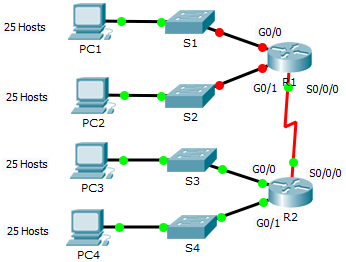
**Liberty University**

**CSIS 331**

**Lab 13 Subnetting Worksheet**

Topology



1. Requirements

IPv4 Addressing

* Create subnets that meet the host requirements using 192.168.100.0/24.

NOTE: You may use the table on the last page as a reference to assist you.

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

a. Based on the topology and host requirements, how many subnets are needed? \_\_\_5\_\_

NOTE: Donʻt forget the routers need one subnet to talk to each other. So far your Subnet Bitmap looks like this: nnnnnnnn.nnnnnnnn.nnnnnnnn.hhhhhhhh (n=network bits covered by subnets mask h = host bits)

b. How many bits, if any, must be borrowed to support the number of subnets needed in the topology table?

n =\_\_3\_\_ (Formula is 2n = subnets). n being the number of subnet bits.

NOTE: Remember you have a 24 bit subnet mask (Class C). The binary form looks like this 11111111.11111111.11111111.00000000. How many bits do you need get the amount of subnets you need?Try to use the formula 2n to calculate close to what you need. For example you donʻt need 62 subnets.

c. How many subnets does this create? \_\_8\_\_ = 2 n

d. How many usable hosts does this create *per* subnet? \_\_\_30\_\_

NOTE: Always subtract 2 host IPʻs for Network and Broadcast IP addresses. You already have 2 8 - 2 = 254 hosts before subnetting but you do not need that many hosts per subnet.  **(n=network/mask bits covered by subnets mask, s=subnet bits h = host bits)** Your binary bitmap should now look *something* like this. nnnnnnnn.nnnnnnnn.nnnnnnnn.sssshhhh (n=network/mask bits covered by subnets mask, s=subnet bits h = host bits). However many bits you borrowed you add to the CIDR of /24. For example if you borrowed 4 extra bits then your CIDR would be /28.

e. Calculate the *binary value* for the first five subnets.. The first subnet is already shown. List them in the table below.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Subnet | Network address | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
| 0 | 192.168.100. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 192.168.100. | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2 | 192.168.100. | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 192.168.100. | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 4 | 192.168.100. | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Remember these binary values: 128 64 32 16 8 4 2 1. Subtract from left to right to get your binary answer. If there is a remainder that matches closely to binary column enough to subtract mark a 1 in that column otherwise mark a 0. You should have eight 0 and 1s

1st Octet:

Can you subtract 128 from 192? Yes. Place a 1 in the 1st binary column. Remainder is **64**.

Can you subtract 64 from **64**? Yes. Place a 1 in the 2nd binary column. Remainder is 0.

Mark six zeroes for the rest of the binary columns as you cannot subtract further.

2nd Octet:

Can you subtract 128 from 168? Yes. Place a 1 in the 1st binary column. Remainder is **40**.

Can you subtract 64 from **40**? No.Place a 0 in the 2nd binary column.

Can you subtract 32 from **40**? Yes. Place a 1 in the 3nd binary column. Remainder is **8**.

Can you subtract 16 from **8?** No. Place a 0 in the 4th binary column.

Can you subtract 8 from 8? Yes. Place a 1 in the 5th binary column. Remainder is 0 .

Mark three zeroes for the rest of the binary columns as you cannot subtract further.

3rdOctet:

Can you subtract 128 from 100? No. Place a 0 in 1st binary column.

Can you subtract 64 from **100**? Yes.Place a 1 in the 2nd binary column. Remainder is **36**.

Can you subtract 32 from **36**? Yes. Place a 1 in the 3nd binary column. Remainder is **4**.

Can you subtract 16 from 4**?** No. Place a 0 in the 4th binary column.

Can you subtract 8 from 4? No. Place a 0 in the 5th binary column.

Can you subtract 4 from 4? Yes. Place a 1 in the 6th binary column. Remainder is 0 .

Mark two zeroes for the rest of the binary columns as you cannot subtract further.

f. Calculate the binary and decimal values of the new subnet mask. Mark them in the Mask 4th octet columns in the table below. Begin with Network 0. **Note:** You may not need to use all rows.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | IP | | | | Mask | | | |
|  | 1st Octet | 2nd Octet | 3rd Octet | 4th Octet | 1st Octet | 2nd Octet | 3rd Octet | 4th Octet |
| Network 0  “Zero Subnet” | 192  11000000 | 168  10101000 | 100  01100100 | 0  00000000 | 255  11111111 | 255  11111111 | 255  11111111 |  |
| Network 1 | 192  11000000 | 168  10101000 |  |  | 255  11111111 | 255  11111111 | 255  11111111 |  |
| Network 2 | 192  11000000 | 168  10101000 |  |  | 255  11111111 | 255  11111111 | 255  11111111 |  |
| Network 3 | 192  11000000 | 168  10101000 |  |  | 255  11111111 | 255  11111111 | 255  11111111 |  |
| Network 4 |  |  |  |  |  |  |  |  |
| Network 5 |  |  |  |  |  |  |  |  |
| Network 6 |  |  |  |  |  |  |  |  |
| Network 7 |  |  |  |  |  |  |  |  |
| Network 8 |  |  |  |  |  |  |  |  |
| Network 9 |  |  |  |  |  |  |  |  |
| Network 10 |  |  |  |  |  |  |  |  |

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**

Example shows 192.168.1.0/27 subnet mask (blocks of 32).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Subnet Number | Subnet Address | First Usable Host Address | Last Usable Host Address | Broadcast Address |
| Example | ex. 192.168.1.0 | ex.192.168.1.1 | ex. 192.168.1.30 | ex. 192.168.1.31 |
|  | ex. 192.168.1.32 | ex.192.168.1.33 | ex. 192.168.1.62 | ex. 192.168.2.63 |
| 0 | 192.168.100.0 | 192.168.100.1 | 192.168.100.30 | 192.168.100.31 |
| **1** | 192.168.100.32 | 192.168.100.33 | 192.168.100.62 | 192.168.100.63 |
| **2** | 192.168.100.64 | 192.168.100.65 | 192.168.100.94 | 192.168.100.95 |
| **3** | 192.168.100.96 | 192.168.100.97 | 192.168.100.126 | 192.168.100.127 |
| **4** | 192.168.100.128 | 192.168.100.129 | 192.168.100.158 | 192.168.100.159 |
| **5** | 192.168.100.160 | 192.168.100.161 | 192.168.100.190 | 192.168.100.191 |
| **6** | 192.168.100.192 | 192.168.100.193 | 192.168.100.222 | 192.168.100.223 |
| **7** | 192.168.100.224 | 192.168.100.254 | 192.168.100.254 | 192.168.100.255 |
| **8** |  |  |  |  |
| **9** |  |  |  |  |
| **10** |  |  |  |  |

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

* + 1. Assign Subnet 0 to the LAN connected to the GigabitEthernet 0/0 interface of R1. Mark here the subnet range: 192.168.100.0 - 192.168.100.31
    2. Assign Subnet 1 to the LAN connected to the GigabitEthernet 0/1 interface of R1. Mark here the subnet range: 192.168.100.32 - 192.168.100.63
    3. Assign Subnet 2 to the LAN connected to the GigabitEthernet 0/0 interface of R2. Mark here the subnet range: 192.168.100.64 - 192.168.100.95
    4. Assign Subnet 3 to the LAN connected to the GigabitEthernet 0/1 interface of R2. Mark here the subnet range: : 192.168.100.96 - 192.168.100.127
    5. Assign Subnet 4 to the WAN link between R1 to R2. Mark here the subnet range: 192.168.100.128 - 192.168.100.159

**Step 3: Addressing Table**

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.

**NOTE**: Do not use the Subnet address or Broadcast address of each subnet as they *are not* usable addresses to assign to a host.

1. Addressing Table

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Device | Interface | IP Address | Subnet Mask | Default Gateway |
| R1 | G0/0 | 192.168.100.1 | 255.255.255.224 | N/A |
| G0/1 | 192.168.100.133 | 255.255.255.224 | N/A |
| S0/0/0 | 192.168.100.1129 | 255.255.255.224 | N/A |
| R2 | G0/0 | 192.168.100.65 | 255.255.255.224 | N/A |
| G0/1 | 192.168.100.97 | 255.255.255.224 | N/A |
| S0/0/0 | 192.168.100.158 | 255.255.255.224 | N/A |
| S1 | VLAN 1 | 192.168.100.2 | 255.255.255.224 | 192.168.100.1 |
| S2 | VLAN 1 | 192.168.100.34 | 255.255.255.224 | 192.168.100.33 |
| S3 | VLAN 1 | 192.168.100.66 | 255.255.255.224 | 192.168.10065 |
| S4 | VLAN 1 | 192.168.100.98 | 255.255.255.224 | 192.168.100.97 |
| PC1 | NIC | 192.168.100.30 | 255.255.255.224 | 192.168.100.1 |
| PC2 | NIC | 192.168.100.62 | 255.255.255.224 | 192.168.100.33 |
| PC3 | NIC | 192.168.100.94 | 255.255.255.224 | 192.168.100.65 |
| PC4 | NIC | 192.168.100.126 | 255.255.255.224 | 192.168.100.97 |

**Ping Table:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Ping From Device** | **Ping to Device IP** | **Possible Y/N** | **If no, Why Not? What did you do to resolve?** |
| R1 | S3 | Y |  |
| R1 | PC4 | Y |  |
| S3 | PC4 | Y |  |

R1 Show Run Output

R1#show running-config

Building configuration...

Current configuration : 837 bytes

!

version 15.1

no service timestamps log datetime msec

no service timestamps debug datetime msec

no service password-encryption

!

hostname R1

!

!

!

!

!

!

!

!

ip cef

no ipv6 cef

!

!

!

!

license udi pid CISCO1941/K9 sn FTX1524V069

!

!

!

!

!

!

!

!

!

!

!

spanning-tree mode pvst

!

!

!

!

!

!

interface GigabitEthernet0/0

ip address 192.168.100.1 255.255.255.224

duplex auto

speed auto

!

interface GigabitEthernet0/1

ip address 192.168.100.33 255.255.255.224

duplex auto

speed auto

!

interface Serial0/0/0

ip address 192.168.100.129 255.255.255.224

clock rate 64000

!

interface Serial0/0/1

no ip address

clock rate 2000000

shutdown

!

interface Vlan1

no ip address

shutdown

!

router eigrp 1

network 192.168.100.0

!

ip classless

!

ip flow-export version 9

!

!

!

!

!

!

!

!

line con 0

!

line aux 0

!

line vty 0 4

login

!

!

!

end

S3 Show Run Output

S3#show run

Building configuration...

Current configuration : 1128 bytes

!

version 12.2

no service timestamps log datetime msec

no service timestamps debug datetime msec

no service password-encryption

!

hostname S3

!

!

!

!

!

spanning-tree mode pvst

spanning-tree extend system-id

!

interface FastEthernet0/1

!

interface FastEthernet0/2

!

interface FastEthernet0/3

!

interface FastEthernet0/4

!

interface FastEthernet0/5

!

interface FastEthernet0/6

!

interface FastEthernet0/7

!

interface FastEthernet0/8

!

interface FastEthernet0/9

!

interface FastEthernet0/10

!

interface FastEthernet0/11

!

interface FastEthernet0/12

!

interface FastEthernet0/13

!

interface FastEthernet0/14

!

interface FastEthernet0/15

!

interface FastEthernet0/16

!

interface FastEthernet0/17

!

interface FastEthernet0/18

!

interface FastEthernet0/19

!

interface FastEthernet0/20

!

interface FastEthernet0/21

!

interface FastEthernet0/22

!

interface FastEthernet0/23

!

interface FastEthernet0/24

!

interface GigabitEthernet0/1

!

interface GigabitEthernet0/2

!

interface Vlan1

ip address 192.168.100.66 255.255.255.224

!

ip default-gateway 192.168.100.65

!

!

!

!

line con 0

!

line vty 0 4

login

line vty 5 15

login

!

!

!

!

end

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CIDRs for mask 0.0.0.0** | /1 | /2 | /3 | /4 | /5 | /6 | /7 | /8 |
| **CIDRs for mask**  **255.0.0.0** | /9 | /10 | /11 | /12 | /13 | /14 | /15 | /16 |
| **CIDRs for mask 255.255.0.0** | /17 | /18 | /19 | /20 | /21 | /22 | /23 | /24 |
| **CIDRs for 255.255.255.0** | /25 | /26 | /27 | /28 | /29 | /30 | /31 | /31 |
| **Subnet Mask** | 128 | 192 | 224 | 240 | 248 | 252 | 254 | 255 |
| **Magic Number** | 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |
| **# of Subnets or Hosts Needed** | 255 | 127 | 63 | 31 | 15 | 7 | 3 | 1 |
| **Bits Borrowed** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |

Source: https://www.interfacett.com/blogs/subnetting-tcpip-network-using-magic-box-method/