POLITECNICO DI MILANO

Software Engineering 2

CodeKataBattle - Improve your programming skills online

Design

Document

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1 - Introduction

1.1 - Purpose

The purpose of the CKB application is to provide students and educators with a platform to improve their programming skills by taking part in friendly competitions (called “Tournaments”) where they can resolve various programming problems (called “Katas”) in their preferred language of choice (e.g. Java or Python).

The platform relies heavily upon GitHub in order to store solutions and to run tests and other activities on each push. As such, the users are required to use their GitHub account to access the application (or register one if they don’t have it).

1.2 - Scope

In this section of the document, we will discuss the main design choices that we have taken in relation to the domain of the product.
Given that CKB is an application that aims to allow its users to compete with other users in online code competition, it seems natural to implement it as a client-server application. More specifically, we agreed on using a three-tier architecture (presentation tier, business tier and data tier) to maintain a separation between the user interface, the logic of the system and the data, and in this way improve the maintainability, the stability and the security of the system. To further improve these aspects of the CKB application we decided to use the microservice approach to develop the system. In this way we also improve the scalability of the system, allowing it to adapt more easily and efficiently to different amounts of active users.

1.3 - Definitions, Acronyms, Abbreviations

In order to reduce ambiguity as much as possible, this document heavily uses acronyms and abbreviations to refer to entities and concepts in the CKB system. This section is aimed at defining each of these acronyms and abbreviations in a precise and concise way.

Acronym	**Definition**
IU	Interested Student: a Student U is Interested by a notification N: ● if U has selected the option to receive notification from all the users. ● if U has selected the option to receive notification only from their friend and the user who has sent N is a friend of U. ● N is a notification of a Tournament in which U is subscribed.

SST	Students Subscribed to a Tournament.
OTC	Original Tournament Creator.
TC	Tournament Coordinator, appointed by the OTC.
CDT	Current DateTime.
ETD	Enrollment Tournament Deadline. After this deadline, it is not possible to join the Tournament as a Student.
FTD	Final Tournament Deadline. After this deadline, the Tournament is ended and the final leaderboard is made available.
MNS	Maximum Number of Subscribers. It is the maximum number of Students that can subscribe to a specific Tournament.
EBD	Enrollment Battle Deadline. After this deadline, it is not possible to join the Battle as a Student.
FBD	Final Battle Deadline. After this deadline, the Battle is ended and the final leaderboard is made available. Moreover, the Tournament related to the Battle is updated with the new leaderboard.
OME	Optional Manual Evaluation. Personal score assigned by the Educator, who checks and evaluates the work done by students (the higher the better).
MAE	Mandatory Automated Evaluation, which includes: ● Functional aspects, measured in terms of number of test cases that pass out of all test cases (the higher the better); ● Timeliness, measured in terms of time passed between the registration deadline and the last commit (the lower the better); ● Quality level of the sources, extracted through Static Analysis Tools that consider multiple aspects such as security, reliability, and maintainability (the higher the better). Aspects are selected by the educator at battle creation time.
DAS	Directly Accepted Student: a Student U is directly accepted in a Tournament T if: ● T is public; ● T is friends only and U is a friend of the OCT of T.
EB	End Battle: ● If OME is not required, EB occurs when the FBD is reached.

	• If OME is required, EB is after the Educator performs it, or when the FTD is reached.
SAT	Static Analysis Tools.

1.4 - Revision History

Version	Date	Changelog
1.0	03/01/2024	First draft of the document. Completed section 1, sections 2 and 3 are work in progress.
1.1	06/01/2024	Added Table of Contents. Completed section 2, 3 and 5. Section 4 WIP.

1.5 - Reference Documents

- The specification document Assignment RDD AY 2023-2024.pdf

1.6 - Document Structure

This document is divided in 5 main parts:

1. **Introduction**: introduces the main architectural and design choices made and briefly explains the motivations behind them.
2. **Architectural Design**: shows in detail the architectural decisions adopted and how they are developed and combined to create the global architecture of the system.
3. **User Interface Design**: shows the design adopted for the user interface, presenting a preview of the interface using the corresponding mockups.
4. **Requirements Traceability**: shows the mapping between the requirements defined in RASD and the design elements previously discussed.
5. **Implementation, Integration and Test Plan**: shows the order in which we plan to implement subsystems and components as well as the plan of the integration and test.
6. **Effort Spent**: contains information about the number of hours each group member has worked on this document.
7. **References**: contains information about the resources used to redact this document.

2 - Architectural Design

2.1 - Overview

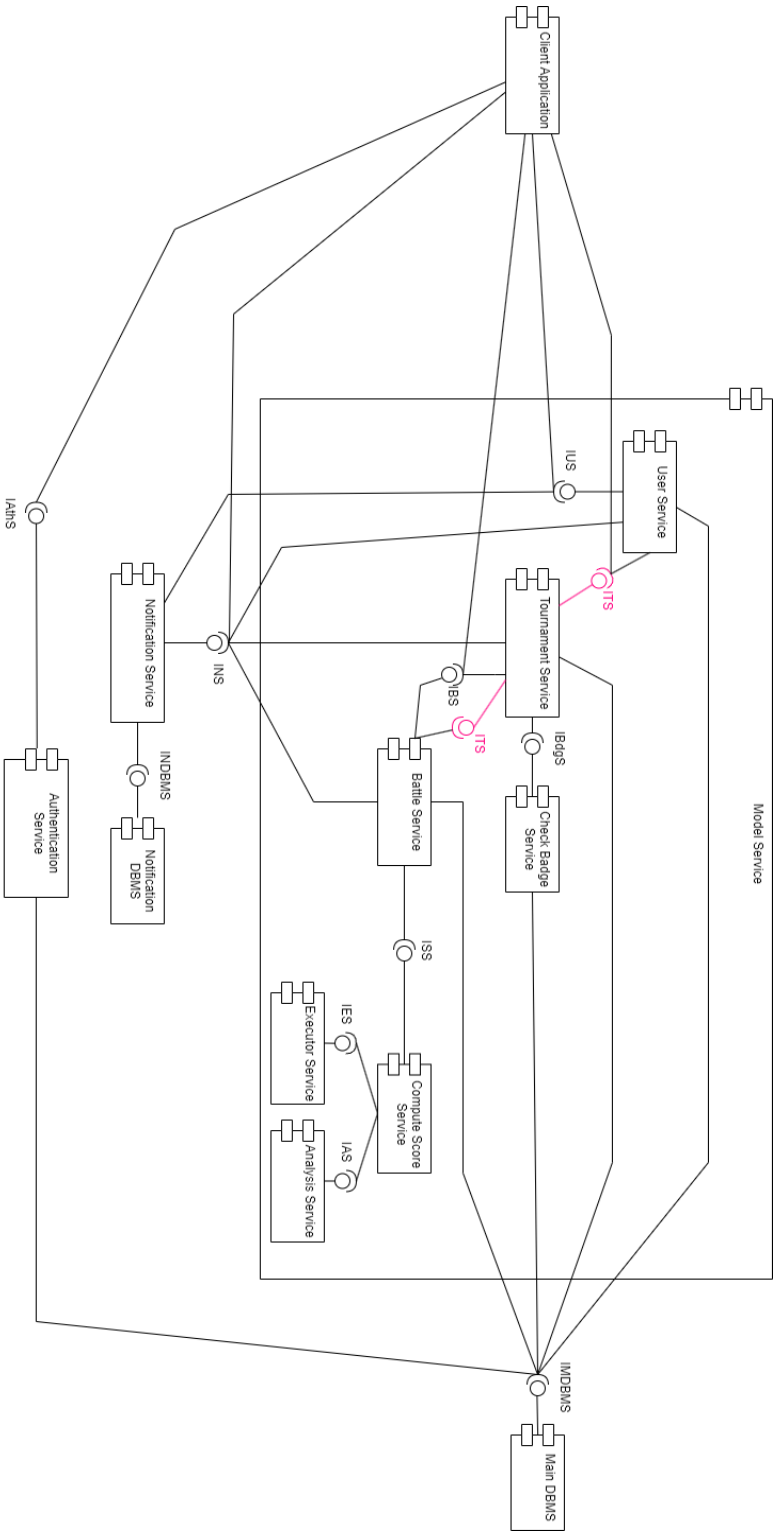
In this section, a general architecture of the CKB system is provided. The architectural choices are summarized in two main design decisions:

- **Client-Server architecture.** Consisting of a Presentation Tier, a Business Tier and a Data Tier. The Presentation Tier is the UI directly shown to the end user: its only objective is to graphically render and present the application to the user. The Business Tier handles everything related to the business logic of the system, by using the internal components (the services). The Data Tier persists the data through two databases: a PostgreSQL (Main DBMS) and a MongoDB instance (Notification DBMS). Further details are provided in section 2.3.1.
- **Microservices.** The Business Tier of the system is divided into several isolated services, in order to reduce coupling as much as possible and to improve scalability of the system as a whole.

2.2 - Component View

This section describes all the identified components and the relationships between them. The Component Diagram precisely shows the dependencies of all the interfaces. After that, a brief description of each component is shown.

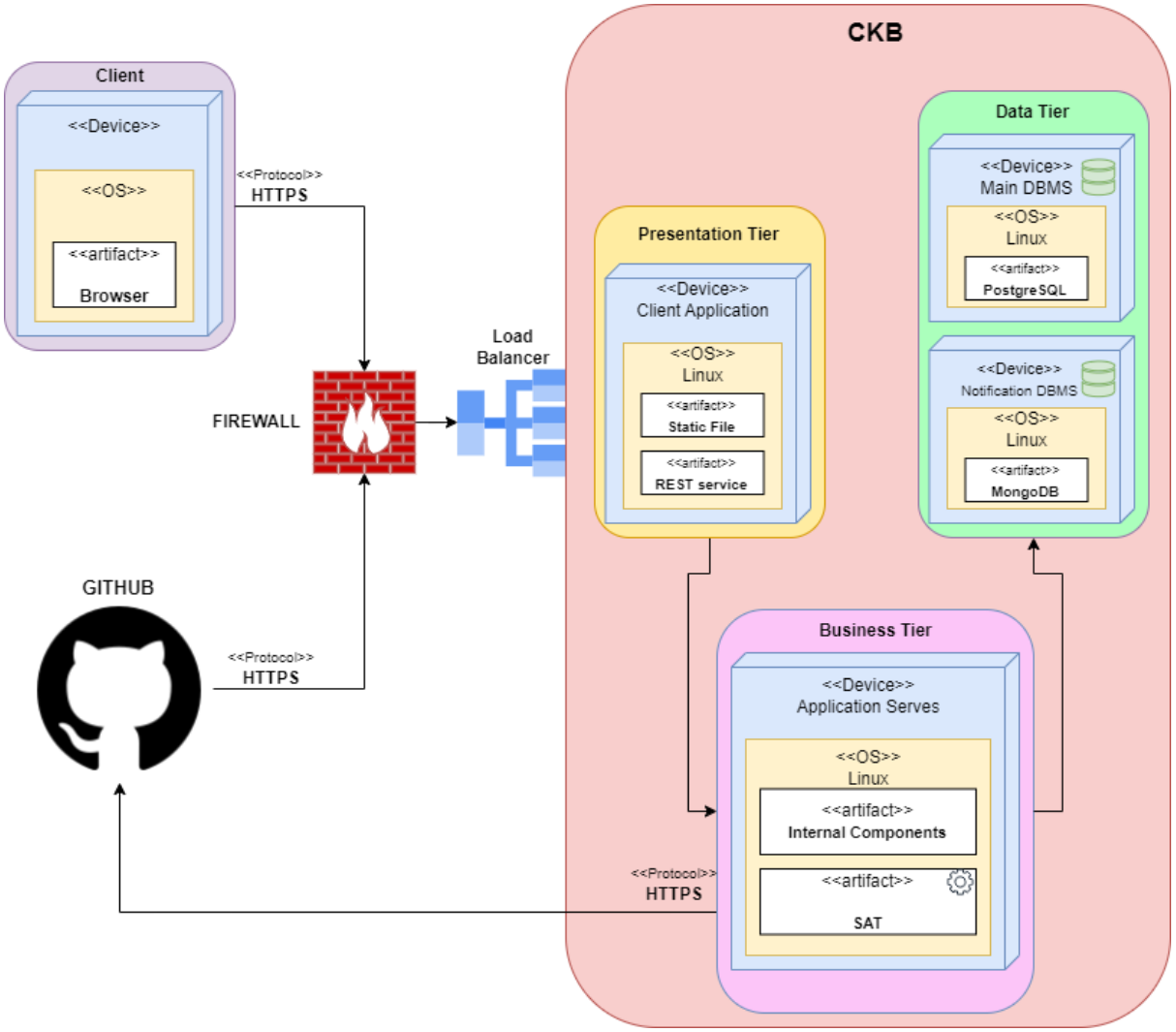
2.2.1 - Component Diagram



2.2.2 - Components Description

- **Client Application.** Represents the web application used by the final user to interface with the CKB system, so it reads the request and sends the html pages.
- **Authentication Service.** Handles authentication with GitHub following the OAuth 2.0 protocol and subsequent token verification processes.
- **User Service.** Handles registered users management, friends' list and privacy policy..
- **Tournament Service.** Handles everything related to tournaments,from creation to end of the Tournament, creation of battle.
- **Battle Service.** Handles everything related to tournament battles and their katas.
- **Executor Service.** Handles execution of code in an isolated sandbox. It is used to run kata submissions and check their output against the provided tests.
- **Analysis Service.** Handles execution of static analysis tools (SATs) in an isolated sandbox.
- **Notification Service.** Abstracts the process of delivering and storing notifications.
- **Main DBMS:** Holds and manages data about Tournaments, Battles, Users, Badges and the relationships between them. The DBMS of choice is PostgreSQL.
- **Notification DBMS:** Holds and manages data about notifications. The DBMS of choice will be a NoSQL solution (Redis).

2.3 - Deployment View



2.3.1 - Deployment View Description

Presentation Tier: It is the frontend layer in the 3-tier architecture, it is the user interface. Communication with the client using the REST standard. The other communication is only with the Business-Tier in order to reduce the dependence.
The client sends a request via Browser, this request arrives in the Presentation-Tier it responds with html pages or messages.
It is a Nginx web server.
Business Tier: This is the middle tier between Presentation and Data.It receives requests by the Presentation-Tier, computes them, if needed communicate with Data-Tier in order to receive data and at the end send the information required at the Presentation-Tier.
It also can receive the code of the repository by GitHub in order to check them and communicate with the Data-Tier to update the data, and the Business-tier communicate with GitHub to authenticate the Client.

Data Tier: This is the tier that keeps track of all data in the system, so all Tournament, Battle, User, Notification and the relationship between them.
Client: It is the client that wants to interact with the system via HTTPS request.
Firewall: It is a device that monitors the packets incoming to the system, if a packet is potentially dangerous it is not forwarder. They are placed before the load balancers, in this way the only packets that enter the network are considered safe
LoadBalancer: A load balancer is a device which performs load balancing. This is the process of distributing a set of requests over a group of resources at the presentation-tier, with the intent of increasing performance, scalability and soundness of the system. It uses Nginx.

2.4 - Component Interfaces

In this section, for each component interface, there are listed methods with their parameter types and return value. Exceptions thrown are omitted as they are not of interest.

- **IUserService (IUS):**
  - getUser(userId: int): User
  - addFriend(notification: JSON): void
  - updateNotificationSetting(privacyLevel: PrivacyLevel): void
  - getTournamentsParticipating(userId: int): List<Tournament>
  - getTournamentsCoordinating(userId: int): List<Tournament>
  - getFriends(userId: int): List<User>
  - getBadges(userId: int): List<Badge>
  - getNotificationSetting(): PrivacyLevel
  - getInterestedUser(tournamentId: int): List<Int>
  - canSend(senderId: int, receiverId: int): bool
- **IAuthService (IAthS):**
  - getOAuthToken(accessCode: string): string
  - getUserProfile(token: string): GHUserProfile
- **ITournamentService (ITS):**
  - createTournament(tournament: Tournament): Tournament
  - joinTournament(notification: JSON): void
  - @overload joinTournament(tournamentId: int, userId: int): void ??
  - addCoordinator(notification: JSON): void
  - addBadge(badgeId: int, tournamentId: int): void
  - updateLeaderboard(leaderboard: List<Team>, tournamentId: int, battleId: int): void
  - getParticipants(tournamentId: int): List<User>
  - banParticipant(clientId: int, participantId: int, tournamentId: int): void
  - updateETD(date: DateTime, tournamentId: int, userId: int): void
  - updateFTD(date: DateTime, tournamentId: int, userId: int): void
  - Getters/Setters

- **IBattleService (IBS):**
  - createBattle(battle: Battle): Battle
  - addKata(battleId: int, kata: Kata): Battle
  - joinBattle(notification: JSON): void
  - @overload joinBattle(battleId: int, userId: int): void ??
  - getTeams(battleId: int): List<Team>
  - getParticipants(battleId: int): List<User>
  - performOME(battleId: int ,teamId: int, userId: int, score: float): void
  - updateEBD(date: DateTime, battleId: int, userId: int): void
  - updateFBD(date: DateTime, battleId: int, userId: int): void
  - forceEndBattle(battleId: int): void
- **IScoreService (ISS):**
  - computeScore(kata: Kata, code: String , evaluationSetting: EvaluationSetting): float
- **IExecutorService (IES):**
  - runTests(test: List<KataTest>, code: String): List<KataTestResult>
- **IAnalysisService (IAS):**
  - runAnalysis(code: String, evaluationSetting: EvaluationSetting): List<float>
- **INotificationService (INS):**
  - sendFriendRequestNotify(senderId: int, receiverId: int): void
  - interactFriendRequestNotify(receiverId: int, notificationId: int, accepted: bool): void
  - sendTeamInvitationNotify(battleId: int, teamId: int, senderId: int, receiverId:int): void
  - interactTeamInvitationNotify(receiverId: int, notificationId: int, accepted: bool): void
  - sendBattleCreationNotify(battle: Battle): void
  - interactBattleCreationNotify(receiverId: int, notificationId: int, accepted: bool): void
  - sendBattleOMENotify(battle: Battle): void
  - sendBattleEndNotify(battle: Battle): void
  - sendTournamentCreationNotify(tournament: Tournament): void
  - interactTournamentCreationNotify(receiverId: int, notificationId: int, accepted: bool): void
  - sendTournamentCoordinatorNotify(senderId: int, receiverId: int): void
  - interactTournamentCoordinatorNotify(receiverId: int, notificationId: int, accepted: bool): void
  - sendTournamentEndNotify(tournament: Tournament): void
  - openNotification(userId: int): List<Notification>
  - errorTournamentFull(userId: int, tournamentId: int): void
  - sendEditTournamentDeadlineNotify(userIds: List<Int>,tournamentId: int): void
  - sendEditBattleDeadlineNotify(userIds: List<Int>,battleId: int): void

- **IBadgeService (IBdgS):**
  - getBadge(badgeId: int): Badge
  - createBadge(badge: Badge): Badge
  - checkRules(tournamentId: int): void
- **INotificationDBMS (INDBMS):**
  - writeNotification(data: JSON):void
  - writeNotification(data: JSON):void aggiungere??
  - getAllNotification(userId: int): List<JSON>
  - deleteNotification(notificationId: int): void
  - checkNotification(notificationId: int, receiverId:int) JSON

2.5 - Runtime View

In this section, there is a list of important use cases and the corresponding sequence diagram to perform them using the previously described component interfaces.
All sequence diagrams are made using Mermaid. As such, it is possible to render them graphically using the appropriate command line application.

UC: Calculate Total Score

```
sequenceDiagram
    participant GHA as GitHub Action
    participant ISS as IScoreService
    participant IES as IExecutorService
    participant IAS as IAnalysisService
    participant DBMS as Main DBMS
    GHA->>ISS: computeScore(kata, code, evalSettings)
    activate ISS
    ISS->>IES: runTests(tests, code)
    activate IES
    alt OK
    IES-->>ISS: List<KataTestResult>
    ISS->>IAS: runAnalysis(code, evalSettings)
    activate IAS
    alt OK
    IAS-->>ISS: SATResult
    ISS->>DBMS: persistScore(teamId, score)
    else ERR
    IAS-->>ISS: Error
    ISS-->>GHA: Error
    end
    deactivate IAS
    else ERR
    IES-->>ISS: Error
```

```
    ISS-->>GHA: Error
    deactivate IES
    end
    deactivate ISS
```

UC: Registration

```
sequenceDiagram
    participant CA as Client Application
    participant GH as GitHub
    participant IAUTH as IAuthService
    participant DBMS as Main DBMS
    CA->>GH: requestGitHubLogin()
    GH->>GH: requestUserPermission()
    alt ACCEPTED:
    GH-->>CA: accessCode
    CA->>IAUTH: getOAuthToken(accessCode)
    IAUTH-->>CA: JWT
    IAUTH->>GH: getUserProfile(jwt)
    GH-->>IAUTH: GHUserProfile
    IAUTH->>DBMS: storeUser(userProfile)
    else REFUSED:
    GH->>CA: showMessage("Permissions refused")
    end
```

UC: Visualize User Profile

```
sequenceDiagram
    participant CA as Client Application
    participant IUS as IUserService
    CA->>+IUS: getUser(userId)
    IUS-->>-CA: User
    CA->>+IUS: getBadges(userId)
    IUS-->>-CA: Badges
    CA->>+IUS: getFriends(userId)
    IUS-->>-CA: List<User>
```

UC: Send Friend Request

```
sequenceDiagram
    participant CAs as Client Application
    participant INS as INotificationService
    participant INDBMS as INotificationDBMS
    CAs->>INS: sendFriendRequestNotify(senderId, receiverId)
    INS->>INS: data = friendNotification(senderId, receiverId)
    INS->> INDBMS: writeNotifcation(data)
```

Nicolò

UC: Send team request

```
sequenceDiagram
participant CAs as Client application (sender)
participant INS as INotificationService
participant INDBMS as INotificationDBMS

CAs->>+INS: sendTeamInvitationNotify(battleId, teamId, senderId,
receiverId)
INS->>+INS: data = teamNotification(battleId, teamId, senderId,
receiverId)
INS->>+ INDBMS: writeNotifcation(data)
```

UC: Accept/Reject team request

```
sequenceDiagram
participant CAr as Client application (receiver)
participant INS as INotificationService
participant INDBMS as INotificationDBMS
participant IBS as IBattleService
participant IMDBMS as IMainDBMS

CAr->>+INS: openNotification(userId)
INS->>+ INDBMS: getAllNotification(userId)
INDBMS->>+INS: List<JSON>
INS->>+ CAr: List<Notification>
CAr->>+INS: interactTeamInvitationNotify(reciverId, notificationId,
accepted)


alt accepted == true:
      INS->>+ INDBMS: getNotification(notificationID)
      INDBMS->>+ INS: notification = JSON
      INS->>+IBS: joinBattle(notification)
      IBS->>+IBS: team = isInBattle(battleId, receiverId)
      alt team != NULL:
            IBS->>+IMDBMS: deleteTeamPartecipant(team.getId(), battleId,
reciverId)
            IMDBMS->>+IMDBMS: execute the delete
    end
    IBS->>+IMDBMS: addTeamPartecipant(teamId, battleId, reciverId)
    IMDBMS->>+IMDBMS: execute the add
end
```

```
INS->>+INDBMS: deleteNotification(notificationId)
INDBMS->>+INDBMS: execute the delete
```

UC: Join battle via notification

```
sequenceDiagram
participant CA as Client application
participant INS as INotificationService
participant INDBMS as INotificationDBMS
participant IBS as IBattleService
participant IMDBMS as IMainDBMS

CA->>+INS: openNotification(userId)
INS->>+ INDBMS: getAllNotification(userId)
INDBMS->>+INS: List<JSON>
INS->>+ CA: List<Notification>
CA->>+INS: interactBattleCreationNotify(receiverId, notificationId,
accepted)

alt accepted == true:
      INS->>+ INDBMS: getNotification(notificationID)
      INDBMS->>+ INS: notification = JSON
      INS->>+IBS: joinBattle(notification)
      IBS->>+IBS: team = newTeam(battleId, reciverId)
      IBS->>+IMDBMS: addTeam(team.getId(), battleId)
      IMDBMS->>+IMDBMS: execute the add
      IBS->>+IMDBMS: addTeamPartecipant(teamId, battleId, reciverId)
      IMDBMS->>+IMDBMS: execute the add
end
INS->>+INDBMS: deleteNotification(notificationId)
INDBMS->>+INDBMS: execute the delete
```

UC: Join battle via webapp

```
sequenceDiagram
participant CA as Client application
participant IBS as IBattleService
participant IMDBMS as IMainDBMS

CA->>+IBS: joinBattle(userId)
IBS->>+IBS: team = newTeam(battleId, reciverId)
IBS->>+IMDBMS: addTeam(team.getId(), battleId)
IMDBMS->>+IMDBMS: execute the add
IBS->>+IMDBMS: addTeamPartecipant(teamId, battleId, reciverId)
IMDBMS->>+IMDBMS: execute the add
```

UC: Join tournament via notification

```
sequenceDiagram
participant CA as Client application
participant INS as INotificationService
participant INDBMS as INotificationDBMS
participant ITS as ITournamentService
participant IMDBMS as IMainDBMS

CA->>+INS: openNotification(userId)
INS->>+ INDBMS: getAllNotification(userId)
INDBMS->>+INS: List<JSON>
INS->>+ CA: List<Notification>
CA->>+INS: interactTournamentCreationNotify(receiverId, notificationId,
accepted)
alt accepted == true:
      INS->>+ INDBMS: getNotification(notificationID)
      INDBMS->>+ INS: notification = JSON
      INS->>+ITS: joinTournament(notification)
      ITS->>+IMDBMS: addTournamentPartecipant(tournamentId, reciverId)
      IMDBMS->>+IMDBMS: execute the add
end
INS->>+INDBMS: deleteNotification(notificationId)
INDBMS->>+INDBMS: execute the delete
```

UC: Join tournament via notification

```
sequenceDiagram
participant CA as Client application
participant ITS as ITournamentService
participant IMDBMS as IMainDBMS
participant INS as INotificationService
participant INDBMS as INotificationDBMS

CA->>+ITS: joinTournament(tournamentId,userId)
ITS->>+ITS: outcome = isFullTournament(tournamentId)
alt outcome == false
    ITS->>+IMDBMS: addTournamentPartecipant(tournamentId, reciverId)
    IMDBMS->>+IMDBMS: execute the add
else
    ITS->>+INS: errorTournamentFull(torunamentId, reciverId)
    INS->>+INS: data = errorTournamentFullNotification(tournamentId,
reciverId)
    INS->>+INDBMS: writeNotificaTion(data)
```

```
end
```

UC:createTournament

```
sequenceDiagram
    participant CA as Client application
    participant ITS as ITournamentService
    participant IMDBMS as IMainDBMS
    participant INS as INotificationService
    participant IUS as IUserService
    participant INDBMS as INotificationDBMS
    CA->>+ITS: createTournament(Tournament)
    ITS->>+IMDBMS: addTorunament(Tournament)
    activate IMDBMS
    alt OKTournament
    IMDBMS-->>ITS: Tournament
    ITS->>+INS: sendTournamentCreationNotify(Tournament)
    INS->>+IUS: getInterestedUsers(TounramentId)
    IUS-->>INS: List<Int>
    INS->>+INDBMS: writeNotifications(Data)
    alt OKNotification
    INDBMS-->>+INS:OK
    INS-->>+ITS:OK
    ITS-->>+CA:OK
    else ErrorNotification
    INDBMS-->>+INS:Error
    INS-->>ITS: Error
    ITS-->>CA: Error
    end
    else ErrorTournament
    IMDBMS-->>ITS: NULL
    ITS-->>CA: Error
    end
```

UC:AddingCoordinator

```
sequenceDiagram
    participant CA as Client application
    participant INS as INotificationService
    participant IUS as IUserService
    participant INDBMS as INotificationDBMS
    CA->>+INS: sendTournamentCoordinatorNotify(sender,reciver)
    INS->>+IUS:canSend(sender,reciver)
```

```
    alt SendNotification
    IUS-->>+INS:True
    INS->>INDBMS:writeNotification(Data)
    alt OK
    INDBMS-->>INS:OK
    INS-->>CA:OK
    else ERROR
    INDBMS-->>INS:Error
    INS-->>CA:Error
    end
    else NotSendNotification
    IUS-->>+INS:False
    INS-->>+CA:OK
    end
```

UC:Accept/Reject TC request

```
sequenceDiagram
    participant CA as Client application
    participant INS as INotificationService
    participant INDBMS as INotificationDBMS
    participant ITS as ITournamentService
    participant IMDBMS as IMainDBMS
    CA->>+INS: interactTournamentCoordinatorNotify(receiverId,
notificationId, accepted)
    INS->>+INDBMS:checkNotification(reciverId,notificationId)
    alt OK
    INDBMS-->>+INS:Notification
            alt Accepted==TRUE
            INS->>+ITS:addCoordinator(notification)
            ITS->>+IMDBMS:writeCoordinator(tournamentId,coordinatorId)
                alt WriteOK
                IMDBMS-->>+ITS:OK
                ITS-->>+INS:OK
                INS-->>+CA:OK
                else WriteError
                IMDBMS-->>+ITS:Error
                ITS-->>+INS:Error
                INS-->>+CA:Error
                end
            else Accepted==False
```

```
            INS-->>+CA:OK
            end
    end
```

UC:CreateBadge

```
sequenceDiagram

    participant CA as Client application
    participant IBdgS as IBadgeService
    participant IMDBMS as IMainDBMS
    CA->>+IBdgS: createBadge(Badge)
    IBdgS->>IMDBMS:writeBadge(Badge)
    alt WriteOK
    IMainDBMS-->>IBdgS:OK
    IBdgS-->>CA: OK
    else WriteError
    IMainDBMS-->>IBdgS:Error
    IBdgS-->>CA: Error
    end
```

UC:CreateBattle

```
sequenceDiagram
    participant CA as Client application
    participant IBS as IBattleService
    participant IMDBMS as IMainDBMS
    participant INS as INotificationService
    participant ITS as ITournamentService
    participant INDBMS as INotificationDBMS
    CA->>+IBS: createBattle(Battle)
    IBS->>+IMDBMS: addBattle(Battle)
    alt OKBattle
    IMDBMS-->>IBS: Battle
    IBS->>+INS: sendBattleCreationNotify(Tournament)
    INS->>+ITS: getParticipant(TounramentId)
    ITS-->>INS: List<Int>
    INS->>+INDBMS: writeNotifications(Data)
    alt OKNotification
    INDBMS-->>+INS:OK
    INS-->>+IBS:OK
    IBS-->>+CA:OK
    else ErrorNotification
    INDBMS-->>+INS:Error
    INS-->>IBS: Error
    IBS-->>CA: Error
```

```
    end
    else ErrorBattle
    IMDBMS-->>IBS: NULL
    IBS-->>CA: Error
    end
```

UC: Perform OME (part 1)

```
sequenceDiagram
    participant CA as Client application
    participant IBS as IBattleService
    participant ITS as ITournamentService
    participant IMDBMS as IMainDBMS
    participant INS as INotificationService
    CA->>+IBS: performOME(battleId, teamId, userId, score)
    IBS->>+IMDBMS: updateScoreOME(battleId, teamId, userId, score)
    alt UpdateOK
    alt CompleteForEachStudents
    IMDBMS-->>+IBS: List<Team>,tournamentId
    IBS->>+ITS: updateLeaderboard(leaderboard,tournamentId,battleId)
    ITS->>+IMDBMS:updateLeaderboard(leaderboard,tournamentId,battleId)
    alt UpdateLeaderboardOK
    IMDBMS-->>+ITS: OK
    ITS->>+INS: EndBattle
    INS->>+ITS: ...
    ITS-->>+IBS: OK\Error
    IBS-->>+CA: OK\Error
    else UpdateLeaderboardError
    IMDBMS-->>+ITS: Error
    ITS-->>+IBS: Error
    IBS-->>+CA: Error
    end
    else NotCompleteForEachStudents
    IMDBMS-->>+IBS: OK
    IBS-->>+CA: OK
    end
    else UpdateError
    IMDBMS-->>+IBS: Error
    IBS-->>+CA: Error
    end
```

UC:EndBattle

```
sequenceDiagram
    participant CA as Client application
    participant IBS as IBattleService
    participant ITS as ITournamentService
    participant IMDBMS as IMainDBMS
    participant INS as INotificationService
    participant INDBMS INotificationDBMS
    IBS->>+ITS: updateLeaderboard(leaderboard,tournamentId,battleId)
    ITS->>+IMDBMS:updateLeaderboard(leaderboard,tournamentId,battleId)
    alt UpdateLeaderboardOK
    IMDBMS-->>+ITS: OK
    ITS->>+INS:sendBattleEndNotify(Battle)
    INS->>+INDBMS:writeNotifications(Notifications)
    alt WriteOk
    INDBMS-->>+INS:OK
    INS-->>+ITS:OK
    else WriteError
    INDBMS-->>+INS:Error
    INS-->>+ITS:Error
    end
    ITS-->>+IBS: OK\Error
    IBS-->>+CA: OK\Error
    end
```

UC: Edit deadline

(This is ETD is equal for FTD, for EBD and FBD change only ITournamentService with IBattleService)

```
sequenceDiagram
    participant CA as Client application
    participant ITS as ITournamentService
    participant IMDBMS as IMainDBMS
    participant INS as INotificationService
    CA->>+ITS: updateETD(date,tournamentId,userId)
    ITS->>+IMDBMS: updateETD(date,tournamentId,userId)
    alt UpdateOk
    IMDBMS-->>+ITS: OK
    ITS->>+INS:sendEditTournamentDeadlineNotify(userIds,tournamentId)
    alt WriteOK
    INS-->>ITS:OK
    ITS-->>CA:OK
    else WriteError
    INS-->>ITS:Error
    ITS-->>CA:Error
```

```
    end
    else UpdateError
    IMDBMS-->>+ITS: Error
    ITS-->>CA:Error
    end
```

UC: Ban Student

```
equenceDiagram
    participant CA as Client application
    participant ITS as ITournamentService
    participant IMDBMS as IMainDBMS
    CA->>+ITS: banParticipant(clientId,participantId,tournamentId)

ITS->>+IMDBMS:deleteParticipant(clientId,participantId,tournamentId)
    alt DeleteOk
    IMDBMS-->>+ITS:OK
    ITS-->>+CA:OK
    else DeleteError
    IMDBMS-->>+ITS:Error
    ITS-->>+CA:Error
    end
```

UC: FBD expired

```
sequenceDiagram
    participant ModelService
    participant IBS as IBattleService
    participant ITS as ITournamentService
    participant INS as INotificationService
    participant INDBMS as INotificationDBMS
    ModelService-->>+IBS: FBDExpired
    alt NotOME
    IBS-->>+ITS: EndBattle
    ITS-->>+IBS: ...
    IBS-->>+ModelService:OK\Error
    end
    alt OME
    IBS->>+INS:sendBattleOMENotify(Battle)
    INS->>+INDBMS:writeNotifications(Notifications)
    alt WriteOK
    INDBMS-->>+INS:OK
    INS-->>+IBS:OK
    IBS-->>+ModelService:OK
```

```
    else WriteError
    INDBMS-->>+INS:Error
    INS-->>+IBS:Error
    IBS-->>+ModelService:Error
    end
    end
```

UC: FTD expired so EndTournament

2.6 - Selected Architectural Styles and Patterns

The main architectural style adopted for the system is Microservices Architecture.
It was chosen for the following main reasons:

- **Scalability:** Microservices can be independently deployed on the cloud. This means that it is possible to dynamically scale the number of instances of each services, depending on the current demand of the users.
- **Availability:** If one or more services fail, the entire system keeps working while autoheal procedures are running to restore the failed services.
- **Maintainability:** Since each service is implemented separately in its own repository, this increases maintainability by reducing coupling and allows multiple teams to work in parallel.
- **Security:** Each microservice communicates with the others only through methods exposed on the interface, in this way a microservice can't access inner methods and parameters of other microservices, and can communicate with DBMSs only through the corresponding microservices.

2.7 - Other Design Decisions

The ERD for the Main DBMS is available at the following URL:
https://editor.ponyorm.com/user/giovanni_or2/CodeKataBattle

3 - User Interface Design

This section is dedicated to presenting a general overview of the user interface of the CodeKataBattle system, as well as showing some mockups mainly focused on UX rather than UI, since that aspect will be handled by focus groups.

3.1 - Overview

```
stateDiagram-v2
    home: Home Page
    login: Login Page
    tournament_list: Tournaments List Page
    tournament_create: Tournament Create Page
```

```
    tournament_details: Tournament Details Page
    tournament_edit: Tournament Edit Page
    battle_details: Battle Details Page
    battle_edit: Battle Edit Page
    battle_create: Battle Create Page
    kata_submission: Kata Submissions Page
    user_profile: User Profile Page
    edit_profile: Edit User Profile Page
    notifications: Notifications Page
    friends_list: Friends List Page
    home --> login: if not logged in
    home --> tournament_list
    home --> user_profile: if logged in
    home --> notifications: if logged in
    home --> tournament_create
    tournament_list --> tournament_details
    tournament_details --> battle_details
     tournament_details --> tournament_edit: if logged user is\ncreator
or coordinator
     tournament_details --> battle_create: if logged user is\ncreator or
coordinator
    battle_details --> battle_edit: if logged user is creator
    battle_details --> kata_submission
    user_profile --> edit_profile
    user_profile --> friends_list
```

3.2 - Mockups

https://www.figma.com/file/T3paTQUDTwdw49rkhTvXBL/Frontend-Mockups?type=design&node-id=0%3A1&mode=design&t=t3KtYBauaHz5l9eE-1

4 - Requirements Traceability

5 - Implementation, Integration and Test Plan

5.1 - Implementation and Integration

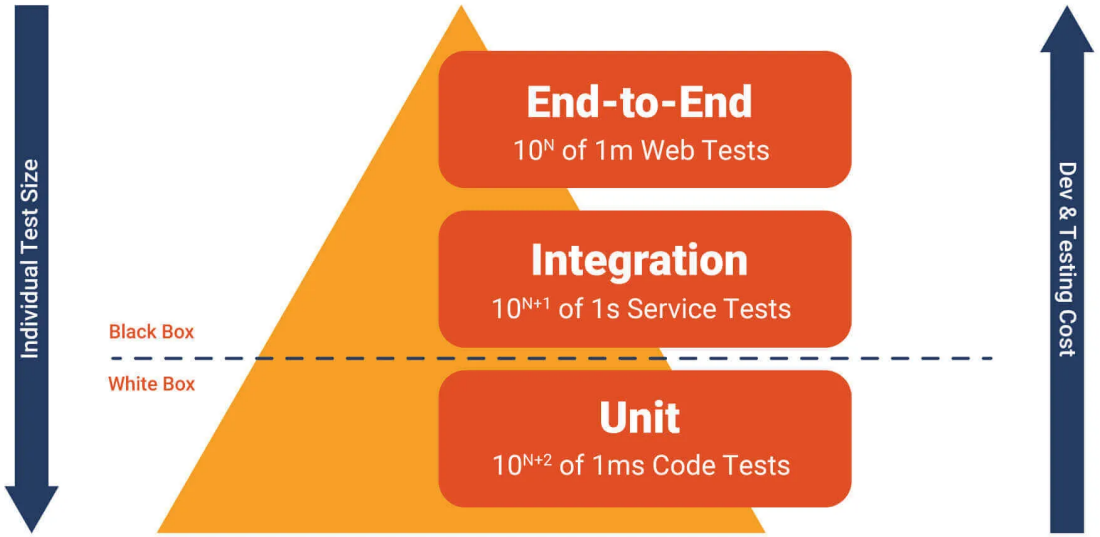
In the implementation phase it is important that the Product Owner follows each step of the implementation in order to guarantee that requirements are being fulfilled correctly.

Regarding the implementation itself, first it is needed to deploy MainDBMS and NotificationDBMS (as they are external applications), after that the implementation can start.
The approaches for implementation are Bottom-up and Thread.
Some components are independent of others, so they are possible to implement using the Thread approach.
–Spiegare Thread–
For the Bottom-up it is possible to implement a few parts of the system in order to reduce the complexity.
–Bottom-up–
Order of services implementation (In the same level it is possible using Thread):

1) ExecutorService, AnalysisService, BadgeService, AuthenticationService, NotificationService;
2) UserService, TournamentService + BattleService, CalculateScoreService;
3) ClientApplication.

5.2 - Test Plan

The approach that will be followed for writing tests is the famous pyramidal approach, where there are many unit tests followed by fewer integration tests and, lastly, only a very small amount of E2E tests.



5.2.1 - Functional Testing (Unit + Integration)

First, the CKB system will be tested by using the properly written unit tests for each module. These tests aim to show the exactness and soundness of the codebase at the level of singular functions, by mocking every dependency. These tests are very short and their execution should be as fast as possible, in order to let the developer iterate quickly without waiting for unit tests to execute.

The next step will be integration testing. These tests span across multiple components, are longer and slower compared to unit tests, and aim to show that components are communicating correctly (following the correct format of inputs and outputs) and no unexpected errors are being thrown.

5.2.2 - End to End Testing (E2E)

The last type of tests to be implemented are End to End tests (E2E), which aim to test end user interactions with the entire system through the UI (Client Application component). These tests require the emulation of an entire browser environment and simulation of user interactions. As such, they are very slow and consume a lot of resources, so there must be a small number of them implemented. They show the correctness of entire application flows at once.

5.2.3 - MVP testing

Lastly, the MVP of the application will be tested by a small, selected group of schools interested in adopting the solution for their students. These tests will be performed

manually and will aim to identify possible sources of confusion in the UI/UX of the program, and solve them before releasing the final version of the product.

6 - Effort Spent

Group Member	Effort Spent (hours)
Nicolò Giallongo	Introduction: 3h Architectural Design: 6h User Interface Design: 1h Requirements Traceability: Implementation, Integration and Test Plan:
Giovanni Orciuolo	Introduction: 1h Architectural Design: 5h User Interface Design: 6h Requirements Traceability: Implementation, Integration and Test Plan: 1h
Giuseppe Vitello	Introduction: 1h Architectural Design: 6h User Interface Design: 1h Requirements Traceability: Implementation, Integration and Test Plan: 1h

7 - References

- Version Control System: GitHub (https://github.com)
- State diagrams made with: Mermaid (https://mermaid.js.org)
- Sequence diagrams made with: Mermaid (https://mermaid.js.org)
- Document written with: Google Documents (https://docs.google.com)