



## SECURITY+ V4 LAB SERIES

### Lab 12: Setting Up a Load Balancer

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Material in this Lab Aligns to the Following	
CompTIA Security+ (SY0-601) Exam Objectives	2.5: Given a scenario, implement cybersecurity resilience
All-In-One CompTIA Security+ Sixth Edition ISBN-13: 978-1260464009 Chapters	13: Cybersecurity Resilience

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## Introduction

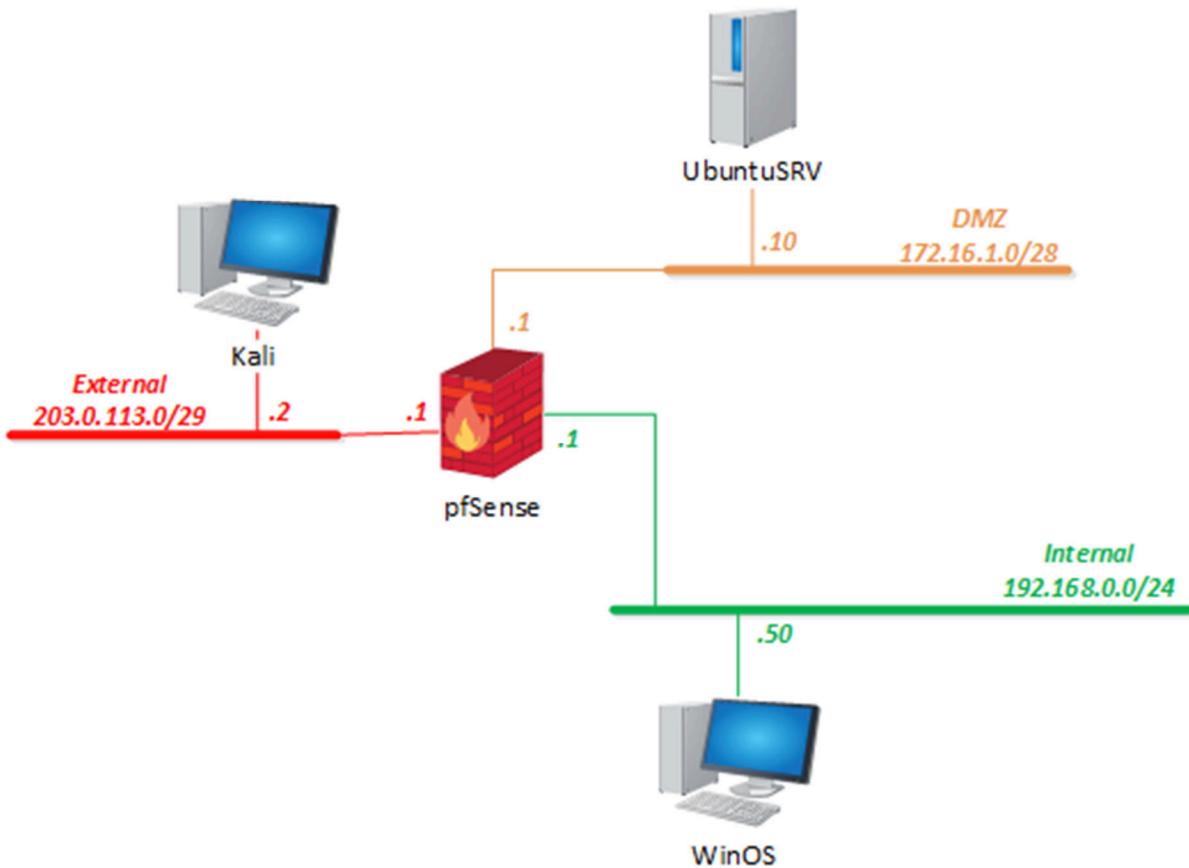
Load balancing will spread the stress from one server to multiple servers. Failover plays a big part in a continuity plan. When a server fails, we still want the business to continue to provide service to its customers. This is where failover kicks in. It detects the status on the production server and takes over when failure is detected.

## Objective

In this lab, you will perform the following tasks:

- Set up and test a load balancer
- Set up and test failover

## Lab Topology



## Lab Settings

The information in the table below will be needed in order to complete the lab. The task sections below provide details on the use of this information.

Virtual Machine	IP Address	Account (if needed)	Password (if needed)
Kali	203.0.113.2	kali	kali
pfSense	192.168.0.1	sysadmin	NDGLabpass123!
UbuntuSRV	172.16.1.10	sysadmin	NDGLabpass123!
WinOS	192.168.0.50	Administrator	NDGLabpass123!

## 1 Set Up the Web Servers

### 1.1 Set Up the Web Server on Windows

In this section, you will set up the load balance on the pfSense firewall. If the company is hosting a website, it is a good practice to load balance the traffic onto different servers, so no single server is getting overloaded.

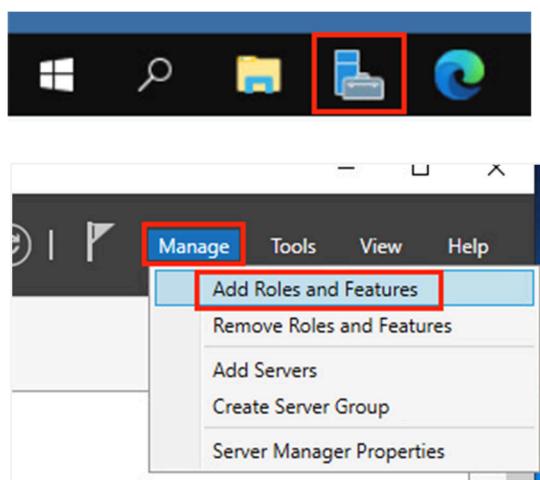
1. Click on the **WinOS** tab to access the *WinOS*.



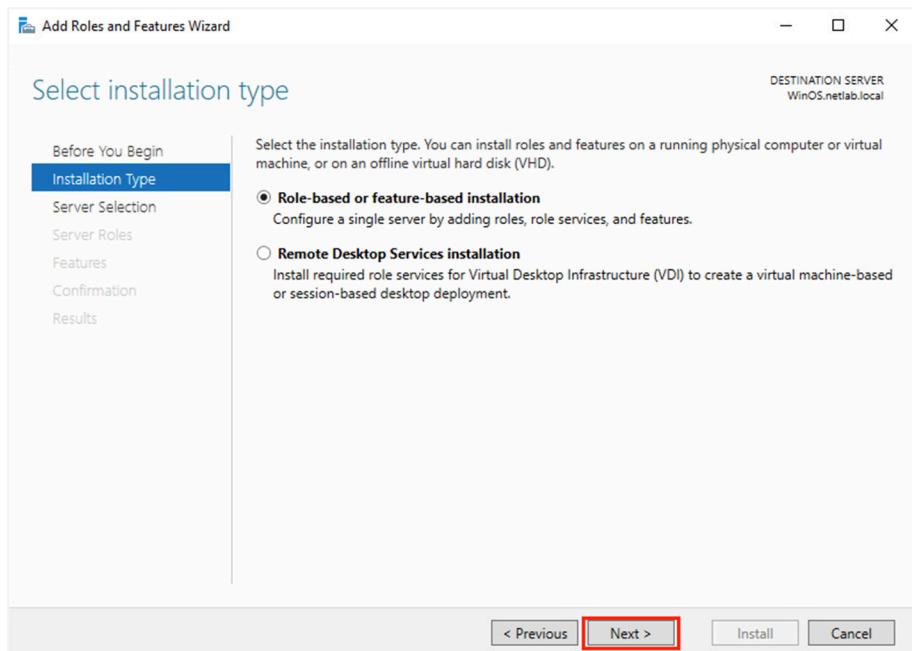
2. Click the dropdown menu, to send **Ctrl+Alt+Delete**. Then, log in to the Client PC as username **administrator**, password **NDGLabpass123!**.



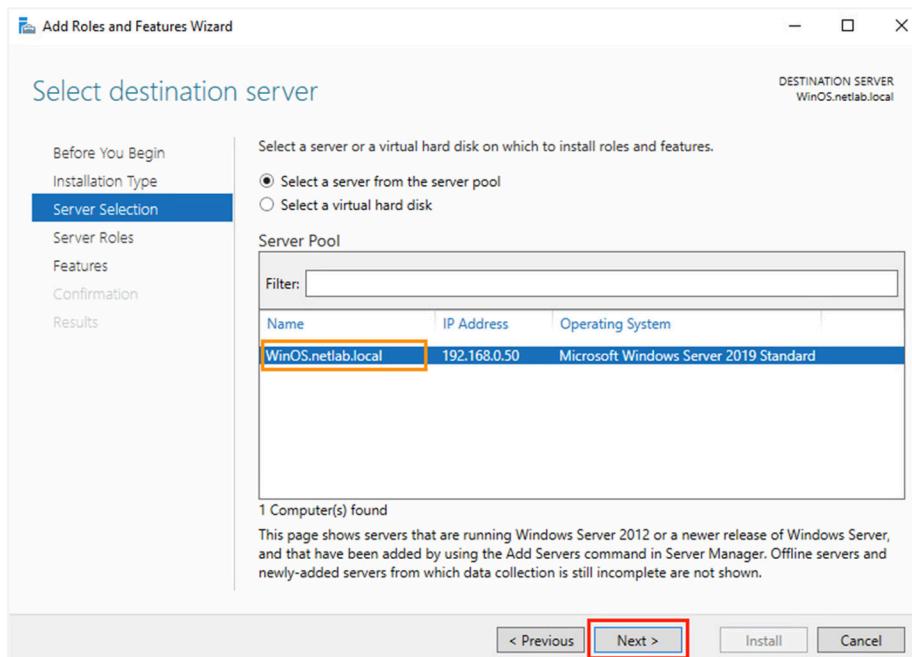
3. Once logged in, click the **Server Manager** icon to launch it. In the *Server Manager* window, click the **Manage** button, then select **Add Roles and Features**. We will add the IIS Role to the server.



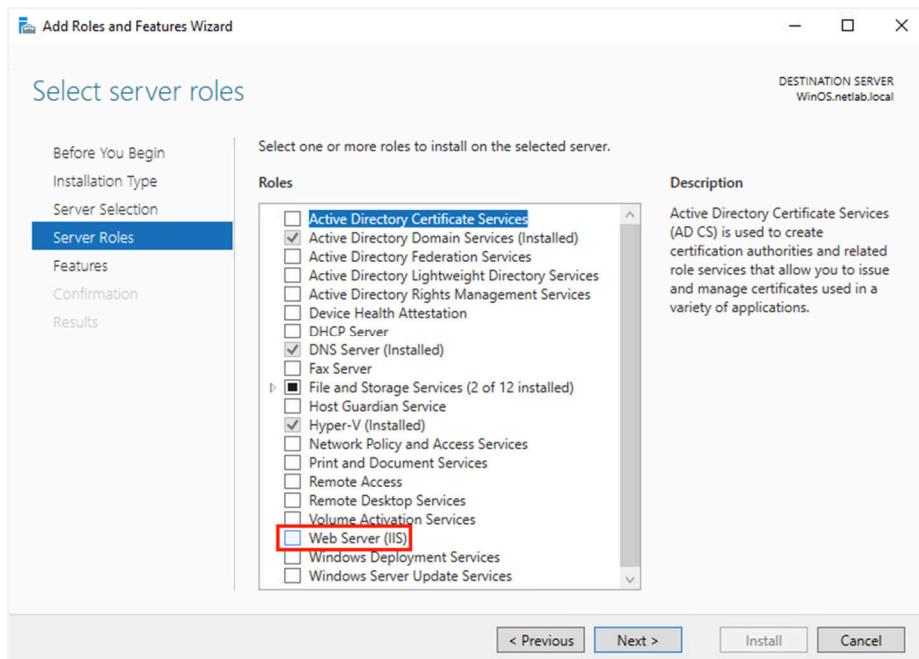
4. On the first *Select installation type* page, click **Next**.



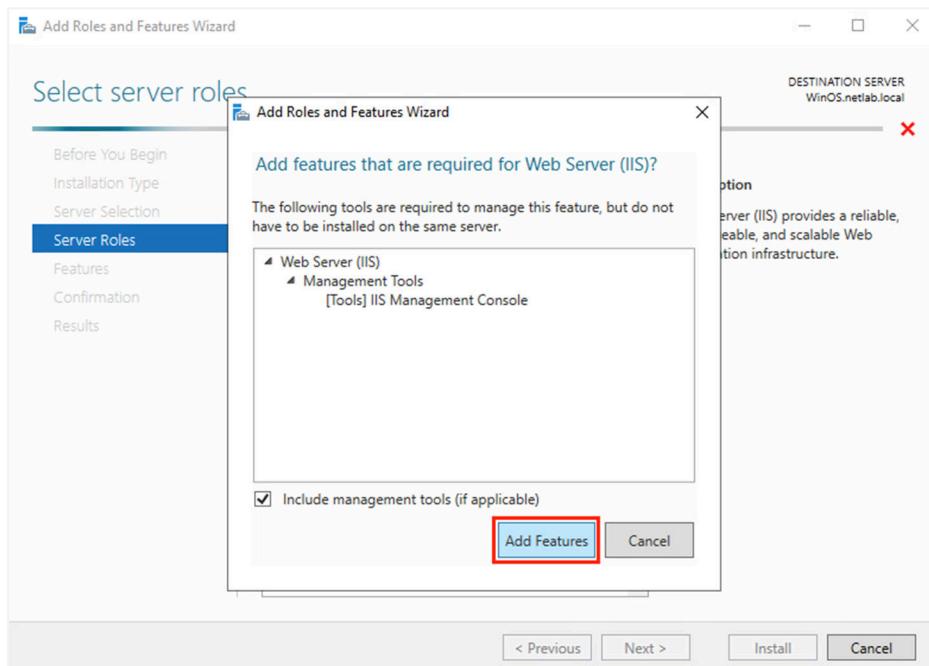
5. Make sure *WinOS.netlab.local* is selected, click **Next**.



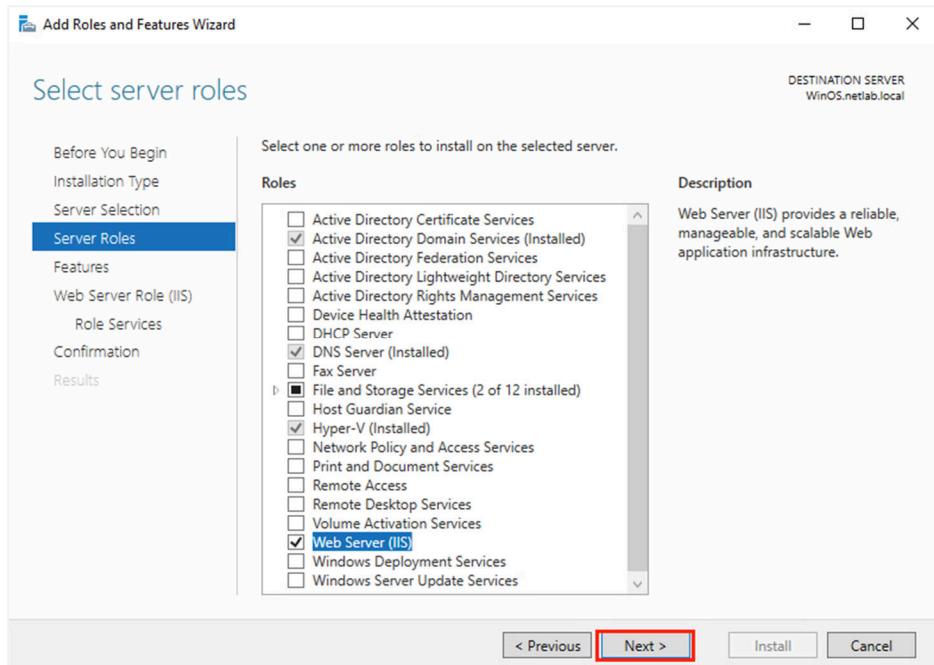
6. At the *Select server roles* step, check to select **Web Server (IIS)**.



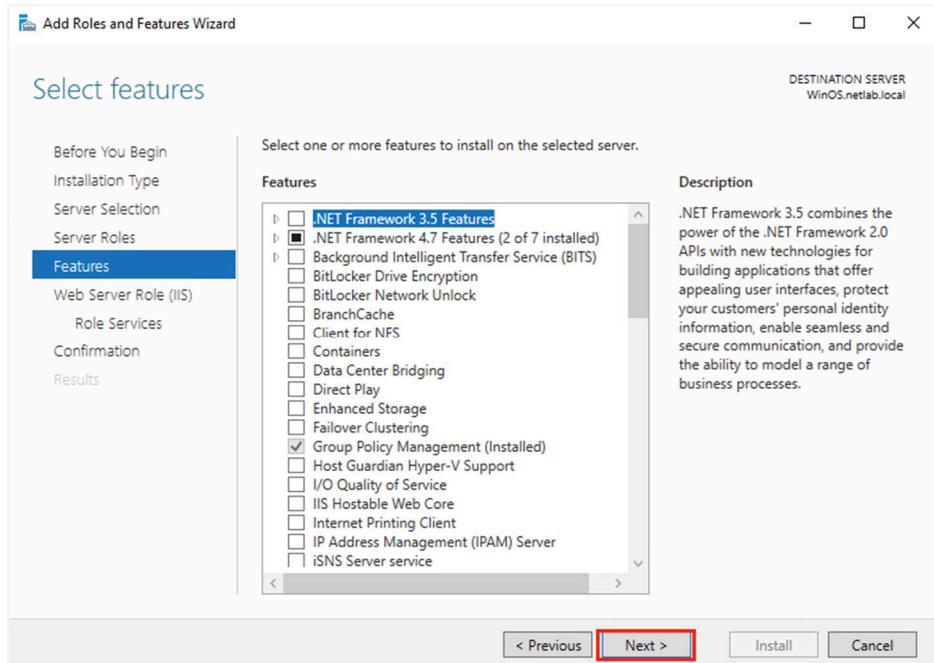
7. In the pop-up window, leave the default settings and click the **Add Features** button.



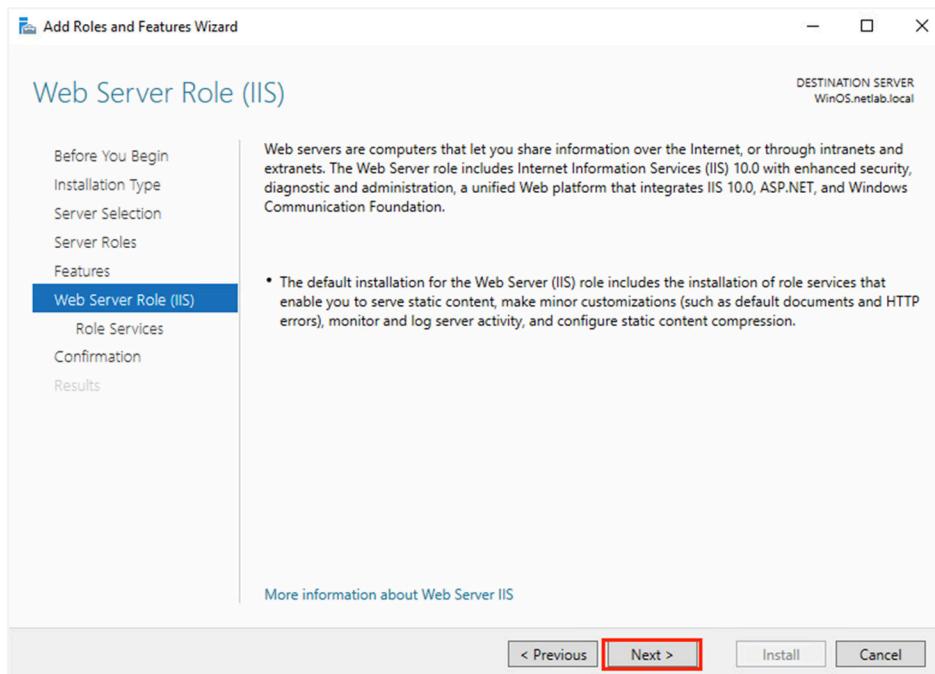
8. You will be brought back to the *Select server roles* page; click **Next**.



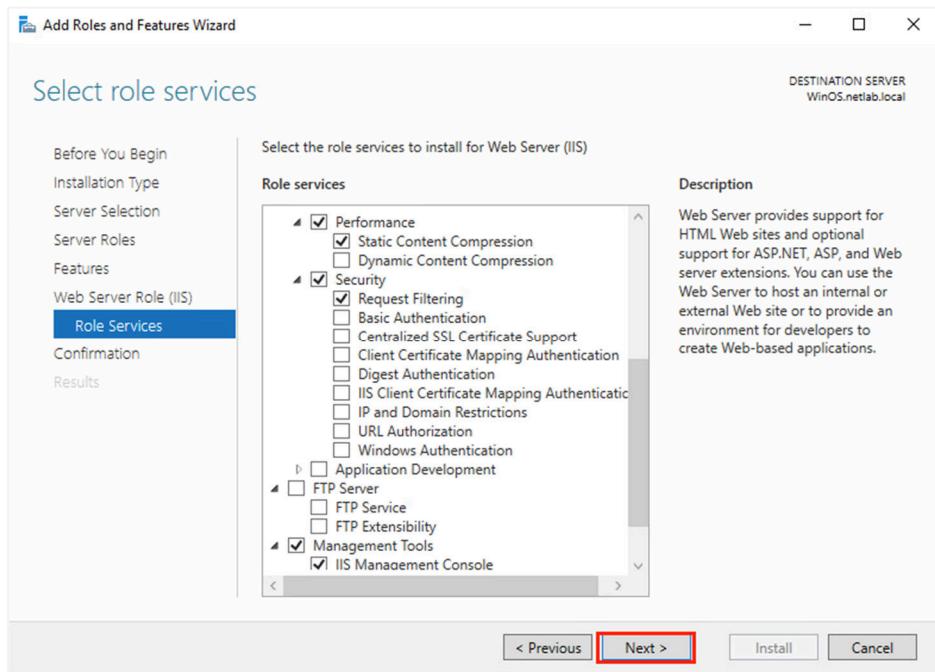
9. On the *Select features* page, click **Next**.



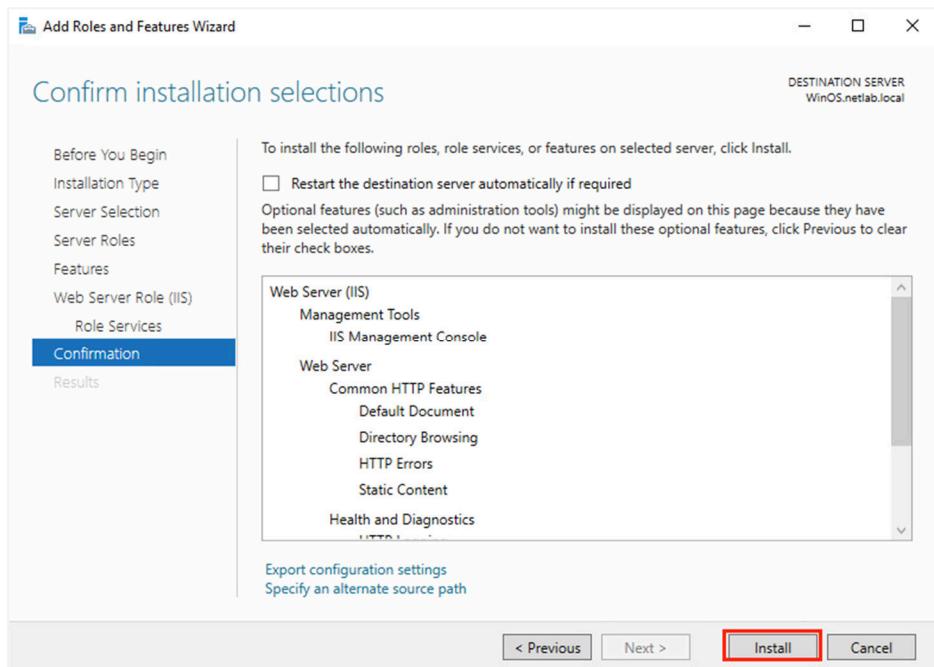
10. On the *Web Server Role(IIS)* page, click **Next**.



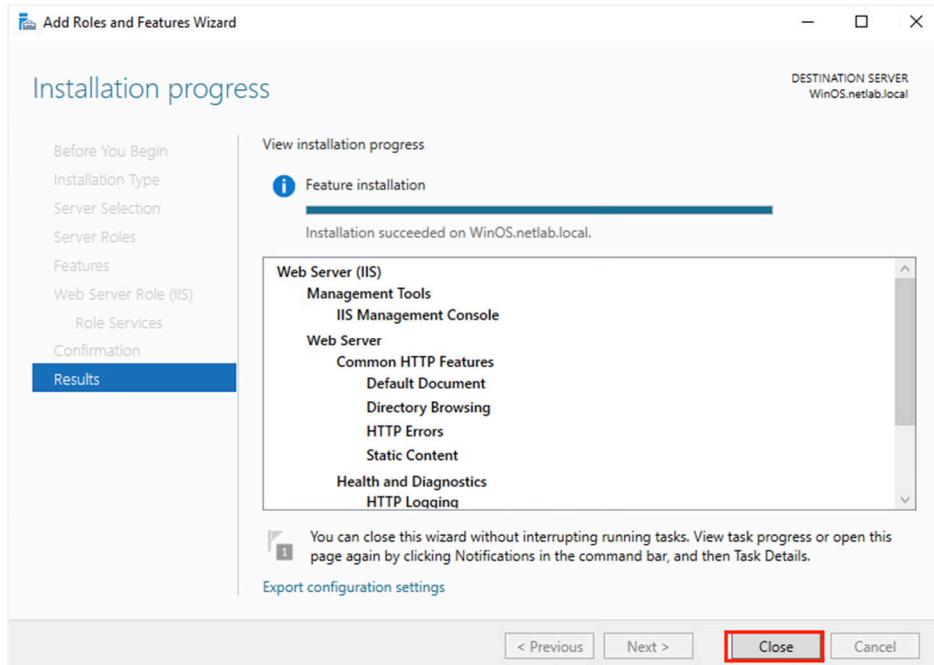
11. On the *Select role services* page, leave the default settings and click **Next**.



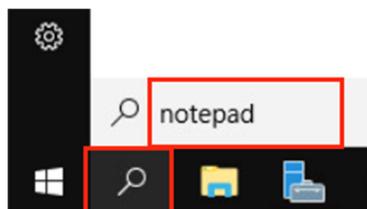
**12. At the *Confirmation installation selections* page, click **Install**.**



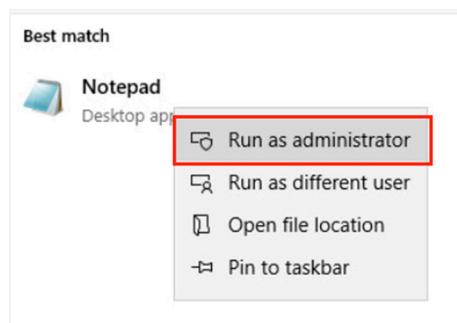
**13. The installation should take 3 - 5 minutes to complete. Once finished, click the **Close** button.**



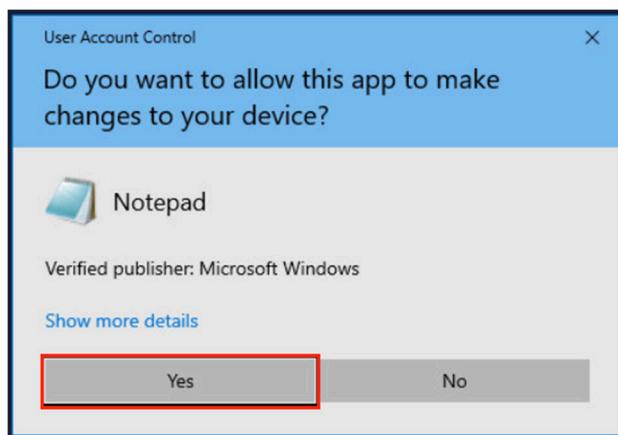
14. You will be brought back to the *Server Manager* window. *IIS Web server* should be running in the background now. Next, let's quickly add a simple index page to our web server. Click the **Magnifier** icon in the taskbar and type **notepad**.



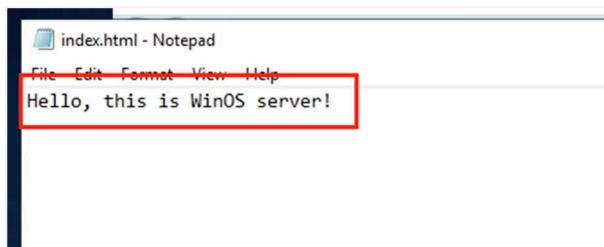
15. In the result, right-click on **Notepad** and select **Run as administrator**.



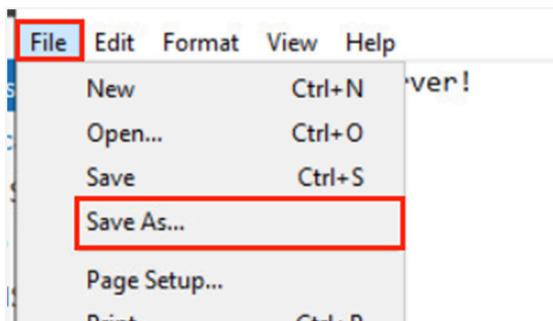
16. When prompted by *User Account Control*, answer **Yes**.



17. In the *Notepad* window, type: **Hello, this is WinOS server!**



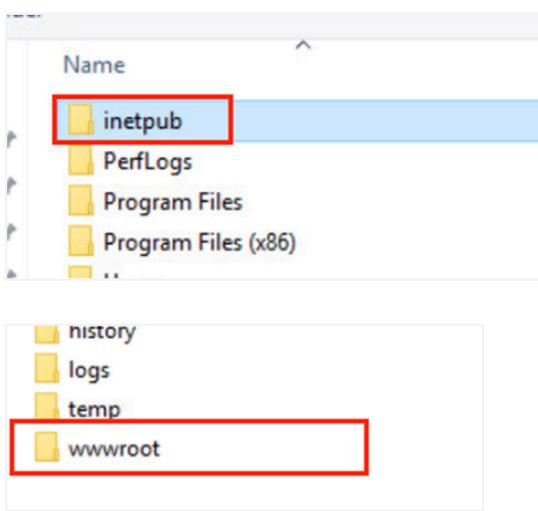
18. In the program menu, click **File**, then select the **Save As...** option.



19. The **Save As** window opens. On the left side, click **This PC**. Then, scroll down on the right side and double-click **Local Disk (C:)**.



20. Double-click **inetpub** to open it, then double-click **wwwroot** to open it.



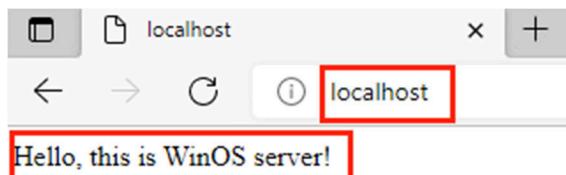
21. At the bottom of the **Save As** window, type **index.html** as the filename. Change the **Save as type** to **All Files (\*.\*)**, change the **Encoding** to **UTF-8**. At last, click **Save**.



22. The index page is set. Let's check it before we move to the next section. Click on the **Edge** icon to open a browser window.



23. In the address bar, type **localhost**, and press **Enter**. You should see the index page showing the words we added in step 17.



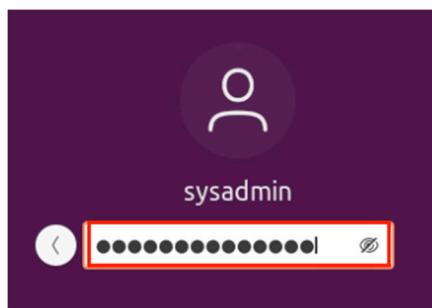
24. Leave everything in its place and proceed to the next section.

## 1.2 Set Up Web Server on UbuntuSRV

1. Click on the **UbuntuSRV** tab to access the *Ubuntu Server*.



2. Log in by clicking on username **sysadmin**, then enter password **NDGLabpass123!**.



3. Click the **Terminal** icon to start a *Terminal*.



4. Type the following command in the *Terminal* window.

```
sysadmin@ubuntusrv:~$ cd /var/www/html
```

```
sysadmin@ubuntusrv:~$ cd /var/www/html
```

5. Let's check what's inside the folder. Type `ls`.

```
sysadmin@ubuntusrv:/var/www/html$ ls  
index.html index.nginx-debian.html robots.txt
```

6. It shows there are three files. It looks like there is an nginx server running. Let's do some cleanup and start to build our own web server. Type and run the following commands; when prompted for the password, enter `NDGLabpass123!`.

```
sysadmin@ubuntusrv~:$ sudo rm index.html  
sysadmin@ubuntusrv~:$ sudo rm index.nginx-debian.html
```

```
sysadmin@ubuntusrv:/var/www/html$ sudo rm index.html  
[sudo] password for sysadmin:  
sysadmin@ubuntusrv:/var/www/html$ sudo rm index.nginx-debian.html  
sysadmin@ubuntusrv:/var/www/html$
```

7. Then, let's stop the nginx service by typing `sudo service nginx stop`.

```
sysadmin@ubuntusrv:/var/www/html$ sudo service nginx stop  
sysadmin@ubuntusrv:/var/www/html$
```

8. We will now add an index page. Type `sudo nano index.html` and you will enter the nano text editor. Type in the words: `Hello, this is the UbuntuSRV server!`

```
GNU nano 4.8                               index.html  
Hello, this is the UbuntuSRV server!
```

9. Press **Ctrl+S** to save, and then **Ctrl+X** to exit.

```
[ Wrote 1 line ]  
^G Get Help  ^O Write Out  ^W Where Is  ^K Cut Text  ^J Justify  
^X Exit  ^R Read File  ^Y Replace  ^U Paste Text  ^T To Spell
```

10. Now, let's start the web server. Type `sudo service apache2 start`. This will start the apache service and open port 80.

11. Click on the **Firefox** icon to start a browser. Same as before, go to address **localhost** to verify the web server is running.



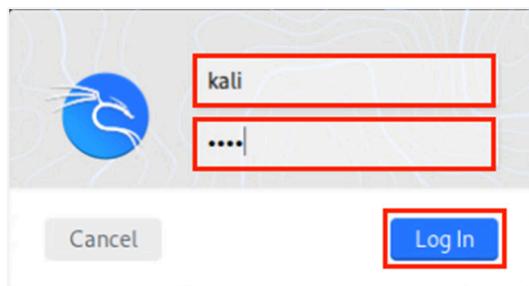
## 2 Set Up the Load Balancing

### 2.1 Set Up Load Balancing

1. Click on the **Kali** tab to access the *Kali* machine.



2. Log in as username **kali**, password **kali**.



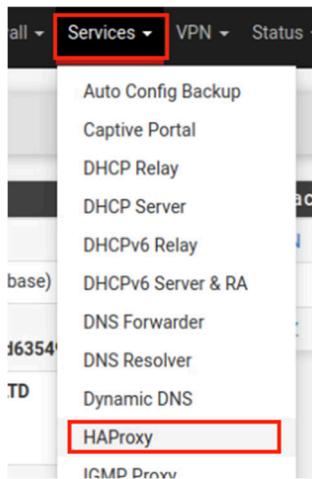
3. Click the browser icon to start the web browser.



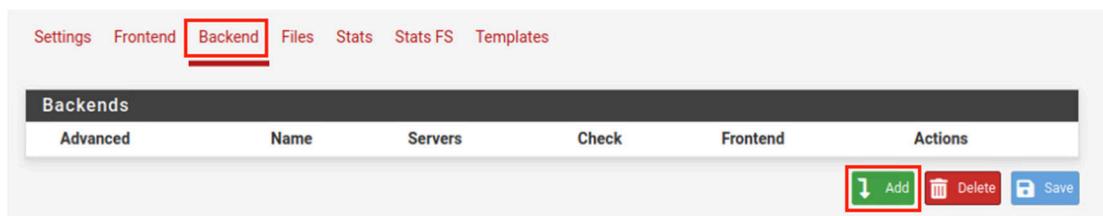
4. In the address bar, type **172.16.1.1**, then press **Enter** to open the pfSense login page. Log in as username **sysadmin**, password **NDGLabpass123!**. If the browser offers to save the password, click **Don't Save**.



5. You will see the default *Dashboard* page. At the top, click on **Services** and select **HAProxy**.



6. We will be configuring the *Backend* first, then configuring the *Frontend*. Click the **Backend** tab, then click the **Add** button.



7. In the *Name* field, to make it easier to remember, we will put **WebServerBackendPool**. Then, in the **Server list** area, click the down-arrow to add a server.



8. After you click the arrow, the page will expand. Fill in the blanks using the following information (You'll need to scroll right to see all fields):

- Name:** WinOS
- Address:** 192.168.0.50
- Port:** 80
- Weight:** 50

Mode	Name	Forwardto	Address	Port
<input checked="" type="checkbox"/> active	WinOS	Address+Port: <input type="button" value="▼"/>	192.168.0.50	<input type="text" value="80"/>

Port	SSL Encrypt(SSL)	checks	Weight	Actions
80	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="50"/>	

9. Once finished, click the arrow again to add another server to the pool. Fill each field with the following information:
- Name: UbuntuSRV
  - Address: 172.16.1.10
  - Port: 80
  - Weight: 50

<input type="checkbox"/> active <input type="button" value="▼"/>	<input type="text" value="UbuntuSRV"/>	Address+Port: <input type="button" value="▼"/>	<input type="text" value="172.16.1.10"/>	<input type="text" value="80"/>
	<input type="text" value="80"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="50"/>

10. Next, we will choose the *Load Balancing* option. Click the + sign to expand the area to show options. Click to select **Round robin**.

**Loadbalancing options (when multiple servers are defined)**

**Loadbalancing options (when multiple servers are defined)**

<b>Balance</b>	<input type="radio"/> None This allows writing your own custom balance settings into the advanced section. Or when you have no need for balancing with only 1 server.
	<input checked="" type="radio"/> Round robin Each server is used in turns, according to their weights. This is the smoothest and fairest algorithm when the server's processing time remains equally distributed. This algorithm is dynamic, which means that server weights may be adjusted on the fly for slow starts for instance.



Round robin simply means the load balancer will be alternating the servers in the server pool depending on their assigned weights.

11. Leave the rest of the configurations untouched. Feel free to check and learn any of the other configurations. Once done, scroll down to the bottom and click the **Save** button.

**Advanced settings**

**Save**

12. You will be brought back to the *Backend* tab. Notice the banner message prompting us the configuration has been changed; click the green **Apply Changes** button.

The screenshot shows the HAProxy configuration interface. At the top, there's a banner message: "The haproxy configuration has been changed. You must apply the changes in order for them to take effect." To the right of this message is a green button with a checkmark icon labeled "Apply Changes", which is highlighted with a red box. Below the banner, the navigation bar includes tabs for Settings, Frontend, Backend (which is selected), Files, Stats, Stats FS, and Templates. Under the Backend tab, there's a section titled "Backends" with a table. The table has columns for Advanced, Name, Servers, Check, Frontend, and Actions. One entry is listed: "WebServerBackendPool" with 2 servers, using HTTP as the check type. At the bottom of the table are buttons for Add, Delete, and Save. The "Add" button is also highlighted with a red box.

13. Click the **Frontend** tab, then the **Add** button to create an entry.

The screenshot shows the HAProxy configuration interface with the "Frontend" tab selected (highlighted with a red box). Below the tabs, there's a section titled "Frontends" with a table. The table has columns for Primary, Shared, On, Advanced, Name, Description, Address, Type, Backend, and Actions. At the bottom of the table are buttons for Add, Delete, and Save. The "Add" button is highlighted with a red box.

14. In the *Edit HAProxy Frontend* section, fill the following information in each field:

- Name: **WebServerFrontend**
- Description: **This is the external access point of the webserver.**
- Status: **Active**

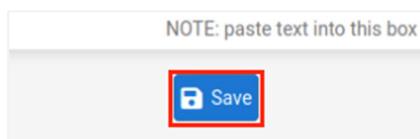
The screenshot shows the "Edit HAProxy Frontend" dialog. It contains three input fields: "Name" with the value "WebServerFrontend", "Description" with the value "This is the external access point of the webserver.", and "Status" with the value "Active". All three fields are highlighted with red boxes.

15. In the *External* address, leave its default setting untouched.

16. Scroll down to the right above the *Stats options* section, click the dropdown menu to select **WebServerBackendPool** as the *Default Backend*.

The screenshot shows the HAProxy configuration interface. At the top, there's a text input field for "new logformat value: YES". Below it, there's a dropdown menu for "Default Backend" which is set to "WebServerBackendPool". A note below the dropdown says: "If a backend is selected with actions above or in other shared frontends, no default is needed and this can be left to 'None'." At the bottom, there's a section titled "Stats options".

17. Leave the rest of the configurations untouched. Feel free to check and learn any of the other configurations. Once done, scroll down to the bottom and click the **Save** button.

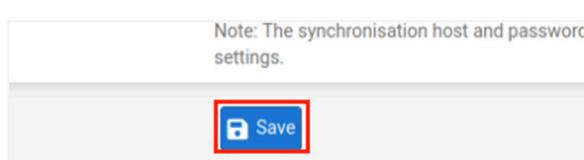


18. Once again, you will see the banner message prompting us the configuration has been changed; click the green **Apply Changes** button. Notice the address **203.0.113.1:80**; remember this. It will be the external/virtual server address we are visiting in a later section.

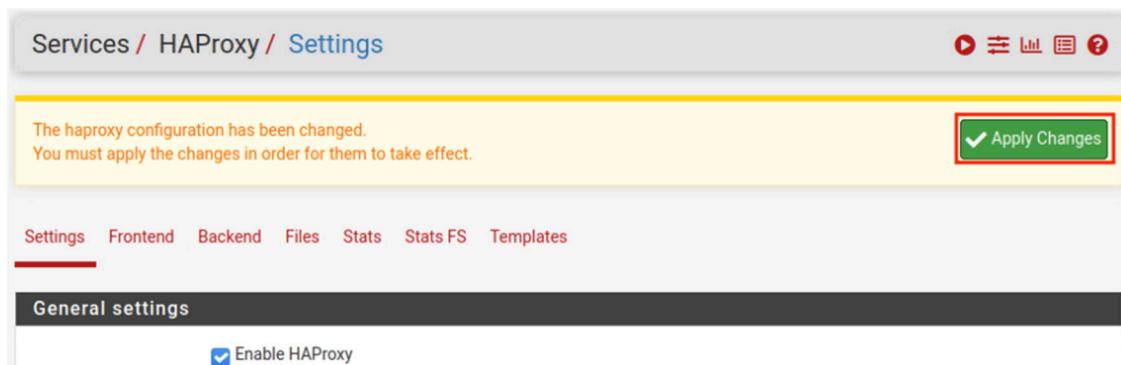
Primary	Shared	On	Advanced	Name	Description	Address	Type	Backend	Actions
<input type="checkbox"/>	<input checked="" type="checkbox"/>			WebServerFrontend	This is the external access point of the webserver.	203.0.113.1:80	http	WebServerBackendPool (default)	

19. Now, let's activate the Load Balancer. Click on the **Settings** tab, then check the **Enable HAProxy** box, fill in the *Maximum connections* as **10**.

20. Leave the rest of the configurations untouched. Feel free to check and learn any of the other configurations. Once done, scroll down to the bottom and click the **Save** button.



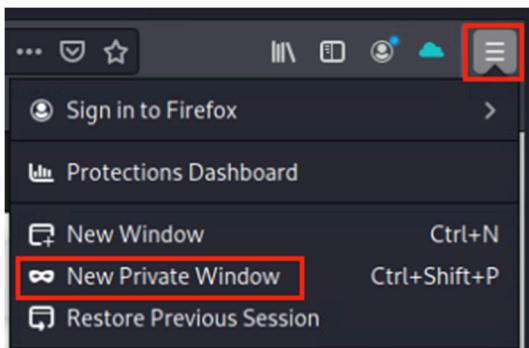
21. The banner message will pop once more; click the green **Apply Changes** button. We have finished setting up the Load Balancing.



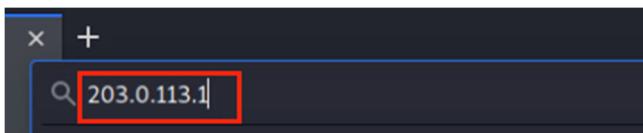
22. Ignore the warning message if it is shown. Proceed to the next section.

## 2.2 Test and Observe the Load Balance

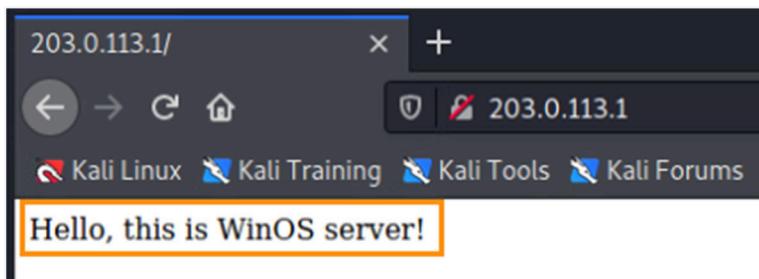
1. In the *Firefox* browser, let's start a private window. Click on the menu button at the top-right corner, then click the **New Private Window** option.



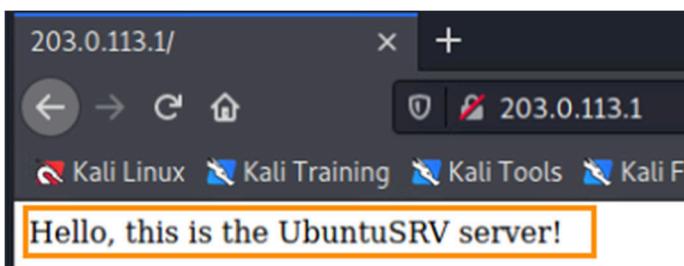
2. In the address bar, type the external/virtual server address shown in Section 2.1, step 18. You can ignore the port number since it is on default HTTP port 80. Press **Enter**.



3. You should see the hello message from the *WinOS server* (this server is the first one in the Backend Pool list).



4. Click the **Refresh** button a few times to observe the change in the hello message. It should be alternating between the *WinOS* and *UbuntuSRV* servers.



Thinking about how load balancer deals with sessions? For example, if a user is on an e-Commerce website, refreshing the page will likely clear the shopping cart. How annoying that is!

Our lab does not deal with sticky sessions, you may want to do a Google search and practice how to use a sticky session.

5. The lab is now complete; you may end the reservation.