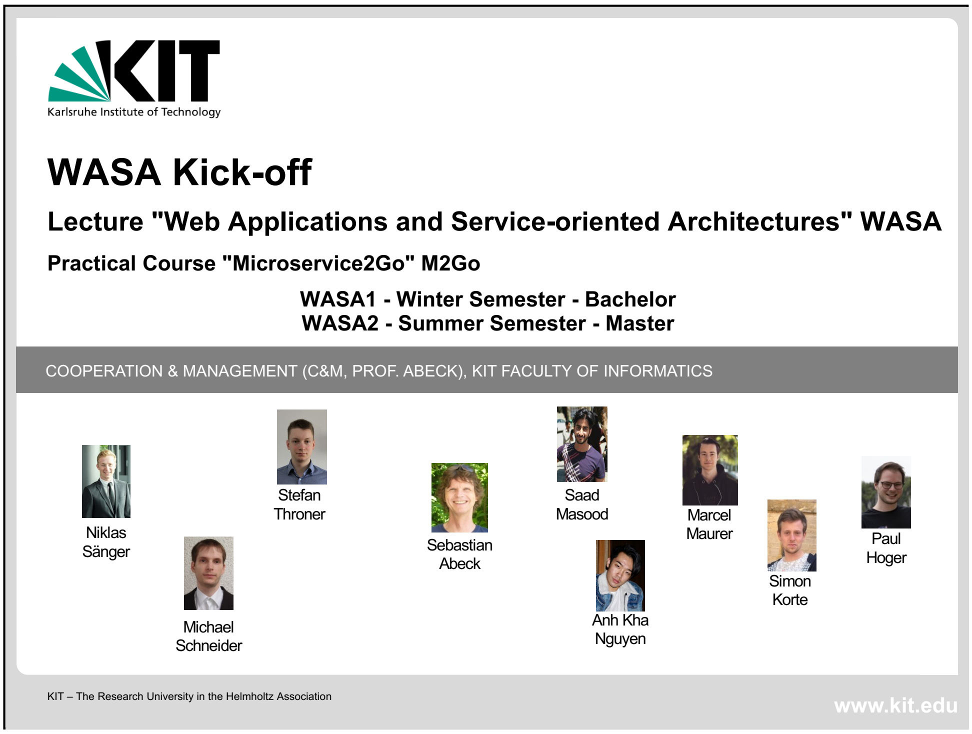


Karlsruhe Institute of Technology

WASA Kick-off

Lecture "Web Applications and Service-oriented Architectures" WASA

Practical Course "Microservice2Go" M2Go

WASA1 - Winter Semester - Bachelor
WASA2 - Summer Semester - Master

COOPERATION & MANAGEMENT (C&M, PROF. ABECK), KIT FACULTY OF INFORMATICS

Niklas Sänger
Michael Schneider
Stefan Throner
Sebastian Abeck
Saad Masood
Anh Kha Nguyen
Marcel Maurer
Simon Korte
Paul Hoger

KIT – The Research University in the Helmholtz Association

www.kit.edu

This course unit [CM-W-WAS] describes the content and the organization of the lecture "Web Applications and Service-oriented Architectures" (WASA) and the practical course Microservice2Go (M2Go) provided by the research group Cooperation & Management (C&M, Prof. Abeck). The M2Go practical course is closely linked with the WASA lecture. Although only the WASA lecture can be taken without passing the M2Go practical course, it is recommended to participate both in WASA and M2Go in parallel. Since the number of WASA lecture places and M2Go practical course places is limited, interested students must apply for a place.

WASA1 (Bachelor): Current concepts of software development and architectures (including Microservices, REST, gRPC, Domain-Driven Design, DevOps, CI/CD, Build Pipelines, Container-virtualized Infrastructures) as well as related technologies and tools (including HTTP, Go, Swagger, Postman, JavaScript/TypeScript, Angular, GitLab-CI, Docker, Kubernetes, Prometheus) are introduced. These concepts and technologies are applied in a systematic engineering approach, called Unified Microservice Engineering (UME), to develop and deploy microservice-based web applications.
The practical course Microservice2Go1 (M2Go1) can optionally be taken in parallel to the WASA1 lecture. In M2Go1, the UME approach is practically applied with the example of a microservice-based car rental application. After a compact introduction to the programming language Golang, the M2Go1 participants learn the systematic engineering of a domain microservice and an application microservice which are both implemented in Golang.

WASA2 (Master): A compact summary of the concepts covered by WASA1 is provided. In WASA2, Identity and Access Management (IAM) as an advanced topic is presented. In its core, IAM is responsible for the authentication and authorization of users and services in a software application. In the lecture, leading IAM concepts and solutions (e.g., Keycloak, Open Policy Agent, Microsoft Entra Verified ID) are introduced to illustrate how the IAM challenges are solved in IT practice. A concrete microservice-based application dealing with the rental of cars is extended by authentication and authorization functionality based on the current Internet standards OpenID Connect and OAuth2.
The practical course Microservice2Go2 (M2Go2) can optionally be taken in parallel to the WASA2 lecture. In M2Go2, the IAM concepts presented in the lecture are practically applied on the existing analysis, design, and implementation artifacts of the microservices which are written in Golang.

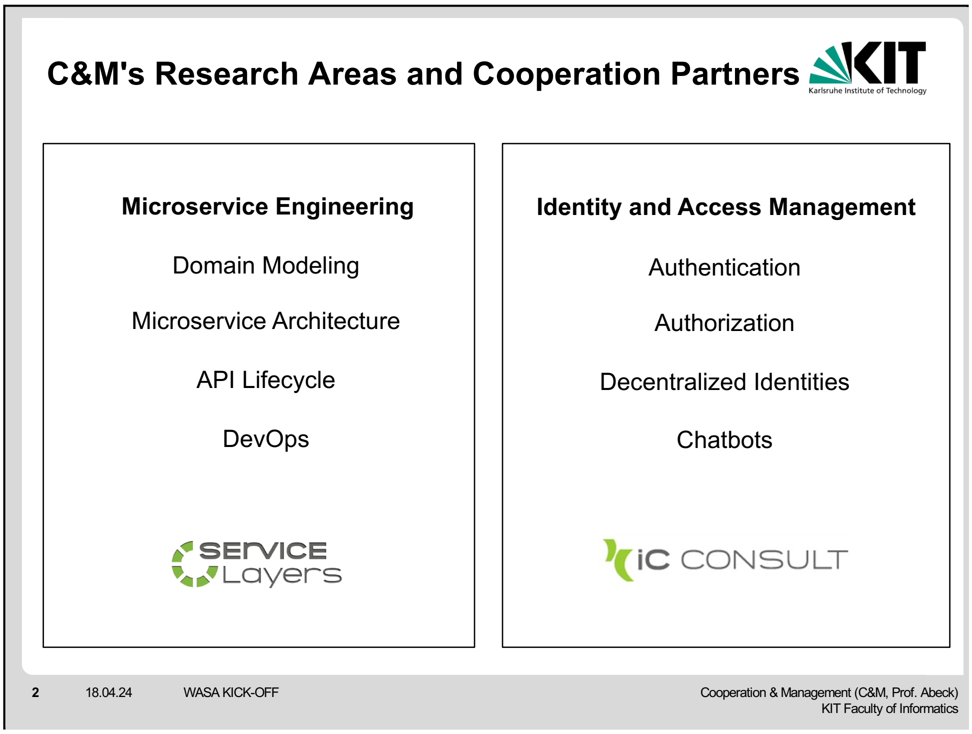
The WASA lectures will be offered as a hybrid (i.e., mixture of presence and online) event. The WASA kick-off lecture will take place **online**
=== on Wednesday, 17th April 2024 at 9:45 am

Each student who wants to take part in the online WASA kickoff lecture must
=== send an email (in German) to cm.research@lists.kit.edu
to apply for one of the restricted WASA lecture (and practical) places. Please do **only** use your **depseudonymized** KIT student email address (see https://my.scc.kit.edu/shib/pseudonymisierung.php for further information).

The lecture material is made available in **English**. During the lecture, the content is presented and discussed in **German**. The **oral examination** is conducted exclusively in **German**. All students write their **practical/seminar thesis** in **English**. Thesis templates are made available in **LaTeX**. Overleaf is used for the writing of the practical and seminar thesis.

C&M	Cooperation & Management
IAM	Identity and Access Management
KIT	Karlsruhe Institute of Technology
M2Go	Microservice2Go
UME	Unified Microservice Engineering
WASA	Web Applications and Service-oriented Architectures

[CM-W-WAS] Cooperation & Management: WASA Kick-off. \\sccfs.scc.kit.edu\OE\TM\VR\Mitglieder\2-1.WASA_M2Go_Aktuell\1.Lecture_Material



C&M's Research Areas and Cooperation Partners

Microservice Engineering

Domain Modeling

Microservice Architecture

API Lifecycle

DevOps

SErVICE Layers

Identity and Access Management

Authentication

Authorization

Decentralized Identities

Chatbots

iC CONSULT

2 18.04.24 WASA KICK-OFF

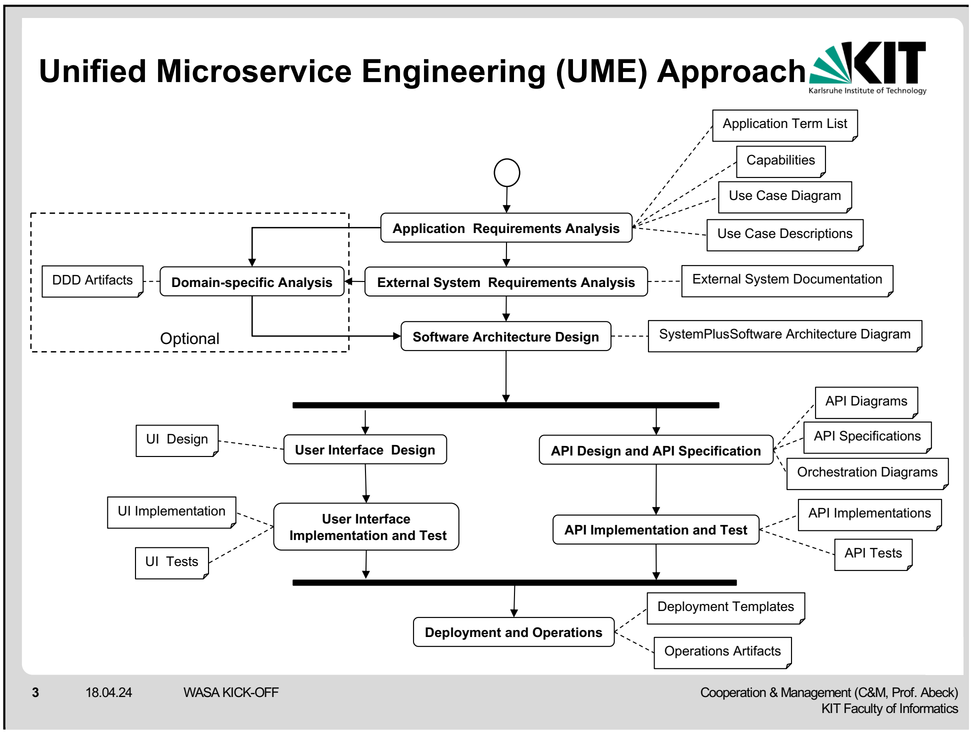
Cooperation & Management (C&M, Prof. Abeck)
KIT Faculty of Informatics

The research work carried out by C&M can be divided into two main areas:

(Microservice Engineering) For the business domain Connected Car, applications based on the concept of domain modeling and microservice architectures are developed. Relevant concepts applied in the microservice engineering approach include Domain-Driven Design (DDD), microservice API design and the implementation of the microservices and their APIs based on a microservice architecture. In addition to development (Dev), the operational aspects (Ops) are intensively taken into account.

(Identity and Access Management) Identity and Access Management (IAM) is a highly relevant crosscutting concern appearing in every web application. Basic IAM concepts include the authentication and authorization of human and technical users of a microservice-based application. Advanced IAM topics include
(i) Advanced authorization, which takes access decisions outside the application (external authorization) based on a broad spectrum of different attributes (fine-grained authorization).
(ii) Decentralized identities, which change the provision of identity in a way that users are owners of and have control over their identity data.
(iii) Usage of chatbot systems based on Large Language Models (LLM) to organize IAM knowledge.

CI/CD	Continuous Integration / Continuous Deployment
DDD	Domain-Driven Design
DevOps	Development and Operations
IAM	Identity and Access Management
LLM	Large Language Model



Unified Microservice Engineering (UME) Approach

Application Requirements Analysis

Application Term List

Capabilities

Use Case Diagram

Use Case Descriptions

DDD Artifacts

Domain-specific Analysis

Optional

External System Requirements Analysis

External System Documentation

Software Architecture Design

SystemPlusSoftware Architecture Diagram

UI Design

User Interface Design

API Design and API Specification

API Diagrams

API Specifications

Orchestration Diagrams

UI Implementation

UI Tests

User Interface Implementation and Test

API Implementation and Test

API Implementations

API Tests

Deployment and Operations

Deployment Templates

Operations Artifacts

3 18.04.24 WASA KICK-OFF

Cooperation & Management (C&M, Prof. Abeck)
KIT Faculty of Informatics

The Unified Microservice Engineering (UME) approach unifies two former approaches developed by C&M, called CMEng and MuleEng. UME consists of one process, the structured development process consisting of the well-known phases analysis, design, implementation and test, and deployment and operations. In the UME approach, the domain-driven aspects are not necessarily part of the engineering process (i.e., they are optional).

(Application Requirements Analysis) The requirements are expressed by use cases with a specific structure. Optional analysis artifacts are vision and goals or the application sketch.
(Application Term List) Application-specific terms are not introduced as a ubiquitous language. Ubiquitous languages are only provided by domains.

(External System Requirements Analysis) The external systems (esp. enterprise applications, business services, or databases) into the microservice application are considered.

(Domain-specific Analysis) In UME, the consideration of domain-specific aspects based on the concept of Domain-Driven Design (DDD) is intentionally kept optional. This analysis leads to Domain APIs which become part of the software architecture.
(DDD Artifacts) These include the ubiquitous language(s) and the domain model(s) of the domains relevant for the application to be developed.

(Software Architecture Design) The software architecture consists of (i) application microservices which are derived from the use cases, (ii) system microservices which integrate the external systems, (iii) optional domain microservices which provide the domain-specific logic, and (iv) Experience APIs which support the requirements of the different user interfaces.

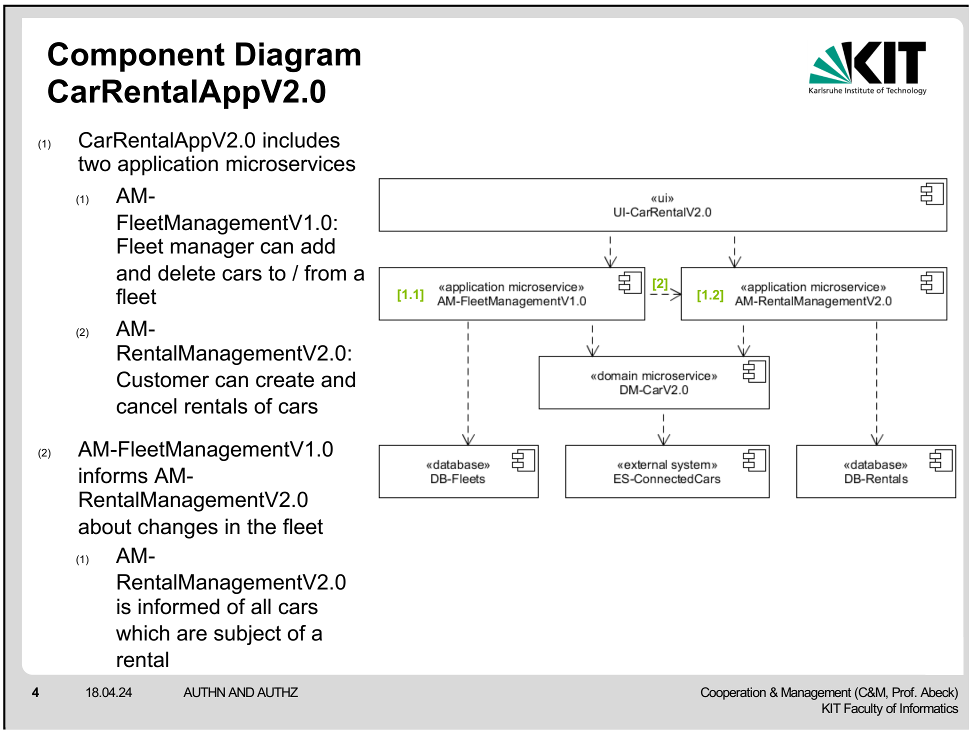
(User Interface Design) (User Interface Implementation and Test) The User Interface (UI) can be designed and implemented and tested in parallel to the design and implementation of the different API types.

(API Design and API Specification) The API is systematically specified based on an API diagram. The API diagram of a Process API is derived from the use case descriptions and the software architecture diagram.

(API Implementation and Test) In UME, the microservices are coded and tested by using a Go-based framework.

(Deployment and Operations) A template-based deployment approach is used in the UME approach.

UI	User Interface
UME	Unified Microservice Engineering



Component Diagram CarRentalAppV2.0

(1) CarRentalAppV2.0 includes two application microservices
  - (1) AM-FleetManagementV1.0: Fleet manager can add and delete cars to / from a fleet
  - (2) AM-RentalManagementV2.0: Customer can create and cancel rentals of cars

(2) AM-FleetManagementV1.0 informs AM-RentalManagementV2.0 about changes in the fleet
  - (1) AM-RentalManagementV2.0 is informed of all cars which are subject of a rental

«ui»
UI-CarRentalV2.0

[1.1] «application microservice»
AM-FleetManagementV1.0

[2]

[1.2] «application microservice»
AM-RentalManagementV2.0

«domain microservice»
DM-CarV2.0

«database»
DB-Fleets

«external system»
ES-ConnectedCars

«database»
DB-Rentals

4 18.04.24 AUTHN AND AUTHZ

Cooperation & Management (C&M, Prof. Abeck)
KIT Faculty of Informatics

(1) The cars to be rented are organized in fleets. This leads to two different functionality parts to be provided by CarRentalAppV2.0, the management of the fleets and the management of the rentals.

(1.1) Initially only one fleet identified by its location is supported. For each fleet, one fleet manager is responsible. In CarRentalAppV2.0, no functionality to coordinate the fleets (e.g., creation of a new fleet, change of a fleet manager) exists.

(1.2) The functionality of AM-RentalManagement was implemented in CarRentalAppV1.0 (CarRentalAppV1.1 added the functionality of customer registration and deregistration to Version V1.0).

(2) The changes of the fleet especially concern the addition, replacement, and deletion of cars to and from the fleet.

(2.1) This means that AM-RentalManagementV2.0 does not need to make requests to AM-FleetManagementV1.0 to determine all available cars which is necessary to carry out a rental.

(«ui» UI-CarRentalV2.0) The user interacts with the UI-CarRentalAppV2.0 in order to rent cars and perform fleet management.

(«application microservice» AM-RentalManagementV2.0) The application logic provides the application-specific functionality in order to allow customers the rental of cars.

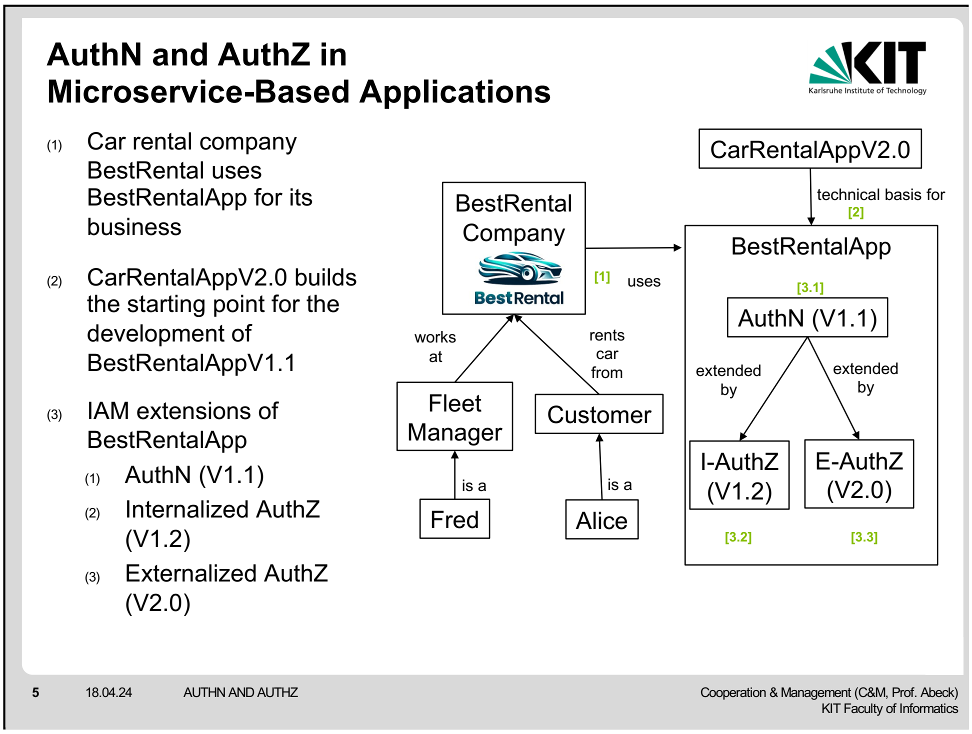
(«application microservice» AM-FleetManagementV1.0) The application logic provides the application-specific functionality in order to allow cars in a location to be organized in a fleet and to allow a fleet manager to manage his fleet.

(«domain microservice» DM-CarV2.0) DM-Car concerns the application agnostic functionality related to a car.

(«external system» ES-ConnectedCars) The external system from which DM-CarV2.0 retrieves its information about cars. It provides basic car information such as brand and model.

(«database» DB-Fleets) The fleet information is persisted in this database.

(«database» DB-Rentals) The rental information is persisted in this database.



AuthN and AuthZ in Microservice-Based Applications

(1) Car rental company BestRental uses BestRentalApp for its business

(2) CarRentalAppV2.0 builds the starting point for the development of BestRentalAppV1.1

(3) IAM extensions of BestRentalApp
   (1) AuthN (V1.1)
   (2) Internalized AuthZ (V1.2)
   (3) Externalized AuthZ (V2.0)

5 18.04.24 AUTHN AND AUTHZ Cooperation & Management (C&M, Prof. Abeck) KIT Faculty of Informatics

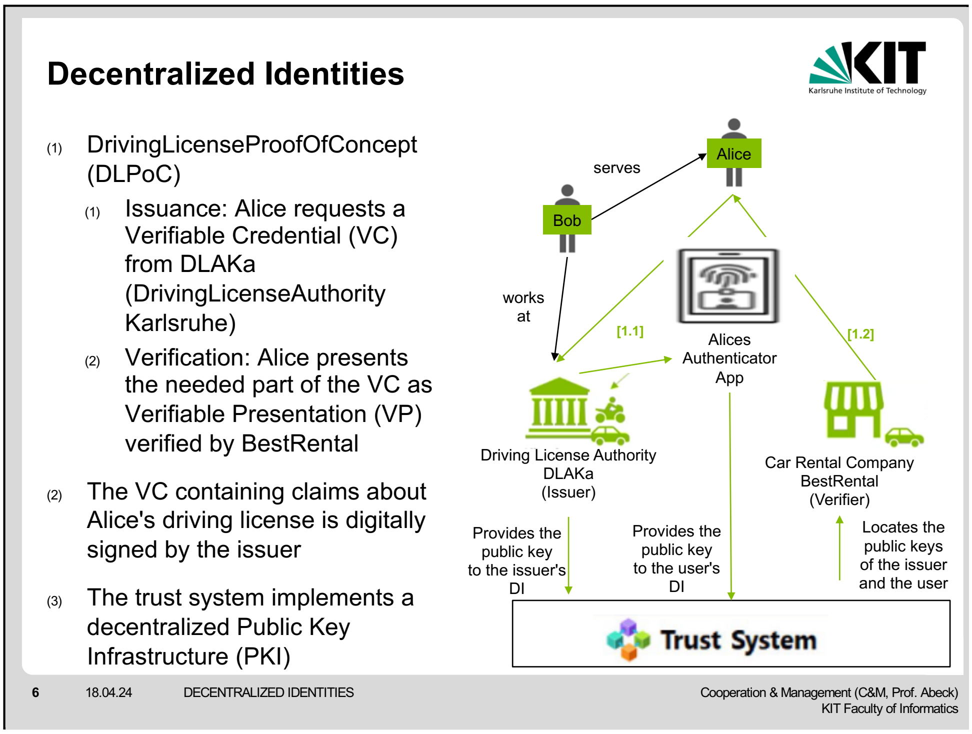
(1) For the demonstration of IAM aspects, a concrete organization called BestRental and a microservice-based application, called BestRentalApp, are introduced. Two roles, Fleet Manager and Customer are distinguished and two persons, Fred and Alice, are introduced.
(1.1) CarRentalAppV2.0 [CM-G-CRAV2.0] provides the basic functionality with respect to rental management and fleet management which is needed by BestRental. Therefore, CarRentalAppV2.0 builds the technical basis for the development of BestRentalAppV1.1[CM-G-BRAV1.1].

(2) CarRentalAppV2.0 corresponds to BestRentalAppV1.0 which only virtually exists.

(3.1) CarRentalAppV2.0 will be extended by an AuthN (AutheNtication) solution which leads to BestRentalAppV1.1 [CM-G-BRAV1.1].
(3.2) BestRentalAppV1.1 will be extended by an Internalized AuthoriZation (I-AuthZ) solution which leads to BestRentalAppV1.2 [CM-G-BRAV1.2].
(3.3) BestRentalAppV1.1 will be extended by an Externalized AuthoriZation (E-AuthZ) solution which leads to BestRentalAppV2.0 [CM-G-BRAV2.0].

AuthN	AutheNtication
AuthZ	AuthoriZation
E-AuthZ	Externalized AuthZ
I-AuthZ	Internalized AuthZ

[CM-G-CRAV2.0] Cooperation & Management: CarRentalAppV2.0. https://gitlab.kit.edu/kit/cm/teaching/carrentalapp/carrentalappv2.0
[CM-G-BRAV1.1] Cooperation & Management: BestRentalAppV1.1, C&M GitLab. https://gitlab.kit.edu/kit/cm/teaching/bestrentalapp/bestrentalappv1.1
[CM-G-BRAV1.2] Cooperation & Management: BestRentalAppV1.2, C&M GitLab. https://gitlab.kit.edu/kit/cm/teaching/bestrentalapp/bestrentalappv1.2
[CM-G-BRAV2.0] Cooperation & Management: BestRentalAppV2.0, C&M GitLab. https://gitlab.kit.edu/kit/cm/teaching/bestrentalapp/bestrentalappv2.0



Decentralized Identities

(1) DrivingLicenseProofOfConcept (DLPoC)

- (1) Issuance: Alice requests a Verifiable Credential (VC) from DLAKa (DrivingLicenseAuthority Karlsruhe)
- (2) Verification: Alice presents the needed part of the VC as Verifiable Presentation (VP) verified by BestRental

(2) The VC containing claims about Alice's driving license is digitally signed by the issuer

(3) The trust system implements a decentralized Public Key Infrastructure (PKI)

serves

Alice

Bob

works at

[1.1]

Alices Authenticator App

[1.2]

Driving License Authority
DLAKa
(Issuer)

Car Rental Company
BestRental
(Verifier)

Provides the public key to the issuer's DI

Provides the public key to the user's DI

Locates the public keys of the issuer and the user

Trust System

6 18.04.24 DECENTRALIZED IDENTITIES

Cooperation & Management (C&M, Prof. Abeck)
KIT Faculty of Informatics

The proof of concept concerns the rental of a car at BestRental by the customer Alice. The approach of decentralized identities is used to proof to BestRental that Alice has a valid driving license. The scenario is adapted from [Mic-Dec] and [iC-LLD].

(1.1) Alice uses her wallet application to carry out the request to DLAKa, the Driving License Authority at Karlsruhe (Ka). She is served by Bob, who works as a DLA clerk at DLAKa. A signed Verifiable Credential (VC) is issued by DLAKa and stored in the digital wallet application, and which attests that Alice owns a valid driving license.
(1.2) Alice presents the VC on the BestRental website. The transaction is logged in Alice's wallet application.

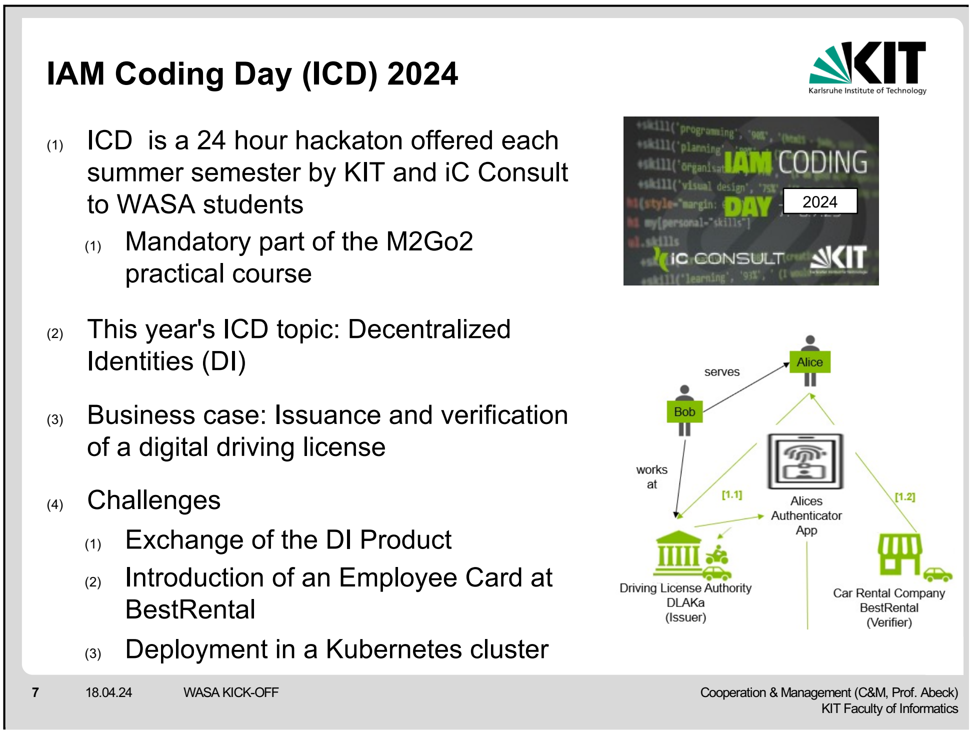
(2) The claims contains attributes which specify (i) the type(s) of mobile vehicle, Alice is allowed to drive, (ii) the year when she passed her driving test.

(3) The VCs issued by DLA are digitally signed with the issuer's private key and the Verified Presentations VP presented by Alice (i.e., the user) to BestRental are digitally signed with Alice's private key. Thus, BestRental needs both the issuer's and Alice's public keys which are made available by a verifiable data registry. The trust system provides the public keys of the involved entities in a decentralized manner.

DLA	Driving License Authority
DLAKa	DrivingLicenseAuthorityKarlsruhe
DI	Decentralized Identity
PKI	Public Key Infrastructure
PoC	Proof of Concept
VC	Verifiable Credential
VP	Verified Presentation

[iC-LL] iC Consult: Lunch & Learn: Decentralized Identities, restricted access. https://ic-consult.atlassian.net/wiki/spaces/EV/pages/3839033345/Lunch+Learn+Decentralized+Identities

[Mic-Dec] Microsoft: Decentralized Identity and Verifiable Credentials. https://query.prod.cms.rt.microsoft.com/cms/api/am/binary/RE5cxkr?culture=en-us&country=us



IAM Coding Day (ICD) 2024

(1) ICD is a 24 hour hackaton offered each summer semester by KIT and iC Consult to WASA students

  (1) Mandatory part of the M2Go2 practical course

(2) This year's ICD topic: Decentralized Identities (DI)

(3) Business case: Issuance and verification of a digital driving license

(4) Challenges

  (1) Exchange of the DI Product

  (2) Introduction of an Employee Card at BestRental

  (3) Deployment in a Kubernetes cluster

7 18.04.24 WASA KICK-OFF

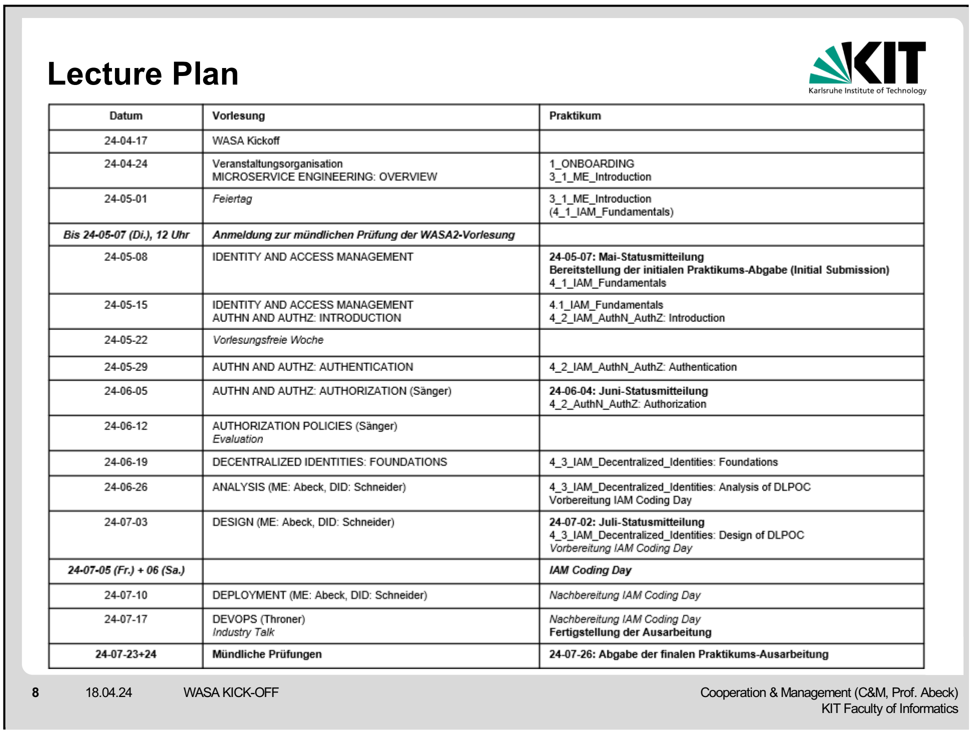
Cooperation & Management (C&M, Prof. Abeck)
KIT Faculty of Informatics

(1) iC Consult is a leading consulting company in the area of Identity and Access Management (IAM). The IAM Coding Day (ICD) is an event which is an important element in the cooperation with the KIT research group Cooperation & Management (C&M).
(1.1) The knowledge transferred by the WASA lecture and the M2Go practical course is applied by the students to solve the ICD challenges.

(2) The concept of Decentralized Identities (DI) is conceptually and practically introduced in WASA and M2Go.

(3) The proposal is to extend C&M's driving license business case by two or three challenges.

(4) The challenges should cover aspects which are interesting for iCC.
(4.1) Challenges should be prepared in current Ba/Ma theses (esp. Ba Maurer).



Lecture Plan

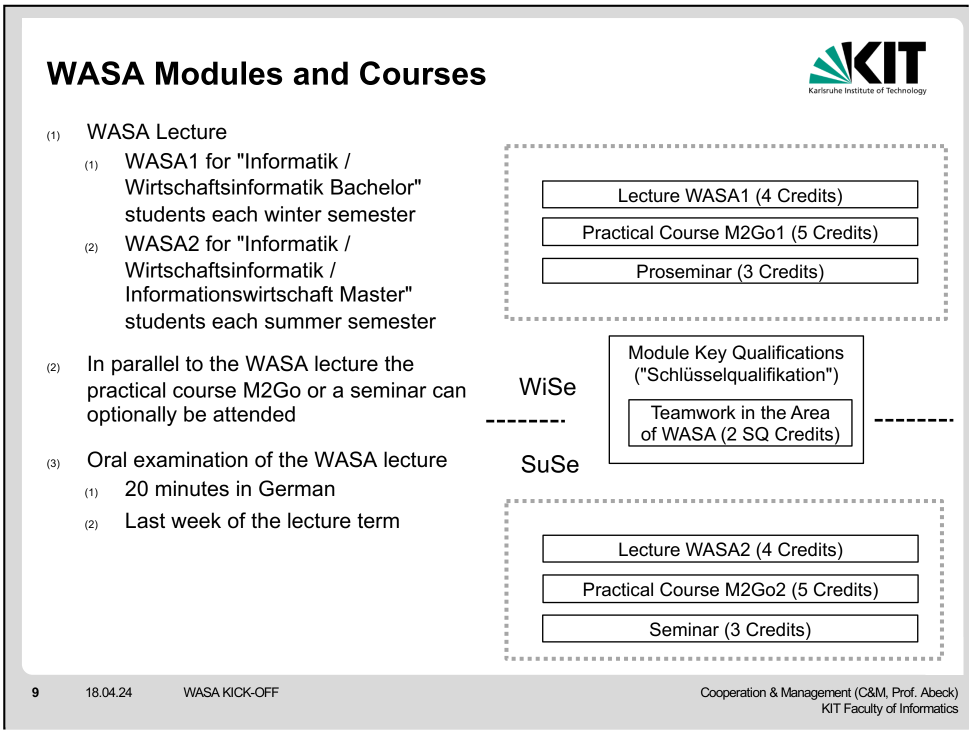
Datum	Vorlesung	Praktikum
24-04-17	WASA Kickoff	
24-04-24	Veranstaltungsorganisation MICROSERVICE ENGINEERING: OVERVIEW	1_ONBOARDING 3_1_ME_Introduction
24-05-01	*Feiertag*	3_1_ME_Introduction (4_1_IAM_Fundamentals)
Bis 24-05-07 (Di.), 12 Uhr	***Anmeldung zur mündlichen Prüfung der WASA2-Vorlesung***	
24-05-08	IDENTITY AND ACCESS MANAGEMENT	**24-05-07: Mai-Statusmitteilung** **Bereitstellung der initialen Praktikums-Abgabe (Initial Submission)** 4_1_IAM_Fundamentals
24-05-15	IDENTITY AND ACCESS MANAGEMENT AUTHN AND AUTHZ: INTRODUCTION	4.1_IAM_Fundamentals 4_2_IAM_AuthN_AuthZ: Introduction
24-05-22	*Vorlesungsfreie Woche*	
24-05-29	AUTHN AND AUTHZ: AUTHENTICATION	4_2_IAM_AuthN_AuthZ: Authentication
24-06-05	AUTHN AND AUTHZ: AUTHORIZATION (Sänger)	**24-06-04: Juni-Statusmitteilung** 4_2_AuthN_AuthZ: Authorization
24-06-12	AUTHORIZATION POLICIES (Sänger) *Evaluation*	
24-06-19	DECENTRALIZED IDENTITIES: FOUNDATIONS	4_3_IAM_Decentralized_Identities: Foundations
24-06-26	ANALYSIS (ME: Abeck, DID: Schneider)	4_3_IAM_Decentralized_Identities: Analysis of DLPOC Vorbereitung IAM Coding Day
24-07-03	DESIGN (ME: Abeck, DID: Schneider)	**24-07-02: Juli-Statusmitteilung** 4_3_IAM_Decentralized_Identities: Design of DLPOC *Vorbereitung IAM Coding Day*
24-07-05 (Fr.) + 06 (Sa.)		***IAM Coding Day***
24-07-10	DEPLOYMENT (ME: Abeck, DID: Schneider)	*Nachbereitung IAM Coding Day*
24-07-17	DEVOPS (Throner) *Industry Talk*	*Nachbereitung IAM Coding Day* **Fertigstellung der Ausarbeitung**
24-07-23+24	**Mündliche Prüfungen**	**24-07-26: Abgabe der finalen Praktikums-Ausarbeitung**

8 18.04.24 WASA KICK-OFF

Cooperation & Management (C&M, Prof. Abeck)
KIT Faculty of Informatics

Stored in C&M's document folder
Mitglieder > 2-1.WASA_M2Go_Aktuell
in the German-language PDF document
veranstaltungsorganisation_sose24

Remark: The lecture plan can only be accessed by students who take part in the WASA lecture.



WASA Modules and Courses

(1) WASA Lecture
  (1) WASA1 for "Informatik / Wirtschaftsinformatik Bachelor" students each winter semester
  (2) WASA2 for "Informatik / Wirtschaftsinformatik / Informationswirtschaft Master" students each summer semester

(2) In parallel to the WASA lecture the practical course M2Go or a seminar can optionally be attended

(3) Oral examination of the WASA lecture
  (1) 20 minutes in German
  (2) Last week of the lecture term

Lecture WASA1 (4 Credits)
Practical Course M2Go1 (5 Credits)
Proseminar (3 Credits)

WiSe

Module Key Qualifications ("Schlüsselqualifikation")
Teamwork in the Area of WASA (2 SQ Credits)

SuSe

Lecture WASA2 (4 Credits)
Practical Course M2Go2 (5 Credits)
Seminar (3 Credits)

9 18.04.24 WASA KICK-OFF

Cooperation & Management (C&M, Prof. Abeck)
KIT Faculty of Informatics

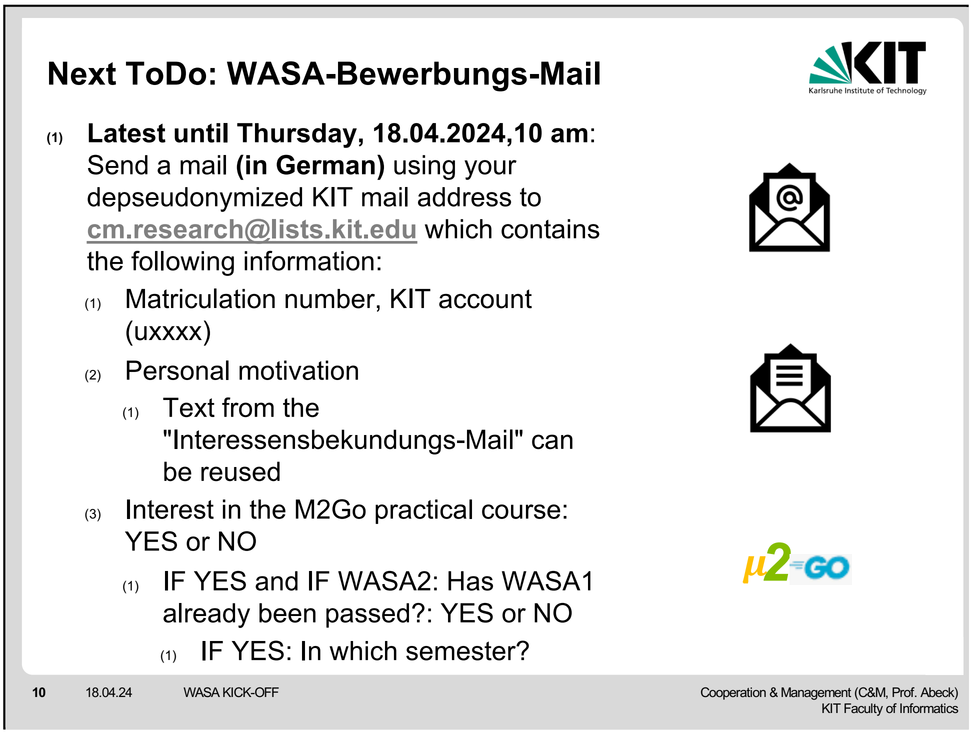
The acronym WASA stands for "Web Applications and Service-oriented Architectures". The following courses are offered: (i) lecture courses WASA1 an WASA2 (ii) practical courses M2Go1 and M2Go2 associated to the lecture courses (iii) proseminar course and seminar (iv) key qualification course (germ. Schlüsselqualifikation SQ).
Remarks: In the Wirtschaftsinformatik study programme the name of the module is "Microservice-basierte Web-Anwendungen".

(1) The lecture courses WASA1 and WASA2 each comprise 2 semester hours. A student who attends one of the lectures acquires 4 credit points (German: Leistungspunkt).

(2) The practical course M2Go is closely linked with the lecture course. The practical course counts 5 credit points meaning a workload of 150 hours. A proseminar and seminar count 3 credit points meaning a workload of 90 hours. A student who wants to carry out a (pro)seminar in parallel to WASA_M2Go will have a workload of 360 hours (4+5+3 = 12 credits) in the semester.

(4) The examiners are Prof. Abeck and one of the C&M's PhDResearchers. Since the examination is in the last week of the lecture term, the students should have a good personal resource management in order to have enough time for the preparation of the examination.

SQ	Schlüsselqualifikation (Key Qualification)



Next ToDo: WASA-Bewerbungs-Mail

(1) **Latest until Thursday, 18.04.2024,10 am**: Send a mail **(in German)** using your depseudonymized KIT mail address to cm.research@lists.kit.edu which contains the following information:

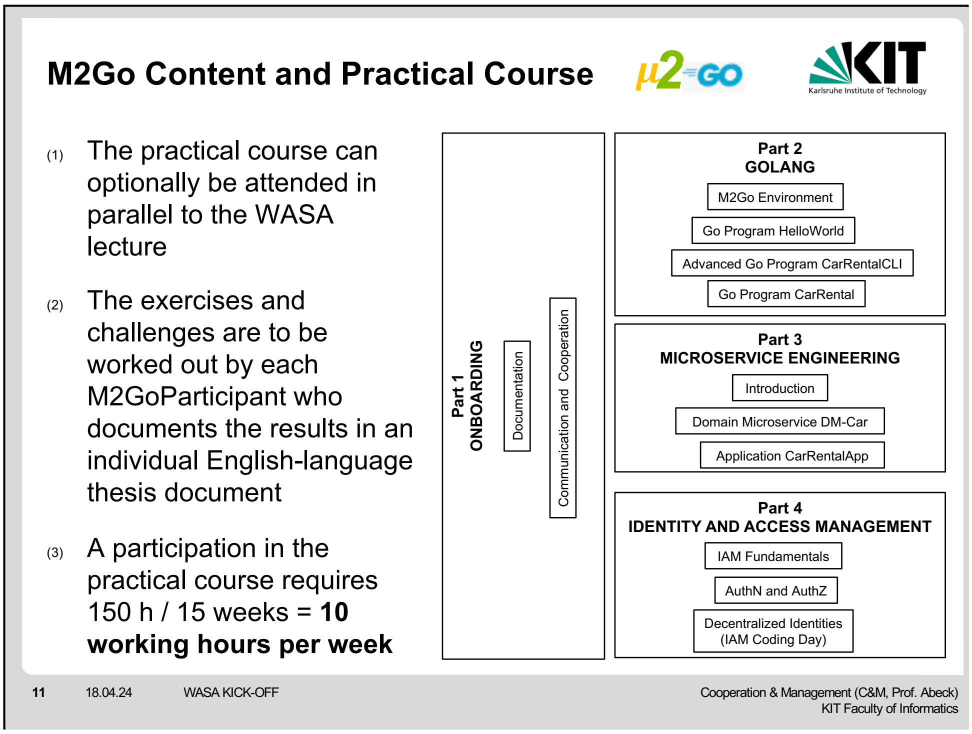
- (1) Matriculation number, KIT account (uxxxx)
- (2) Personal motivation
  - (1) Text from the "Interessensbekundungs-Mail" can be reused
- (3) Interest in the M2Go practical course: YES or NO
  - (1) IF YES and IF WASA2: Has WASA1 already been passed?: YES or NO
    - (1) IF YES: In which semester?

10 18.04.24 WASA KICK-OFF

Cooperation & Management (C&M, Prof. Abeck)
KIT Faculty of Informatics

A student who participates in the WASA lecture and optionally in the practical/seminar course must have the necessary time resources to cope with the workload (lecture: 120 hours, practical course: 150 hours, seminar course: 90 hours).

(1.1) The uxxxx student name is needed for the invitation of the participants to the C&M GitLab. An invitation requires that the participant has once logged in the GitLab.
(1.2) The motivation and the experiences should be summarized in one or two paragraphs (about 3 to 6 sentences).
(1.3) It is possible to apply only for the WASA lecture.
If the answer is YES, a personal folder in the C&M document storage and a personal repository in the C&M GitLab will be made available.
(1.3.1) This question can be ignored in the case of the winter semester in which WASA1 is offered.



M2Go Content and Practical Course

µ2GO

KIT Karlsruhe Institute of Technology

(1) The practical course can optionally be attended in parallel to the WASA lecture

(2) The exercises and challenges are to be worked out by each M2GoParticipant who documents the results in an individual English-language thesis document

(3) A participation in the practical course requires 150 h / 15 weeks = **10 working hours per week**

Part 1
ONBOARDING

Documentation

Communication and Cooperation

Part 2
GOLANG

M2Go Environment

Go Program HelloWorld

Advanced Go Program CarRentalCLI

Go Program CarRental

Part 3
MICROSERVICE ENGINEERING

Introduction

Domain Microservice DM-Car

Application CarRentalApp

Part 4
IDENTITY AND ACCESS MANAGEMENT

IAM Fundamentals

AuthN and AuthZ

Decentralized Identities
(IAM Coding Day)

11 18.04.24 WASA KICK-OFF

Cooperation & Management (C&M, Prof. Abeck)
KIT Faculty of Informatics

(1) The WASA lecture content and the M2Go practical course content are closely coupled.

(2) For each M2Go part, exercise documents are made available. M2GoParticipants create their own practical thesis document in which they document the solutions of the exercises. The practical thesis document should make clear that an M2GoParticipant has carried out each part of an exercise. Therefore, the solutions should be long enough, but not longer. The text should be expressed in the own words of the M2GoParticipant. If text is copied, the source must be referenced. M2GoParticipants can make contributions to the presentation of the M2Go content in the WASA lecture. An English-language LaTeX document is made available in Overleaf.

(3) The work starts immediately and the workload constantly arises every week. Therefore, students interested in participating in M2Go must make sure that they have enough time resources before they decide to do the M2Go practical course.

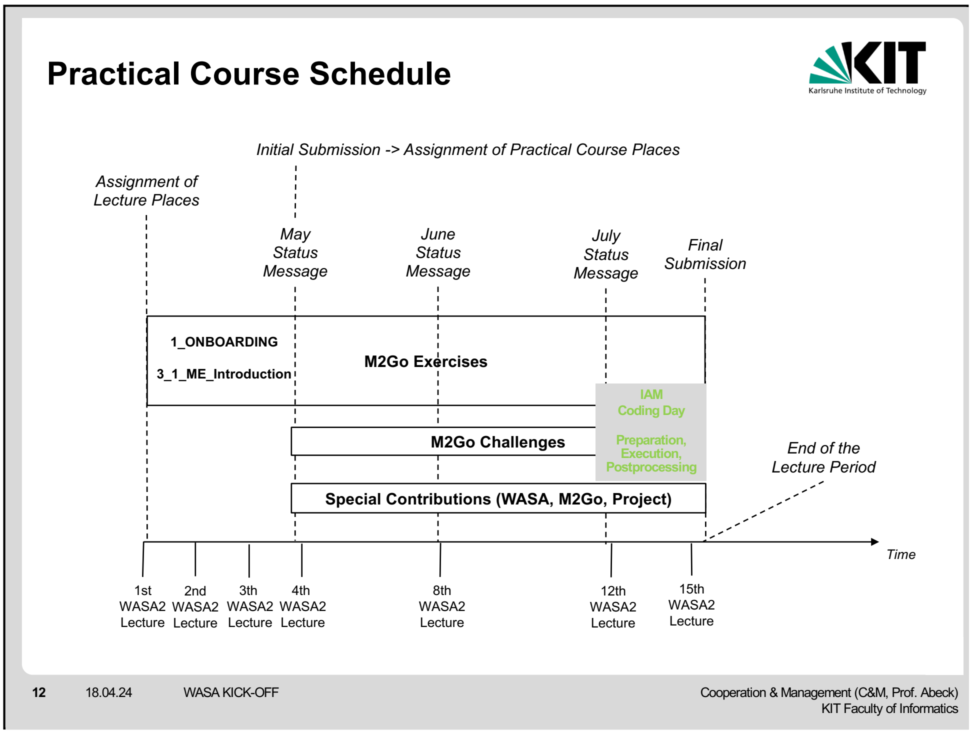
The practical course consists of the following four parts:

(C&M Org) All participants of the M2Go practical course must observe a few rules which exist at C&M to ease the cooperation between its members.

(Golang) This part provides a concise and practical introduction to the Go programming language. This includes the installation of the needed environment to code and run Go programs. Besides the well-known program "Hello World" some of the central Go language elements are investigated with the example of a more complex Go program CarRental and an advanced Go program CarRentalCLI.

(Microservice Engineering) In the following part, Go is used as the programming language to implement microservices of the application CarRentalApp. C&M’s Unified Microservice Engineering (UME) approach introduces specific analysis and design artifacts which build the basis for the Go-based microservice implementation.

(Identity and Access Management) The last part is concerned with the relevant cross-cutting concern of Identity and Access Management (IAM). The access management includes the authentication and authorization of human and technical subjects who need access to the application BestRentalApp and their functions and data. A specific topic investigated in this part are IAM chatbots.



Practical Course Schedule

Karlsruhe Institute of Technology

Initial Submission -> Assignment of Practical Course Places

Assignment of Lecture Places

May Status Message

June Status Message

July Status Message

Final Submission

1_ONBOARDING

3_1_ME_Introduction

M2Go Exercises

IAM Coding Day

Preparation, Execution, Postprocessing

M2Go Challenges

Special Contributions (WASA, M2Go, Project)

End of the Lecture Period

Time

1st WASA2 Lecture

2nd WASA2 Lecture

3th WASA2 Lecture

4th WASA2 Lecture

8th WASA2 Lecture

12th WASA2 Lecture

15th WASA2 Lecture

12 18.04.24 WASA KICK-OFF

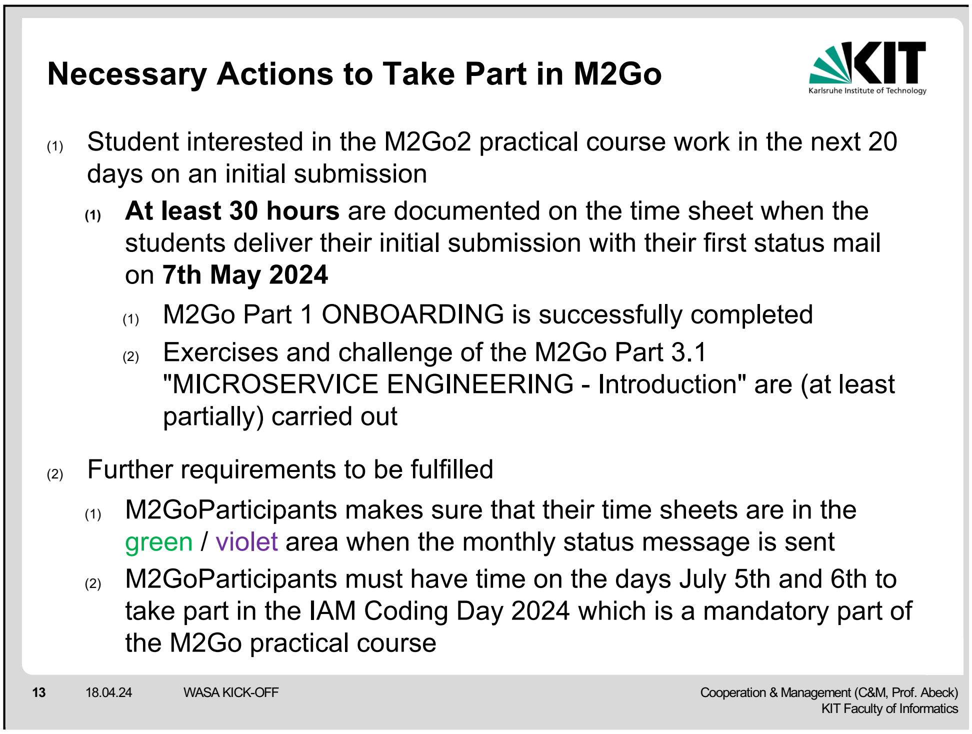
Cooperation & Management (C&M, Prof. Abeck)
KIT Faculty of Informatics

The figure illustrates the schedule of the M2Go2 practical course.

(Initial Submission) The practical course starts with M2Go exercises of Part 1 which makes sure that the WASA2Participant has successfully carried out the onboarding to the C&M environment and spends enough time for working out solutions of M2Go exercises.

(M2Go Challenges) The M2Go challenges are extensions of the M2Go exercises for which the M2GoParticipant works out individual and more complex solutions.

(Special Contributions) They go beyond the pure solutions of the M2Go exercises and challenges. Valuable special contributions are a prerequisite for a very good grade (i.e., 1,0 or 1,3).



Necessary Actions to Take Part in M2Go

(1) Student interested in the M2Go2 practical course work in the next 20 days on an initial submission

  (1) **At least 30 hours** are documented on the time sheet when the students deliver their initial submission with their first status mail on **7th May 2024**

    (1) M2Go Part 1 ONBOARDING is successfully completed

    (2) Exercises and challenge of the M2Go Part 3.1 "MICROSERVICE ENGINEERING - Introduction" are (at least partially) carried out

(2) Further requirements to be fulfilled

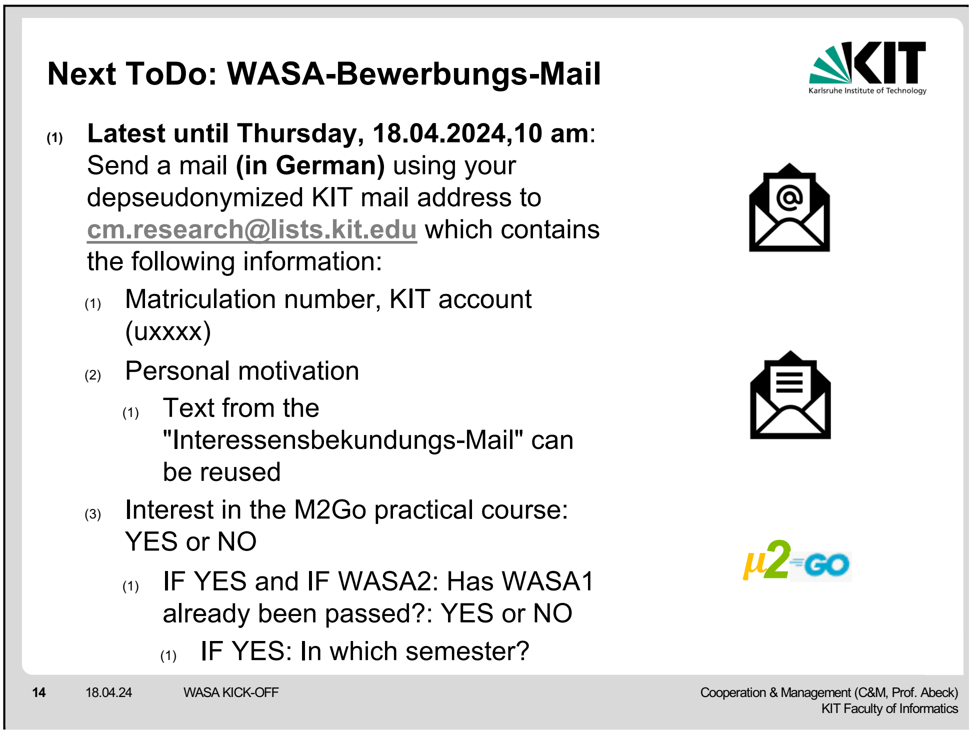
  (1) M2GoParticipants makes sure that their time sheets are in the green / violet area when the monthly status message is sent

  (2) M2GoParticipants must have time on the days July 5th and 6th to take part in the IAM Coding Day 2024 which is a mandatory part of the M2Go practical course

13 18.04.24 WASA KICK-OFF Cooperation & Management (C&M, Prof. Abeck)
KIT Faculty of Informatics

On this page the requirements are summarized which must be fulfilled to successfully participate in the M2Go practical course. A participation in the practical course M2Go2 is only possible in combination with the WASA2 lecture. The WASA lecture can be attended without participating in the M2Go practical course.

(2.1.1) The M2Go document 1_ONBOARDING is made available at
(i) on the C&M website: **https://cm.tm.kit.edu/download/ONBOARDING.pdf**
(ii) in the document storage: **Mitglieder > 2-1.WASA_M2Go_Aktuell > 2.M2Go > 1_ONBOARDING.pdf**



Next ToDo: WASA-Bewerbungs-Mail

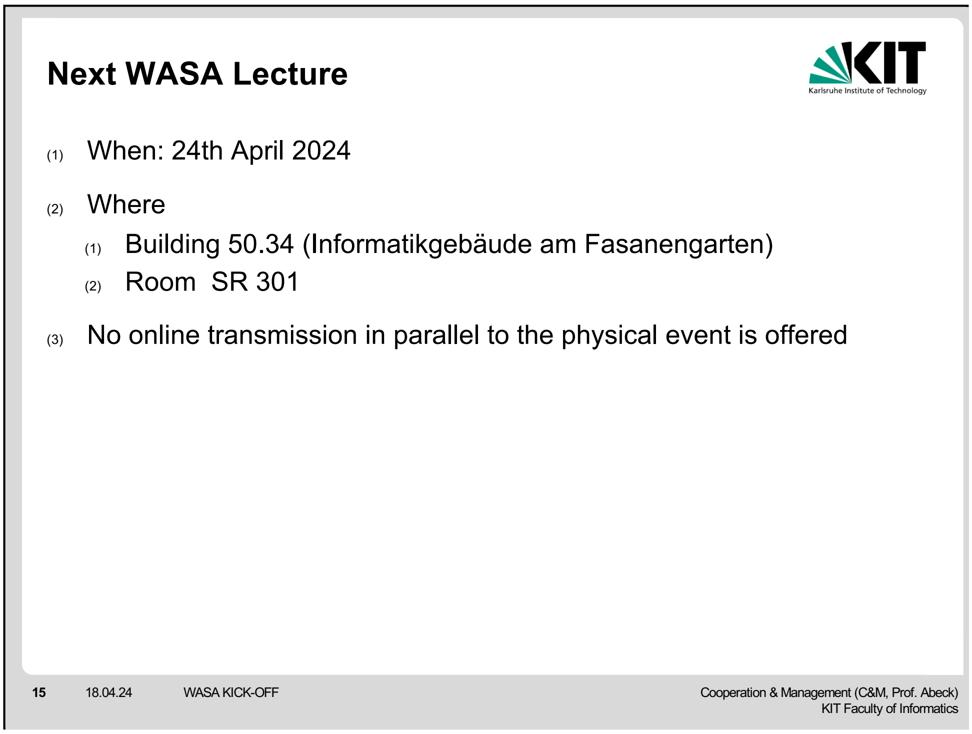
- (1) **Latest until Thursday, 18.04.2024,10 am**: Send a mail **(in German)** using your depseudonymized KIT mail address to cm.research@lists.kit.edu which contains the following information:
  - (1) Matriculation number, KIT account (uxxxx)
  - (2) Personal motivation
    - (1) Text from the "Interessensbekundungs-Mail" can be reused
  - (3) Interest in the M2Go practical course: YES or NO
    - (1) IF YES and IF WASA2: Has WASA1 already been passed?: YES or NO
      - (1) IF YES: In which semester?

14 18.04.24 WASA KICK-OFF

Cooperation & Management (C&M, Prof. Abeck)
KIT Faculty of Informatics

A student who participates in the WASA lecture and optionally in the practical/seminar course must have the necessary time resources to cope with the workload (lecture: 120 hours, practical course: 150 hours, seminar course: 90 hours).

(1.1) The uxxxx student name is needed for the invitation of the participants to the C&M GitLab. An invitation requires that the participant has once logged in the GitLab.
(1.2) The motivation and the experiences should be summarized in one or two paragraphs (about 3 to 6 sentences).
(1.3) It is possible to apply only for the WASA lecture.
If the answer is YES, a personal folder in the C&M document storage and a personal repository in the C&M GitLab will be made available.
(1.3.1) This question can be ignored in the case of the winter semester in which WASA1 is offered.



Next WASA Lecture

(1) When: 24th April 2024

(2) Where
  - (1) Building 50.34 (Informatikgebäude am Fasanengarten)
  - (2) Room SR 301

(3) No online transmission in parallel to the physical event is offered