GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Distributed High-Availability Systems, PG_00063920		
Field of study	Rozproszone systemy o wysokiej dostępności		
Date of commencement of studies	February 2025	Academic year of realisation of subject	2024/2025
Education level	second-cycle studies	Subject group	Optional subject group Specialty subject group Subject group related to scientific research in the field of study
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	Polish
Semester of study	1	ECTS credits	3.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Computer Architecture -> Faculty of Electronics Telecommunications and Informatics -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Andrzej Sobecki	
	Teachers	dr inż. Andrzej Sobecki	

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	0.0	0.0	15.0	0.0	30

E-learning hours included: 0.0

eNauczanie source addresses:

Moodle ID: 45379 Rozproszone systemy o wysokiej dostępności
https://enauczanie.pg.edu.pl/moodle/course/view.php?id=45379

Learning activity and number of study hours

Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours	Self-study	SUM
Number of study hours	30	6.0	39.0	75

Subject objectives

The subject aims at informing students about development and deployment the distributed applications and usage the distributed file systems. Moreover, students will get knowledge about the kubernetes and docker swarm cluster which are desired environment for deployment distributed applications.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_U12] is able, to an increased extent, to analyze the operation of components and systems related to the field of study, as well as to measure their parameters and study their technical characteristics, and to plan and carry out experiments related to the field of study, including computer simulations, interpret the obtained results and draw conclusions	The student is able to design a system in microservice architecture.	[SU1] Ocena realizacji zadania
[K7_W11] knows and understands, to an increased extent, the general principles of creation and development of forms of individual entrepreneurship and the economic, legal and other conditions of various types of activities related to the awarded qualification, including the principles of protection of industrial property and copyright law	The student understands the economic benefits of using microservice architecture in relation to the pace of system development and the costs of maintaining large monolithic systems.	[SW1] Ocena wiedzy faktograficznej
[K7_W10] knows and understands, to an increased extent, the basic processes occurring in the life cycle of equipment, objects and technical systems, as well as methods of supporting processes and functions, specific to the field of study	The student is able to prepare a CI/CD process for a system created in a microservice architecture.	[SW1] Ocena wiedzy faktograficznej
[K7_W03] knows and understands, to an increased extent, the construction and operating principles of components and systems related to the field of study, including theories, methods and complex relationships between them and selected specific issues - appropriate for the curriculum	The student knows and describes various application development architectures. He knows the differences, advantages and disadvantages of using monolithic layered architectures and target distributed architectures.	[SW1] Ocena wiedzy faktograficznej

Subject contents

Course content – lecture
Application scalability, deployment;
Distributed application architectures (monolith -> micro services (CQRS / Event Sourcing/Saga);
Containerization of services -> docker, docker-compose, docker swarm, kubernetes;
Deploying and maintaining a distributed application -> monitoring (clusters / cloud computing - OpenSTack / AWS);
Monitoring -> Sentry / Jaeger / Promethes + Grafana /Load balancery / Queue systems;
Locust.io / Jmeter load testing toolsHDFS (Hive) / IPFS;
Distributed File Systems;
Distributed databases (Hbase / Neo4j, ArangoDB)Blockchain -> Bitcoin / Ethereum / Stellar / GRP (graph);
Distributed computing environment (Apache Spark / YARN -> JupyterLab -> PySpark -> .net context submit).

Course content – project
The system was implemented in a microservice architecture, utilizing the Saga, CQRS, and Event Sourcing patterns. The project will ultimately be deployed on a server cluster.

Prerequisites and co-requisites

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Project	50.0%	50.0%
Midterm colloquium	50.0%	50.0%

Recommended reading	Basic literature	1. Cloud Native DevOps with Kubernetes, John Arundel, Justin Domingus2. Kubernetes Patterns: Reusable Elements for Designing Cloud-Native Applications, Bilgin Ibryam, Roland Huß3. KUBERNETES: A Simple Guide to Master Kubernetes for Beginners and Advanced Users (2020 Edition), Brian Docker4. Hands-On Docker for Microservices with Python: Design, deploy, and operate a complex system with multiple microservices using Docker and Kubernetes, Jaime Buelta5. gRPC: Up and Running: Building Cloud Native Applications with Go and Java for Docker and Kubernetes, Kasun Indrasiri, Danesh Kuruppu6. The Kubernetes Book, Nigel Poulton7. Hands-On Microservices with C# 8 and .NET Core 3: Refactor you monolith architecture into microservices using Azure, 3rd Edition, Gaurav Aroraa, Ed Price8. Pro ASP.NET Core 3: Develop Cloud-Ready Web Applications Using MVC, Blazor, and Razor Pages, Adam Freeman9. Practical Microservices Architectural Patterns - Event-Based Java Microservices with Spring Boot and Spring Cloud, Binildas Christudas10. Monolith to Microservices: Evolutionary Patterns to Transform Your Monolith, Sam Newman11. Practical Microservices: Build Event-Driven Architectures with Event Sourcing and CQRS, Ethan Garofolo12. Architecting Modern Data Platforms, Jan Kunigk, Ian Buss, Paul Wilkinson & Lars George13. Advanced Analytics with Spark, Sandy Ryza, Uri Laserson, Sean Owen & Josh Wills14. Big Data Analytics with Hadoop 3, Sridhar Alla,15. Modern Big Data Processing with Hadoop, V. Naresh Kumar Prashant Shindgikar
	Supplementary literature	6. The Kubernetes Book, Nigel Poulton 7. Hands-On Microservices with C# 8 and .NET Core 3: Refactor you monolith architecture into microservices using Azure, 3rd Edition, Gaurav Aroraa, Ed Price 8. Pro ASP.NET Core 3: Develop Cloud-Ready Web Applications Using MVC, Blazor, and Razor Pages, Adam Freeman
	eResources addresses	
Example issues/ example questions/ tasks being completed	1. Explain what CNCF is2. What is Infrastructure as a Code3. RDD vs DataFrame4. HDFS vs IPFS5. pySpark vs python6. The role of Yarn	
Practical activites within the subject	Not applicable	

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