



OST

Eastern Switzerland
University of Applied Sciences

Blockchain (BlCh)

Admin

Thomas Bocek

25.09.2021

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.hsr.ch> / <https://dsl.rj.ost.ch>
- Exercises: Teams
 - Team code: pq6c050 (works only for OST students)
- Lectures: pre-recorded, videos available on <https://dsl.rj.ost.ch/lect> and Youtube
 - Videos and PDFs will be uploaded before the lecture starts on Friday 08:10
 - Youtube will only have the lectures videos, admin related videos & PDFs only via <https://dsl.rj.ost.ch/lect/hs21/>
 - Same as in previous semester FS21

Blockchain

Kurzzeichen:

M_BlCh

Durchführungszeitraum:

HS/21

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):

OST Rapperswil

Empfohlene Module:

Distributed Systems (M_DSy, FS/22)

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.

BlCh 2021: Plan

Nr	Date	Lecture*	Lecturer
01	24.09.2021	Admin, Challenge Task, Repetition DS1 (part 1)	Bocek
02	01.10.2021	Repetition DS1 (part 2)	Bocek
03	08.10.2021	Ethereum and Solidity	Bocek
04	15.10.2021	NFTs and DeFi	Bocek
05	22.10.2021	P2P and DHTs	Bocek
06	29.10.2021	Algorithms for Distributed Systems	Bocek
07	05.11.2021	Crypto Mining, PoW, PoS	Bocek
08	12.11.2021	WebRTC, Applied Cryptography	Bocek
09	19.11.2021	Layer 2 Solutions	Bocek
10	26.11.2021	HTLCs, Cross-chain Atomic Swaps	Bocek
11	03.12.2021	NEO guest lecture	Machado
12	10.12.2021	Exam preparation, guest lecture 2	Bocek
13	17.12.2021	Challenge Task Presentations	you
14	24.12.2021	Challenge Task Award Winner Announcement, Q&A (from 08:10 – 09:50)	you
15	14.01.2022	Beratungswoche	Bocek

BlCh Exercises

- Challenge Task
 - Starts 01.10.2021 (lecture 2)
 - **No exercises today!**
- Goal: practical application of distributed systems concepts and tools
- Online: via MS Teams
 - Friday exercise u11: 10:10 – 11:50
 - Friday exercise u12: 13:10 – 14:50
 - Friday exercise u13: 15:10 – 16:50

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)
- Must include storage besides the blockchain (either centralized or decentralized, e.g., IPFS)

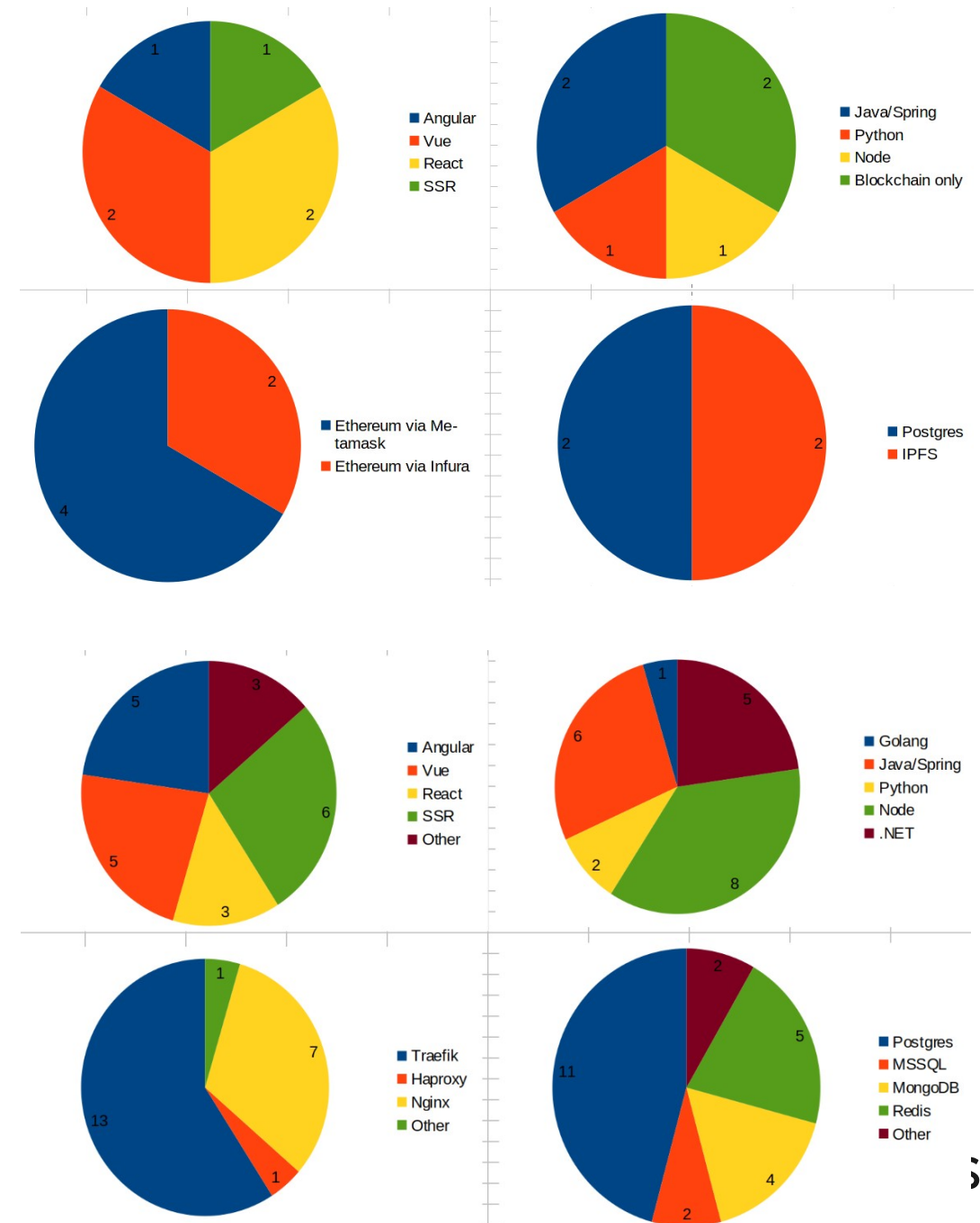
- Challenge Task HS 2021
- Design and implementation of an application including NFTs
 - Ideally, the application is a decentralized application (DApp).
- Requirements
 - A working prototype
 - Use latest stable releases of chosen libraries and frameworks
 - An NFT stored on a public blockchain (can be testnet)
 - Transfer of an NFT triggered directly or indirectly via the frontend (can be testnet)

BICH 2021: Plan

Nr	Date	Lecture*	Suggested Milestone
01	24.09.2021	Admin, Challenge Task, Repetition DS1 (part 1)	Group forming, idea for (d)app
02	01.10.2021	Repetition DS1 (part 2)	Setup dev environment
03	08.10.2021	Ethereum and Solidity	Information flow
04	15.10.2021	NFTs and DeFi	Bocek
05	22.10.2021	P2P and DHTs	Bocek
06	29.10.2021	Algorithms for Distributed Systems	Bocek
07	05.11.2021	Crypto Mining, PoW, PoS	Hand-in 1 , first versions of frontend/backend NFT
08	12.11.2021	WebRTC, Applied Cryptography	Bocek
09	19.11.2021	Layer 2 Solutions	Bocek
10	26.11.2021	HTLCs, Cross-chain Atomic Swaps	Bocek
11	03.12.2021	NEO guest lecture	Connecting everything
12	10.12.2021	Exam preparation, guest lecture 2	Testing, testing, testing
13	17.12.2021	Challenge Task Presentations	Hand-in 2 (16.12.2021, 23:59 CET)
14	24.12.2021	CT Award Winner Announcement, Q&A (from 08:10 – 09:50)	you
15	14.01.2022	Beratungswoche	Bocek

BlCh Challenge Task

- Deliverables, 16.12.2021, 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 FS20, HS20)
- If you **pass** the CT, you'll get 15 points that will be counted towards the exam
- 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.



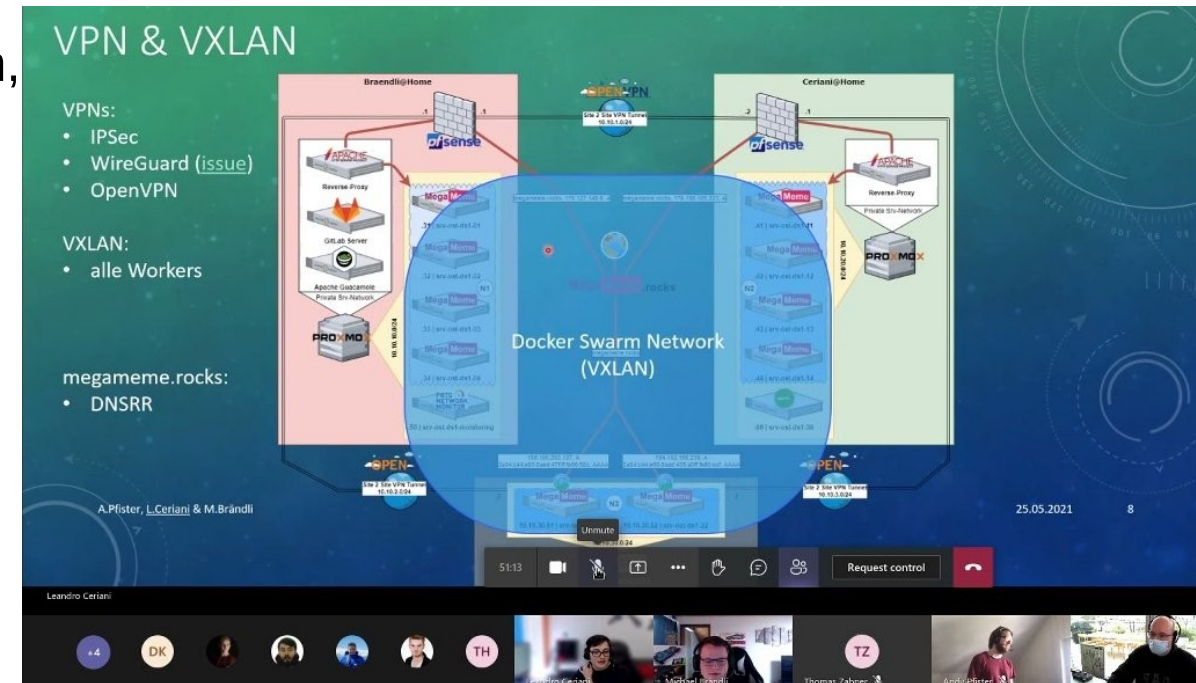
ADSB Challenge Task HS 2020

- 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

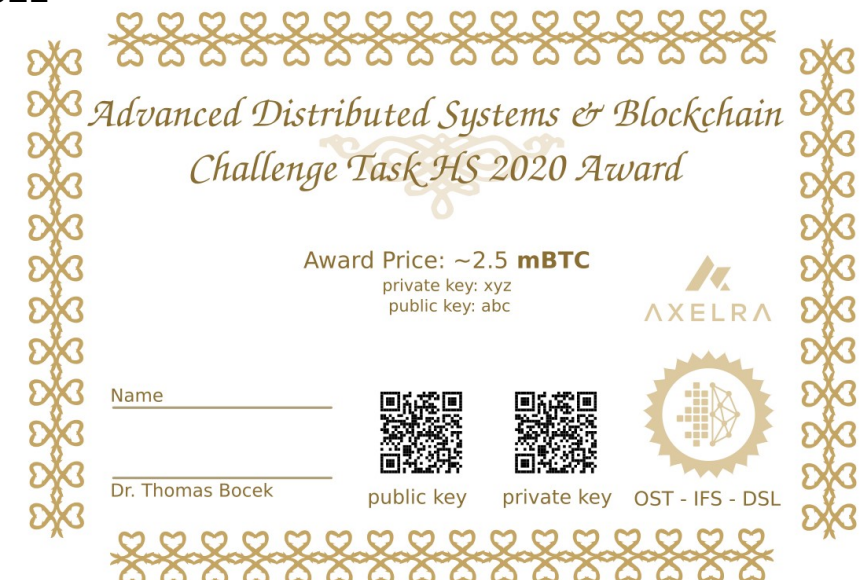


BlCh Recommendation

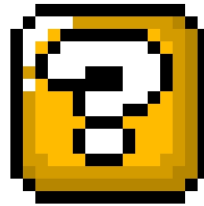
- Follow the lecture closely
 - Lecture slides contain relevant
 - Reading further literature is recommended
 - Link are provided in the slides
- Post-processing the lecture
 - If topics or statements from the lecture are not clear, research and resolve them
- Actively participate in the challenge task
 - 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 Friday Morning – 08:10
- Challenge task, group members: send to thomas.bocek@ost.ch until next week
 - Work on challenge task during exercise hours and at home
- 4 requirements to be met
 - 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 (can be testnet)
- All 4 requirements must be fulfilled to pass this course
- Deliverables
 - 04.11.2021, 23:59 (CET) first hand-in of your initial version of the frontend/backend/NFT
 - 10.12.2021, 23:59 (CET) - well documented infrastructure, source code, and presentation
- Presentations during on the 17.12. via MS Teams
- OST BCh Challenge Task Winner HS 2021
 - 24.12.2021



Questions?



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