

Cloud Computing Project Report

Title: Creating a VM on Azure and Hosting a Static Website

Submitted by: Nikhil

Assigned by: 1stop.ai

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ABSTRACT

This project explores the end-to-end process of deploying a static website using Microsoft Azure's Infrastructure as a Service (IaaS) platform. Specifically, we provision and configure a Virtual Machine (VM) running Ubuntu 24.04 LTS and install the Nginx web server to serve static content. The aim is to demonstrate how cloud-based virtual infrastructure can be leveraged for simple web hosting tasks, providing flexibility, scalability, and hands-on exposure to real-world deployment environments.

The report outlines the complete workflow—from creating and securing the VM, installing necessary software, uploading website files, and configuring firewalls and network settings, to finally verifying deployment through browser access via a public IP address. This practical implementation reinforces foundational concepts in cloud computing, such as resource provisioning, security group configuration, and virtual networking.

Through this project, students gain hands-on experience with Azure's VM ecosystem and learn how to deploy and manage static websites in a secure and controlled manner. It not only strengthens understanding of hosting fundamentals but also introduces industry-relevant skills necessary for future roles in DevOps, web development, and cloud infrastructure management.

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OBJECTIVE

The primary objectives of this project are to:

- **Understand and apply the fundamentals of cloud computing** by working directly with Microsoft Azure's Infrastructure as a Service (IaaS) offerings.
- **Create, configure, and manage Virtual Machines (VMs)** within the Azure platform to host web services.
- **Gain practical experience working with Linux server environments**, particularly Ubuntu 24.04 LTS.
- **Install and configure the Nginx web server** to host and serve static content over HTTP.
- **Deploy and test a static website** built using HTML and CSS, simulating real-world frontend deployment.
- **Implement basic security configurations** using Azure Network Security Groups (NSG) to manage inbound and outbound traffic.
- **Verify deployment through public IP access** and ensure that the web server is functional and reachable.
- **Monitor VM performance** using Azure's built-in monitoring tools and metrics such as CPU usage and memory availability.
- **Apply secure access techniques** such as SSH key authentication and restricted port access to prevent unauthorized usage.
- **Bridge academic knowledge with real-world infrastructure**, developing familiarity with modern DevOps and cloud hosting techniques.

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INTRODUCTION

Cloud computing provides scalable, on-demand computing resources over the internet, enabling businesses, developers, and students to leverage virtual infrastructure without the need for physical hardware. Among the various service models, **Infrastructure as a Service (IaaS)** offers the greatest flexibility, allowing users to provision virtual machines (VMs), configure network settings, install software, and control the server environment completely.

Microsoft Azure, one of the leading cloud platforms, delivers robust IaaS capabilities through its Virtual Machine service. Azure VMs can run various operating systems, such as Linux or Windows, and are often used to host web servers, databases, applications, and static or dynamic websites.

In this project, we leverage Azure to create a **Linux-based (Ubuntu 24.04 LTS)** virtual machine and host a **static website themed around the Indian Army**. The website is developed using standard frontend technologies like **HTML** and **CSS**, along with multimedia components such as images and embedded videos. To serve the site, we configure **Nginx**, a lightweight and efficient open-source web server. The deployment process also involves **security configurations** via Azure's **Network Security Groups (NSG)** and **performance monitoring** using Azure's native diagnostic tools.

This hands-on exercise introduces students to real-world cloud deployment scenarios and provides practical insights into hosting, configuring, and securing a server in a cloud environment. It also strengthens foundational skills in Linux administration, web server setup, and cloud-based resource management—essential knowledge areas in today's DevOps and cloud-native development landscape.



A screenshot of the Microsoft Azure portal interface. At the top, there's a navigation bar with 'Microsoft Azure', a search bar, and user information. Below it, the main content area shows a 'Virtual machine' named 'hoststaticwebsite'. The 'Overview' tab is selected, displaying basic details like status (Running), location (Central India (Zone 1)), and subscription (Azure for Students). A 'Tags' section allows adding tags. On the left, a sidebar lists other options like 'Connect', 'Networking', 'Settings', etc. At the bottom, there are tabs for 'Properties', 'Monitoring', 'Capabilities (7)', 'Recommendations (9)', and 'Tutorials'. The 'Networking' section on the right shows a public IP address of 98.70.58.92 and a network interface named hoststaticwebsite390_z1.

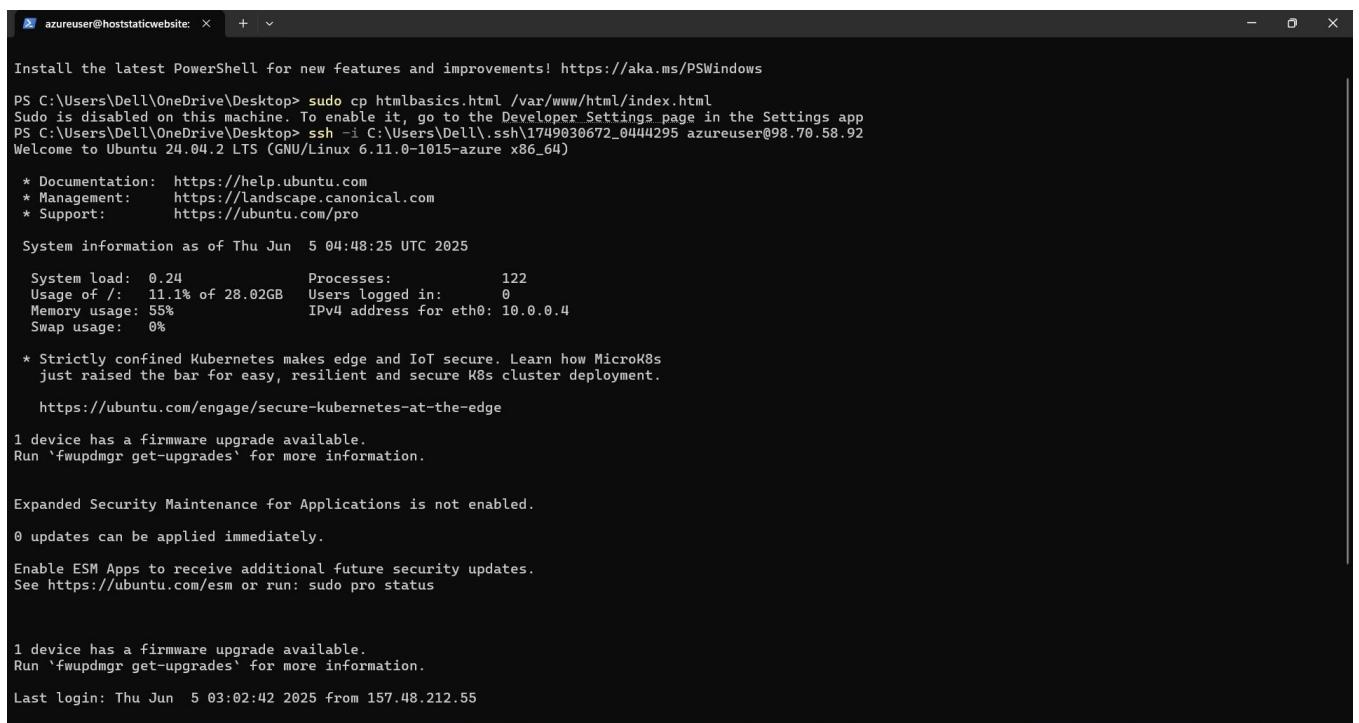
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METHODOLOGY

The project began with logging into Azure and creating a new Virtual Machine under the resource group named 'hoststaticwebsite_group'. The configuration included selecting 'Ubuntu 24.04 LTS' as the OS image and choosing a 'Standard_B1s' instance type for its cost-effectiveness.

SSH key authentication was set up to ensure secure login. Inbound port rules were configured to allow traffic on ports 22 (SSH), 80 (HTTP), and 443 (HTTPS). Nginx was installed using the command `sudo apt update && sudo apt install nginx`.

The static website files were then securely uploaded to the VM's Nginx web root directory at `/var/www/html` using SCP from the local machine. After uploading, the Nginx server was restarted and tested to verify it served the uploaded HTML page.



A screenshot of a Windows terminal window titled "azureuser@hoststaticwebsite: ~". The window displays the output of a "systemctl status" command on an Ubuntu 24.04.2 LTS system. The output includes system load (0.24), memory usage (55%), swap usage (0%), and network information (IPv4 address 10.0.0.4). It also shows a note about Kubernetes security and a link to a blog post. The terminal shows a user has run "fwupd" to check for updates, and there is a note about ESM Apps. The last line shows the user last logged in on June 5, 2025, from an IP address of 157.48.212.55.

```
Install the latest PowerShell for new features and improvements! https://aka.ms/PSWindows
PS C:\Users\Dell\OneDrive\Desktop> sudo cp htmlbasics.html /var/www/html/index.html
Sudo is disabled on this machine. To enable it, go to the Developer Settings page in the Settings app
PS C:\Users\Dell\OneDrive\Desktop> ssh -i C:\Users\Dell\.ssh\1749030672_0444295 azureuser@98.70.58.92
Welcome to Ubuntu 24.04.2 LTS (GNU/Linux 6.11.0-1015-azure x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:    https://landscape.canonical.com
 * Support:       https://ubuntu.com/pro

System information as of Thu Jun  5 04:48:25 UTC 2025

 System load:  0.24           Processes:      122
 Usage of /:   11.1% of 28.02GB  Users logged in:  0
 Memory usage: 55%            IPv4 address for eth0: 10.0.0.4
 Swap usage:  0%

* Strictly confined Kubernetes makes edge and IoT secure. Learn how MicroK8s just raised the bar for easy, resilient and secure K8s cluster deployment.
  https://ubuntu.com/engage/secure-kubernetes-at-the-edge

1 device has a firmware upgrade available.
Run 'fwupd get-upgrades' for more information.

Expanded Security Maintenance for Applications is not enabled.
0 updates can be applied immediately.

Enable ESM Apps to receive additional future security updates.
See https://ubuntu.com/esm or run: sudo pro status

1 device has a firmware upgrade available.
Run 'fwupd get-upgrades' for more information.

Last login: Thu Jun  5 03:02:42 2025 from 157.48.212.55
```

Azure VM Basic Configuration

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```
azureuser@hoststaticwebsite:~$ sudo apt update && sudo apt install nginx
Hit:1 http://azure.archive.ubuntu.com/ubuntu noble InRelease
Get:2 http://azure.archive.ubuntu.com/ubuntu noble-updates InRelease [126 kB]
Hit:3 http://azure.archive.ubuntu.com/ubuntu noble-backports InRelease
Hit:4 http://azure.archive.ubuntu.com/ubuntu noble-security InRelease
Hit:5 https://packages.microsoft.com/repos/azure-cli noble InRelease
Get:6 http://azure.archive.ubuntu.com/ubuntu noble-updates/main amd64 Packages [1112 kB]
Get:7 http://azure.archive.ubuntu.com/ubuntu noble-updates/universe amd64 Packages [1070 kB]
Get:8 http://azure.archive.ubuntu.com/ubuntu noble-updates/universe Translation-en [273 kB]
Fetched 2582 kB in 1s (2520 kB/s)
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
2 packages can be upgraded. Run 'apt list --upgradable' to see them.
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
nginx is already the newest version (1.24.0-2ubuntu7.3).
0 upgraded, 0 newly installed, 0 to remove and 2 not upgraded.
azureuser@hoststaticwebsite:~$ |
```

Nginx successfully installed

The screenshot shows the Azure portal interface for creating a new virtual machine. The top navigation bar includes 'Microsoft Azure', a search bar, and user profile information. The main page title is 'Create a virtual machine'. A warning message states: 'Changing Basic options may reset selections you have made. Review all options prior to creating the virtual machine.' Below this are three buttons: 'Help me create a low cost VM', 'Help me create a VM optimized for high availability', and 'Help me choose the right VM size for my workload'. A note from Azure says: 'Azure now automatically generates an SSH key pair for you and allows you to store it for future use. It is a fast, simple, and secure way to connect to your virtual machine.' The configuration section includes fields for 'Username *' (set to 'azureuser'), 'SSH public key source' (set to 'Generate new key pair'), 'SSH Key Type' (set to 'RSA SSH Format'), and 'Key pair name *' (set to 'hoststaticwebsite.key'). Under 'Inbound port rules', it says: 'Select which virtual machine network ports are accessible from the public internet. You can specify more limited or granular network access on the Networking tab.' The 'Public inbound ports *' field has 'None' selected. At the bottom, there are navigation buttons: '< Previous', 'Next : Disks >', 'Review + create', and 'Give feedback'.

VM Deployment Confirmation

important codes that were used is –

ssh -i C:\Users\Del\ssh\1749030672_0444295 azureuser@98.70.58.92 – this is the code used to Connect to the remote server using ssh with using a specific private key.

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```
Windows PowerShell x + v
azureuser@hoststaticwebsite:~$ ssh azureuser@98.70.58.92
ssh: connect to host 98.70.58.92 port 22: Connection timed out
azureuser@hoststaticwebsite:~$ telnet 98.70.58.92 22
Trying 98.70.58.92...
telnet: Unable to connect to remote host: Connection timed out
azureuser@hoststaticwebsite:~$ 
Broadcast message from root@hoststaticwebsite (Thu 2025-06-05 14:41:06 UTC):
The system will power off now!
Connection to 98.70.58.92 closed by remote host.
Connection to 98.70.58.92 closed.
PS C:\Users\OneDrive\Desktop> sudo systemctl restart sshd
Sudo is disabled on this machine. To enable it, go to the Developer Settings page in the Settings app
PS C:\Users\OneDrive\Desktop> az login
Select the account you want to log in with. For more information on login with Azure CLI, see https://go.microsoft.com/fwlink/?linkid=2271136
Retrieving tenants and subscriptions for the selection...
[Tenant and subscription selection]
No Subscription name Subscription ID Tenant
--- -----
[1] * Azure for Students 6b169c15-7b1b-4eb2-a5bf-e978e85283e2 Default Directory

The default is marked with an *; the default tenant is 'Default Directory' and subscription is 'Azure for Students' (6b169c15-7b1b-4eb2-a5bf-e978e85283e2).

Select a subscription and tenant (Type a number or Enter for no changes): 1
Tenant: Default Directory
Subscription: Azure for Students (6b169c15-7b1b-4eb2-a5bf-e978e85283e2)

[Announcements]
With the new Azure CLI login experience, you can select the subscription you want to use more easily. Learn more about it and its configuration at https://go.microsoft.com/fwlink/?linkid=2271236

If you encounter any problem, please open an issue at https://aka.ms/azclibug

[Warning] The login output has been updated. Please be aware that it no longer displays the full list of available subscriptions by default.

PS C:\Users\OneDrive\Desktop>
```

Code- az login- successful login

```
https://ubuntu.com/engage/secure-kubernetes-at-the-edge
1 device has a firmware upgrade available.
Run 'fwupdmgmt get-upgrades' for more information.

Expanded Security Maintenance for Applications is not enabled.

0 updates can be applied immediately.

Enable ESM Apps to receive additional future security updates.
See https://ubuntu.com/esm or run: sudo pro status

1 device has a firmware upgrade available.
Run 'fwupdmgmt get-upgrades' for more information.

Last login: Thu Jun 5 14:26:16 2025 from 157.48.213.169
azureuser@hoststaticwebsite:~$ sudo systemctl status nginx
● nginx.service - A high performance web server and a reverse proxy server
   Loaded: loaded (/usr/lib/systemd/system/nginx.service; enabled; preset: enabled)
   Active: active (running) since Thu 2025-06-05 14:41:26 UTC; 22min ago
     Docs: man:nginx(8)
 Main PID: 792 (nginx)
    Tasks: 2 (limit: 1056)
   Memory: 3.1M (peak: 3.4M)
      CPU: 21ms
     CGroup: /system.slice/nginx.service
             └─792 "nginx: master process /usr/sbin/nginx -g daemon on; master_process on;"
               ├─794 "nginx: worker process"

Jun 05 14:41:26 hoststaticwebsite systemd[1]: Starting nginx.service - A high performance web server and a reverse proxy server...
Jun 05 14:41:26 hoststaticwebsite systemd[1]: Started nginx.service - A high performance web server and a reverse proxy server.
azureuser@hoststaticwebsite:~$
```

Nginx server status checked -successful

SCP command used - scp -i "C:/Users/Dell/.ssh/1749030672_0444295" "C:/Users/Dell/OneDrive/Desktop/coding folder/HTML-CSS-code/htmlbasics.html" azureuser@98.70.58.92:/var/www/html/

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The screenshot shows a Windows desktop environment. In the center, there is a Microsoft Edge browser window displaying the URL <https://www.showmyip.com>. Below it is a Windows PowerShell window titled "Windows PowerShell" showing command-line output related to Azure configuration. To the right of the browser is a code editor window titled "1749030672_0444295" containing a large amount of RSA PRIVATE KEY data. The desktop background features a blue and white "Try Azure" advertisement for Pizzahut.co.in.

```
+ iJvRNBu0L2Lju0KcyQ5PzUpPmjq+ys/Ap1UaasvNUk8GCKPdKmIpyf5M18KeI
by-azure"
Config {
    "autoUpgradeMinorVersion": false,
    "enableAutomaticUpgrade": null,
    "forceUpdateTag": null,
    "id": "/subscriptions/e6169c15-7b1b-4eb2-a5bf-e978e85283e2/resourceGroups/virtualmachines/hoststaticwebsite/extensions/enablevmaccess",
    "instanceView": null,
    "location": "centralindia",
    "name": "enablevmaccess",
    "protectedSettings": null,
    "protectedSettingsFromKeyVault": null,
    "provisionAfterExtensions": null,
    "provisioningState": "Succeeded",
    "publisher": "Microsoft.OSTCExtensions",
    "resourceGroup": "hoststaticwebsite_group",
    "settings": {},
    "suppressFailures": null,
    "tags": null,
    "type": "Microsoft.Compute/virtualMachines/extensions",
    "typeHandlerVersion": "1.5",
    "typePropertiesType": "VMAccessForLinux"
}
PS C:\Users\DELL\OneDrive\Desktop> ssh -i C:\Users\DELL\.ssh\1749030672_0444295 user@98.70.58.92
ssh: connect to host 98.70.58.92 port 22: Connection timed out
PS C:\Users\DELL\OneDrive\Desktop> C:\Users\DELL\.ssh\1749030672_0444295
PS C:\Users\DELL\OneDrive\Desktop> C:\Users\DELL\.ssh\1749030672_0444295
PS C:\Users\DELL\OneDrive\Desktop>
```

```
-----BEGIN RSA PRIVATE KEY-----
MIIEGjIBAAKCAEYAaoaVwakHxXPSBB9WkjHLKS+kdiTsztJt1s/W/8LHTD05
JTSy6gtmSmNCRTYqgFgnJZxt95Lh7RcvD1prPH5Wl12lmz9CS9riune
7VTs1aMtoABB1Loakarsq2x1oF5s4/7OsyULxqutjw77aE/efoYMAOG34xap+oa
uJlyxxm/w9u6x+04Fybk1pxma4FeAvqdjlxpykcmxFjk0kbprvnxEOPF3sldky/e
v7x7bFz8oURr0st5F0n1nwrx24hZWoN3luua/n9gDcYuCh9D83EDQh8GTAPt
+8GBhceCFdyF+c3vKu1os3FrRra/BzXl1191rsyP/KloNgpfk4Cc6jb0Hkk
nyGxyTpT8i+Rx9h0oRCb+35QxTGr6xCzMcvo1VaZlWWNC914zjimMK0t81KT5o
0PsPwKdVGmLzCVBgij3Sp1Kcn+TMFcnaA/ySkbg2Wxt+V1QelRMpeCJ16ZmOT
BKGcpfhw84FgsVAp0AAEfCggABF4mknoJbw1qlGTC7Ldmx/Ow7bzcrcc0R
BQZEPm710T1SXZfdB15EJ81bMEwae8/c/k1Q0E1jm1xVLPh/kKEjV690012h
vkZVBPe1ngYxzh4A26HjjJrRxc1JgrJX67Jez8tsBeSYHqg5TJcqmdpkyc
wz7u13MqrzBSNHzeegacwA3xctie2197/bf2h1zKwes8cET9offhkf5739yjs
RrdQRmfNSiJxbYgs1z3CbGPk81aGz32JybhNOrkH80Jg/zazXtg/rL9UMGS9ehw
3KNC5ZBvdB71ND6TA90zYxxqcff7zez/yOnWzfkpyKeawryuqtq4lC4Uqv590
TV1arpx1p1001fq4qtsmtAGx7AeMr1u0EBEXxtWelladhbhW1lt3wacInOPXHy6u
QcqiYNTETCgBjPzS15Vn/Pz3CRkOhFKBYlnDz/PosPKOSiIvcmrmoa77R3Qbwx
hx49EWQp2z2fb714RFg1Tw5NvK2mRAoiBAOvch17+s1/wi/mvUHcn711+0313+
SM5A/pBNBt0zQOCmAT1wP172DGTAEG1S2zahb/pk01h4AC8uzPjZxRnwzkwzvAFy
HehhW70uXg4P1CmElym8zZM0/jouaScdeB8Fk4X48dJt85fgpwCDXc
GdnPw2gt4316pK05YlWEWh1mlfRwmRicpmSVSxJtAsz3euzr+19vv/rSw41pYc
jmyNZKUeh9rls tvZQeh1V4x/ADRa1twBwQ0jikWhg3PLjt3Yr1C1MfEu/Gxs
slwg2Kdm+y1ougsE9gy/1CmcprJmZmChut26xwIVk/Fykvpn1mlu9Nnfaw
31/cKJ69kRcGGVN9Se0sbk/YNlm.ahitJUc1Ave9MlJHCNG2AtjfgusoOp1/xg
u5mt3aEVm50mldkSh4ZP3014jpcA2nBkcdvgUu/5WVEYMA54XQMuwz1qP8
k1+3d2t8AkzY3hw8pkdahEaztufdf+4c1EouWcCgcAbTRvpVyy4Kko0ZJNY07A8
0vg86dXXX7L8RYGmgorBYK9o0qpPLR99ocKAn981jT311wQY0lRm1457z+Yd
TUB5XN6sQ5j1fDma+05mhv89N1mZT4ky/lssyvsvbJXTP2DRxTO4wz2X68A0C
TYyfxntXYk+jKxsX9XjihGUsgyIootlwpg50xb2R8D6ondChb270A7ImnAlia
kuY7AHFGwPYVGVSH8quuR0l11tg4c/egwCkTTbY4UCGcB632w3Cz0ouRiduHF
hiHPRTzYm10XPp0A8FLuA1MzaMcl1260b1hePOd4fZps9eXwfjX12kpuDvRe
cccf1a171/Bs09v9h0d2irXbWut+r75RowoR9wkv1d2dk1h071+p9TG
```

Got private key through command and connected to remote server with ssh command with private key

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CODE EXPLANATION

The HTML structure of the static website is designed with multiple semantic tags like `<header>`, `<nav>`, `<section>`, and `<footer>`. These provide clear divisions for user interface layout.

Styling was handled using embedded CSS, with a military green color scheme to reflect the Indian Army theme. Fonts were set explicitly to 'Times New Roman' to align with academic formatting requirements.

The website featured a responsive grid using:

```

```
display: grid;
```

```
grid-template-columns: repeat(auto-fit, minmax(250px, 1fr));
```

```

This layout adapts to screen size, making the site mobile-friendly. Additional features included image cards, YouTube video embeds for military showcases, and a 'Back to Top' button using JavaScript scroll behavior.

A screenshot of a code editor interface, likely VS Code, showing the file structure and code for a static website. The left sidebar shows an 'EXPLORER' view with 'OPEN EDITORS' containing 'htmlbasics.html' and 'HTML-CSS-CODE' containing 'If_Else' and '57u6'. The main area displays the 'htmlbasics.html' file with the following code:

```
<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <title>Indian Army: Strength & Technology</title>
    <style>
        * {
            margin: 0;
            padding: 0;
            box-sizing: border-box;
            font-family: 'Times New Roman', Times, serif;
        }

        body {
            background-color: #f5f5f5;
            color: #333;
            line-height: 1.6;
            font-size: 12px;
        }

        header {
            background-color: #2e3b2e;
            color: #fff;
            padding: 20px 0;
            text-align: center;
        }

        header h1 {
            margin-bottom: 10px;
            font-size: 16px;
        }

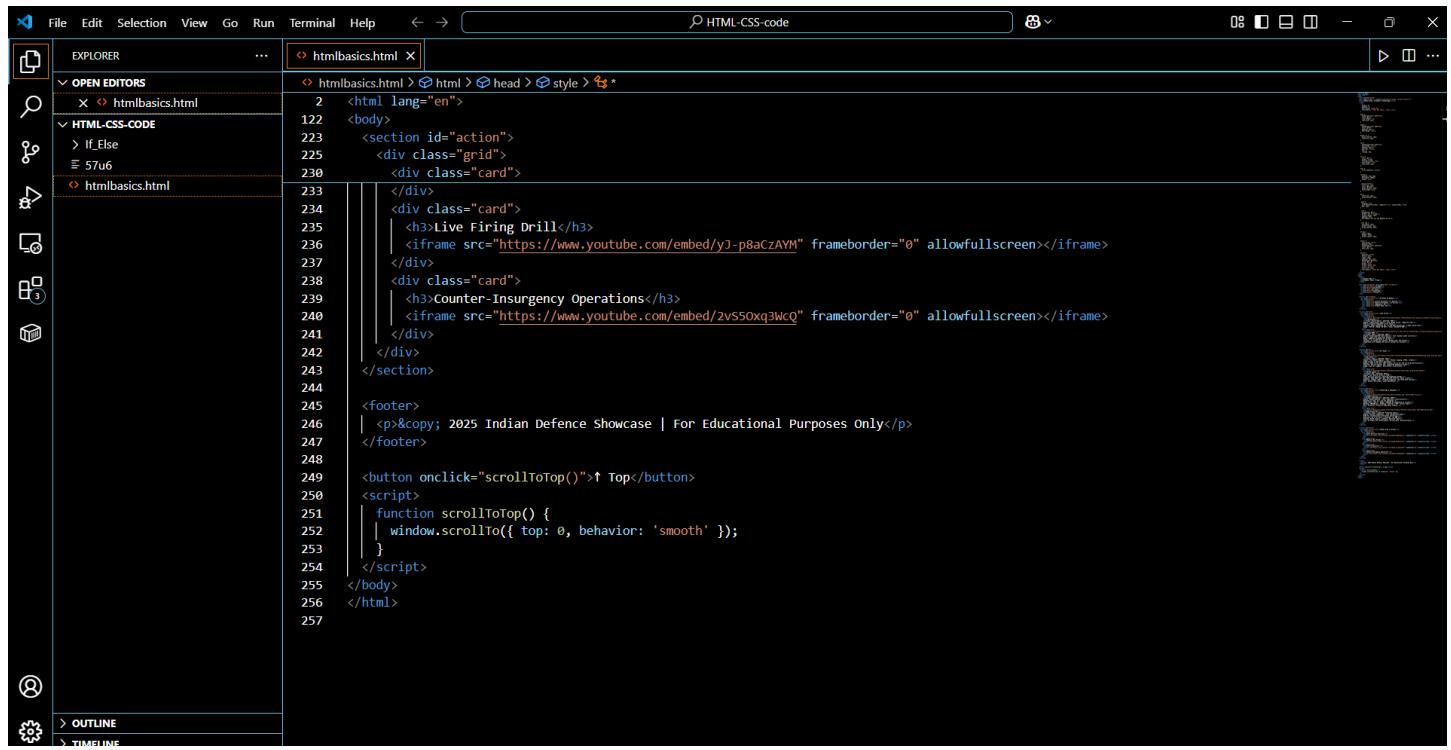
        nav {
            background-color: #1f2a1f;
            text-align: center;
            padding: 10px 0;
        }
    </style>

```

The status bar at the bottom indicates 'Ln 13, Col 6' and other system details like battery level and network status.

CSS Styling

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```
<html lang="en">
  <body>
    <section id="action">
      <div class="grid">
        <div class="card">
          </div>
          <div class="card">
            <h3>Live Firing Drill</h3>
            <iframe src="https://www.youtube.com/embed/yJ-p8aCzAYM" frameborder="0" allowfullscreen></iframe>
          </div>
          <div class="card">
            <h3>Counter-Insurgency Operations</h3>
            <iframe src="https://www.youtube.com/embed/2vs50xq3WcQ" frameborder="0" allowfullscreen></iframe>
          </div>
        </div>
      </section>
      <footer>
        <p>&copy; 2025 Indian Defence Showcase | For Educational Purposes Only</p>
      </footer>
      <button onclick="scrollToTop()">↑ Top</button>
      <script>
        function scrollToTop() {
          window.scrollTo({ top: 0, behavior: 'smooth' });
        }
      </script>
    </body>
  </html>
```

HTML code – structure

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NETWORK SECURITY CONFIGURATION

The VM's security posture was managed using Azure's Network Security Groups (NSG). Inbound rules were added to allow only HTTP (80), HTTPS (443), and SSH (22) traffic. SSH was restricted to the creator's IP to enhance access control.

These rules ensure minimum surface exposure to external threats. No unnecessary ports were left open. Azure also allows tracking of security metrics through its built-in security center, which helps identify misconfigurations.

The screenshot shows the Microsoft Azure portal interface for creating a new virtual machine. The top navigation bar includes 'Microsoft Azure', a search bar, and user account information. Below the header, the breadcrumb path 'Home > Create a resource > Create a virtual machine' is visible. The main content area is titled 'Create a virtual machine' with a green validation message 'Validation passed'. There are three help buttons: 'Help me create a low cost VM', 'Help me create a VM optimized for high availability', and 'Help me choose the right VM size for my workload'. The 'Review + create' tab is selected from a navigation bar that also includes 'Basics', 'Disks', 'Networking', 'Management', 'Monitoring', 'Advanced', and 'Tags'. Under the 'Price' section, it shows '1 X Standard B1s by Microsoft' at a cost of '0.9318 INR/hr'. It also notes 'Subscription credits apply' and provides a link to 'Pricing for other VM sizes'. The 'TERMS' section contains legal disclaimers about Microsoft's terms and privacy policy. At the bottom, there are fields for 'Name' (Shrijesh kumar Choubey) and 'Preferred e-mail address' (shrijesh.choubey_cs.aiml24@qla.ac.in). Below these are 'Previous' and 'Next >' buttons, and a prominent blue 'Create' button. To the right, there are links for 'Download a template for automation' and 'Give feedback'.

VM DEPLOYMENT SUCCESSFUL

The screenshot shows the Microsoft Azure portal interface for managing a Network Security Group (NSG). The top navigation bar includes 'Microsoft Azure', a search bar, and user account information. The left sidebar shows 'hoststaticwebsite-nsg' under 'Network security group' with options for 'Overview', 'Activity log', 'Access control (IAM)', 'Tags', 'Diagnose and solve problems', 'Resource visualizer', 'Settings', 'Monitoring', 'Automation', and 'Help'. The main content area is titled 'hoststaticwebsite-nsg' with a sub-section 'Inbound Security Rules'. It displays a table of rules:

Priority ↑	Name ↑	Port ↑	Protocol ↑	Source == all	Destination == all	Action == all	Action ↑
300	HTTP	80	TCP	Any	Any	Allow	
310	Allow-SSH	22	TCP	157.48.213.169	Any	Allow	
320	HTTPS	443	TCP	Any	Any	Allow	
65000	AllowVnetInBound	Any	Any	VirtualNetwork	VirtualNetwork	Allow	
65001	AllowAzureLoadBalancer...	Any	Any	AzureLoadBalancer	Any	Allow	
65500	DenyAllInBound	Any	Any	Any	Any	Deny	

Below this, there is a section for 'Outbound Security Rules' with two entries:

Priority ↑	Name ↑	Port ↑	Protocol ↑	Source == all	Destination == all	Action == all	Action ↑
65000	AllowVnetOutBound	Any	Any	VirtualNetwork	VirtualNetwork	Allow	
65001	AllowInternetOutBound	Any	Any	Any	Internet	Allow	
65500	DenyAllOutBound	Any	Any	Any	Any	Deny	

At the bottom, there is a note: 'Add or remove favorites by pressing Ctrl+Shift+F+F'.

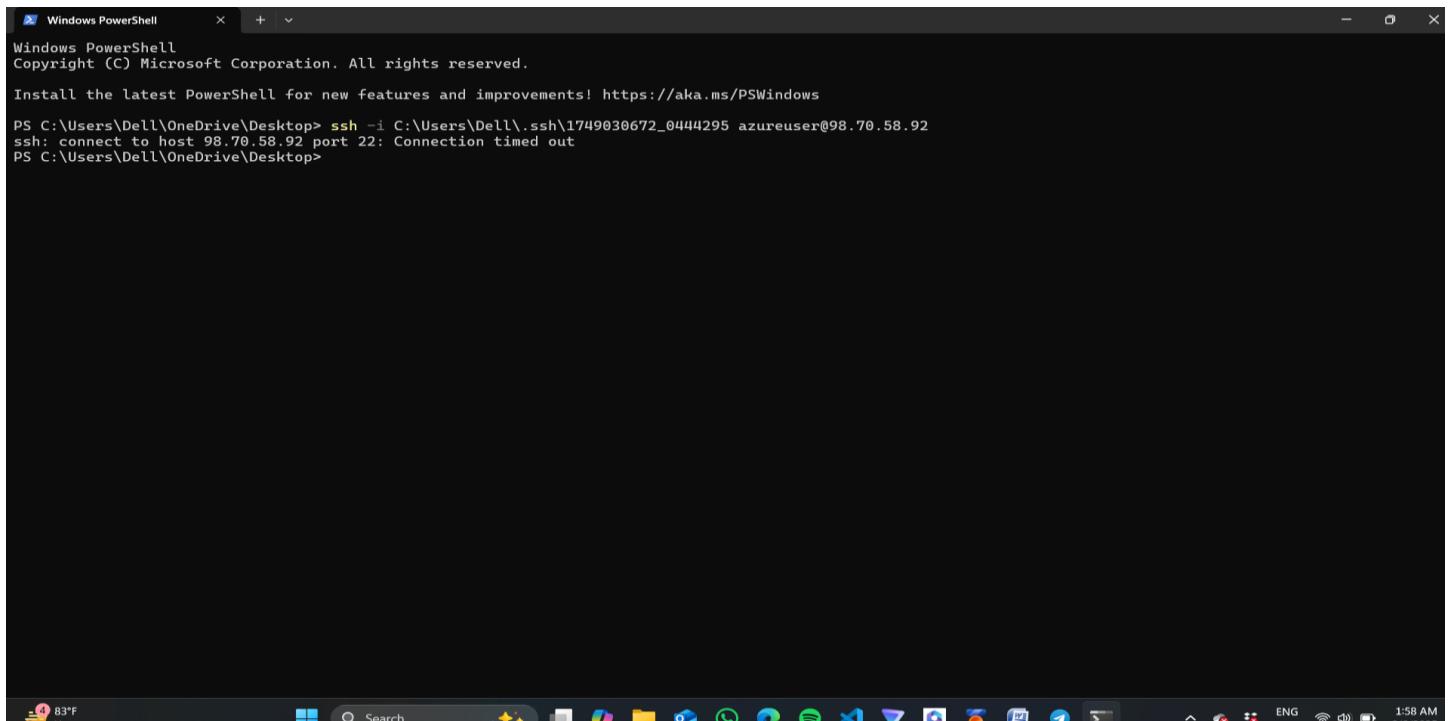
NSG Rules for HTTP, HTTPS, SSH

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DEPLOYMENT CHALLENGES

During deployment, the initial issue faced was SSH and HTTP port inaccessibility due to NSG misconfiguration. A `telnet` test revealed port blocks.

The solution was to manually edit NSG rules to ensure ports 22 and 80 were open to inbound connections. Image path issues due to local paths were fixed by correctly copying assets into the `/var/www/html/` folder and referencing them using relative links.

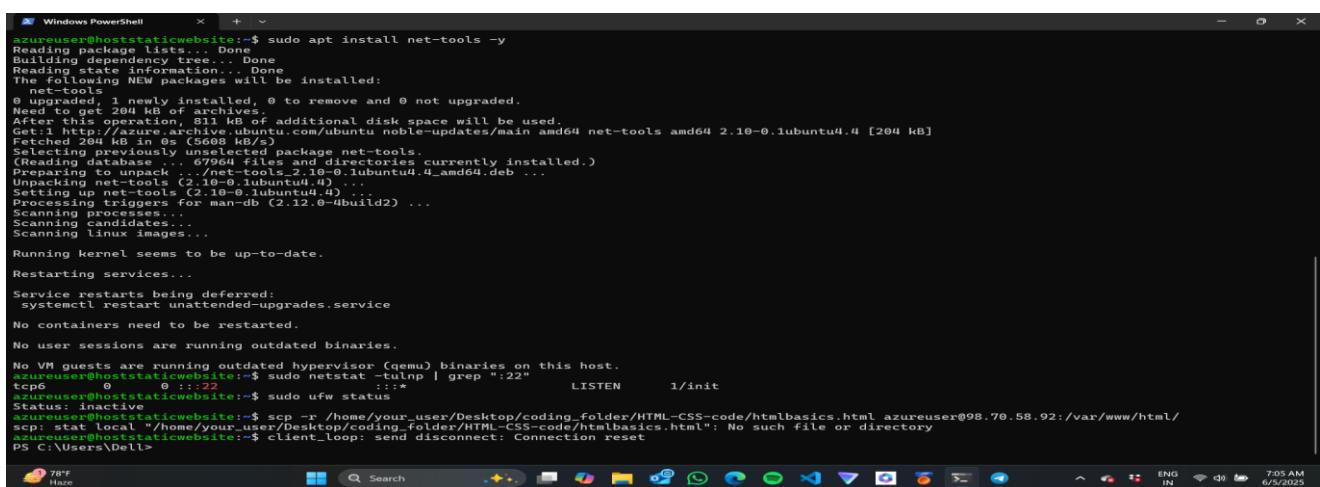


```
Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.

Install the latest PowerShell for new features and improvements! https://aka.ms/PSWindows

PS C:\Users\OneDrive\Desktop> ssh -i C:\Users\OneDrive\Desktop\ssh\1749030672_0444295 azureuser@98.70.58.92
ssh: connect to host 98.70.58.92 port 22: Connection timed out
PS C:\Users\OneDrive\Desktop>
```

ssh connection timed out – due to port - 22



```
Windows PowerShell
azureuser@hoststaticwebsite:~$ sudo apt install net-tools -y
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following NEW packages will be installed:
  net-tools
0 upgraded, 1 newly installed, 0 to remove and 0 not upgraded.
Need to get 204 kB of archives.
After this operation, 816 kB of additional disk space will be used.
Get:1 http://ubuntu.archive.ubuntu.com/ubuntu focal-updates/main amd64 net-tools amd64 2.10-0.lubuntu4.4 [204 kB]
Fetched 204 kB in 0s (5668 kB/s)
Selecting previously unselected package net-tools.
(Reading database ... 6999 files and directories currently installed.)
Preparing to unpack .../net-tools_2.10-0.lubuntu4.4_amd64.deb ...
Unpacking net-tools (2.10-0.lubuntu4.4) ...
Setting up net-tools (2.10-0.lubuntu4.4) ...
Processing triggers for man-db (2.12.0-4build2) ...
Scanning processes...
Scanning candidates...
Scanning linux images...
Running kernel seems to be up-to-date.
Restarting services...
Service restarts being deferred:
systemctl restart unattended-upgrades.service
No containers need to be restarted.
No user sessions are running outdated binaries.

No VM guests are running outdated hypervisor (Qemu) binaries on this host.
azureuser@hoststaticwebsite:~$ sudo netstat -tulpn | grep ":22"
tcp        0      0 0.0.0.0:22              0.0.0.0:*                LISTEN      1/init
azureuser@hoststaticwebsite:~$ sudo ufw status
Status: inactive
azureuser@hoststaticwebsite:~$ acc -r /home/your_user/Desktop/coding_folder/HTML-CSS-code/htmlbasics.html azureuser@98.70.58.92:/var/www/html/
azureuser@hoststaticwebsite:~$ client_loop: send disconnect: Connection reset
PS C:\Users\OneDrive\Desktop>
```

other major problems faced due to sudo command not operating properly

Cloud Computing Project Report

```
azureuser@hoststaticwebsite: ~ + ~
just raised the bar for easy, resilient and secure K8s cluster deployment.

https://ubuntu.com/engage/secure-kubernetes-at-the-edge

Expanded Security Maintenance for Applications is not enabled.

0 updates can be applied immediately.

Enable ESM Apps to receive additional future security updates.
See https://ubuntu.com/esm or run: sudo pro status

Last login: Thu Jun  5 15:29:41 2025 from 157.48.213.169
azureuser@hoststaticwebsite:~$ scp -i C:\Users\DELL\ssh\1749030672_0444295 your-website-folder/* azureuser@98.70.58.92:/var/www/html/
scp: stat local "your-website-folder/*": No such file or directory
azureuser@hoststaticwebsite:~$ sudo apt update && sudo apt install nginx -y
Hit:1 http://azure.archive.ubuntu.com/ubuntu noble InRelease
Get:2 http://azure.archive.ubuntu.com/ubuntu noble-updates InRelease [126 kB]
Hit:3 http://azure.archive.ubuntu.com/ubuntu noble-backports InRelease
Hit:4 http://azure.archive.ubuntu.com/ubuntu noble-security InRelease
Get:5 http://azure.archive.ubuntu.com/ubuntu noble-updates/main amd64 Packages [1112 kB]
Hit:6 https://packages.microsoft.com/repos/azure-cli noble InRelease
Get:7 http://azure.archive.ubuntu.com/ubuntu noble-updates/universe amd64 Packages [1070 kB]
Fetched 2309 kB in 1s (2281 kB/s)
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
2 packages can be upgraded. Run 'apt list --upgradable' to see them.
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
nginx is already the newest version (1.24.0-2ubuntu7.3).
0 upgraded, 0 newly installed, 0 to remove and 2 not upgraded.
azureuser@hoststaticwebsite:~$ scp -i C:\Users\DELL\ssh\1749030672_0444295 your-website-folder/* azureuser@98.70.58.92:/var/www/html/
scp: stat local "your-website-folder/*": No such file or directory
azureuser@hoststaticwebsite:~$ ls ~/your-website-folder
ls: cannot access '/home/azureuser/your-website-folder': No such file or directory
azureuser@hoststaticwebsite:~$ scp -i C:\Users\DELL\ssh\1749030672_0444295 "C:\Users\DELL\OneDrive\Desktop\coding folder\HTML-CSS-code\htmlbasics.html" azu
reuser@98.70.58.92:/var/www/html/
Warning: Identity file C:\Users\DELL\ssh\1749030672_0444295 not accessible: No such file or directory.
^[[
```

83°F Haze Windows 10 Taskbar showing various pinned and running applications like File Explorer, Microsoft Edge, and others. System tray shows battery level, signal strength, and date/time.

Errors occurred with secured copy protocol

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TESTING & VALIDATION

After deployment, the site was tested by visiting the public IP in a browser (<http://98.70.58.92/htmlbasics.html>). The site loaded successfully on both desktop and mobile browsers.

Additionally, Nginx service status was confirmed with:

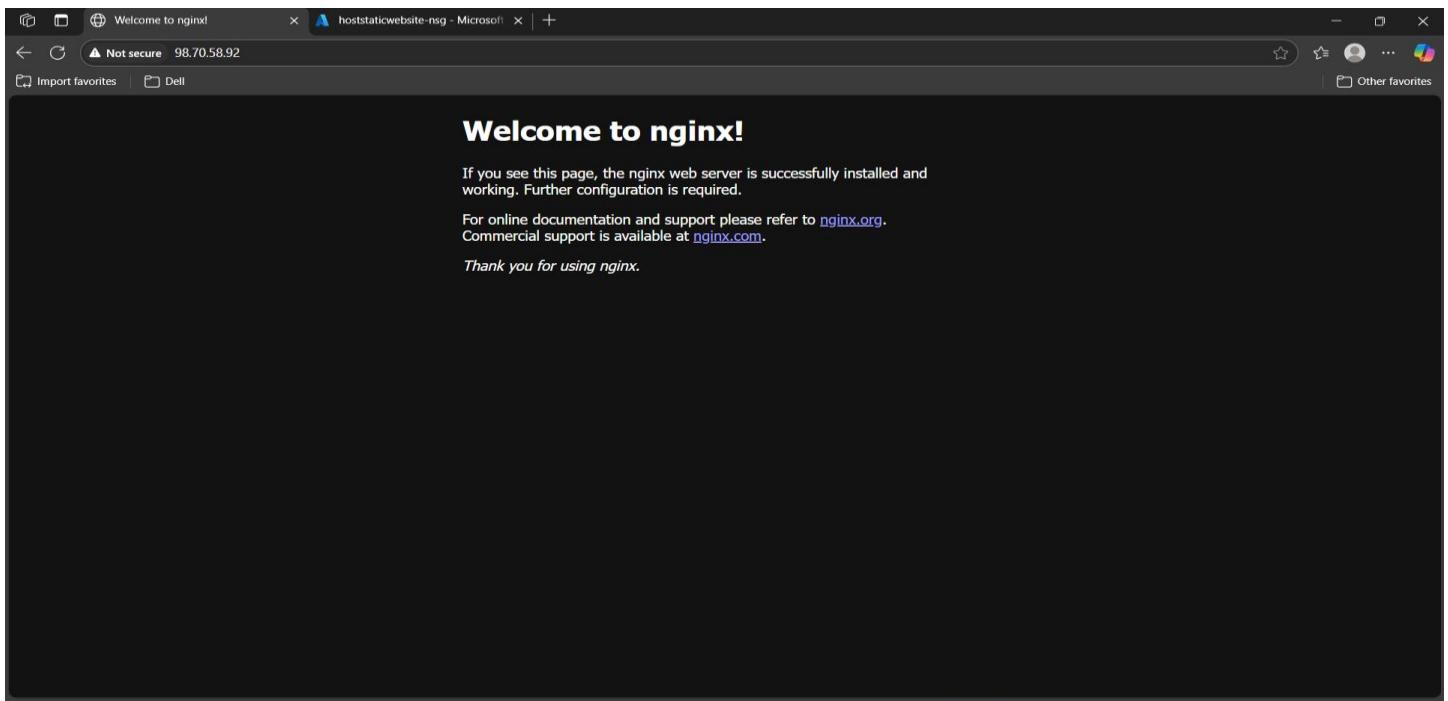
systemctl status nginx

The Azure dashboard was checked to confirm that the VM status was 'Running' and inbound port traffic was being handled correctly.

The screenshot shows the Microsoft Azure portal interface for creating a new virtual machine. The top navigation bar includes 'Microsoft Azure', a search bar, and various icons. The main title is 'Create a virtual machine'. Below the title, there are three help buttons: 'Help me create a low cost VM', 'Help me create a VM optimized for high availability', and 'Help me choose the right VM size for my workload'. The 'Management' tab is selected, while 'Basics', 'Disks', 'Networking', 'Monitoring', 'Advanced', 'Tags', and 'Review + create' are also listed. A sub-section titled 'Configure management options for your VM' discusses Microsoft Defender for Cloud, stating it provides unified security management and advanced threat protection across hybrid cloud workloads. It notes that the subscription is protected by the Foundational Cloud Security Posture Management Free Plan. Under the 'Identity' section, there is an option to 'Enable system assigned managed identity' with a checked checkbox. The 'Microsoft Entra ID' section includes an option to 'Login with Microsoft Entra ID' with an unchecked checkbox, accompanied by a note about RBAC role assignment. At the bottom, there are navigation buttons for '< Previous', 'Next : Monitoring >', and 'Review + create', along with a 'Give feedback' link.

Deployed Website Preview

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Nginx service status confirmed

```
azureuser@hoststaticwebsite: ~ + ^

Hit:4 http://archive.ubuntu.com/ubuntu noble-security InRelease
Get:5 http://archive.ubuntu.com/ubuntu noble-updates/main amd64 Packages [1112 kB]
Hit:6 https://packages.microsoft.com/repos/azure-cli noble InRelease
Get:7 http://archive.ubuntu.com/ubuntu noble-updates/universe amd64 Packages [1070 kB]
Fetched 2309 kB in 1s (2281 kB/s)
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
2 packages can be upgraded. Run 'apt list --upgradable' to see them.
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
nginx is already the newest version (1.24.0-2ubuntu7.3).
0 upgraded, 0 newly installed, 0 to remove and 2 not upgraded.
azureuser@hoststaticwebsite:~$ scp -i C:\Users\DELL\ssh\1749030672_0444295 your-website-folder/* azureuser@98.70.58.92:/var/www/html/
scp: stat local "your-website-folder/*": No such file or directory
azureuser@hoststaticwebsite:~$ ls ~/your-website-folder
ls: cannot access '/home/azureuser/your-website-folder': No such file or directory
azureuser@hoststaticwebsite:~$ scp -i C:\Users\DELL\ssh\1749030672_0444295 "C:\Users\DELL\OneDrive\Desktop\coding folder\HTML-CSS-code\htmlbasics.html" azureuser@98.70.58.92:/var/www/html/
Warning: Identity file C:\Users\DELL\ssh\1749030672_0444295 not accessible: No such file or directory.
^[ssh: connect to host 98.70.58.92 port 22: Connection timed out
scp: Connection closed
azureuser@hoststaticwebsite:~$ [200~systemctl status nginx~
[200~systemctl: command not found
azureuser@hoststaticwebsite:~$ systemctl status nginx
● nginx.service - A high performance web server and a reverse proxy server
   Loaded: loaded (/usr/lib/systemd/system/nginx.service; enabled; preset: enabled)
     Active: active (running) since Thu 2025-06-05 20:42:17 UTC; 1min ago
       Docs: man:nginx(8)
      Main PID: 821 (nginx)
         Tasks: 2 (limit: 1056)
        Memory: 2.7M (peak: 3.3M)
          CPU: 18ms
        CGroup: /system.slice/nginx.service
            └─821 "nginx: master process /usr/sbin/nginx -g daemon on; master_process on;"
               ├─822 "nginx: worker process"
Jun 05 20:42:16 hoststaticwebsite systemd[1]: Starting nginx.service - A high performance web server and a reverse proxy server...
Jun 05 20:42:17 hoststaticwebsite systemd[1]: Started nginx.service - A high performance web server and a reverse proxy server.
azureuser@hoststaticwebsite:~$ |
```

System status - Active

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SECURITY BEST PRACTICES

Key practices followed include:

- SSH key authentication (disabling password login)
- IP whitelisting for SSH in NSG
- Only opening essential ports
- Installing only necessary software packages
- Keeping the system up to date with `apt upgrade`
- Avoiding root user login by using 'azureuser' with limited privileges.

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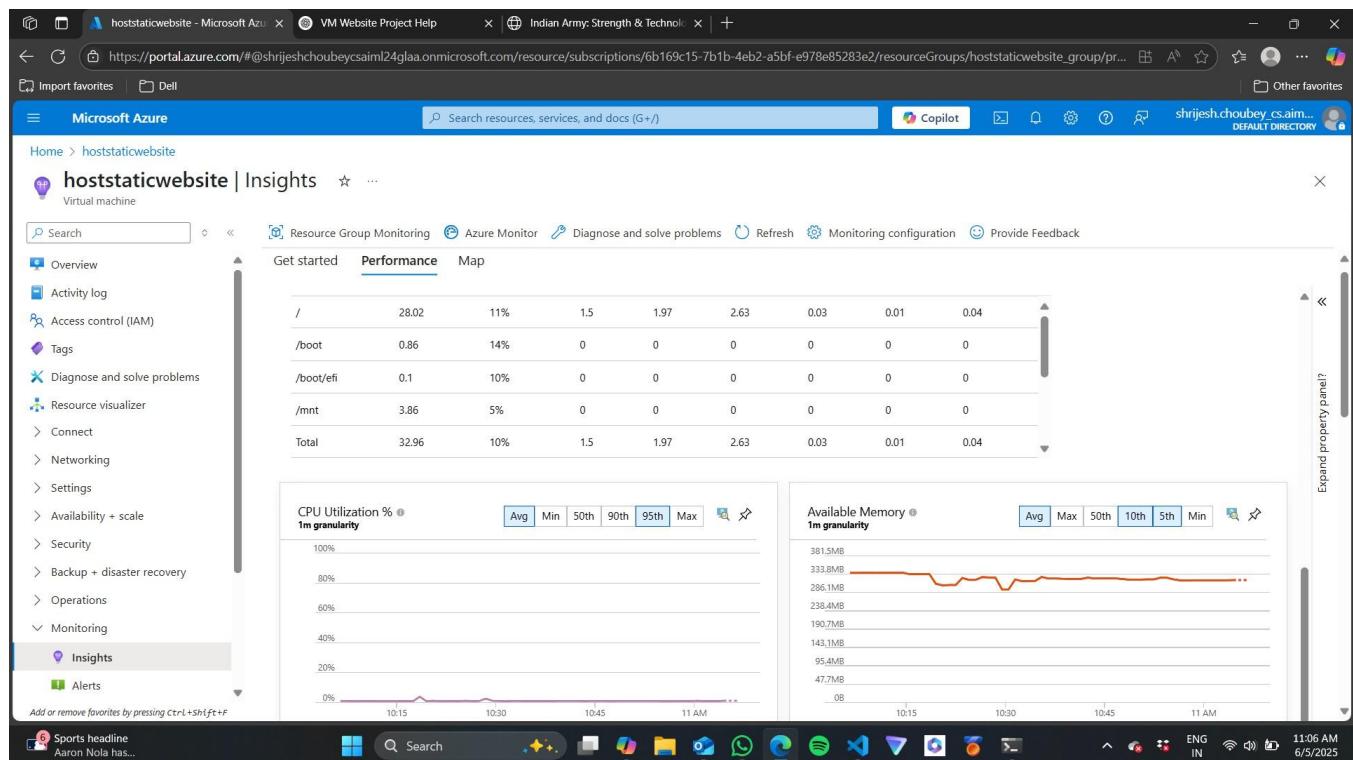
PERFORMANCE MONITORING

Azure Monitor and built-in diagnostics tools were used to track resource usage. CPU and RAM metrics showed the VM was operating well below capacity. This confirms that a Standard_B1s instance is sufficient for small static websites.

Installed Azure extensions include:

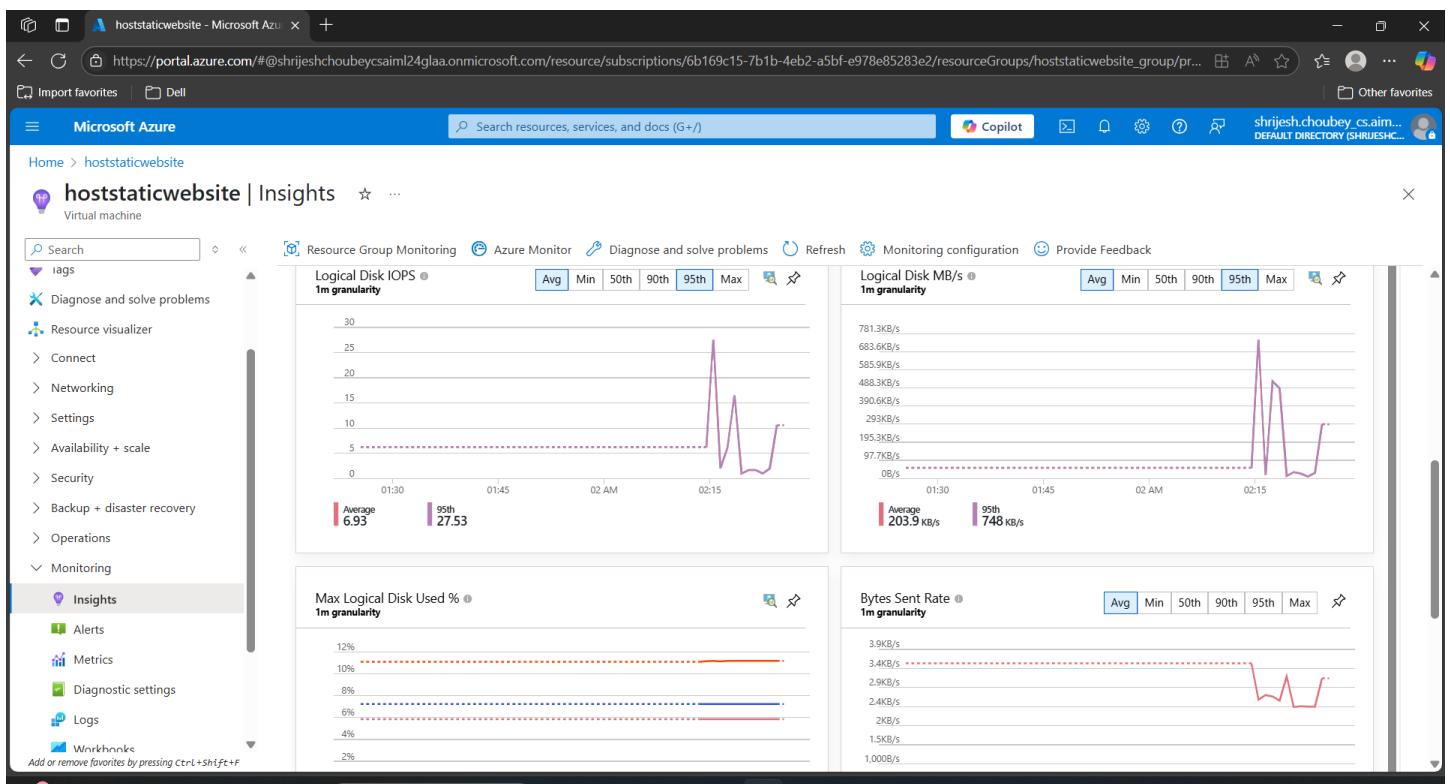
- Azure Monitor Linux Agent
- Azure Performance Diagnostics

These provide real-time metrics and enable performance tracing if needed.

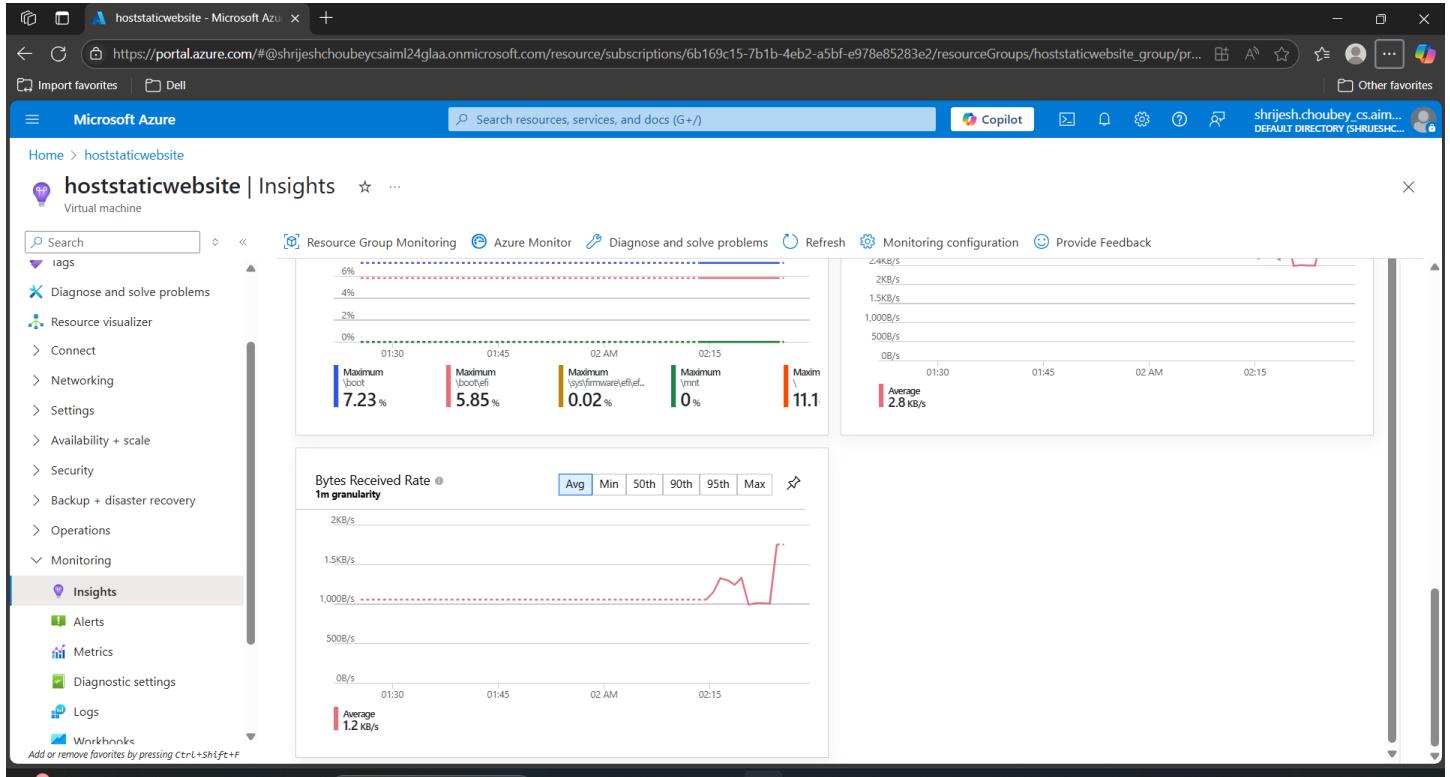


Azure Monitor - CPU and RAM Insights

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Disk running performance



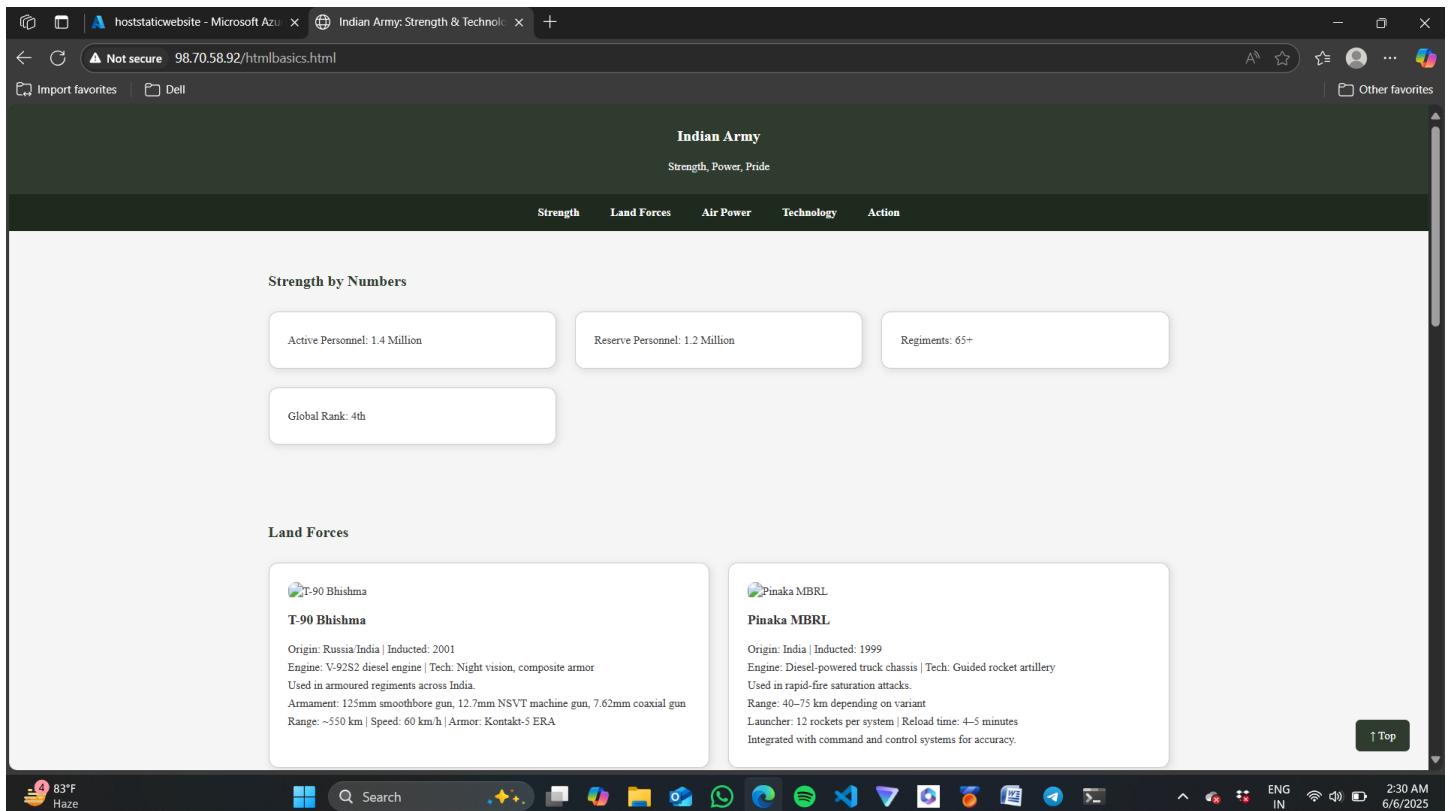
Other monitoring insights – bytes received rate

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CONCLUSION

This project demonstrated a real-world example of provisioning a VM on Azure, configuring it securely, deploying a static website, and validating performance.

Students gain insights into cloud networking, web servers, file transfer security, and performance metrics. Future extensions could include deploying a React or Flask app, adding an SSL certificate via Let's Encrypt, or setting up a CI/CD deployment pipeline.



Website successfully working

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REFERENCES

- Microsoft Azure Documentation: <https://learn.microsoft.com/en-us/azure/>
- Ubuntu Documentation: <https://ubuntu.com/>
- Nginx Documentation: <https://nginx.org/en/docs/>
- Mozilla Developer Network (HTML/CSS): <https://developer.mozilla.org/>
- ChatGPT by OpenAI (for technical explanations)