# **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 |

* 10.0.0.0 /8 is reserved for private IP use
* 127.0.0.0 /8 is reserved for loopback purposes, being 127.0.0.1 the loopback address of the local host.

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 |

Those are ranges of IP addresses reserved for internal/private networks, i.e these IP addresses are not routed through the public internet. Private networks are usually behind a router with a public IP address doing NAT translation.

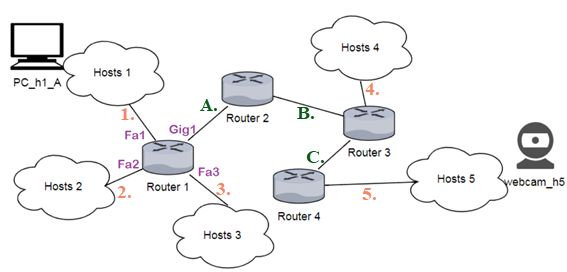
3. What is subnetting? Why is it useful?

IPv4 addresses are divided in two parts, network and host, determined by the subnet mask.

Subnetting is useful because it allows to group hosts in the same location so routers can send data to multiple destination hosts without having to store all these host's IP routing entries in its routing table, therefore keeping table within a manageable size.

Subnetting refers to partitioning a network into **smaller groups of IP addresses.** Initially the Internet IP address space was partitioned using Class A, B, and C subnets, which use masks /8, /16 and /24. These subnets can be further partitioned for different reasons: to segregate different kinds of traffic (e.g. iSCSI vs host communications), for establishing security controls, or for performance or security reasons

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



A total of eight subnets, five of them being used for hosts (labeled 1 to 5) and other three for router to router communications (labeled A, B and C)

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 | 192.168.4.192/27 | 192.168.4.223 | 192.168.4.193 | 192.168.4.222 |
| **C** | Router3-Router4 | 192.168.4.224/27 | 192.168.4.255 | 192.168.4.225 | 192.168.4.254 |

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 | Gi1 | 192.168.4.192 | Gi1 | 192.168.4.160/27 |
| Fa2 | 192.168.4.32/27 |  |  | Gi1 | 192.168.4.224/27 |
| Fa3 | 192.168.4.64/27 |  |  | Gi1 | 192.168.4.96/27 |
| Gig1 | 192.168.4.160/27 |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
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|  |  |  |  |  |  |

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)