Emerging Software Design Workshop (Java)

Preparation

Import from GitHub: https://github.com/ozihler/esdws-2019

Requirements:

- Java 11+, Angular 8+, NPM 6.4.1+
- Run it:
  - Frontend: Go to package.json and run “start”, or Terminal: cd /frontend, then: npm install, npm run ng serve
  - Backend: run “Application”
- Run backend tests: LibraryTest.java (this is what we will need today)
  - If tests run with gradle in IntelliJ: File > Settings > Build,Execution,Deployment > Gradle > Build and run using IntelliJ IDEA, Run tests using IntelliJ IDEA

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Emerging Software Design – Basic Idea

OOP: Bring **state** and **logic** together in meaningful new classes by refactoring

1. Extract some logic as **method**
2. **Wrap state** in **new class**
3. **Move extracted method** into newly created class

6 Step Emerging Design Process

1. **Separate responsibilities within the method**
2. Extract private method
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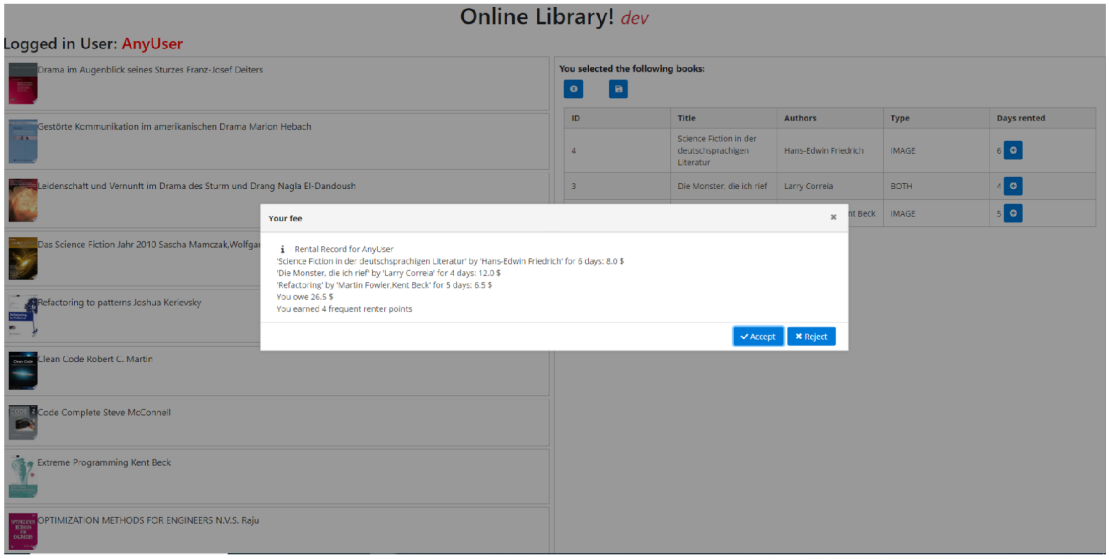
Look for nouns in variables & method names: candidates for domain objects!

Examining the app and code base



What we are going to do today

- Extract domain concepts and logic into domain classes
- Extract and wrap infrastructure logic and presentation logic
- Get to know some background on layered architecture patterns and DDD and how get there using automated refactoring
- Have an example of how to structure the project as classes and packages towards a »screaming architecture«

E1: Introduce Book Entity (15')

- Introduce Book.java in `Library#calculateFee` with the following constructor:
- `Book(int key, String title, String authors, String readingMode, String link)`
- Use Book wherever the primitive String[] book array was used (implement getters)
- Try to use **Parallel Change** to replace
  - String[] book --> Book book
  - List<String[]> books --> List<Book> books
- Do not move any more logic into Book yet
- Add Book to new package »**library.domain.entities**«

Parallel Change

1. Create **new structure** in parallel to existing one
2. Step-by-step **add write accesses** to new structure next to **every write access** to old structure (**state** of new structure becomes the same as the one of the old structure)
3. Step-by-step **switch read accesses** from old to new structure
4. Step-by-step **remove write accesses** to old structure
5. Remove old structure

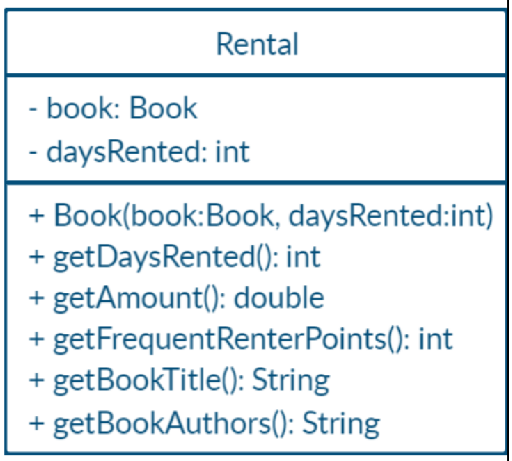
Run tests whenever it makes sense!

Entities & Value Objects in a nutshell

- An Entity is an object with an identity. The Book »Clean Code« is not the same as book »Clean Architecture«
- A Value Object has no identity. 1 Dollar = 1 Dollar. Although the object may be different, the identity of the two objects is still *equal.* Any ID is a value object. Values are typically immutable, see String
- It often depends on the context if an object is treated as entity or as value object
- In an all encompasing OOP system, there are no primitive types anymore, so all Strings, integers, etc. are at least value objects or entities.
- So a book constructor looks like this:
  - `Book(Key key, Title title, Authors authors, ReadingMode readingMode, Link link)`
- See e.g. DDD for more details. All Exercises have a sister branch with «-with-value-objects« where there are now primitive types anymore

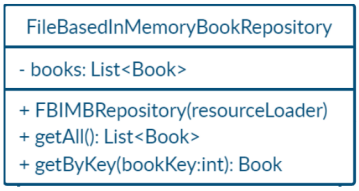
E2: Introduce `Rental` Value Object (20')

- Replace String[] rental with Rental rental
- `Rental` should get the following constructor:
  - `public Rental(Book book, int daysRented)`
- Extract and move the following logic into Rental
  - `public int getDaysRented()`
  - `public double getAmount()`
  - `public int getFrequentRenterPoints()`
  - `public String getBookTitle()`
  - `Public String getBookAuthors()`
- Use **Parallel Change**
- Add Rental to package »**domain.values**«



E3: Introduce FileBasedBookRepository (20')

- Extract **file reading and parsing** logic for Book into a new `BookRepository` class
- `FileBasedInMemoryBookRepository` should get the following two methods:
  - `public Collection<Movie> getAll()`
  - `public Book findById(int id)`



- `FileBasedBookRepository` should **load the file in its constructor**
- Use `FileBasedBookRepository` also for `Library#getBooks()` (without altering getBooks() return type: convert books to String[] again!)
- Initialise the repo in Library's constructor
- Move FileBasedBookRepository to package »**library.adapters.file_persistance**«

E4: Split the while loop (15')

- Into 4 loops
- Extract the following methods for the 3 additional loops:
  - `double getTotalAmount(List<Rental> rentals)`
  - `int getFrequentRenterPoints(List<Rental> rentals)`
  - `String toDocument(List<Rental> rentals)`
- Don't extract any methods for creating a Rental yet

Technique: Loop Splitting

- If the body of a loop contains **several responsibilities** that should be separated, the loop needs to be **duplicated** so that **each loop has only a single responsibility**
- **Create a List** in the first loop and iterate over it in all the following loops
- This approach of duplicating the control structure is also feasible for other control structures (e.g. if, switch) with several responsibilities in the body

E5: RentBookRequest (15')

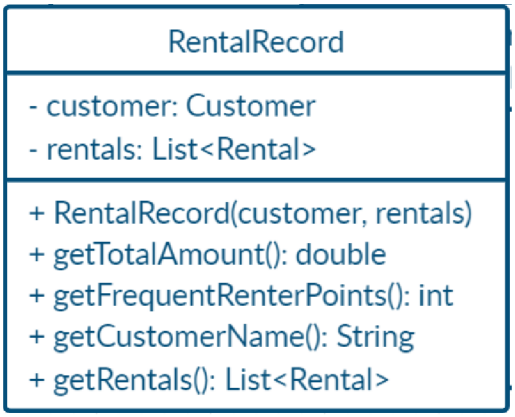
- Introduce a Data Transfer Object (DTO) that wraps bookId and daysRented
- Replace all accesses to the variables with accesses to rentBookRequest.getBookId() and getDaysRented()
- Add all to a List<RentalBookRequest> rentalBookRequests and iterate over it to create rentals (loop splitting)
- move it to package »**library.application.use_cases.rent_books.ports**«

E6: Extract domain concept – create `RentalRecord` (10')

- With member variables `List<Rental>` rentals and `Customer customer`
- And methods
  - `public double getTotalAmount()`
  - `public int getFrequentRenterPoints()`
  - `public String getCustomerName()`
  - `public List<Rental> getRentals()`

Extract the loops into own methods and move them to RentalRecord

Add RentalRecord to package »**domain.values**«



E7: Extract Presentation Logic – create `RestRentalRecordPresenter`

- add method `present(RentalRecord rentalRecord)` to StringRentalRecordPresenter, which formats the rental record to a List.of(String). Store this in a field called List<String> rentalsResponse
- Add getter for the rentalsResponse and use it in Library#calculateFee
- also move `format(rentals)` to RestRentalRecordPresenter

Clean Architecture: Use Case (Interactor), DDD: Services, Onion: Application Layer

- A Use Case (Interactor) controls the »dance of entities«. Entities should not leak out of the use case
- Onion Architecture calls this »application layer«, as it's application specific code.
- In DDD, a similar concept to a use case is a Service, but services appear to be broader and tend contain more functionality.
- Use cases are specific to the application. Entities may be used in different use cases.
- Example: RentBooks
- Fetch data through repositories, create entities, orchestrate entity interactions
- Procedural in nature
- No dependencies to UI, DB, or Frameworks
- Input/Output: simple request/response data structures, no dependencies to entities or frameworks! (mostly primitives, DTOs, no logic!)

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Architecture: Ports and Adapters

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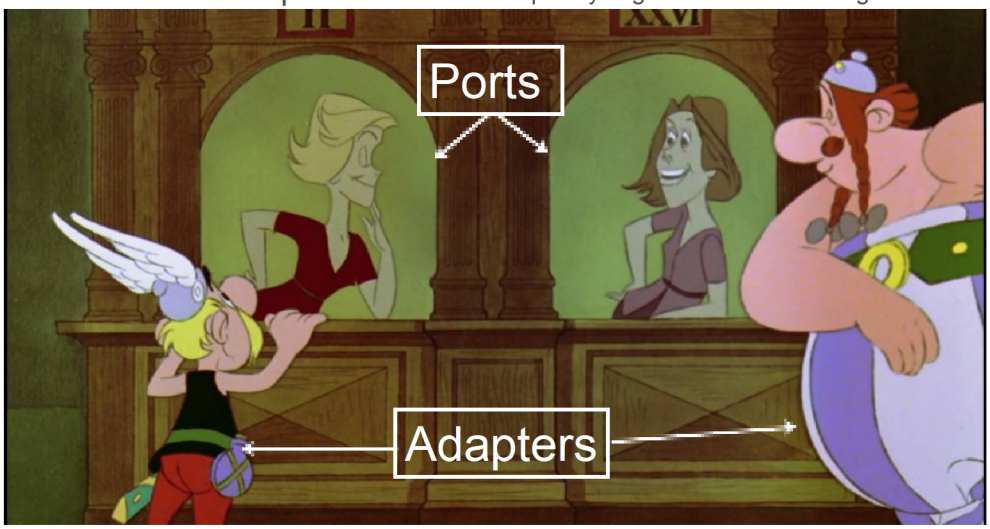
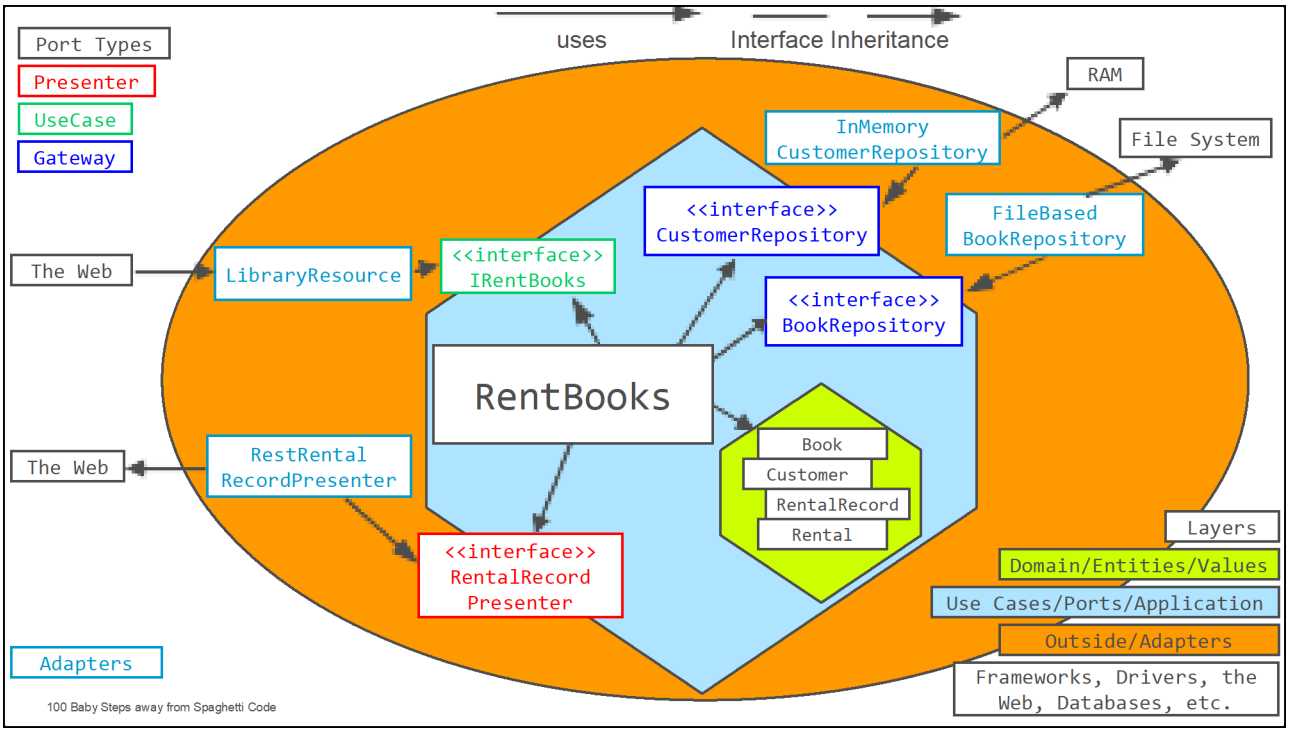


How does the input/output look like? Who decides?

Do we know *how* the output is produced? Who decides?

Do we know *how many different* actions each adapter can perform?

Who *depends* on whom?


Port Types
Presenter
UseCase
Gateway
uses
Interface Inheritance
RAM
InMemory CustomerRepository
File System
<<interface>> CustomerRepository
FileBased BookRepository
The Web
LibraryResource
<<interface>> IRentBooks
<<interface>> BookRepository
RentBooks
Book
Customer
RentalRecord
Rental
The Web
RestRental RecordPresenter
<<interface>> RentalRecord Presenter
Layers
Domain/Entities/Values
Use Cases/Ports/Application
Outside/Adapters
Frameworks, Drivers, the Web, Databases, etc.
Adapters
100 Baby Steps away from Spaghetti Code

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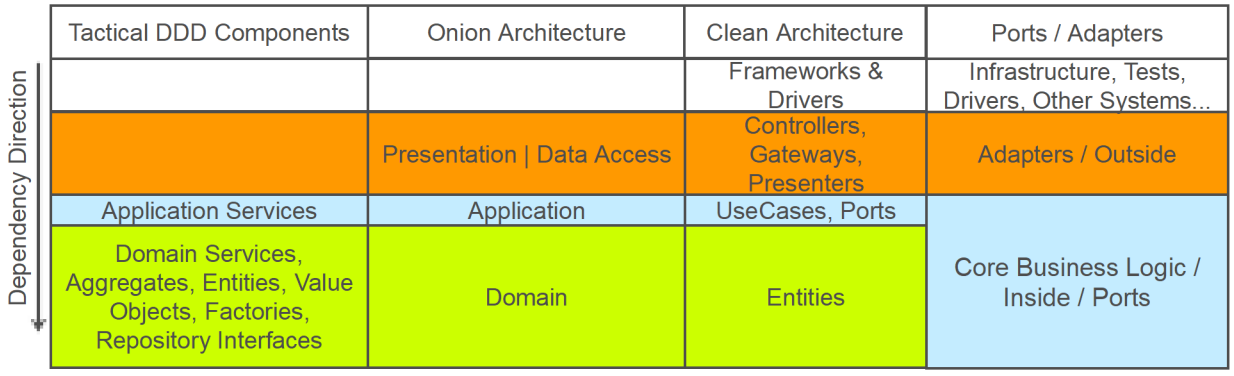
Dependency Direction
Tactical DDD Components
Onion Architecture
Clean Architecture
Ports / Adapters
Frameworks & Drivers
Infrastructure, Tests, Drivers, Other Systems...
Presentation | Data Access
Controllers, Gateways, Presenters
Adapters / Outside
Application Services
Application
UseCases, Ports
Domain Services, Aggregates, Entities, Value Objects, Factories, Repository Interfaces
Domain
Entities
Core Business Logic / Inside / Ports

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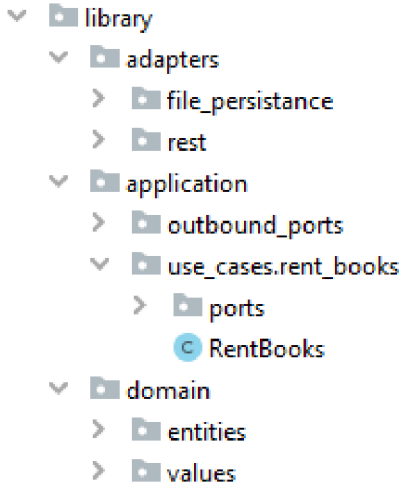
Possible Package Structure



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Technique: Duplicate & Reduce

- Technique to split methods containing multiple responsibilities needed by different callers

1. Duplicate the method by:
   - Copy-Paste (plus rename) or
   - “Push members down” to all subclasses or
   - “Inline method implementation” on caller side
2. Reduce the copy to what is needed for the specific caller or in the given scope

- Replace temporary variable with query/extract method
- Introduce parameter object/extract parameter
- Parallel Change
- Narrow Change
- Loop Splitting
- Duplicate & Reduce
- Separating responsibilities and concerns
- * Emerging inheritance via Introduce Polymorphism
- Emerging reasonable compositions
- Code generations, refactorings, IDE suggestions
- The basics of common architecture patterns like Onion, Ports/Adapters, Clean Architecture
- Concepts like Entity, Value Object, Aggregates, Factory, Repository, Service, Use Case, etc.

Last Page…

- I hope you had fun and gained some new or different insights today!
- You can contact me e.g. via oliver.zihler@zuehlke.com
- See also Alistair Cockburn in the Hexagon (1-3, that's how I learned about Ports/Adapters): https://www.youtube.com/watch?v=th4AgBcrEHA
- Books: Clean Code, Clean Architecture, Clean Coder, DDD, Implementing DDD, DDD Quickly, DDD Distilled, Principles, Patterns, and Practices in DDD, Refactoring (old and new), Refactoring to Patterns
- Courses on Refactoring and Code Smells: https://www.industriallogic.com/
- Use the Spring Boot/Angular Project as a template for your own project if you like!