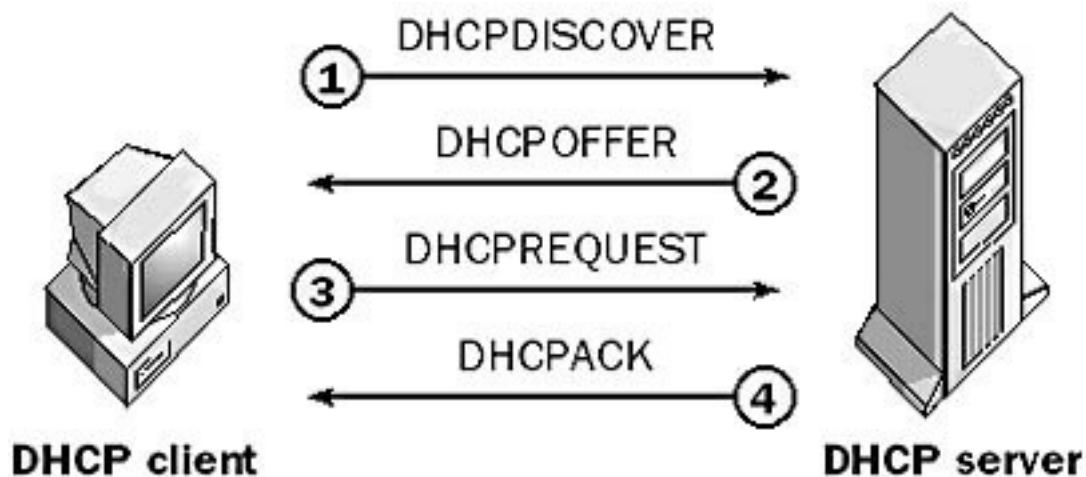


Resume: For this laboratory we will have to play with the DHCP protocol on windows environment, and explain the main DHCP options that exist for windows DHCP clients.

THEORY

DHCP protocol:

The Dynamic Host Configuration Protocol (DHCP) is a protocol that relieves the human operators from the stress of allocating IP addresses on the hosts, (the servers and the routers need to have a static IP for reasons of effectiveness), of a network. The effectiveness of a DHCP protocol is shown when we are having a network with many hosts, or hosts that are moving a lot, also as a dynamic protocol gives us the ability to have more hosts for less IP addresses by using simple probability. DHCP and NAT are the two most helpful protocols to overcome the limitations of IPv4 addresses.



How DHCP works:

In this case I believe it will be useful to explain what a protocol is because it is a term that is used mostly on the programming part of computer networks industry. Protocol is a receipt that help two or more individuals, (devices in our case), to communicate with each other properly. Since the IT, (Internet Technology), vector is almost always about two or more devices that wish to communicate with each other, it is logical that we hear the term protocol alot.

Also DHCP is a protocol that helps devices to communicate with each other in order to allocate effectivelly the necessary IP adressess on each device. This how it works. If we assume that we have a device with a running DHCP protocol, (a DHCP server or a router) activated on a network:

1. When a client connects to the same network with the DHCP device, sends a broadcast that either ask for his old address or asks for a new one with a DHCPDISCOVER message.
2. When the DHCP device receives the DHCPDISCOVER message, (if it approves the request), checks the available IP addresses and makes an offer of one available IP by sending a DHCPOFFER mesage to the client.

3. When the client receives the DHCPOFFER, responds to the offer by sending to the DHCP device the DHCPREQUEST to confirm that it wants to have the offered IP address.
4. Eventually when the DHCP device receives the DHCPREQUEST, seals the deal, by allocating the IP address to the client and by sending acknowledgment with a DHCPACK message, like saying "Ok, this IP address is yours now".

Of course the protocol is not that simple. There are details like how the two devices are doing the broadcast in order to communicate, what are they doing when something is going on, (for example if there is a lack of IP addresses or some technical issue), or if some other problem occurs while the protocol is running.

These four steps though are the backbone of the DHCP protocol so they need to be understood in order for us to be able to use the DHCP protocol bit more effectively.

DHCP devices:

DHCP is a relatively easy protocol with high compatibility, so as it was expected there are countless applications out there that are using DHCP, in many flavors and in any way possible. From the typical router with DHCP feature, to Windows Server DHCP role, to DHCP Cisco or Linux servers to any DHCP application imaginable like third party software for automated subnetting.

Logically though the two main categories that divide the DHCP devices are Servers and Routers. Servers are used mostly in larger networks with a server machine dedicated to allocate dynamically addresses to the hosts, while smaller networks, (typical home networks), are using the built in DHCP function of a Router. It is possible to find somehow ad hoc devices and applications for IP addresses allocation, but it is not a good practice to use ad hoc solutions to this topic, so it is not a common practice for DHCP.

What a (windows) client need to know:

It could be more useful to give some hints what a DHCP client need to know, but because this laboratory is related with windows environment, we will be focusing more on the windows point of view of configuring our NIC, (Network Interface Card). That is not a big problem though because on Linux and Mac are running the same principles and differences are located only to the user interface of each different OS.

In order to have the ability to communicate with a DHCP device we need to activate DHCP protocol for client to our Computer. The DHCP software is built in and we don't have to install something. The only thing that we have to do actually is to go to the right location and to press a simple and humble radio checkbox that we want to activate the DHCP for our computer the default gateway and for DNS respectively.

To find the location we just have to go to network center. Through the network center we have to go to NIC settings. There we have to find the IPv4 protocol and click to change the settings to it.

As we see to the picture, the two necessary radio buttons that we have to click to activate the DHCP protocol are extremely easy to be located.

The first button activates the DHCP for the PC and for the default gateway. The other one will activate the DHCP for our DNS.

Other alternatives for windows client:

The most default way to do things for the usual users is through the graphical interface. That is not a bad choice, that opposite actually. Even the most hardcore CLI, (Command Line Interface), users are admitting that the use of a graphical interface is usually easier and reduces the possibility of mistakes on simple tasks. The use of CLI shines when we are handling many elements or when we need to have freedom to do complicated or automated things with our computer.

A good policy that Microsoft tends to keep is that there are many ways to do the same thing and in this case, we have many different ways to activate our DHCP to our client, typically through some kind of CLI.

The second most popular way to activate and handle DHCP protocol for a client, is through the official CLI for windows that is called CMD.exe, (CoMmanD prompt). We do that through a built in tool on CMD that is called Netch and we actually use the command "netsh interface ip set address probably_our_ethernet_interface dhcp". It is important to point out though that after activating DHCP the main work on it is happening to Ipconfig, one other tool that gives us the ability to do renew and release of the leased ip that we got from the DHCP device.

The new big thing on Windows is Powershell. Powershell is not very known popular to the masses, but it is gaining slowly popularity, especially through the IT professionals.

There are two key features of powershell that is making it a gamechanger. First is that newer versions of windows are build up with the powershell as a backbone and the second one is that the powershell respects and embeds other CLI's like CMD, (windows), and Bash, (Linux), so every possibility to access DHCP through bash or cmd is now transferred to Powershell that has as well its own cmdlets to access DHCP like Set-NetIPInterface

Disclaimer: In my efforts to find other approaches to activate/configurate/deactivate DHCP on a client. It got clear to me that Microsoft doesn't endorse other ways to activate DHCP to a client. Even if it is possible to configure almost everything to a DHCP server through CLI, on the client side of DHCP the ways are hidden and they offer a very limited manageability that needs a bit "out of the box" mindset to be achieved. It is clear that Microsoft doesn't want us to manage the DHCP of a client with other ways instead of the typical user interface.

PREPARATION

What we will need:

I have already installed a physical server windows server 2012 r2 that supports a network of virtual servers and I have a laptop that is configured and connected to the same network with the 2 virtual domain controllers. There are already shared folders that I can use.

I added as well a router, (ASUS

rt-ac51u dual-band router, instead of switch), and the only necessary addition to the existant architecture is the necessary role feature to make My Domain controller to work as DHCP server.

The existant Architecture:

Before I add the router that I am using now, I had an architecture with 4 registered IP addresses to the main network of the Movian Lund 10.20.0.x. The IP address 10.20.0.158 was dedicated to my physical server, and two IP addresses (10.20.0.159 and 10.20.0.160) were dedicated to my two virtual servers that are managing the Active domain on my virtual network. The last IP address 10.20.0.161 was used as ballander either for my physical laptop or either for the virtual workspaces that I used to install every now on the then.

The old archotecture had as Standard gateway the IP address 10.20.0.1 and as DNS the very same IP or in the case of my Domain controller the loop back address 127.0.0.1.

After installing my Router, i had to configure a new architecture. My new architecture was based to the ip address that my router gave me through DHCP. The router, (my standard gateway) took the IP address 192.168.1.1 for itself by default and it gave me through DHCP the following IP addresses. The IP adress 192.168.1.223 was dedicated to my physical server, and two IP addresses

(192.168.1.224 and 192.168.1.225) were dedicated to my two virtual servers that are managing the Active domain on my virtual network. The last IP address 192.168.1.226 was used as ballander either for my physical laptop or either for the virtual workspaces that I used to install every now on the then.

The new architecture has as Standard gateway the IP address 192.168.1.1 and as DNS the very same IP for the physical server and in the case of my Domain controllers the address of my main domain controller 192.168.1.224.

The problem with the default gateway

Ok. The problem with the default gateway was a small problem, because it was or the one case or the other, (or the main default gateway of the big network 10.20.0.1, or the default of the router 192.168.0.1), it was a bigger problem to compromise somehow with the router on which IP I will use, that to decide which of the two default IP addresses I will use.

A problem that I caused to myself is that I forgot that I had the default ip (10.20.0.1) to my domain network, and I thought that I was using the ip adress of my physical server, (10.20.0.158). My mistake came from my notion that the physical server had to be a router for my virtual network, and my assumption was so strong that I refused to see the things differently.

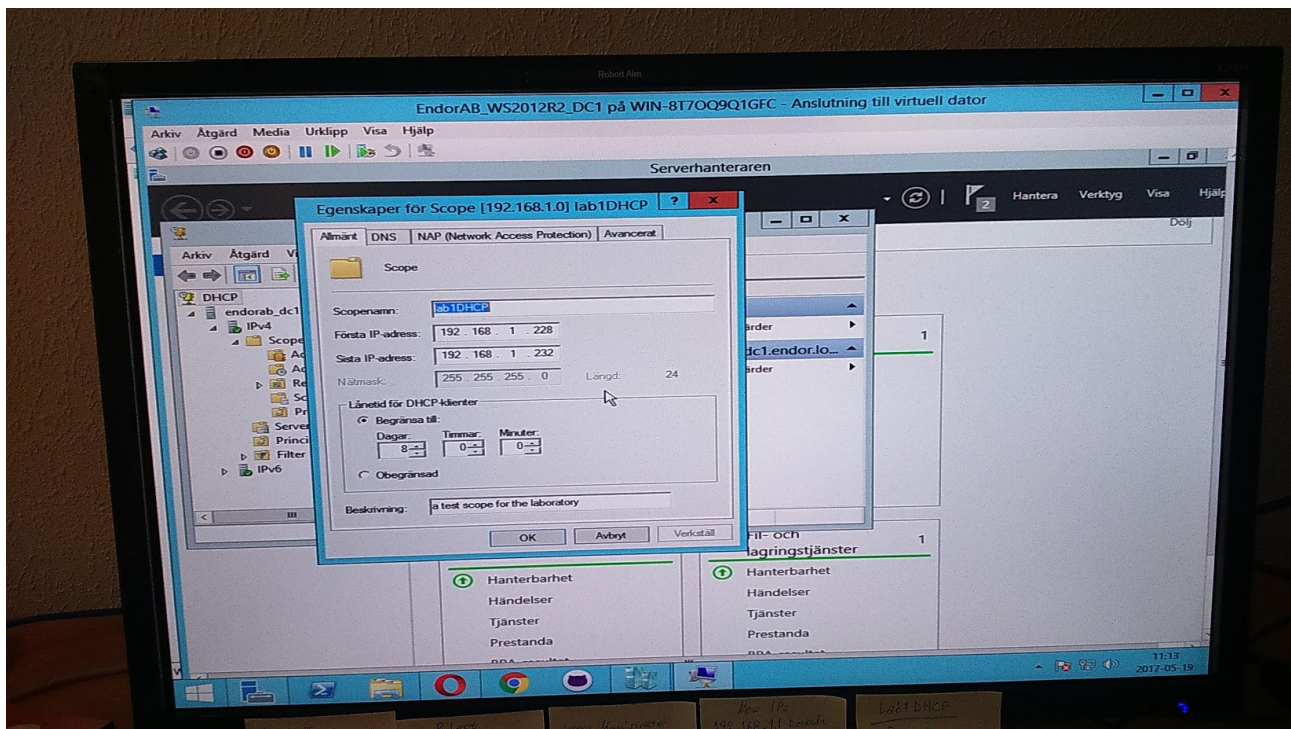
The DNS problem.

The funny thing with the DNS problem was that it was the exactly opposite of the of default IP problem. The optimal DNS IP address was the one that was the most encapsulated one. It wasn't the default DNS IP, it wasn't the IP of the physical server, but it was the address of the virtual server that works as Domain controller for my virtual windows server network.

It is logical that I hadn't in mind to try the default DNS IP as my DNS, because I new that I had to use my active domain, but in my mind it was really unclear if I had to use the IP f the physical machine or the virtual. The answer was the virtual and it is logical because the domain controller of my domain was the virtual server and I understand why I should choose that as my DNS but when I was trying to fix the problem back then I was unable to locate the problem.

The problem with the two DHCP devices:

As I worked my way to the laboratory, i had a small theoretical problem that fortunate remained as a theoretical and it doesn't became an actual problem. Tha problem was with the existance of two separated DHCP devices. The answer to this problem was simple but demanding. Two diffrent DHCP devices shouldn't exist on the same network. So the router had to stop to be a DHCP device for my network. The change was easy after a I had already turned my IP addresses form dynamic to static, (for obvious reasons).



IMPLEMENTATION OF THE LABORATORY

Even if it doesn't feel essential for my documentation to explain step by step what I did in order to install the role based feature DHCP, I will need to explain at list few things so I will be able to prove that I did everything as professionally as possible. At the beginning it is useful to explain two things:

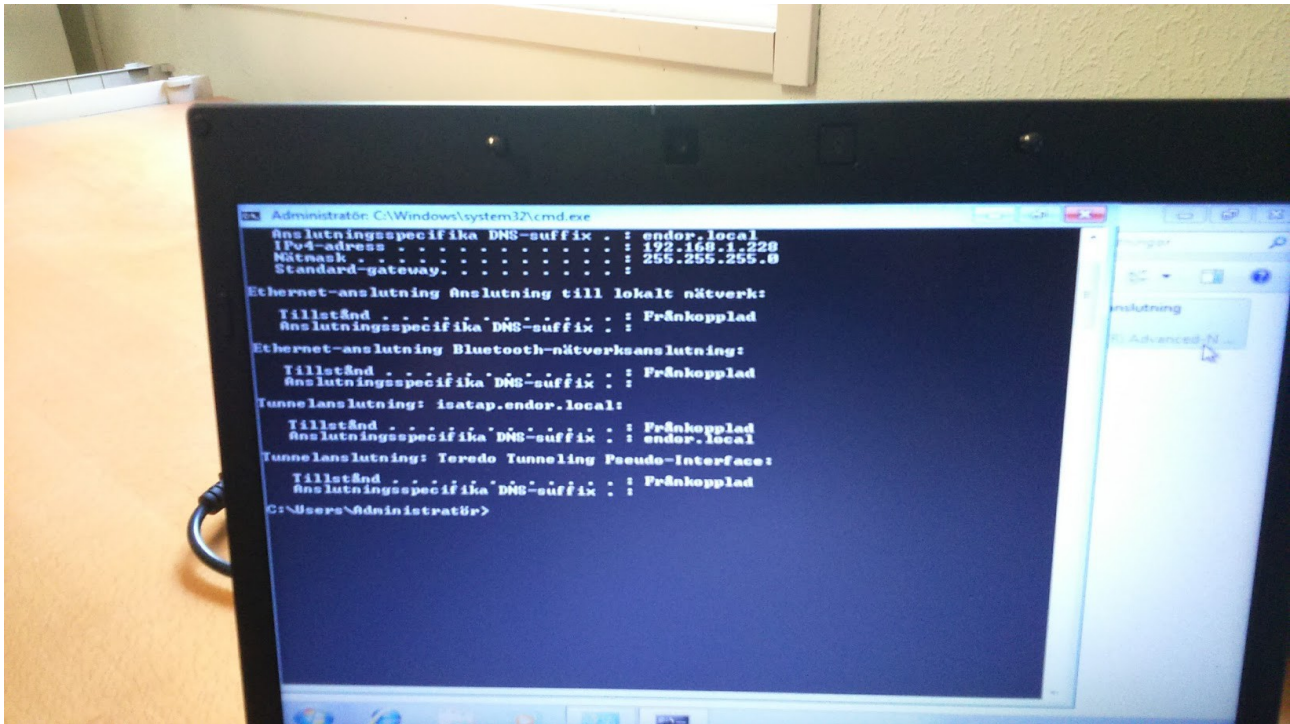
- 1 There are two ways to install DHCP role feature on windows server 2012, by powershell and by graphical interface. I choose to use the graphical interface. It is more fancy and it is the best way to reduce mistakes.
- 2 I reduced the complexity as much as possible. I used a scope just to be bit more profesional and to avoid to collide with my previous IP addresses or possible feature addresses but that was all. Nothing more than that.

What I did:

I went to the server manager. I clicked the the add new role, and it runned the add a new role wizard. Through the progress I choose DHCP and I installed it with all the necessary depedencies. Because my network was virtual, I did something that I will never do so lightly on a real network and I let the machines of my active domain to restart automatically through the installation.

Same time I should explain that I went to the interface of my router through the ip address <http://192.168.1.1> and I deactivated the DHCP feature from my router. The process was wihtout problem because as I already said I already had my IP addresses changed from dynamic to static.

After the installation of the DHCP role feature on my main domain controller and the necessary restart I was able to make my main domain controller to work as a DHCP server. In order to achieve that I went to the DHCP menu through the server manager and through the DHCP wizard I activated a DHCP server protocol with a scope of four addresses, (from 192.168.1.228 to 192.168.1.232). After finishing the process I test that everything works properly by connecting my laptop and by activating DHCP on it. My laptop just made with its DHCP activated just did a gentle jump from the old address 192.168.1.226 to the new one 192.168.1.228 and now we are sure that DHCP works as it should.



CONCLUSIONS

if there is something to take from the whole progress is that the DHCP protocol is widely used from almost every network and it highly adjustable to any kind of software. But at least on the world of Microsoft, despite the high manageability of the DHCP servers, access to the DHCP of the clients is very limited and preferably only by the graphical interface. At the end the windows servers are giving many useful options for a windows server, (for example multiple scopes), that are useful to be known by a network administrator.