Technical University of Cluj-Napoca
Computer Science Department

Distributed Systems
Undergraduate Program

Prof. Tudor Cioara, Conf. Cristina Pop, S.l. Marcel Antal

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Overall Schedule - Laboratory and Project

Week	Laboratory Presentation	Laboratory Evaluation	Project Presentation	Project Evaluation
1	• Lab Resources • Assignment 1 presentation • Laboratory work 1.1: 3 – tier REST services		• Project requirements	
2	• Laboratory work 1.2: Micro-services Development			
3	• Laboratory work 1.3: React App Development			
4	Q&A		• Laboratory work P1: Deployment using Docker	
5	• Assignment 2 presentation • Laboratory work 2.1: Indirect Communication Using Queues	Assignment 1 – full application		Assignment 1 – deployed on docker
6	• Laboratory work 2.2: Indirect Communication Using Topics			
7			• Laboratory work P2: Deployment using Docker • Load balancer and reverse proxy	
8	Q&A		• CI/CD on Cloud (*optional for the extra point*)	
9	• Assignment 3 presentation • Laboratory work: Web Sockets and Security	Assignment 2 – full application		Assignment 2 – deployed on docker with load balancing and reverse proxy

10			• Laboratory work P3: Basic Security	
11	Q&A		Q&A	
12		Assignment 3 – full application		Assignment 3 - deployed on docker with load balancing and reverse proxy
13				Late evaluations
14				Late evaluations

Detailed Description - Laboratory and Project

Lab Resources

Key Technical Skills	Setup Software Stack Version Control (Git and Gitlab) CI/CD Tutorial Deployment on cloud (any cloud provider account is accepted) for 1 bonus point at the exam

Assignment 1 – tier REST services and React App

Basic DS Concepts	Client - Server Architecture Request-Reply Communication Paradigm HTTP Protocol and Methods HTTP state management mechanisms URI-based resource access (REST Services)
Key Technical Skills	HTTP state management mechanisms on Client Side (Session storage, Cookies) Authorization and Authentication Process (Roles) Custom Queries for fast DB access (eager vs lazy load) Deployment of web application in Tomcat Server and Node server
Conceptual Architecture	Client application - 3-tier REST Server-side services
Technologies	React (Angular) + Spring REST Hibernate + Mysql/PostgreSQL
Useful Links	https://biblioteca.utcluj.ro/files/carti-online-cu-coperta/329-5.pdf

Assignment 2 - Indirect Communication Using Queues and Web sockets.

Basic DS Concepts	Message Oriented Middleware
Key Technical Skills	Using Queues as Message Buffers for Client-Server communication Using Web Sockets for Asynchronous Client-Server Communication Deployment of client, server and middleware applications
Conceptual Architecture	Queue-based Message Oriented Middleware Bi-directional, full-duplex, real-time client/server communications
Technologies	RabbitMQ JSR 356 or the Java API for WebSocket
Useful Links	https://www.baeldung.com/java-websockets https://biblioteca.utcluj.ro/files/carti-online-cu-coperta/329-5.pdf

Assignment 3 – Web sockets and security

Basic DS Concepts	Web sockets and security
Key Technical Skills	Securing Communication using SSL Converting server side to REST services Web sockets-based communication Spring security Deployment of server and client applications as individual executables
Conceptual Architecture	Authentication and authorization component integration, chat microservice with WebSocket communication
Technologies	Web sockets and security
Useful Links	https://spring.io/projects/spring-security https://spring.io/guides/gs/messaging-stomp-websocket/

Final Project

Basic DS Concepts	Architecture of large heterogeneous distributed application Non-Functional requirements of Distributed Systems Virtualization CI/CD Pipeline
Key Technical Skills	Scalability: Deployment using Dockers Security: HTTPS and JWT over REST SSL Setting Time zone and keeping time consistent within application Deployment in Docker, network configuration, port forwarding Load balancing and reverse proxy
Conceptual Architecture	Service-based architecture of large distributed system
Technologies	Spring REST + React (or Angular) Hibernate + MySql / PostgreSQL RabbitMQ JSR 356 or the Java API for WebSocket HTTPS and JWT over REST and SSL, WS Security Docker for resource virtualization
Useful Links	https://www.guru99.com/security-web-services.html https://biblioteca.utcluj.ro/files/carti-online-cu-coperta/329-5.pdf