



University of Nicosia, Cyprus

Course Code	Course Title	ECTS Credits
COMP-515	Distributed Systems	10
Department	Semester	Prerequisites
Computer Science	Spring	None
Type of Course	Field	Language of Instruction
Required	Computer Science	English
Level of Course	Year of Study	Lecturer(s)
2 nd Cycle	1 st or 2 nd	Dr Harald Gjermundrød
Mode of Delivery	Work Placement	Co-requisites
face-to-face	N/A	None

Objectives of the Course:

The main objectives of the course are to:

- introduce the principles of design, construction and development of distributed systems along with distributed algorithms
- cover in detail the different interaction paradigms for distributed systems like interprocess communication, remote invocation, and indirect communication
- cover in detail distributed algorithms for time, state consistency, coordination and agreement
- provide deep knowledge and contrast different middleware paradigms like distributed objects, components based, and peer-to-peer systems
- explain in detail naming structure and organization in distributed systems
- expose the students to development tools/environments/frameworks to develop distributed systems.

Learning Outcomes:

After completion of the course students are expected to be able to:

1. describe the principals, design, architecture, organization, algorithms and development

of distributed systems

2. compare and contrast the following interaction methods: interprocess communication, remote invocation, and indirect communication that are used in distributed systems
3. critically assess time, state consistency, coordination and agreement algorithms used in distributed systems.
4. critically assess different middleware paradigms like distributed objects, components based, and peer-to-peer systems
5. summarize the naming structure and organization in distributed systems
6. demonstrate the ability to select an appropriate distributed algorithm that fulfills the design requirements for a distributed system
7. demonstrate the ability to select an appropriate middleware paradigm that fulfills the design requirements for a distributed system
8. design and develop a distributed system based on a description of its required functionality and purpose.

Course Contents:

1. Characterization of Distributed Systems
 - a) Examples of distributed systems
 - b) Trends in distributed systems
 - c) Focus on resource sharing
 - d) Challenges like heterogeneity, scalability, failure handling, and security
2. System models
 - a) Physical models
 - b) Architectural models
 - c) Fundamental models
3. Interprocess Communication
 - a) The API for the Internet protocols
 - b) External data representation and marshaling
 - c) Multicast communication
 - d) Network virtualization: Overlay networks
4. Remote Invocation
 - a) Request-reply protocols
 - b) Remote procedure call
 - c) Remote method invocation
 - d) Case study of a RPC/RMI technology
5. Indirect communication
 - a) Group communication
 - b) Publish-subscribe systems
 - c) Message queues
 - d) Shared memory approaches
6. Distributed objects and components
 - a) Distributed objects
 - b) Case study of a distributed object middleware
 - c) From objects to components
 - d) Case studies of a component based middleware
7. Peer-to-peer Systems
 - a) Napster and its legacy
 - b) Peer-to-peer middleware
 - c) Routing overlays
 - d) Case study of an overlay network and application

8. Name Services
 - a) Name services and the Domain Name System
 - b) Directory services
 - c) X.500 Directory Service.
9. Time and Global States
 - a) Clocks, events and process states
 - b) Synchronizing physical clocks
 - c) Logical time and logical clocks
 - d) Global states
10. Coordination and Agreement
 - a) Distributed mutual exclusion
 - b) Elections
 - c) Coordination and agreement in group communication
11. Designing Distributed systems
 - a) Case study of all the aspects of a large distributed system

Learning Activities and Teaching Methods:

Lectures, Practical Exercises, Projects and Assignments.

Assessment Methods:

Projects, Mid-term Exam, Final Exam.

Required Textbooks/Reading:

Authors	Title	Publisher	Year	ISBN
G. Coulouris, J. Dollimore, T. Kindberg, G. Blair	Distributed Systems: Concepts and Design, 5 th Edition	Addison Wesley	2011	978-0132143011

Recommended Textbooks/Reading:

Authors	Title	Publisher	Year	ISBN
Andrew S. Tanenbaum and Maarten Van Steen	Distributed Systems: Principles and Paradigms, 2 nd Edition	Prentice Hall	2006	978-0132392273

