UNIVERSITY of NICOSIA

Course Syllabus

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

Course Objectives:

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 Content:

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, and Assignments.

Assessment Methods:

Final Exam, Midterm Exam, Individual Programming Assignments, Individual Assignments, and Individual Project

Required Textbooks / Readings:

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

Recommended Textbooks / Readings:

Title	Author(s)	Publisher	Year	ISBN
Distributed Systems, 3rd Edition	Maarten Van Steen and Andrew S. Tanenbaum	CreateSpace Independent Publishing Platform	2017	978-15-43057386