Code: ING-INF/05	**Credits:** 9
Matter: Computer Networks	
Main language of instruction: Italian	
Other language of instruction: English	

Teaching Staff

Head instructor
Prof. Gabriele ROMANIELLO - gabriele.romaniello@unicusano.it

Introduction

1. *Objective of the course:*

The Computer Networks Course aims to provide the student a good knowledge of the principles governs the design of network and model its behavior. The Course proposes the basic concepts of layered architecture, and declines them in the study of protocols and, more generally, of mechanisms commonly used in packet-switched networks, with a focus on the Internet and Web.

The educational objective of the course is to provide the student with detailed knowledge on the functioning of TCP / IP stack and the underlying mechanisms, such as reliable transport or congestion control, routing algorithms, network devices, switches and routers.

The E-tivities associated with the course develop skills necessary to design and analyze computer networks through the use of computing systems.

Objectives

2. *Course Structure:*
- Illustrate the basic principles of a network architecture
- Illustrate the operating principles of a layered architecture
  Illustrate the main protocols of each level of the Internet architecture
- Describe the main protocols of the various applications distributed for the Web

Competencies:

A.   Knowledge and understanding.

At the end of the course, the student will have knowledge of the problems inherent in the functioning of the different levels of the protocol stack and network architecture. Also, the student will acquire the ability to understand issues such as the origin of delays and losses during transmission of the packages, the operating principles of the different distributed applications, the problems connected to reliable data transport over an unreliable channel, the operating principles of addressing e Internet routing, problems related to data transmission in local networks.

The student will finally come made able to compare the consequences deriving from the architectural choices to be made in the design of a network architecture. Furthermore, through the E-tivities the students will acquire the ability to simulate architectures and applications within emulation environments for computer networks such as Netkit and Mininet.

B.   Applying knowledge and understanding.

The student will be able to use tools such as traffic analyzers for local networks. You will also be able to apply the principles learned for the design of simple distributed applications.

The E-tivities involve the application of theoretical knowledge to practical problems, such as simple design network configurations and solve problems related to the operation of a DNS or a router in a local network, from solve with the aid of emulation environments for computer networks (Netkit, Mininet).

C.   Making judgements.

The student will be able to identify the most appropriate network protocols for the services to be provided. In addition, the student, will also be able to interpret the performance indicators of one network (throughput, delays, etc), and to collect the data necessary for the design and configuration of a simple local network. Finally, the student will be able to carry out bibliographic searches, to analyze and interpret the relevant sources, to analyze new network protocols and web applications.

D.   Communication skills.

The student will be able to describe and hold conversations on issues related to design and management of a network, the resolution of the typical problems of a simple local network, using adequate terminology.

E.   Learning skills.

At the end of the course, the student will have knowledge of the fundamental notions necessary for the analysis and computer network design. This will allow to identify the interactions between the different levels of the stack protocol of a

layered architecture, such as the Internet, and the differences between different network architectures and service models.

Syllabus

3. *Programme of the course:*

Subject 1. Introduction and architectures.
Basic concepts of networking; Layered architectures; Physical means; Origin of delays and losses; Service models; Internet architecture.

Subject 2. Web.
Main network applications and their protocols, Web.

Subject 3. Other application protocols.
E-mail; File transfer; DNS; Peer-to-peer applications. Exercise on Telnet for diagnostics and SSH for remote administration.

Subject 4. Transport: services and mechanisms
Transportation level services; connection-oriented or connectionless transport; stop-and-wait protocols, sliding window.

Subject 5. Transport protocols
UDP; TCP

Subject 6. Network: IP
Network level; router; IP protocol.

Subject 7. Network: Routing
Routing algorithms; Internet routing (RIP, OSPF, BGP). Exercise on simple topologies and on NAT with Netkit or Mininet.

Subject 8. Datalink
Connection level; shared medium access protocols; Ethernet.

Evaluation system and criteria

The exam usually consists in carrying out a written test with the goal to verify

the acquired concepts and in carrying out a series of activities (e-tivity) uploaded within the virtual classrooms.

The expected learning outcomes about the knowledge of the subject and the ability to apply them are evaluated by the written test, while communication skills, ability to draw conclusions and ability to self-study are evaluated through the e-tivities.

Bibliography and resources

4. *Materials to consult*

The didactic material on the platform is divided into 6 modules. They fully cover the e program each of them contains handouts, slides and video lessons in which the teacher comments on the slides. Such material contains all the elements necessary to tackle the study of the subject.

5. *Recommended bibliography*

Suggested readings are:

- James F. Kurose, Keith W. Ross, "Computer Networking – A Top-Down approach", 7th edition, Pearson