

Networking DHCP Worksheet

Use DHCP In Your LAN

In this worksheet you will work out a subnet mask for your private network, and reconfigure your private network to get IP addresses by DHCP.

Work out a subnet and subnet mask for your private LAN.

Start with the network 192.168.x.0/24 (replace the value "x" with the last part of your physical host's IP address). You will create a subnet that can hold 10 hosts.

There are reference tables at the end of this section, showing binary patterns. These may help in answering the following questions.

1. How many *available* host bits do you have to work with in the 192.168.x.0/24 network? (Don't overthink this, it's easy.)
2. How many host bits do you need, to count at least 10 hosts? These are your subnet's host-ID bits. These will be the rightmost of your *available* host bits.
3. How many of the *available* host bits are left over, to count subnets? These are your subnet-ID bits. How many subnets does this give?
4. The original netmask has 24 "1" bits in it. The new subnet mask adds the subnet-ID bits to the original netmask. How many total bits is this? Use this below, when it asks for *(CIDR-bits)*.
5. Write this new subnet mask out in binary:
6. Write the subnet mask again, in dotted-decimal form.
7. You must use the fourth subnet — subnet-ID 3. Write this subnet-ID in binary, using as many bits as you have subnet-ID bits.
8. Pad the subnet-ID on the right with 0's for the host-ID bits, and write the result in dotted-decimal form. Add this to the 192.168.x network ID, and use it below when it asks for *(subnet-ID)*.
9. Your VyOS router VM will have host-ID 1. Write the subnet-ID bits for 3 followed by the host-ID bits for 1, to make the binary form of the original *available* host bits.
Then write this number in decimal form:
10. Combine the original network ID, 192.168.x, with the *available* host bits you just calculated, to form your *(router's-IP-address)*:
11. Your *(first-client-address)* has host-ID 4. Write the subnet-ID bits for 3 followed by the host-ID bits for 2, to make the binary form of the original *available* host bits.
Then write this number in decimal form:
12. Your *(last-client-address)* has host-ID one less than the biggest number that fits in your host-ID bits. Write the subnet-ID bits for 3 followed by the host-ID bits for this host-ID, to make the binary form of the original *available* host bits.
Then write this number in decimal form:

Reference tables

Power of 2	Value
2^0	1
2^1	2
2^2	4
2^3	8
2^4	16
2^5	32
2^6	64
2^7	128
2^8	256
2^9	512
2^{10}	1024

Bit Pattern	Hexa-dec-imal	Dec-imal	Bit Pattern	Hexa-dec-imal	Dec-imal
0000	0	0	1000	8	8
0001	1	1	1001	9	9
0010	2	2	1010	a	10
0011	3	3	1011	b	11
0100	4	4	1100	c	12
0101	5	5	1101	d	13
0110	6	6	1110	e	14
0111	7	7	1111	f	15

bit pos'n	Bit Pattern	Value
7	1000 0000	128
6	0100 0000	64
5	0010 0000	32
4	0001 0000	16
3	0000 1000	8
2	0000 0100	4
1	0000 0010	2
0	0000 0001	1

# of bits	Bit Pattern	Value
0	0000 0000	0
1	1000 0000	128
2	1100 0000	192
3	1110 0000	224
4	1111 0000	240
5	1111 1000	248
6	1111 1100	252
7	1111 1110	254
8	1111 1111	255

Add a DHCP server to your router.

In the above exercise, you calculated your private LAN's subnet ID, your router's IP address, and the starting and ending IP addresses for the clients — the range of DHCP addresses. Use these values for the following steps.

Start your VyOS VM and login to the router, using account "vyos" and password "vyos". Enter these commands (for more information, see http://vyos.net/wiki/User_Guide (URL: http://vyos.net/wiki/User_Guide)):

- Start the configuration:

```
configure
```

- Configure a DHCP server to hand out IP addresses automatically. In the following, you can skip comment lines that begin with a "#".

```
#-----
# Set dhcp server on private LAN's gateway router.
# Fill in the correct values from the worksheet for items enclosed in {}.
# 2016-10-26
#-----

set service dhcp-server disabled 'false'

set service dhcp-server shared-network-name LAN authoritative 'enable'

set service dhcp-server shared-network-name LAN subnet '{subnet-ID}/{CIDR-bits}' default-router '{router-IP}'
set service dhcp-server shared-network-name LAN subnet '{subnet-ID}/{CIDR-bits}' dns-server '{dns-server-IP}'
set service dhcp-server shared-network-name LAN subnet '{subnet-ID}/{CIDR-bits}' domain-name 'INSIDE'
set service dhcp-server shared-network-name LAN subnet '{subnet-ID}/{CIDR-bits}' lease '86400'

set service dhcp-server shared-network-name LAN subnet '{subnet-ID}/{CIDR-bits}' start '{first-client-IP}'
```

Check your work with the command:

```
show service
```

If it doesn't look right, **del** the incorrect lines, and re-enter them correctly.

- Apply the configuration:

```
commit
```

- Save the configuration for future reboots:

```
save
```

- ... and quit:

```
exit
```

Configure Windows VM for DHCP

- Start your Windows VM. Login to Windows, using account "joe" and password "joe".
- Select "Start-Button -> Control Panel -> Network and Internet".

Click on "View network status and tasks" under "Network and Sharing Center".

Click on "Change adapter settings" on the left.

- Right-click the Local Area Connection network. Choose "Properties".
- Find and select the line "Internet Protocol Version 4 (TCP/IPv4)". Then click on the Properties button.
- Check the box "Obtain an IP address automatically".

Check the box "Obtain DNS server address automatically".

Click on "OK", then "Close".

Configure Linux VM for DHCP

Start your Linux VM. Login, using account "joe" and password "joe". Use the appropriate GUI tool, depending on what Linux distribution you installed.

Ubuntu

- Click on the Start button in the lower left corner.

Choose "Preferences", then choose "Network Connections".

- Choose "Manual wired connection" (or maybe "auto Ethernet"), then click on "Edit"
- Choose the "IPv4 Settings" tab.
- Set the Method to "Automatic (DHCP)".
- Click on the "Save..." button, then the "Close" button in the Network Connections window.

Fedora

- Click on "Activities" in the upper left. Then choose the Applications icon at the bottom.

Choose "Settings".

- Choose "Network".

Click on the "Settings" icon in the lower right corner.

- Choose the "IPv4" item on the left.

On the right, set IPv4 to "ON", set Addresses to "Automatic (DHCP)", set DNS to "ON", and set Routes to "ON".

- Click on "Apply", then close the Network window.

Test DHCP

- Restart all three VMs --- router, Linux VM, Windows VM.
- Inspect the IP address on each VM. Do they make sense compared to the "start" and "stop" values set for the dhcp-server service on the router?
- Ping each of your VMs from another one, using its given IP address. You should be able to reach each VM.
- Try pinging one of the VMs on your neighbor's physical host. You should be able to ping other people in the class, including the instructor.

Congratulations! You've set up DHCP on your LAN.

Homepage: montcs.bloomu.edu (URL: <https://montcs.bloomu.edu/>)

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