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Fundamental Understanding of Network and Network Security

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Introduction

This paper encompasses the aspects of how website was created and operated in the 2008 to 2010 era. As current technologies has long surpassed the methods of the technologies just 12 years ago. I have made this paper for the people to understand the traditional and the fundamental way of hosting a website, and also the security aspects back then. This even includes an explanation of group policy management, a very overlooked concept in the field of IT, and for aspiring IT professionals as myself, this is a necessary skill to learn. Since current technologies require a variety of skills are required to present a fully working website (including programming languages such as python or C++, scripting languages such Java script, HTML, CSS and backend applications, understanding of API and etc..), it can be daunting for new aspiring developers, this paper creates the fundamental understanding of network and network security, in which these aspiring developers and take an understanding of the past technologies and move ahead with their careers.

The working has all been done on windows 2008 r2 server using a virtual machine. The infrastructure required are Windows Desktop, Preferably with i5 Processor (Even i3 will be sufficient). RAM recommended 8 GB (Min 4 GB) HDD can be above 500 GB, Router: D-Link router with wi-fi support. Software are Operating System: Windows 10 (Prefer Windows 7 or Windows 8) Windows server 2008. Software: Virtual Box (VMware also acceptable)

The first four topics are about creating website (Creation of forest, active domains, and DNS configurations), the next four topics are about group policy management, and the last topic is a simple router configuration.

The following table explains each part of the paper with a brief description.

Topic Name	Description	Infrastructure	Software
Create a network, Host a HTML page in IIS Web server, Configure a DNS server, Configuring Active Directory Domain Controller	Create virtual machines using Should connect three PC via ethernet cable or using virtual machines and communicate with each other, Install IIS service within the machine • Create a HTML page & host in the created VM • Browse from other machines to access the hosted HTML page, Configure a DNS server inside the windows server for domain name & IP	Windows Desktop. Preferably with i5 Processor (Even i3 will be sufficient). RAM recommended 8 GB (Min 4 GB) HDD can be above 500 GB.	Operating System: Windows 10 (Prefer Windows 7 or Windows 8) Windows server 2008. Software: Virtual Box (VMware also acceptable)

Topic Name	Description	Infrastructure	Software
	mapping Suggest a single machine multiple configured servers for both web & DNS Can use the existing website template from previous activity for this configuration. Give a domain name to the website created. Can host multiple sites as well. Reviewer to access the website using domain name from the said browser, Install Active directory service within the machine • Create new forest • Create 2 user and try to		

Topic Name	Description	Infrastructure	Software
	login from the machines connected to the domain		
Configuring Group policy, Configuring Group policy for windows update, Configuring Group policy to disable Backing up in local machine, Configuring Group policy to delegate control to reset the password of the users.	Configure active directory and create a new forest with at least 2 machines. • Use any windows flavour preferably windows server 2008 • Install Active directory service within the machine • Create three or more users and try to login from the machine connected to the domain • One user should have access to USB and the others should not have USB access • One user	Windows Desktop. Preferably with i5 Processor (Even i3 will be sufficient). RAM recommended 8 GB (Min 4 GB) HDD can be above 500 GB.	Operating System: Windows 10 (Prefer Windows 7 or Windows 8) Windows server 2008. Software: Virtual Box (VMware also acceptable)

Topic Name	Description	Infrastructure	Software
	should have access to Camera and the others should not have camera access • One user should have access to SD Card reader and the others should not have access. • One user should have access to CD/DVD drive and the other user should not have access, Create 2 user and try to login from the machine connected to the domain Check for windows update every day at 5.00pm for the first user and at		

Topic Name	Description	Infrastructure	Software
	7.00pm for the second user, • Create 2 or more user and try to login from the machine connected to the domain • One user should have access to take back up and the other user should not have access to take back up • One user takes back up of few files / directories in the system using the scheduled back up configuration, • Create 3 user and try to login from the machine connected to the domain • One user should have		

Topic Name	Description	Infrastructure	Software
	permission to reset the password of other user and the other user should not have permission to reset password • One user should reset other users' passwords and access		
Configure a router	• Create a network of 3 machines • Allow internet access to two machine and one machine should not have internet access	Windows Desktop. Preferably with i5 Processor (Even i3 will be sufficient). RAM recommended 8 GB (Min 4 GB) HDD can be above 500 GB. Router: D-Link router with wi-fi support.	Operating System: Windows 10 (Prefer Windows 7 or Windows 8) Software: Virtual Box (VMware also acceptable)

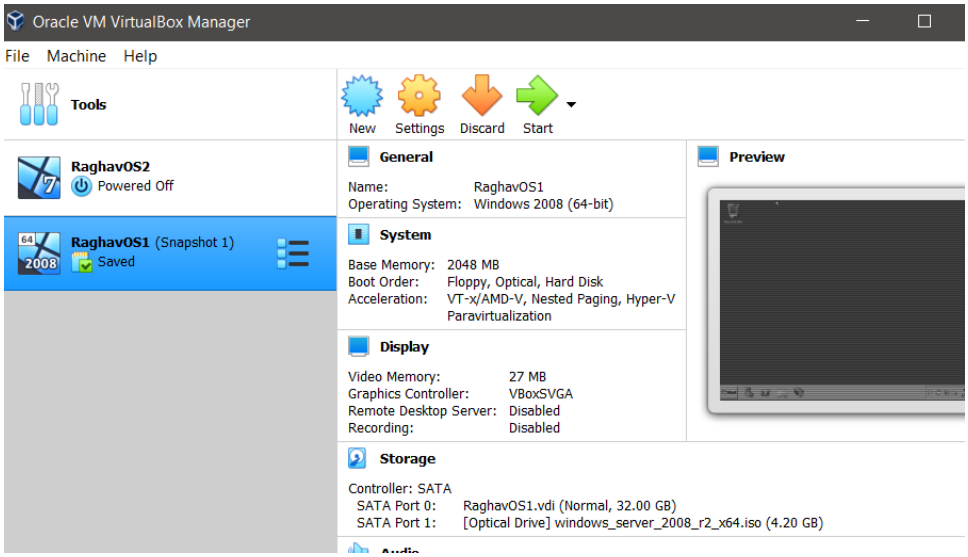
In the following topics, I have used ">" which means select the given option to continue . For example in each directory if wanted to access the sub directories, I select the main category and in the main category , I select the desired sub category, this is represented by ">"

Topic 1

Create a network

The first step was to create a virtual machine. I used a virtual box for this task. I installed windows 7(.iso file, as it is a recognizable for my virtual machine) and set it up on my virtual box. The other one I used windows 2008 server r2 and set it up on my virtual box.

This figure is basic representation of the above steps

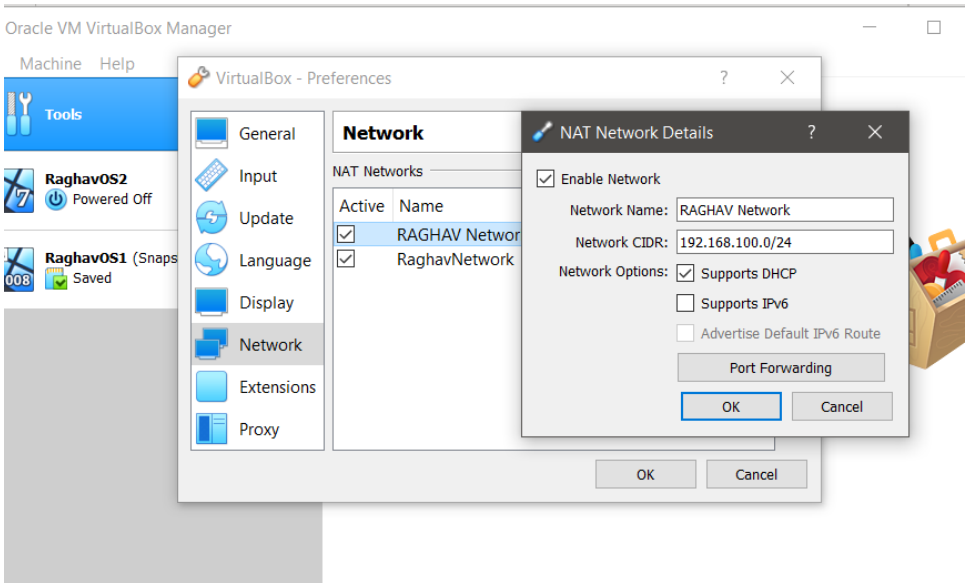


On virtual box, I went to "tools" > "preference"> "Network".

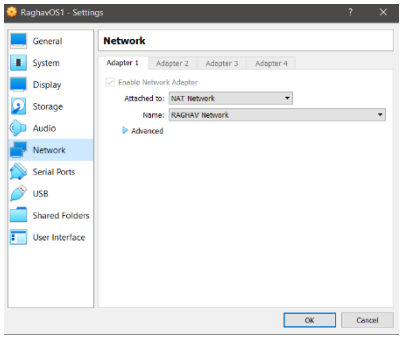
On network option I clicked on the option which adds "new NAT network." I created my NAT Network and

named it “RAGHAV Network.” In this network I had to edit it, and I entered a unique IP address for it. For this I entered the IP address as 192.168.100.0.

This figure is basic representation of the above steps



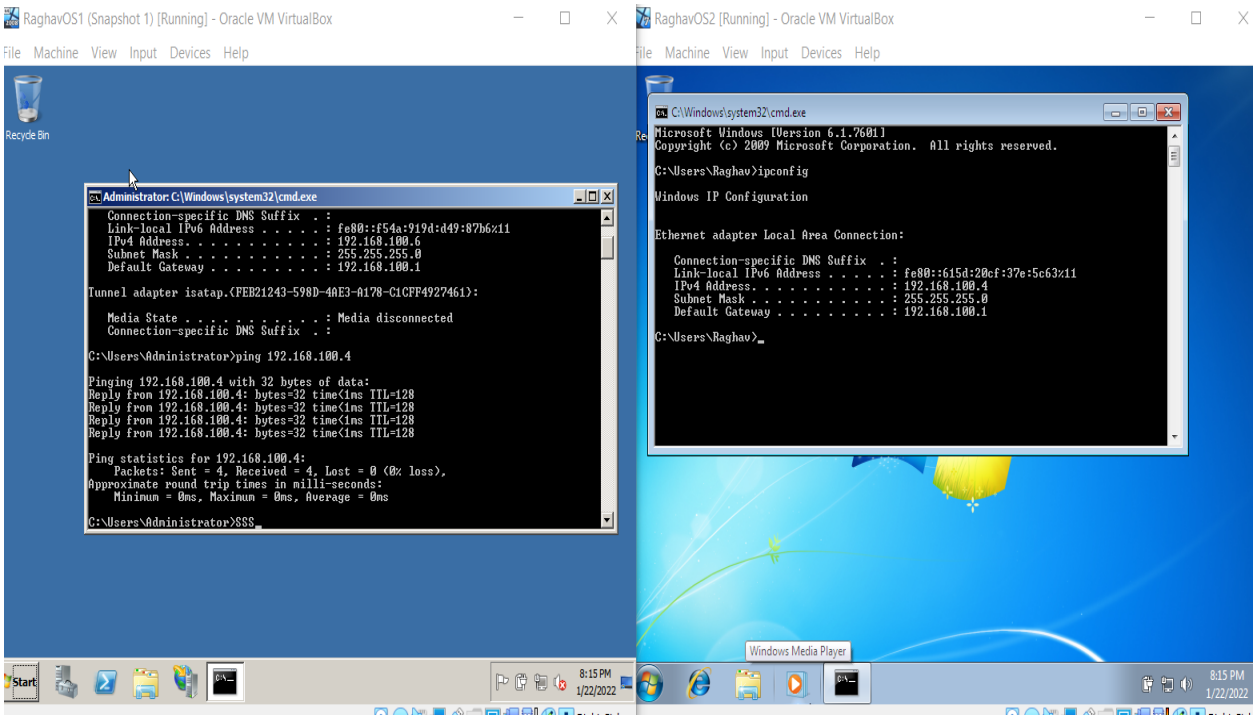
I had to create this unique IP address because if I hadn’t, the VM would take default address which is 10.0.2.15. If it has the default address, it wouldn't be able to communicate. This is why I created this unique IP address.



Now to make my VM connect to this NAT Network, I had to go the settings of the VM and selected network, then changed from the default NAT to my NAT Network.

Now I have run my VM’s and have opened their command prompt. I entered “ipconfig” to know their IP address generated. Now that I have their IP address. Now, to communicate with the other VM I had to Enter this

command “ping 192.168.100.4” (where 192.168.100.4 is the IP address of my windows 7) with this command it starts to communicate with windows 7. As shown; it says “reply from 192.168.100.4: bytes=32 time<1ms TTL=128” which confirms that my system is communicating with windows server 2008 r2.

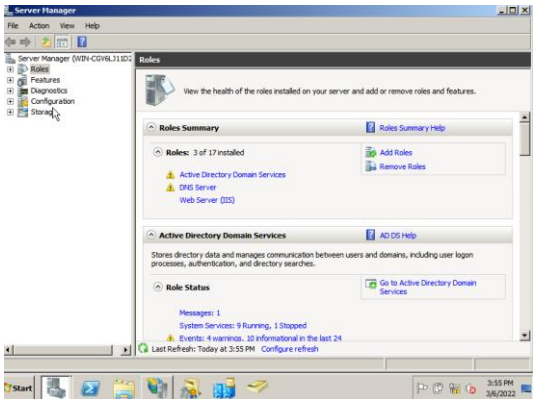


This is the end of the first topic , here we gave a detailed description of the steps taken to configure the connection. This topic will serve as the base for the rest of topics as it just explains my virtual machine configurations.

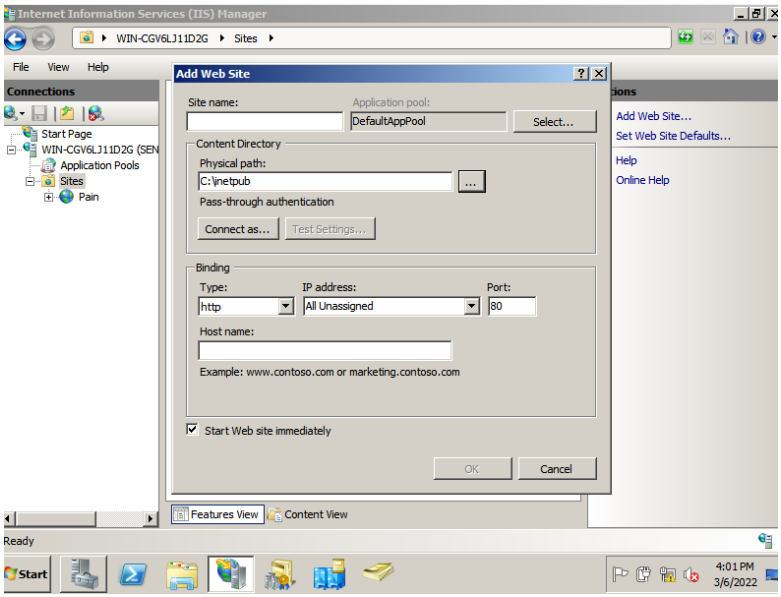
Topic 2

Host a HTML page in IIS Web server

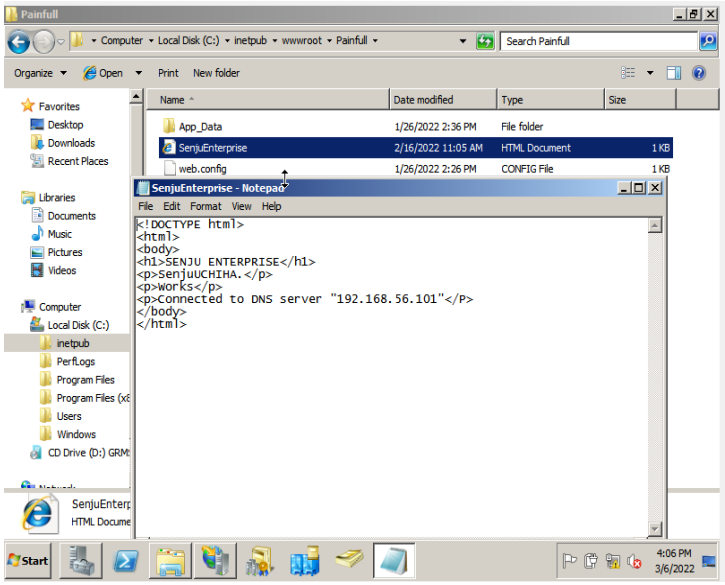
The first step. Once you open windows 2008 on the virtual box, go to the “start” > “Administrative Tools” and click on IIS manager. Now once in roles section, add a role web server IIS and download it by selecting the default options itself.



Now click on web server IIS, tap on your default home server, then the option for sites will show up. Under sites go and add a Web site. Input a desired site name. For physical path go for Local Disk(C:)>inetpub>wwwroot. Select your IP address on your VM. Change the port to 8082 and now click “ok”.

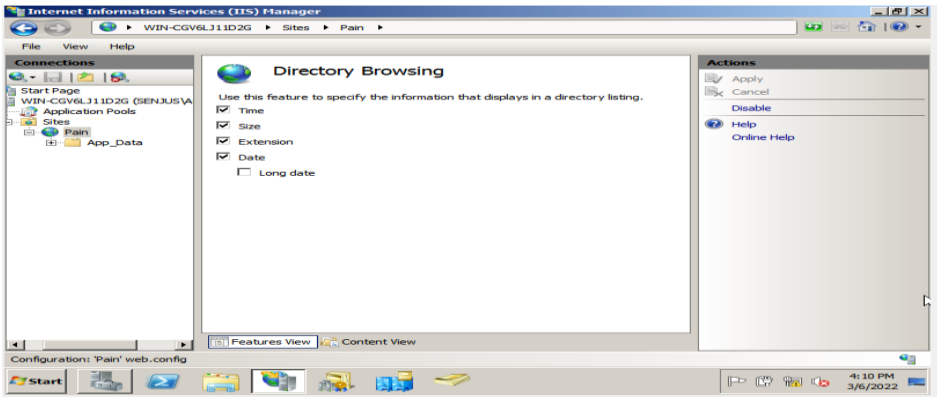


After creating a website go to file explorer Local Disk (C:)> inetpub>wwwroot, here right click and go to new text document. Now enter the HTML code so hold a server. Now save this html page as “.html.”



This part includes the language “HTML” hyper text markup language, and this language is used to create webpages, for the purposes of this paper, the code only creates a web page with few texts on it.

Now return back to the IIS manager and go to your website, under your website select directory browsing and click enable to host the HTML page.

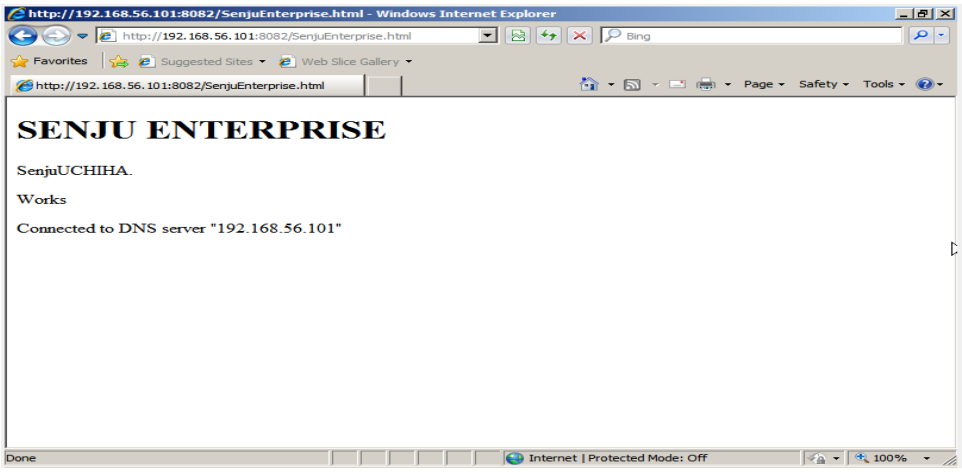


This is to enable the web page as site for others to access.

Now go to your Virtual box and go to another VM and ensure the new VM is on the same bridge Network as the host machine. In this VM go to server manager>Configure IE ESC> and select off. Now open the browser

and type http://192.168.56.101:8082/SenjuEnterprise.html. The IP address and port of your host server. This is to prove that my html website is on the network.

This is the end of the topic, it gives a detailed description of the steps taken to host a webpage.



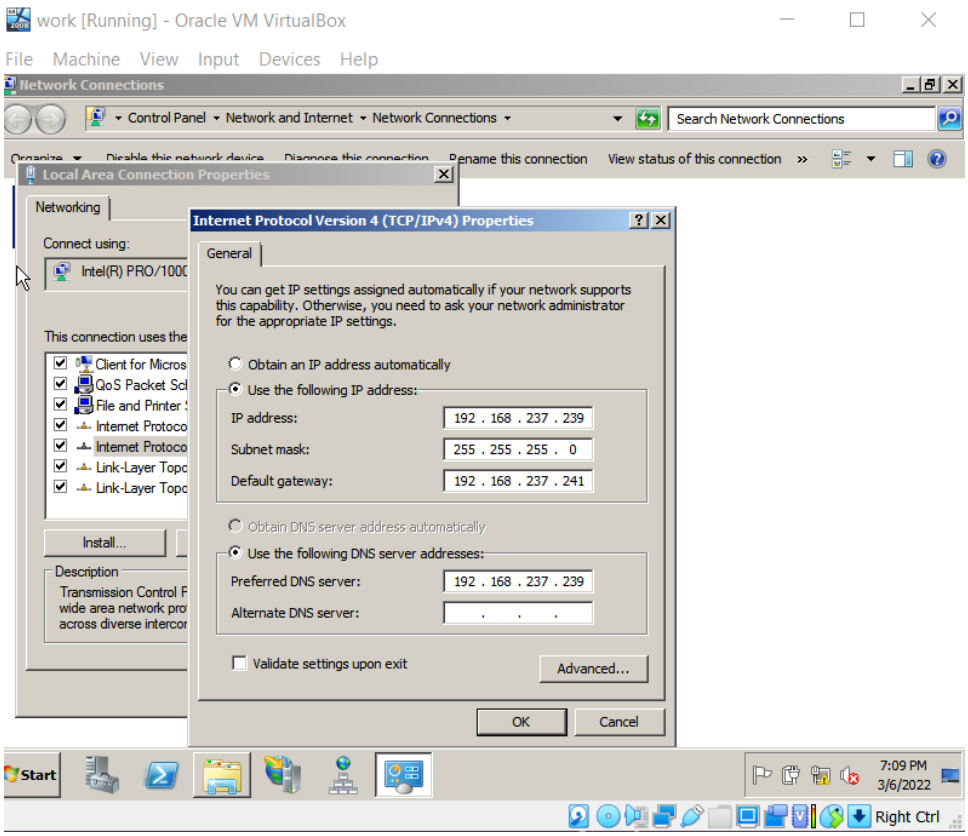
Topic 3

Configure a DNS server

The first step is identifying the IP address (IPV4), subnet mask and default gateway of the VM we are using. We can do it by going to command prompt and enter “ipconfig.” Make sure the VM network is a bridge network. Now in the VM go to start and type “NCPA.CPL” then right click on logo and go to properties. Click IPV4 and select use this IP address and manually enter the details. For the preferred DNS server just enter the VM’s IP address.

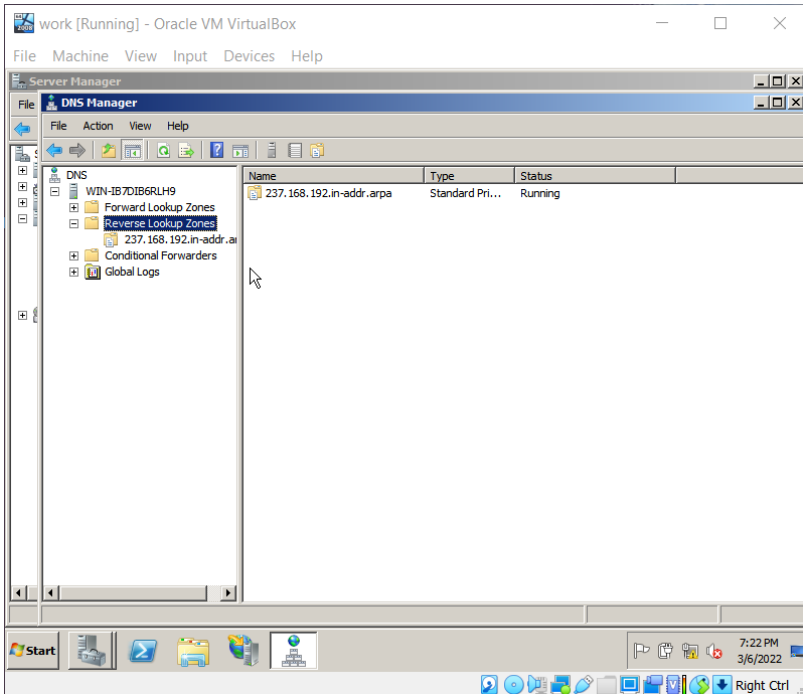
DNS (Domain Name server) is a server where it stores IP address in a form of a name, for example if we type “google.com” the DNS returns the IP of google.

This figure represents the above steps.



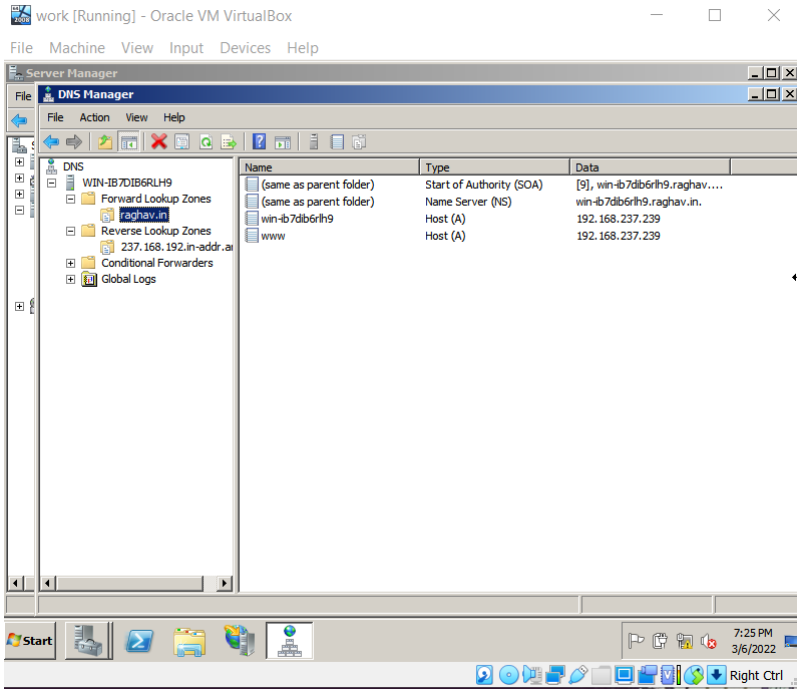
Now go to Server Manager> Roles> add roles and select DNS server and install it. After installation, go to administrative tools> DNS server> DNS > the VM server, in this section there is forward lookup zone and reverse lookup zone. Now right click on reverse lookup zone and select “new zone” now enter and choose the default options till where u need to enter the network ID, here enter the IP address without the last part.

This is the part where “lookup zones” are used , this case there are two :- forward lookup zone and reverse lookup zone. They are similar, the only difference is that for forward lookup zone the name is mapped to our IP and opposite is for reverse.



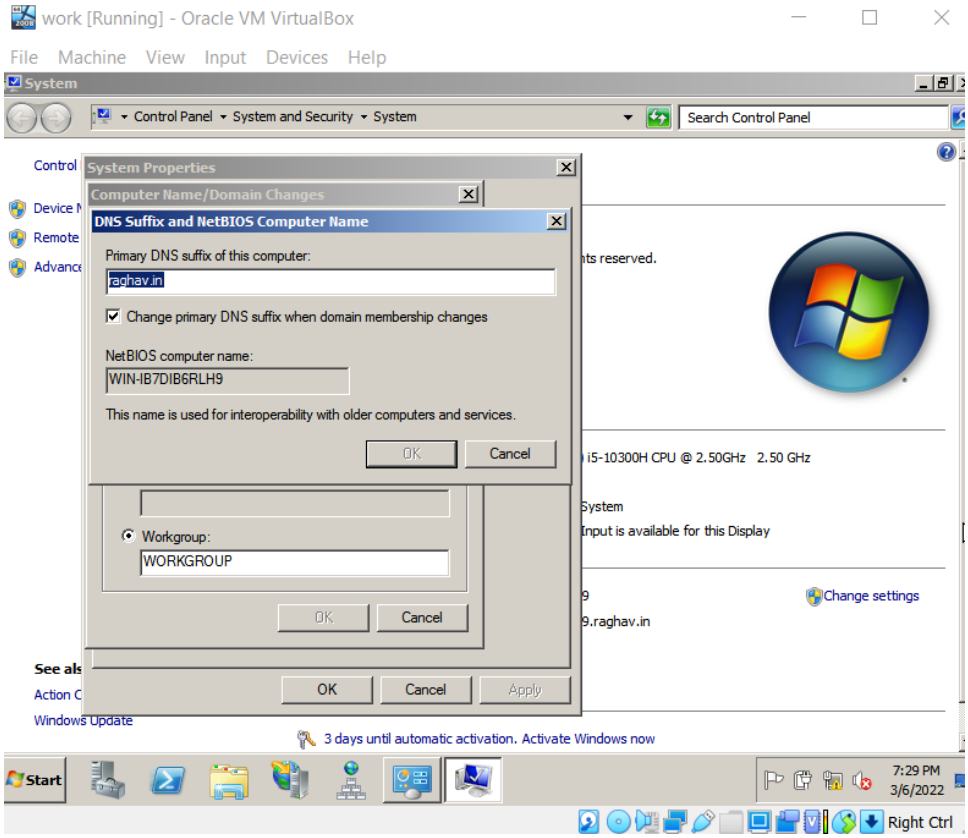
Now for the forward lookup zone, right click and choose “new zone” and select default options and enter a desired zone name. (Raghav.in)

In this case we chose forward look up zone.



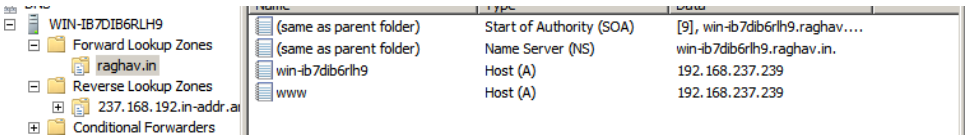
Now go to start> right click on computer and select properties. Select change settings > change > more here enter the forward lookup zone name.

Here we input the host name for our IP.



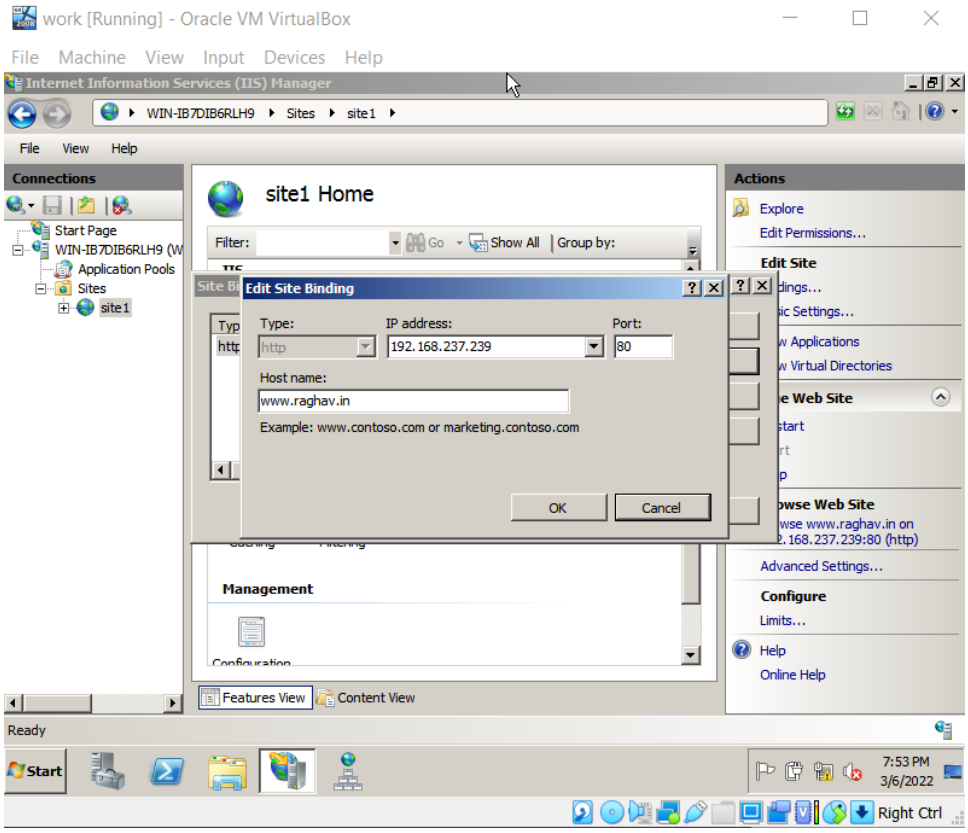
And now restart the VM.

Now in the forward lookup zone right click to add a new host (A). For the name just keep it as “www” and as for IP enter the VM IP address.



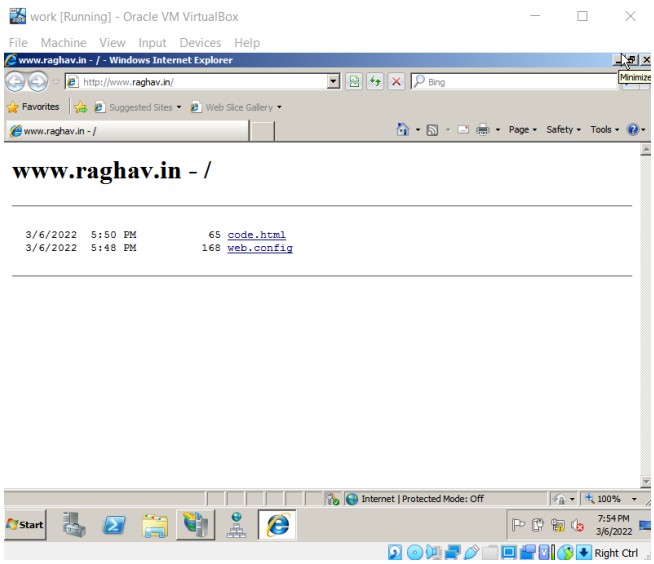
Now go to the website which was already hosted. Go to IIS>Sites> site created and click on edit biding select the one that already exists and add a host name example: www.raghav.in.

With this DNS is configured.



In the browser of VM just type domain name, and the site hosted gets displayed.

This is the proof that the DNS is configured as we don't need to type our IP address but instead only the name of our website, this website name is "Raghav."



This is the end of the topic. This is a e a detailed description of the steps taken to configure a DNS server

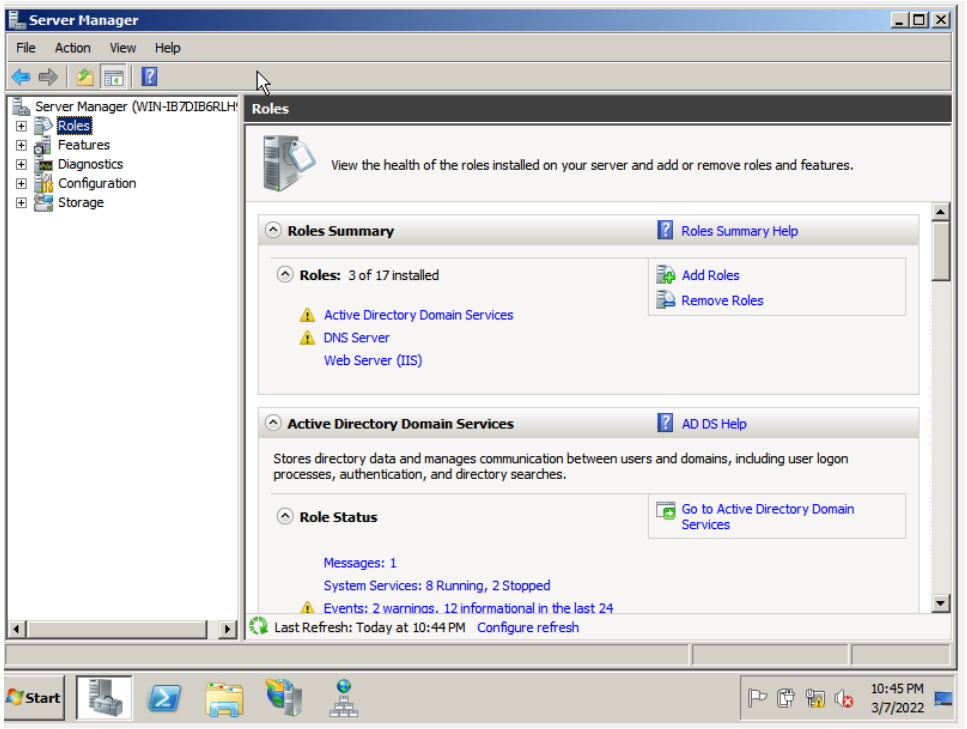
Topic 4

Configuring Active Directory Domain Controller

Now to add a layer to our website, this general way of describing the active directories.

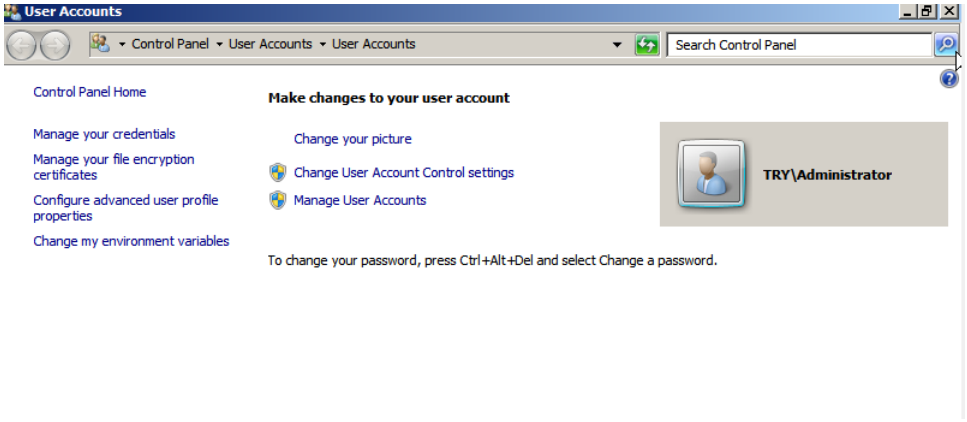
To do configure active directory we need the DNS configured first, otherwise it wont work because we need the zones to be activated. So, in this case I used all configurations I did in the last topic. This is also where we create a forest.

In the VM where created and configured a DNS server, we must go the event manager and select “add roles” select “Active Directory Domains and Services” select the default options and install it.



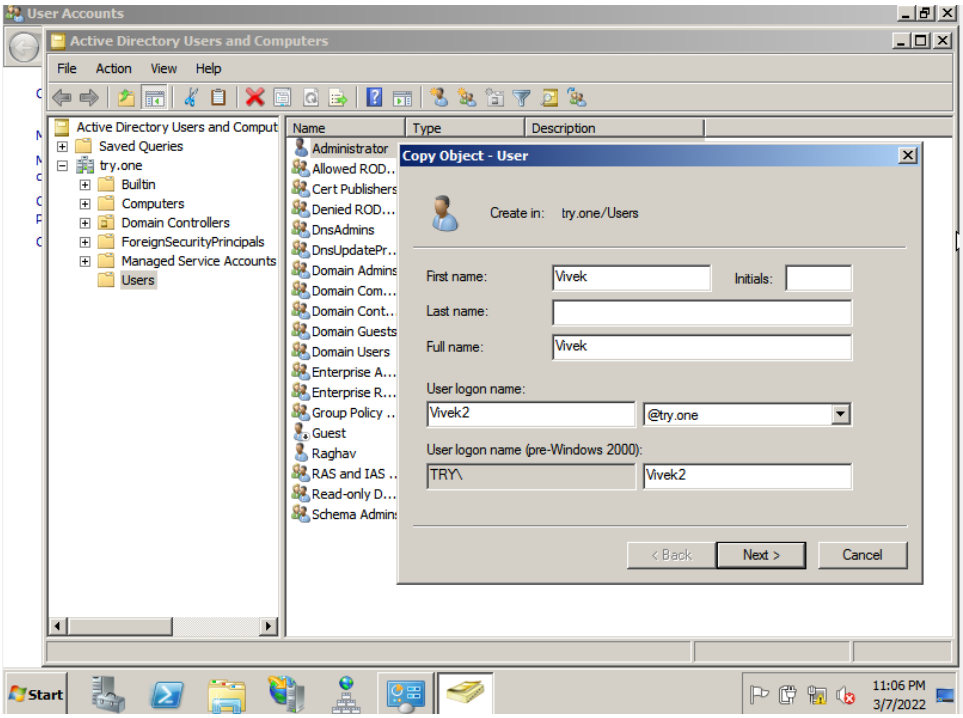
After this step, restart the VM and go to “start” and type in “dcpromo” and select the default options and then select to “create a domain in new forests” then give a desired FQDN of the forest root domain (try.one), now continue with the default options and input a desired password (following the password rules of windows 2008) and let the VM restart. After it restarts when shows up the login screen it should show “try/Administrator”, which confirms the creations of the forest.

This is how forest has been created. Forest in Active directory can be recognized as something like a domain of domains, where we can host multiple domains in a single domain.



Now once Active directory Domains and services and the forest is created, we go to start >Administrative tools > Active Directories users and computers, in this section we go to the forest we created (try.one) in that we go to users. In the user's section we right click on “administrator” and select copy, this will show the user creation option, here we enter desired credentials for the user and create a password for it. (We copy from administrator because it has the authority to access the domain) Now we do it twice to create another user.

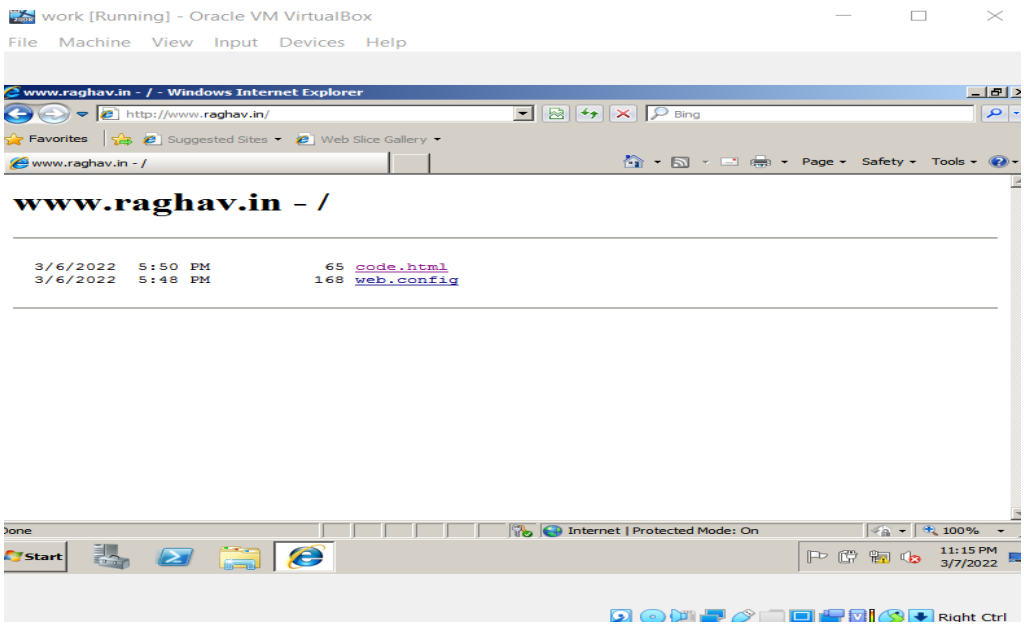
This step is to add users to it and one of users e give administrative access. This user we are going to analyze even further in group policies.



Now to access the domain we created from the users we created, we go to “start” next to log off we click that option to switch users, now enter the username and password to login.

Now we change the users, once we boot the virtual box .

Now in this user we go to the browser available, and type in our domain name to access the website. We follow the same step for the second user. After inputting the domain it should show our website created in the domain.



This is the end of the topic. This is a a detailed description of the steps taken to configure an active directory server.

Topic 5

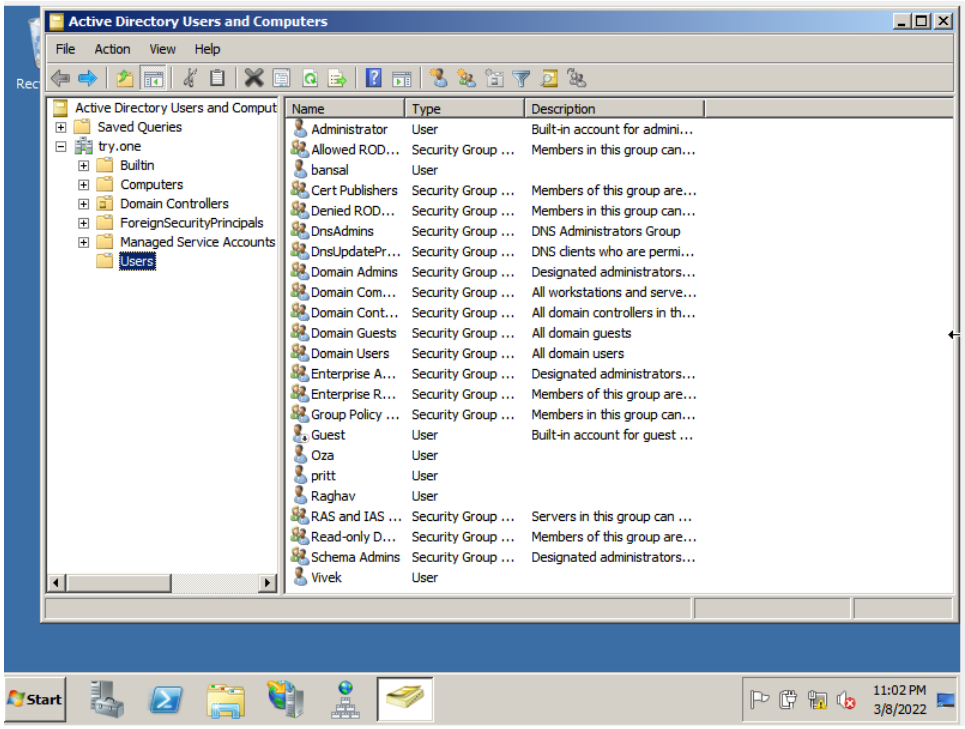
Configuring Group policy

Group Policy is just like a policy or set of instruction for a group of users to follow, one of the applications can be of lets take an example of company with lets say 100 employees. The manager wants to restrict access for all the employee's computer, making sure the employee's don't access certain parts of company's computer, in this case windows provides a solution, we can create a policy which states that all users should not have access to some certain files, so all the users in that policy will not have access for those files, the only user who can access those files will be the administrator. This topic is going to be implementation of this. We still need the active directories to serve a better example so we will be using those, and since active directories require DNS configuration, this topic can be considered a continuation of the last topic, and hence we'll be using the previous configuration.

In the VM where Active domain and controllers are installed, we go to start >Administrative tools > Active Directories users and computers, in this section we go to the forest we created (try.one) in that we go to

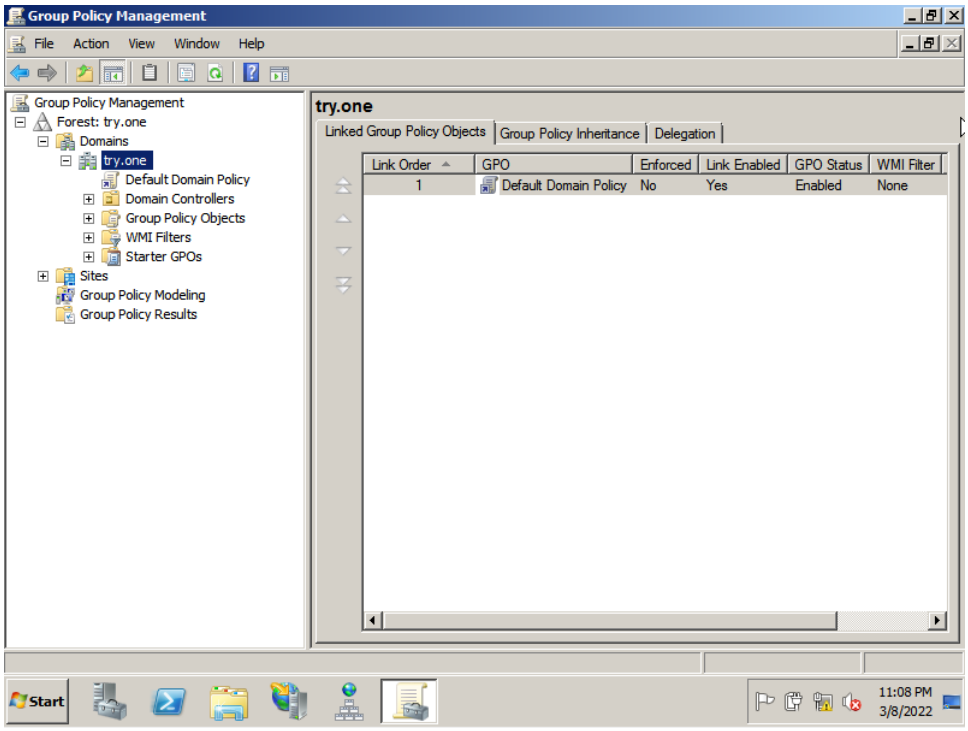
users. In the user's section we right click on “administrator” and select copy, this will show the user creation option, here we enter desired credentials for the user and create a password for it. (We copy from administrator because it has the authority to access the domain) Now we repeat these steps and create 4 users.

This is how users has been created.



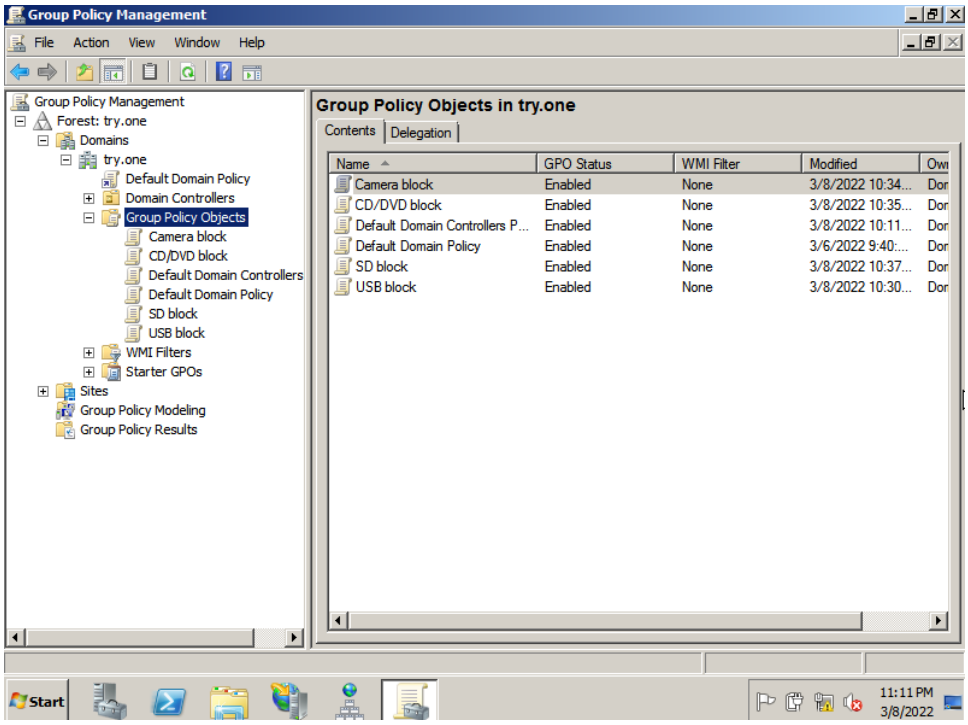
Now we go to “start” and “type Group Policy Management” and enter, we select our forest then we select Domains then we select on our forest name, in this section we see the section of Group Policy Object in our forest.

Now to create objects,

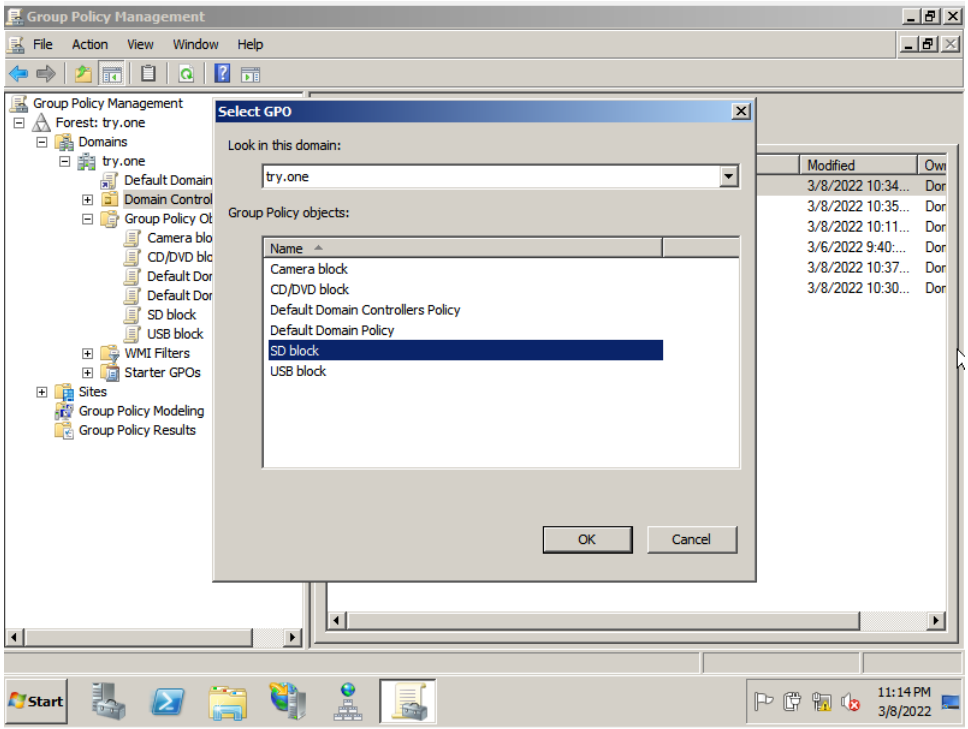


We right click on Group Policy Objects and select “new” and input a desired name suitable for referring blocking of USB/SD card/Camera/CD/DVD, and we continue till we make four GPO following these.

Now with the object created to block camera is done. The group policy is policy which users follow, so we now created “camera block” now we just need to add this the policy, a process knows as group policy object linking. Since the object has been created, now link it to up the group of users created before.

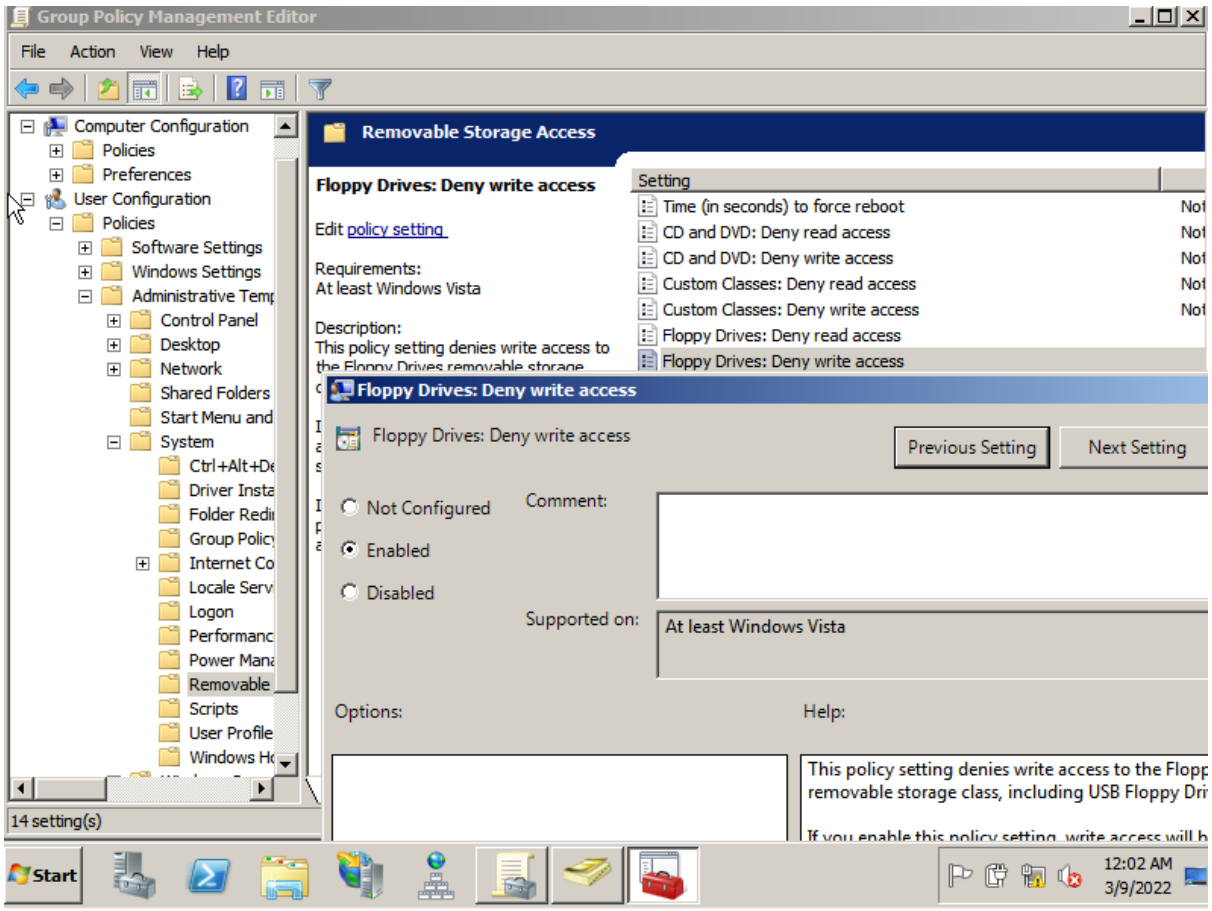


After creating these four GPO, we right click on Domain controllers and select “Link an Existing GPO”, in that we select the four GPO we created.



Now that the object is linked, and we continue this process similarly for other parts of computer.

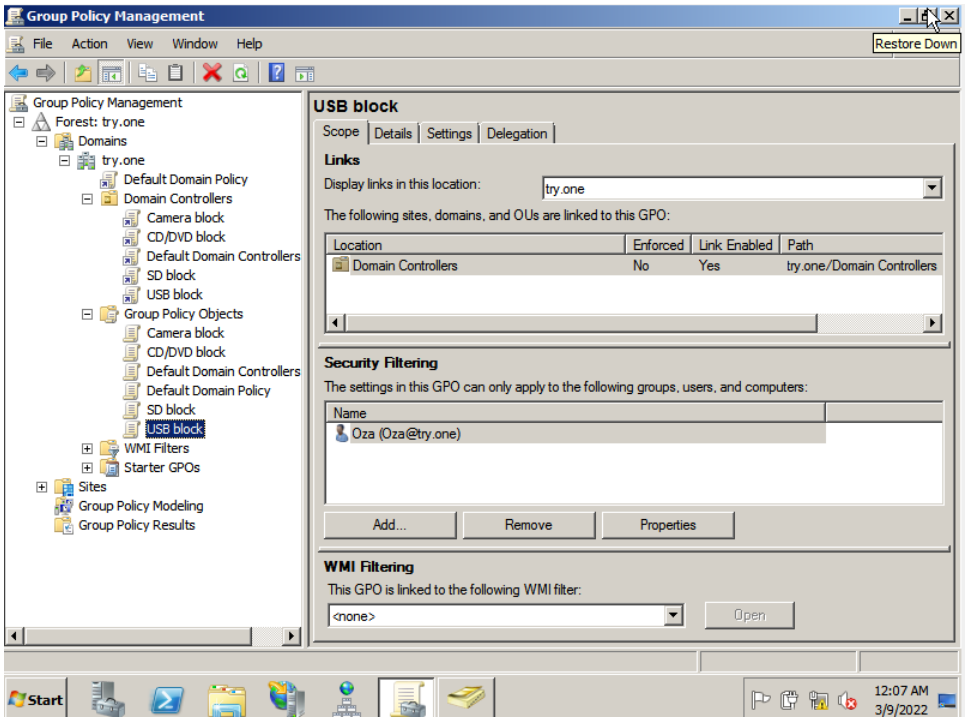
After link the four GPO we right click on the GPO for USB block and select “edit” now here under User Configuration under this we go under policies under that we Administrative Templates, in this section we search for system, in system we select Removable Storage Access, in this section, we select both Floppy Disk: Deny read and write, and enable both, apply and close.

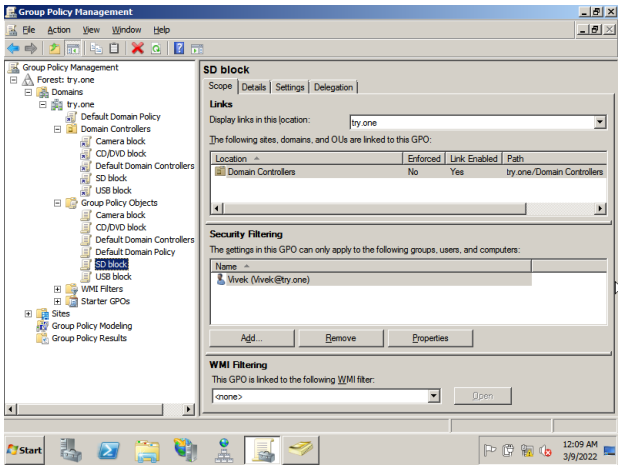


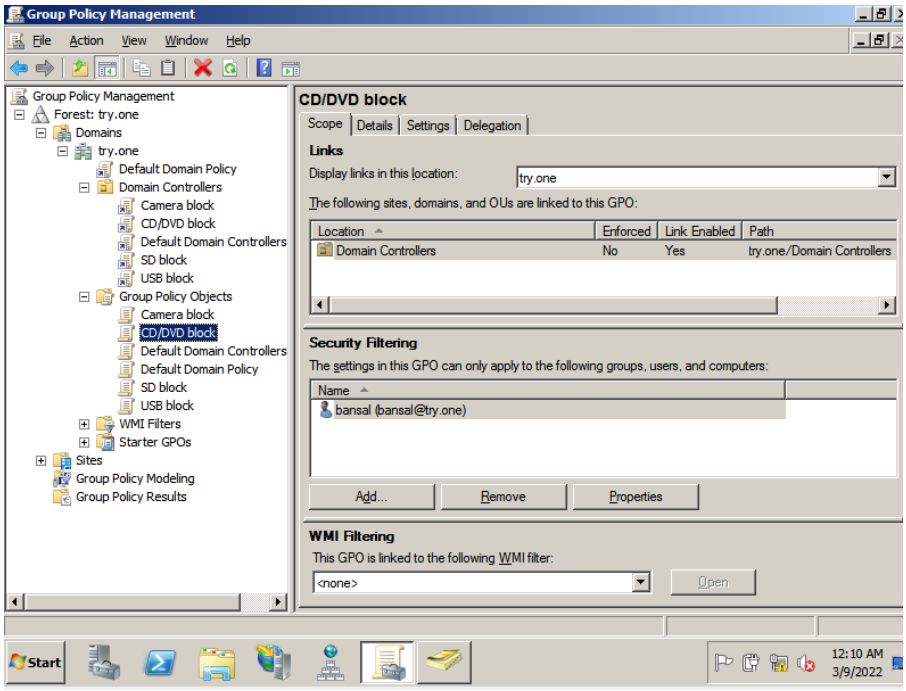
In this case, since we are blocking access to few parts of computer, it does not mean that we cant block others, almost all the folders under “system” can configured in our way.

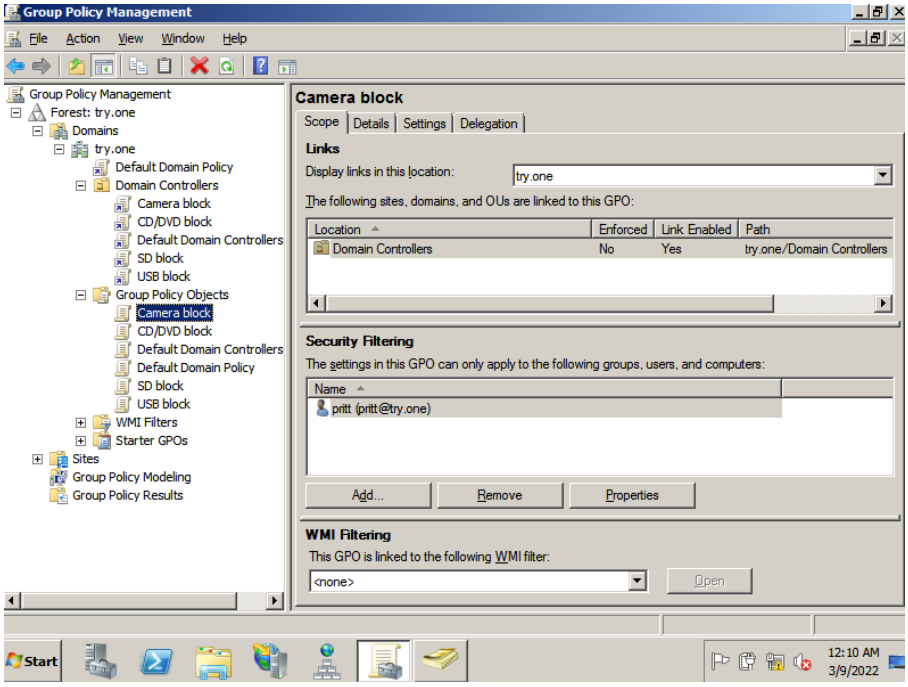
We follow the same steps for the other three GPO, for CD/DVD block, we enable CD and DVD: Deny read and write. For Camera block GPO we enable WPD devices: Deny read and write. For SD card block we enable Tape Drivers: Deny read and write.

Now once we edited our GPO's, we left click on one of our GPO and under "security filtering" we see the option for "name", here we remove the default Authorized Users and add the user we don't want access to the GPO here for example to remove access for USB we add a user in the name section. Now we follow the same step for other GPO's.









This is the end of the topic. This gives us a detailed description of the steps taken to configure an active directory server and configure group policy

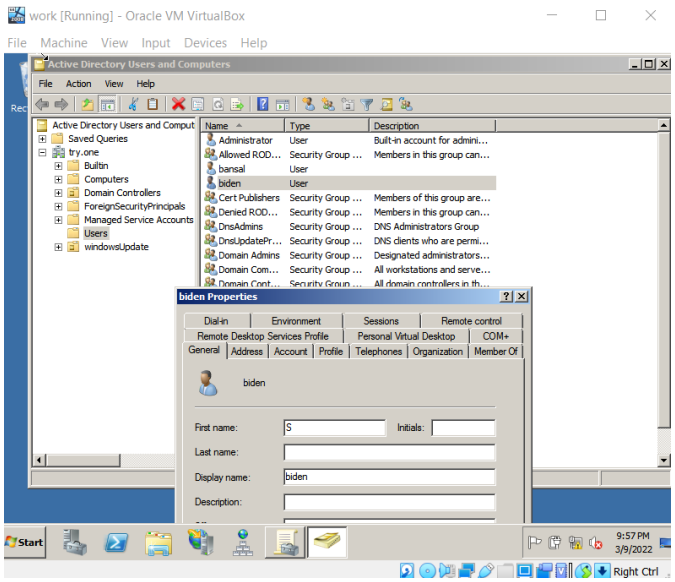
Topic 6

Configuring Group policy for windows update

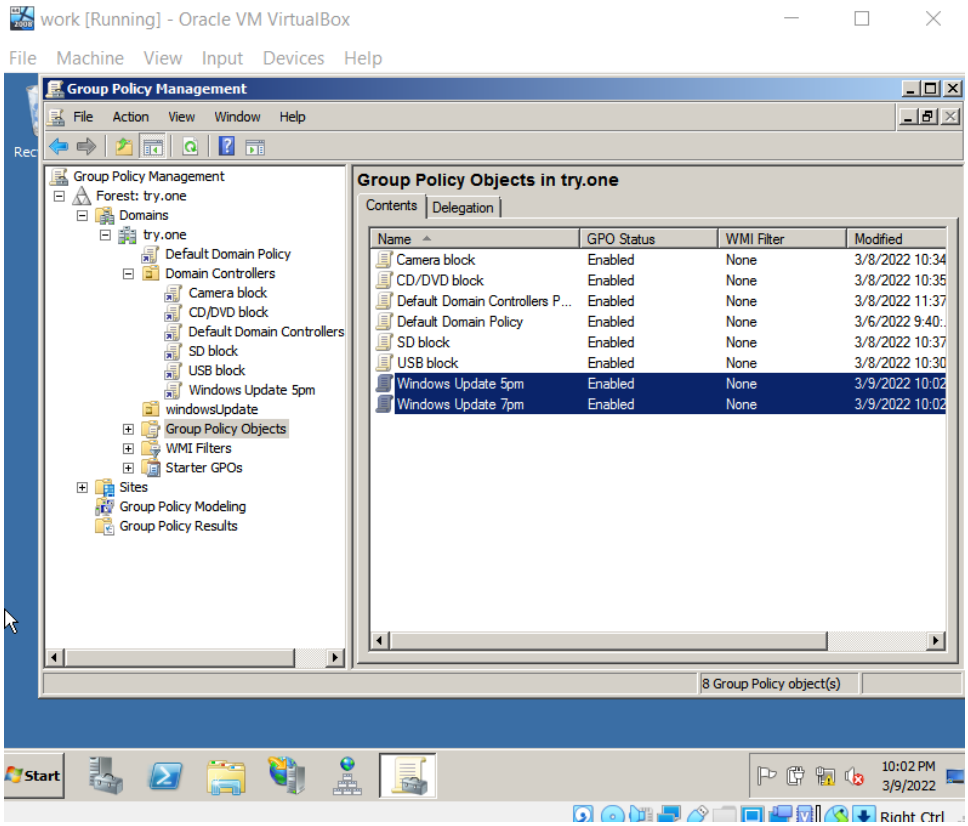
Now we cant try other applications for group policy management, another application of this, assume a company with 200 systems , it would be very impractical if each system had to be individually updated. In this case we can add a user to all these system create a group for them and then create policy which states the time at which the updating can happen.

Again we will be using the previous topic configuration as group policy requires active directory.

In the VM where Active domain and controllers are installed, we go to start >Administrative tools > Active Directories users and computers, in this section we go to the forest we created (try.one) in that we go to users. In the user's section we right click on “administrator” and select copy, this will show the user creation option, here we enter desired credentials for the user and create a password for it. (We copy from administrator because it has the authority to access the domain). We do this step again to create another user.

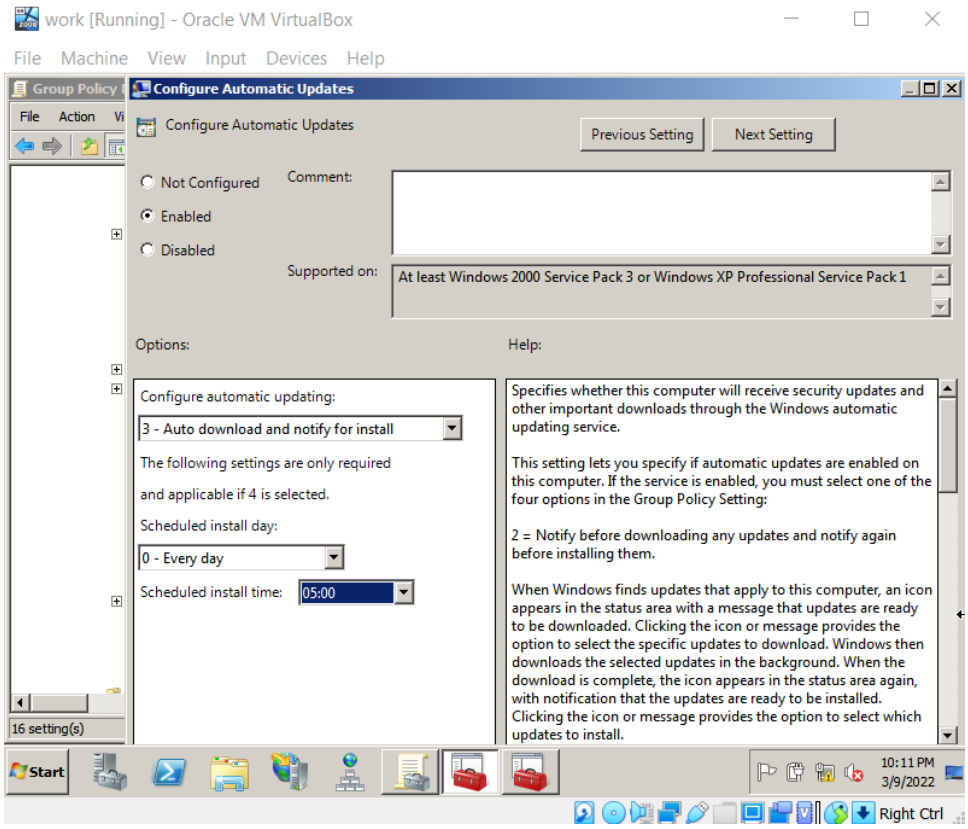


Now we open Group policy management right click on “Group Policy Objects” and select new, and input a desired name referring windows update, and do it twice.



Now we right click on the window update GPO and select “edit”, under Computer Configuration, we select policies, under this we select “Administrative templates” in this section we search and select “windows update”, now under windows update we first open “Configure Automatic Updates” we first click on “enabled” and in options every we keep the time at 5pm, and hit “apply” and “ok.”

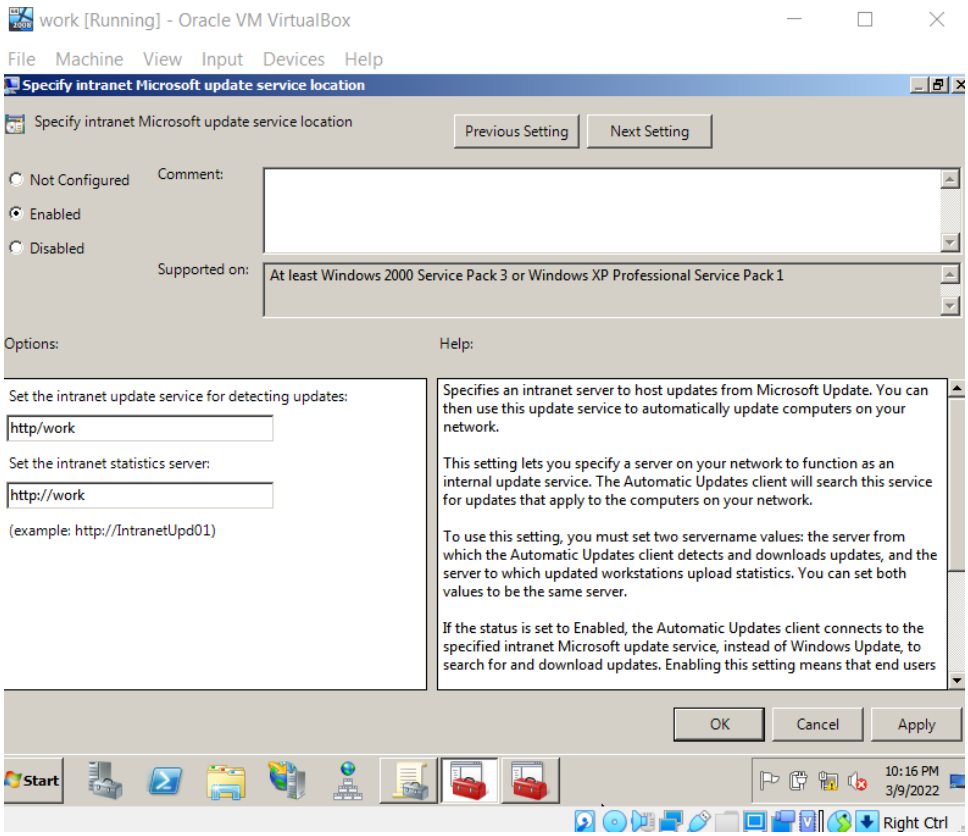
The time can changed to whenever we want. The other group policy objects are from the previous topics. Multiple objects can be linked to group policy.



This gives us further configuration options.

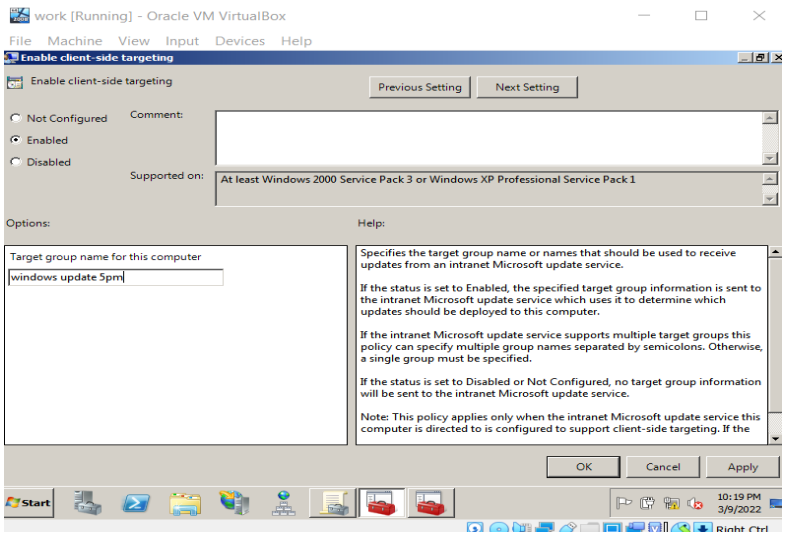
After this, under in the same windows update section we select “Specify Intranet Microsoft Update Service Location” in this we select enabled and, in the option, we enter our server details and select “apply” and “ok.”

The specify intranet Microsoft update service location is a windowed managed application to make updates happen , in this case we can use it to automate the updates.



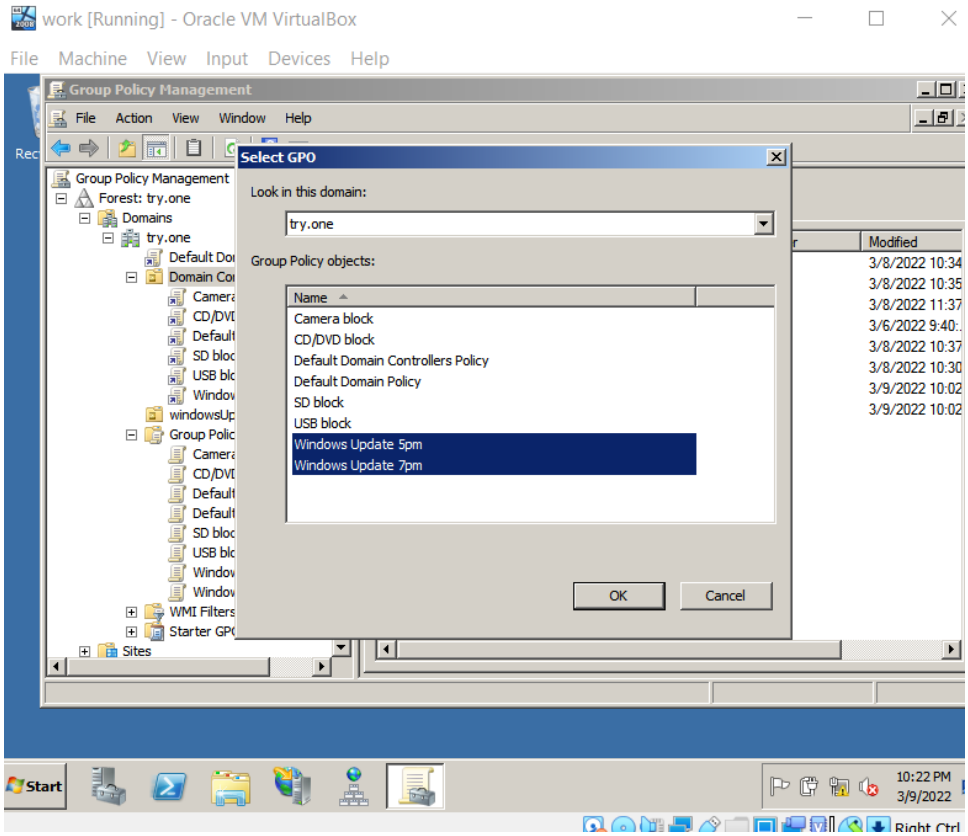
After this, under in the same windows update section we select “Enable Client-Side Targeting” in this section we select enabled and under “Target group Name for Computer” we input our Windows Update GPO name.

The client side targeting is a policy which can automatically assign the user to the group.



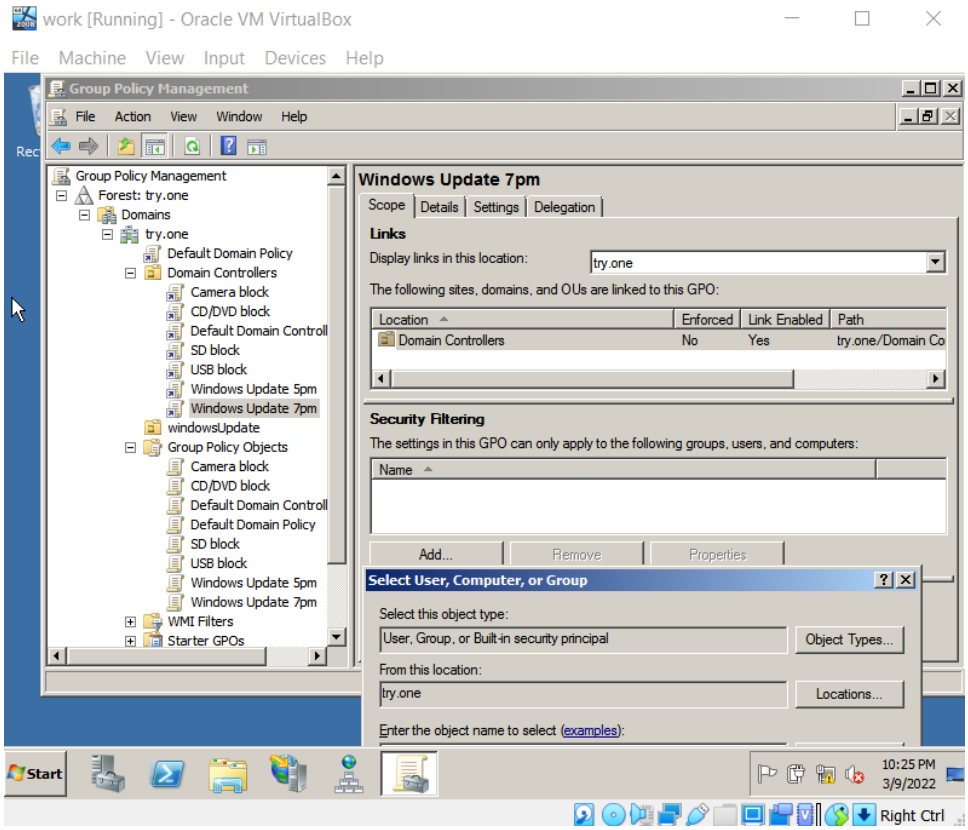
Now we repeat the steps for the windows update GPO and change the time 7pm.

Now back to Group Policy Management, we right click on Domain Controller and select “Link an existing GPO and select our windows update GPO.



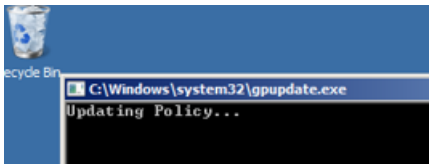
Now under Domain Controllers we select our windows update GPO, in this section under “Security Filtering” we remove authorized users and add the user want to check for windows update at 7pm, now we do the same for windows update at 5pm.

In our domain with policy connected to our group. We can manually or automatically assign users (by client side targeting) and once object(windows update) is linked, all the users in the group, will get automatic windows update on these timing.

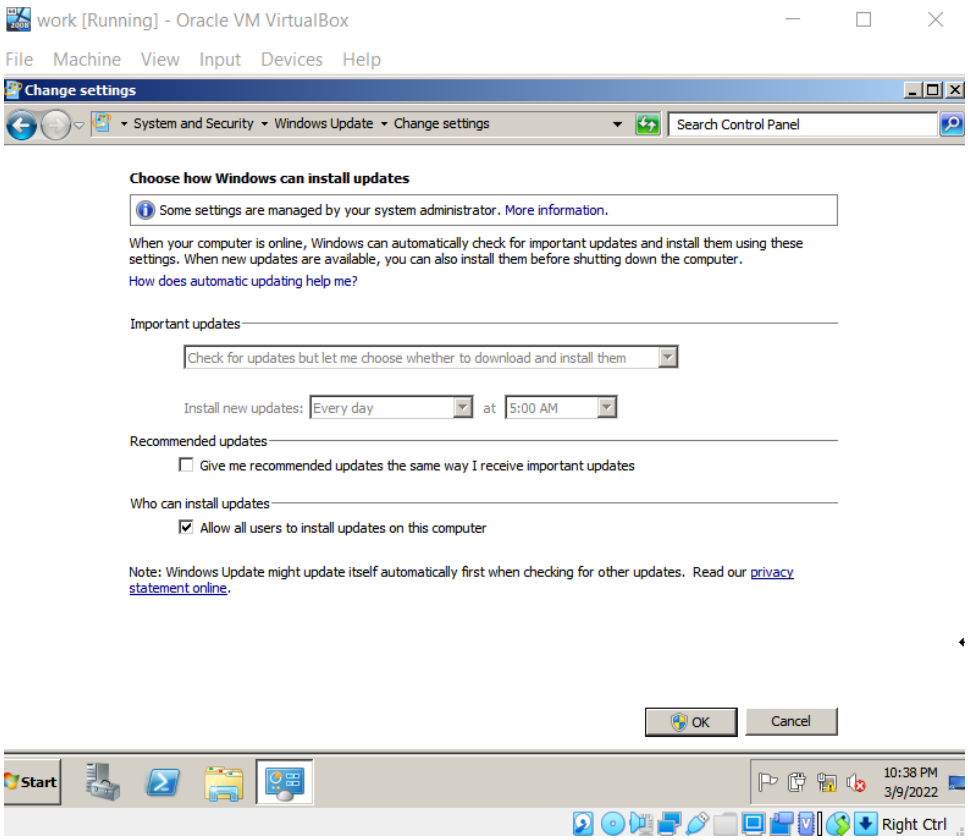


After this step, the last step is input “win + R” and type the command “gpupdate /force” and execute it. This will update the group policy.

This is not required but some systems require the “gpupddate/force command, group policy update” as some systems does not automatically update the group policy, or it could be another group policy preventing it.



To confirm, we switch users for example the one to check windows update 5pm, we enter the login details, go to start and type “Windows update” and select “change settings” and we’ll see the time is set at everyday at 5pm and it can’t be changed to show success.



This is the end of the topic. This gives us a detailed description of the steps taken to configure an active directory server and configure group policy

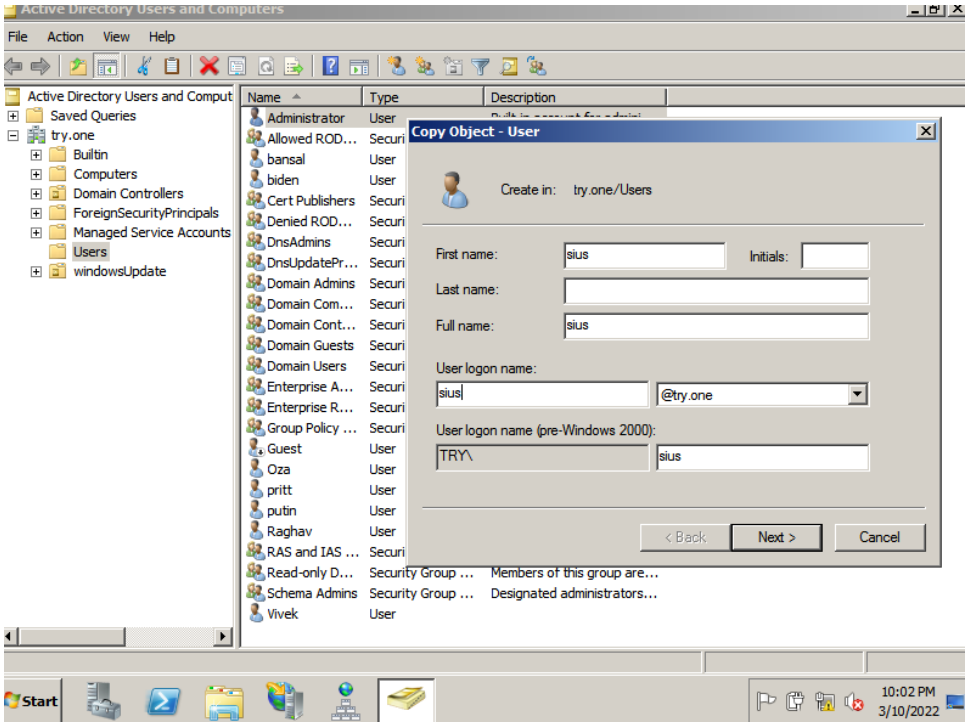
Topic 7

Configuring Group policy to disable Backing up in local machine

Now we can try other applications for group policy management, another application of this, assume a company with 200 employee's, and assuming the work is crucial, and for some unpredictable reason, windows crashes and requires a hard reset, which means deletion of all the progress unsaved, since it's a unpredictable its quite hard to force the employee's to save their progress, hence to automatically have a back up for the system we can create a policy about back and add it the group of employee's. We are going to enable and disable.

Again we will be using the previous topic configuration as group policy requires active directory.

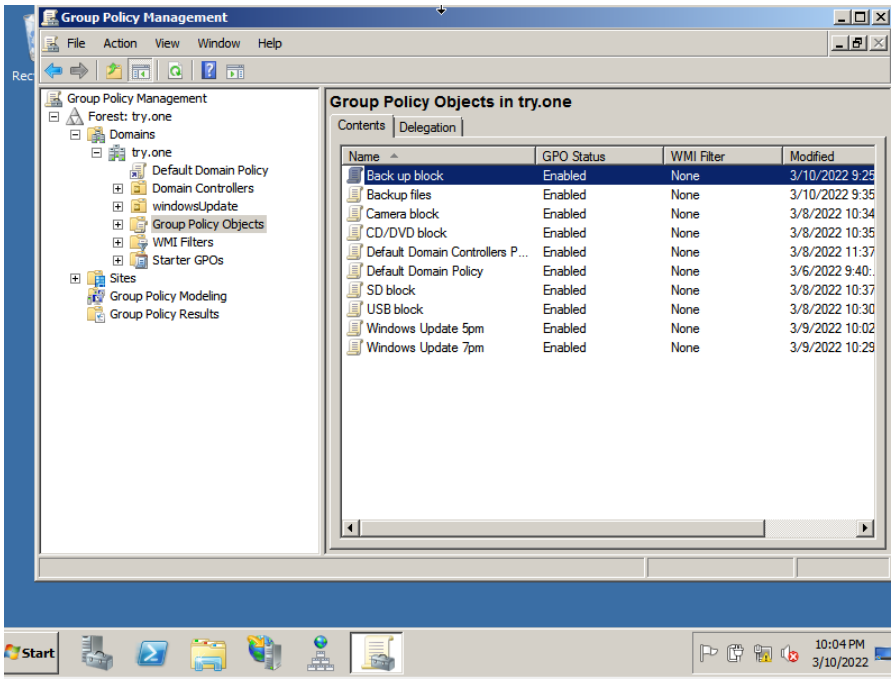
In the VM where Active domain and controllers are installed, we go to start >Administrative tools > Active Directories users and computers, in this section we go to the forest we created (try.one) in that we go to users. In the user's section we right click on “administrator” and select copy, this will show the user creation option, here we enter desired credentials for the user and create a password for it. (We copy from administrator because it has the authority to access the domain). We do this step again to create another user.



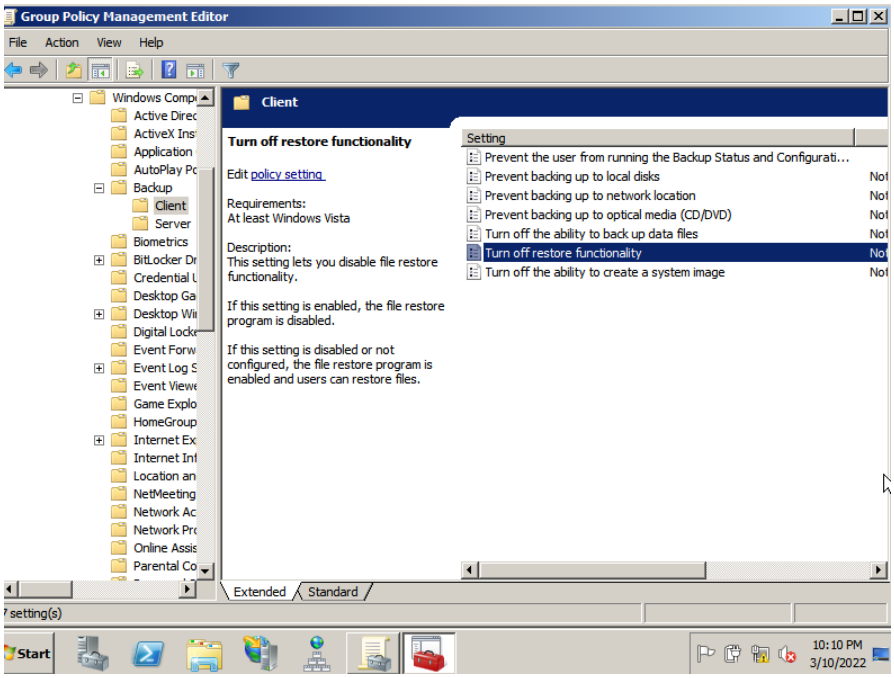
Now we open Group policy management right click on “Group Policy Objects” and select new and input a desired name referring windows back up block.

We can refer the objects to anything we want, for simplicity sake we take windows back up.

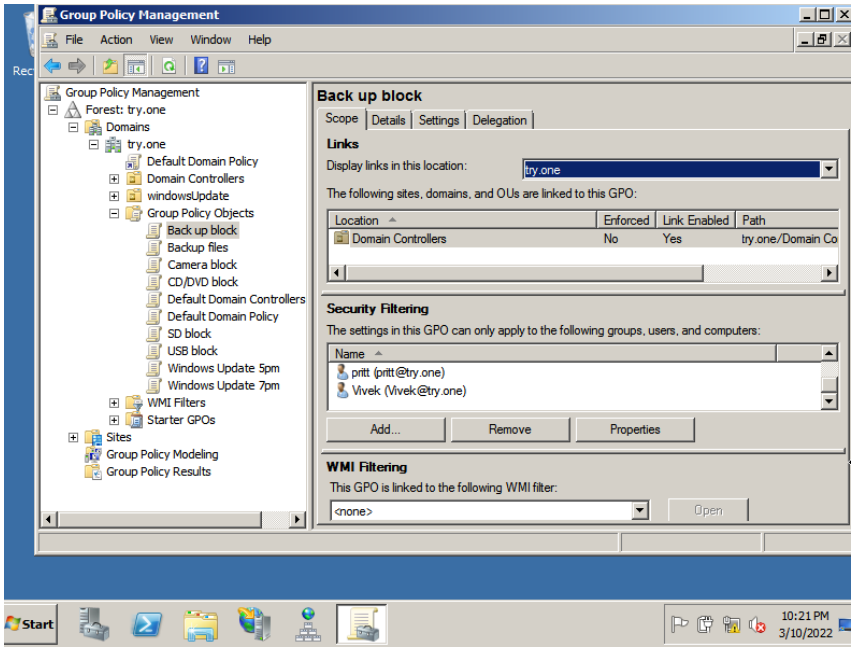
This process creates users, one with administrative access.



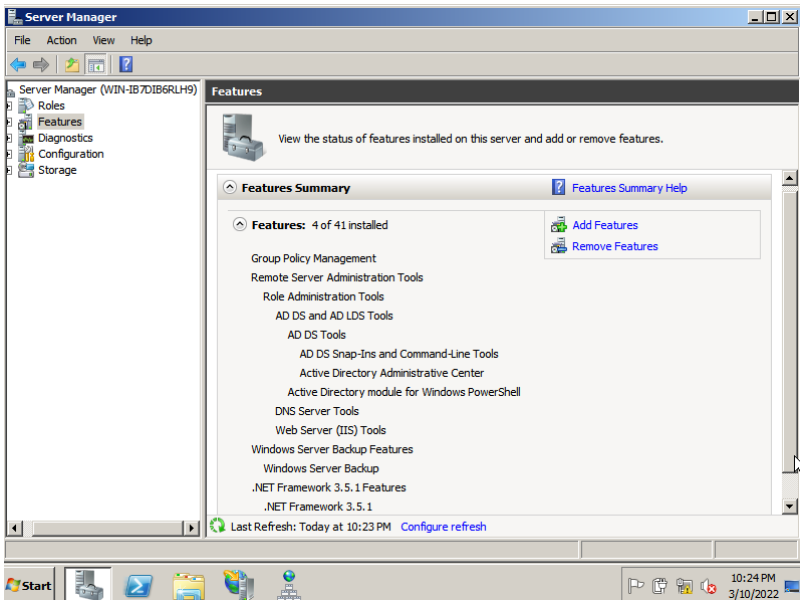
Now we right click on back up block and select edit. Here we go to “Policies”, under polices we select “Administrative Templates”, in here we search and select “backup” and in this se we choose the “client” section and choose the “Turn off the ability to back up data files” and enable it and hit apply.



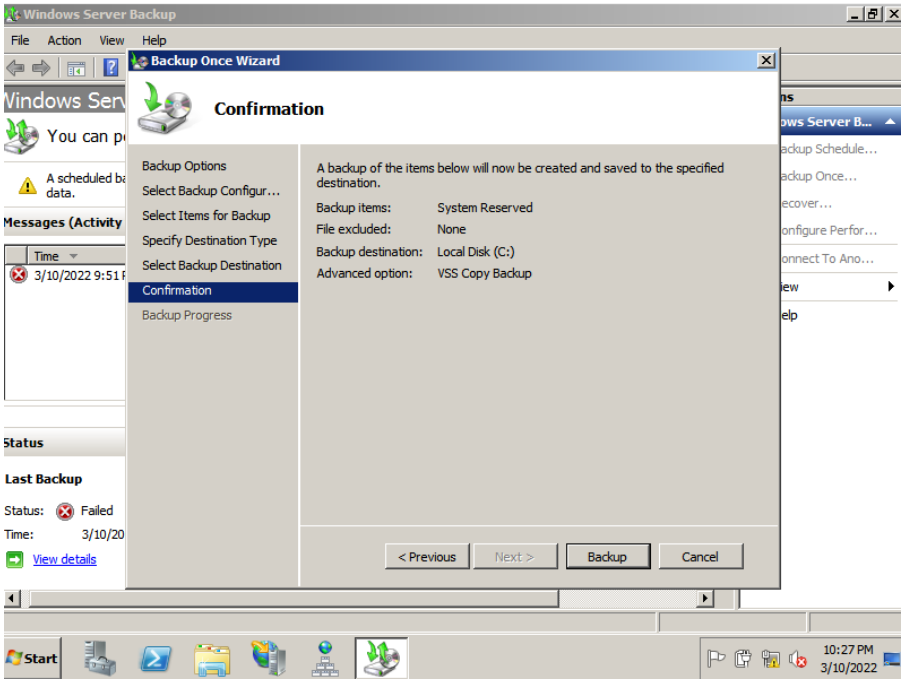
Now, back to Group Policy management we right click on domain controllers and click “Link to an existing GPO” and select the GPO we created. In this Section select our GPO and under “security filtering” we remove authorized users, and the users do not want access to back up.



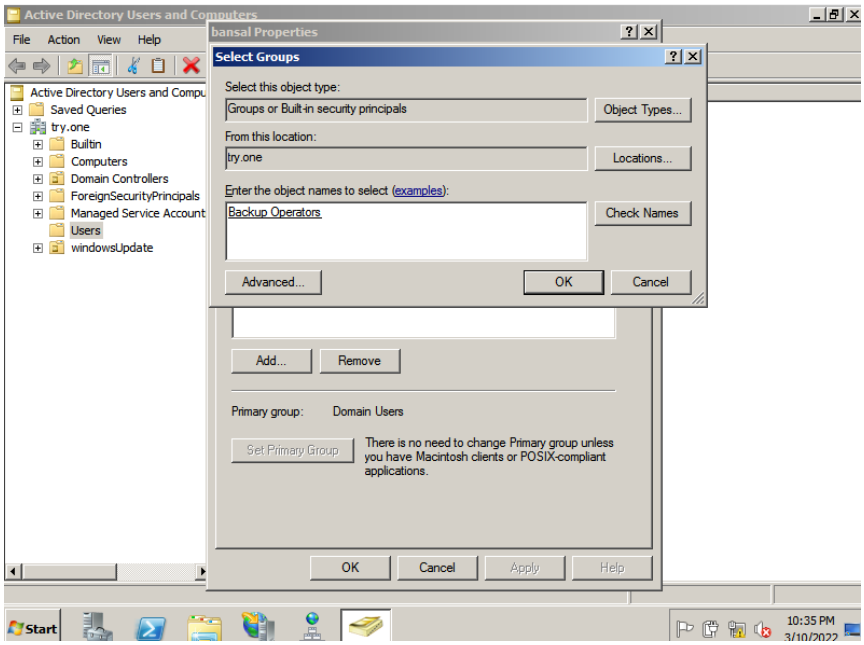
Now we go to “event manager” here we go to “features” and select add features and choose back up.



Now we go to start>Administrative tools>windows backup. Here we go to backup once and choose a desired drive to restore in desired file.

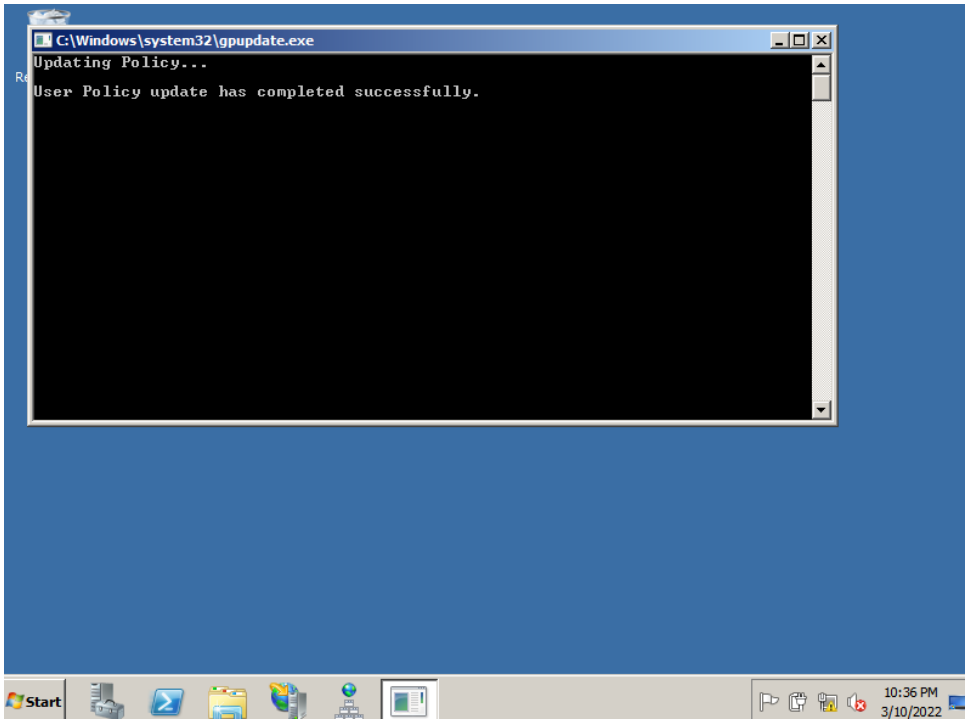


After this we go to Active directory Users and Computers and select a use who we want to have back files, we right click on that user go to “member of” and add back, now our user will have back up files.



After this step, the last step is input “win + R” and type the command “gpupdate /force” and execute it. This will update the group policy.

This is not required but some systems require the “gpupddate/force command, group policy update” as some systems does not automatically update the group policy, or it could be another group policy preventing it.



This is the end of the topic. This gives us a detailed description of the steps taken to configure an active directory server and configure group policy

Topic 8

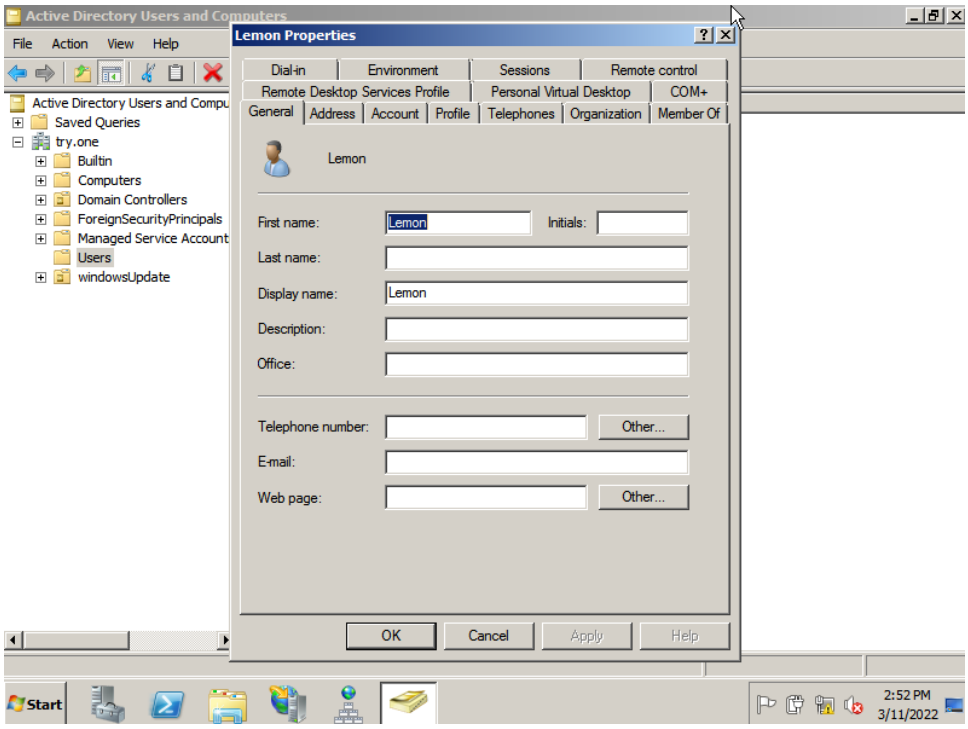
Configuring Group policy to delegate control to reset the password of the users

One of the most important scenarios group policy is used for, and a primary role for an administrator. There are multiple instances when only the administrator should have access to control or reset passwords. A very fundamental security step, this group policy is seen everywhere from schools and colleges to government buildings.

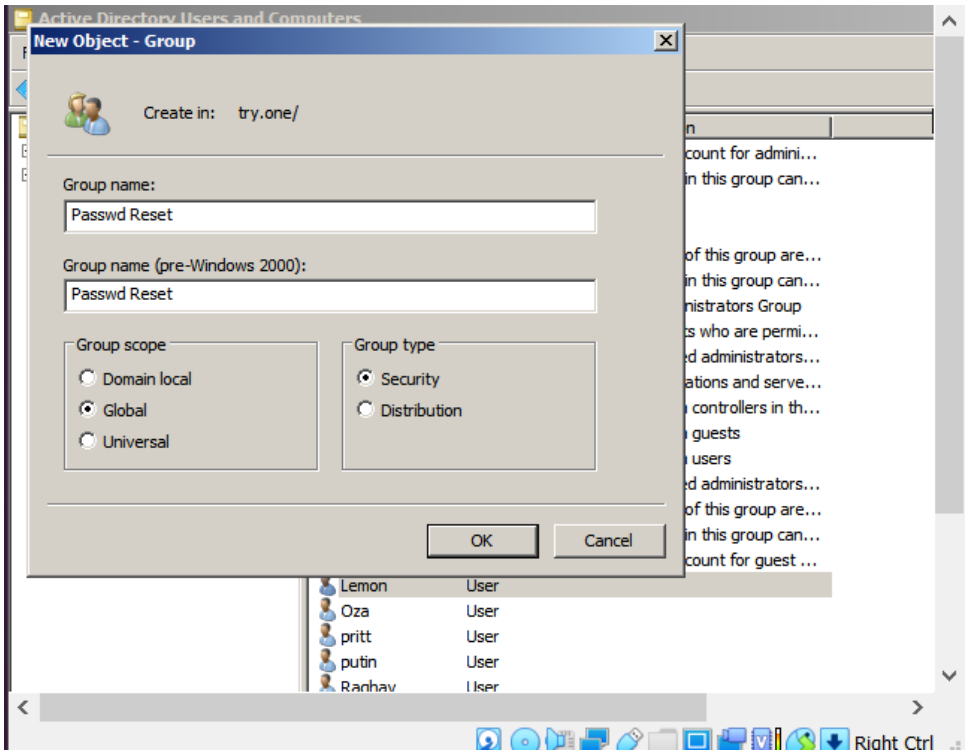
An important step and also very overlooked one, after we create an object and delegate control to administrator it is still vulnerable if the ability to back up files is still on. If we leave this feature on, even after deleting a password the user can just restore back till it had password.

Again we will be using the previous topic configuration as group policy requires active directory.

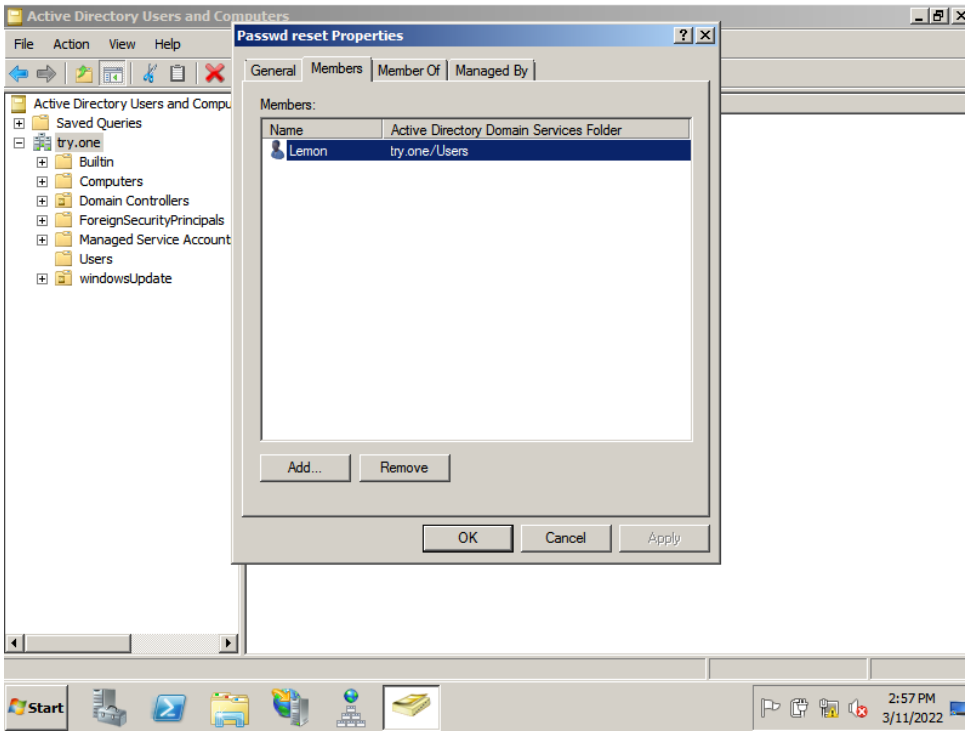
In the VM where Active domain and controllers are installed, we go to start >Administrative tools > Active Directories users and computers, in this section we go to the forest we created (try.one) in that we go to users. In the user's section we right click on “administrator” and select copy, this will show the user creation option, here we enter desired credentials for the user and create a password for it. (We copy from administrator because it has the authority to access the domain).



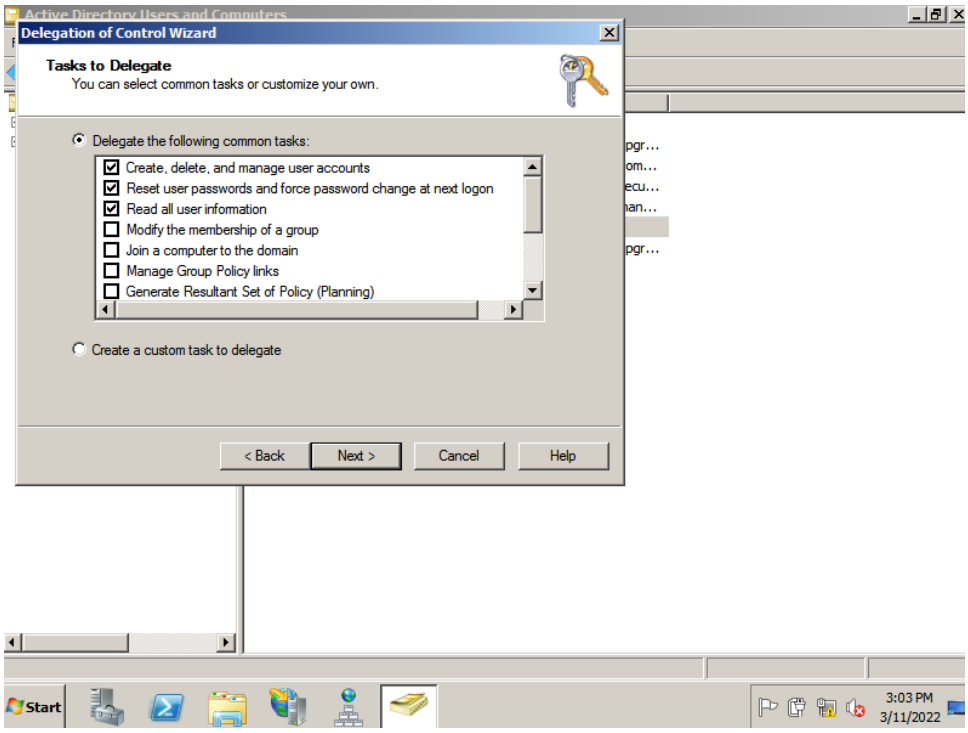
Now we right click on our forest which was created (try.one) and select new>group.



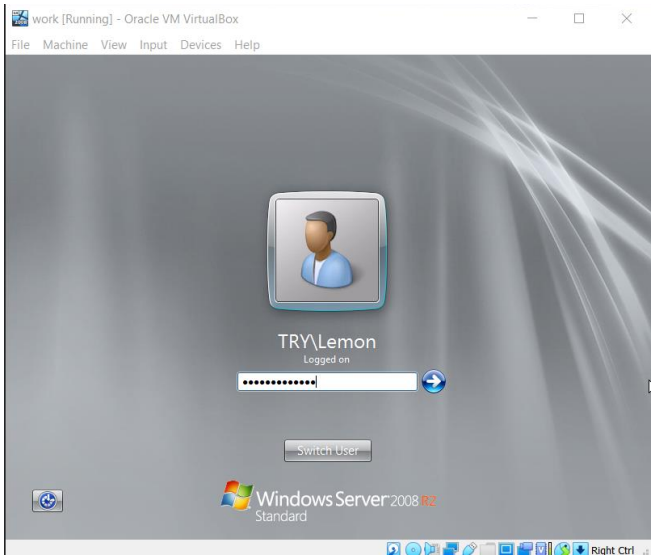
After we created the group, we go back to users' section, we right click on user we just created and select “add to a group” and we go and input the passwd rest group we just created. To check if he is in the group, we go to the group created in our forest and select our group and click on “members.”



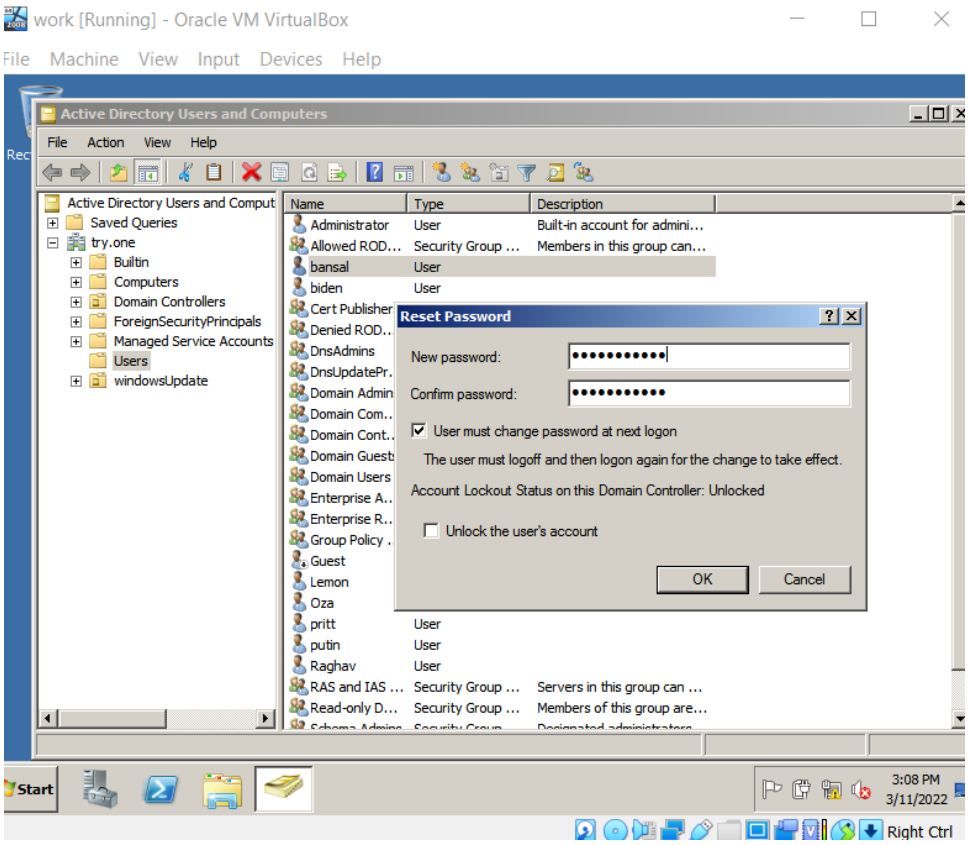
After adding our user to this group, we now right click on our forest (try.one) and select “delegate control” we click next and add the passwd reset group we created and select the option to reset passwords and finish.



After this we go to “start” and switch users, to the user we created in the password reset group. Now enter the login credentials for the user.



Here go to start>Active Directories Users and Computers, and search for any user in the user section. We right click on that user we will see the option to reset password, hit enter and input a new desired password for the user.



This is the end of the topic.

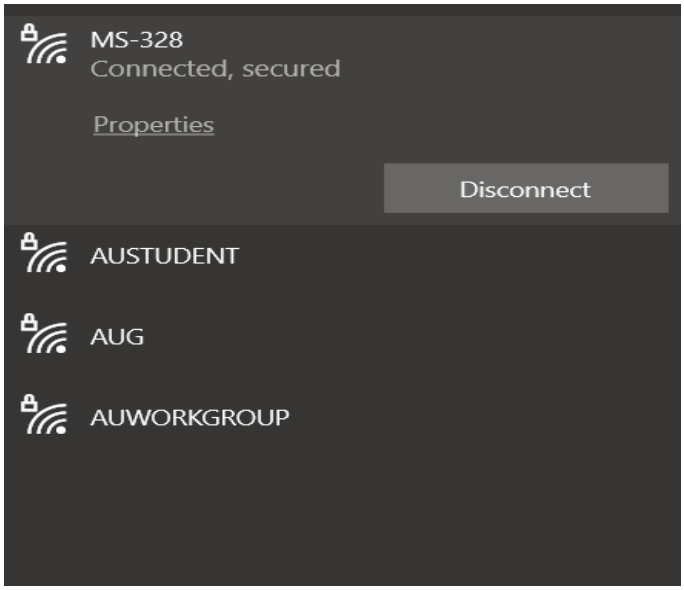
Topic 9

Router Configuration

A router is in the network layer in OSI model, a router gives a route for a packet to travel. In this paper we have seen the creation of web pages and group policies, now to last step to introduce router, we've seen how

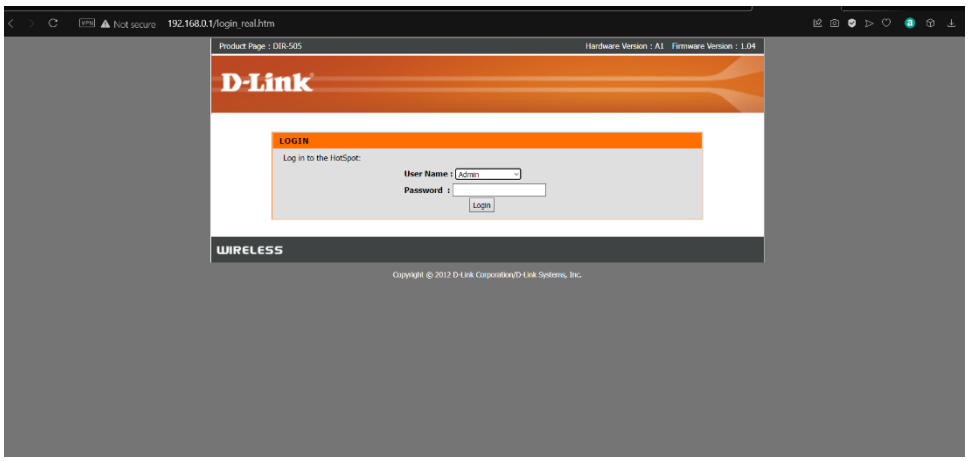
to create and host a website, with a router configuration we can bring it to the internet and not just systems under same network. A router can also reject users from accessing the website.

The first step is to turn on a D-link router. Once it's on we connect it to our laptop, using the password given by the router. (The password is on the router.)

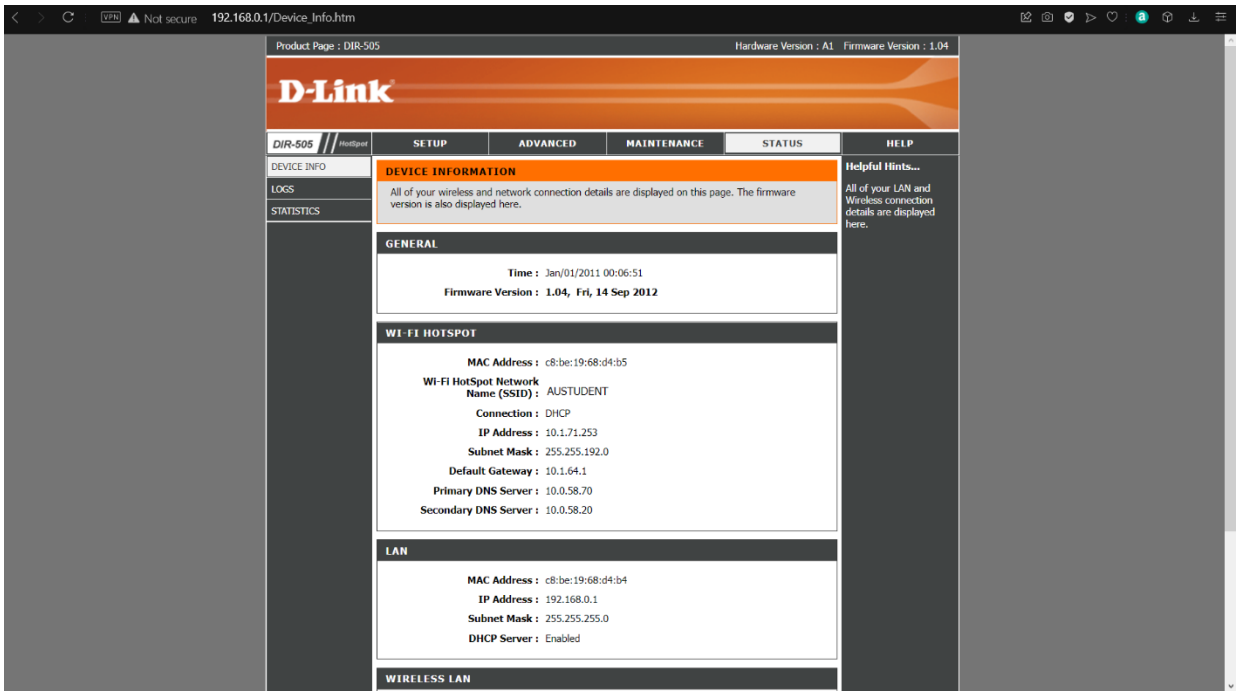


After accessing Wi-Fi, we connect it to 3 devices.

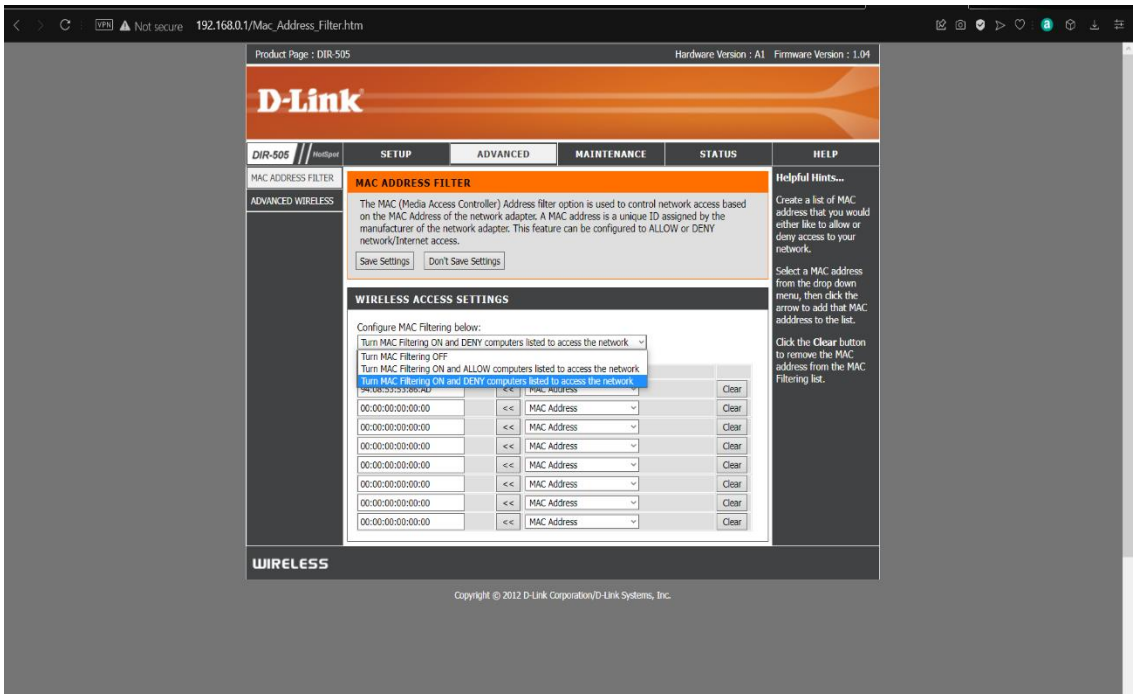
Now on any of the devices we open a browser and type the default IP address to the admin page for D-Link. Which is “192.168.0.1”



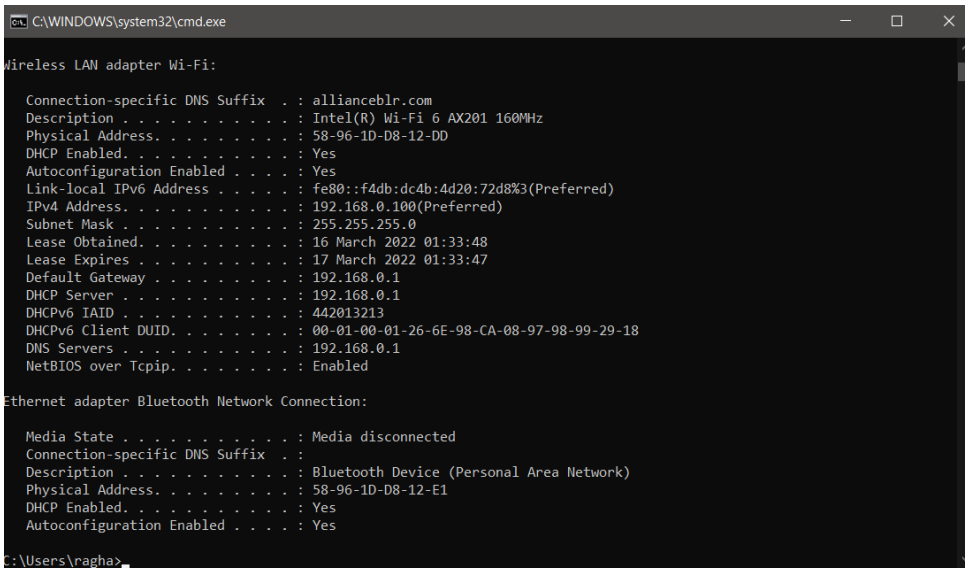
Since its not configured yet we just login and join a Wi-Fi which is already connected.



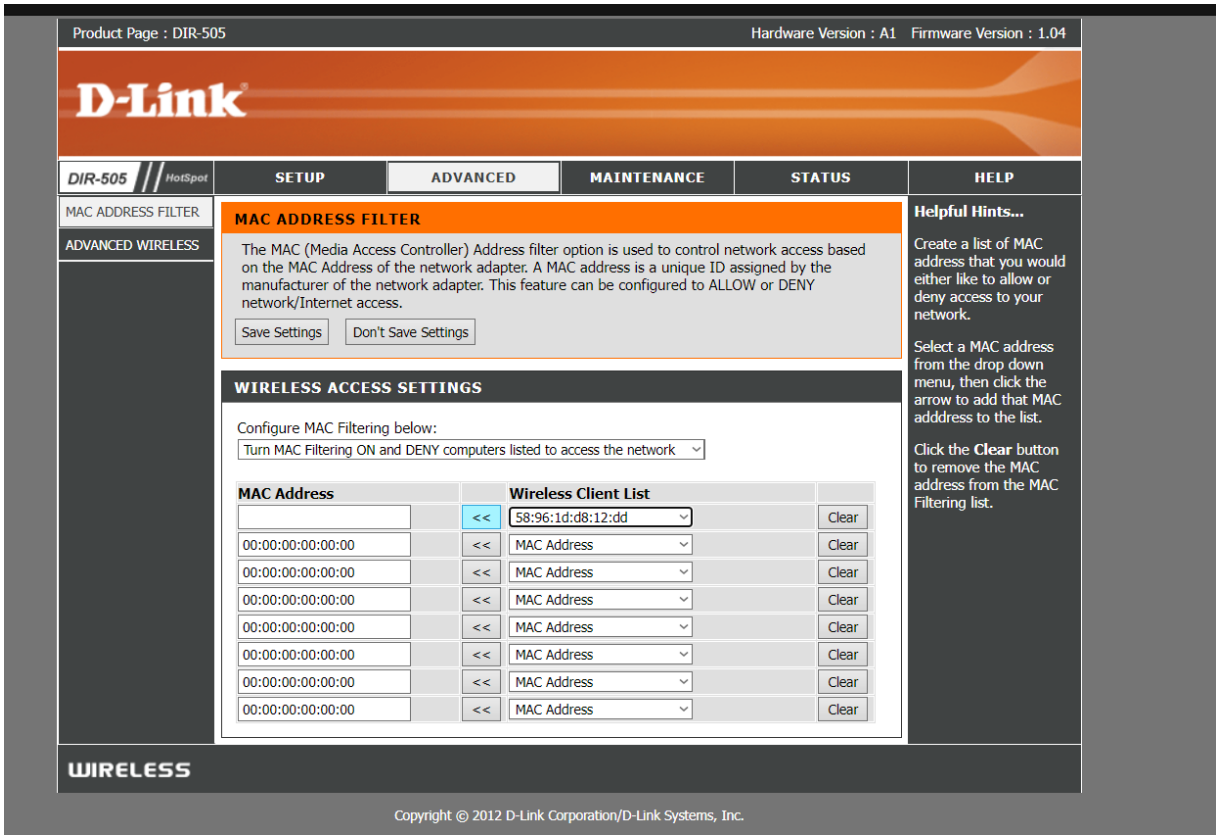
From here in the home page of D-Link page, we select the “WIRELESS LAN SETUP” and move to the “ADVANCED” section, and under” Configure MAC Filtering below” we select the option of “Turn MAC filtering ON and DENY Computers listed to access the network.”



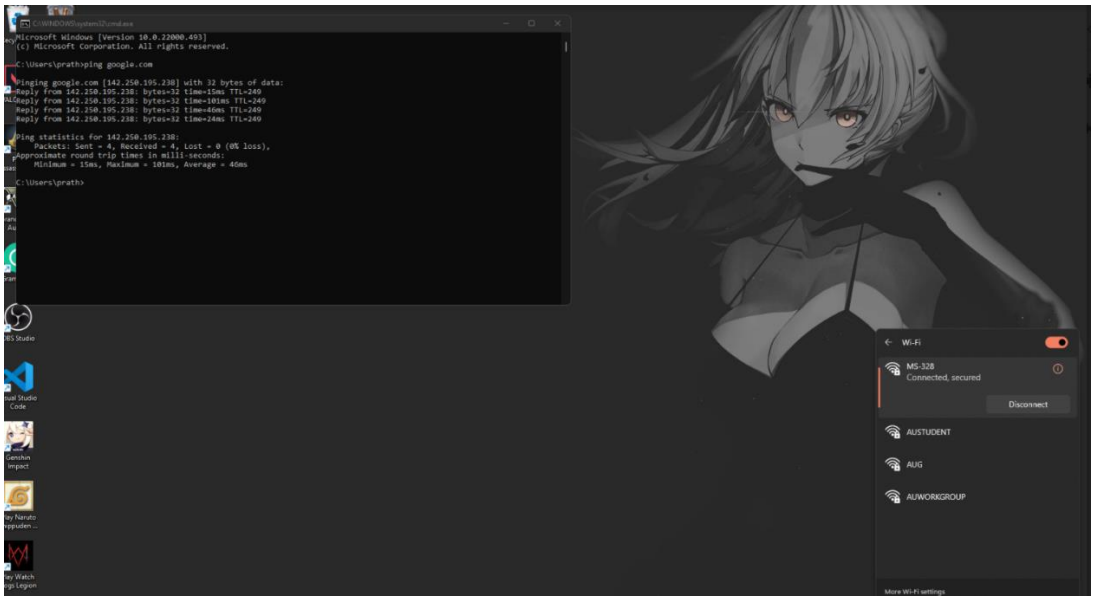
Now from here we need to find our MAC address (also called physical address.) We do this by opening command prompt and typing this command “ipconfig /all”



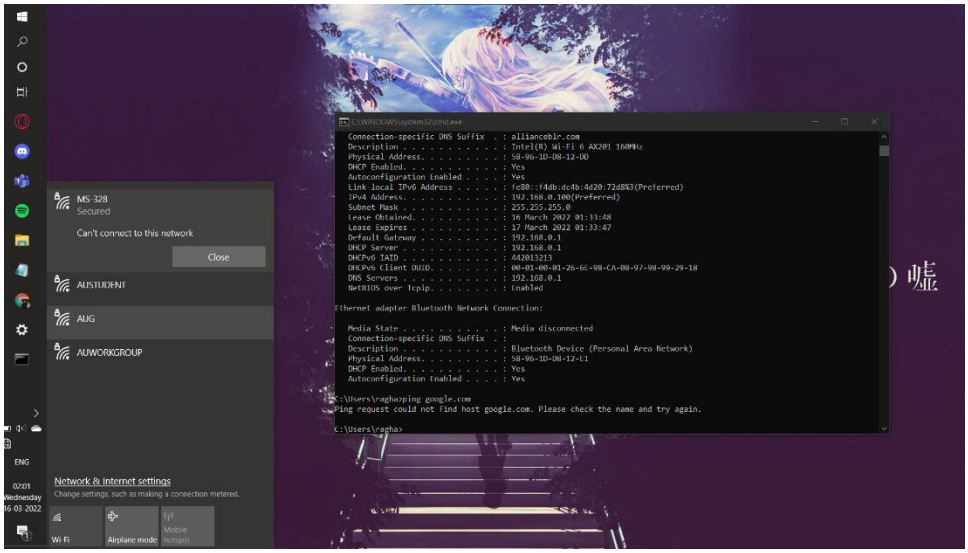
As we can see our physical address is “58-96-1D-D8-12-E1" now back to the D-Link system page we select the MAC Address we don’t want to access the internet, click on “<<” option.



Now save settings. To check if wifi is working log in to the other device and open cmd and type “ping google.com” (To check if it connects to the internet)



As we can see we are getting a reply, this means it's connected to the internet, now back to the device where we denied access to the internet.



References:

https://learn.microsoft.com/en-us/iis/install/installing-iis-7/installing-iis-7-and-above-on-windows-server-2008-or-windows-server-2008-r2

https://admx.help/?Category=Windows_10_2016&Policy=Microsoft.Policies.WindowsUpdate::CorpWuURL

Instructor name:

Amaresh Maduraiveeran amaresh.m@k7computing.com

Software downloads:

https://www.virtualbox.org/wiki/Downloads

https://www.microsoft.com/en-za/download/details.aspx?id=22077

We have gone through the period of 2008 to 2010 and seen how a developer and an operator would be. This period of time was at a constant change, many more complications and advancements has occurred. We learn extensively the period before this and to enter the developer or operator position, most people tend to skip over this part of our history.

All of figures we screenshot on my laptop, the hardware specification is given. All of the figures and information was on my own research.