❖ **Title:** Enable Cross-Region Backup Replication for EC2 using AWS Backup

❖ **Objective:**

Configure an AWS Backup Plan to automatically back up an EC2 instance and replicate the backups to another AWS region. This ensures data durability and disaster recovery readiness across geographical locations.

❖ **Steps:**

We are creating an automated system where **EC2 backups happen regularly in one region and automatically get replicated to another AWS region**. This way, even if the entire primary region fails (disaster, outage, natural calamity), we can still restore our EC2 instance from the backup stored safely in another region.

1. **Select two regions**
   - 1 primary AWS region (**Europe - Frankfurt - eu-central-1**)
   - 1 replica AWS region (**Canada - Central - ca-central-1**)
   - Launch an EC2 Instance in primary region (here Frankfurt)
   - Go to the AWS Management Console → EC2 → Launch Instance.
   - Select OS Amazon Linux (or Ubuntu) → Here selected OS is Amazon linux.
   - Choose an instance type (t2.micro).
   - Configure security group: Allow HTTP (Port 80) and SSH (Port 22).
   - Launch the instance and Connect to the instance via SSH.

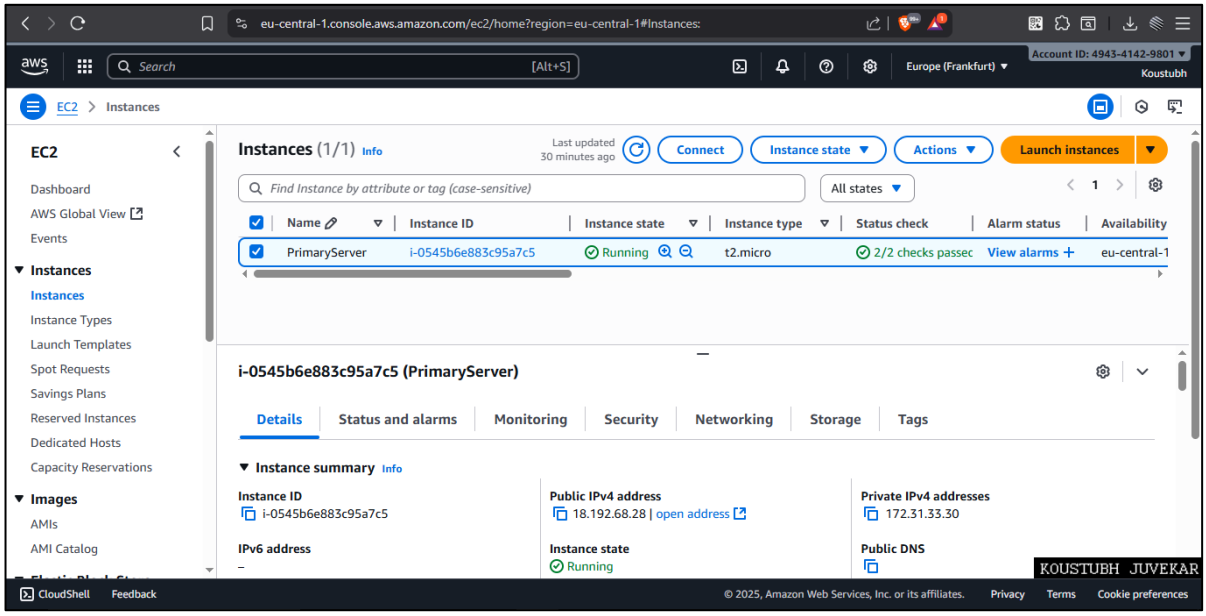

Image 1: *Launching an EC2 in primary region (**Frankfurt - eu-central-1**)*

2. **Install and Configure Nginx with Test Application**

```
sudo yum update -y
sudo yum install nginx -y
sudo systemctl start nginx
```

```
sudo systemctl enable nginx
sudo systemctl status nginx
```

Move into the web directory:

```
cd /usr/share/nginx/html/
```

Create a simple test page:

```
sudo nano test.html
```

Insert this code: (or you can add your html page for test)

```
<!DOCTYPE html>
<html lang="en">
<head>
  <meta charset="UTF-8">
  <title>Cross-Region Backup Test</title>
  <style>
    body {
      font-family: Arial, sans-serif;
      background: linear-gradient(to right, #00b09b, #96c93d);
      color: white;
      text-align: center;
      padding-top: 15%;
    }
    h1 {
      font-size: 3em;
      margin-bottom: 20px;
      text-shadow: 2px 2px 4px rgba(0,0,0,0.5);
    }
    p {
      font-size: 1.2em;
      background: rgba(0, 0, 0, 0.4);
      display: inline-block;
      padding: 10px 20px;
      border-radius: 10px;
    }
  </style>
</head>
<body>
  <h1> Cross-Region Backup Replication Demo</h1>
  <p>This is Testing Application.<br><br>This EC2 instance is running
on <strong>Nginx</strong>.<br><br>
     This is EC2 in Primary region <strong>Europe - Frankfurt - eu-
central-1.</strong><br>
     A replica is created in the Canada region.<strong>Canada -
Central - ca-central-1.</strong></p>
</body>
</html>
```

Save it (Ctrl + X) → (press y) → Enter.

```
sudo systemctl reload nginx
```

This is testing HTML page. Access it in Primary region http://18.192.68.28/test.html

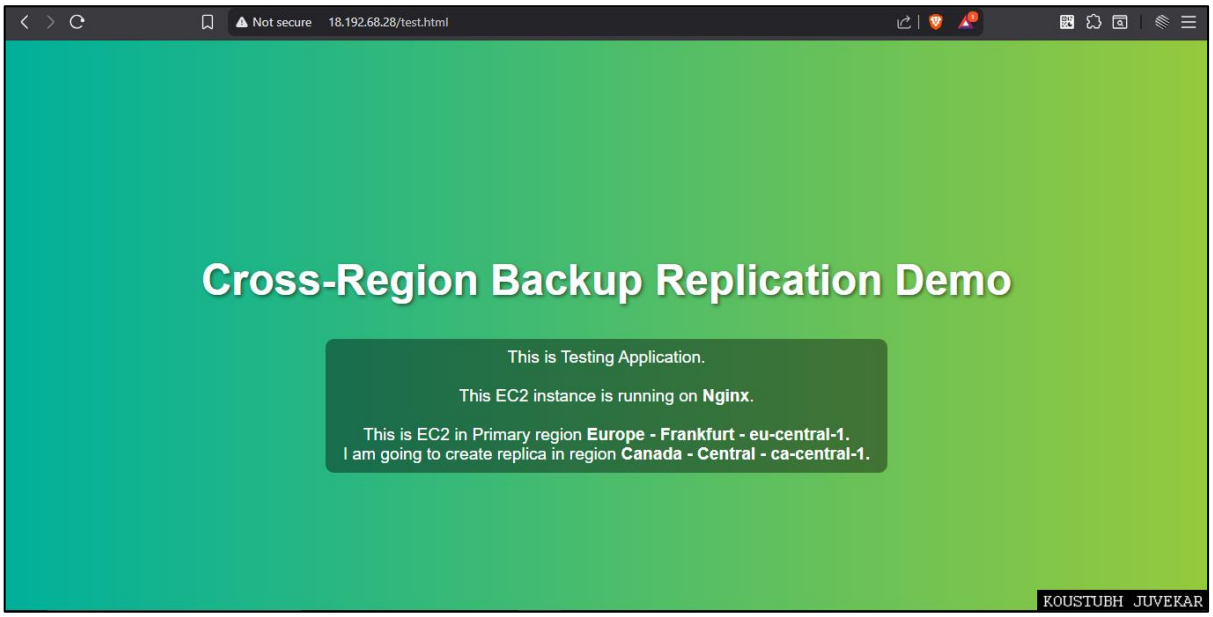

Image 2: *Testing Application output in browser – Primary Region -* `http://18.192.68.28/test.html`

3. Create Backup Vaults

- In console search, search for **AWS Backup.** Click on it.

Image 3: *Console search for AWS Backup*

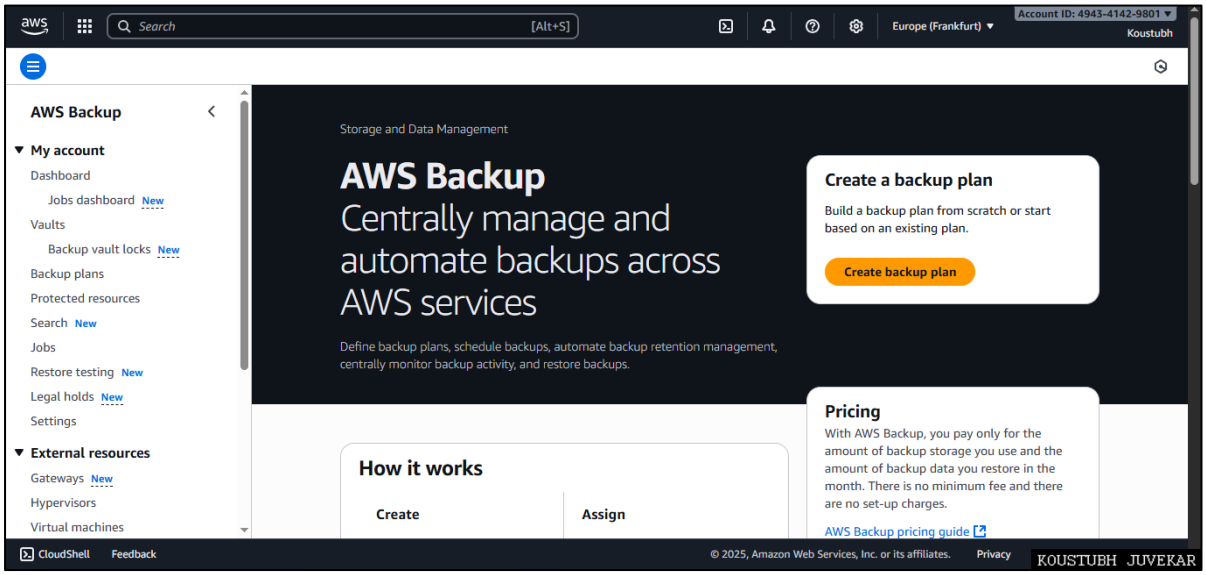

Image 3.1: *AWS backup console page*

Click on Vaults → **Create New Vault**

In the **Frankfurt region**, create a **Backup Vault.**

- **Vault Name** - PrimaryEC2Vault
- **Vault Type** - Backup Vault
- **Encryption key** - (default) aws/backup

Click on **Create vault**

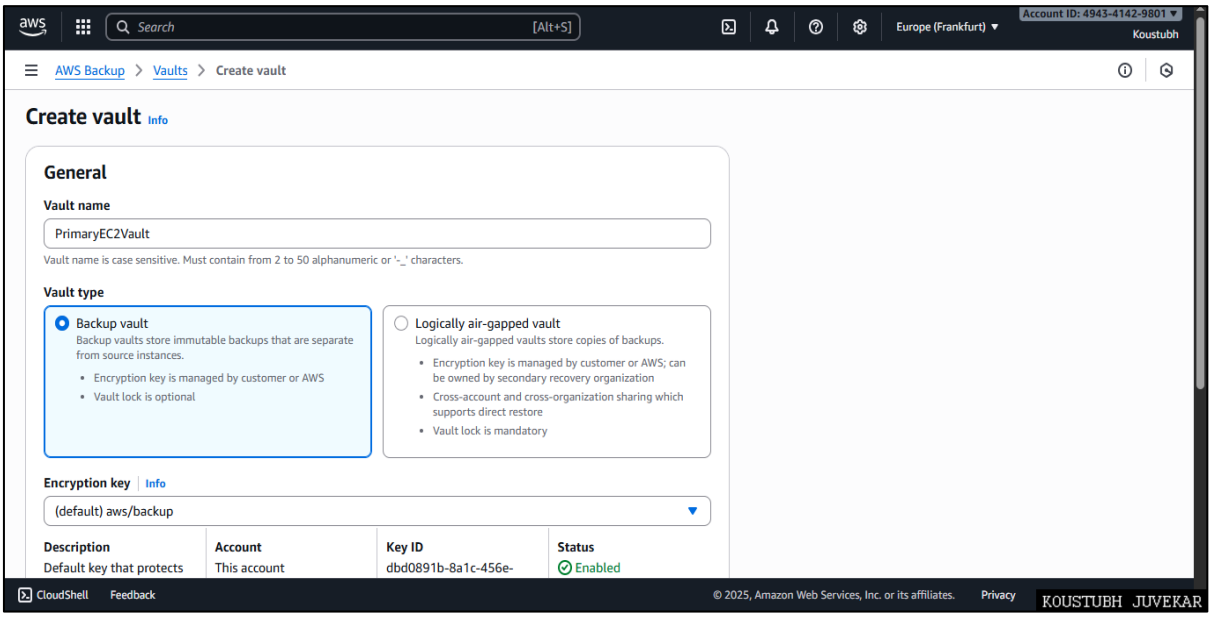

Image 3.2: *Creating vault*

- After creating vault, click on **Vaults.**
- List of created vaults displayed here. Click on newly created vault **PrimaryEC2Vault**.
- Details of **PrimaryEC2Vault** will be displayed. Backup Vault created!

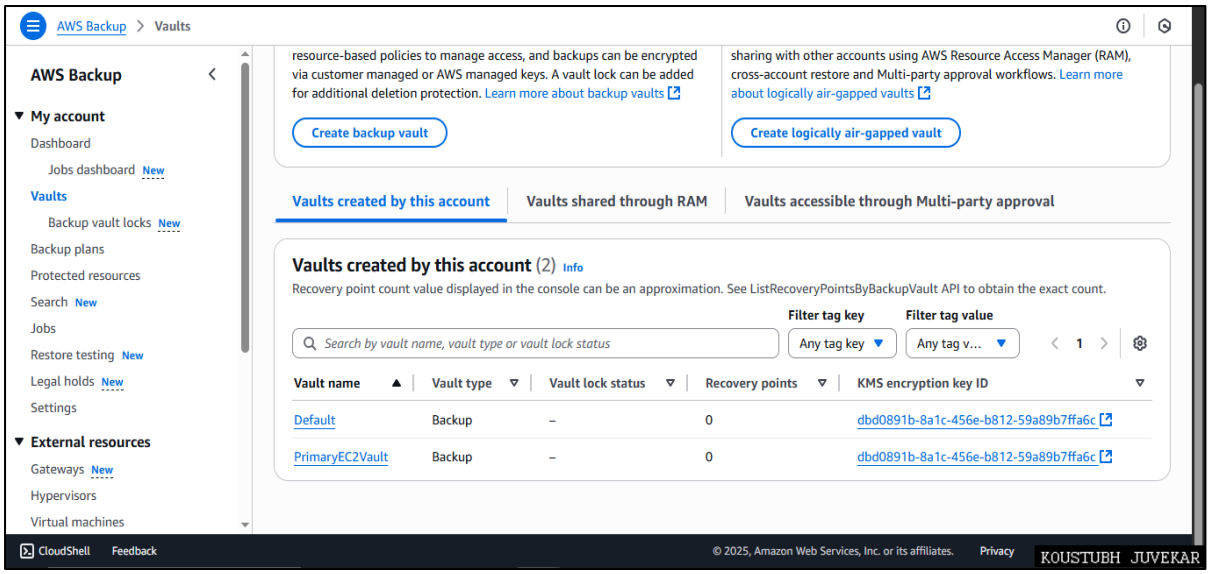

Image 3.3: *Vault created – Vault list – PrimaryEC2Vault*

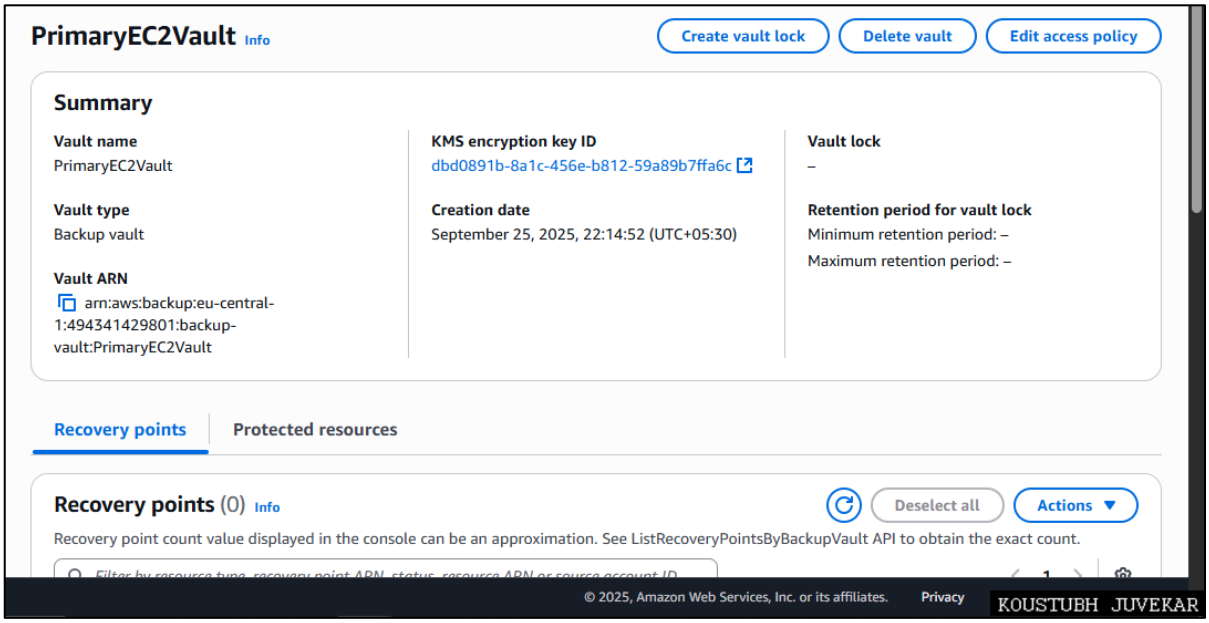

Image 3.4: *Clicked on PrimaryEC2Vault - Details of PrimaryEC2Vault*

4. Create Backup Plan

In Frankfurt region (Primary Region), go to **Backup Plans** → **Create Backup Plan**

- **Start options →**
  - **Backup plan options -** Start with a template
  - **Templates -** Daily-35day-Retention
  - **Backup plan name –** MyBackup

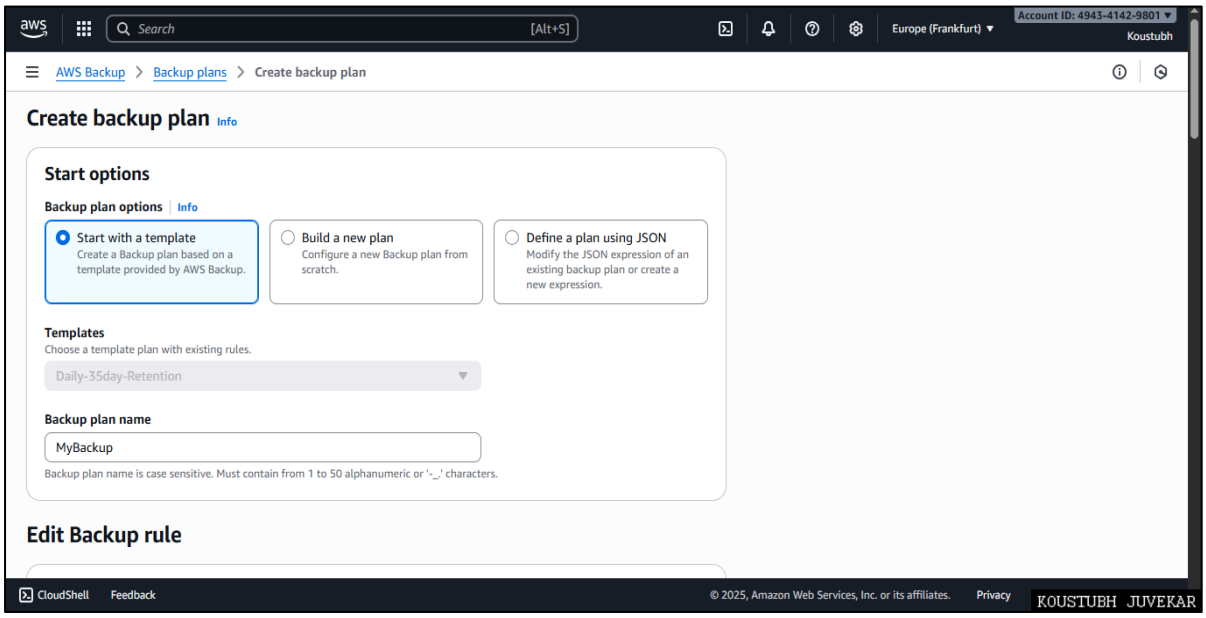

Image 4: *Backup plan creating (Start Options)*

- **Backup rules** → Edit Backup rule or Add backup rule → Backup rule configuration
  - **Schedule** →
    - **Backup rule name –** DailyBackups
    - **Backup vault –** Select **PrimaryEC2Vault**
    - **Backup frequency –** Daily

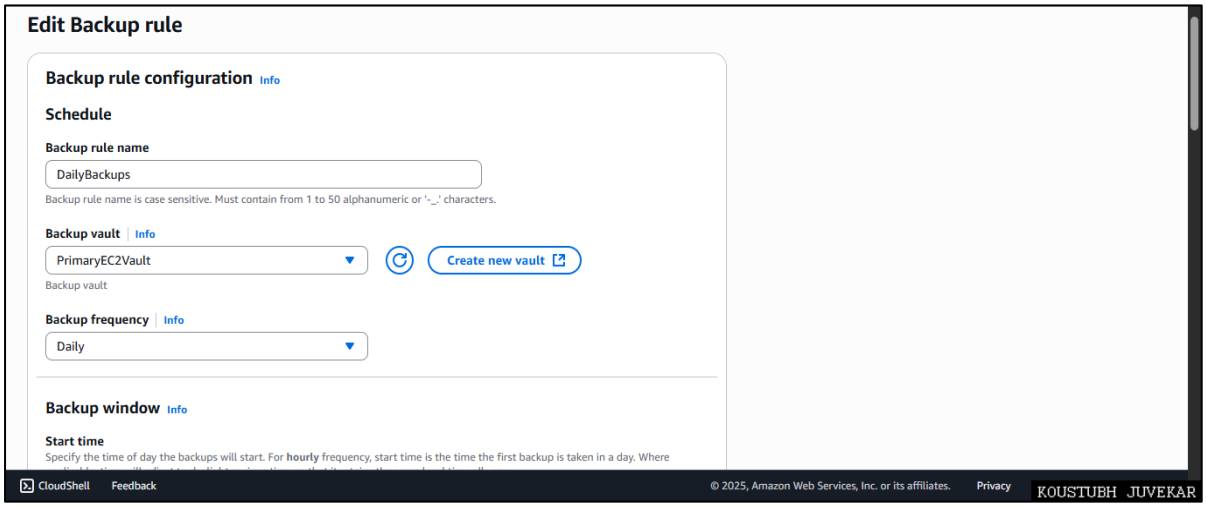

Image 4.1: *Backup plan creating – Edit Backup rule (Backup rule configuration -* ***Schedule****)*

(P.T.O.)

- **Backup window →**
  - **Start time –** Set time 05:00
  - **Start within –** 1 hour
  - **Complete Within –** 7 days

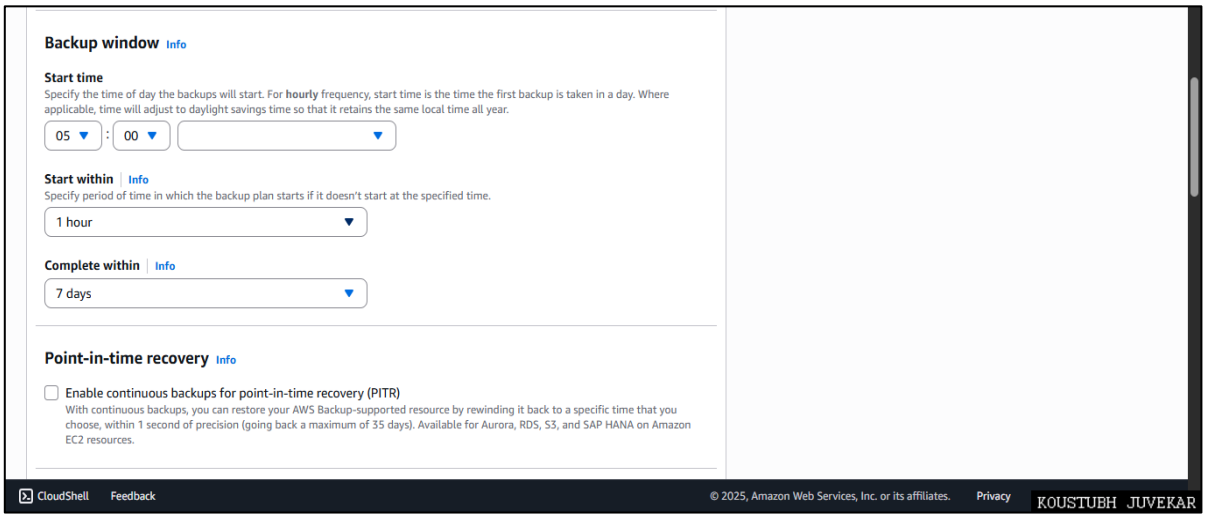

Image 4.2: *Backup plan creating – Edit Backup rule (Backup rule configuration –* ***Backup Window****)*

- **Lifecycle →**
  - **Cold storage –** Select Move backups from warm to cold storage

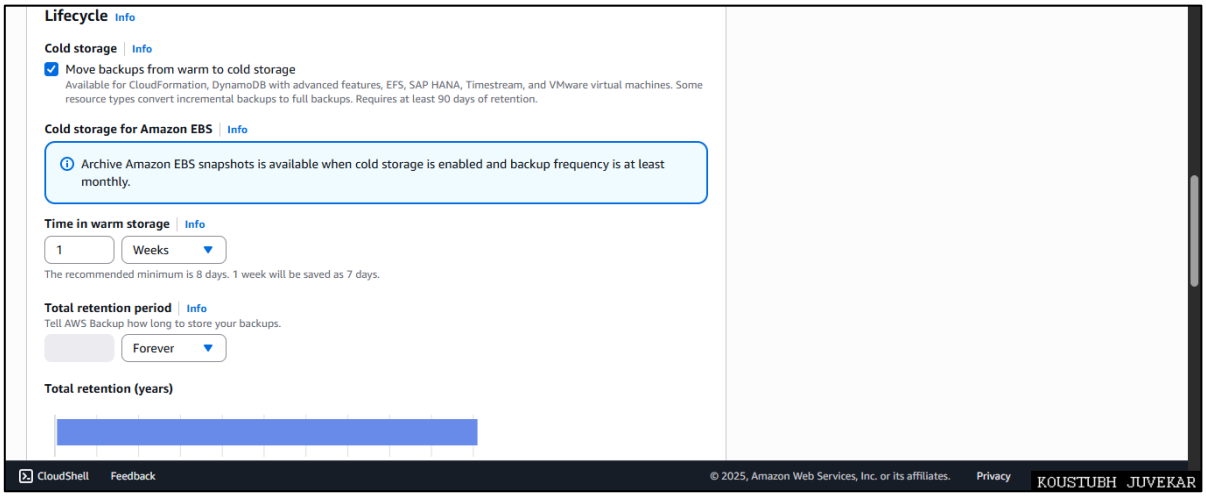

Image 4.3: *Backup plan creating – Edit Backup rule (Backup rule configuration –* ***Lifecycle****)*

- **Copy to destination –** ***optional*** *(You can create later, for this project creating here)*
  - **Region –** Select Secondary region (**Canada - Central - ca-central-1**)
  - **Destination vault** → Click on **Create new vault** → It will directly go to Canada region → Create vault there → **SecondaryEC2VaultCanada**

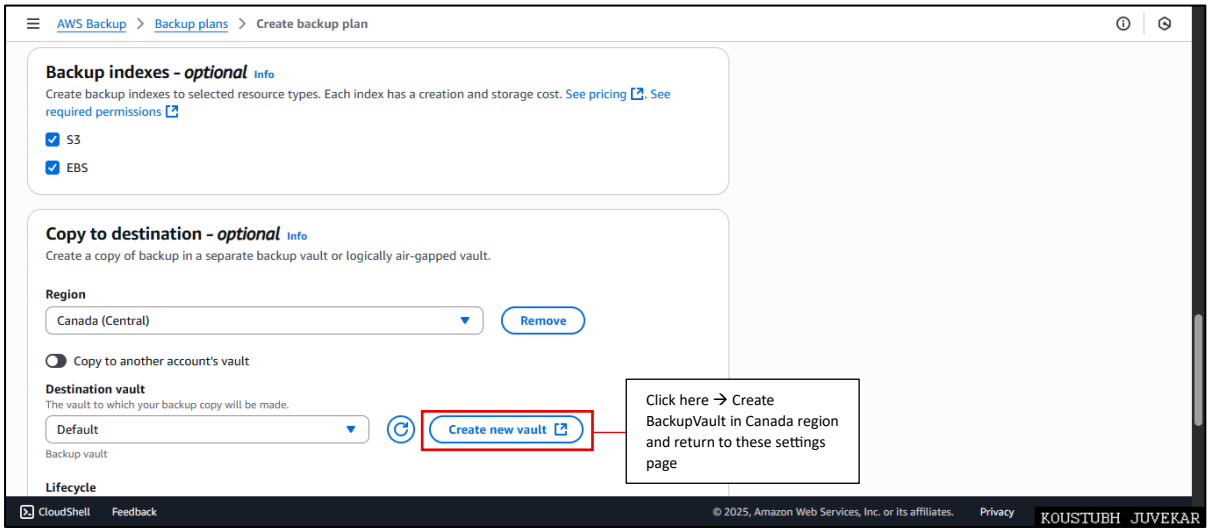

Image 4.4: *Backup plan creating – Edit Backup rule (Backup rule configuration –* ***Copy to Destination - optional****)*

Create a secondary vault in Canada - Central (ca-central-1), in the same way as described in step 3 for the primary region.

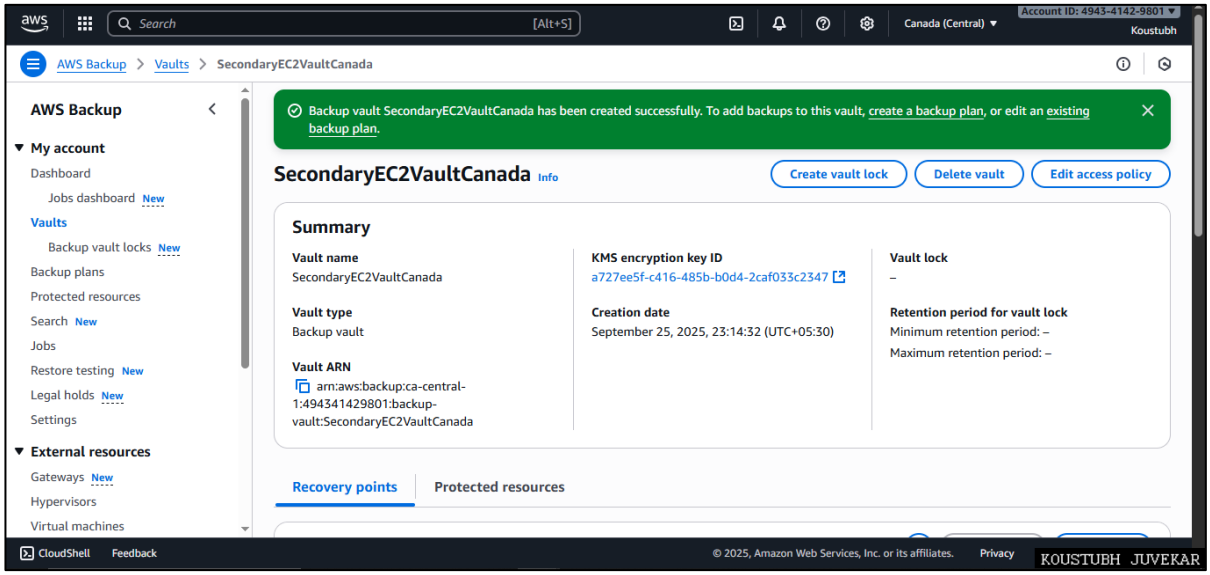

Image 4.5: *Created New vault in Secondary Region (Canada - Central - ca-central-1)*

- Return to previous window (Frankfurt region - **Edit Backup rule: DailyBackups** page)
- Again, click on refresh button in front of **Destination vault –** then select **SecondaryEC2VaultCanada** from list.

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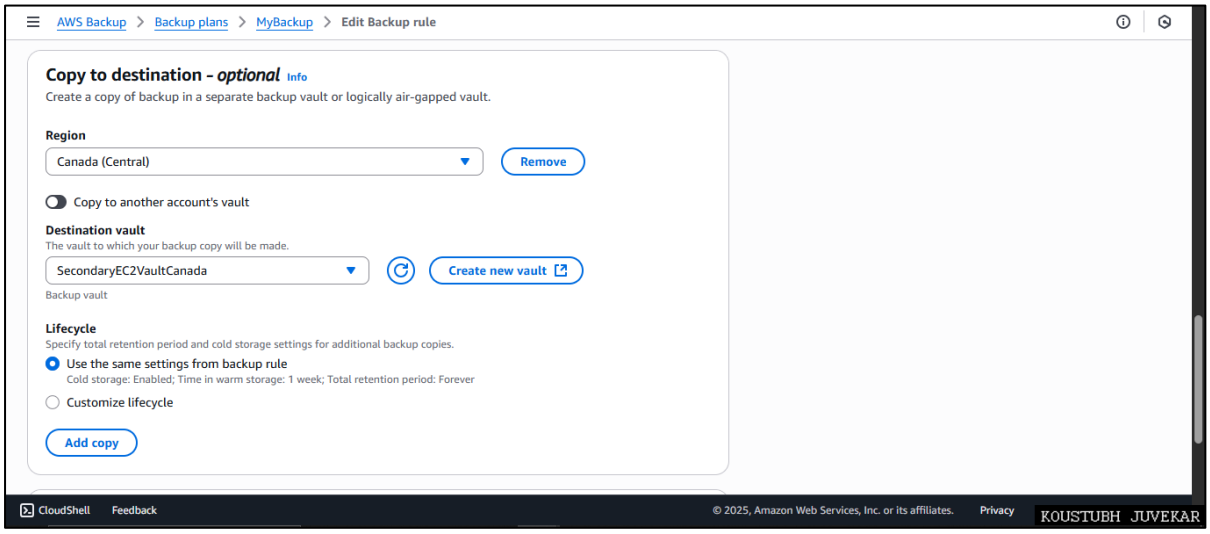

Image 4.6: *Backup plan creating – Edit Backup rule (Backup rule configuration –* ***Copy to Destination - optional****)*

Keep remaining setting as it is.

Click on **Save Backup rule**

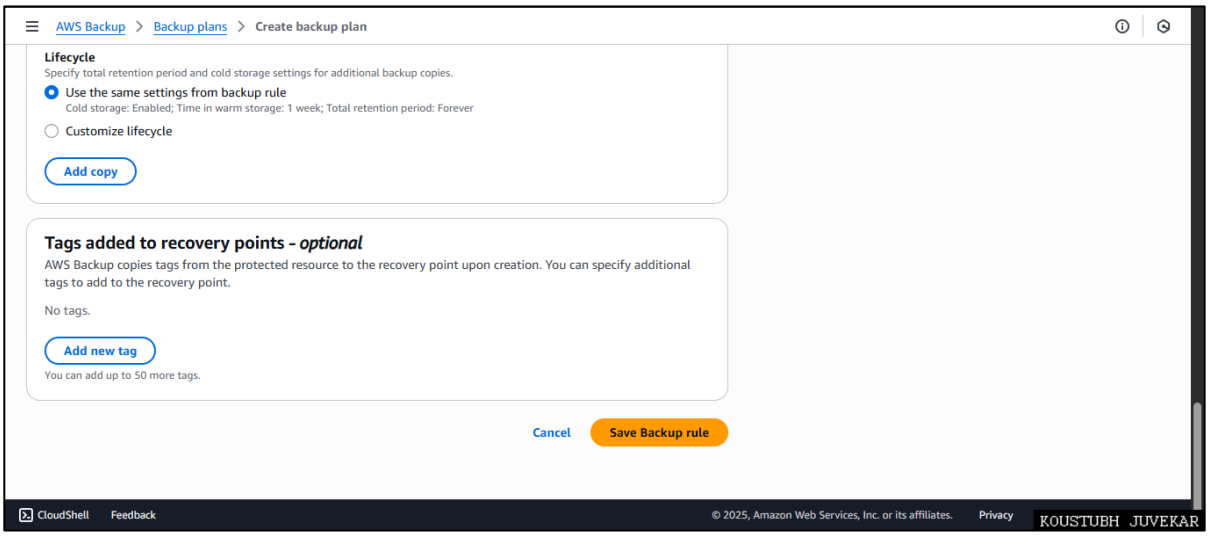

Image 4.7: *Save backup rule*

- **Advanced Backup settings**
  Select – Windows VSS, Back up ACLs, Back up object tags

  Click on **Create plan**

Backup plan is created!

(P.T.O.)

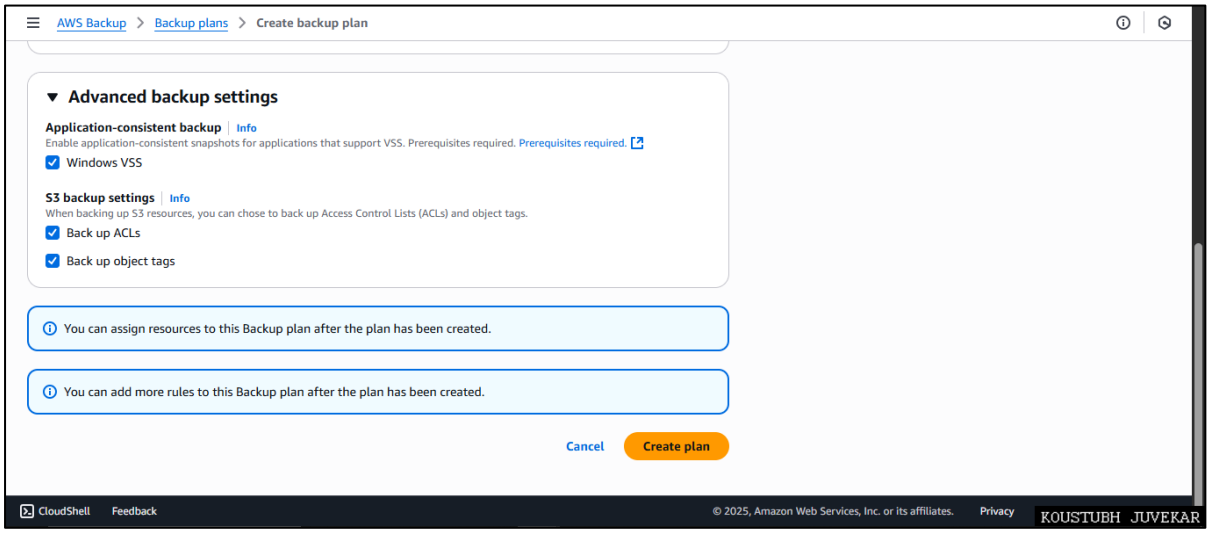

Image 4.8: *Backup plan created*

5. Assign Resources to the Plan

General →

- **Resource assignment name –** MyResource1
- **IAM Role** – Default role

**** Default role :*** *AWS Backup uses the IAM role* ***AWSBackupDefaultServiceRole.*** *If this role does not exist, AWS automatically creates it the first time you create a backup plan.*

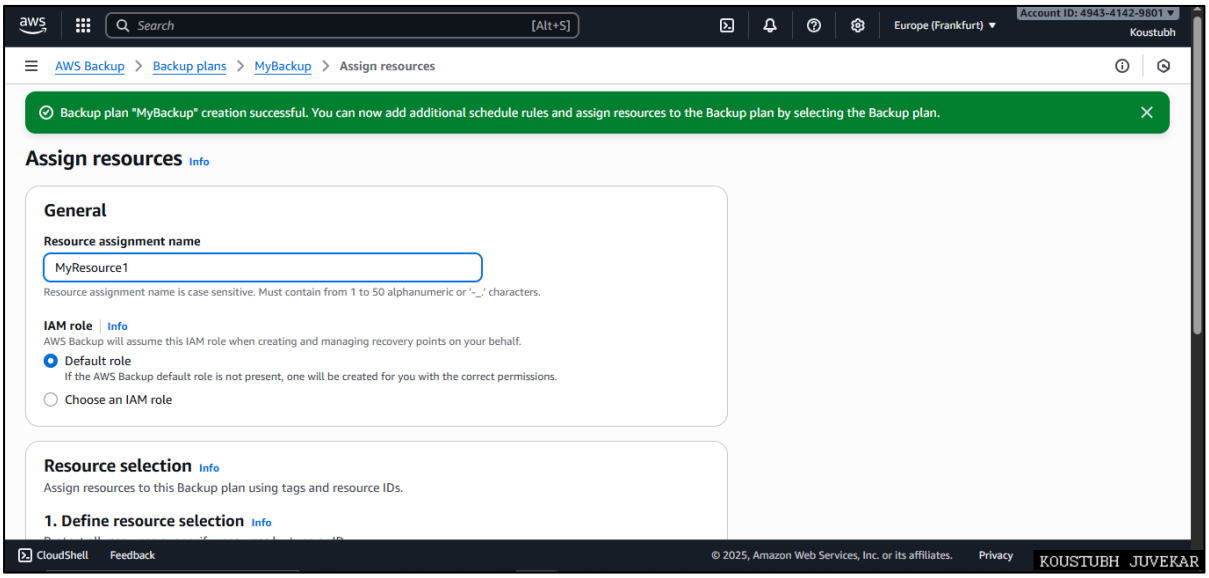

Image 5: *Assigning resources*

Resource selection →

1. Define resource selection

You can select **Include all resource types** OR **Include specific resource types.**
Here selected **Include specific resource types.**

2. Select specific resource types

- **Resource types -** EC2
- **Instance IDs –** Select instance ID of EC2 launched in Primary region, i-0545b6e883c95a7c5

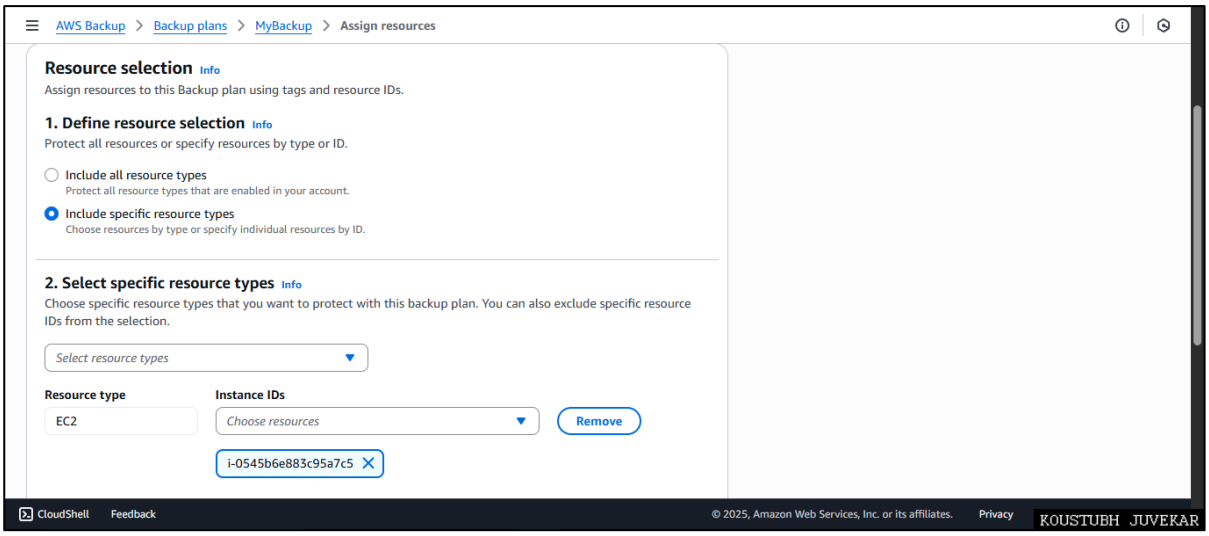

Image 5.1: *Assigning resources – Select specific resource types*

Click on **Assign Resources**

Resources assigned!

Go to **AWS Backup page → Backup plans → MyBackup → DailyBackups**

Here, backup details are displayed and under copy configuration **destination region and vault is displayed.**

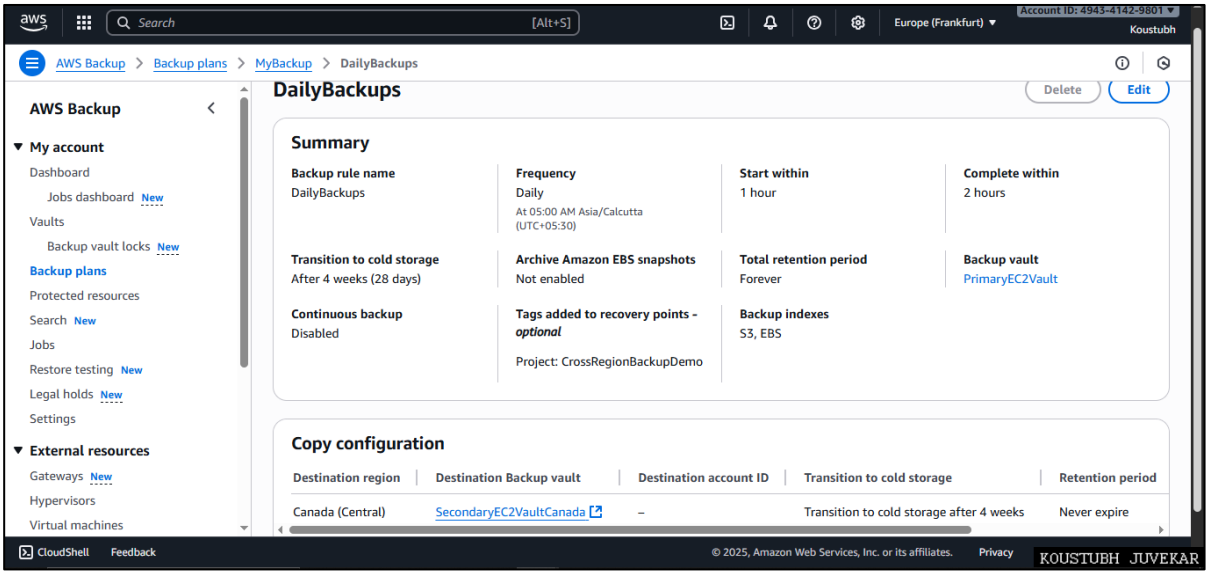

Image 5.2: *Details of backup plans – MyBackup - DailyBackups*

6. Run an On-Demand Backup

- In the **backup plan,** click **Create on-demand backup.**

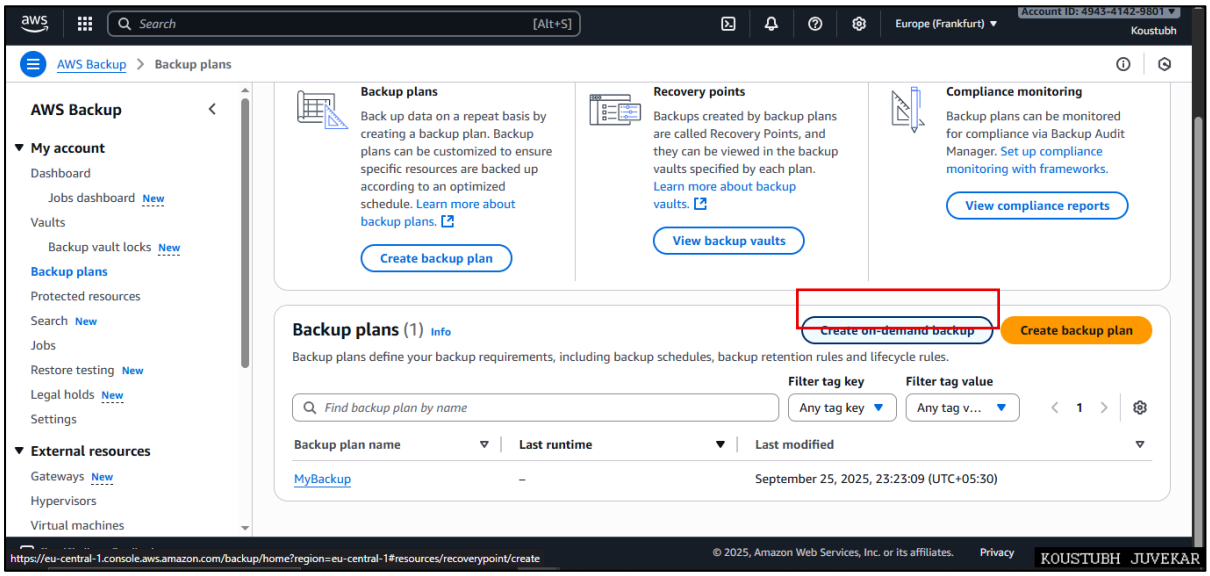

Image 6: *Creating on-demand backup (testing)*

Create on-demand backup

Settings →

- **Resource type** – EC2
- **Instance ID** - i-0545b6e883c95a7c5
- **Backup window** – Create backup now
- **Total retention period** – 35 days
- **Backup vault** – PrimaryEC2Vault
- **IAM role** – Default role

Click on **Create on-demand backup**

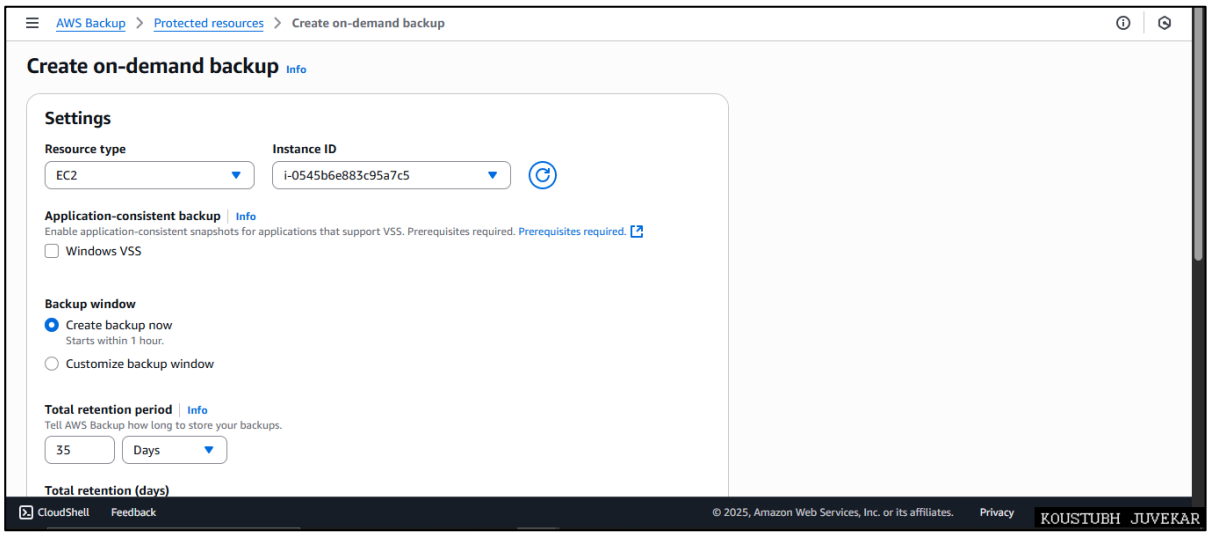

Image 6.1: *Creating on-demand backup – Select Settings*

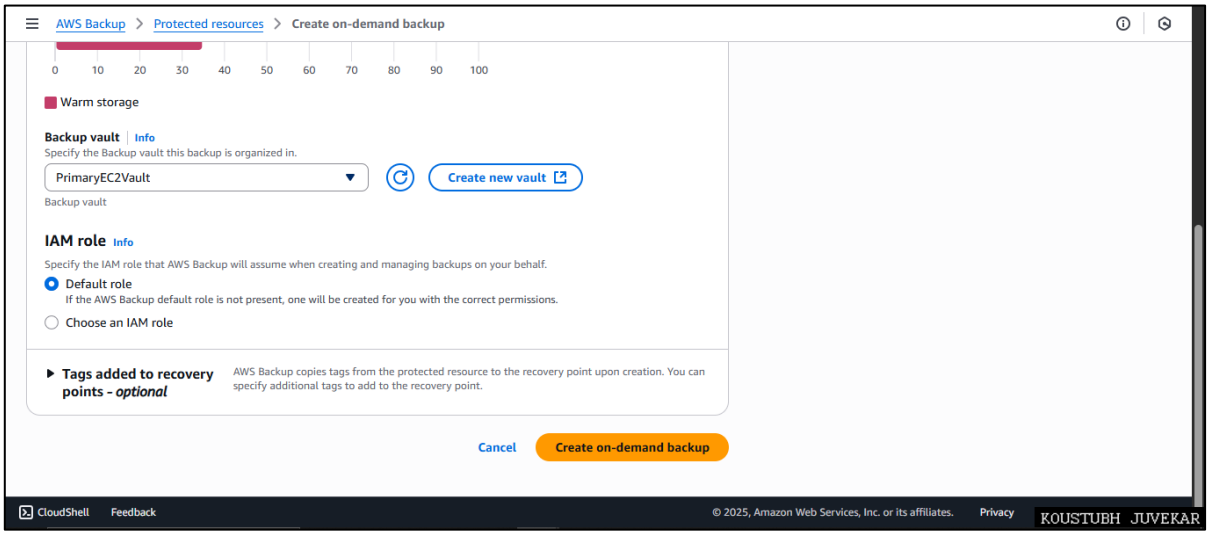

Image 6.2: *Creating on-demand backup – Select Settings*

Clicked on Create on-demand backup. Backup starts here. Notification will be displayed on the screen.

Go to **Jobs** – Backup job list will be displayed there with **Backup job ID, Status.**

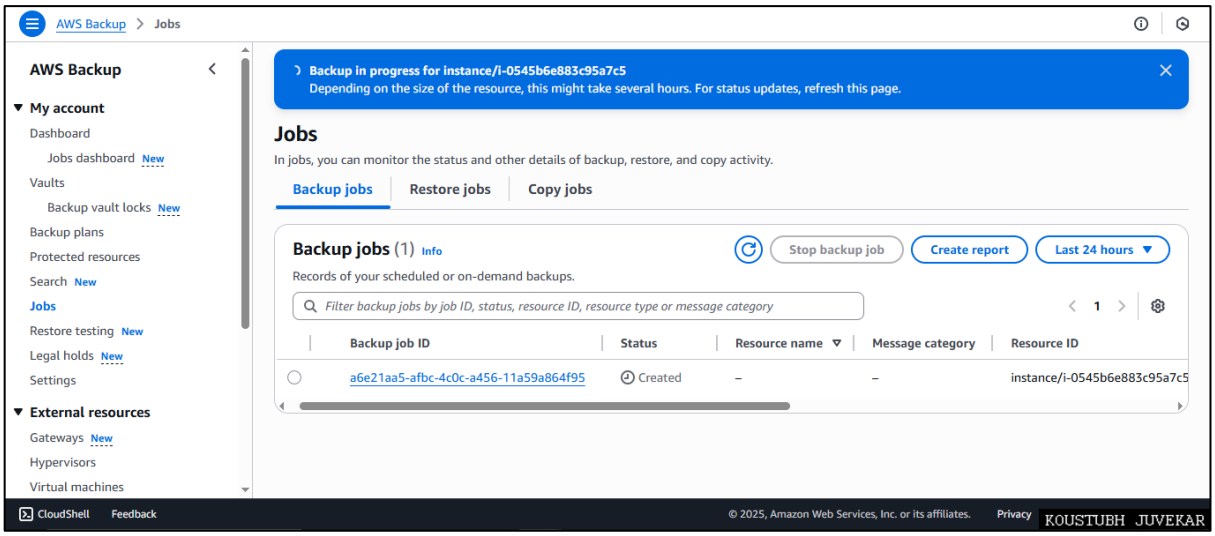

Image 6.3: *Backup started – **Backup jobs created***

It may take some time!

Refresh it! Once it complete, status will be updated as **completed.**

(P.T.O.)

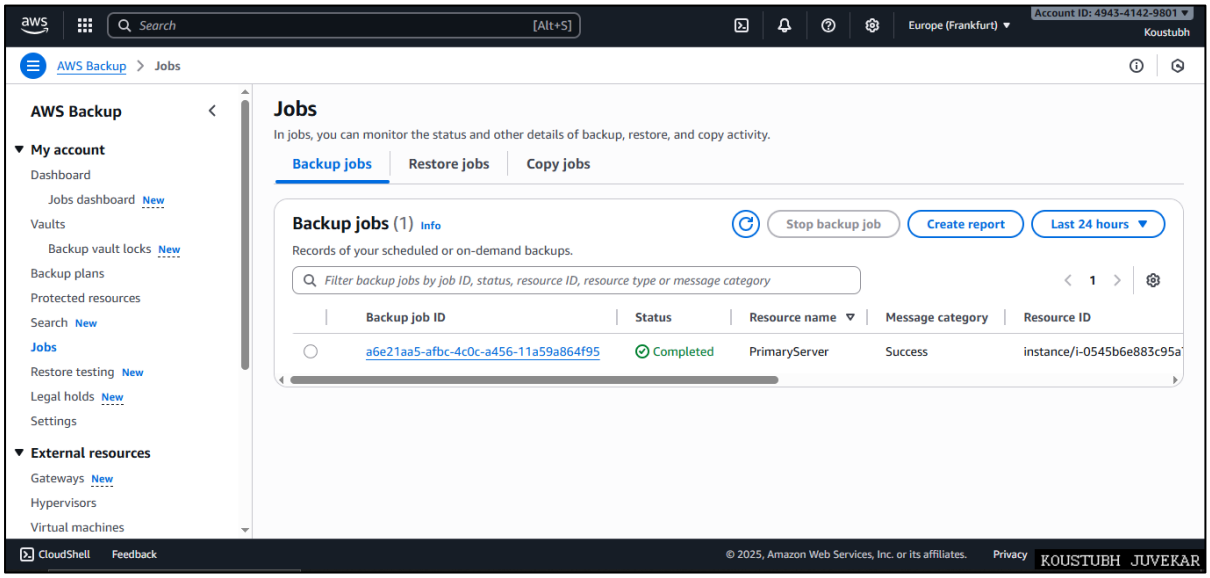

***Image 6.4**: Backup jobs created*

Click on **backup job id.** All the details will be displayed.

- Recovery Point ARN
- Status
- Resource name
- Creation date and time
- Etc.

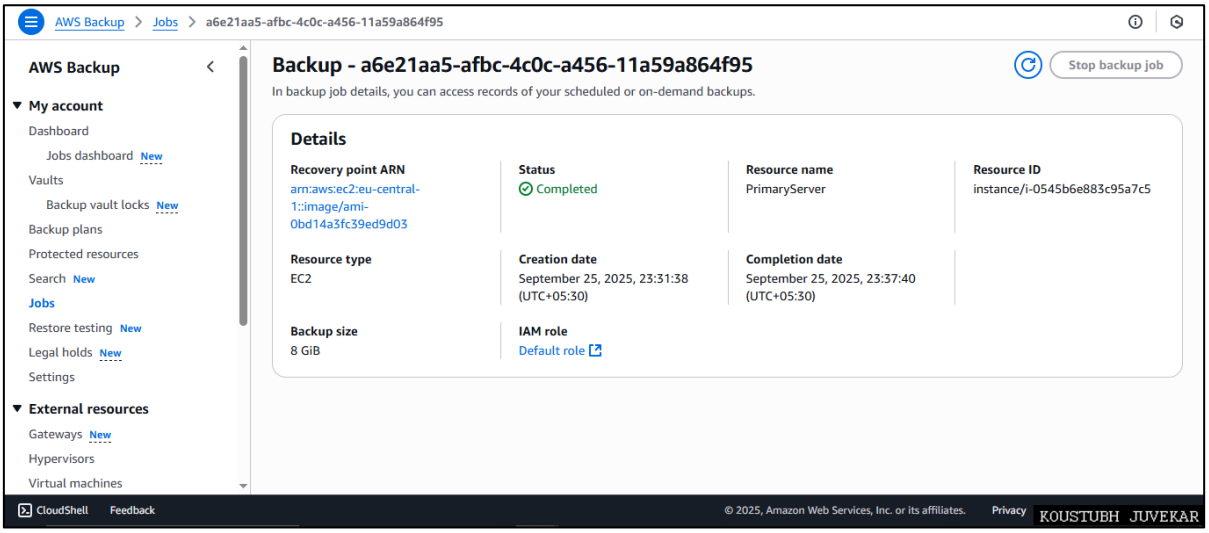

***Image 6.5**: Backup jobs details*

Again, go back to **jobs** option.

7. Verify Cross-Region Copy

Go to **Jobs → Copy Jobs** in Frankfurt.

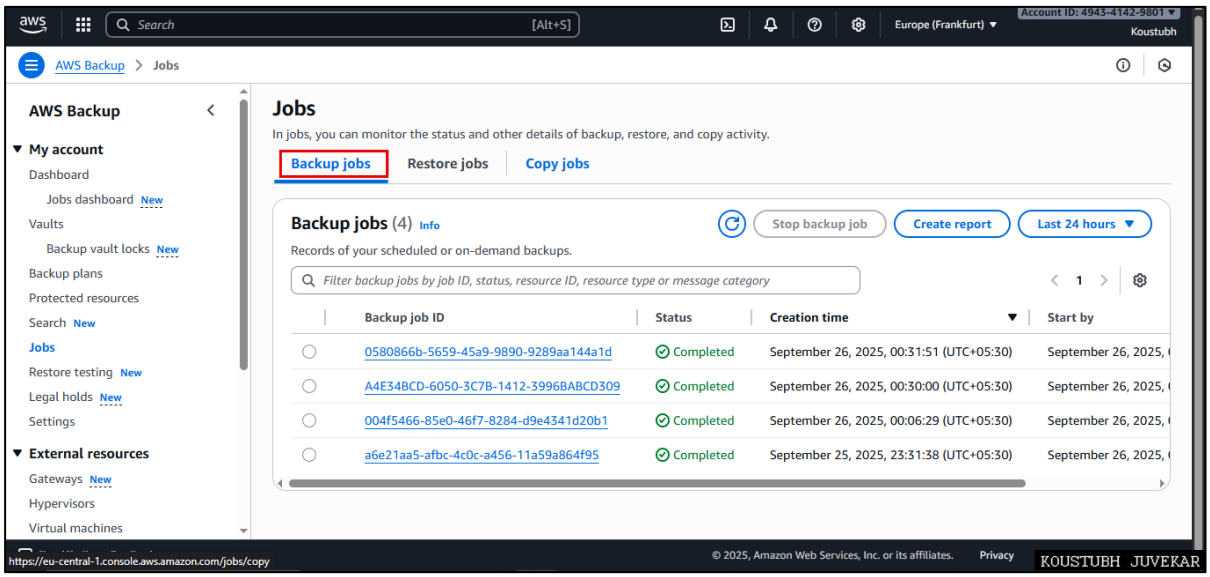

***Image 7**: Backup jobs*

Click on **Copy jobs**

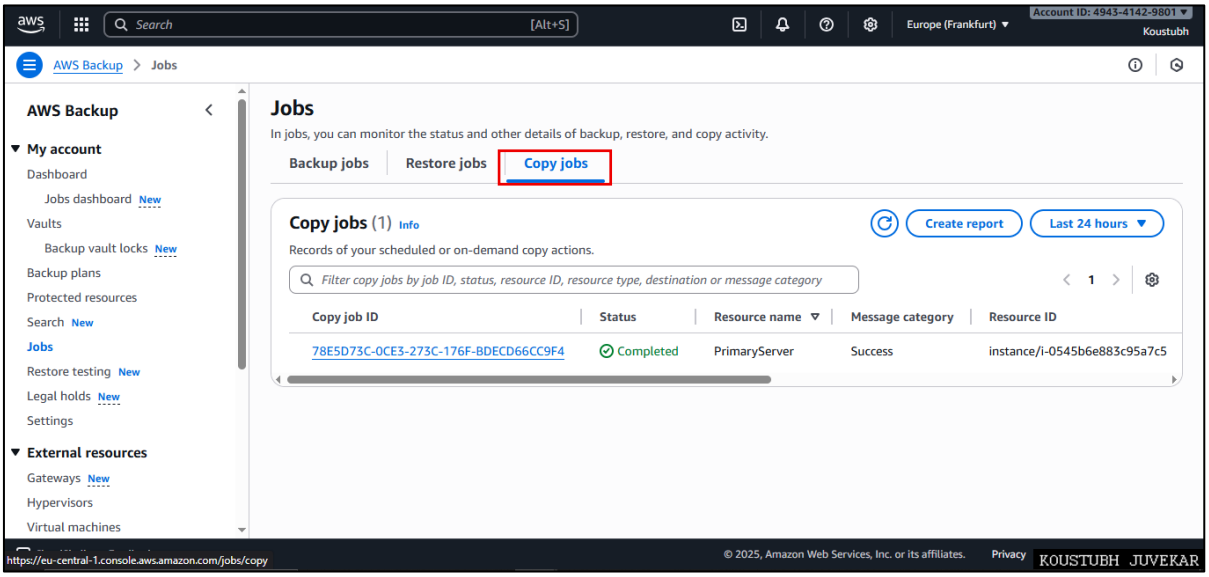

***Image 7.1**: Copy jobs*

Here **Copy job ID** and **status** is given – **completed.**
That means backup is created in **Secondary region (Canada central).**

(P.T.O.)

8. Test the Restore (Secondary region - Canada Region)

Go to **Canada region** → Open **Backup vault** → **SecondaryEC2VaultCanada.** Now **recovery point** is generated there, confirm recovery point exists.

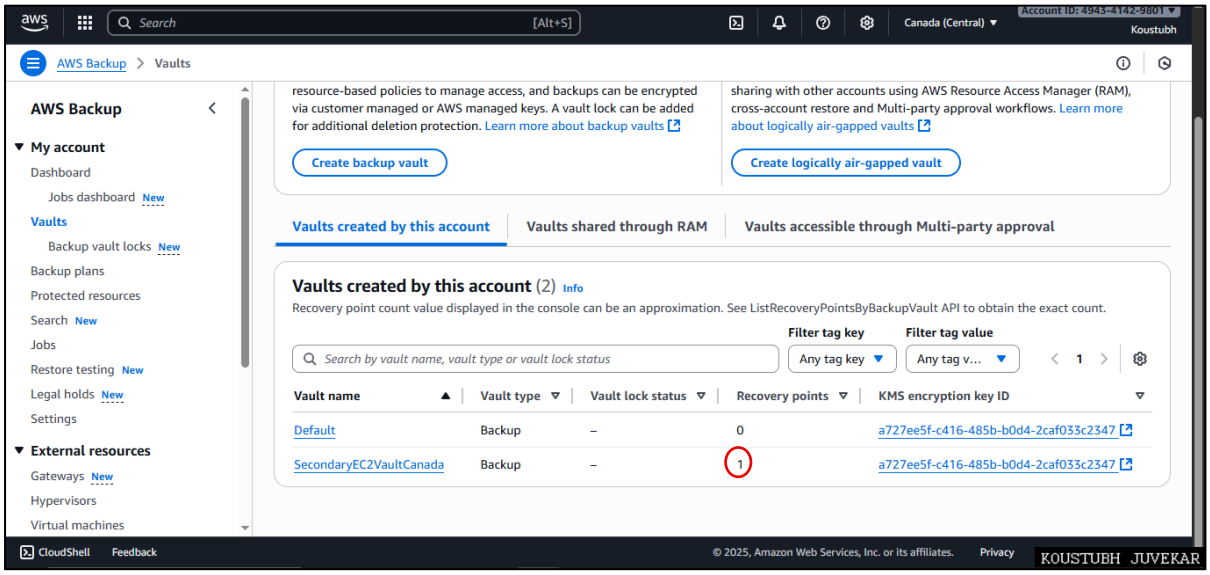

***Image 8**: Secondary region (Canada region) – Recovery Point created in SecondaryEC2VaultCanada*

Click On **SecondaryEC2VaultCanada.**
Recovery Points generated there**. That is an AMI created by AWS Backup.**

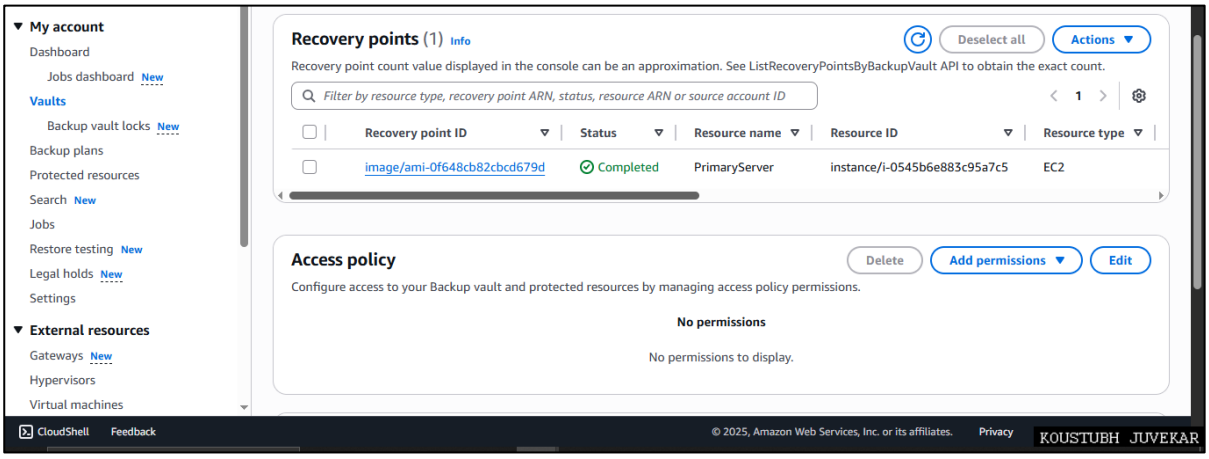

***Image 8.1**: Secondary region (Canada region) – Recovery Point list*

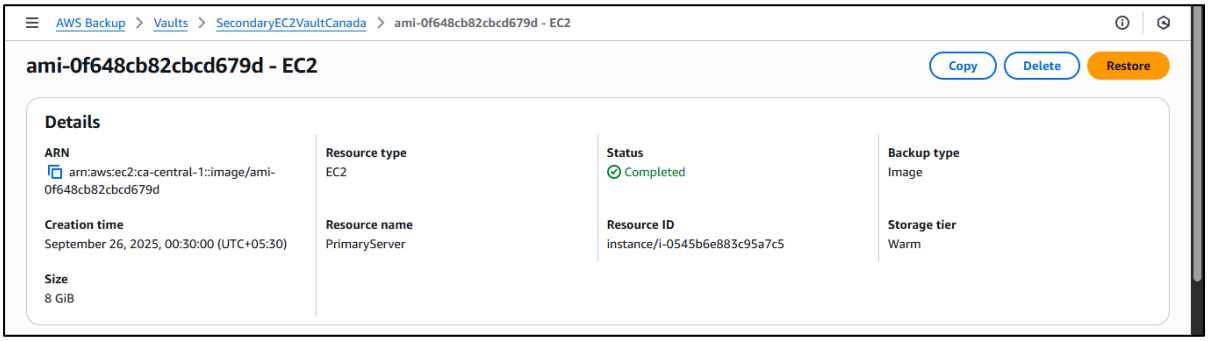

***Image 8.2**: Secondary region (Canada region) – SecondaryEC2VaultCanada – Recovery Point = an AMI is generated*

Click on the **AMI ID.**

It was verified whether the backup accurately corresponded to the **EC2 instance launched in the Frankfurt region.** The HTML application page that was tested in Europe (Frankfurt – eu-central-1) should also be displayed in Canada (Central – ca-central-1) when an **EC2 instance is launched using the AMI generated through Cross-Region Backup Replication**.

So, launch an EC2 using **AMI.**

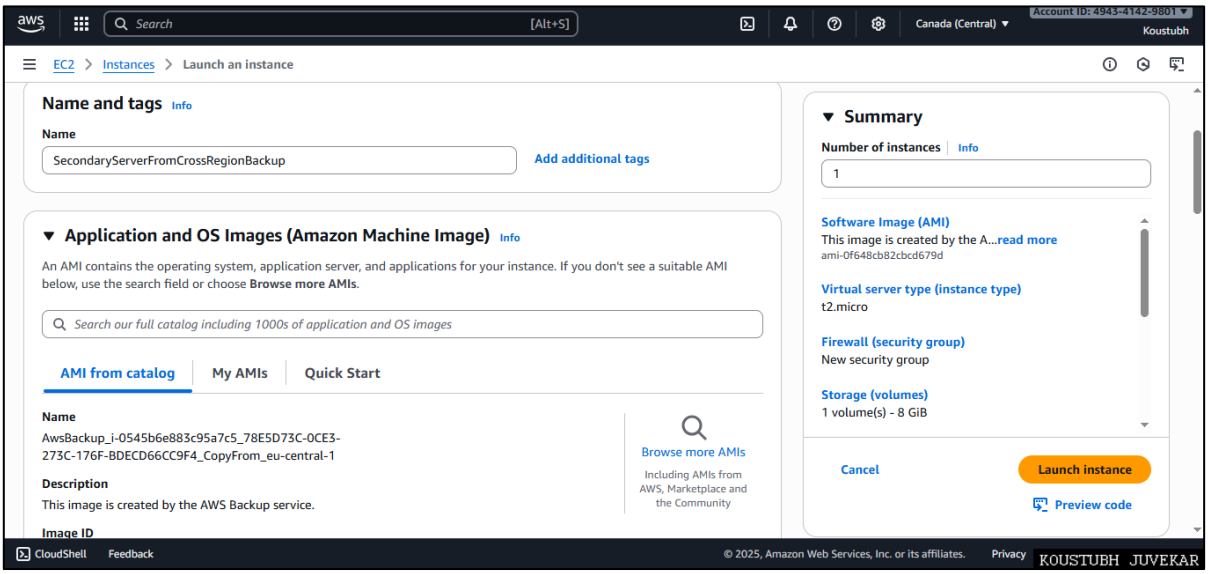

***Image 8.3**: Secondary region (Canada region) – Launching EC2 using AMI generated by Cross-Region Backup Replication*

Copy its public IP and run in the browser.

In Secondary Region → Canada → IP is `99.79.161.219`

Primary Region → Frankfurt → IP was `18.192.68.28`

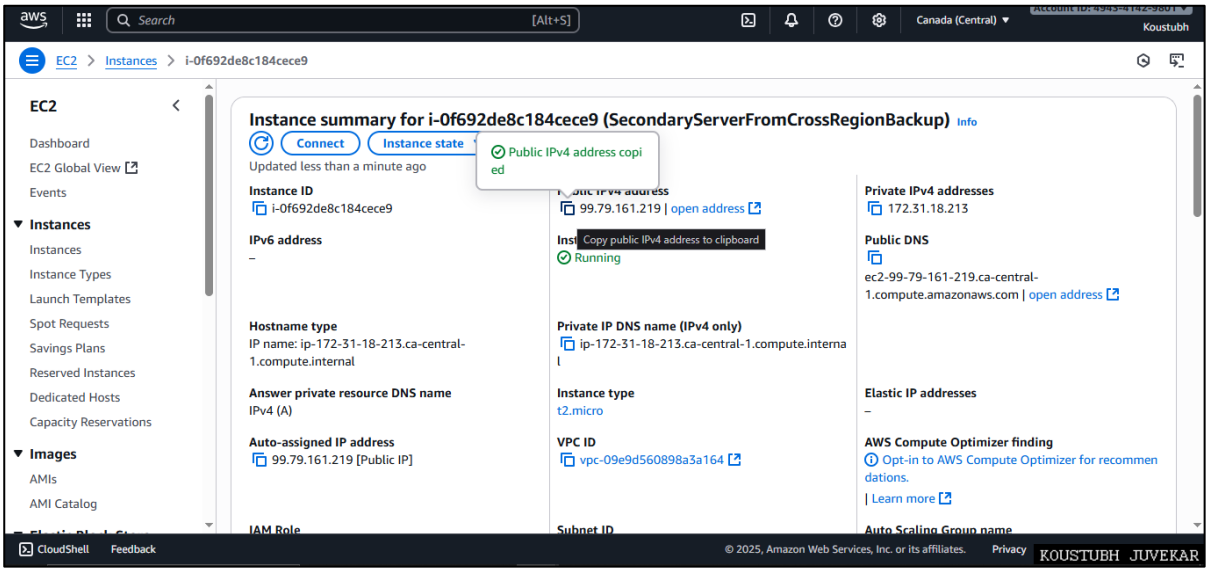

***Image 8.4**: Secondary region (Canada region) – EC2 launched – IP 99.79.161.219*

Access http://99.79.161.219/test.html to verify. （Secondary Region (Canada - Central - ca-central-1))

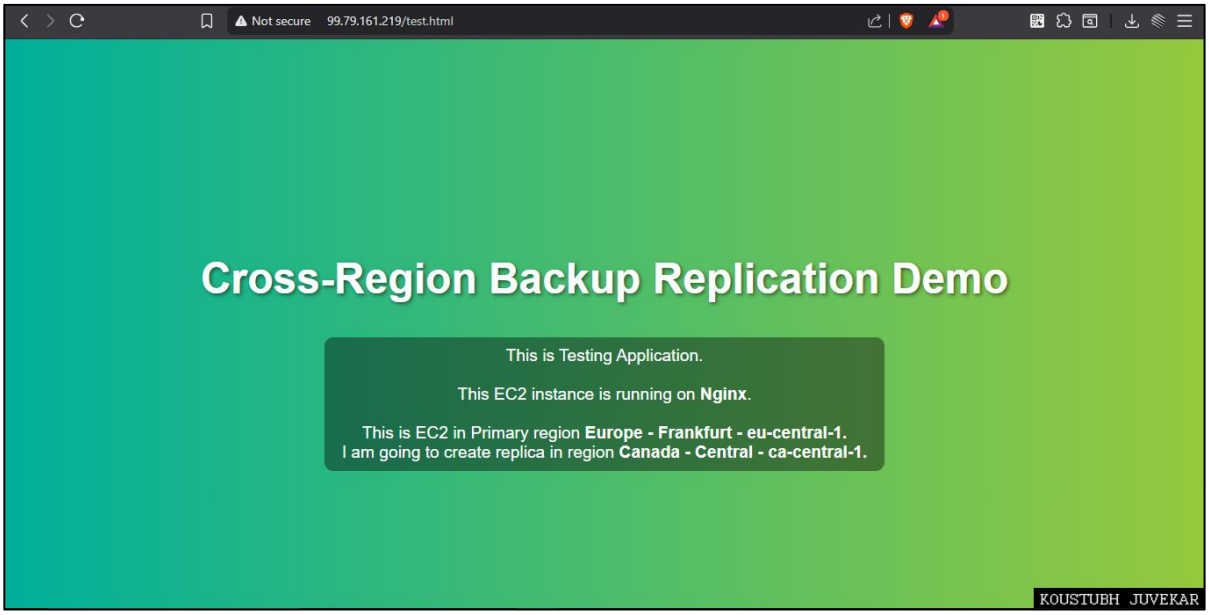

***Image 8.5**: Secondary region (Canada region) – EC2 launched – IP `http://99.79.161.219/test.html` output*

So, the output page is identical to that in the Primary Region **Europe - Frankfurt - eu-central-1**.

❖ **Result:**

Cross-Region Backup Replication for EC2 using AWS Backup was implemented successfully. Backups from the Primary Region (Europe - Frankfurt, eu-central-1) were automatically replicated to the Secondary Region (Canada - Central, ca-central-1), and the EC2 instance was successfully restored from the replicated backup in the Secondary Region.

❖ **The reason and benefits of cross-region backup replication:**

- **Disaster Recovery (DR):** Ensures business continuity even if the primary AWS region becomes unavailable due to natural disasters, power failures, or large-scale outages.
- **Data Durability:** Replicating backups across geographically distant regions reduces the risk of data loss.
- **Compliance & Governance:** Many organizations and regulations require that data be stored in multiple locations for resilience and audit readiness.
- **High Availability:** Applications and workloads can be quickly restored in another region, minimizing downtime.

❖ **Any issues encountered and how they were resolved:**

1. **Cross-Region Copy Delay:**
   - ? After configuring the copy rule, the recovery point did not appear immediately in the Canada (Central) vault, which initially caused confusion. The reason behind it was identified: only new backups are eligible for replication, whereas existing backups are not copied.
   - ? In addition, there was no option to trigger the copy instantly, so replication started later as per the backup schedule.

   Issue Fixed:
   - ✓ Additional on-demand backups were created in the Primary region (Europe - Frankfurt - eu-central-1), which successfully triggered the copy jobs.
   - ✓ This ensured that recovery points were eventually replicated to the Secondary region (Canada - Central - ca-central-1).

2. **Restore Failure via AWS Backup Console**
   - ? While attempting to restore the EC2 instance directly from the recovery point in the Secondary Region (Canada - Central - ca-central-1), using the AWS Backup console, the process failed.
   - ? The restore from AWS Backup console failed because the original VPC, subnet, and security groups from Frankfurt were not available in the Canada region, causing a configuration mismatch.

   Issue Fixed:
   - ✓ The issue was resolved by navigating to the EC2 → AMIs section in the Canada region.
   - ✓ The AMI generated through the cross-region backup was available there.
   - ✓ A new EC2 instance was successfully launched directly from this AMI, and the test application page was verified to be identical to the one in the Primary region (Frankfurt).

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