



OST

Eastern Switzerland
University of Applied Sciences

Blockchain (BlCh)

Admin

Thomas Bocek

17.09.2022

About Me

- OST, Lecturer
 - Distributed systems and blockchains
 - (VSS/DSA/DS1/DS2,WED1,3)
- Co-founder Axelra AG
 - May 2019
 - Tech Delivery, MVP in 100 days - Digitalization / Blockchain
 - CTO, operative
- Co-founder modum.io AG
 - Since 2016
 - Digitalizing Supply Chain - Digitalization / Blockchain
 - Board member, strategic
- General interests: distributed systems, blockchain, startups



BlCh Administration

- Module Description
- Website: <https://dsl.i.ost.ch>
- Exercises onsite **and** remote: **Teams**
 - Team code: 82yh8gm
- Lectures: pre-recorded, videos available on <https://dsl.i.ost.ch/lect> and **Youtube**
 - Videos and PDFs will be uploaded before the lecture starts on Wednesday 08:10
 - Youtube will only have the lectures videos, admin related videos & PDFs only via <https://dsl.i.ost.ch/lect/hs22/>
 - Same as in previous semester **FS22**

Blockchain

Kurzzeichen:

M_BlCh

Durchführungszeitraum:

HS/21-HS/22

ECTS-Punkte:

4

Lernziele:

Verteilte Systeme sind allgegenwärtig in beruflichem und privatem Alltag; sie führen Konzepte und Technologien aus unterschiedlichen Bereichen der Informatik zusammen. Die Themengebiete in diesem Modul umfassen:

- Synchronization in Distributed Systems (Causality, Lamports Clock, Vector Clocks)
- Blockchain Security Considerations and Cryptography
- DHTs (Chord, Kademlia)
- Distributed Systems with WebRTC
- Distributed Batch Processing with Apache Spark
- Ethereum, IOTA, NEO
- Consensus Mechanisms, Atomic Swaps

Verantwortliche Person:

Bocek Thomas

Standort (angeboten):

Rapperswil

Empfohlene Module:

Distributed Systems (M_DSy, FS/22-FS/23)

Zusätzlich vorausgesetzte Kenntnisse:

Englisch

(Dieses Modul wird teilweise in Englisch gehalten.)

BlCh Administration

Kurzzeichen:

BlCh

Lernziele:

Plan und Lerninhalt:

Die Themengebiete in diesem Modul können variieren und werden in der ersten Vorlesung bekanntgegeben.

- If there is interest in further topics (blockchain and distributed systems related), please talk to me.

BICH 2022: Plan

Nr	Date	Lecture*	Lecturer
01	21.09.2022	Admin, Challenge Task, Repetition DSy (part 1)	Bocek
02	28.09.2022	Repetition DSy (part 2)	Bocek
03	05.10.2022	Ethereum and Solidity	Bocek
04	12.10.2022	NFTs and DeFi	Bocek
05	19.10.2022	P2P and DHTs	Bocek
06	26.10.2022	DeFi Introduction	Bocek
07	02.11.2022	DeFi DEX	Bocek
08	09.11.2022	Algorithms for Distributed Systems 1, DeFi NFT Markets	Bocek
09	16.11.2022	HTLCs, Cross-chain Atomic Swaps, and Algorithms for Distributed Systems	Bocek
10	23.11.2022	WebRTC, Layer 2 Solutions	Bocek
11	30.11.2022	Security Considerations, Layer 2 Use Cases, NFT Markets, and Smart Contract Testing	Bocek
12	07.12.2022	Exam preparation, guest lecture	Bocek, tbd
13	14.12.2022	Challenge Task Presentations	you
14	21.12.2022	Q&A and Challenge Task Award Winner Announcement	Bocek

BlCh Exercises

- Challenge Task
 - Starts 28.09.2022 (lecture 2)
 - **No exercises today!**
- Goal: practical application of distributed systems concepts and tools
- Onsite and remote: via MS Teams
 - Wednesday exercise u11: 10:10 – 11:50

Plan und Lerninhalt:

Die Themengebiete in diesem Modul können variieren und werden in der ersten Vorlesung bekanntgegeben.

In den Übungen entwickeln Studentengruppen eine verteilte Applikation (Challenge Task II), welche diverse Requirements erfüllen muss. Das Erfüllen dieser Requirements ist Voraussetzung für das Bestehen der Übungen und für die Zulassung zur Prüfung. Ein Beispiel eines Challenge Tasks aus dem HS18 war es, eine vollständige verteilte P2P Applikation zu erstellen, welche mithilfe einer Blockchain Nachrichten notariell beglaubigen kann.

BlCh Challenge Task

- Leistungsbewertung

Während der Prüfungssession:

Schriftliche Prüfung, 60 Minuten

Zulassungsbedingungen zur Prüfung:

Nach Ankündigung, Abgabe erfolgreich gelöste Übungsaufgaben.

- Must include a simple frontend (e.g., HTML, Vue, React, Svelte, Angular)
 - You can combine with other modules "Mobile and GUI Engineering"
- Must include a public blockchain (e.g., Ethereum, Solana)

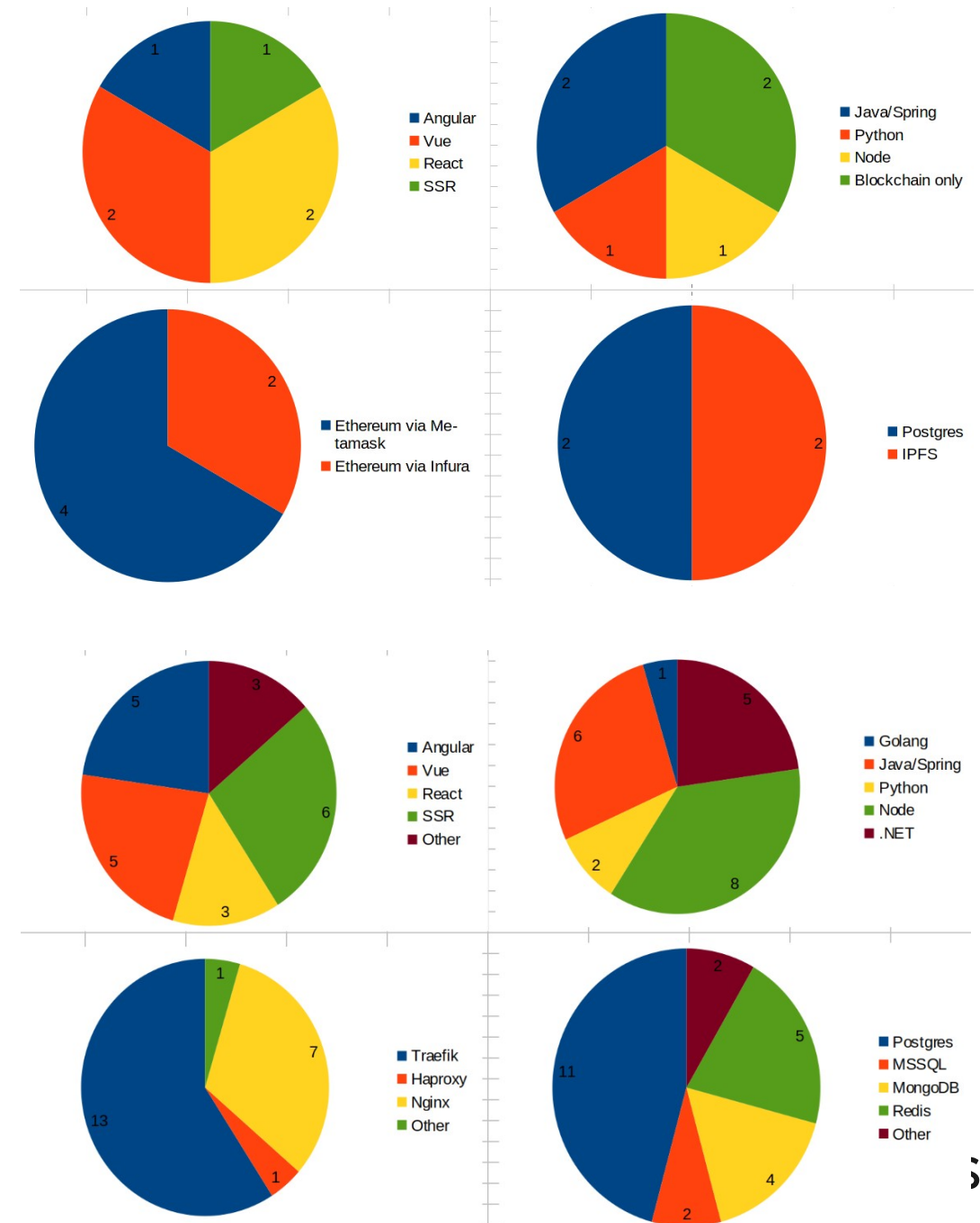
- Challenge Task HS 2022
- Design and implementation of an onchain voting application
 - Ideally, the application is a decentralized application (DApp).
- Requirements
 - A working prototype for your use-case
 - Use latest stable releases of chosen libraries and frameworks
 - Submission of a voting proposal (can be testnet)
 - Onchain voting on proposal with at least 2 participants / identities (can be testnet)
 - Successful vote needs to trigger either an ERC20 or an NFT transfer (can be testnet)
 - Voting status and process need to be shown in the frontend

BCh 2022: Plan / Challenge Task

Nr	Date	Lecture*	Suggested Milestone
01	21.09.2022	Admin, Challenge Task, Repetition DSy (part 1)	Group forming, idea for (d)app
02	28.09.2022	Repetition DSy (part 2)	Group forming done, setup dev environment
03	05.10.2022	Ethereum and Solidity	Information flow
04	12.10.2022	NFTs and DeFi	
05	19.10.2022	P2P and DHTs	
06	26.10.2022	DeFi Introduction	
07	02.11.2022	DeFi DEX	Hand-in 1 (01.12.2022) , first version (initial commit)
08	09.11.2022	Algorithms for Distributed Systems 1, DeFi NFT Markets	
09	16.11.2022	HTLCs, Cross-chain Atomic Swaps, and Algorithms for Distributed Systems	
10	23.11.2022	WebRTC, Layer 2 Solutions	
11	30.11.2022	Security Considerations, Layer 2 Use Cases, NFT Markets, and Smart Contract Testing	Connecting everything
12	07.12.2022	Exam preparation, guest lecture	Testing, testing, testing
13	14.12.2022	Challenge Task Presentations	Hand-in 2 (13.12.2022, 23:59 CET)
14	21.12.2022	Q&A and Challenge Task Award Winner Announcement	you

BlCh Challenge Task

- Deliverables, 13.12.2022, 23:59 (CET)
 - Well documented code and infrastructure
 - Presentation (slides) and demo of the application, also showing the architecture and design decisions
- Libraries and tools
 - Allowed to use any language, framework, and platforms. However, the supervisors are familiar with those: Java, Golang, JavaScript, Linux (see FS22, HS21)
- If you **fail** the CT, you fail this course



DSA Challenge Task 2018

- Design and implementation of a fully-distributed, P2P messaging application with an integrated, blockchain-based notary service
- Requirements
 - Full decentralization and P2P
 - Send messages between peers
 - Quickly and easily verify messages
- Each winner: 0.01311 BTC (50CHF)
 - They used the IOTA blockchain as a signaling layer for WebRTC.
 - Everything decentralized



DSA Challenge Task 2019

- Design and implementation of a fully-distributed, P2P gambling game
- Requirements:
 - Fully decentralization and P2P communication
 - Waiting room with chat
 - Fully decentralized gambling
- Each winner: 0.0075 BTC (~50CHF)
 - Simple yet efficient design
 - Blockchain-based four-in-a-row
 - Technology: Ethereum with web3.js and WebRTC



DS1/VSS Challenge Task FS 2020

- Free choice project
- Requirements
 - Use at least one text protocol, at least one binary protocol
 - Load balancing
 - Scalable service with authentication
- Each winner: 5.27mBTC (0.00527BTC)
 - They gathered weather data from multiple locations, and they used many components: ActiveMQ, Eureka discovery services, Kibana, Docker compose, running on self-hosted gitlab.



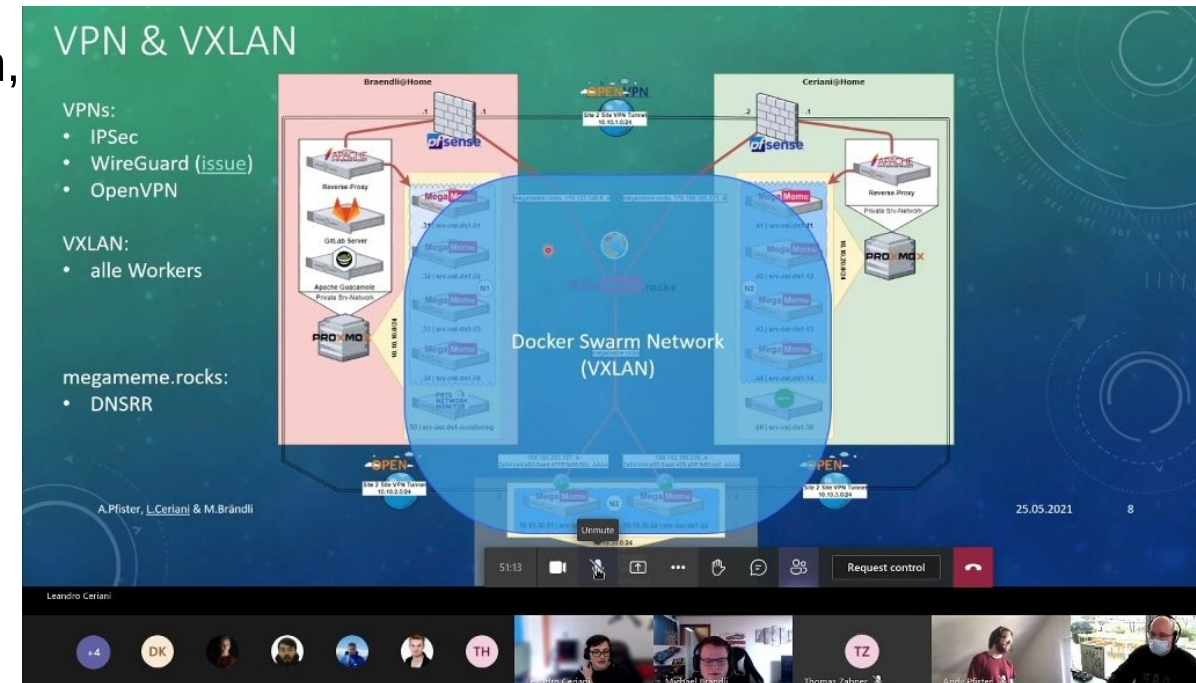
ADSB Challenge Task HS 2020

- Design and implementation of a decentralized financial application
- Requirements
 - Full decentralization and P2P mechanisms for the financial product (e.g., WebRTC, TomP2P, libp2p) or use scalable mechanisms ready to be deployed on the cloud
 - Graphical (GUI/Web-based) frontend
 - Public blockchain based
- Each winner: 2.625 mBTC (0.002625 BTC)
 - Donation platform and used the blockchain to keep track of donations



DS1 Challenge Task FS 2021

- This semester's challenge task (CT) is the design and implementation of a simple distributed system, with the following components:
 - Simple Frontend (e.g., HTML, Vue, React, Svelte)
 - Loadbalancer(e.g., traefik, nginx, HAproxy, Caddy)
 - Two instances of a service (your choice)
 - One storage backend (Postgres, simple KV memory storage)
 - JWT Authentication
- Each winner: 1.35 mBTC (0.00135 BTC)
 - Voting meme platform with Svelte and Ruby on Rails with docker swarm, GlusterFS, and CockroachDB



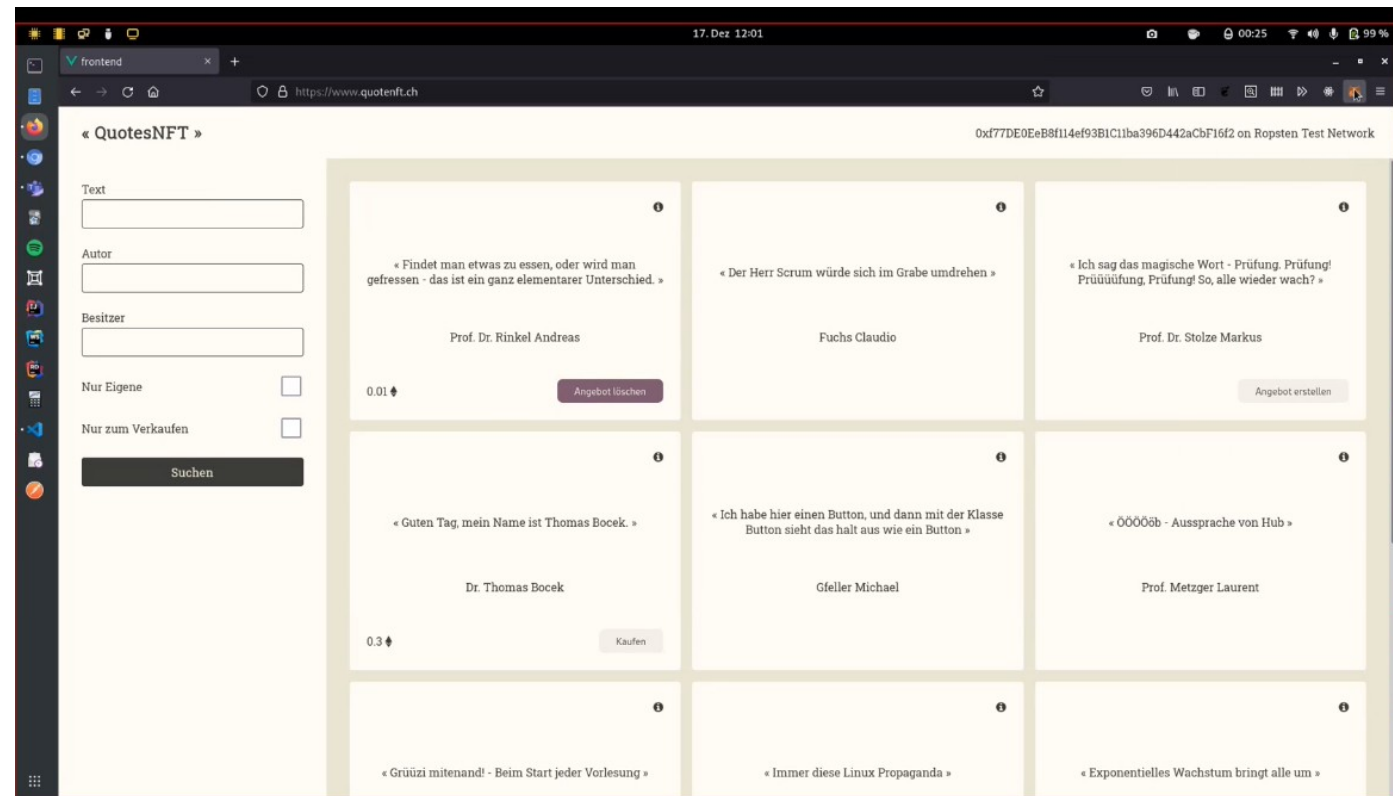
BlCh Challenge Task HS 2021

- This semester's challenge task (CT) is the design and implementation of an application including NFTs. Ideally, the application is a decentralized application (Dapp).

Requirements:

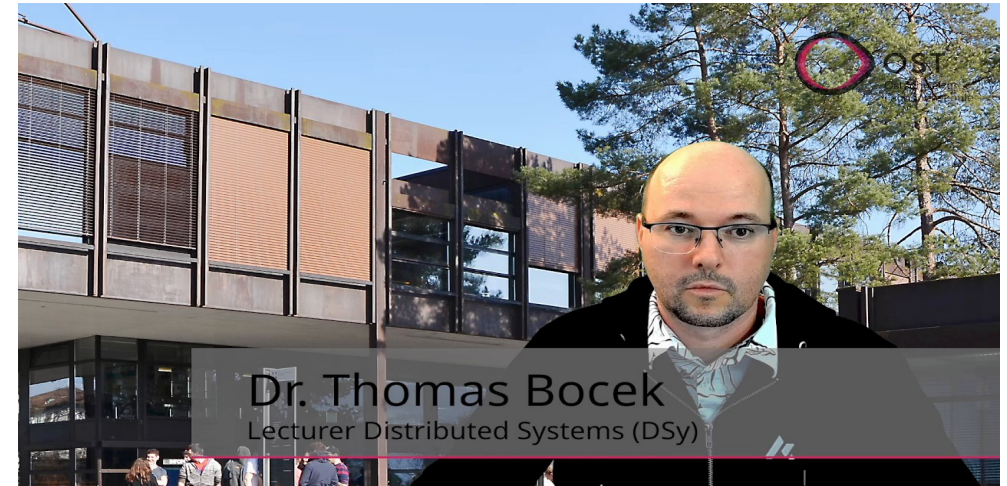
- A working prototype for your use-case
- Use latest stable releases of chosen libraries and frameworks
- An NFT stored on a public blockchain (can be testnet)
- Transfer of an NFT triggered directly or indirectly via the frontend/backend (can be testnet)
- Each winner: 1 mBTC (0.001 BTC)

- QuoteNFT is a platform to trade NFT quotes. The trading happens on a smart contract and is fully decentralized. Their project uses Vue.js for the frontend, node and express with TypeScript for the backend, and MetaMask to connect to Ethereum. Their QuoteNFT platform uses Traefik as a reverse proxy and docker-compose to orchestrate the services



DSy Challenge Task FS 2022

- This semester's challenge task (CT) is the design and implementation of a simple distributed system (of your choice), with at least one service with a websocket, and where a service instance can fail.
- Requirements
 - Load balancing with scalable service
 - Failover of a service instance
 - A websocket needs to send data from a service to the frontend. You need to implement (consume) a websocket (using e.g., Blazor that integrates websockets does not fulfill this requirement). You can produce websocket data in your backend or use 3rd party websocket services (e.g., crypto market data)
 - Dockerized
 - Persistent storage (storage does not need to be scalable, but you can build it scalable if you want)
 - Use latest stable releases of chosen libraries and frameworks
- Amy Gdala, a web application to memorize information by talking about your day (writing a diary) and to search for all your stored information with natural language queries. Their techstack included GPT-3, Kibana/Elastic Search, Coqui-STT/TTS, Python for micro-services, Kubernetes, and Istio for gRPC load balancing.



BlCh Recommendation

- Follow the lecture closely
 - Lecture slides contain relevant
 - Reading further literature is recommended
 - Link are provided in the slides
- Post-processing the lecture
 - If topics or statements from the lecture are not clear, research and resolve them
- Actively participate in the challenge task
 - Trying to understand it theoretically is not enough – hands-on is key!
 - If its not working, **read logs**, try to figure it out by yourself. If its still not working, ask
 - Do not miss the opportunity of discussing details with your supervisor
- 10 lectures
 - (25h = 20h + 5h; ca. 2.5h / week)
 - ~2h frontal teaching
 - ~1/2 h post-processing
- 12 exercises / challenge task
 - (72h = 60h + 12h ca. 6h / week)
 - ~5h challenge task
 - ~1h post-processing
- Exam
 - ~23h exam preparation
- 4 ECTS = 120h
- Prüfung:
 - Closed book 60min, no coding, Hilfsmittel: none

Summary

- Lectures videos online before Wednesday morning – 08:10
- Challenge task, group members: send to thomas.bocek@ost.ch until next week
 - Work on challenge task during exercise hours and/or at home
- 6 requirements to be met
 - A working prototype for your use-case
 - Use latest stable releases of chosen libraries and frameworks
 - Submission of a voting proposal (can be testnet)
 - Onchain voting on proposal with at least 2 participants / identities (can be testnet)
 - Successful vote needs to trigger either an ERC20 or an NFT transfer (can be testnet)
 - Voting status and process need to be shown in the frontend
- All 6 requirements must be fulfilled to pass this course
- Deliverables
 - 01.11.2022, 23:59 (CET) first hand-in of your initial version of the frontend/backend
 - 13.12.2022, 23:59 (CET) - well documented infrastructure, source code, and presentation
- Presentations during on the 14.12.2022 onsite (1.267)
- OST BICh Challenge Task Winner HS 2022
 - 21.12.2022

