Computer Practical – Week 11

Objectives

The aim of this week's computer practical includes:

- Design an IPv4 subnetting scheme, and
- Implement the design by assigning IP addresses to devices and verifying connectivity

Tasks

Accordingly, you will need to complete the following tasks in this week's computer practical class:

1. Packet Tracer - Subnetting Exercise 1
2. Packet Tracer - Subnetting Exercise 2
3. (optional) Packet Tracer - Designing and Implementing a VLSM Addressing Scheme

Instructions of the activities are given on the next pages.

Assessment

This week's Computer Practical is assessed in class, and it is worth 2% of the total score of the course.

Notes:

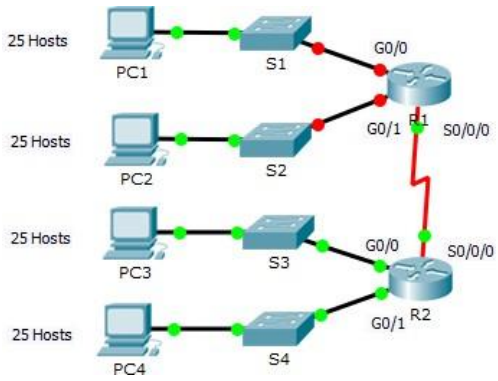
- To be awarded marks for this computer practical, a student must:
  - attend week 11 Computer Practical class (being absent from the class will result in zero marks for week 11's computer practical), and
  - complete tasks 1 and 2 above (i.e. Subnetting Exercise 1 and Subnetting Exercise 2) and submit the 2 PKA files for tasks 1 and 2 in class using the "Computer Practical-Week 11-Submission" link in Week 11 section of Learnonline course site. If you cannot finish the two activities in class, let your tutor know before leaving the class, and submit the 2 PKA files by Sunday 11:59 pm of Week 11. Late submission will result in zero marks for week 11's computer practical.
- Task 3 is an optional task and it is not assessed, and students are not required to submit the completed PKA file for task 3, but you are encouraged to complete this activity and use it to learn more about VLSM. Contact teaching staff if you have any questions when doing this optional activity.

Packet Tracer - Subnetting Exercise 1

Before start:

1. Download from Learnonline course website (**Computer Practical-Week 11** folder) the Packet Tracer activity file: `wk11-computer-prac-PKA-a-subnetting-exercise-1.pka`
2. Open the Packet Tracer activity file downloaded and set your User Profile.
3. Follow the instruction given below to complete this Packet Tracer activity

Topology



Addressing Table

Device	Interface	IP Address	Subnet Mask	Default Gateway
R1	G0/0			
	G0/1			
	S0/0/0			
R2	G0/0			
	G0/1			
	S0/0/0			
S1	VLAN 1			
S2	VLAN 1			
S3	VLAN 1			
S4	VLAN 1			
PC1	NIC			
PC2	NIC			
PC3	NIC			
PC4	NIC			

Objectives

Part 1: Design an IP Addressing Scheme

Part 2: Assign IP Addresses to Network Devices and Verify Connectivity

Scenario

In this activity, you are given the network address of 192.168.100.0/24 to subnet and provide the IP addressing for the network shown in the topology. Each LAN in the network requires enough space for, at least, 25 addresses for end devices, the switch and the router. The connection between R1 to R2 will require an IP address for each end of the link.

Part 1: Design an IP Addressing Scheme

Make sure you work out the answers for the questions below for practice, but you do not need to submit the answers.

Step 1: Subnet the 192.168.100.0/24 network into the appropriate number of subnets.

a. Based on the topology, how many subnets are needed? _____

b. How many bits must be borrowed to support the number of subnets in the topology table? _____

c. How many subnets does this create? _____

d. How many usable hosts does this create per subnet? _____

Note: If your answer is less than the 25 hosts required, then you borrowed too many bits.

e. Calculate the binary value for the first five subnets. The first subnet is already shown.

```
Net 0: 192 . 168 . 100 .  0   0   0   0   0   0   0   0
Net 1: 192 . 168 . 100 . _____________________________
Net 2: 192 . 168 . 100 . _____________________________
Net 3: 192 . 168 . 100 . _____________________________
Net 4: 192 . 168 . 100 . _____________________________
```

f. Calculate the binary and decimal value of the new subnet mask.

```
11111111.11111111.11111111. ____________________________
   255   .   255   .   255   . _____
```

g. Fill in the **Subnet Table**, listing the decimal value of all available subnets, the first and last usable host address, and the broadcast address. Repeat until all addresses are listed.
Note: You may not need to use all rows.
Subnet Table:

Subnet Number	Subnet Address	First Usable Host Address	Last Usable Host Address	Broadcast Address
0				
1				
2				
3				
4				
5				
6				
7				
8				

Step 2: Assign the subnets to the network shown in the topology.

a. Assign Subnet 0 to the LAN connected to the GigabitEthernet 0/0 interface of R1: _____

b. Assign Subnet 1 to the LAN connected to the GigabitEthernet 0/1 interface of R1: _____

c. Assign Subnet 2 to the LAN connected to the GigabitEthernet 0/0 interface of R2: _____

d. Assign Subnet 3 to the LAN connected to the GigabitEthernet 0/1 interface of R2: _____

e. Assign Subnet 4 to the WAN link between R1 to R2: _____

Step 3: Document the addressing scheme.

Fill in the **Addressing Table** using the following guidelines:

a. Assign the first usable IP addresses to R1 for the two LAN links and the WAN link.

b. Assign the first usable IP addresses to R2 for the LANs links. Assign the last usable IP address for the WAN link.

c. Assign the second usable IP addresses to the switches.

d. Assign the last usable IP addresses to the hosts.

Part 2: Assign IP Addresses to Network Devices and Verify Connectivity

Most of the IP addressing is already configured on this network. Implement the following steps to complete the addressing configuration.

Step 1: Configure IP addressing on R1 LAN interfaces.

Step 2: Configure IP addressing on S3, including the default gateway.

Step 3: Configure IP addressing on PC4, including the default gateway.

Step 4: Verify connectivity.

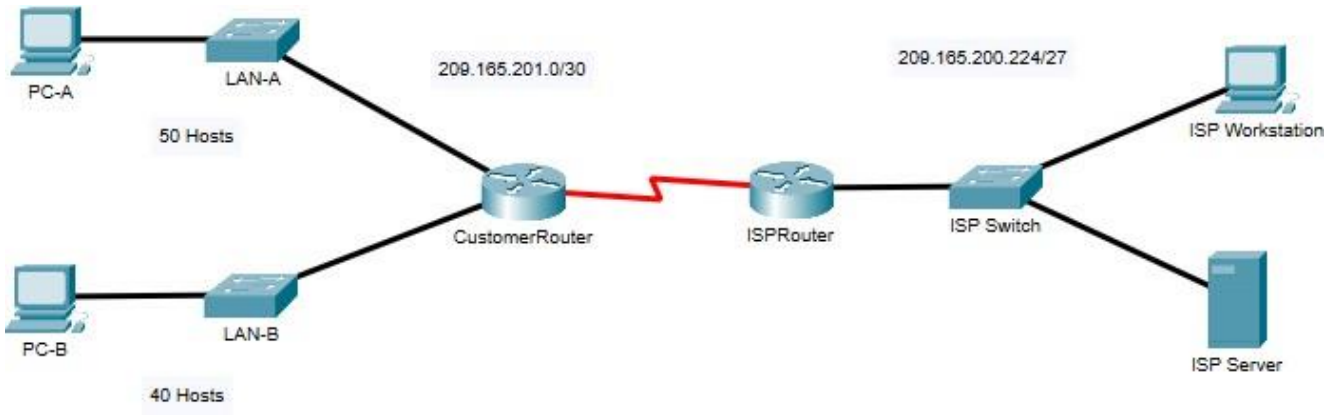
You can only verify connectivity from R1, S3, and PC4. However, you should be able to ping every IP address listed in the **Addressing Table**.

Packet Tracer – Subnetting Exercise 2

Before start:

1. Download from Learnonline course website (**Computer Practical-Week 11** folder) the Packet Tracer activity file: `wk11-computer-prac-PKA-b-subnetting-exercise-2.pka`
2. Open the Packet Tracer activity file downloaded and set your User Profile.
3. Follow the instruction given below to complete this Packet Tracer activity

Topology



Addressing Table

Device	Interface	IP Address	Subnet Mask	Default Gateway
CustomerRouter	G0/0			N/A
	G0/1			
	S0/1/0	209.165.201.2	255.255.255.252	
LAN-A Switch	VLAN1			
LAN-B Switch	VLAN1			
PC-A	NIC			
PC-B	NIC			
ISPRouter	G0/0	209.165.200.225	255.255.255.224	N/A
	S0/1/0	209.165.201.1	255.255.255.252	
ISPSwitch	VLAN1	209.165.200.226	255.255.255.224	209.165.200.225
ISP Workstation	NIC	209.165.200.235	255.255.255.224	209.165.200.225
ISP Server	NIC	209.165.200.240	255.255.255.224	209.165.200.225

Objectives

Part 1: Design an IPv4 Network Subnetting Scheme

Part 2: Configure the Devices

Part 3: Test and Troubleshoot the Network

Background / Scenario

In this activity, you will subnet the Customer network into multiple subnets. The subnet scheme should be based on the number of host computers required in each subnet, as well as other network considerations, like future network host expansion.

After you have created a subnetting scheme and completed the table by filling in the missing host and interface IP addresses, you will configure the host PCs, switches and router interfaces.

After the network devices and host PCs have been configured, you will use the **ping** command to test for network connectivity.

Part 1: Subnet the Assigned Network

Step 1: Create a subnetting scheme that meets the required number of subnets and required number of host addresses.

In this scenario, you are a network technician assigned to install a new network for a customer. You must create multiple subnets out of the 192.168.0.0/24 network address space to meet the following requirements:

a. The first subnet is the LAN-A network. You need a minimum of 50 host IP addresses.

b. The second subnet is the LAN-B network. You need a minimum of 40 host IP addresses.

c. You also need at least two additional unused subnets for future network expansion.

Note: Variable length subnet masks will not be used. All of the device subnet masks should be the same length.

d. Answer the following questions to help create a subnetting scheme that meets the stated network requirements:

How many host addresses are needed in the largest required subnet?

What is the minimum number of subnets required?

The network that you are tasked to subnet is 192.168.0.0/24. What is the /24 subnet mask in binary?

e. The subnet mask is made up of two portions, the network portion, and the host portion. This is represented in the binary by the ones and the zeros in the subnet mask.

In the network mask, what do the ones represent?

In the network mask, what do the zeros represent?

f. To subnet a network, bits from the host portion of the original network mask are changed into subnet bits. The number of subnet bits defines the number of subnets.

Given each of the possible subnet masks depicted in the following binary format, how many subnets and how many hosts are created in each example?

Hint: Remember that the number of host bits (to the power of 2) defines the number of hosts per subnet (minus 2), and the number of subnet bits (to the power of two) defines the number of subnets. The subnet bits (shown in bold) are the bits that have been borrowed beyond the original network mask of /24. The /24 is the prefix notation and corresponds to a dotted decimal mask of 255.255.255.0.

1) (/25) 11111111.11111111.11111111.**1**0000000

Dotted decimal subnet mask equivalent:

Number of subnets? Number of hosts?

2) (/26) 11111111.11111111.11111111.**11**000000

Dotted decimal subnet mask equivalent:

Number of subnets? Number of hosts?

3) (/27) 11111111.11111111.11111111.**111**00000

Dotted decimal subnet mask equivalent:

Number of subnets? Number of hosts?

4) (/28) 11111111.11111111.11111111.**1111**0000

Dotted decimal subnet mask equivalent:

Number of subnets? Number of hosts?

5) (/29) 11111111.11111111.11111111.**11111**000

Dotted decimal subnet mask equivalent:

Number of subnets? Number of hosts?

6) (/30) 11111111.11111111.11111111.**111111**00

Dotted decimal subnet mask equivalent:

Number of subnets? Number of hosts?

Considering your answers above, which subnet masks meet the required number of minimum host addresses?

Considering your answers above, which subnet masks meets the minimum number of subnets required?

Considering your answers above, which subnet mask meets both the required minimum number of hosts and the minimum number of subnets required?

When you have determined which subnet mask meets all of the stated network requirements, derive each of the subnets. List the subnets from first to last in the table. Remember that the first subnet is 192.168.0.0 with the chosen subnet mask.

Subnet Address	Prefix	Subnet Mask

Step 2: Fill in the missing IP addresses in the Addressing Table

Assign IP addresses based on the following criteria: Use the ISP Network settings as an example.

a. Assign the first subnet to LAN-A.

1) Use the first host address for the CustomerRouter interface connected to LAN-A switch.
2) Use the second host address for the LAN-A switch. Make sure to assign a default gateway address for the switch.
3) Use the last host address for PC-A. Make sure to assign a default gateway address for the PC.

b. Assign the second subnet to LAN-B.

1) Use the first host address for the CustomerRouter interface connected to LAN-B switch.
2) Use the second host address for the LAN-B switch. Make sure to assign a default gateway address for the switch.
3) Use the last host address for PC-B. Make sure to assign a default gateway address for the PC.

Part 2: Configure the Devices

Configure basic settings on the PCs, switches, and router. Refer to the Addressing Table for device names and address information.

Step 1: Configure CustomerRouter.

a. Set the enable secret password on CustomerRouter to **Class123**

b. Set the console login password to **Cisco123**.

c. Configure **CustomerRouter** as the hostname for the router.

d. Configure the G0/0 and G0/1 interfaces with IP addresses and subnet masks, and then enable them.

e. Save the running configuration to the startup configuration file.

Step 2: Configure the two customer LAN switches.

Configure the IP addresses on interface VLAN 1 on the two customer LAN switches. Make sure to configure the correct default gateway on each switch.

Step 3: Configure the PC interfaces.

Configure the IP address, subnet mask, and default gateway settings on **PC-A** and **PC-B**.

Part 3: Test and Troubleshoot the Network

In Part 3, you will use the **ping** command to test network connectivity.

a. Determine if PC-A can communicate with its default gateway. Do you get a reply?

b. Determine if PC-B can communicate with its default gateway. Do you get a reply?

c. Determine if PC-A can communicate with PC-B. Do you get a reply?

If you answered “no” to any of the preceding questions, then you should go back and check your IP address and subnet mask configurations, and ensure that the default gateways have been correctly configured on PC-A and PC-B.

Packet Tracer - Designing and Implementing a VLSM Addressing Scheme (Optional computer practical task)

Note:

1. Download from Learnonline course website (**Computer Practical-Week 11** folder) the Packet Tracer activity file: `wk11-computer-prac-PKA-c-VLSM.pka`
2. Open the Packet Tracer activity file downloaded and set your User Profile.
3. Follow the instruction given inside the .pka file to complete this activity
4. This activity is optional and it is not assessed, and you are not required to submit the completed .pka file, but please feel free to do so, and you are encouraged to contact teaching staff if you need any help with this activity.