# **Lab 3: Preliminary study**

## **Rules**

* You must complete the preliminary study **before** attending to its corresponding lab session.
* You should deliver **only one** report per group.
* You must deliver this report as a **.pdf** file with the following name: “lab3pre\_NIA1\_NIA2\_NIA3.zip”.
* The preliminary study must be delivered via the **Aula Global**.
* The preliminary study represents **25%** of its corresponding lab’s score.
* When solving an exercise that requires the use of **equations**, you have to properly develop the problem and explain the meaning of each term. In addition, you must provide your final response in the units of the International System of Units (SI).

## **Exercises**

1. Fill the table of IP classes below. Check your answer by looking into the Internet. Is there any range in Class A that cannot be used?

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Class** | **Range** | **No. Networks** | **No. Hosts** | **Mask** | **Broadcast** |
| A | 0.0.0.0 – 127.255.255.255 | 27 | 224 - 2 | 255.0.0.0 | x.255.255.255 |
| B | 128.0.0.0 – 191.255.255.255 | 214 | 216 - 2 | 255.255.0.0 | x.x.255.255 |
| C | 192.0.0.0 – 223.255.255.255 | 221 | 28 - 2 | 255.255.255.0 | x.x.x.255 |

2. What is the difference between private and public addresses? Fill the table below corresponding to the ranges of private IP addresses.

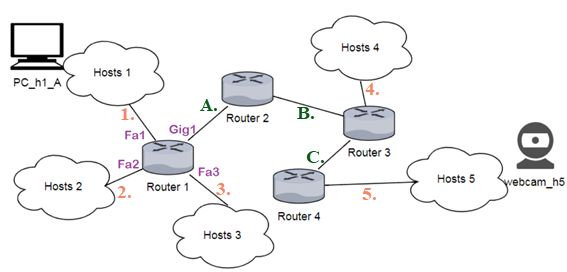
|  |  |
| --- | --- |
| **Class** | **Range** |
| A | 10.0.0.0 – 10.255.255.255 |
| B | 172.16.0.0 – 172.31.255.255 |
| C | 192.168.0.0 – 192.168.255.255 |

3. What is subnetting? Why is it useful?

Subnetting is partitioning a network into **smaller groups of IP addresses** in comparison to simply using Class A, B, and C conventions. Each subdivision **(subnet)** of a single Class A, B, or C network works **as if it was a network itself.**

This configuration allows routers to send data to multiple destination hosts without having to store all these host's IP addresses in its routing table, just the subnet the particular hosts belong. Fragmenting a network can also be useful for example in a corporation to filter traffic depending on the purpose of the subnet and its location.

4. How many sub-networks do you see in the following image? Put them a name and indicate them in the figure below.



5. Assuming that you have been provided the range 192.168.4.0/24, assign a group of 32 IPs to each of the subnetworks (including broadcast and network addresses). Indicate the first and the last available IPs, as well as network and broadcast addresses.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Net** | **name** | **Range (@Network)** | **@Broadcast** | **@First host** | **@Last host** |
| **1** | Hosts\_1 | 192.168.4.0/27 | 192.168.4.31 | 192.168.4.1 | 192.168.4.30 |
| **2** | Hosts\_2 | 192.168.4.32/27 | 192.168.4.63 | 192.168.4.33 | 192.168.2.62 |
| **3** | Hosts\_3 | 192.168.4.64/27 | 192.168.4.95 | 192.168.4.65 | 192.168.4.94 |
| **4** | Hosts\_4 | 192.168.4.96/27 | 192.168.4.127 | 192.168.4.97 | 192.168.4.126 |
| **5** | Hosts\_5 | 192.168.4.128/27 | 192.168.4.159 | 192.168.4.129 | 192.168.4.158 |
| **A** | Router1-Router2 | 192.168.4.160/27 | 192.168.4.191 | 192.168.4.161 | 192.168.4.190 |
| **B** | Router2-Router3 | 192.168.4.224/30 | 192.168.4.227 | 192.168.4.225 | 192.168.4.226 |
| **C** | Router3-Router4 | 192.168.4.228/30 | 192.168.4.231 | 192.168.4.229 | 192.168.4.230 |

6. Assign an appropriate IP address both to PC\_h1\_A and webcam\_h5.

PC\_h1\_A | Hosts\_1 | IP: *192.168.4.2*

webcam\_h5 | Hosts\_5 | IP: *192.168.4.130*

7. In the proposed IP assignation, every subnetwork has exactly the same number of IP addresses available. How would you improve such an assignation in case of needing 62 hosts in *hosts 1*? Propose a new IP assignation by filling the table below. **Hint**: *think about how many IPs router-router subnets do actually need.*

I may consolidate two contiguous /27 subnets into a single /26 subnet.

For example 192.168.4.0/26 and 192.168.4.32/27 into 192.168.4.0/26 (64 IPs)

I can use smaller subnets for the connections between routers (3 subnets)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Net** | **name** | **Range (@Network)** | **@Broadcast** | **@First host** | **@Last host** |
| **1** | Hosts\_1 | 192.168.4.0/26 | 192.168.4.63 | 192.168.4.1 | 192.168.4.62 |
| **2** | Hosts\_2 | 192.168.4.64/27 | 192.168.4.95 | 192.168.4.65 | 192.168.2.94 |
| **3** | Hosts\_3 | 192.168.4.96/27 | 192.168.4.127 | 192.168.4.97 | 192.168.4.126 |
| **4** | Hosts\_4 | 192.168.4.128/27 | 192.168.4.159 | 192.168.4.129 | 192.168.4.158 |
| **5** | Hosts\_5 | 192.168.4.160/27 | 192.168.4.191 | 192.168.4.161 | 192.168.4.190 |
| **A** | Router1-Router2 | 192.168.4.224/30 | 192.168.4.227 | 192.168.4.225 | 192.168.4.226 |
| **B** | Router2-Router3 | 192.168.4.228/30 | 192.168.4.231 | 192.168.4.229 | 192.168.4.230 |
| **C** | Router3-Router4 | 192.168.4.232/30 | 192.168.4.235 | 192.168.4.233 | 192.168.4.234 |

8. Consider again the first IP assignation where you assigned 32 IPs to each of the subnetworks. Complete the forwarding table (interfaces and IPs) of Router 1 at times T=0, T=10 and T=20. Note that Router 1 has 4 interfaces as shown in the topology above: Fa1, Fa2, Fa3 and Gig1. Assume that routers exchange information every 10 time units.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **T = 0** | | **T = 10** | | **T = 20** | |
| **Interface** | **IP** | **Interface** | **IP** | **Interface** | **IP** |
| Fa1 | 192.168.4.0/27 |  |  |  |  |
| Fa2 | 192.168.4.32/27 |  |  |  |  |
| Fa3 | 192.168.4.64/27 |  |  |  |  |
| Gig1 | 192.168.4.160/27 |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

Router 1

IP Addresses corresponding to the different router interfaces

Fa1 192.168.4.1 /27

Fa2 192.168.4.33 /27

Fa3 192.168.4.65 /27

Gig1 192.168.4.97 /27

Router 2

Fa1 192.168.4.98 /27

Fa2

Destination Subnet Gateway Interface

192.168.4.0 /27 on-link Fa1

192.168.4.96 /27 192.168.4.98 Gig1

192.168.4.128/27 192.168.4.98 Gig1

9. Use the following applet to explain the concept of NAT and explain what you observe.

*Applet:* [*http://www.netbook.cs.purdue.edu/animations/NAT%20Concept.html*](http://www.netbook.cs.purdue.edu/animations/NAT%20Concept.html)