

## Lab23– Understanding Availability Set and Load balancer – Azure

### Availability set

An Availability Set is a logical grouping capability that you can use in Azure to ensure that the VM resources you place within it are isolated from each other when they are deployed within an Azure datacenter. Azure ensures that the VMs you place within an Availability Set run across multiple physical servers, compute racks, storage units, and network switches. If a hardware or Azure software failure occurs, only a subset of your VMs are impacted, and your overall application stays up and continues to be available to your customers. Availability Sets are an essential capability when you want to build reliable cloud solutions.

Let's consider a typical VM-based solution where you might have four front-end web servers and 2 back-end VMs. With Azure, you'd want to define two availability sets before you deploy your VMs: one availability set for the web tier and one availability set for the back tier. When you create a new VM you can then specify the availability set as a parameter to the az vm create command, and Azure automatically ensures that the VMs you create within the available set are isolated across multiple physical hardware resources. If the physical hardware that one of your Web Server or back-end VMs is running on has a problem, you know that the other instances of your Web Server and back-end VMs remain running because they are on different hardware.

Use Availability Sets when you want to deploy reliable VM-based solutions in Azure.

### Load Balancer

With Azure Load Balancer, you can scale your applications and create high availability for your services. Load Balancer supports inbound and outbound scenarios, provides low latency and high throughput, and scales up to millions of flows for all TCP and UDP applications.

Load Balancer distributes new inbound flows that arrive on the Load Balancer's frontend to backend pool instances, according to rules and health probes.

Additionally, a public Load Balancer can provide outbound connections for virtual machines (VMs) inside your virtual network by translating their private IP addresses to public IP addresses.

Azure Load Balancer is available in two SKUs: Basic and Standard. There are differences in scale, features, and pricing. Any scenario that's possible with Basic Load Balancer can also be created with Standard Load Balancer, although the approaches might differ slightly. As you learn about Load Balancer, it is important to familiarize yourself with the fundamentals and SKU-specific differences.

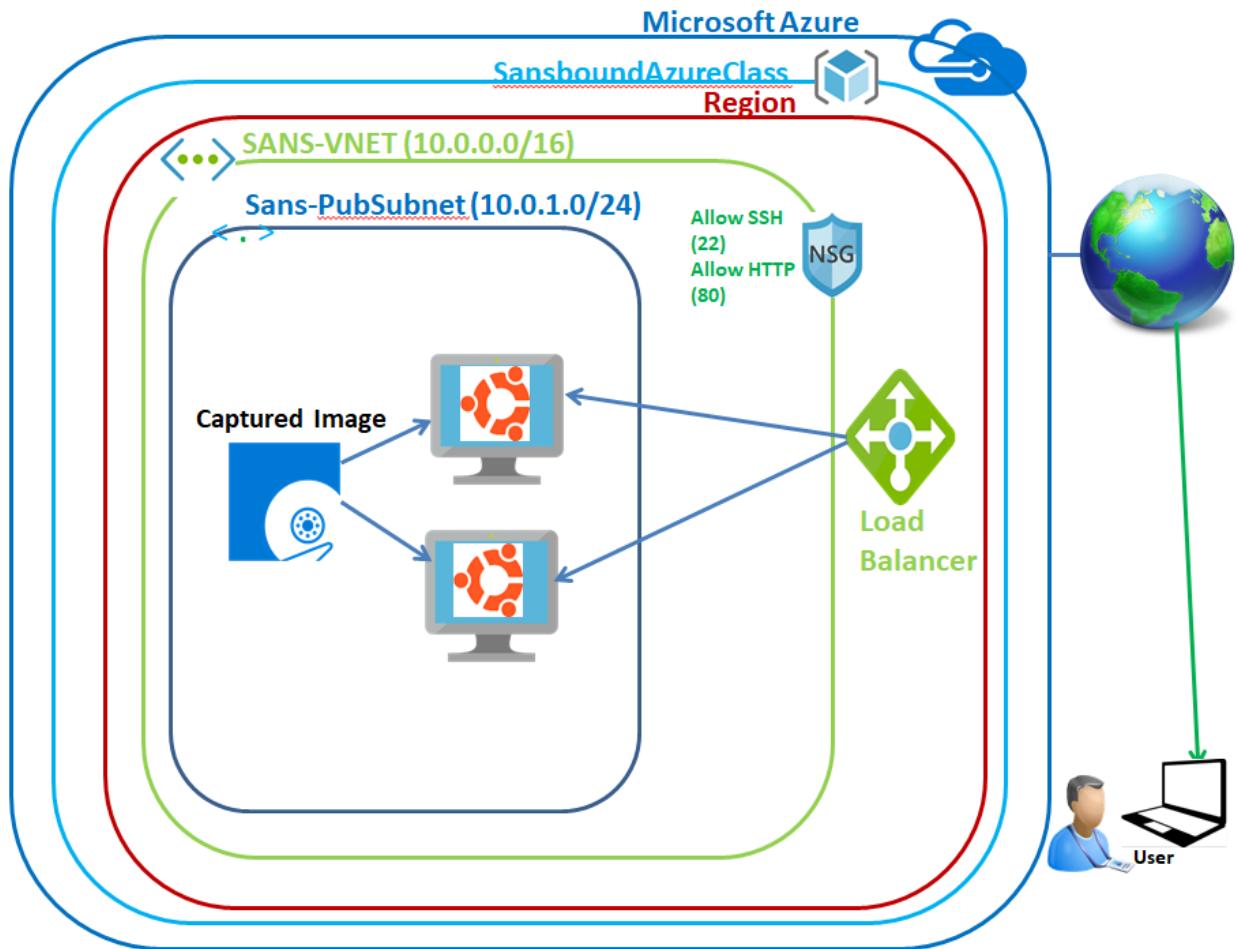
## Why use Load Balancer?

You can use Azure Load Balancer to:

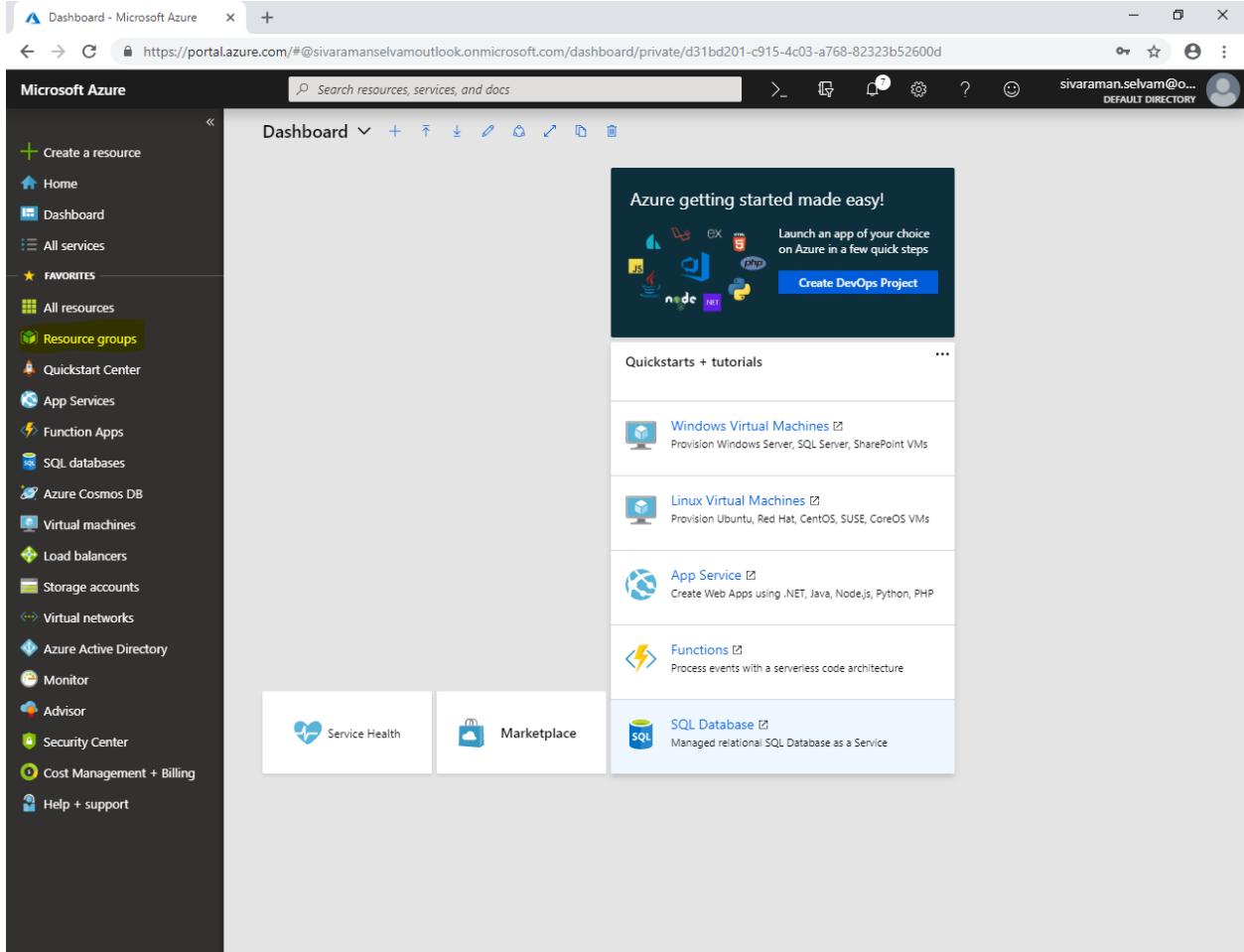
- Load-balance incoming internet traffic to your VMs. This configuration is known as a [Public Load Balancer](#).
- Load-balance traffic across VMs inside a virtual network. You can also reach a Load Balancer front end from an on-premises network in a hybrid scenario. Both scenarios use a configuration that is known as an [Internal Load Balancer](#).
- Port forward traffic to a specific port on specific VMs with inbound network address translation (NAT) rules.
- Provide [outbound connectivity](#) for VMs inside your virtual network by using a public Load Balancer.

### Note

Azure provides a suite of fully managed load-balancing solutions for your scenarios. If you are looking for Transport Layer Security (TLS) protocol termination ("SSL offload") or per-HTTP/HTTPS request, application-layer processing, review [Application Gateway](#). If you are looking for global DNS load balancing, review [Traffic Manager](#). Your end-to-end scenarios might benefit from combining these solutions as needed.

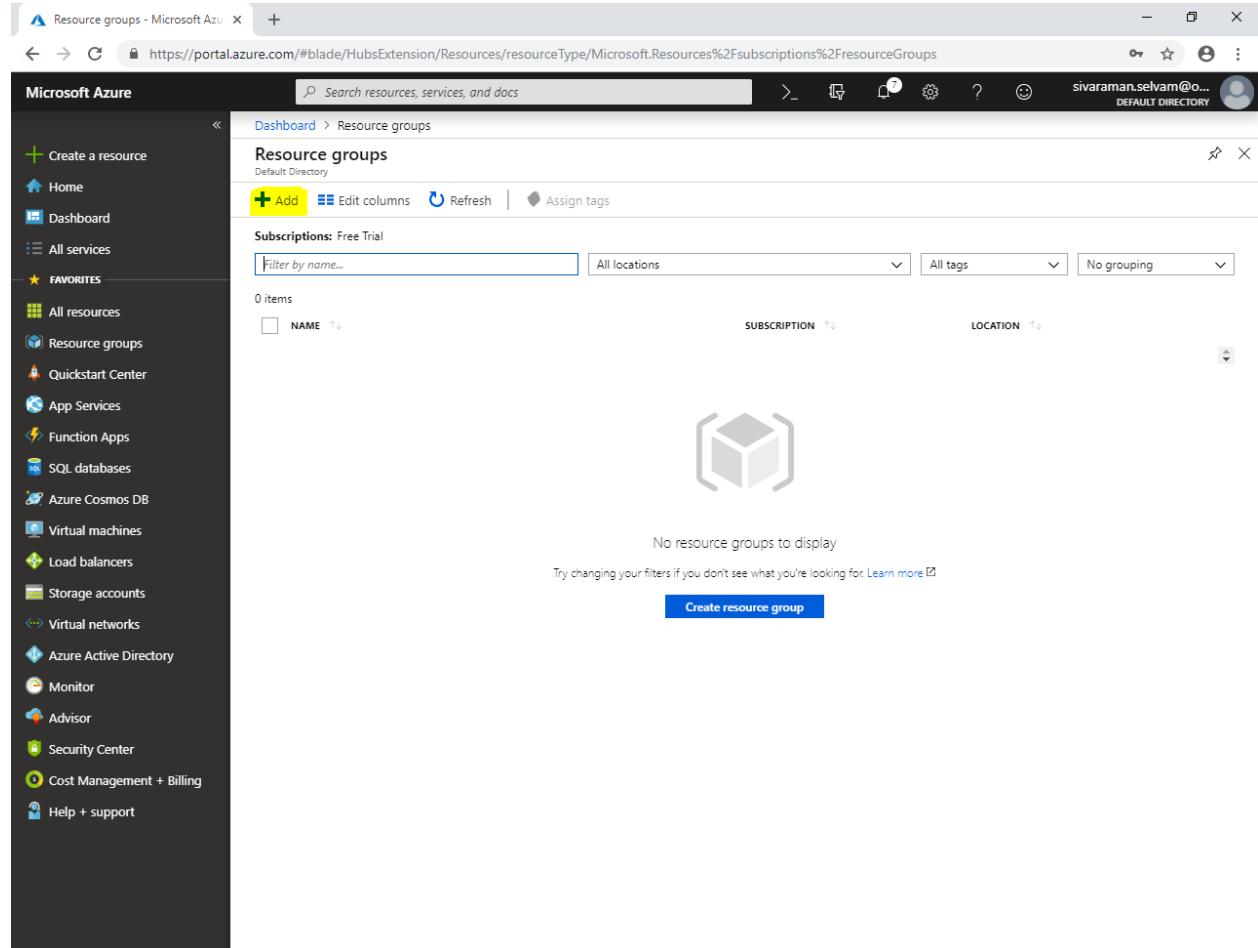
**Topology:**

In Azure portal, click “Resource groups”.



The screenshot shows the Microsoft Azure portal interface. On the left, a dark sidebar lists various services under "FAVORITES", with "Resource groups" highlighted by a yellow box. The main content area displays a "Dashboard" with a central box titled "Azure getting started made easy!" featuring icons for various services like Node.js, Python, and Java. Below this are sections for "Quickstarts + tutorials" and "Service Health". At the bottom of the sidebar, there are links for "Marketplace" and "Help + support".

Click "Add".



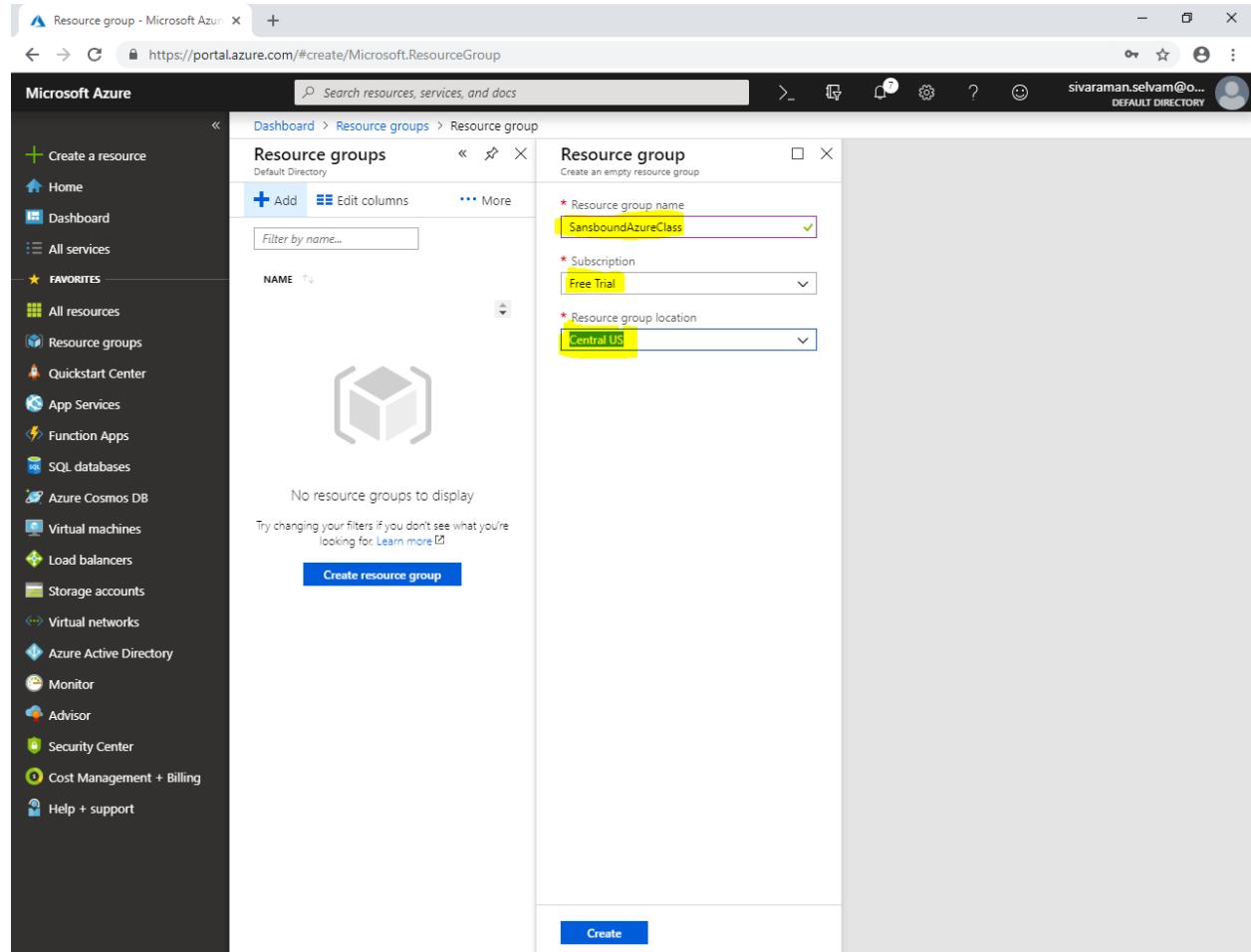
The screenshot shows the Microsoft Azure Resource Groups page. The left sidebar contains a navigation menu with various services like Home, Dashboard, All services, and Favorites. Under Favorites, 'Resource groups' is selected. The main content area is titled 'Resource groups' and shows a table with one column header: 'NAME'. A large, semi-transparent watermark of a 3D cube is overlaid on the page. At the top of the content area, there is a search bar and several filter options: 'Filter by name...', 'All locations', 'All tags', and 'No grouping'. Below the search bar, it says 'Subscriptions: Free Trial'. The table below shows '0 items'. A message 'No resource groups to display' is centered, followed by a note 'Try changing your filters if you don't see what you're looking for. Learn more' and a blue 'Create resource group' button.

While create “Resource group”,

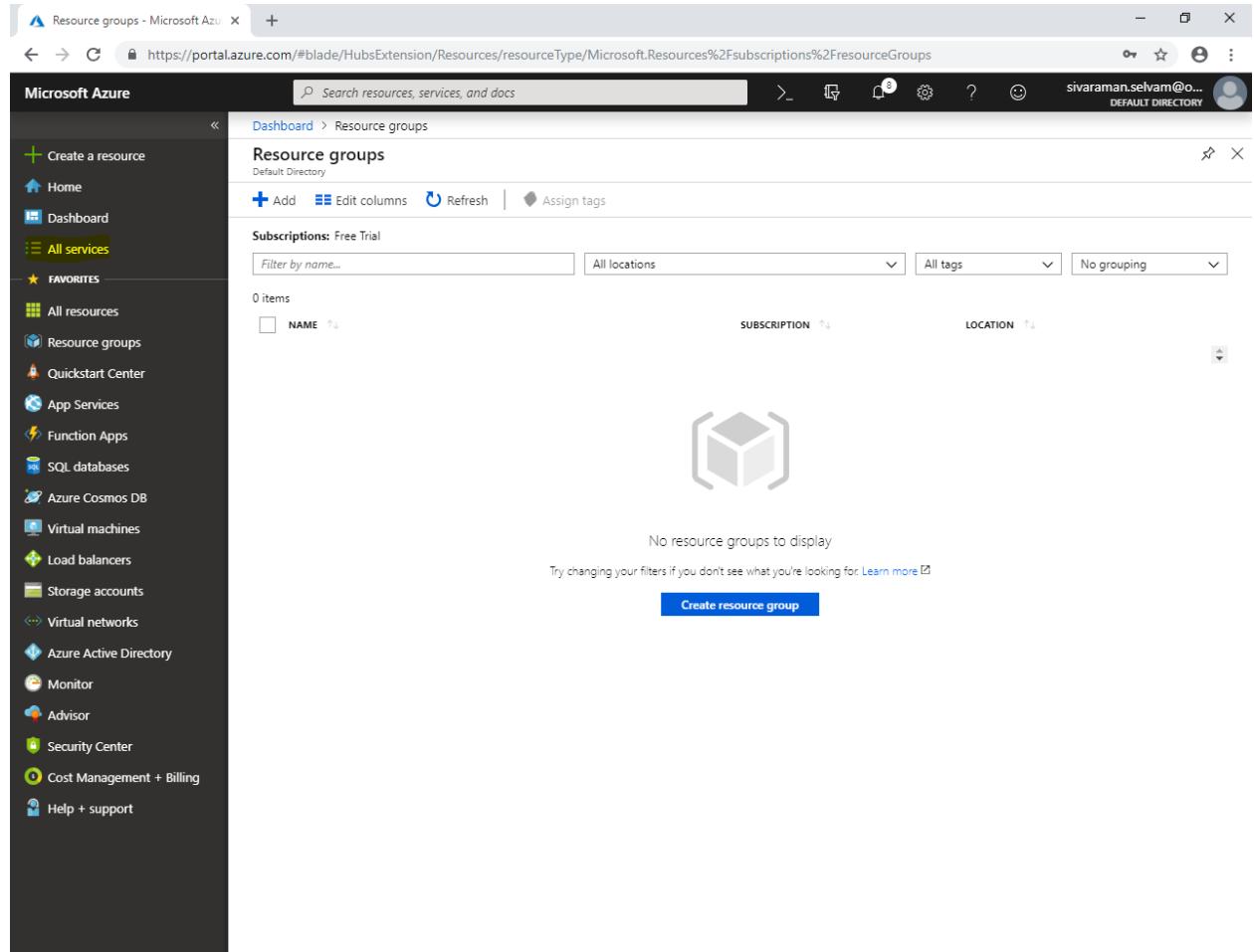
Type “Resource group name” as “**SansboundAzureClass**”.

Select “Resource group location” as “**CentralUS**”.

Click “**Create**”.



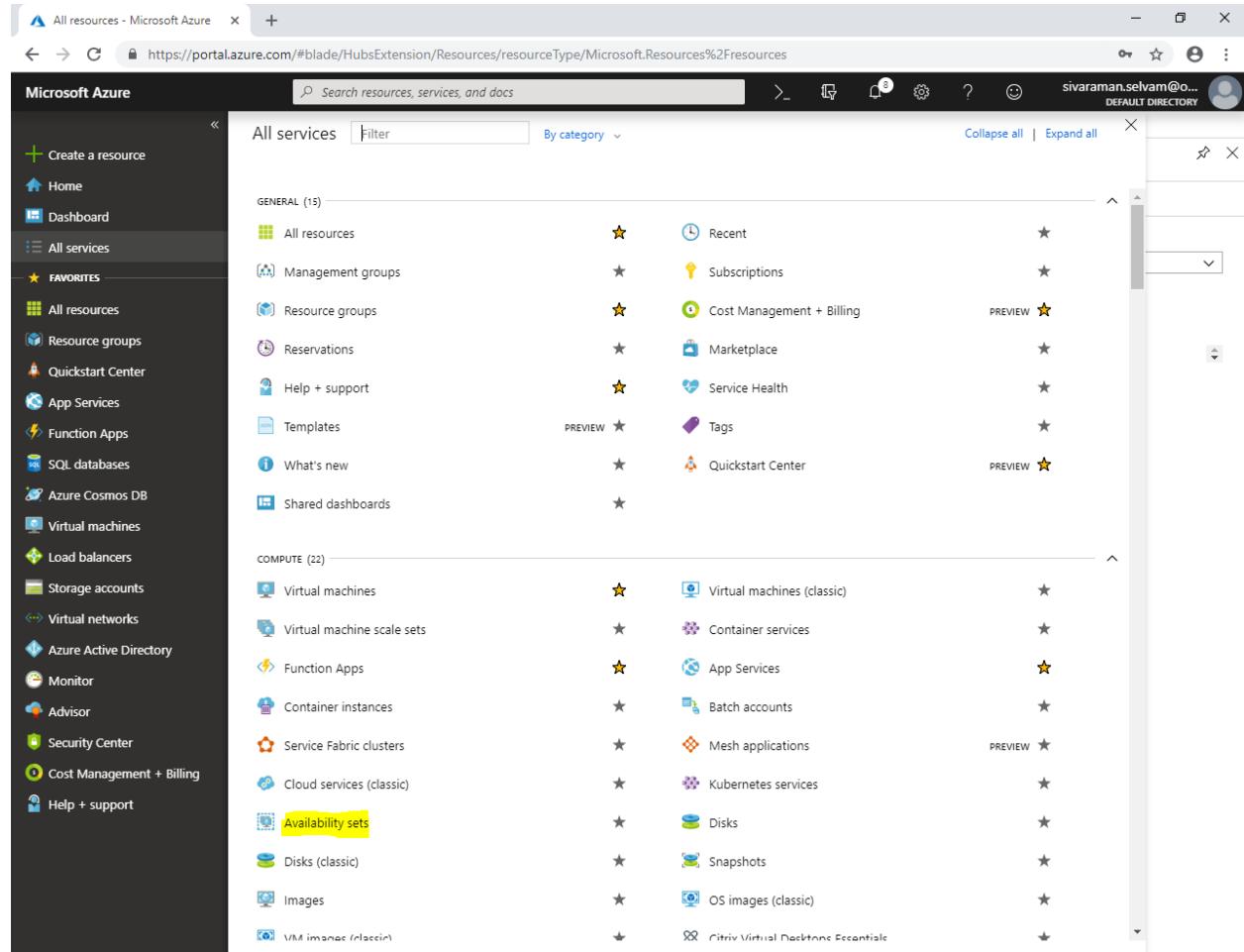
Click "All services",



The screenshot shows the Microsoft Azure portal interface. The left sidebar has a dark theme with various service icons and names. The 'All services' option is highlighted with a yellow background. The main content area is titled 'Resource groups' and shows a message 'No resource groups to display'. It includes a 'Create resource group' button and filter options for 'NAME', 'SUBSCRIPTION', and 'LOCATION'. The top navigation bar shows the URL as https://portal.azure.com/#blade/HubsExtension/Resources/resourceType/Microsoft.Resources%2Fsubscriptions%2FresourceGroups and the user's email as sivaraman.selvam@o... .

In "All services",

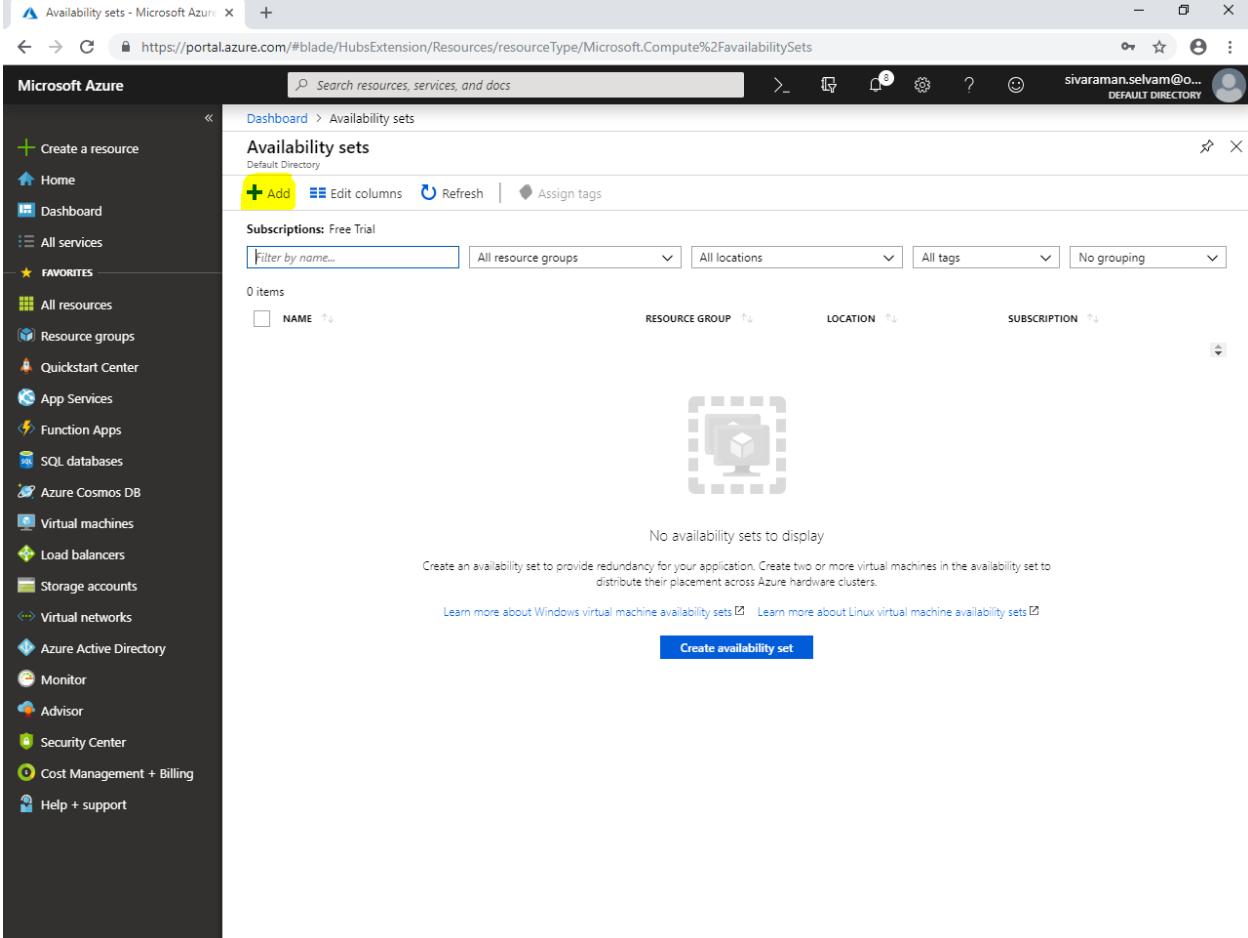
Click "Availability sets".



The screenshot shows the Microsoft Azure portal's 'All services' blade. On the left is a dark sidebar with various service icons and names. The 'All services' icon is selected. The main area lists services under two categories: 'GENERAL (15)' and 'COMPUTE (22)'. In the 'GENERAL' category, 'Availability sets' is listed and highlighted with a yellow box. In the 'COMPUTE' category, several options like Virtual machines, Container services, App Services, etc., are listed.

In “Availability sets”,

Click “Add”.



The screenshot shows the Microsoft Azure portal interface. The left sidebar contains a list of services: Create a resource, Home, Dashboard, All services, Favorites (All resources, Resource groups, Quickstart Center, App Services, Function Apps, SQL databases, Azure Cosmos DB, Virtual machines, Load balancers, Storage accounts, Virtual networks, Azure Active Directory, Monitor, Advisor, Security Center, Cost Management + Billing, Help + support). The main content area is titled "Availability sets" under "Default Directory". It shows a table with columns: NAME, RESOURCE GROUP, LOCATION, and SUBSCRIPTION. A large "No items" message is displayed above the table. Below the table, there is a note: "Create an availability set to provide redundancy for your application. Create two or more virtual machines in the availability set to distribute their placement across Azure hardware clusters." Two links are provided: "Learn more about Windows virtual machine availability sets" and "Learn more about Linux virtual machine availability sets". A prominent blue "Create availability set" button is located at the bottom of the page.

While create availability set,

Type “**Name**” as “**Sans-Cluster**”.

Select “**Subscription**” as “**Free Trial**”.

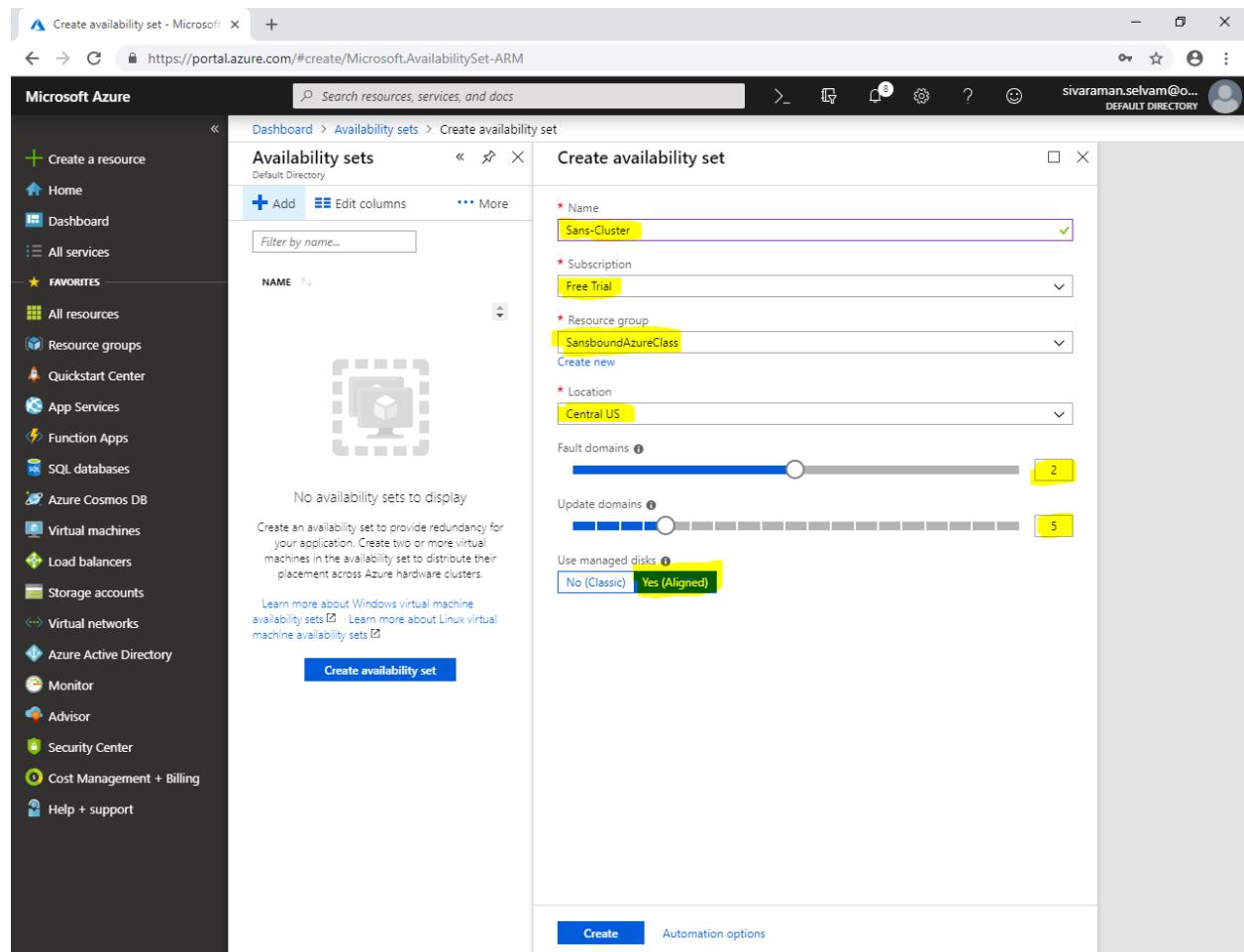
Select “**Resource group**” as “**SansboundAzureClass**”.

Select “**Location**” as “**Central US**”.

Default fault domain as “**2**” for (Free Trial account).

Update domains : Reserved : **5 No's**

Ensure “**Use Managed disks**” as “**Yes**”.

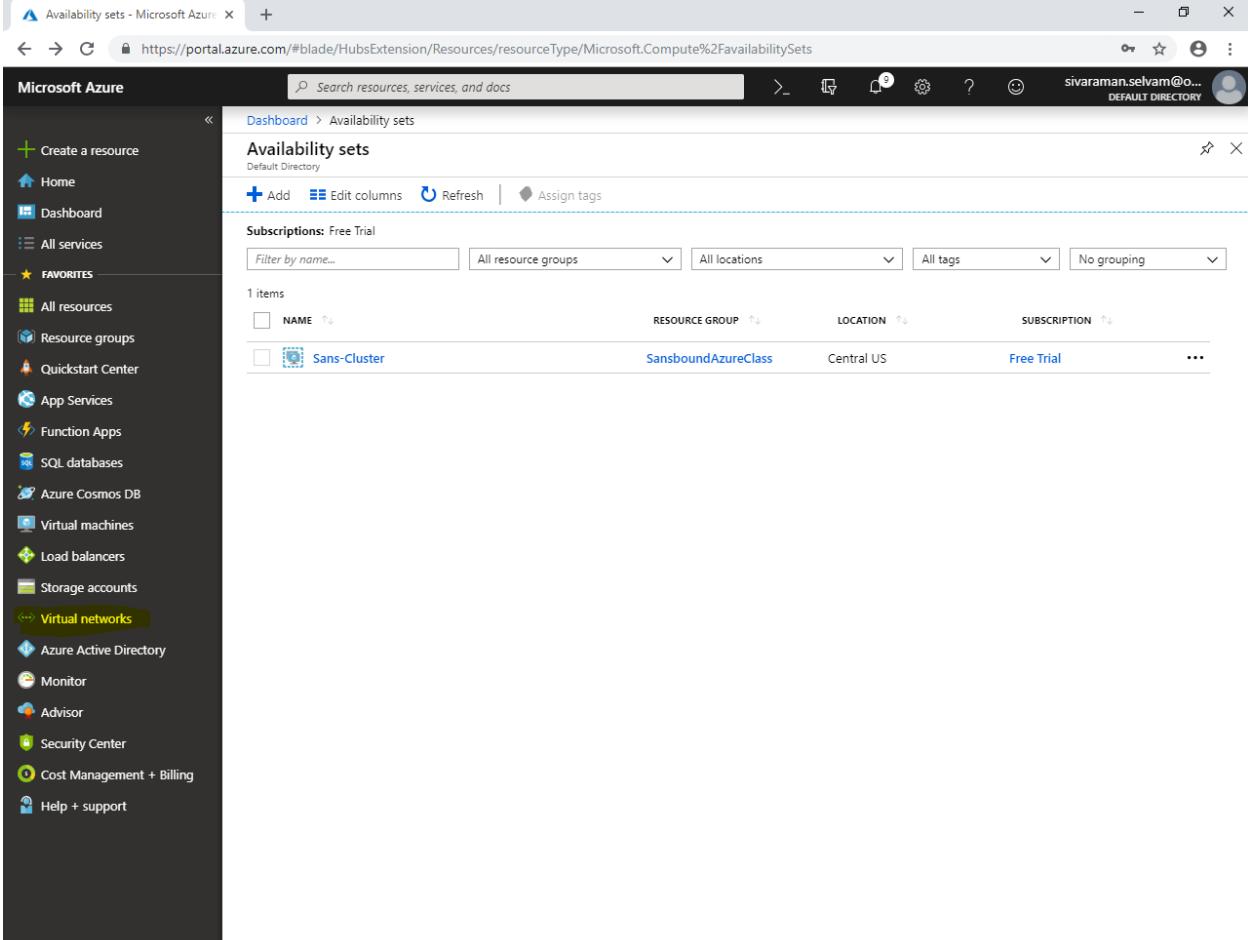


The screenshot shows the 'Create availability set' page in the Microsoft Azure portal. The 'Name' field is filled with 'Sans-Cluster'. The 'Subscription' dropdown shows 'Free Trial'. The 'Resource group' dropdown shows 'SansboundAzureClass'. The 'Location' dropdown shows 'Central US'. The 'Fault domains' slider is set to 2. The 'Update domains' slider is set to 5. The 'Use managed disks' dropdown is set to 'Yes (Aligned)'. At the bottom, there are 'Create' and 'Automation options' buttons.

In “Availability sets”,

Click “Refresh” to view Availability sets.

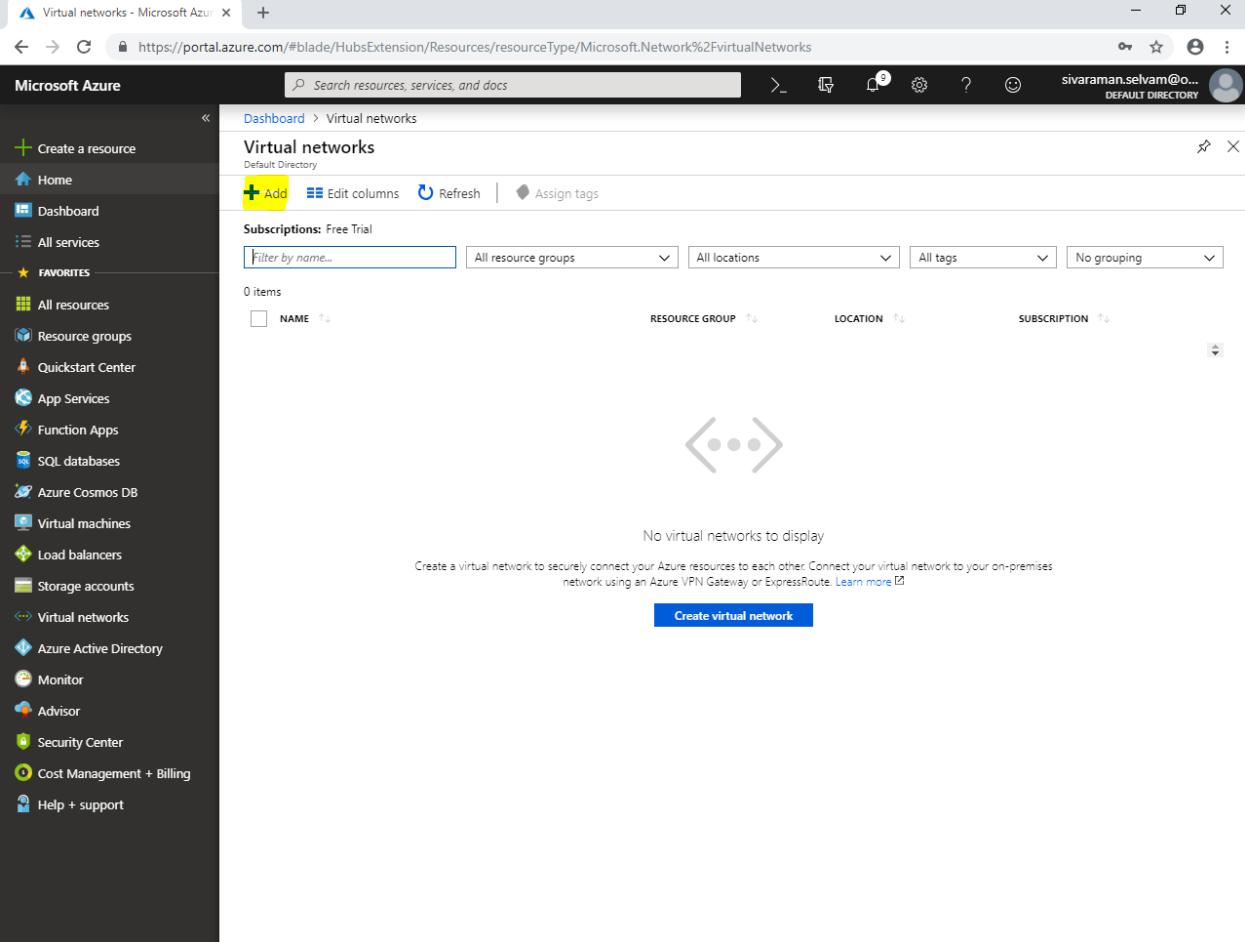
You have required to click “Virtual networks”.



The screenshot shows the Microsoft Azure portal interface. The left sidebar is open, displaying various service categories. The "Virtual networks" link under the "All services" section is highlighted with a yellow box. The main content area is titled "Availability sets" and shows a single item named "Sans-Cluster". The item details are as follows:

NAME	RESOURCE GROUP	LOCATION	SUBSCRIPTION
Sans-Cluster	SansboundAzureClass	Central US	Free Trial

Click "Add".



The screenshot shows the Microsoft Azure portal interface for managing virtual networks. The left sidebar contains a 'Create a resource' button and a list of services including Home, Dashboard, All services, Favorites (All resources, Resource groups, Quickstart Center, App Services, Function Apps, SQL databases, Azure Cosmos DB, Virtual machines, Load balancers, Storage accounts, Virtual networks, Azure Active Directory, Monitor, Advisor, Security Center, Cost Management + Billing, and Help + support). The main content area is titled 'Virtual networks' under 'Default Directory'. It features a search bar, filter options (Subscriptions: Free Trial, Filter by name..., All resource groups, All locations, All tags, No grouping), and sorting columns (NAME, RESOURCE GROUP, LOCATION, SUBSCRIPTION). A large 'Add' button is highlighted with a yellow box. Below the table, a message says 'No virtual networks to display' and provides instructions to 'Create a virtual network to securely connect your Azure resources to each other. Connect your virtual network to your on-premises network using an Azure VPN Gateway or ExpressRoute.' A 'Create virtual network' button is at the bottom.

While create network,

Type “**Name**” as “**SANS-VNET**”.

Type “**Address range**” as **10.0.0.0/16**.

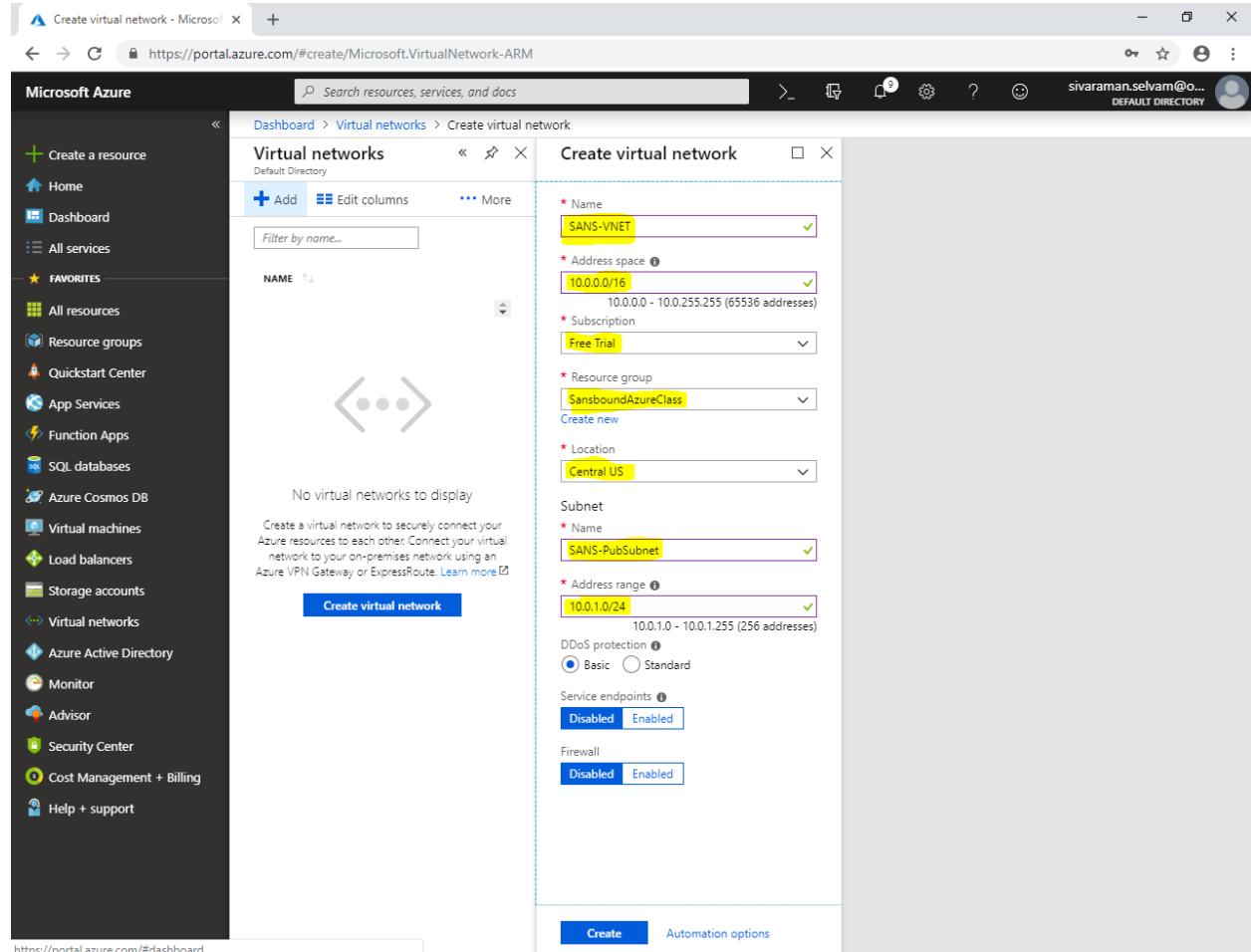
Select “**Subscription**” as “**Free Trial**”.

Select “**Resource group**” as “**SansboundAzureClass**”.

Select “**Location**” as “**Central US**”.

Type “**Subnet**” name as “**SANS-PubSubnet**”.

Select “**Address range**” as **10.0.1.0/24**.

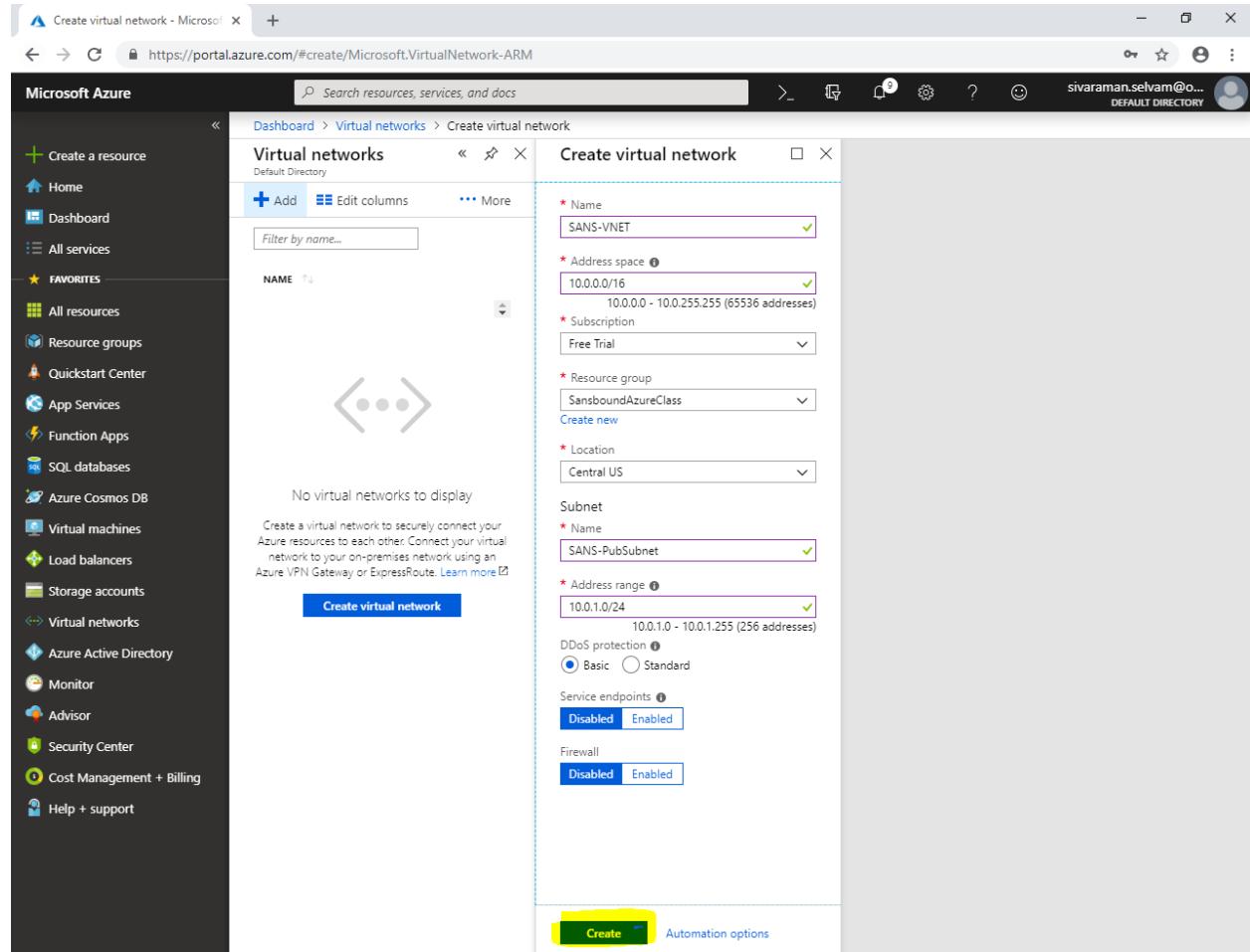


The screenshot shows the Microsoft Azure portal interface for creating a virtual network. The left sidebar navigation bar includes options like Home, Dashboard, All services, Favorites, and various Azure service icons. The main content area is titled "Create virtual network" under "Virtual networks". The "Create virtual network" form has the following fields filled:

- Name:** SANS-VNET
- Address space:** 10.0.0.0/16 (10.0.0.0 - 10.0.255.255 (65536 addresses))
- Subscription:** Free Trial
- Resource group:** SansboundAzureClass
- Location:** Central US
- Subnet:** SANS-PubSubnet
- Address range:** 10.0.1.0/24 (10.0.1.0 - 10.0.1.255 (256 addresses))
- DDoS protection:** Basic (radio button selected)
- Service endpoints:** Disabled
- Firewall:** Enabled

At the bottom of the form are "Create" and "Automation options" buttons.

Click "Create",

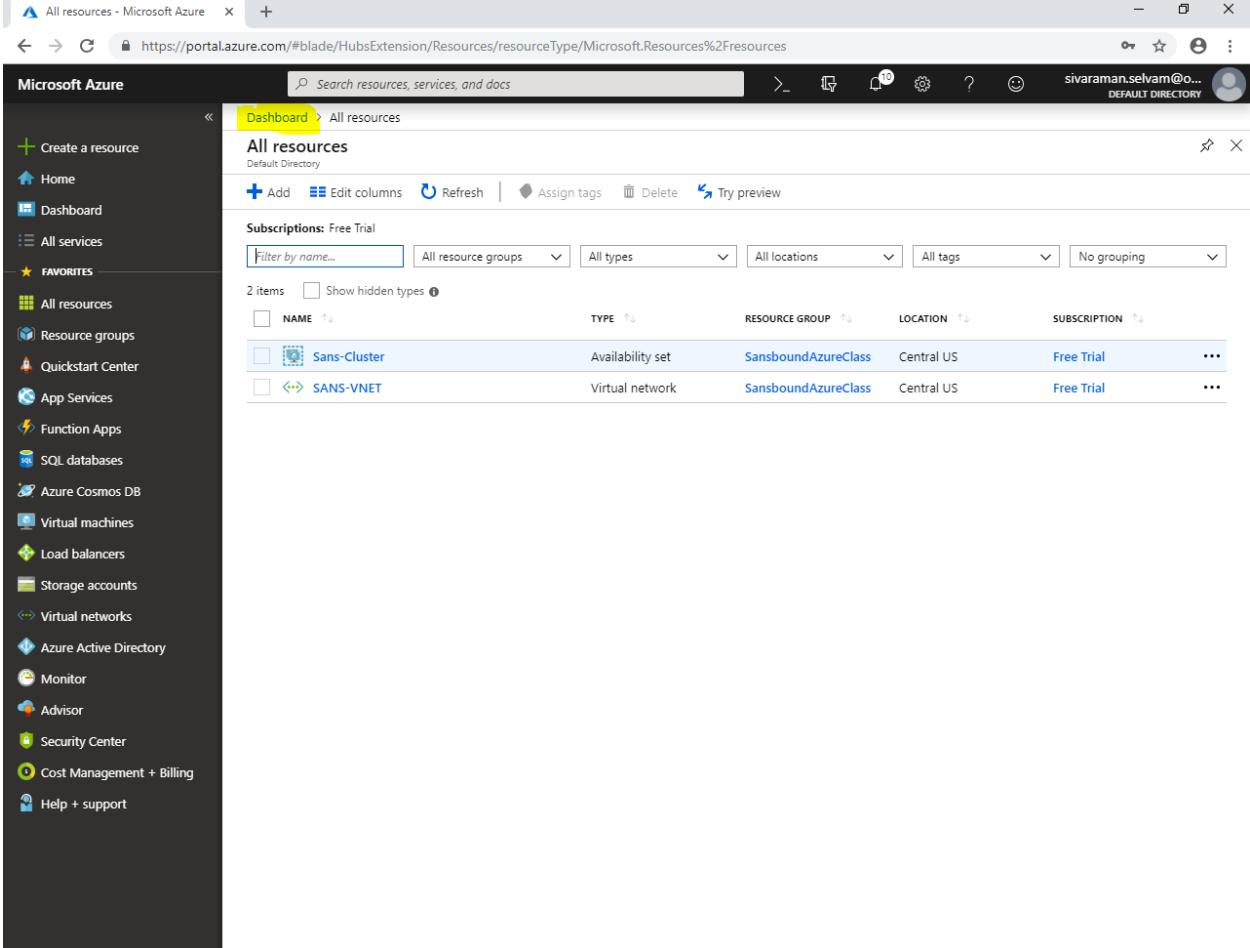


The screenshot shows the Microsoft Azure portal interface for creating a virtual network. The left sidebar contains a list of services, and the main area shows the 'Virtual networks' blade with a 'Create virtual network' dialog open. The dialog fields are filled as follows:

- Name: SANS-VNET
- Address space: 10.0.0.0/16 (10.0.0.0 - 10.0.255.255 (65536 addresses))
- Subscription: Free Trial
- Resource group: SansboundAzureClass
- Location: Central US
- Subnet Name: SANS-PubSubNet
- Address range: 10.0.1.0/24 (10.0.1.0 - 10.0.1.255 (256 addresses))
- DDoS protection: Basic (radio button selected)
- Service endpoints: Disabled
- Firewall: Disabled

A yellow box highlights the 'Create' button at the bottom of the dialog.

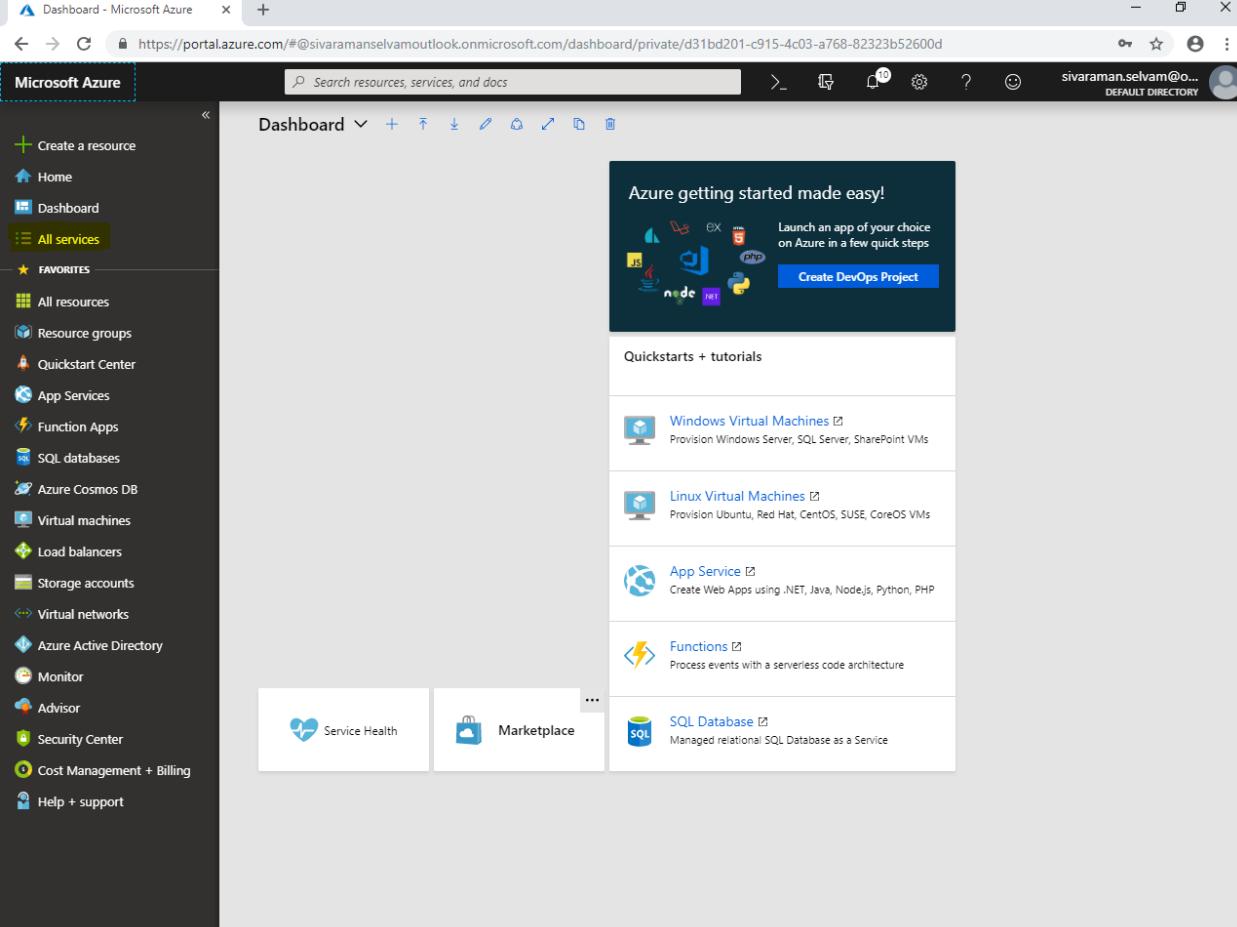
Click “Dashboard”.



The screenshot shows the Microsoft Azure portal interface. The left sidebar contains a navigation menu with various service icons and links. The main content area is titled "All resources" and shows a list of resources. The "Dashboard" link in the sidebar is highlighted with a yellow box. The main title bar also has "Dashboard" under the "All resources" section. The resource list table includes columns for NAME, TYPE, RESOURCE GROUP, LOCATION, and SUBSCRIPTION. Two items are listed: "Sans-Cluster" (Availability set) and "SANS-VNET" (Virtual network), both associated with "SansboundAzureClass" in Central US under the "Free Trial" subscription.

NAME	TYPE	RESOURCE GROUP	LOCATION	SUBSCRIPTION
Sans-Cluster	Availability set	SansboundAzureClass	Central US	Free Trial
SANS-VNET	Virtual network	SansboundAzureClass	Central US	Free Trial

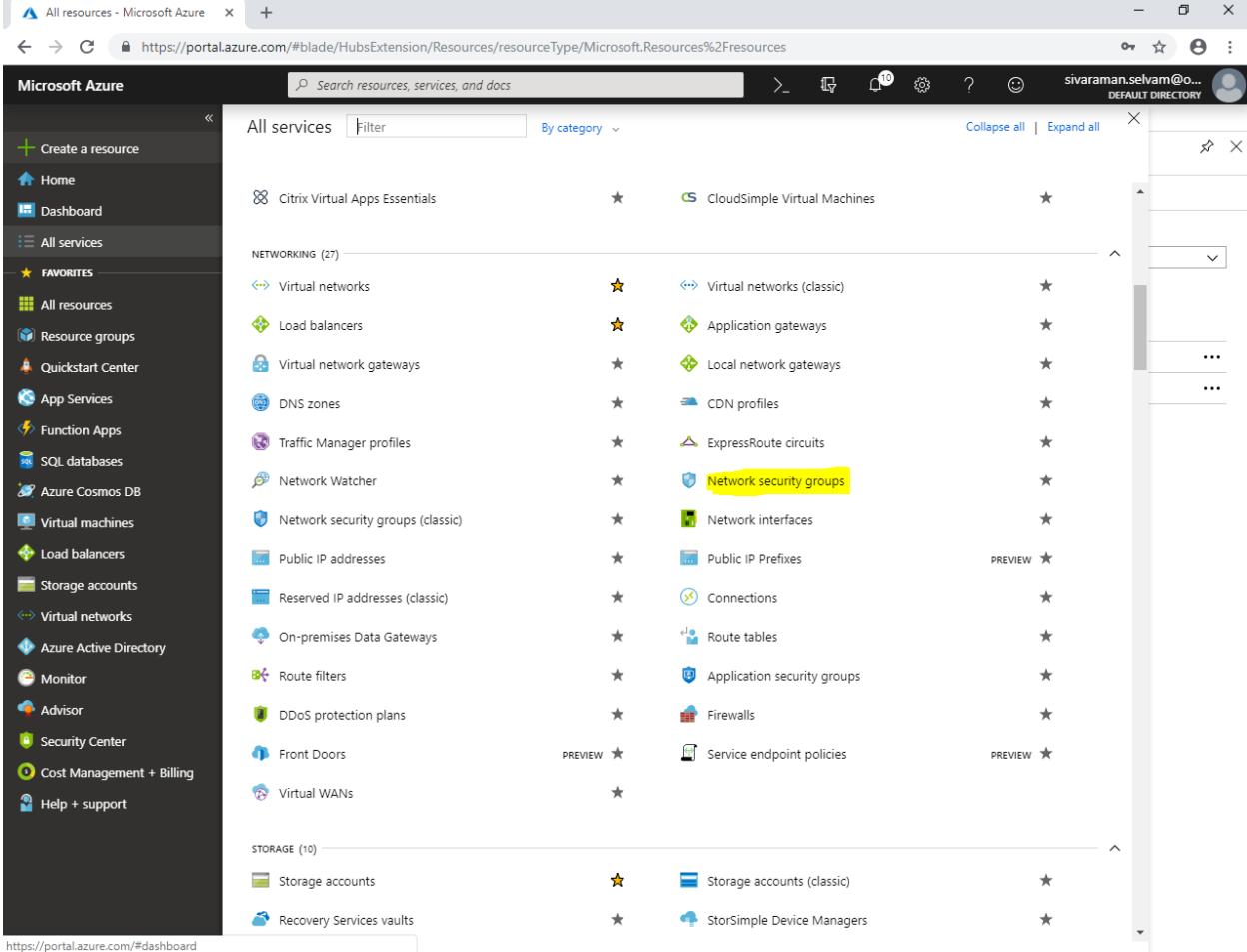
Click “**All services**” in left side panel.



The screenshot shows the Microsoft Azure dashboard. On the left, there is a dark sidebar with various service icons and names. The "All services" option is highlighted with a yellow box. The main content area has a banner at the top that says "Azure getting started made easy!" with a "Create DevOps Project" button. Below the banner, there's a section titled "Quickstarts + tutorials" with links to "Windows Virtual Machines", "Linux Virtual Machines", "App Service", "Functions", and "SQL Database". At the bottom of the sidebar, there are links for "Service Health" and "Marketplace".

In “All services”,

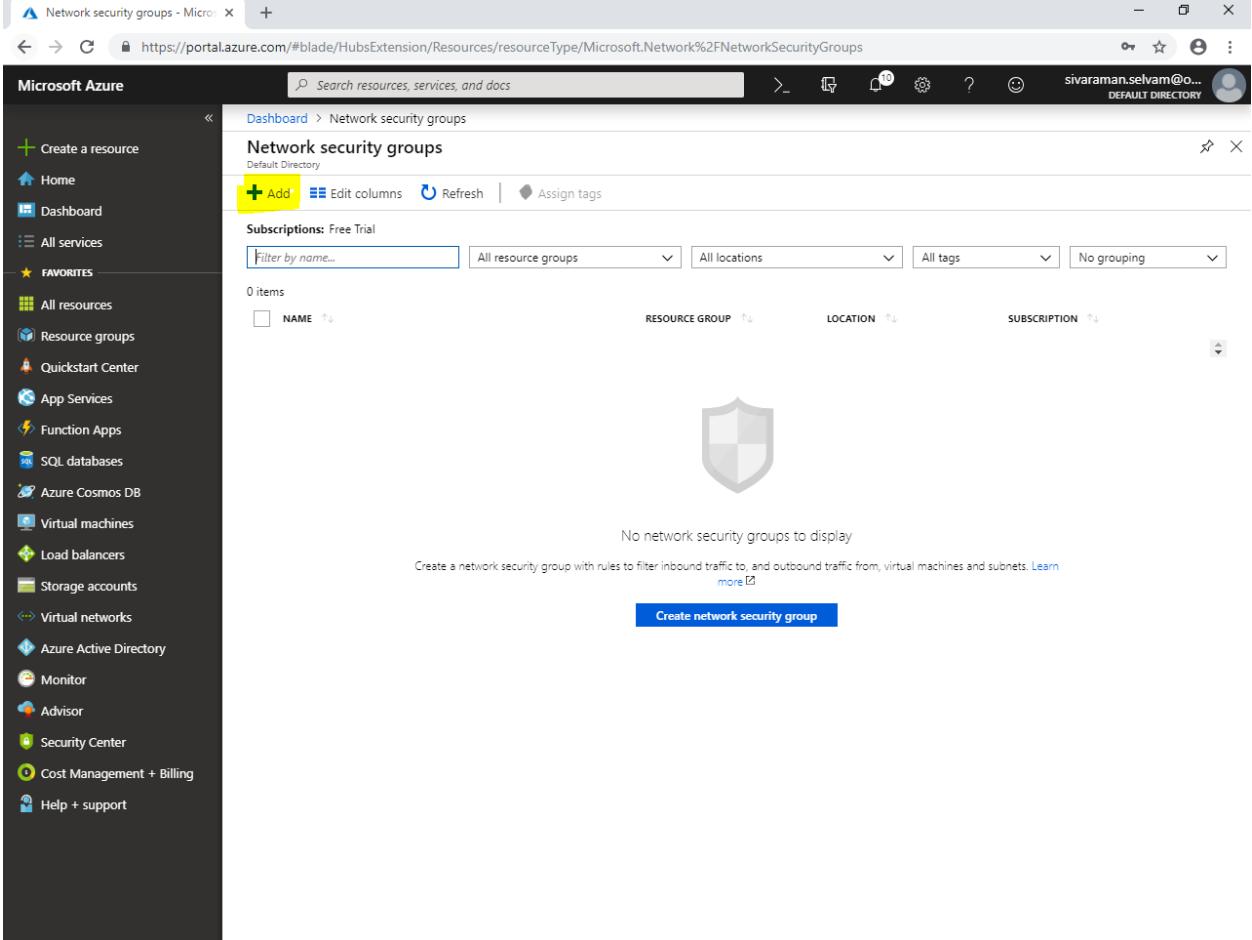
Click “Network security group”.



The screenshot shows the Microsoft Azure portal's 'All services' blade. On the left is a navigation menu with various service icons and names. The main area lists services under categories. The 'NETWORKING (27)' category is expanded, showing items like Virtual networks, Load balancers, and Network security groups. The 'Network security groups' item is highlighted with a yellow box. Other items in the list include Virtual networks (classic), Application gateways, Local network gateways, CDN profiles, ExpressRoute circuits, Network interfaces, Public IP Prefixes (Preview), Connections, Route tables, Application security groups, Firewalls, Service endpoint policies (Preview), and Virtual WANs. Below this is a 'STORAGE (10)' section with Storage accounts, Storage accounts (classic), and StorSimple Device Managers.

In “Network security groups”,

Click “Add”.



The screenshot shows the Microsoft Azure portal interface. The left sidebar contains a list of services under "FAVORITES". The main content area is titled "Network security groups" and displays a table with one column header: "NAME". A large shield icon is centered below the table. Below the table, a message reads "No network security groups to display". At the bottom right, there is a blue button labeled "Create network security group". The top navigation bar includes a search bar, a dashboard link, and a user profile for "sivaraman.selvam@o...".

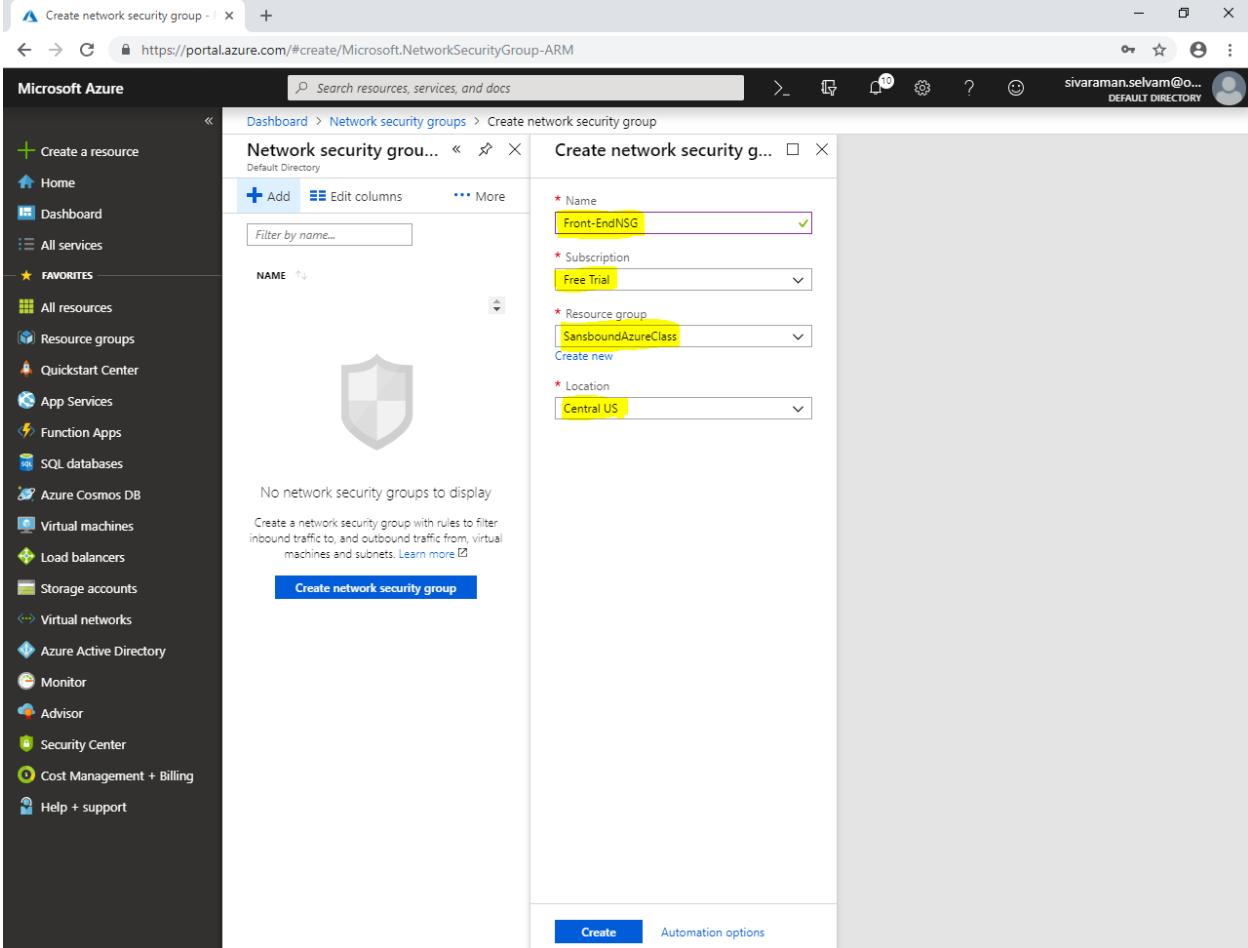
While create network security group,

Type “**Name**” as “**Front-EndNSG**”.

Select “**Subscription**” as “**Free Trial**”.

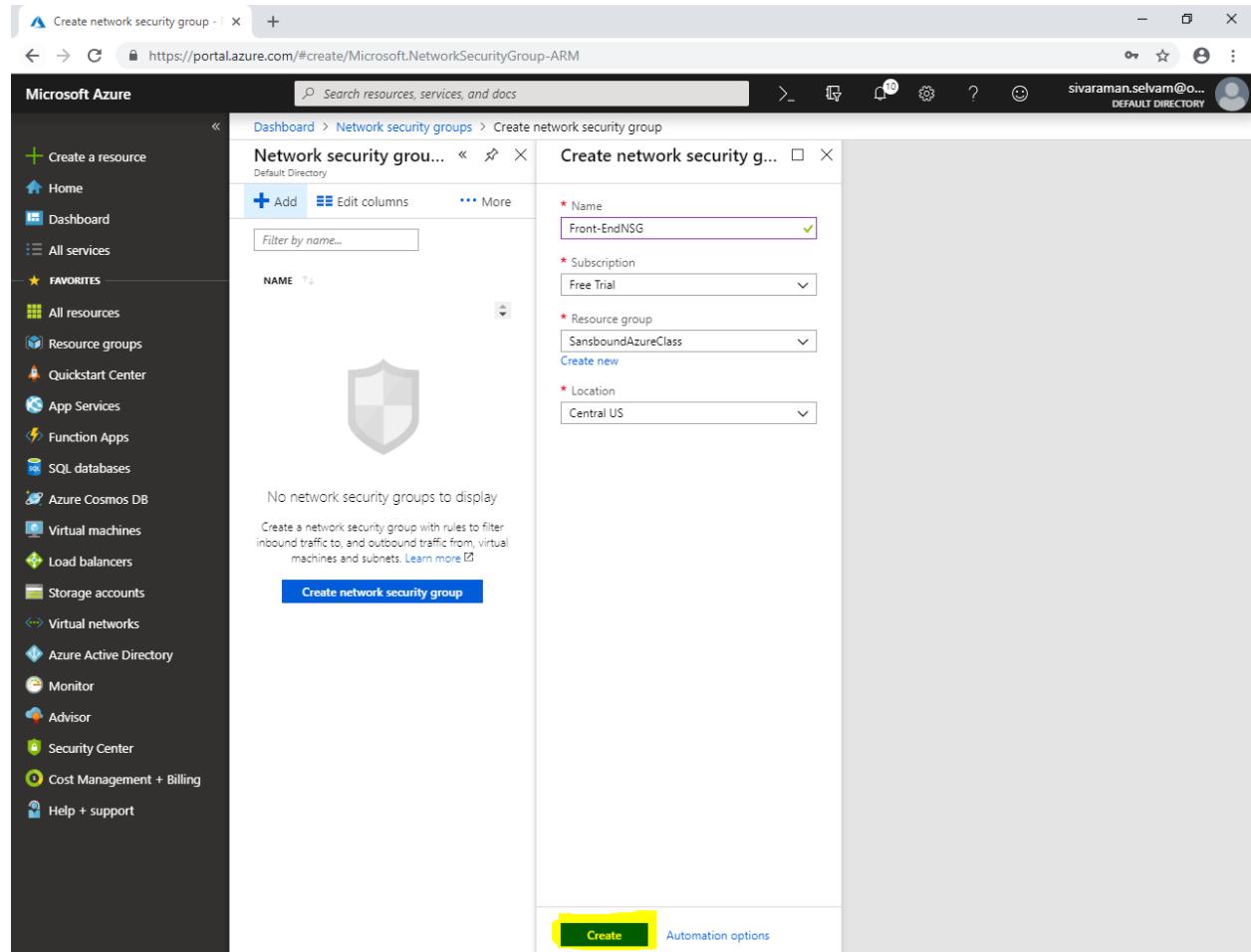
Select “**Resource group**” as “**SansboundAzureClass**”.

Select “**Location**” as “**Central US**”.



The screenshot shows the Microsoft Azure portal interface for creating a Network Security Group (NSG). The left sidebar contains various service links like Home, Dashboard, and Resource groups. The main area shows the 'Create network security group' wizard. The 'Name' field is filled with 'Front-EndNSG'. The 'Subscription' dropdown is set to 'Free Trial'. The 'Resource group' dropdown is set to 'SansboundAzureClass'. The 'Location' dropdown is set to 'Central US'. A large shield icon is displayed in the center of the form. At the bottom, there are 'Create' and 'Automation options' buttons.

Click “Create”.

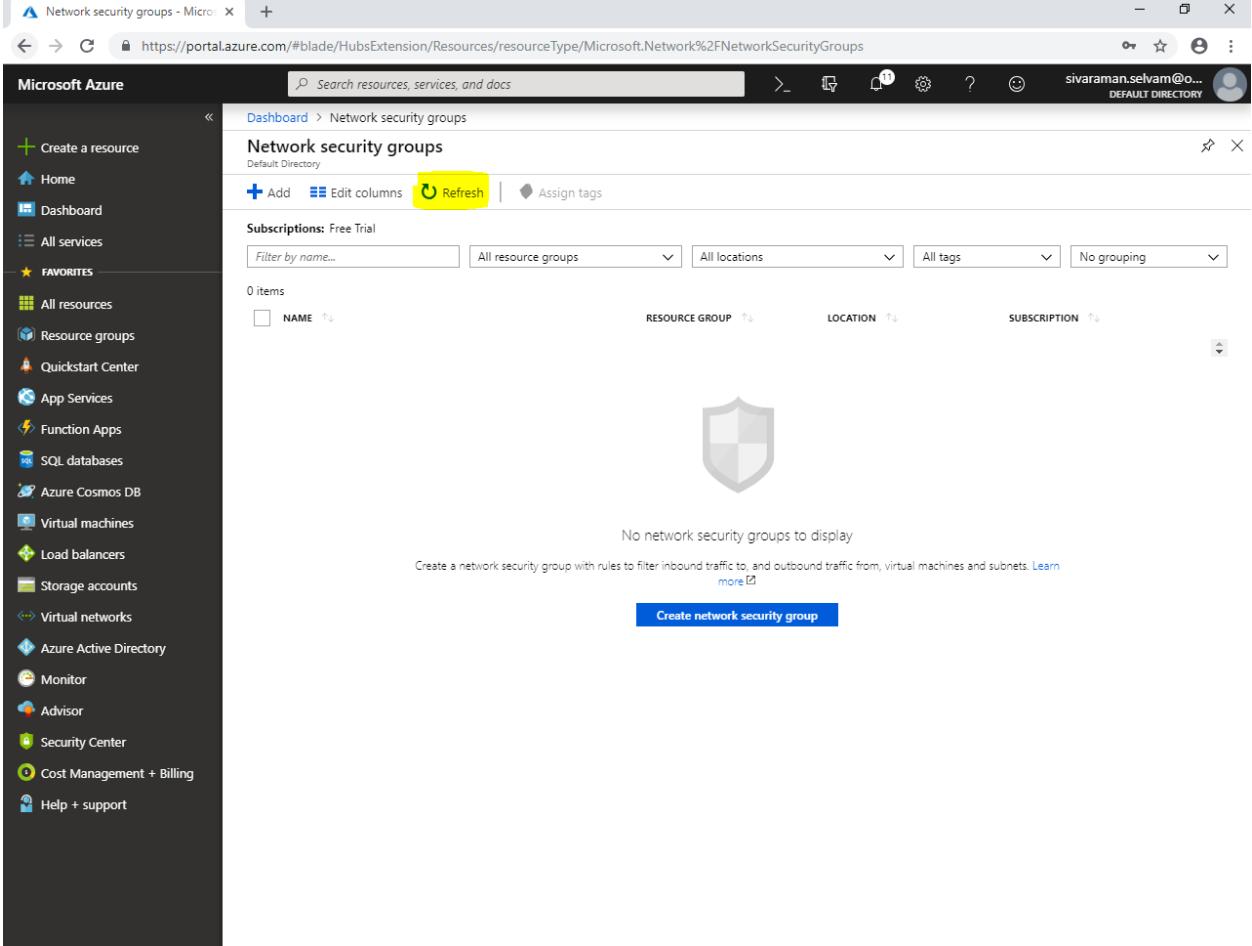


The screenshot shows the Microsoft Azure portal interface for creating a Network Security Group (NSG). The left sidebar contains various service icons under 'FAVORITES'. The main area displays a 'Network security group' list with one item, 'Front-EndNSG', selected. To the right is a 'Create network security group' form with the following fields filled:

- Name: Front-EndNSG
- Subscription: Free Trial
- Resource group: SansboundAzureClass
- Location: Central US

A large yellow box highlights the 'Create' button at the bottom of the form. Below the form, there's a note about creating a network security group with rules to filter inbound and outbound traffic from virtual machines and subnets, followed by a 'Learn more' link.

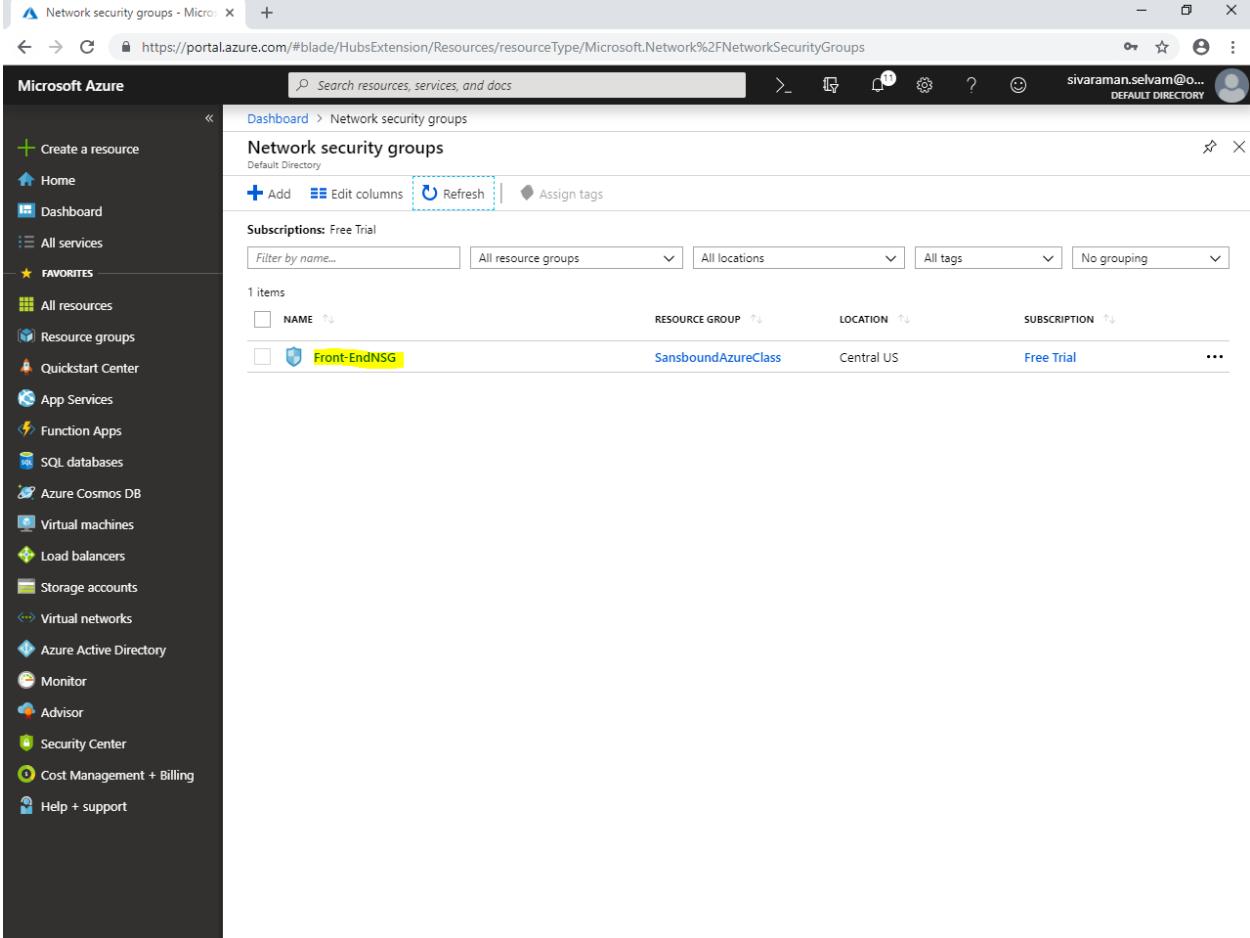
Click "Refresh".



The screenshot shows the Microsoft Azure portal interface. The left sidebar is filled with various service icons under categories like Home, All services, Favorites, and All resources. The main content area is titled 'Network security groups' and shows a list of network security groups. At the top of this list is a blue 'Refresh' button, which is highlighted with a yellow rectangular box. Below the refresh button are several filter options: 'Subscriptions: Free Trial', 'Filter by name...', dropdown menus for 'All resource groups', 'All locations', 'All tags', and 'No grouping', and a sorting section with columns for 'NAME', 'RESOURCE GROUP', 'LOCATION', and 'SUBSCRIPTION'. A large shield icon is centered on the page, and below it, the text 'No network security groups to display' is visible. At the bottom of the list area is a blue 'Create network security group' button.

In “Network security groups”,

Click “Front-EndNSG”.

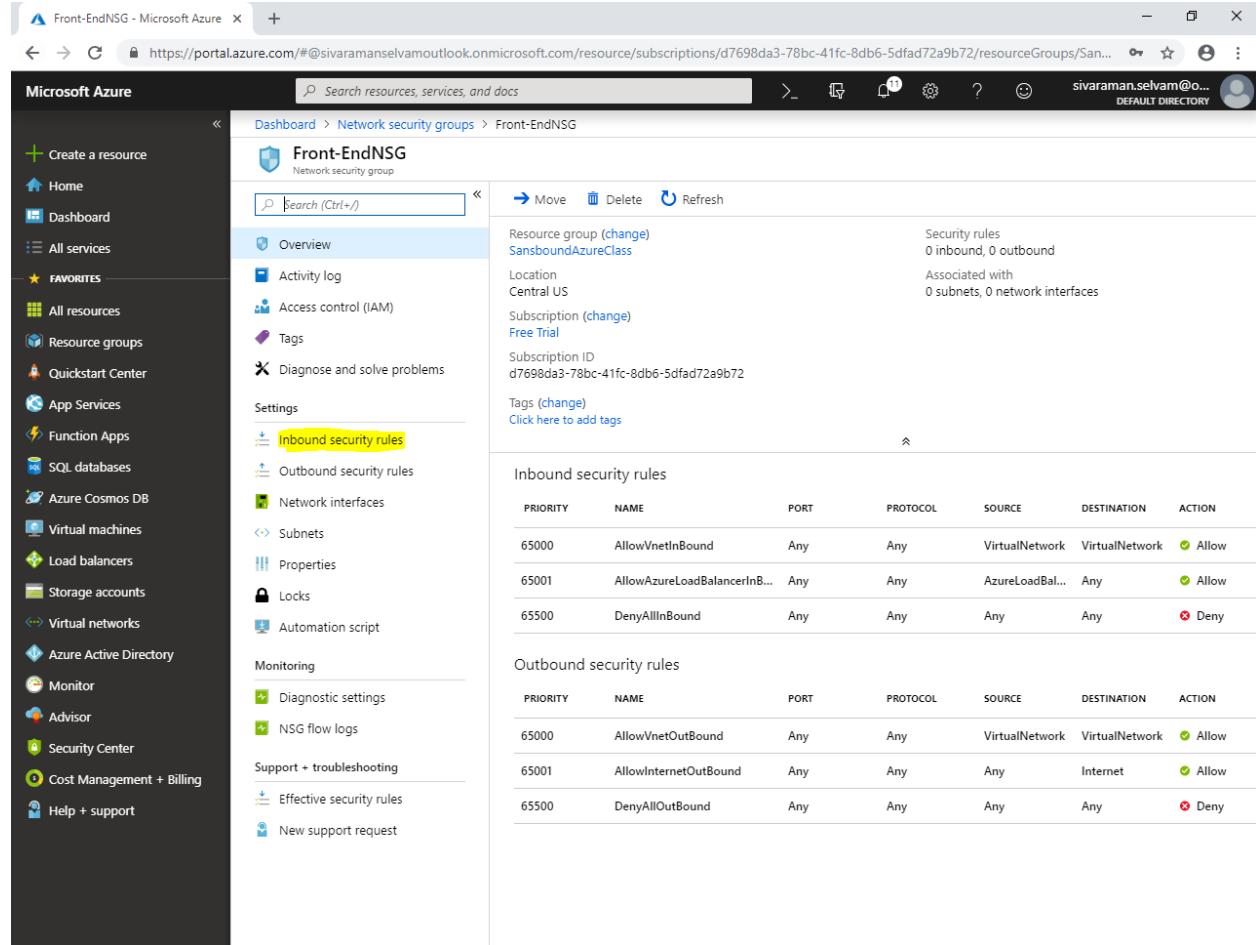


The screenshot shows the Microsoft Azure portal interface. The left sidebar is filled with various service icons under the 'FAVORITES' section. The main content area is titled 'Network security groups' and shows one item listed:

NAME	RESOURCE GROUP	LOCATION	SUBSCRIPTION
Front-EndNSG	SansboundAzureClass	Central US	Free Trial

In “Front-EndNSG”,

Click “Inbound security rules”.



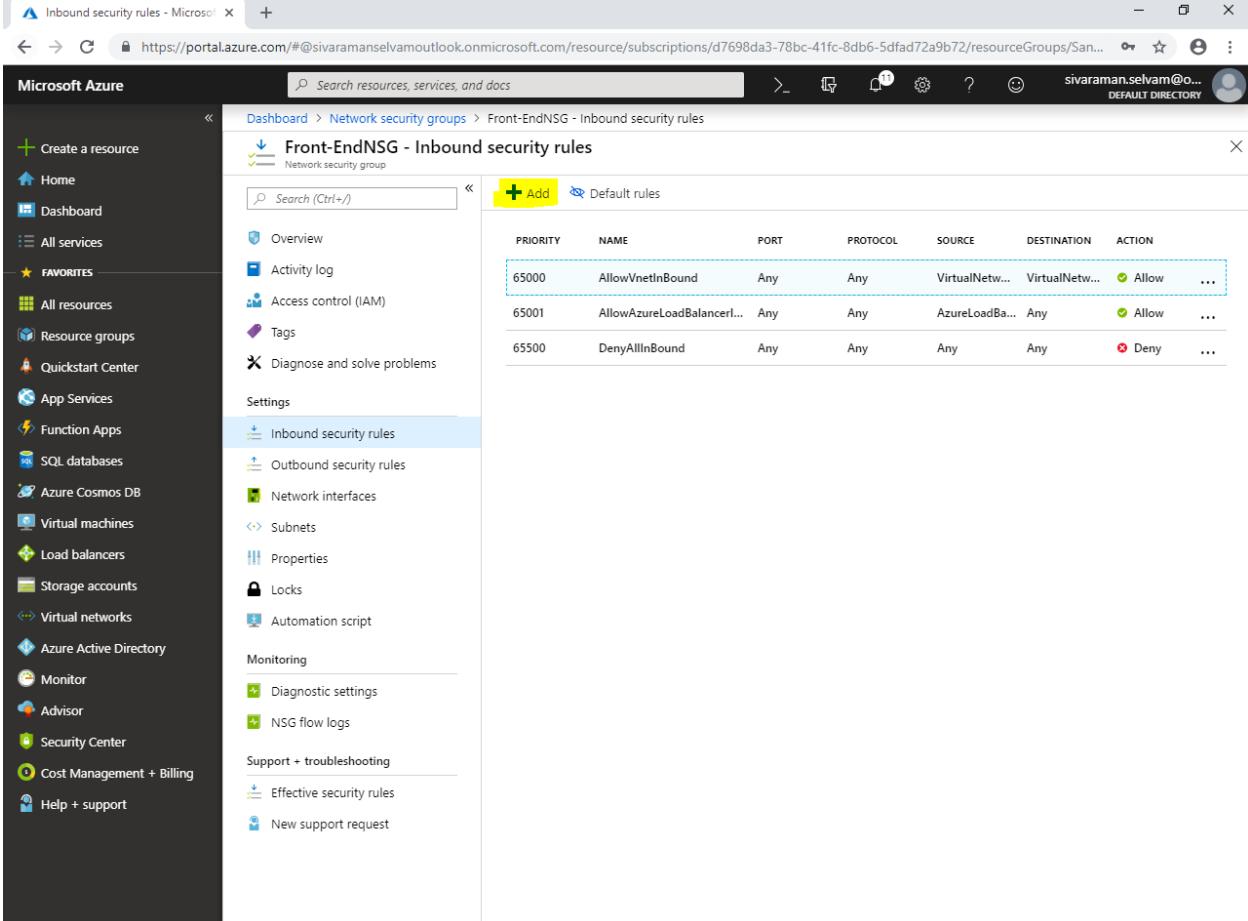
The screenshot shows the Microsoft Azure portal interface. The left sidebar contains a navigation menu with various service icons. The main content area is titled "Front-EndNSG" and displays the "Overview" tab. On the right, there are sections for "Resource group (change)", "Location", "Subscription", and "Tags". Below these, under "Settings", the "Inbound security rules" link is highlighted with a yellow box. The "Inbound security rules" table lists three entries:

PRIORITY	NAME	PORT	PROTOCOL	SOURCE	DESTINATION	ACTION
65000	AllowVnetBound	Any	Any	VirtualNetwork	VirtualNetwork	Allow
65001	AllowAzureLoadBalancerInB...	Any	Any	AzureLoadBal...	Any	Allow
65500	DenyAllInBound	Any	Any	Any	Any	Deny

Below the inbound rules, there is a section for "Outbound security rules" which is currently empty.

In “Inbound security rules”,

Click “Add”.



PRIORITY	NAME	PORT	PROTOCOL	SOURCE	DESTINATION	ACTION	...
65000	AllowVnetInBound	Any	Any	VirtualNetw...	VirtualNetw...	<span style="color: green;">Allow</span>	<span style="color: blue;">...</span>
65001	AllowAzureLoadBalancer...	Any	Any	AzureLoadBa...	Any	<span style="color: green;">Allow</span>	<span style="color: blue;">...</span>
65500	DenyAllInBound	Any	Any	Any	Any	<span style="color: red;">Deny</span>	<span style="color: blue;">...</span>

While “**Add inbound security rule**”,

Select “**Source**” as “**Any**”.

Select “**Source port ranges**” as “**\***”.

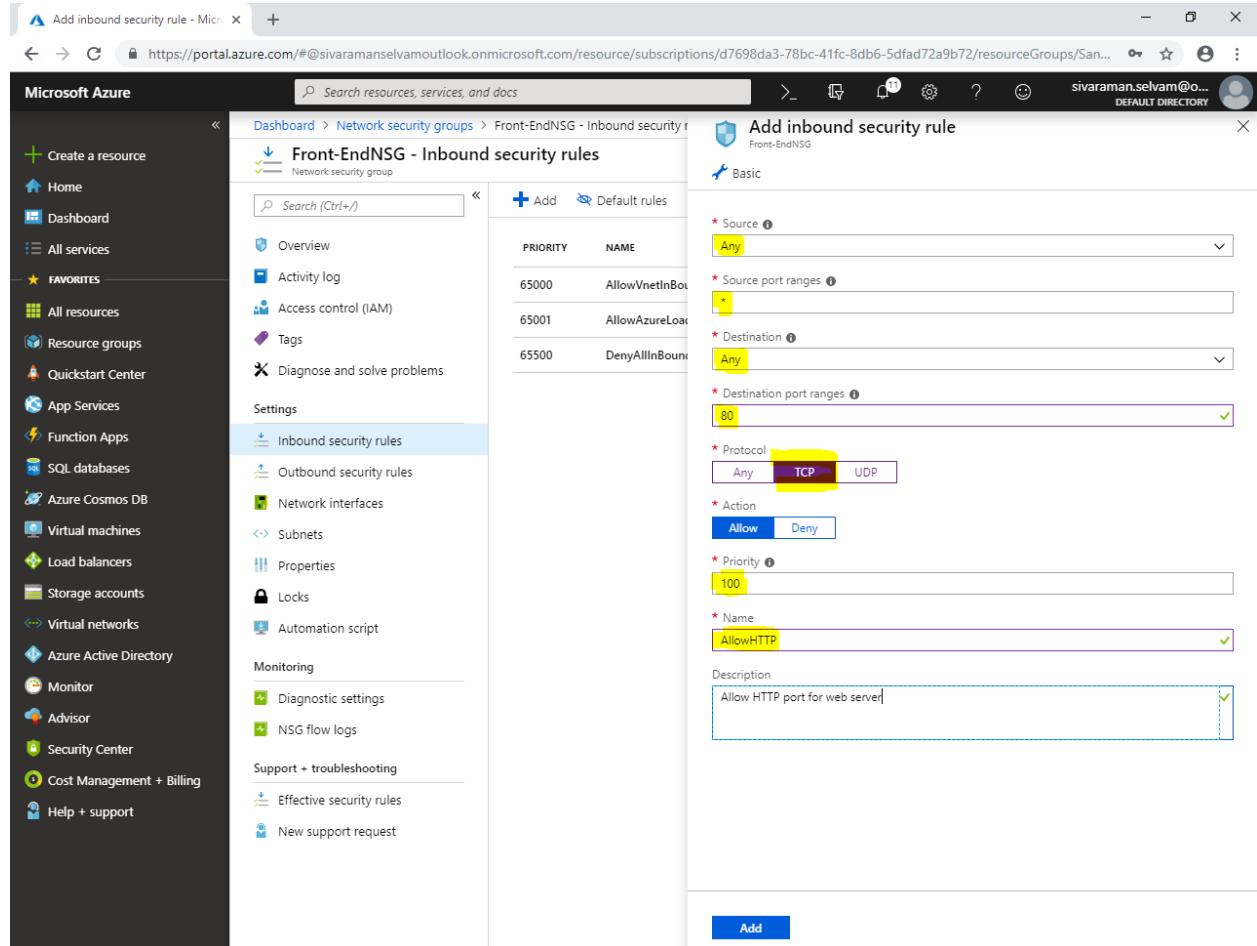
Select “**Destination**” as “**Any**”.

Select “**Destination port ranges**” as “**80**”.

Click “**Protocol**” as “**TCP**”.

Ensure “**Priority**” as “**100**”

Type “**Name**” as “**AllowHTTP**”.



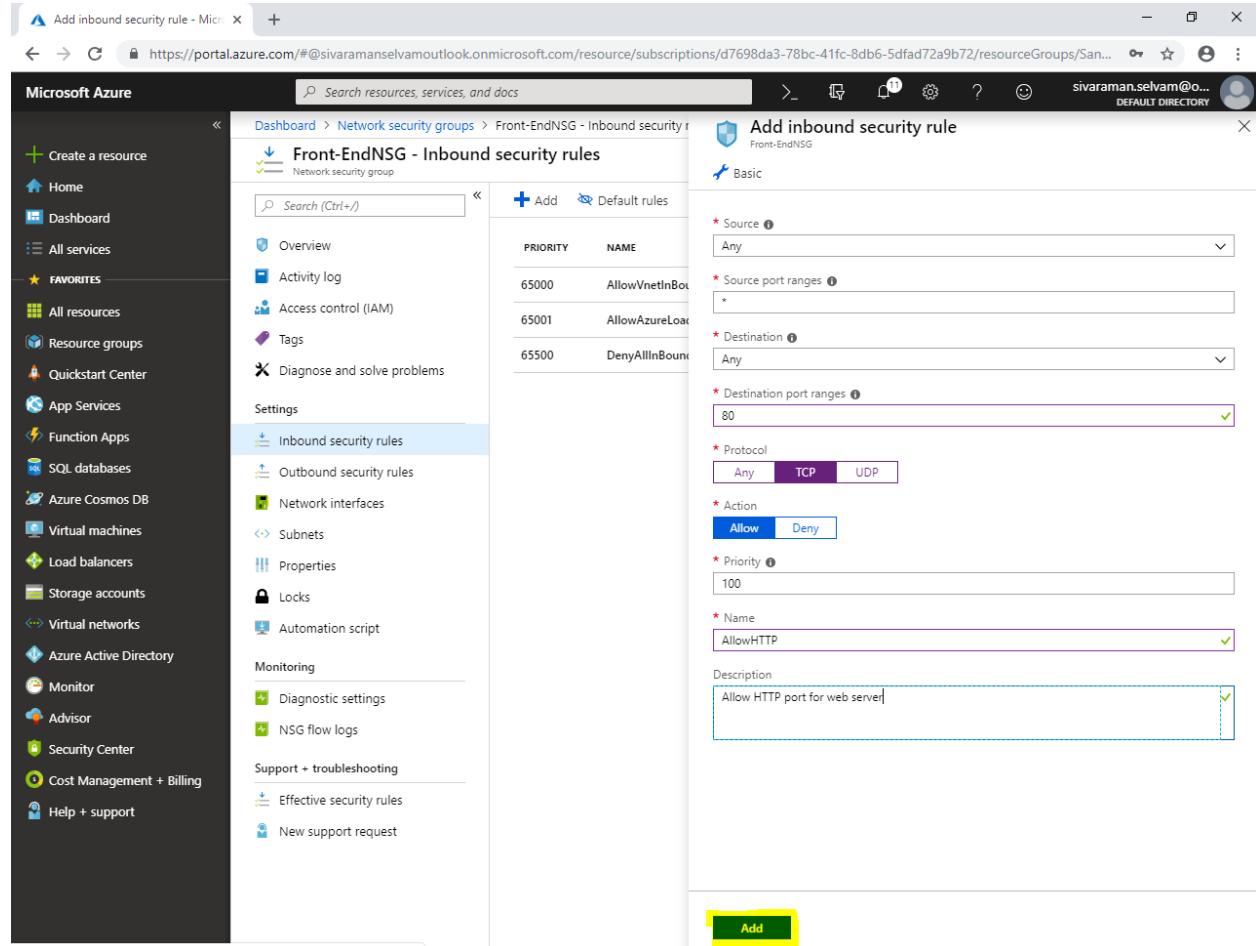
The screenshot shows the Microsoft Azure portal interface for managing network security groups. On the left, the navigation menu includes options like Home, Dashboard, All services, Favorites, and various Azure services. The main area displays the 'Front-EndNSG - Inbound security rules' section. A table lists three existing rules:

PRIORITY	NAME
65000	AllowVnetInBound
65001	AllowAzureLoadBalancer
65500	DenyAllInBound

A new rule is being added with the following configuration:

- Source:** Any
- Source port ranges:** \*
- Destination:** Any
- Destination port ranges:** 80
- Protocol:** TCP (selected)
- Action:** Allow
- Priority:** 100
- Name:** AllowHTTP
- Description:** Allow HTTP port for web server

Click "Add".



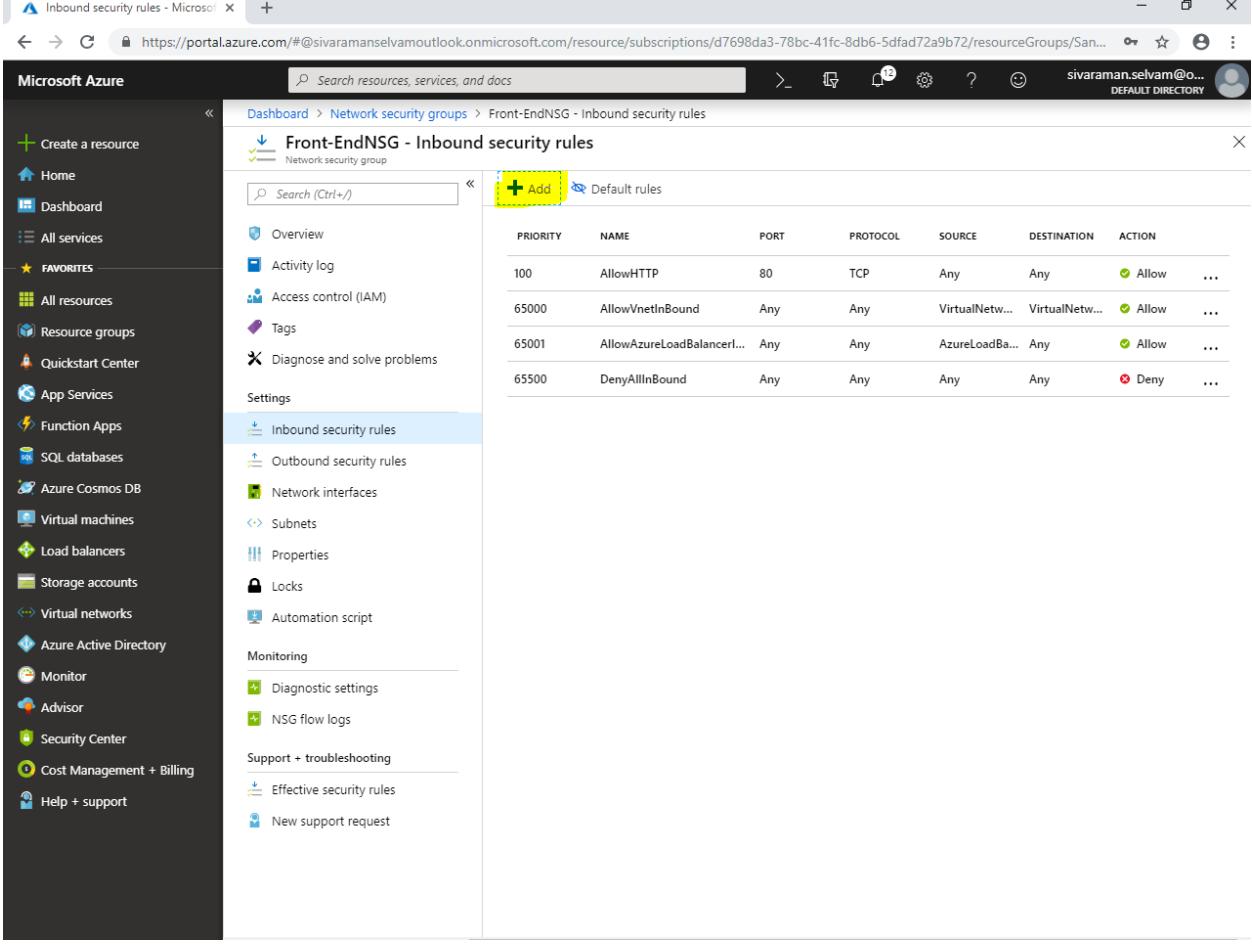
The screenshot shows the Microsoft Azure portal interface for managing Network Security Groups (NSGs). The left sidebar lists various services, and the main area shows the 'Front-EndNSG - Inbound security rules' configuration. A new rule is being added, with the 'Inbound security rules' tab selected in the sidebar. The 'Basic' configuration pane is displayed, showing the following settings:

- Source:** Any
- Source port ranges:** \*
- Destination:** Any
- Destination port ranges:** 80
- Protocol:** TCP
- Action:** Allow
- Priority:** 100
- Name:** AllowHTTP
- Description:** Allow HTTP port for web server

The 'Add' button at the bottom of the form is highlighted with a yellow box.

Now you are able to see that inbound security rules has been created for “100”.

Click “Add”.



The screenshot shows the Microsoft Azure portal interface for managing Network Security Groups (NSGs). The left sidebar contains a navigation menu with various service icons. The main content area is titled "Front-EndNSG - Inbound security rules". On the left, there's a sidebar with options like Overview, Activity log, Access control (IAM), Tags, Diagnose and solve problems, Settings (which is selected and highlighted in blue), Inbound security rules (selected), Outbound security rules, Network interfaces, Subnets, Properties, Locks, Automation script, Monitoring, Diagnostic settings, NSG flow logs, Support + troubleshooting, Effective security rules, and New support request. At the top right, there's a search bar and a "Default rules" link. The main table lists four security rules:

PRIORITY	NAME	PORT	PROTOCOL	SOURCE	DESTINATION	ACTION	... (More)
100	AllowHTTP	80	TCP	Any	Any	Allow	...
65000	AllowVnetInBound	Any	Any	VirtualNetw...	VirtualNetw...	Allow	...
65001	AllowAzureLoadBalancer...	Any	Any	AzureLoadBa...	Any	Allow	...
65500	DenyAllInBound	Any	Any	Any	Any	Deny	...

While “Add inbound security rule”,

Select “Source” as “Any”.

Select “Source port ranges” as “\*”.

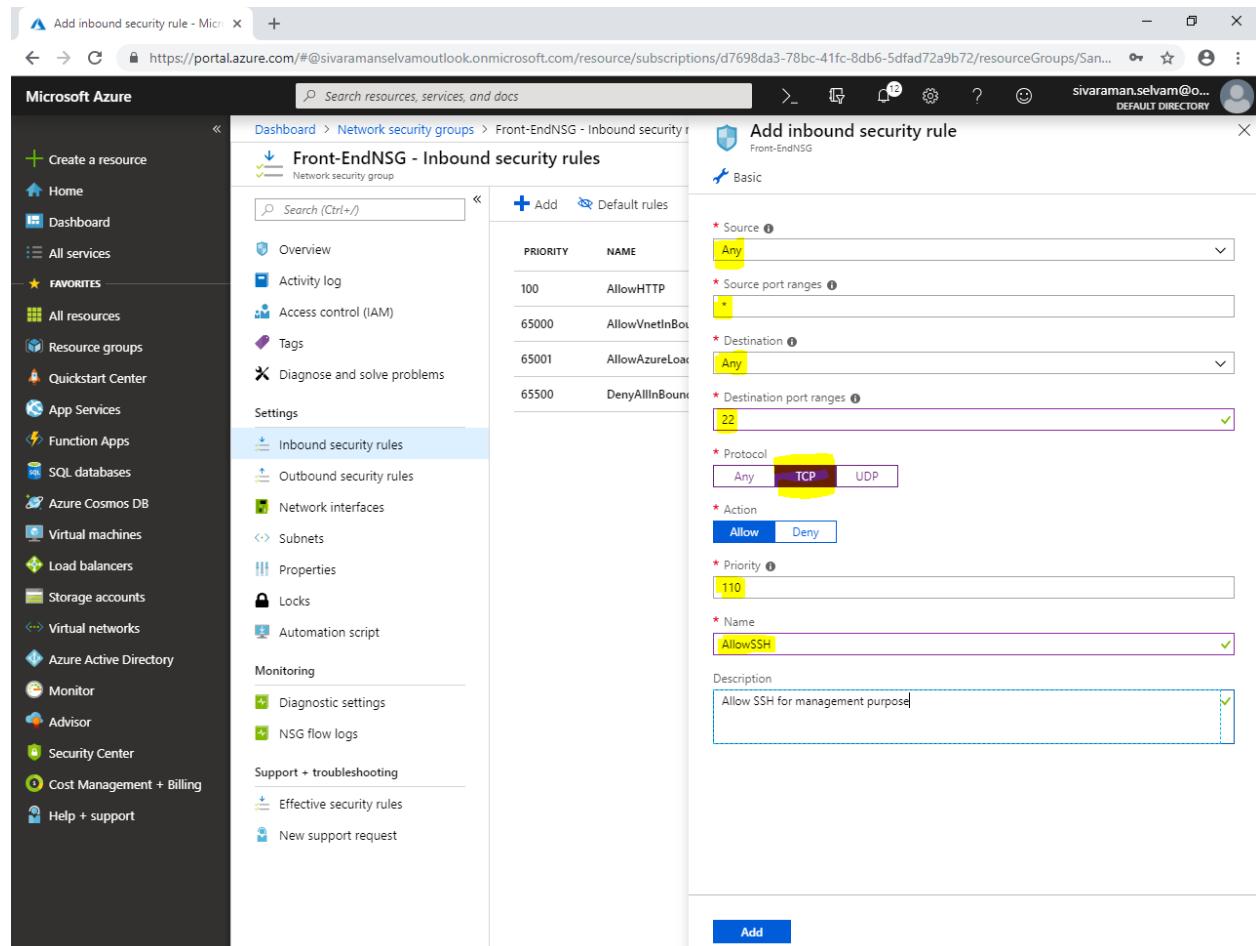
Select “Destination” as “Any”.

Select “Destination port ranges” as “22”.

Click “Protocol” as “TCP”.

Ensure “Priority” as “110”

Type “Name” as “AllowSSH”.

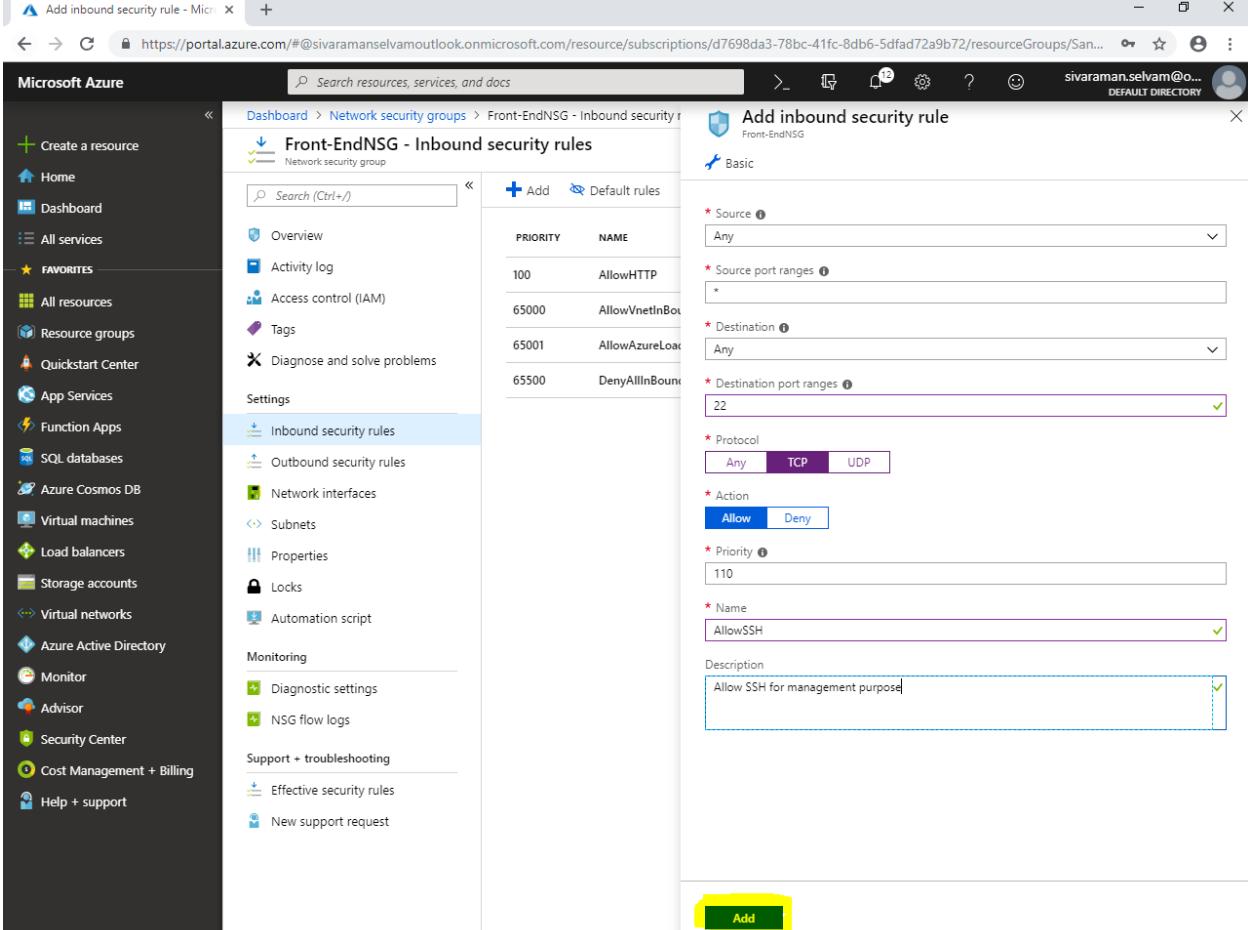


The screenshot shows the Microsoft Azure portal interface. On the left, there's a navigation sidebar with various service icons like Home, Dashboard, All services, Favorites, All resources, Resource groups, Quickstart Center, App Services, Function Apps, SQL databases, Azure Cosmos DB, Virtual machines, Load balancers, Storage accounts, Virtual networks, Azure Active Directory, Monitor, Advisor, Security Center, Cost Management + Billing, and Help + support. The main content area is titled "Add inbound security rule - Microsoft Azure" and shows the URL <https://portal.azure.com/#@sivaramansevamoutlook.onmicrosoft.com/resource/subscriptions/d7698da3-78bc-41fc-8db6-5dfad72a9b72/resourceGroups/San...>. The page displays the "Front-EndNSG - Inbound security rules" section under "Network security group". It lists existing rules: 100 (AllowHTTP), 65000 (AllowVnetInbound), 65001 (AllowAzureLoadBalancer), and 65500 (DenyAllInbound). A new rule is being added with the following parameters:

PRIORITY	NAME
100	AllowHTTP
65000	AllowVnetInbound
65001	AllowAzureLoadBalancer
65500	DenyAllInbound
110	AllowSSH

The "Protocol" dropdown is set to "TCP". The "Action" dropdown is set to "Allow". The "Priority" input field is set to "110". The "Name" input field is set to "AllowSSH". The "Description" text area contains the note "Allow SSH for management purpose".

Click "Add".



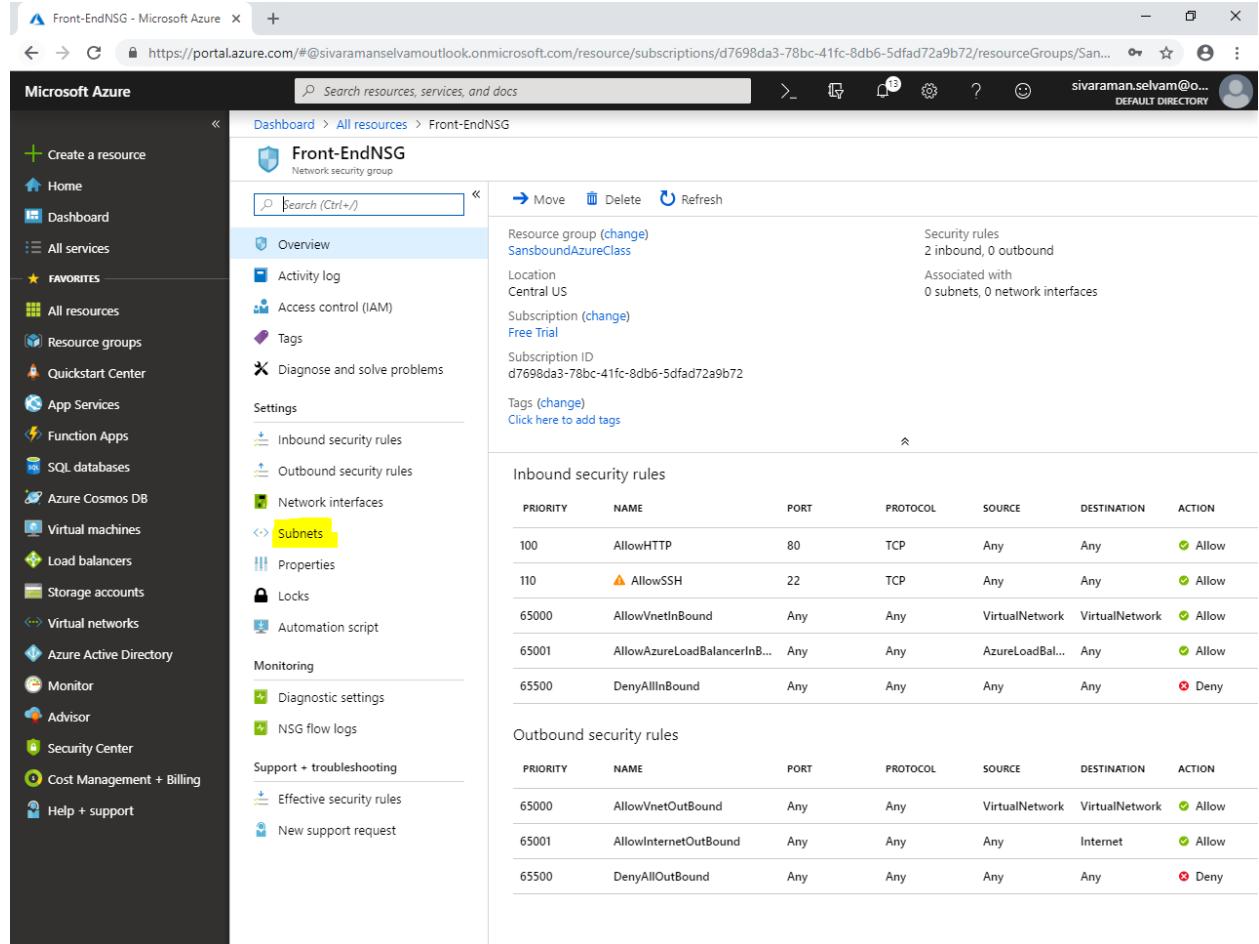
The screenshot shows the Microsoft Azure portal interface for managing Network Security Groups (NSGs). The left sidebar contains a navigation menu with various service icons and links. The main content area is titled "Front-EndNSG - Inbound security rules" under the "Network security groups" section. On the right, a form is displayed for adding a new inbound security rule. The "Basic" tab is selected. The configuration fields include:

- Source:** Any
- Source port ranges:** \*
- Destination:** Any
- Destination port ranges:** 22
- Protocol:** TCP
- Action:** Allow
- Priority:** 110
- Name:** AllowSSH
- Description:** Allow SSH for management purpose

A yellow box highlights the "Add" button at the bottom of the form.

In “Front-EndNSG”,

Click “Subnets”.



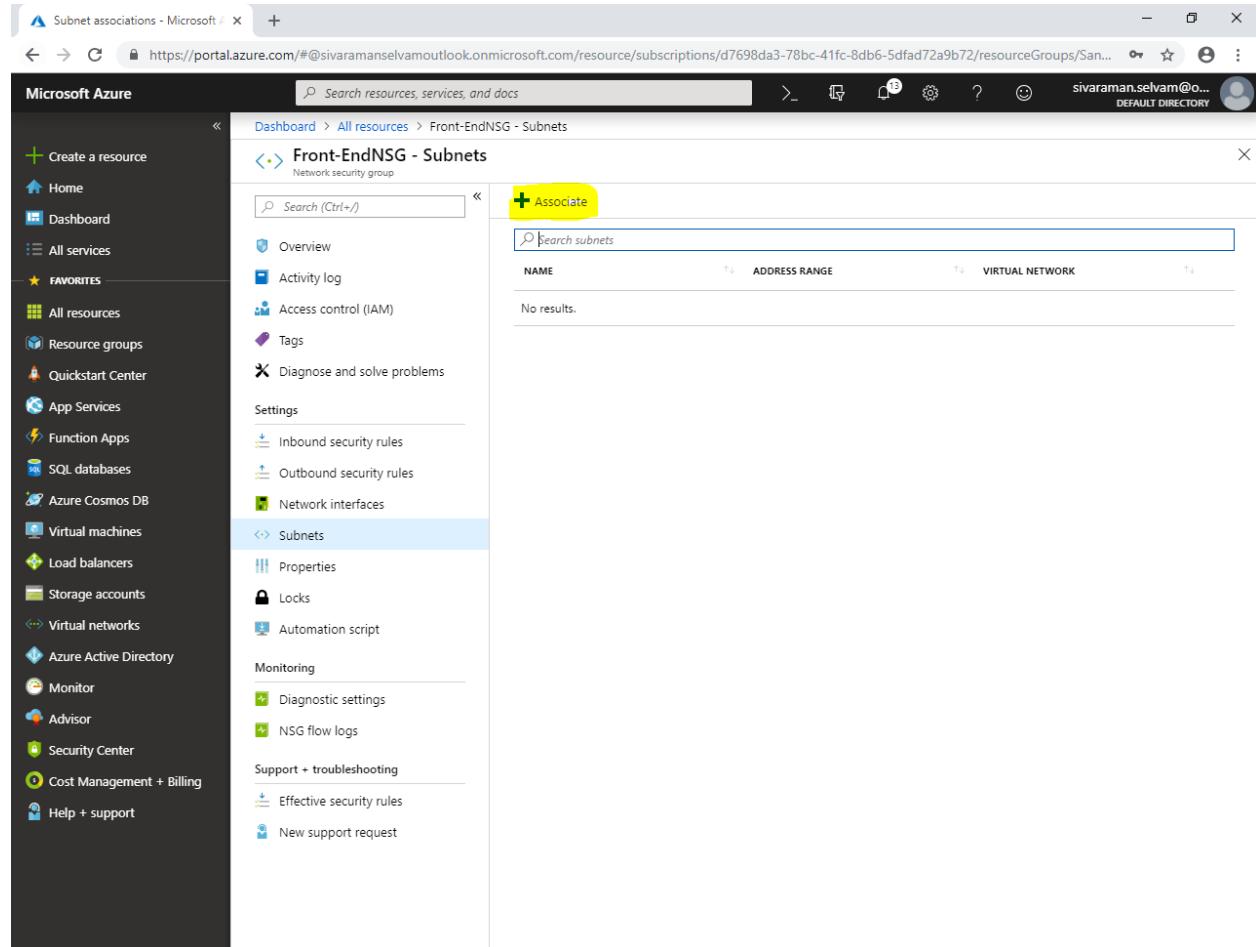
The screenshot shows the Microsoft Azure portal interface for the 'Front-EndNSG' Network Security Group. The left sidebar contains a navigation menu with various service icons. The main content area displays the 'Overview' tab for the NSG, which includes details like the resource group (SansboundAzureClass), location (Central US), subscription (Free Trial), and tags. Below this, two tables show security rules: 'Inbound security rules' and 'Outbound security rules'. The 'Inbound security rules' table lists several rules, including 'AllowHTTP' (Priority 100, Port 80, TCP, Any, Any, Allow) and 'AllowSSH' (Priority 110, Port 22, TCP, Any, Any, Allow). The 'Outbound security rules' table lists three rules, including 'AllowVnetInBound' (Priority 65000, Any, Any, VirtualNetwork, VirtualNetwork, Allow). The 'Subnets' link under the 'Network interfaces' section of the left sidebar is highlighted with a yellow box.

PRIORITY	NAME	PORT	PROTOCOL	SOURCE	DESTINATION	ACTION
100	AllowHTTP	80	TCP	Any	Any	Allow
110	AllowSSH	22	TCP	Any	Any	Allow
65000	AllowVnetInBound	Any	Any	VirtualNetwork	VirtualNetwork	Allow
65001	AllowAzureLoadBalancerInB...	Any	Any	AzureLoadBal...	Any	Allow
65500	DenyAllInBound	Any	Any	Any	Any	Deny

PRIORITY	NAME	PORT	PROTOCOL	SOURCE	DESTINATION	ACTION
65000	AllowVnetOutBound	Any	Any	VirtualNetwork	VirtualNetwork	Allow
65001	AllowInternetOutBound	Any	Any	Any	Internet	Allow
65500	DenyAllOutBound	Any	Any	Any	Any	Deny

In “Subnets”,

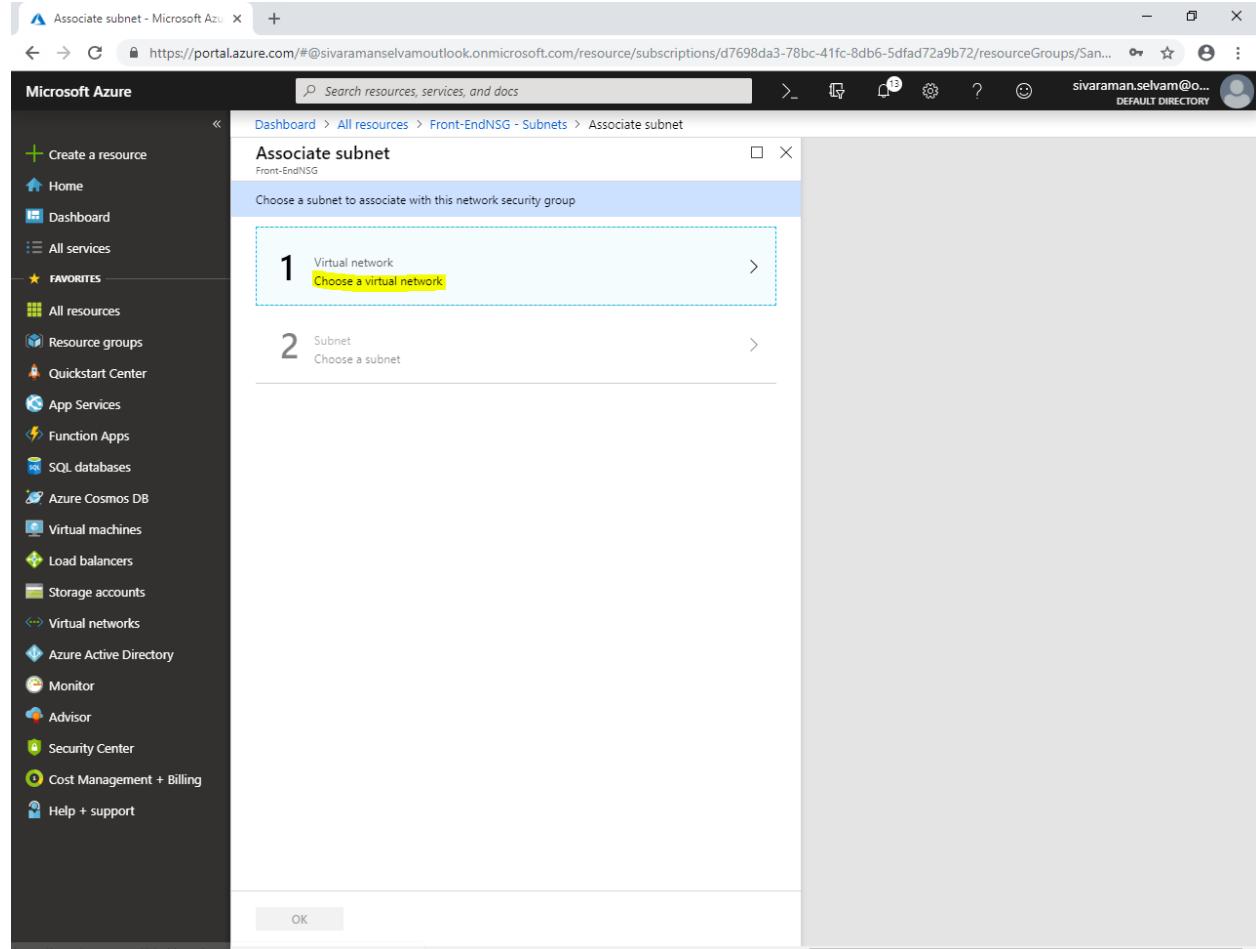
Click “Associate” to associate the subnet to “Front-EndNSG” network security group.



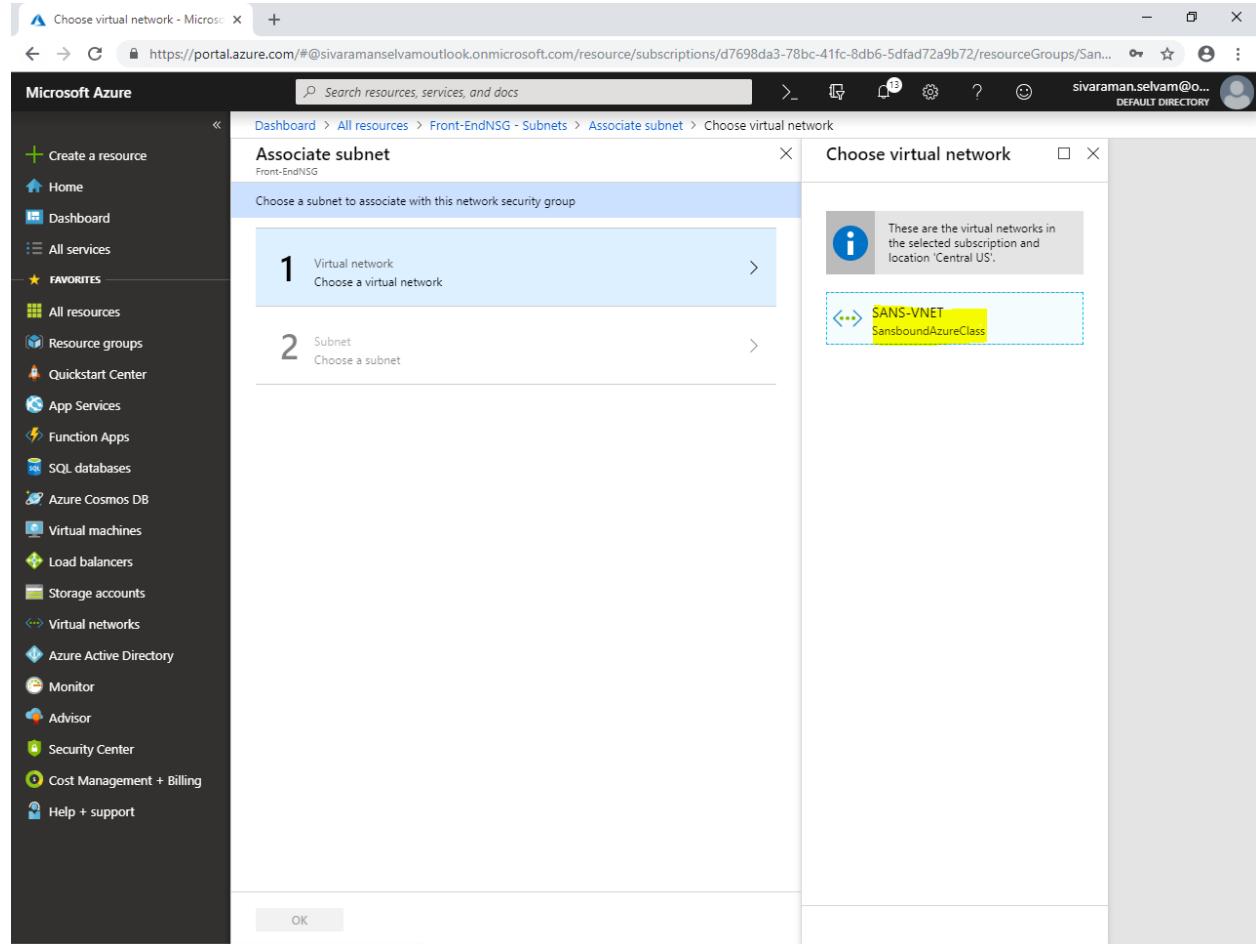
The screenshot shows the Microsoft Azure portal interface. The left sidebar contains a navigation menu with various service icons. The main content area is titled "Front-EndNSG - Subnets" under "Network security group". A search bar at the top right says "Search subnets". Below it is a table with columns: NAME, ADDRESS RANGE, and VIRTUAL NETWORK. The table displays the message "No results.". On the far left of the main content area, there is a vertical list of options: Overview, Activity log, Access control (IAM), Tags, Diagnose and solve problems, Properties, Locks, Automation script, Diagnostic settings, NSG flow logs, Effective security rules, and New support request. The "Subnets" option is currently selected. At the top of the main content area, there is a large blue button labeled "+ Associate".

While “Associate subnet”,

Click “Choose a virtual network”,



Click “**SANS-VNET**” to select the virtual network.

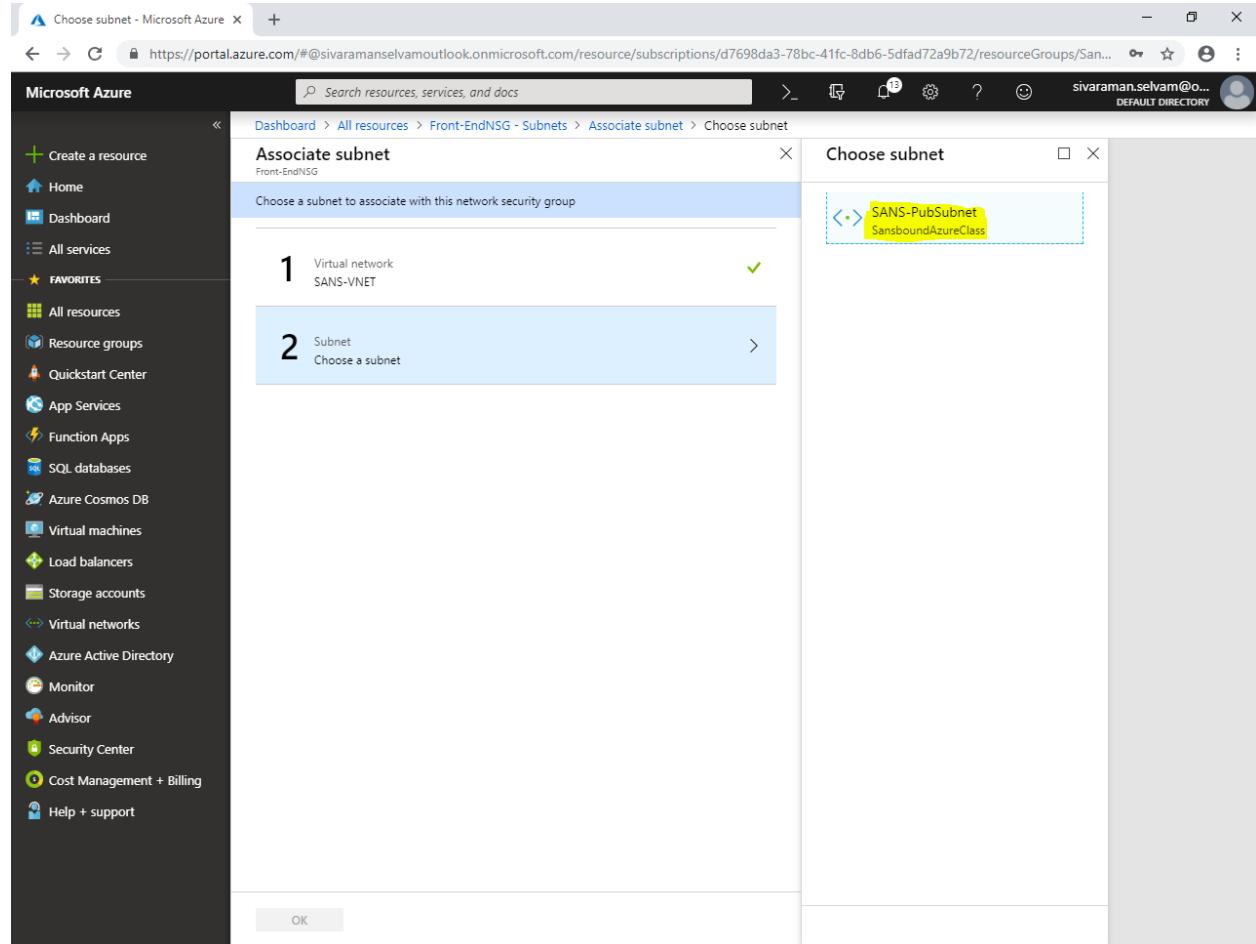


The screenshot shows the Microsoft Azure portal interface. The user is navigating through the following steps:

- Dashboard > All resources > Front-EndNSG - Subnets > Associate subnet > Choose virtual network
- Associate subnet (Front-EndNSG) - Step 1: Choose a subnet to associate with this network security group
- Step 1: Virtual network (Choose a virtual network)
- Step 2: Subnet (Choose a subnet)

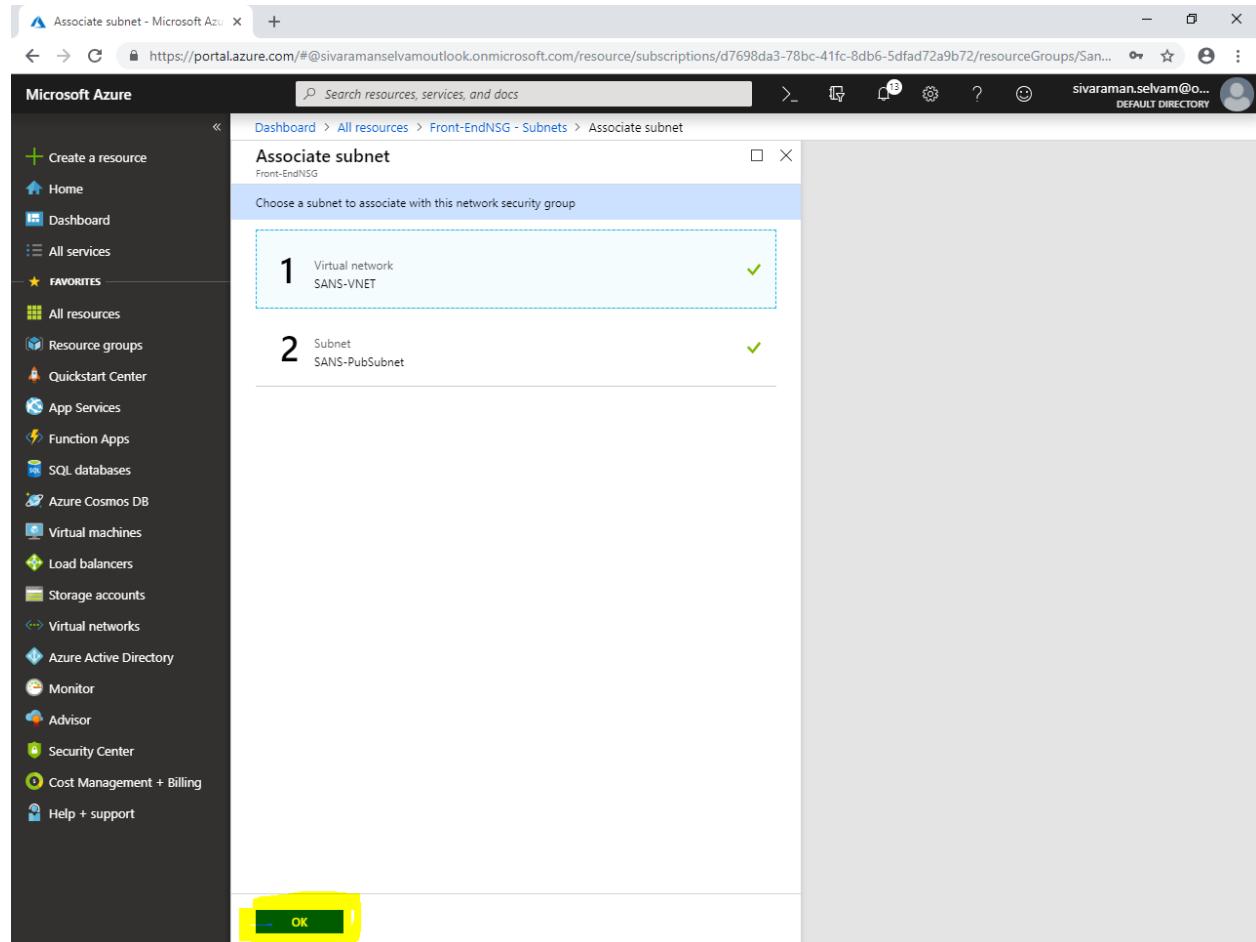
A callout box highlights the "SANS-VNET" option in the "Choose virtual network" dropdown, which is part of a larger list of virtual networks. An information icon in the top right corner of the dropdown provides details about the selected subscription and location.

To “Choose a subnet” click “**SANS-PubSubnet**”.

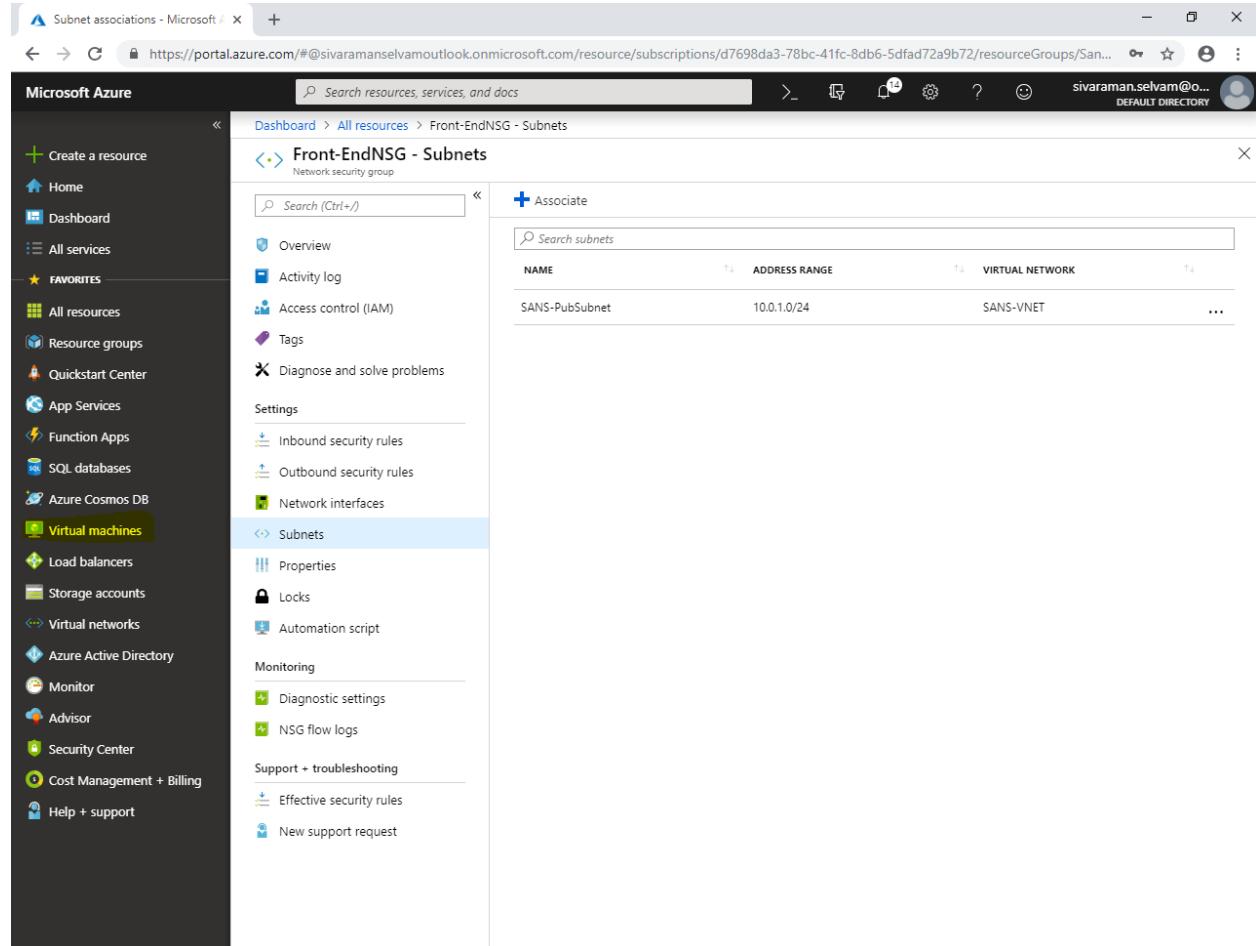


The screenshot shows the Microsoft Azure portal interface. The left sidebar contains various service icons such as Create a resource, Home, Dashboard, All services, Favorites, All resources, Resource groups, Quickstart Center, App Services, Function Apps, SQL databases, Azure Cosmos DB, Virtual machines, Load balancers, Storage accounts, Virtual networks, Azure Active Directory, Monitor, Advisor, Security Center, Cost Management + Billing, and Help + support. The main content area shows a navigation path: Dashboard > All resources > Front-EndNSG - Subnets > Associate subnet > Choose subnet. The current step is "Choose a subnet". It displays two options: "Virtual network" (SANS-VNET) and "Subnet". The "Subnet" option is highlighted with a yellow box and has a dashed blue border around it, indicating it is the target for clicking. The "OK" button is visible at the bottom of the dialog.

Click "Ok".



Click "Virtual machines",



The screenshot shows the Microsoft Azure portal interface. The left sidebar is open, displaying various service categories. The 'Virtual machines' link is highlighted with a yellow box. The main content area shows the 'Front-EndNSG - Subnets' page for a Network Security Group. The 'Subnets' section is selected in the navigation menu. A table lists one subnet: 'SANS-PubSubnet' with 'ADDRESS RANGE' 10.0.1.0/24 and 'VIRTUAL NETWORK' SANS-VNET.

NAME	ADDRESS RANGE	VIRTUAL NETWORK
SANS-PubSubnet	10.0.1.0/24	SANS-VNET

**While create virtual machine,**

Select “Subscription” as “**Free Trial**”.

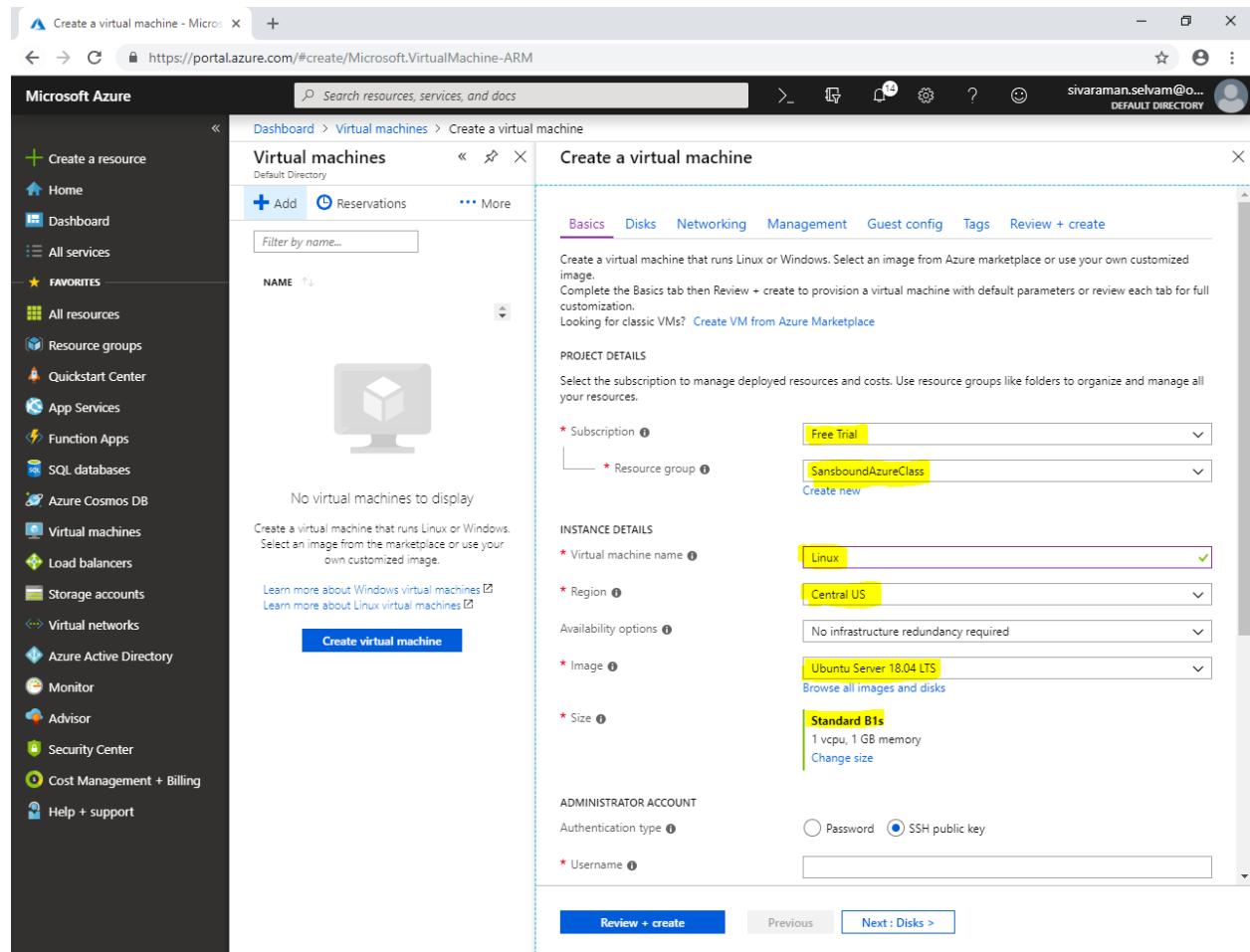
Select “Resource group” as “**SansboundAzureClass**”.

Type “Virtual machine name” as “**Linux**”.

Select “Region” as “**Central US**”.

Select “Image” as “**Ubuntu Server 18.04**”.

Change “VM size” as “**Standard B1s**”.

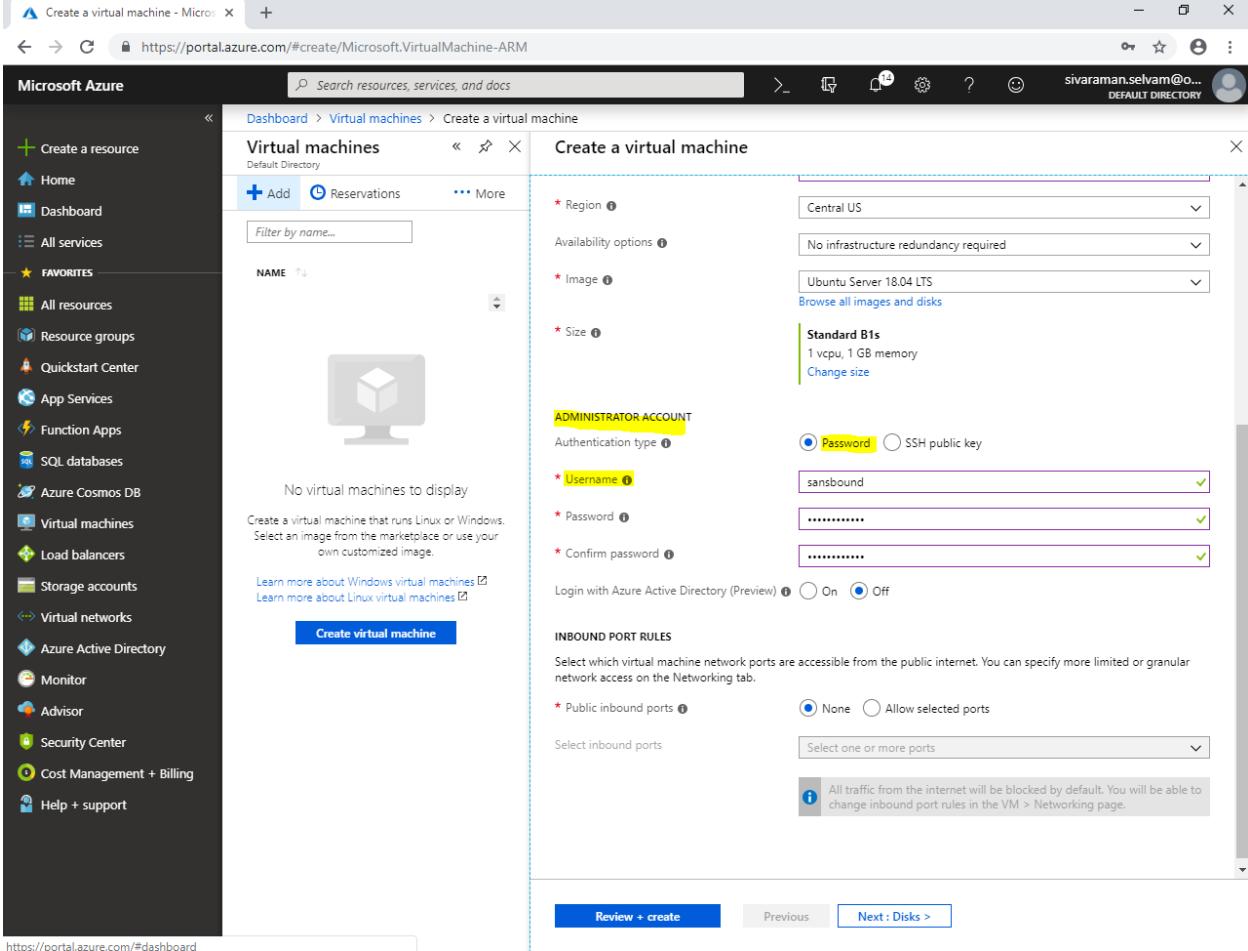


The screenshot shows the Microsoft Azure portal interface for creating a new virtual machine. The left sidebar contains various service icons like Home, Dashboard, All services, Favorites, Resource groups, and more. The main area is titled 'Create a virtual machine' under 'Virtual machines'. The 'PROJECT DETAILS' section includes fields for Subscription (set to 'Free Trial'), Resource group (set to 'SansboundAzureClass'), and Virtual machine name (set to 'Linux'). The 'INSTANCE DETAILS' section includes fields for Region (set to 'Central US'), Image (set to 'Ubuntu Server 18.04 LTS'), and Size (set to 'Standard B1s'). The 'ADMINISTRATOR ACCOUNT' section includes fields for Authentication type (set to 'SSH public key') and Username. At the bottom, there are 'Review + create' and 'Next: Disks >' buttons.

In “Administrator Account”,

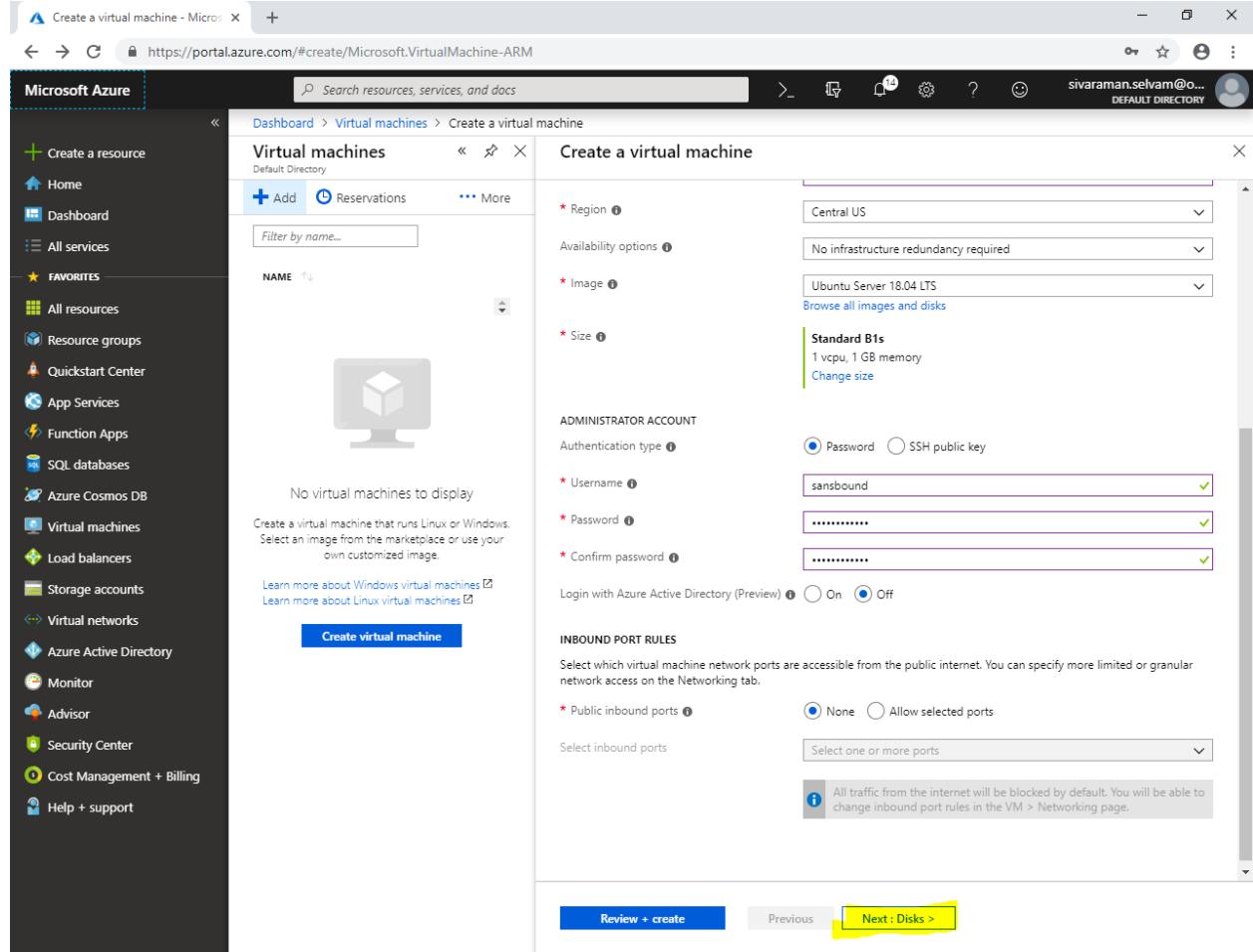
Set “Authentication type” as “Password”.

Type “Username” as “sansbound” and type password for the virtual machine.



The screenshot shows the Microsoft Azure portal interface for creating a new virtual machine. The left sidebar lists various services like Home, Dashboard, and Virtual machines. The main area shows a list of existing virtual machines and the 'Create a virtual machine' wizard. In the 'Create a virtual machine' step, the 'ADMINISTRATOR ACCOUNT' section is highlighted. It includes fields for 'Authentication type' (set to 'Password'), 'Username' (set to 'sansbound'), and 'Password' and 'Confirm password' (both shown as masked dots). Other configuration options like Region (Central US), Image (Ubuntu Server 18.04 LTS), and Size (Standard B1s) are also visible.

Click “Next : Disks”.



The screenshot shows the Microsoft Azure portal interface for creating a new virtual machine. The left sidebar contains various service icons, and the main area is titled "Create a virtual machine". The "Virtual machines" section shows no existing VMs. The "Create a virtual machine" form is filled out with the following details:

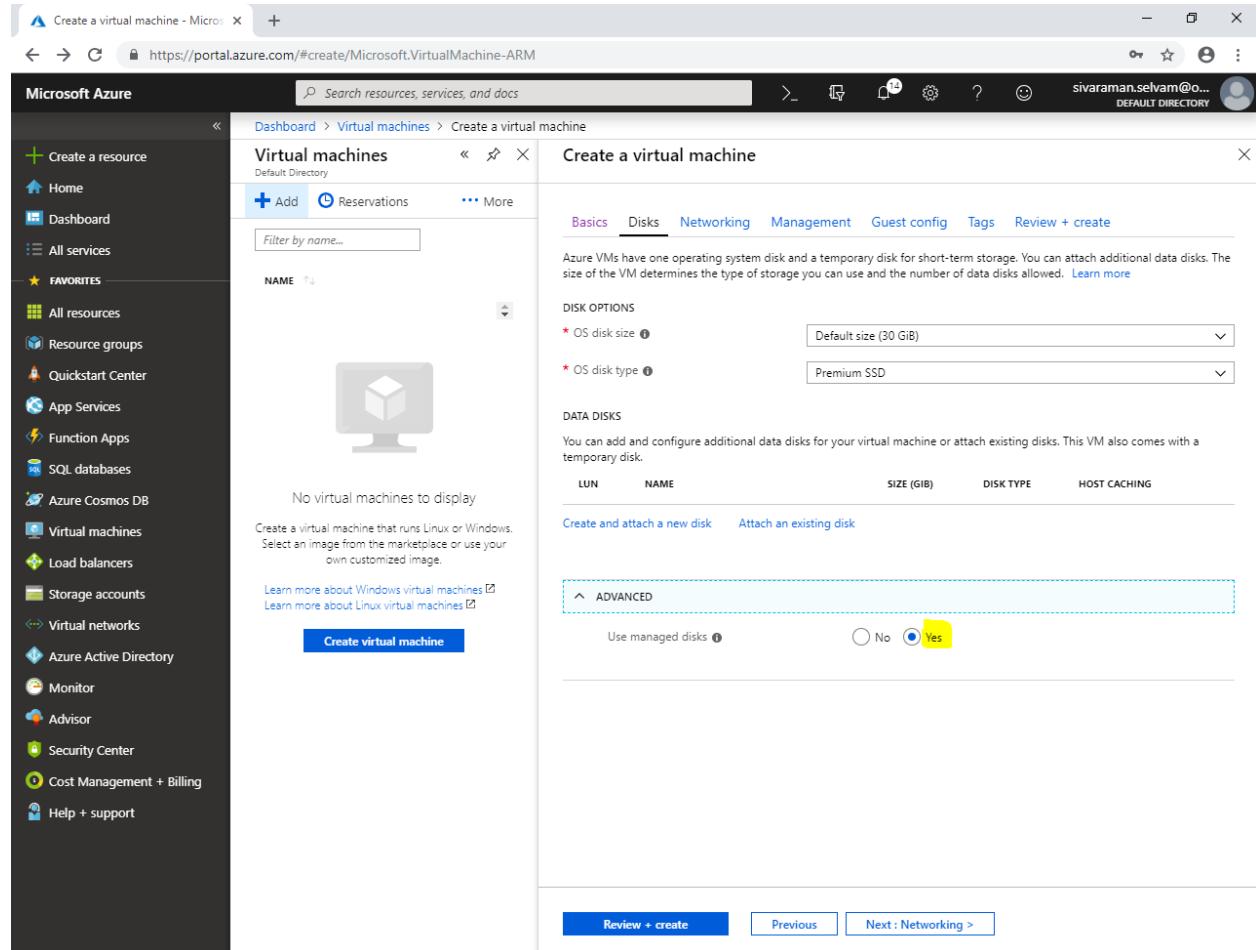
- Region:** Central US
- Image:** Ubuntu Server 18.04 LTS
- Size:** Standard B1s (1 vcpu, 1 GB memory)
- Administrator Account:**
  - Authentication type: Password (selected)
  - Username: sansbound
  - Password: [REDACTED]
  - Confirm password: [REDACTED]
- Inbound Port Rules:**
  - Public inbound ports: None (selected)
  - Select inbound ports: A dropdown menu showing "Select one or more ports".
  - A note: "All traffic from the internet will be blocked by default. You will be able to change inbound port rules in the VM > Networking page."

At the bottom of the form, there are "Review + create" and "Previous" buttons, and the "Next: Disks >" button, which is highlighted with a yellow box.

In “Disks”,

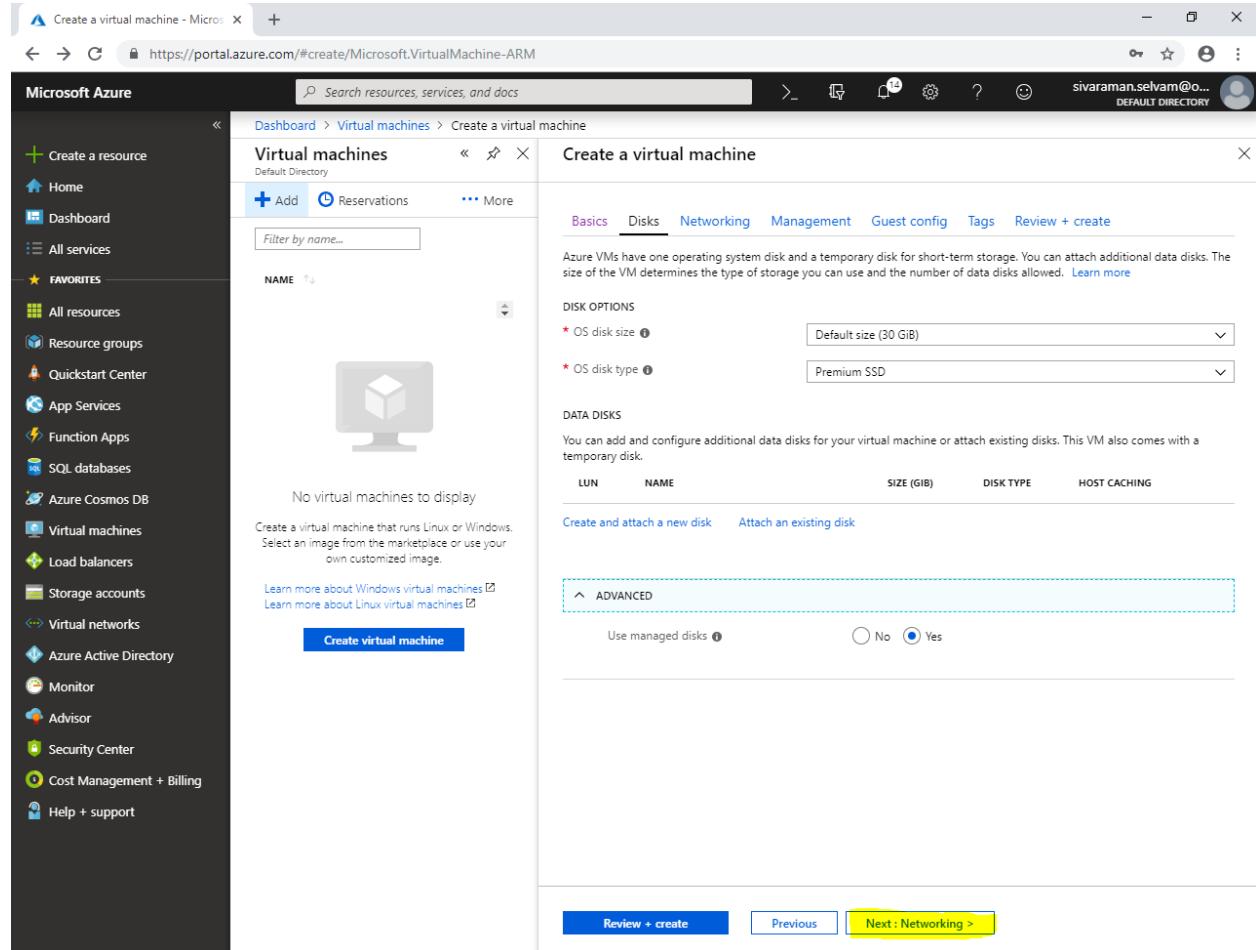
Expand “Advanced”,

Ensure “Use managed disks” as “Yes”.



The screenshot shows the Microsoft Azure portal interface for creating a new virtual machine. The left sidebar lists various services like Home, Dashboard, and Storage accounts. The main area shows the 'Virtual machines' section with a search bar and a 'Create a virtual machine' button. The 'Disks' tab is currently selected. Under 'DISK OPTIONS', the 'OS disk size' is set to 'Default size (30 GiB)' and the 'OS disk type' is set to 'Premium SSD'. In the 'DATA DISKS' section, there's a note about temporary disks. Below these, there are buttons for 'Create and attach a new disk' and 'Attach an existing disk'. A 'Create virtual machine' button is at the bottom left. A 'Review + create' button is at the bottom right. A yellow box highlights the 'ADVANCED' section where the 'Use managed disks' radio button is selected ('Yes').

Click "Next : Networking >".



The screenshot shows the 'Create a virtual machine' wizard in the Microsoft Azure portal. The current step is 'Networking'. The 'Networking' tab is selected in the top navigation bar. The main area displays networking options for the virtual machine, including network interface cards (NICs) and security groups. At the bottom of the screen, there are three buttons: 'Review + create' (blue), 'Previous' (light blue), and 'Next: Networking >' (yellow, indicating it is the current step). The URL in the browser address bar is <https://portal.azure.com/#create/Microsoft.VirtualMachine-ARM>.

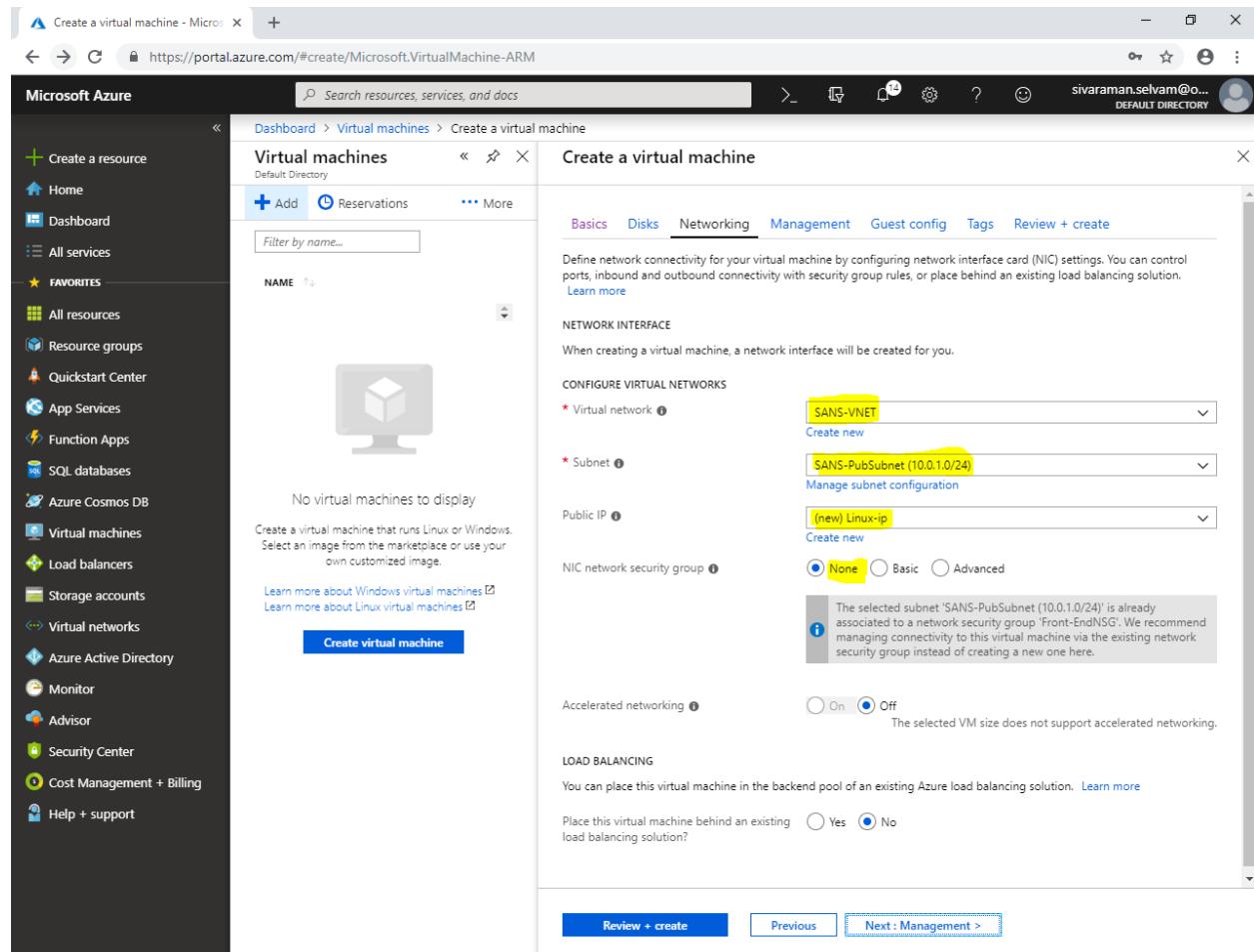
In "Networking",

Ensure "Virtual network" as "**SANS-VNET**".

Ensure "Subnet" as "**SANS-PubSubnet**".

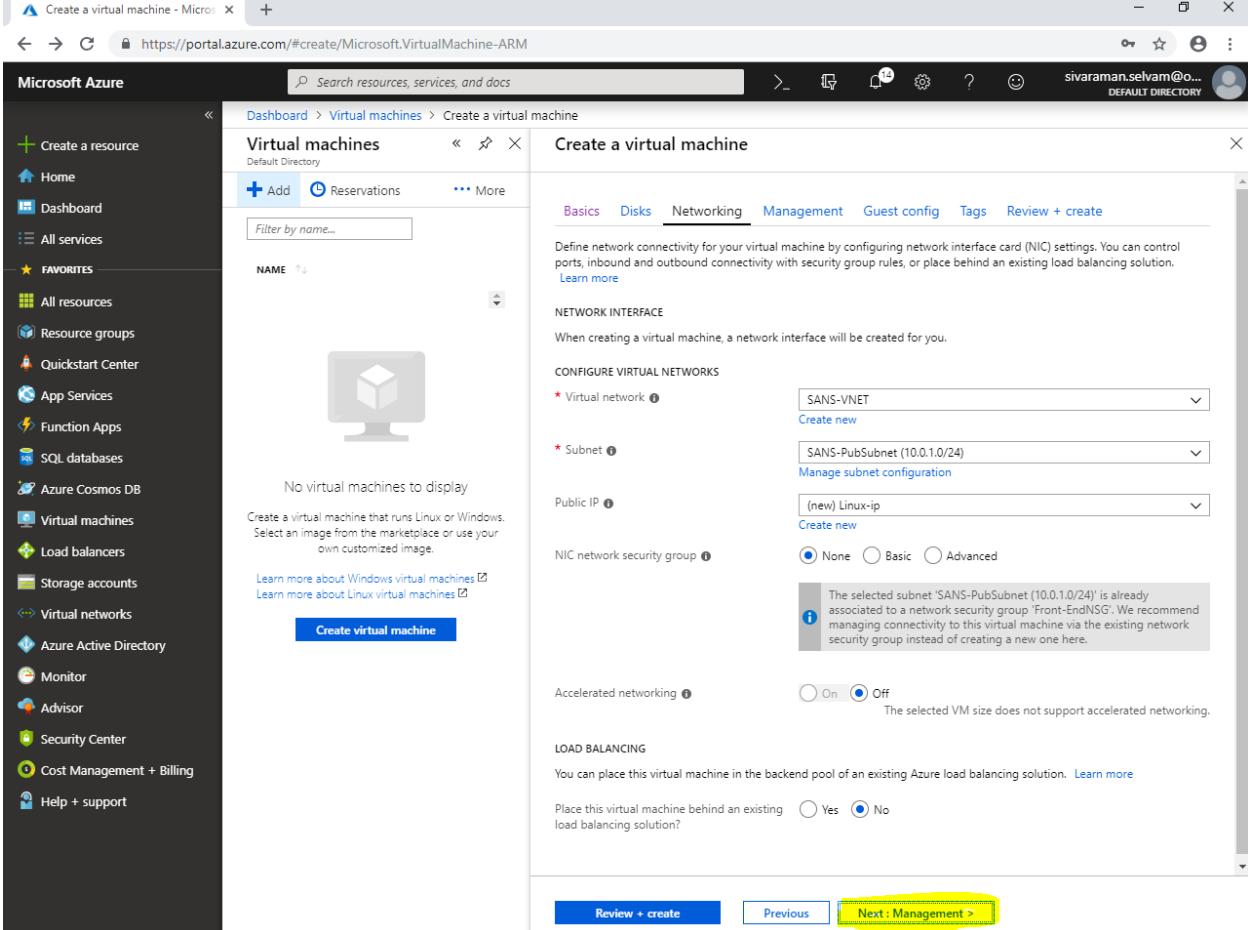
Ensure Public IP is selected.

Ensure "NIC network security group" as "**None**".



The screenshot shows the 'Create a virtual machine' wizard in the Microsoft Azure portal. The 'Networking' tab is selected. The 'Virtual network' dropdown is set to 'SANS-VNET'. The 'Subnet' dropdown is set to 'SANS-PubSubnet (10.0.1.0/24)'. The 'Public IP' dropdown is set to '(new) Linux-ip'. The 'NIC network security group' section has a radio button selected for 'None'. A note indicates that the selected subnet is already associated with a network security group. Accelerated networking is turned off. The 'Review + create' button is at the bottom.

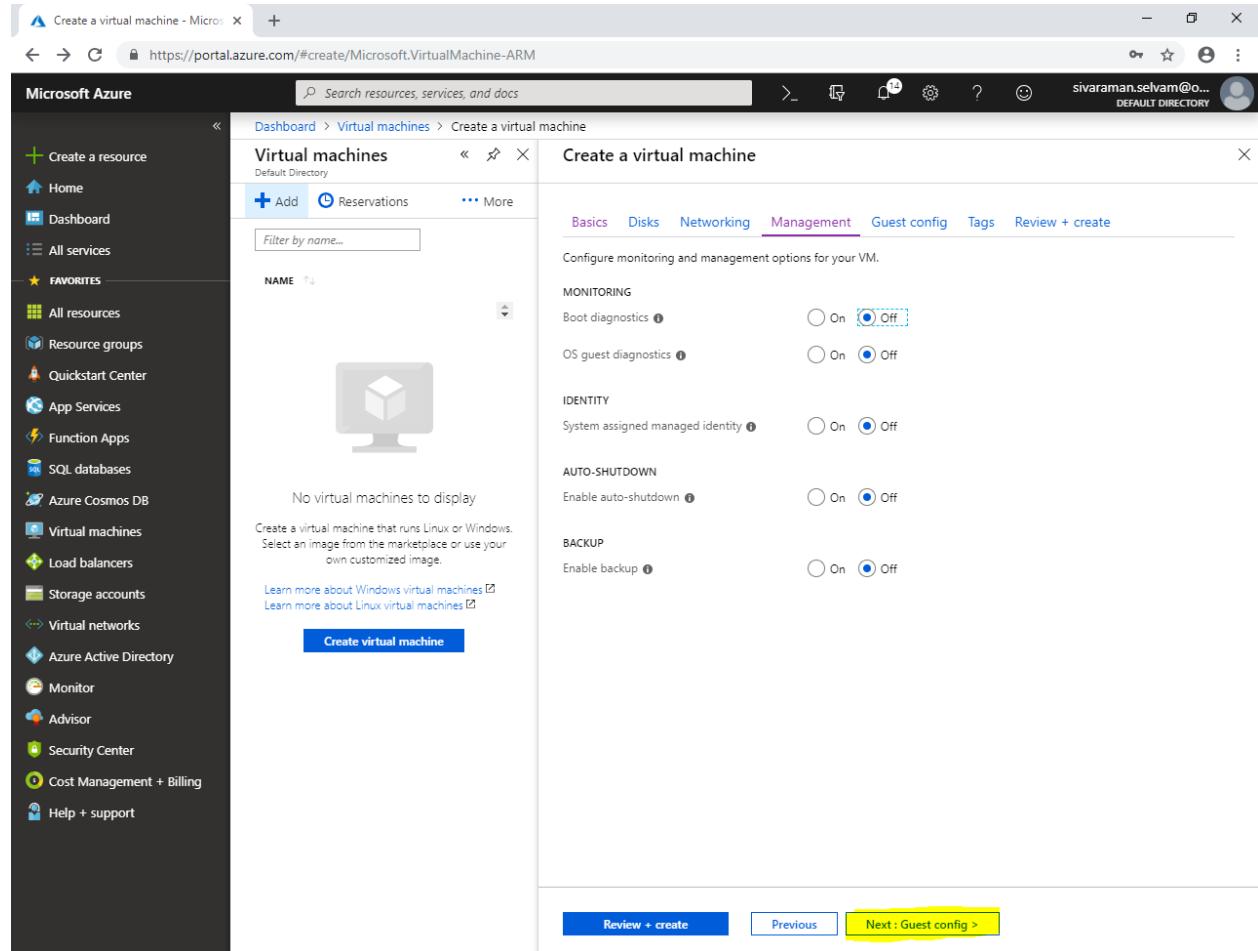
Click "Next : Management".



The screenshot shows the Microsoft Azure portal interface for creating a new virtual machine. The left sidebar contains various service icons, and the main area is titled 'Virtual machines'. A sub-header 'Create a virtual machine' is present. The 'Management' tab is currently selected. The configuration section includes fields for 'Virtual network' (set to 'SANS-VNET'), 'Subnet' (set to 'SANS-PubSubNet (10.0.1.0/24)'), and 'Public IP' (set to '(new) Linux-ip'). Under 'NIC network security group', the 'None' option is selected. There is a note about a conflict with an existing network security group. Accelerated networking is set to 'Off'. In the 'LOAD BALANCING' section, it asks if the VM should be placed behind an existing load balancer, with 'No' selected. At the bottom, there are buttons for 'Review + create', 'Previous', and 'Next : Management >'. The 'Next : Management >' button is highlighted with a yellow box.

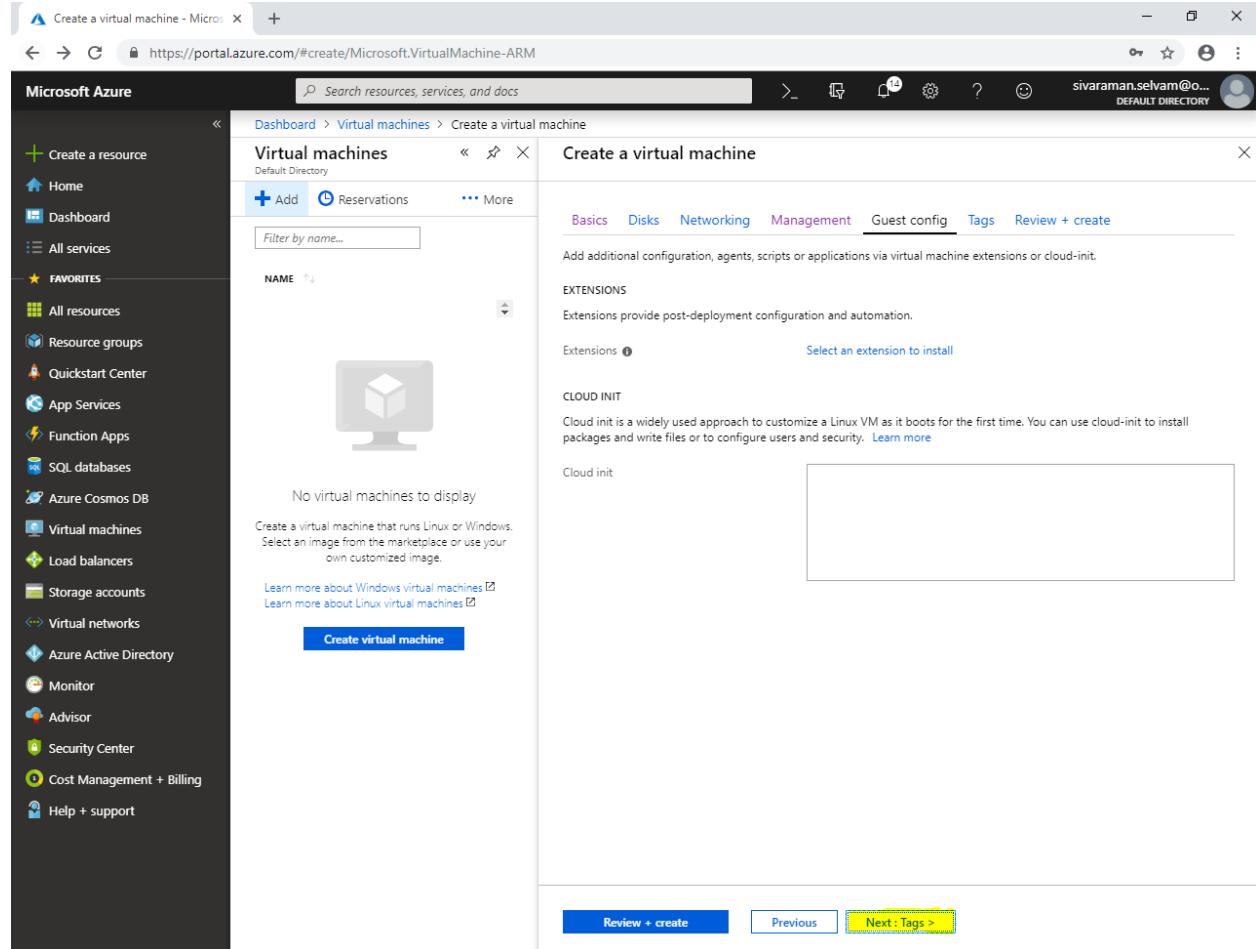
In “Management”,

Click “Next : Guest config”.



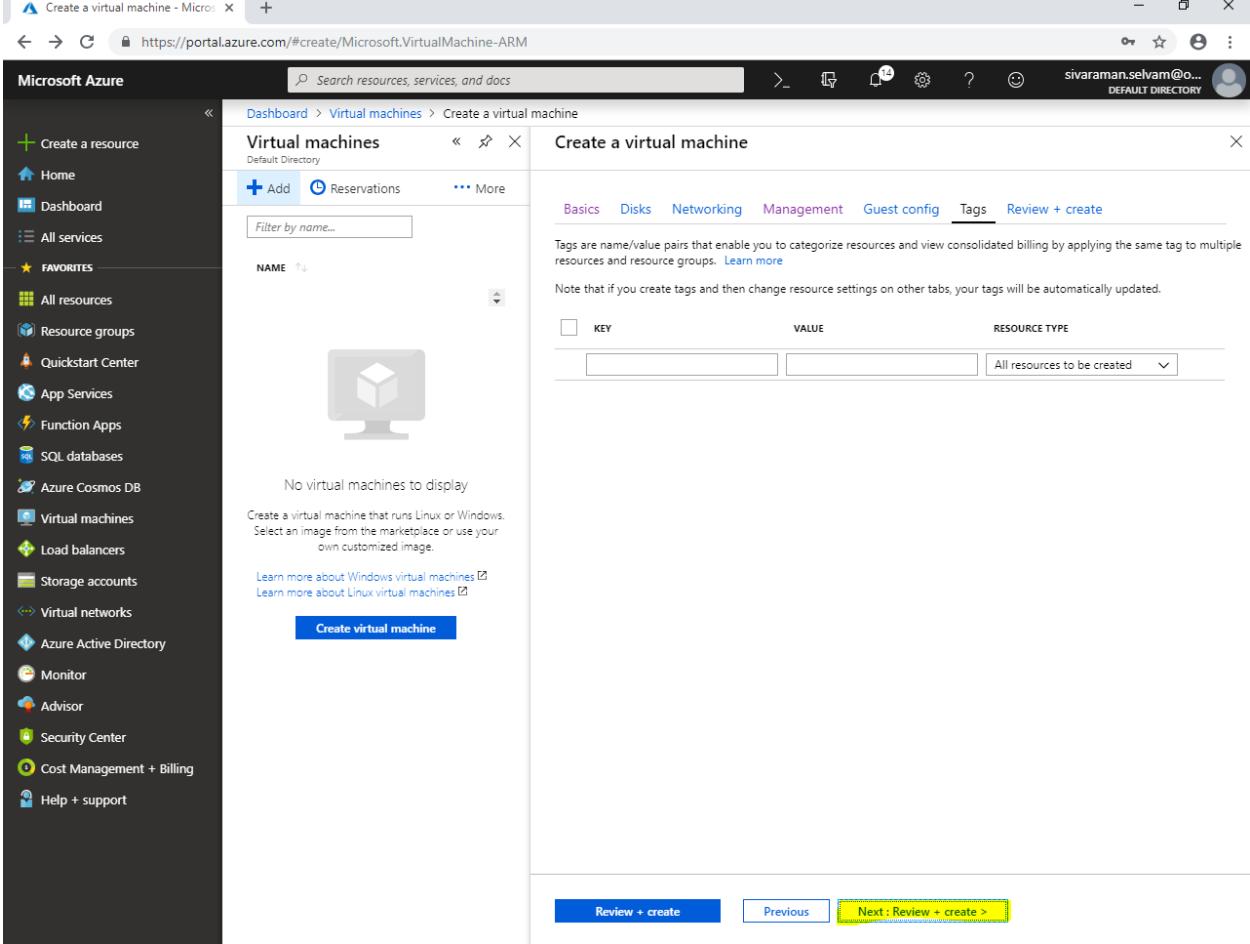
In “Guest config”,

Click “Next : Tags >”.



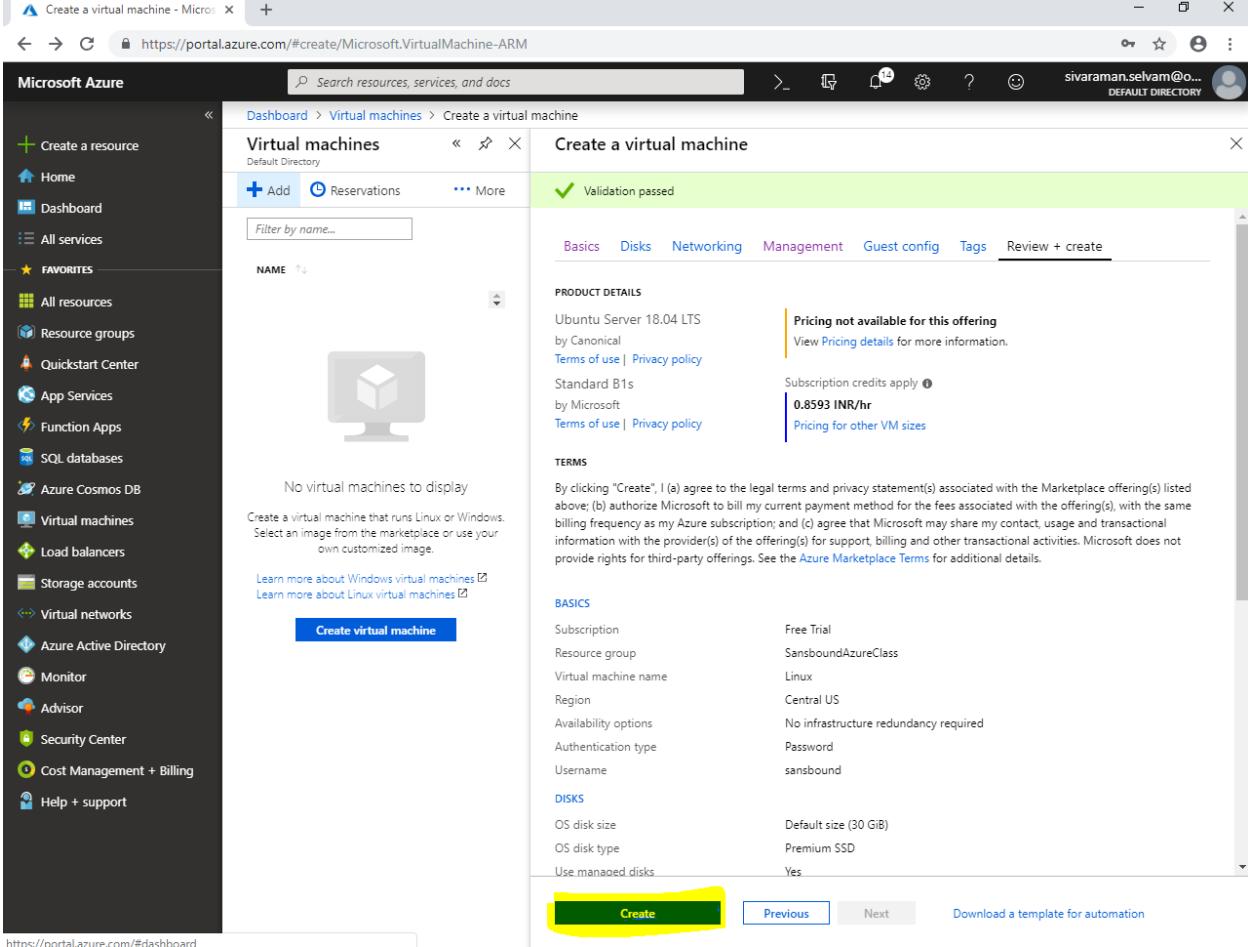
In “Tags”,

Click “Next : Review + create”.



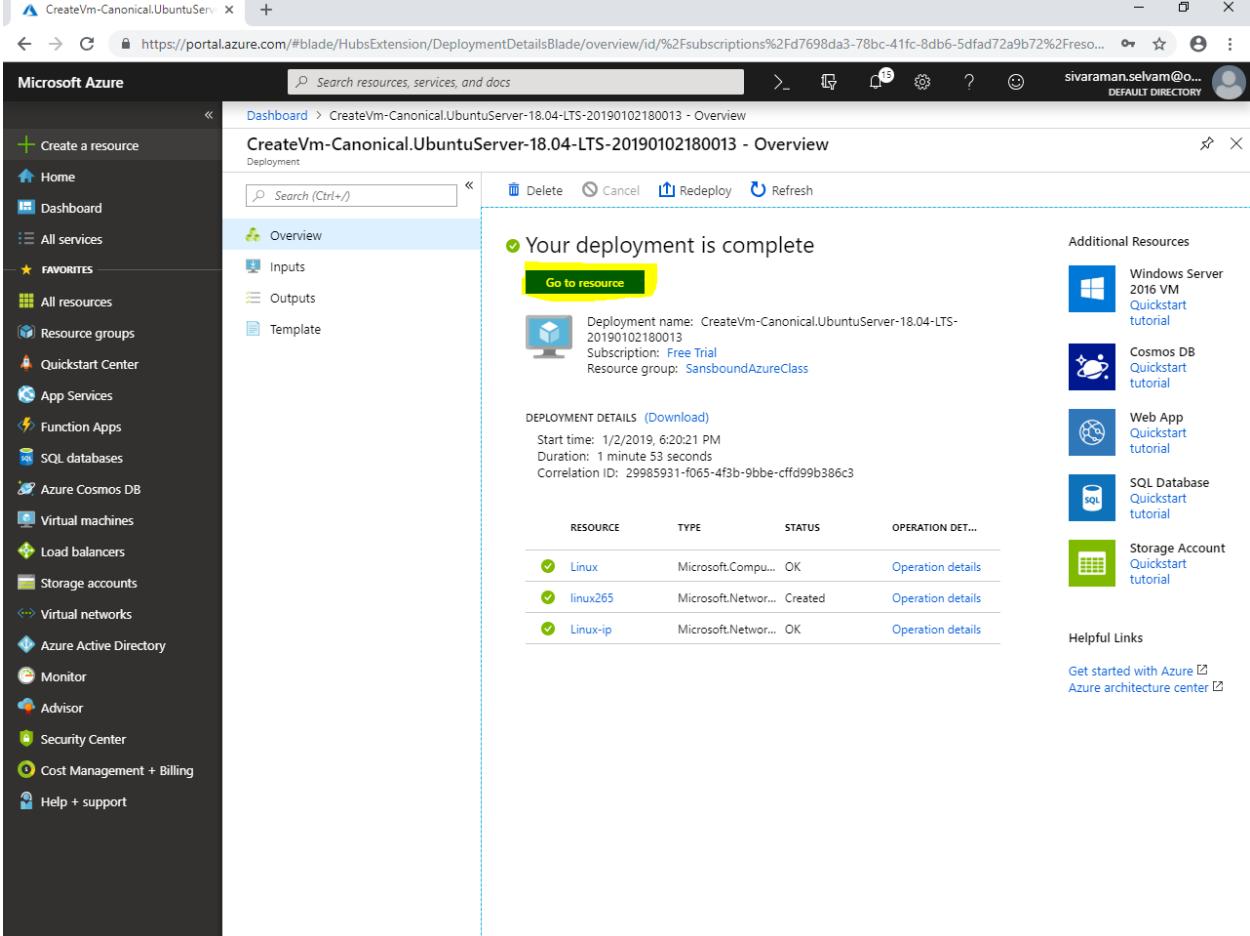
The screenshot shows the Microsoft Azure portal interface for creating a new virtual machine. The left sidebar contains a navigation menu with various services like Home, Dashboard, All services, Favorites, and Virtual machines. The main area is titled 'Create a virtual machine' under 'Virtual machines'. The 'Tags' tab is currently selected. A table allows adding key-value pairs for tags, with a row example: 'KEY' (empty), 'VALUE' (empty), and 'RESOURCE TYPE' set to 'All resources to be created'. At the bottom, there are buttons for 'Review + create' (highlighted in yellow), 'Previous', and 'Next : Review + create >' (also highlighted in yellow).

Click “Create”.



The screenshot shows the Microsoft Azure portal interface for creating a new virtual machine. The left sidebar contains navigation links for resources, services, and management. The main area is titled "Virtual machines" and shows a "Create a virtual machine" wizard. The "Review + create" step is currently selected. A green banner at the top right indicates "Validation passed". The "PRODUCT DETAILS" section lists "Ubuntu Server 18.04 LTS" by Canonical, with a note that "Pricing not available for this offering". The "TERMS" section contains legal disclaimers. The "BASICS" section includes fields for "Subscription" (Free Trial), "Resource group" (SansboundAzureClass), "Virtual machine name" (Linux), "Region" (Central US), "Availability options" (No infrastructure redundancy required), "Authentication type" (Password), and "Username" (sansbound). The "DISKS" section shows "OS disk size" (Default size (30 GB)), "OS disk type" (Premium SSD), and "Use managed disks" (Yes). At the bottom, a large yellow button labeled "Create" is highlighted with a yellow box, and other buttons for "Previous", "Next", and "Download a template for automation" are visible.

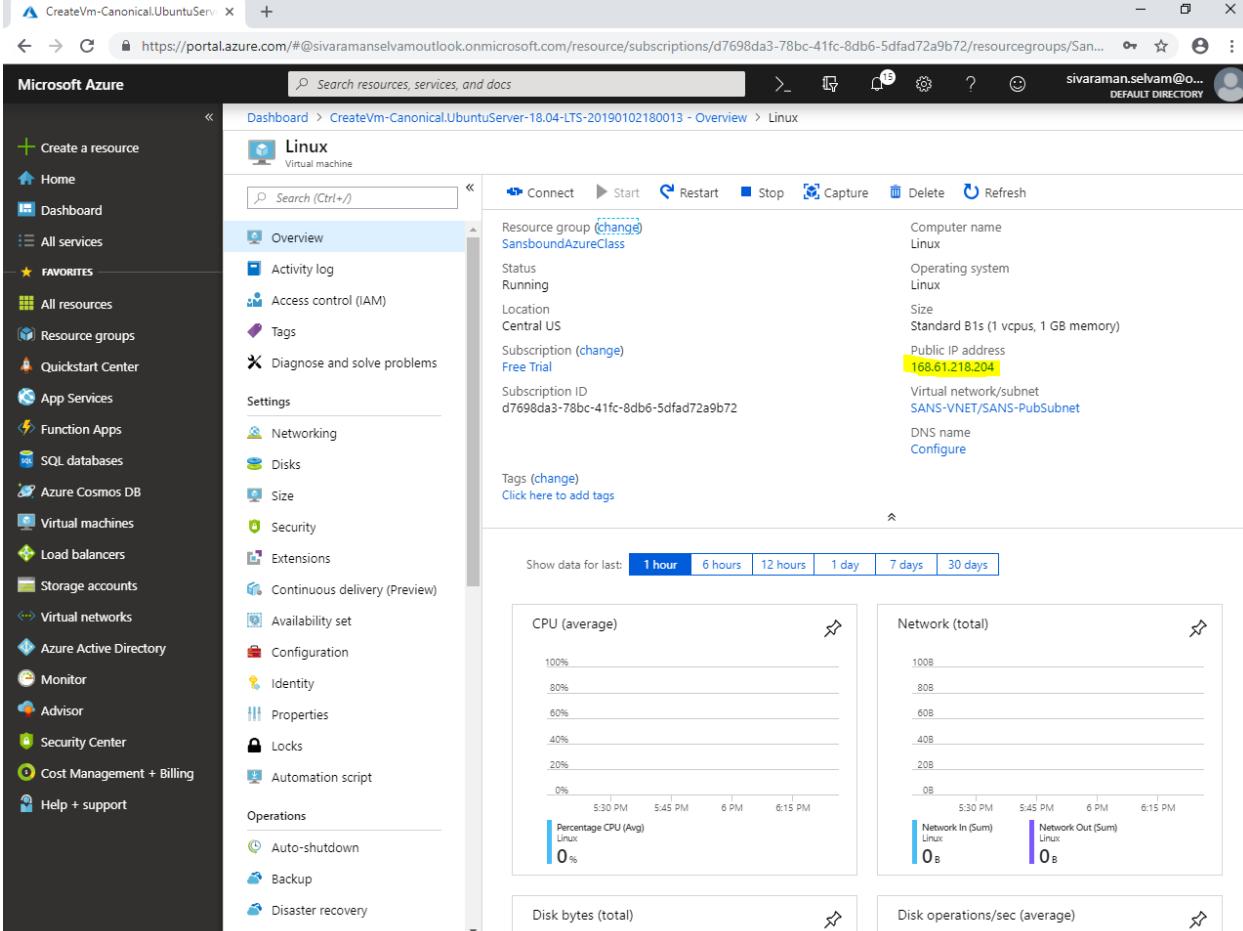
Click “Go to resource”.



The screenshot shows the Microsoft Azure portal interface. On the left, the sidebar lists various services like Home, Dashboard, All services, Favorites, and more. The main content area displays the "CreateVm-Canonical.UbuntuServer-18.04-LTS-20190102180013 - Overview" page. A prominent message says "Your deployment is complete" with a yellow "Go to resource" button highlighted. Below this, deployment details are listed: Deployment name: CreateVm-Canonical.UbuntuServer-18.04-LTS-20190102180013, Subscription: Free Trial, Resource group: SansboundAzureClass. A table shows three resources: Linux (Microsoft.Compu... OK), linux265 (Microsoft.Networ... Created), and Linux-ip (Microsoft.Networ... OK). To the right, there's a section for "Additional Resources" with links to Windows Server 2016 VM Quickstart tutorial, Cosmos DB Quickstart tutorial, Web App Quickstart tutorial, SQL Database Quickstart tutorial, and Storage Account Quickstart tutorial. At the bottom, there are "Helpful Links" for Get started with Azure and Azure architecture center.

RESOURCE	TYPE	STATUS	OPERATION DET...
✓ Linux	Microsoft.Compu...	OK	<a href="#">Operation details</a>
✓ linux265	Microsoft.Networ...	Created	<a href="#">Operation details</a>
✓ Linux-ip	Microsoft.Networ...	OK	<a href="#">Operation details</a>

Kindly note the public IP address of Linux / Ubuntu.



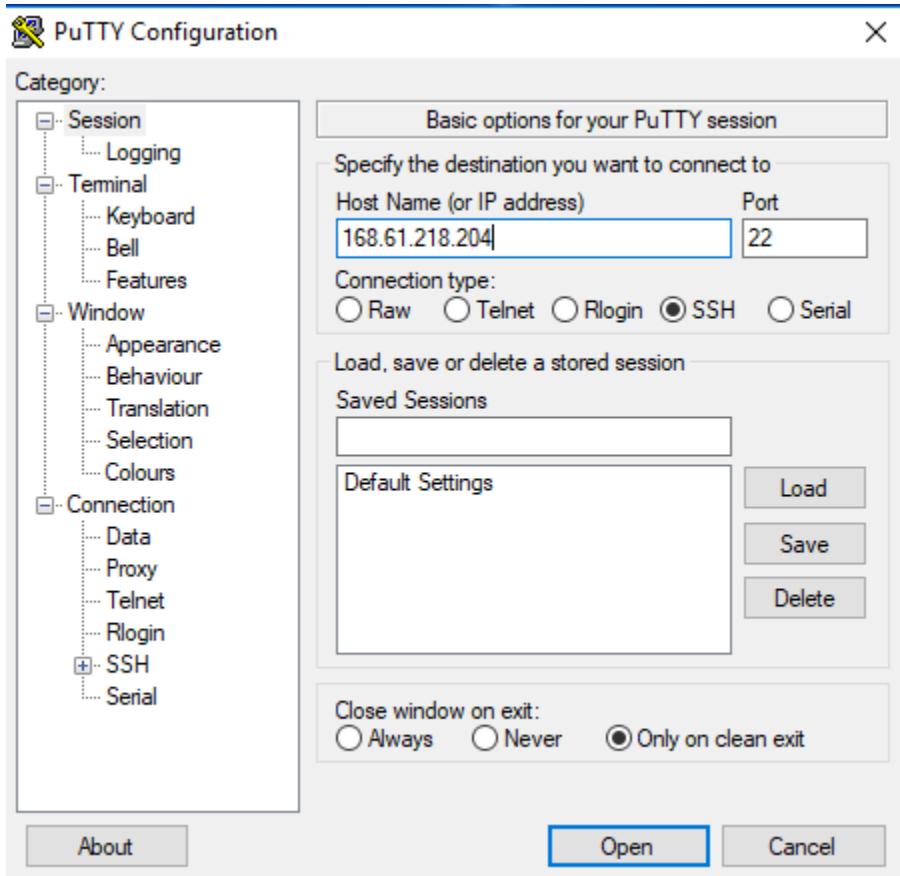
The screenshot shows the Microsoft Azure portal interface. On the left, the navigation menu is visible with various service icons. The main content area displays the 'Overview' tab for a Linux virtual machine named 'CreateVm-Canonical.UbuntuServer'. Key details shown include:

- Resource group: SansboundAzureClass
- Status: Running
- Location: Central US
- Subscription: Free Trial
- Subscription ID: d7698da3-78bc-41fc-8db6-5dfad72a9b72
- Computer name: Linux
- Operating system: Linux
- Size: Standard B1s (1 vcpus, 1 GB memory)
- Public IP address: **168.61.218.204** (highlighted in yellow)
- Virtual network/subnet: SANS-VNET/SANS-PubSubNet
- DNS name: Configure

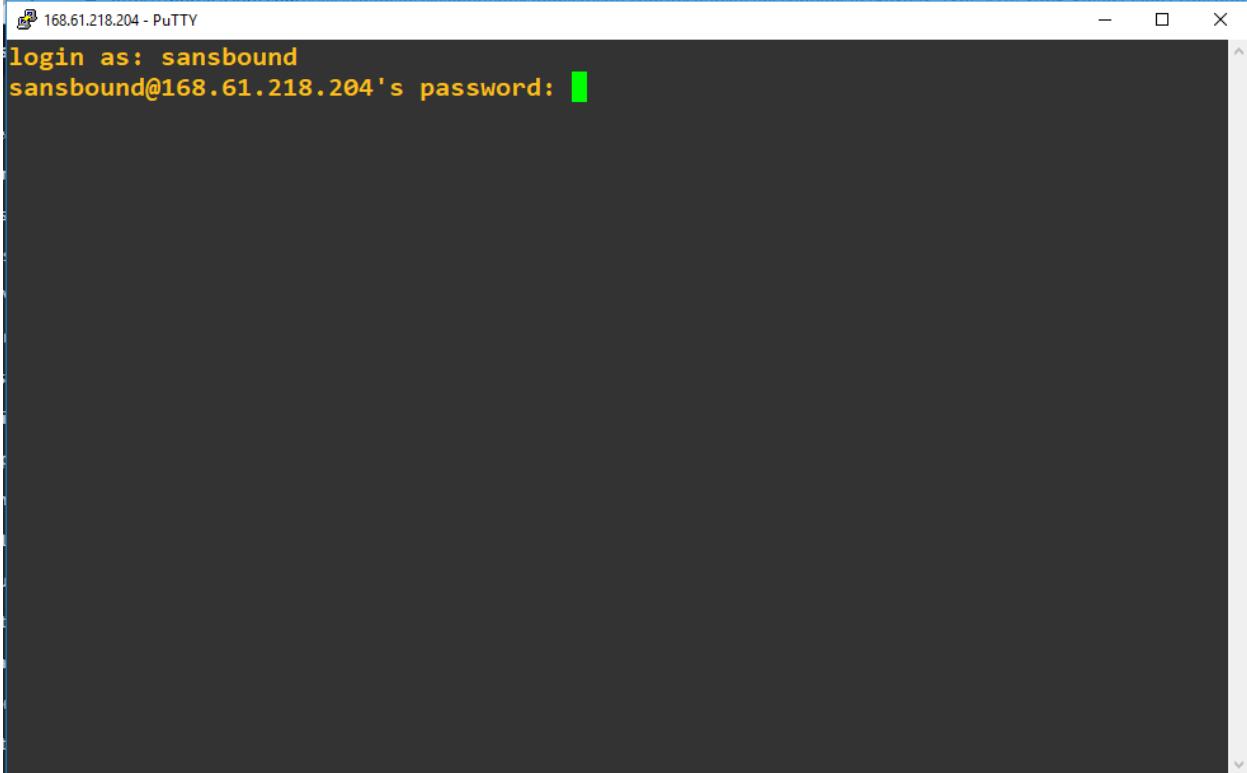
Below the main details, there are four performance charts: CPU (average), Network (total), Disk bytes (total), and Disk operations/sec (average). The CPU chart shows 0% usage over the last hour. The Network chart shows 0B for both In and Out traffic. The Disk charts show 0B total bytes and 0 operations per second.

From your local machine, launch “**putty.exe**” to connect the Ubuntu.

Type Public IP address of Ubuntu in putty and click “**Open**” to connect.

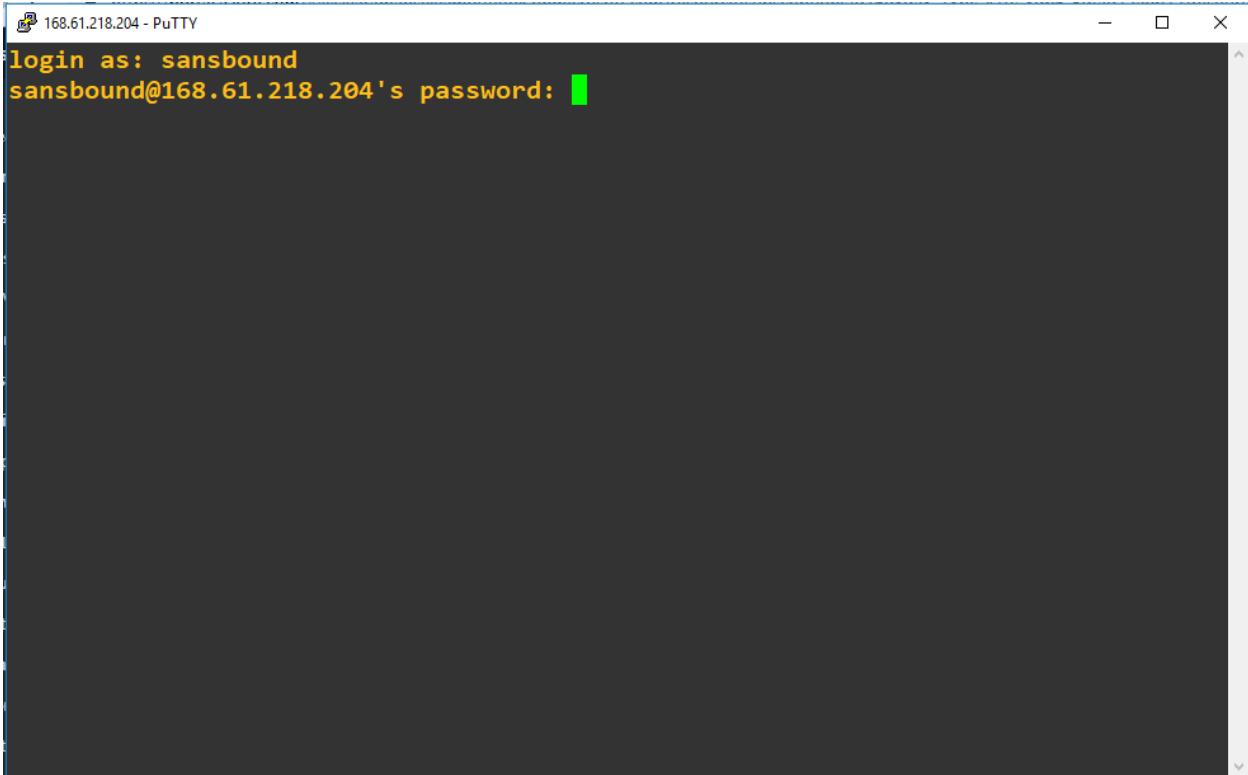


Type username as “**sansbound**” and press “**Enter**”.



A screenshot of a PuTTY terminal window titled "168.61.218.204 - PuTTY". The window shows a login prompt:  
**login as: sansbound**  
**sansbound@168.61.218.204's password:** [REDACTED]

Type “**Password**” of Ubuntu and press “**Enter**”.



A screenshot of a PuTTY terminal window titled "168.61.218.204 - PuTTY". The window shows a single line of text: "login as: sansbound" followed by "sansbound@168.61.218.204's password: █". The cursor is positioned at the end of the password field, indicated by a small green square. The background of the terminal is dark gray, and the text is white.

You have successfully logged into Ubuntu server.

```
sansbound@Linux: ~
System load:  0.16      Processes:        104
Usage of /:   4.0% of 28.90GB  Users logged in:    0
Memory usage: 27%          IP address for eth0: 10.0.1.4
Swap usage:   0%
Get cloud support with Ubuntu Advantage Cloud Guest:
  http://www.ubuntu.com/business/services/cloud

3 packages can be updated.
3 updates are security updates.

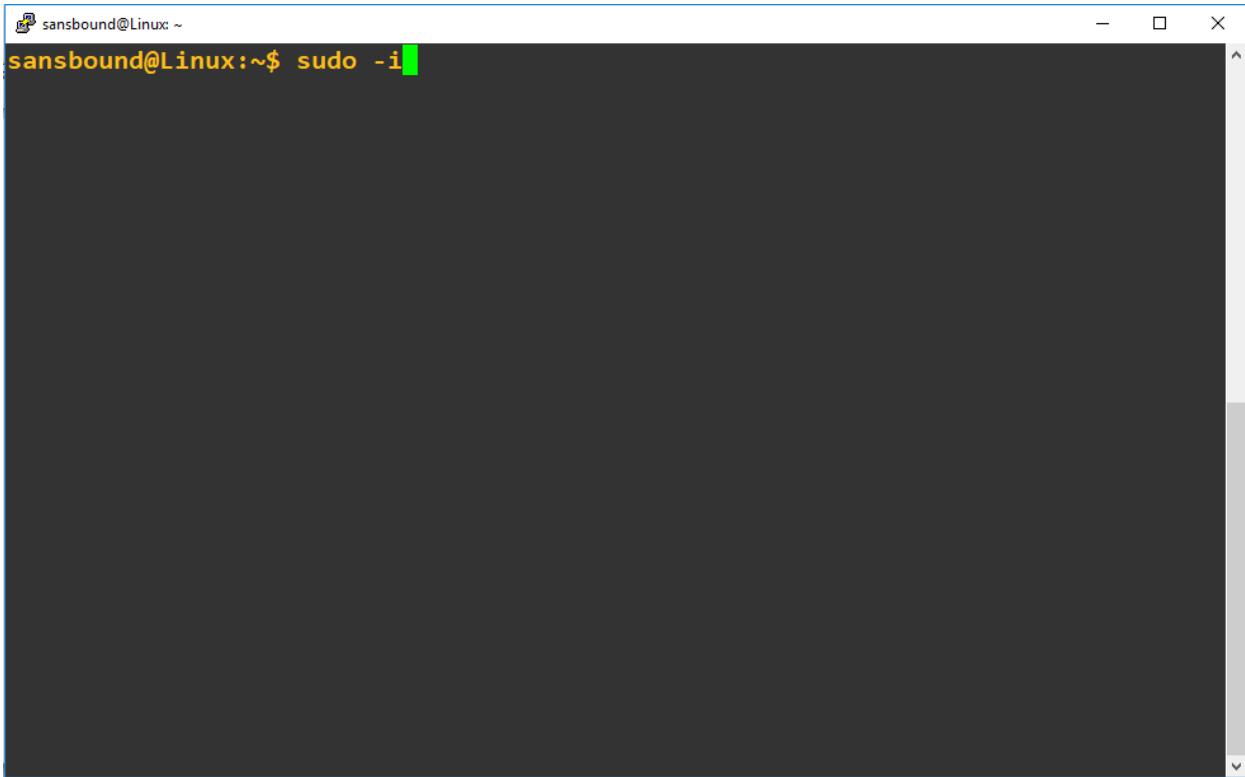
The programs included with the Ubuntu system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*copyright.

Ubuntu comes with ABSOLUTELY NO WARRANTY, to the extent permitted by
applicable law.

To run a command as administrator (user "root"), use "sudo <command>".
See "man sudo_root" for details.

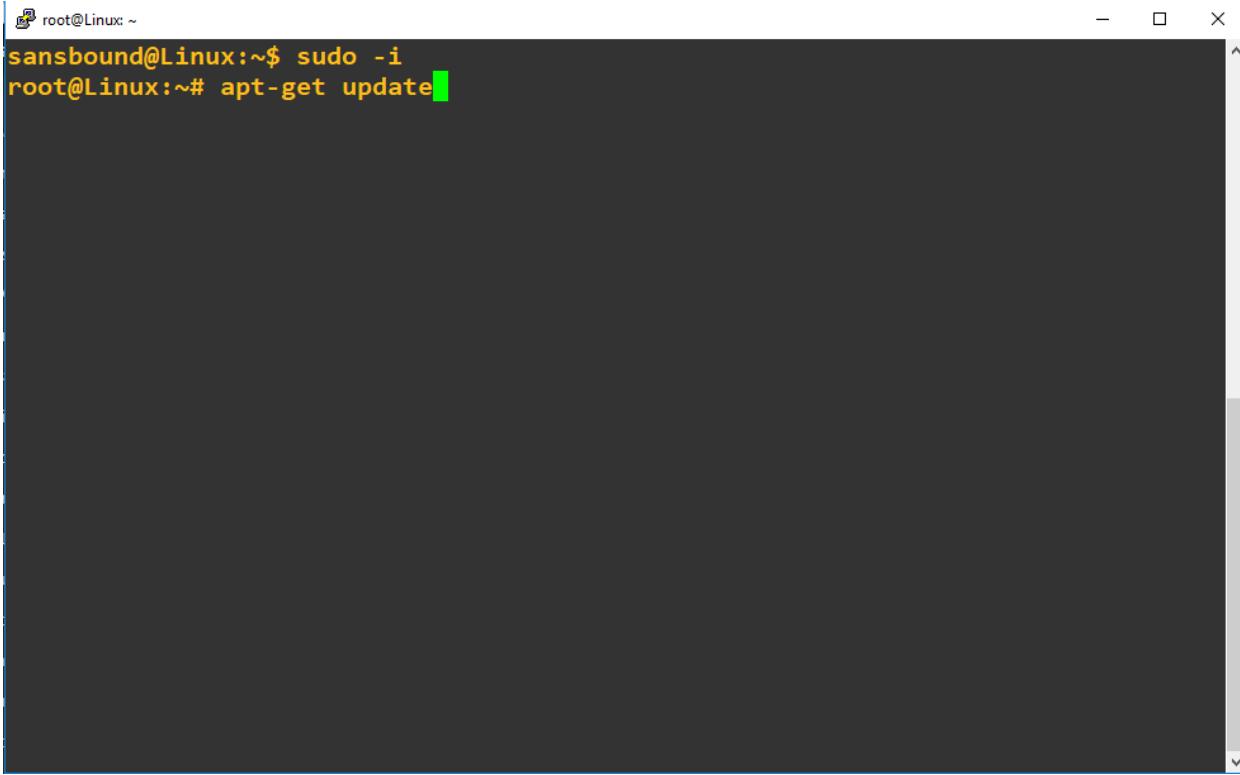
sansbound@Linux:~$
```

Type “**sudo –i**” and press “**Enter**” to login Ubuntu as a root account.



A screenshot of a terminal window titled "sansbound@Linux: ~". The window contains the command "sansbound@Linux:~\$ sudo -i" which has been partially typed. The background of the terminal is dark gray, and the text is white. The window has standard operating system window controls (minimize, maximize, close) at the top right corner.

Type “**apt-get update**” and press “**Enter**” to update the packages.



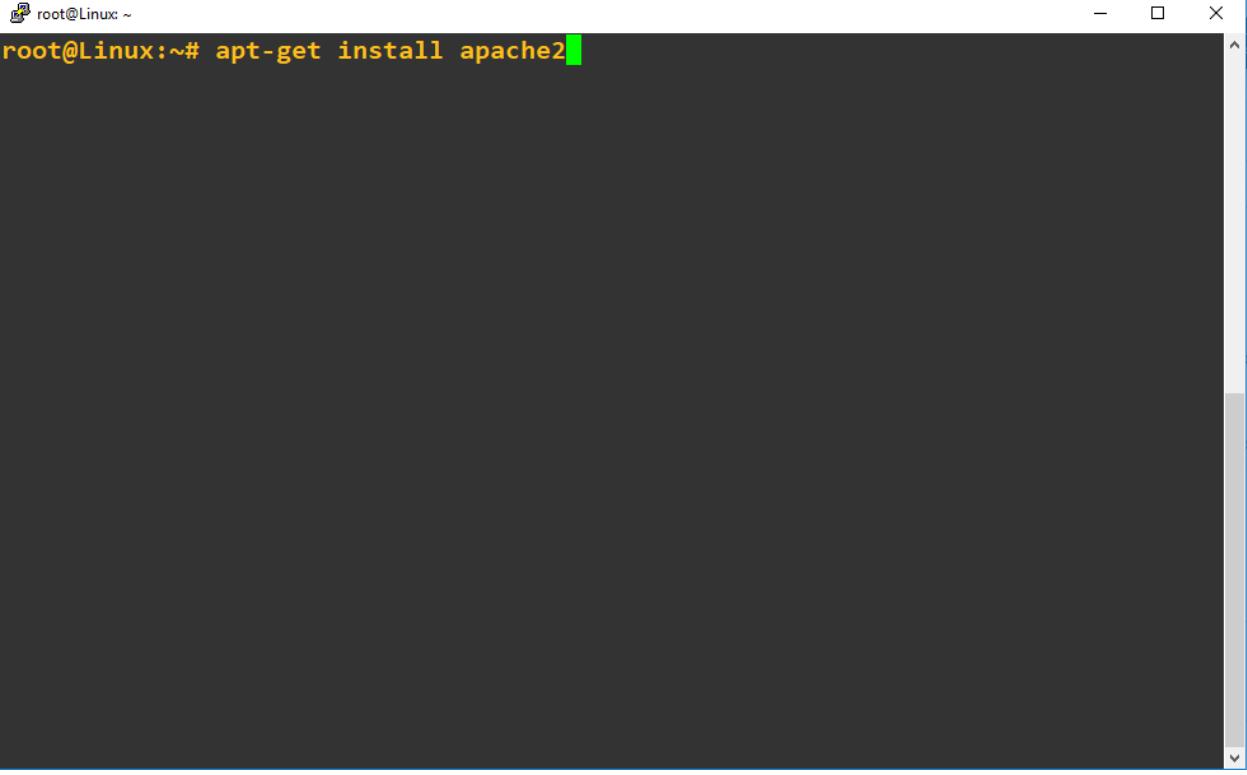
A screenshot of a terminal window titled "root@Linux: ~". The window contains the following text:

```
sansbound@Linux:~$ sudo -i
root@Linux:~# apt-get update
```

You have successfully updated Ubuntu packages from internet.

```
root@Linux: ~
Get:14 http://azure.archive.ubuntu.com/ubuntu bionic-updates/main Translation-en [177 kB]
Get:15 http://azure.archive.ubuntu.com/ubuntu bionic-updates/universe amd64 Packages [706 kB]
Get:16 http://azure.archive.ubuntu.com/ubuntu bionic-updates/universe Translation-en [171 kB]
Get:17 http://azure.archive.ubuntu.com/ubuntu bionic-backports/universe Sources [2068 B]
Get:18 http://security.ubuntu.com/ubuntu bionic-security/main Sources [66.7 kB]
Get:19 http://security.ubuntu.com/ubuntu bionic-security/universe Sources [28.6 kB]
Get:20 http://security.ubuntu.com/ubuntu bionic-security/multiverse Sources [133.6 B]
Get:21 http://security.ubuntu.com/ubuntu bionic-security/main amd64 Packages [23.5 kB]
Get:22 http://security.ubuntu.com/ubuntu bionic-security/main Translation-en [88.9 kB]
Get:23 http://security.ubuntu.com/ubuntu bionic-security/universe amd64 Packages [110 kB]
Get:24 http://security.ubuntu.com/ubuntu bionic-security/universe Translation-en [62.2 kB]
Fetched 12.8 MB in 3s (4635 kB/s)
Reading package lists... Done
root@Linux:~#
```

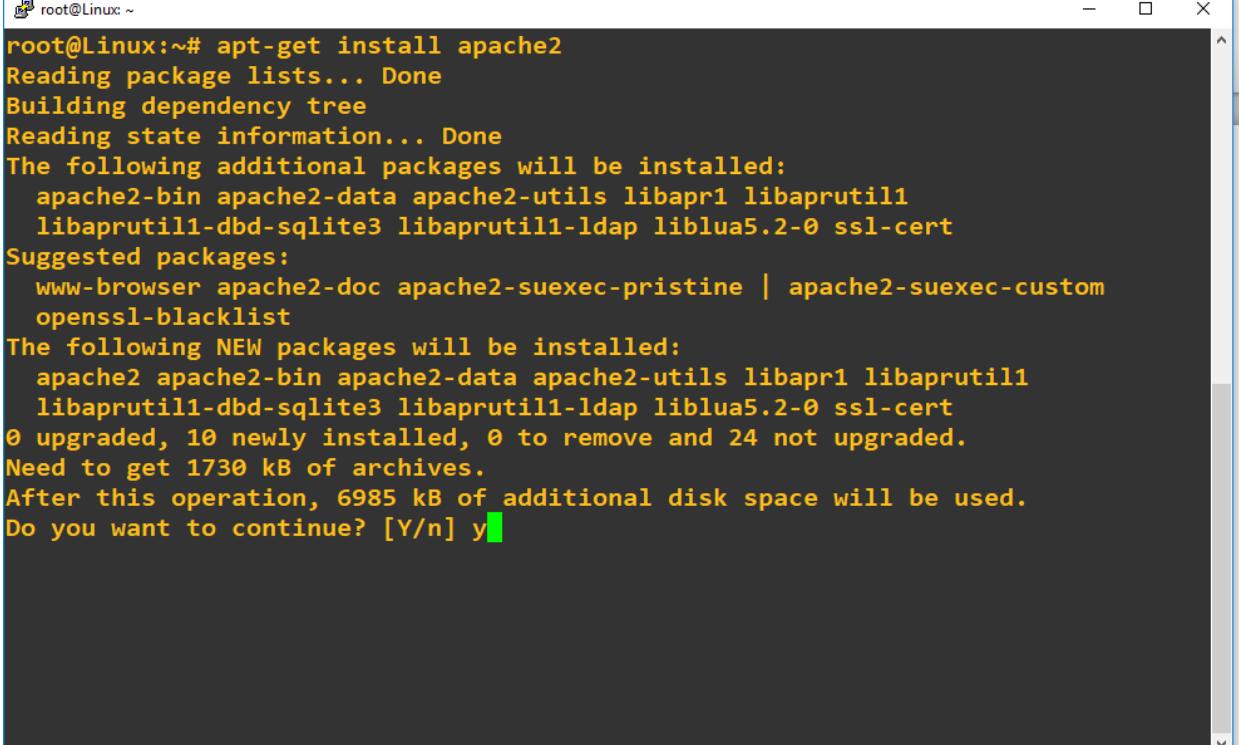
Type “**apt-get install apache2**” and press “Enter”.



The image shows a terminal window with a black background and white text. In the top left corner, there is a small icon of a computer monitor. The window title bar contains the text "root@Linux:~#". The main area of the terminal shows the command "root@Linux:~# apt-get install apache2" followed by a green cursor. The window has standard operating system window controls (minimize, maximize, close) at the top right. A vertical scroll bar is visible on the right side of the terminal window.

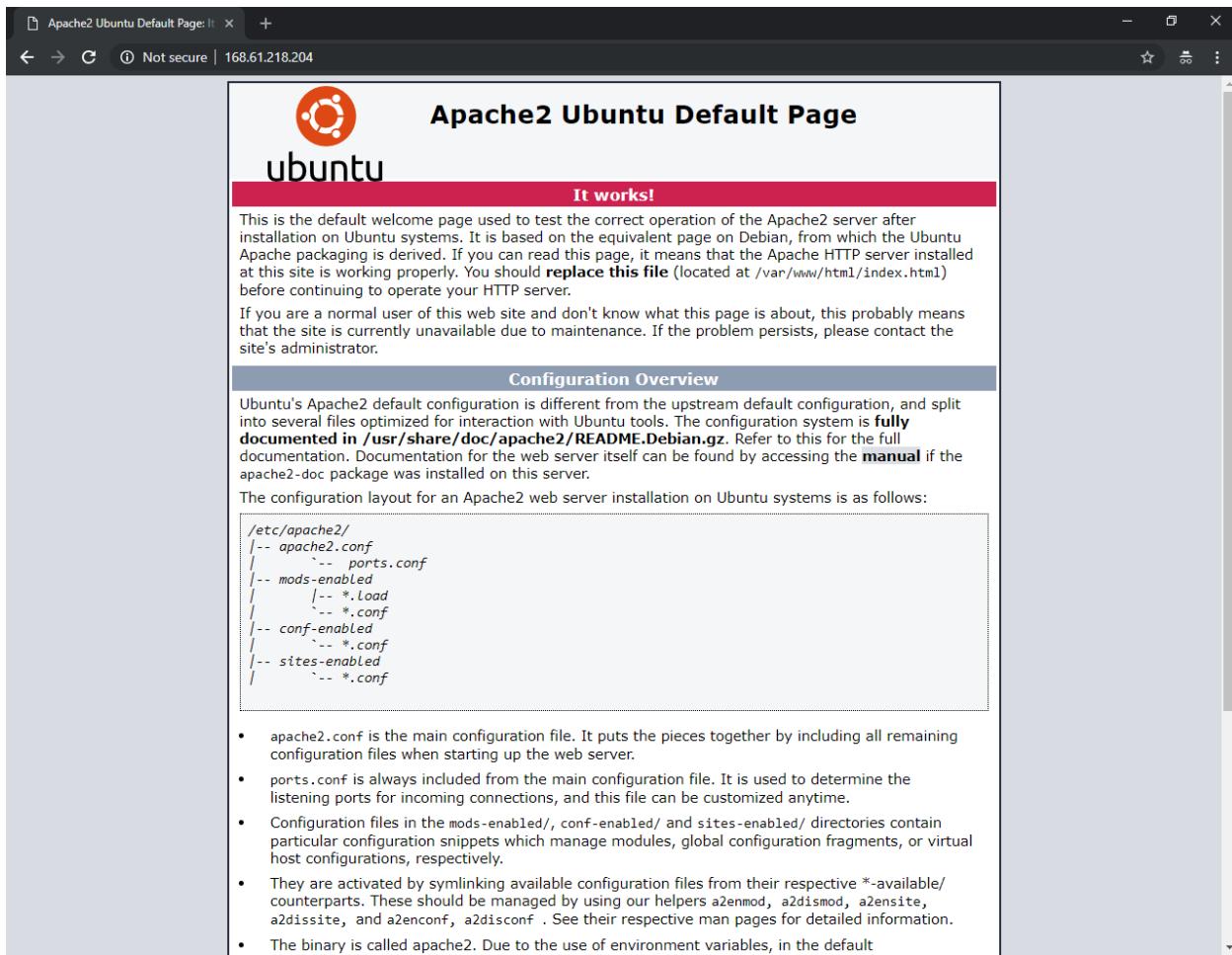
```
root@Linux:~# apt-get install apache2
```

Type “y” and press “Enter”.



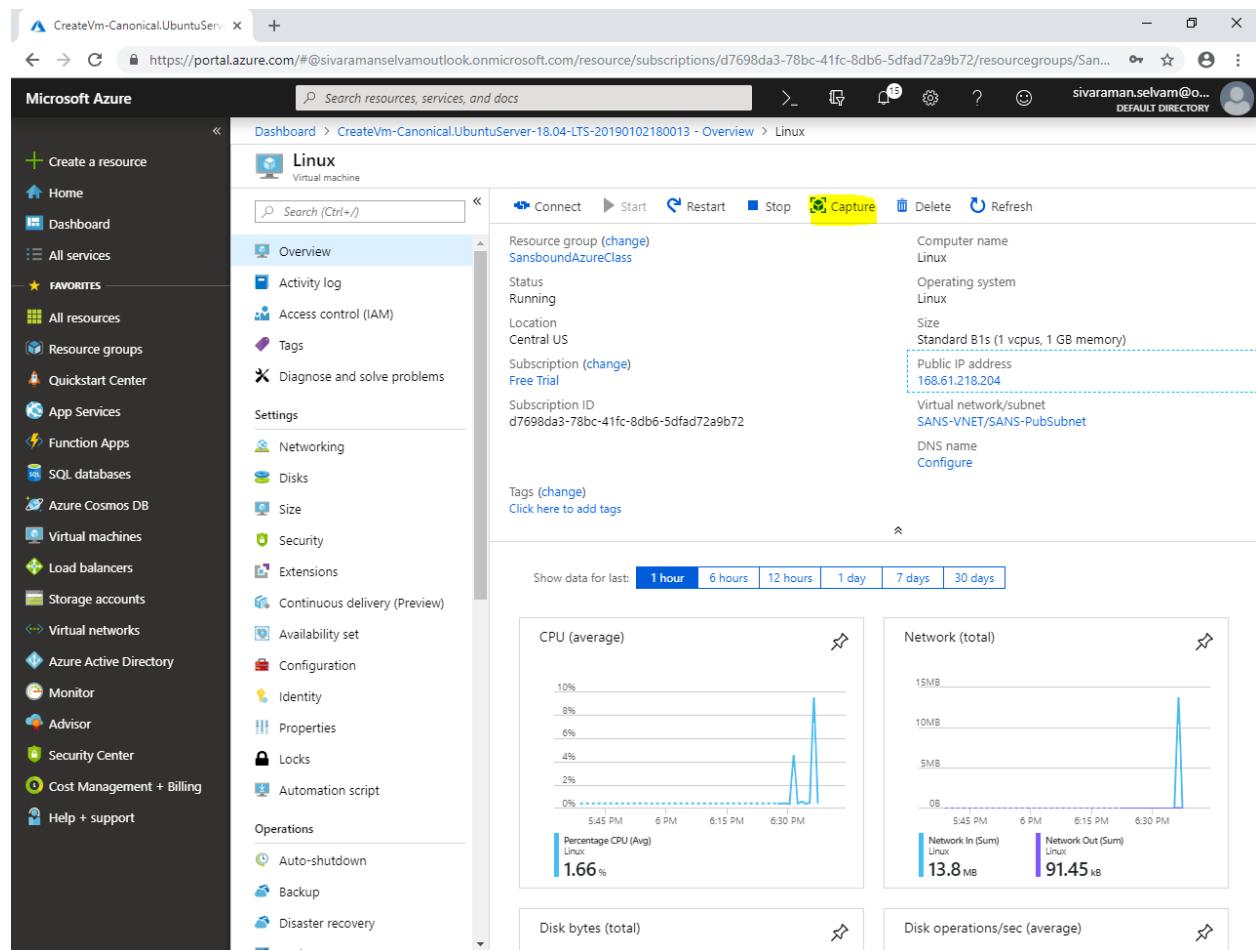
```
root@Linux:~# apt-get install apache2
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
  apache2-bin apache2-data apache2-utils libapr1 libaprutil1
  libaprutil1-dbd-sqlite3 libaprutil1-ldap liblua5.2-0 ssl-cert
Suggested packages:
  www-browser apache2-doc apache2-suexec-pristine | apache2-suexec-custom
  openssl-blacklist
The following NEW packages will be installed:
  apache2 apache2-bin apache2-data apache2-utils libapr1 libaprutil1
  libaprutil1-dbd-sqlite3 libaprutil1-ldap liblua5.2-0 ssl-cert
0 upgraded, 10 newly installed, 0 to remove and 24 not upgraded.
Need to get 1730 kB of archives.
After this operation, 6985 kB of additional disk space will be used.
Do you want to continue? [Y/n] y
```

Type public IP address of Ubuntu in browser and press “Enter”.



In Ubuntu virtual machine,

Click “Capture” to capture the virtual machine as image.



The screenshot shows the Microsoft Azure portal interface. On the left, there's a navigation sidebar with various service icons like Home, Dashboard, All services, Favorites, and more. The main content area is titled 'CreateVm-Canonical.UbuntuServer - Overview' for a Linux virtual machine. At the top right, there are buttons for Connect, Start, Stop, Capture (which is highlighted with a yellow box), Delete, and Refresh. Below these are sections for Resource group, Status, Location, Subscription, Computer name, Operating system, Size, Public IP address, Virtual network/subnet, and DNS name. A 'Tags' section allows adding tags. At the bottom, there are four performance charts: CPU (average), Network (total), Disk bytes (total), and Disk operations/sec (average). The CPU chart shows a single data series for Percentage CPU (Avg) Linux at 1.66%. The Network chart shows Network In (Sum) Linux at 13.8 MB and Network Out (Sum) Linux at 91.45 kB. The Disk bytes chart shows Disk bytes (total) and Disk operations/sec (average) over time from 5:45 PM to 6:30 PM.

While “**create image**”,

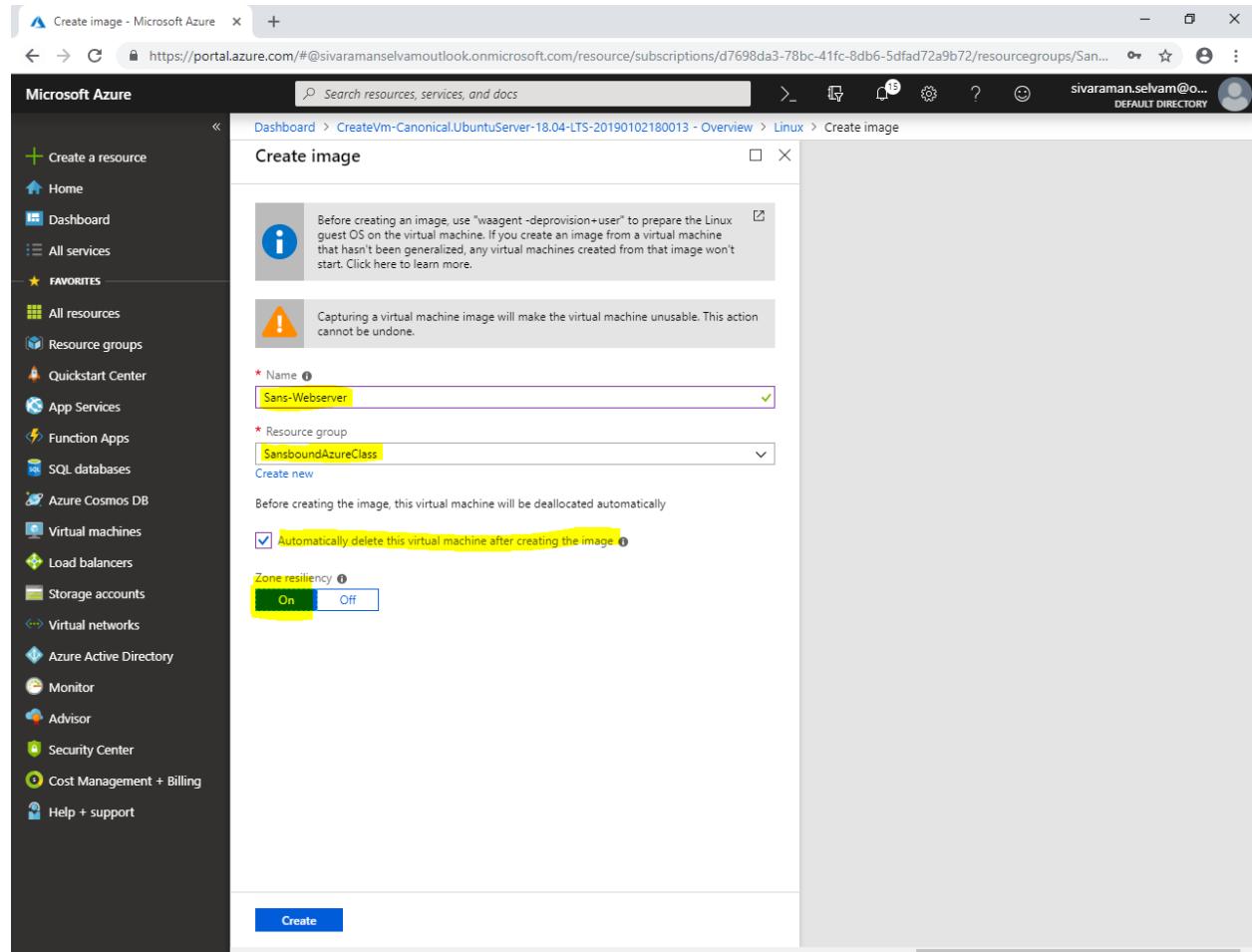
Type “**Name**” as “**Sans-Webserver**”.

Select “**Resource group**” as “**SansboundAzureClass**”.

Need to check “**Automatically delete this virtual machine after creating the image**”.

In “**Zone resiliency**” click “**On**”.

## Cloud Computing - Azure



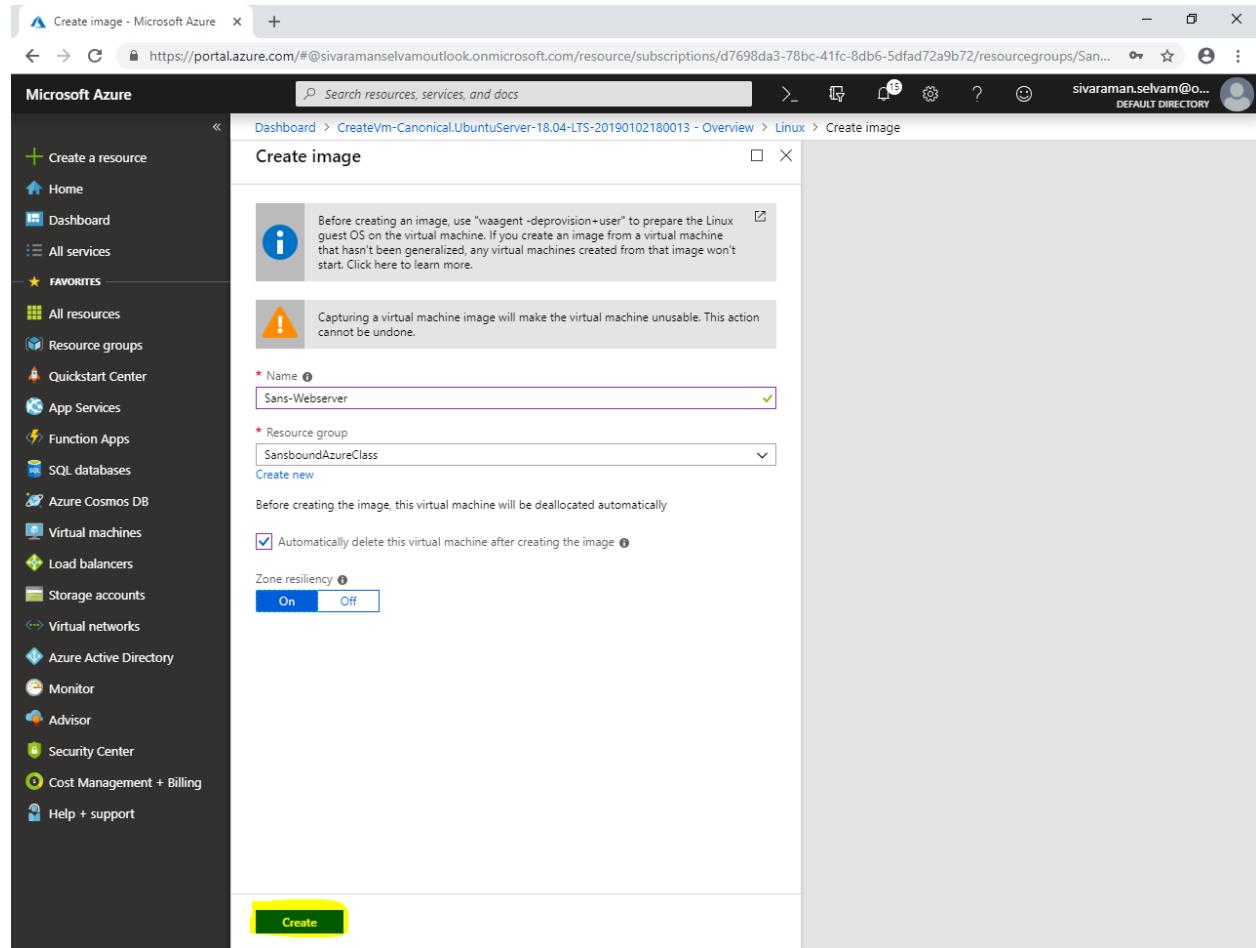
The screenshot shows the Microsoft Azure portal interface for creating a virtual machine image. The left sidebar lists various services like Home, Dashboard, All services, and Favorites. The main area is titled 'Create image' and shows the configuration for a Linux VM. Key fields include:

- Name:** Sans-Webserver
- Resource group:** SansboundAzureClass
- Zone resiliency:** On (highlighted with a yellow box)
- Create** button (highlighted with a yellow box)

Informational and warning messages are present, such as a note about preparing the guest OS and a warning about making the VM unusable.

Click “Create”.

## Cloud Computing - Azure



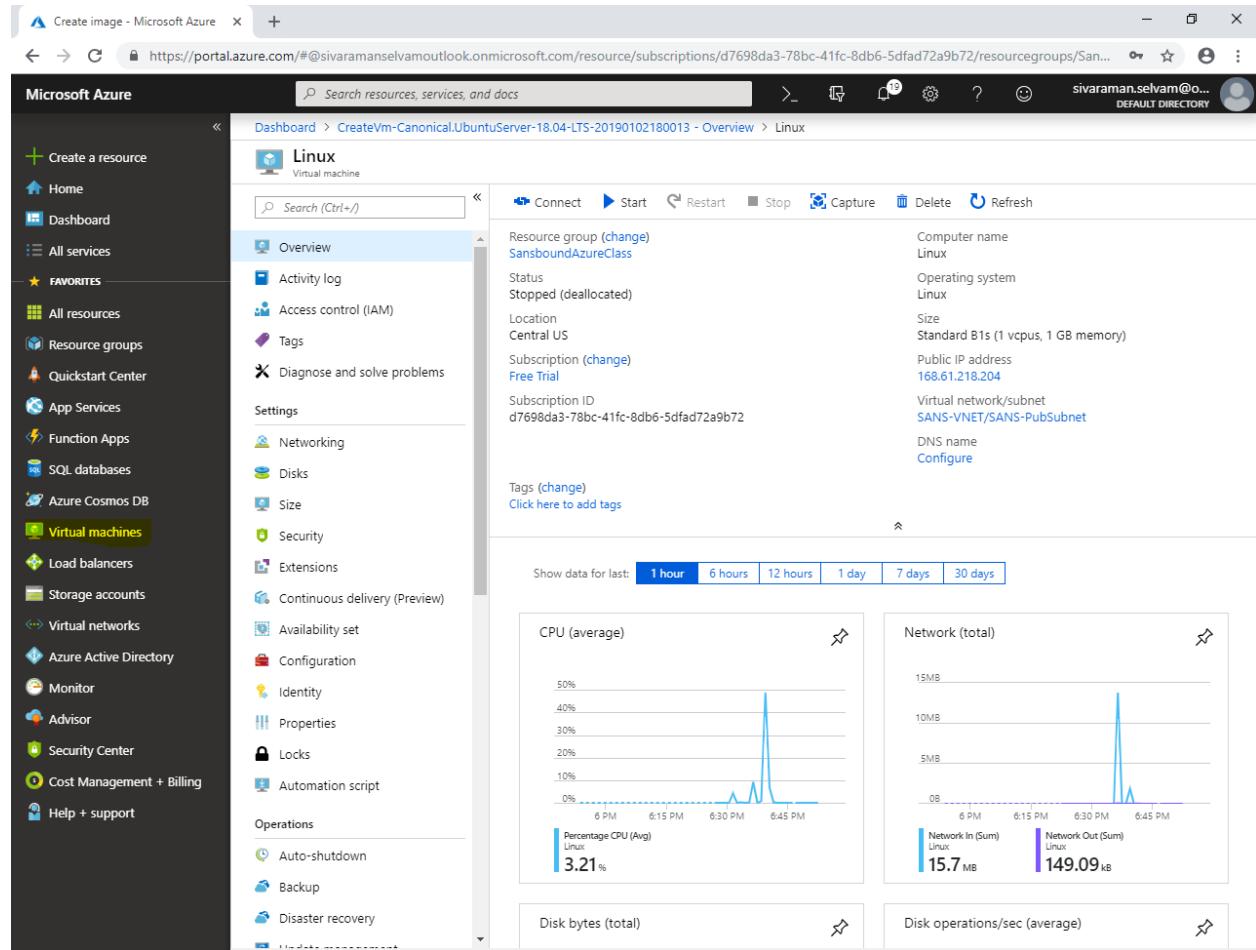
The screenshot shows the Microsoft Azure portal interface for creating a virtual machine image. The left sidebar lists various services like Home, Dashboard, All services, and Favorites. The main content area is titled 'Create image' and contains the following fields:

- Info message:** A note about preparing the Linux guest OS before creating the image.
- Name:** Sans-Webserver (highlighted with a yellow box).
- Resource group:** SansboundAzureClass (highlighted with a yellow box).
- Automatically delete this virtual machine after creating the image:** A checked checkbox.
- Zone resiliency:** A radio button set to 'On' (highlighted with a yellow box).

At the bottom right of the form is a large yellow 'Create' button.

## Cloud Computing - Azure

Click “Virtual machines” in left side panel.



The screenshot shows the Microsoft Azure portal interface. The left sidebar is open, showing various service categories. The "Virtual machines" option is selected and highlighted in green. The main content area is titled "Linux" and "Virtual machine". It displays the following details:

- Resource group (change):** SansboundAzureClass
- Status:** Stopped (deallocated)
- Location:** Central US
- Subscription (change):** Free Trial
- Subscription ID:** d7698da3-78bc-41fc-8db6-5dfad72a9b72
- Computer name:** Linux
- Operating system:** Linux
- Size:** Standard B1s (1 vcpus, 1 GB memory)
- Public IP address:** 168.61.218.204
- Virtual network/subnet:** SANS-VNET/SANS-PubSubNet
- DNS name:** Configure

Below these details is a section for "Tags (change)" with a link to "Click here to add tags".

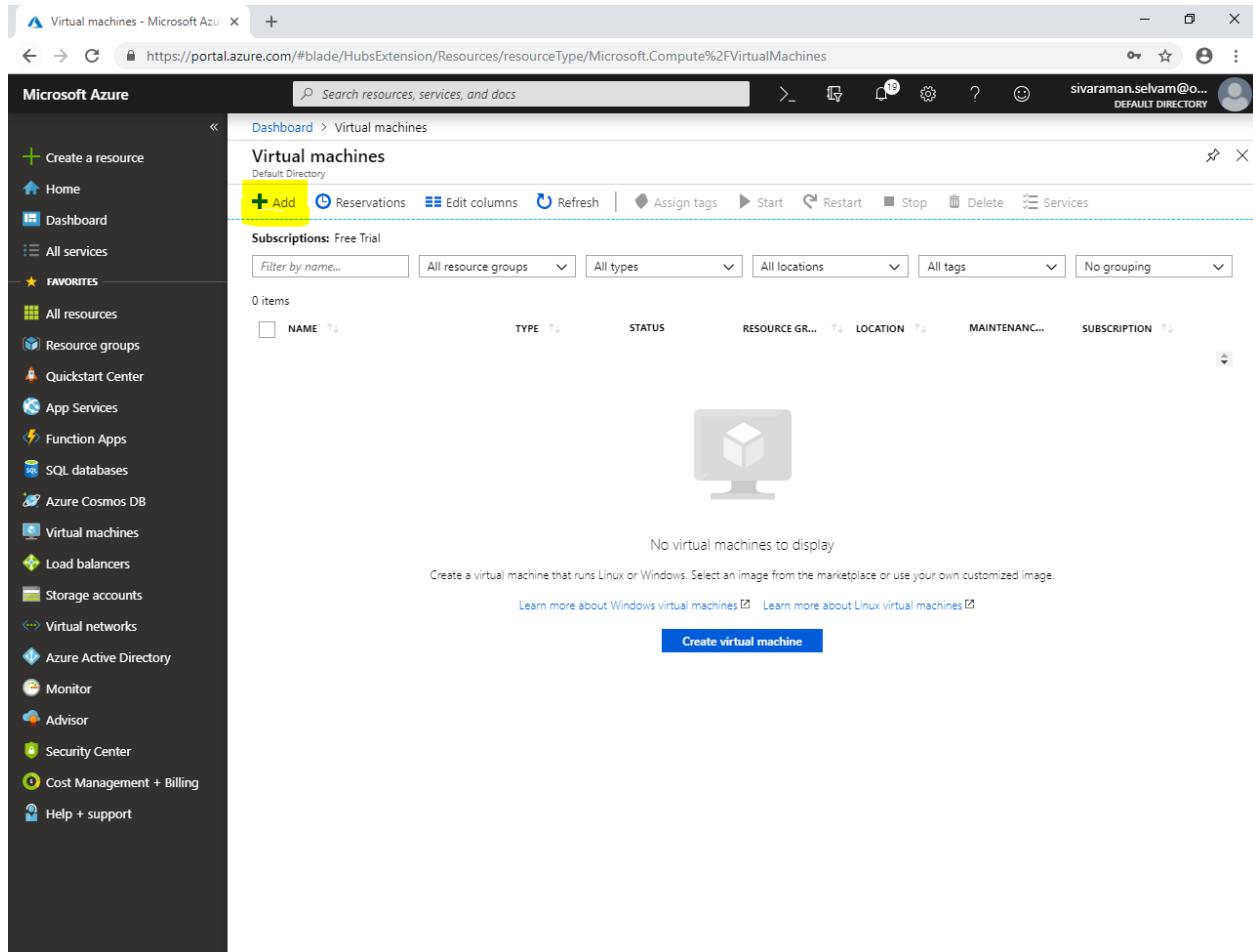
Performance monitoring charts are shown at the bottom, with data for the last hour:

- CPU (average):** Percentage CPU Avg. Linux 3.21%
- Network (total):** Network In (Sum) Linux 15.7 MB, Network Out (Sum) Linux 149.09 kB
- Disk bytes (total):**
- Disk operations/sec (average):**

In “Virtual machines”,

Click “Add”.

## Cloud Computing - Azure



The screenshot shows the Microsoft Azure portal interface. The left sidebar is dark-themed and lists various services under 'FAVORITES'. The main area is titled 'Virtual machines' and shows a single item in the list, which is a placeholder image of a computer monitor with a 3D cube icon. Below the list, it says 'No virtual machines to display' and provides links to learn more about Windows and Linux virtual machines. A prominent blue button at the bottom right says 'Create virtual machine'.

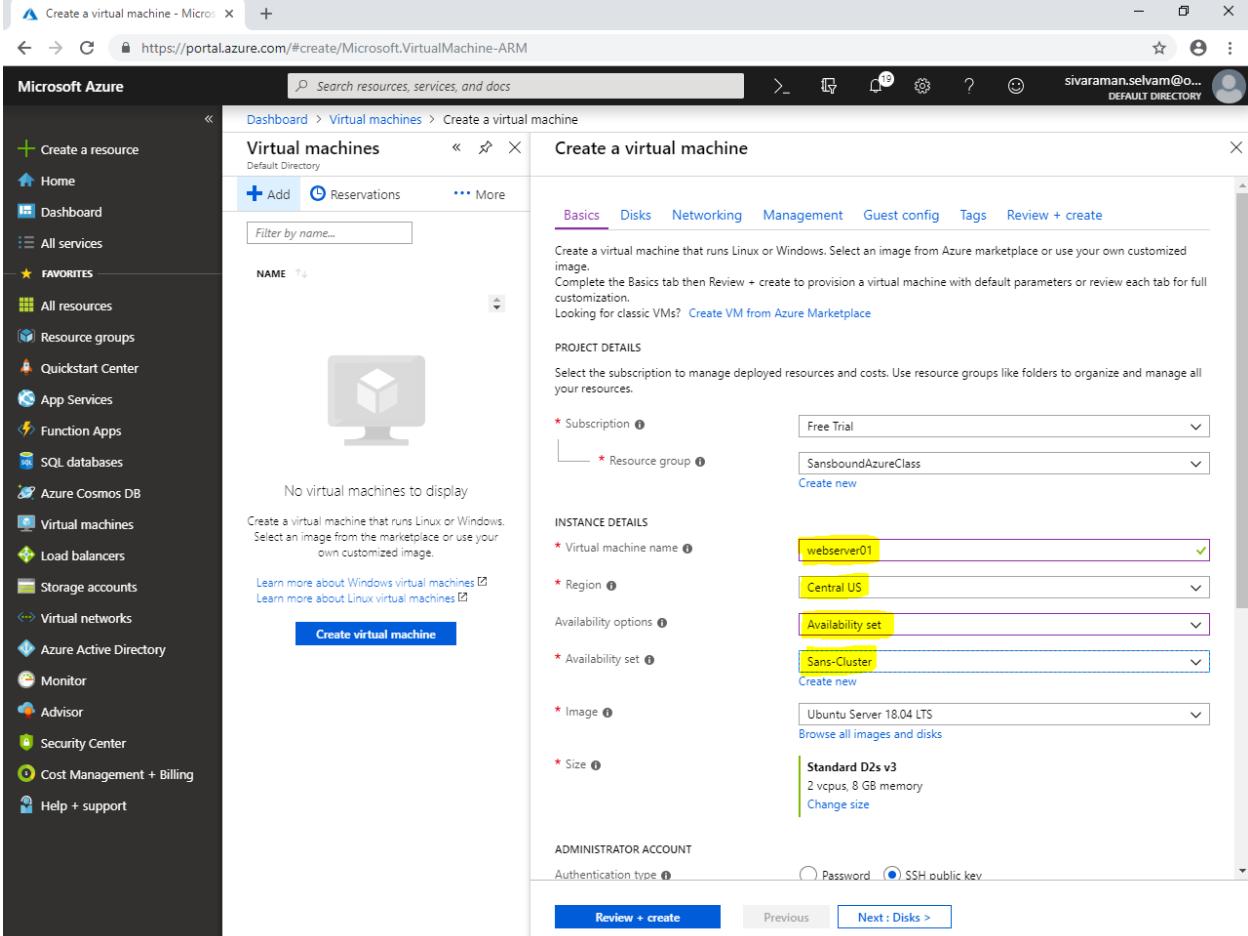
Type “Virtual machine name” as “**webservice01**”.

## Cloud Computing - Azure

Select “Region” as “Central US”.

Select “Availability options” as “Availability Set”.

Select “Availability set” as “Sans-Cluster”.



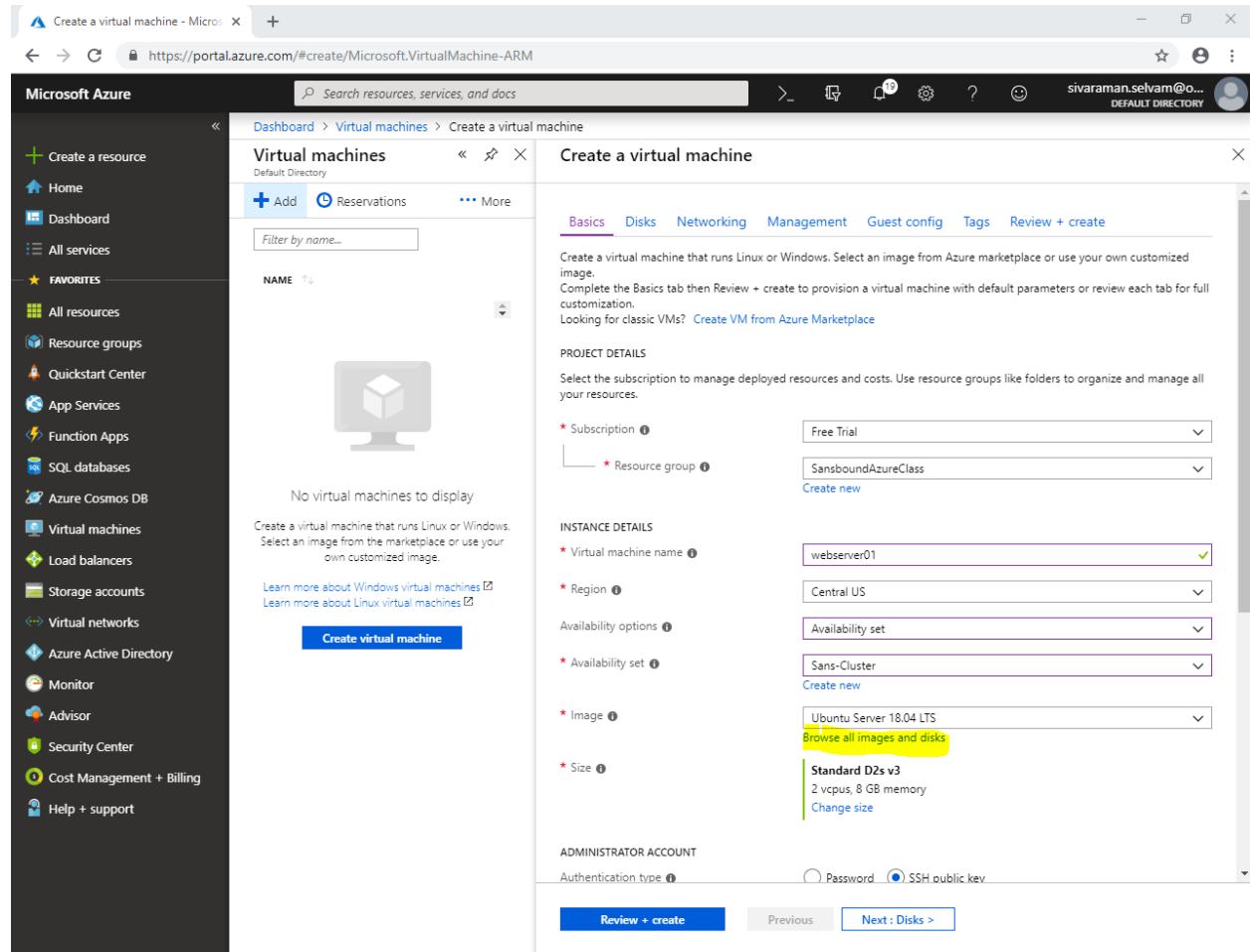
The screenshot shows the Microsoft Azure portal interface for creating a new virtual machine. The left sidebar lists various services like Home, Dashboard, and Virtual machines. The main panel is titled 'Create a virtual machine' under 'Virtual machines'. The 'INSTANCE DETAILS' section is active, containing the following configuration:

- Virtual machine name: webservice01
- Region: Central US
- Availability options: Availability set
- Availability set: Sans-Cluster
- Image: Ubuntu Server 18.04 LTS
- Size: Standard D2s v3

At the bottom, there are 'Review + create' and 'Next : Disks >' buttons.

In “Image” click “Browse all images and disks”.

## Cloud Computing - Azure



[Create a virtual machine - Microsoft Azure](https://portal.azure.com/#create/Microsoft.VirtualMachine-ARM)

<https://portal.azure.com/#create/Microsoft.VirtualMachine-ARM>

**Microsoft Azure**

Dashboard > Virtual machines > Create a virtual machine

**Virtual machines**

**Create a virtual machine**

**Basics** Disks Networking Management Guest config Tags Review + create

Create a virtual machine that runs Linux or Windows. Select an image from Azure marketplace or use your own customized image.

Select the subscription to manage deployed resources and costs. Use resource groups like folders to organize and manage all your resources.

**PROJECT DETAILS**

\* Subscription: Free Trial

\* Resource group: SansboundAzureClass

**INSTANCE DETAILS**

\* Virtual machine name: webserver01

\* Region: Central US

Availability options: Availability set

\* Availability set: Sans-Cluster

\* Image: Ubuntu Server 18.04 LTS

\* Size: Standard D2s v3  
2 vcpus, 8 GB memory  
Change size

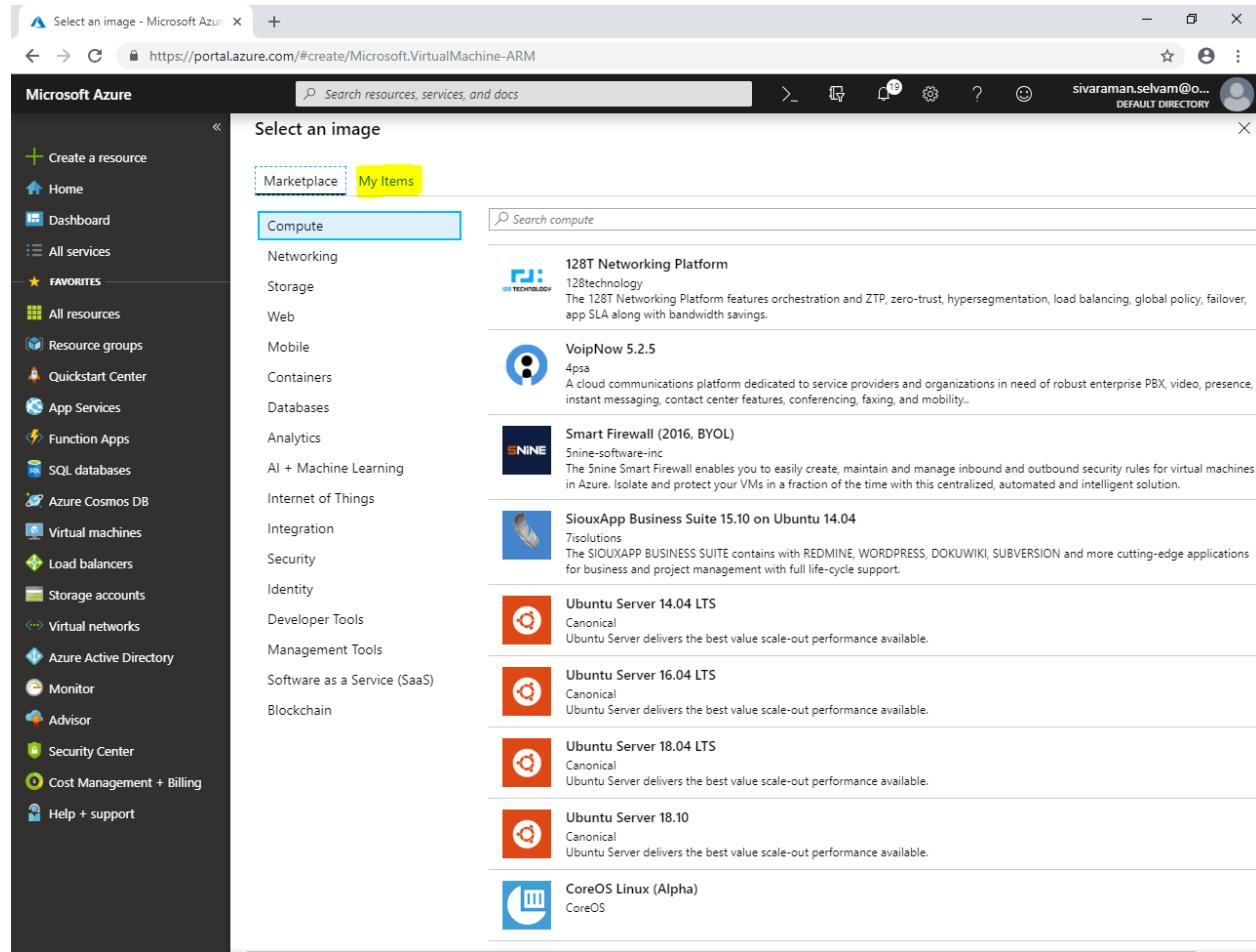
**ADMINISTRATOR ACCOUNT**

Authentication type: Password, SSH public key

**Review + create** Previous Next : Disks >

Click “**My Items**”.

## Cloud Computing - Azure

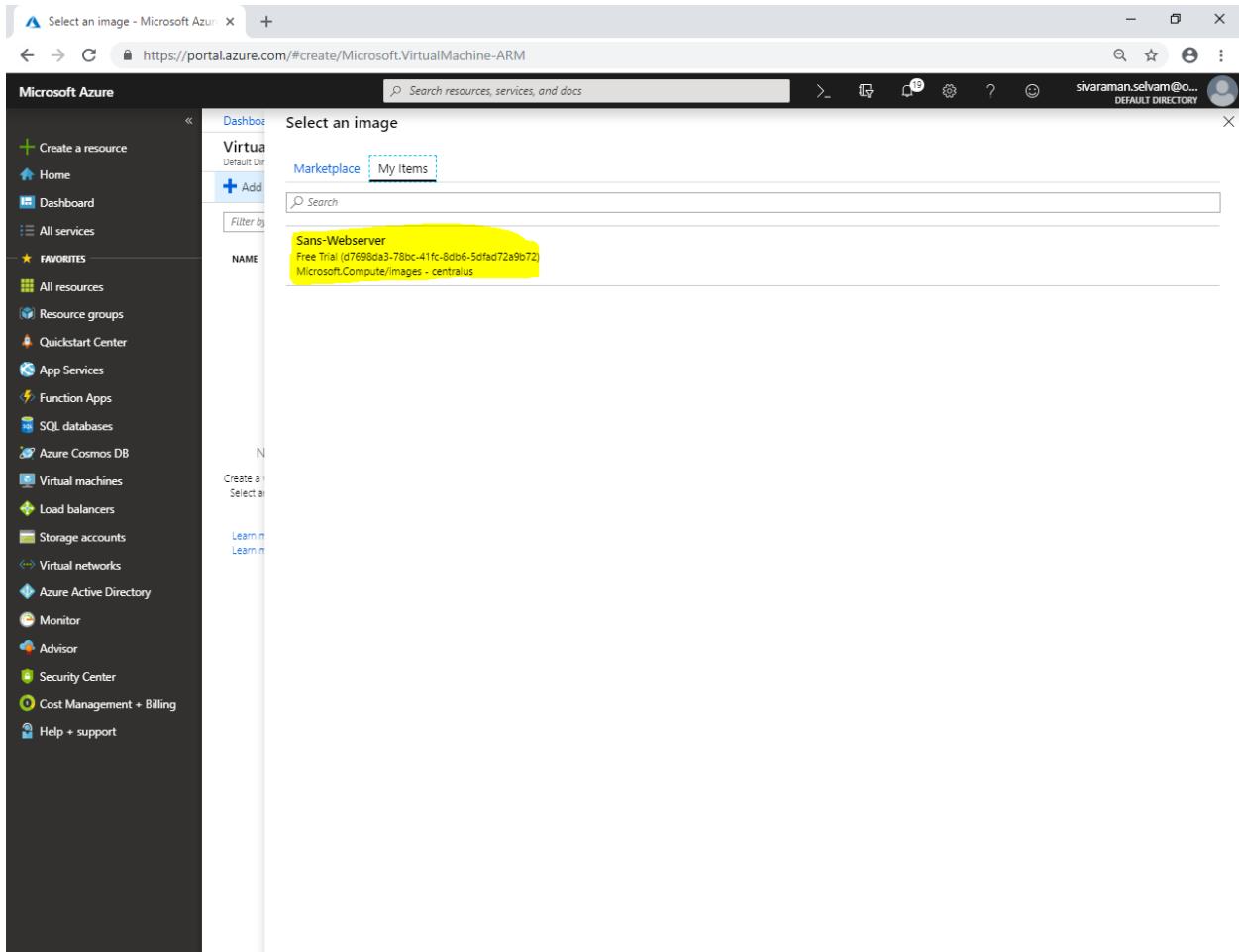


The screenshot shows the Microsoft Azure portal interface. On the left, there is a navigation sidebar with various service icons and links such as Home, Dashboard, All services, Favorites, Resource groups, Quickstart Center, App Services, Function Apps, SQL databases, Azure Cosmos DB, Virtual machines, Load balancers, Storage accounts, Virtual networks, Azure Active Directory, Monitor, Advisor, Security Center, Cost Management + Billing, and Help + support. The main content area is titled "Select an image". At the top of this section, there are two tabs: "Marketplace" (which is currently selected) and "My Items". Below the tabs, there is a search bar labeled "Search compute". The "Compute" category is highlighted with a blue border. To the right of the search bar, there is a "Search compute" input field. The list of images is as follows:

- 128T Networking Platform** (128Technology): The 128T Networking Platform features orchestration and ZTP, zero-trust, hypersegmentation, load balancing, global policy, failover, app SLA along with bandwidth savings.
- VoipNow 5.2.5** (4psa): A cloud communications platform dedicated to service providers and organizations in need of robust enterprise PBX, video, presence, instant messaging, contact center features, conferencing, faxing, and mobility..
- Smart Firewall (2016, BYOL)** (5nine-software-inc): The 5nine Smart Firewall enables you to easily create, maintain and manage inbound and outbound security rules for virtual machines in Azure. Isolate and protect your VMs in a fraction of the time with this centralized, automated and intelligent solution.
- SiouxApp Business Suite 15.10 on Ubuntu 14.04** (7solutions): The SIOUXAPP BUSINESS SUITE contains with REDMINE, WORDPRESS, DOKUWIKI, SUBVERSION and more cutting-edge applications for business and project management with full life-cycle support.
- Ubuntu Server 14.04 LTS** (Canonical): Ubuntu Server delivers the best value scale-out performance available.
- Ubuntu Server 16.04 LTS** (Canonical): Ubuntu Server delivers the best value scale-out performance available.
- Ubuntu Server 18.04 LTS** (Canonical): Ubuntu Server delivers the best value scale-out performance available.
- Ubuntu Server 18.10** (Canonical): Ubuntu Server delivers the best value scale-out performance available.
- CoreOS Linux (Alpha)** (CoreOS): CoreOS

Click “**Sans-Webserver**” image.

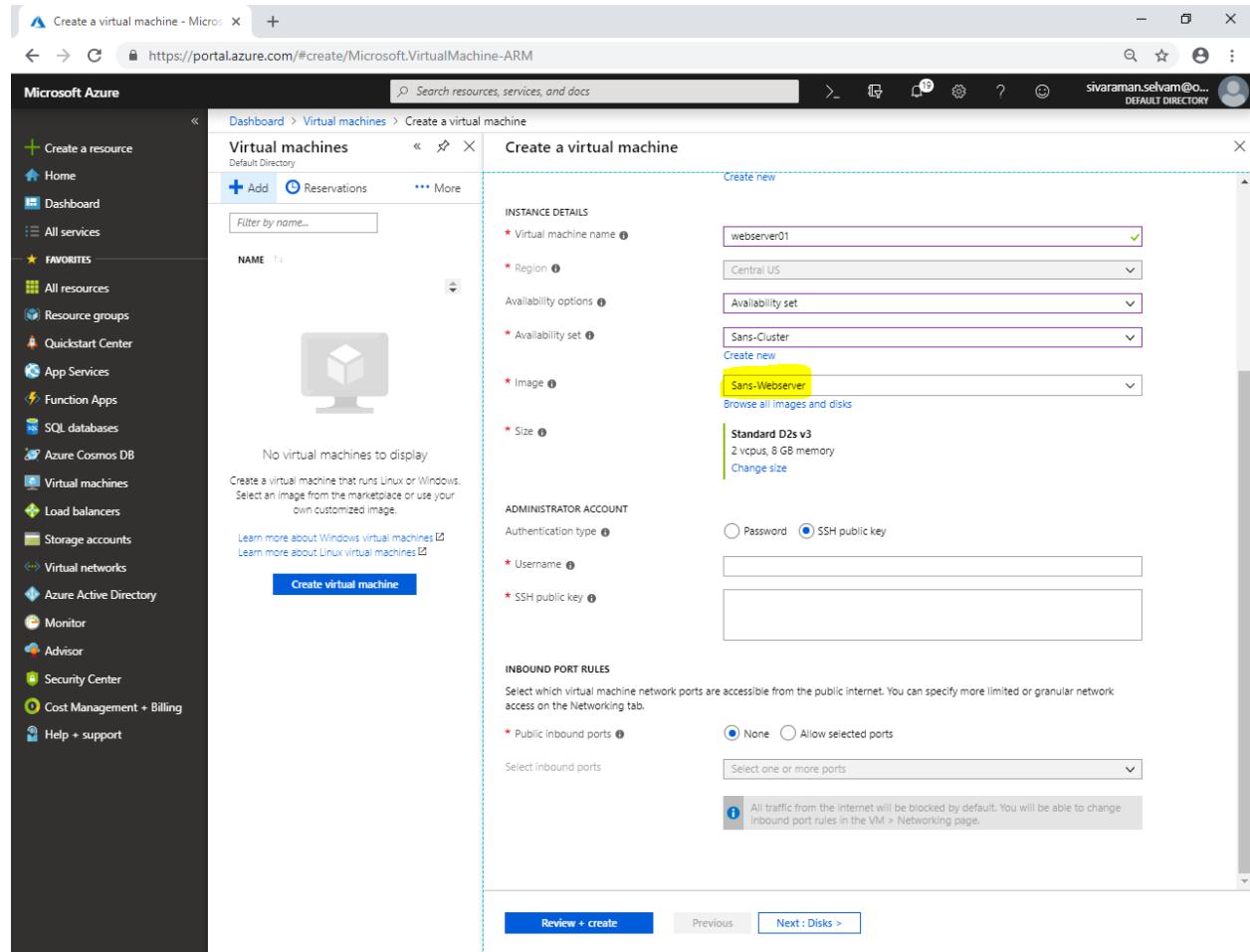
## Cloud Computing - Azure



The screenshot shows the Microsoft Azure portal interface. On the left, there's a sidebar with various service icons like Home, Dashboard, All services, Favorites, Resource groups, Quickstart Center, App Services, Function Apps, SQL databases, Azure Cosmos DB, Virtual machines, Load balancers, Storage accounts, Virtual networks, Azure Active Directory, Monitor, Advisor, Security Center, Cost Management + Billing, and Help + support. The main area is titled "Select an image" and has tabs for Marketplace and My Items. The Marketplace tab is selected, and the search bar contains "Sans-Webserver". A yellow box highlights the search result "Sans-Webserver", which is described as "Free Trial (d7695da3-78bc-41fc-8db6-50fad72a9072) Microsoft.Compute/images - centralus". Below the search results, there are buttons for "Create a new image" and "Select an image".

Ensure that you have selected "**Sans-Webserver**".

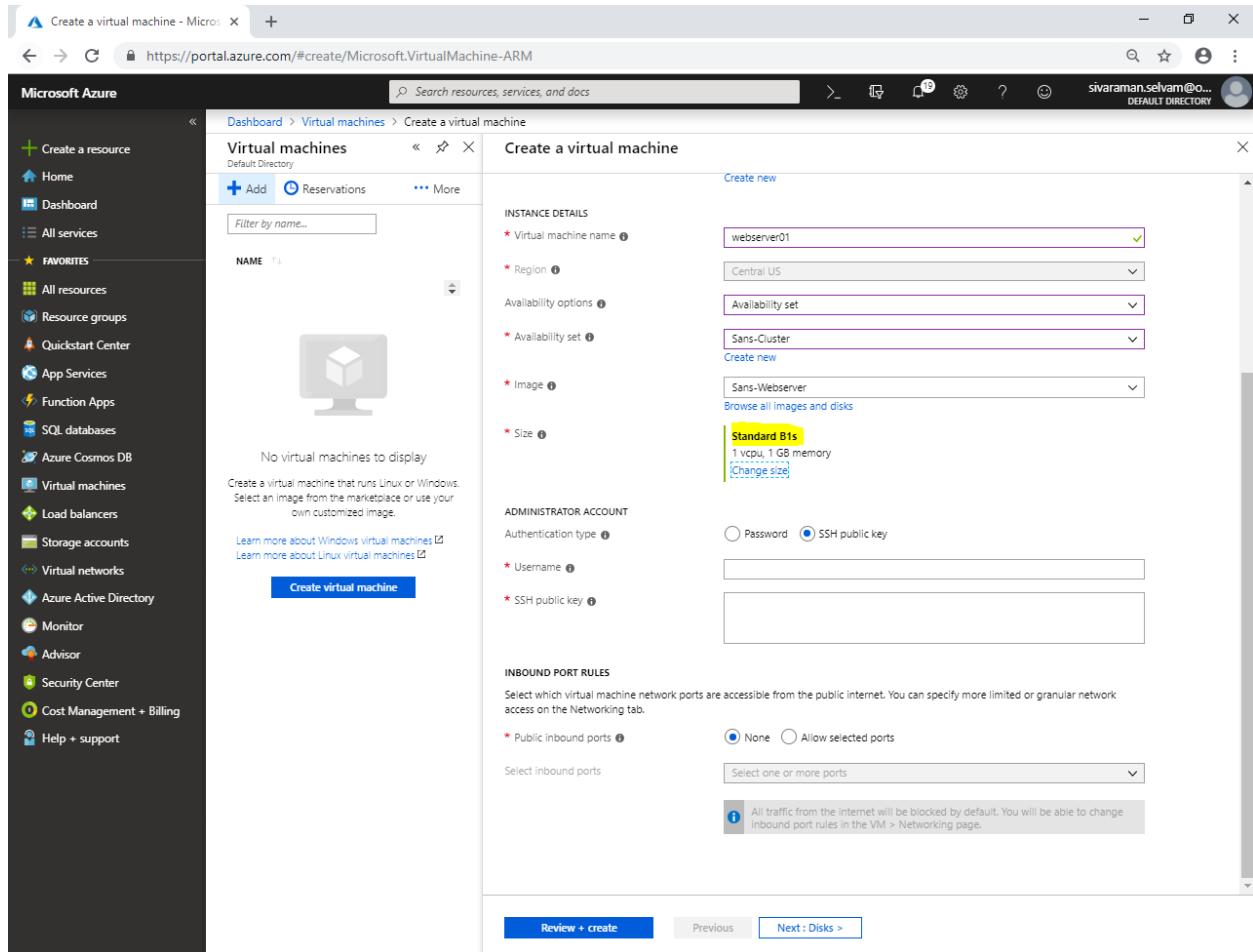
## Cloud Computing - Azure



The screenshot shows the Microsoft Azure portal interface for creating a new virtual machine. The left sidebar has a dark theme with various service icons. The main area is titled 'Create a virtual machine' under 'Virtual machines'. The 'INSTANCE DETAILS' section includes fields for 'Virtual machine name' (set to 'webserver01'), 'Region' (set to 'Central US'), 'Availability options' (set to 'Availability set' and 'Sans-Cluster'), 'Image' (highlighted with a yellow box, showing 'Sans-Webserver' selected from a dropdown), and 'Size' (set to 'Standard D2s v3'). The 'ADMINISTRATOR ACCOUNT' section shows 'Authentication type' as 'SSH public key'. The 'INBOUND PORT RULES' section has 'Public inbound ports' set to 'None'. At the bottom, there are 'Review + create' and 'Next : Disks >' buttons.

Change “VM Size” as “Standard B1s”.

## Cloud Computing - Azure



**INSTANCE DETAILS**

- \* Virtual machine name: webserver01
- \* Region: Central US
- Availability options: Availability set: Sans-Cluster
- \* Image: Sans-Webserver
- \* Size: Standard B1s (1 vcpu, 1 GB memory)

**ADMINISTRATOR ACCOUNT**

- Authentication type: SSH public key
- \* Username: (empty field)
- \* SSH public key: (empty field)

**INBOUND PORT RULES**

- 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.
- \* Public inbound ports: None
- Select inbound ports: Select one or more ports

**Review + create**    Previous    **Next : Disks >**

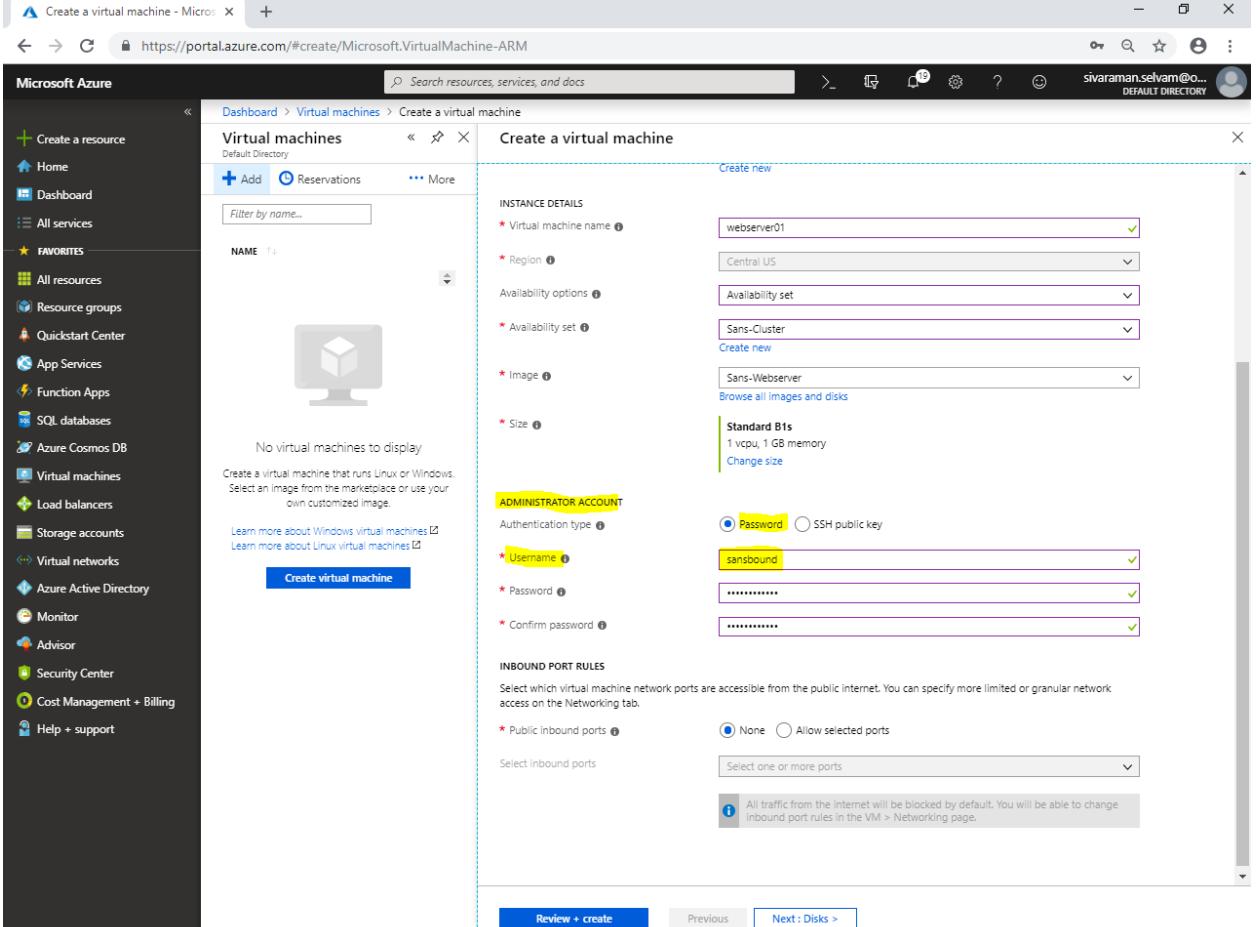
In “Administrator account”,

## Cloud Computing - Azure

Click “**Authentication type**” as “**Password**”.

Type “**Username**” as “**sansbound**”.

Type “**Password**” for the Ubuntu server.

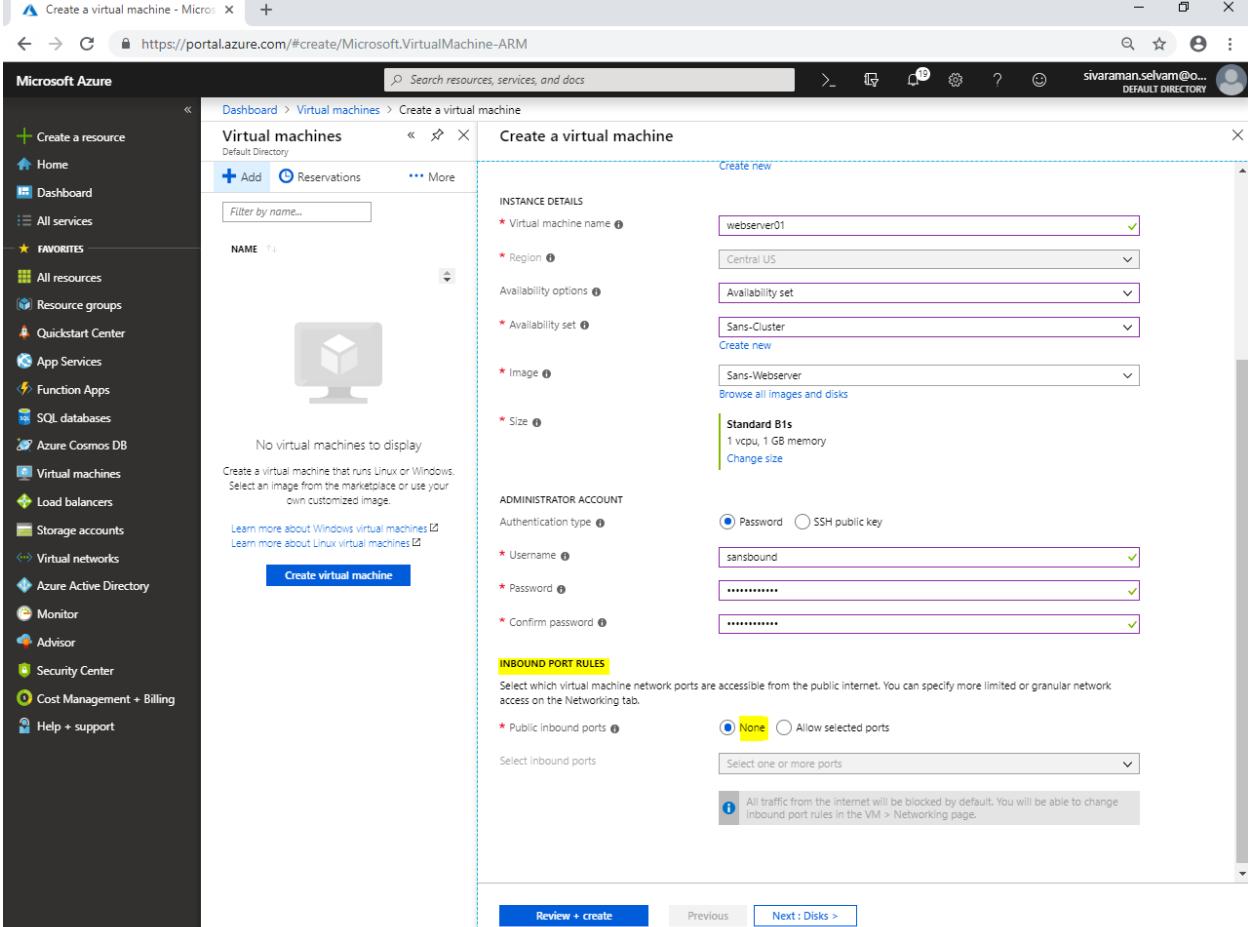


The screenshot shows the Microsoft Azure portal interface for creating a new virtual machine. The left sidebar lists various services like Home, Dashboard, and Storage accounts. The main panel is titled 'Create a virtual machine' under 'Virtual machines'. The 'INSTANCE DETAILS' section includes fields for Name (set to 'webserver01'), Region (set to 'Central US'), Availability set (set to 'Sans-Cluster'), and Image (set to 'Sans-Webserver'). In the 'ADMINISTRATOR ACCOUNT' section, the 'Authentication type' is set to 'Password', and the 'Username' field contains 'sansbound'. The 'INBOUND PORT RULES' section has 'Public inbound ports' set to 'None'. At the bottom, there are 'Review + create' and 'Next: Disks >' buttons.

Ensure “**Inbound port rules**” as “**None**”.

## Cloud Computing - Azure

Because associated subnet for “Front-EndNSG”.



The screenshot shows the Microsoft Azure portal interface for creating a new virtual machine. The left sidebar contains various service links like Home, Dashboard, All services, Resource groups, etc. The main area shows a list of 'Virtual machines' with one entry ('webserver01') and a 'Create a virtual machine' wizard on the right.

**INSTANCE DETAILS**

- Virtual machine name: webserver01
- Region: Central US
- Availability options: Availability set (Sans-Cluster)
- Image: Sans-Webserver
- Size: Standard B1s (1 vcpu, 1 GB memory)

**ADMINISTRATOR ACCOUNT**

- Authentication type: Password
- Username: sansbound
- Password: (obscured)
- Confirm password: (obscured)

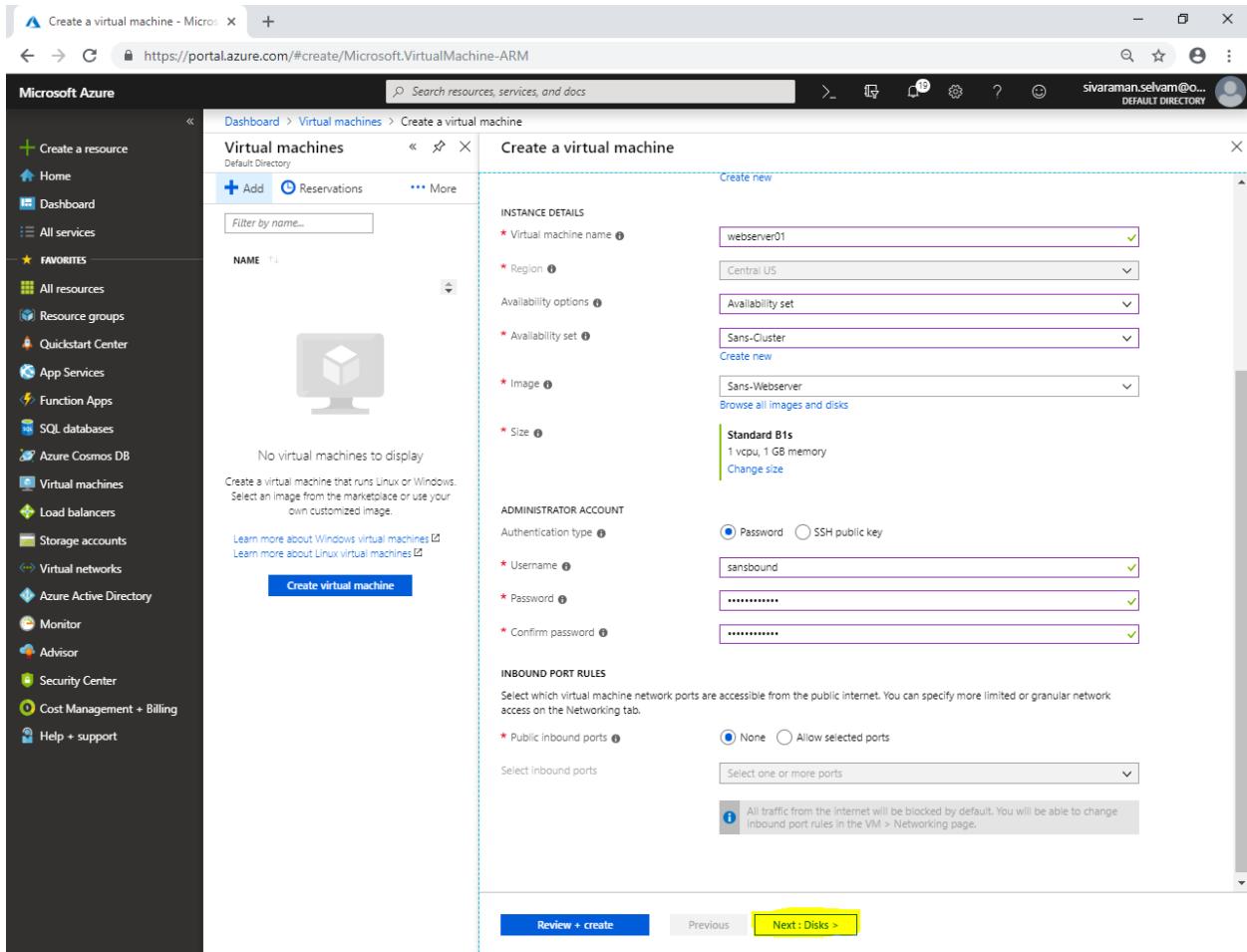
**INBOUND PORT RULES**

- Public inbound ports: None
- Select inbound ports: (dropdown menu)

At the bottom, there are 'Review + create' and 'Next : Disks >' buttons.

Click “Next : Disks >”.

## Cloud Computing - Azure



The screenshot shows the Microsoft Azure portal interface for creating a new virtual machine. The left sidebar contains a navigation menu with various service icons. The main area is titled "Create a virtual machine" and includes the following fields:

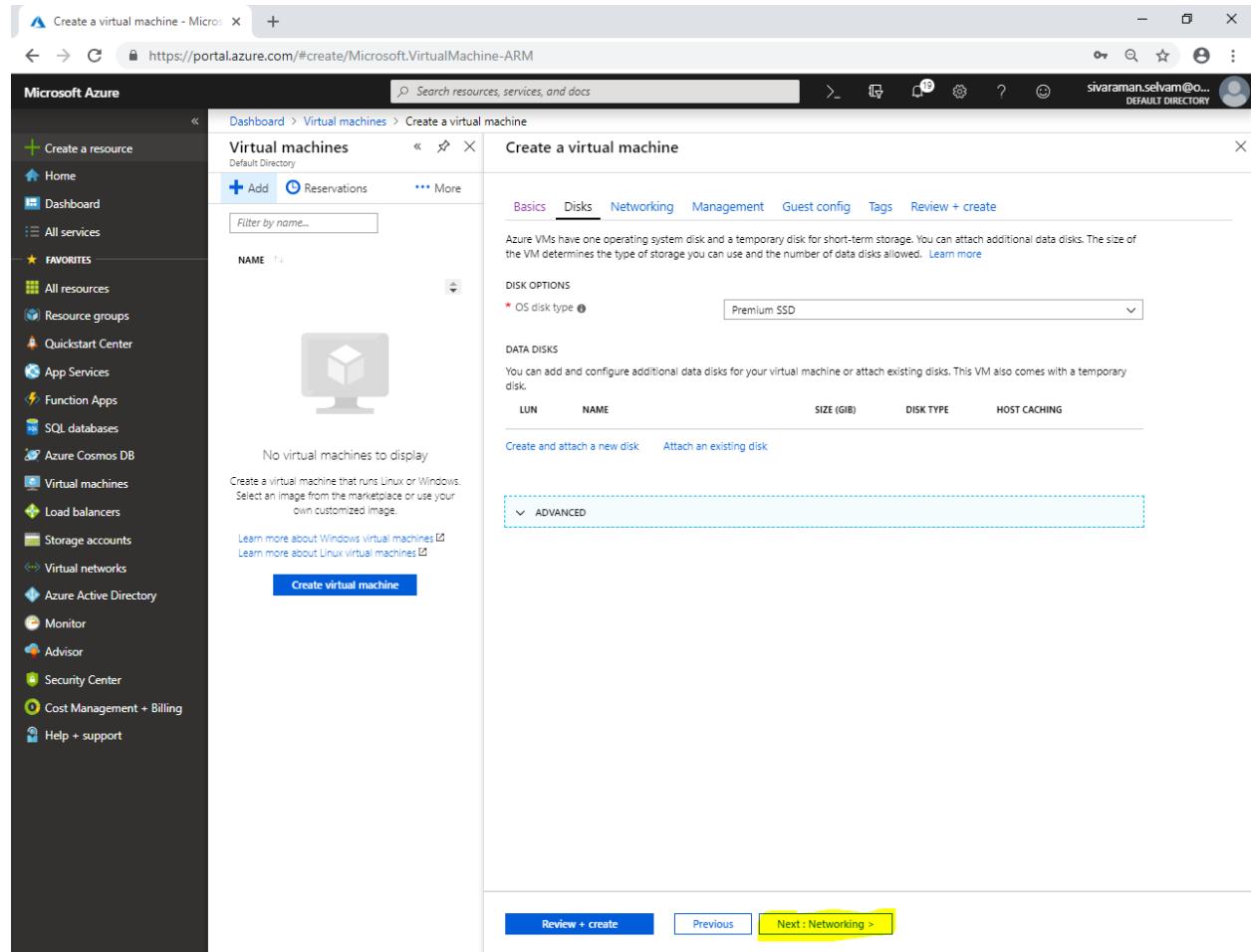
- INSTANCE DETAILS:**
  - Virtual machine name: webserver01
  - Region: Central US
  - Availability options: Availability set (Sans-Cluster)
  - Image: Sans-Webserver (Standard B1s, 1 vcpu, 1 GB memory)
  - Size: Standard B1s (1 vcpu, 1 GB memory)
- ADMINISTRATOR ACCOUNT:**
  - Authentication type: Password (selected)
  - Username: sansbound
  - Password: (redacted)
  - Confirm password: (redacted)
- INBOUND PORT RULES:**
  - Public inbound ports: None (selected)
  - Select inbound ports: Select one or more ports
  - Note: All traffic from the internet will be blocked by default. You will be able to change inbound port rules in the VM > Networking page.

At the bottom, there are "Review + create" and "Previous" buttons, and a highlighted "Next + Disks >" button.

In “Disks”,

## Cloud Computing - Azure

Click “Next : Networking >”.



The screenshot shows the Microsoft Azure portal interface for creating a new virtual machine. The left sidebar contains various service icons like Home, Dashboard, All services, Favorites, and Resource groups. The main area is titled 'Create a virtual machine' under 'Virtual machines'. The 'Networking' tab is currently selected, indicated by a yellow box. Other tabs include Basics, Disks, Management, Guest config, Tags, and Review + create. In the 'Networking' section, there's a note about OS disk type being Premium SSD. Below that, there's a table for 'DATA DISKS' with columns LUN, NAME, SIZE (GiB), DISK TYPE, and HOST CACHING. At the bottom, there are buttons for 'Review + create', 'Previous', and 'Next : Networking >' (which is also highlighted with a yellow box).

In “Networking”,

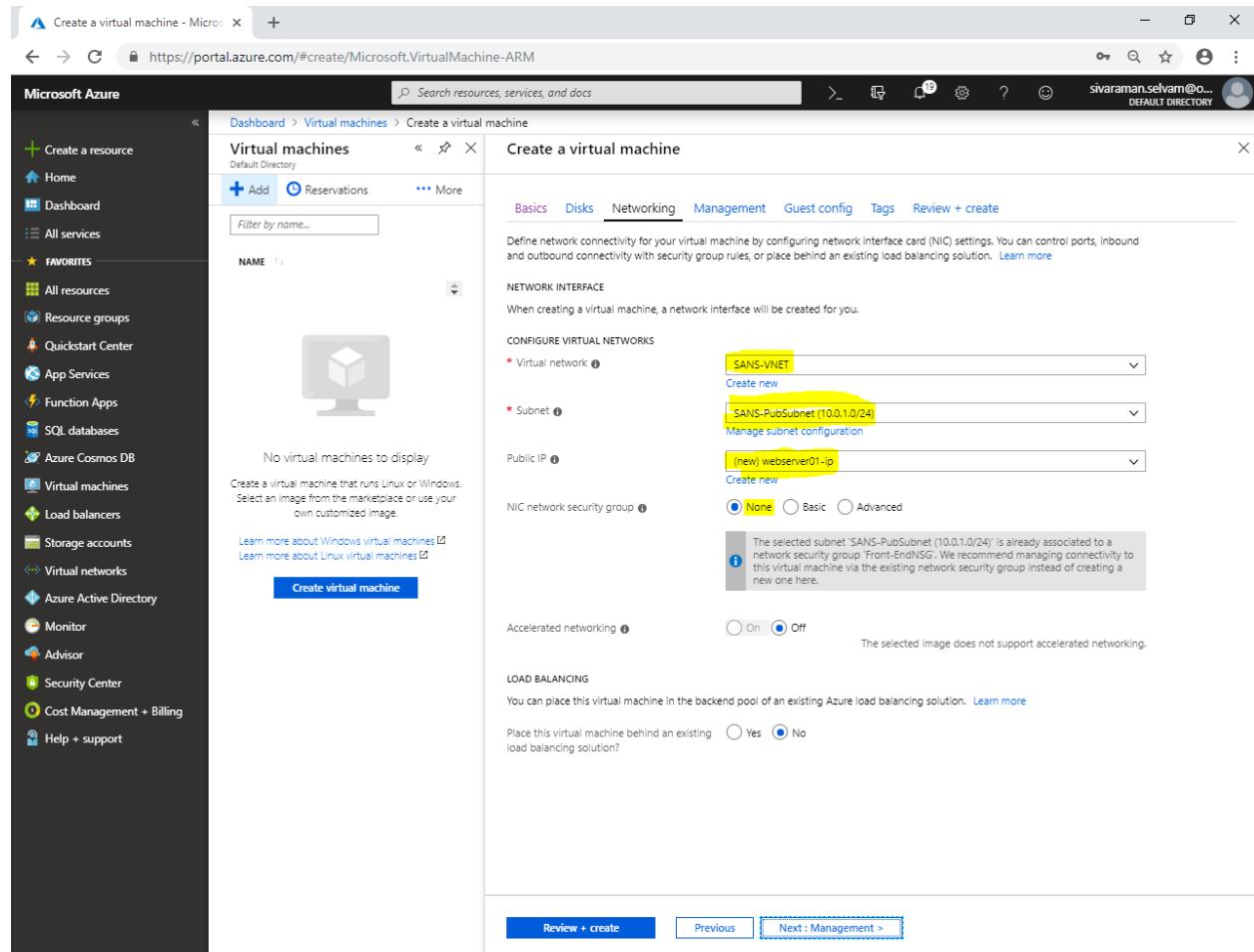
## Cloud Computing - Azure

Ensure “Virtual network” as “**SANS-VNET**”.

Ensure “Subnet” as “**SANS-PubSubnet**”.

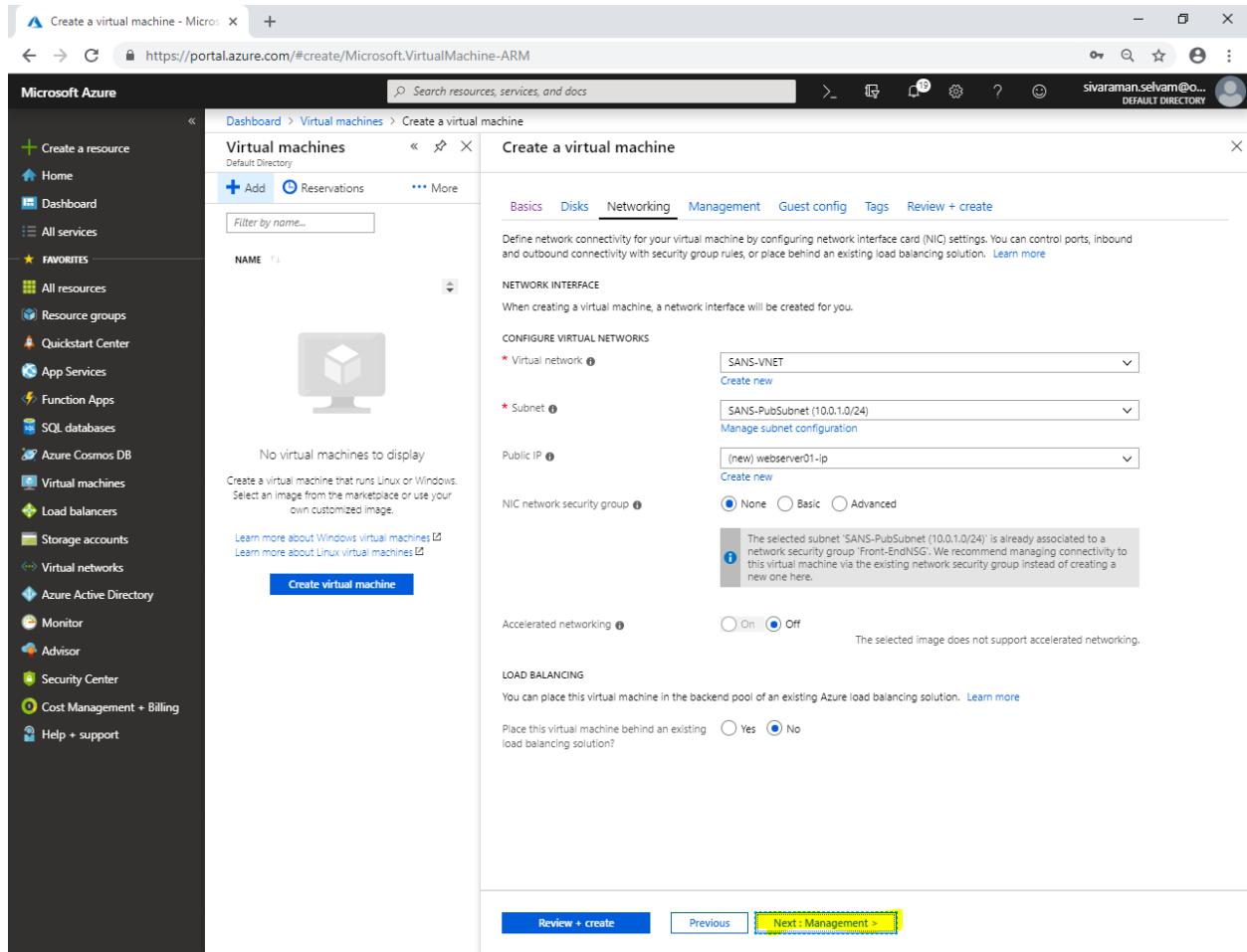
Ensure “**Pubic IP**” is selected.

Ensure “**NIC network security group**” as “**None**”.



Click “**Next : Management >**”.

## Cloud Computing - Azure



The screenshot shows the Microsoft Azure portal interface for creating a new virtual machine. The left sidebar contains a navigation menu with various services like Home, Dashboard, All services, Favorites, and more. The main area is titled 'Create a virtual machine' under 'Virtual machines'. The 'Networking' tab is selected. The configuration section includes:

- Virtual network:** SANS-VNET (selected from a dropdown).
- Subnet:** SANS-PubSubnet (10.0.1.0/24) (selected from a dropdown).
- Public IP:** (new) webserver01-ip (selected from a dropdown).
- NIC network security group:** None (radio button selected).
- Accelerated networking:** Off (radio button selected).
- Load balancing:** No (radio button selected).

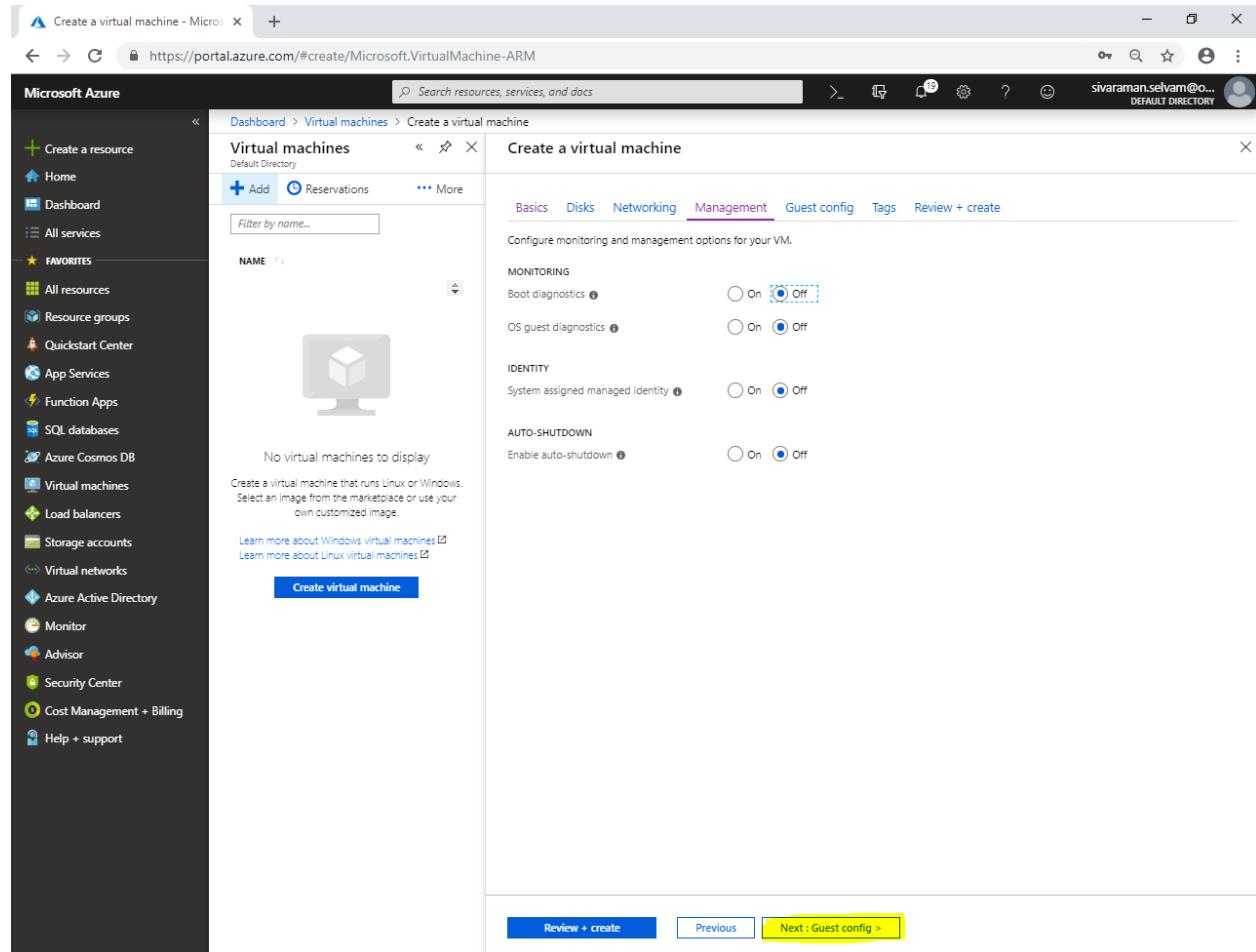
A note in the NIC network security group section states: "The selected subnet 'SANS-PubSubnet (10.0.1.0/24)' is already associated to a network security group 'Front-EndNSG'. We recommend managing connectivity to this virtual machine via the existing network security group instead of creating a new one here."

At the bottom, there are buttons for 'Review + create', 'Previous', and 'Next : Management >'.

In “Management”,

## Cloud Computing - Azure

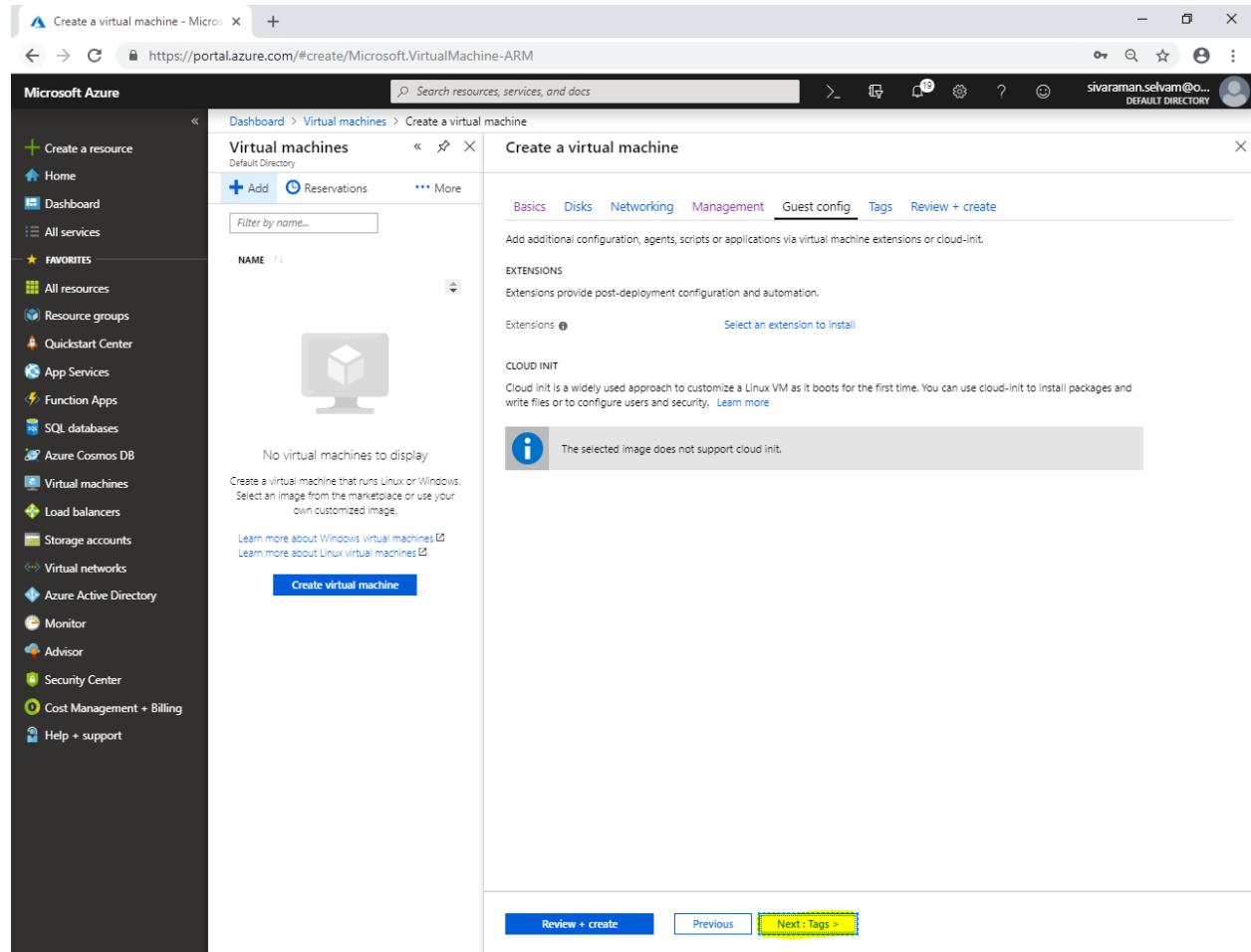
Click “Next : Guest config >”.



The screenshot shows the Microsoft Azure portal interface for creating a new virtual machine. The left sidebar contains various service icons. The main area is titled "Create a virtual machine" and shows the "Guest config" tab selected. The configuration section includes options for monitoring (Boot diagnostics and OS guest diagnostics), identity (System assigned managed identity), and auto-shutdown. At the bottom, there are buttons for "Review + create", "Previous", and "Next : Guest config >".

## Cloud Computing - Azure

Click “Next : Tags >”.

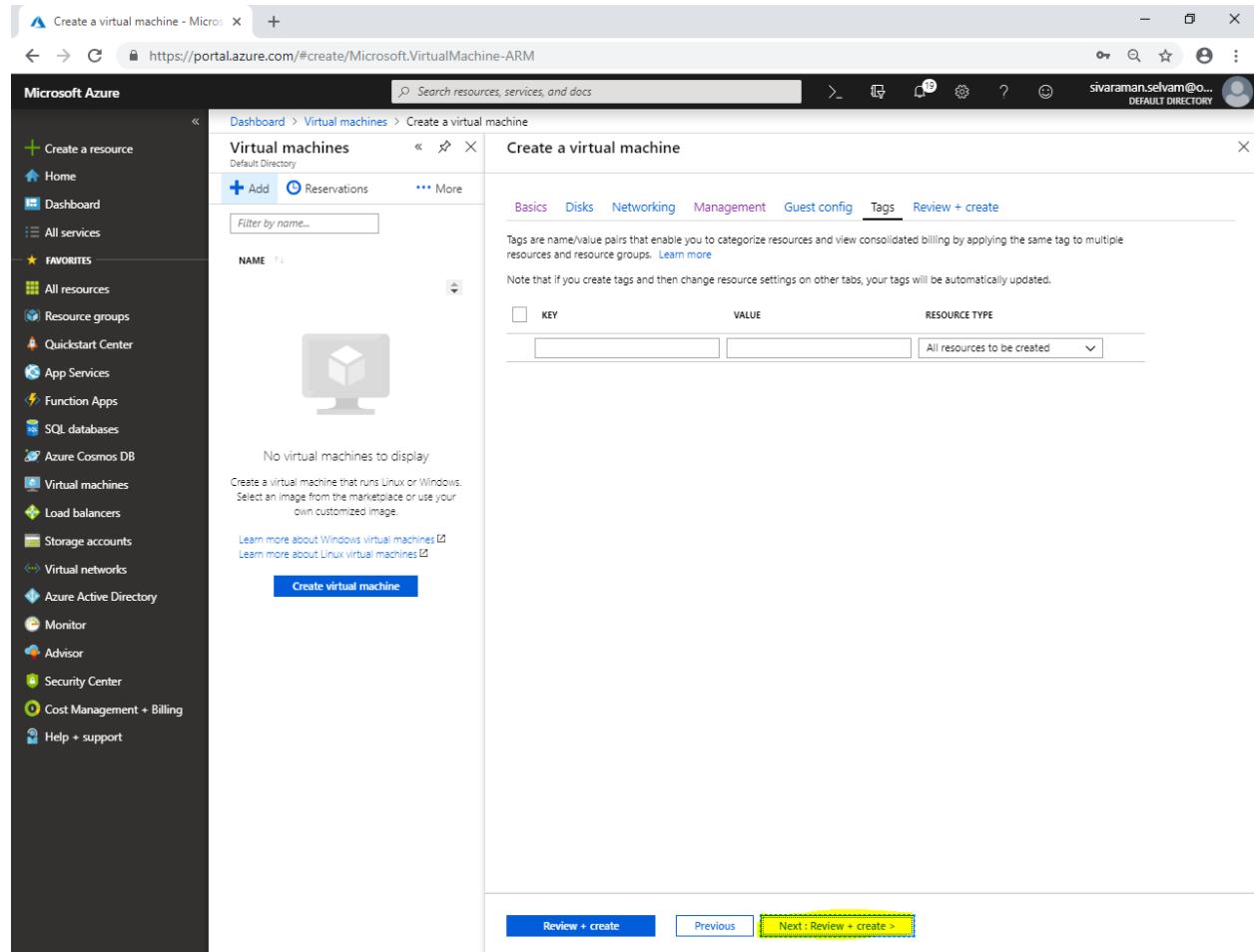


The screenshot shows the Microsoft Azure portal interface for creating a virtual machine. The left sidebar contains various service icons. The main area is titled 'Create a virtual machine' under 'Virtual machines'. The 'Guest config' tab is selected. Below it, there's a note about extensions and cloud-init. A message box indicates that the selected image does not support cloud init. At the bottom, there are 'Review + create', 'Previous', and 'Next : Tags >' buttons, with 'Next : Tags >' being highlighted by a yellow box.

In “Tags”,

## Cloud Computing - Azure

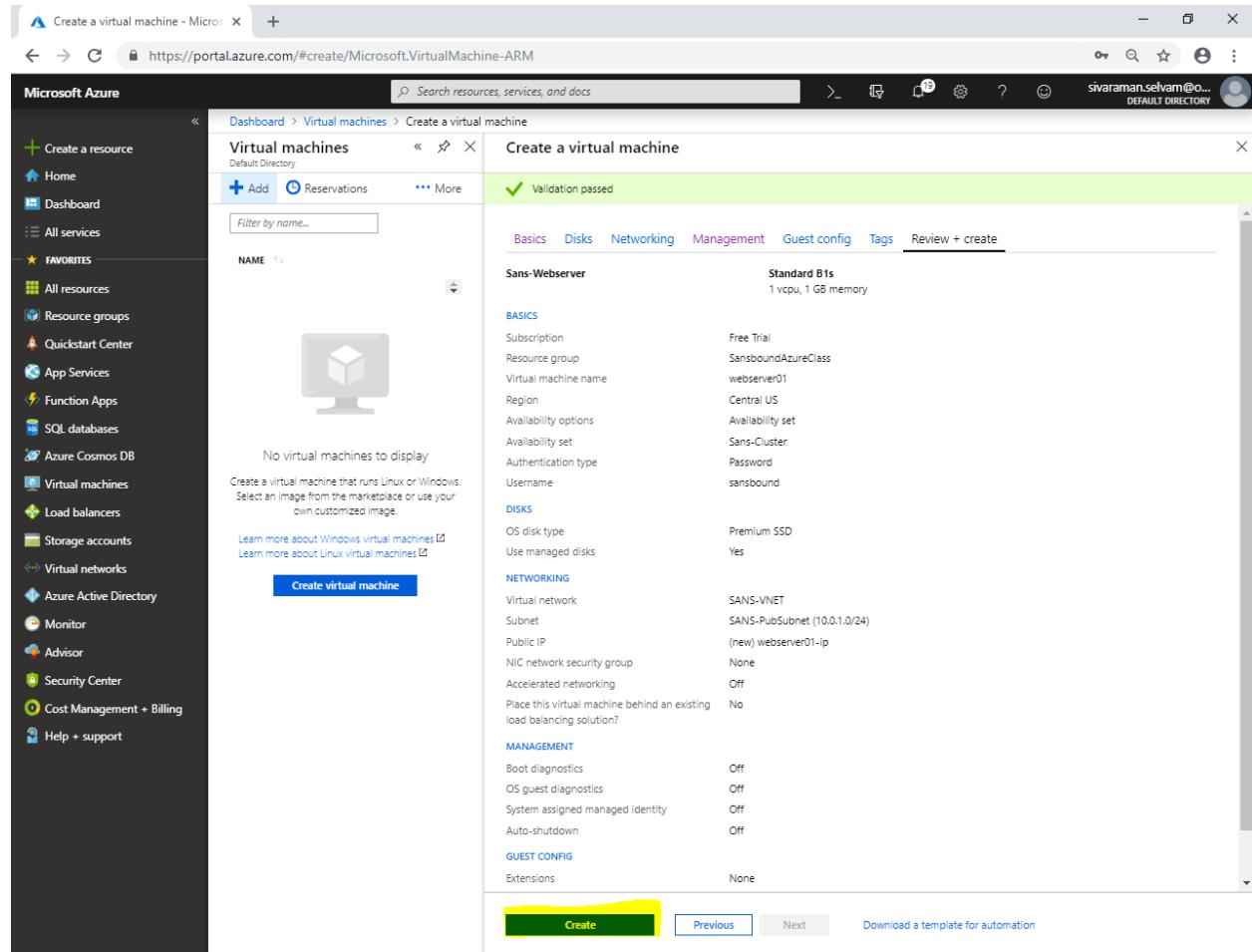
Click “Next : Review + create”.



The screenshot shows the Microsoft Azure portal interface for creating a virtual machine. The left sidebar contains various service icons. The main area is titled 'Create a virtual machine' under 'Virtual machines'. The 'Tags' tab is currently active. At the bottom, there are three buttons: 'Review + create' (highlighted with a yellow box), 'Previous', and 'Next : Review + create >'.

Click “Create”.

## Cloud Computing - Azure



**Virtual machines**

**Create a virtual machine**

**Validation passed**

**BASICS**

Subscription	Free Trial
Resource group	SansboundAzureClass
Virtual machine name	webserver01
Region	Central US
Availability options	Availability set
Availability set	Sans-Cluster
Authentication type	Password
Username	sansbound

**DISKS**

OS disk type	Premium SSD
Use managed disks	Yes

**NETWORKING**

Virtual network	SANS-VNET
Subnet	SANS-PubSubnet (10.0.1.0/24)
Public IP	(new) webserver01-ip
NIC network security group	None
Accelerated networking	Off
Place this virtual machine behind an existing load balancing solution?	No

**MANAGEMENT**

Boot diagnostics	Off
OS guest diagnostics	Off
System assigned managed identity	Off
Auto-shutdown	Off

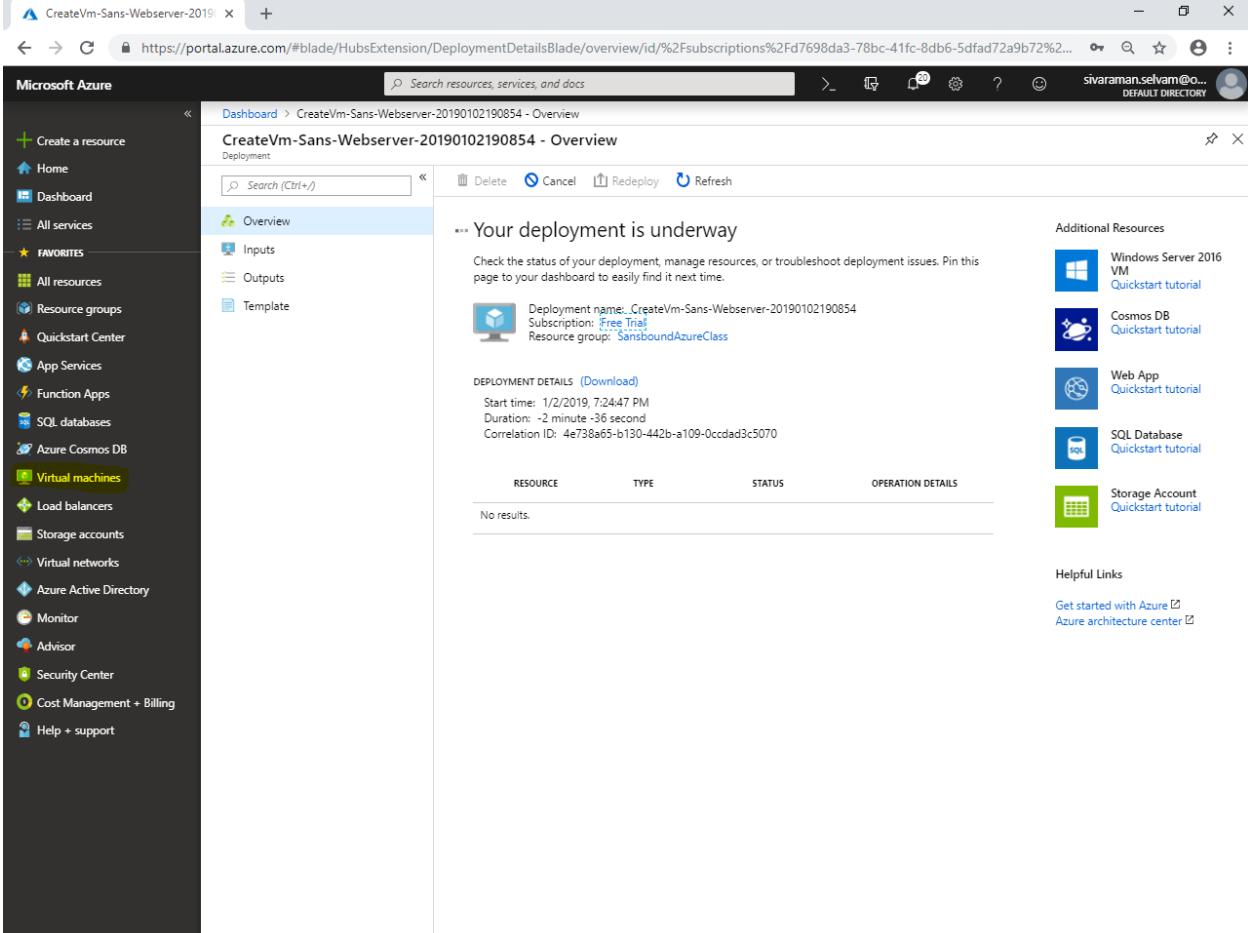
**GUEST CONFIG**

Extensions	None
------------	------

**Create**    **Previous**    **Next**    **Download a template for automation**

## Cloud Computing - Azure

Click “Virtual machines” in left side panel.

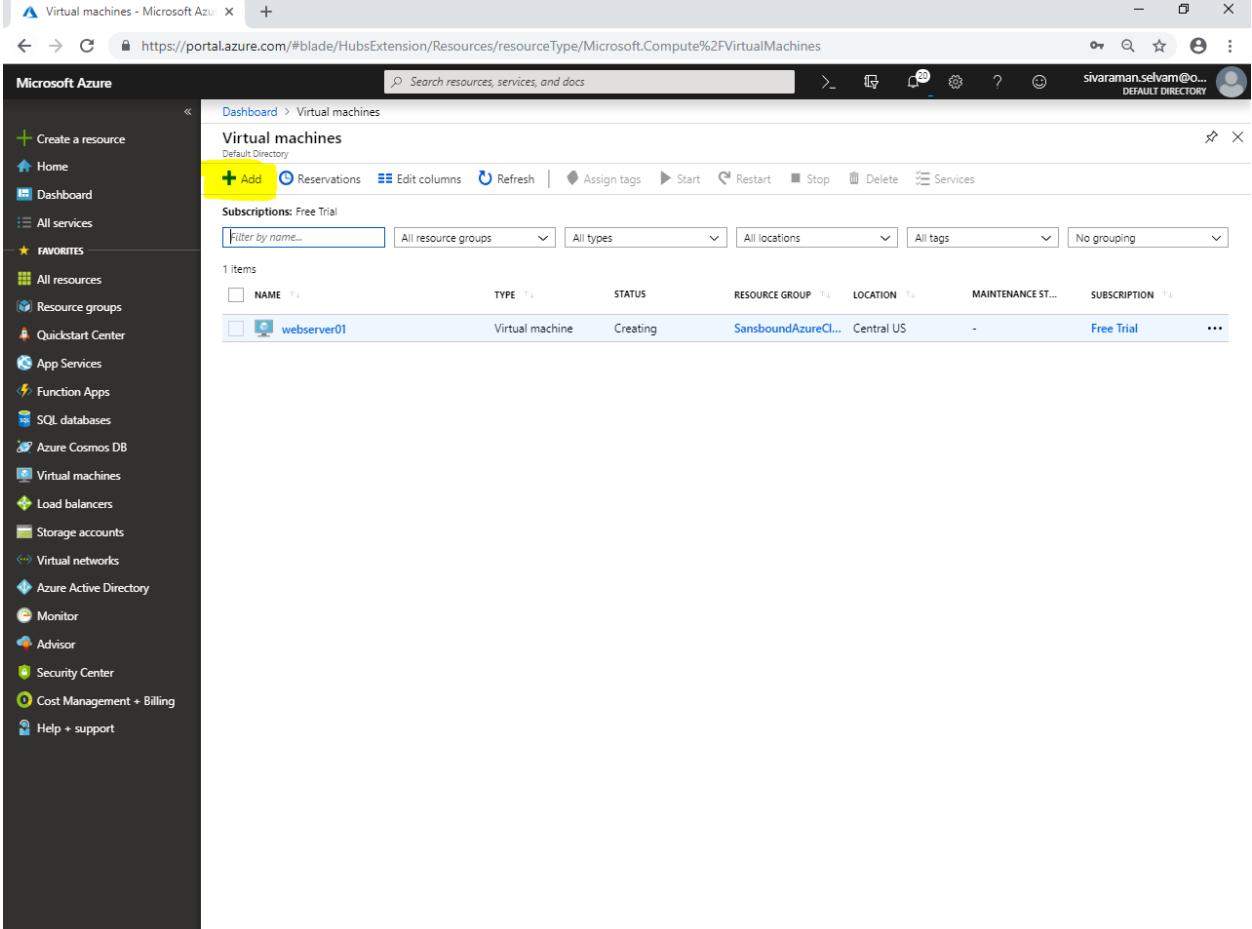


The screenshot shows the Microsoft Azure portal interface. The left sidebar is dark-themed and lists various services: Create a resource, Home, Dashboard, All services, FAVORITES (with a star icon), All resources, Resource groups, Quickstart Center, App Services, Function Apps, SQL databases, Azure Cosmos DB, Virtual machines (which is highlighted with a yellow box), Load balancers, Storage accounts, Virtual networks, Azure Active Directory, Monitor, Advisor, Security Center, Cost Management + Billing, and Help + support. The main content area shows the "CreateVm-Sans-Webserver-20190102190854 - Overview" page for a deployment. The title bar includes the URL https://portal.azure.com/#blade/HubsExtension/DeploymentDetailsBlade/overview/id/%2fsubscriptions%2Fd7698da3-78bc-41fc-8db6-5dfad72a9b72%2... and the user sivaraman.selyam@o... with a DEFAULT DIRECTORY link. The page displays deployment details like Deployment name: CreateVm-Sans-Webserver-20190102190854, Subscription: Free Trial, and Resource group: SansboundAzureClass. It also shows DEPLOYMENT DETAILS with start time (1/2/2019, 7:24:47 PM), duration (-2 minute -36 second), and Correlation ID: 4e738a65-b130-442b-a109-0ccdad3c5070. A table titled "RESOURCE" with columns "TYPE", "STATUS", and "OPERATION DETAILS" shows "No results." There are sections for Additional Resources (Windows Server 2016 VM, Cosmos DB, Web App, SQL Database, Storage Account) and Helpful Links (Get started with Azure, Azure architecture center).

In “Virtual machines”,

## Cloud Computing - Azure

Click “Add”.



The screenshot shows the Microsoft Azure portal interface for managing virtual machines. The left sidebar contains a navigation menu with various services like Home, Dashboard, All services, Resource groups, Quickstart Center, App Services, Function Apps, SQL databases, Azure Cosmos DB, Virtual machines, Load balancers, Storage accounts, Virtual networks, Azure Active Directory, Monitor, Advisor, Security Center, Cost Management + Billing, and Help + support. The main content area is titled "Virtual machines" and shows a table of existing resources. A yellow box highlights the "Add" button at the top left of the table header. The table has columns for NAME, TYPE, STATUS, RESOURCE GROUP, LOCATION, MAINTENANCE ST..., and SUBSCRIPTION. One item is listed: "webserver01" (Virtual machine, Creating, SansboundAzureCl..., Central US, -, Free Trial). The URL in the browser bar is https://portal.azure.com/#blade/HubsExtension/Resources/resourceType/Microsoft.Compute%2FVirtualMachines.

Select “Subscription” as “Free Trial”.

## Cloud Computing - Azure

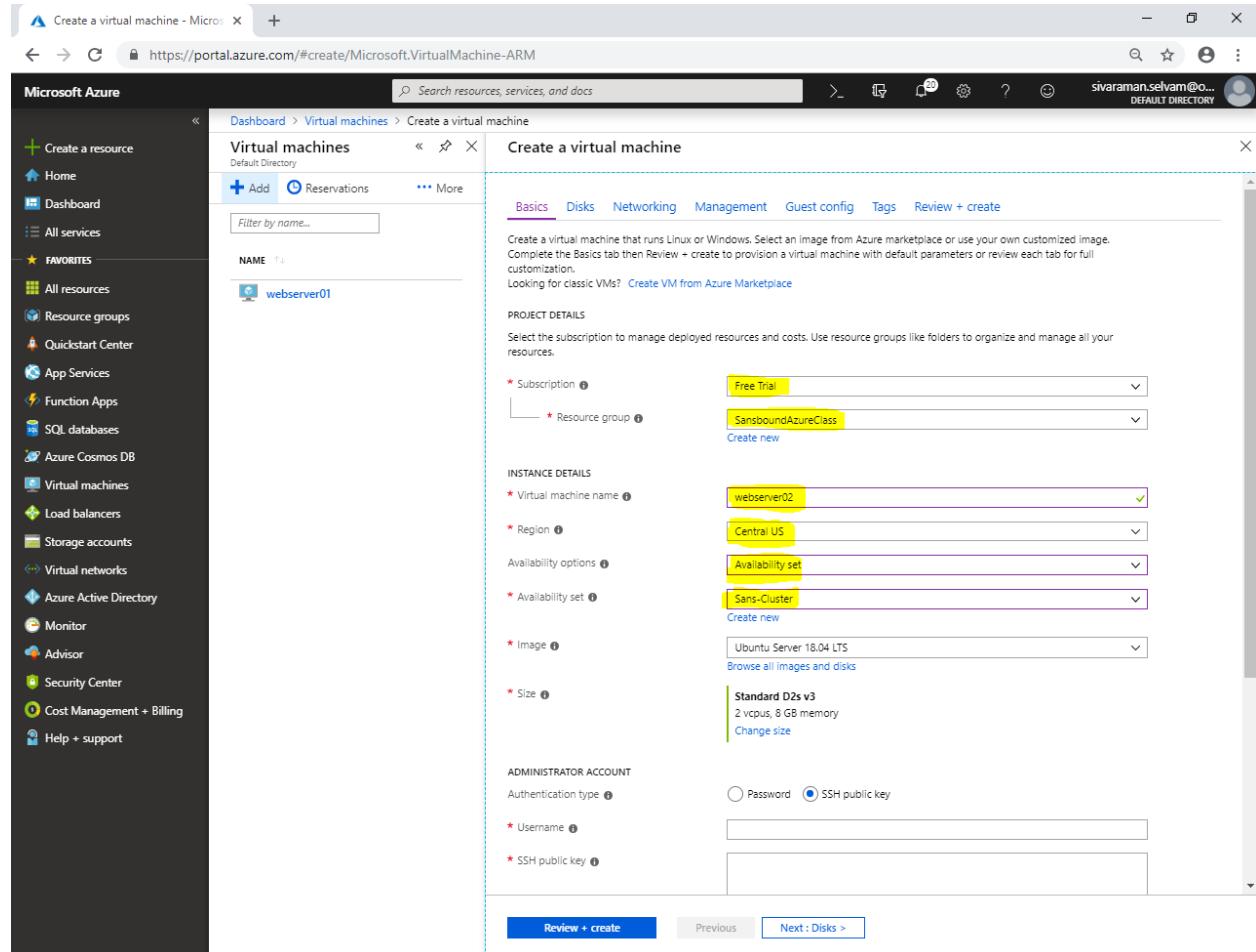
Select “Resource group” as “**SasboundAzureClass**”.

Type “Virtual machine name” as “**webserver02**”.

Select “Region” as “**Central US**”.

In “Availability Options” select “**Availability set**”.

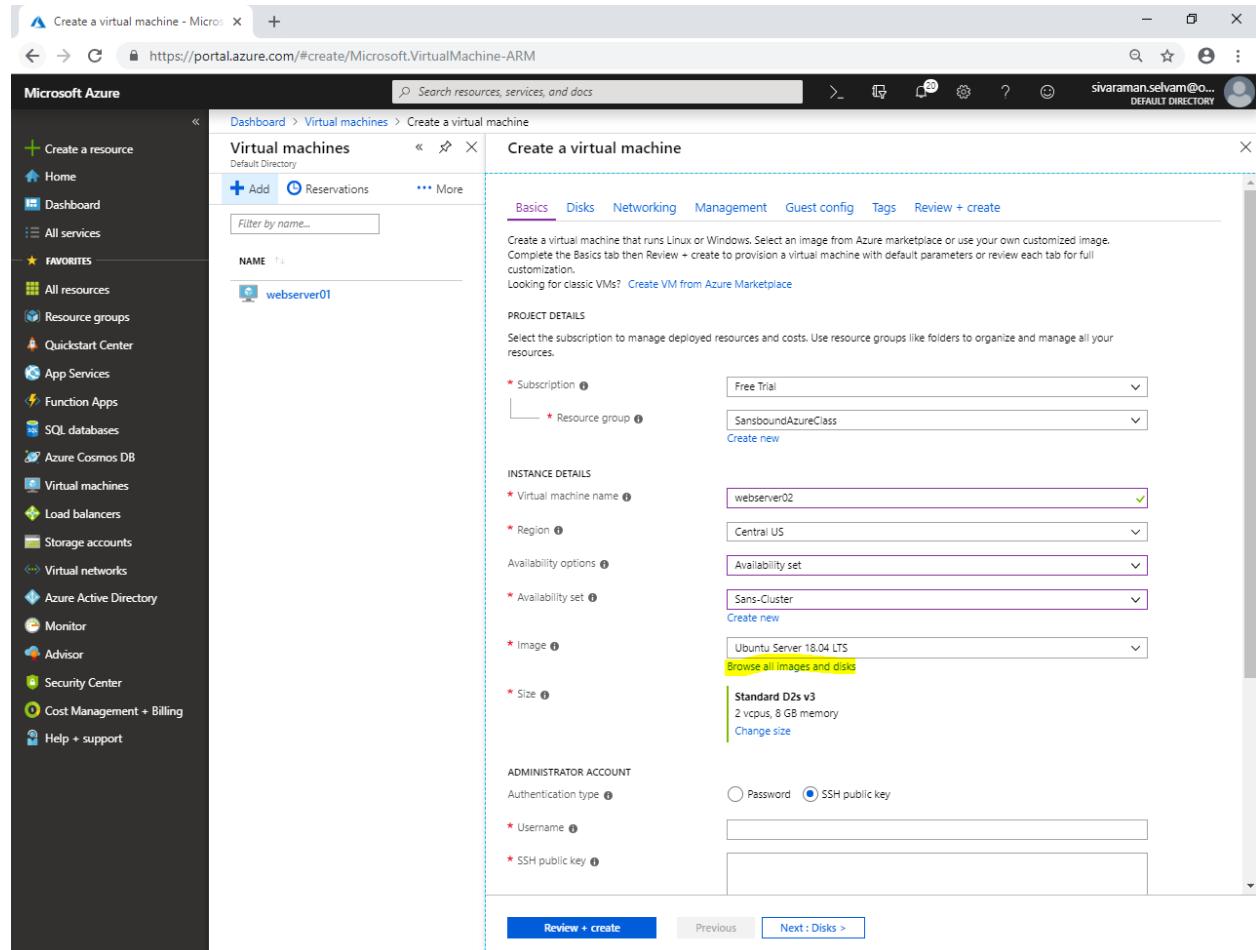
In “Availability set” select “**Sans-Cluster**”.



The screenshot shows the Microsoft Azure portal interface for creating a new virtual machine. The left sidebar lists various services like Home, Dashboard, and Virtual machines. The main area is titled 'Create a virtual machine' under 'Virtual machines'. The 'Basics' tab is selected. In the 'PROJECT DETAILS' section, the subscription is set to 'Free Trial' and the resource group is 'SasboundAzureClass'. Under 'INSTANCE DETAILS', the virtual machine name is 'webserver02', the region is 'Central US', and the availability options are set to 'Availability set' with 'Sans-Cluster' selected. The 'Image' is set to 'Ubuntu Server 18.04 LTS', and the 'Size' is 'Standard D2s v3'. In the 'ADMINISTRATOR ACCOUNT' section, the authentication type is 'SSH public key'. Buttons at the bottom include 'Review + create' and 'Next : Disks >'.

## Cloud Computing - Azure

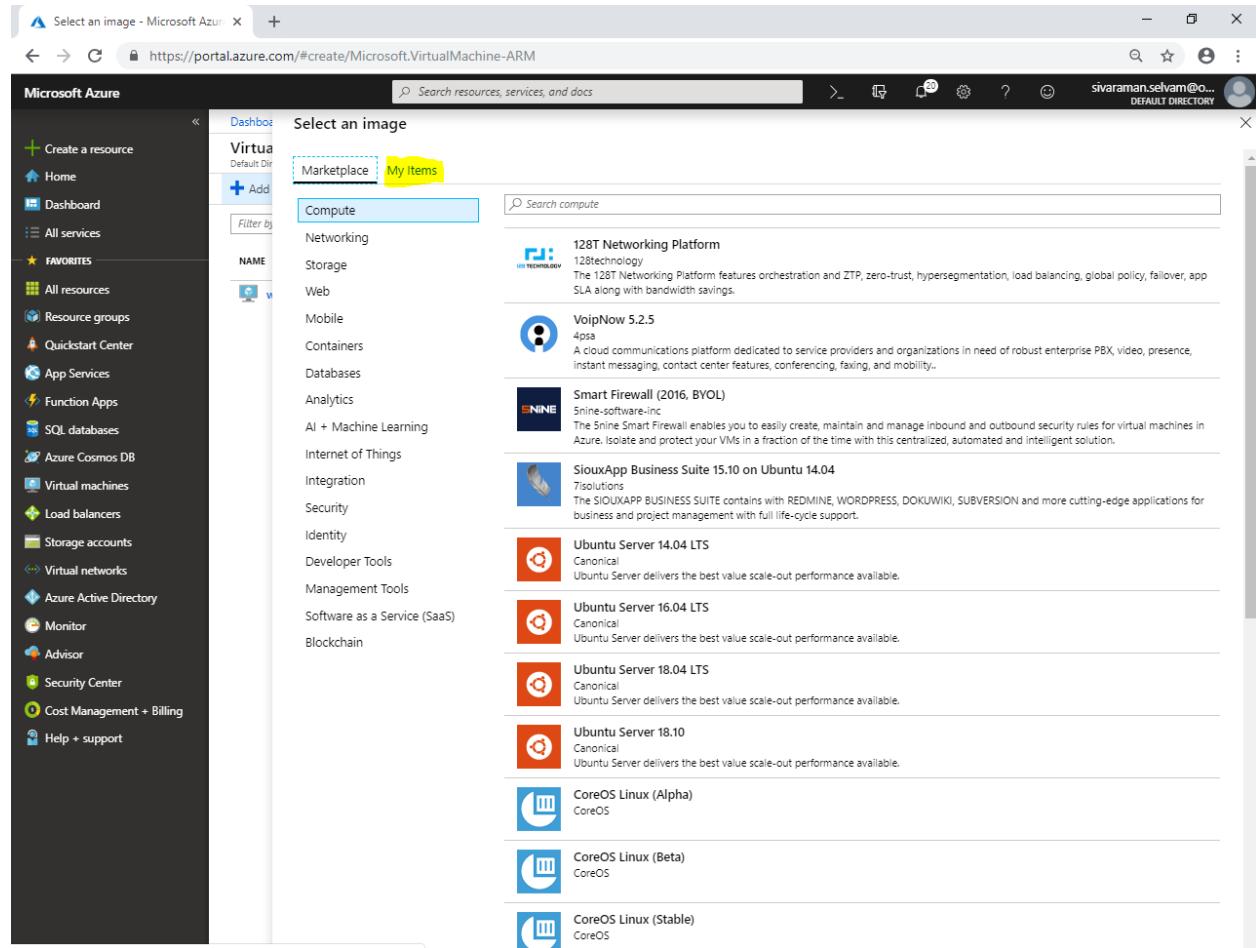
Click “Browse all images and disks”.



The screenshot shows the Microsoft Azure portal interface for creating a new virtual machine. The left sidebar contains various service links like Home, Dashboard, All services, and Resource groups. The main area shows the 'Virtual machines' blade with a 'Create a virtual machine' wizard open. The 'INSTANCE DETAILS' tab is active, displaying fields for the VM name (set to 'webserver02'), Region (set to 'Central US'), Availability options (set to 'Availability set'), and Image (set to 'Ubuntu Server 18.04 LTS'). A yellow box highlights the 'Image' dropdown, and the option 'Browse all images and disks' is visible below it. Other tabs like Basics, Disks, Networking, Management, Guest config, Tags, and Review + create are also present.

## Cloud Computing - Azure

Click “My Items”.



Select an image

Marketplace My items

Compute

Networking Storage Web Mobile Containers Databases Analytics AI + Machine Learning Internet of Things Integration Security Identity Developer Tools Management Tools Software as a Service (SaaS) Blockchain

128T Networking Platform  
128Technology  
The 128T Networking Platform features orchestration and ZTP, zero-trust, hypersegmentation, load balancing, global policy, failover, app SLA along with bandwidth savings.

VoipNow 5.2.5  
4psa  
A cloud communications platform dedicated to service providers and organizations in need of robust enterprise PBX, video, presence, instant messaging, contact center features, conferencing, faxing, and mobility..

Smart Firewall (2016, BYOL)  
5nine.software\_inc  
The 5nine Smart Firewall enables you to easily create, maintain and manage inbound and outbound security rules for virtual machines in Azure. Isolate and protect your VMs in a fraction of the time with this centralized, automated and intelligent solution.

SiouxApp Business Suite 15.10 on Ubuntu 14.04  
7isolutions  
The SIOUXAPP BUSINESS SUITE contains with REDMINE, WORDPRESS, DOKUWIKI, SUBVERSION and more cutting-edge applications for business and project management with full life-cycle support.

Ubuntu Server 14.04 LTS  
Canonical  
Ubuntu Server delivers the best value scale-out performance available.

Ubuntu Server 16.04 LTS  
Canonical  
Ubuntu Server delivers the best value scale-out performance available.

Ubuntu Server 18.04 LTS  
Canonical  
Ubuntu Server delivers the best value scale-out performance available.

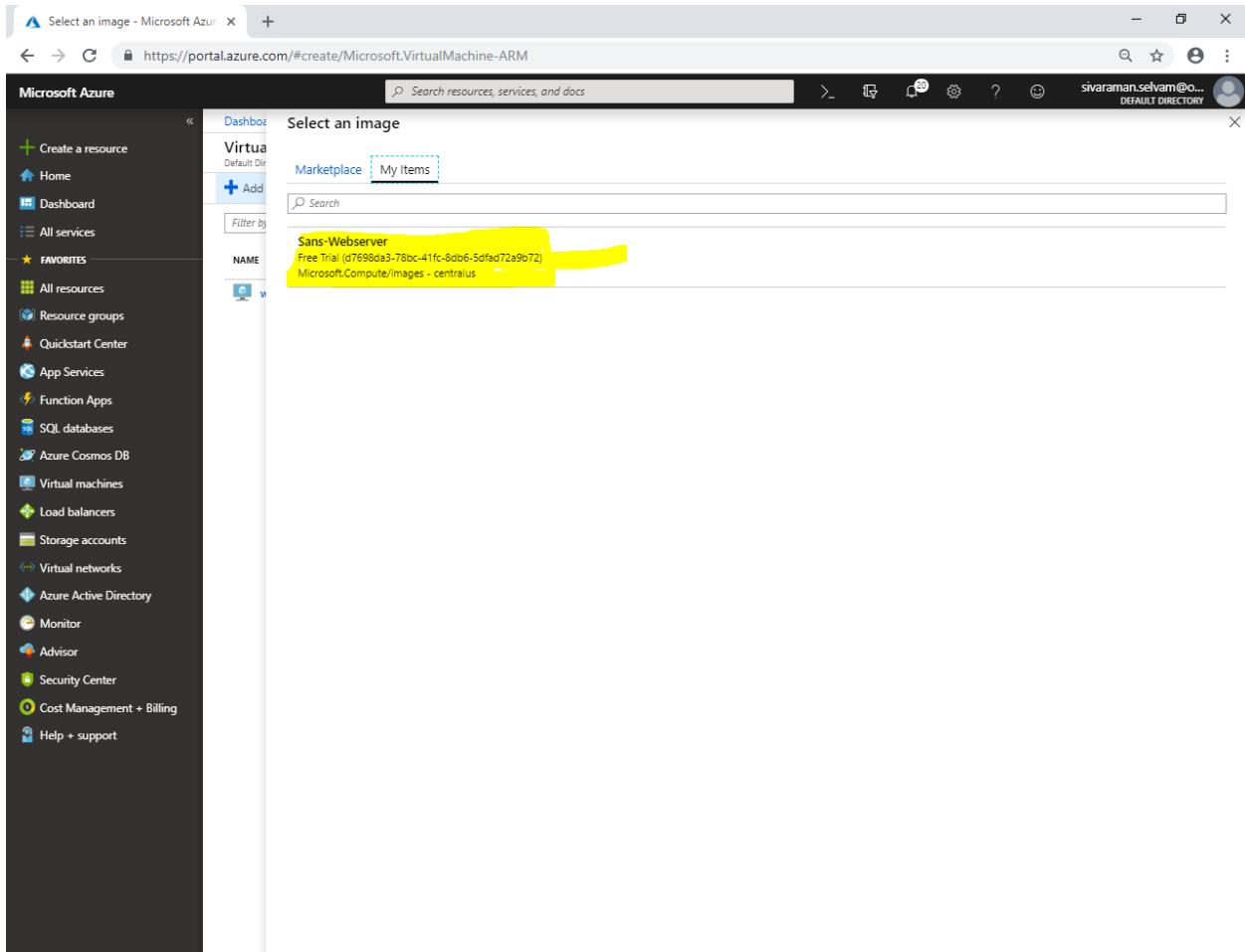
CoreOS Linux (Alpha)  
CoreOS

CoreOS Linux (Beta)  
CoreOS

CoreOS Linux (Stable)  
CoreOS

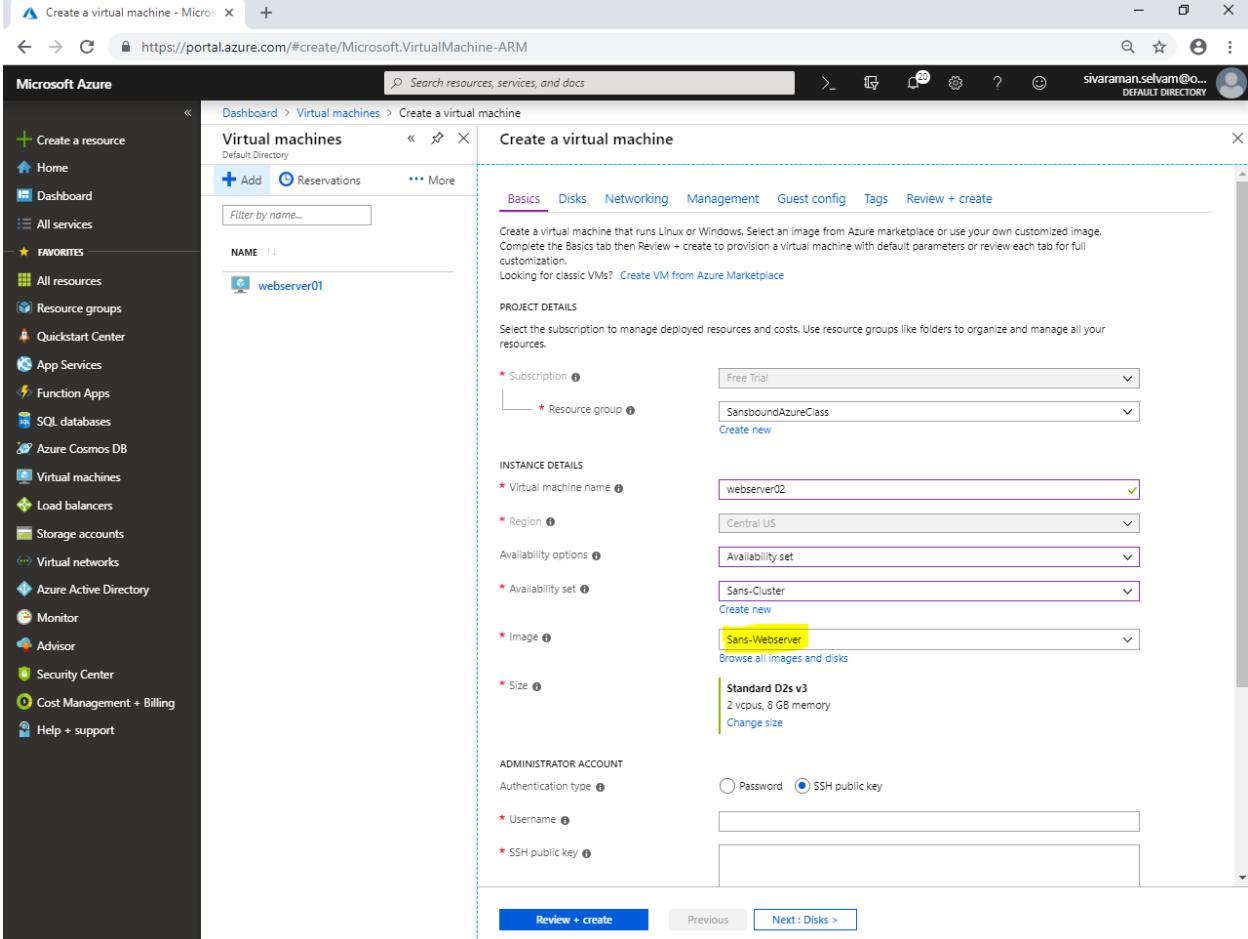
In "My Items",

Click "**Sans-Webserver**" to select the captured image.



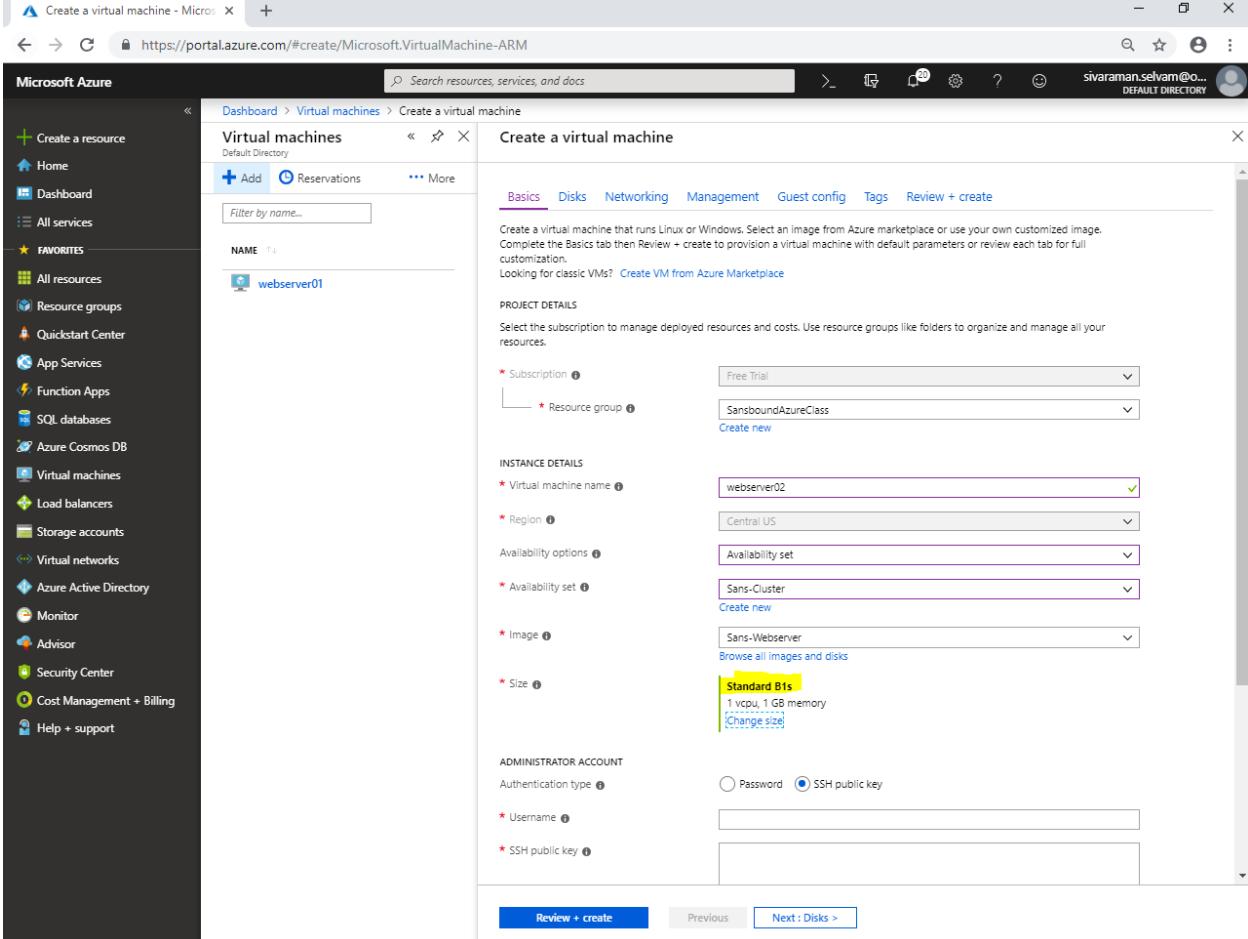
The screenshot shows the Microsoft Azure portal interface. On the left, there's a sidebar with various service icons like Home, Dashboard, All services, Favorites, All resources, Resource groups, Quickstart Center, App Services, Function Apps, SQL databases, Azure Cosmos DB, Virtual machines, Load balancers, Storage accounts, Virtual networks, Azure Active Directory, Monitor, Advisor, Security Center, Cost Management + Billing, and Help + support. The main content area has a title 'Select an image'. Below it, there are two tabs: 'Marketplace' (which is active) and 'My Items'. Under 'Marketplace', there's a search bar and a table with columns 'NAME' and 'TYPE'. The first item listed is 'Sans-Webserver' (Free Trial (d7698da3-78bc-41fc-8db6-5cfad72a9b72)) from 'Microsoft.Compute/images - centralus'. A yellow box highlights this row. At the top of the page, there's a header bar with the URL 'https://portal.azure.com/#create/Microsoft.VirtualMachine-ARM', a search bar, and a user profile icon.

Ensure that you have selected captured image as “Image”.



The screenshot shows the Microsoft Azure portal interface for creating a new virtual machine. The left sidebar contains a navigation menu with various services like Home, Dashboard, All services, Favorites, Resource groups, Quickstart Center, App Services, Function Apps, SQL databases, Azure Cosmos DB, Virtual machines, Load balancers, Storage accounts, Virtual networks, Azure Active Directory, Monitor, Advisor, Security Center, Cost Management + Billing, and Help + support. The main content area is titled 'Create a virtual machine' under 'Virtual machines'. The 'Basics' tab is selected. The 'PROJECT DETAILS' section includes fields for 'Subscription' (set to 'Free Trial'), 'Resource group' (set to 'SansboundAzureClass'), and 'Virtual machine name' (set to 'webserver02'). The 'INSTANCE DETAILS' section includes fields for 'Region' (set to 'Central US'), 'Availability options' (set to 'Availability set'), 'Availability set' (set to 'Sans-Cluster'), and 'Image' (set to 'Sans-Webserver'). The 'Size' dropdown is set to 'Standard D2s v3'. The 'ADMINISTRATOR ACCOUNT' section shows 'Authentication type' as 'SSH public key', with 'Username' and 'SSH public key' fields filled in. At the bottom, there are 'Review + create', 'Previous', and 'Next : Disks >' buttons.

Change “VM size” as “Standard B1s”.



The screenshot shows the Microsoft Azure portal interface for creating a new virtual machine. The left sidebar contains various service icons like Home, Dashboard, All services, Favorites, Resource groups, Quickstart Center, App Services, Function Apps, SQL databases, Azure Cosmos DB, Virtual machines, Load balancers, Storage accounts, Virtual networks, Azure Active Directory, Monitor, Advisor, Security Center, Cost Management + Billing, and Help + support. The main area is titled "Create a virtual machine" under "Virtual machines". The "Basics" tab is selected. In the "PROJECT DETAILS" section, the "Subscription" dropdown is set to "Free Trial" and the "Resource group" dropdown is set to "SansboundAzureClass". Under "INSTANCE DETAILS", the "Virtual machine name" is "webserver02", "Region" is "Central US", "Availability options" is "Availability set", and "Availability set" is "Sans-Cluster". The "Image" dropdown is set to "Sans-Webserver" and the "Size" dropdown is set to "Standard B1s". In the "ADMINISTRATOR ACCOUNT" section, the "Authentication type" is "SSH public key", "Username" is "root", and "SSH public key" is a placeholder field. At the bottom, there are "Review + create", "Previous", and "Next : Disks >" buttons.

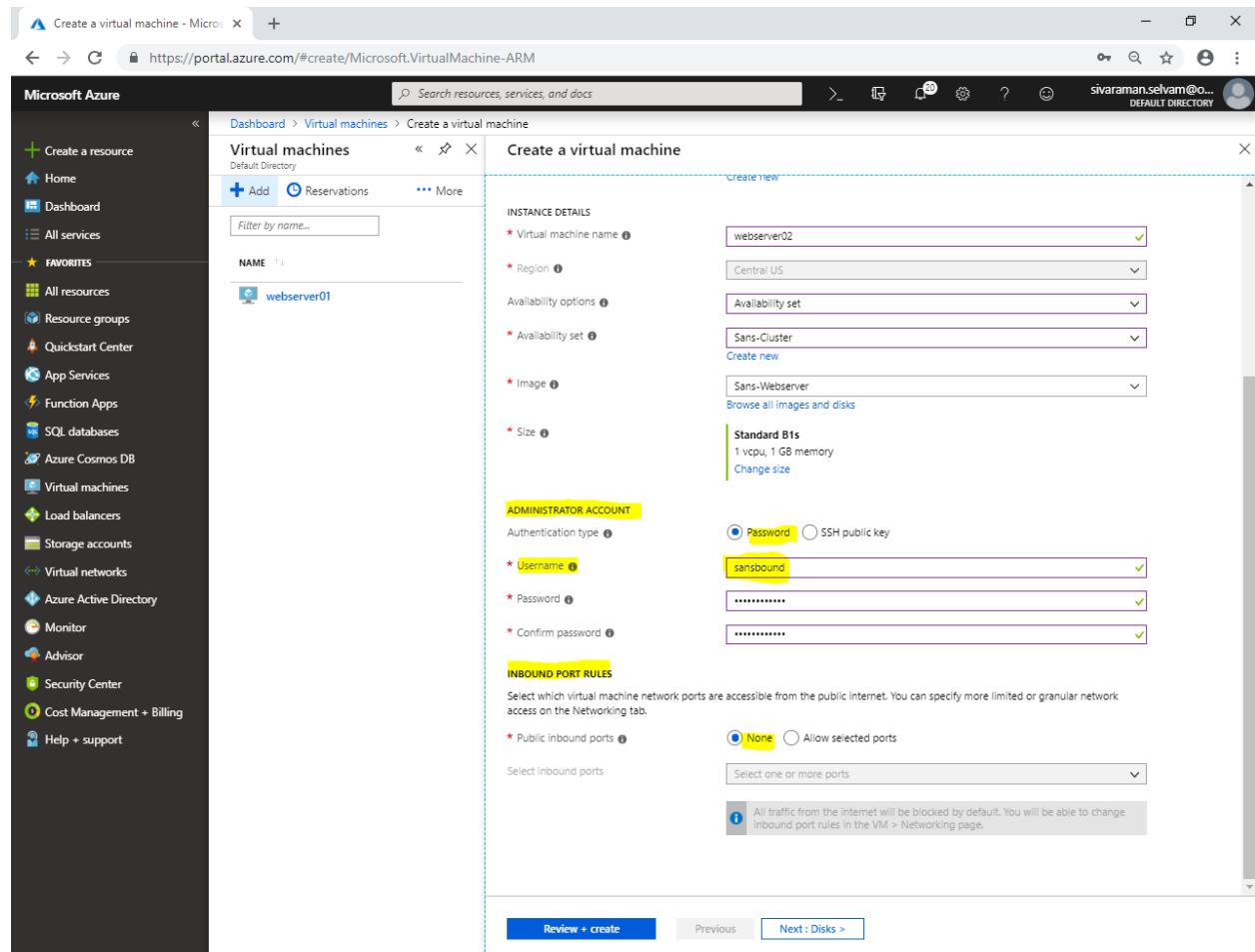
In “Administrator Account”,

Set “Authentication type” as “Password”.

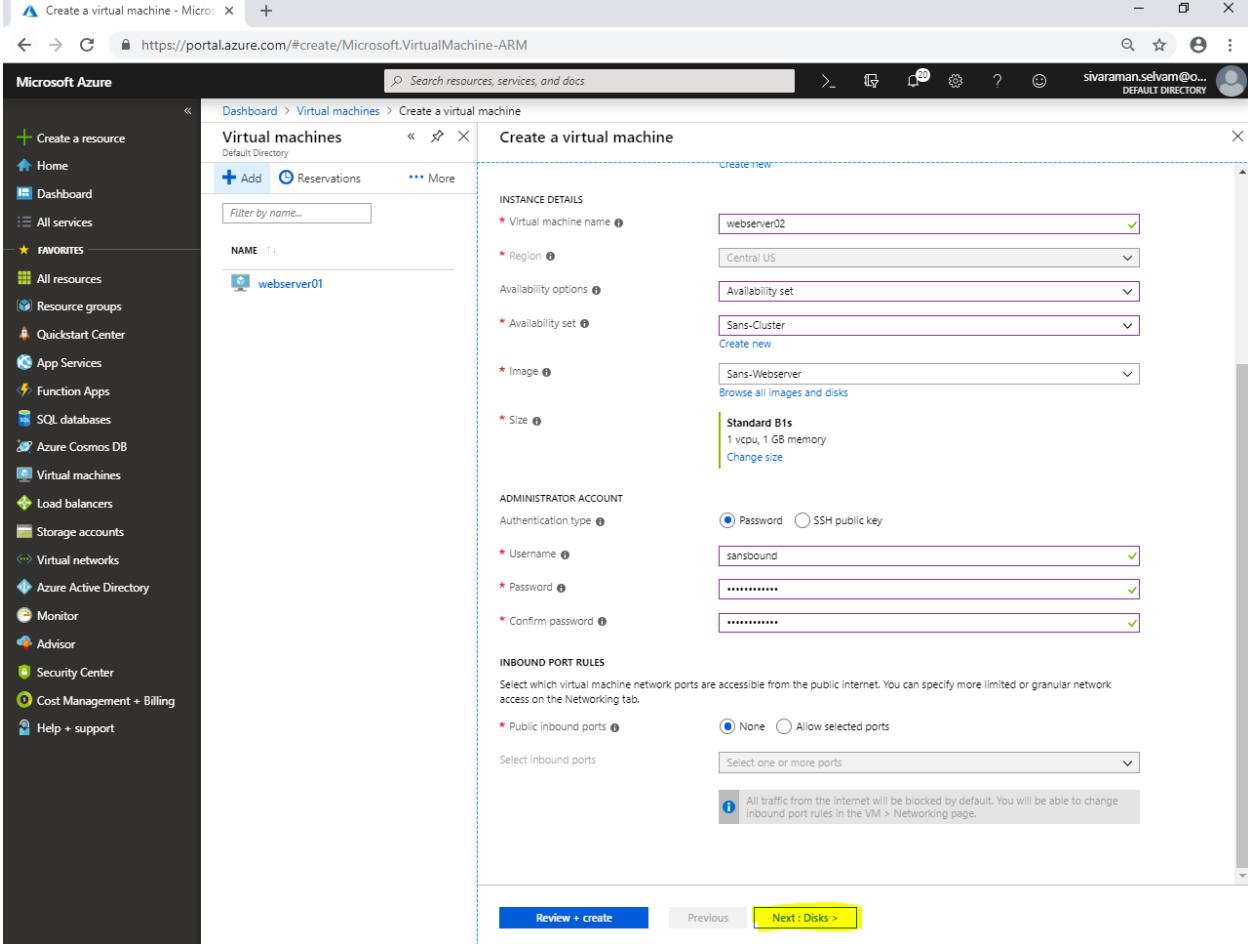
Type “Username” as “sansbound”.

Type “Password” for Ubuntu.

Ensure that “Inbound Port rules” as “None”.



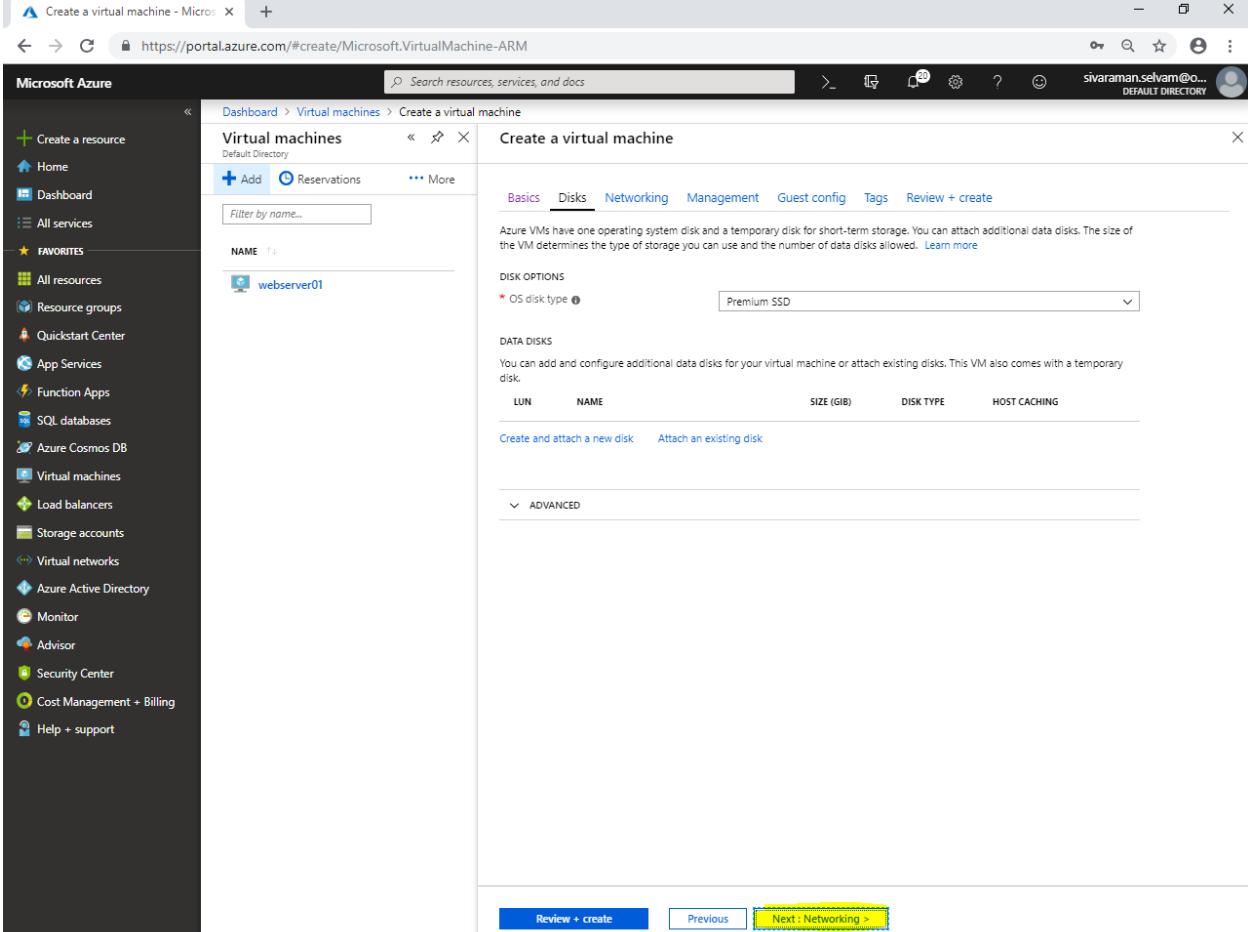
Click "Next : Disks >".



The screenshot shows the Microsoft Azure portal interface for creating a new virtual machine. The left sidebar contains various service links like Home, Dashboard, All services, Favorites, and more. The main area is titled 'Create a virtual machine' under 'Virtual machines'. The 'INSTANCE DETAILS' section includes fields for 'Virtual machine name' (set to 'webserver02'), 'Region' (set to 'Central US'), 'Availability options' (set to 'Availability set' and 'Sans-Cluster'), 'Image' (set to 'Sans-Webserver'), and 'Size' (set to 'Standard B1s'). The 'ADMINISTRATOR ACCOUNT' section shows 'Authentication type' as 'Password' (selected), with 'Username' ('sansbound'), 'Password' ('\*\*\*\*\*'), and 'Confirm password' ('\*\*\*\*\*') all filled in. Under 'INBOUND PORT RULES', the 'Public Inbound ports' dropdown is set to 'None'. At the bottom, there are 'Review + create' and 'Next : Disks >' buttons, with 'Next : Disks >' being highlighted by a yellow box.

In “Disks”,

Click “Next : Networking >”.



The screenshot shows the Microsoft Azure portal interface for creating a new virtual machine. The left sidebar contains various service links like Home, Dashboard, All services, and Storage accounts. The main panel shows the 'Virtual machines' section with a list of existing VMs including 'webserver01'. The current step is 'Create a virtual machine' under the 'Basics' tab. In the 'DISK OPTIONS' section, the 'OS disk type' is set to 'Premium SSD'. Below it, the 'DATA DISKS' section is collapsed. At the bottom of the wizard, there are buttons for 'Review + create' (which is highlighted in blue), 'Previous', and 'Next : Networking >' (which is highlighted with a yellow box).

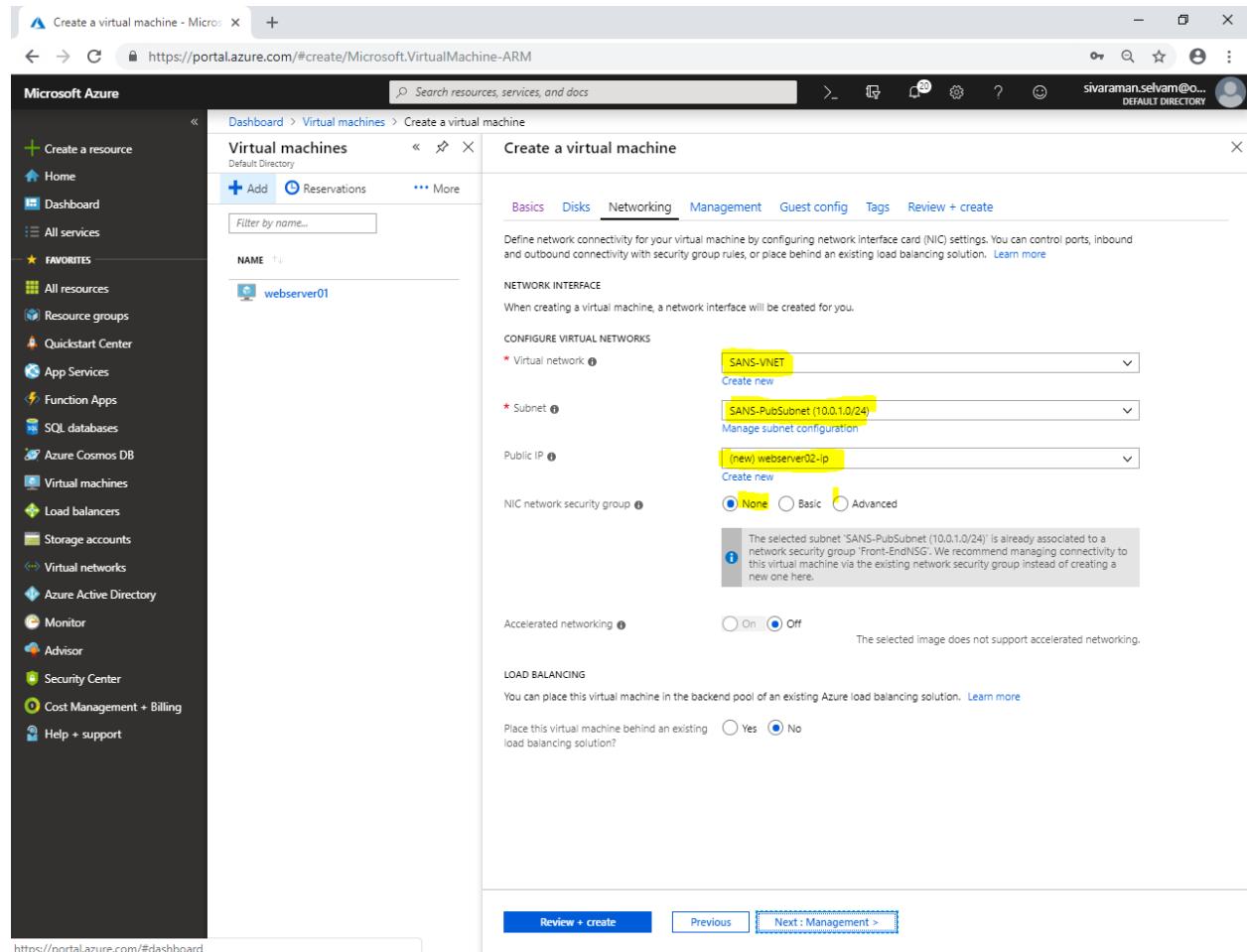
## In “Networking”

Ensure “Virtual network” as “Sans-VNET”.

Ensure “Subnet” as “SANS-PubSubnet”.

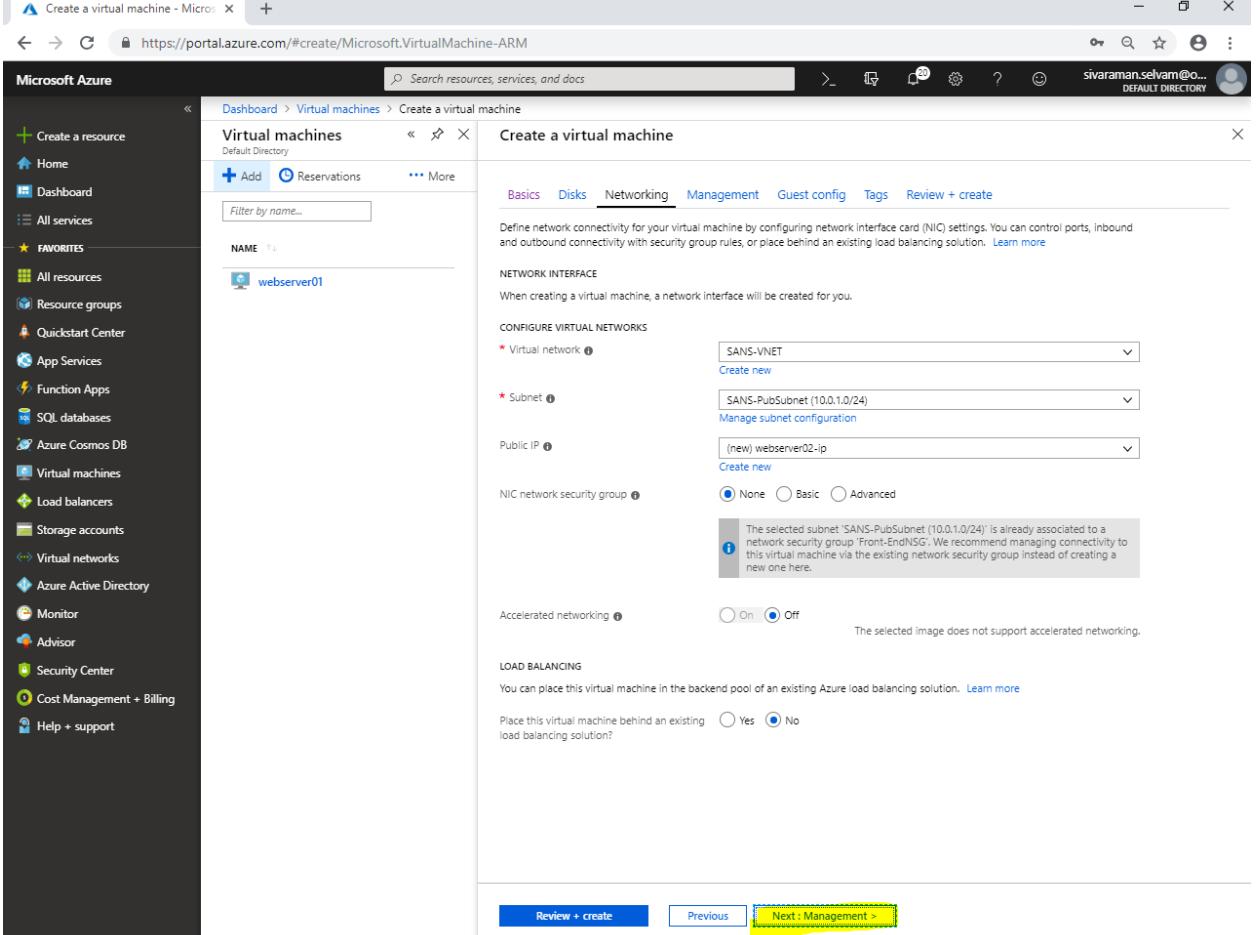
Select “Public IP” is selected.

Ensure “NIC network security group” as “None”.



The screenshot shows the 'Create a virtual machine' wizard in the Microsoft Azure portal. The 'Networking' tab is selected. The 'Virtual network' dropdown is set to 'SANS-VNET'. The 'Subnet' dropdown is set to 'SANS-PubSubnet (10.0.1.0/24)'. The 'Public IP' dropdown is set to '(New) webserver02-ip'. The 'NIC network security group' dropdown is set to 'None'. The 'Accelerated networking' section has 'Off' selected. At the bottom, there are 'Review + create', 'Previous', and 'Next : Management >' buttons.

Click "Next : Management >".

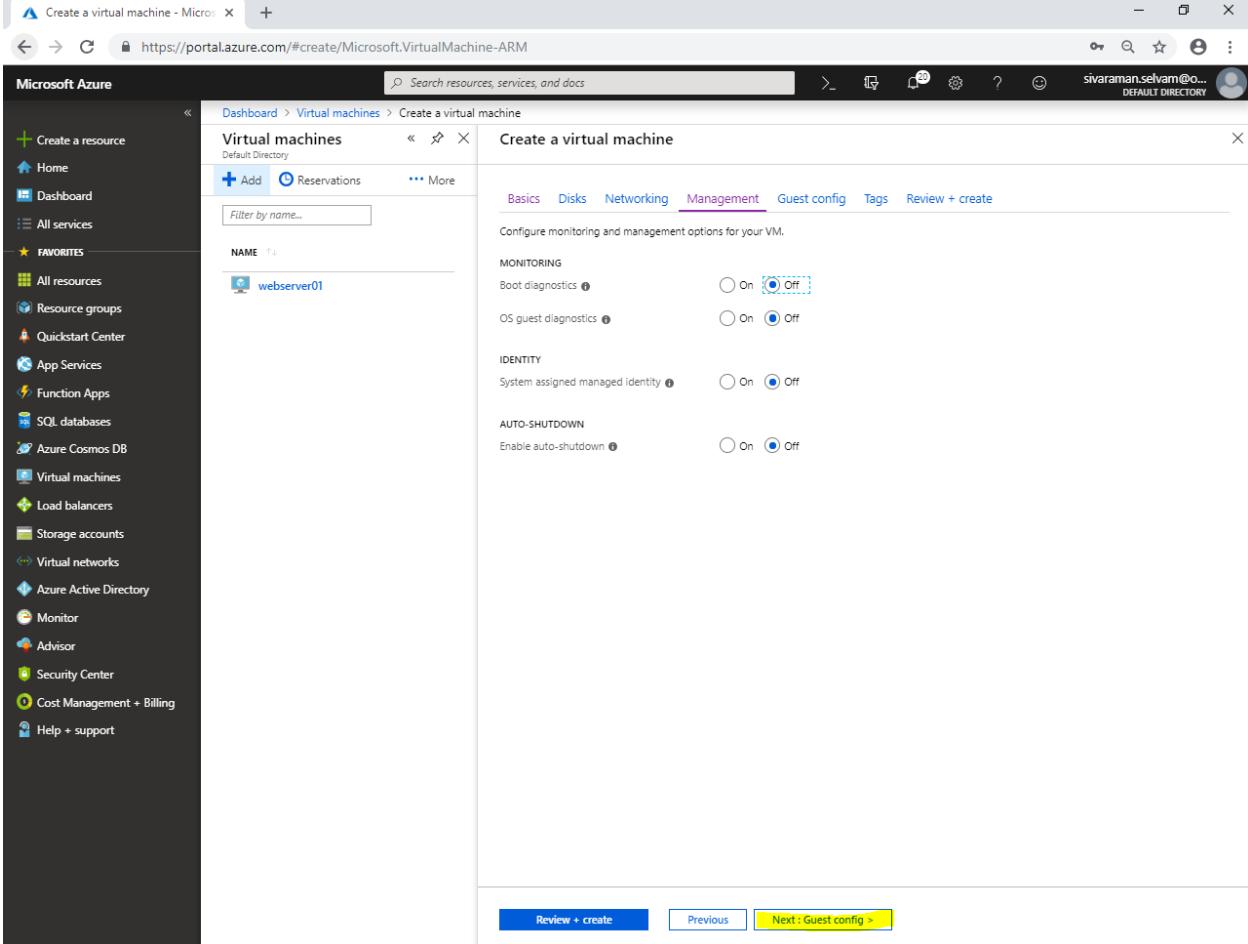


The screenshot shows the Microsoft Azure portal interface for creating a new virtual machine. The left sidebar contains various service links like Home, Dashboard, All services, Favorites, and Resource groups. The main area shows the 'Virtual machines' blade with a list containing 'webserver01'. The central part of the screen is the 'Create a virtual machine' wizard, currently on the 'Networking' tab. It displays network configuration options: a virtual network named 'SANS-VNET' (with a dropdown menu for 'Create new'), a subnet named 'SANS-PubSubnet (10.0.1.0/24)' (with a link to 'Manage subnet configuration'), and a public IP address named '(new) webserver02-ip' (with a link to 'Create new'). Below these, there's a section for 'NIC network security group' with radio buttons for 'None', 'Basic', and 'Advanced', and a note indicating that the selected subnet is already associated with a network security group. Under 'LOAD BALANCING', it asks if the VM should be placed behind an existing load balancing solution, with 'Yes' and 'No' radio buttons. At the bottom of the wizard, there are 'Review + create', 'Previous', and 'Next : Management >' buttons, with 'Next : Management >' being highlighted with a yellow box.

## Cloud Computing - Azure

In “Management”,

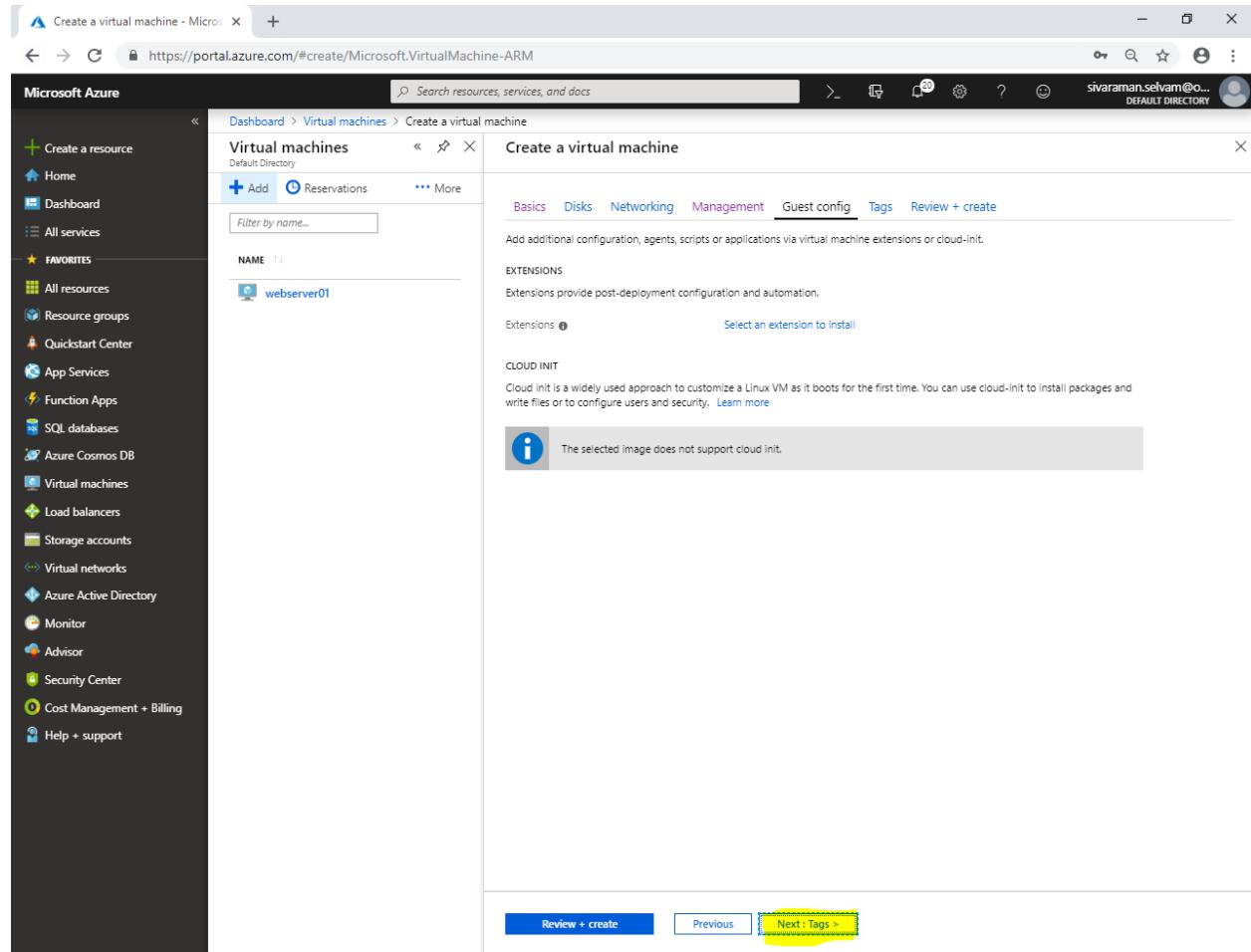
Click “Next : Guest config >”.



The screenshot shows the Microsoft Azure portal interface for creating a new virtual machine. The left sidebar contains a navigation menu with various services like Home, Dashboard, All services, Favorites, and more. The main area is titled 'Virtual machines' and shows a list of existing VMs, with one named 'webserver01' selected. The current step is 'Create a virtual machine' under 'Management'. The configuration screen includes sections for MONITORING (Boot diagnostics set to Off, OS guest diagnostics set to Off), IDENTITY (System assigned managed identity set to Off), and AUTO-SHUTDOWN (Enable auto-shutdown set to Off). At the bottom, there are buttons for 'Review + create', 'Previous', and 'Next : Guest config >' (which is highlighted with a yellow background).

## Cloud Computing - Azure

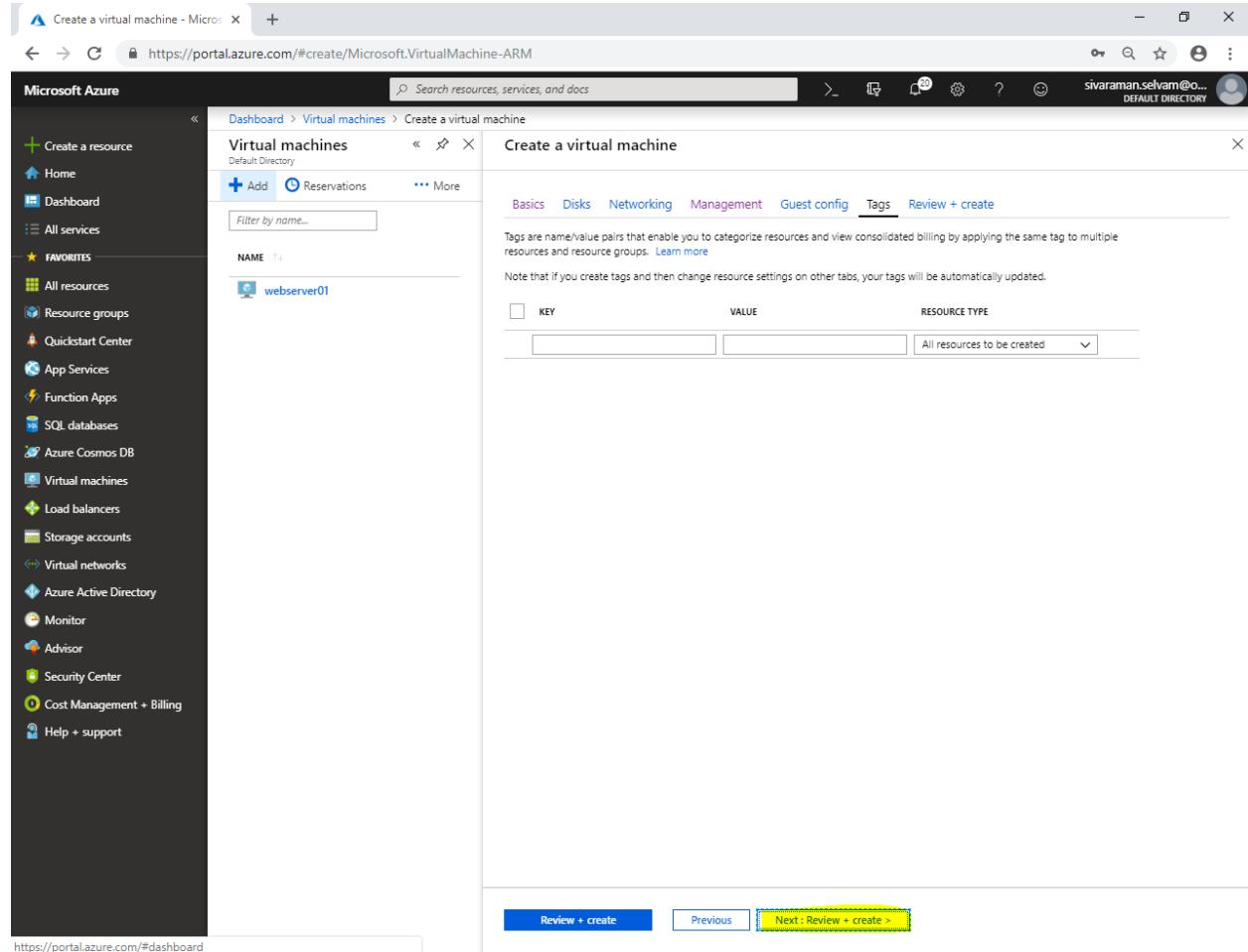
Click "Next : Tags >".



The screenshot shows the Microsoft Azure portal interface for creating a new virtual machine. On the left, there's a sidebar with various service icons. The main area is titled 'Create a virtual machine' under 'Virtual machines'. A table lists one item: 'NAME' with 'webserver01'. Below this, there are sections for 'EXTENSIONS' and 'CLOUD INIT'. Under 'CLOUD INIT', it says 'The selected image does not support cloud init.' At the bottom, there are buttons for 'Review + create', 'Previous', and 'Next : Tags >'. The 'Next : Tags >' button is highlighted with a yellow box.

## Cloud Computing - Azure

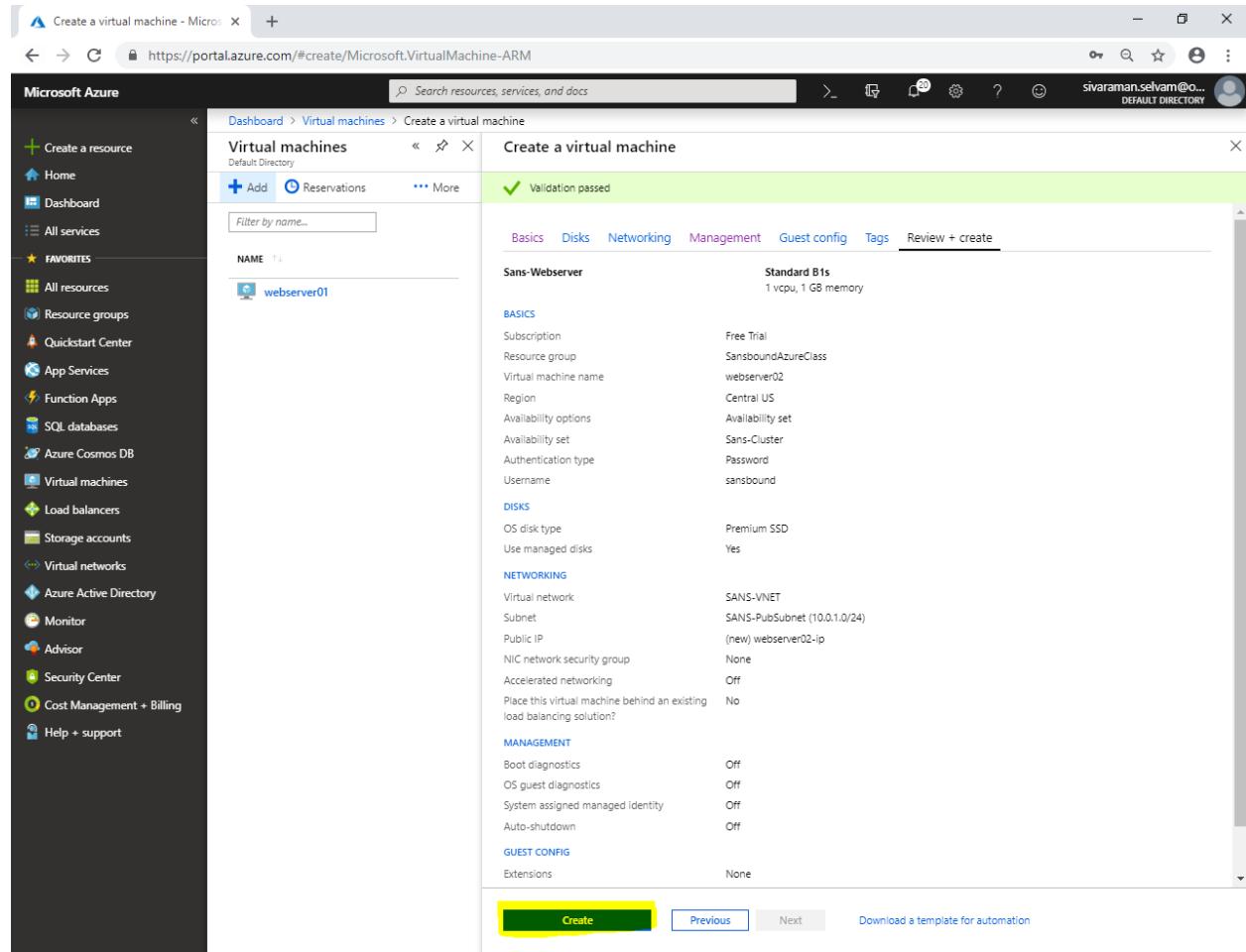
Click "Next : Review + create >".



The screenshot shows the Microsoft Azure portal interface for creating a virtual machine. On the left, the navigation menu includes options like Home, Dashboard, All services, Favorites, and various Azure service links. The main area is titled 'Create a virtual machine' under 'Virtual machines'. The 'Tags' tab is currently active. A table allows adding tags with columns for KEY, VALUE, and RESOURCE TYPE. One tag is listed: KEY is empty, VALUE is empty, and RESOURCE TYPE is set to 'All resources to be created'. At the bottom, there are buttons for 'Review + create', 'Previous', and 'Next : Review + create >'. The 'Next : Review + create >' button is highlighted with a yellow box.

## Cloud Computing - Azure

Click “Create”.



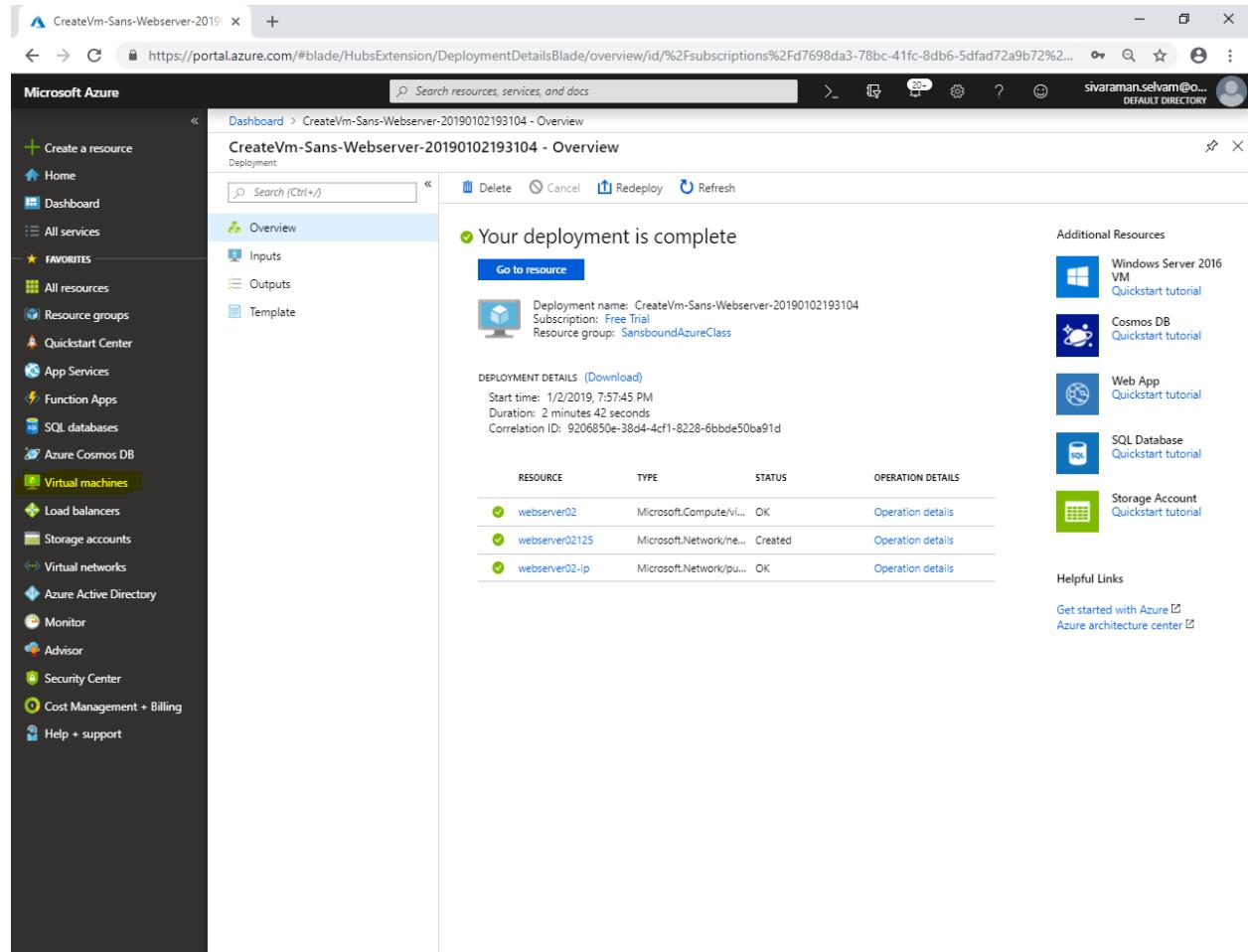
The screenshot shows the Microsoft Azure portal interface for creating a new virtual machine. The left sidebar contains various service icons. The main area is titled 'Create a virtual machine' under 'Virtual machines'. A green bar at the top indicates 'Validation passed'. The configuration steps are as follows:

- BASICS:**
  - Subscription: Free Trial
  - Resource group: SansboundAzureClass
  - Virtual machine name: webserver02
  - Region: Central US
  - Availability options: Availability set
  - Availability set: Sans-Cluster
  - Authentication type: Password
  - Username: sansbound
- DISKS:**
  - OS disk type: Premium SSD
  - Use managed disks: Yes
- NETWORKING:**
  - Virtual network: SANS-VNET
  - Subnet: SANS-PubSubnet (10.0.1.0/24)
  - Public IP: (new) webserver02-ip
  - NIC network security group: None
  - Accelerated networking: Off
  - Place this virtual machine behind an existing load balancing solution?: No
- MANAGEMENT:**
  - Boot diagnostics: Off
  - OS guest diagnostics: Off
  - System assigned managed identity: Off
  - Auto-shutdown: Off
- GUEST CONFIG:**
  - Extensions: None

At the bottom, there are 'Create', 'Previous', and 'Next' buttons, along with a link to 'Download a template for automation'.

## Cloud Computing - Azure

Click “**Virtual machines**” in left side panel.

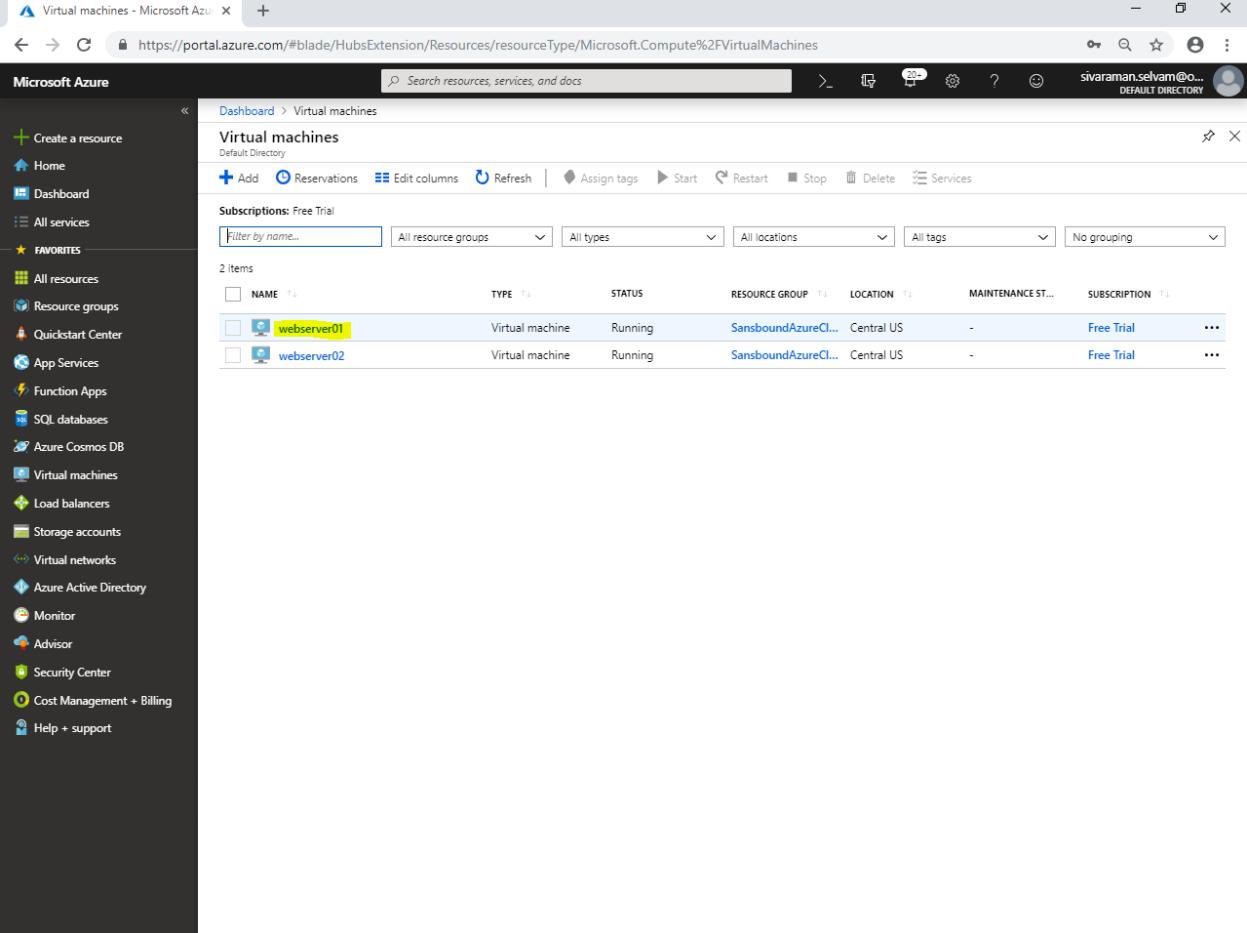


The screenshot shows the Microsoft Azure portal interface. The left sidebar is dark-themed and lists various services: Create a resource, Home, Dashboard, All services, Favorites, All resources, Resource groups, Quickstart Center, App Services, Function Apps, SQL databases, Azure Cosmos DB, Virtual machines (which is highlighted in yellow), Load balancers, Storage accounts, Virtual networks, Azure Active Directory, Monitor, Advisor, Security Center, Cost Management + Billing, and Help + support.

The main content area displays the "CreateVm-Sans-Webserver-20190102193104 - Overview" page. At the top, there's a search bar and navigation icons. Below that, a deployment summary says "Your deployment is complete". It shows the deployment name, subscription, and resource group. Deployment details include start time (1/2/2019, 7:57:45 PM), duration (2 minutes 42 seconds), and correlation ID (9206850e-38d4-4cf1-8228-6bbde50ba91d). A table lists three resources: webserver02 (Microsoft.Compute/virtualmachines, OK), webserver02125 (Microsoft.Network/networkInterfaces, Created), and webserver02-ip (Microsoft.Network/publicIPAddresses, OK). On the right, there are sections for Additional Resources (Windows Server 2016 VM, Cosmos DB, Web App, SQL Database, Storage Account) and Helpful Links (Get started with Azure, Azure architecture center).

In “Virtual machine”,

Click “webserver01”.

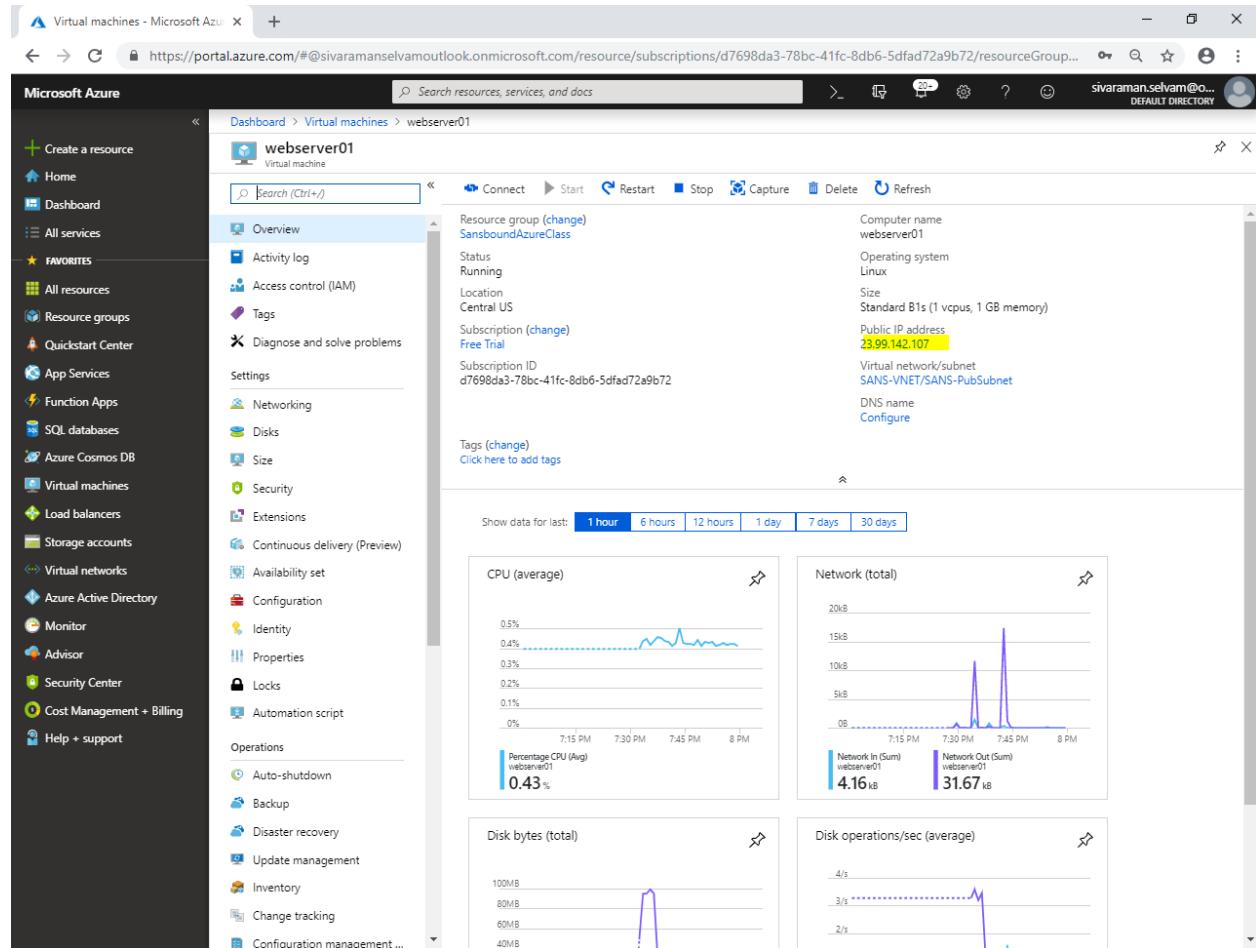


The screenshot shows the Microsoft Azure portal interface for managing virtual machines. The left sidebar contains a list of services under 'Virtual machines'. The main area displays a table of virtual machines with the following details:

NAME	TYPE	STATUS	RESOURCE GROUP	LOCATION	MAINTENANCE ST...	SUBSCRIPTION
webserver01	Virtual machine	Running	SansboundAzureCl...	Central US	-	Free Trial
webserver02	Virtual machine	Running	SansboundAzureCl...	Central US	-	Free Trial

## Cloud Computing - Azure

Kindly note IP address of “**webserver01**”.



The screenshot shows the Microsoft Azure portal interface for a virtual machine named "webserver01".

**Resource Group:** SansboundAzureClass

**Status:** Running

**Location:** Central US

**Subscription:** Free Trial

**Subscription ID:** d7698da3-78bc-41fc-8db6-5dfad72a9b72

**Public IP Address:** 139.91.142.107

**Virtual Network/Subnet:** SANS-VNET/SANS-PubSubNet

**DNS Name:** Configure

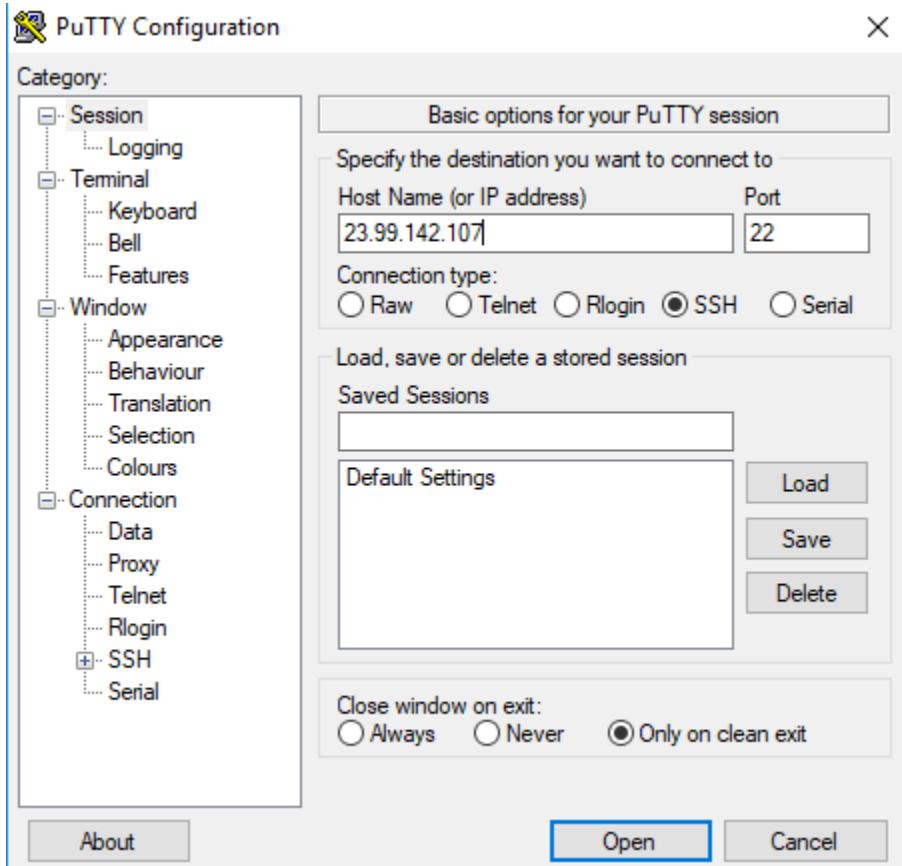
**Tags:** Click here to add tags

**Metrics (Recent 1 hour):**

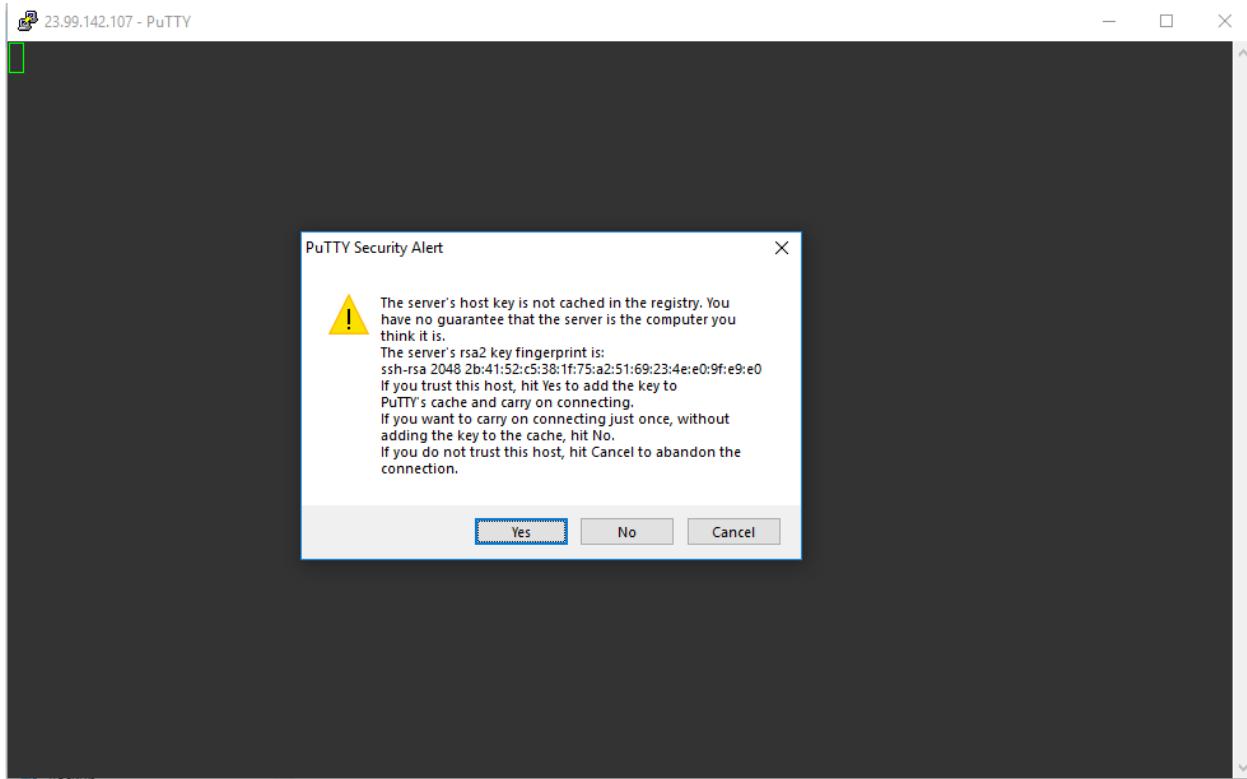
- CPU (average):** Percentage CPU (Avg) webserver01 0.43 %
- Network (total):** Network In (Sum) webserver01 4.16 kB; Network Out (Sum) webserver01 31.67 kB
- Disk bytes (total):** Disk usage over time showing a peak around 7:45 PM.
- Disk operations/sec (average):** Disk activity over time showing a peak around 7:45 PM.

From your local machine, launch “**putty.exe**”.

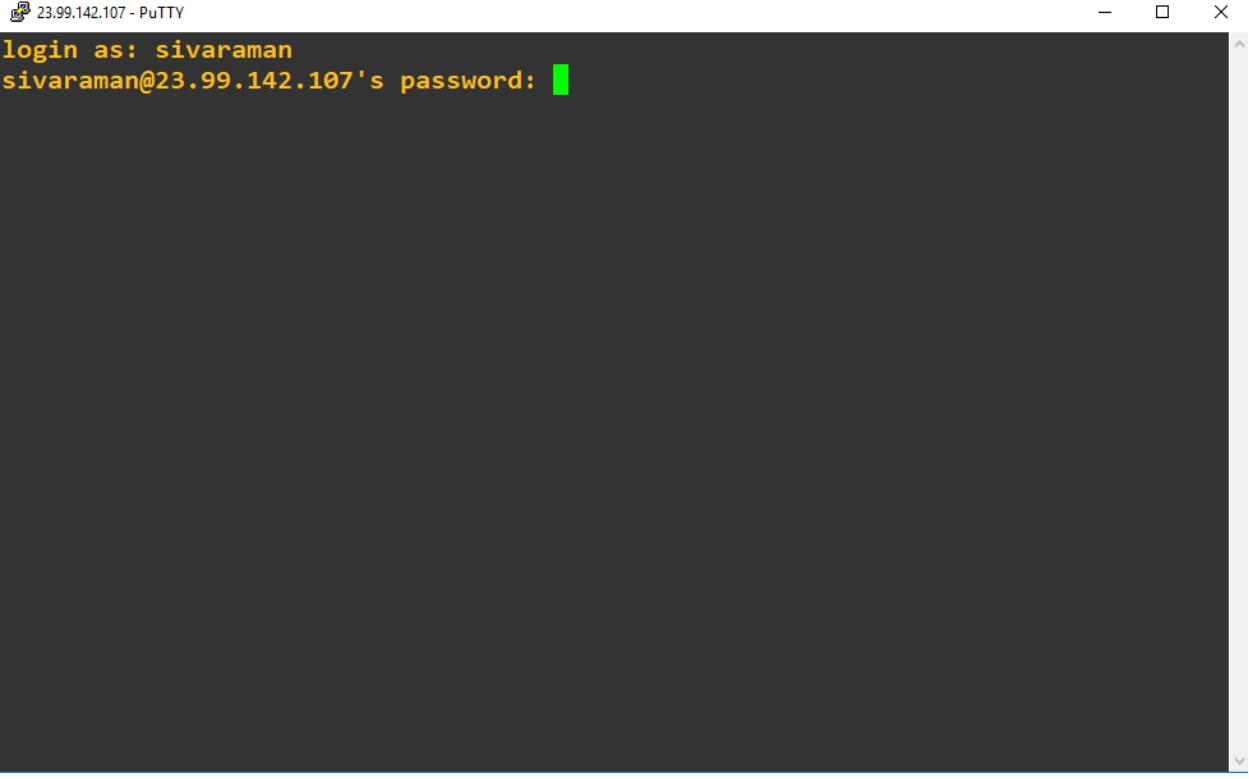
Type Public IP address of “**webserver01**” and click “**Open**” to connect webserver01.



Click "Yes".

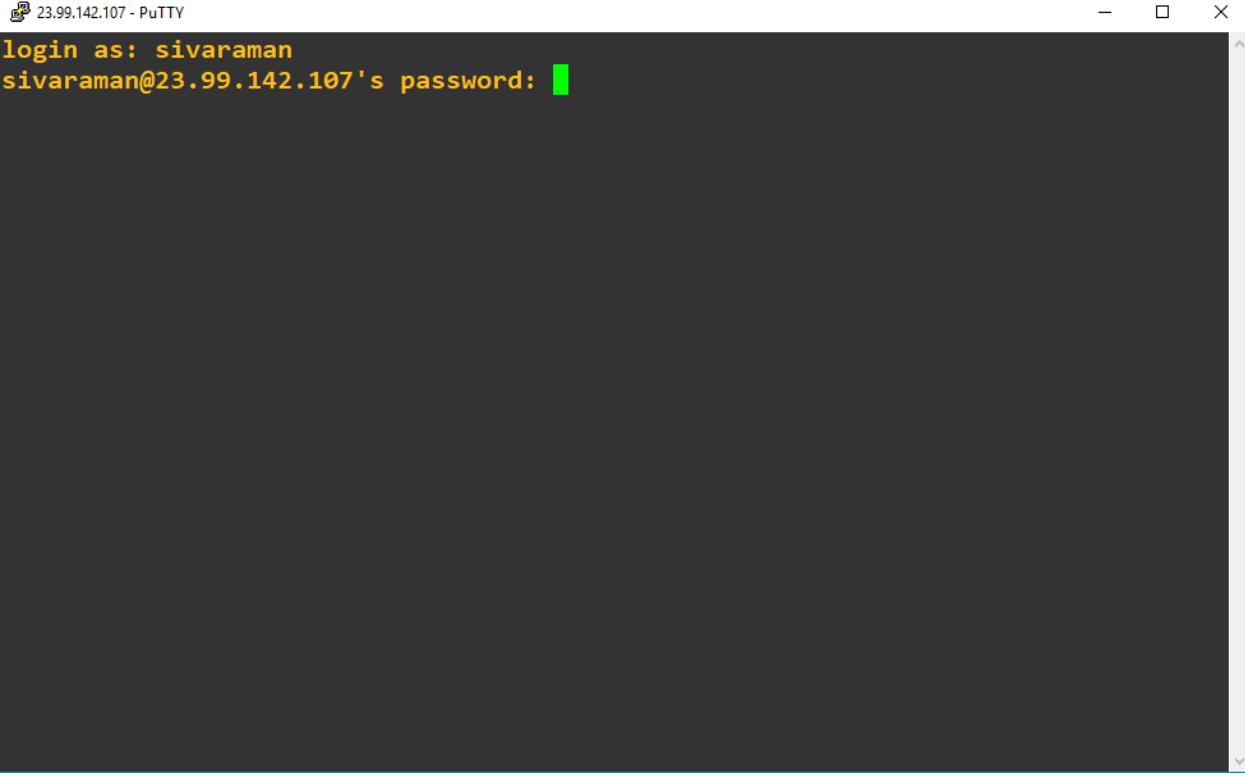


Type “**username**” as “**sivaraman**” and press “**Enter**”.



A screenshot of a PuTTY terminal window titled "23.99.142.107 - PuTTY". The window shows a login prompt:  
**login as: sivaraman**  
**sivaraman@23.99.142.107's password:** [REDACTED]

Type “**Password**” of Ubuntu and press “**Enter**”.



A screenshot of a PuTTY terminal window titled "23.99.142.107 - PuTTY". The window shows the following text:  
**login as: sivaraman**  
**sivaraman@23.99.142.107's password:** █

You have logged on to Ubuntu successfully.

```
sansbound@webserver01: ~
System load: 0.0          Processes: 107
Usage of /: 4.2% of 28.90GB  Users logged in: 0
Memory usage: 27%          IP address for eth0: 10.0.1.5
Swap usage: 0%

* MicroK8s is Kubernetes in a snap. Made by devs for devs.
  One quick install on a workstation, VM, or appliance.

- https://bit.ly/microk8s

* Full K8s GPU support is now available!

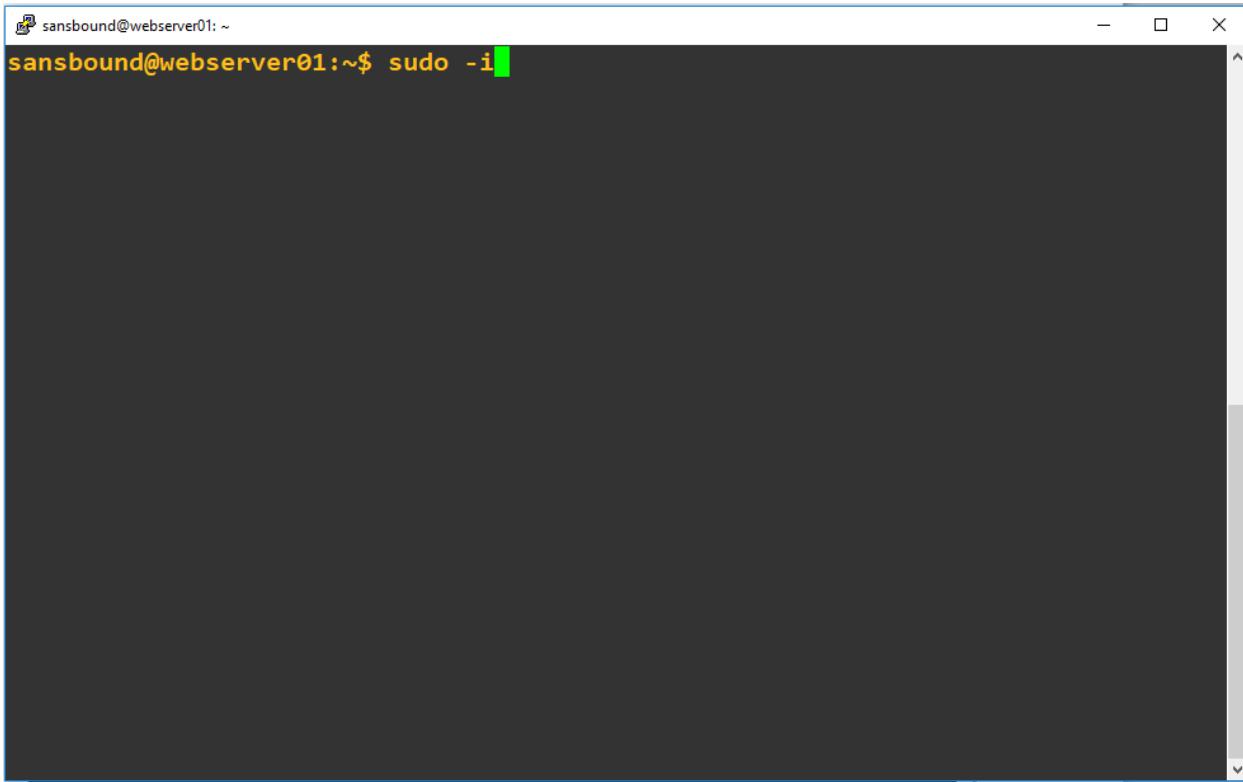
- https://blog.ubuntu.com/2018/12/10/using-gpgpus-with-kubernetes

Get cloud support with Ubuntu Advantage Cloud Guest:
http://www.ubuntu.com/business/services/cloud

32 packages can be updated.
20 updates are security updates.

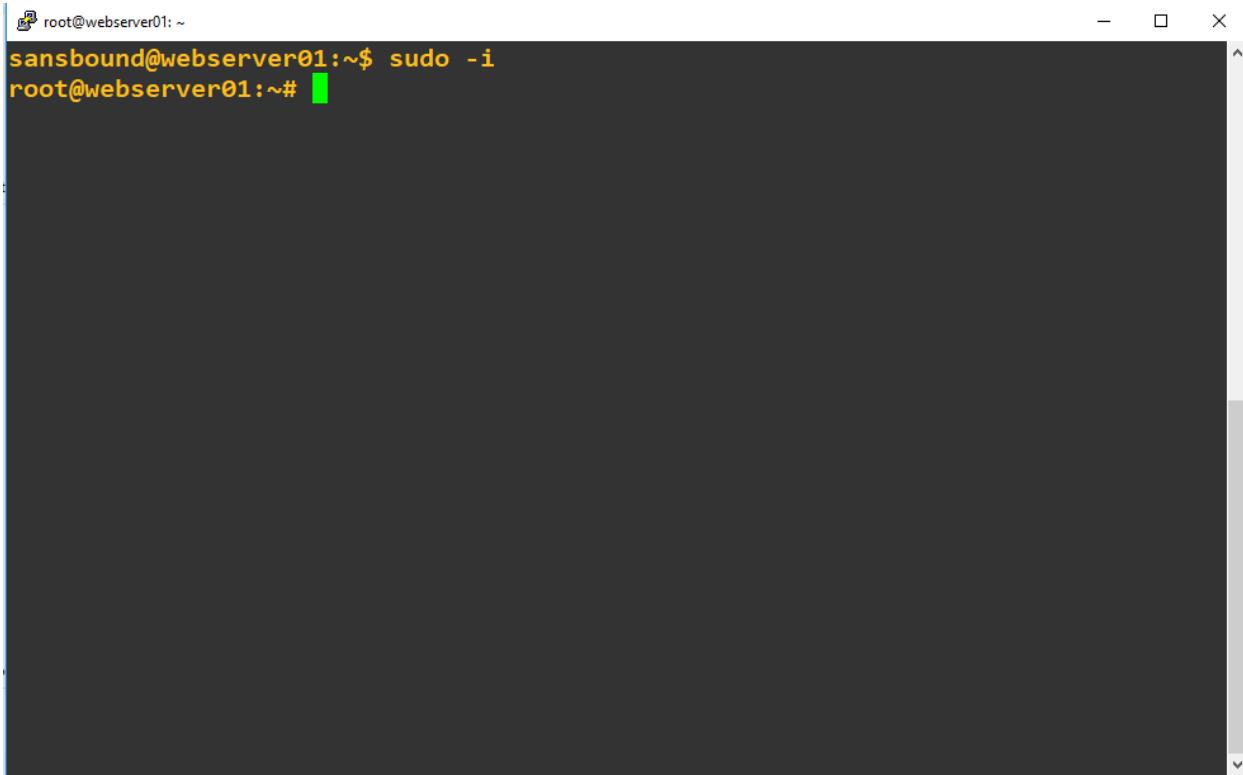
Last login: Wed Jan  2 13:00:17 2019 from 121.244.57.3
sansbound@webserver01:~$
```

Type “**sudo -i**” and press “**Enter**”.



A screenshot of a terminal window titled "sansbound@webserver01: ~". The window contains the command "sudo -i" which has been partially typed by the user. The terminal has a dark background and light-colored text. The cursor is positioned at the end of the typed command.

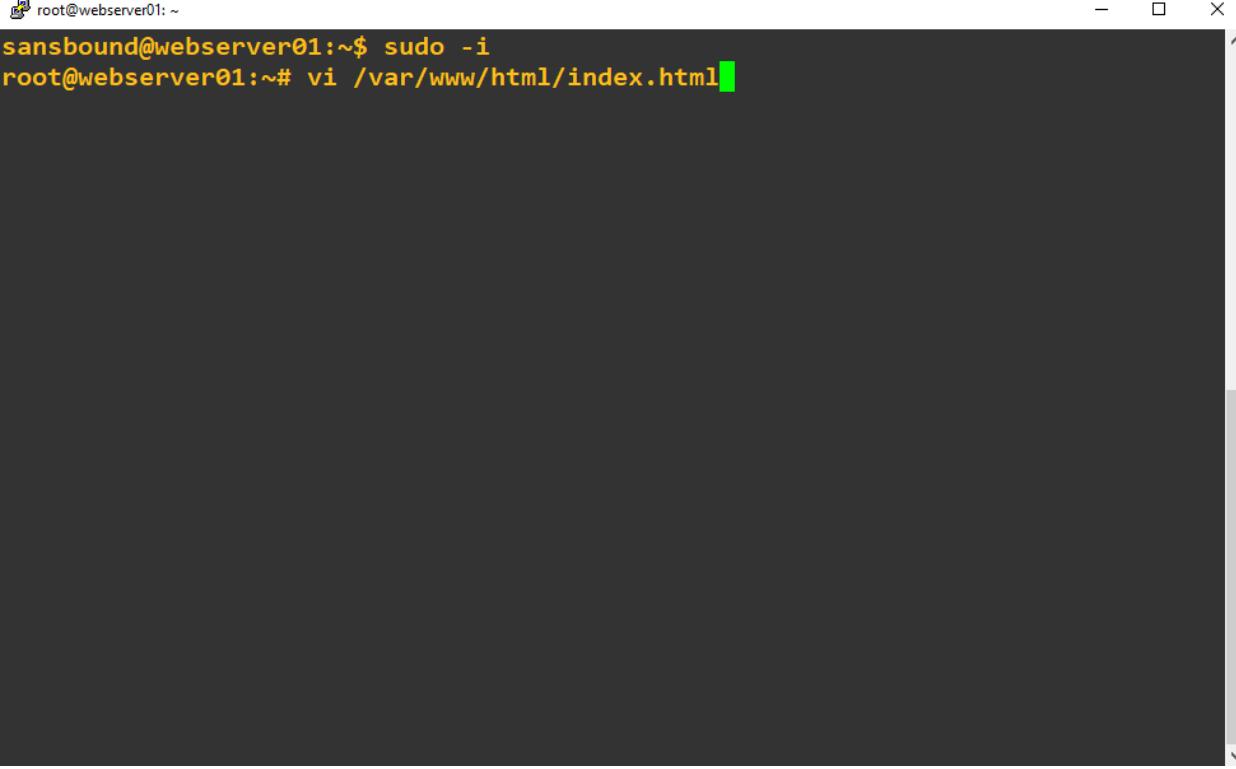
You have successfully logged in as root user.



A screenshot of a terminal window titled "root@webserver01: ~". The window shows the command "sudo -i" being run by the user "sansbound" and the resulting root shell prompt "#". The terminal has a dark background and light-colored text. There are standard window controls (minimize, maximize, close) at the top right.

```
root@webserver01: ~
sansbound@webserver01:~$ sudo -i
root@webserver01:~#
```

Type “**vi /var/www/html/index.html**” and press “**Enter**”.



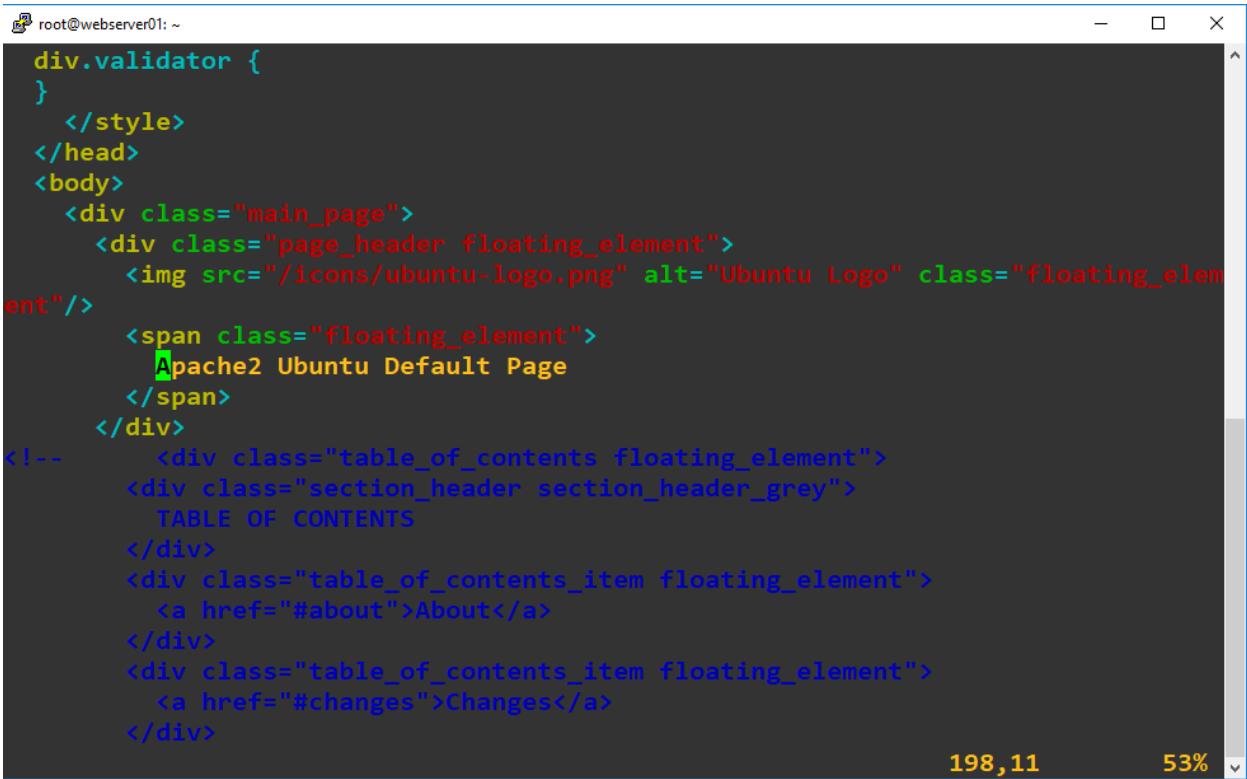
The screenshot shows a terminal window with a dark background and light-colored text. At the top left, there is a small icon of a computer monitor. The window title bar contains the text "root@webserver01: ~". The main area of the terminal shows the following command being typed:

```
sansbound@webserver01:~$ sudo -i  
root@webserver01:~# vi /var/www/html/index.html
```

The text "vi /var/www/html/index.html" is highlighted with a green rectangle, indicating it is the current input or selection. The terminal window has standard window controls (minimize, maximize, close) at the top right corner.

Go to line 198,

Press “**Insert**” key.



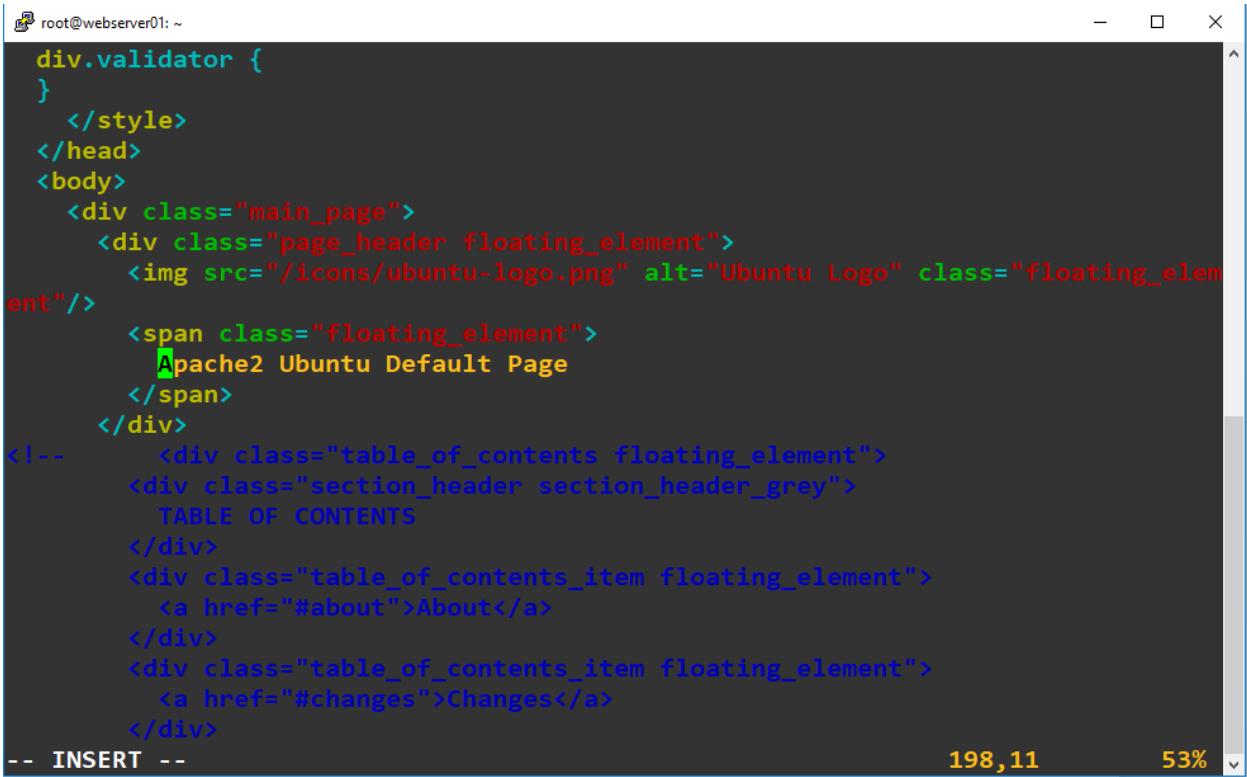
```
root@webserver01: ~


}
</style>
</head>
<body>
<div class="main_page">
    <div class="page_header floating_element">
        
        <span class="floating_element">
            Apache2 Ubuntu Default Page
        </span>
    </div>
<!--
    <div class="table_of_contents floating_element">
        <div class="section_header section_header_grey">
            TABLE OF CONTENTS
        </div>
        <div class="table_of_contents_item floating_element">
            <a href="#about">About</a>
        </div>
        <div class="table_of_contents_item floating_element">
            <a href="#changes">Changes</a>
        </div>
-->


```

198,11      53%

Ensure that “**Insert**” is pressed.



A screenshot of a terminal window titled "root@webserver01: ~". The window displays the content of a web page from an Apache server. The page includes an Ubuntu logo, a title "Apache2 Ubuntu Default Page", and a table of contents with links to "About" and "Changes". At the bottom left, it says "-- INSERT --". On the right side of the window, there are status indicators: "198,11" and "53%".

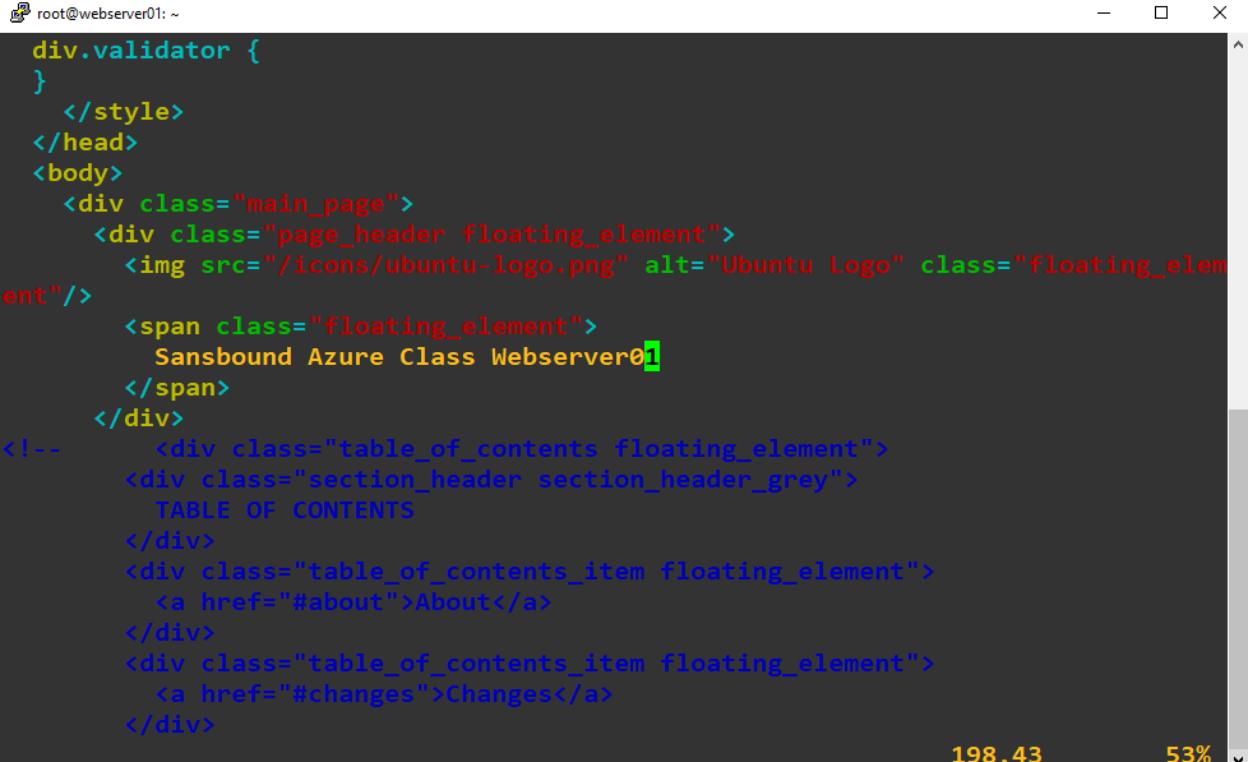
```
root@webserver01: ~

```

Delete the previous previous text and type “**Sansbound Azure Class Webserver01**”.

```
root@webserver01: ~
div.validator {
}
</style>
</head>
<body>
    <div class="main_page">
        <div class="page_header floating_element">
            
            <span class="floating_element">
                Sansbound Azure Class Webserver01
            </span>
        </div>
<!--
        <div class="table_of_contents floating_element">
            <div class="section_header section_header_grey">
                TABLE OF CONTENTS
            </div>
            <div class="table_of_contents_item floating_element">
                <a href="#about">About</a>
            </div>
            <div class="table_of_contents_item floating_element">
                <a href="#changes">Changes</a>
            </div>
        </div>
-- INSERT --                                198,44      53% ↓
```

Press “**Escape**” key.

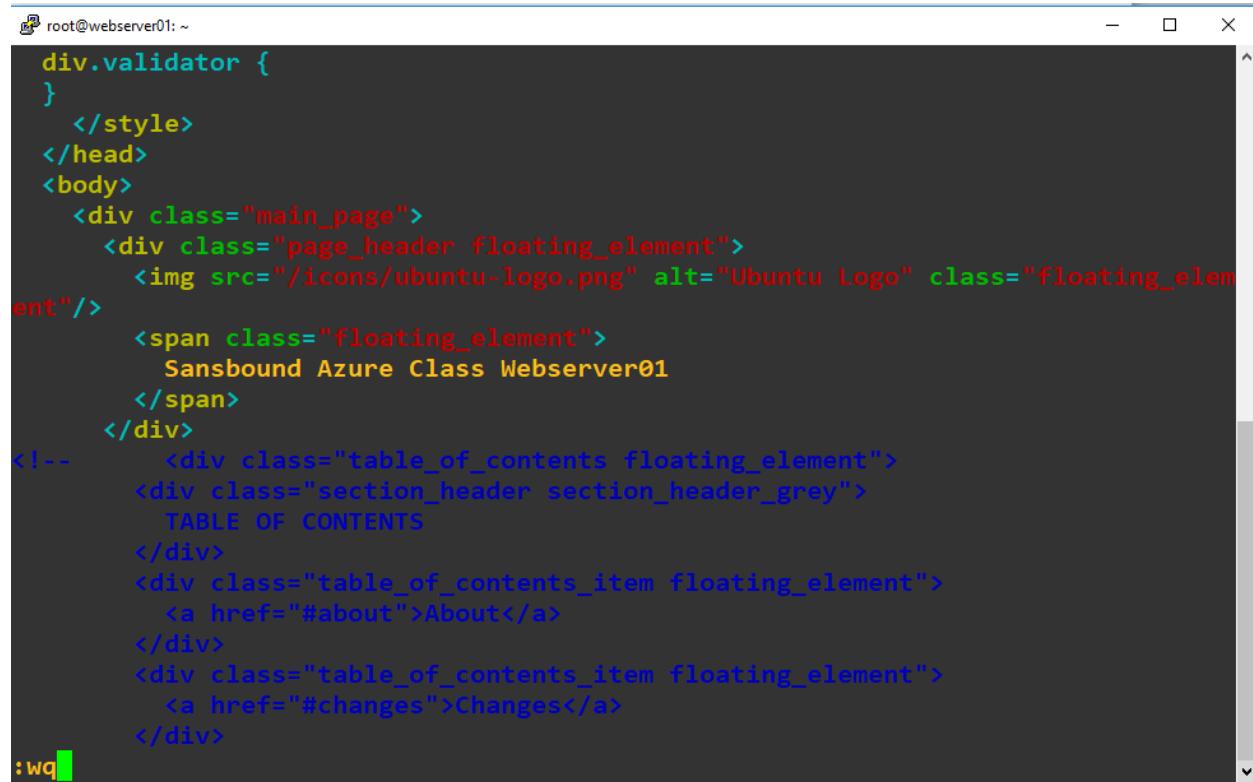


The screenshot shows a terminal window titled "root@webserver01: ~". The window displays a portion of an HTML document with syntax highlighting. The code includes CSS styles for a ".validator" class, HTML structure for a header and body, and a floating element containing the text "Sansbound Azure Class Webserver01". There are also comments indicating sections for a table of contents. The terminal interface includes standard window controls (minimize, maximize, close) and status bars at the bottom showing "198,43" and "53%".

```
root@webserver01: ~

```

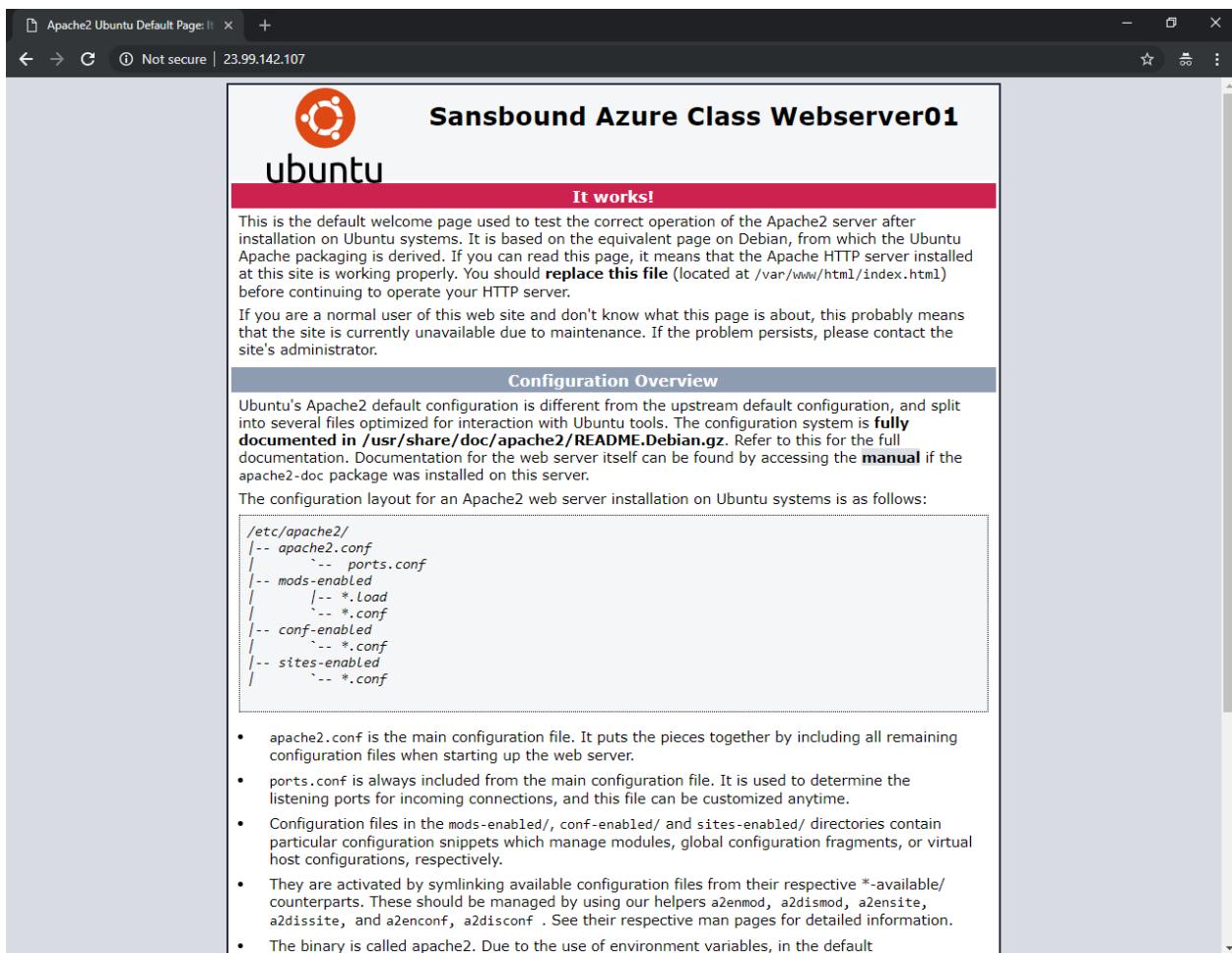
Type “:wq” and press “Enter”.



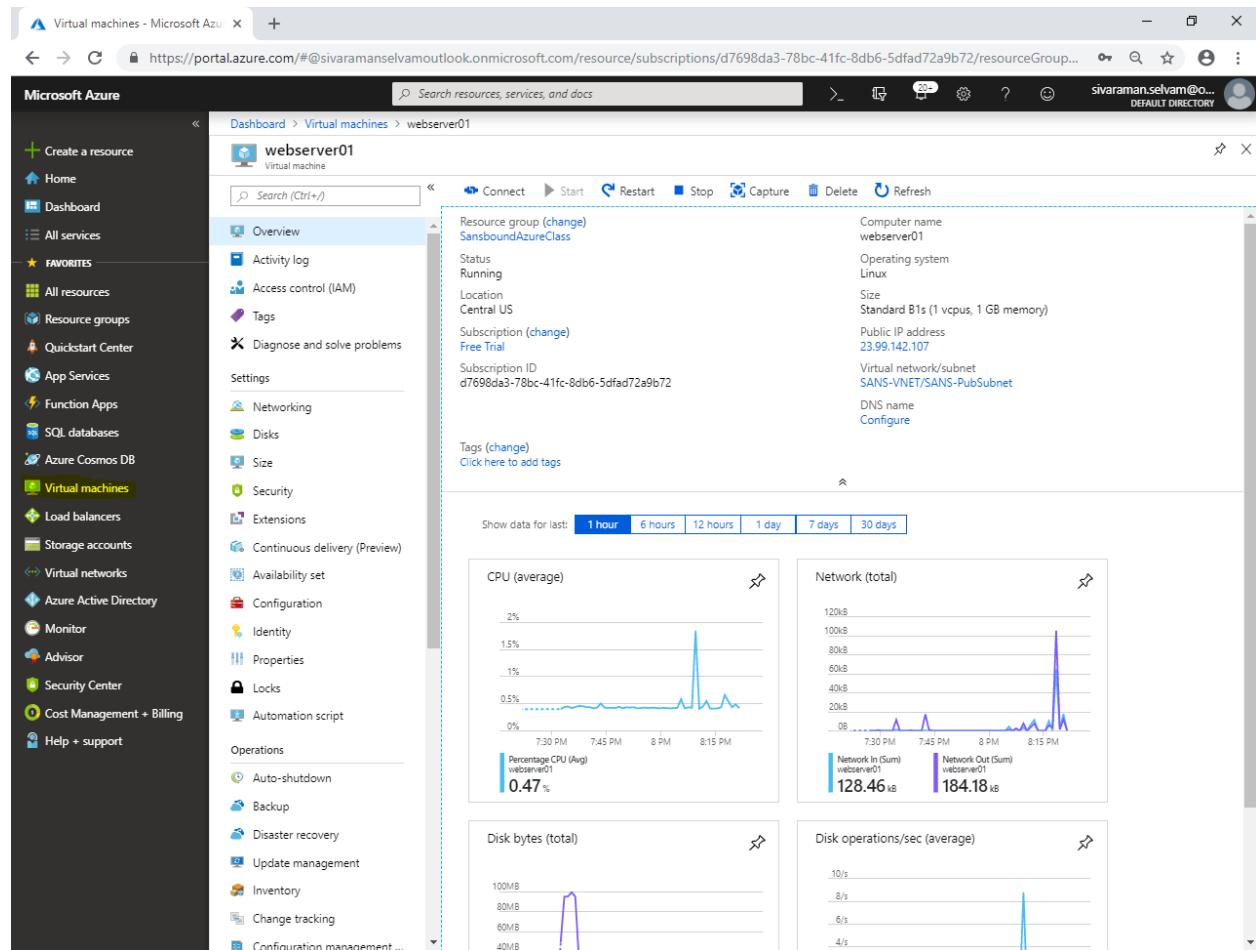
```
root@webserver01: ~
div.validator {
}
</style>
</head>
<body>
<div class="main_page">
<div class="page_header floating_element">

<span class="floating_element">
    Sansbound Azure Class Webserver01
</span>
</div>
<!--
<div class="table_of_contents floating_element">
<div class="section_header section_header_grey">
    TABLE OF CONTENTS
</div>
<div class="table_of_contents_item floating_element">
    <a href="#about">About</a>
</div>
<div class="table_of_contents_item floating_element">
    <a href="#changes">Changes</a>
</div>
-->
: wq
```

Type “**webserver01**” Public IP address in browser and press “**Enter**”.



In “virtual machines” from left side panel.



The screenshot shows the Microsoft Azure portal interface. The left sidebar is collapsed, showing the "Virtual machines" option under the "All services" category. The main content area displays the details for a virtual machine named "webserver01".

**Resource group:** SansboundAzureClass

**Status:** Running

**Location:** Central US

**Subscription:** Free Trial

**Public IP address:** 23.99.142.107

**Virtual network/subnet:** SANS-VNET/SANS-PubSubNet

**DNS name:** Configure

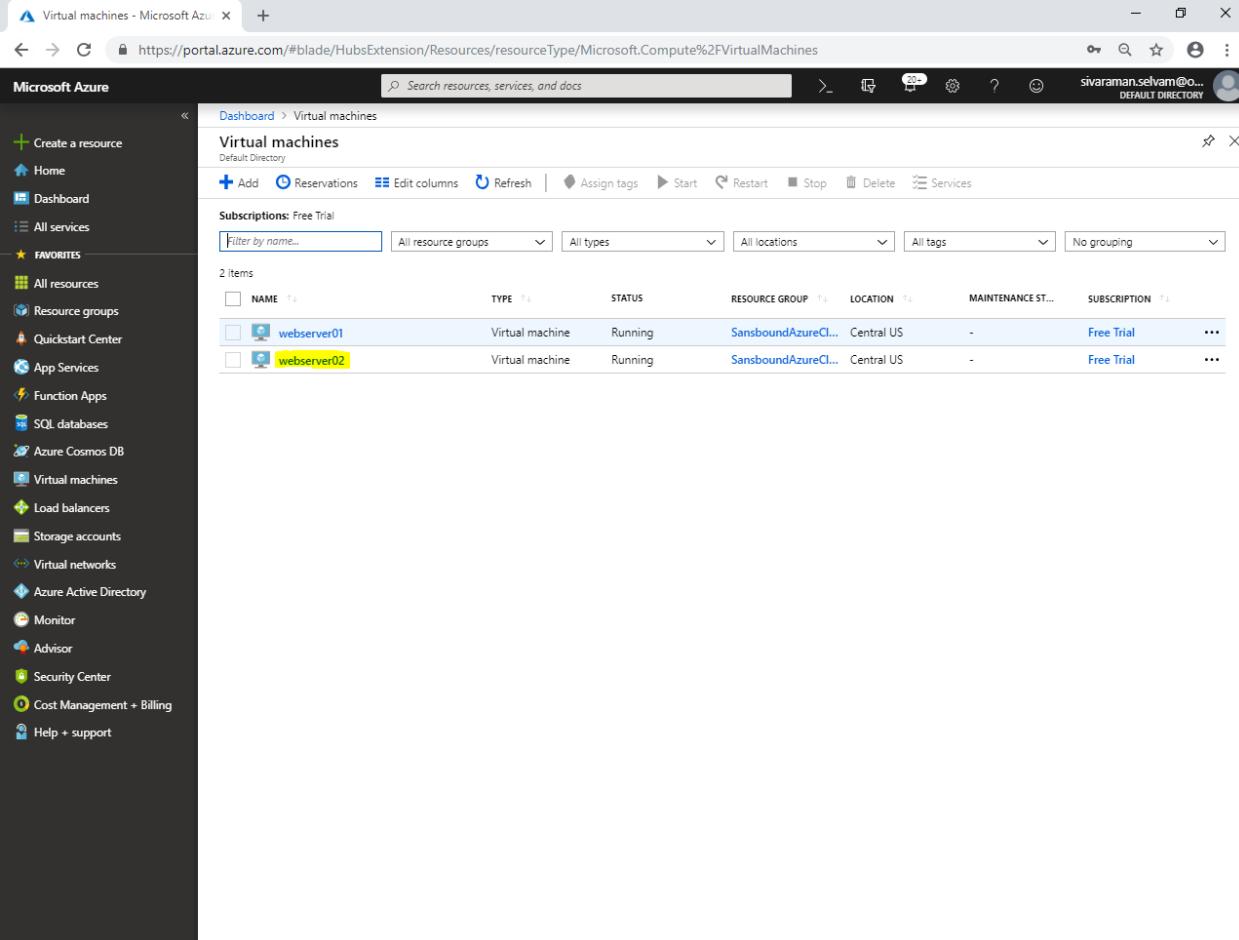
**Tags:** Click here to add tags

**Metrics:**

- CPU (average):** Percentage CPU (Avg) webserver01 0.47 %
- Network (total):** Network In (Sum) webserver01 128.46 kB, Network Out (Sum) webserver01 184.18 kB
- Disk bytes (total):** Disk usage 100MB, 80MB, 60MB, 40MB
- Disk operations/sec (average):** Operations per second 10/s, 8/s, 6/s, 4/s

In “Virtual machines”,

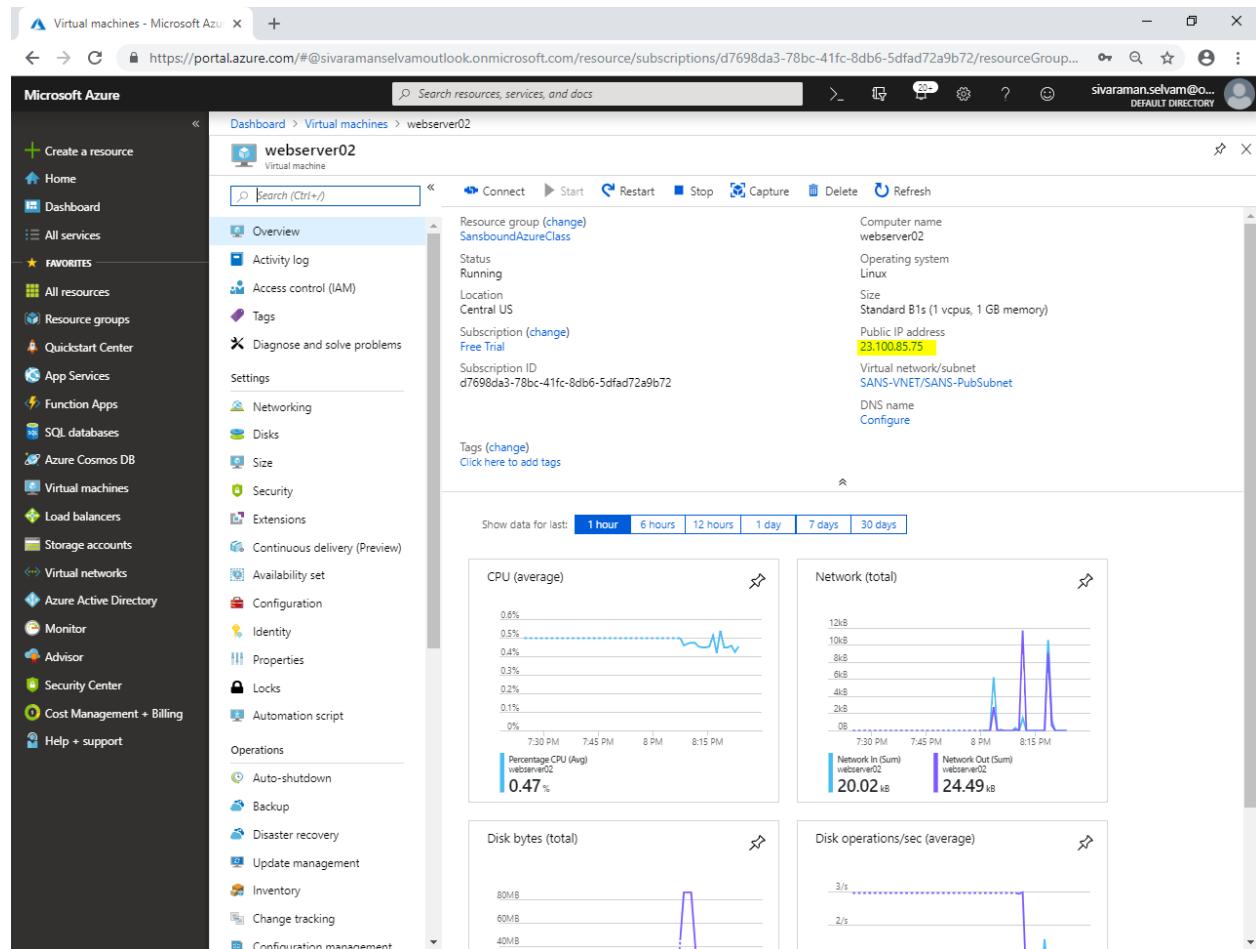
Click “webserver02”.



The screenshot shows the Microsoft Azure portal's "Virtual machines" blade. The URL in the browser is <https://portal.azure.com/#blade/HubsExtension/Resources/resourceType/Microsoft.Compute%2FVirtualMachines>. The page displays a list of two virtual machines:

NAME	TYPE	STATUS	RESOURCE GROUP	LOCATION	MAINTENANCE ST...	SUBSCRIPTION
webserver01	Virtual machine	Running	SansboundAzureCl...	Central US	-	Free Trial
webserver02	Virtual machine	Running	SansboundAzureCl...	Central US	-	Free Trial

Kindly note public IP address of the “**webserver02**”.



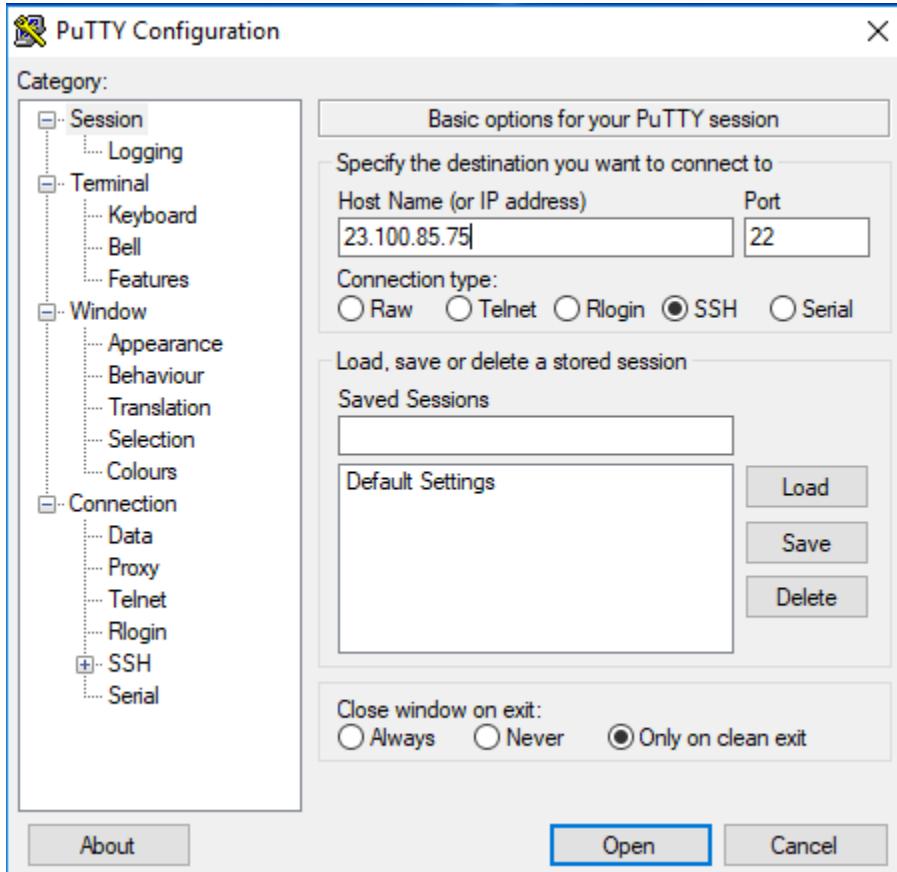
The screenshot shows the Microsoft Azure portal interface for a virtual machine named "webserver02". The left sidebar contains a list of services including Home, Dashboard, All services, Favorites, All resources, Resource groups, Quickstart Center, App Services, Function Apps, SQL databases, Azure Cosmos DB, Virtual machines, Load balancers, Storage accounts, Virtual networks, Azure Active Directory, Monitor, Advisor, Security Center, Cost Management + Billing, Help + support. The main content area displays the "Overview" tab for "webserver02". Key details shown include:

- Resource group: SansboundAzureClass
- Status: Running
- Location: Central US
- Subscription: Free Trial
- Public IP address: 23.100.85.75
- Virtual network/subnet: SANS-VNET/SANS-PubSubNet
- DNS name: Configure

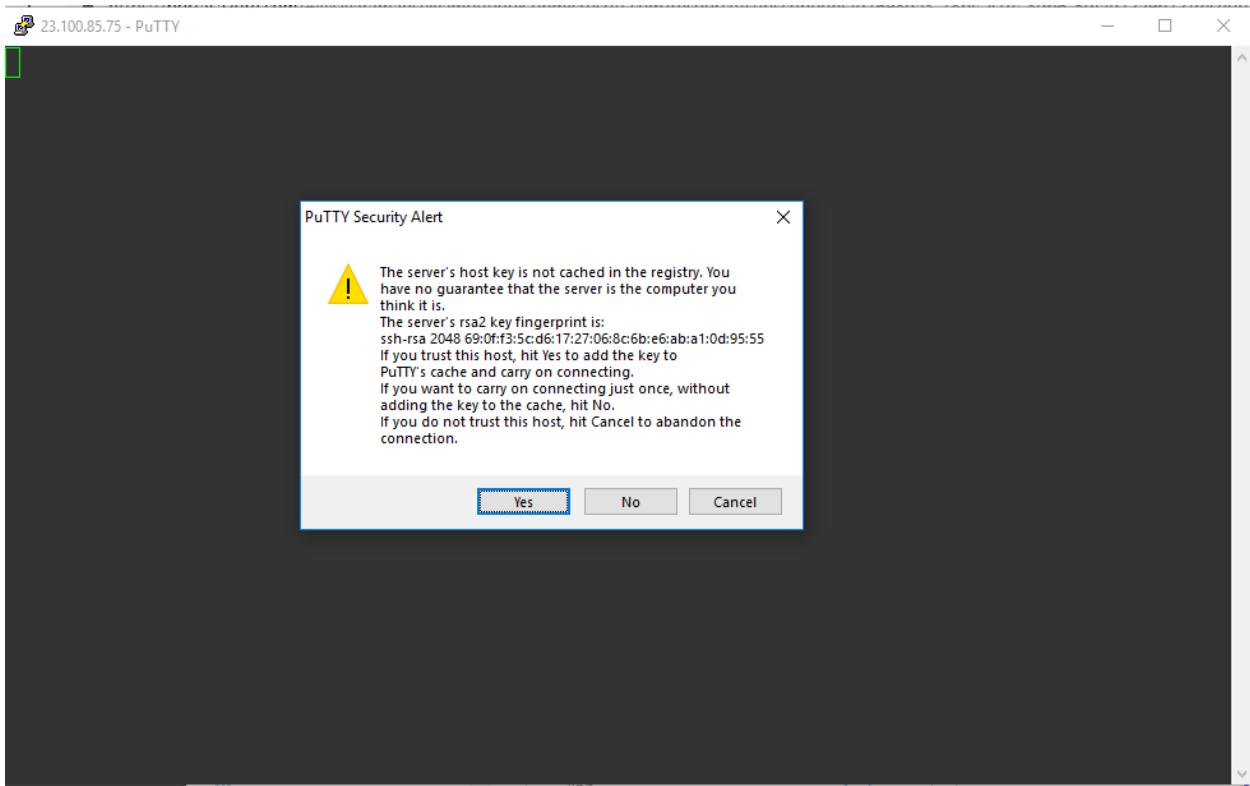
Below the details, there are four performance charts: CPU (average), Network (total), Disk bytes (total), and Disk operations/sec (average). The CPU chart shows 0.47% usage. The Network chart shows Network In (Sum) at 20.02 kB and Network Out (Sum) at 24.49 kB. The Disk bytes chart shows a single peak around 8 PM. The Disk operations/sec chart shows a single peak around 8:15 PM.

From your local machine, launch putty.exe.

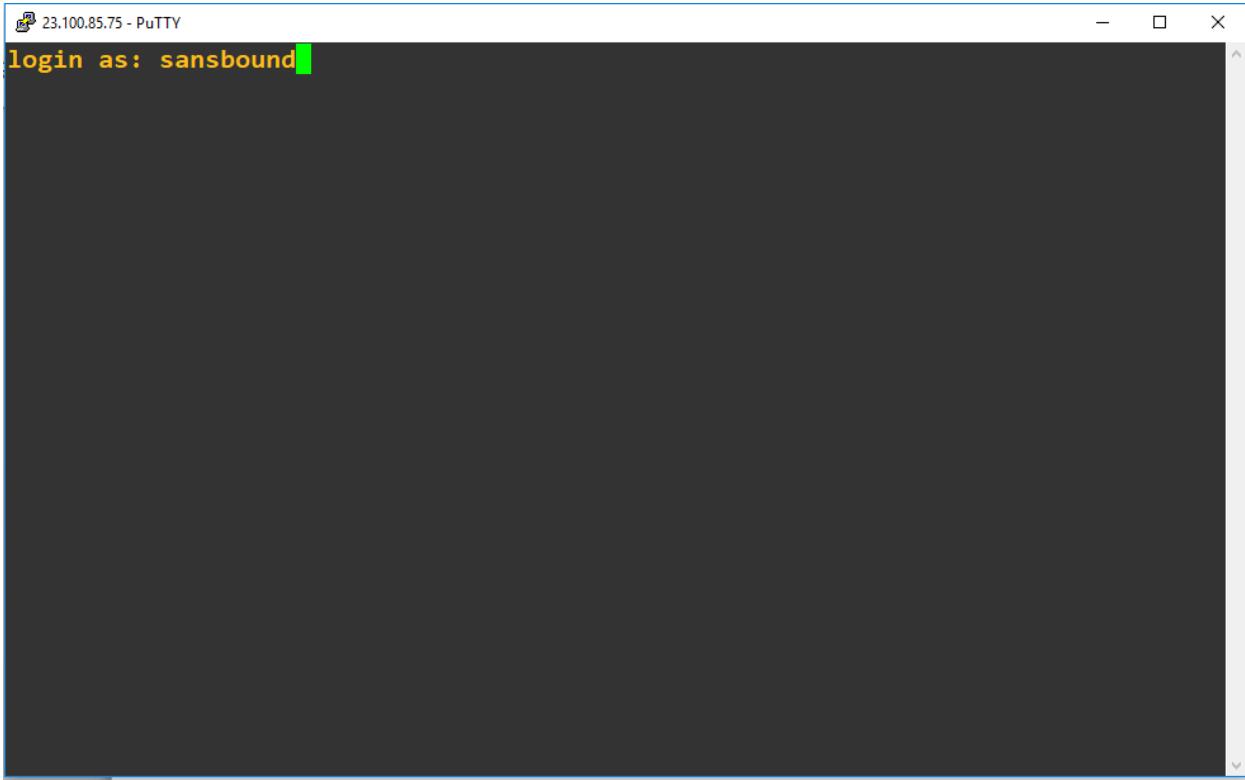
In Putty, type Public IP address of “**Webserver02**” and click “**Open**” to connect.



Click “Yes”.

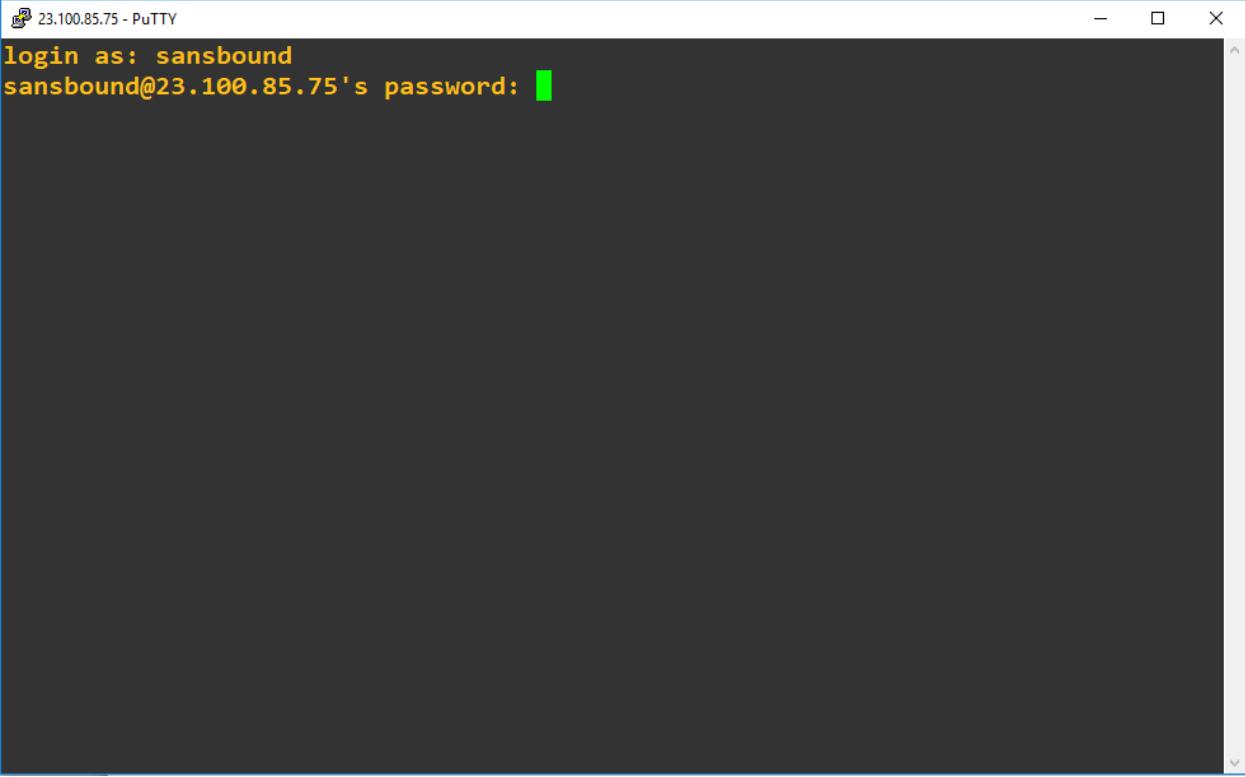


Type username of Webserver02 as “sansbound” and press “Enter”.



A screenshot of a PuTTY terminal window titled "23.100.85.75 - PuTTY". The window shows a single line of text: "login as: sansbound". The text "sansbound" is highlighted with a green selection bar, indicating it is selected or being typed. The rest of the window is a dark gray terminal session area.

Type password of webserver02 and press “Enter”.



A screenshot of a PuTTY terminal window titled "23.100.85.75 - PuTTY". The window shows a login prompt:  
**login as: sansbound**  
**sansbound@23.100.85.75's password:** [REDACTED]

You have successfully logged into webserver02.

```
sansbound@webserver02: ~
System load:  0.0          Processes:      107
Usage of /:   4.2% of 28.90GB  Users logged in:  0
Memory usage: 28%          IP address for eth0: 10.0.1.6
Swap usage:   0%

* MicroK8s is Kubernetes in a snap. Made by devs for devs.
  One quick install on a workstation, VM, or appliance.

- https://bit.ly/microk8s

* Full K8s GPU support is now available!

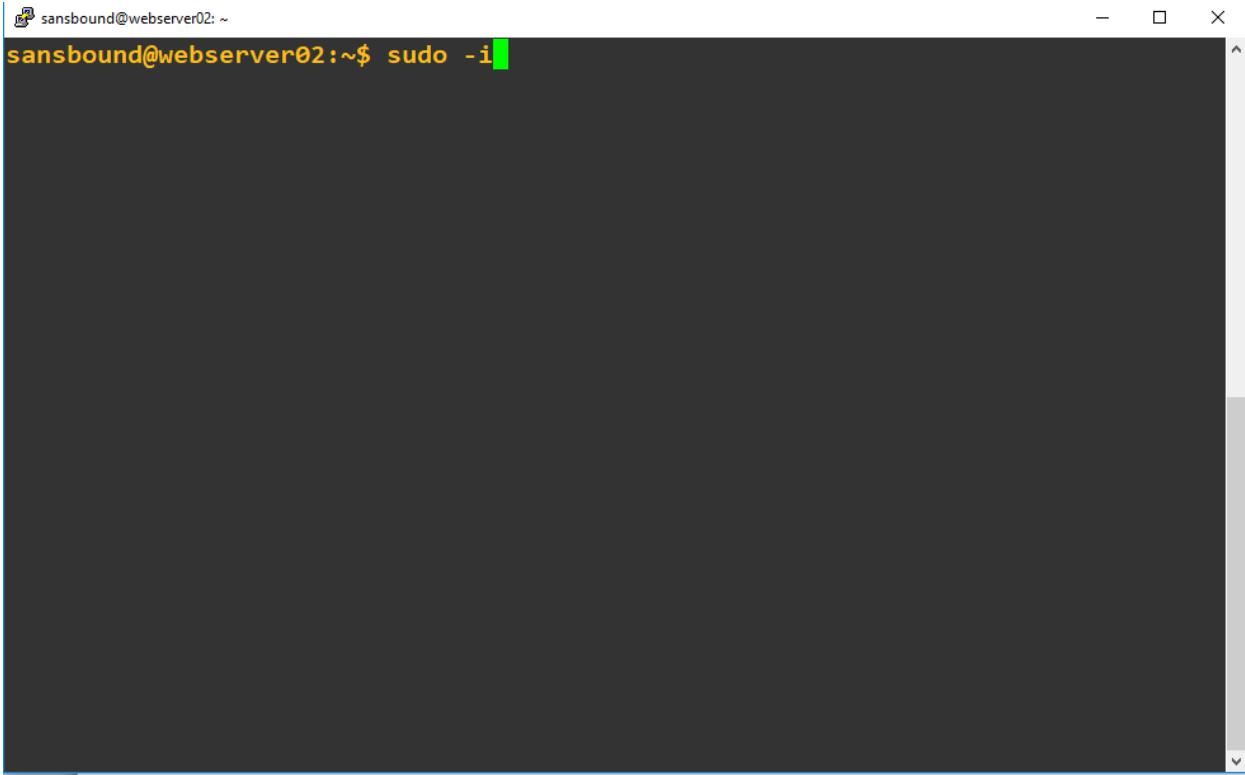
- https://blog.ubuntu.com/2018/12/10/using-gpgpus-with-kubernetes

Get cloud support with Ubuntu Advantage Cloud Guest:
http://www.ubuntu.com/business/services/cloud

32 packages can be updated.
20 updates are security updates.

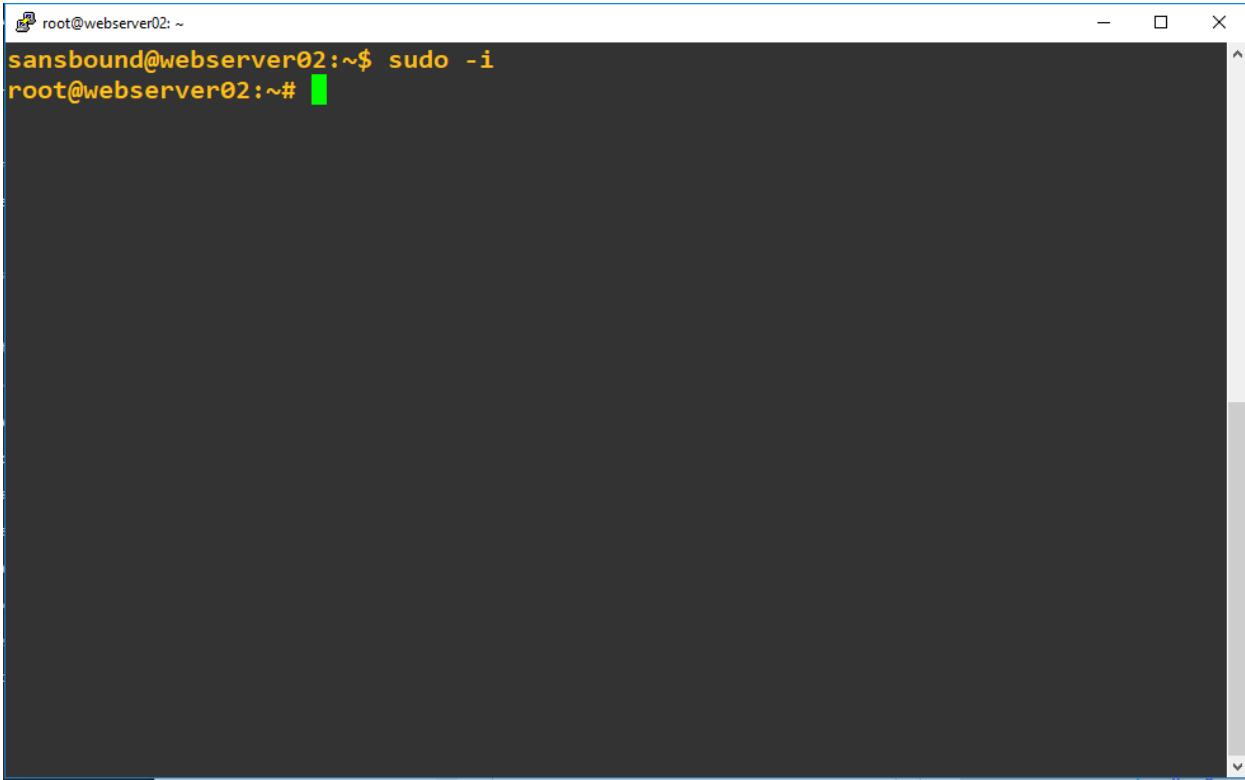
Last login: Wed Jan  2 13:00:17 2019 from 121.244.57.3
sansbound@webserver02:~$
```

Type “**sudo -i**” and press “**Enter**” to login as root account.



A screenshot of a terminal window titled "sansbound@webserver02:~". The window contains a single line of text: "sansbound@webserver02:~\$ sudo -i". The text is highlighted in green, indicating it has been selected or copied. The terminal has a dark background and a light-colored border. There are standard window controls (minimize, maximize, close) at the top right.

You have successfully logged in as a root account.



A screenshot of a terminal window titled 'root@webserver02: ~'. The window shows the command 'sudo -i' being entered, followed by a password prompt indicated by a red asterisk. The terminal has a dark background with light-colored text. The title bar includes the server name and the current directory (~). The window has standard operating system window controls (minimize, maximize, close) at the top right.

```
root@webserver02: ~
sansbound@webserver02:~$ sudo -i
root@webserver02:~# *
```

Type “**vi /var/www/html/index.html**” and press “Enter”.

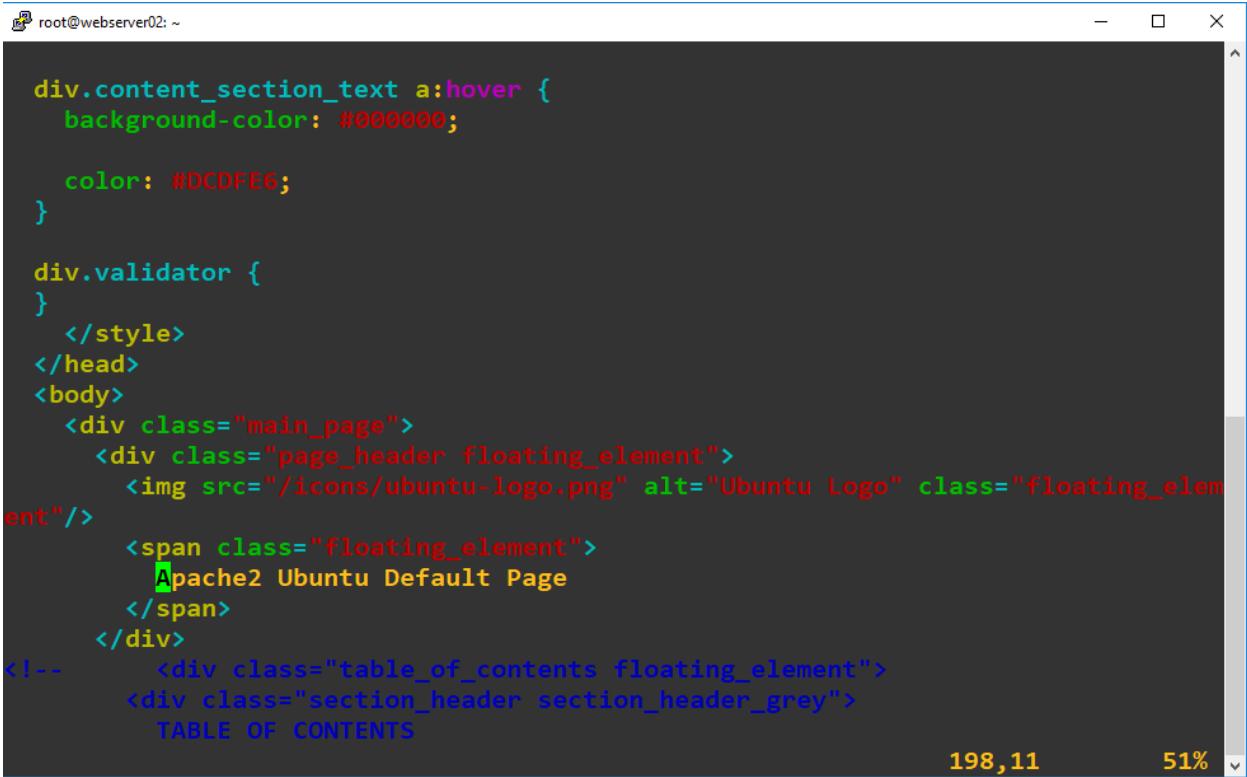


The image shows a terminal window with a dark background and light-colored text. In the top left corner, there is a small icon of a computer monitor. The window title bar contains the text "root@webserver02: ~". The main area of the terminal shows the following command being entered:

```
sansbound@webserver02:~$ sudo -i  
root@webserver02:~# vi /var/www/html/index.html
```

The text "index.html" is highlighted with a green selection bar, indicating it is the current input focus. The terminal window has a standard window frame with minimize, maximize, and close buttons in the top right corner. A vertical scroll bar is visible on the right side of the terminal window.

Go to Line “198” and press “**Insert**” key.

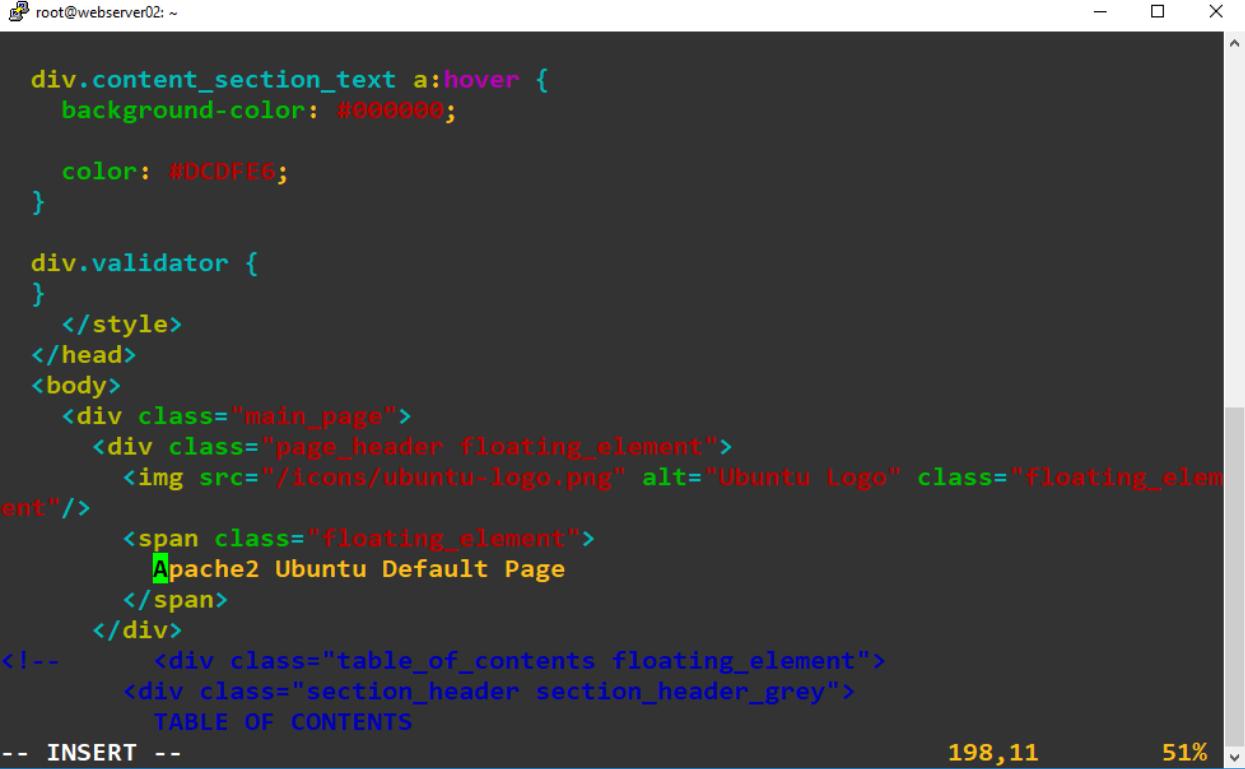


The screenshot shows a terminal window with the command "root@webserver02: ~" at the top. The window displays the source code of the Apache2 Ubuntu Default Page. The code includes CSS styles for hovering over links and floating elements, along with HTML for the page header and body. A specific line of code is highlighted in yellow: "TABLE OF CONTENTS". The status bar at the bottom right of the terminal window shows the line number "198,11" and the zoom level "51%".

```
root@webserver02: ~
div.content_section_text a:hover {
    background-color: #000000;
    color: #DCDFE6;
}

div.validator {
}
</style>
</head>
<body>
    <div class="main_page">
        <div class="page_header floating_element">
            
            <span class="floating_element">
                Apache2 Ubuntu Default Page
            </span>
        </div>
<!--    <div class="table_of_contents floating_element">
        <div class="section_header section_header_grey">
            TABLE OF CONTENTS
    </div>
```

Ensure that “**Insert**” key is pressed.



A screenshot of a terminal window titled "root@webserver02: ~". The window displays the source code of an HTML page. The code includes CSS styles for hovering over links and floating elements, along with the main content of the page. The content features an Ubuntu logo, a "Apache2 Ubuntu Default Page" message, and a "TABLE OF CONTENTS" section. At the bottom of the terminal, the status bar shows the text "-- INSERT --" and the coordinates "198,11" and "51%".

```
root@webserver02: ~

div.content_section_text a:hover {
    background-color: #000000;
    color: #DCDFE6;
}

div.validator {
}
</style>
</head>
<body>
    <div class="main_page">
        <div class="page_header floating_element">
            
            <span class="floating_element">
                Apache2 Ubuntu Default Page
            </span>
        </div>
    <!-- <div class="table_of_contents floating_element">
        <div class="section_header section_header_grey">
            TABLE OF CONTENTS
    -- INSERT --
```

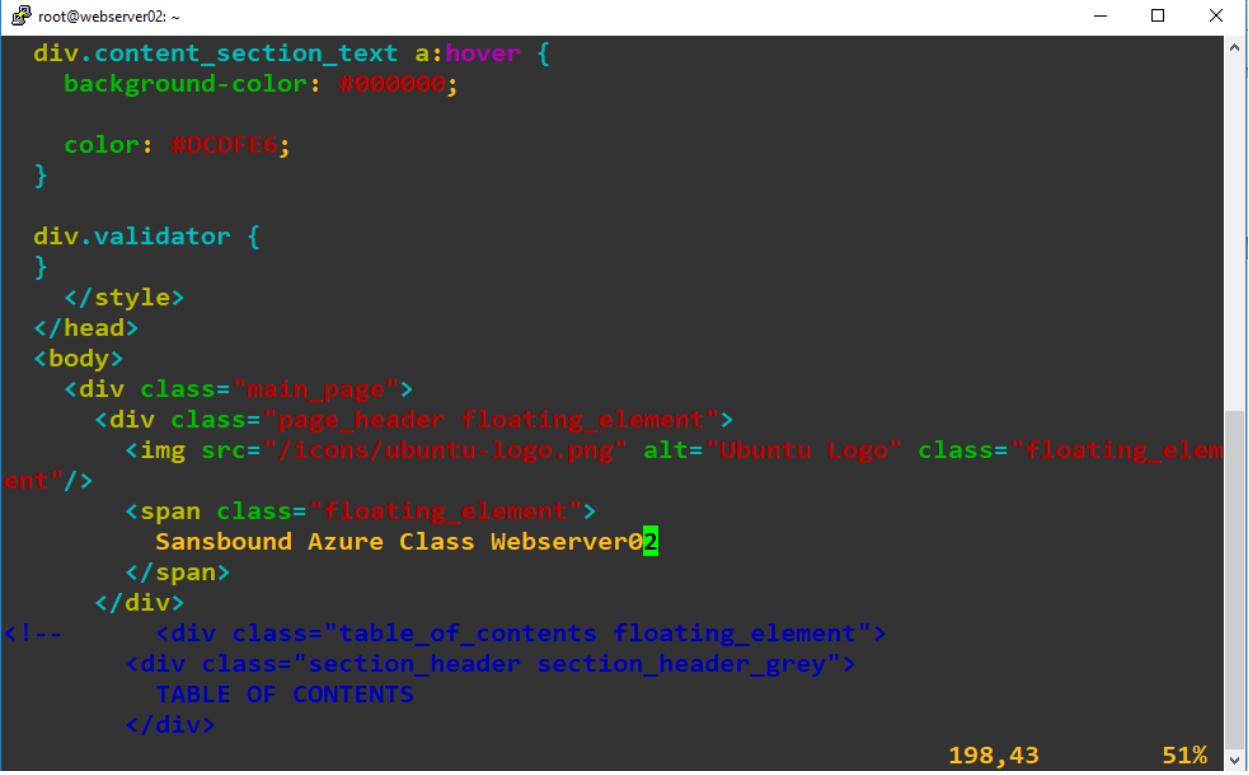
Delete previous values and type as “**Sansbound Azure Class Webserver02**”.

```
root@webserver02: ~
div.content_section_text a:hover {
    background-color: #000000;
    color: #DCDFE6;
}

div.validator {
}
</style>
</head>
<body>
    <div class="main_page">
        <div class="page_header floating_element">
            
            <span class="floating_element">
                Sansbound Azure Class Webserver02
            </span>
        </div>
<!--     <div class="table_of_contents floating_element">
        <div class="section_header section_header_grey">
            TABLE OF CONTENTS
        </div>
-- INSERT --
```

198,44      51%

Press "Escape" key.



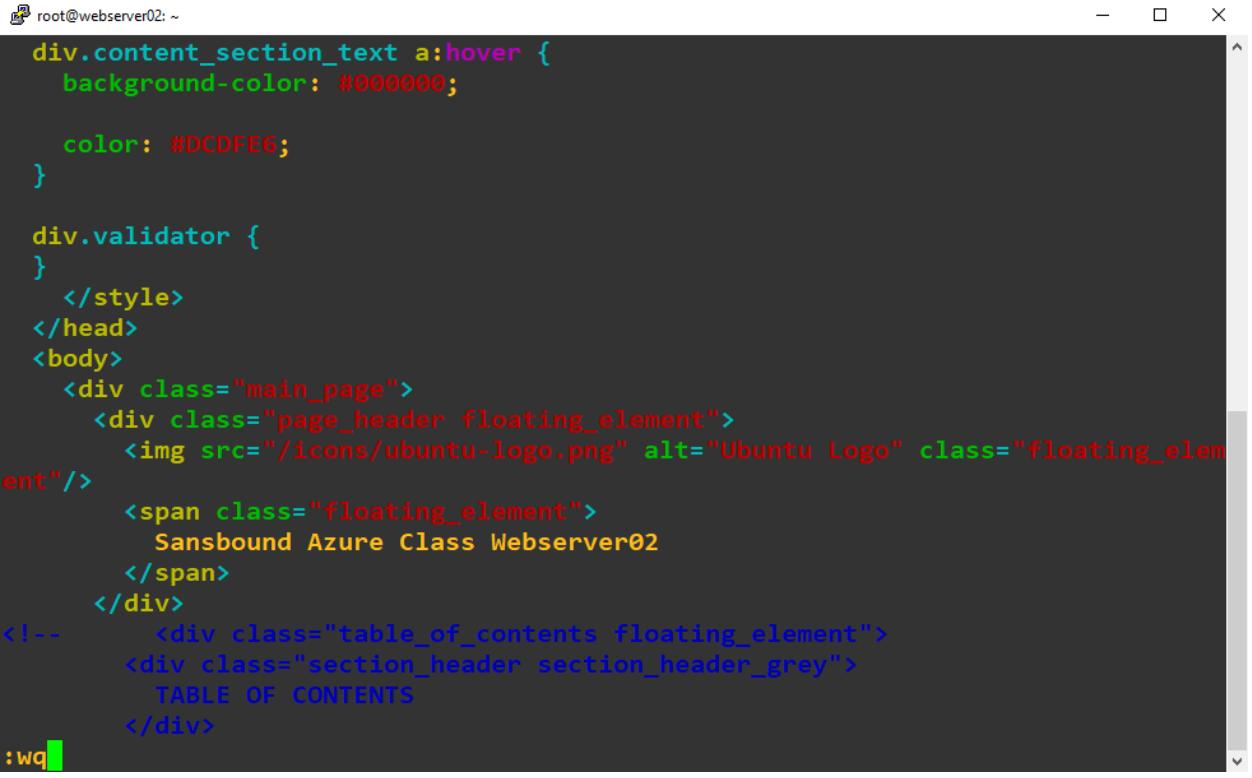
The screenshot shows a terminal window with the following content:

```
root@webserver02: ~


The terminal window has a dark background. The status bar at the bottom right shows "198,43" and "51%".

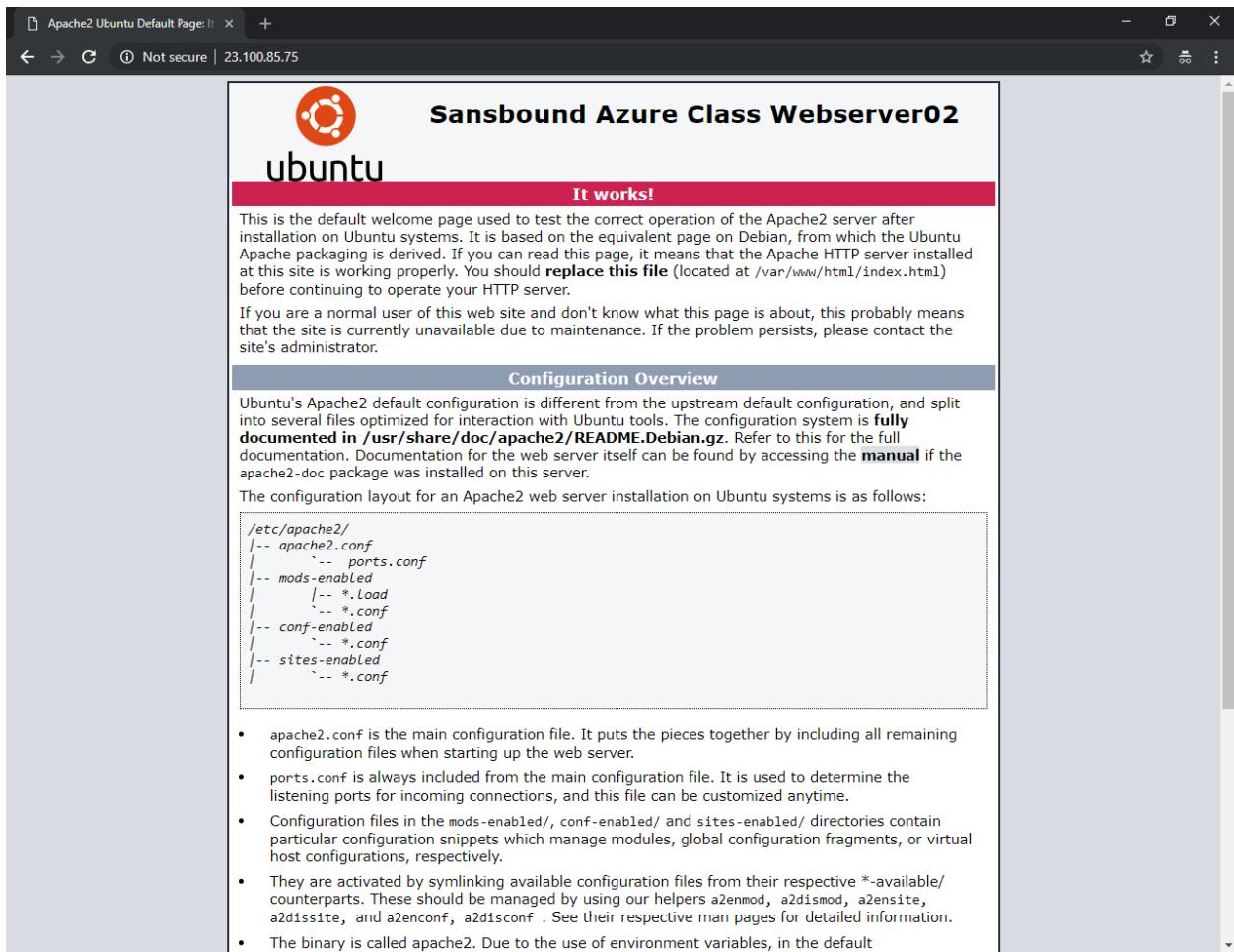

```

Type “:wq” and press “Enter”.

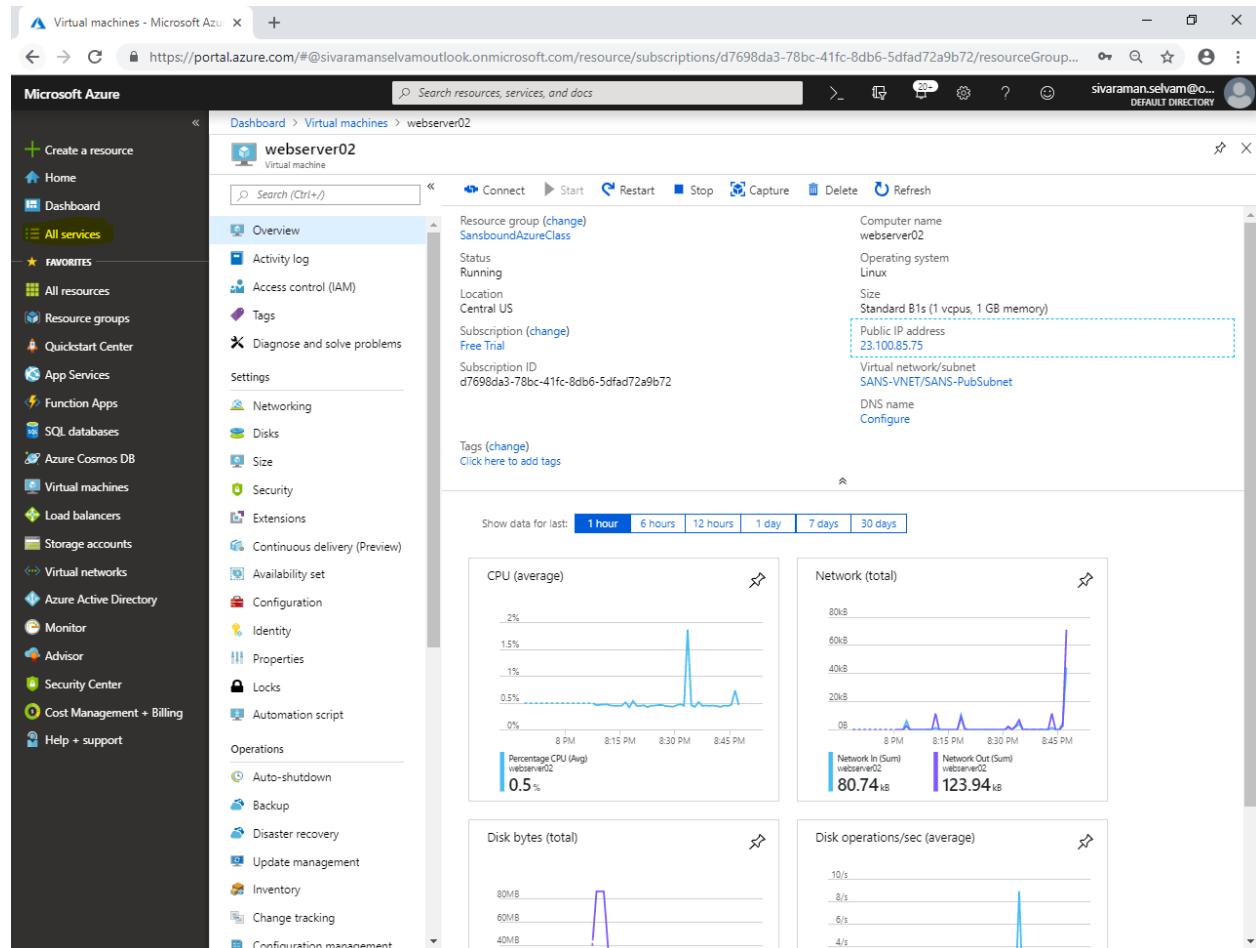


A screenshot of a terminal window titled "root@webserver02: ~". The window contains a block of XML-like code with syntax highlighting. The code includes CSS styles for a "content\_section\_text" class and an "a:hover" selector, as well as HTML elements like "div.validator", "body", and "main\_page". A floating element with the Ubuntu logo and the text "Sansbound Azure Class Webserver02" is displayed. At the bottom of the terminal, the command ":wq" is typed in green, indicating the user is saving and exiting the session.

Type public IP address of Webserve02 in browser and press “Enter”.

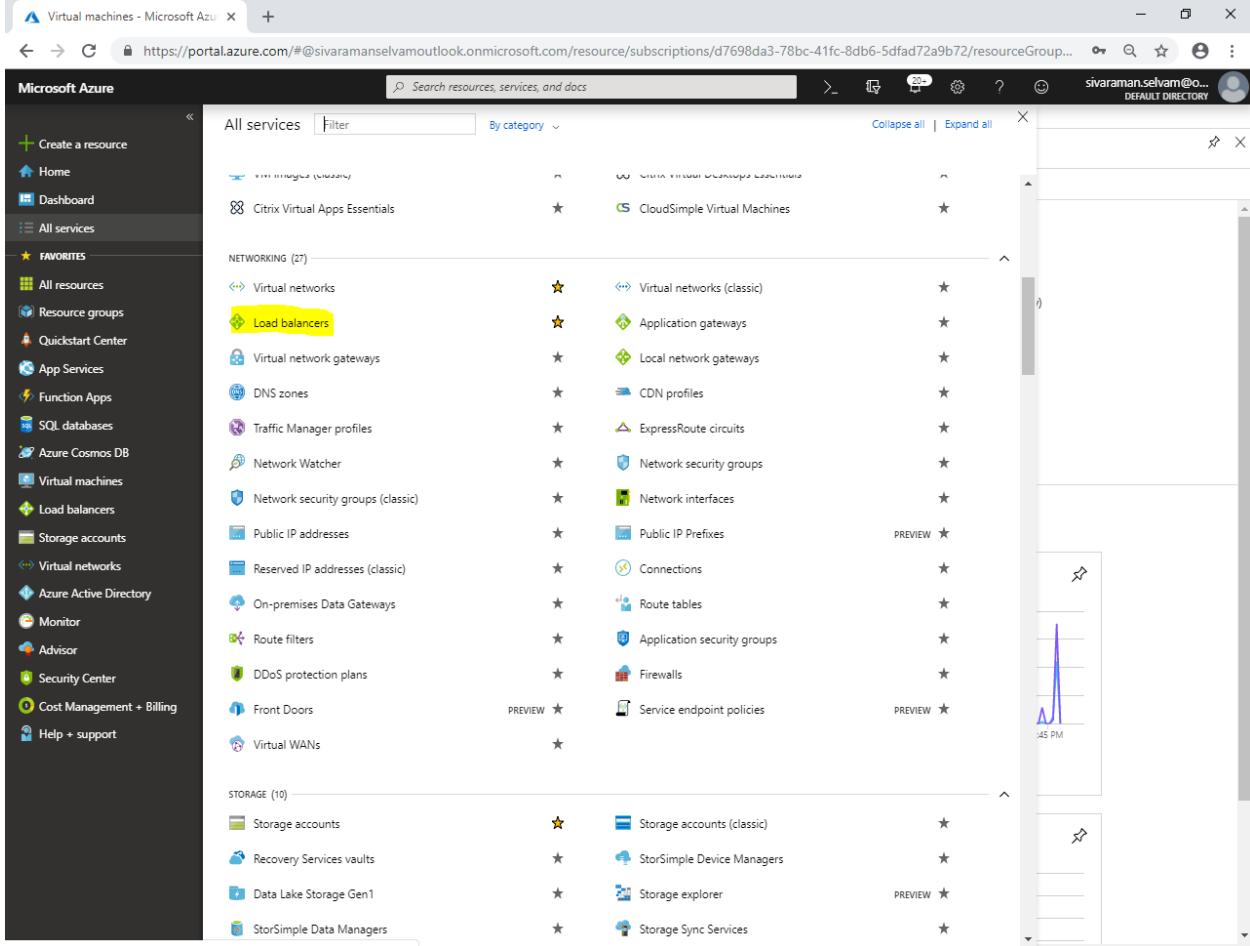


Click "All services",



The screenshot shows the Microsoft Azure portal interface for a virtual machine named 'webserver02'. The left sidebar is expanded to show the 'All services' section under 'Virtual machines'. The main content area displays the VM details, including its resource group ('SansboundAzureClass'), status ('Running'), location ('Central US'), subscription ('Free Trial'), and size ('Standard B1s (1 vcpus, 1 GB memory)'). It also shows the public IP address ('23.100.85.75') and the virtual network/subnet ('SANS-VNET/SANS-PubSubNet'). Below these details are sections for 'Tags (change)' and 'Configure'. At the bottom, there are four performance monitoring charts: 'CPU (average)', 'Network (total)', 'Disk bytes (total)', and 'Disk operations/sec (average)'. The 'CPU (average)' chart shows a sharp spike from 0.5% to 2% around 8:30 PM. The 'Network (total)' chart shows Network In at 80.74 kB and Network Out at 123.94 kB. The 'Disk bytes (total)' chart shows a peak at 80MB. The 'Disk operations/sec (average)' chart shows a peak at 10/s.

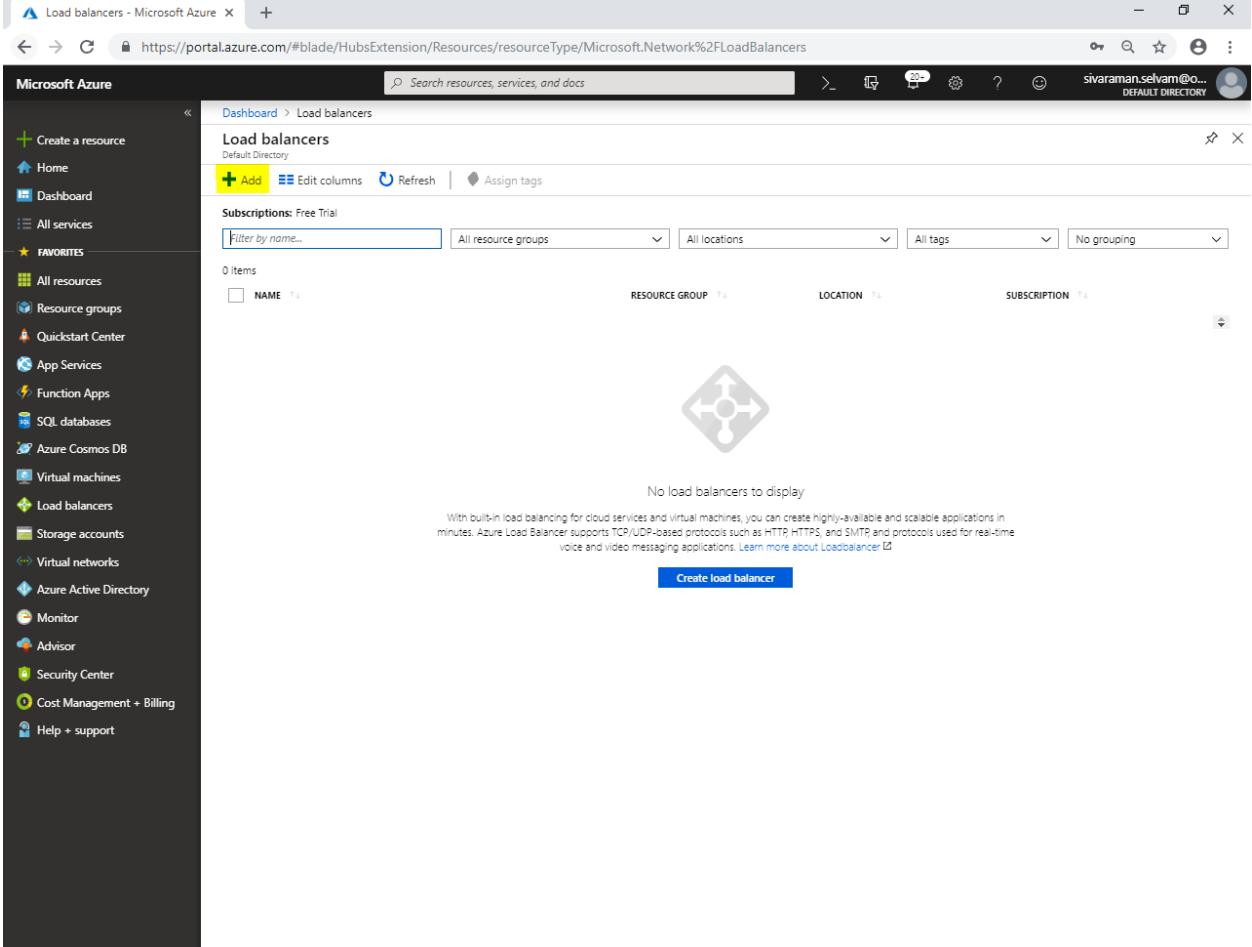
Click “Load balancers”,



The screenshot shows the Microsoft Azure portal's "All services" page. The left sidebar lists various service categories. Under the "NETWORKING" section, the "Load balancers" option is highlighted with a yellow box. The main pane displays a grid of networking services, with "Load balancers" being the selected item.

Category	Service	Status
NETWORKING (27)	Virtual networks	★
	Load balancers	★
STORAGE (10)	Storage accounts	★
	StorSimple Data Managers	★

Click "Add".



The screenshot shows the Microsoft Azure portal interface for managing load balancers. The left sidebar contains a navigation menu with various service icons. The main content area is titled "Load balancers" and displays a table with no items. A large, central icon of a network connection is present. Below the table, there is descriptive text about Azure Load Balancer and a prominent blue "Create load balancer" button.

Load balancers - Microsoft Azure + New

<https://portal.azure.com/#blade/HubsExtension/Resources/resourceType/Microsoft.Network%2FLoadBalancers>

Microsoft Azure

Dashboard > Load balancers

Load balancers

Default Directory

**Add** Edit columns Refresh Assign tags

Subscriptions: Free Trial

Filter by name... All resource groups All locations All tags No grouping

0 items

NAME	RESOURCE GROUP	LOCATION	SUBSCRIPTION
------	----------------	----------	--------------

No load balancers to display

With built-in load balancing for cloud services and virtual machines, you can create highly-available and scalable applications in minutes. Azure Load Balancer supports TCP/UDP-based protocols such as HTTP, HTTPS, and SMTP and protocols used for real-time voice and video messaging applications. [Learn more about Loadbalancer](#)

Create load balancer

While create load balancer,

Type “**Name**” as “**Sans-WebLB**”.

Click “**Type**” as “**Public**”.

Click “**SKU**” as “**Basic**”.

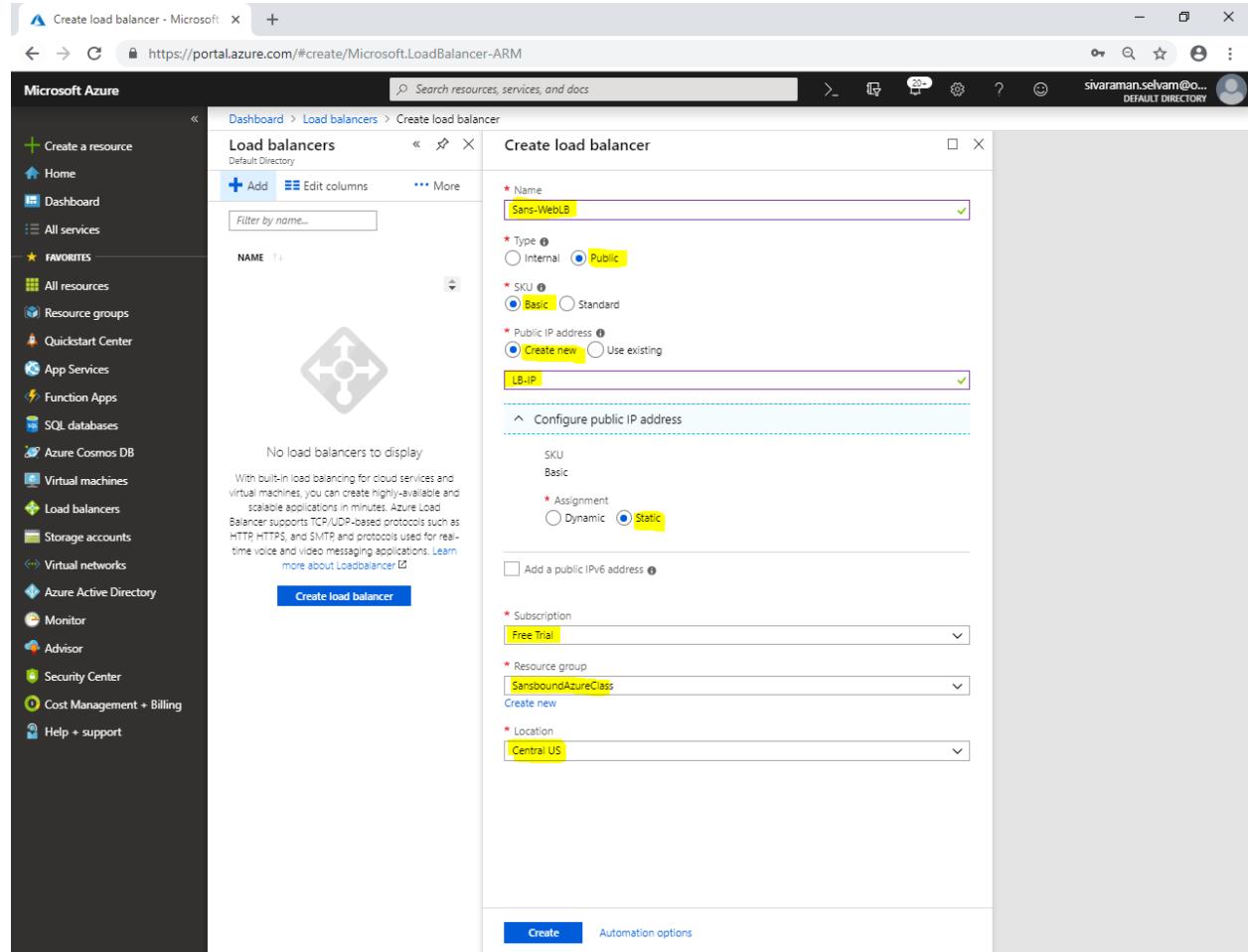
Click “**Public IP address**” as “**Create new**” type “**LB-IP**”.

Set “**Assignment**” as “**Static**”.

Select “**Subscription**” as “**Free Trial**”.

Select “**Resource group**” as “**SansboundAzureClass**”.

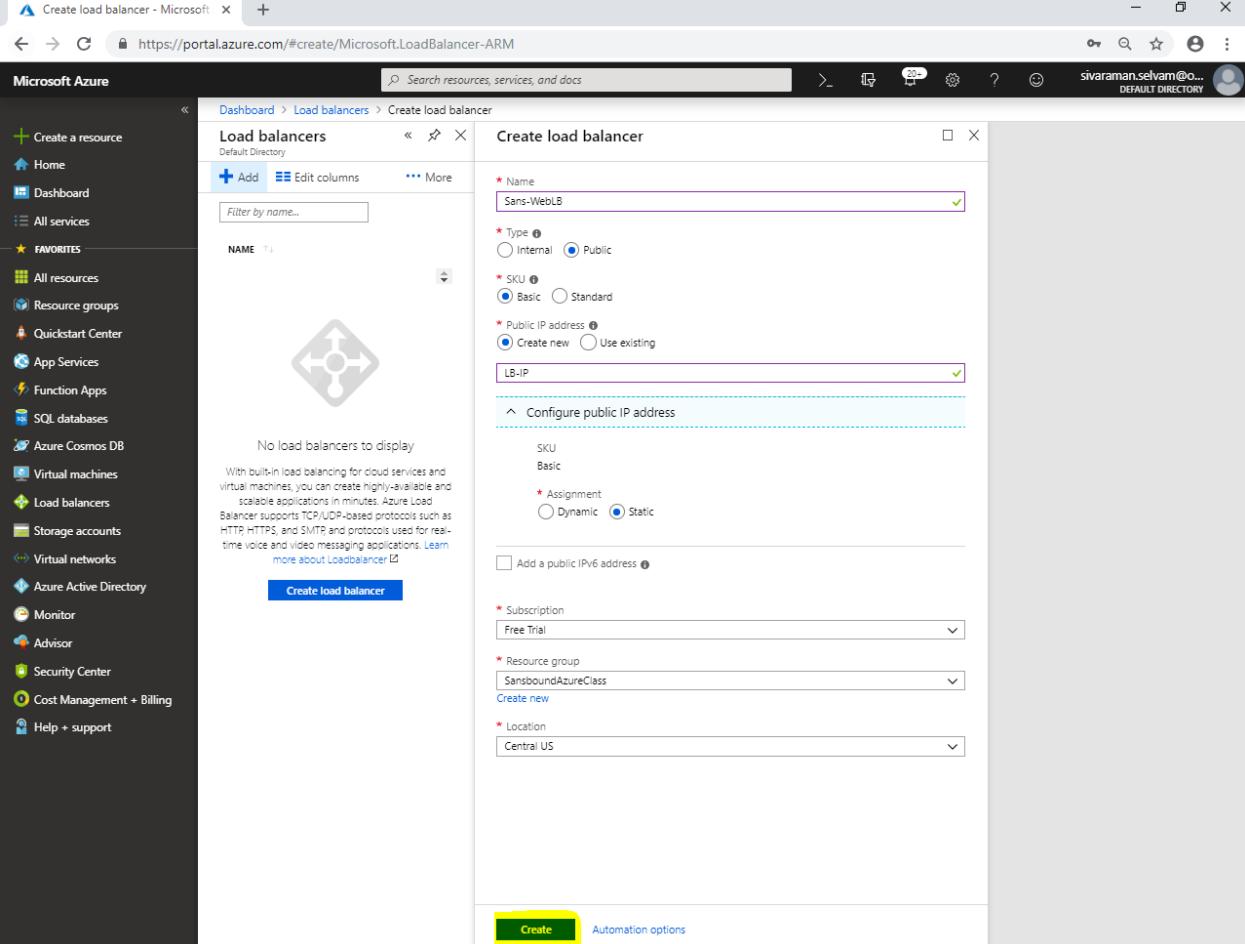
Select “**Location**” as “**Central US**”.



The screenshot shows the Microsoft Azure portal interface for creating a load balancer. The left sidebar lists various Azure services. The main area shows the 'Load balancers' blade with a 'Create load balancer' dialog open. The dialog fields are as follows:

- Name:** Sans-WebLB
- Type:** Public (radio button selected)
- SKU:** Basic (radio button selected)
- Public IP address:** Create new (radio button selected), LB-IP
- Assignment:** Static (radio button selected)
- Subscription:** Free Trial
- Resource group:** SansboundAzureClass
- Location:** Central US

Click "Create".

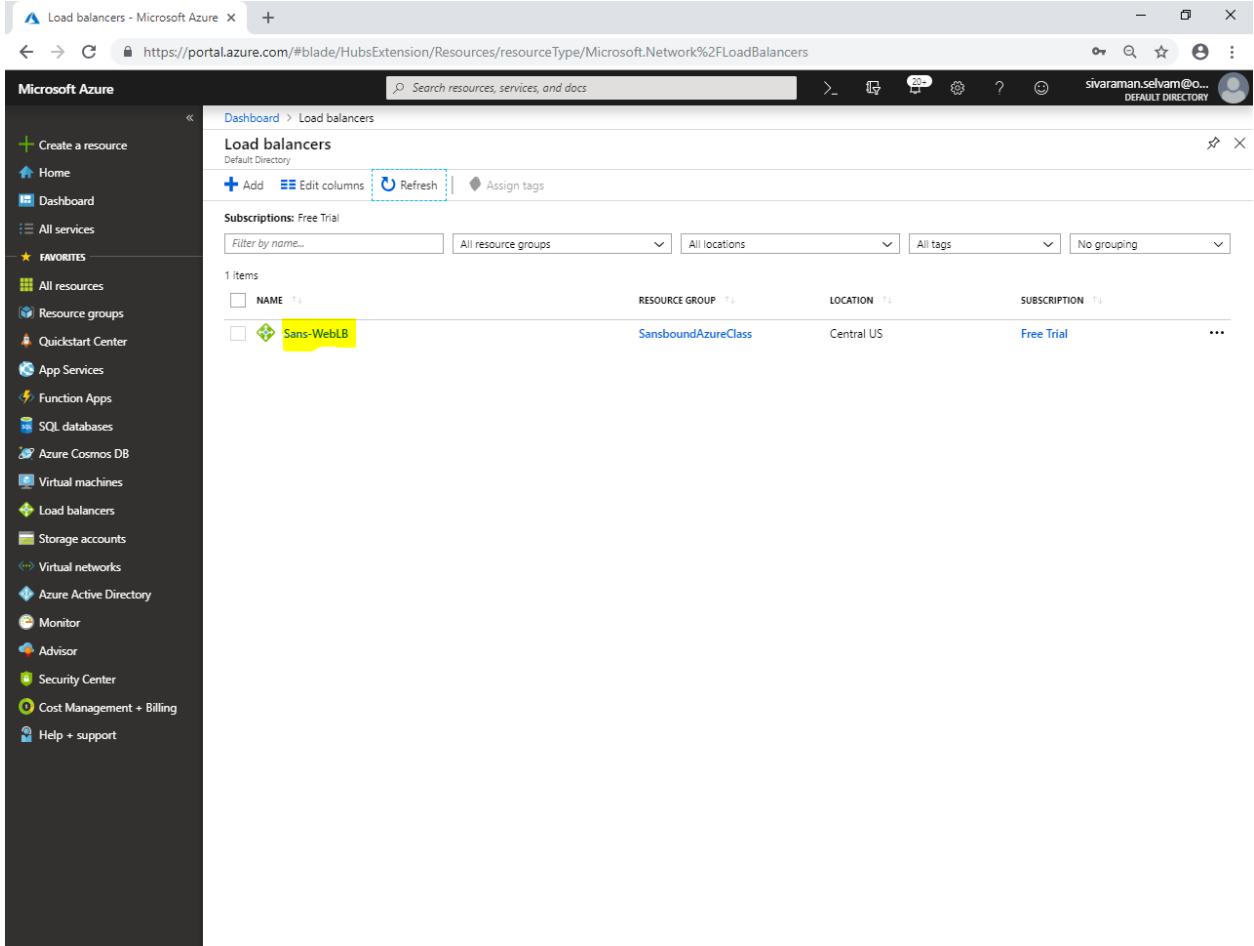


The screenshot shows the Microsoft Azure portal interface for creating a load balancer. The left sidebar contains various service icons, and the main dashboard shows a 'Load balancers' section with a table and a note about built-in load balancing. A central modal window titled 'Create load balancer' is open, prompting for configuration details:

- Name:** Sans-WebLB
- Type:** Public (radio button selected)
- SKU:** Basic (radio button selected)
- Public IP address:** Create new (radio button selected)
- LB-IP:** (input field)
- Configure public IP address:** (section)
  - SKU:** Basic
  - Assignment:** Static (radio button selected)
  - Add a public IPv6 address:** (checkbox)
- Subscription:** Free Trial
- Resource group:** SansboundAzureClass
- Location:** Central US

A large yellow box highlights the 'Create' button at the bottom left of the modal.

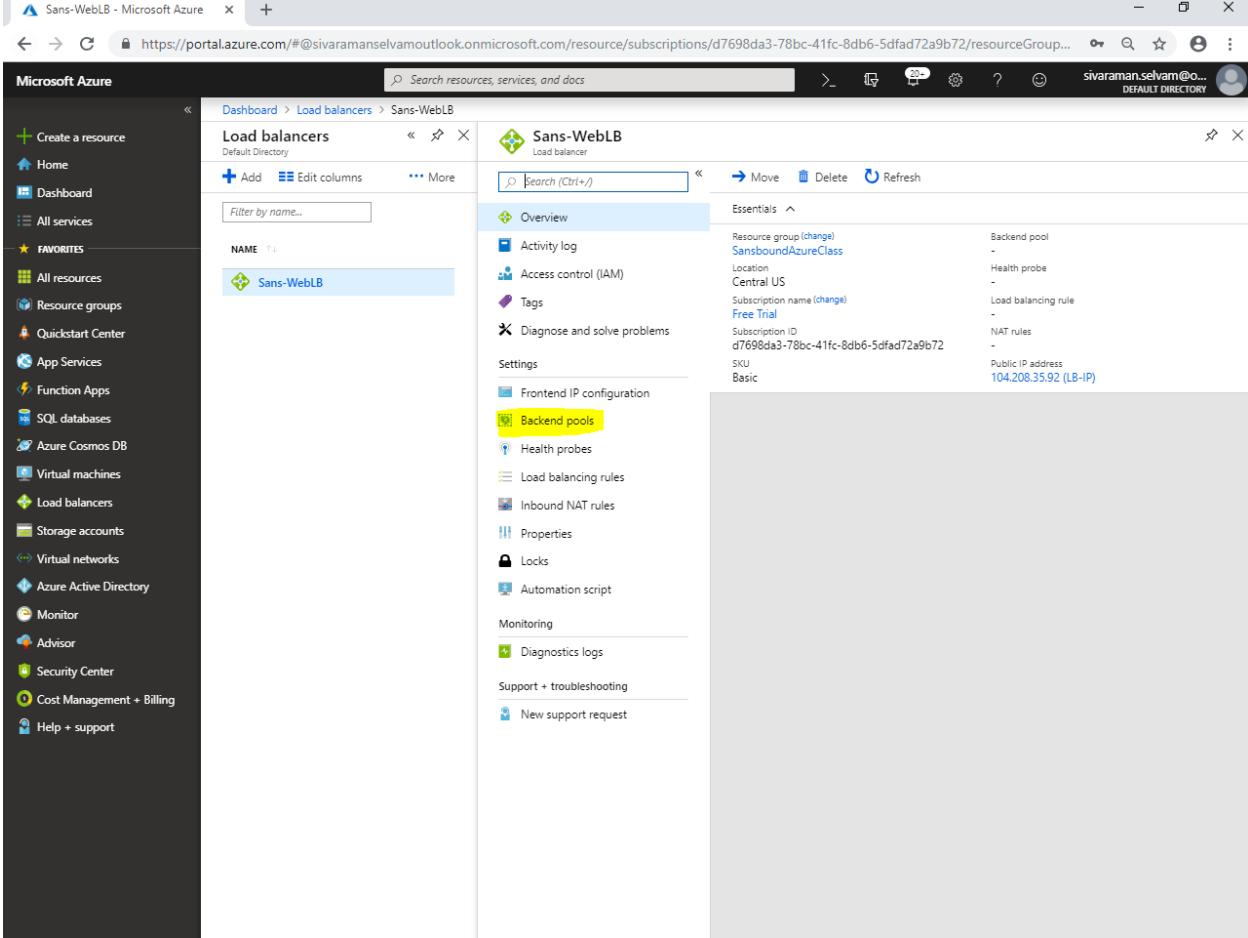
Click “Sans-WebLB”.



The screenshot shows the Microsoft Azure portal interface. The left sidebar navigation bar is visible, showing various service categories like Home, Dashboard, All services, and Load balancers. The main content area is titled "Load balancers" under the "Default Directory". A table lists one item: "Sans-WebLB". The table columns are NAME, RESOURCE GROUP, LOCATION, and SUBSCRIPTION. The "NAME" column shows "Sans-WebLB", the "RESOURCE GROUP" column shows "SansboundAzureClass", the "LOCATION" column shows "Central US", and the "SUBSCRIPTION" column shows "Free Trial". The "Sans-WebLB" entry is highlighted with a yellow box.

NAME	RESOURCE GROUP	LOCATION	SUBSCRIPTION
Sans-WebLB	SansboundAzureClass	Central US	Free Trial

Click “Backend pools”.

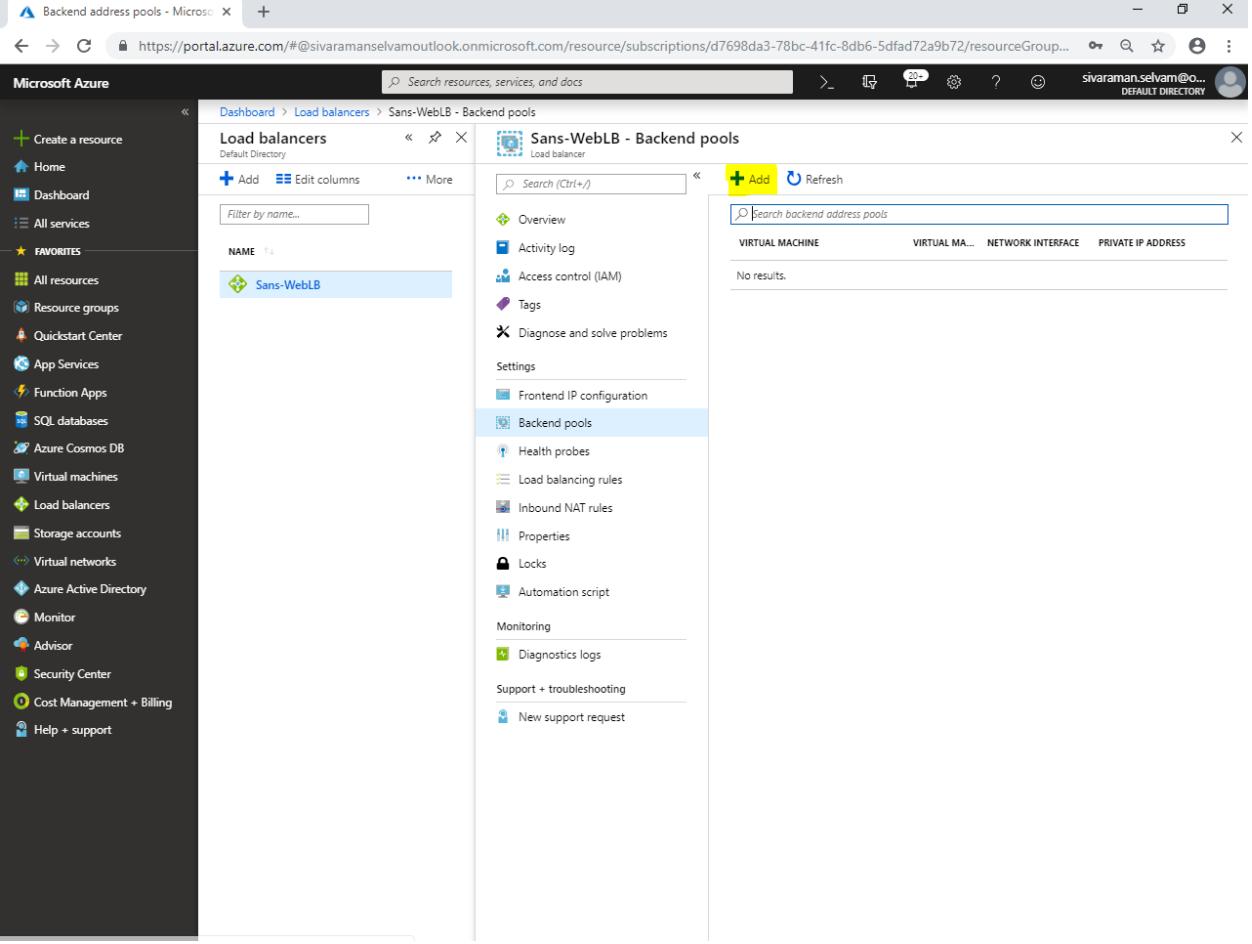


The screenshot shows the Microsoft Azure portal interface. On the left, the navigation menu is visible with various service icons. In the center, the 'Load balancers' blade for the 'Sans-WebLB' resource is displayed. The 'Overview' tab is selected. Under the 'Frontend IP configuration' section, the 'Backend pools' link is highlighted with a yellow box. Other options like 'Health probes', 'Load balancing rules', 'Inbound NAT rules', 'Properties', 'Locks', and 'Automation script' are also listed. On the right side, the 'Essentials' pane provides details about the load balancer, including its resource group, location, subscription ID, SKU, and public IP address.

Resource group (change)	Backend pool
SansboundAzureClass	-
Location	Health probe
Central US	-
Subscription name (change)	Load balancing rule
Free Trial	-
Subscription ID	NAT rules
d7698da3-78bc-41fc-8db6-5dfad72a9b72	-
SKU	Public IP address
Basic	104.208.35.92 (LB-IP)

In “Backend pools”,

Click “Add”.



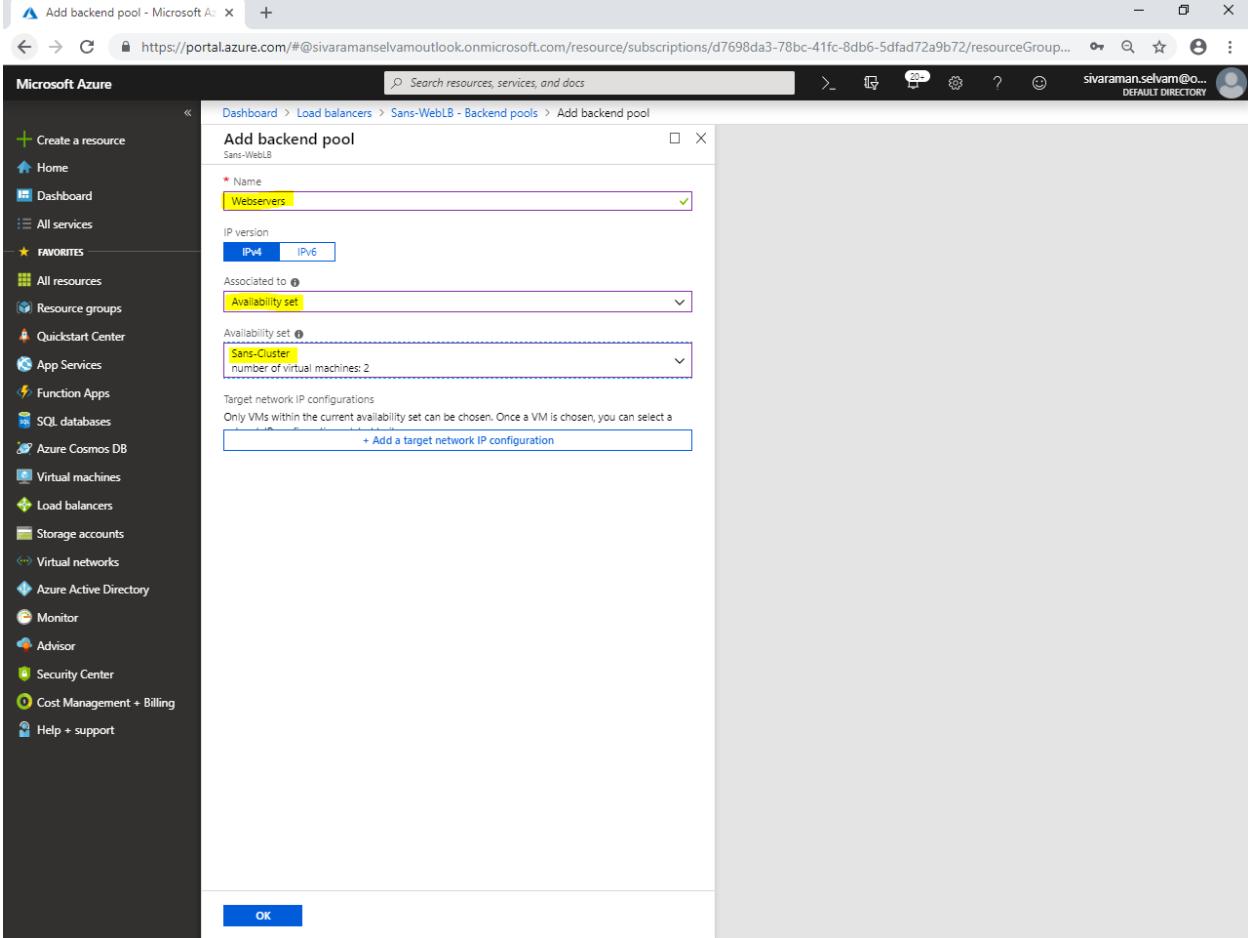
The screenshot shows the Microsoft Azure portal interface. The left sidebar contains a list of services including Home, Dashboard, All services, Favorites (All resources, Resource groups, Quickstart Center, App Services, Function Apps, SQL databases, Azure Cosmos DB, Virtual machines, Load balancers, Storage accounts, Virtual networks, Azure Active Directory, Monitor, Advisor, Security Center, Cost Management + Billing, and Help + support). The main content area is titled "Load balancers" and shows a sub-section for "Sans-WebLB - Backend pools". The sub-section title is "Backend pools". On the right, there is a table with columns: VIRTUAL MACHINE, VIRTUAL MA..., NETWORK INTERFACE, and PRIVATE IP ADDRESS. A search bar at the top right of the main content area says "Search backend address pools".

While “Add backend pool”,

Type “Name” as “**Webservers**”

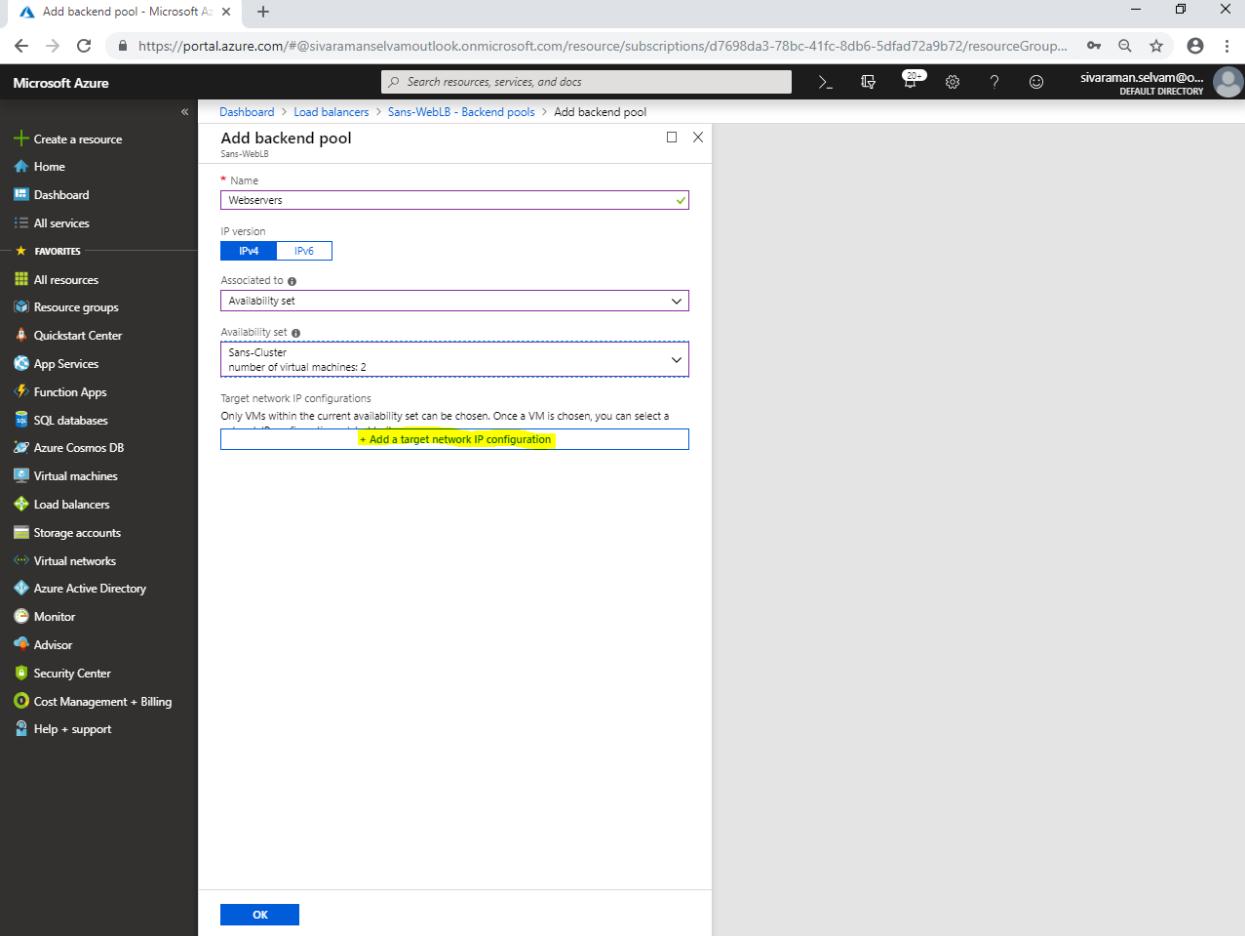
In “Associated to” select “**Availability set**”.

Select “**Availability set**” as “**Sans-Cluster**”.



The screenshot shows the Microsoft Azure portal interface. The user is in the 'Load balancers' section, specifically adding a new 'Backend pool' for the 'Sans-WebLB' load balancer. The 'Name' field is populated with 'Webservers'. Under 'Associated to', the 'Availability set' dropdown is selected, and 'Sans-Cluster' is chosen from the list. At the bottom of the dialog, there is an 'OK' button.

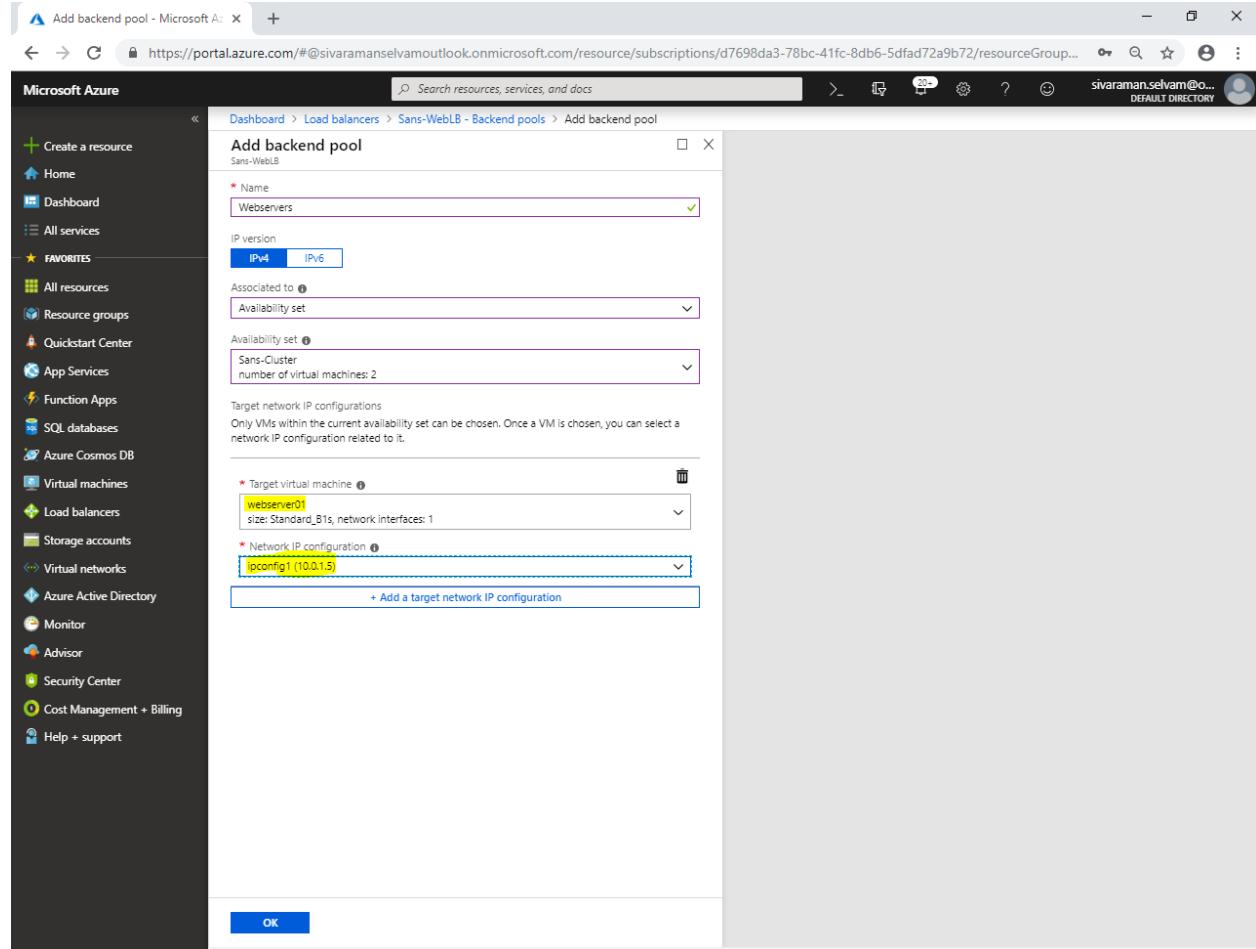
Click “Add a target network IP configuration”.



The screenshot shows the Microsoft Azure portal interface for creating a backend pool. The left sidebar lists various services like Home, Dashboard, All services, and Load balancers. The main content area is titled 'Add backend pool' under 'Load balancers'. It has fields for 'Name' (Webservers), 'IP version' (IPv4 selected), 'Associated to' (Availability set dropdown), and 'Availability set' (dropdown showing 'Sans-Cluster' with 'number of virtual machines: 2'). Below these is a section for 'Target network IP configurations' with a note: 'Only VMs within the current availability set can be chosen. Once a VM is chosen, you can select a target IP configuration for it.' A blue button labeled '+ Add a target network IP configuration' is highlighted with a yellow box. At the bottom are 'OK' and 'Cancel' buttons.

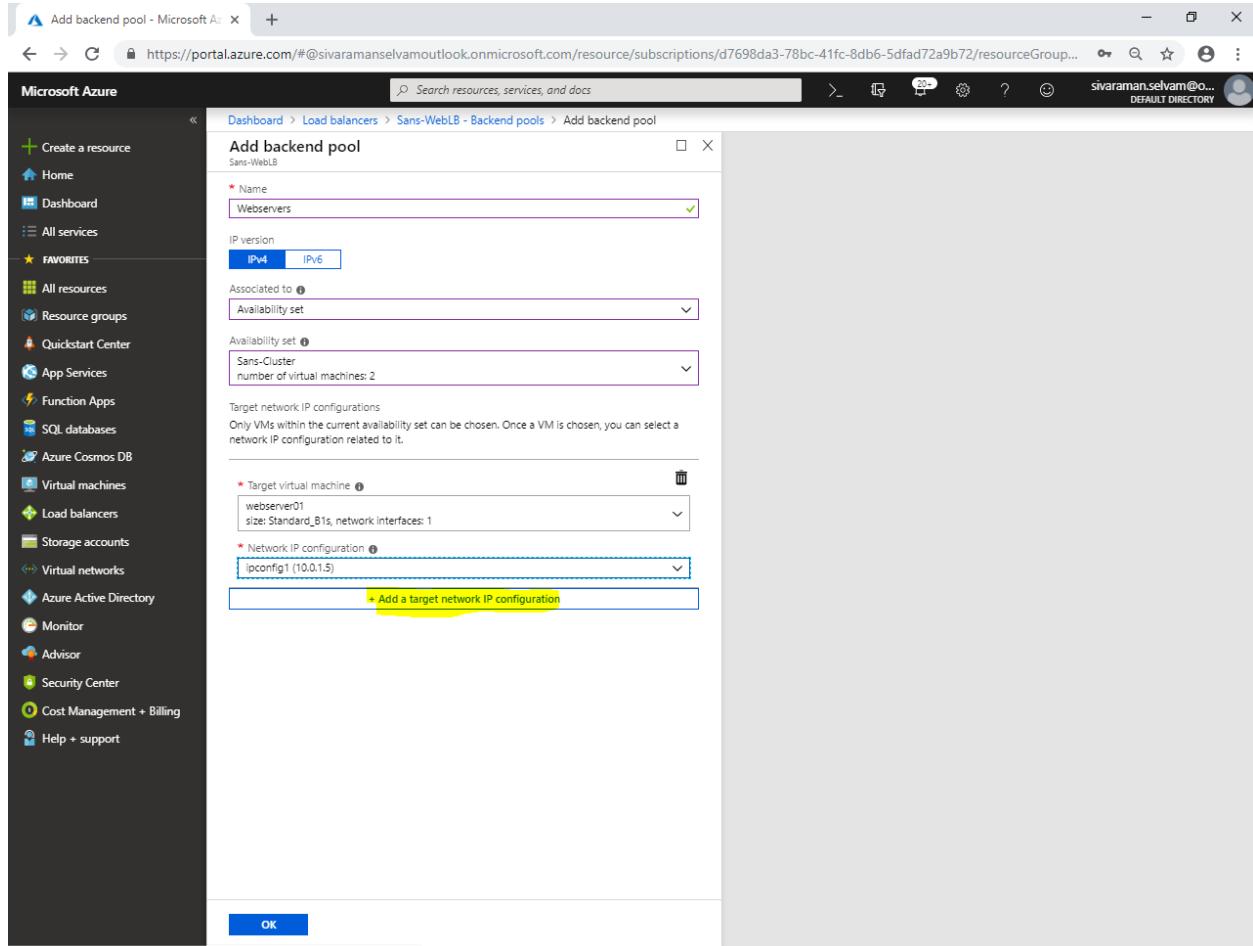
Select “**Target virtual machine**” as “**“webserver01”**”.

Select “**Network IP configuration**” as “**“ipconfig1 (10.0.1.5)”**”.



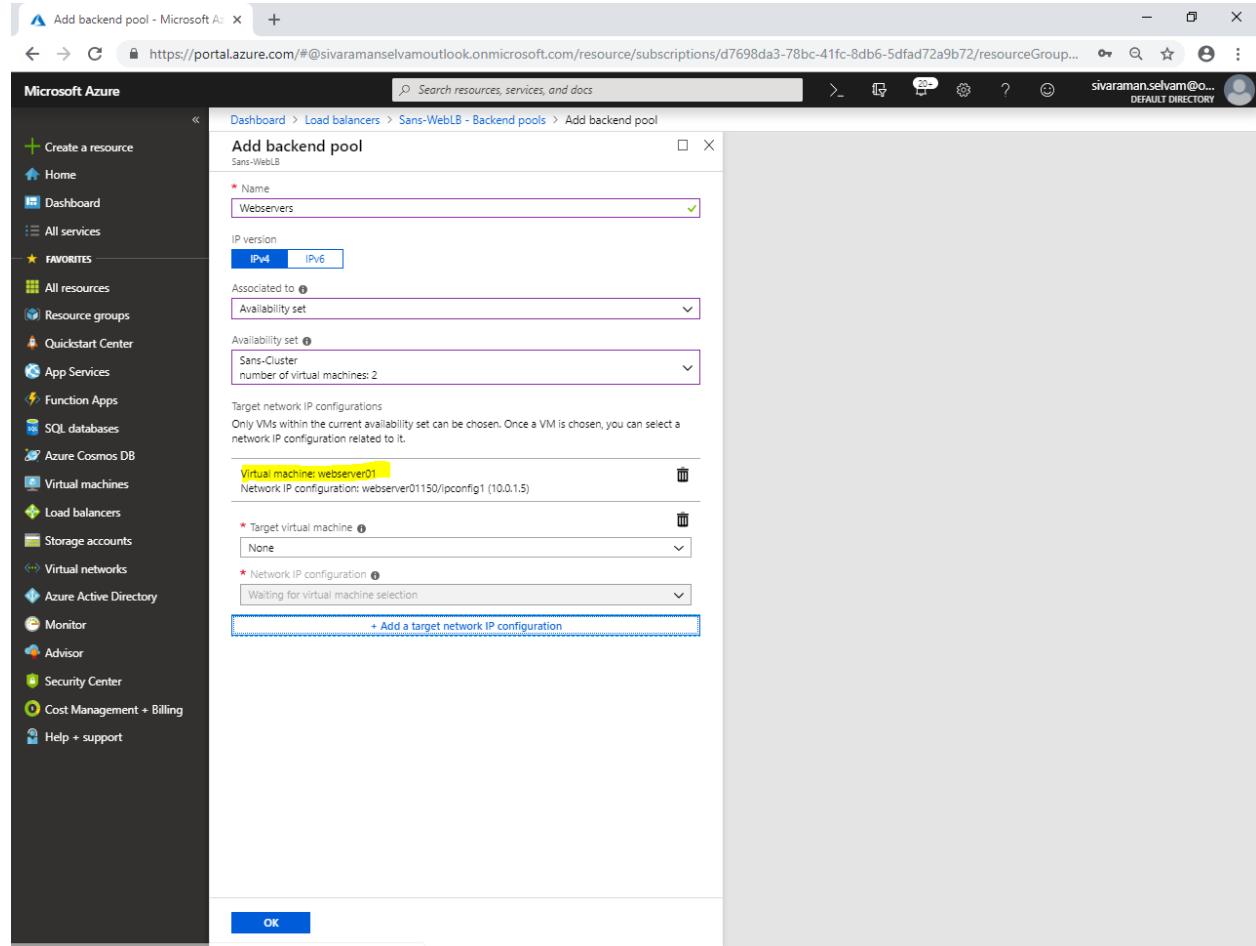
The screenshot shows the 'Add backend pool' dialog box in the Microsoft Azure portal. The 'Name' field is populated with 'Webservers'. The 'IP version' is set to 'IPv4'. The 'Associated to' dropdown is set to 'Availability set' with 'Sans-Cluster' selected. In the 'Target network IP configurations' section, the 'Target virtual machine' is set to 'webserver01' and the 'Network IP configuration' is set to 'ipconfig1 (10.0.1.5)'. A blue dashed box highlights the 'ipconfig1 (10.0.1.5)' selection.

Click “Add a target network IP configuration”.



The screenshot shows the Microsoft Azure portal interface. The user is navigating through the 'Load balancers' section to add a new backend pool for a specific load balancer named 'Sans-WebLB'. The 'Name' field is set to 'Webservers'. The 'IP version' is selected as 'IPv4'. Under 'Associated to', the 'Availability set' dropdown is open, showing 'Availability set' and 'Sans-Cluster'. In the 'Target network IP configurations' section, there is a list of virtual machines: 'webservice01' (size: Standard\_B1s, network interfaces: 1) and 'ipconfig1 (10.0.1.5)'. A blue rectangular box highlights the 'Add a target network IP configuration' button at the bottom of this list. The 'OK' button is visible at the bottom right of the dialog.

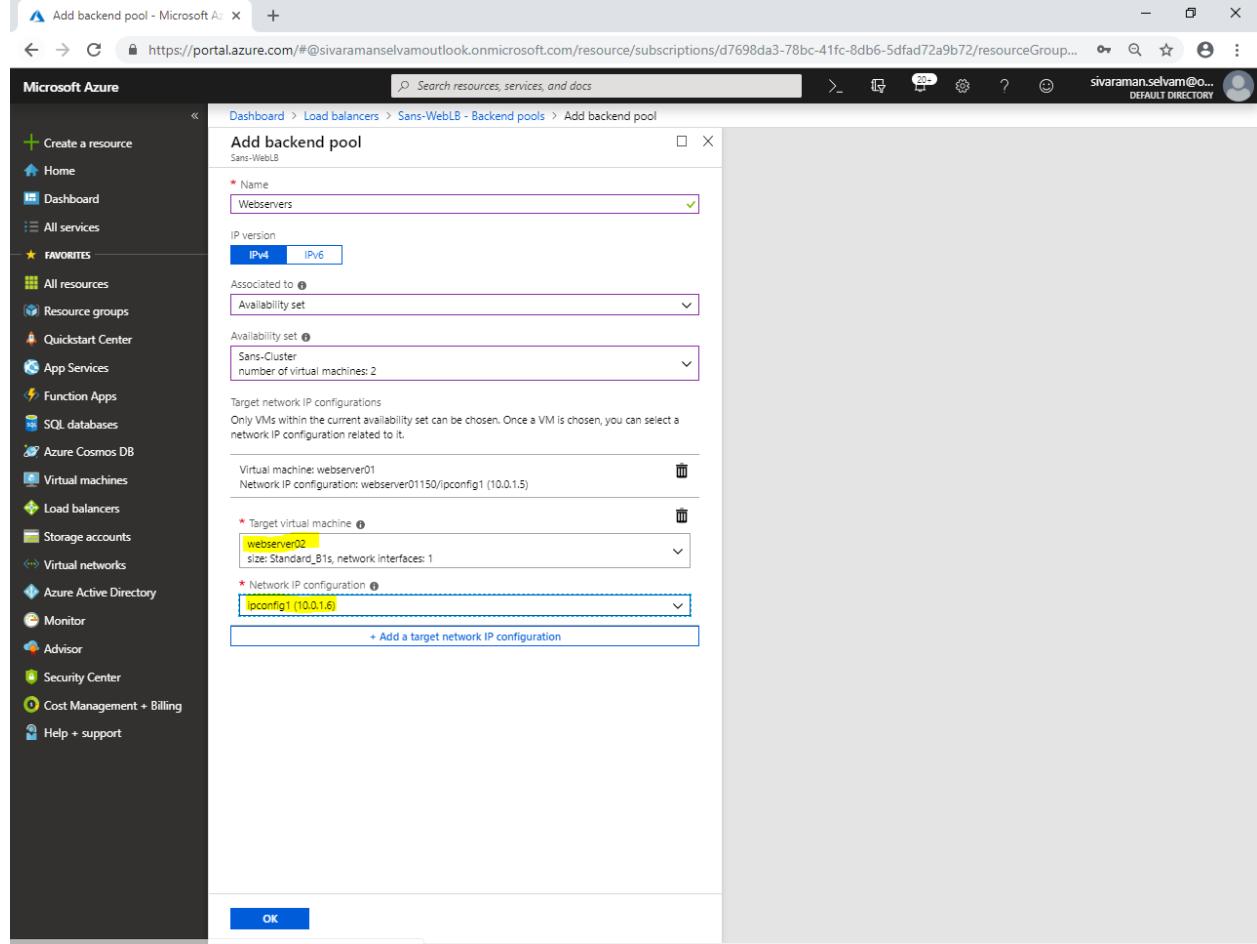
You are able to see that “**webserver01**” has been successfully added in target network IP configuration.



The screenshot shows the Microsoft Azure portal interface for adding a backend pool. The left sidebar lists various services like Home, Dashboard, All services, and Load balancers. The main content area is titled "Add backend pool" under "Load balancers". The "Name" field is populated with "Webservers". The "IP version" is set to "IPv4". The "Associated to" dropdown is set to "Availability set", which is further specified as "Sans-Cluster" with "number of virtual machines: 2". Below this, the "Target network IP configurations" section shows a single entry for "Virtual machine: webserver01" with "Network IP configuration: webserver01150/pcconfig1 (10.0.1.5)". There is also a button "+ Add a target network IP configuration". At the bottom right of the form is an "OK" button.

Select “**Target virtual machine**” as “**“webserver02”**”.

Select “**Network IP configuration**” as “**“ipconfig1 (10.0.1.6)”**”.



Add backend pool - Microsoft Azure

Microsoft Azure

Dashboard > Load balancers > Sans-WebLB - Backend pools > Add backend pool

Name: Webservers

IP version: IPv4

Associated to: Availability set: Sans-Cluster

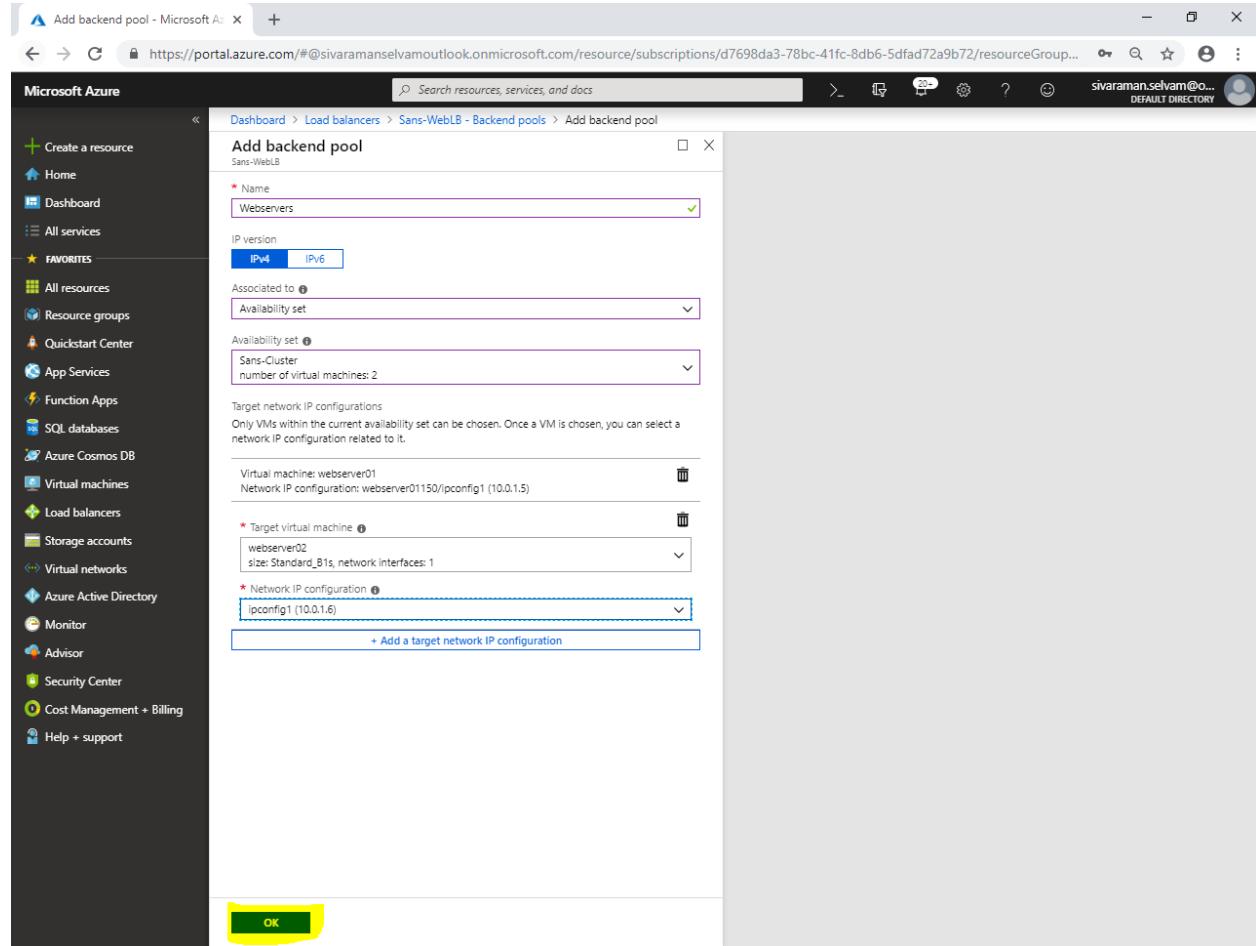
Target network IP configurations:

- Virtual machine: webserver01 Network IP configuration: webserver01150/ipconfig1 (10.0.1.5)
- Target virtual machine: webserver02 Network IP configuration: ipconfig1 (10.0.1.6)

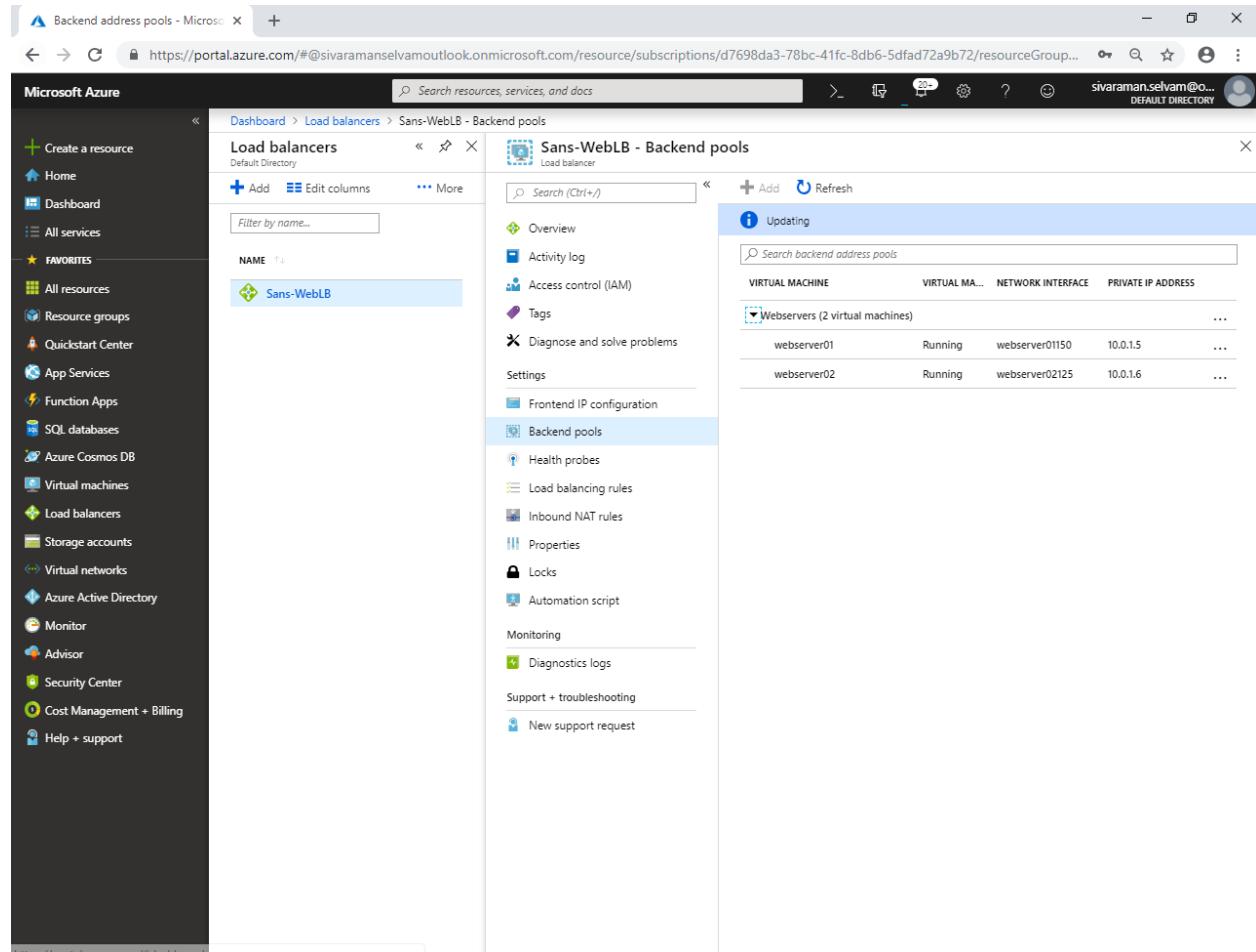
+ Add a target network IP configuration

OK

Click "OK".



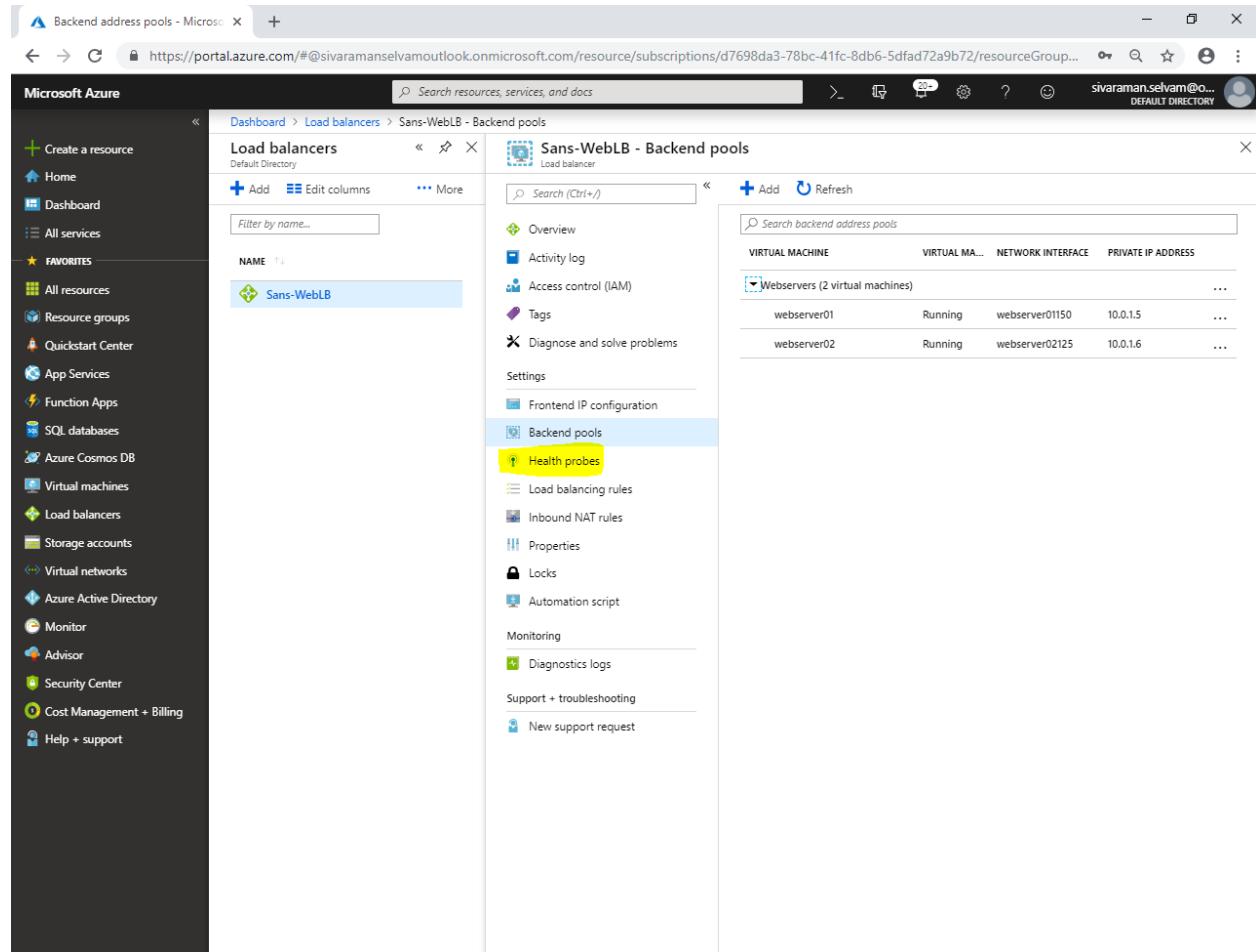
You are able to see that **webserver01** and **webserver02** servers are added successfully in Backend pools of "**Sans-WebLB**".



The screenshot shows the Microsoft Azure portal interface. The left sidebar contains a list of services including Home, Dashboard, All services, Favorites, All resources, Resource groups, Quickstart Center, App Services, Function Apps, SQL databases, Azure Cosmos DB, Virtual machines, Load balancers, Storage accounts, Virtual networks, Azure Active Directory, Monitor, Advisor, Security Center, Cost Management + Billing, and Help + support. The main content area shows the "Load balancers" section under "Sans-WebLB - Backend pools". The "Backend pools" tab is selected. A table lists two virtual machines: webserver01 and webserver02, both running on the network interface webserver01150 with private IP addresses 10.0.1.5 and 10.0.1.6 respectively.

VIRTUAL MACHINE	VIRTUAL MA...	NETWORK INTERFACE	PRIVATE IP ADDRESS
webserver01	Running	webserver01150	10.0.1.5
webserver02	Running	webserver02125	10.0.1.6

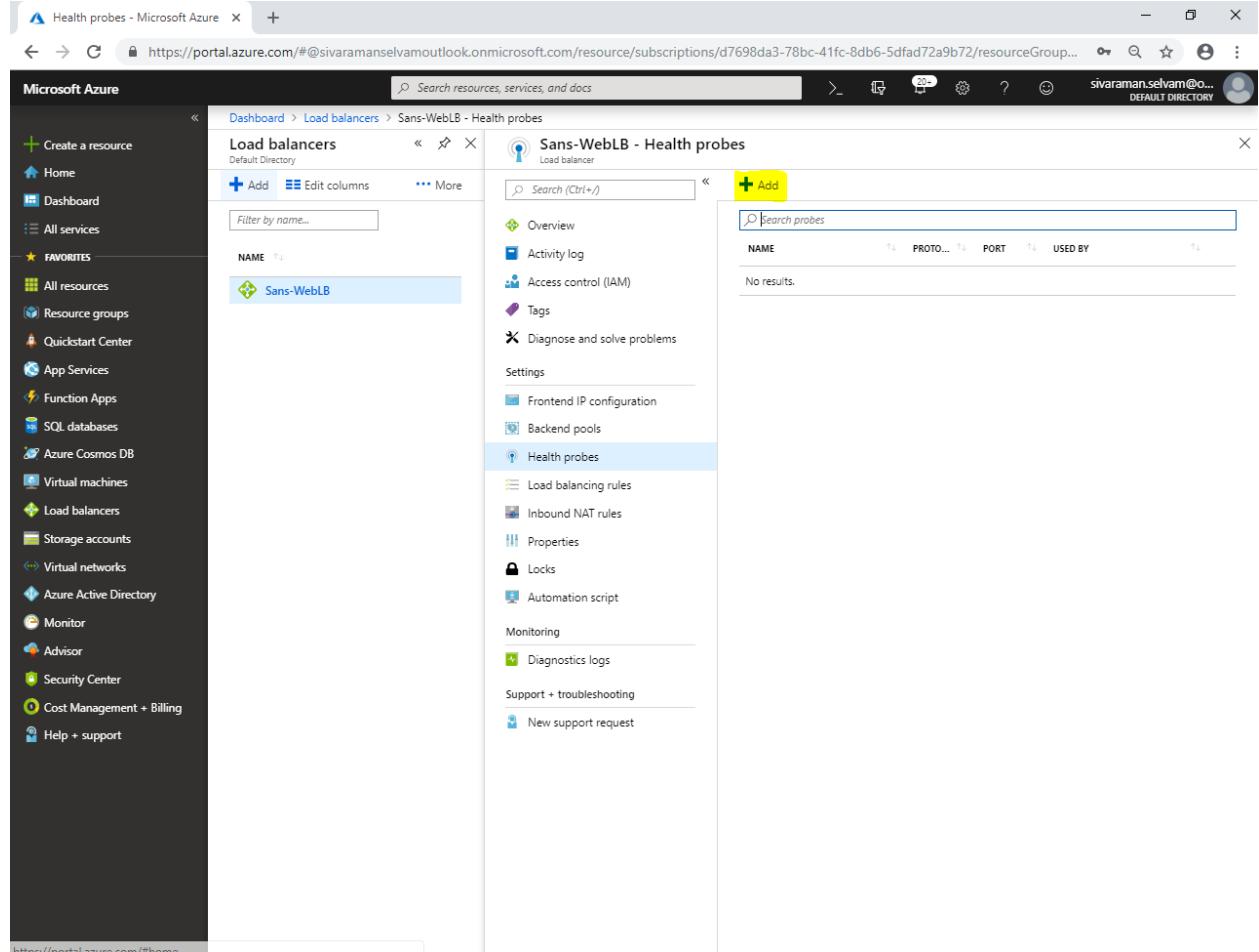
Click “**Health probes**”.



The screenshot shows the Microsoft Azure portal interface. On the left, the navigation sidebar lists various services like Home, Dashboard, All services, and Load balancers. The main content area shows the 'Load balancers' blade for a resource group named 'Sans-WebLB'. A specific load balancer named 'Sans-WebLB' is selected. The right side displays the 'Backend pools' blade for this load balancer. Under the 'Backend pools' section, there is a list of two virtual machines: 'webservice01' and 'webservice02', both marked as 'Running'. Below the list, a table provides details for each VM. On the far right, a sidebar offers links for Overview, Activity log, Access control (IAM), Tags, Diagnose and solve problems, Settings (with 'Backend pools' selected), Monitoring (with 'Diagnostics logs' selected), and Support + troubleshooting.

VIRTUAL MACHINE	VIRTUAL MA...	NETWORK INTERFACE	PRIVATE IP ADDRESS
webservice01	Running	webserver01150	10.0.1.5
webservice02	Running	webserver02125	10.0.1.6

Click “Add”.



The screenshot shows the Microsoft Azure portal interface. The left sidebar contains various service icons. The main navigation bar at the top includes 'Dashboard', 'Load balancers', and the current page 'Sans-WebLB - Health probes'. The main content area displays a list of health probes under the heading 'Sans-WebLB - Health probes'. A search bar and a 'Filter by name...' dropdown are present. On the right, there is a table with columns: NAME, PROTO..., PORT, and USED BY. A note says 'No results.' Below the table, there are several navigation links: Overview, Activity log, Access control (IAM), Tags, Diagnose and solve problems, Settings, Frontend IP configuration, Backend pools, Health probes (which is highlighted in blue), Load balancing rules, Inbound NAT rules, Properties, Locks, Automation script, Monitoring, and Diagnostics logs. At the bottom, there are support links: Support + troubleshooting and New support request. A large yellow box highlights the 'Add' button in the top right corner of the probe list.

While “Add health probe”,

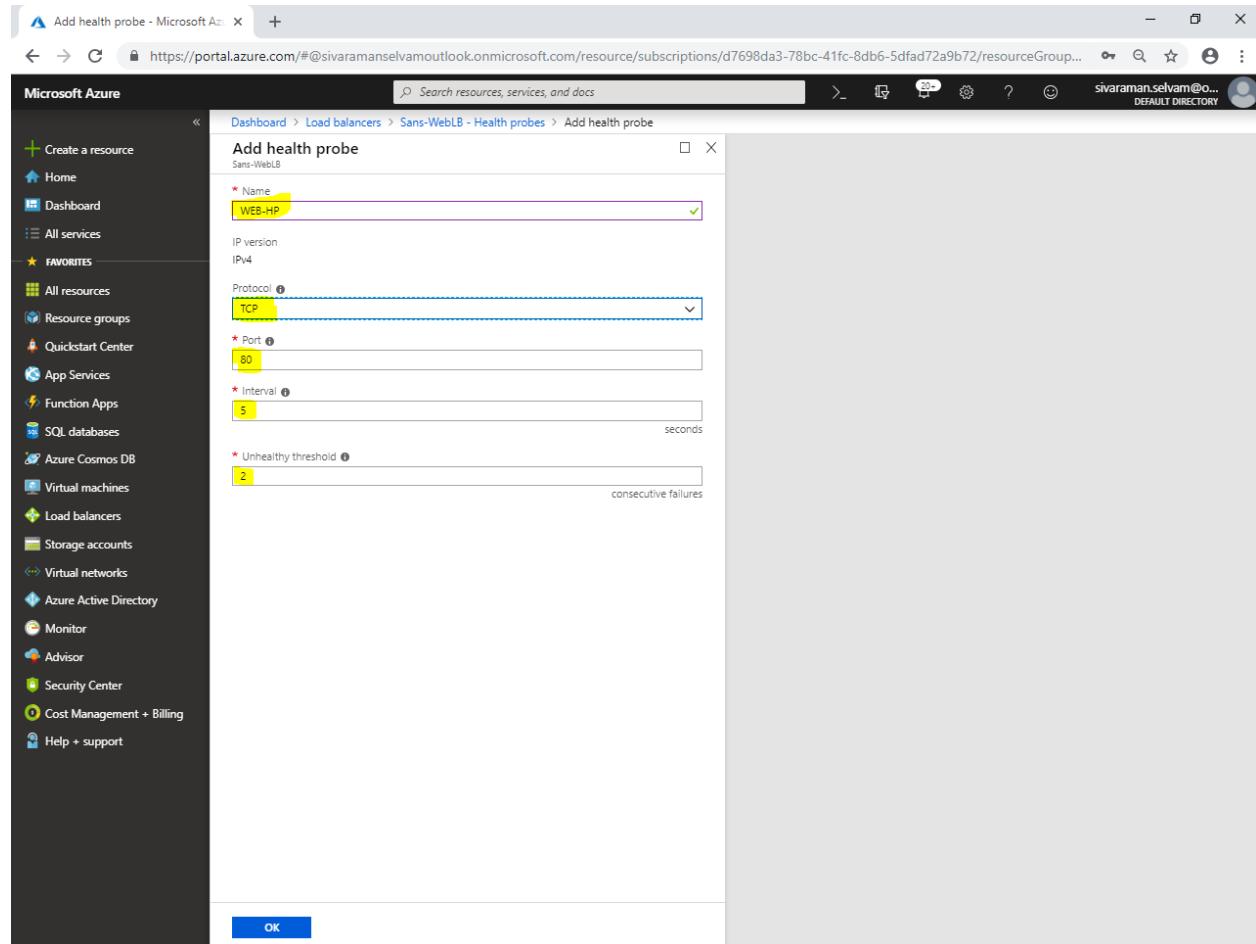
Type “Name” as “WEB-HP”.

Select “Protocol” as “TCP”.

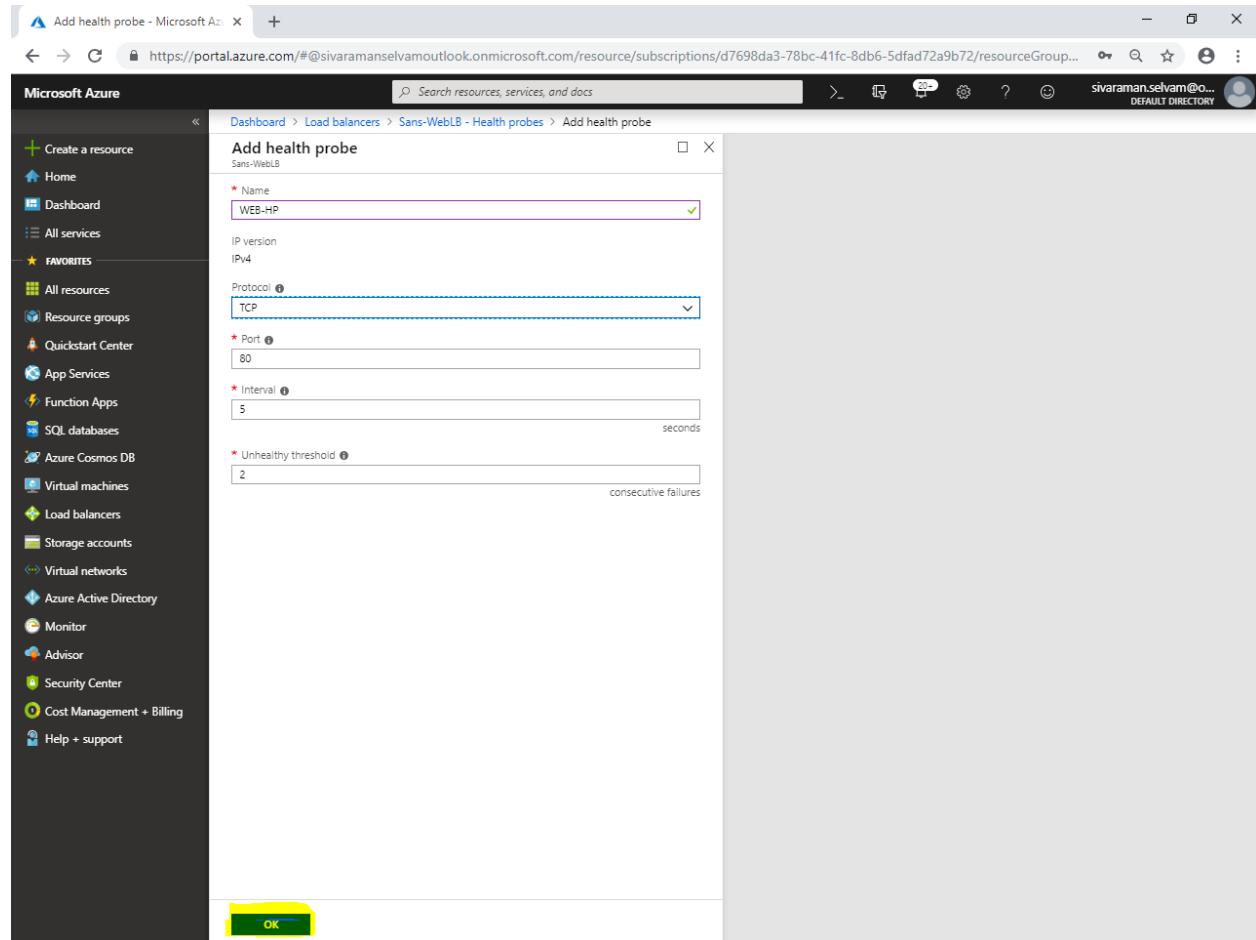
Select “Port” as “80”.

Type “Interval” as “5” seconds (for check status of virtual machine and 80 port).

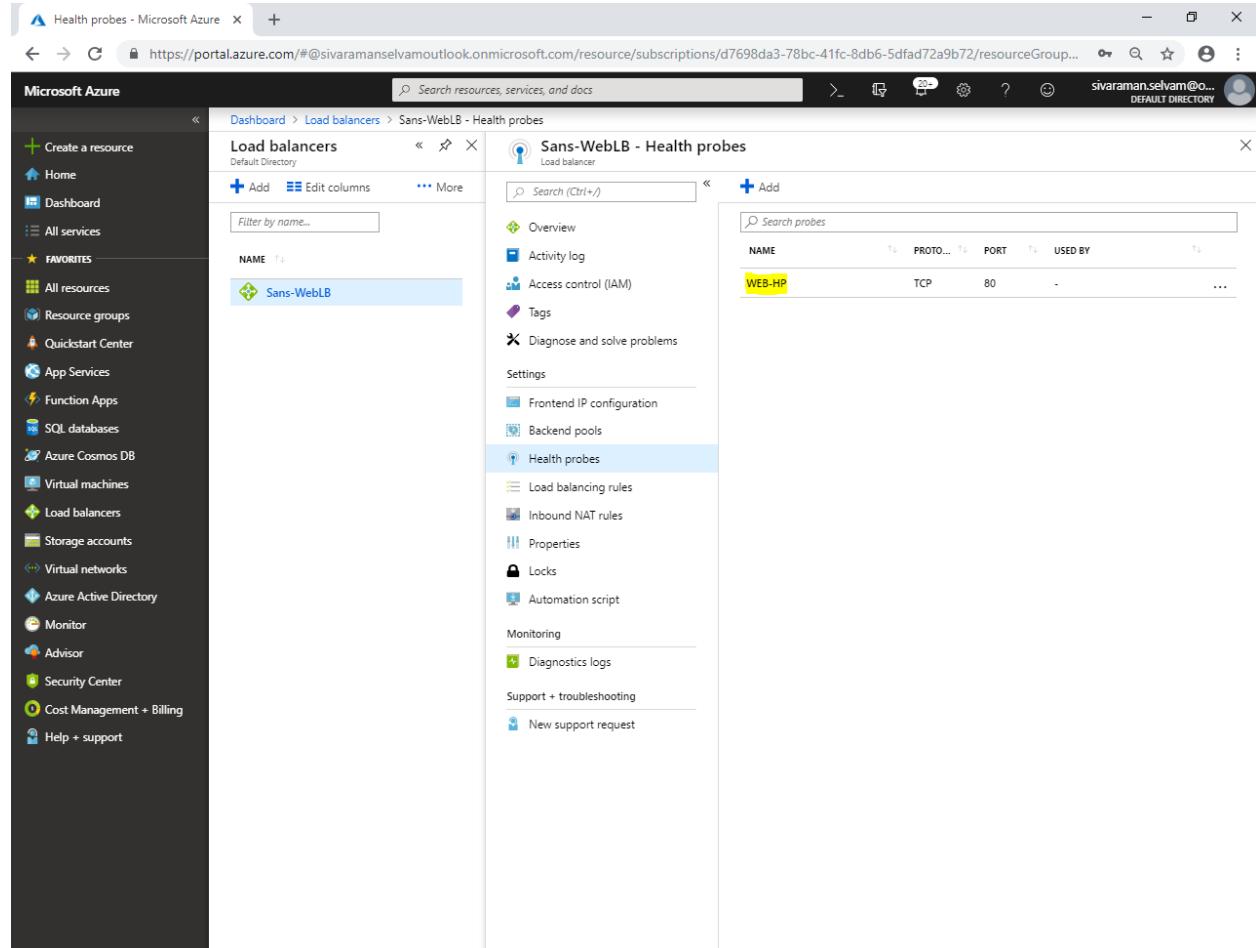
Type “Unhealthy threshold” as “2”.



Click "OK".

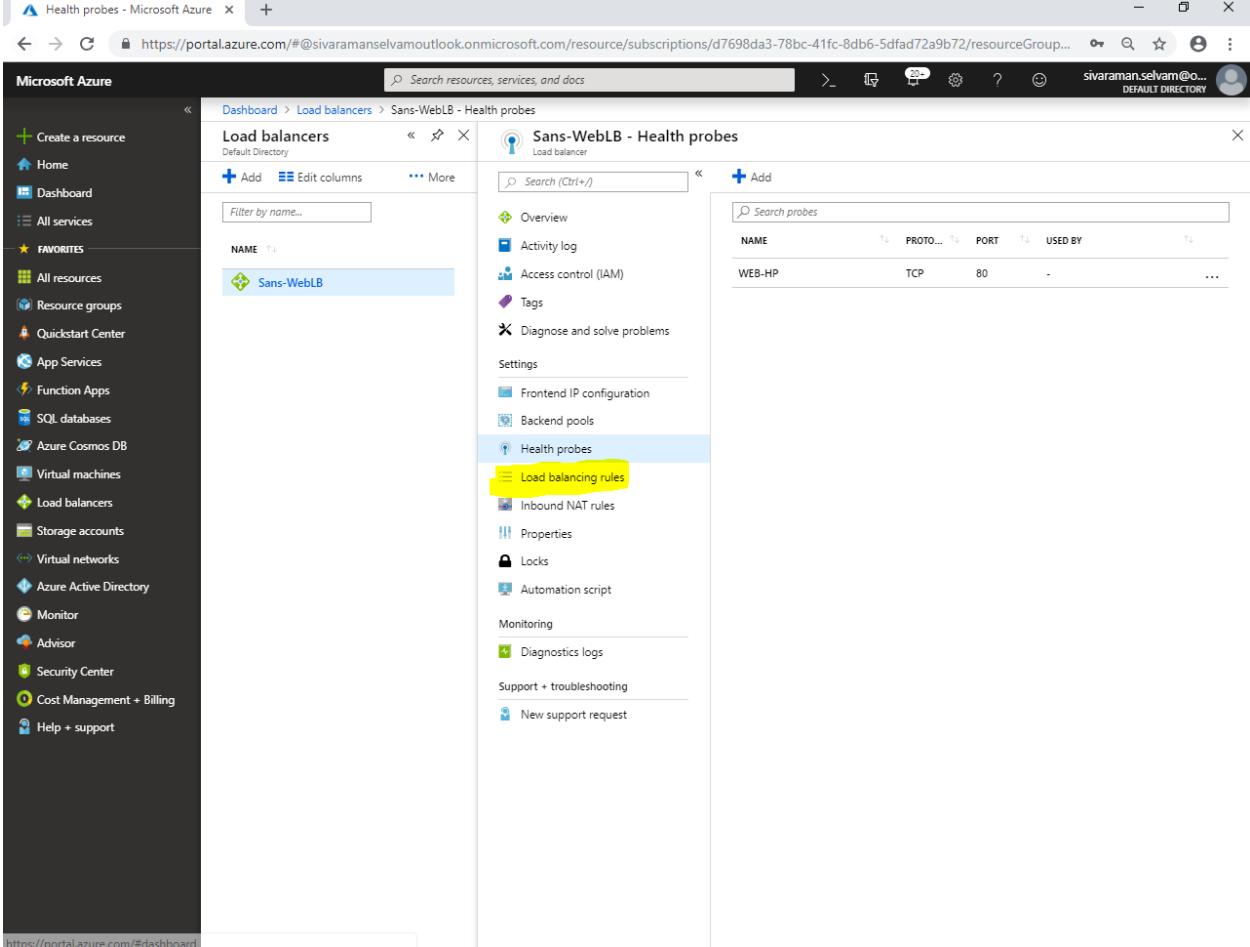


You have successfully created “WEB-HP” health probe.



The screenshot shows the Microsoft Azure portal interface. The left sidebar contains a list of services: Create a resource, Home, Dashboard, All services, Favorites, All resources, Resource groups, Quickstart Center, App Services, Function Apps, SQL databases, Azure Cosmos DB, Virtual machines, Load balancers, Storage accounts, Virtual networks, Azure Active Directory, Monitor, Advisor, Security Center, Cost Management + Billing, and Help + support. The main content area shows the 'Load balancers' section under 'Sans-WebLB - Health probes'. A table lists one probe: NAME: WEB-HP, PROTO.: TCP, PORT: 80, USED BY: -. The 'Health probes' option in the navigation menu is highlighted.

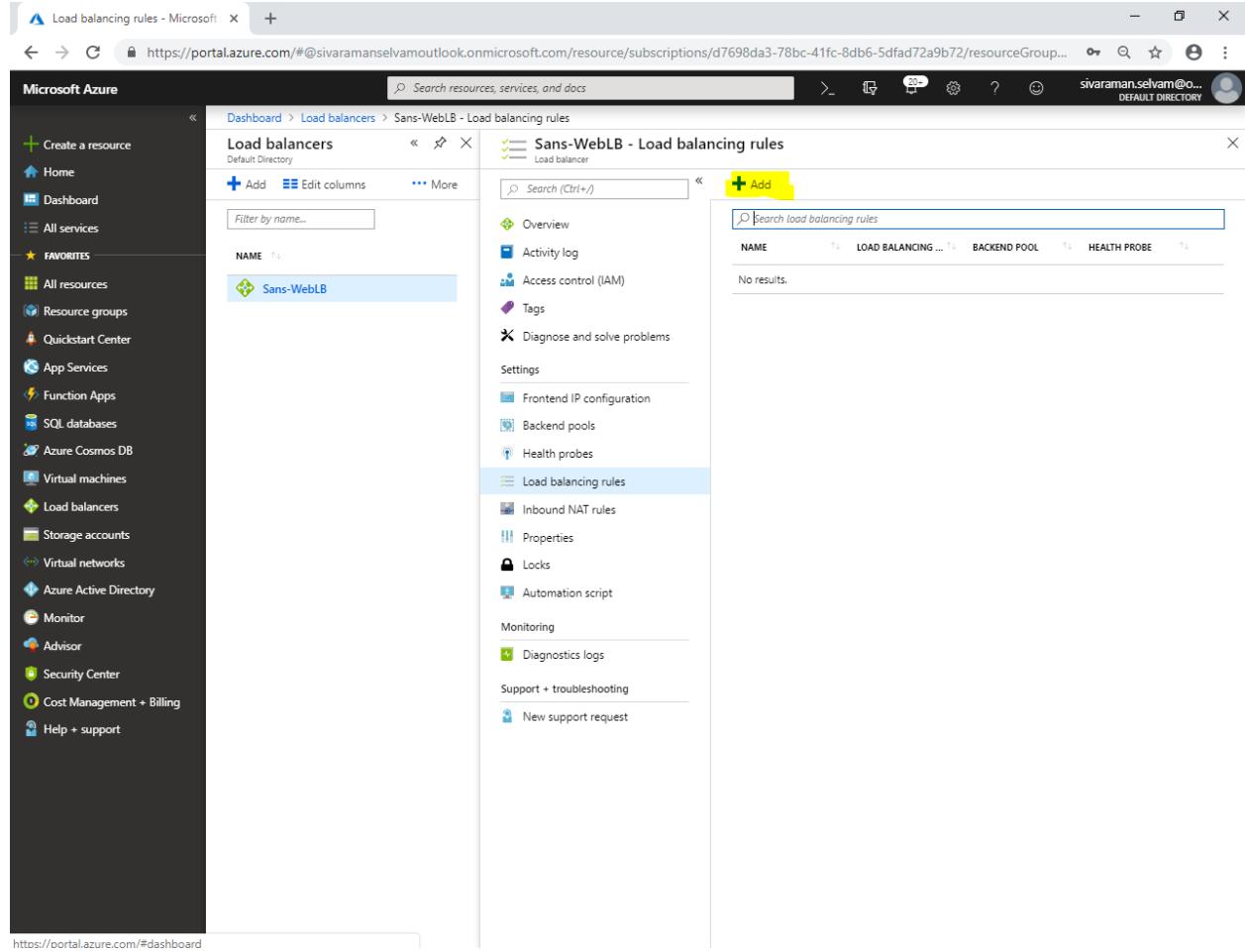
Click “Load balancing rules”.



The screenshot shows the Microsoft Azure portal interface. On the left, the navigation menu is visible with various service icons. The main content area displays the 'Load balancers' page for a resource group named 'Sans-WebLB - Health probes'. The 'Health probes' section is currently selected. Under 'Health probes', the 'Load balancing rules' option is highlighted with a yellow box. To the right, there is a table showing a single probe entry: 'WEB-HP' with TCP port 80. The URL of the page is https://portal.azure.com/#@sivaramanselvamoutlook.onmicrosoft.com/resource/subscriptions/d7698da3-78bc-41fc-8db6-5dfad72a9b72/resourceGroup...

In “Load balancing rules”,

Click “Add”.



The screenshot shows the Microsoft Azure portal interface for managing load balancers. The left sidebar contains a list of services, including Load balancers, which is currently selected. The main content area shows a list of existing load balancers under the heading "Sans-WebLB - Load balancing rules". A prominent yellow box highlights the blue "+ Add" button located at the top right of this list. To the right of the list, there is a search bar labeled "Search load balancing rules" and a table header with columns for NAME, LOAD BALANCING..., BACKEND POOL, and HEALTH PROBE. Below the table, it says "No results."

While “Add load balancing rule”,

Type “Name” as “LB-Rule”.

Ensure IP version as “IPV4”.

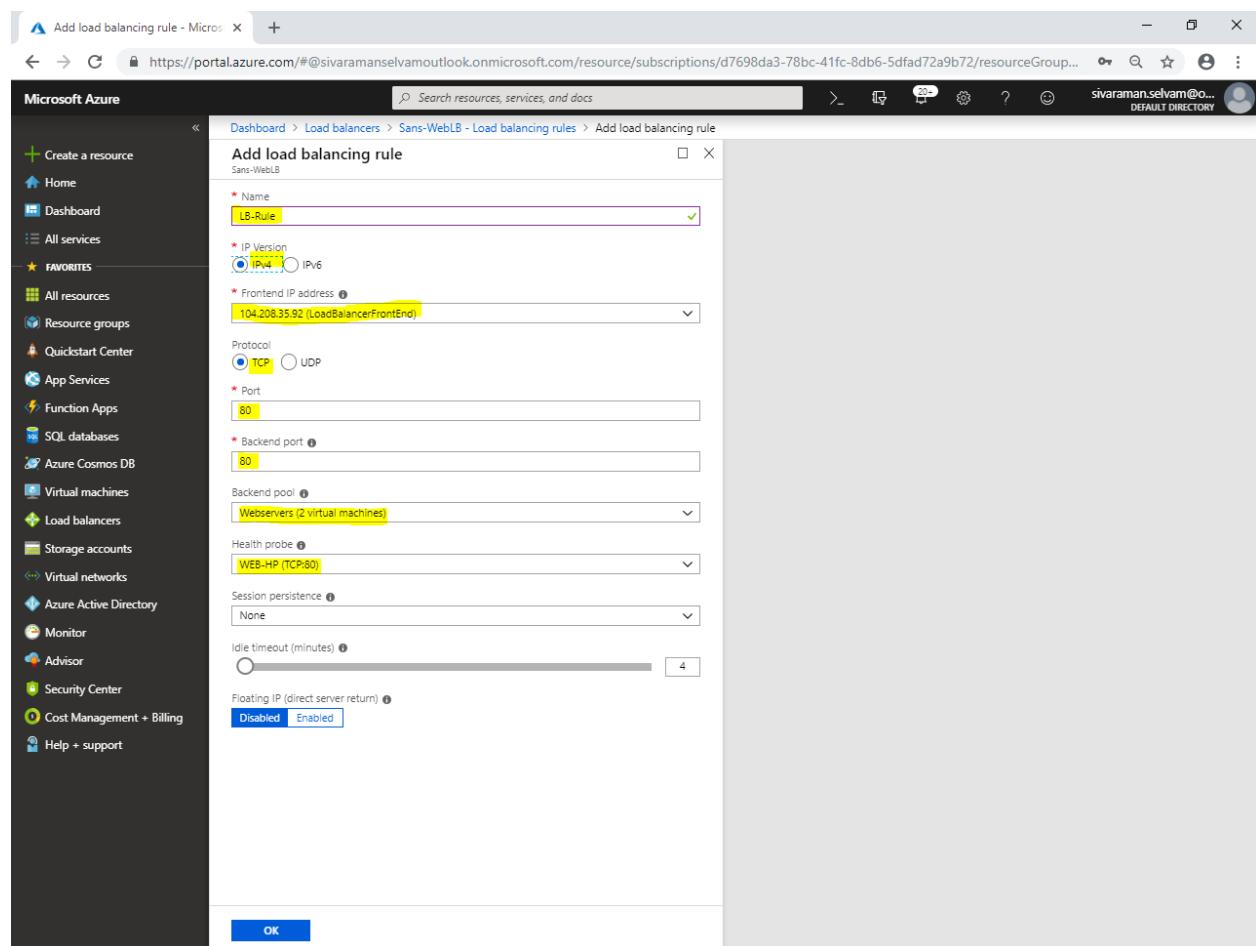
Ensure “FrontEnd IP address” is selected with IP address.

Set “Protocol” as “TCP”.

Ensure “Port” as “80” and “Backend port” as “80”.

Ensure “Backendpool” as “Webservers”.

Ensure “Health probe” as “WEB-HP”.

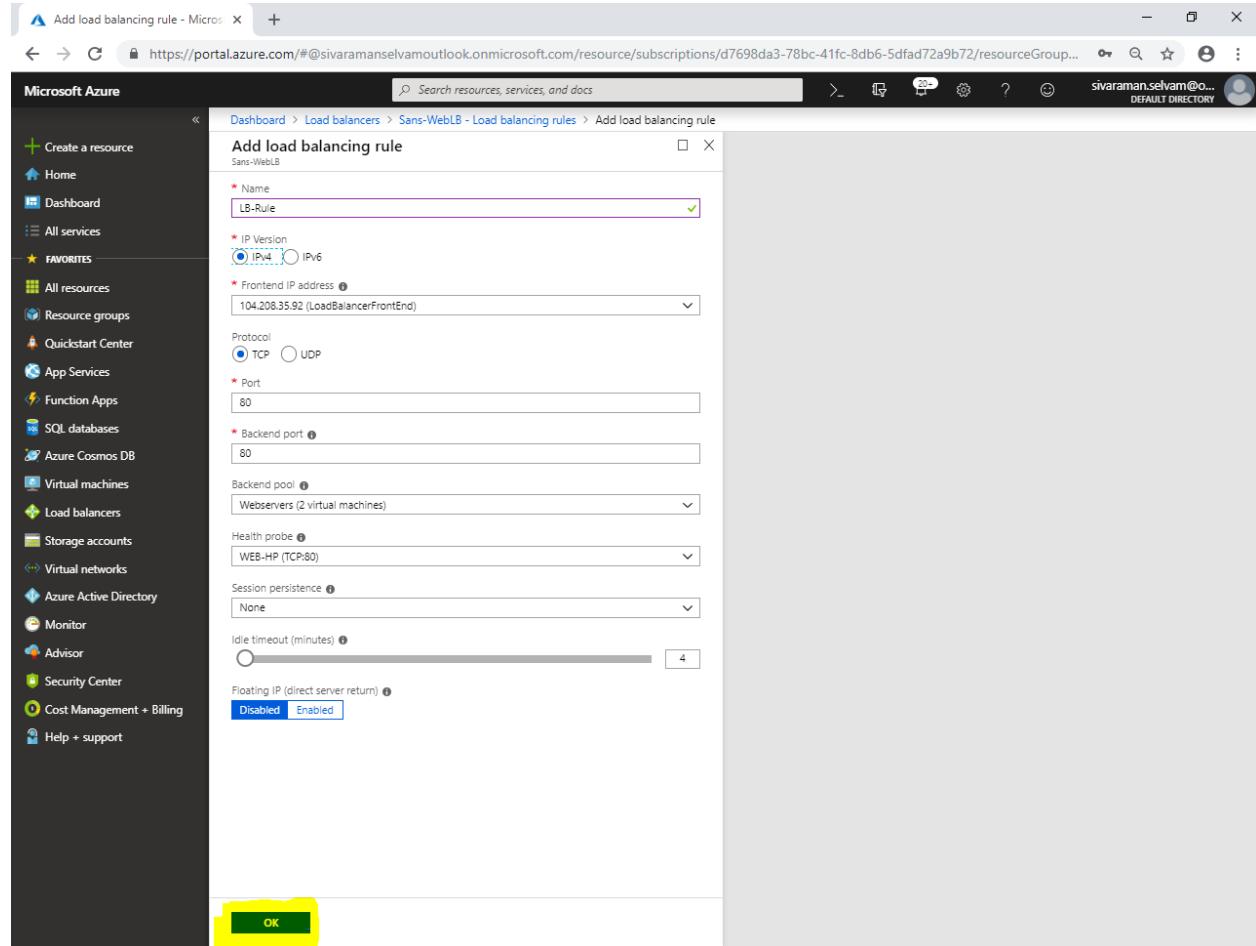


The screenshot shows the Microsoft Azure portal interface for adding a load balancing rule. The left sidebar contains various service icons like Home, Dashboard, All services, and Load balancers. The main content area is titled "Add load balancing rule" under "Sans-WebLB". The configuration fields are as follows:

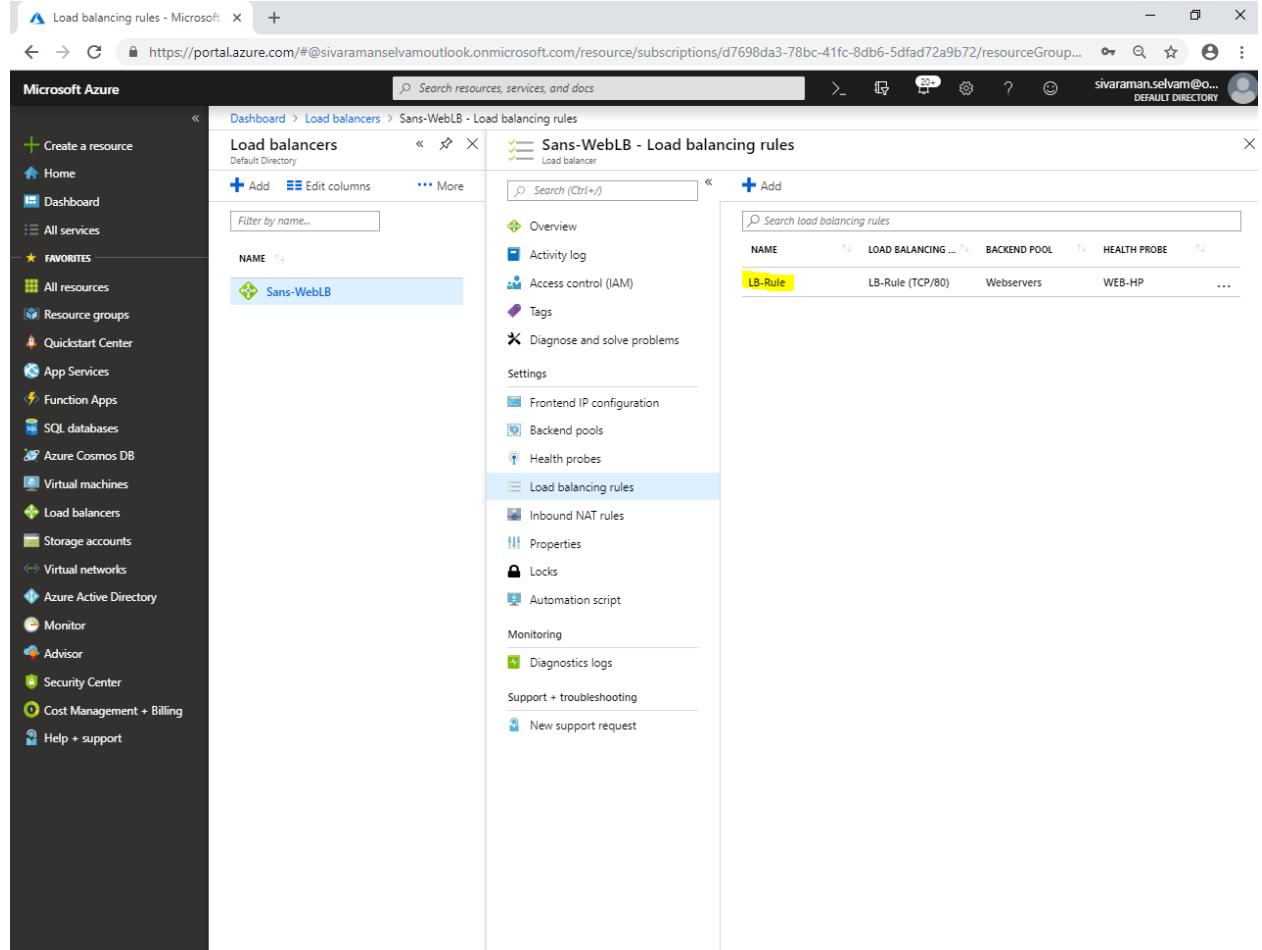
- Name:** LB-Rule
- IP Version:** IPv4
- Frontend IP address:** 104.208.35.92 (LoadBalancerFrontEnd)
- Protocol:** TCP
- Port:** 80
- Backend port:** 80
- Backend pool:** Webservers (2 virtual machines)
- Health probe:** WEB-HP (TCP:80)
- Session persistence:** None
- Idle timeout (minutes):** 4
- Floating IP (direct server return):** Disabled

At the bottom right is a blue "OK" button.

Click "OK".



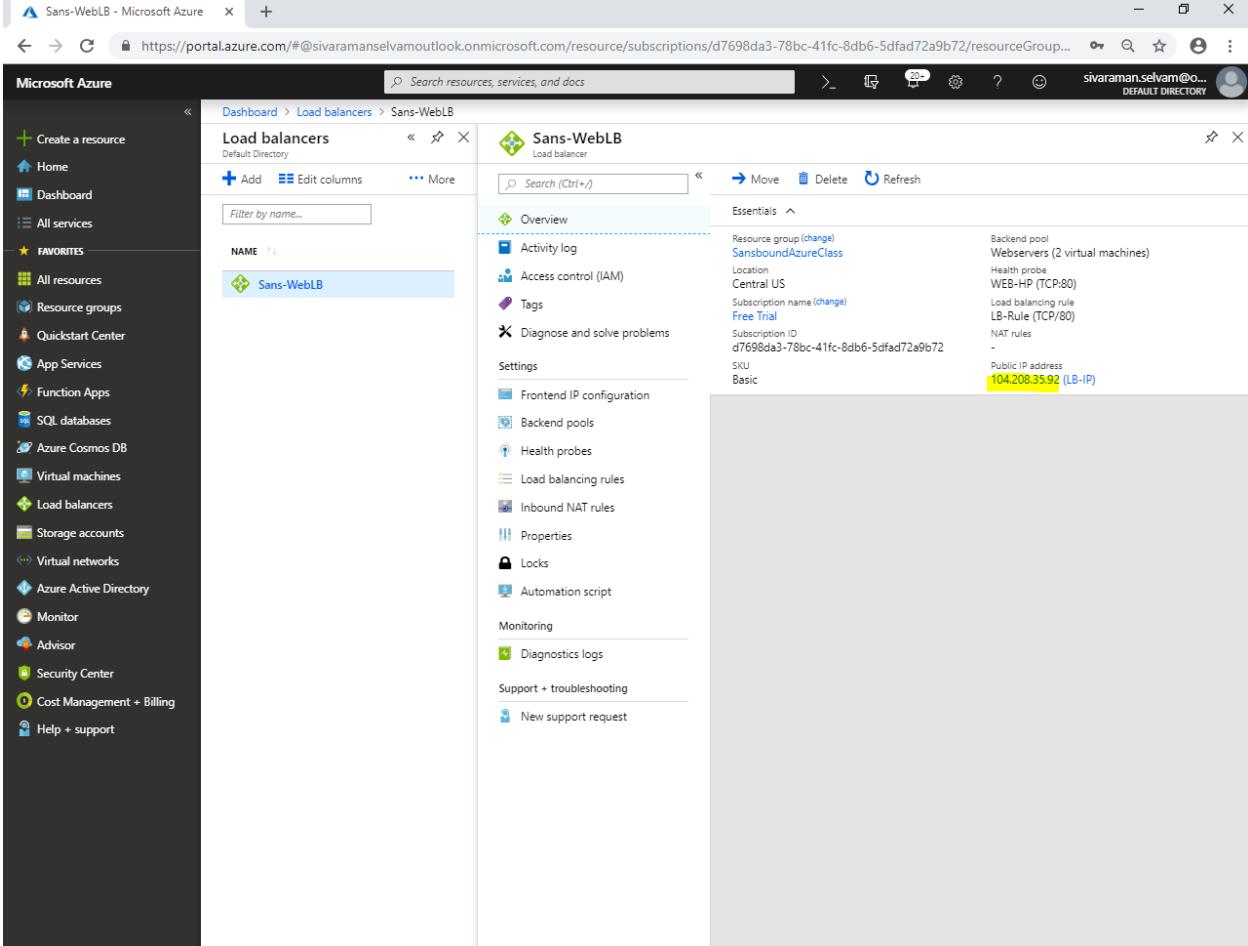
You are able to see the “LBRule”.



The screenshot shows the Microsoft Azure portal interface. The left sidebar contains a navigation menu with various services like Home, Dashboard, All services, and Load balancers. The main content area is titled 'Load balancers' and shows a list of load balancers, with 'Sans-WebLB' selected. On the right, under the 'Load balancing rules' section, there is a table with the following data:

NAME	LOAD BALANCING	BACKEND POOL	HEALTH PROBE
LB-Rule	LB-Rule (TCP/80)	Webservers	WEB-HP

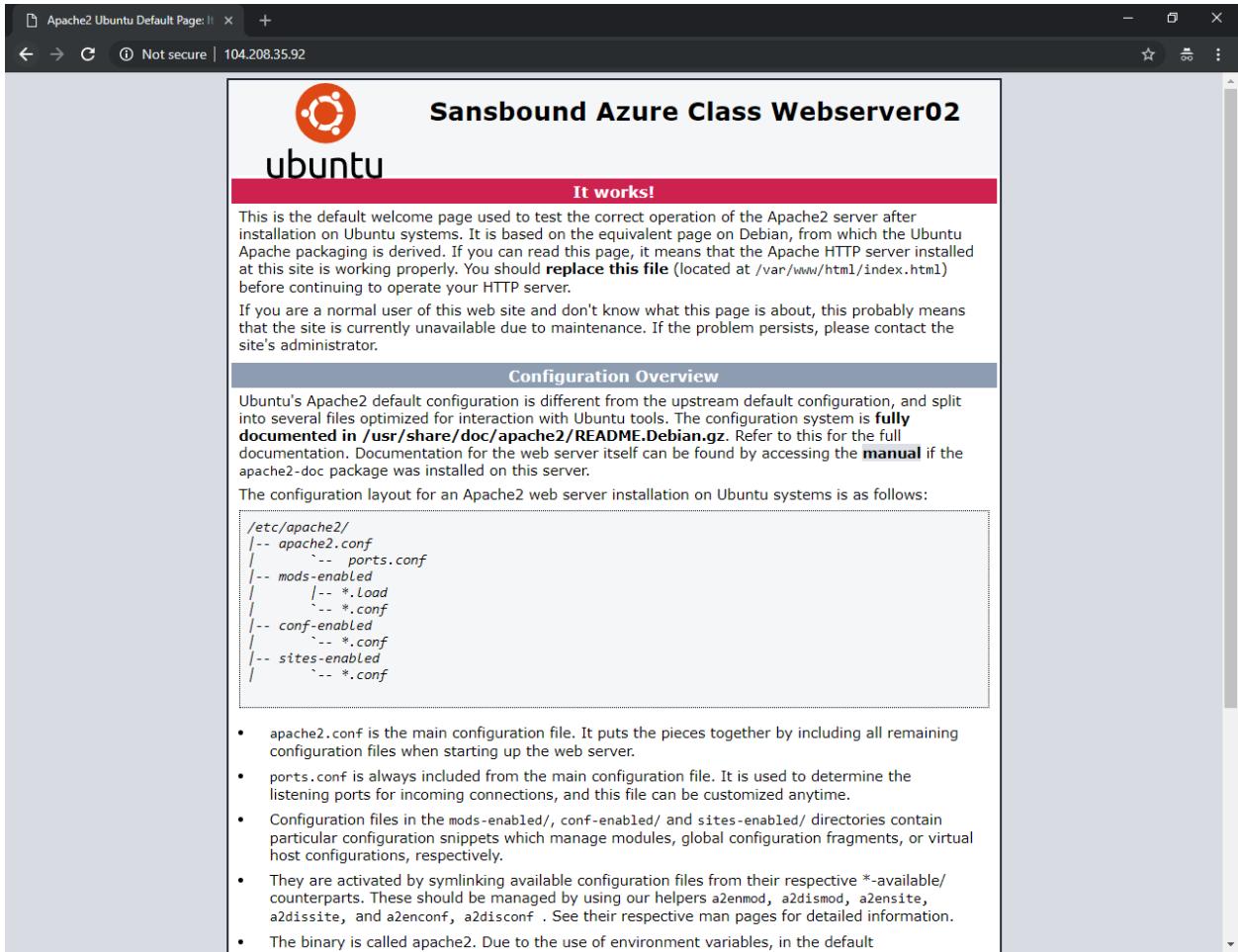
In “**Sans-WebLB**”, kindly note the Public IP address.



The screenshot shows the Microsoft Azure portal interface. The left sidebar navigation bar includes options like Create a resource, Home, Dashboard, All services, Favorites, All resources, Resource groups, Quickstart Center, App Services, Function Apps, SQL databases, Azure Cosmos DB, Virtual machines, Load balancers, Storage accounts, Virtual networks, Azure Active Directory, Monitor, Advisor, Security Center, Cost Management + Billing, and Help + support. The main content area displays the 'Load balancers' section under 'Dashboard > Load balancers > Sans-WebLB'. The 'Sans-WebLB' load balancer is selected. The 'Overview' tab is active, showing details such as Resource group (change) SansboundAzureClass, Location Central US, Subscription name (change) Free Trial, Subscription ID d7698da3-78bc-41fc-8db6-5dfad72a9b72, SKU Basic, Backend pool Webservers (2 virtual machines), Health probe WEB-HP (TCP:80), Load balancing rule LB-Rule (TCP/80), NAT rules -, and Public IP address 104.208.35.92 (LB-IP). The 'Public IP address' field is highlighted with a yellow box.

From your local machine, paste the public IP in browser and press “**Enter**”.

I have got the webserver02 page successfully.



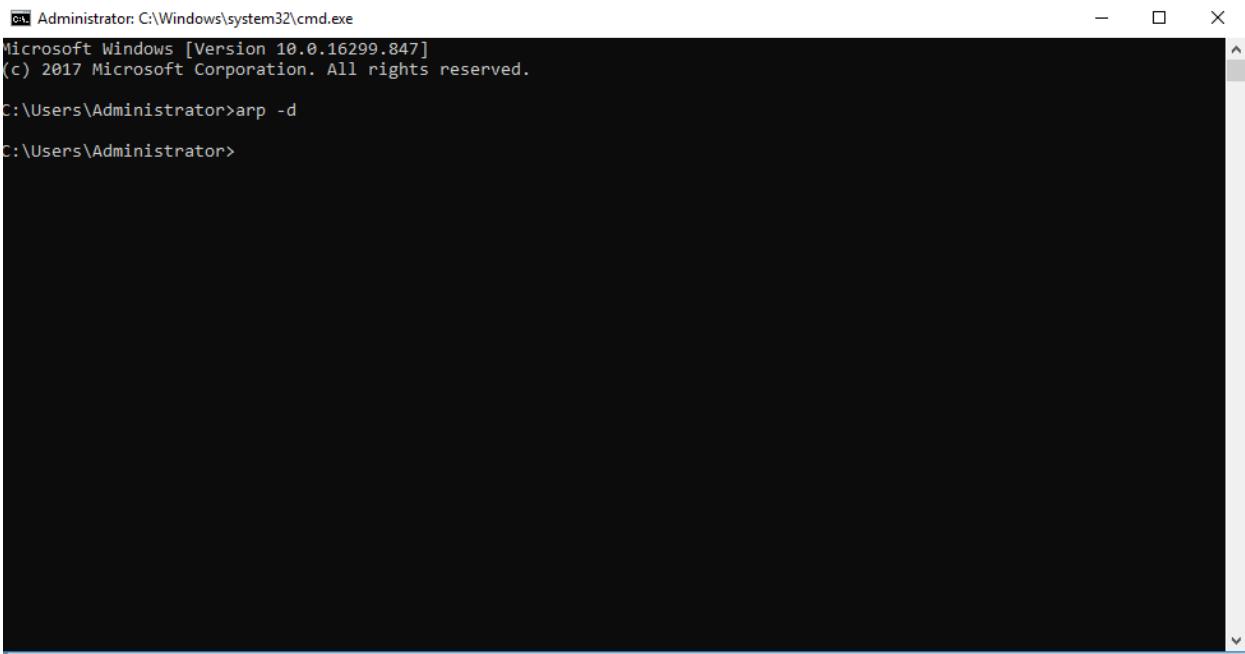
The screenshot shows a web browser window displaying the Apache2 Ubuntu Default Page. The URL in the address bar is 104.208.35.92. The page title is "Sansbound Azure Class Webserver02". The content includes:

- Ubuntu Logo:** A red circle with a white outline and a white icon inside.
- Title:** Sansbound Azure Class Webserver02
- Section:** It works!
- Text:** This is the default welcome page used to test the correct operation of the Apache2 server after installation on Ubuntu systems. It is based on the equivalent page on Debian, from which the Ubuntu Apache packaging is derived. If you can read this page, it means that the Apache HTTP server installed at this site is working properly. You should **replace this file** (located at `/var/www/html/index.html`) before continuing to operate your HTTP server.
- Text:** If you are a normal user of this web site and don't know what this page is about, this probably means that the site is currently unavailable due to maintenance. If the problem persists, please contact the site's administrator.
- Section:** Configuration Overview
- Text:** Ubuntu's Apache2 default configuration is different from the upstream default configuration, and split into several files optimized for interaction with Ubuntu tools. The configuration system is **fully documented in `/usr/share/doc/apache2/README.Debian.gz`**. Refer to this for the full documentation. Documentation for the web server itself can be found by accessing the **manual** if the `apache2-doc` package was installed on this server.
- Text:** The configuration layout for an Apache2 web server installation on Ubuntu systems is as follows:
- File Tree:**

```
/etc/apache2/
|-- apache2.conf
|   '-- ports.conf
|-- mods-enabled
|   '-- *.Load
|   '-- *.conf
|-- conf-enabled
|   '-- *.conf
|-- sites-enabled
|   '-- *.conf
```
- List:**
  - `apache2.conf` is the main configuration file. It puts the pieces together by including all remaining configuration files when starting up the web server.
  - `ports.conf` is always included from the main configuration file. It is used to determine the listening ports for incoming connections, and this file can be customized anytime.
  - Configuration files in the `mods-enabled/`, `conf-enabled/` and `sites-enabled/` directories contain particular configuration snippets which manage modules, global configuration fragments, or virtual host configurations, respectively.
  - They are activated by symlinking available configuration files from their respective `*-available/` counterparts. These should be managed by using our helpers `a2enmod`, `a2dismod`, `a2ensite`, `a2dissite`, and `a2enconf`, `a2disconf`. See their respective man pages for detailed information.
  - The binary is called `apache2`. Due to the use of environment variables, in the default

In Command prompt,

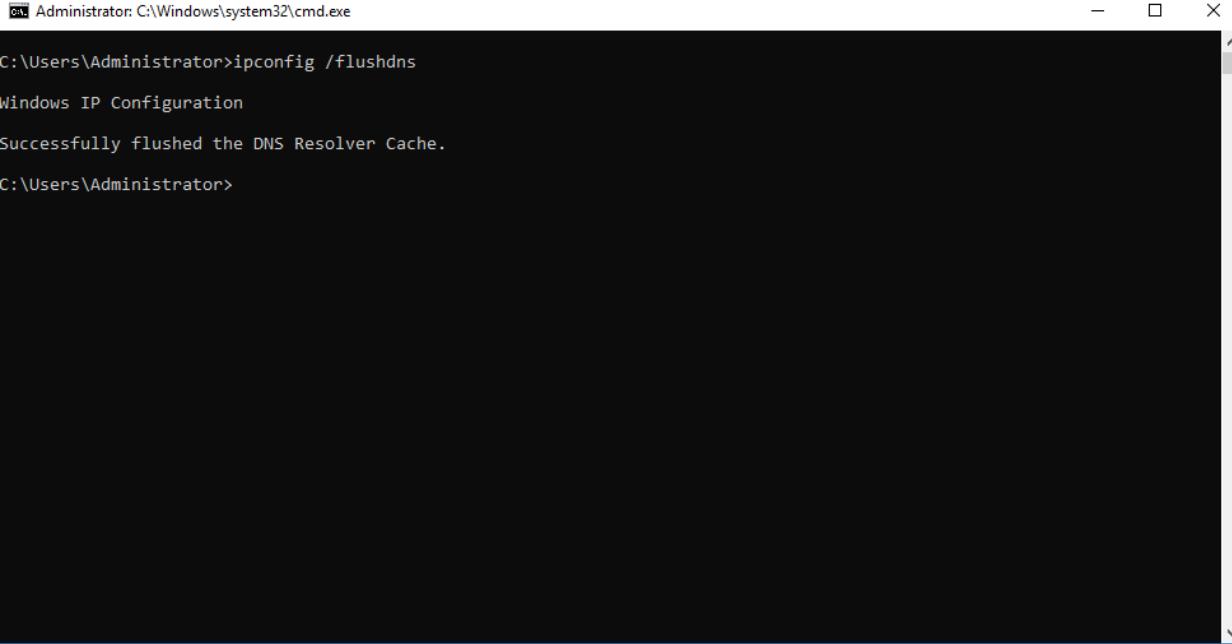
Type “**arp -d**” and press “**Enter**”.



```
Administrator: C:\Windows\system32\cmd.exe
Microsoft Windows [Version 10.0.16299.847]
(c) 2017 Microsoft Corporation. All rights reserved.

C:\Users\Administrator>arp -d
C:\Users\Administrator>
```

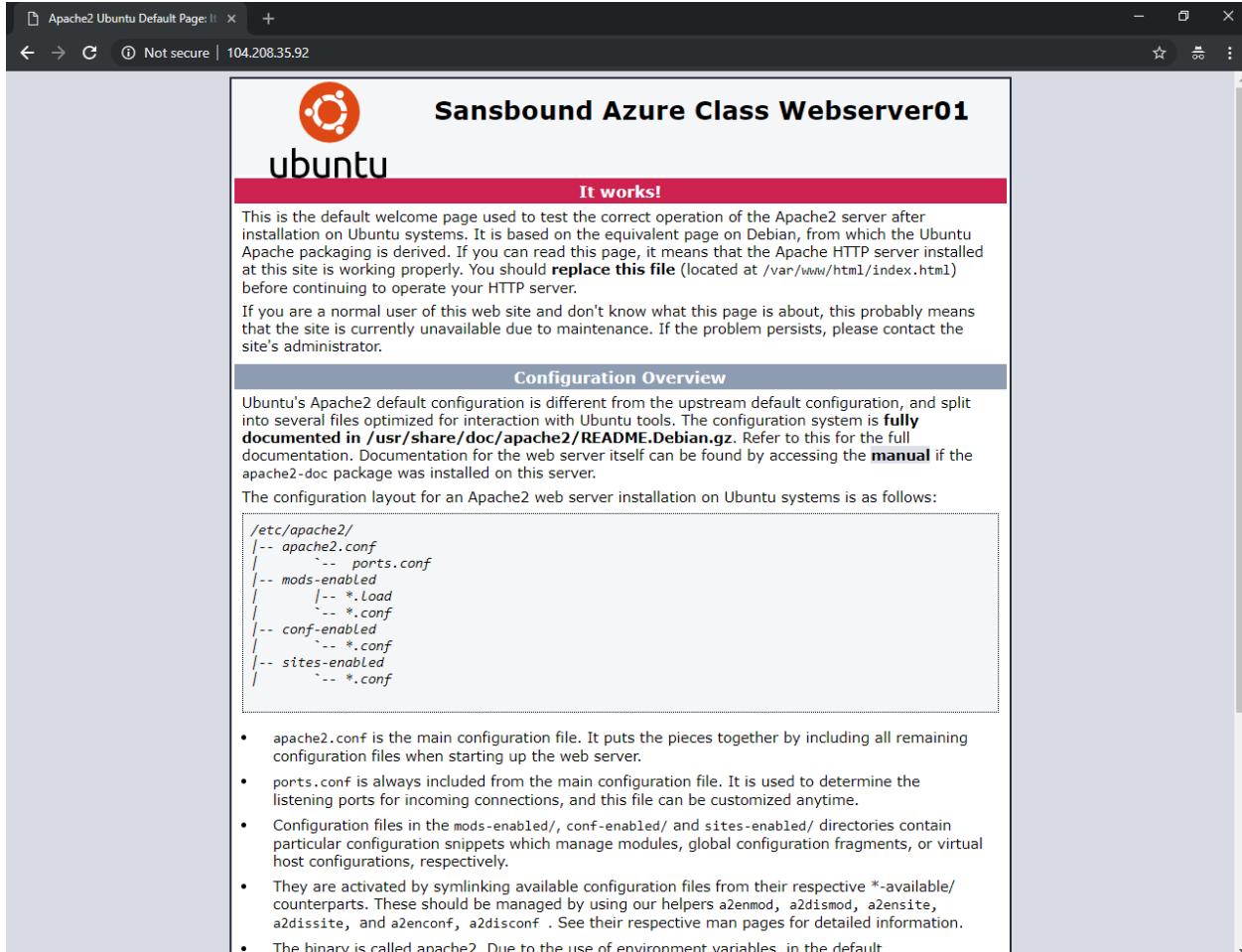
Type “**ipconfig /flushdns**”.



```
Administrator: C:\Windows\system32\cmd.exe
C:\Users\Administrator>ipconfig /flushdns
Windows IP Configuration
Successfully flushed the DNS Resolver Cache.
C:\Users\Administrator>
```

Click “Refresh” button in “web browser”.

After some try you will get webserver01 page.



**Note: You have successfully configured availability set with Load balancer and web traffic has been load balanced successfully.**