Cloud Server Project: dptech.online

Student: Diego Pedraza
Student ID: 35549445
Unit: ICT171 - Server Environments and Architectures
Project Name: DP IT Technology
Project Type: Cloud-hosted IT services website with secure access **Primary**

Important Links

Item	Enlace
Main Server Website	https://dptech.online
Test Server Website	https://dptech2.online
Public IP (Main)	http://3.107.180.255/
Public IP (Test)	http://13.237.145.105/
GitHub Repository and Video	https://github.com/DiegoF-Git/dptech-server
Video	https://drive.google.com/file/d/11duZoOSc0iHV3zHagozMK2RU6HUgikIo/view?usp=sharing https://youtu.be/ju6WTU65M8Q

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Project Purpose and Scope

This cloud infrastructure project was built to create a fully functional IT services website **dptech.online** using AWS EC2 intended to emulate a live business environment. DPTech provides a variety of services including hardware repairs and replacement, virus removal, data retrieval, networking support and cloud IT consulting. The solution was designed to be full secure, cost-efficient and scalable with some automated processes to simulate a production quality cloud deployment. The scope included buying a domain, changing DNS records a domain registrar, launching a Linux EC2 instance, loading and configuring a web server, setting up TLS, writing a backup process, using cron to automate different processes and documenting a total cost of ownership over three years. Each of these tasks was performed in such a manner to create the most reproducible and releasable instance which would allow for the sever to be redeployed independently at a later date.

Why Infrastructure as a Service (IaaS)?

This project specifically uses IaaS (AWS EC2) rather than Platform as a Service (PaaS) or Software as a Service (SaaS) to demonstrate:

- Full control over the server environment
- Manual configuration and deployment skills
- SSH access for direct server management
- Real-world server administration experience
- Complete understanding of the technology stack

Documentation Approach

This documentation is designed to be:

- **Reproducible**: Another ICT171 student could rebuild this server without additional research
- **Complete**: All commands, configurations, and decisions are documented
- **Professional**: Written as technical documentation for IT staff
- **Practical**: Focused on real implementation

Cloud Infrastructure Overview

Element	Detail
Platform	AWS EC2 – IaaS
Instance Type	t3.micro (Free Tier eligible)
OS	Ubuntu Server 24.04 LTS
Main	3.107.180.255 (172.31.13.70 private IP)

Element	Detail
Test (with Elastic IP)	13.237.145.105 (172.31.4.126 private IP)
Security Rules	TCP: 22 (SSH), 80 (HTTP), 443 (HTTPS)

Local Machine Setup

- **Operating System**: Windows 11
- **Terminal Tool**: MobaXterm
- **SSH Key File**: D:\amazon\diegokey.pem
- **Website Files Folder**: D:\amazon\webEC2
- **Git Client**: GitHub Desktop
- **Git Files Folder**: D:\github\dptech-server

Domain Configuration

Domains registered on Namecheap and configured as follows:

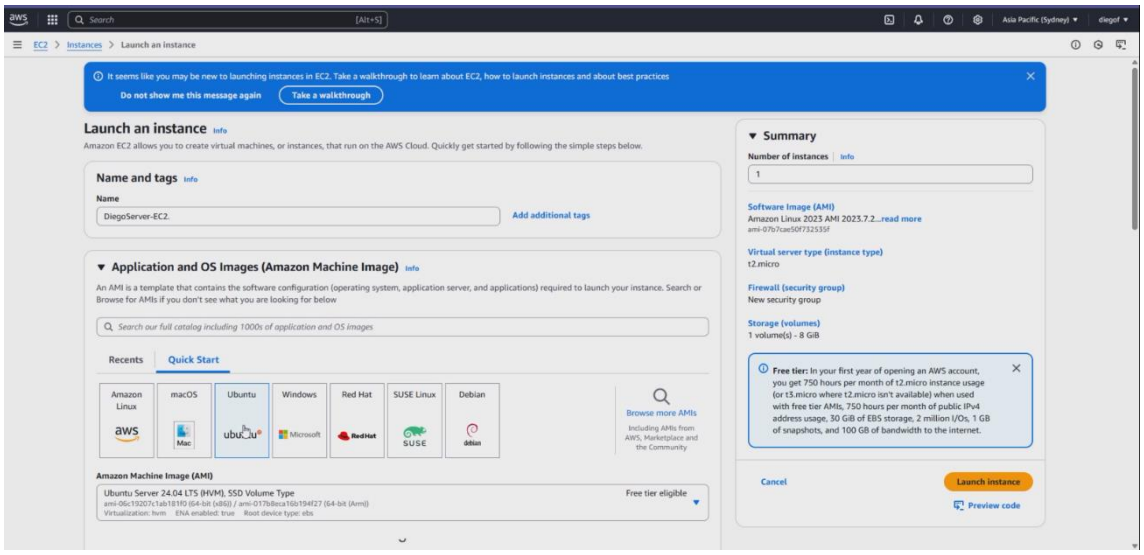
Domain	IP Address	SSL	Purpose
dptech.online	3.107.180.255	✅	Main server
dptech2.online	13.237.145.105	✅	Replica Test server for documentation

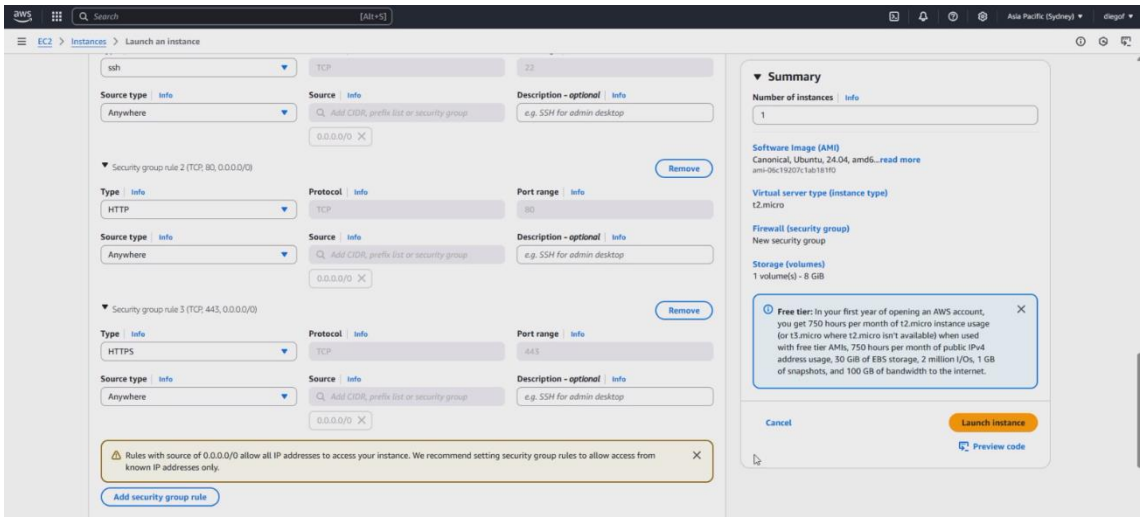
Both domains use A records pointing to their respective public Elastic IPs.

Hosting Platform: Amazon EC2

Amazon EC2 (Elastic Compute Cloud) was selected for this project due to its flexibility, affordability, and industry relevance.

Step-by-Step Configuration:





Enter the page:

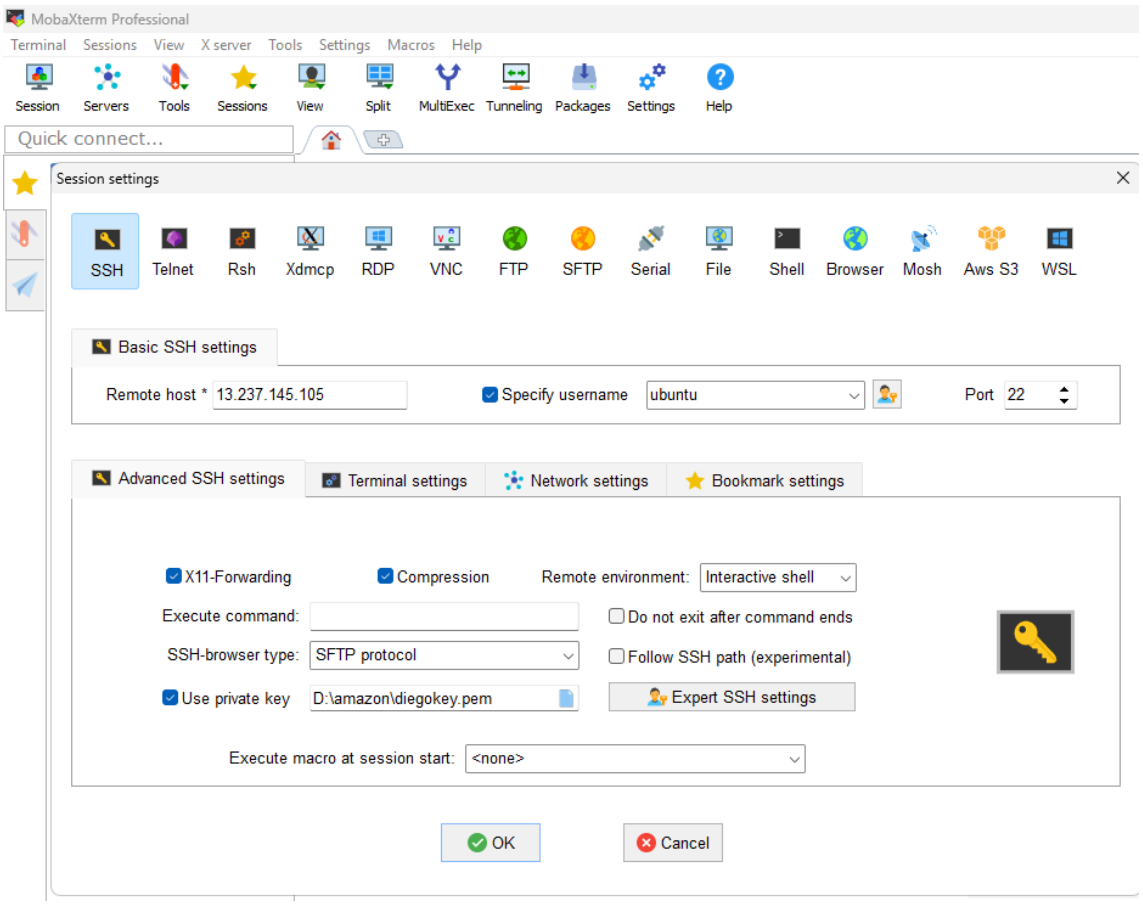
- http://aws.amazon.com/ec2/

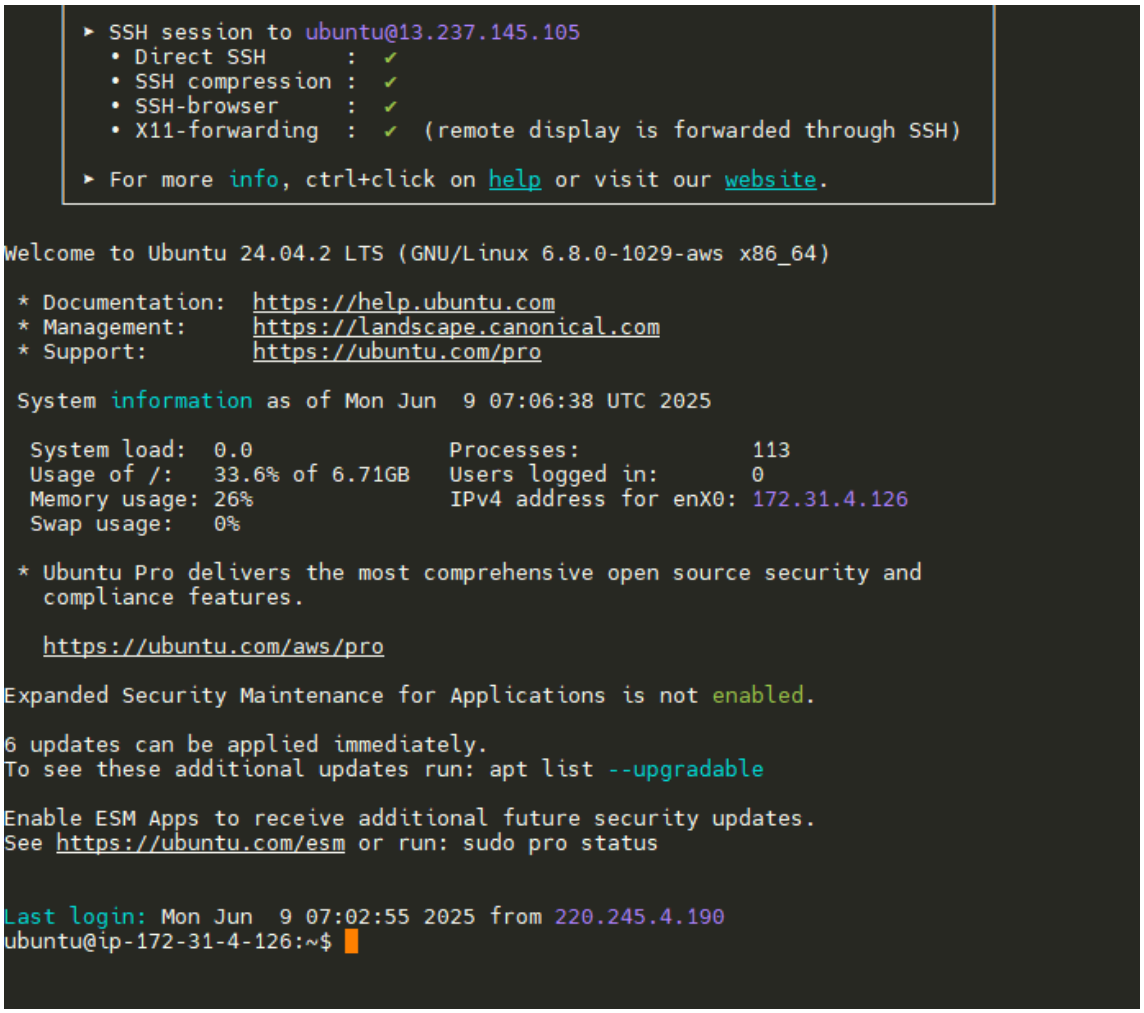
Or console page:

- https://console.aws.amazon.com
- Logged into AWS Console and selected EC2 from the Services menu.
- Launched a new instance
- Name and tags, name: DiegoServer-EC2 (DiegoServer2-EC2 Replica Test server)
- using **Ubuntu Server 24.04 LTS (64-bit ARM)**.
- Chose **t3.micro** instance type under the free tier.
- Created a new key pair (diegokey.pem) and downloaded it securely.
- Set up the security group to allow incoming traffic on TCP ports:
    - 22 (SSH) for secure shell access
    - 80 (HTTP) for web access

- 443 (HTTPS) for encrypted connections

SSH Connection





- Used MobaXterm from Windows to SSH into the server:
- ssh -i diegokey.pem ubuntu@3.107.180.255

Note: For the test server used:

- ssh -i diegokey.pem ubuntu@13.237.145.105

Key File Security in MobaXterm

Set proper permissions for the key file

chmod 400 /drives/d/amazon/diegokey.pem

Verify permissions

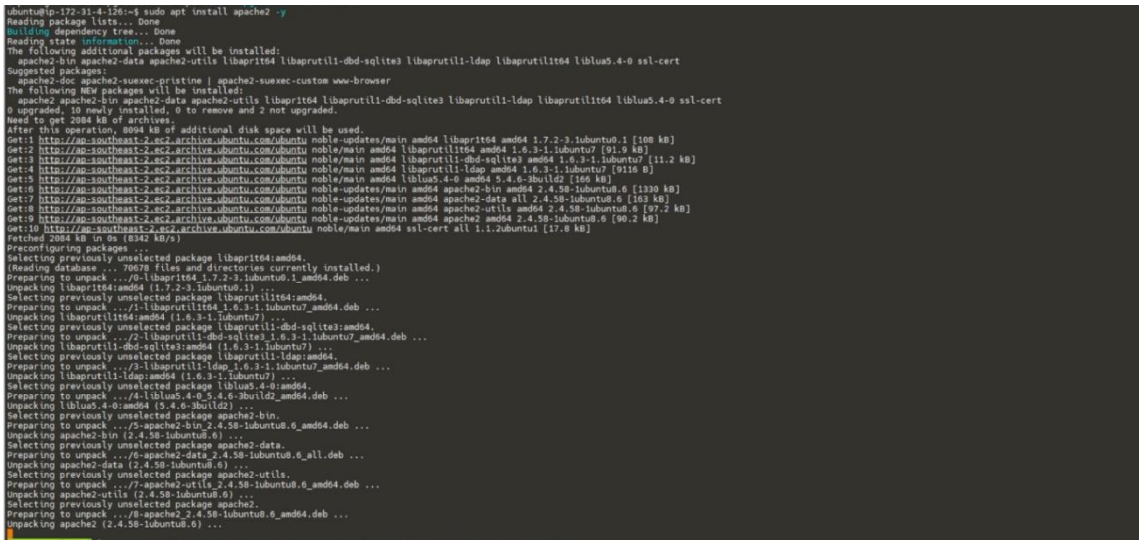
ls -la /drives/d/amazon/diegokey.pem

First Connection Checklist

1. Ensure EC2 instance is running in AWS Console
2. Verify Security Group allows SSH (port 22) from your IP
3. Confirm key file has correct permissions (400)

4. Use correct username: ubuntu for Ubuntu Server

Apache-Server



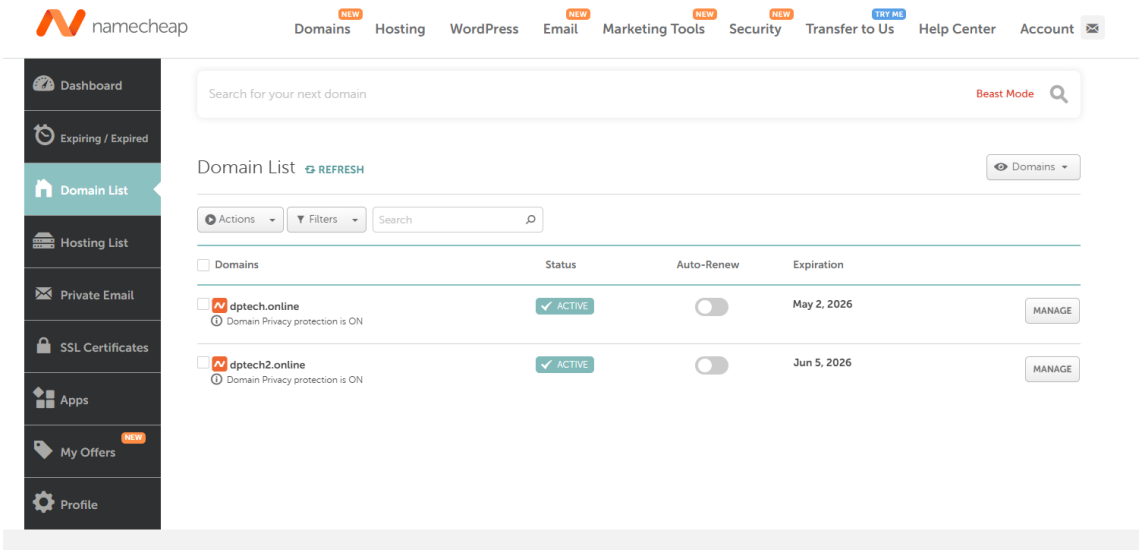
- Updated the package list and installed Apache web server:
- sudo apt update
- sudo apt install apache2 -y
- sudo systemctl enable apache2
- sudo systemctl start apache2
- Verified service with systemctl status apache2 and accessed the default Apache landing page from a browser.

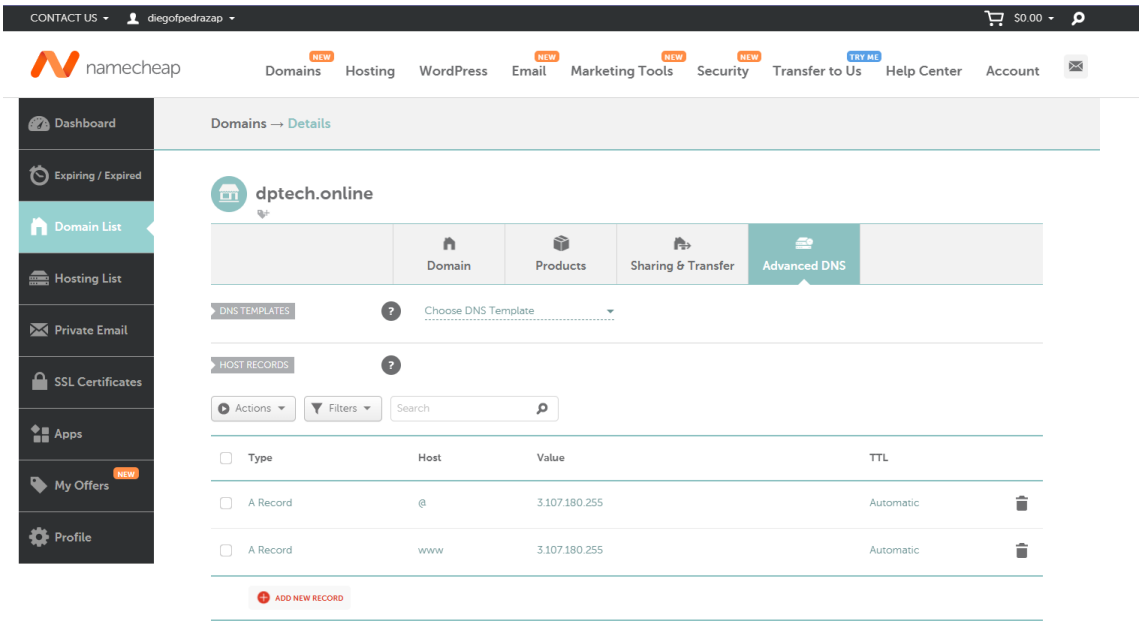
Testing Apache Installation

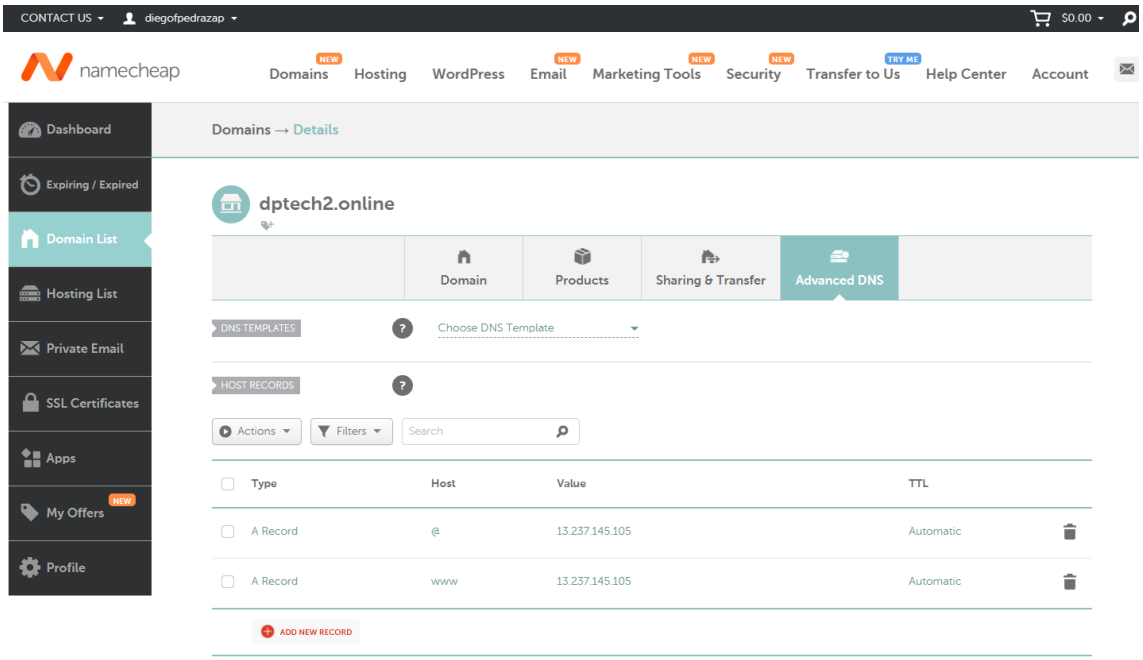
1. **Local test**: curl http://localhost

2. **External test**: Navigate to http://YOUR_EC2_IP in that case 3.107.180.255 (Main Server) or 13.237.145.105 (Test Server) in browser
3. **Check logs**: sudo tail -f /var/log/apache2/access.log

Domain Registration and DNS Setup







- Purchased the domain dptech.online from Namecheap ($1.16 AUD/year).
- Purchased the domain dptech2.online from Namecheap ($1.16 AUD/year).
- Logged into Namecheap Dashboard > Domain List > Manage > Advanced DNS.
- **For dptech.online:**
    - Added A record: @ pointing to 3.107.180.255
    - Added A record: www pointing to 3.107.180.255
- **For dptech2.online (Test Server):**
    - Added A record: @ pointing to 13.237.145.105
    - Added A record: www pointing to 13.237.145.105
- Set TTL to Automatic for both domains.
- Confirmed DNS propagation using external DNS checkers and the following terminal commands:
- dig dptech.online
- nslookup dptech.online
- wget http://dptech.online
- curl -Iv https://dptech.online
- Full propagation occurred within approximately 15–20 minutes.

TLS Certificate Setup (Let's Encrypt)

To enable secure connections:

- Ensured port 443 was open in the EC2 instance's security group.
- wget http://dptech.online
- sudo apt update
- sudo apt install snapd -y
- sudo snap install core
- sudo snap refresh core
- sudo snap install --classic certbot
- sudo ln -s /snap/bin/certbot /usr/bin/certbot
- sudo certbot --apache

Perform the following sub-actions when prompted:

In the Enter email address... field: enter the email address, die_fpp@hotmail.com was entered.

In "You mut agree in order to register with the ACME server. Do I agree?", answer (Y) is: Y

Next option, answer (No): N

Then in dptech2.online enter www.dptech2.online, which is a "Requesting a certificate for both."

And finally, choose 2: 00-default-le-ssl.conf, choose: 2

- Installed Snap and Certbot tools:
- sudo snap install core
- sudo snap refresh core
- sudo snap install --classic certbot
- sudo ln -s /snap/bin/certbot /usr/bin/certbot
- Installed the certificate with Apache integration:
- sudo certbot --apache
- Selected both domains during the prompt (dptech.online and www.dptech.online).
- Auto-redirect from HTTP to HTTPS was enabled.
- Verified certificate with browser (lock icon) and CLI tools:

curl -Iv https://dptech.online

```
ubuntu@ip-172-31-4-126:~$ curl -Iv https://dptech2.online
* Host dptech2.online:443 was resolved.
* IPv6: (none)
* IPv4: 13.237.145.105
*   Trying 13.237.145.105:443...
* Connected to dptech2.online (13.237.145.105) port 443
* ALPN: curl offers h2,http/1.1
* TLSv1.3 (OUT), TLS handshake, Client hello (1):
*  CAfile: /etc/ssl/certs/ca-certificates.crt
*  CApath: /etc/ssl/certs
* TLSv1.3 (IN), TLS handshake, Server hello (2):
* TLSv1.3 (IN), TLS handshake, Encrypted Extensions (8):
* TLSv1.3 (IN), TLS handshake, Certificate (11):
* TLSv1.3 (IN), TLS handshake, CERT verify (15):
* TLSv1.3 (IN), TLS handshake, Finished (20):
* TLSv1.3 (OUT), TLS change cipher, Change cipher spec (1):
* TLSv1.3 (OUT), TLS handshake, Finished (20):
* SSL connection using TLSv1.3 / TLS_AES_256_GCM_SHA384 / X25519 / id-ecPublicKey
* ALPN: server accepted http/1.1
* Server certificate:
*  subject: CN=dptech2.online
*  start date: Jun  5 19:53:33 2025 GMT
*  expire date: Sep  3 19:53:32 2025 GMT
*  subjectAltName: host "dptech2.online" matched cert's "dptech2.online"
*  issuer: C=US; O=Let's Encrypt; CN=E6
*  SSL certificate verify ok.
*   Certificate level 0: Public key type EC/prime256v1 (256/128 Bits/secBits), signed using ecdsa-with-SHA384
*   Certificate level 1: Public key type EC/secp384r1 (384/192 Bits/secBits), signed using sha256WithRSAEncryption
*   Certificate level 2: Public key type RSA (4096/152 Bits/secBits), signed using sha256WithRSAEncryption
* using HTTP/1.x
> HEAD / HTTP/1.1
> Host: dptech2.online
> User-Agent: curl/8.5.0
> Accept: */*
>
* TLSv1.3 (IN), TLS handshake, Newsession Ticket (4):
* TLSv1.3 (IN), TLS handshake, Newsession Ticket (4):
* old SSL session ID is stale, removing
< HTTP/1.1 200 OK
HTTP/1.1 200 OK
< Date: Thu, 05 Jun 2025 20:54:34 GMT
Date: Thu, 05 Jun 2025 20:54:34 GMT
< Server: Apache/2.4.58 (Ubuntu)
Server: Apache/2.4.58 (Ubuntu)
< Last-Modified: Thu, 05 Jun 2025 17:02:29 GMT
Last-Modified: Thu, 05 Jun 2025 17:02:29 GMT
< ETag: "29af-636d61424c07b"
ETag: "29af-636d61424c07b"
< Accept-Ranges: bytes
Accept-Ranges: bytes
< Content-Length: 10671
Content-Length: 10671
< Vary: Accept-Encoding
Vary: Accept-Encoding
< Content-Type: text/html
Content-Type: text/html

<
* Connection #0 to host dptech2.online left intact
ubuntu@ip-172-31-4-126:~$
```

- Confirmed certificate was issued by Let's Encrypt and set to renew automatically.

Website

Updating Files

Every time changes are made, this is the process of updating files from our main computer to the EC2 server, from the local terminal then in the Ubuntu terminal where the files are copied to the Ubuntu user folder and then to the /var/www/ destination.

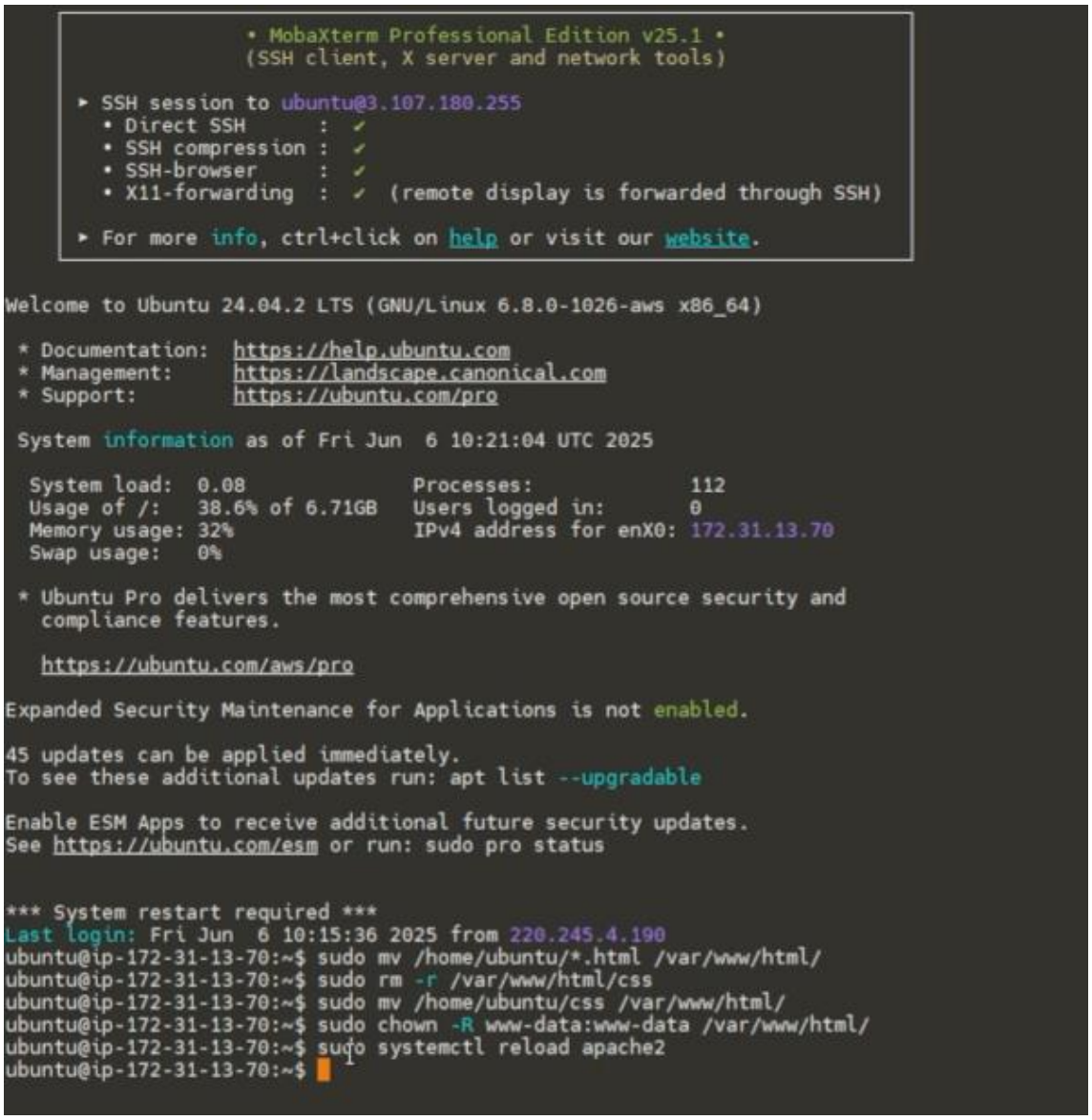
In MobaXterm terminal:

cd /drives/d/amazon/webEC2/v2

chmod 400 /drives/d/amazon/diegokey.pem

scp -i /drives/d/amazon/diegokey.pem /drives/d/amazon/webEC2/v2/*.html ubuntu@3.107.180.255:/home/ubuntu/

scp -i /drives/d/amazon/diegokey.pem -r /drives/d/amazon/webEC2/v2/css ubuntu@3.107.180.255:/home/ubuntu/



On the server via SSH: In summary

sudo mv /home/ubuntu/*.html /var/www/html/

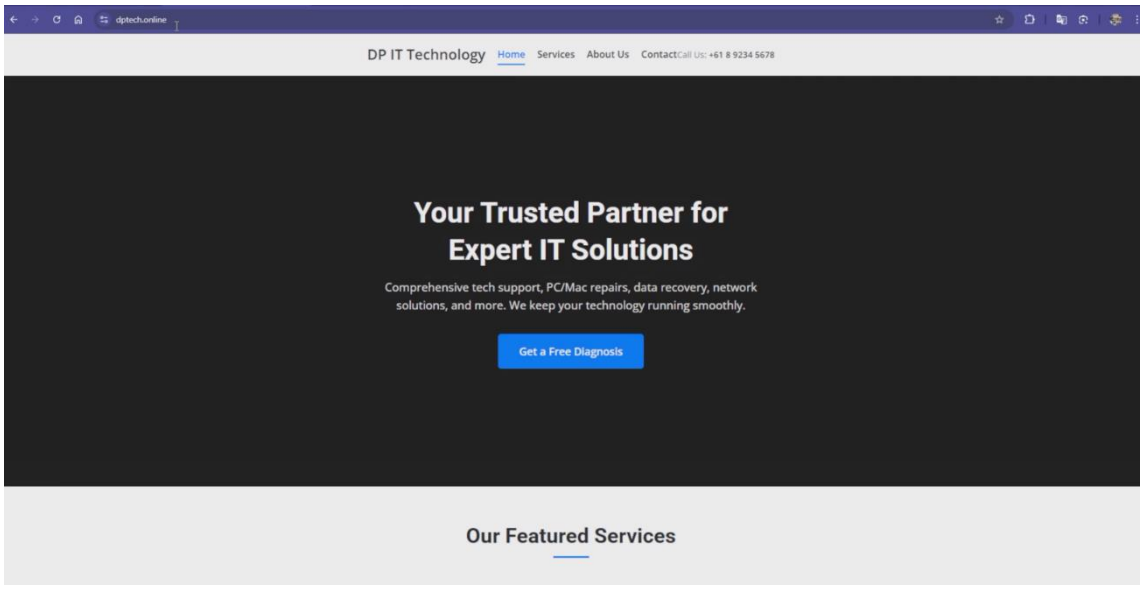
sudo rm -r /var/www/html/css

sudo mv /home/ubuntu/css /var/www/html/

sudo chown -R www-data:www-data /var/www/html/

sudo systemctl reload apache2

Website-Update



- Cleaned the default contents of /var/www/html:
- sudo rm /var/www/html/index.html
- Uploaded custom HTML, CSS, and images using MobaXterm:
- scp -i diegokey.pem index.html ubuntu@3.107.180.255:/var/www/html/
- Verified file permissions and ownership:
- sudo chown www-data:www-data /var/www/html/index.html
- Reloaded Apache to confirm new content:
- sudo systemctl reload apache2
- Website loaded properly at https://dptech.online/.

Website Design and Template Attribution

The frontend of the **dptech.online** website was developed using a customized HTML/CSS template based on the open-source Bootstrap template:

- **Source template**: Business Frontpage – Start Bootstrap
- **License**: MIT License

The template was adapted to match the branding and service structure of DPTech. This includes modified color schemes, HTML sections, and service categories.

Icons Used

This project makes use of **Font Awesome Free Icons** to enhance visual clarity and modern design:

- Font Awesome
- **License**: Free icons are released under **Creative Commons Attribution 4.0** and **MIT License**

DP IT Technology Services Summary

DP IT Technology is an independent IT solutions provider offering a comprehensive range of technical services including:

- **Support & Maintenance**
  PC/Mac & Mobile Repair, Help Desk (Remote/On-site), Virus Removal & Optimization, Preventive Maintenance
- **Hardware & Assembly**
  Custom PC Building, Component Upgrades, Hardware Diagnostics, Component Sales
- **Software & Data**
  OS & Application Installation, Advanced Data Recovery, Secure Backup Solutions, Software Configuration
- **Networks & Infrastructure**
  Network Design & Installation, Server Administration, Network Security (Firewalls, VPN), Structured Cabling
- **Additional Services**
  Strategic IT Consulting, Technology Training, Cloud Solutions, Business IT Support
- **Contact Us**
  Ready to help with your technology needs. Contact us for a free consultation!

Script

Script 1: Daily Status Report

Objective

The daily_status_report.sh script is designed to generate a snapshot of the server's status including uptime, CPU and memory usage, and disk space. It stores the output in a timestamped file under /home/ubuntu/server_reports/.

Step-by-step Instructions

1. Create the folder to store the reports

```
mkdir -p /home/ubuntu/server_reports
```

2. Create the script file

```
nano /home/ubuntu/daily_status_report.sh
```

3. Paste the following content

```
#!/bin/bash

# Script to generate server status report

# Author: Diego Pedraza

# This script creates comprehensive server status reports


NOW=$(date +"%Y-%m-%d_%H-%M")

REPORT="/home/ubuntu/server_reports/report_$NOW.txt"
```

```
echo "===== SERVER STATUS REPORT =====" > $REPORT
echo "Date and Time: $(date)" >> $REPORT
echo "-------------------------------" >> $REPORT
echo "Uptime:" >> $REPORT
uptime >> $REPORT
echo "" >> $REPORT
echo "CPU and Memory Usage:" >> $REPORT
top -b -n1 | head -n 10 >> $REPORT
echo "" >> $REPORT
echo "Disk Usage:" >> $REPORT
df -h >> $REPORT
echo "" >> $REPORT
echo "Free Memory:" >> $REPORT
free -h >> $REPORT
echo "" >> $REPORT
echo "Top 5 Processes by Memory Usage:" >> $REPORT
ps aux --sort=-%mem | head -n 5 >> $REPORT

echo "Report saved to: $REPORT"
```

Use Ctrl + O to save and Ctrl + X to exit.

4. Make the script executable

```
chmod +x /home/ubuntu/daily_status_report.sh
```

5. Test the script manually

```
/home/ubuntu/daily_status_report.sh
```

Verify the result in:

```
ls -la /home/ubuntu/server_reports/
```

6. Make the script system-wide

```
sudo mv /home/ubuntu/daily_status_report.sh /usr/bin/daily_status_report
sudo chown ubuntu /usr/bin/daily_status_report
```

Now you can run it from any location with:

```
daily_status_report
```

Script 2: Apache Monitor

Objective

This script checks whether the Apache service (apache2) is active. If it's not running, it automatically restarts the service and logs the event. It's useful for keeping your website always online without requiring manual checks.

Step-by-step Instructions

1. Create the log directory

```
mkdir -p /home/ubuntu/apache_logs
```

2. Create the script file

```
nano /home/ubuntu/apache_monitor.sh
```

3. Paste the following content

```
#!/bin/bash

# Apache Monitoring Script

# Author: Diego Pedraza

# Monitors Apache service and automatically restarts if needed


LOGFILE="/home/ubuntu/apache_logs/apache_monitor.log"

TIMESTAMP=$(date +"%Y-%m-%d %H:%M:%S")


echo "[$TIMESTAMP] Checking Apache service..." >> $LOGFILE


# Check if Apache is active

if systemctl is-active --quiet apache2

then

   echo "[$TIMESTAMP] Apache is running." >> $LOGFILE

else

   echo "[$TIMESTAMP] Apache is NOT running. Restarting..." >> $LOGFILE

   sudo systemctl start apache2

   if systemctl is-active --quiet apache2

   then

      echo "[$TIMESTAMP] Apache successfully restarted." >> $LOGFILE

   else

      echo "[$TIMESTAMP] Failed to restart Apache!" >> $LOGFILE
```

fi

fi

Save with Ctrl + O, then exit with Ctrl + X.

4. Make the script executable

chmod +x /home/ubuntu/apache_monitor.sh

5. Test it manually

First stop the service (just for testing):

sudo systemctl stop apache2

Then run the script:

/home/ubuntu/apache_monitor.sh

Check the log with:

cat /home/ubuntu/apache_logs/apache_monitor.log

6. Make it system-wide (optional)

sudo mv /home/ubuntu/apache_monitor.sh /usr/bin/apache_monitor

sudo chown ubuntu /usr/bin/apache_monitor

Now you can run it from anywhere:

apache_monitor

Scripts Summary

These two scripts demonstrate automation capabilities on the server:

- **daily_status_report**: Provides comprehensive system health monitoring
- **apache_monitor**: Ensures website availability through automatic service recovery

Both scripts can be scheduled via cron for fully automated operation.

Cron Job Setup

- Opened crontab:
- sudo nano /etc/crontab
- Added the following entries:
- 0 * * * * ubuntu /usr/bin/daily_status_report
- */5 * * * * ubuntu /usr/bin/apache_monitor
- Checked cron logs to verify automatic execution
- Confirmed scripts are running automatically as scheduled

Clarification on Dual Domains

Important Note: The screenshots and video documentation come from the test server (dptech2.online) as the original production server (dptech.online) was deployed in Assignment 1 and has been continuously run since then without documentation of the setup process.

- **dptech.online – Primary website hosted on an EC2 instance (IP: 3.107.180.255) deployed in Assignment 1. Since I did not create an Elastic IP, I have not restarted or shut down the server, to avoid losing the IP registered in Assignment1.**
- **dptech2.online – Mirror server created for video and documentation purposes, using Elastic IP (13.237.145.105).**

The two domains are nearly identical in functionality and configuration. The test server was created to properly record the setup steps which were missed initially on the main instance.

Total Cost of Ownership (TCO) - 3 Year Analysis

Three-Year Cost Summary

Platform	Year 1	Year 2	Year 3	3-yr Grand Total
On-Prem	$10,094	$3,116	$3,240	$16,450
Cloud Platform (IaaS)	$1,344	$1,385	$1,426	$4,155
Web Platform (SaaS)	$862	$888	$915	$2,665

Cloud Platform (IaaS) - Cost Breakdown (AUD)

AWS EC2 (Amazon Elastic Compute Cloud) is a web service that provides secure, resizable compute capacity in the cloud. It is designed to make web-scale cloud computing easier for developers.

Cost Bucket	Year 1	Year 2	Year 3	3-yr Sub-Total
Compute (t3.small 0.0408 AUD/h, +3%)	$357	$368	$379	$1,104
Storage (gp3 100 GB, +3%)	$61	$63	$65	$189
Daily Snapshots (30 GB, +3%)	$298	$307	$316	$921
Data Transfer (100 GB/mo @ $0.12/GB, +3%)	$154	$159	$164	$477
Route 53 + Domain	$49	$49	$49	$147
DevOps Labour (6h @ $55, +3%)	$330	$340	$350	$1,020

Cost Bucket	Year 1	Year 2	Year 3	3-yr Sub-Total
Contingency 10% (Opex)	$95	$99	$103	$297
IaaS Annual Total	**$1,344**	**$1,385**	**$1,426**	**$4,155**

On-Prem (Dell R550) - Cost Breakdown (AUD)

Cost Bucket	Year 1	Year 2	Year 3	3-yr Sub-Total
CapEx (server + UPS + FW)	$7,006	$-	$-	$7,006
Rack & Cooling	$300	$318	$337	$955
Power (250W avg @ $0.30 kWh, +6%)	$657	$697	$739	$2,093
Software (cPanel $60 / Acronis 120, +3%)	$420	$433	$446	$1,299
Domain + DNS	$26	$27	$27	$80
IT Staff (0.5 FTE @ $85, +3%)	$1,320	$1,360	$1,401	$4,081
Contingency 10% (Opex)	$272	$281	$290	$843
On-Prem Annual Total	**$10,094**	**$3,116**	**$3,240**	**$16,450**

Web Platform (SaaS) - Cost Breakdown (AUD)

WordPress.com is a hosted Software as a Service (SaaS) platform that allows users to create and manage websites and blogs without needing to manage the underlying server infrastructure, security, or software updates.

Cost Bucket	Year 1	Year 2	Year 3	3-yr Sub-Total
Plan Subscription (US$15/mo, +3%)	$286	$274	$292	$822
Media Overage (10 GB/yr @ $1.20/GB, +6%)	$12	$13	$14	$39
Domain (internal)	$26	$27	$27	$80

Cost Bucket	Year 1	Year 2	Year 3	3-yr Sub-Total
Content Manager (10/mo @ $40, +3%)	$480	$494	$509	$1,483
Contingency 10% (Opex)	$78	$80	$83	$241
SaaS Annual Total	**$862**	**$888**	**$915**	**$2,665**

Final Testing Checklist

- ✅ DNS resolves and A records confirmed
- ✅ Apache Web Server fully operational
- ✅ HTTPS enabled with valid certificate
- ✅ Website content deployed successfully
- ✅ Backup script tested manually and via cron
- ✅ Files timestamped correctly with zip format
- ✅ Server secure, ports configured properly
- ✅ Platform aligns with real-world IT business simulation

Troubleshooting Guide

Common Issues and Solutions

SSH Connection Issues

Error: Permission denied (publickey)

Solution: Check key file permissions in terminal in (my case used MobaXterm)

chmod 400 /drives/d/amazon/diegokey.pem

Error: Connection timeout

Solution: Verify security group allows SSH from your IP

Check AWS Console > EC2 > Security Groups > Inbound Rules

DNS Not Resolving

Check DNS propagation status

dig dptech.online @8.8.8.8

nslookup dptech.online

If not resolving after 30 minutes:

1. Verify A records in Namecheap dashboard

2. Check IP address is correct

3. Clear local DNS cache

Apache Issues

Apache not starting

sudo systemctl status apache2

sudo journalctl -xe | grep apache2

Check for configuration errors

sudo apache2ctl configtest

Common fix: Another service using port 80

sudo netstat -tulpn | grep :80

SSL Certificate Problems

Certificate not working

sudo certbot certificates

Force renewal if needed

sudo certbot renew --force-renewal

Check Apache SSL module

sudo a2enmod ssl

sudo systemctl restart apache2

Website Not Loading

Check file permissions

ls -la /var/www/html/

Files should be owned by www-data

Fix permissions if needed

sudo chown -R www-data:www-data /var/www/html/

sudo chmod -R 755 /var/www/html/

Check Apache error logs

sudo tail -f /var/log/apache2/error.log

Performance Monitoring

System Resource Monitoring

Real-time system monitoring

htop

Disk usage

df -h

Memory usage

free -m

Apache connections

sudo netstat -anp | grep :80 | wc -l

Apache status module (if enabled)

sudo a2enmod status

sudo systemctl restart apache2

Log Analysis

Monitor Apache access logs

sudo tail -f /var/log/apache2/access.log

Check for errors

sudo tail -f /var/log/apache2/error.log

System logs

sudo journalctl -f

Security Best Practices

Server Hardening Steps Implemented

1. **SSH Security**
    - Key-based authentication only

    - Password authentication disabled
    - Root login disabled
2. **Firewall Configuration**
    - Only necessary ports open (22, 80, 443)
    - Security groups properly configured
3. **Regular Updates**

sudo apt install

4. **SSL/TLS Configuration**
    - HTTPS enforced with redirect
    - Strong cipher suites
    - Regular certificate renewal
5. **File Permissions**
    - Proper ownership for web files
    - Restricted access to sensitive files
    - Regular permission audits

Backup Best Practices

- Automated daily backups via cron
- Timestamped archives for version history
- Optional off-site backup capability
- Regular backup testing and verification

Video

link is on Github

Video Content Overview

The video demonstration covers:

1. Live server functionality demonstration
2. SSH connection process
3. Apache configuration walkthrough
4. SSL certificate verification
5. Backup script execution
6. Website navigation and features

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