OST
Eastern Switzerland
University of Applied Sciences

Distributed Systems & Blockchain (DS1)

Admin

Thomas Bocek

20 February 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

DS1 Administration

- Module Description
- Website: https://dsl.hsr.ch
- Exercises: Teams
  - Team code: ngh0p3h (works only for OST students)
- Lectures: pre-recorded, videos available on https://dsl.hsr.ch/lect, videos will be uploaded before the lecture starts on Tuesday 13:10.
  - Controls allows for faster playback, webpage split in semesters.

Distributed Systems & Blockchain

Kurzzeichen:
M_DS1

Durchführungszeitraum:
FS/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 umfassen:

- Protocols for Distributed Systems
- Fully Distributed Systems and NAT issues
- BitTorrent, Tor, Rsync
- RPC and Queues
- Blockchain Introduction
- Smart Contracts and Cryptocurrencies

Verantwortliche Person:
Bocek Thomas

Empfohlene Module:
Betriebssysteme 1 (M_Bsys1, HS/19-HS/20), Software-Engineering 1 (M_SE1, HS/17-HS/20)

Zusätzlich vorausgesetzte Kenntnisse:
Englisch
(Dieses Modul wird teilweise in Englisch gehalten.)

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DS1 FS21

- Die Themengebiete können variieren und werden in der ersten Vorlesung bekanntgegeben.
- Wenn euch ein Thema stark interessiert und es in den Themenbereicht “verteilte Systeme” fällt, dann meldet euch

- Mögliche weitere Themen sind:
  - Protocols, Security
  - Scalability
  - DHTs
  - RPCs and Queues
  - DNS and DNSSEC
  - Distributed Applications
  - Blockchain, Bitcoin
  - Mail DKIM/SPF/DMARC

DS1: Plan 2021

Nr	Date	Vorlesung*	Dozent
01	23.02.2021	Admin / Introduction	Bocek
02	02.03.2021	Protocols, Basics	Bocek
03	09.03.2021	Application Protocols	Bocek
04	16.03.2021	Distributed Applications: load balancing	Bocek
05	23.03.2021	Distributed Applications: CORS, gRPC, git	Bocek
06	30.03.2021	Authorization (basic auth, digest auth, session-based, JWT), queues	Bocek
07	-	Eeaster Vacations	Bocek
08	13.04.2021	Containers and VMs	Bocek
09	20.04.2021	Docker, Docker Compose, Connecting everything	-
10	27.04.2021	Real-world examples	TBA
11	04.05.2021	Blockchain, Bitcoin, Ethereum I	Bocek
12	11.05.2021	Blockchain, Bitcoin, Ethereum II	Bocek
13	18.05.2021	Challenge Task Presentations I	you
14	25.05.2021	Challenge Task Presentations II	you
15	01.06.2021	Challenge Task Award Winner Announcement, Q&A	Bocek

* topics may change

DS1 Exercises

- Challenge Task (description of HS18, HS19, HS19, FS20)
  - **Starts 02.03.2020 (lecture 2)**
    - **No exercises today!**
- Goal: practical application of distributed systems concepts and tools
- In den Übungen entwickeln Studentengruppen eine einfache verteile Applikation (Challenge Task I), 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 könnte ein vollständig verteiltes Tic-tac-toe sein.

- Online: via MS Teams
  - Tuesday exercise u14: 15:10 – 16:50
  - Wednesday exercise u13: 10:10 – 11:50
  - Wednesday exercise u12: 13:10 – 14:50
  - Wednesday exercise u11: 15:10 – 16:50

- Leistungsbewertung

Während der Prüfungssession:

Schriftliche Prüfung, 60 Minuten

Zulassungsbedingungen zur Prüfung:

Nach Ankündigung, Abgabe erfolgreich gelöste Übungsaufgaben.

DS1 Administration / Challenge Task

- Design and implementation of a simple distributed system, with the following components:
  1. Simple Frontend (e.g., HTML, Vue, React, Svelte, Angular)
  2. Loadbalancer (e.g., traefik)
  3. Two instances of a service (your choice)
     1. Coin tracker, survey / form, monitor application health, link shortener, email client, …
  4. One storage backend (Postgres, simple KV memory storage)
  5. Authentication (JWT)
- Group of 2 or 3 students
  - You have time during the exercises to work on the challenge task
  - Technology stack: your free to choose
  - Alpine Linux VM image provided (64bit) if you don’t want to deploy on your machine
  - Each student's group is free to decide about specifics of building the distributed system
- Requirements
  1. Load balancing
  2. Scalable service
  3. JWT authentication
  4. Dockerized
  5. Use latest stable releases of chosen libraries and frameworks
- Non-scalable storage (you can build it scalable if you want)
- The solution may use existing libraries and code, but those must open software software

VSS: Plan 2020

Nr	Date	Vorlesung*	Dozent	Suggested Milestone
01	23.02.2021	Admin / Introduction	01	Group forming, idea for services
02	02.03.2021	Protocols, Basics	02	Setup dev environment
03	09.03.2021	Application Protocols	03	Information flow
04	16.03.2021	Distributed Applications: load balancing	04	Load balancer working
05	23.03.2021	Distributed Applications: CORS, gRPC, git	05	
06	30.03.2021	Authorization (basic auth, digest auth, session-based, JWT), queues	06	Storage backend ready
07	-	Eeaster Vacations	07	
08	13.04.2021	Containers and VMs	08	Frontend ready
09	20.04.2021	Docker, Docker Compose, Connecting everything	09	
10	27.04.2021	Real-world examples	10	Connecting everything, dockerization
11	04.05.2021	Blockchain, Bitcoin, Ethereum I	11	
12	11.05.2021	Blockchain, Bitcoin, Ethereum II	12	Testing, testing, testing
13	18.05.2021	Challenge Task Presentations I	13	
14	25.05.2021	Challenge Task Presentations II	14	
15	01.06.2021	Challenge Task Award Winner Announcement, Q&A	15	

* topics may change

DS1 Administration / Challenge Task

- Deliverables, 17.05.2021, 23:59 (CET)
  - Well documented code and infrastructure
  - Presentation (slides) and demo of the application, also showing the architecture and design decisions during weeks 18.5. / 25.5.
- Libraries and tools
  - Allowed to use any language, framework, and platforms. However, the supervisors are familiar with those: Java, Golang, JavaScript, Linux (see FS20, lecture 14)
- **If CT passed**, you'll get 15 points that will be counted towards the exam.
- **If CT failed**, you cannot write the exam.
- Organization
  - n groups of 2-3 people, if group members found, send email to thomas.bocek@ost.ch (due to remote lectures, finding students may not be easy, in that case, I'll randomly assign groups, who did not form a group yet).
  - During the challenge task, the group shall meet online every week during exercise hours to work on the task and discuss the next steps.
  - The groups shall utilize their homework times to work on the CT, besides the exercise time slots assigned on Tuesday/Wednesday.
  - You **do not have** to join the exercise, but you can. Supervisors will be available.
  - The groups shall determine and set-up an internal project plan.
  - Distribute the workload so that each group member gets a fair load of work.

DSA Challenge Task 2018

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

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DSA Challenge Task 2019

- Design and implementation of a fully-distributed, P2P gambling game
- Requirements:
  1. Fully decentralization and P2P communication
  2. Waiting room with chat
  3. 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

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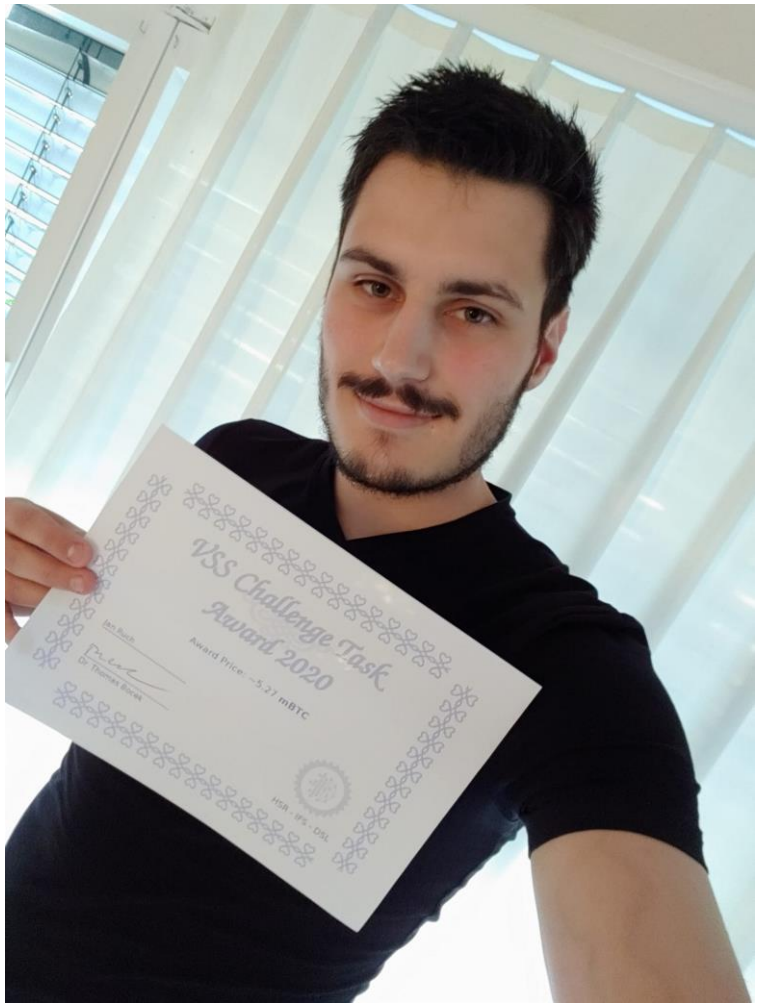
DS1/VSS Challenge Task FS 2020

- 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 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
  - ~½ 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 1h, no coding, Hilfsmittel: none

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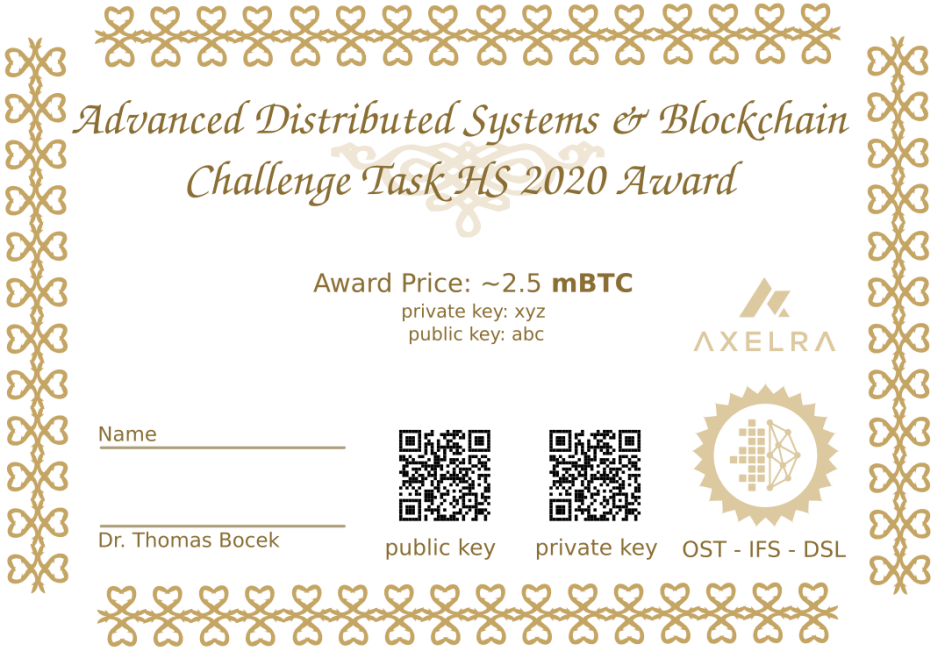
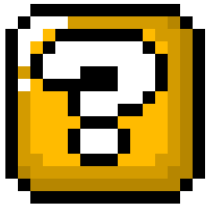
Summary

- Lectures Videos online before Tuesday Morning – 13:10
- Challenge task, group members: send to thomas.bocek@ost.ch until next week
  - Work on challenge task during exercise hours and at home
- 5 requirements to be met
  1. Load balancing
  2. Scalable service
  3. JWT authentication
  4. Dockerized
  5. Use latest stable releases of chosen libraries and frameworks
- All 5 requirements must be fulfilled to write exam
- Final hand-in with presentation and demo: 17.05.2021
- Presentations during the week 18.5. / 25.5. via MS Teams
- OST DS1 Challenge Task Winner FS 2021
  - 01.06.2021



Questions?



Dr. Thomas Bocek
thomas.bocek@ost.ch