Lab5 explanations

Task:

Use Packet Tracer to create a network topology like the one bellow and setup IP Addressing and manual routes such that:

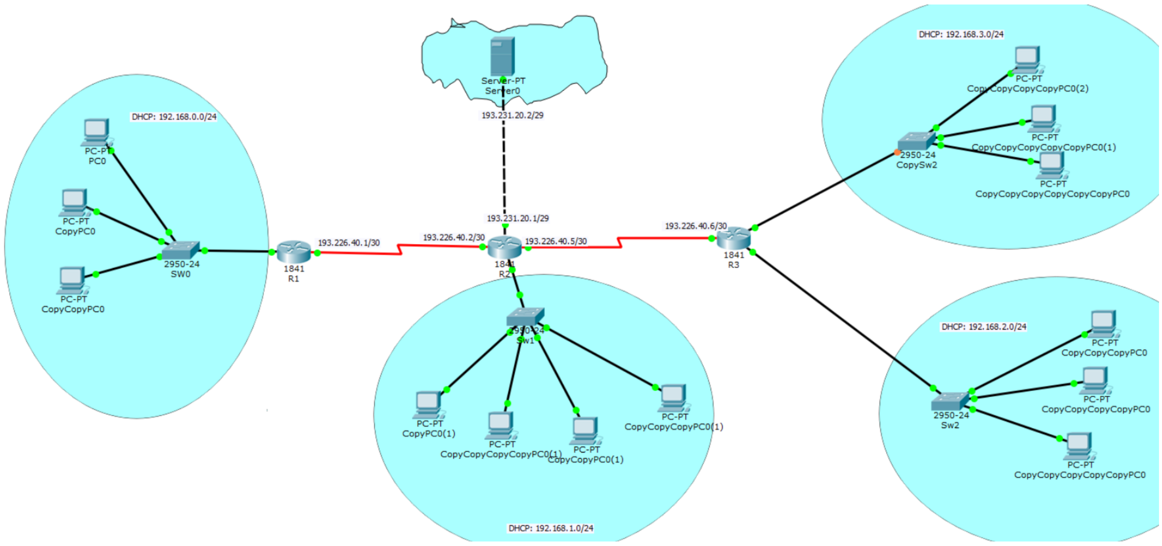
- All local LAN PCs have intra-lan access to each other (ping)
- Setup routing such that LAN 192.168.2.0/24 and 192.168.3.0/24 could access each other. Do you need to do anything?
- Setup NAT access from all networks to the server in Internet (193.231.20.2) such that its web server is accessible from all LANs

The links between R1-R2-R3 are serial links. You need to ***add serial interfaces*** to those 1841 Routers as they are not equipped with. There is no special setup for serial links otherwise. Just IP addressing.

Requirements:

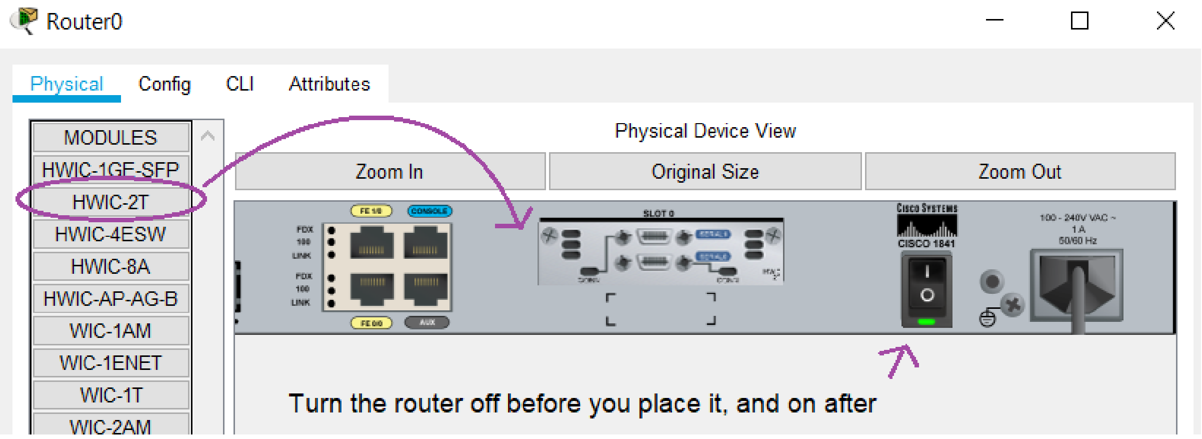
1. Be able to access the Internet Server 193.231.20.2 from all networks (NAT)
2. Be able to access networks 192.168.2.0 and 192.168.3.0 from each other
3. What happens with network access between private nets 192.168.0.0 and 192.168.1.0.
4. What happens with network access between private nets 192.168.x.0 ? Can this be solved ?

▼ Image



Solution:

We begin with ***placing serial interfaces*** in the routers since they are not equiped with.



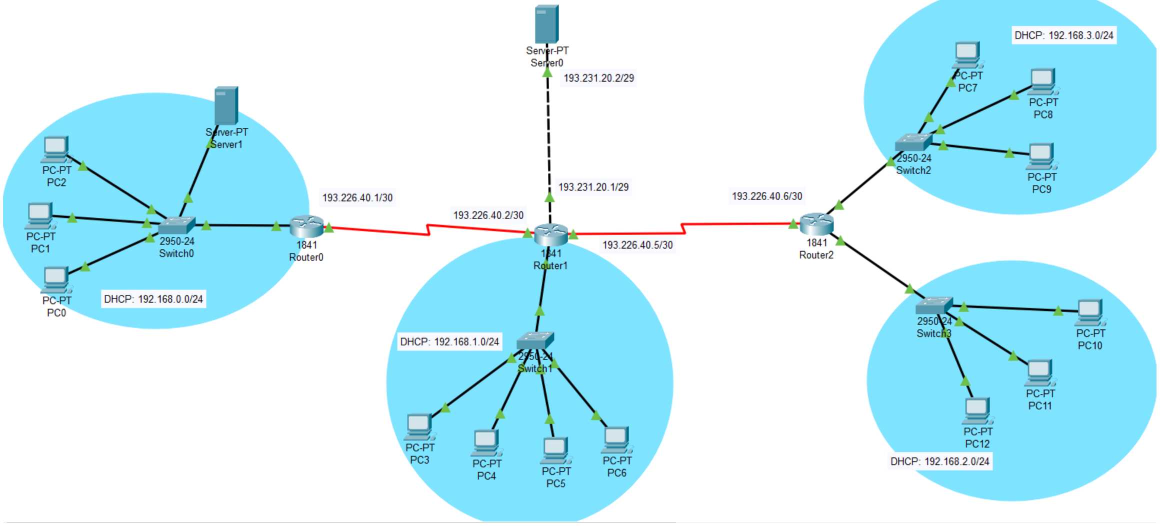
Turn the router off before you place it, and on after

DHCP configuration on the router.

In order to configure a DCHP service on a router you need to setup a dhcp pool, define its range and parameters and excluded IPs. The necessary commands are (from config mode):

1. To enter the router configurations we need administrative privileges
   - `enable`
2. From here we enter configuration mode
   - `config t` | `conf t` . To exit ctrl + z or type exit
3. Define a dhcp pool of addresses to be delivered
   - `ip dhcp pool <name_of_pool>`
4. Define the network range
   - `network 192.168.0.0 255.255.255.0`
5. Define the default gateway (if any) that should be passed to the clients
   - `default-router 192.168.0.1`
6. Define the DNS server (if any) that should be passed to the clients
   - `dns-server 192.168.0.3`
7. If there any IPs in that range that you do not want to be served to PCs - add them to the excluded range:
   - `ip dhcp excluded-address 192.168.0.1` (for a single IP)
   - `ip dhcp excluded-address 192.168.0.1 192.168.0.10` (for a range of IPs)
8. Make router settings changes permanent
   - `copy running-config startup-config`

We set our addresses and we have this:



Set the routing tables for the routers

We have to add the netoworks to which we're not directly connected

Static routing:

Example: we want to get from 1 to 2, so we enter the config in Router0 at 'Routing' → Static.

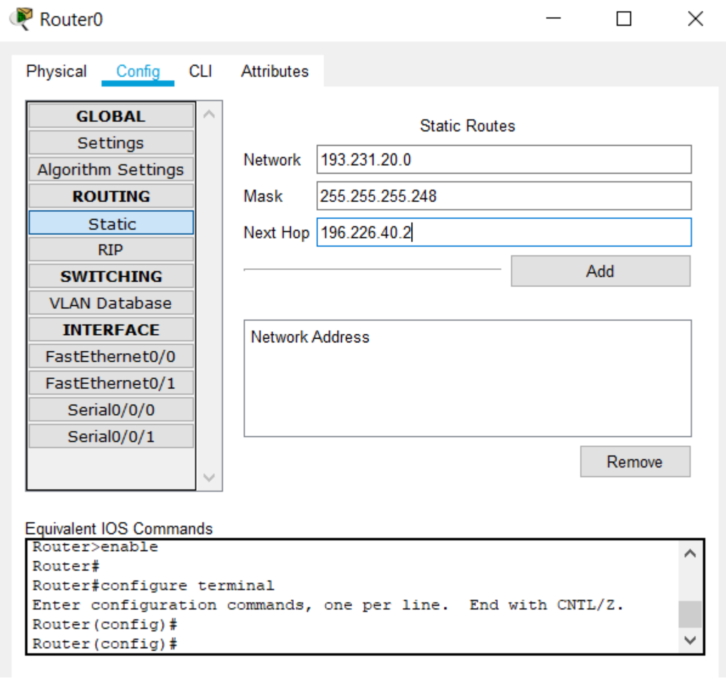
We give:

-the network where we want to go

-the mask for that network

-next hop which here is Router1 with 193.226.40.2

We hit 'add' and we have a routing from 192.168.0.0 to 193.231.20.0



Static Routes

Network 193.231.20.0

Mask 255.255.255.248

Next Hop 196.226.40.2

Network Address

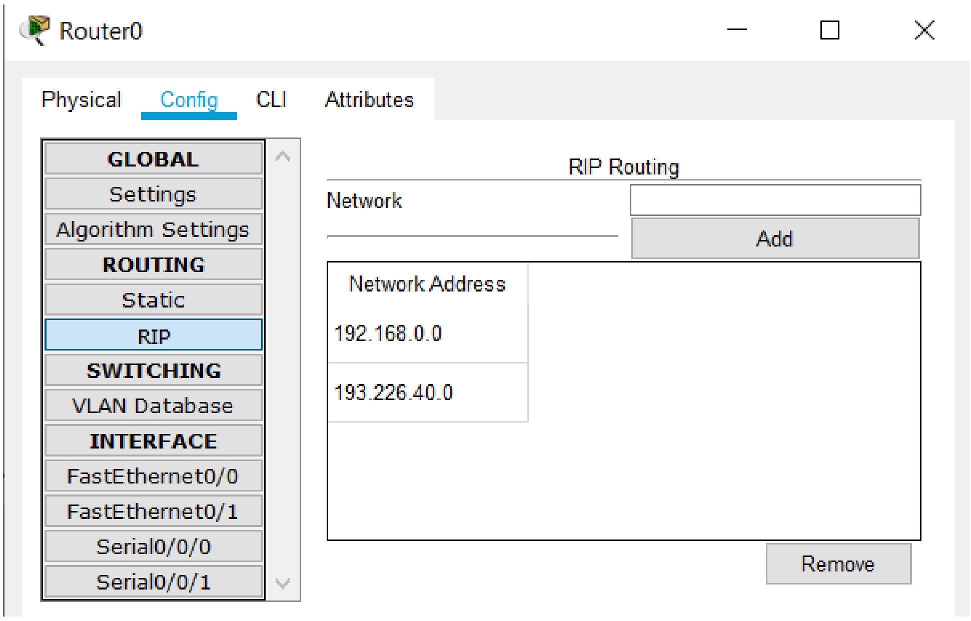
Equivalent IOS Commands

```
Router>enable
Router#
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#
Router(config)#
```

RIP:

Needs to know which networks are accessible from our network. We set in each router all the networks accessible from that router.

▼ Router0

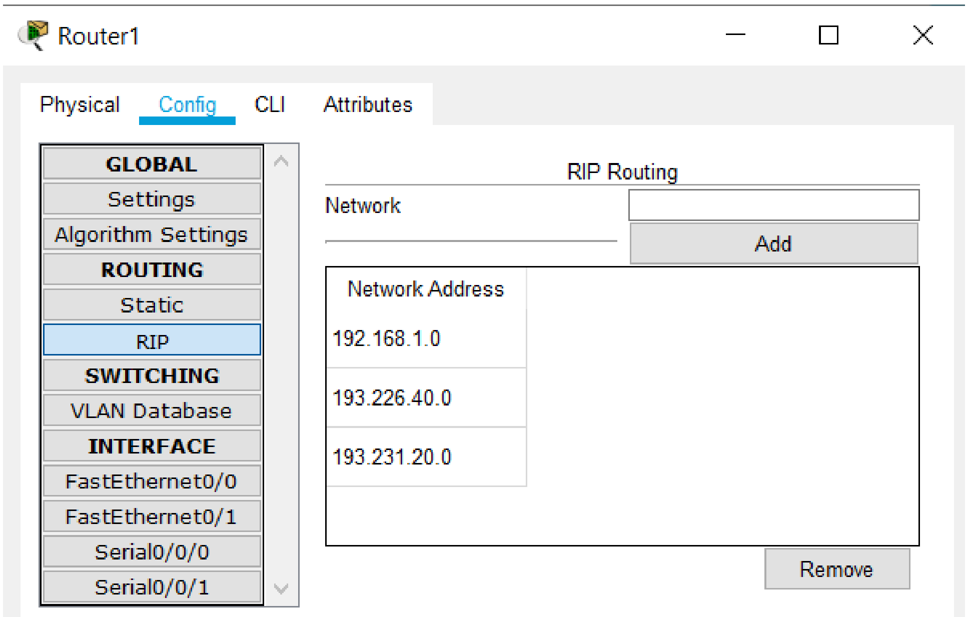


RIP Routing

Network

Network Address
192.168.0.0
193.226.40.0

▼ Router1

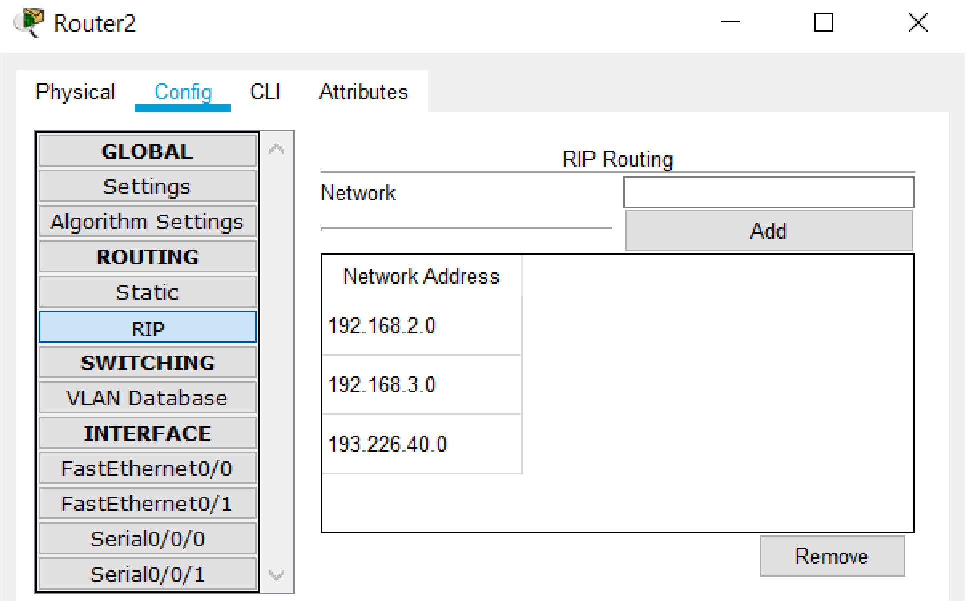


RIP Routing

Network

Network Address
192.168.1.0
193.226.40.0
193.231.20.0

▼ Router2



Network Address
192.168.2.0
192.168.3.0
193.226.40.0

NAT configuration.

In order to config NAT on a router on needs to specify one or multiple ***inside*** *(local LAN)* ***interfaces*** and one or multiple ***outside*** *(WAN)* interfaces.

After setting up NAT all packets travelling from an inside interface to an outside interface are NAT-ted (their IP addresses are changed according to the NAT policy in place).

Suppose in our case that FastEthernet 0/0 (192.168.1.0/24 range) is inside and FastEthernet 0/1 0/0/0 (193.231.20.1) is outside.

In order to accomplish NAT we do the following:

1. Click the router → `enable` → `conf t`
2. Go to our inside interface and specify that it's an inside interface
   - `interface FastEthernet 0/0`
   - `ip nat inside` → `exit`
3. Define FastEthernet 0/1 as WAN (outside) interface
   - `interface FastEthernet 0/1`
   - `ip nat outside` → `exit`

Note: For step 2 and 3 we can enter conf t, then from "Config" tab select the interface instead of writting "interface Fast...."

4. Define an Access list with the addresses from the inside that can be nat-ted.
   - `access list 1 permit 192.168.1.1 0.0.0.5` (last one is masks of bits from the IP Address that can vary)
   - ▼ Or extended lists that are defined as lists of rules

     These allow the actions where they are going to be applied from source (192.168.0.0 0.0.0.255 -equiv to 192.168.0.0/24 to destination 193.231.20.0/24)

     - ip access-list extended nat-internet

- permit ip 192.168.0.0 0.0.0.255 193.231.20.0 0.0.0.255
- permit ip 192.168.1.0 0.0.0.255 193.231.20.0 0.0.0.255
- permit ip 192.168.2.0 0.0.0.255 193.231.20.0 0.0.0.255
- permit ip 192.168.3.0 0.0.0.255 193.231.20.0 0.0.0.255

5. Define a pool of addresses to be allocated to the clients when NAT-ted. First IP – last IP netmask for those IPs

- `ip nat pool iSP 193.231.20.1 193.231.20.1 netmask 255.255.255.248`

6. Define the NAT policy.

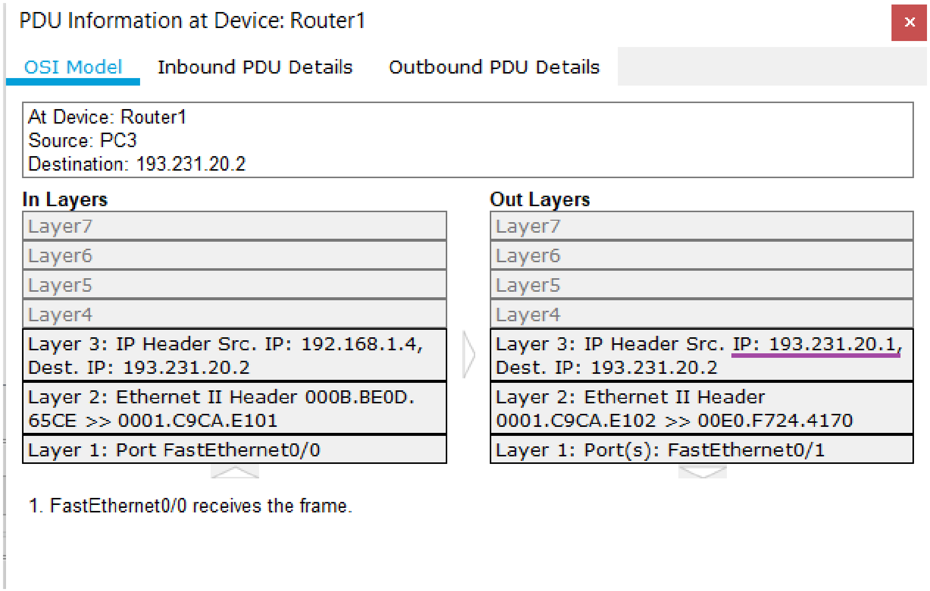
The ***NAT policy*** applies NAT by selecting a source and a NAT pool or single IP (which replace the private range).

Overload allows to use a ***single outside IP*** from the defined pool for multiple clients – by altering the port. ***One port is allocated on that IP for each outgoing client***. Overload allows this behavior.

- `ip nat inside source list 1 interface FastEthernet 0/1 overload`
- or: `ip nat inside source list 1 pool ISP overload`

In simulation mode we see now that in out layers our src has been modified with the router address.

NAT splits the simulation into 2 parts : source → router and router → destination



PDU Information at Device: Router1

At Device: Router1
Source: PC3
Destination: 193.231.20.2

In Layers	Out Layers
Layer7	Layer7
Layer6	Layer6
Layer5	Layer5
Layer4	Layer4
Layer 3: IP Header Src. IP: 192.168.1.4, Dest. IP: 193.231.20.2	Layer 3: IP Header Src. IP: 193.231.20.1, Dest. IP: 193.231.20.2
Layer 2: Ethernet II Header 000B.BE0D.65CE >> 0001.C9CA.E101	Layer 2: Ethernet II Header 0001.C9CA.E102 >> 00E0.F724.4170
Layer 1: Port FastEthernet0/0	Layer 1: Port(s): FastEthernet0/1

1. FastEthernet0/0 receives the frame.