



# NETWORK FUNDAMENTALS LABS

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## **LABS**

labs are proving the theoretical concepts that have been taught in lectures and enhance the technical skills for learners

# HOW TO PREPARE YOUR PC TO DO THE LABS EFFECTIVELY?

**1- It is preferred that you do your labs and Assignments in your Virtual Machine not on your original operating systems.**

*To setup A Virtual Machine on your pc see “index”*

## **2- During Testing Don't forget to**

- a. Turn off Firewall Both on Client and Server PCs
- b. Turn off Firewall of any Antivirus Both Client and Server.
- c. Test Connectivity between Client and Server.
- d. Do not use Proxy Server on Both Client and Server PCs

## **3- After finished your labs don't forget to:**

- a. Uninstall the programs you used
- b. Disabled the accounts you create
- c. Disables the rules you setup on firewall
- d. Enable your firewall and antivirus
- e. Use your proxy server

## **Labs**

**In these labs, you will learn how to Configure TCP/IP Protocols on your pcs (Clients & Servers) and prove the theoretical concepts that have been taught in lectures which will enhance your technical skills**

# Lab 1

## ❖ Building the network (Configuring your IP address )

- ✚ By default the DHCP (distribute IP address to Client) will give your PC an IP address if they are assigned to obtain an IP address automatically.

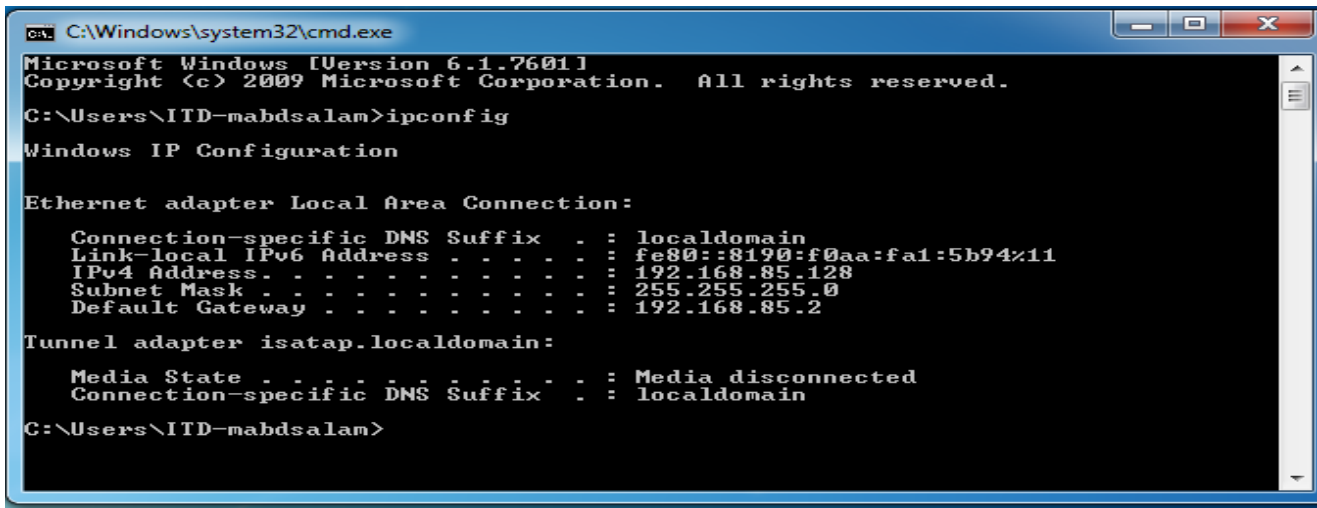
To know your current IP address (logical) use the command:

### ➤ 1- Ipconfig Command

#### ➤ Ipconfig

Gives details about your network settings

Start →cmd→ipconfig



```
C:\Windows\system32\cmd.exe
Microsoft Windows [Version 6.1.7601]
Copyright (c) 2009 Microsoft Corporation. All rights reserved.

C:\Users\ITD-mabdsalam>ipconfig

Windows IP Configuration

Ethernet adapter Local Area Connection:

    Connection-specific DNS Suffix  . : localdomain
    Link-local IPv6 Address . . . . . : fe80::8190:f0aa:fa1:5b94%11
    IPv4 Address. . . . . : 192.168.85.128
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . : 192.168.85.2

Tunnel adapter isatap.localdomain:

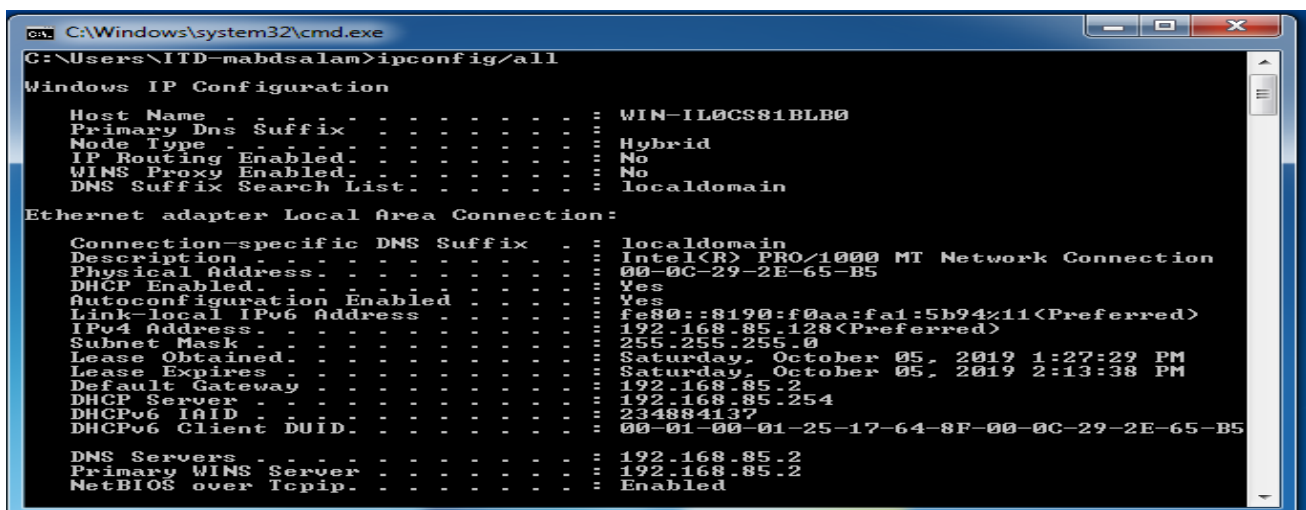
    Media State . . . . . : Media disconnected
    Connection-specific DNS Suffix  . : localdomain

C:\Users\ITD-mabdsalam>
```

#### ➤ Ipconfig /all

Gives more details about your network settings

Start →cmd→ipconfig/all



```
C:\Windows\system32\cmd.exe
C:\Users\ITD-mabdsalam>ipconfig/all

Windows IP Configuration

    Host Name . . . . . : WIN-IL0CS81BLB0
    Primary Dns Suffix . . . . . : 
    Node Type . . . . . : Hybrid
    IP Routing Enabled . . . . . : No
    WINS Proxy Enabled . . . . . : No
    DNS Suffix Search List . . . . . : localdomain

Ethernet adapter Local Area Connection:

    Connection-specific DNS Suffix  . : localdomain
    Description . . . . . : Intel(R) PRO/1000 MT Network Connection
    Physical Address. . . . . : 00-0C-29-2E-65-B5
    DHCP Enabled. . . . . : Yes
    Autoconfiguration Enabled . . . . : Yes
    Link-local IPv6 Address . . . . . : fe80::8190:f0aa:fa1:5b94%11(Preferred)
    IPv4 Address. . . . . : 192.168.85.128(Preferred)
    Subnet Mask . . . . . : 255.255.255.0
    Lease Obtained . . . . . : Saturday, October 05, 2019 1:27:29 PM
    Lease Expires . . . . . : Saturday, October 05, 2019 2:13:38 PM
    Default Gateway . . . . . : 192.168.85.2
    DHCP Server . . . . . : 192.168.85.254
    DHCPv6 IAID . . . . . : 234884137
    DHCPv6 Client DUID . . . . . : 00-01-00-01-25-17-64-8F-00-0C-29-2E-65-B5

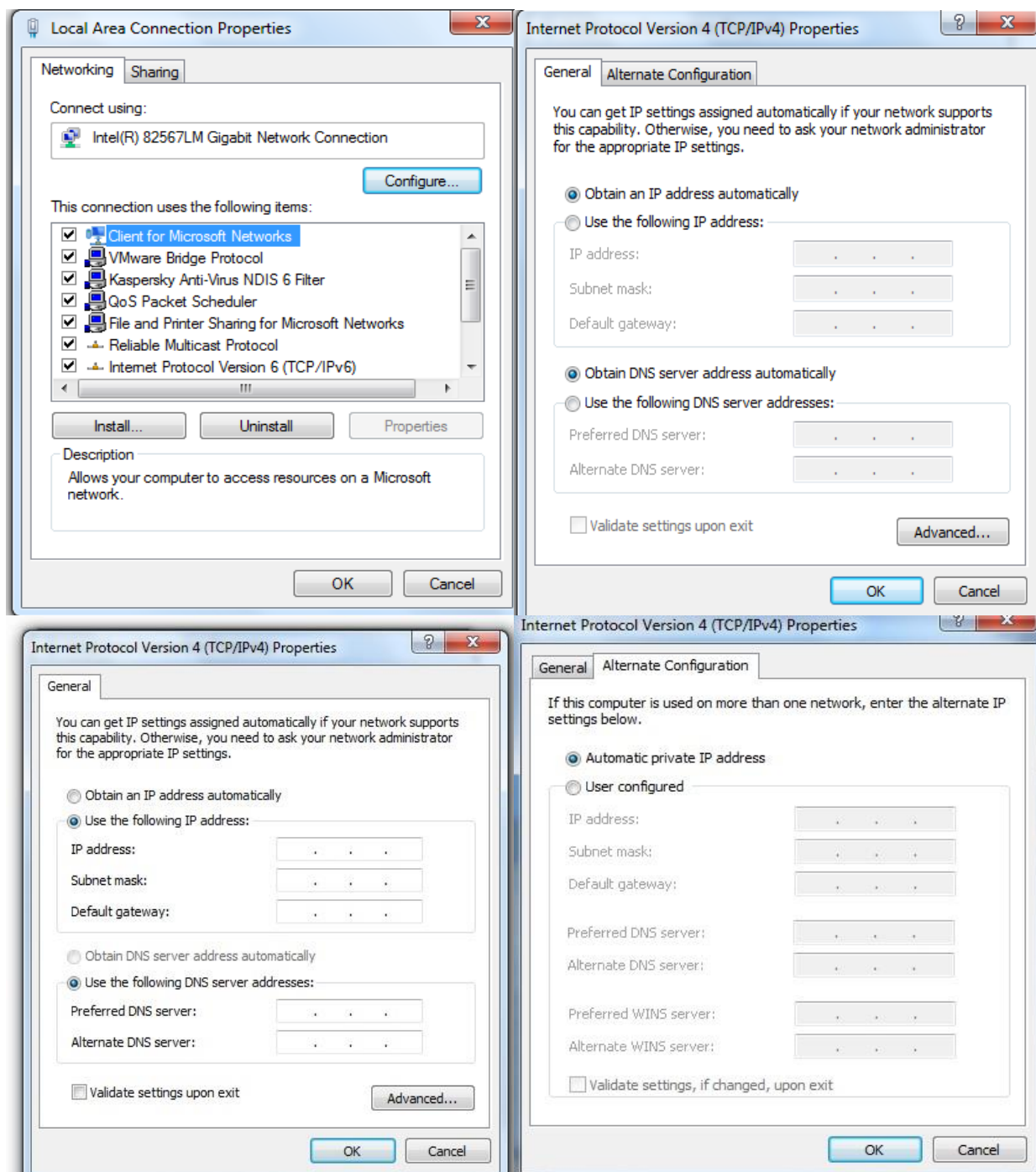
    DNS Servers . . . . . : 192.168.85.2
    Primary WINS Server . . . . . : 192.168.85.2
    NetBIOS over Tcpip. . . . . : Enabled
```

- ipconfig /release ---To Release the conflict or faulty IP Address.
- ipconfig /renew --- To Request a new IP from a DHCP server

- ✚ IF there is a problem and your pc can't get an IP address you can configure it Manually

## ➤ 2- Configure IP address manually.

**Start → Control panel → Network and Internet → Network and sharing Center**  
**→ In the Left panel Change Adaptor settings → select Local Area Connection adaptor → Double click and edit network settings**



Click the Advanced button and you can add IP address, Gateway, DNS,..etc

IP Settings

DNS WINS

IP addresses

| IP address | Subnet mask |
|------------|-------------|
|------------|-------------|

Add... Edit... Remove

Default gateways:

| Gateway | Metric |
|---------|--------|
|---------|--------|

Add... Edit... Remove

☒ Automatic metric

Interface metric:

OK Cancel

✚ To check the connectivity between devices use the  
To know your Real IP (Static) address

Use website like as :

<https://whatismyipaddress.com/>

Instant IP Address Lookup

whatismyipaddress.com/ip-lookup

MY IP IP LOOKUP HIDE MY IP VPNs TOOLS LEARN

Home » IP Tools » IP Lookup

## IP Lookup

### Lookup IP Address Location

If you can find out the IPv4 or IPv6 address of an Internet user, you can get an idea what part of the country or world they're in by using our IP Lookup tool.

What to do: Enter the IP address you're curious about in the box below, then click "Get IP Details." Read the information below for an explanation.

#### How to get someone's IP address

Once you have an IP address it is as easy as pasting and clicking above. But if you don't know how to get someone's IP address read: [11 Ways To Get Someone's IP Address](#)

#### What you will get with this tool:

Waiting for www.facebook.com...

Ad WebEngage

Want to Increase User Retention?

Get a Demo

Increase Customer Retention

WebEngage LEARN MORE

FIND THE BEST VPN IN SECONDS.

VPN Simplifier™

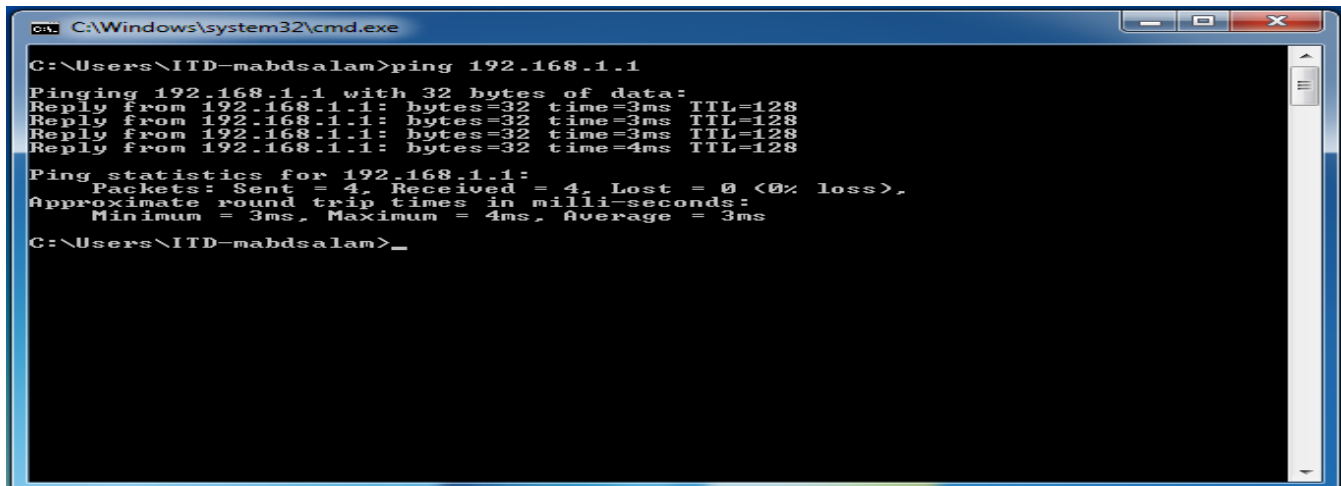
Show Me

- **3- Ping Command**
- **Check the connectivity**

Ping *Destination IP Of\_Remote\_Host*

- Suppose that the remote host has the ip 192.168.1.1

**C:\>ping 192.168.1.1**



```
C:\Windows\system32\cmd.exe
C:\Users\ITD-mabdsalan>ping 192.168.1.1
Pinging 192.168.1.1 with 32 bytes of data:
Reply from 192.168.1.1: bytes=32 time=3ms TTL=128
Reply from 192.168.1.1: bytes=32 time=3ms TTL=128
Reply from 192.168.1.1: bytes=32 time=3ms TTL=128
Reply from 192.168.1.1: bytes=32 time=4ms TTL=128
Ping statistics for 192.168.1.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 3ms, Maximum = 4ms, Average = 3ms
C:\Users\ITD-mabdsalan>
```

- **Check the Availability of website**

**C:\>ping Yahoo.com**

- **Continue ping operation unlimited** ( just add the switch "-t")

**C:\>ping 192.168.1.1 -t**

to exit write : ctrl+c

- **To control the number of pinging packets,**  
(just add the switch "-n" followed by the required packet number (space) )

**C:\>ping 192.168.1.1 -n 7**

- **To control the size of pinging packets,**  
(just add the switch "-l" followed by the required packet size)

**C:\>ping 163.121.25.40 -l 2000**

**C:\> Ping 163.121.12.40 -l 2000 -n 6**

```
Reply from 163.121.12.40: bytes=2000 time=1ms TTL=128
Reply from 163.121.12.40: bytes=2000 time=1ms TTL=128
Reply from 163.121.12.40: bytes=2000 time=1ms TTL=128
Reply from 163.121.12.40: bytes=2000 time=1ms TTL=128
Reply from 163.121.12.40: bytes=2000 time=1ms TTL=128
Reply from 163.121.12.40: bytes=2000 time=1ms TTL=128
```



## ➤ 4- MAC address

to know **your** current MAC (physical) address use the command:

✚ **Ipconfig /all**

✚ **Get mac**

```
C:\Windows\system32\cmd.exe
C:\Users\ITD-mabdsalam>ipconfig/all

Windows IP Configuration

Host Name . . . . . : WIN-IL0CS81BLB0
Primary Dns Suffix . . . . . : localdomain
Node Type . . . . . : Hybrid
IP Routing Enabled . . . . . : No
WINS Proxy Enabled . . . . . : No
DNS Suffix Search List . . . . . : localdomain

Ethernet adapter Local Area Connection:

Connection-specific DNS Suffix . : localdomain
Description . . . . . : Intel(R) PRO/1000 MT Network Connection
Physical Address. . . . . : 00-0C-29-2E-65-B5
DHCP Enabled. . . . . : Yes
Autoconfiguration Enabled . . . . : Yes
Link-local IPv6 Address . . . . . : fe80::8190:f0aa:fa1:5b94%11<Preferred>
IPv4 Address. . . . . : 192.168.85.128<Preferred>
Subnet Mask . . . . . : 255.255.255.0
Lease Obtained . . . . . : Saturday, October 05, 2019 1:27:29 PM
Lease Expires . . . . . : Saturday, October 05, 2019 3:28:37 PM
Default Gateway . . . . . : 192.168.85.2
DHCP Server . . . . . : 192.168.85.254
DHCPv6 IAID . . . . . : 234884137
DHCPv6 Client DUID. . . . . : 00-01-00-01-25-17-64-8F-00-0C-29-2E-65-B5

DNS Servers . . . . . : 192.168.85.2
Primary WINS Server . . . . . : 192.168.85.2
NetBIOS over Tcpip. . . . . : Enabled

Tunnel adapter isatap.localdomain:

Media State . . . . . : Media disconnected
Connection-specific DNS Suffix . : localdomain
Description . . . . . : Microsoft ISATAP Adapter
Physical Address. . . . . : 00-00-00-00-00-00-E0
DHCP Enabled. . . . . : No
Autoconfiguration Enabled . . . . : Yes

C:\Users\ITD-mabdsalam>getmac

Physical Address      Transport Name
=====
00-0C-29-2E-65-B5    \Device\NPF{BC5A0ADE-E1FB-46EC-9665-278B8FD25A2D}
```

✚ To know **other devices** MAC (physical) address use the **ARP** command:

## ➤ 5- ARP Command

**Definition:** ARP (**A**ddress **R**esolution **P**rotocol) mapping an Internet Protocol (IP) address to its corresponding physical network address (Mac)

ARP request is **broadcast**; an ARP reply is **unicast**

**Run the following command to view the contents of the ARP cache (Run as Admin)**

**C:\>arp -a**

C. To delete the arp cache write the command

**C:\>arp -d**

## ➤ 6- Routing Table Commands

A routing table is a set of rules, often viewed in table format, that is used to determine where data packets traveling over an Internet Protocol (IP) network will be directed. All IP-enabled devices, including routers and switches, use routing tables.

- To view the local routing table, write the command

**C:/>route print**

- To add a route to the routing table, write the command

Destination Net ID   mask IP   GW IP   metric value, IF # "interface #" or IF IP

Destination Net ID   mask IP                      GW IP                      metric value

C:/>Route add 163.121.12.0 mask 255.255.255.0 163.121.12.1   metric 1   (Most trusted)

C:/>Route add 163.121.12.0 mask 255.255.255.0 163.121.12.1   metric 100   (least trusted)

**Problem:** With route add command: Element Not found – parameter is in correct  
Solving:

**Adding new route using Net ID NOT Host ID**

Route add 163.121.12.0 mask 255.255.255.0 163.121.12.1   >>> **Right**

Route add 163.121.12.10 mask 255.255.255.0 163.121.12.1   >>> **Wrong**

(163.121.12.10 is Host IP not Net ID)

**Metric:** is switch can be added to the end of the add commands to differentiate between the routes to the same destinations. You can assign this value from 0 to 255 the default value is 20. The **lowest value is most trusted**.

- To add a default route, write the command

**C:\>route add 0.0.0.0 mask 0.0.0.0 163.121.25.1**

- To Show the default route before adding new route:

**C:\>Route print 0.0.0.0**

Add new default route: will not delete the old default route but add another one with another metric

-To delete a certain route, write the command

**C:\>route delete 157.0.0.0**

-To Delete default route:

**C:\> route delete 0.0.0.0** → will delete **all** default routes



**But:**

**C:\> route delete 0.0.0.0 mask 0.0.0.0 163.121.25.1** → will delete default route **only**

## ➤ 7- Opened ports and sessions

netstat (network statistics) is a command-line tool that displays network connections (both incoming and outgoing), routing tables, and a number of network interface statistics. It is available on Unix, Unix-like, and Windows NT-based operating systems.

**To know about the concurrent TCP connections on my PC, write the following command**

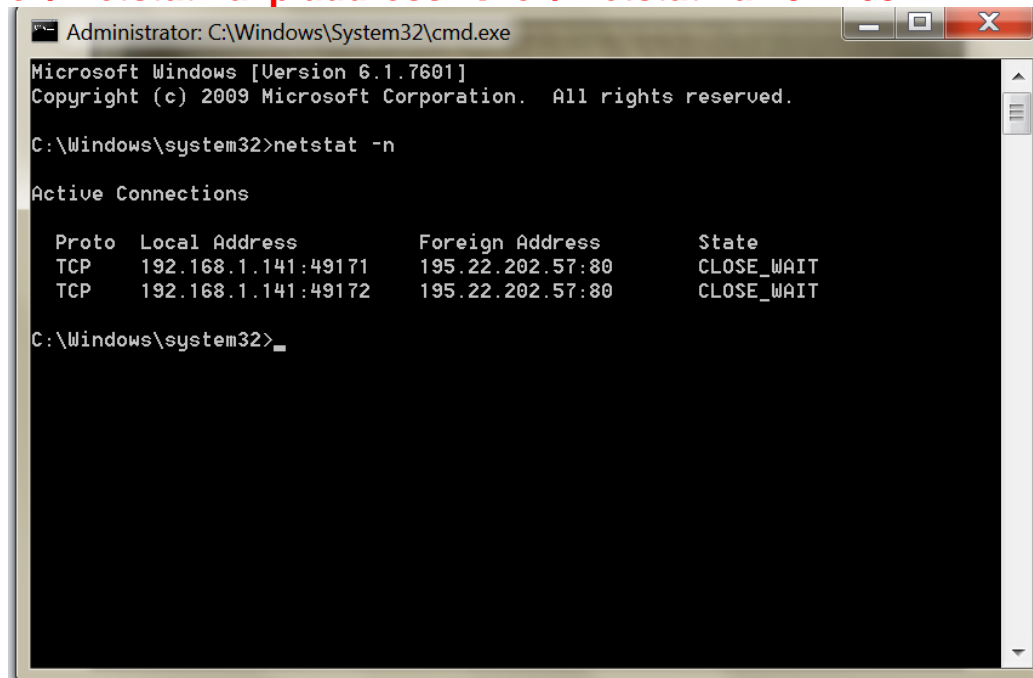
**C:\>netstat -n**

Displays addresses and port numbers in numerical form.

**To know about the concurrent TCP connections on my PC, write the following command**

**c:\>netstat -n**

**c:\>netstat -a ip address → c:\>netstat -a 192.168.1.1**



```
Administrator: C:\Windows\System32\cmd.exe
Microsoft Windows [Version 6.1.7601]
Copyright (c) 2009 Microsoft Corporation. All rights reserved.

C:\Windows\system32>netstat -n

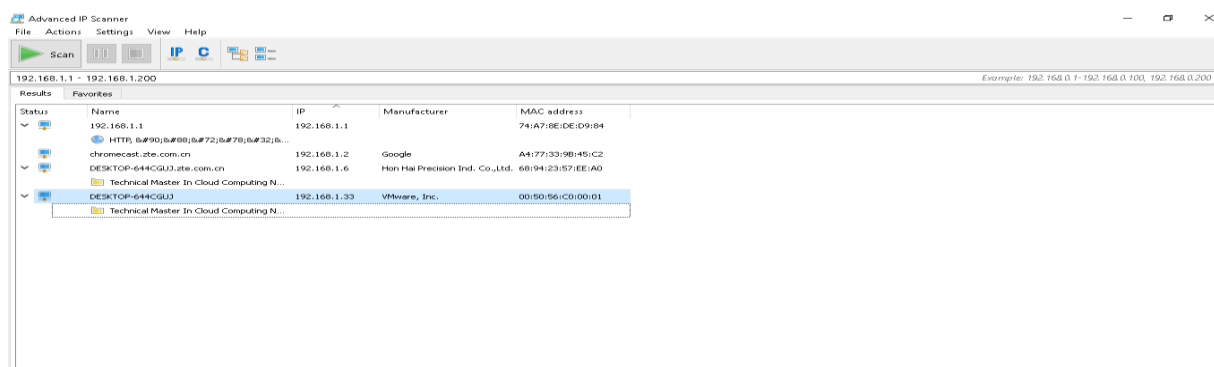
Active Connections

Proto Local Address           Foreign Address         State
TCP    192.168.1.141:49171      195.22.202.57:80       CLOSE_WAIT
TCP    192.168.1.141:49172      195.22.202.57:80       CLOSE_WAIT

C:\Windows\system32>
```

## ➤ 8- Port Scanning

You can use any port scanner to scan ports locally or on a remote PC, try using the IP Scanner.



## Lab 2

### ➤ 8- Domain name System:

Translating human-friendly computer hostnames (URL) into IP addresses.

For example, the domain name

[www.example.com](http://www.example.com)

translates to the addresses: 93.184.216.34 ([IPv4](#)) and

: 2606:2800:220:1:248:1893:25c8:1946 ([IPv6](#)).

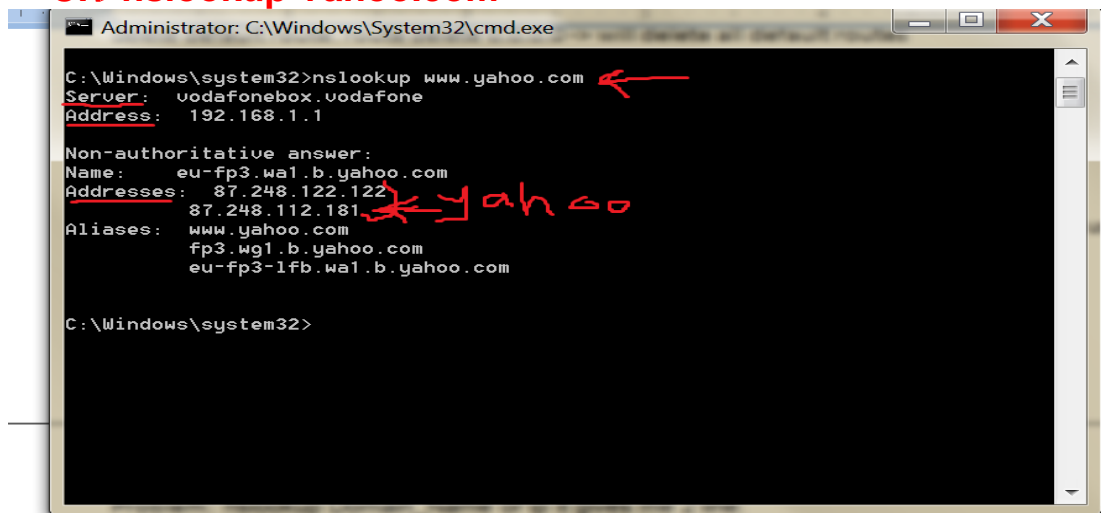
#### LOCAL DNS ON PC

- 1) Hosts file C:\Windows\System32\drivers\etc\hosts
- 2) Hosts file in Linux /etc/hosts

-To know which IP address related to a certain domain name, type the following command;

**C:\>nslookup Domain\_Name**

**C:\>nslookup Yahoo.com**



```
Administrator: C:\Windows\System32\cmd.exe
C:\Windows\system32>nslookup www.yahoo.com
Server: uodafonebox.vodafone
Address: 192.168.1.1

Non-authoritative answer:
Name: eu-fp3.wa1.b.yahoo.com
Addresses: 87.248.122.122
           87.248.112.181
Aliases: www.yahoo.com
          fp3.wg1.b.yahoo.com
          eu-fp3-1fb.wa1.b.yahoo.com

C:\Windows\system32>
```

server unknown -> it should be DNS Server name but it unknown

address 62.240.110.198 -> DNS Server which used to resolve IP address

-To know which domain name mapped to a certain IP address, type the following command;

**C:\>nslookup IP\_address**

**C:\>nslookup 87.248.113.14**

**C:\>nslookup www.yahoo.com**

```
Server: host-213-131-65-20.static.link.com.eg
Address: 213.131.65.20 >>>> DNS Server which used to resolve IP address

Non-authoritative answer:
Name: www.yahoo-ht3.akadns.net
Address: 87.248.113.14 >>>> yahoo IP Address
Aliases: www.yahoo.com
```

## ➤ 9- Dealing with FTP protocol:

We need to have: \* **ftp server** \*

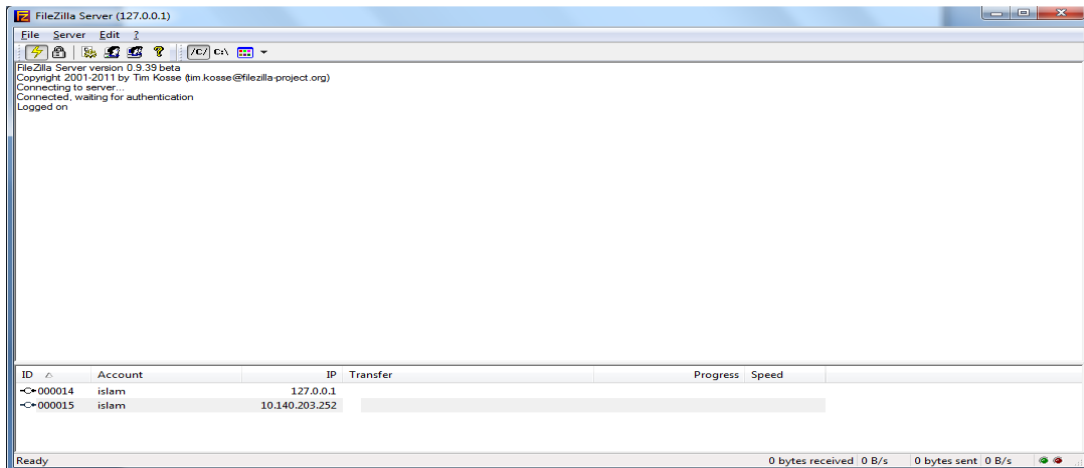
- user account (Authentication)
- home directory
- permission (Authorization)

**Steps:**

### **Step 1 : Configure FTP server**

1. Install FileZilla ftp server on one machine.

#### **A. Concerning FileZilla ftp server,**

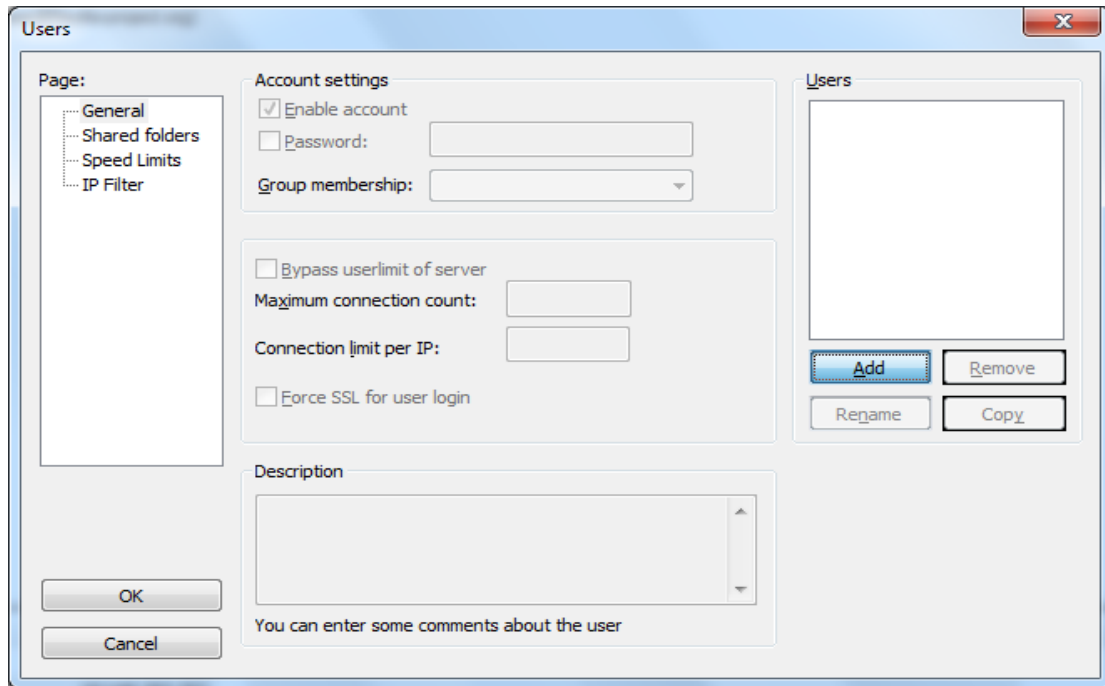


**B. We need to add users, who can log on the ftp server remotely, by going to**

**Edit menu → Users, then click the Add button.**

**C. Add the user and set the shared folders and permissions.**

**Then click Ok**



## Step 2 : Configure FTP Clients

### ❖ Method 1 (Using URL)

1) Internet explorer (**N.B.: YOU MAY DISABLE THE PROXY**)

**ftp:\\IP → ftp:\\192.168.1.1.**

**ftp:\\IP:port no → ftp:\\192.168.1.1:553**

### ❖ Method 2 (FTP Commands)

Using windows built-in Cmd

- ftp >? **/// to see all commands**

- ftp >open ip

**Enter username and password**

- get filename **/// download file& save in the current directory**

- put file name

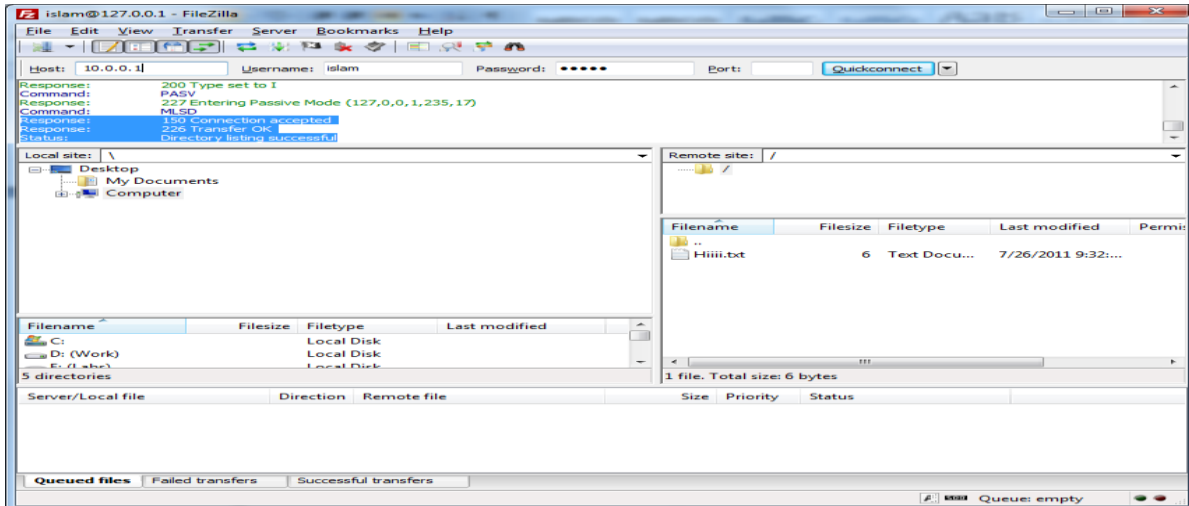
- hash **// to see progress bar during process of download**

- disconnect **//close session**

- bye **// close ftp service**

### ❖ Method 3 (FTP FileZilla Client)

- First check connectivity between your machine and your colleague's one (using ping)
- Start the FileZilla ftp server, then go to the Client and run the Filezilla ftp client.
- Type the IP address of the ftp server host and the username and password allowed to access this ftp server, and then click connect.



## ➤ 10-Using Remote Administration

### 1) Using Windows Built-in Remote Desktop:

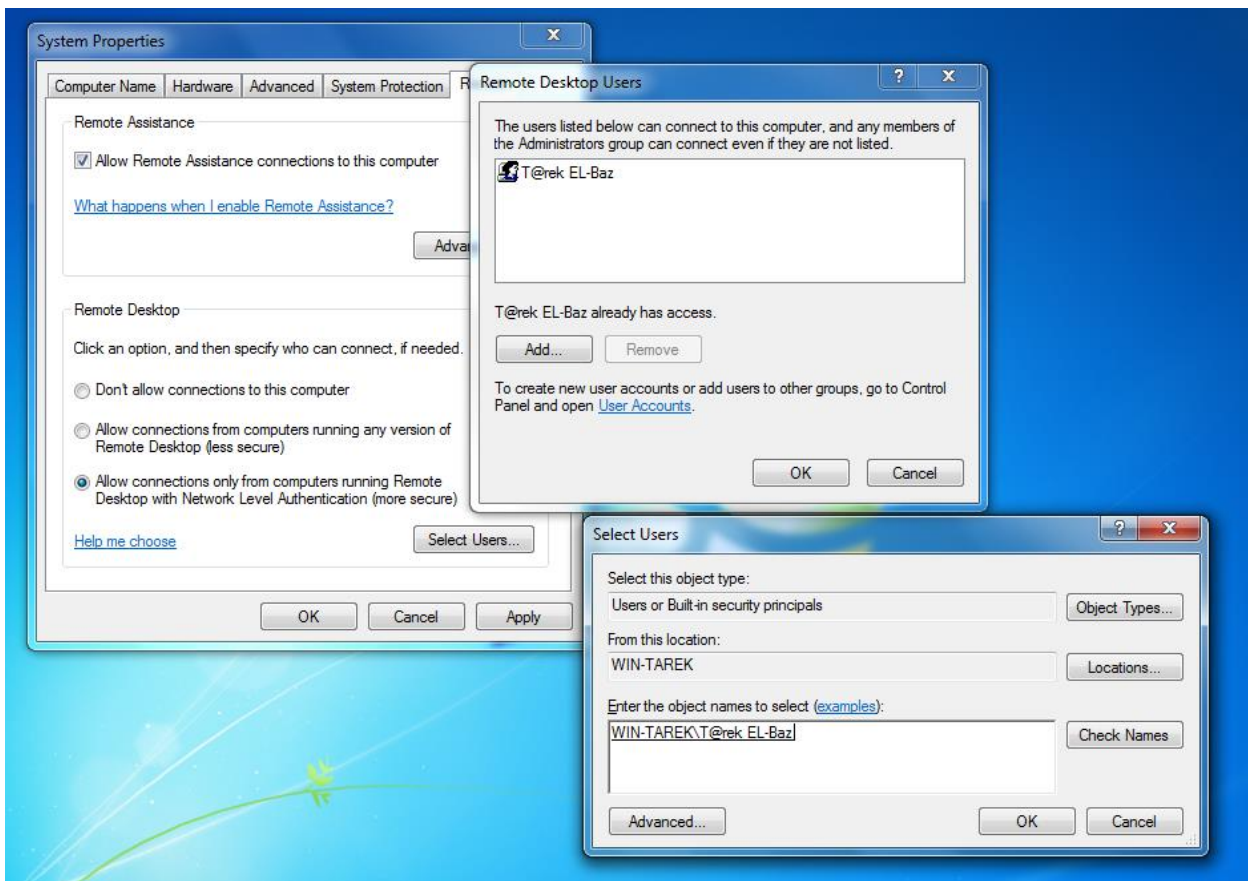
**Start → R\_Click on my computer → Remote Settings → Remote Desktop**

**You have 3 optins:**

- Do not allow connections to this computer
- Allow connections from computers Running any version of remote desktop
- Allow connections from computers running any version of remote desktop with Network level of authentication.

**You can add any user you want**

**N.B: YOU MAY NEED TO ADD THE USER TO THE REMOTE DESKTOP USERS GROUP**



## ➤ 11- Dealing with Electronic Mail Service

Email can be :

**Web based:** like yahoo, Hotmail  
Access by http ///IE

**Mail Client:** like r@iti.net.eg  
Access by outlook, Thunderbird, incredimail\_install

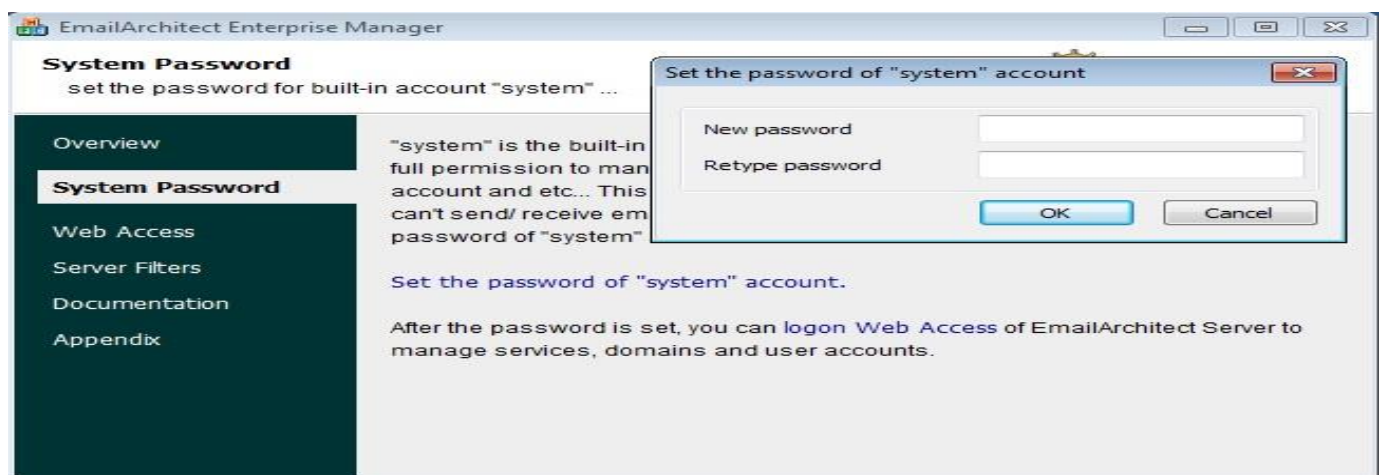
**IMAP:** Mail stays on server, accessed remotely, normally needs to be deleted manually.

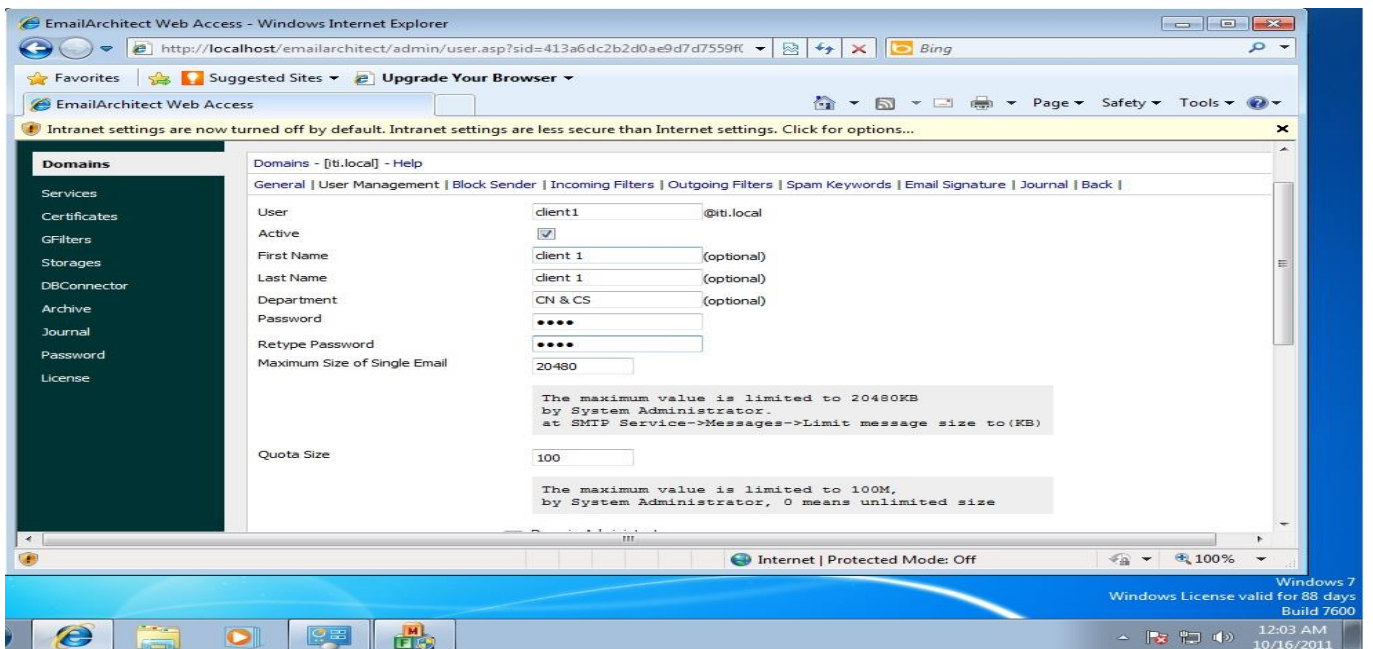
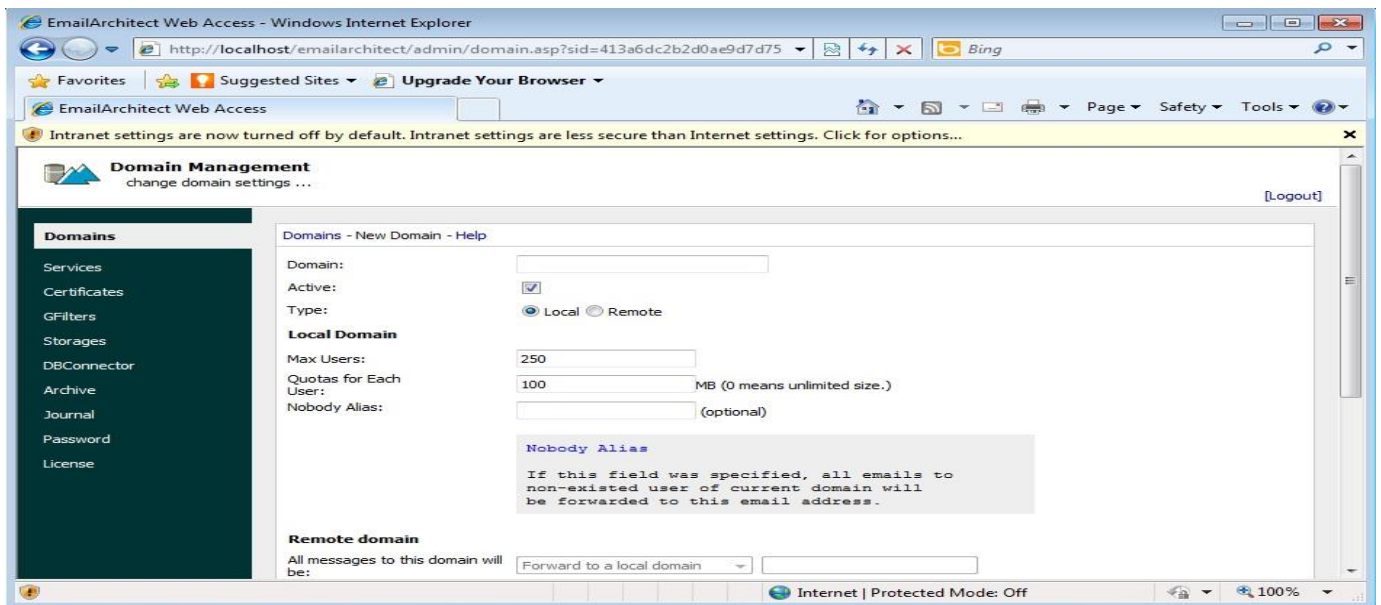
**POP3:** "Store and Forward" technology, stays on POP3 server until downloaded to client program, then normally auto-deleted from server

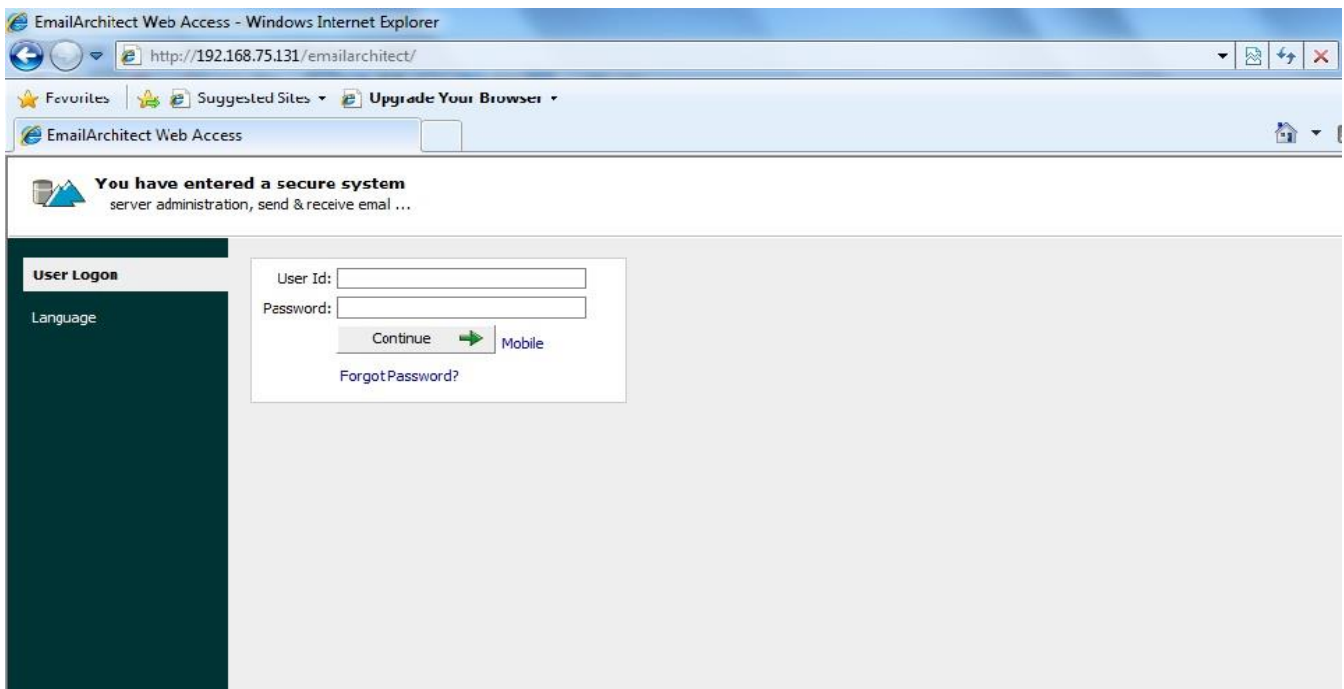
**SMTP:** used for communication between mail servers,  
Client normally sends direct to SMTP server

**Email Architect Server Software:**





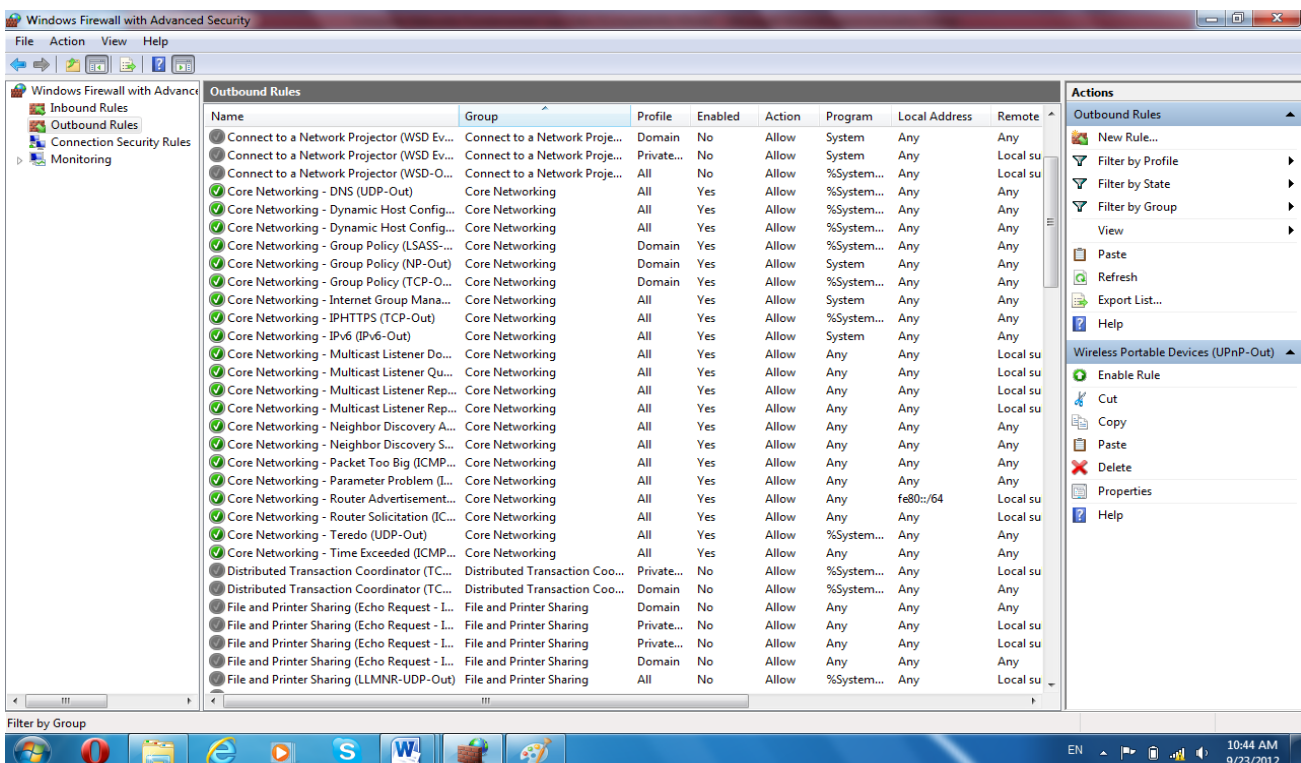




## ➤ 12- Advanced Firewall Options:

Start → Control Panel → System & Security → Windows Fire → Advanced Settings  
 → on the right panel click on New Rule → Rule Type: Custom → Protocol & Ports  
 → protocol type: ICMPv4 → Custom: Apply to All ICMPV4 → Action: Block This  
 Connection → Name: Block ICMP

From the Remote Machine Try to initiate a ping Request and see the output

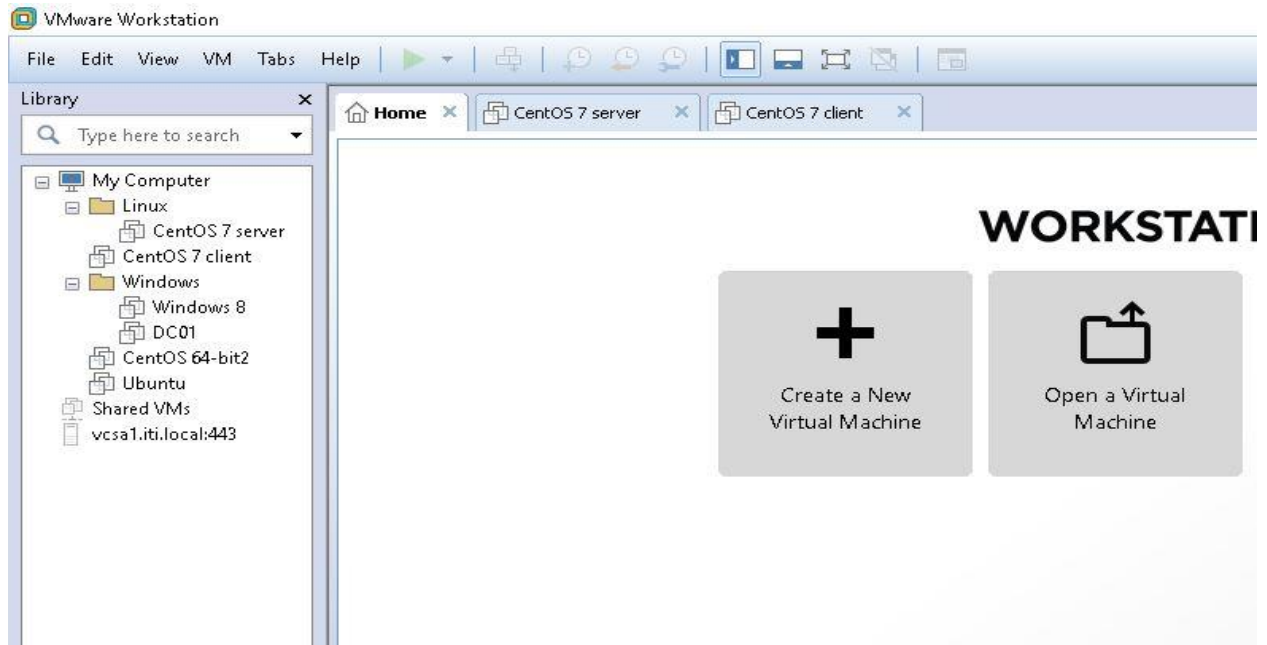


# Index:

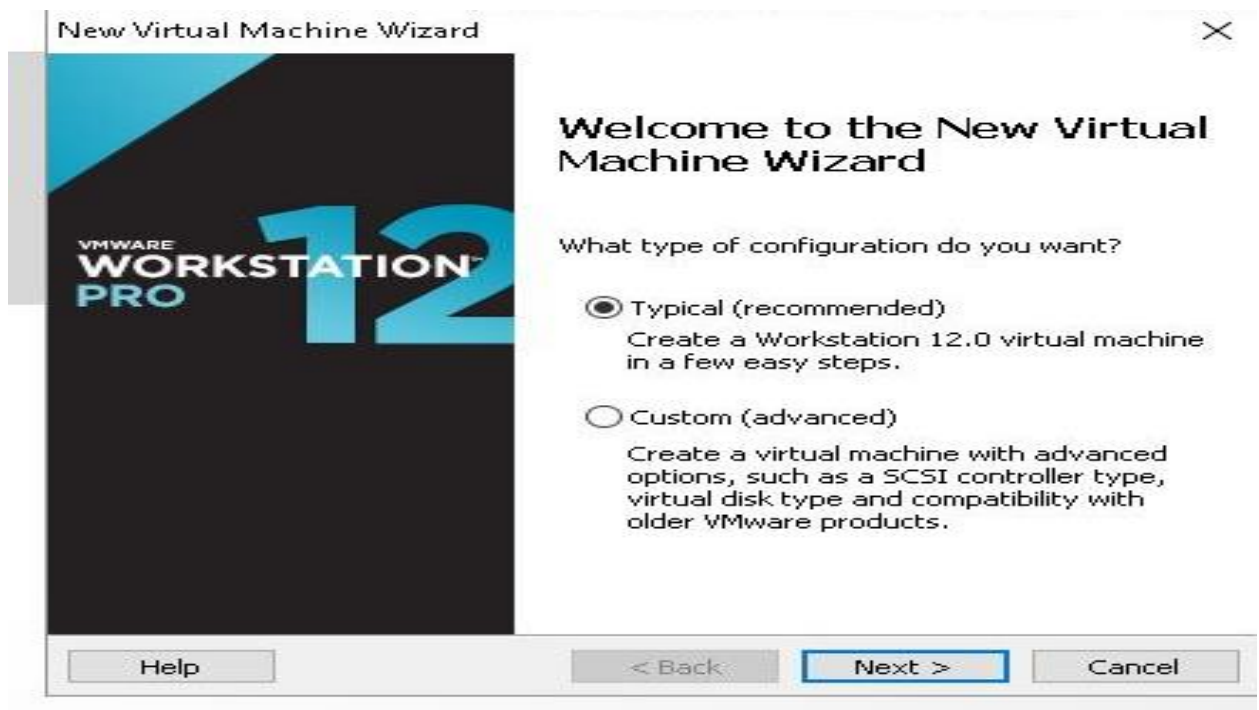
## How to setup a virtual Machine (VM)

Install VMWARE WorkStation 12.0 or current version

- Create A virtual Machine



- Choose between the two option typical or custom( More Details )



- Choose how to install the OS either from H/W (Host Machine), .ISO Image, I Will install the operating system later.

New Virtual Machine Wizard ✕

**Guest Operating System Installation**  
A virtual machine is like a physical computer; it needs an operating system. How will you install the guest operating system?

Install from:

☒ Installer disc:  
DVD R/W Drive (F:) ▼  
➡ Insert the installer disc into this drive to continue.

☐ Installer disc image file (iso):  
\_\_\_\_\_ ▼ Browse...

☐ I will install the operating system later.  
The virtual machine will be created with a blank hard disk.

Help < Back Next > Cancel

- Here we choose win 8.1 So It asks about the license

New Virtual Machine Wizard ✕

**Easy Install Information**  
This is used to install Windows 8 x64.

Windows product key  
- - - -

Version of Windows to install  
Windows 8.1 Enterprise ▼

Personalize Windows

Full name: Tarek

Password: \_\_\_\_\_ (optional)

Confirm: \_\_\_\_\_

☐ Log on automatically (requires a password)

Help < Back Next > Cancel



- Store the disk as single disk file

New Virtual Machine Wizard

**Name the Virtual Machine**  
What name would you like to use for this virtual machine?

Virtual machine name:

Location:

The default location can be changed at Edit > Preferences.

New Virtual Machine Wizard

**Ready to Create Virtual Machine**  
Click Finish to create the virtual machine and start installing Windows 8 x64 and then VMware Tools.

The virtual machine will be created with the following settings:

|                   |   |
|-------------------|---|
| Name:             | win 8.1                                     |
| Location:         | D:\VM\win 8.1                               |
| Version:          | Workstation 12.0                            |
| Operating System: | Windows 8 x64                               |
| Hard Disk:        | 60 GB, Split                                |
| Memory:           | 1024 MB                                     |
| Network Adapter:  | NAT   |
| Other Devices:    | CD/DVD, USB Controller, Printer, Sound Card |

☒ Power on this virtual machine after creation

New Virtual Machine Wizard

**Specify Disk Capacity**  
How large do you want this disk to be?

The virtual machine's hard disk is stored as one or more files on the host computer's physical disk. These file(s) start small and become larger as you add applications, files, and data to your virtual machine.

Maximum disk size (GB):

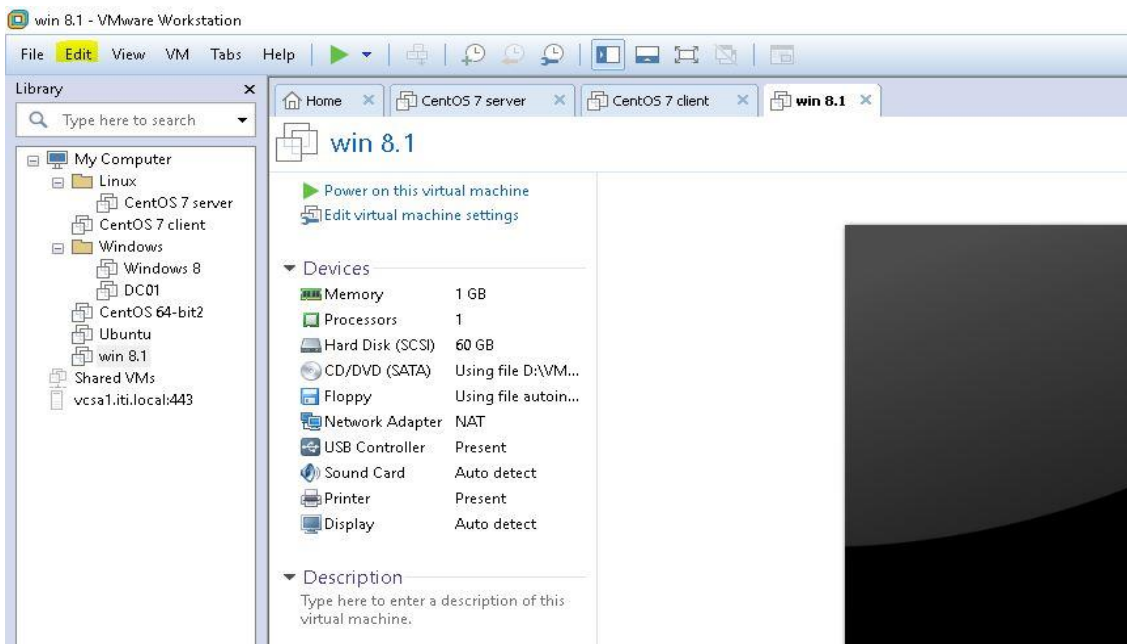
Recommended size for Windows 8 x64: 60 GB

☐ Store virtual disk as a single file

☒ Split virtual disk into multiple files

Splitting the disk makes it easier to move the virtual machine to another computer but may reduce performance with very large disks.

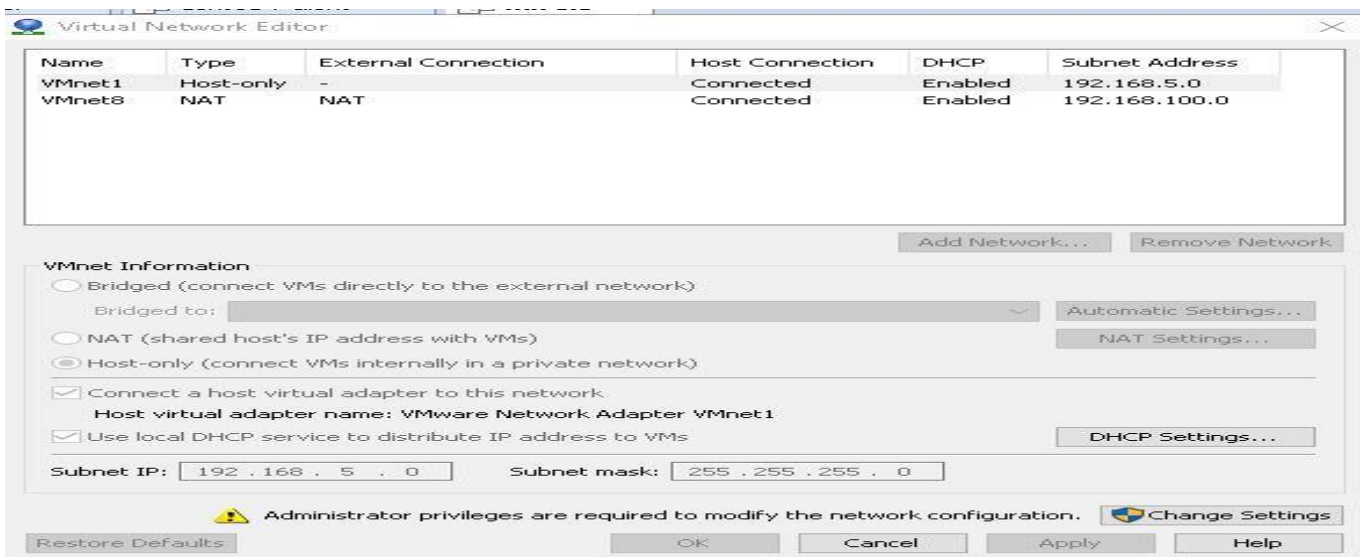


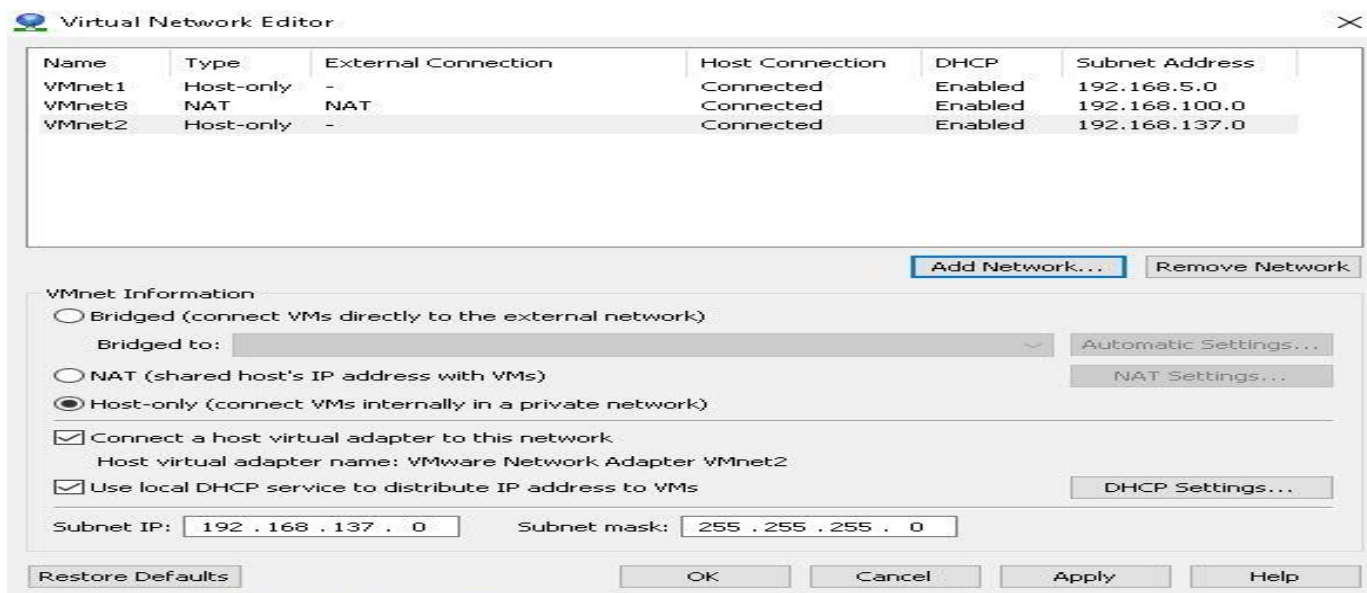


I. From edit menu → Virtual Network Edit → We have 3 option

- a. **Host only:** makes virtual LAN communicate between you and other VM or LAN, with DHCP to provide communication
- b. **NAT:** change the IP of the internal
- c. **Bridge:** communication between you and all machine

II. Add New Network Connection





## d. Connect the VM to the vNIC

