour | On-Demand RHEL base pricing: 0.0152 USD per Hour | On-Demand Windows base pricing: 0.0196 USD per Hour

**Key pair (login)**

Key pair name: EduCloud-KeyPair | Create new key pair

**Network settings**

Subnet: Don't include in launch template | Create new subnet

When you specify a subnet, a network interface is automatically added to your template.

Availability Zone: Don't include in launch template | Enable additional zones

Not applicable for EC2 Auto Scaling

Firewall (security groups): Info

A security group is a set of firewall rules that control the traffic for your instance. Add rules to allow specific traffic to reach your instance.

**Summary**

Software Image (AMI): Configured web server with Apache... | ami-000a1b5c0635ba3bc  
Virtual server type (instance type): t3.micro  
Firewall (security group): EduCloud-WebServer-SG  
Storage (volumes): 2 volume(s) - 28 GiB

**Create launch template**

## Successfully created launch template which includes AMI of educloud-webserver-1

**Success**  
Successfully created EduCloud-WebServer-Template (lt-0270f5718c6279bcf).

**Actions log**

**Next Steps**

**Launch an instance**  
With On-Demand Instances, you pay for compute capacity by the second (for Linux, with a minimum of 60 seconds) or by the hour (for all other operating systems) with no long-term commitments or upfront payments. Launch an On-Demand Instance from your launch template.

**Launch instance from this template**

**Create an Auto Scaling group from your template**  
Amazon EC2 Auto Scaling helps you maintain application availability and allows you to scale your Amazon EC2 capacity up or down automatically according to conditions you define. You can use Auto Scaling to help ensure that you are running your desired number of Amazon EC2 Instances during demand spikes to maintain performance and decrease capacity during lulls to reduce costs.

**Create Auto Scaling group**

**Create Spot Fleet**  
A Spot Instance is an unused EC2 instance that is available for less than the On-Demand price. Because Spot Instances enable you to request unused EC2 instances at steep discounts, you can lower your Amazon EC2 costs significantly. The hourly price for a Spot Instance (of each instance type in each Availability Zone) is set by Amazon EC2, and adjusted gradually based on the long-term supply of and demand for Spot Instances. Spot instances are well-suited for data-analysis, batch jobs, background processing, and optional tasks.

**Create Spot Fleet**

**View launch templates**

**Launch Templates (1)**

Launch Template ID	Launch Template Name	Default Version	Latest Version	Create Time	Created By	Manage
lt-0270f5718c6279bcf	EduCloud-WebServer-Template	1	1	2026-01-29T09:03:47.000Z	arn:aws:siam::139749347006:root	false

The screenshot shows the AWS EC2 Launch Template details for 'EduCloud-WebServer-Template'. It includes sections for 'Launch template details' (Launch template ID: lt-0270f3718c6279bcf, Launch template name: EduCloud-WebServer-Template, Default version: 1, Owner: arn:aws:iam::139749347006:root) and 'Launch template version details' (Version 1 (Default), Description: Web server with Apache, users, cron jobs, Date created: 2026-01-29T09:03:47.000Z). The 'Instance details' tab is selected, showing AMI ID: ami-000a1b5c0635ba38c, Instance type: t3.micro, Availability Zone: -, and Security group IDs: sg-0834453f1ae82fe95.

## Creating Target Group

The screenshot shows the 'Create target group' wizard at Step 1: Target group details. It displays 'Target group details' (Name: EduCloud-TG, Target type: Instance, Protocol: Port, Port: 80, Protocol version: HTTP1) and 'Health check details' (Health check protocol: HTTP, Health check path: /, Health check port: traffic-port, Interval: 30 seconds, Timeout: 5 seconds, Healthy threshold: 2, Unhealthy threshold: 2, Success codes: 200).

The screenshot shows the 'Target groups' page for 'EduCloud-TG'. It displays 'Details' (Target type: Instance, Protocol: Port, Port: 80, Protocol version: HTTP1, VPC: vpc-0fddc429bf867a8c5) and a summary of targets (0 Total targets, 0 Healthy, 0 Unhealthy, 0 Unused, 0 Initial, 0 Draining). The 'Targets' tab is selected, showing a table with columns: Instance ID, Name, Port, Zone, Health status, Health status details, Admin..., Overri..., Launch... (No registered targets). A note states: 'Target groups route requests to individual registered targets using the protocol and port number specified. Health checks are performed on all registered targets according to the target group's health check settings. Anomaly detection is automatically applied to HTTP/HTTPS target groups with at least 3 healthy targets.'

# Application Load Balancer (ALB)

The screenshot shows the AWS CloudShell interface with the URL [https://console.aws.amazon.com/ec2/loadbalancers/create?refid=MyAWSAccount](#). The page is titled "Create Application Load Balancer". The "Basic configuration" section contains fields for "Load balancer name" (set to "EduCloud-ALB"), "Scheme" (with options "Internet-facing" and "Internal" selected), and "Load balancer IP address type" (with options "IPv4" (selected), "Dualstack", and "Dualstack without public IPv4"). Other sections like "Network mapping", "Security groups", and "Listeners and routing" are partially visible below.

The screenshot continues from the previous one, showing the "Network mapping" section. It details the selected VPC ("EduCloudVPC"), the IP pool ("10.0.0.0/16"), and the chosen Availability Zones and subnets: "us-east-1a (use1-az1)" and "us-east-1b (use1-az2)". The "Security groups" section is also partially visible at the bottom.

The screenshot shows the "Listeners and routing" section. A new listener for "HTTP:80" is being created with "Protocol" set to "HTTP" and "Port" set to "80". The "Default action" is set to "Forward to target groups". The "Target group" section lists a single target group named "EduCloud-ALB-SG" with the ARN "sg-0505e52b09bb2911a" and the VPC "vpc-0fddc429bf867a8c3". The "Weight" and "Percent" columns are present but empty.

Screenshot of the AWS EC2 Load Balancers console showing the creation of a new Application Load Balancer (ALB) named "EduCloud-ALB".

**Success message:** Successfully created load balancer: EduCloud-ALB. It might take a few minutes for your load balancer to fully set up and route traffic. Targets will also take a few minutes to complete the registration process and pass initial health checks.

**Introducing ALB target optimizer:** Target optimizer lets you enforce a maximum number of requests per target using an ALB-provided agent; improving success rates, latency, and efficiency. [Learn more](#)

**EduCloud-ALB Details:**

- Load balancer type:** Application
- Status:** Provisioning
- VPC:** vpc-0fddc429bf867a8c5
- Load balancer IP address type:** IPv4
- Hosted zone:** Z355XD01RQ7X7K
- Availability Zones:** us-east-1b (use1-az2), us-east-1a (use1-az1)
- Load balancer ARN:** arn:aws:elasticloadbalancing:us-east-1:139749347006:loadbalancer/app/EduCloud-ALB/c9423b59ce70ede
- DNS name info:** EduCloud-ALB-1947718251.us-east-1.elb.amazonaws.com (A Record)

**Listeners and rules:** (1) Info

**Actions:** Manage rules, Manage listener, Add listener

Screenshot of the AWS EC2 Load Balancers console showing the list of existing load balancers.

**Load balancers (1) What's new?**

Elastic Load Balancing scales your load balancer capacity automatically in response to changes in incoming traffic.

Name	State	Type	Scheme	IP address type	VPC ID	Availability Zones	Security groups
EduCloud-ALB	Provisioning...	application	Internet-facing	IPv4	vpc-0fddc429bf867a8c5	2 Availability Zones	sg-0505e52b098

**0 load balancers selected**

Select a load balancer above.

## Auto Scaling Group

Screenshot of the AWS Auto Scaling Groups console.

**Amazon EC2 Auto Scaling** helps maintain the availability of your applications.

Auto Scaling groups are collections of Amazon EC2 instances that enable automatic scaling and fleet management features. These features help you maintain the health and availability of your applications.

**How it works:** Diagram showing an "Auto Scaling group" containing three boxes. One box is solid, one is dashed, and one is dotted. An arrow points from the solid box to the dashed box, labeled "Scale out as needed". Below the boxes are labels "Minimum size" and "Scale out as needed".

**Create Auto Scaling group:** Get started with EC2 Auto Scaling by creating an Auto Scaling group. [Create Auto Scaling group](#)

**Pricing:** Amazon EC2 Auto Scaling features have no additional fees beyond the service fees for Amazon EC2, CloudWatch (for scaling policies), and the other AWS resources that you use. Visit the pricing page of each service to learn more.

**Getting started:** [What is Amazon EC2 Auto Scaling?](#)

Screenshot of the AWS EC2 Auto Scaling Groups creation wizard Step 4: Configure group size and scaling.

**EduCloud-ASG** (Must be unique to this account in the current Region and no more than 255 characters.)

**Launch template** [Info](#)

For accounts created after May 31, 2023, the EC2 console only supports creating Auto Scaling groups with launch templates. Creating Auto Scaling groups with launch configurations is not recommended but still available via the CLI and API until December 31, 2023.

**Launch template** Choose a launch template that contains the instance-level settings, such as the Amazon Machine Image (AMI), instance type, key pair, and security groups.

**EduCloud-WebServer-Template** [Create a launch template](#) [Version](#)

**Description** Web server with Apache, users, cron jobs

**AMI ID** ami-000a1b5c0635ba38c

**Key pair name** EduCloud-KeyPair

**Launch template** [EduCloud-WebServer-Template](#) It-0270f5718c6279bcf

**Instance type** t3.micro

**Security groups** -

**Security group IDs** sg-0834453f1ae82fe95

**Additional details**

[Create a launch template version](#) [Description](#) [AMI ID](#) [Key pair name](#) [Launch template](#) [Instance type](#) [Security groups](#) [Security group IDs](#) [Additional details](#)

Screenshot of the AWS EC2 Auto Scaling Groups creation wizard Step 5: Choose instance launch options.

**Choose instance launch options** [Info](#)

Choose the VPC network environment that your instances are launched into, and customize the instance types and purchase options.

**Instance type requirements** [Info](#)

You can keep the same instance attributes or instance type from your launch template, or you can choose to override the launch template by specifying different instance attributes or manually adding instance types.

**Launch template** [EduCloud-WebServer-Template](#) **Version** Default **Description** Web server with Apache, users, cron jobs

**Instance type** t3.micro

**VPC** Choose the VPC that defines the virtual network for your Auto Scaling group.

vpc-0fdcc429bf867a8c3 (EduCloudVPC) [Create a VPC](#)

**Availability Zones and subnets** Define which Availability Zones and subnets your Auto Scaling group can use in the chosen VPC.

Select Availability Zones and subnets

Screenshot of the AWS EC2 Auto Scaling Groups creation wizard Step 6: Integrate with other services - optional.

**Integrate with other services - optional** [Info](#)

Use a load balancer to distribute network traffic across multiple servers. Enable service-to-service communications with VPC Lattice. Shift resources away from impaired Availability Zones with zonal shift. You can also customize health check replacements and monitoring.

**Load balancing** [Info](#)

Use the options below to attach your Auto Scaling group to an existing load balancer, or to a new load balancer that you define.

**Select Load balancing options**

No load balancer Traffic to your Auto Scaling group will not be fronted by a load balancer.

Attach to an existing load balancer Choose from your existing load balancers.

Attach to a new load balancer Quickly create a basic load balancer to attach to your Auto Scaling group.

**Attach to an existing load balancer**

**Select the load balancers to attach**

Choose from your load balancer target groups This option allows you to attach Application, Network, or Gateway Load Balancers.

Choose from Classic Load Balancers

**Existing load balancer target groups** Only instance target groups that belong to the same VPC as your Auto Scaling group are available for selection.

Select target groups

EduCloud-TG | HTTP Application Load Balancer: EduCloud-ALB

**VPC Lattice integration options** [Info](#)

To improve network visibility and availability, Integrate your Auto Scaling group with VPC Lattice. VPC Lattice facilitates communication between AWS services and helps you manage

The screenshot shows the 'Create Auto Scaling group' step in the AWS EC2 console. Under 'VPC Lattice integration options', the 'No VPC Lattice service' option is selected. It describes how VPC Lattice will not manage the Auto Scaling group's network access and connectivity with other services. The 'Attach to VPC Lattice service' option is also available, with a note that incoming requests associated with specified VPC Lattice target groups will be routed to the Auto Scaling group. Below this, there are sections for 'Application Recovery Controller (ARC) zonal shift' and 'Health checks'. The 'EC2 health checks' section shows 'Always enabled'. There is an optional checkbox for 'Turn on Elastic Load Balancing health checks' which is checked and marked as 'Recommended'. A note states that EC2 Auto Scaling will start to detect and act on health checks performed by Elastic Load Balancing. At the bottom, there are links for CloudShell, Feedback, and Console Mobile App, along with copyright information for 2026 and links for Privacy, Terms, and Cookie preferences.

## Policy Configuration:

### Scaling Policies

The screenshot shows the 'Create Auto Scaling group' step in the AWS EC2 console. In the sidebar, 'Add tags' is selected. The main area shows the 'Desired capacity' section where 'Specify your group size' is set to 2. Below it is the 'Scaling' section, which includes 'Min desired capacity' (2) and 'Max desired capacity' (5). The 'Automatic scaling - optional' section has 'Target tracking scaling policy' selected, with a note about choosing a CloudWatch metric and target value. Other options like 'No scaling policies' are also shown. The 'Scaling policy name' is set to 'EduCloud-CPU-Scaling-Policy'. The 'Metric type' is set to 'Average CPU utilization'. At the bottom, there are links for CloudShell, Feedback, and Console Mobile App, along with copyright information for 2026 and links for Privacy, Terms, and Cookie preferences.

ASG created

The screenshot shows the AWS EC2 Auto Scaling Groups console. The left sidebar is collapsed. The main area displays the 'EduCloud-ASG Capacity overview' page. Key details include:

- Desired capacity:** 2
- Scaling limits:** 2 - 5
- Desired capacity type:** Units (number of instances)
- Status:** -

Below this, the 'Date created' is listed as Thu Jan 29 2026 16:32:37 GMT+0530 (India Standard Time). The navigation bar at the bottom includes tabs for Details, Integrations, Automatic scaling, Instance management, Instance refresh, Activity, Monitoring, and Tags - moved.

The screenshot shows the AWS EC2 Auto Scaling Groups console. The left sidebar is collapsed. The main area displays the 'Auto Scaling groups (1) Info' page. The single group listed is 'EduCloud-ASG' with the following details:

- Name:** EduCloud-ASG
- Launch template:** EduCloud-WebServer-Template
- Version:** Version 2
- Instances:** 2
- Status:** -
- Desired capacity:** 2
- Min:** 2
- Max:** 5
- Availability Zones:** 2 Availability Zones

The navigation bar at the top includes tabs for Launch configurations, Launch templates, Actions, and Create Auto Scaling group.

## Monitoring Instance Launch

The screenshot shows the AWS EC2 Auto Scaling Groups console. The left sidebar is collapsed. The main area displays the 'Activity' tab under the 'EduCloud-ASG' page. It shows two entries in the 'Activity history':

Status	Description	Cause	Start time	End time
Successful	Launching a new EC2 instance: i-01ff9876dd39bc07d	At 2026-01-29T11:02:37Z a user request created an AutoScalingGroup changing the desired capacity from 0 to 2. At 2026-01-29T11:02:41Z an instance was started in response to a difference between desired and actual capacity, increasing the capacity from 0 to 2.	2026 January 29, 04:32:43 PM +05:30	2026 January 29, 04:32:50 PM +05:30
Successful	Launching a new EC2 instance: i-08241c6c7ecc52076	At 2026-01-29T11:02:37Z a user request created an AutoScalingGroup changing the desired capacity from 0 to 2. At 2026-01-29T11:02:41Z an instance was started in response to a difference between desired and actual capacity, increasing the capacity from 0 to 2.	2026 January 29, 04:32:43 PM +05:30	2026 January 29, 04:32:50 PM +05:30

The navigation bar at the bottom includes tabs for Details, Integrations, Automatic scaling, Instance management, Instance refresh, Activity, Monitoring, and Tags - moved.

## Desired Capacity of 2

The screenshot shows the AWS EC2 Instances page. In the left sidebar, under the 'Instances' section, 'Instances' is selected. The main area displays a table titled 'Instances (2/5) Info' with two rows selected. The selected instances are 'EduCloud-ASG-WebServer-1' and 'EduCloud-ASG-WebServer'. The table columns include Name, Instance ID, Instance state, Instance type, Status check, Alarm status, Availability Zone, and Public IPv4 DNS. Below the table, a message says '2 instances selected'. Under the 'Monitoring' tab, there are four panels: CPU utilization (%), Network in (bytes), Network out (bytes), and Network packets in (count), all showing 'No data available.'.

The screenshot shows the AWS EC2 Instances page. In the left sidebar, under the 'Instances' section, 'Instances' is selected. The main area displays a table titled 'Instances (1/5) Info' with one row selected. The selected instance is 'EduCloud-ASG-WebServer'. The table columns are the same as the previous screenshot. Below the table, a detailed view for the selected instance 'i-08241c6c7ecc52076 (EduCloud-ASG-WebServer)' is shown. The 'Details' tab is selected, displaying information such as Instance ID (i-08241c6c7ecc52076), Public IPv4 address (10.0.2.149), Private IPv4 addresses (10.0.2.149), Public DNS (ip-10-0-2-149.ec2.internal), and VPC ID. Other tabs include Status and alarms, Monitoring, Security, Networking, Storage, and Tags.

The screenshot shows the AWS EC2 Target Groups console for the target group 'EduCloud-TG'. Key details include:

- Target type:** Instance
- Protocol:** HTTP: 80
- Protocol version:** HTTP1
- VPC:** vpc-0fddc429bf867a8c3
- Targets:** 2 Total targets (2 Healthy, 0 Unhealthy, 0 Anomalous)
- Health checks:** 0 Unused, 0 Initial, 0 Draining
- Registered targets:** 2 (Info: Anomaly mitigation: Not applicable)

Educloud Trainer Portal live Created from the Golden image From Educloud-Websever-1

Inherited successfully, instances only allow traffic from ALB

<http://educloud-alb-1947718251.us-east-1.elb.amazonaws.com/>

The screenshot shows the Edu Cloud Student Portal homepage. Key features and statistics include:

- Enterprise-Grade Cloud**
- Secure Trainer-Student File Portal** on AWS Cloud
- Uptime SLA:** 99.9%
- AWS Services:** 10+
- Auto-Scale:** 5 → 10GB
- File Portal:** Secure trainer-student exchange (Live)
- Statistics:** 2,547 (Last checked), 100% (Current), 24/7 (Available)
- File Portal Features:** Upload (Trainers share materials), Download (Students access files), Encrypted (256-bit security), Real-time (Instant notifications)

## Student Portal

Not secure educloud-alb-1947718251.us-east-1.elb.amazonaws.com/student-portal/

EduCloud Home Materials Submit Work Resources Trainer Portal

STUDENT PORTAL

# Your Personal Learning Hub

Powered by AWS Cloud

Access course materials, submit assignments, and track your progress—all in one secure cloud platform

**24/7** Access **100%** Secure **Fast** Downloads

[Browse Materials](#) [Submit Work](#)

EXPLORE MATERIALS

**My Learning Portal** Online

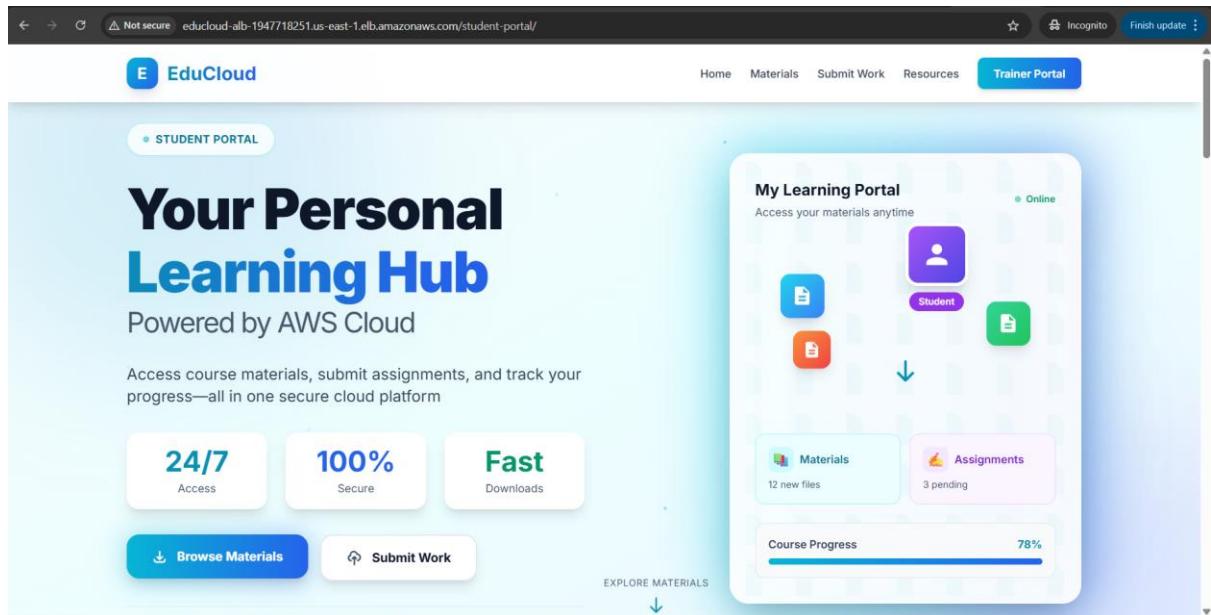
Access your materials anytime

Student

Materials 12 new files

Assignments 3 pending

Course Progress 78%



Not secure educloud-alb-1947718251.us-east-1.elb.amazonaws.com/student-portal/

EduCloud Home Materials Submit Work Resources Trainer Portal

STUDY MATERIALS

## Download Course Materials

Access notes, slides, and learning resources uploaded by your trainer

**Linux Essentials** Reviewed

Shell commands and system administration fundamentals

PDF • 1.8 MB Updated 3d ago

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**AWS Fundamentals** In Progress

Cloud computing basics and AWS architecture overview

PDF • 2.4 MB Updated 5d ago

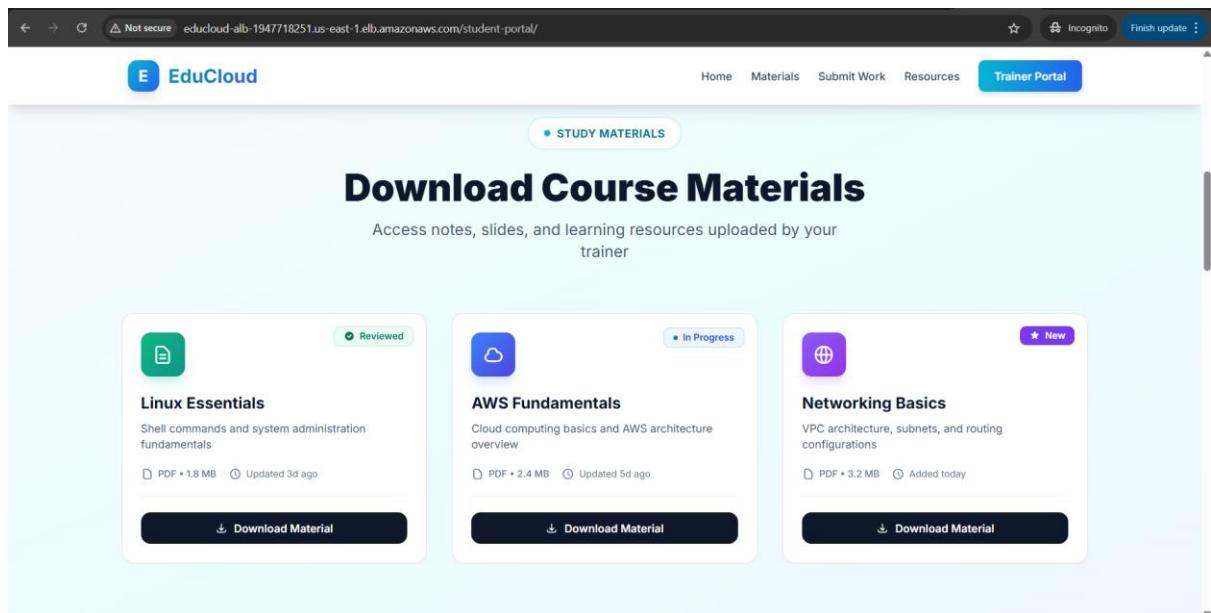
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EduCloud Home Materials Submit Work Resources Trainer Portal

ASSIGNMENT SUBMISSION

## Submit Your Work

Upload your completed assignment and receive detailed feedback from your instructor

**Assignment Title \***

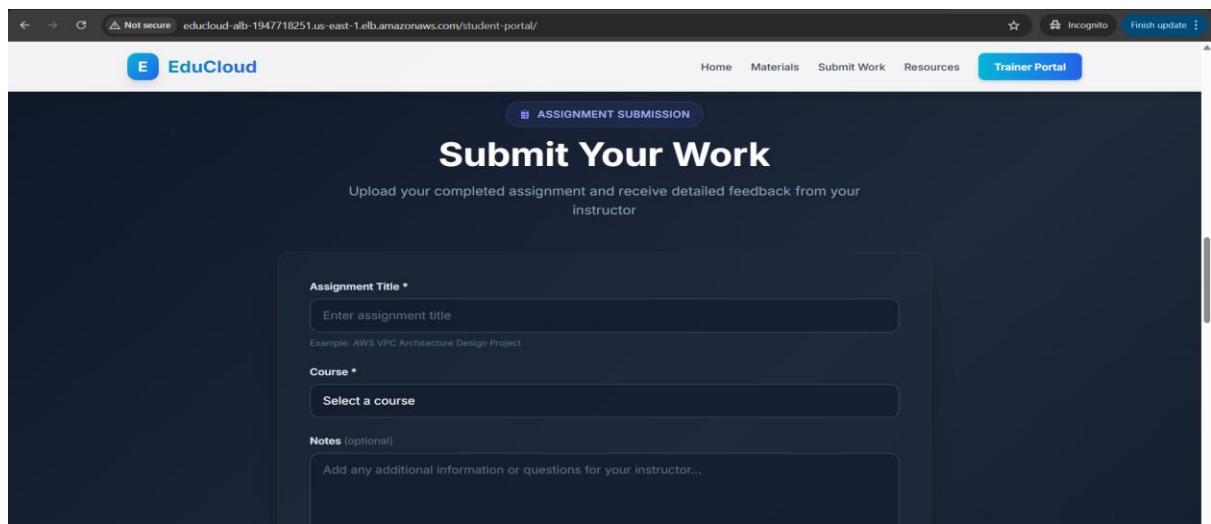
Enter assignment title  
Example: AWS VPC Architecture Design Project

**Course \***

Select a course

**Notes (optional)**

Add any additional information or questions for your instructor...



## Load Testing & Auto Scaling Verification desired capacity 2

The screenshot shows the AWS EC2 Instances page. On the left, there's a navigation sidebar with options like Dashboard, EC2 Global View, Events, Instances (selected), Instance Types, Launch Templates, Spot Requests, Savings Plans, Reserved Instances, Dedicated Hosts, Capacity Reservations, Capacity Manager, Images, AMIs, AMI Catalog, Elastic Block Store, Volumes, Snapshots, Lifecycle Manager, and Network & Security. The main area shows a table of instances:

Name	Instance ID	Instance state	Instance type	Status check	Alarm status	Availability Zone	Public IPv4 DNS
EduCloud-ASG-WebServer	i-01d74ef7aa0c094dc	Running	t3.micro	3/3 checks passed	View alarms +	us-east-1b	-
EduCloud-ASG-WebServer	i-078f97712718a75a6	Running	t3.micro	3/3 checks passed	View alarms +	us-east-1a	-
EduCloud-WebServer-1	i-0688bc64d500b5be2	Running	t3.micro	3/3 checks passed	View alarms +	us-east-1a	-
EduCloud-Bastion	i-0b3feae601901d1c	Running	t3.micro	3/3 checks passed	View alarms +	us-east-1a	ec2-98-84-47-197.com...

Below the table, it says "2 instances selected". The "Monitoring" tab is active, showing four charts: CPU utilization (%), Network in (bytes), Network out (bytes), and Network packets in (count). All charts show "No data available." The footer includes links for CloudShell, Feedback, and Console Mobile App, along with copyright information: © 2026, Amazon Web Services, Inc. or its affiliates.

## http access logs

```
[root@ip-10-0-5-45 ~]# sudo su
[root@ip-10-0-5-45 ec2-user]#
[root@ip-10-0-5-45 ec2-user]# tail -f /var/log/httpd/access_log
10.0.1.57 - [29/Jan/2026:19:46:10 +0530] "GET / HTTP/1.1" 200 220761 "-" "ELB-HealthChecker/2.0"
10.0.6.194 - [29/Jan/2026:19:46:10 +0530] "GET / HTTP/1.1" 200 220761 "-" "ELB-HealthChecker/2.0"
10.0.1.57 - [29/Jan/2026:19:46:40 +0530] "GET / HTTP/1.1" 200 220761 "-" "ELB-HealthChecker/2.0"
10.0.6.194 - [29/Jan/2026:19:46:40 +0530] "GET / HTTP/1.1" 200 220761 "-" "ELB-HealthChecker/2.0"
10.0.1.57 - [29/Jan/2026:19:47:10 +0530] "GET / HTTP/1.1" 200 220761 "-" "ELB-HealthChecker/2.0"
10.0.6.194 - [29/Jan/2026:19:47:10 +0530] "GET / HTTP/1.1" 200 220761 "-" "ELB-HealthChecker/2.0"
10.0.1.57 - [29/Jan/2026:19:47:40 +0530] "GET / HTTP/1.1" 200 220761 "-" "ELB-HealthChecker/2.0"
10.0.6.194 - [29/Jan/2026:19:47:40 +0530] "GET / HTTP/1.1" 200 220761 "-" "ELB-HealthChecker/2.0"
10.0.1.57 - [29/Jan/2026:19:48:10 +0530] "GET / HTTP/1.1" 200 220761 "-" "ELB-HealthChecker/2.0"
10.0.6.194 - [29/Jan/2026:19:48:10 +0530] "GET / HTTP/1.1" 200 220761 "-" "ELB-HealthChecker/2.0"
10.0.1.57 - [29/Jan/2026:19:48:15 +0530] "GET /aws-demo.mp4 HTTP/1.1" 404 236 "http://educloud-alb-1947718251.us-east-1.elb.amazonaws.com/" "Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/143.0.0.0 Safari/537.36"
10.0.1.57 - [29/Jan/2026:19:48:18 +0530] "GET /demo.mp4 HTTP/1.1" 404 236 "http://educloud-alb-1947718251.us-east-1.elb.amazonaws.com/" "Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/143.0.0.0 Safari/537.36"
10.0.1.57 - [29/Jan/2026:19:48:19 +0530] "GET /demo.mp4 HTTP/1.1" 304 "-" "Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/143.0.0.0 Safari/537.36"
10.0.1.57 - [29/Jan/2026:19:48:19 +0530] "GET /demo.mp4 HTTP/1.1" 404 236 "http://educloud-alb-1947718251.us-east-1.elb.amazonaws.com/" "Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/143.0.0.0 Safari/537.36"
10.0.1.57 - [29/Jan/2026:19:48:26 +0530] "GET /aws-demo.mp4 HTTP/1.1" 404 236 "http://educloud-alb-1947718251.us-east-1.elb.amazonaws.com/" "Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/143.0.0.0 Safari/537.36"
10.0.1.57 - [29/Jan/2026:19:48:27 +0530] "GET /demo.mp4 HTTP/1.1" 404 236 "http://educloud-alb-1947718251.us-east-1.elb.amazonaws.com/" "Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/143.0.0.0 Safari/537.36"
10.0.1.57 - [29/Jan/2026:19:48:27 +0530] "GET /demo.mp4 HTTP/1.1" 404 236 "http://educloud-alb-1947718251.us-east-1.elb.amazonaws.com/" "Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/143.0.0.0 Safari/537.36"
10.0.1.57 - [29/Jan/2026:19:48:40 +0530] "GET / HTTP/1.1" 200 220761 "-" "ELB-HealthChecker/2.0"
10.0.6.194 - [29/Jan/2026:19:48:40 +0530] "GET / HTTP/1.1" 200 220761 "-" "ELB-HealthChecker/2.0"
```

## Triggering Auto Scaling (Scale Out)

<https://us-east-1.console.aws.amazon.com/ec2/home?region=us-east-1#AutoScalingGroupsid=EduCloud-ASG&view=activity>

EC2 > Auto Scaling groups

### Auto Scaling groups (1/1) Info

Name	Launch template/configuration	Instances	Status	Desired capacity	Min	Max	Availability Zones
EduCloud-ASG	EduCloud-WebServer-Template   Version 2	2	-	2	2	5	2 Availability Zones

**Auto Scaling group: EduCloud-ASG**

Status	Description	Cause	Start time	End time
Waiting for instance warm up	Launching a new EC2 instance: i-04f74df8cb8e84af2	At 2026-01-29T15:14:55Z a monitor alarm TargetTracking-EduCloud-ASG-AlarmHigh-e935c114-5b46-47f6-b596-0f0x91abc6b1 in state ALARM triggered policy EduCloud-CPU+Scaling-Policy changing the desired capacity from 2 to 4. At 2026-01-29T15:15:02Z an instance was started in response to a difference between desired and actual capacity, increasing the capacity from 2 to 4.	2026 January 29, 08:45:05 PM +0:30	
Waiting for instance warm up	Launching a new EC2 instance: i-08aa9a4306c581437	At 2026-01-29T15:14:55Z a monitor alarm TargetTracking-EduCloud-ASG-AlarmHigh-e935c114-5b46-47f6-b596-0f0x91abc6b1 in state ALARM triggered policy EduCloud-CPU+Scaling-Policy changing the desired capacity from 2 to 4. At 2026-01-29T15:15:02Z an instance was started in response to a difference between desired and actual capacity, increasing the capacity from 2 to 4.	2026 January 29, 08:45:05 PM +0:30	
Successful	Launching a new EC2 instance: i-01d74ef7aacc094dc	At 2026-01-29T15:14:52Z a user request update of AutoScalingGroup constraints to min: 2, max: 5, desired: 2 changing the desired capacity from 0 to 2. At 2026-01-29T15:15:02Z an instance was started in response to a difference between desired and actual capacity, increasing the capacity from 0 to 2.	2026 January 29, 07:24:34 PM +0:30	2026 January 29, 07:24:39 PM +0:30

[https://us-east-1.console.aws.amazon.com/cloudwatch/home?region=us-east-1#alarmsV2:~\(alarmStateFilter=~ALARM\)](https://us-east-1.console.aws.amazon.com/cloudwatch/home?region=us-east-1#alarmsV2:~(alarmStateFilter=~ALARM))

CloudWatch > Alarms

### Alarms (1)

Name	State	Last state update (UTC)	Conditions	Actions
TargetTracking-EduCloud-ASG-AlarmHigh-e935c114-5b46-47f6-b596-0f0x91abc6b1	In alarm	2026-01-29 15:14:55	CPUUtilization > 60 for 3 datapoints within 3 minutes	Actions enabled

<https://us-east-1.console.aws.amazon.com/ec2/home?region=us-east-1#Instances>

EC2 > Instances

### Instances (1/7) Info

Name	Instance ID	Instance state	Instance type	Status check	Alarm status	Availability Zone	Public IPv4 DNS
EduCloud-ASG-WebServer	i-08aa9a4306c581437	Running	t3.micro	Initializing	View alarms +	us-east-1b	-
EduCloud-ASG-WebServer	i-01d74ef7aacc094dc	Running	t3.micro	3/3 checks passed	View alarms +	us-east-1b	-
EduCloud-ASG-WebServer	i-078f97712718a75a6	Running	t3.micro	3/3 checks passed	View alarms +	us-east-1a	-
EduCloud-ASG-WebServer	i-04f74df8cb8e84af2	Running	t3.micro	3/3 checks passed	View alarms +	us-east-1a	-
EduCloud-ASG-WebServer-1	i-0688bc64d500b3be2	Running	t3.micro	3/3 checks passed	View alarms +	us-east-1a	-
EduCloud-Bastion	i-03faee601901d1c	Running	t3.micro	3/3 checks passed	View alarms +	us-east-1a	ec2-98-84-47-197.com...
NFS-Client-Test	i-01d680f35d897c073	Stopped	t3.micro	-	View alarms +	us-east-1a	-

**i-078f97712718a75a6 (EduCloud-ASG-WebServer)**

Details	Status and alarms	Monitoring	Security	Networking	Storage	Tags
<b>Instance summary</b>						
Instance ID i-078f97712718a75a6	Public IPv4 address -	Private IPv4 addresses 10.0.2.49	Public DNS -			
IPv6 address -	Instance state Running					
Hostname type IP name: ip-10-0-2-49.ec2.internal	Private IP DNS name (IPv4 only) ip-10-0-2-49.ec2.internal					
Answer private resource DNS name -	Instance type t3.micro					
					Elastic IP addresses -	

Not secure educloud-alb-1947718251.us-east-1.elb.amazonaws.com

Edu Cloud  
Powered by AWS

Architecture Student Portal Trainer Portal

Enterprise-Grade Cloud

# Secure Trainee

End-to-end secure file sharing platform built with **Linux**, **EC2**, **S3**, and complete AWS infrastructure automation.

99.9% Uptime SLA | 10+ AWS Services | 5 → 10GB Auto-Scale

[View Architecture](#) [Download PDF](#)

Built with: EC2 S3 RDS Lambda CloudFront VPC ALB

File Portal Secure trainer-student exchange Live

Trainer Students

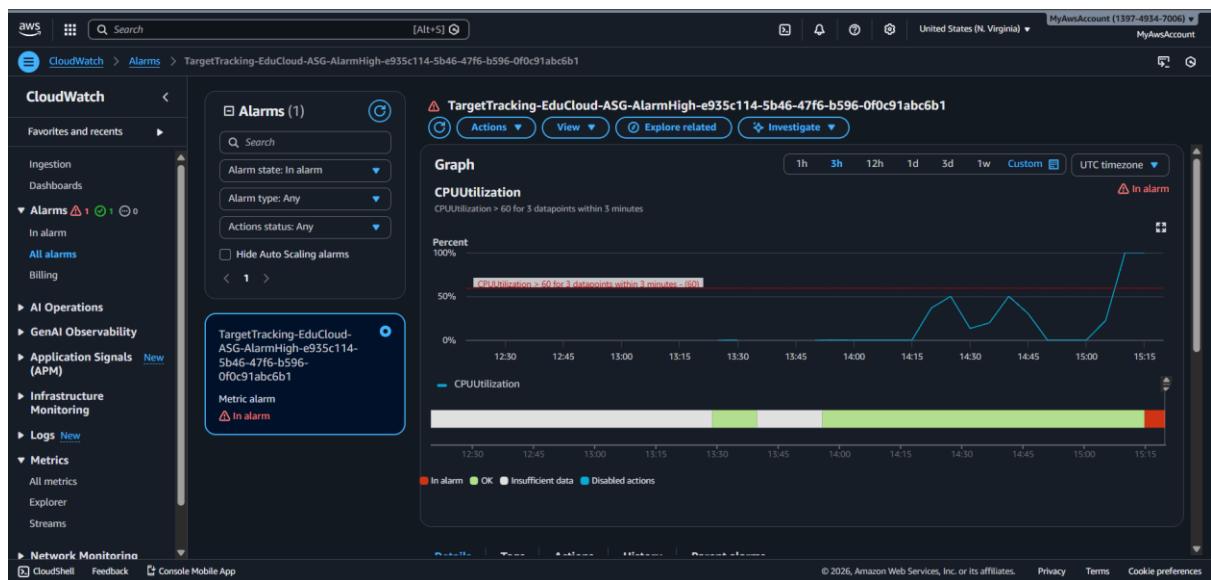
Upload Trainers share materials Download Students access files

Encrypted 256-bit security Real-time Instant notifications

WATCH DEMO 2,547 100% 24/7

21°C Mostly clear Search ENG IN 20:48 29-01-2026

The screenshot shows the Edu Cloud application running in a browser. The main page highlights secure file sharing built on AWS services like Linux, EC2, S3, and Lambda. It features uptime statistics (99.9%), a large number of AWS services (10+), and auto-scale capabilities (5 → 10GB). A 'File Portal' section is displayed, showing icons for a 'Trainer' and 'Students', with options for 'Upload' and 'Download'. Below this, security features like 'Encrypted' (256-bit) and 'Real-time' notifications are mentioned. The bottom of the screen shows a Windows taskbar with various pinned icons and system status.



<https://us-east-1.console.aws.amazon.com/ec2/home?region=us-east-1#AutoScalingGroupsId=EduCloud-ASG&view=activity>

EC2 > Auto Scaling groups

### Auto Scaling groups (1/1) Info

Name	Launch template/configuration	Instances	Status	Desired capacity	Min	Max	Availability Zones
EduCloud-ASG	EduCloud-WebServer-Template   Version 2	2	-	2	2	5	2 Availability Zones

#### Auto Scaling group: EduCloud-ASG

Status	Description	Cause	Start time	End time
Successful	Launching a new EC2 instance: i-002afad463cd41f5	At 2026-01-29T15:20:55z a monitor alarm TargetTracking-EduCloud-ASG-AlarmHigh-e935c114-5b46-47f6-b596-0f091abcb6b1 in state ALARM triggered policy EduCloud-CPU-Scaling-Policy changing the desired capacity from 4 to 5. At 2026-01-29T15:21:07z an instance was started in response to a difference between desired and actual capacity, increasing the capacity from 4 to 5.	2026 January 29, 08:51:09 PM +05:30	2026 January 29, 08:56:16 PM +05:30
Successful	Launching a new EC2 instance: i-04f74df8cb8e84af2	At 2026-01-29T15:14:55z a monitor alarm TargetTracking-EduCloud-ASG-AlarmHigh-e935c114-5b46-47f6-b596-0f091abcb6b1 in state ALARM triggered policy EduCloud-CPU-Scaling-Policy changing the desired capacity from 2 to 4. At 2026-01-29T15:15:02z an instance was started in response to a difference between desired and actual capacity, increasing the capacity from 2 to 4.	2026 January 29, 08:45:05 PM +05:30	2026 January 29, 08:50:14 PM +05:30
Successful	Launching a new EC2 instance: i-08aa9a4506c581437	At 2026-01-29T15:14:55z a monitor alarm TargetTracking-EduCloud-ASG-AlarmHigh-e935c114-5b46-47f6-b596-0f091abcb6b1 in state ALARM triggered policy EduCloud-CPU-Scaling-Policy changing the desired capacity from 2 to 4. At 2026-01-29T15:15:02z an instance was started in response to a difference between desired and actual capacity, increasing the capacity from 2 to 4.	2026 January 29, 08:45:05 PM +05:30	2026 January 29, 08:50:10 PM +05:30

<https://us-east-1.console.aws.amazon.com/ec2/instances?region=us-east-1>

EC2 > Instances

### Instances (1/8) Info

Name	Instance ID	Instance state	Instance type	Status check	Alarm status	Availability Zone	Public IPv4 Df
EduCloud-ASG-WebServer	i-002afad463cd41f5	Running	t3.micro	3/3 checks passed	View alarms +	us-east-1b	-
EduCloud-ASG-WebServer	i-08aa9a4506c581437	Running	t3.micro	3/3 checks passed	View alarms +	us-east-1b	-
<b>EduCloud-ASG-WebServer</b>	i-01d74ef7aacc094dc	Running	t3.micro	3/3 checks passed	View alarms +	us-east-1b	-
EduCloud-ASG-WebServer	i-078a97112718a75a6	Running	t3.micro	3/3 checks passed	View alarms +	us-east-1a	-
EduCloud-ASG-WebServer	i-04f74df8cb8e84af2	Running	t3.micro	3/3 checks passed	View alarms +	us-east-1a	-
EduCloud-WebServer-1	i-0688be64d500b3be2	Running	t3.micro	3/3 checks passed	View alarms +	us-east-1a	-
EduCloud-Bastion	i-0b3feeee601901d1c	Running	t3.micro	3/3 checks passed	View alarms +	us-east-1a	ec2-98-84-47-

#### i-01d74ef7aacc094dc (EduCloud-ASG-WebServer)

Details	Status and alarms	Monitoring	Security	Networking	Storage	Tags
<b>Instance summary</b>						
Instance ID i-01d74ef7aacc094dc	Public IP4 address -	Private IP4 addresses 10.0.5.45				
IPv6 address -	Instance state Running	Public DNS -				
Hostname type IP name: ip-10-0-5-45.ec2.internal	Private IP DNS name (IPv4 only) ip-10-0-5-45.ec2.internal	Instance type -	Elastic IP addresses -			
Answer private resource DNS name -						

<https://us-east-1.console.aws.amazon.com/ec2/target-groups?region=us-east-1>

EC2 > Target groups > EduCloud-TG

### EduCloud-TG

#### Details

Target type	Protocol : Port	Protocol version	VPC
Instance	HTTP: 80	HTTP1	vpc-0fdcc429bf867a8c5
IP address type	Load balancer EduCloud-ALB		
5 Total targets	0 Healthy 0 Unhealthy 0 Anomalous	0 Unused 0 Initial 0 Draining	

#### Distribution of targets by Availability Zone (AZ)

Select values in this table to see corresponding filters applied to the Registered targets table below.

Targets	Monitoring	Health checks	Attributes	Tags
<b>Registered targets (5) Info</b>				
Anomaly mitigation: Not applicable				
Target groups route requests to individual registered targets using the protocol and port number specified. Health checks are performed on all registered targets according to the target group's health check settings. Anomaly detection is automatically applied to HTTP/HTTPS target groups with at least 3 healthy targets.				
<input type="text"/> Filter targets				

## Reducing (scale in)

**CloudWatch Alarms**

Alarms (1)

Name	State	Last state update (UTC)	Conditions	Actions
TargetTracking-EduCloud-ASG-AlarmLow-49522056-a05f-4ed0-accc-806e3cad7110	In alarm	2026-01-29 15:56:15	CPUUtilization < 45 for 15 datapoints within 15 minutes	Actions enabled

<https://us-east-1.console.aws.amazon.com/cloudwatch/home?region=us-east-1#breadcrumb..>

**EC2 Auto Scaling groups**

Auto Scaling groups (1/1) Info

Name	Launch template/configuration	Instances	Status	Desired capacity	Min	Max	Availability Zones
EduCloud-ASG	EduCloud-WebServer-Template   Version 5	5	-	4	2	5	2 Availability Zones

**Auto Scaling group: EduCloud-ASG**

Activity history (14)

Status	Description	Cause	Start time	End time
Terminating EC2 instance: i-002af0ad463cd41f5 - Waiting For ELB Connection Draining.	At 2026-01-29T15:36:13Z a monitor alarm TargetTracking-EduCloud-ASG-AlarmLow-49522056-a05f-4ed0-accc-806e3cad7110 in state ALARM triggered policy EduCloud-CPU-Scaling-Policy changing the desired capacity from 5 to 4. At 2026-01-29T15:36:18Z an instance was taken out of service in response to a difference between desired and actual capacity, shrinking the capacity from 5 to 4. At 2026-01-29T15:36:18Z instance i-002af0ad463cd41f5 was selected for termination.		2026 January 29, 09:06:18 PM +05:30	
Successful	Launching a new EC2 instance: i-002af0ad463cd41f5	At 2026-01-29T15:20:55Z a monitor alarm TargetTracking-EduCloud-ASG-AlarmHigh-e935c114-5b46-47fb-b596-0fc91abcb61 in state ALARM triggered policy EduCloud-CPU-Scaling-Policy changing the desired capacity from 4 to 5. At 2026-01-29T15:21:07Z an instance was started in response to a difference between desired and actual capacity, increasing the capacity from 4 to 5.	2026 January 29, 08:51:09 PM +05:30	2026 January 29, 08:56:16 PM +05:30

<https://us-east-1.console.aws.amazon.com/ec2/home?region=us-east-1#Home>

**EC2 Target groups**

EduCloud-TG

Details

Target type	Protocol : Port	Protocol version
Instance	HTTP: 80	HTTP1
IP address type	Load balancer EduCloud-ALB	VPC vpc-0fddc429bf867a8c3

5 Total targets    4 Healthy    0 Unhealthy    0 Unused    0 Initial    1 Draining

0 Anomalous

Distribution of targets by Availability Zone (AZ)

Targets    Monitoring    Health checks    Attributes    Tags

Registered targets (5) Info

Anomaly mitigation: Not applicable

Anomaly detection is automatically applied to HTTP/HTTPS target groups with at least 3 healthy targets.

<https://us-east-1.console.aws.amazon.com/ec2/target-groups/EduCloud-TG?region=us-east-1#Targets>

**Auto Scaling groups (1/1) Info**

Name	Launch template/configuration	Instances	Status	Desired capacity	Min	Max	Availability Zones
EduCloud-ASG	EduCloud-WebServer-Template   Version 5	5	-	4	2	5	2 Availability Zones

**Auto Scaling group: EduCloud-ASG**

Status	Description	Cause	Start time	End time
Terminating EC2	Connection draining in progress	At 2026-01-29T15:41:32Z a monitor alarm TargetTracking-EduCloud-ASG-AlarmLow-49522056-a05f-4ed0-accc-806e5cad7110 in state ALARM triggered policy EduCloud-CPU-Scaling-Policy changing the desired capacity from 4 to 3. At 2026-01-29T15:41:42Z an instance was taken out of service in response to a difference between desired and actual capacity, shrinking the capacity from 4 to 3. At 2026-01-29T15:41:42Z instance i-078f97712718a75a6 was selected for termination.	2026 January 29, 09:11:42 PM +05:30	
Terminating EC2	In progress	At 2026-01-29T15:36:18Z a monitor alarm TargetTracking-EduCloud-ASG-AlarmLow-49522056-a05f-4ed0-accc-806e5cad7110 in state ALARM triggered policy EduCloud-CPU-Scaling-Policy changing the desired capacity from 5 to 4. At 2026-01-29T15:36:18Z an instance was taken out of service in response to a difference between desired and actual capacity, shrinking the capacity from 5 to 4. At 2026-01-29T15:36:18Z instance i-002af0ad63cd41f5 was selected for termination.	2026 January 29, 09:06:18 PM +05:30	
Successful	Launching a new EC2	At 2026-01-29T15:20:55Z a monitor alarm TargetTracking-EduCloud-ASG-AlarmHigh-e935c114-b46-47f6-b596-0fc91ab6b1 in state ALARM triggered policy EduCloud-CPU-Scaling-Policy changing the desired capacity from 4 to 5. At 2026-01-29T15:21:07Z an instance was started in response to a	2026 January 29, 08:51:09 PM +05:30	2026 January 29, 08:56:16 PM +05:30

**Auto Scaling groups (1/1) Info**

Name	Launch template/configuration	Instances	Status	Desired capacity	Min	Max	Availability Zones
EduCloud-ASG	EduCloud-WebServer-Template   Version 5	5	Updating capacity...	3	2	5	2 Availability Zones

**Auto Scaling group: EduCloud-ASG**

Status	Description	Cause	Start time	End time
Terminating EC2	Connection draining in progress	At 2026-01-29T15:43:23Z a monitor alarm TargetTracking-EduCloud-ASG-AlarmLow-49522056-a05f-4ed0-accc-806e5cad7110 in state ALARM triggered policy EduCloud-CPU-Scaling-Policy changing the desired capacity from 3 to 2. At 2026-01-29T15:43:34Z an instance was taken out of service in response to a difference between desired and actual capacity, shrinking the capacity from 3 to 2. At 2026-01-29T15:43:35Z instance i-01d74ef7aac094dc was selected for termination.	2026 January 29, 09:13:55 PM +05:30	
Terminating EC2	Connection draining in progress	At 2026-01-29T15:41:32Z a monitor alarm TargetTracking-EduCloud-ASG-AlarmLow-49522056-a05f-4ed0-accc-806e5cad7110 in state ALARM triggered policy EduCloud-CPU-Scaling-Policy changing the desired capacity from 4 to 3. At 2026-01-29T15:41:42Z an instance was taken out of service in response to a difference between desired and actual capacity, shrinking the capacity from 4 to 3. At 2026-01-29T15:41:42Z instance i-078f97712718a75a6 was selected for termination.	2026 January 29, 09:11:42 PM +05:30	
Terminating EC2	Terminating EC2	At 2026-01-29T15:36:18Z a monitor alarm TargetTracking-EduCloud-ASG-AlarmLow-49522056-a05f-4ed0-accc-806e5cad7110 in state ALARM triggered policy EduCloud-CPU-Scaling-Policy changing the desired capacity from 4 to 5. At 2026-01-29T15:21:07Z an instance was started in response to a	2026 January 29, 08:51:09 PM +05:30	2026 January 29, 08:56:16 PM +05:30

[us-east-1.console.aws.amazon.com/ec2/home?region=us-east-1#Instances:v=3;\\$case=true%5C;client=false;\\$regex=tags:false%5C;client=false](https://us-east-1.console.aws.amazon.com/ec2/home?region=us-east-1#Instances:v=3;$case=true%5C;client=false;$regex=tags:false%5C;client=false)

**Instances (1/8) Info**

Name	Instance ID	Instance state	Instance type	Status check	Alarm status	Availability Zone	Public IPv4
EduCloud-ASG-WebServer	i-002af0ad63cd41f5	Terminated	t2.micro	-	<a href="#">View alarms</a> +	us-east-1b	-
EduCloud-ASG-WebServer	i-08a9a4306c581437	Running	t2.micro	3/3 checks passed	<a href="#">View alarms</a> +	us-east-1b	-
EduCloud-ASG-WebServer	i-01d74ef7aac094dc	Running	t2.micro	3/3 checks passed	<a href="#">View alarms</a> +	us-east-1b	-
<b>EduCloud-ASG-WebServer</b>	<b>i-078f97712718a75a6</b>	<b>Running</b>	<b>t2.micro</b>	<b>3/3 checks passed</b>	<b><a href="#">View alarms</a> +</b>	<b>us-east-1a</b>	<b>-</b>
EduCloud-ASG-WebServer	i-04f74d8cb8e9af4f	Running	t2.micro	3/3 checks passed	<a href="#">View alarms</a> +	us-east-1a	-
EduCloud-WebServer-1	i-0688b64d500b3b2	Running	t2.micro	3/3 checks passed	<a href="#">View alarms</a> +	us-east-1a	-
EduCloud-Bastion	i-0b3fceae601901d1c	Running	t2.micro	3/3 checks passed	<a href="#">View alarms</a> +	us-east-1a	ec2-98-84-47-

**i-078f97712718a75a6 (EduCloud-ASG-WebServer)**

**Details** **Status and alarms** **Monitoring** **Security** **Networking** **Storage** **Tags**

**Instance summary**

Instance ID	Public IPv4 address	Private IPv4 addresses
i-078f97712718a75a6	-	10.0.2.49
	Running	Public DNS
	Private IP DNS name (IPv4 only) ip-10-0-2-49.ec2.internal	Elastic IP addresses
	Instance type	

## Load balanced to 2 desired

The screenshot shows the AWS EC2 Instances page. The left sidebar navigation includes: Dashboard, EC2 Global View, Events, Instances (selected), Instance Types, Launch Templates, Spot Requests, Savings Plans, Reserved Instances, Dedicated Hosts, Capacity Reservations, Capacity Manager, Images (AMIs, AMI Catalog), Elastic Block Store (Volumes, Snapshots, Lifecycle Manager), Network & Security, CloudShell, Feedback, and Console Mobile App.

The main content area displays a table titled "Instances (1/8) Info" with the following columns: Name, Instance ID, Instance state, Instance type, Status check, Alarm status, Availability Zone, and Public IPv4. The table lists several instances, including EduCloud-ASG-WebServer instances in various states (Terminated, Running, Pending) across different availability zones (us-east-1a, us-east-1b).

Details for instance i-078f97712718a75a6 (EduCloud-ASG-WebServer) are shown, including its instance summary, public and private IPv4 addresses, and elastic IP addresses.

The screenshot shows the AWS EC2 Target groups page. The left sidebar navigation is identical to the previous screenshot.

The main content area shows the "EduCloud-TG" target group details. It includes sections for Details (Target type: Instance, Protocol: HTTP, Port: 80, Load balancer: EduCloud-ALB, VPC: vpc-0fddc429bfb67a8c3), Targets (2 total targets, 2 healthy, 0 unhealthy, 0 unused, 0 initial, 0 draining), and Registered targets (2). A note indicates that target groups route requests to individual registered targets using the protocol and port number specified. Health checks are performed on all registered targets according to the target group's health check settings.

At 2026-01-29T15:43:23Z a monitor alarm TargetTracking-EduCloud-ASG-AlarmLow-49522056-a05f-4ed0-accc-806e3cad7110 in state ALARM triggered policy EduCloud-CPU-Scaling-Policy changing the desired capacity from 3 to 2. At 2026-01-29T15:43:34Z an instance was taken out of service in response to a difference between desired and actual capacity, shrinking the capacity from 3 to 2. At 2026-01-29T15:43:35Z instance i-01d74ef7aacc094dc was selected for termination.

**Auto Scaling groups (1/1) Info**

Name	Launch template/configuration	Instances	Status	Desired capacity	Min	Max	Availability Zones
EduCloud-ASG	EduCloud-WebServer-Template   Version 2	2	-	2	2	5	2 Availability Zones

**Auto Scaling group: EduCloud-ASG**

Terminating EC2 instance	Description	Timestamp	Timestamp
i-01d74ef7aacc094dc	At 2026-01-29T15:43:23Z a monitor alarm TargetTracking-EduCloud-ASG-AlarmLow-49522056-a05f-4ed0-accc-806e5cad7f110 in state ALARM triggered policy EduCloud-CPU-Scaling-Policy changing the desired capacity from 3 to 2. At 2026-01-29T15:43:34Z an instance was taken out of service in response to a difference between desired and actual capacity, shrinking the capacity from 3 to 2. At 2026-01-29T15:43:35Z instance i-01d74ef7aacc094dc was selected for termination.	2026 January 29, 09:13:35 PM	2026 January 29, 09:19:18 PM +05:30
i-078f97712718a75a6	At 2026-01-29T15:43:23Z a monitor alarm TargetTracking-EduCloud-ASG-AlarmLow-49522056-a05f-4ed0-accc-806e5cad7f110 in state ALARM triggered policy EduCloud-CPU-Scaling-Policy changing the desired capacity from 3 to 2. At 2026-01-29T15:41:42Z an instance was taken out of service in response to a difference between desired and actual capacity, shrinking the capacity from 3 to 2. At 2026-01-29T15:41:42Z instance i-078f97712718a75a6 was selected for termination.	2026 January 29, 09:11:42 PM	2026 January 29, 09:17:25 PM +05:30
i-002af0ad463cd41f5	At 2026-01-29T15:43:23Z a monitor alarm TargetTracking-EduCloud-ASG-AlarmLow-49522056-a05f-4ed0-accc-806e5cad7f110 in state ALARM triggered policy EduCloud-CPU-Scaling-Policy changing the desired capacity from 5 to 4. At 2026-01-29T15:36:18Z an instance was taken out of service in response to a difference between desired and actual capacity, shrinking the capacity from 5 to 4. At 2026-01-29T15:36:18Z instance i-002af0ad463cd41f5 was selected for termination.	2026 January 29, 09:06:18 PM	2026 January 29, 09:12:22 PM +05:30

## CloudFront CDN Setup

Created subfolder structure inside materials/

```
root@ip-10-0-2-223:/home/ec2-user
[root@ip-10-0-2-223 ec2-user]# aws s3 ls s3://educloud-materials-mdnihal01fe27/materials/
  PRE students/
  PRE support/
  PRE trainers/
  PRE week1_linux_basics/
  PRE week2_aws_basics/
2026-01-20 15:02:48      0
2026-01-28 21:06:50    68 README-materials.txt
2026-01-28 21:06:50    25 lecture1.pdf
2026-01-28 21:06:50    64 nfs-test.txt
2026-01-28 21:06:50   17 test-inheritance.txt
2026-01-28 21:06:50  100 test-material.txt
2026-01-28 21:06:50   18 trainer_works.txt
[root@ip-10-0-2-223 ec2-user]#
```

**Objects (12)**

Name	Type	Last modified	Size	Storage class
server1 (1).pem	pem	January 20, 2026, 18:47:22 (UTC+05:30)	1.6 KB	Standard
students/	Folder	-	-	-
support/	Folder	-	-	-
test-inheritance.txt	txt	January 28, 2026, 21:06:50 (UTC+05:30)	17.0 B	Standard
test-material.txt	txt	January 28, 2026, 21:06:50 (UTC+05:30)	100.0 B	Standard
trainer_works.txt	txt	January 28, 2026, 21:06:50 (UTC+05:30)	18.0 B	Standard
trainers/	Folder	-	-	-
week1_linux_basics/	Folder	-	-	-
week2_aws_basics/	Folder	-	-	-

```
root@ip-10-0-2-223:/home/ec2-user
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# ls -la /mnt/educloud-data/materials/
total 4
drwxrwsr-x. 5 root      trainers   53 Jan 30 11:07 .
drwxr-xr-x. 8 root      root      133 Jan 22 15:48 ..
drwxrws---. 2 student1 students   6 Jan 30 11:06 students
drwxrws---. 2 support1 support    6 Jan 30 11:06 support
drwxrws---. 4 trainer1 trainers  4096 Jan 30 11:07 trainers
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# |
```

```
root@ip-10-0-2-223:/home/ec2-user
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# ls -la /mnt/educloud-data/materials/trainers/
total 28
drwxrws---. 4 trainer1 trainers  4096 Jan 30 11:07 .
drwxrwsr-x. 5 root      trainers   53 Jan 30 11:07 ..
-rw-rw----. 1 trainer1 trainers   68 Jan 23 19:38 README-materials.txt
-rw-rw----. 1 trainer1 trainers   25 Jan 23 20:54 lecture1.pdf
-rw-rw-r--. 1 trainer1 trainers   64 Jan 27 16:55 nfs-test.txt
-rw-rw----. 1 trainer1 trainers   17 Jan 23 21:26 test-inheritance.txt
-rw-r--r--. 1 trainer1 trainers  100 Jan 28 15:17 test-material.txt
-rw-r--r--. 1 trainer1 trainers   18 Jan 27 22:52 trainer_works.txt
drwxrwxr-x. 2 trainer1 trainers   60 Jan 27 18:44 week1_linux_basics
drwxrwxr-x. 2 trainer1 trainers   27 Jan 27 18:44 week2_aws_basics
[root@ip-10-0-2-223 ec2-user]#
```

```
root@ip-10-0-2-223:/home/ec2-user
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# ls -la /mnt/educloud-data/materials/trainers/
total 36
drwxrws---. 4 trainer1 trainers  4096 Jan 30 11:34 .
drwxrwsr-x. 5 root      trainers   53 Jan 30 11:07 ..
-rw-rw----. 1 trainer1 trainers   68 Jan 23 19:38 README-materials.txt
-rw-rw----. 1 trainer1 trainers   25 Jan 23 20:54 lecture1.pdf
-rw-rw-r--. 1 trainer1 trainers   64 Jan 27 16:55 nfs-test.txt
-rw-rw----. 1 trainer1 trainers   17 Jan 23 21:26 test-inheritance.txt
-rw-r--r--. 1 trainer1 trainers  100 Jan 28 15:17 test-material.txt
-rw-r--r--. 1 trainer1 trainers  218 Jan 30 11:34 trainer_lecture1.pdf
-rw-r--r--. 1 trainer1 trainers  110 Jan 30 11:34 trainer_module2.txt
-rw-r--r--. 1 trainer1 trainers   18 Jan 27 22:52 trainer_works.txt
drwxrwxr-x. 2 trainer1 trainers   60 Jan 27 18:44 week1_linux_basics
drwxrwxr-x. 2 trainer1 trainers   27 Jan 27 18:44 week2_aws_basics
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# ls -la /mnt/educloud-data/materials/students/
total 8
drwxrws---. 2 student1 students   67 Jan 30 11:35 .
drwxrwsr-x. 5 root      trainers   53 Jan 30 11:07 ..
-rw-r--r--. 1 student1 students  236 Jan 30 11:34 student_assignment1.pdf
-rw-r--r--. 1 student1 students  109 Jan 30 11:35 student_studyguide.txt
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# ls -la /mnt/educloud-data/materials/support/
total 8
drwxrws---. 2 support1 support    64 Jan 30 11:35 .
drwxrwsr-x. 5 root      trainers   53 Jan 30 11:07 ..
-rw-r--r--. 1 support1 support   287 Jan 30 11:35 support_faq.txt
-rw-r--r--. 1 support1 support   217 Jan 30 11:35 support_troubleshooting.txt
[root@ip-10-0-2-223 ec2-user]# |
```

Cron jobs to sync to s3 bucket /materials/\*

```

root@ip-10-0-2-223:~# tail -30 /var/log/educloud-sync-materials.log
[2026-01-30 11:41:47] Total files to sync: 15
delete: s3://educloud-materials-mdnihil0ife27/materials/README-materials.txt
delete: s3://educloud-materials-mdnihil0ife27/materials/test-material.txt
delete: s3://educloud-materials-mdnihil0ife27/materials/nfs-test.txt
upload: ./mnt/educloud-data/materials/trainers/lecture1.pdf to s3://educloud-materials-mdnihil0ife27/materials/trainers/lecture1.pdf
upload: ./mnt/educloud-data/materials/trainers/trainer_module2.txt to s3://educloud-materials-mdnihil0ife27/materials/trainers/trainer_module2.txt
delete: s3://educloud-materials-mdnihil0ife27/materials/trainer_works.txt
upload: ./mnt/educloud-data/materials/trainers/trainer_works.txt to s3://educloud-materials-mdnihil0ife27/materials/trainers/trainer_works.txt
upload: ./mnt/educloud-data/materials/trainers/week1_linux_basics/commands_cheatsheet.txt to s3://educloud-materials-mdnihil0ife27/materials/trainers/week1_linux_basics/commands_cheatsheet.txt
delete: s3://educloud-materials-mdnihil0ife27/materials/lecture1.pdf
upload: ./mnt/educloud-data/materials/support/support_faq.txt to s3://educloud-materials-mdnihil0ife27/materials/support/support_faq.txt
upload: ./mnt/educloud-data/materials/students/student_studyguide.txt to s3://educloud-materials-mdnihil0ife27/materials/students/student_studyguide.txt
delete: s3://educloud-materials-mdnihil0ife27/materials/week1_linux_basics/linux_intro.txt
upload: ./mnt/educloud-data/materials/trainers/week1_linux_basics/linux_intro.txt to s3://educloud-materials-mdnihil0ife27/materials/trainers/week1_linux_basics/linux_intro.txt
upload: ./mnt/educloud-data/materials/trainers/week2_aws_basics/aws_intro.txt to s3://educloud-materials-mdnihil0ife27/materials/trainers/week2_aws_basics/aws_intro.txt
delete: s3://educloud-materials-mdnihil0ife27/materials/test-inheritance.txt
upload: ./mnt/educloud-data/materials/trainers/test-inheritance.txt to s3://educloud-materials-mdnihil0ife27/materials/trainers/test-inheritance.txt
delete: s3://educloud-materials-mdnihil0ife27/materials/week1_linux_basics/commands_cheatsheet.txt
upload: ./mnt/educloud-data/materials/students/student_assignment1.pdf to s3://educloud-materials-mdnihil0ife27/materials/students/student_assignment1.pdf
upload: ./mnt/educloud-data/materials/trainers/README-materials.txt to s3://educloud-materials-mdnihil0ife27/materials/trainers/README-materials.txt
upload: ./mnt/educloud-data/materials/support/support_troubleshooting.txt to s3://educloud-materials-mdnihil0ife27/materials/support/support_troubleshooting.txt
upload: ./mnt/educloud-data/materials/trainers/test-material.txt to s3://educloud-materials-mdnihil0ife27/materials/trainers/test-material.txt
upload: ./mnt/educloud-data/materials/trainers/nfs-test.txt to s3://educloud-materials-mdnihil0ife27/materials/trainers/nfs-test.txt
[2026-01-30 11:41:48] SUCCESS! Materials synced to S3
[2026-01-30 11:41:49] Files in S3: 15
[2026-01-30 11:41:49] Sync process completed
[2026-01-30 11:41:49] =====
[root@ip-10-0-2-223:~# ]

```

## /materials/support

Amazon S3

Buckets

Objects (2)

Name	Type	Last modified	Size	Storage class
<a href="#">support_faq.txt</a>	txt	January 30, 2026, 11:41:49 (UTC+05:30)	287.0 B	Standard
<a href="#">support_troubleshooting.txt</a>	txt	January 30, 2026, 11:41:49 (UTC-05:30)	217.0 B	Standard

## /materials/students

Amazon S3

Buckets

Objects (2)

Name	Type	Last modified	Size	Storage class
<a href="#">student_assignment1.pdf</a>	pdf	January 30, 2026, 11:41:49 (UTC+05:30)	236.0 B	Standard
<a href="#">student_studyguide.txt</a>	txt	January 30, 2026, 11:41:49 (UTC+05:30)	109.0 B	Standard

## /materials/trainers

The screenshot shows the AWS S3 console interface. On the left, the navigation pane is open with sections like 'Buckets', 'Access management and security', 'Storage management and insights', and 'AWS Marketplace for S3'. The main area displays a table titled 'Objects (10)' containing ten items. The columns include Name, Type, Last modified, Size, and Storage class. The objects listed are:

Name	Type	Last modified	Size	Storage class
lecture1.pdf	pdf	January 30, 2026, 11:41:49 (UTC+0:30)	25.0 B	Standard
nfs-test.txt	txt	January 30, 2026, 11:41:49 (UTC+0:30)	64.0 B	Standard
README-materials.txt	txt	January 30, 2026, 11:41:49 (UTC+0:30)	68.0 B	Standard
test-inheritance.txt	txt	January 30, 2026, 11:41:49 (UTC+0:30)	17.0 B	Standard
test-material.txt	txt	January 30, 2026, 11:41:49 (UTC+0:30)	100.0 B	Standard
trainer_lecture1.pdf	pdf	January 30, 2026, 11:41:49 (UTC+0:30)	218.0 B	Standard
trainer_module2.txt	txt	January 30, 2026, 11:41:49 (UTC+0:30)	110.0 B	Standard
trainer_works.txt	txt	January 30, 2026, 11:41:49 (UTC+0:30)	18.0 B	Standard

At the bottom of the page, there are links for 'Privacy', 'Terms', and 'Cookie preferences'.

## CloudFront Distribution

The screenshot shows the AWS CloudFront console. The left sidebar includes sections for 'Distributions', 'Policies', 'Functions', 'Static IPs', 'VPC origins', 'SaaS', 'Telemetry', 'Monitoring', 'Alarms', and 'Logs'. The main area is titled 'Distributions (0)' and shows a table with one entry: 'No distributions'. A button labeled 'Create distribution' is visible. Below this, the 'Edit behavior' for a specific distribution is shown. The 'Settings' tab is selected, displaying options for 'Path pattern', 'Origin and origin groups', 'Compress objects automatically', 'Viewer', 'Allowed HTTP methods', 'Restrict viewer access', and 'Cache key and origin requests'. The 'Origin and origin groups' section shows the URL 'educloud-materials-mdnihal01fe27.s3.us-east-1.amazonaws.com-mloproevfx9'. The 'Compress objects automatically' section has 'Yes' selected. The 'Viewer' section has 'HTTP and HTTPS' selected. The 'Allowed HTTP methods' section has 'GET, HEAD' selected. The 'Restrict viewer access' section has 'No' selected. The 'Cache key and origin requests' section includes links for 'CloudShell', 'Feedback', and 'Console Mobile App'.

Restrict other user should be selected yes and only be accessed by the signed url for that need key groups for key groups need public key for public key need Generate 2048-bit RSA private key this and Generate public key from private key this need to be created

## Steps

```
root@ip-10-0-2-223:~/cloudfront-keys
[root@ip-10-0-2-223 ~]#
[root@ip-10-0-2-223 ~]#
[root@ip-10-0-2-223 ~]#
[root@ip-10-0-2-223 ~]# mkdir -p ~/cloudfront-keys
[root@ip-10-0-2-223 ~]#
[root@ip-10-0-2-223 ~]# cd ~/cloudfront-keys
[root@ip-10-0-2-223 cloudfront-keys]#
[root@ip-10-0-2-223 cloudfront-keys]# openssl genrsa -out private_key.pem 2048
[root@ip-10-0-2-223 cloudfront-keys]# openssl rsa -pubout -in private_key.pem -out public_key.pem
writing RSA key
[root@ip-10-0-2-223 cloudfront-keys]# ls -lh
total 8.0K
-rw-----. 1 root root 1.7K Jan 30 16:05 private_key.pem
-rw-r--r--. 1 root root 451 Jan 30 16:06 public_key.pem
[root@ip-10-0-2-223 cloudfront-keys]#
[root@ip-10-0-2-223 cloudfront-keys]#
[root@ip-10-0-2-223 cloudfront-keys]# cat public_key.pem
-----BEGIN PUBLIC KEY-----
MIIBIjANBgkqhkiG9w0BAQEFAAOCAQ8AMIIIBGkCQAQEAE350hcu1BRe3n0RbKyyBF
74TKE XSS foUYFnwIzaGLeMc7Kbs5jwpxkynC3BDKb9bICJWD3/oHOfcZveo4ZKJ
MCMM+92Ckt9I85z5fcwHccwZC9SffFj0iBBrKcuLoxhYs5iEGigQxI7sRhWd+Gw3K
sel/TdXvIkfCRJKC7iB46jInK/VQWSNFFuIOiyMw+dXH4jM9YsngEqMcx+GAYWK
S6P2em+DVJCPCsqRYWmfoG7Ibq0gpkn5uoOnX48c460f6aRyGkYpi23rkxBxhu5
kHObwnEtH4u7pmfmIi1Yv/lazlbn1QXESDxL7AwT8hmHOgZJdbCp2W+whFXH1++9
rQIDAQAB
-----END PUBLIC KEY-----
[root@ip-10-0-2-223 cloudfront-keys]# |
```

The screenshot shows the AWS CloudFront console interface. On the left, there's a navigation sidebar with options like Logs, Reports & analytics, Security, Key management (with Public keys selected), Savings Bundle, Resource sharing, and Settings. The main area is titled 'Create public key' under 'Public key'. It has fields for 'Name' (set to 'EduCloud-Signed-URL-Key-2026'), 'Description - optional' (set to 'CloudFront signed URL key for EduCloud materials'), and 'Key' (which contains the RSA PEM code from the terminal). At the bottom right are 'Cancel' and 'Create public key' buttons.

The screenshot shows the AWS CloudFront Key groups page. A green success message at the top right reads "Successfully created EduCloud-Materials-KeyGroup key group." The main table lists one key group:

ID	Name	Description	Last modified
ebc13ef5-5709-4629-b0b8-1722f8c7d7b8	EduCloud-Materials-K...	Key group for EduCloud signed URLs	January 30, 2026 at 10:59:41 AM UTC

The left sidebar includes sections for Logs, Reports & analytics, Security, Key management, and Savings Bundle.

## To generate pre signed url

The screenshot shows the AWS CloudFront Distribution behavior configuration page for distribution ID E3JWCNZDBK5OC. The "Edit behavior" tab is selected. The configuration includes:

- Allowed HTTP methods:** GET, HEAD (selected)
- Restrict viewer access:** Yes (selected)
- Trusted authorization type:** Trusted key groups (recommended) (selected)
- Add key groups:** EduCloud-Materials-KeyGroup (ebc13ef5-5709-4629-b0b8-1722f8c7d7b8) (selected)
- Cache key and origin requests:** Cache policy and origin request policy (recommended) (selected)
- Cache policy:** CachingOptimized (selected)

The status bar at the bottom indicates "Recommended for S3".

## Bucket policy for the distribution

## Install Python Dependencies

```
sudo yum install python3-pip -y
```

```
pip3 install cryptography botocore --user
```

## Created Signed URL Generator Script

## Created the Python script

```
root@ip-10-0-2-223:~/cloudfront-keys
[root@ip-10-0-2-223 cloudfront-keys]#
[root@ip-10-0-2-223 cloudfront-keys]#
[root@ip-10-0-2-223 cloudfront-keys]#
[root@ip-10-0-2-223 cloudfront-keys]# ls
generate_signed_url.py  private_key.pem  public_key.pem
[root@ip-10-0-2-223 cloudfront-keys]# ls -ls
total 12
4 -rw-r--r--. 1 root root 3620 Jan 30 16:49 generate_signed_url.py
4 -rw-----. 1 root root 1704 Jan 30 16:05 private_key.pem
4 -rw-r--r--. 1 root root 451 Jan 30 16:06 public_key.pem
[root@ip-10-0-2-223 cloudfront-keys]#
[root@ip-10-0-2-223 cloudfront-keys]# chmod +x generate_signed_url.py
[root@ip-10-0-2-223 cloudfront-keys]#
[root@ip-10-0-2-223 cloudfront-keys]# ls -lh generate_signed_url.py
-rwxr-xr-x. 1 root root 3.6K Jan 30 16:49 generate_signed_url.py
[root@ip-10-0-2-223 cloudfront-keys]#
[root@ip-10-0-2-223 cloudfront-keys]# |
```

## Test Generating Signed URL for Trainer Material

### SIGNED URL GENERATED SUCCESSFULLY

Used the domain name and key id from public key created in the key management tab in cloud front

#### Generate signed URL for trainer material

```
root@ip-10-0-2-223:~/cloudfront-keys
[root@ip-10-0-2-223 cloudfront-keys]#
[root@ip-10-0-2-223 cloudfront-keys]#
[root@ip-10-0-2-223 cloudfront-keys]#
[root@ip-10-0-2-223 cloudfront-keys]# CLOUDFRONT_DOMAIN="d2m70x2w7nx7v.cloudfront.net"
[root@ip-10-0-2-223 cloudfront-keys]#
[root@ip-10-0-2-223 cloudfront-keys]# KEY_ID="K3RNQZB1HILQ5B"
[root@ip-10-0-2-223 cloudfront-keys]#
[root@ip-10-0-2-223 cloudfront-keys]# ls -lh
total 12K
-rwxr-xr-x. 1 root root 3.6K Jan 30 16:49 generate_signed_url.py
-rw-----. 1 root root 1.7K Jan 30 16:05 private_key.pem
-rw-r--r--. 1 root root 451 Jan 30 16:06 public_key.pem
[root@ip-10-0-2-223 cloudfront-keys]#
[root@ip-10-0-2-223 cloudfront-keys]#
[root@ip-10-0-2-223 cloudfront-keys]# python3 generate_signed_url.py \
    "https://$CLOUDFRONT_DOMAIN/trainers/trainer_lecture1.pdf" \
    "$KEY_ID" \
    "private_key.pem" \
24
=====
☒ SIGNED URL GENERATED SUCCESSFULLY
=====

☒ original URL:
https://d2m70x2w7nx7v.cloudfront.net/trainers/trainer_lecture1.pdf

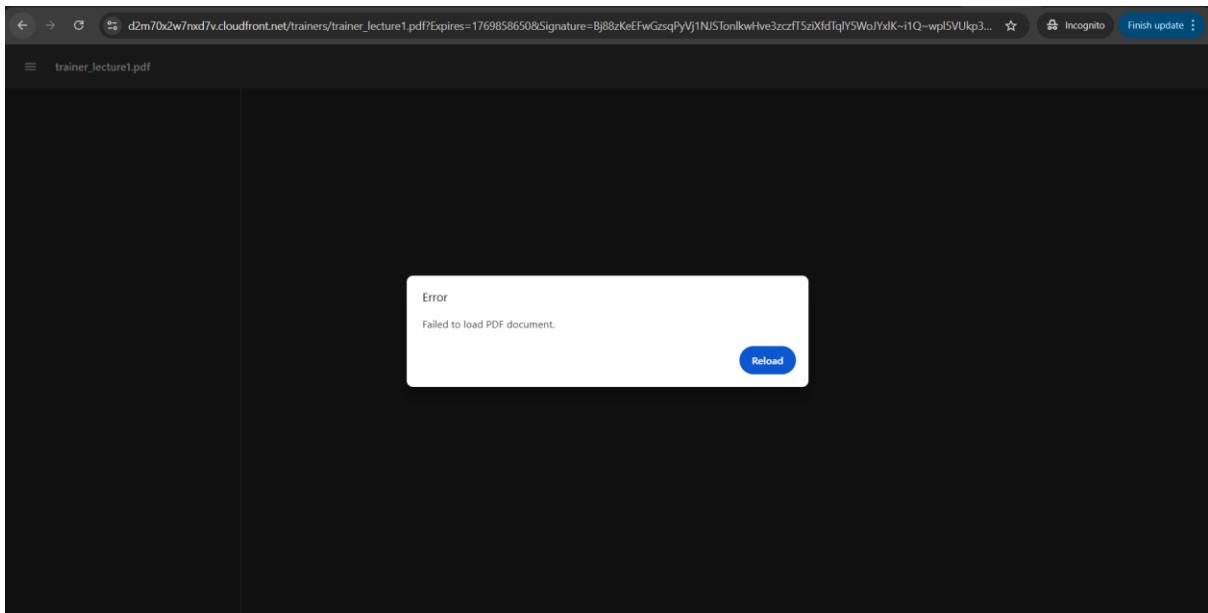
☒ Signed URL (copy this entire line):
https://d2m70x2w7nx7v.cloudfront.net/trainers/trainer_lecture1.pdf?Expires=1769858650&Signature=Bj88zKeEFwGzsqPyVj1NJSTonlkwHve3czfT5zixfdTq]YSwoJYx1K-i1Q-wp]5VuKp3DpBr1EZxXc6N54rohI9ng2tmHQu3Qc8BFfexL7ef99qlqwX-6-h5fa1hwRuo3djYmaRMt3hQwpzFd3nu6n1FDs-A1lbZisyy7P0Cpc77blarPVzipkKvZMSQ-lh1rjPoTLx3-kth-HSvzaLNLH2B4PmfIAF9T9D1-kxwZeLZZtGnrHhtytJAcIQJnP6HOVVLLYdiAy134dAsyZttu1v0Tp3m63hCI2faui9KCRWlzscaUAVZcdjtWpsjNdSjLfPcfTyrd8GXg__&Key-Pair-Id=K3RNQZB1HILQ5B

☒ Expires at:
2026-01-31 11:24:10 UTC
(Valid for 24 hours)
=====

☒ Paste the signed URL in your browser to access the content
=====

[root@ip-10-0-2-223 cloudfront-keys]# |
```

There is no actual pdf



## Generate Signed URLs for All Materials different paths

```

root@ip-10-0-2-223:~# cd cloudfront-keys
[root@ip-10-0-2-223 cloudfront-keys]# ./generate_signed_url.py \
    "https://${CLOUDFRONT_DOMAIN}/students/student_studyguide.txt" \
    "${KEY_ID}" "private_key.pem"
=====
[+] SIGNED URL GENERATED SUCCESSFULLY
=====

[+] original URL:
  https://d2m70x2w7nx7v.cloudfront.net/students/student_studyguide.txt

[+] Signed URL (copy this entire line):
  https://d2m70x2w7nx7v.cloudfront.net/students/student_studyguide.txt?Expires=1769860130&Signature=JEUJ86L0Op25lT-mHWhDFHL8Pm4HtJFuQB6TS7MzfkgFMq1bMw~eHruhkBM03KVoio1zGP
  TYzgB7XAC-N2jTxJP781YSQYkd-Sfbobp7Oxhm2HDLQcJds-e-bmFc6787-sxb355ndfU8-4000UsMy6vgI5h3-qv-jswlTdDH2AmmSt4WeV3CyKRsUB8cbLFFdwVGhd7U4a8aGMB8eNiufTe3Ps4x1PMwdCiG50drvB6DP7
  -27V-06qPSrIzic1LT8sQR3VtZ5Jz1L9BrIMD8WrYersdeyNQK4wOKdrqntR05sEHR4SA2NTRuJ4whBvtIo3loHiwomHyx8zw__&key-Pair-Id=k3RNQZB1HILQ5B

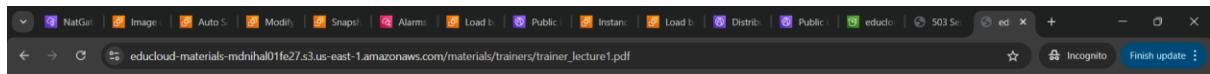
[+] Expires at:
  2026-01-31 11:48:50 UTC
  (Valid for 24 hours)

[+] Paste the signed URL in your browser to access the content
=====

[root@ip-10-0-2-223 cloudfront-keys]#

```

## Direct S3 Access Failed



## CloudFront Without Signature



[https://d2m70x2w7nx7v.cloudfront.net/materials/students/student\\_studyguide.txt?Expires=1769880811&Signature=GEzDHkU0waXITsTkjPEZaCU0eEPlfczlblmcX4HygST02zbh76FlnzSW-awdAQkig-GmSadVEcsMzVXD-HECyC1mSkPpCYq5qmCzVCgAVgGr0G2f1kr6VGk1z5CO92IfQI3EraXSC0~PiWtey71DI0UTlQBjoEH-nAlT3kjvFBGUzIICe0L1JYMVUBFEnbm7Q44oHvvCa6OKAN8gY-VFEbqNKJ9rdGqduEPg8N7yaxERaJmFHFcTY1Yb4q~d7Ljr9xZX-wyWF2~wqY220sD1LKHcdQzhyC2w3wPuNLno1UF1BsJ4L8Q~LT~okEjNSiKguz~EeS6WJ6YPP6u4WcMMA\\_&Key-Pair-Id=K3RNQZB1HILQ5B](https://d2m70x2w7nx7v.cloudfront.net/materials/students/student_studyguide.txt?Expires=1769880811&Signature=GEzDHkU0waXITsTkjPEZaCU0eEPlfczlblmcX4HygST02zbh76FlnzSW-awdAQkig-GmSadVEcsMzVXD-HECyC1mSkPpCYq5qmCzVCgAVgGr0G2f1kr6VGk1z5CO92IfQI3EraXSC0~PiWtey71DI0UTlQBjoEH-nAlT3kjvFBGUzIICe0L1JYMVUBFEnbm7Q44oHvvCa6OKAN8gY-VFEbqNKJ9rdGqduEPg8N7yaxERaJmFHFcTY1Yb4q~d7Ljr9xZX-wyWF2~wqY220sD1LKHcdQzhyC2w3wPuNLno1UF1BsJ4L8Q~LT~okEjNSiKguz~EeS6WJ6YPP6u4WcMMA_&Key-Pair-Id=K3RNQZB1HILQ5B)

**Through ALB accessing website prepopulating the file from the student table and click on download button generates pre signed url**

The screenshot shows the EduCloud Trainer Portal interface. At the top, there are navigation links for Home, Materials, Submit Work, Resources, and Trainer Portal. Below the header, a main title "Download Course Materials" is displayed, followed by a subtitle "Access notes, slides, and learning resources uploaded by your trainer". There are six course materials listed in a grid:

- aws-basics-guide.txt** (New): TXT Document • Ready to download. File size: 285 B.
- linux-commands.pdf** (Available): PDF Document • Ready to download. File size: 348 B.
- networking-notes.txt** (Updated): TXT Document • Ready to download. File size: 413 B.
- python-intro.txt** (New): TXT Document • Ready to download. File size: 268 B.
- student\_assignment1.pdf** (Available): PDF Document • Ready to download. File size: 348 B.
- student\_studyguide.txt** (Updated): TXT Document • Ready to download. File size: 348 B.

At the bottom of the page, there is a toolbar with various icons and a status bar showing the date (31-01-2026) and time (12:39).

## Downloads file

The screenshot shows a browser window displaying a study guide document titled "Study Guide - Week 1". The document contains the following content:

```

Study Guide - Week 1
- S3 Bucket creation
- IAM roles and policies
- CloudFront basics
- Signed URL concepts

```

The browser interface includes a search bar, a toolbar with various icons, and a status bar at the bottom showing the date (31-01-2026) and time (12:39).

## new test file created for student and synced through script

```

root@ip-10-0-2-223:/mnt/educloud-data/materials/students
[root@ip-10-0-2-223 students]# ls -lh /mnt/educloud-data/materials/students/
total 24K
-rw-r--r-- 1 student1 students 285 Jan 31 12:05 aws-basics-guide.txt
-rw-r--r-- 1 student1 students 348 Jan 31 12:05 linux-commands.pdf
-rw-r--r-- 1 student1 students 413 Jan 31 12:05 networking-notes.txt
-rw-r--r-- 1 student1 students 276 Jan 31 12:05 python-intro.txt
-rw-r--r-- 1 student1 students 236 Jan 30 11:34 student_assignment1.pdf
-rw-r--r-- 1 student1 students 109 Jan 30 11:35 student_studyguide.txt
[root@ip-10-0-2-223 students]# [root@ip-10-0-2-223 students]# sudo /opt/educloud/scripts/sync-materials-to-s3.sh
[2026-01-31 12:06:26] =====
[2026-01-31 12:06:26] Starting materials sync to S3
[2026-01-31 12:06:26] Source: /mnt/educloud-data/materials
[2026-01-31 12:06:26] Destination: s3://educloud-materials-mdnihal0ife27/materials
[2026-01-31 12:06:26] =====
[2026-01-31 12:06:26] Total files to sync: 19
upload: ./aws-basics-guide.txt to s3://educloud-materials-mdnihal0ife27/materials/students/aws-basics-guide.txt
upload: ./python-intro.txt to s3://educloud-materials-mdnihal0ife27/materials/students/python-intro.txt
upload: ./linux-commands.pdf to s3://educloud-materials-mdnihal0ife27/materials/students/linux-commands.pdf
upload: ./networking-notes.txt to s3://educloud-materials-mdnihal0ife27/materials/students/networking-notes.txt
[2026-01-31 12:06:27] ✅ SUCCESS: Materials synced to S3
[2026-01-31 12:06:28] Files in S3: 23
[2026-01-31 12:06:28] Sync process completed
[2026-01-31 12:06:28] =====
[root@ip-10-0-2-223 students]#

```

The screenshot shows the AWS S3 console interface. On the left, there's a navigation sidebar with sections like 'Buckets', 'Access management and security', 'Storage management and insights', and 'Account and organization settings'. The main area displays a list of objects under the 'students/' prefix. The table includes columns for Name, Type, Last modified, Size, and Storage class. The objects listed are:

Name	Type	Last modified	Size	Storage class
aws-basics-guide.txt	txt	January 31, 2026, 12:06:28 (UTC+05:30)	285.0 B	Standard
linux-commands.pdf	pdf	January 31, 2026, 12:06:28 (UTC+05:30)	348.0 B	Standard
networking-notes.txt	txt	January 31, 2026, 12:06:28 (UTC+05:30)	413.0 B	Standard
python-intro.txt	txt	January 31, 2026, 12:06:28 (UTC+05:30)	276.0 B	Standard
student_assignment1.pdf	pdf	January 30, 2026, 11:41:49 (UTC+05:30)	236.0 B	Standard
student_studyguide.txt	txt	January 30, 2026, 11:41:49 (UTC+05:30)	109.0 B	Standard

## File listing as cards fetch from the s3 bucket

The screenshot shows the EduCloud student portal. At the top, there's a header with the EduCloud logo, a search bar, and links for 'Home', 'Materials', 'Submit Work', 'Resources', and 'Trainer Portal'. Below the header, a message says 'Access notes, slides, and learning resources uploaded by your trainer'. A large circular progress indicator with the text 'Loading Your Materials...' is centered on the page.

The screenshot shows the EduCloud student portal displaying course materials. The title 'Download Course Materials' is at the top, followed by a sub-instruction 'Access notes, slides, and learning resources uploaded by your trainer'. Below this, there's a grid of six cards, each representing a different file:

- aws-basics-guide.txt**: TXT Document • Ready to download. Status: New. Download File button.
- linux-commands.pdf**: PDF Document • Ready to download. Status: Available. Download File button.
- networking-notes.txt**: TXT Document • Ready to download. Status: Updated. Download File button.
- python-intro.txt**: TXT Document • Ready to download. Status: New. Download File button.
- student\_assignment1.pdf**: PDF Document • Ready to download. Status: Available. Download File button.
- student\_studyguide.txt**: TXT Document • Ready to download. Status: Updated. Download File button.

At the bottom of the browser window, you can see the Windows taskbar with various pinned icons and system status indicators.

The screenshot shows a 'Save As' dialog box from EduCloud. The file name is set to 'python-intro'. The background features a Network tab in the developer tools, displaying various network requests and their details.

The screenshot shows a file explorer window with the 'Downloads' folder selected. It lists several files and folders, including 'python-intro', 'EduCloud-report', 'jenkins installation', and 'Asset-Package\_07312025.49d3aab7f9e61...'.

The screenshot shows a 'Save As' dialog box from EduCloud. The file name is set to 'aws-basics-guide'. The background features a Network tab in the developer tools, displaying requests for 'generate\_url.php' and 'aws-basics-guide.txt'.

User clicks "Download File"

JavaScript sends request to /api/generate\_url.php

PHP generates signed URL with private key

JSON response returns signed URL to browser

Browser fetches file from CloudFront signed URL

CloudFront validates signature

CloudFront serves cached file (or fetches from S3 if not cached)

File downloads as Blob in browser memory

createObjectURL generates blob:// URL

Invisible <a> link clicks automatically

Browser "Save As" dialog appears

File saved to user's Downloads folder

## SNS Email Notifications

### Created topic for the sns

The screenshot shows the AWS SNS console with a green success message at the top: "Topic EduCloud-NewMaterial-Notifications fifo created successfully. You can create subscriptions and send messages to them from this topic." Below this, the topic details are displayed: Name: EduCloud-NewMaterial-Notifications fifo, ARN: arn:aws:sns:us-east-1:139749347006:EduCloud-NewMaterial-Notifications fifo, Display name: EduCloud Materials, Type: FIFO, Topic owner: 139749347006, Retention policy: Inactive, Throughput scope: MessageGroup, Content-based message deduplication: Disabled. The Subscriptions tab shows a table with no subscriptions found. There are tabs for Subscriptions, Access policy, Archive policy, Delivery status logging, Encryption, Tags, and Integrations.

### Created and confirmed subscription

The screenshot shows a browser window with the URL sns.us-east-1.amazonaws.com/confirmation.html?TopicArn=arn:aws:sns:us-east-1:139749347006:EduCloud-NewMaterial-Notifications&Token=2336412f37fb687f5d51e6e2425929f... The page displays a green box with the heading "Subscription confirmed!" and the message "You have successfully subscribed." It also shows the subscription ID: arn:aws:sns:us-east-1:139749347006:EduCloud-NewMaterial-Notifications:e75887ea-50f6-4451-abe9-7126ab3ab82e. A link "click here to unsubscribe" is provided at the bottom.

The screenshot shows a browser window with the same confirmation URL as the previous one. The page displays a green box with the heading "Subscription confirmed!" and the message "You have successfully subscribed." It also shows the subscription ID: arn:aws:sns:us-east-1:139749347006:EduCloud-NewMaterial-Notifications:55309227-4431-4e2f-8a23-9d2c064efb3b. A link "click here to unsubscribe" is provided at the bottom.

The screenshot shows the AWS SNS Subscriptions page. On the left, there's a sidebar with 'Amazon SNS' and 'Subscriptions' selected. The main area is titled 'Subscriptions (2)' with a search bar. It lists two entries:

ID	Endpoint	Status	Protocol	Topic
55509227-4431-4e2f-8a25-9d2c...	mohammednihamakandar@gmail...	Confirmed	EMAIL	EduCloud-NewMaterial-Notificat...
e75887ea-50f6-4451-abe9-7126...	mrihal2589@gmail.com	Confirmed	EMAIL	EduCloud-NewMaterial-Notificat...

At the bottom right, there are buttons for 'Edit', 'Delete', 'Request confirmation', 'Confirm subscription', and 'Create subscription'. The URL is https://us-east-1.console.aws.amazon.com/console/home?region=us-east-1.

## Lambda Function for Notifications

The screenshot shows the AWS Lambda landing page. It features a large heading 'AWS Lambda' with the tagline 'lets you run code without thinking about servers.' Below it is a code editor with the following Node.js code:

```

1 exports.handler = async (event) => {
2   console.log(event);
3   return 'Hello from Lambda!';
4 }
5

```

There are tabs for '.NET', 'Java', 'Node.js', 'Python', 'Ruby', and 'Custom runtime'. A 'Run' button and a 'Get started' callout are also present. The URL is https://us-east-1.console.aws.amazon.com/lambda/home?region=us-east-1.

The screenshot shows the 'Create function' page under the Lambda Functions section. It includes fields for 'Function name' (EduCloud-S3-Notification-Handler), 'Runtime' (Python 3.14), 'Basic execution - new' (Enable durable execution), 'Architecture' (x86\_64), and 'Permissions' (Info). On the right, there's a 'Tutorials' sidebar with a 'Create a simple web app' section and a 'Start tutorial' button. The URL is https://us-east-1.console.aws.amazon.com/lambda/functions/CreateFunction?functionName=EduCloud-S3-Notification-Handler&region=us-east-1.

```

# AWS Lambda function to handle S3 notifications
# This function triggers when new files are uploaded to the 'materials' folder in an S3 bucket.
# It sends an email notification to all subscribed students.

import boto3
sns_client = boto3.client('sns')
SNS_TOPIC_ARN = os.environ['SNS_TOPIC_ARN']

def lambda_handler(event, context):
    """
    Triggered when new file is uploaded to S3 materials/ folder.
    Sends email notification to all subscribed students.
    """

    # Parse S3 event
    for record in event['Records']:
        # Get bucket and object info
        bucket_name = record['s3']['bucket']['name']
        object_key = record['s3']['object']['key']
        object_size = record['s3']['object']['size']
        event_time = record['eventTime']

        # Skip if not in materials folder
        if not object_key.startswith('materials/students/'):
            print(f"Skipping {object_key} - not in students folder")
            continue

        # Create email subject
        subject = f"New Learning Material Available: {object_key}"

        # Create email body
        message = f"""
        NEW STUDY MATERIAL UPLOADED 🎉

        Hello Student! 🌟

        Great news! Your trainer has uploaded new learning material for you.

        (file_emoji) FILE DETAILS:
        Filename: {filename}
        File Size: {size_formatted}
        Uploaded: {time_formatted}
        Category: Student Materials
        """

    sns_client.publish(TopicArn=SNS_TOPIC_ARN, Message=message)

```

## Environment variable

### SNS\_TOPIC\_ARN

```

# AWS Lambda function to handle S3 notifications
# This function triggers when new files are uploaded to the 'materials' folder in an S3 bucket.
# It sends an email notification to all subscribed students.

import boto3
sns_client = boto3.client('sns')
SNS_TOPIC_ARN = os.environ['SNS_TOPIC_ARN']

def lambda_handler(event, context):
    """
    Triggered when new file is uploaded to S3 materials/ folder.
    Sends email notification to all subscribed students.
    """

    # Parse S3 event
    for record in event['Records']:
        # Get bucket and object info
        bucket_name = record['s3']['bucket']['name']
        object_key = record['s3']['object']['key']
        object_size = record['s3']['object']['size']
        event_time = record['eventTime']

        # Skip if not in materials folder
        if not object_key.startswith('materials/students/'):
            print(f"Skipping {object_key} - not in students folder")
            continue

        # Create email subject
        subject = f"New Learning Material Available: {object_key}"

        # Create email body
        message = f"""
        NEW STUDY MATERIAL UPLOADED 🎉

        Hello Student! 🌟

        Great news! Your trainer has uploaded new learning material for you.

        (file_emoji) FILE DETAILS:
        Filename: {filename}
        File Size: {size_formatted}
        Uploaded: {time_formatted}
        Category: Student Materials
        """

    sns_client.publish(TopicArn=SNS_TOPIC_ARN, Message=message)

```

## SNS Permissions to Lambda

### Inline policy for the sns to lambda

**Specify permissions**

Add permissions by selecting services, actions, resources, and conditions. Build permission statements using the JSON editor.

```

1 {
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": [
        "sns:Publish"
      ],
      "Resource": "arn:aws:sns:us-east-1:139749347006:EduCloud-NewMaterial-Notifications"
    }
  ]
}

```

**Policy editor**

Visual JSON Actions ▾

Edit statement Select a statement

Select an existing statement in the policy or add a new statement.

+ Add new statement

Identity and Access Management (IAM)

Policy SnsPublishPolicy created.

Permissions Trust relationships Tags Last Accessed Revoke sessions

Permissions policies (2) Info

You can attach up to 10 managed policies.

Policy name	Type	Attached entities
AWSLambdaBasicExecutionRole-f5130486-6bd4-4ba6-8cac-7be38e08611b	Customer managed	1
SnsPublishPolicy	Customer inline	0

Permissions boundary (not set)

Generate policy based on CloudTrail events

Generate policy

Permissions Destinations Function URL Environment variables Tags VPC RDS databases Monitoring and operations tools Concurrency and recursion detection Asynchronous invocation Code signing File systems State machines

EduCloud-S3-Notification-Handler-role-575n9xn4

Resource summary

To view the resources and actions that your function has permission to access, choose a service.

- Amazon CloudWatch Logs 3 actions, 2 resources
- Search Resource-based policy
- Amazon CloudWatch Logs 3 actions, 2 resources
- Amazon SNS 1 action, 1 resource

arnaws:logs:us-east-1:139749347006: Allow: logs>CreateLogGroup

arnaws:logs:us-east-1:139749347006:log-group:/aws/lambda/EduCloud-S3-Notification-Handler/\* Allow: logs>CreateLogStream Allow: logs:PutLogEvents

Lambda obtained this information from the following policy statements:

- Managed policy AWSLambdaBasicExecutionRole-f5130486-6bd4-4ba6-8cac-7be38e08611b, statement 0
- Managed policy AWSLambdaBasicExecutionRole-f5130486-6bd4-4ba6-8cac-7be38e08611b, statement 1

Resource-based policy statements View policy Edit Delete Add permissions

## Configuring S3 Event Notification

The screenshot shows the 'General configuration' section of the AWS S3 event notification creation wizard. It includes fields for 'Event name' (set to 'NewStudentMaterialNotification'), 'Prefix - optional' (set to 'materials/students/'), and 'Suffix - optional' (set to 'jpg'). A note at the top states: 'To enable notifications, you must first add a notification configuration that identifies the events you want Amazon S3 to publish and the destinations where you want Amazon S3 to send the notifications.'

The screenshot shows the 'Event types' section. It lists several event types under 'Object creation': 'All object create events' (checked), 'Put' (unchecked), 'Post' (unchecked), 'Copy' (unchecked), and 'Multipart upload completed' (unchecked). Under 'Object removal', there are two unchecked options: 'All object removal events' and 'Permanently deleted'. Under 'Object restore', there is one unchecked option: 'All restore object events'.

The screenshot shows the 'Destination' section. It contains a note: 'Before Amazon S3 can publish messages to a destination, you must grant the Amazon S3 principal the necessary permissions to call the relevant API to publish messages to an SNS topic, an SQS queue, or a Lambda function.' Below this, it says 'Choose a destination to publish the event.' with a 'Learn more' link. The 'Lambda function' option is selected. The 'Specify Lambda function' section shows 'EduCloud-S3-Notification-Handler' as the chosen function. At the bottom right are 'Cancel' and 'Save changes' buttons.

## Event Notification created in s3 bucket

The screenshot shows the AWS CloudTrail console interface. At the top, there's a green success message: "Successfully created event notification 'NewStudentMaterialNotification'. Operation successfully completed." Below this, a section titled "AWS CloudTrail data events" contains a message: "You can view and configure CloudTrail data events for Amazon S3 bucket object-level operations in the AWS CloudTrail console." A button labeled "AWS CloudTrail" is visible. The main area is titled "Event notifications (1)" and lists one entry: "Name: NewStudentMaterialNotification, Event types: All object create events, Filters: materials/students/, Destination type: Lambda function, Destination: EduCloud-S3-Notification-Handler". There are "Edit", "Delete", and "Create event notification" buttons at the top right of this list. Below this, there's a section for "Amazon EventBridge" with a message: "Send notifications to Amazon EventBridge for all events in this bucket Off".

## Both the email received the email (worked when it was in public network)

The screenshot shows a Gmail inbox with one unread email. The subject is "New Learning Material Available: test-notification.txt". The sender is "EduCloud Materials <no-reply@sns.amazonaws.com> to me". The email body starts with "Hello Student! 🎉" and "Great news! Your trainer has uploaded new learning material for you." It includes a "FILE DETAILS" section with the following information:

- Filename: test-notification.txt
- File Size: 1.00 KB
- Uploaded: January 31, 2026 at 10:55 AM UTC
- Category: Student Materials

Below this, there's a "HOW TO ACCESS:" section with three steps:

- Visit your student portal
- Navigate to the "Materials" section
- Find "test-notification.txt" and click "Download"

At the bottom of the email are "Reply", "Forward", and "Smiley" buttons.

This screenshot shows a second Gmail inbox screen, identical to the first one, also displaying an email from "EduCloud Materials" about a new learning material upload. The email content is identical to the one in the first screenshot, including the subject, sender, body text, file details, and how-to-access instructions.

The screenshot shows the AWS CloudWatch Log Management interface. The left sidebar has a tree view with 'CloudWatch' selected, under 'Logs' there is a 'Log Management New' section. The main area is titled 'Log events' with a search bar and filter options. It lists log entries with columns for 'Timestamp' and 'Message'. The messages include initialization and start events for a Lambda function, followed by a message indicating a notification was sent.

The screenshot shows a Gmail inbox with 8,258 messages. The 'Primary' tab is selected. There are several new messages from 'EduCloud Materials' with subject lines like 'New Learning Material Available: test-ec2-1769857683.txt' and 'New Learning Material Available: test-notification.txt'. Other messages from 'Shopify' and 'Social' categories are also visible.

This screenshot shows the same Gmail inbox as the previous one, but with a different set of messages. It includes new messages from 'EduCloud Materials' with subjects like 'New Learning Material Available: planetext-test-1769858730.txt', 'New Learning Material Available: beautiful-test-1769858459.txt', and 'New Learning Material Available: test-ec2-1769857683.txt'. The inbox count is now 8,258.

## Rds entry for upload via lambda trigger

The screenshot shows the AWS Lambda function configuration page for 'EduCloud-S3-Notification-Handler'. Under the 'Edit environment variables' section, there are four environment variables listed: SNS\_TOPIC\_ARN, RDS\_HOST, RDS\_PASSWORD, and RDS\_DB. Each variable has a value assigned and a 'Remove' button. Below this is an 'Add environment variable' button. On the right side, there is a 'Tutorials' tab with a 'Create a simple web app' section containing a brief description and a 'Start tutorial' button.

## Updated lambda for the rds entry on upload

The screenshot shows the AWS Lambda function configuration page for 'EduCloud-S3-Notification-Handler'. The code editor displays the following Python script:

```
1 #!/usr/bin/python3
2
3 from datetime import datetime
4
5
6
7
8 sns_client = boto3.client('sns')
9 SNS_TOPIC_ARN = os.environ['SNS_TOPIC_ARN']
10
11 # RDS Configuration from environment variables
12 RDS_HOST = os.environ['RDS_HOST']
13 RDS_USER = os.environ['RDS_USER']
14 RDS_PASSWORD = os.environ['RDS_PASSWORD']
15 RDS_DB = os.environ['RDS_DB']
16
17
18 def get_db_connection():
19     """Create and return database connection"""
20     try:
21         connection = pymysql.connect(
22             host=RDS_HOST,
23             user=RDS_USER,
24             password=RDS_PASSWORD,
25             database=RDS_DB,
26             connect_timeout=5,
27             cursorclass=pymysql.cursors.DictCursor
28         )
29
30         return connection
31     except Exception as e:
32         print(f"Database connection failed: {str(e)}")
```

The sidebar on the right shows a 'Tutorials' section titled 'Create a simple web app' with a brief description and a 'Start tutorial' button.

## Permission for lambda to rds

RDS is in private subnet, Lambda must be in same subnet to connect

The screenshot shows the AWS Lambda function configuration page for 'EduCloud-S3-Notification-Handler'. The 'Edit VPC' section is open, showing the following configuration:

- VPC Info:** A dropdown menu is open, showing 'vpc-0fdc429fbf867a8c3 (10.0.0.0/16)'.
- Allow IPv6 traffic for dual-stack subnets:** An unchecked checkbox.
- Subnets:** A dropdown menu is open, showing 'Choose subnets' and 'subnet-08ca5f19432fb7f (10.0.2.0/24) us-east-1a X'. Below it, it says 'Name: Private-Subnet-Servers'.
- Security groups:** A dropdown menu is open, showing 'Choose security groups'.
- View security group rules:** A table titled 'Security group rules (0)' is shown, with a note 'Last fetched 4 minutes ago'.

The sidebar on the right shows a 'Tutorials' section titled 'Create a simple web app' with a brief description and a 'Start tutorial' button.

The screenshot shows the AWS EC2 Security Groups console. A security group named "Lambda functions" is selected, which is associated with the VPC "EduCloudVPC". The "Inbound rules" section is empty. The "Outbound rules" section contains two entries:

- Type: MySQL/Aurora, Protocol: TCP, Port range: 3306, Destination: Custom, Description: Allow Lambda to RDS.
- Type: HTTPS, Protocol: TCP, Port range: 443, Destination: Anywhere, Description: Allow Lambda to AWS services (S3, SNS).

A note at the bottom states: "Rules with destination of 0.0.0.0/0 or ::/0 allow your instances to send traffic to any IPv4 or IPv6 address. We recommend setting security group rules to be more restrictive and to only allow traffic to specific known IP addresses."

## Iam role for Lambda

The screenshot shows the AWS IAM Roles console. A role named "EduCloud-S3-Notification-Handler-role-375n9xn4" is selected. A green success message at the top states: "Policy was successfully attached to role." The "Permissions" tab is active, showing the attached policies:

- AWSLambdaBasicExecutionRole-f5130486-6bd4-4b...
- AWSLambdaVPCAccessExecutionRole
- SnsPublishPolicy

The "Permissions boundary" and "Generate policy based on CloudTrail events" sections are also visible.

After adding iam role add try this else get error

This vpc edit is required to run lambda in vpc

**After doing all these it will not work because we kept lambda in private so to communicate it need vpc end points to talk one service to other service**

**Created interface vpc endpoint to connect lambda with sns**

**Interface should allow network where lambda resides if no in bound from the lambda's subnet allowed to the vpc end point sg it wont allow lambda connection**

**Same done over here allowed lambda's sg**

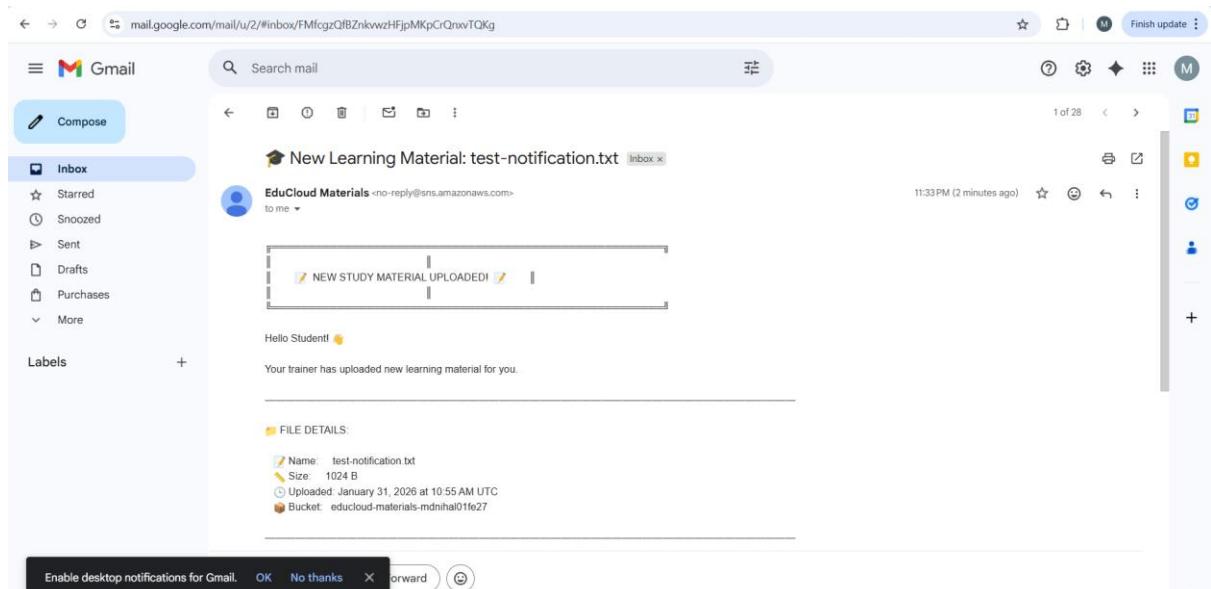
Only after allowing traffic from the sg of lambda it worked before we have done it in keeping lambda in public now it for private with vpc endpoints

```

aws Lambda Functions EduCloud-S3-Notification-Handler
[Alt+S] Search
[...] United States (N. Virginia) MyAWSAccount
INFO Tutorials >
Learn how to implement common use cases in AWS Lambda.
Create a simple web app ^ In this tutorial you will learn how to:
  • Build a simple web app, consisting of a Lambda function with a function URL that outputs a webpage
  • Invoke your function through its function URL
  Learn more Start tutorial
EXPLORER PROBLEMS OUTPUT CODE REFERENCE LOG TERMINAL Execution Results
EDUCLOUD-S3-NOTIFICATION... lambda_function.py requirements.txt
lambda_function.py
lambda_function.py
lambda_function.py
requirements.txt
Status: Succeeded Test Event Name: S3TestEvent
Response:
{
  "statusCode": 200,
  "body": "{\"message\": \"Notifications sent and data stored successfully\", \"processed_files\": 1}"
}
The area below shows the last 4 KB of the execution log.
Function Logs:
START RequestId: 268f83d8-00ca-4b29-89a3-9d3e78fe51ab Version: $LATEST
  ✓ SNS Notification sent for test-notification.txt
MessageId: 5919d045-670f-52e1-998b-b1bd211b2395
  ✓ Record inserted into RDS with ID: 8
  ✓ Database record created with ID: 8
END RequestId: 268f83d8-00ca-4b29-89a3-9d3e78fe51ab
REPORT RequestId: 268f83d8-00ca-4b29-89a3-9d3e78fe51ab Duration: 445.08 ms Billed Duration: 1264 ms Memory Size: 128 MB
Memory Used: 91 MB Init Duration: 818.27 ms
Request ID: 268f83d8-00ca-4b29-89a3-9d3e78fe51ab
ENVIRONMENT VARIABLES
RDS_DB = educlead_db
RDS_HOST = educlead-mysql-db.c6n4sgm4g...
RDS_PASSWORD = Mdnihal2000
RDS_USER = admin
SNS_TOPIC_ARN = arn:aws:sns:us-east-1:139...
CloudShell Feedback Console Mobile App
© 2026, Amazon Web Services, Inc. or its affiliates. Privacy Terms Cookie preferences

```

worked when the lambda was in private subnet



Rds entry 8 the record

```

MySQL [educlead_db]> DESCRIBE uploads;
+-----+-----+-----+-----+-----+
| Field | Type | Null | Key | Default | Extra |
+-----+-----+-----+-----+-----+
| id   | int  | NO  | PRI | NULL    | auto_increment |
| filename | varchar(255) | NO  |     | NULL    |             |
| s3_path | varchar(500) | YES |     | NULL    |             |
| uploader | varchar(100) | NO  | MUL | NULL    |             |
| upload_timestamp | timestamp | YES |     | CURRENT_TIMESTAMP | DEFAULT_GENERATED |
| file_size | varchar(20) | YES |     | NULL    |             |
| file_type | varchar(50) | YES |     | NULL    |             |
+-----+-----+-----+-----+-----+
7 rows in set (0.010 sec)

MySQL [educlead_db]> SELECT * FROM uploads;
+----+-----+-----+-----+-----+-----+-----+-----+
| id | filename | s3_path | uploader | upload_timestamp | file_size | file_type |
+----+-----+-----+-----+-----+-----+-----+
| 1  | linux_basics_week1.pdf | NULL | trainer1 | 2026-01-27 07:17:28 | 12MB | PDF |
| 2  | aws_vpc_tutorial.pdf | NULL | trainer2 | 2026-01-27 07:17:28 | 8MB | PDF |
| 3  | assignment1.tar.gz | NULL | student1 | 2026-01-27 07:17:28 | 25MB | Archive |
| 4  | docker_intro.pdf | NULL |          | 2026-01-27 07:17:28 | 15MB | PDF |
| 5  | assignment2.tar.gz | NULL | student2 | 2026-01-27 07:17:28 | 18MB | Archive |
| 6  | internet_explor.pdf | NULL |          | 2026-01-27 07:17:28 | 10MB | PDF |
| 7  | assignment3.tar.gz | NULL | student3 | 2026-01-27 07:17:28 | 30MB | Archive |
| 8  | test-notification.txt | materials/students/test-notification.txt | trainer1 | 2026-01-31 18:03:01 | 1024 B | TXT |
+----+-----+-----+-----+-----+-----+-----+
8 rows in set (0.006 sec)

MySQL [educlead_db]>

```

```

root@ip-10-0-2-223:~/home/ec2-user#
[root@ip-10-0-2-223 ec2-user]# 
[root@ip-10-0-2-223 ec2-user]# 
[root@ip-10-0-2-223 ec2-user]# echo "Manual sync test - $(date '+%Y-%m-%d %H:%M:%S')" > /mnt/educloud-data/materials/students/manual-sync-test.txt
[root@ip-10-0-2-223 ec2-user]# sudo nano /opt/educloud/scripts/sync-materials-to-s3.sh
[root@ip-10-0-2-223 ec2-user]# sudo /opt/educloud/scripts/sync-materials-to-s3.sh
=====
[2026-02-01 00:14:59] =====
[2026-02-01 00:14:59] Starting materials sync to S3
[2026-02-01 00:14:59] Source: /mnt/educloud-data/materials
[2026-02-01 00:14:59] Destination: s3://educloud-materials-mdnihal01fe27/materials
=====
[2026-02-01 00:14:59] Total files to sync: 25
[2026-02-01 00:14:59] uplaid: /mnt/educloud-data/materials/students/manual-sync-test.txt to s3://educloud-materials-mdnihal01fe27/materials/students/manual-sync-test.txt
[2026-02-01 00:15:00] @ SUCCESS! Materials synced to S3
[2026-02-01 00:15:01] Files in S3: 29
[2026-02-01 00:15:01] Sync process completed
[2026-02-01 00:15:01] =====
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# mysql -h educloud-mysql1-db.c6n4sgm4gf6o.us-east-1.rds.amazonaws.com -u admin -p
Enter password:

```

```

root@ip-10-0-2-223:~/home/ec2-user#
[2026-02-01 00:15:00] @ SUCCESS! Materials synced to S3
[2026-02-01 00:15:00] Files in S3: 29
[2026-02-01 00:15:01] Sync process completed
[2026-02-01 00:15:01] =====
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# mysql -h educloud-mysql1-db.c6n4sgm4gf6o.us-east-1.rds.amazonaws.com -u admin -p
Enter password:
Welcome to the MariaDB monitor. Commands end with ; or \g.
Your MySQL connection id is 94
Server version: 8.0.43 Source distribution

Copyright (c) 2000, 2018, Oracle, MariaDB Corporation Ab and others.

Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.

MySQL [(none)]> SHOW DATABASES;
+-----+
| Database |
+-----+
| educlead_db |
| information_schema |
| mysql |
| performance_schema |
| sys |
+-----+
5 rows in set (0.012 sec)

MySQL [(none)]> USE educlead_db;
Reading table information for completion of table and column names
You can turn off this feature to get a quicker startup with -A

Database changed
MySQL [educlead_db]> SELECT * FROM uploads;
+----+-----+-----+-----+-----+-----+-----+
| id | filename | s3_path | uploader | upload_timestamp | file_size | file_type |
+----+-----+-----+-----+-----+-----+-----+
| 1 | linux_basics_week1.pdf | NULL | trainer1 | 2026-01-27 07:17:28 | 12MB | PDF |
| 2 | aws_vpc_tutorial.pdf | NULL | trainer2 | 2026-01-27 07:17:28 | 8MB | PDF |
| 3 | assignment1.tar.gz | NULL | student1 | 2026-01-27 07:17:28 | 25MB | Archive |
| 4 | docker_intro.pdf | NULL | student1 | 2026-01-27 07:17:28 | 15MB | PDF |
| 5 | kubernetes_getting_starte... | NULL | student2 | 2026-01-27 07:17:28 | 10MB | Archive |
| 6 | kubernetes_getting_starte... | NULL | student2 | 2026-01-27 07:17:28 | 22MB | PDF |
| 7 | assignment3.tar.gz | NULL | student3 | 2026-01-27 07:17:28 | 30MB | Archive |
| 8 | test-notification.txt | materials/students/test-notification.txt | trainer1 | 2026-01-31 18:03:01 | 1024 B | TXT |
| 9 | manual-sync-test.txt | materials/students/manual-sync-test.txt | trainer1 | 2026-01-31 18:45:02 | 39 B | TXT |
+----+-----+-----+-----+-----+-----+-----+
9 rows in set (0.001 sec)

MySQL [educlead_db]> 

```

mail.google.com/mail/u/0/#inbox

Gmail Search mail

Inbox 8,263

Compose

Primary Promotions Social

1-50 of 9,138

New Learning Material: manual-sync-test.txt

New Learning Material: test-notification.txt

12:15 AM 11:33 PM

mail.google.com/mail/u/0/#inbox/1MfcgZQfBZnkVwSmPkVrkzbRHmDvh

Gmail Search mail

Inbox 8,262

Compose

New Learning Material: manual-sync-test.txt

EduCloud Materials <no-reply@sns.amazonaws.com> to me

12:15 AM (5 minutes ago)

Hello Student!

Your trainer has uploaded new learning material for you.

FILE DETAILS:

- Name: manual-sync-test.txt
- Size: 39 B
- Uploaded: January 31, 2026 at 06:45 PM UTC
- Bucket: educloud-materials-mdnihal01fe27

Reply Forward

Upgrade

**Lambda kept in private subnet in vpc and can communicate with rds why because its in same vpc, lambda and rds are in same vpc they can communicate through security groups but as lambda is In private and sns, cloud watch se are out of vpc gloabal service they need to be comminicated via vpc end points after creating end points we we should allow vpc endpoint sg from lambda's sg (inbounds) and vpc dns resolution enabled so that dns of its is resolved**

```
root@ip-10-0-2-223:~# mysql -h educloud-mysql1-db.c6n4sgm4gf6.us-east-1.rds.amazonaws.com -u admin -p
Enter password:
Welcome to the MariaDB monitor.  Commands end with ; or \g.
Your MySQL connection id is 24
Server version: 8.0.43 Source distribution

Copyright (c) 2000, 2018, Oracle, MariaDB Corporation Ab and others.

Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.

MySQL [(none)]> SHOW DATABASES;
+-----+
| Database |
+-----+
| educloud_db |
| information_schema |
| mysql |
| performance_schema |
| sys |
+-----+
5 rows in set (0.024 sec)

MySQL [(none)]> USE educloud_db;
Reading table information for completion of table and column names
You can turn off this feature to get a quicker startup with -A
Database changed
MySQL [educloud_db]> SHOW TABLES;
+-----+
| Tables_in_educloud_db |
+-----+
| student_uploads_view |
| students |
| trainers |
| uploads |
+-----+
4 rows in set (0.002 sec)

MySQL [educloud_db]>
MySQL [educloud_db]>
```

```
root@ip-10-0-2-223:~# mysql -h educloud-mysql1-db.c6n4sgm4gf6.us-east-1.rds.amazonaws.com -u admin -p
Enter password:
Welcome to the MariaDB monitor.  Commands end with ; or \g.
Your MySQL connection id is 24
Server version: 8.0.43 Source distribution

Copyright (c) 2000, 2018, Oracle, MariaDB Corporation Ab and others.

Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.

MySQL [educloud_db]> DESCRIBE uploads;
+-----+-----+-----+-----+-----+
| id | int | NO | PRI | NULL | auto_increment |
| filename | varchar(255) | NO | NULL |
| s3_path | varchar(500) | YES | NULL |
| uploader | varchar(100) | NO | MUL | NULL |
| upload_timestamp | timestamp | YES | CURRENT_TIMESTAMP | DEFAULT_GENERATED |
| file_size | varchar(20) | YES | NULL |
| file_type | varchar(50) | YES | NULL |
+-----+-----+-----+-----+-----+
7 rows in set (0.014 sec)

MySQL [educloud_db]> SELECT * FROM uploads ORDER BY id DESC LIMIT 5;
+-----+-----+-----+-----+-----+-----+-----+
| id | filename | s3_path | uploader | upload_timestamp | file_size | file_type |
+-----+-----+-----+-----+-----+-----+-----+
| 9 | manual-sync-test.txt | materials/students/manual-sync-test.txt | trainer1 | 2026-01-31 18:45:02 | 39 B | TXT |
| 8 | test-notification.txt | materials/students/test-notification.txt | trainer1 | 2026-01-31 18:03:01 | 1024 B | TXT |
| 7 | assignment3.tar.gz | NULL | student3 | 2026-01-27 07:17:28 | 30MB | Archive |
| 6 | kubernetes_guide.pdf | NULL | trainer2 | 2026-01-27 07:17:28 | 22MB | PDF |
| 5 | assignment2.tar.gz | NULL | student2 | 2026-01-27 07:17:28 | 18MB | Archive |
+-----+-----+-----+-----+-----+-----+
5 rows in set (0.002 sec)

MySQL [educloud_db]> UPDATE uploads SET upload_type = 'assignment' WHERE uploader LIKE 'student%';
ERROR 1054 (42S22): Unknown column 'upload_type' in 'field list'
MySQL [educloud_db]> ALTER TABLE uploads ADD COLUMN upload_type ENUM('material', 'assignment') DEFAULT 'material';
Query OK, 0 Rows affected (0.038 sec)
Records: 0 Duplicates: 0 Warnings: 0

MySQL [educloud_db]> UPDATE uploads SET upload_type = 'assignment' WHERE uploader LIKE 'student%';
Query OK, 3 rows affected (0.006 sec)
Rows matched: 3 Changed: 3 Warnings: 0

MySQL [educloud_db]> DESCRIBE uploads;
+-----+-----+-----+-----+-----+
| Field | Type | Null | Key | Default | Extra |
+-----+-----+-----+-----+-----+
| id | int | NO | PRI | NULL | auto_increment |
| filename | varchar(255) | NO | NULL |
| s3_path | varchar(500) | YES | NULL |
| uploader | varchar(100) | NO | MUL | NULL |
| upload_timestamp | timestamp | YES | CURRENT_TIMESTAMP | DEFAULT_GENERATED |
| file_size | varchar(20) | YES | NULL |
| file_type | varchar(50) | YES | NULL |
| upload_type | enum('material','assignment') | YES | material |
+-----+-----+-----+-----+-----+
8 rows in set (0.002 sec)

MySQL [educloud_db]>
```

## Synced to s3

The screenshot shows the AWS S3 console with the bucket 'educloud-materials-mdnihal01fe27'. The left sidebar shows general purpose buckets like 'Directory buckets', 'Table buckets', and 'Vector buckets'. Under 'Access management and security', there are 'Access Points', 'Access Points for FSx', 'Access Grants', and 'IAM Access Analyzer'. Under 'Storage management and insights', there are 'Storage Lens' and 'Batch Operations'. The main pane displays the 'Objects (7)' section. A search bar at the top allows filtering by prefix. Below it is a table with columns: Name, Type, Last modified, Size, and Storage class. The objects listed are all folders:

Name	Type	Last modified	Size	Storage class
archives/	Folder	-	-	-
assignments/	Folder	-	-	-
backups/	Folder	-	-	-
lambda/	Folder	-	-	-
logs/	Folder	-	-	-
materials/	Folder	-	-	-
test-cli/	Folder	-	-	-

The screenshot shows the AWS S3 console with the path 'educloud-materials-mdnihal01fe27/assignments/'. The left sidebar shows the same navigation structure as the previous screenshot. The main pane displays the 'Objects (1)' section. A search bar at the top allows filtering by prefix. Below it is a table with columns: Name, Type, Last modified, Size, and Storage class. The object listed is a folder:

Name	Type	Last modified	Size	Storage class
student1/	Folder	-	-	-

The screenshot shows the AWS S3 console with the path 'educloud-materials-mdnihal01fe27/assignments/student1/'. The left sidebar shows the same navigation structure. The main pane displays the 'Objects (3)' section. A search bar at the top allows filtering by prefix. Below it is a table with columns: Name, Type, Last modified, Size, and Storage class. The objects listed are tar.gz files:

Name	Type	Last modified	Size	Storage class
final-project-submission.tar.gz	gz	February 3, 2026, 11:04:46 (UTC+05:30)	233.0 B	Standard
math_assignment.tar.gz	gz	February 3, 2026, 11:04:46 (UTC+05:30)	143.0 B	Standard
science_assignment.tar.gz	gz	February 3, 2026, 11:04:46 (UTC+05:30)	143.0 B	Standard

```
[root@ip-10-0-2-223 ec2-user]# sudo touch /var/log/educloud/sync-assignments.log
[root@ip-10-0-2-223 ec2-user]#
[root@ip-10-0-2-223 ec2-user]# sudo /opt/educloud/scripts/sync-assignments-to-s3.sh
[root@ip-10-0-2-223 ec2-user]# cat /var/log/educloud/sync-assignments.log
[2026-02-03 11:04:43] Syncing assignments to S3...
upload: ./assignments/student1/final-project-submission.tar.gz to s3://educloud-materials-mdnihal01fe27/assignments/student1/final-project-submission.tar.gz
upload: ./assignments/student1/science_assignment.tar.gz to s3://educloud-materials-mdnihal01fe27/assignments/student1/science_assignment.tar.gz
upload: ./assignments/student1/math_assignment.tar.gz to s3://educloud-materials-mdnihal01fe27/assignments/student1/math_assignment.tar.gz
[2026-02-03 11:04:43] Sync completed
[root@ip-10-0-2-223 ec2-user]#
```

The screenshot shows the AWS Lambda console interface. At the top, the URL is `us-east-1.console.aws.amazon.com/lambda/home?region=us-east-1#/functions/EduCloud-Assignment-Notification?tab=code`. The navigation bar includes 'Lambda > Functions > EduCloud-Assignment-Notification'. The main title is 'EduCloud-Assignment-Notification'. Below it, there's a 'Function overview' section with tabs for 'Diagram' and 'Template'. A diagram shows a single function icon labeled 'EduCloud-Assignment-Notification' with '(0)' layers. Buttons for '+ Add trigger' and '+ Add destination' are present. To the right, there are sections for 'Throttle', 'Copy ARN', 'Actions', 'Export to Infrastructure Composer', 'Download', 'Description' (last modified 56 seconds ago), 'Function ARN' (arn:aws:lambda:us-east-1:139749347006:function:EduCloud-Assignment-Notification), and 'Function URL' (Info). On the far right, there's a 'Create a simple web app' tutorial with a 'Start tutorial' button.

## Trainer received email when student uploads assignments

The screenshot shows a Gmail inbox with 413 messages. The subject of the top email is 'New Assignment from Rajesh Kumar' from 'Educloud <no-reply@sns.amazonaws.com>'. The email body contains the following text:

NEW ASSIGNMENT SUBMITTED  
Student: Rajesh Kumar (student1)  
File: test-assignment.tar.gz  
Size: 2.00 KB  
Time: 2026-02-03 06:47:50 IST  
S3 Path: s3://educlead-materials-mdnihal01fe27/assignments/student1/test-assignment.tar.gz  
Upload ID: #10  
Action: Review and grade the assignment

At the bottom of the email, there is a link to unsubscribe: <https://sns.us-east-1.amazonaws.com/unsubscribe.html?SubscriptionArn=arn:aws:sns:us-east-1:139749347006:EduCloud-Assignment-Notifications:63396829-9c5b-4c4b-93f7-ec1af71bbald&Endpoint=mdnihalmakanadar@gmail.com>

## Vpc configuration for the lambda

The screenshot shows the AWS Lambda console with the 'Configuration' tab selected for the 'EduCloud-Assignment-Notification' function. On the left, a sidebar lists various configuration options like General configuration, Triggers, Permissions, Destinations, Function URL, Environment variables, Tags, and VPC. The VPC section is expanded, showing the VPC ID 'vpc-0fdcc429bf867a8c3' and its association with the 'EduCloudVPC'. It also lists two subnets: 'Allow IPv6 traffic = false' and 'subnet-08caef194329fb7f (10.0.2.0/24) | us-east-1a, Private-Subnet-Servers'. A security group 'sg-04b26d71595cd5ff4 (EduCloud-Lambda-SG)' is assigned. Below this, a table titled 'Security group rules (1)' shows one inbound rule: 'sg-04b26d71595cd5ff4' with 'Protocol' set to 'Custom TCP' and 'Ports' set to '443', with 'Source' set to 'sg-04b26d71595cd5ff4'. A note indicates the last fetch was 20 minutes ago. To the right, a 'Create a simple web app' tutorial is displayed.

## DB entry by student1

```
root@ip-10-0-2-223:/home/ec2-user
performance_schema |
sys
5 rows in set (0.015 sec)

MySQL [(none)]> USE educloud_db;
Reading table information for completion of table and column names
You can turn off this feature to get a quicker startup with -A
Database changed
MySQL [educloud_db]> USE your_database_name;
ERROR 1049 (42000): Unknown database 'your_database_name'
MySQL [educloud_db]> USE your_database_name;
ERROR 1049 (42000): Unknown database 'your_database_name'
MySQL [educloud_db]> SHOW TABLES;
+ Tables_in_educloud_db +
| student_uploads_view |
| students |
| trainers |
| uploads |
4 rows in set (0.002 sec)

MySQL [educloud_db]> SELECT * FROM uploads ORDER BY id DESC LIMIT 5;
+-----+-----+-----+-----+-----+
| id | filename | s3_path | uploader | upload_timestamp | file_size | file_type |
+-----+-----+-----+-----+-----+
| 11 | test-assignment.tar.gz | s3://educloud-materials-mdniha10ife27/assignments/student1/test-assignment.tar.gz | student1 | 2026-02-03 07:03:50 | 2.00 KB | GZ |
| 10 | test-assignment.tar.gz | s3://educloud-materials-mdniha10ife27/assignments/student1/test-assignment.tar.gz | student1 | 2026-02-03 06:47:49 | 2.00 KB | GZ |
| 9 | manual-sync-test.txt | materials/students/manual-sync-test.txt | trainer1 | 2026-01-31 18:45:02 | 39 B | TXT |
| 8 | test-notification.txt | materials/students/test-notification.txt | trainer1 | 2026-01-31 18:03:01 | 1024 B | TXT |
| 7 | assignment3.tar.gz | NULL | student3 | 2026-01-27 07:17:28 | 30MB | Archive |
+-----+-----+-----+-----+-----+
5 rows in set (0.002 sec)

MySQL [educloud_db]> SELECT table_name FROM user_tables;
ERROR 1146 (42S02): Table 'educloud_db.user_tables' doesn't exist
MySQL [educloud_db]>
```

```

root@ip-10-0-2-223:/home/ec2-user
+-----+-----+-----+-----+-----+
| Field | Type   | Null | Key | Default | Extra       |
+-----+-----+-----+-----+-----+
| id    | int    | NO   | PRI | NULL    | auto_increment |
| filename | varchar(255) | NO   | YES  | NULL    |                |
| s3_path | varchar(500) | NO   | YES  | NULL    |                |
| uploader | varchar(100) | NO   | YES  | MUL    |                |
| upload_timestamp | timestamp | NO   | YES  | CURRENT_TIMESTAMP | DEFAULT_GENERATED |
| file_size | varchar(20) | YES  | YES  | NULL    |                |
| file_type | varchar(50) | YES  | YES  | NULL    |                |
| upload_type | enum('material','assignment') | YES  | YES  | material |                |
+-----+-----+-----+-----+-----+
8 rows in set (0.007 sec)

MySQL [educloud_db]> select * from uploads;
+-----+-----+-----+-----+-----+
| id | filename | s3_path | uploader | upload_timestamp | file_size |
+-----+-----+-----+-----+-----+
| 1 | linux_basics_week1.pdf | NULL | trainer1 | 2026-01-27 07:17:28 | 12MB |
| PDF | material | NULL | trainer2 | 2026-01-27 07:17:28 | 8MB |
| PDF | material | NULL | student1 | 2026-01-27 07:17:28 | 25MB |
| 3 | assignment1.tar.gz | NULL | student1 | 2026-01-27 07:17:28 | 15MB |
| Archive | assignment | NULL | trainer3 | 2026-01-27 07:17:28 | 18MB |
| 4 | docker_intro.pdf | NULL | student2 | 2026-01-27 07:17:28 | 22MB |
| PDF | material | NULL | student2 | 2026-01-27 07:17:28 | 30MB |
| 5 | assignment2.tar.gz | NULL | student3 | 2026-01-27 07:17:28 | 39 B |
| Archive | assignment | NULL | student1 | 2026-02-03 06:47:49 | 2.00 KB |
| 6 | kubernetes_guide.pdf | NULL | student1 | 2026-02-03 07:03:50 | 2.00 KB |
| PDF | material | NULL | student2 | 2026-02-03 11:12:31 | 2.00 KB |
| 7 | assignment3.tar.gz | NULL | student2 | 2026-01-31 18:03:01 | 1024 B |
| Archive | assignment | NULL | student1 | 2026-01-31 18:45:02 | 39 B |
| 8 | test-notification.txt | materials/students/test-notification.txt | student1 | 2026-02-03 07:17:28 | 39 B |
| TXT | material | NULL | student1 | 2026-02-03 07:17:28 | 39 B |
| 9 | manual-sync-test.txt | materials/students/manual-sync-test.txt | student1 | 2026-02-03 07:17:28 | 39 B |
| TXT | material | NULL | student1 | 2026-02-03 07:17:28 | 39 B |
| 10 | test-assignment.tar.gz | s3://educloud-materials-mdnihai0ife27/assignments/student1/test-assignment.tar.gz | student1 | 2026-02-03 07:17:28 | 39 B |
| GZ | assignment | NULL | student1 | 2026-02-03 07:17:28 | 39 B |
| 11 | test-assignment.tar.gz | s3://educloud-materials-mdnihai0ife27/assignments/student1/test-assignment.tar.gz | student1 | 2026-02-03 07:17:28 | 39 B |
| GZ | assignment | NULL | student1 | 2026-02-03 07:17:28 | 39 B |
| 12 | testOthers-assignment.tar.gz | s3://educloud-materials-mdnihai0ife27/assignments/student2/testOthers-assignment.tar.gz | student2 | 2026-02-03 11:12:31 | 2.00 KB |
| GZ | assignment | NULL | student2 | 2026-02-03 11:12:31 | 2.00 KB |
+-----+-----+-----+-----+-----+
12 rows in set (0.001 sec)

MySQL [educloud_db]>

```

## Final student upload flow

### client

```

student1@ip-10-0-2-24:~#
[root@ip-10-0-2-24 ec2-user]# su - student1
Last login: Tue Feb  3 13:42:21 UTC 2026 on pts/3
[student1@ip-10-0-2-24 ~]$ lftp -u student1 10.0.2.223
Password:
Interrupt
[student1@ip-10-0-2-24 ~]$ ^C
[student1@ip-10-0-2-24 ~$]
[student1@ip-10-0-2-24 ~$]
[student1@ip-10-0-2-24 ~$] lftp -u student1 10.0.2.223
Password:
lftp student1@10.0.2.223:~> ls
-rw-rw---- 1 0          1003      66 Jan 23 14:08 README-assignments.txt
-rw-rw---- 1 1004        1003      34 Jan 23 15:39 assignment1.tar.gz
drwxr--r-- 2 1004        1003     129 Feb  3 11:21 student1
drwxr--r-- 2 1005        1003      6 Jan 28 05:48 student2
drwxr--r-- 2 1006        1003      6 Jan 28 05:48 student3
-rw-rw---- 1 1004        1003     17 Jan 23 15:59 test-inheritance.txt
lftp student1@10.0.2.223:> cd student1
lftp student1@10.0.2.223:/student1> ls
-rw-r--r-- 1 1004        1003    233 Feb  2 07:41 final-project-submission.tar.gz
-rw-r--r-- 1 1004        1003    143 Jan 28 07:32 math_assignment.tar.gz
-rw-r--r-- 1 1004        1003    143 Jan 28 07:32 science_assignment.tar.gz
lftp student1@10.0.2.223:/student1> bye
[student1@ip-10-0-2-24 ~]$ ls
final-project final-project-submission.tar.gz final-test.txt my-final-assignment.tar.gz
[student1@ip-10-0-2-24 ~$] lftp -u student1 10.0.2.223
Password:
lftp student1@10.0.2.223:> cd student1
cd ok, cwd=/student1
lftp student1@10.0.2.223:/student1> ls
-rw-r--r-- 1 1004        1003    233 Feb  2 07:41 final-project-submission.tar.gz
-rw-r--r-- 1 1004        1003    143 Jan 28 07:32 math_assignment.tar.gz
-rw-r--r-- 1 1004        1003    143 Jan 28 07:32 science_assignment.tar.gz
lftp student1@10.0.2.223:/student1> put my-final-assignment.tar.gz
200 bytes transferred
lftp student1@10.0.2.223:/student1> ls
-rw-r--r-- 1 1004        1003    233 Feb  2 07:41 final-project-submission.tar.gz
-rw-r--r-- 1 1004        1003    143 Jan 28 07:32 math_assignment.tar.gz
-rw-r--r-- 1 1004        1003    200 Feb  3 13:47 my-final-assignment.tar.gz
-rw-r--r-- 1 1004        1003    143 Jan 28 07:32 science_assignment.tar.gz
lftp student1@10.0.2.223:/student1> bye
[student1@ip-10-0-2-24 ~$]

```

### Server

```

root@ip-10-0-2-223:~# exit
[ec2-user@ip-10-0-2-24 ~]$ exit
logout
Connection to 10.0.2.24 closed.
[root@ip-10-0-1-81 ec2-user]# ssh -i educloud-keypair ec2-user@10.0.2.223
A newer release of "Amazon Linux" is available.
Version 2023.10.20260120:
Run '/usr/bin/dnf check-release-update' for full release and version update info
      _#####
     /### \
    / \   https://aws.amazon.com/linux/amazon-linux-2023
   V_-->
  / \
 / \
/m/` 

Last login: Tue Feb  3 16:43:45 2026 from 10.0.1.81
[ec2-user@ip-10-0-2-223 ~]$ sudo su
[root@ip-10-0-2-223 ec2-user]# ls -lh /m
materials/ media/ mnt/
[root@ip-10-0-2-223 ec2-user]# ls -lh /mnt/educloud-data/assignments/student
ls: cannot access '/mnt/educloud-data/assignments/student': No such file or directory
[root@ip-10-0-2-223 ec2-user]# ls -lh /mnt/educloud-data/assignments/students
ls: cannot access '/mnt/educloud-data/assignments/students': No such file or directory
[root@ip-10-0-2-223 ec2-user]# ls -lh /mnt/educloud-data/assignments/
total 12K
-rw-rw----, 1 root students 66 Jan 23 19:38 README-assignments.txt
-rw-rw----, 1 student1 students 34 Jan 23 21:09 assignment1.tar.gz
drwxr-xr-x, 2 student1 students 163 Feb  3 19:17 student1
drwxr-xr-x, 2 student2 students  6 Jan 28 11:18 student2
drwxr-xr-x, 2 student3 students  6 Jan 28 11:18 student3
-rw-rw----, 1 student1 students 17 Jan 23 21:29 test-inheritance.txt
[root@ip-10-0-2-223 ec2-user]# ls -lh /mnt/educloud-data/assignments/student
total 16K
-rw-rw----, 1 student1 students 233 Feb  2 13:11 final-project-submission.tar.gz
-rw-rw----, 1 student1 students 143 Jan 28 13:02 math_assignment.tar.gz
-rw-rw----, 1 student1 students 200 Feb  3 19:17 my-final-assignment.tar.gz
-rw-rw----, 1 student1 students 143 Jan 28 13:02 science_assignment.tar.gz
[root@ip-10-0-2-223 ec2-user]#

```

## Cron

```

root@ip-10-0-2-223:~# 
[root@ip-10-0-2-223 ec2-user]# 
[root@ip-10-0-2-223 ec2-user]# 
[root@ip-10-0-2-223 ec2-user]# 
[root@ip-10-0-2-223 ec2-user]# 
[root@ip-10-0-2-223 ec2-user]# cat /var/logs/
cat: /var/logs/: No such file or directory
[root@ip-10-0-2-223 ec2-user]# ls /var/logs/
ls: cannot access '/var/logs': No such file or directory
[root@ip-10-0-2-223 ec2-user]# ls /var/log/
README btmp cloud-init-output.log dnf.log hawkey.log httpd php-fpm sssd vsftpd.log-20260130
amazon btmp-20260201 cloud-init.log dnf.rpm.log hawkey.log-20260129 journal private tallylog vsftpd.log-20260201
audit chrony dnf.librepo.log hawkey.log-20260201 lastlog sa vsftpd.log wtmp
[root@ip-10-0-2-223 ec2-user]# ls /var/log/educloud/
archive.log backup.log sync-materials.log trainer1-backup.log upload-logs.log
archive1.log backup1.log sync-assignments.log test.log trainer2-archive.log
[root@ip-10-0-2-223 ec2-user]# ls /var/log/educloud/sync-assignments.log
/var/log/educloud/sync-assignments.log
[root@ip-10-0-2-223 ec2-user]# cat /var/log/educloud/sync-assignments.log
[2026-02-03 11:04:43] Syncing assignments to S3...
upload: ../../assignments/student1/final-project-submission.tar.gz to s3://educloud-materials-mdnihal01fe27/assignments/student1/final-project-submission.tar.gz
upload: ../../assignments/student1/science_assignment.tar.gz to s3://educloud-materials-mdnihal01fe27/assignments/student1/science_assignment.tar.gz
upload: [2026-02-03 11:04:43] @ Sync completed
[2026-02-03 19:20:48] Syncing assignments to S3...
upload: ../../assignments/student1/my-final-assignment.tar.gz to s3://educloud-materials-mdnihal01fe27/assignments/student1/my-final-assignment.tar.gz
[2026-02-03 19:20:48] @ Sync completed
[root@ip-10-0-2-223 ec2-user]#

```

## Se bucket aws console

Name	Type	Last modified	Size	Storage class
final-project-submission.tar.gz	gz	February 3, 2026, 11:04:46 (UTC+05:30)	233.0 B	Standard
math_assignment.tar.gz	gz	February 3, 2026, 11:04:46 (UTC+05:30)	143.0 B	Standard
my-final-assignment.tar.gz	gz	February 3, 2026, 19:20:49 (UTC+05:30)	200.0 B	Standard
science_assignment.tar.gz	gz	February 3, 2026, 11:04:46 (UTC+05:30)	143.0 B	Standard

## Email sent for the trainer

The screenshot shows a Gmail inbox with 412 messages. The message from 'Educloud' is highlighted. The subject is 'New Assignment from Rajesh Kumar'. The message body contains the following text:

```
NEW ASSIGNMENT SUBMITTED
Student: Rajesh Kumar (student1)
File: my-final-assignment.tar.gz
Size: 200.00 B
Time: 2026-02-03 13:50:51 IST
S3 Path: s3://educloud-materials-mdnihal01fe27/assignments/student1/my-final-assignment.tar.gz
Upload ID: #13
```

Below the message, there are 'Reply', 'Forward', and other interaction buttons.

## Database entry

```
root@ip-10-0-2-223:/home/ec2-user
student_uploads_view
students
trainers
uploads
4 rows in set (0.002 sec)

MySQL [educloud_db]> SELECT * FROM uploads
-> SELECT * FROM uploads;
ERROR 1064 (42000): You have an error in your SQL syntax; check the manual that corresponds to your MySQL server version for the right syntax to use near 'SELECT * FROM upl
oads' at line 2
MySQL [educloud_db]> SELECT * FROM uploads;
+-----+-----+-----+-----+
| id | filename | s3_path | uploader | upload_timestamp | file_size |
+-----+-----+-----+-----+
| 1 | linux_basics_week1.pdf | NULL | trainer1 | 2026-01-27 07:17:28 | 12MB |
| 2 | aws_vpc_tutorial.pdf | NULL | trainer2 | 2026-01-27 07:17:28 | 8MB |
| 3 | assignment1.tar.gz | NULL | student1 | 2026-01-27 07:17:28 | 25MB |
| 4 | docker_intro.pdf | NULL | trainer3 | 2026-01-27 07:17:28 | 15MB |
| 5 | assignment2.tar.gz | NULL | student2 | 2026-01-27 07:17:28 | 18MB |
| 6 | kubernetes_guide.pdf | NULL | trainer2 | 2026-01-27 07:17:28 | 22MB |
| 7 | assignment3.tar.gz | NULL | student3 | 2026-01-27 07:17:28 | 30MB |
| 8 | test-notification.txt | materials/students/test-notification.txt | trainer1 | 2026-01-31 18:03:01 | 1024 B |
| 9 | manual-sync-test.txt | materials/students/manual-sync-test.txt | trainer1 | 2026-01-31 18:45:02 | 39 B |
| 10 | test-assignment.tar.gz | s3://educloud-materials-mdnihal01fe27/assignments/student1/test-assignment.tar.gz | student1 | 2026-02-03 06:47:49 | 2.00 KB |
| 11 | test-assignment.tar.gz | s3://educloud-materials-mdnihal01fe27/assignments/student1/test-assignment.tar.gz | student1 | 2026-02-03 07:03:50 | 2.00 KB |
| 12 | testOthers-assignment.tar.gz | s3://educloud-materials-mdnihal01fe27/assignments/student2/testOthers-assignment.tar.gz | student2 | 2026-02-03 11:12:31 | 2.00 KB |
| 13 | my-final-assignment.tar.gz | s3://educloud-materials-mdnihal01fe27/assignments/student1/my-final-assignment.tar.gz | student1 | 2026-02-03 13:50:50 | 200.00 B |
+-----+-----+-----+-----+
13 rows in set (0.001 sec)

MySQL [educloud_db]>
```

## Final work flow nfs (Client)

Trainer uploads from his pc

```
[root@ip-10-0-2-24 ~]# df -h | grep materials
10.2.233.:/mnt/educloud-data/materials 10G 105M 9.9G 2% /mnt/educloud-materials
[root@ip-10-0-2-24 ~]# echo "Final sns and rds check from trainer - $(date)" | sudo tee /mnt/educloud-materials/students/final-rds-sns-demo.txt
Final sns and rds check from trainer - Tue Feb 3 13:58:28 UTC 2026
[root@ip-10-0-2-24 ~]# ls -la /mnt/educloud-materials/students/
total 60
drwxrwsr-x 2 root     trainers 4096 Feb  3 13:58 .
drwxrws--- 5 root     trainers 53 Jan 30 05:37 ..
-rw-r--r-- 1 student1 students 285 Jan 31 00:14 aws-basics-guide.txt
-rw-r--r-- 1 student1 students 52 Jan 31 11:20 beautiful-test-1769858459.txt
-rw-r--r-- 1 root     trainers 68 Feb  3 13:58 final-rds-sns-demo.txt
-rw-r--r-- 1 student1 students 20 Jan 31 10:45 lambda-tutorial.txt
-rw-r--r-- 1 student1 students 348 Jan 31 06:35 linux-commands.pdf
-rw-r--r-- 1 root     students 39 Jan 31 18:44 manual-sync-test.txt
-rw-r--r-- 1 student1 students 413 Jan 31 06:35 networking-notes.txt
-rw-r--r-- 1 student1 students 52 Jan 31 11:25 planetext-test-1769858730.txt
-rw-r--r-- 1 student1 students 276 Jan 31 06:35 python-intro.txt
-rw-r--r-- 1 student1 students 20 Jan 31 16:39 rds-test-1769877575.txt
-rw-r--r-- 1 student1 students 20 Jan 31 16:39 student_assignment1.pdf
-rw-r--r-- 1 student1 students 109 Jan 30 06:05 student_studyguide.txt
-rw-r--r-- 1 student1 students 58 Jan 31 11:08 test-ec2-1769857683.txt
-rw-r--r-- 1 root     students 53 Feb  2 05:41 test-from-client.txt
[root@ip-10-0-2-24 ~]#
```

## (Server) file merriors in server

```
[root@ip-10-0-2-223 ~]# ls -ls /mnt/educloud-data/materials/students/
total 56
# -rw-r--r-- 1 student1 students 285 Jan 31 12:05 aws-basics-guide.txt
# -rw-r--r-- 1 student1 students 53 Jan 31 16:20 beautiful-test-1769858459.txt
# -rw-r--r-- 1 root     trainers 68 Feb  3 19:28 final-rds-sns-demo.txt
# -rw-r--r-- 1 student1 students 20 Jan 31 16:15 lambda-tutorial.txt
# -rw-r--r-- 1 student1 students 348 Jan 31 12:05 linux-commands.pdf
# -rw-r--r-- 1 root     students 39 Feb  1 00:14 manual-sync-test.txt
# -rw-r--r-- 1 student1 students 413 Jan 31 12:05 networking-notes.txt
# -rw-r--r-- 1 student1 students 52 Jan 31 16:55 planetext-test-1769858730.txt
# -rw-r--r-- 1 student1 students 276 Jan 31 12:05 python-intro.txt
# -rw-r--r-- 1 student1 students 20 Jan 31 22:09 rds-test-1769877575.txt
# -rw-r--r-- 1 student1 students 20 Jan 31 11:35 student_assignment1.pdf
# -rw-r--r-- 1 student1 students 109 Jan 30 11:35 student_studyguide.txt
# -rw-r--r-- 1 student1 students 58 Jan 31 16:38 test-ec2-1769857683.txt
# -rw-r--r-- 1 root     students 53 Feb  2 11:11 test-from-client.txt
[root@ip-10-0-2-223 ~]#
```

## Cron job to sync to s3

```
[root@ip-10-0-2-223 ~]# ls -ls /mnt/educloud-data/materials/students/
total 56
# -rw-r--r-- 1 student1 students 285 Jan 31 12:05 aws-basics-guide.txt
# -rw-r--r-- 1 student1 students 53 Jan 31 16:20 beautiful-test-1769858459.txt
# -rw-r--r-- 1 root     trainers 68 Feb  3 19:28 final-rds-sns-demo.txt
# -rw-r--r-- 1 student1 students 20 Jan 31 16:15 lambda-tutorial.txt
# -rw-r--r-- 1 student1 students 348 Jan 31 12:05 linux-commands.pdf
# -rw-r--r-- 1 root     students 39 Feb  1 00:14 manual-sync-test.txt
# -rw-r--r-- 1 student1 students 413 Jan 31 12:05 networking-notes.txt
# -rw-r--r-- 1 student1 students 52 Jan 31 16:55 planetext-test-1769858730.txt
# -rw-r--r-- 1 student1 students 276 Jan 31 12:05 python-intro.txt
# -rw-r--r-- 1 student1 students 20 Jan 31 22:09 rds-test-1769877575.txt
# -rw-r--r-- 1 student1 students 20 Jan 31 11:35 student_assignment1.pdf
# -rw-r--r-- 1 student1 students 109 Jan 30 11:35 student_studyguide.txt
# -rw-r--r-- 1 student1 students 58 Jan 31 16:38 test-ec2-1769857683.txt
# -rw-r--r-- 1 root     students 53 Feb  2 11:11 test-from-client.txt
[root@ip-10-0-2-223 ~]# [root@ip-10-0-2-223 ~]# ls -ls /opt/educloud/scripts/
total 24
# -rwxr-xr-x 1 ec2-user ec2-user 2930 Jan 28 15:13 archive-assignments.sh
# -rwxr-xr-x 1 root     root   2007 Jan 28 20:07 backup-materials.sh
# -rwxr-xr-x 1 ec2-user ec2-user 2158 Jan 28 15:09 backup-materials.sh
# -rwxr-xr-x 1 root     root   600 Feb  3 10:58 sync-assignments-to-s3.sh
# -rwxr-xr-x 1 root     root   1209 Feb  1 00:14 sync-materials-to-s3.sh
# -rwxr-xr-x 1 ec2-user ec2-user 2519 Jan 28 15:12 upload-logs.sh
[root@ip-10-0-2-223 ~]# ls -ls /opt/educloud/scripts/sync-materials-to-s3.sh
# -rwxr-xr-x 1 root     root 1209 Feb  1 00:14 /opt/educloud/scripts/sync-materials-to-s3.sh
[root@ip-10-0-2-223 ~]# sudo /opt/educloud/scripts/sync-materials-to-s3.sh
[2026-02-03 19:32:03] =====
[2026-02-03 19:32:03] Starting material sync to S3
[2026-02-03 19:32:03] Source: /mnt/educloud-data/materials
[2026-02-03 19:32:03] Destination: s3://educloud-materials-mdnihal0ife27/materials
[2026-02-03 19:32:03] =====
[2026-02-03 19:32:03] Total files to sync: 27
upload: ../../mnt/educloud-data/materials/students/final-rds-sns-demo.txt to s3://educloud-materials-mdnihal0ife27/materials/students/final-rds-sns-demo.txt
upload: ../../mnt/educloud-data/materials/students/linux-commands.pdf to s3://educloud-materials-mdnihal0ife27/materials/students/linux-commands.pdf
upload: ../../mnt/educloud-data/materials/students/student_assignment1.pdf to s3://educloud-materials-mdnihal0ife27/materials/students/student_assignment1.pdf
[2026-02-03 19:32:03] @ SUCCESS: Materials synced to S3
[2026-02-03 19:32:04] Files in S3: 31
[2026-02-03 19:32:04] Sync process completed
[2026-02-03 19:32:04]
[root@ip-10-0-2-223 ~]#
```

The screenshot shows the AWS S3 console interface. At the top, the URL is `us-east-1.console.aws.amazon.com/s3/buckets/educloud-materials-mdnihil01fe27?region=us-east-1&prefix=materials/students/&showversions=false`. Below the header, the navigation path is `Amazon S3 > Buckets > educloud-materials-mdnihil01fe27 > materials > students/`. A "Copy S3 URI" button is visible on the right. The main area is titled "Objects (14)" and contains a table of 14 files. The columns include Name, Type, Last modified, Size, and Storage class. The files are:

Name	Type	Last modified	Size	Storage class
aws-basics-guide.txt	txt	January 31, 2026, 12:06:28 (UTC+05:30)	285.0 B	Standard
beautiful-test-1769858459.txt	txt	January 31, 2026, 16:51:14 (UTC+05:30)	52.0 B	Standard
mail-rds-sns-demo.txt	txt	February 3, 2026, 19:32:04 (UTC+05:30)	68.0 B	Standard
lambda-tutorial.txt	txt	January 31, 2026, 16:15:11 (UTC+05:30)	20.0 B	Standard
linux-commands.pdf	pdf	February 3, 2026, 19:32:04 (UTC+05:30)	348.0 B	Standard
manual-sync-test.txt	txt	February 1, 2026, 00:15:01 (UTC+05:30)	39.0 B	Standard
networking-notes.txt	txt	January 31, 2026, 12:06:28 (UTC+05:30)	413.0 B	Standard
planetext-test-1769858730.txt	txt	January 31, 2026, 16:55:36 (UTC+05:30)	52.0 B	Standard
python-intro.txt	txt	January 31, 2026, 12:06:28 (UTC+05:30)	276.0 B	Standard
rds-test-1769877575.txt	txt	January 31, 2026, 22:09:37 (UTC+05:30)	20.0 B	Standard
student_assignment1.pdf	pdf	February 3, 2026, 19:32:04 (UTC+05:30)	236.0 B	Standard
student_studyguide.txt	txt	January 30, 2026, 11:41:49 (UTC+05:30)	109.0 B	Standard
test-ec2-1769857683.txt	txt	January 31, 2026, 16:38:25 (UTC+05:30)	58.0 B	Standard
test-from-client.txt	txt	February 2, 2026, 11:47:43 (UTC+05:30)	53.0 B	Standard

At the bottom, there are links for "cloudShell", "Feedback", and "Console Mobile App".

## Students receives email

The screenshot shows a Gmail inbox. The left sidebar shows "Compose", "Inbox (8,295)", "Starred", "Snoozed", "Sent", "Drafts", "Purchases", "Travel", and "More". The "Labels" section has a "+" sign. The main area shows an incoming email from "EduCloud Materials <no-reply@sns.amazonaws.com> to me". The subject is "New Learning Material: final-rds-sns-demo.txt". The email was sent at "7:32PM (1 minute ago)". The message body starts with "Hello Student! 🌟". It says "Your trainer has uploaded new learning material for you." Below that is a "FILE DETAILS" section with the following information:

- Name: final-rds-sns-demo.txt
- Size: 68 B
- Uploaded: February 03, 2026 at 02:02 PM UTC
- Bucket: educloud-materials-mdnihil01fe27

At the bottom, there are "Reply", "Forward", and a reply icon.

## Rds entry in uploads table by trainer

```

root@ip-10-0-2-223:/home/ec2-user
| student_uploads_view |
| students               |
| trainers                |
| uploads                 |
+-----+
4 rows in set (0.002 sec)

MySQL [edulcloud_db]> SELECCCT * FROM trainers;
ERROR 1064 (42000): You have an error in your SQL syntax; check the manual that corresponds to your MySQL server version for the right syntax to use near 'SELECCCT * FROM trai
niners' at line 1
MySQL [edulcloud_db]> SELECT * FROM trainers;
+----+-----+-----+-----+
| id | name | email | subject | created_at |
+----+-----+-----+-----+
| 1  | Dr. Anand Kumar | trainer1@edulcloud.com | Linux System Administration | 2026-01-27 07:15:45 |
| 2  | Prof. Meera Joshi | trainer2@edulcloud.com | AWS Cloud Solutions | 2026-01-27 07:15:45 |
| 3  | Mr. Karthik Rao | trainer3@edulcloud.com | DevOps & Automation | 2026-01-27 07:15:45 |
+----+-----+-----+-----+
3 rows in set (0.005 sec)

MySQL [edulcloud_db]> SELECT * FROM student_uploads_view;
Empty set (0.002 sec)

MySQL [edulcloud_db]> SELECT 8 FROM UPLOADS ORDER BY id DESC LIMIT 5;
ERROR 1146 (42000): Table 'edulcloud_db.UPLOADS' doesn't exist
MySQL [edulcloud_db]> SELECT * FROM UPLOADS ORDER BY id DESC LIMIT 5;
ERROR 1146 (42000): Table 'edulcloud_db.UPLOADS' doesn't exist
MySQL [edulcloud_db]> SELECT * FROM uploads ORDER BY id DESC LIMIT 5;
+----+-----+-----+-----+
| id | filename | s3_path | uploader | upload_timestamp | file_size |
+----+-----+-----+-----+
| 16 | final-rds-sns-demo.txt | materials/students/final-rds-sns-demo.txt | trainer1 | 2026-02-03 14:02:06 | 68 B |
| 15 | linux-commands.pdf | materials/students/linux-commands.pdf | trainer1 | 2026-02-03 14:02:06 | 348 B |
| 14 | student_assignment1.pdf | materials/students/student_assignment1.pdf | trainer1 | 2026-02-03 14:02:06 | 236 B |
| 13 | my-final-assignment.tar.gz | s3://edulcloud-materials-mdnihal0ife27/assignments/student1/my-final-assignment.tar.gz | student1 | 2026-02-03 13:50:50 | 200.00 B |
| 12 | teststudent-assignment.tar.gz | s3://edulcloud-materials-mdnihal0ife27/assignments/student2/testOthers-assignment.tar.gz | student2 | 2026-02-03 11:12:31 | 2.00 KB |
| 11 | assignment | assignment | student1 | 2026-02-03 11:12:31 | 0 B |
+----+-----+-----+-----+
5 rows in set (0.001 sec)

MySQL [edulcloud_db]> 

```

## Live website

The screenshot shows a web browser window for the URL [edulcloud-alb-1947718251.us-east-1.elb.amazonaws.com](https://edulcloud-alb-1947718251.us-east-1.elb.amazonaws.com). The page features a header with the Edu Cloud logo and navigation links for Architecture, Student Portal, and Trainer Portal. Below the header, there's a large banner with the text "Secure Trainer-Student File Portal". The main content area is titled "File Portal" and describes it as "Secure trainer-student exchange". It includes icons for Trainer, Student, Upload, Download, Encrypted, and Real-time features. At the bottom, there are performance metrics: 99.9% Uptime SLA, 10+ AWS Services, 5→10GB Auto-Scale, 2,547 Cloud objects, 100% Concurrency, and 24/7 Availability. The status bar at the bottom shows the date (03-02-2026), time (19:42), and system information.

## Student portal

The screenshot shows the EduCloud Student Portal homepage. At the top, there's a navigation bar with links for Home, Materials, Submit Work, Resources, and Trainer Portal. Below the navigation is a large section titled "Your Personal Learning Hub" with the subtitle "Powered by AWS Cloud". It highlights "24/7 Access", "100% Secure", and "Fast Downloads". There are buttons for "Browse Materials" and "Submit Work". A "My Learning Portal" box on the right shows a "Student" icon, a "Materials" section with 12 new files, an "Assignments" section with 3 pending, and a "Course Progress" bar at 78%. The bottom of the screen shows a Windows taskbar with various icons and system status.

This screenshot shows the EduCloud Student Portal after navigating to the "Materials" section. The page displays a message: "Access notes, slides, and learning resources uploaded by your trainer". A circular loading icon and the text "Loading Your Materials..." are visible. At the bottom, there's a "Assignment Submission" button.

This screenshot shows the EduCloud Student Portal displaying a list of available files. The files listed are:

- aws-basics-guide.txt (TXT Document • Ready to download)
- beautiful-test-1769858459.txt (TXT Document • Ready to download)
- final-rds-sns-demo.txt (TXT Document • Ready to download)
- lambda-tutorial.txt (TXT • 285 B • Available)
- linux-commands.pdf (PDF • Available)
- manual-sync-test.txt (TXT • 68 B • Available)

Each file entry includes a "Download File" button. A tooltip for the "final-rds-sns-demo.txt" file indicates that anyone using the device can see downloaded files.

