Internet Architecture

Academic Year: (2019 / 2020) **Review date: 16-05-2020**

Department assigned to the subject: Telematic Engineering Department

Coordinating teacher: GARCIA MARTINEZ, ALBERTO

Type: Electives ECTS Credits : 3.0

Year : Semester :

OBJECTIVES

The Internet Architecture course is devoted to understanding how Internet works at a global scope in the current moment. We will understand how networks are connected one to each other, which are the economic incentives and their implications in the way networks connect along with the roles played by the different agents involved.
One of the most relevant problems Internet faces is IP address scarcity (in the Internet Protocol version most widely used, IPv4). We will understand the magnitude of the problem. We will also understand the current deployed solutions: different ways of using private addressing (NAT, VPNs, etc.), IPv4 address market, and the development of a new protocol with a larger address space, IPv6. We will discuss the
implications of each of these solutions to network functionality.
Regarding to the methodology for the course, the approach followed is practical, focused on the analysis of real data and the deployment (in a virtual environment) of the proposed solutions. We intend knowledge to emerge from the access, processing and analysis of real data, and from the experience in the configuration of network scenarios. The objective is to empower the student to access by himself to the data/experience and build from this input its own knowledge.

DESCRIPTION OF CONTENTS: PROGRAMME

1. Introduction to Python.
 1.1 Data processing with Python: ¿pandas¿ library

2. Internet Architecture.
 2.1 Interdomain routing. BGP routing. Pricing and relationships between networks. Internet business model
  2.1.1 Quantitative analysis of the current Internet.
 2.2 Content Data Networks (CDN), cloud, datacenters
  2.2.1 Quantitative análisis of connectivity to CDNs

3. Addressing in the Internet
 3.1 Public address assignment governance and policies. Address scarcity. Address market.
  3.1.1 Quantitative analysis of assigned addresses.
  3.1.2 Quantitative analysis of the IP address market
 3.2 Use of private addresing
  3.2.1 NATs and Carrier Grade NATs (CGNs)
   3.2.1.1 Configuring NATs and CGNs
  3.2.2 Virtual Private Networks
   3.2.2.1 Configuring VPNs
 3.3. IPv6 addressing
  3.3.1 Configuring IPv6 addresses

LEARNING ACTIVITIES AND METHODOLOGY

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Data analysis is a skill growingly required in the job market, that is just assumed to be known by any engineer. In this course we provide basic knowledge to data processing through a programming

interface. For real data analysis, we use Python, and in particular the pandas library, a tool providing flexible data processing with a low entry barrier (we devote some course time to present these tools). We apply the tool to real data to analyse in the laboratory how many different networks are in the Internet, which is the distance between them, how many addresses have been assigned to date, who is the owner, how many are transferred between networks, which are the top buyers and sellers, how many routers are traversed when accessing to most popular destinations, etc.

On the other hand, we use virtual network topologies (using the CORE virtual network framework) to understand how NATs and CGNs are configured, and their drawbacks, how VPNs are deployed or IPv6 address management.

ASSESSMENT SYSTEM

25% laboratory
15% partial exam
60% final examen

% end-of-term-examination:	60
% of continuous assessment (assigments, laboratory, practicals…):	40

BASIC BIBLIOGRAPHY

- Iljitsch van Beijnum BGP, O'Reilly.