UCCN2003 TCP/IP Internetworking
UCCN2243 Internetworking Principles & Practices

Lab 01: Review of IPv4 Subnets and Basic Routing

Instructions:

1. Solve all the lab case studies, starting with case study #1, with Packet Tracer v5.3.2.
2. All the exercises are design case studies with specifications.
3. Most of the case studies are not fully guided, and you are required to design these networks based on the specifications and the hints.
4. You may require the lab manuals and lecture notes of UCCN1003/1004 for references.

Case Study #1: Network with both Duplicate IP addresses

Build a network based on Figure 1 with the following specifications:

1. Use Cisco 2811 routers with a NM-2FE2W module, so that the routers have 4 Fastethernet ports. Use 2960 model for your switches.

2. Set the router interface IP according to Figure 1. Notice that there are duplicate IP addresses in the network: two 200.1.1.1, two 200.1.1.2, two 202.2.2.1, and two 202.2.2.2 in the network. All subnet masks are /24.

3. Put in proper static routes. Please DO NOT put dynamic routes since this will "confuse" the whole network.

4. **Objective of the case study: 196.6.6.1 (PC0) can ping 195.5.5.1 (Server0).**

5. Save the network as "lab1-1.pkt" after it is working.
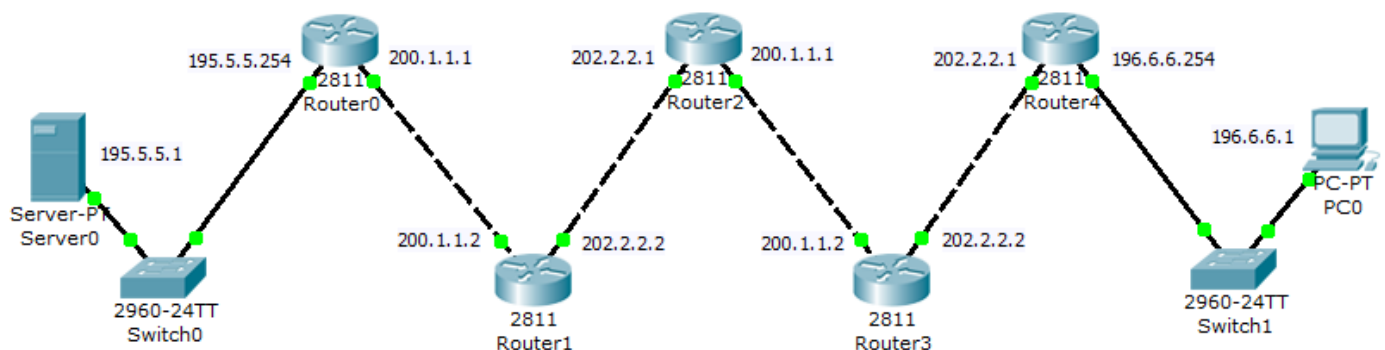
Figure 1: All subnet masks are /24.

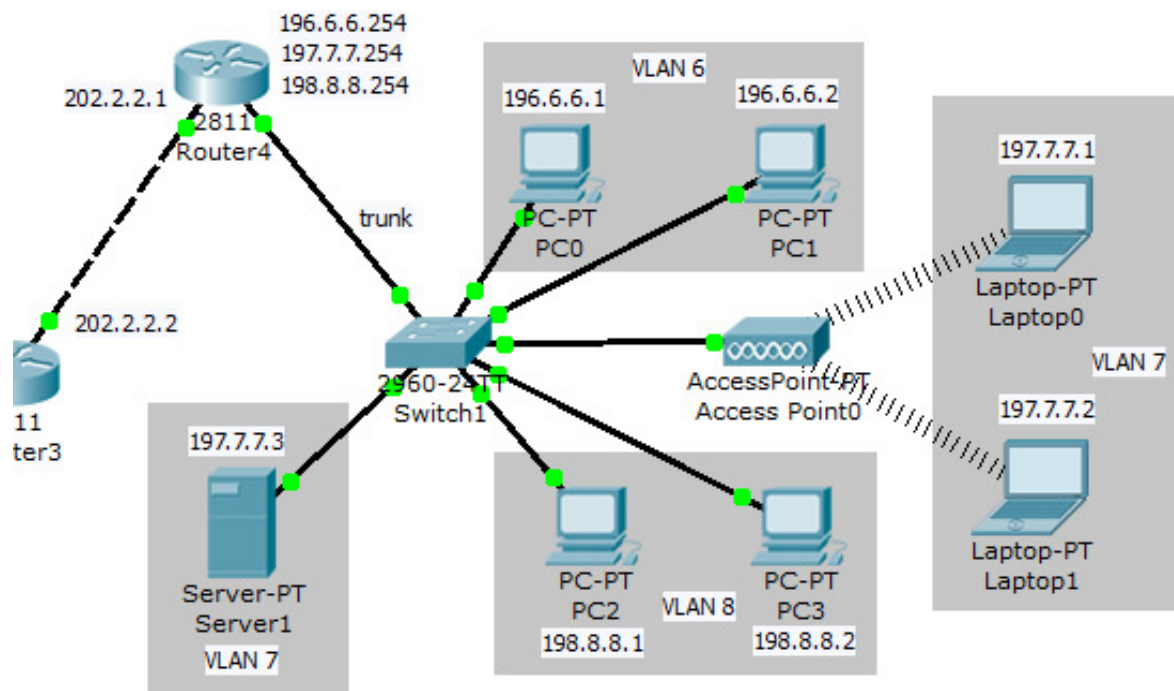**Hints on some useful commands:**

- `Router0(config)#ip route 0.0.0.0 0.0.0.0 200.1.1.2`
- `Router1(config)#ip route 195.5.5.0 255.255.255.0 200.1.1.1`
- `Router1(config)#ip route 0.0.0.0 0.0.0.0 202.2.2.1`
- `Router2(config)#ip route 195.5.5.0 255.255.255.0 202.2.2.2`
- `Router2(config)#ip route 0.0.0.0 0.0.0.0 200.1.1.2`
- `Router3(config)#ip route 195.5.5.0 255.255.255.0 200.1.1.1`
- `Router3(config)#ip route 0.0.0.0 0.0.0.0 202.2.2.1`
- `Router4(config)#ip route 195.5.5.0 255.255.255.0 202.2.2.2`

Study these routes carefully. You provide all default routes pointing to right direction. You provide another routes point to 195.5.5.0 which is the left direction.

Case Study #2: VLAN & IP Subnets

Expand network of Figure 1 to include a network based on Figure 2 with the following specifications:

1. Use the same Switch1 and PC0. Add in PC1, PC2, PC3, Laptop0, Laptop1, Server1 and Access Point0. Connect these devices according to Figure 2.

2. Configure static IP to the end devices and router according to the network in Figure 2.

3. Build 3 VLANs (VLAN 6, VLAN 7, and VLAN 8)

4. PC0 and PC1 belong to VLAN 6.

5. Laptop0, Laptop1, Server1 and Access Point0 belong to VLAN 7.

6. PC2 and PC3 belong to VLAN 8.

7. Remember that Router4 are required to have sub-interfaces and trunk mode (802.11q).

8. Remember to set the switch port of Switch1 (which is connected to Router4) to Trunk mode.

9. Set the sub-interfaces gateway IP addresses according to the Figure 2 (196.6.6.254, 197.7.7.254, and 198.8.8.254).

10. **Objective of the case study: Laptop0 can ping PC0, PC1, PC2, PC3, Server0 and Server1.**

11. Save the network as "lab1-2.pkt" if it is working.

Figure 2: All subnet masks are /24
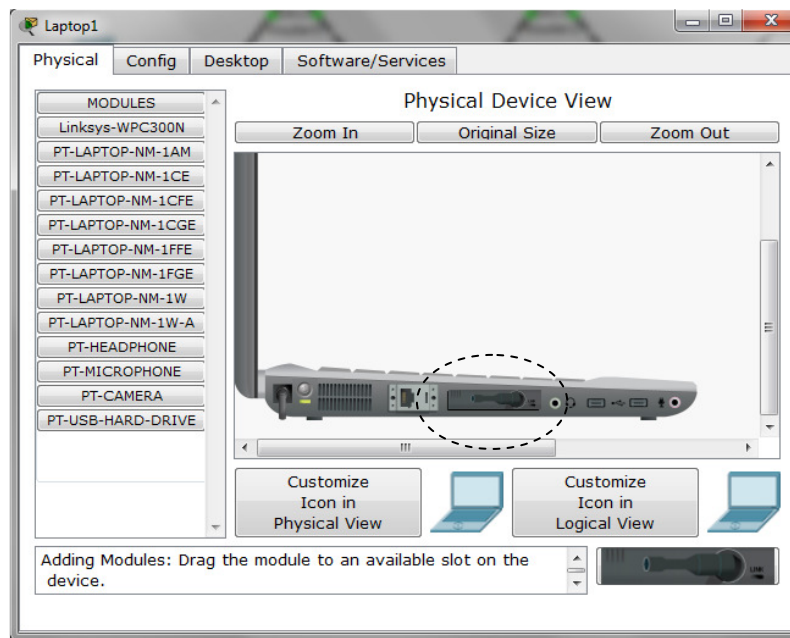
Hints on wireless LAN with the laptops:

1. Remember to change network card of labtops to Linksys-WPC300N

Hints on some useful commands:

- `Switch1(config)#vlan 6`
- `Switch1(config-vlan)#exit`
- `Switch1(config)#vlan 7`
- `Switch1(config-vlan)#exit`
- `Switch1(config)#vlan 8`
- `Switch1(config-vlan)#exit`

- `Switch1(config)#int fa0/1`
- `Switch1(config-if)#switchport mode trunk`

- `Switch1(config)#int fa0/2`
- `Switch1(config-if)#switchport access vlan 6`

- `Switch1(config)#int fa0/3`
- `Switch1(config-if)#switchport access vlan 6`

- `Switch1(config)#int fa0/4`
- `Switch1(config-if)#switchport access vlan 7`

- `Switch1(config)#int fa0/7`
- `Switch1(config-if)#switchport access vlan 7`

- `Switch1(config)#int fa0/5`
- `Switch1(config-if)#switchport access vlan 8`

- `Switch1(config)#int fa0/6`
- `Switch1(config-if)#switchport access vlan 8`

- `Switch1#show vlan`

- `Router4(config)#int fa1/0`
- `Router4(config-if)#no ip address`

- `Router4(config-if)#int fa1/0.6`
- `Router4(config-subif)#encapsulation dot1q 6`
- `Router4(config-subif)#ip address 196.6.6.254 255.255.255.0`

- `Router4(config-if)#int fa1/0.7`
- `Router4(config-subif)#encapsulation dot1q 7`
- `Router4(config-subif)#ip address 197.7.7.254 255.255.255.0`

- `Router4(config-if)#int fa1/0.8`
- `Router4(config-subif)#encapsulation dot1q 8`
- `Router4(config-subif)#ip address 198.8.8.254 255.255.255.0`

Case Study #3: Local & Remote DHCP Service

Figure 2 is again expanded based on Figure 3. Provide the network with additional specifications as indicated in the following:

1. All the PCs and laptops will obtain their dynamic IP addresses from two devices: (i) Server0, (ii) Router2. There are 2 subnets and 3 VLANs in the network that require the support of DHCP service.

2. Add in PC4 and connect it to Switch0. PC4 will be in IP subnet 195.5.5.0/24. PC4 will obtain its dynamic IP locally from Server0.

3. Add in PC5 and connect it to Router1. PC5 will be in IP subnet 199.9.9.0/24. PC5 will obtain its dynamic IP remotely from Router2 (202.2.2.1).

4. VLAN 6 and VLAN 8 will receive their dynamic IPs from the Server0 (195.5.5.1).

5. VLAN 7 receives dynamic IP from the Router2 (200.1.1.1).

6. You can obtain dynamic IP by "switching" the "Static" option to "DHCP" in IP Configuration of the Desktop tab in the PCs or Laptops.
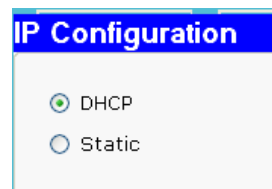
7. **Objective of the case study: Each VLAN and subnet receives its correct IP address, subnet mask, and default gateway. After that, each PC, laptop and server can ping each other.**

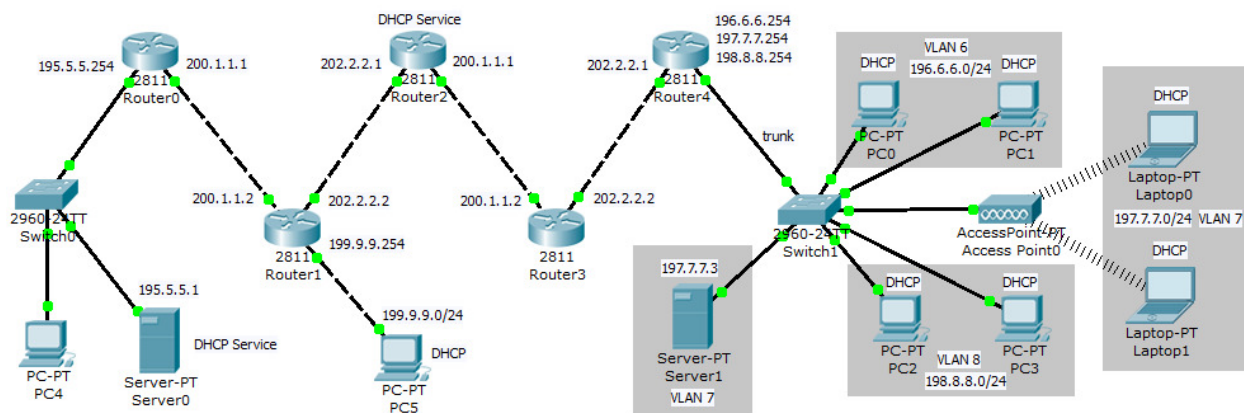8. Save the network as "lab1-3.pkt" if the network is working.

Figure 3

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Hints on setting up DHCP service:

1. Set two "pools" of DHCP range in Router2 as shown in the following:

- `Router2(config)#ip dhcp pool SUB1`
- `Router2(dhcp-config)#network 199.9.9.0 255.255.255.0`
- `Router2(dhcp-config)#default-router 199.9.9.254`
- `Router2(dhcp-config)#exit`
- `Router2(config)#ip dhcp pool VLAN7`
- `Router2(dhcp-config)#network 197.7.7.0 255.255.255.0`
- `Router2(dhcp-config)#default-router 197.7.7.254`
- `Router2(dhcp-config)#exit`

2. Configure the DHCP service (3 DHCP pools) in Server0 as shown in the following figure:
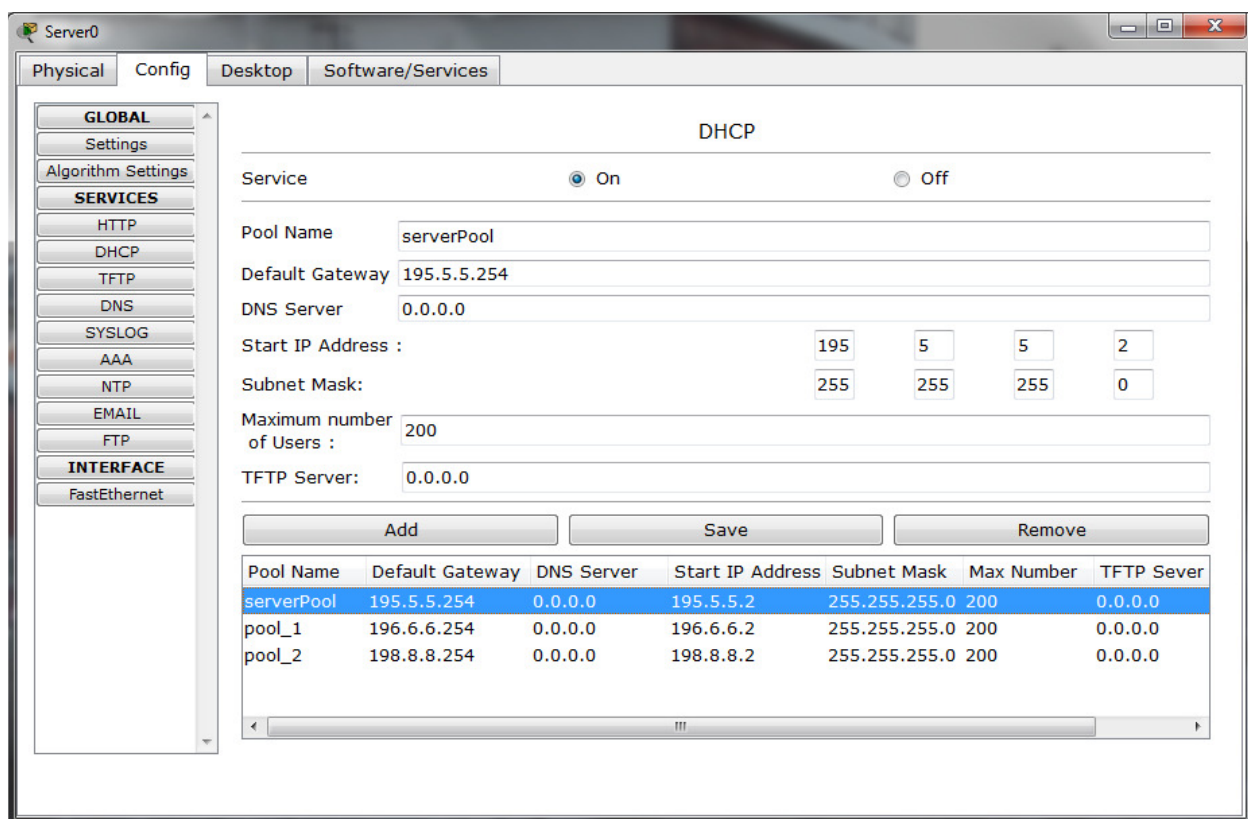
Hints on setting up additional routes:

1. Add routes so that the PCs can access to the DHCP services and communicate with other subnets or VLANs. Otherwise the network won't work. Please study this part carefully.

- `Router2(config)#ip route 199.9.9.0 255.255.255.0 202.2.2.2`
- `Router3(config)#ip route 199.9.9.0 255.255.255.0 200.1.1.1`
- `Router4(config)#ip route 199.9.9.0 255.255.255.0 202.2.2.2`
- `Router4(config)#ip route 200.1.1.0 255.255.255.0 202.2.2.2`

Hints on setting up remote DHCP service in routers:

1. DHCP can obtain remote DHCP service with the help of routers.

2. Set the router IP interfaces that require remote DHCP service with the command "ip helper-address *DHCP_Server_IP*".

- `Router1(config)#int fa1/0`
- `Router1(config-if)#ip helper-address 202.2.2.1`

- `Router4(config)#int fa1/0.6`
- `Router4(config-subif)#ip helper-address 195.5.5.1`

- `Router4(config)#int fa1/0.7`
- `Router4(config-subif)#ip helper-address 200.1.1.1`

- `Router4(config)#int fa1/0.8`
- `Router4(config-subif)#ip helper-address 195.5.5.1`

Case Study #4: IP Subnet in WAN

Expand network of Figure 3 and build a network based on Figure 4 with the following specifications:

1. Add in PC6, PC7, PC8, Server2, and Printer0 to the network.

2. Add in two DSL modem, one Cable modem and a 2690 switch.

3. Add in the CLOUD-PT-EMPTY to simulate the WAN for both DSL and cable connection. Follow the hints to configure this device.

4. Connect these devices to Switch0 as shown in Figure 4.

5. Set static IP for Server2 and Printer0.

6. PC6, PC7, and PC8 will obtain there dynamic IP addresses "locally".

7. **Objective of the case study: PC7 can ping all PCs,and servers in the whole network.**
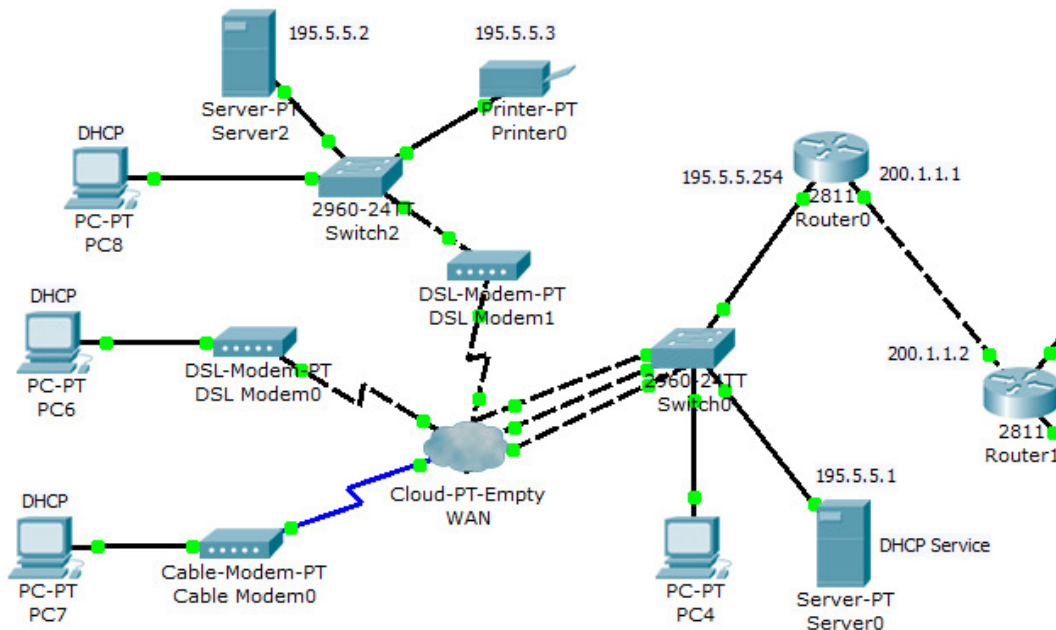
Figure 4

Hints on setting up Cloud-PT-Empty to simulate WAN:

1. Get CLOUD-PT-EMPTY device. Not CLOUD-PT

2. Add two PT-CLOUD-NM-1AM modules to the Cloud-PT-Empty device (which are phone line modem interfaces).

3. Add two PT-CLOUD-NM-CX modules to the Cloud-PT-Empty device (which are coaxial interfaces).

4. Add Four PT-CLOUD-NM-1CFE modules to the Cloud-PT-Empty device (which are Fast ethernet interfaces).
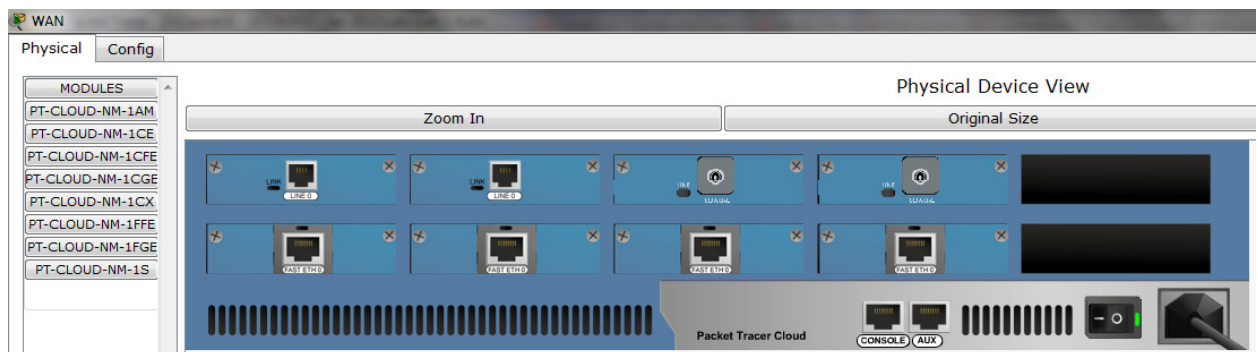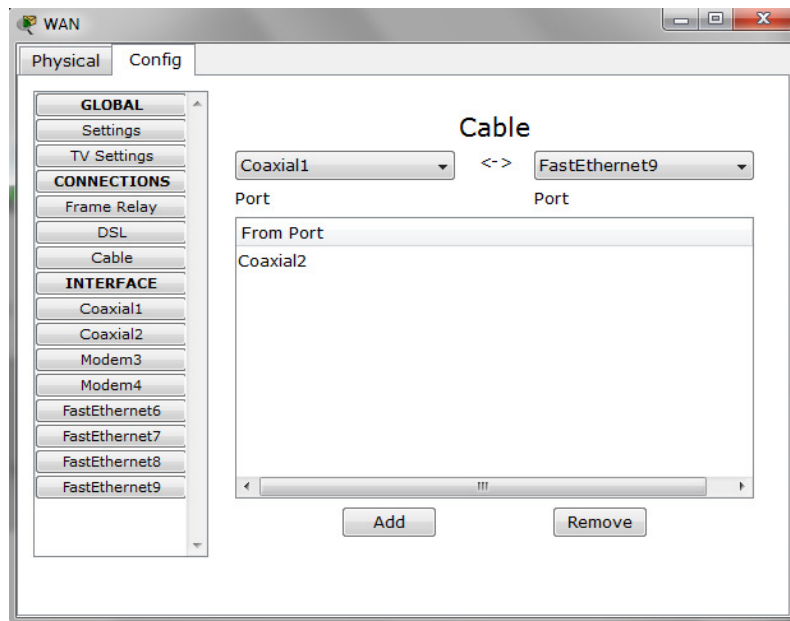

5. Click on "Config" tab and then FastEthernet9, click on "Cable" as shown in the right. The default is "DSL".
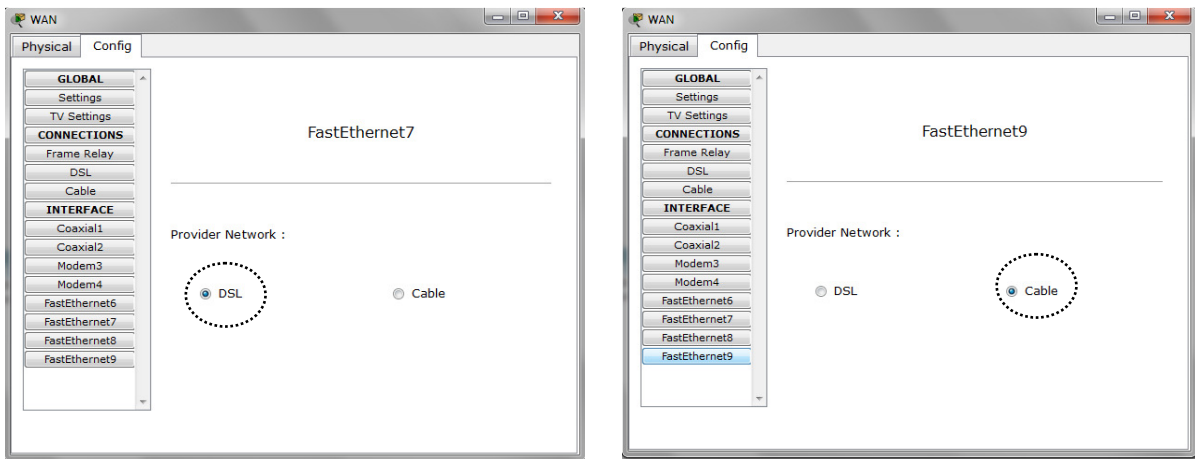
6. Press "Config" tab and then "Cable". Link one coaxial ports to a FastEthernet port (which has been set to "Cable" as shown in previous step 5). Remember to press the "Add" button.

7. Press "Config" tab and then "DSL". Link two Modem ports to different FastEthernet ports (which have been set to DSL as shown in step 5). Remember to press the "Add" button.