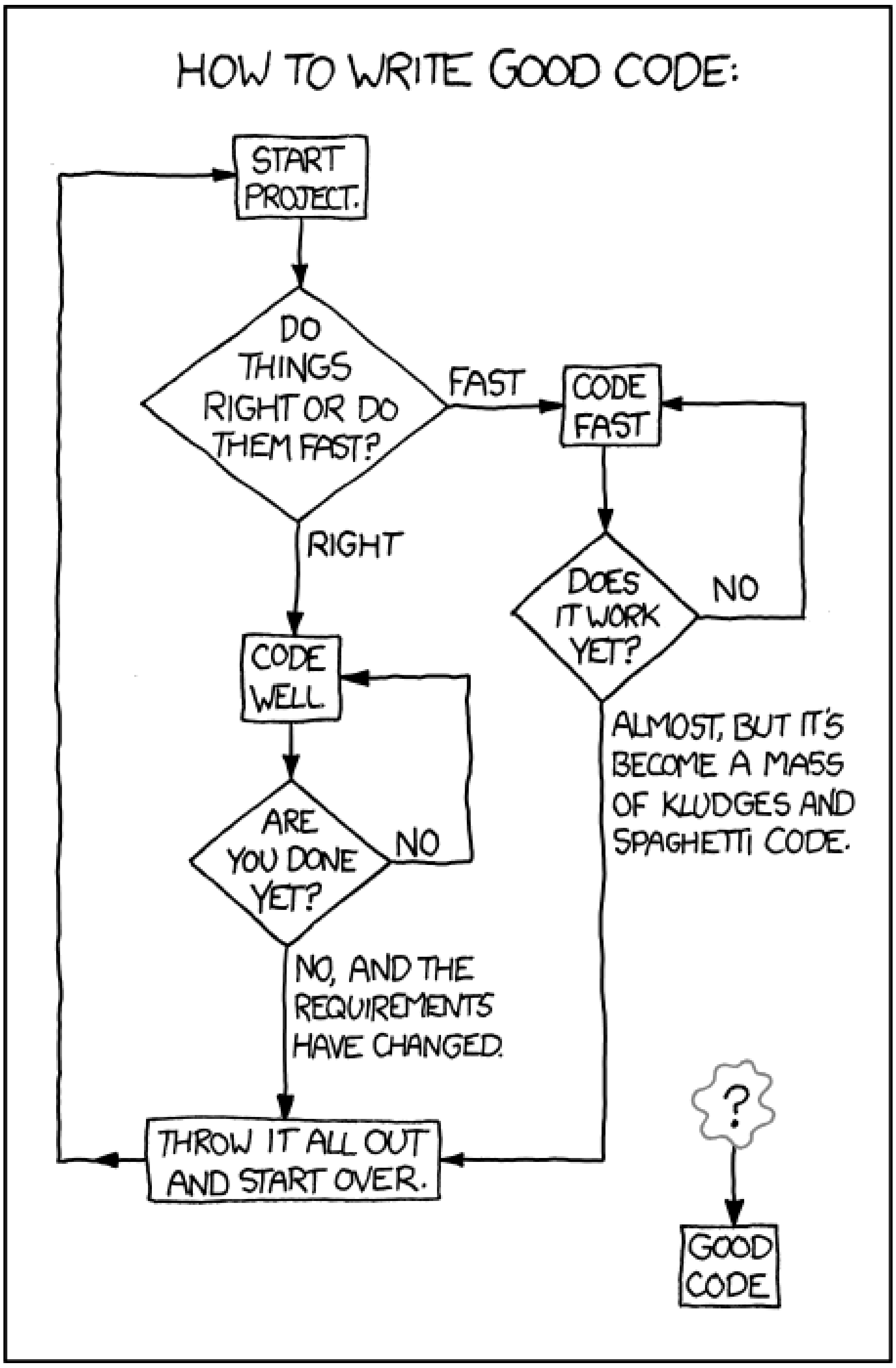
Assignment 1

Group 13B
17-12-2021


HOW TO WRITE GOOD CODE:
START PROJECT.
DO THINGS RIGHT OR DO THEM FAST?
FAST
CODE FAST
DOES IT WORK YET?
NO
ALMOST, BUT IT'S BECOME A MASS OF KLUDGES AND SPAGHETTI CODE.
RIGHT
CODE WELL.
ARE YOU DONE YET?
NO
NO, AND THE REQUIREMENTS HAVE CHANGED.
THROW IT ALL OUT AND START OVER.
?
GOOD CODE

Authors

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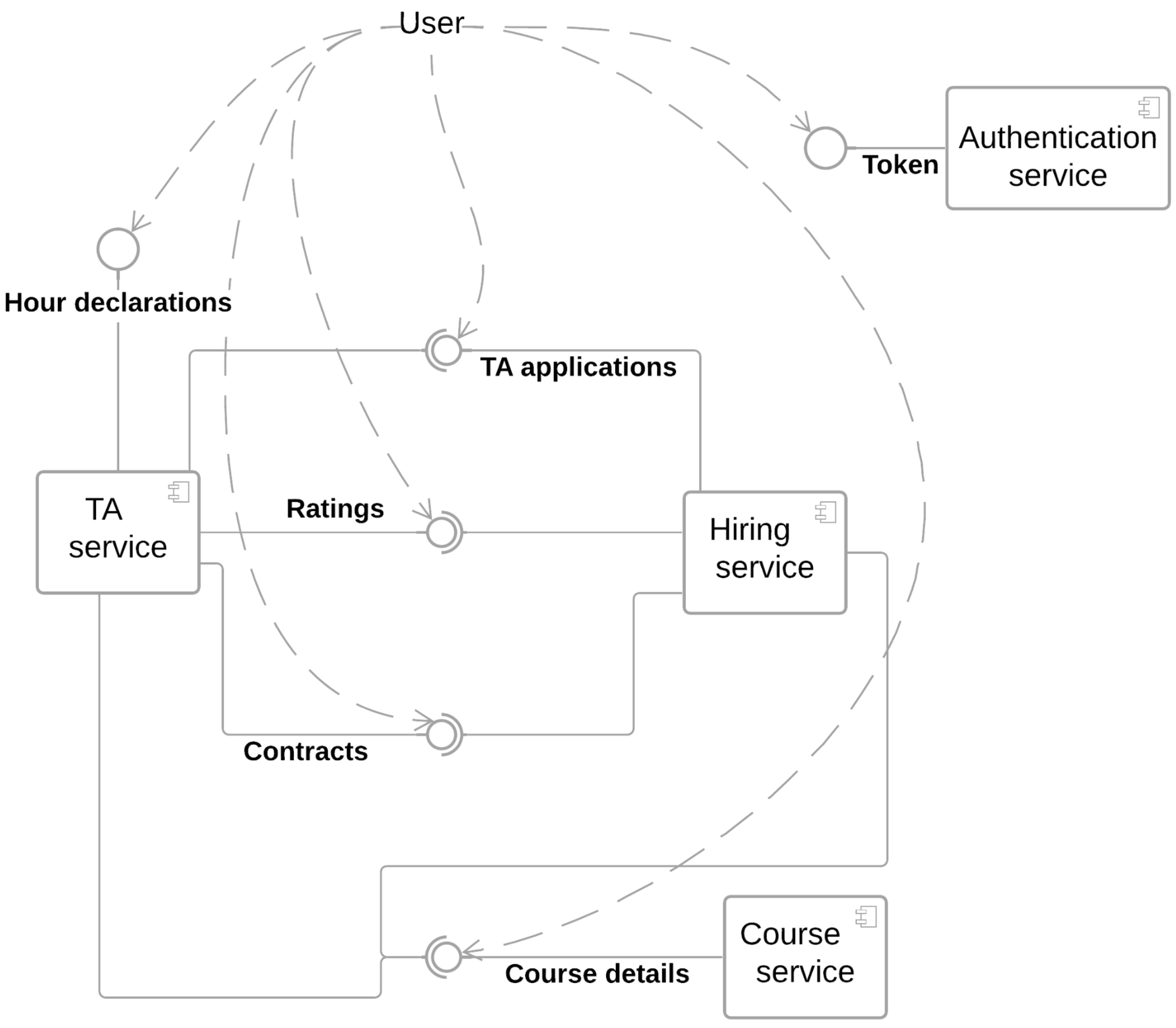
Part 1

Bounded contexts / DDD

We identified 4 bounded contexts in our project: authentication, hiring, TA, course

We have identified four bounded contexts within our application. These bounded contexts consist of authentication, hiring, TA (contracts + submitting worked hours), and course information. We need the authentication service to make sure that no user can impersonate another user without either their verified token or their user password combination. With authentication out of the way our application will mainly consist of 2 workflows: either TAs are being hired, or TAs are being paid. These 2 workflows can be reasonably separated since paying out one TA is barely related to the hiring process of another. However there is still one main way the two workflows are connected and it is the metadata of the course. Both processes need to know who is responsible for approving contracts and worked hours. For this purpose we create our final service, the course information service. The course information will contain all the metadata that a course will have and supply this to our other services.



Authentication service

This service will handle the authentication of users of our application. It will have a database containing all usernames and (securely hashed) passwords of users. This service can be asked to create a JWT token which the user can then use to prove their identity to the other microservices.

The token given, if the user is authenticated, is a signed string containing the user's netid and an expiration date. This token can then be verified by the other microservices to get the netid and check if a user with that netid has permission to do a certain task or operation. This way we do not require any communication to the authorization service while a request is propagating through our microservice architecture, significantly reducing the load on the authentication microservice and improving performance while not compromising on security in any way.

Note that it is not the task of the Authentication microservice to determine your role in the system. Its only purpose is to issue a token which can then be provided to other microservices as proof that the user is who they claim to be. One should see this as a form of identification you can carry around. You then send this identification along with any request you make to our application. Each application will then individually determine what your role should be based on information it already has or can collect from other services. For example, your role as a responsible lecturer is not in any way stored in your JWT token, but is validated by each microservice separately by checking your netid against the list of responsible lecturers for a particular course.

Whilst we could have chosen to have our authentication service also save user information, such as what courses they lecture, we decided against this. Our main reasoning was that we want our system to be scalable and flexible. Having our authentication system also incorporate a lot of user information does not make our application scalable because all instances of the services need the exact same information, otherwise the token for a session could be ruined, and the token would need to constantly be refreshed in the case that somebody else changes the users permissions. It also hurts our flexibility since we now assume all data to be present in the token, and a small change in its structure now needs to be incorporated in every service. Furthermore, it would also affect security, since a user who has had one of their roles taken away (for instance, due to account compromise) would still in practice retain those roles until all of their tokens expire. Hence we decided that only storing the netid in the JWT token is the optimal route, not only in terms of security but also scalability and performance.

Course service

This service is responsible for keeping track of courses and their responsible lecturers. We want this information to be available for both the hiring service and TA service. We are aware that this microservice is getting close to just a database talking to other databases. But since two of our main bounded contexts, hiring and submitting worked hours, are dependent on this data we deemed it necessary to split off this functionality into its own simple and highly-scalable service.

Courses are needed in the hiring service for applications and acceptance of applications. The hiring service needs it to check if the course has started yet and whether or not a certain user is a responsible lecturer and therefore has permission to accept an application. Furthermore, courses are needed in the TA service to check if a user can approve declared hours of a TA for the same reason. What sets apart our course microservice from an authorization microservice responsible for distributing roles is the fact that the information related to authorization is merely a small part of the information the course microservice provides about courses - name, start date, description, list of responsible lecturers, etc. This makes the course microservice an integral part of the internal network and all requests made to this service still require authentication via a JWT token for security reasons.

We expect this service to be the main bottleneck of our application since our other internal services can communicate with this service quite often. However, the course service is mostly a read only database. Changes to its data can be made but are neither critical nor require instant response. This makes it so that this service is exceptionally scalable in the event of a server overload occurring. If scaling is necessary, the different instances of this microservice can very effectively utilize caching in order to preserve its high performance even when the number of requests to this microservice is exceptionally high.

We could also have chosen to incorporate this service into our other services. However, this introduces a problem. Either one of our services runs the database, or both of them do. If one runs the database this could result in choking behaviour, where a system hogs up all the resources to first resolve its own needs, taking out one of our services if another one is busy. If both of them run the database then there will be a lot of overhead keeping them in sync and it is not clear which of the two services should receive the original update request. This made it trivial to split this area of concern into another microservice. Although splitting this functionality into its own microservice increases the general complexity of the entire network, this makes the entire system more scalable and easier to maintain in the long term.

Hiring service

This service is in charge of the hiring of new TAs. It will store and process all TA applications submitted by students and will be responsible for “transferring” an accepted TA to the TA service. Clustering this functionality into one service makes sense, the process of hiring someone has very little to do with an hour declaration service. Splitting this functionality into its own microservice allows it to easily be scaled up when the application period for many courses is open, and scaling it down when very few students want to apply.

The hiring service will not be running in isolation as it is the start of every TA's journey and therefore close to the heart of our application. First and foremost, the service which the hiring service needs to communicate with the most is the course microservice. It requires this communication to check the start date of the course or to verify the start date of the course a student is applying to be a TA for. Checking whether the user is a responsible lecturer through their netid is necessary for functionality such as approving or rejecting applications, retrieving a list of all applicants, and accessing the auto recommendation system.

Then at the final stage there will also be some communication with the TA service. This communication exists for two main reasons: to retrieve past TA performance and to transfer an accepted application. The past TA performance is needed to aid lecturers when making a selection between candidates. When an application is eventually approved, a contract is created on the TA service for the newly accepted TA. From now on, this new TA will only mainly communicate with the TA service.

Alternatively, we could have merged the TA service with the hiring service. However, we would argue that splitting the application into two sides: “applying for a TA” and “working as a TA”, is very logical and significantly improves scalability by allowing scaling up the two microservices independently from each other when necessary. This is possible mainly thanks to the fact that there is a clear split in functionality between the two. As a result, we are able to split the features into two microservices, with their own distinct features, which can retain their high performance even when the system is under heavy load thanks to their highly-scalable nature.

TA service

This service will handle everything that has to do with TAs. The TA contact, hour declarations, and ratings are all stored and processed here. We choose to make this separate from the hiring service since there is a natural split in functionality between the features a student who is applying as a TA and someone who is an active TA would use.

When a student has applied and is accepted by a lecturer their information is “transferred” to the TA service and a contract is generated. This contract will be the main entity that makes a student a TA. This contract can also later store the rating of the TA given by lecturers.

With the process of declaring hours also being handled through this microservice we have introduced quite a lot of functionality, but not without reason. In some situations we deemed it better to partly sacrifice potential scalability for a significantly lower overhead. With this service containing the contracts of every TA we do not need to communicate with any other service when declaring worked hours. The alternative was to create a contract service, but in that case declaring worked hours would always require a call to the contract service to determine whether or not a student is filling in more hours than they are allowed. This would result in two microservices that are heavily coupled together, which would not improve scalability in a meaningful way, but would only introduce unnecessary overhead. Seeing as how we do not have another service that requires this information, we can easily merge this functionality into one service in order to achieve better performance in high-demand situations.

While most of our requests to this service can be run in isolation, there is still a need for effective communication with other services. As mentioned before, there will still be necessary communication with the course service, which stores our lecturer data, especially when it comes to approving the hour declarations for a specific course. Not only that, there will also be requests originating from inside the network that will call this service, namely the hiring service. The hiring service is the bread and butter of our application in combination with the TA service. When the hiring service has approved a new TA it sends over the contract to the TA service effectively transforming the student into a TA. Finally, the TA service also exposes an endpoint for internal use, the ratings of a TA, this allows a recommendation system to quickly look up the score of every TA for automatic recommendation.

The big speaking point was moving the rating attribute into this service and not the hiring service, as both options are valid for their own reasons. Our current solution of moving the rating into the TA service introduces extra overhead since it is an attribute that is only used by the hiring service. However, we like to look at our future flexibility. Storing the rating in the TA service makes more sense logically - it is related to the work of an active TA, not to their application. Furthermore, we could in the future also use other data, such as hours worked, to create a more accurate score. This data cannot be exposed directly as it would contain financial or otherwise sensitive information. Therefore we decided that with the rating being implemented in the TA service we have more future potential which was more desirable in our eyes.

Gateway

Our gateway service only routes requests to the other services. It does not have a database, and does not process any information. This decouples it from the other services entirely, improving the scalability and maintainability of our entire application.

Summary

Course service

Stores all information of a course (dates, lecturer, etc.).

Users can create courses, and other services request course information (e.g. the netid of the responsible lecturer in order to check permissions, etc.).

Authentication service

Handles authentication.

Allows users to register. Allows registered users to login, and provides them with a JWT token that other services can then verify independently.

TA service

Handles active and past contracts, hour declarations, and ratings.

TAs can submit hour declarations, and lecturers can approve them. Requests the netid of the lecturer for authorization before allowing users to approve hours or create contracts. Automatically approves a TA application when a contract is created.

Hiring service

Handles applications.

Users can apply to be TAs, and lecturers can manage applications.

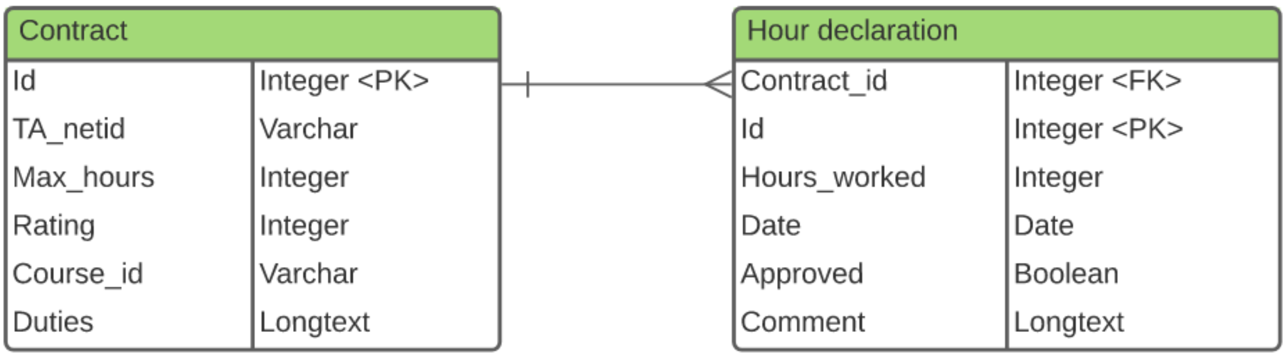
Requests course details to check if the user can apply at that time. Requests the netid of the lecturer for authorization before allowing users to modify applications (e.g. approve, reject, etc.).

Requests ratings and past contracts when showing applications to lecturers.

When an application is approved, it makes a request to the TA service to create a contract.

Database structure

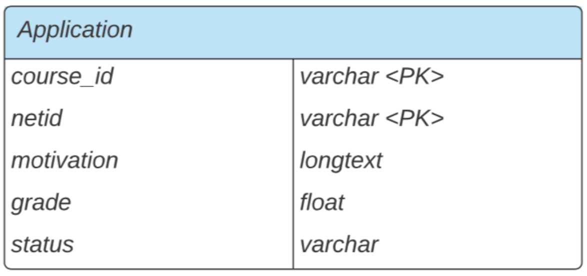
TA service



Contract	
Id	Integer <PK>
TA_netid	Varchar
Max_hours	Integer
Rating	Integer
Course_id	Varchar
Duties	Longtext

Hour declaration	
Contract_id	Integer <FK>
Id	Integer <PK>
Hours_worked	Integer
Date	Date
Approved	Boolean
Comment	Longtext

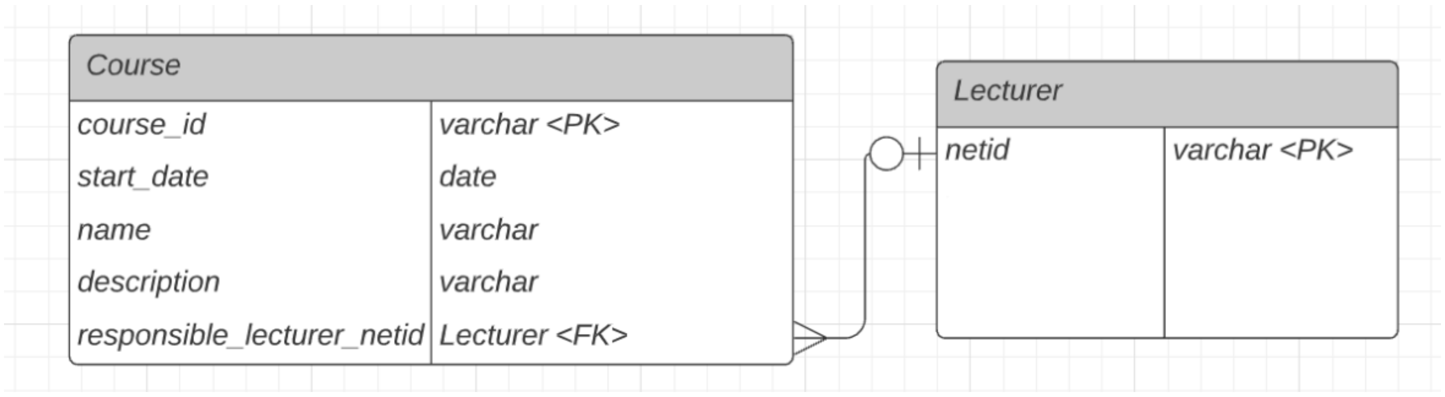
Hiring service



Application	
course_id	*varchar <PK>*
netid	*varchar <PK>*
motivation	*longtext*
grade	*float*
status	*varchar*

Remarks
The hiring microservice will handle everything that has to do with the hiring proccess. It will only need to store applications of students with their motivation and grade. This all can be stored in one simple table.

Course service



Authentication service

Users	
netid	varchar <PK>
password_hash	varchar

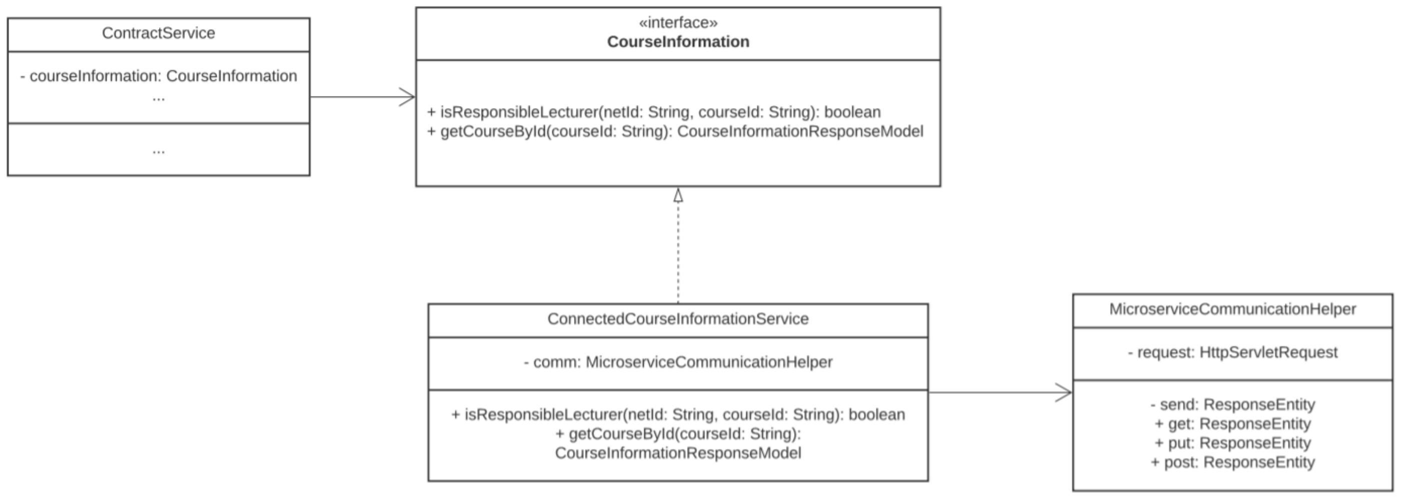
Remarks:
The authentication service is not responsible for roles. Roles in our application are context-dependent and the authentication service only deals with authentication and not authorization.

Part 2

Adapter pattern

The adapter pattern is probably the pattern that can emerge the most. It focuses on being able to switch between different implementations depending on what is needed and is very closely related to Java's concept of an interface. The pattern is most useful when dealing with code that cannot or will not be changed to meet a new output format but still needs to communicate with newer machines. In those cases we want to create an adapter between the old and the new machine and this is where the adapter pattern was born. On our new machine we will implement this adapter and the adapter itself will implement some common interface that all adapters share. This way we can swap out the adapter we are using depending on the format that we are presented with.

This pattern greatly improves code maintainability as it makes developers avoid writing a single god class for parsing but will instead allow them simply to create a new class that can be swapped out. Even when only one format is presented the pattern should still be applied. Especially because you cannot know in advance if there will be any new format in the future that you will need to adapt your code to. This pattern also helps alleviate complex modules by hiding implementation specifics behind an interface which can then also easily be mocked. This overall makes the adapter pattern one of the easiest to work with patterns, and one that in general can even be created on accident.


ContractService
- courseInformation: CourseInformation
...
...
«interface»
CourseInformation
+ isResponsibleLecturer(netId: String, courseId: String): boolean
+ getCourseById(courseId: String): CourseInformationResponseModel
ConnectedCourseInformationService
- comm: MicroserviceCommunicationHelper
+ isResponsibleLecturer(netId: String, courseId: String): boolean
+ getCourseById(courseId: String): CourseInformationResponseModel
MicroserviceCommunicationHelper
- request: HttpServletRequest
- send: ResponseEntity
+ get: ResponseEntity
+ put: ResponseEntity
+ post: ResponseEntity

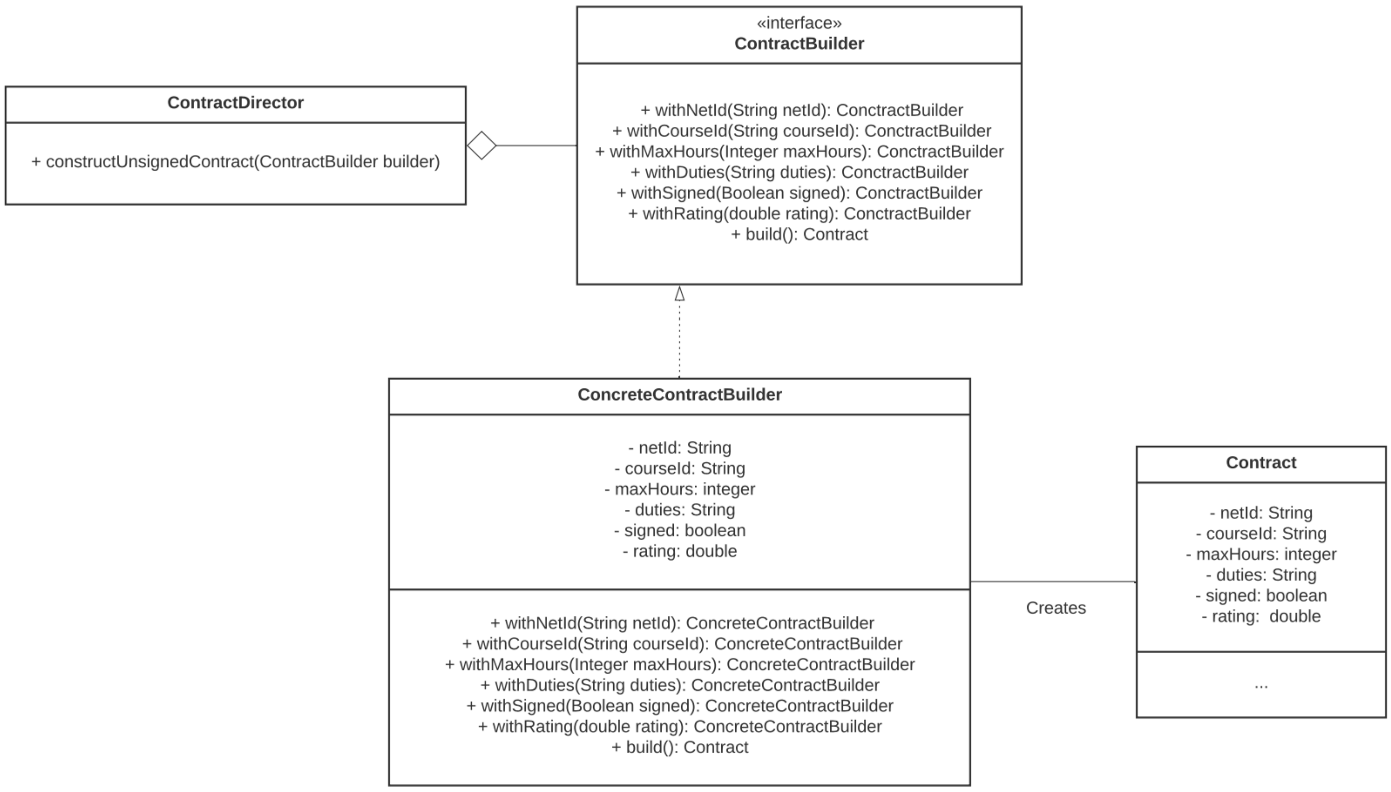
An example implementation of the adapter pattern:

- The contract service: https://gitlab.ewi.tudelft.nl/cse2115/2021-2022/sem-group-13b/sem-repo-13b/-/blob/55afc6264f963a2c9da18ac836706934f9307de9/ta-service/src/main/java/nl/tudelft/sem/template/ta/services/ContractService.java
- The adapter: https://gitlab.ewi.tudelft.nl/cse2115/2021-2022/sem-group-13b/sem-repo-13b/-/blob/55afc6264f963a2c9da18ac836706934f9307de9/ta-service/src/main/java/nl/tudelft/sem/template/ta/services/communication/ConnectedCourseInformationService.java
- The interface: https://gitlab.ewi.tudelft.nl/cse2115/2021-2022/sem-group-13b/sem-repo-13b/-/blob/55afc6264f963a2c9da18ac836706934f9307de9/ta-service/src/main/java/nl/tudelft/sem/template/ta/interfaces/CourseInformation.java
- The adaptée: https://gitlab.ewi.tudelft.nl/cse2115/2021-2022/sem-group-13b/sem-repo-13b/-/blob/55afc6264f963a2c9da18ac836706934f9307de9/ta-service/src/main/java/nl/tudelft/sem/template/ta/services/communication/MicroserviceCommunicationHelper.java

Builder pattern

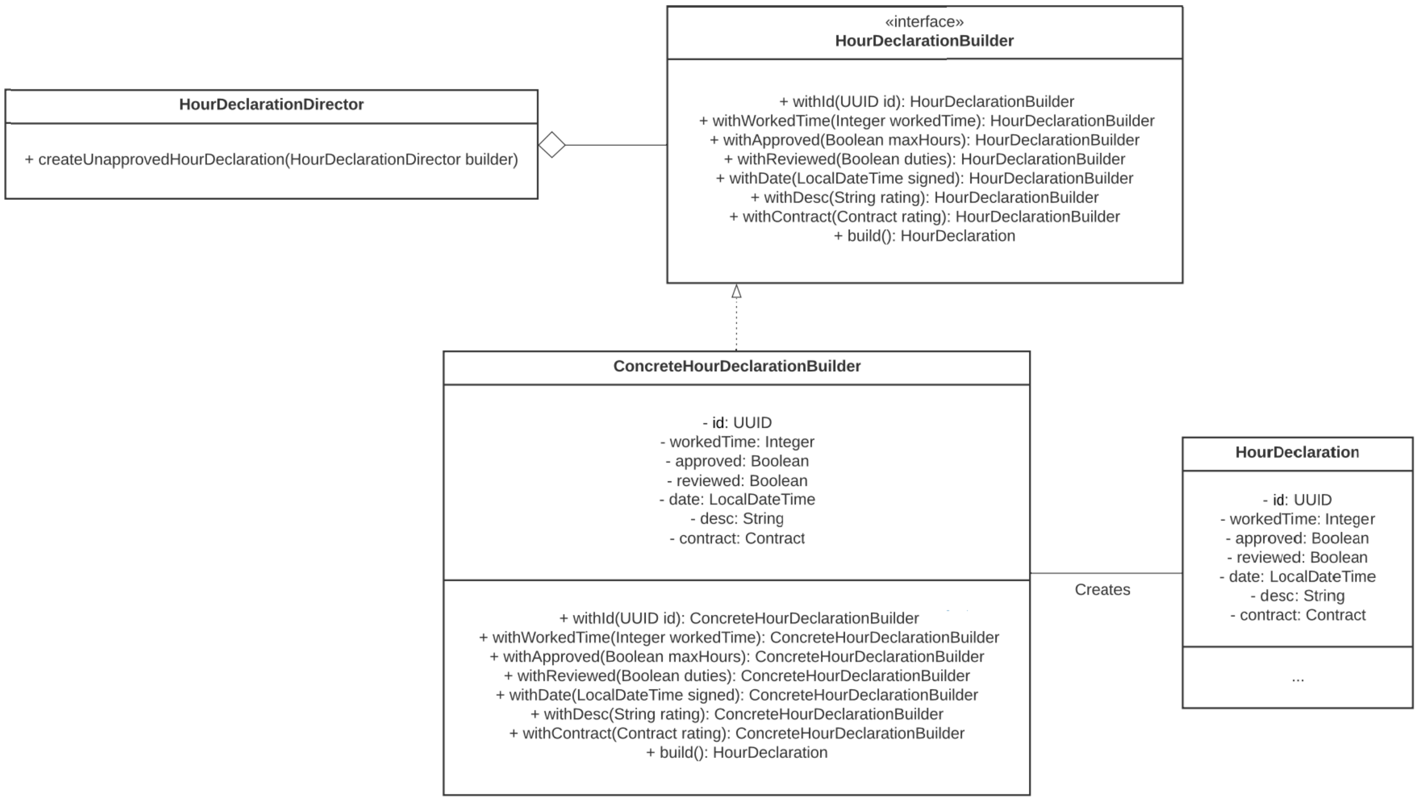
The builder pattern enables us to build complex objects in a simple and less error-prone way. It serves as a verbose interface, making the creation of objects with many attributes very straightforward.

We have utilised the builder pattern in many places throughout the application. We chose to use this pattern for instantiating most of our models due to its simplicity - instead of invoking a lot of setters every time we create an instance of an object, or using constructor with many arguments, where making a mistake in the order of arguments is easy, we chose to create builders in order to keep our code maintainable and easily readable even by people not familiar with the codebase.


«interface»
ContractBuilder
+ withNetId(String netId): ConctractBuilder
+ withCourseId(String courseId): ConctractBuilder
+ withMaxHours(Integer maxHours): ConctractBuilder
+ withDuties(String duties): ConctractBuilder
+ withSigned(Boolean signed): ConctractBuilder
+ withRating(double rating): ConctractBuilder
+ build(): Contract
ContractDirector
+ constructUnsignedContract(ContractBuilder builder)
ConcreteContractBuilder
- netId: String
- courseId: String
- maxHours: integer
- duties: String
- signed: boolean
- rating: double
+ withNetId(String netId): ConcreteContractBuilder
+ withCourseId(String courseId): ConcreteContractBuilder
+ withMaxHours(Integer maxHours): ConcreteContractBuilder
+ withDuties(String duties): ConcreteContractBuilder
+ withSigned(Boolean signed): ConcreteContractBuilder
+ withRating(double rating): ConcreteContractBuilder
+ build(): Contract
Creates
Contract
- netId: String
- courseId: String
- maxHours: integer
- duties: String
- signed: boolean
- rating: double
...

An example implementation of the builder pattern for the Contract entity.

- Contract.java
  https://gitlab.ewi.tudelft.nl/cse2115/2021-2022/sem-group-13b/sem-repo-13b/-/blob/7ef6f63e26deb369d2a890a6c8b27f563d6a03f0/ta-service/src/main/java/nl/tudelft/sem/template/ta/entities/Contract.java
- ContractBuilder.java
  https://gitlab.ewi.tudelft.nl/cse2115/2021-2022/sem-group-13b/sem-repo-13b/-/blob/7ef6f63e26deb369d2a890a6c8b27f563d6a03f0/ta-service/src/main/java/nl/tudelft/sem/template/ta/entities/builders/ConcreteContractBuilder.java
- ConcreteContractBuilder.java
  https://gitlab.ewi.tudelft.nl/cse2115/2021-2022/sem-group-13b/sem-repo-13b/-/blob/7ef6f63e26deb369d2a890a6c8b27f563d6a03f0/ta-service/src/main/java/nl/tudelft/sem/template/ta/entities/builders/interfaces/ContractBuilder.java
- ContractDirector.java
  https://gitlab.ewi.tudelft.nl/cse2115/2021-2022/sem-group-13b/sem-repo-13b/-/blob/7ef6f63e26deb369d2a890a6c8b27f563d6a03f0/ta-service/src/main/java/nl/tudelft/sem/template/ta/entities/builders/directors/ContractDirector.java
- A use case of the director on line 69
  https://gitlab.ewi.tudelft.nl/cse2115/2021-2022/sem-group-13b/sem-repo-13b/-/blob/7ef6f63e26deb369d2a890a6c8b27f563d6a03f0/ta-service/src/main/java/nl/tudelft/sem/template/ta/services/ContractService.java


«interface»
HourDeclarationBuilder
+ withId(UUID id): HourDeclarationBuilder
+ withWorkedTime(Integer workedTime): HourDeclarationBuilder
+ withApproved(Boolean maxHours): HourDeclarationBuilder
+ withReviewed(Boolean duties): HourDeclarationBuilder
+ withDate(LocalDateTime signed): HourDeclarationBuilder
+ withDesc(String rating): HourDeclarationBuilder
+ withContract(Contract rating): HourDeclarationBuilder
+ build(): HourDeclaration
HourDeclarationDirector
+ createUnapprovedHourDeclaration(HourDeclarationDirector builder)
ConcreteHourDeclarationBuilder
- id: UUID
- workedTime: Integer
- approved: Boolean
- reviewed: Boolean
- date: LocalDateTime
- desc: String
- contract: Contract
+ withId(UUID id): ConcreteHourDeclarationBuilder
+ withWorkedTime(Integer workedTime): ConcreteHourDeclarationBuilder
+ withApproved(Boolean maxHours): ConcreteHourDeclarationBuilder
+ withReviewed(Boolean duties): ConcreteHourDeclarationBuilder
+ withDate(LocalDateTime signed): ConcreteHourDeclarationBuilder
+ withDesc(String rating): ConcreteHourDeclarationBuilder
+ withContract(Contract rating): ConcreteHourDeclarationBuilder
+ build(): HourDeclaration
Creates
HourDeclaration
- id: UUID
- workedTime: Integer
- approved: Boolean
- reviewed: Boolean
- date: LocalDateTime
- desc: String
- contract: Contract
...

An example implementation of the builder pattern for the Hour centity.

- HourDeclaration.java
  https://gitlab.ewi.tudelft.nl/cse2115/2021-2022/sem-group-13b/sem-repo-13b/-/blob/7ef6f63e26deb369d2a890a6c8b27f563d6a03f0/ta-service/src/main/java/nl/tudelft/sem/template/ta/entities/HourDeclaration.java
- HourDeclarationBuilder.java
  https://gitlab.ewi.tudelft.nl/cse2115/2021-2022/sem-group-13b/sem-repo-13b/-/blob/7ef6f63e26deb369d2a890a6c8b27f563d6a03f0/ta-service/src/main/java/nl/tudelft/sem/template/ta/entities/builders/ConcreteHourDeclarationBuilder.java
- ConcreteHourDeclarationBuilder.java
  https://gitlab.ewi.tudelft.nl/cse2115/2021-2022/sem-group-13b/sem-repo-13b/-/blob/7ef6f63e26deb369d2a890a6c8b27f563d6a03f0/ta-service/src/main/java/nl/tudelft/sem/template/ta/entities/builders/interfaces/HourDeclarationBuilder.java
- HourDeclarationDirector.java
  https://gitlab.ewi.tudelft.nl/cse2115/2021-2022/sem-group-13b/sem-repo-13b/-/blob/7ef6f63e26deb369d2a890a6c8b27f563d6a03f0/ta-service/src/main/java/nl/tudelft/sem/template/ta/entities/builders/directors/HourDeclarationDirector.java
- A use case of the director on line 47
  https://gitlab.ewi.tudelft.nl/cse2115/2021-2022/sem-group-13b/sem-repo-13b/-/blob/7ef6f63e26deb369d2a890a6c8b27f563d6a03f0/ta-service/src/main/java/nl/tudelft/sem/template/ta/services/HourService.java