

COMP 3004 - Deliverable #3

System Architecture and Design

Brackit - Mobile Tournament Bracket Creation

Metadata

Team / App Name: Brackit

Team member names

Name	Student ID
Jaime Herzog	101009321
Suohong Liu	101002340
Xiyi Liu	101004577
Alex Trostanovsky	100984702

Contents

Architecture	2
1 Description	2
1.1 Functional & Non-Functional Requirements	2
2 Justification of Architectural Style Choices	2
2.1 Object-Oriented Architectural Style	2
2.2 Client-Server Architectural Style	3
3 Architectural Diagrams	4
Design	5
1 Description and Rationalization	5
2 Design Patterns	5
Design Diagrams	6

Architecture

1 Description

1.1 Functional & Non-Functional Requirements

In developing **Brackit**, we set out to address an urgent need by tournament organizers and attendants to visualize, manage, and interact with double elimination brackets on their mobile devices. At a high level, we committed to developing a product that will meet the following **functional requirements**:

1. Tournament Organizers (TO's) can create, host, maintain, and visualize double elimination brackets.
2. Registered **Brackit** Users, as well as Guests, can use the application to join created tournaments.
3. **Brackit** will store and maintain user profiles that will describe users' history:
 - Matches won/lost
 - Tournaments entered/created

In terms of **non-functional requirements**, we believed **Brackit** should be *usable* on mobile devices. **Brackit** users should be able to:

- View and access all components (Brackets, Rounds, Matches) of a tournament on an Android device.
- Seamlessly enter tournament competitors to brackets on an Android device.

Conceptually, **Brackit** needed to support the creation and maintenance of the following *components*:

- *Tournament*: The highest level of abstraction utilized in Bracket creation. A tournament acts a *container* for brackets. **Brackit** supports double-elimination tournaments, where competitors cease to be eligible to win the tournament after losing two matches [1].
- *Bracket*: Given the number of entrants and their corresponding seeds (ranks), Double elimination brackets dictate competitor matchups and the progression of competitors through the Winners and Losers brackets. Brackets contain a dynamic list of Rounds.
- *Round*: Rounds contain a dynamic list of Matches.
- *Match*: Matches pair the strongest and weakest (according to rank) players in a Round.

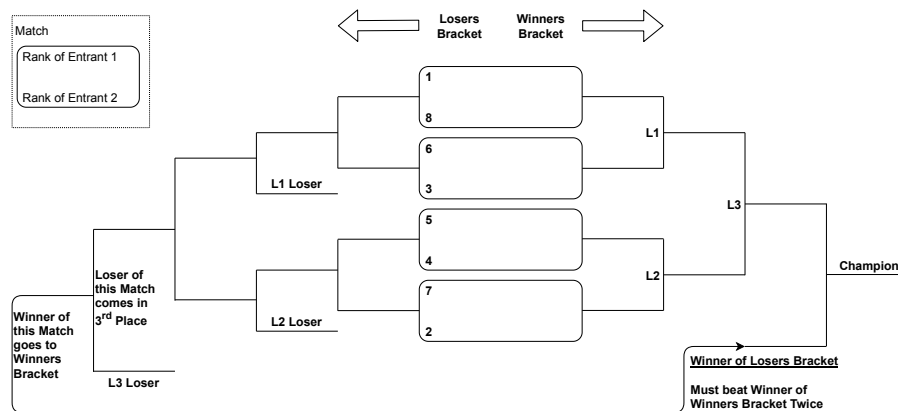
2 Justification of Architectural Style Choices

2.1 Object-Oriented Architectural Style

As described above, a Double Elimination Tournament mobile management application must maintain a set of well-defined entities (i.e. a Tournaments, Brackets, Rounds, and Matches) with predetermined relationships. For example, given n competitors, a correct double elimination tournament will contain $\lceil \lg n \rceil$ rounds in the Winners bracket and $\lceil \lg n \rceil + \lceil \lg \lg n \rceil$ rounds in the Losers bracket. In addition, the progression of competitors can be calculated at the creation of a tournament, and handling this progression follows a deterministic approach (e.g. The winner of Match 1 of Round 1 in the Winners Bracket will always progress to Match 1 Round 2 in the Winners Bracket - see Figure 1 for an illustrative example).

Therefore, to encourage an efficient decomposition of the algorithm and entities associated with Double Elimination Tournament creation, we decided to model the architecture of **Brackit** using an **Object-Oriented** (OO) architecture. Specifically, we chose to model each of the components of our application as objects. This allowed us to encapsulate the expected behaviour of each of the tournament objects while maintain a valid separation of concerns. To further explicate the validity of the choice of an OO architecture for **Brackit** consider the dynamic nature of Tournament creation.

A tournament bracket acts as a container for rounds, which themselves act as containers for matches. To handle the progression of a competition, the data associated with each match (i.e. which competitor won or lost) should be self contained within the match object instantiation, but also must be accessible through attributes of that object. Therefore defining the Match construct as an object allows the definition of self-contained class methods and attributes that achieve these intended behaviours.



2.2 Client-Server Architectural Style

Nam dui ligula, fringilla a, euismod sodales, sollicitudin vel, wisi. Morbi auctor lorem non justo. Nam lacus libero, pretium at, lobortis vitae, ultricies et, tellus. Donec aliquet, tortor sed accumsan bibendum, erat ligula aliquet magna, vitae ornare odio metus a mi. Morbi ac orci et nisl hendrerit mollis. Suspendisse ut massa. Cras nec ante. Pellentesque a nulla. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Aliquam tincidunt urna. Nulla ullamcorper vestibulum turpis. Pellentesque cursus luctus mauris.

Nulla malesuada porttitor diam. Donec felis erat, congue non, volutpat at, tincidunt tristique, libero. Vivamus viverra fermentum felis. Donec nonummy pellentesque ante. Phasellus adipiscing semper elit. Proin fermentum massa ac quam. Sed diam turpis, molestie vitae, placerat a, molestie nec, leo. Maecenas lacinia. Nam ipsum ligula, eleifend at, accumsan nec, suscipit a, ipsum. Morbi blandit ligula feugiat magna. Nunc eleifend consequat lorem. Sed lacinia nulla vitae enim. Pellentesque tincidunt purus vel magna. Integer non enim. Praesent euismod nunc eu purus. Donec bibendum quam in tellus. Nullam cursus pulvinar lectus. Donec et mi. Nam vulputate metus eu enim. Vestibulum pellentesque felis eu massa.

Quisque ullamcorper placerat ipsum. Cras nibh. Morbi vel justo vitae lacus tincidunt ultrices. Lorem ipsum dolor sit amet, consectetur adipiscing elit. In hac habitasse platea dictumst. Integer tempus convallis augue. Etiam facilisis. Nunc elementum fermentum wisi. Aenean placerat. Ut imperdiet, enim sed gravida sollicitudin, felis odio placerat quam, ac pulvinar elit purus eget enim. Nunc vitae tortor. Proin tempus nibh sit amet nisl. Vivamus quis tortor vitae risus porta vehicula.

3 Architectural Diagrams

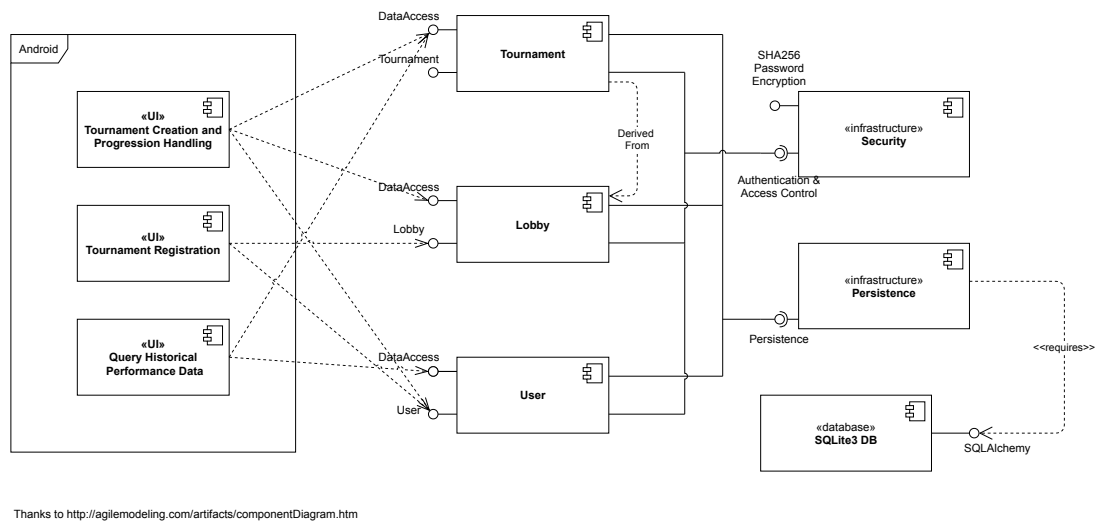


Figure 2: Brackit - UML 2 Architectural Component Diagram

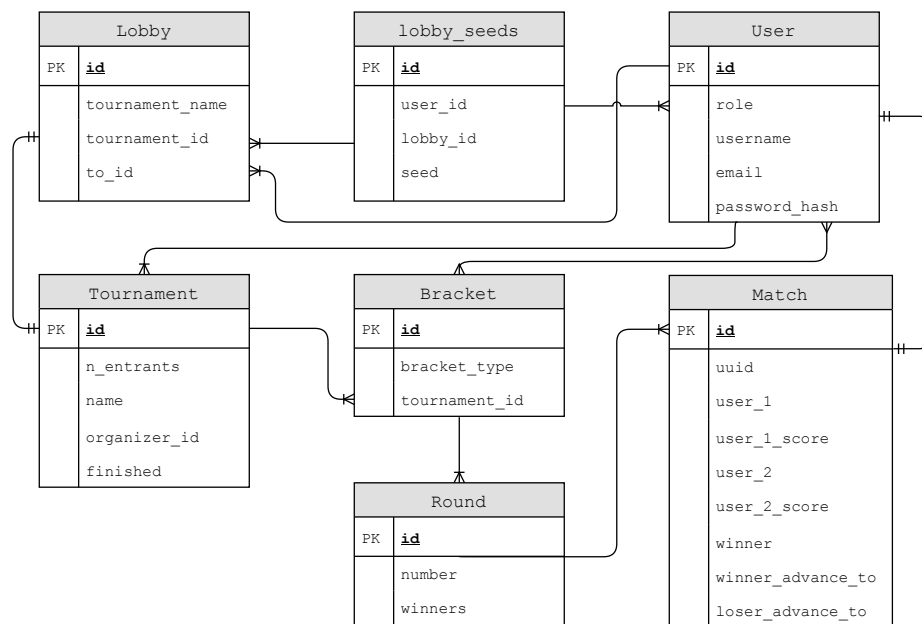


Figure 3: Brackit - Entity Relationship (ER) Diagram

Design

1 Description and Rationalization

The Bracket backend was designed primarily to marry extensibility with the correctness of our relatively complex domain. The main challenge of the backend's design is the creation of correct brackets, as well as the maintenance of brackets as they progress to completion.

When we create a Tournament, we create a tournament object in the backend, which itself creates the bracket. Depending on the bracket type, it creates the appropriate number of rounds, with each round having its appropriate number of matches. This is handled automatically because the number of rounds is deterministic to the number of entrants and the type of bracket. See the discussion on the justification of the object-oriented architecture. So far, we only have the double elimination bracket type implemented, but this can be expanded easily by just adding additional cases in the Bracket constructor. An alternative approach would be to create an abstract Bracket class with each bracket type as an implementation of the abstract Bracket class. This may allow for code that is easier to read and iterate on, and would be worth the time spent refactoring if this project were to be expanded on.

A specific implementation challenge is handling how each match knows who is the entrant which is playing in said match. This is called progression - for matches in the initial rounds, this is trivial as the entrants are simply placed into the matches when the Tournament is instantiated, but as the tournament progresses,

Our backend uses the Flask python package to expose our bracket and user information to the frontend, as well as SQLAlchemy to manage our information in the database. SQLAlchemy has a Model package which models our objects in the table, and provides the interface from which we interact with our database at runtime. We model each class in our class diagram in models.py, which creates tables for each class and defines the table relationships in an object oriented style. This allows us to query the database itself easily and safely when the APIs are invoked, enabling easy retrieval of the specific object being requested. Additionally, these models allow for easy sql querying for user data, such as users cross-tournament wins and losses.

2 Design Patterns

1. Facade Pattern

The Facade pattern intends to provide a unified interface to a set of interfaces in a subsystem. For our backend, the API endpoints contained in the routes.py constitute our Facade, as each endpoint provides a centralized and easy to use endpoint which the user can access and which invokes all necessary interfaces to execute the necessary code in the backend.

This pattern facilitates a single way in which frontend clients can access backend data, as well as centralizes all exposed endpoints on the server side, allowing for ease of extensibility.

2. Singleton Pattern

The Singleton pattern intends to ensure a class has only one instance, and to allow global access to that class. The Flask app object leverages the Singleton pattern in its design, as it is instantiated only once when the server is started, and is accessed globally throughout the backend.

The justification for the use of the Singleton pattern for the app object is because the app class itself, when instantiated, is the representation of the Flask server instance at compile time, and is how we modify and customize our server, i.e. specifying the database schema, or specifying the API endpoints. Additionally, ensuring the app is only instantiated once maintains consistency throughout the session, as multiple apps could potentially create multiple duplicate endpoints, which would create unintentional behaviour such as method invocation duplication.

Design Diagrams

Thanks to <http://agilemodeling.com/artifacts/classDiagram.htm#CompositionAssociations>

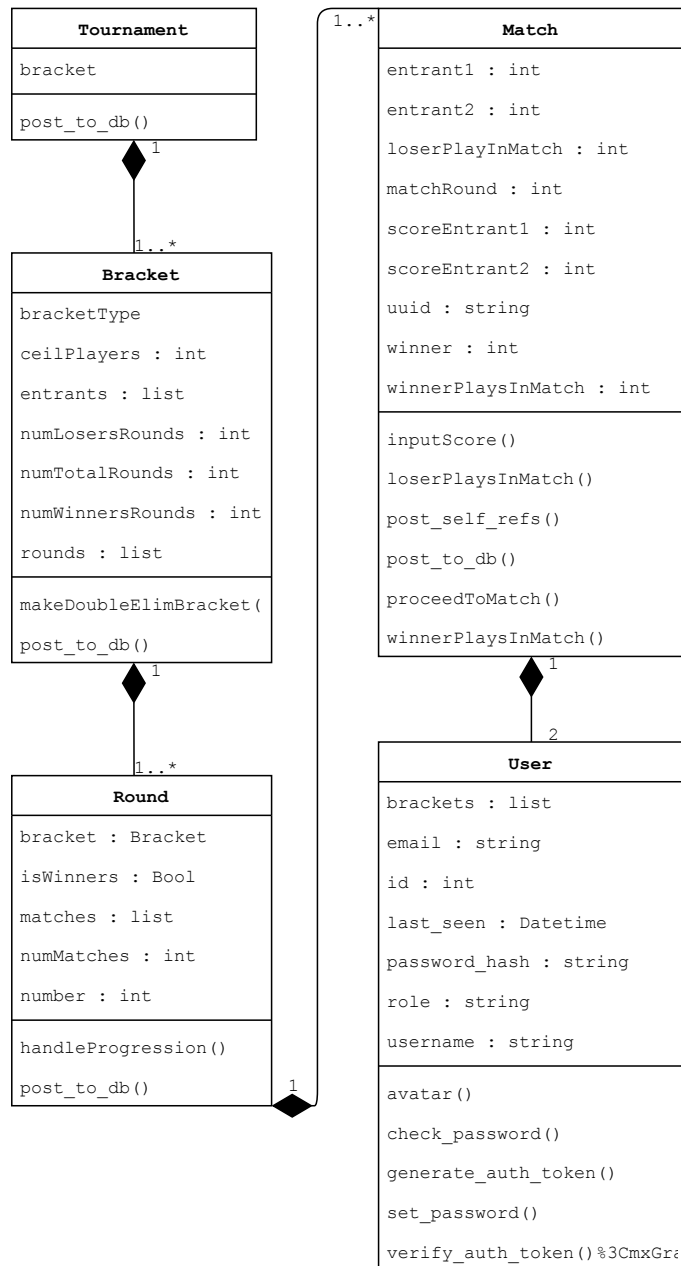


Figure 4: Brackit - UML Class Diagram

iiiiii HEAD

References

- [1] Wikipedia. Double-elimination tournament — Wikipedia, the free encyclopedia, 6-October-2019. [Online; accessed 14-March-2020].
- [2] candied-orange ([https://softwareengineering.stackexchange.com/users/131624/candied orange](https://softwareengineering.stackexchange.com/users/131624/candied%20orange)). Tournament bracket algorithm. Software Engineering. [Online; accessed 14-March-2020].

===== llllllll 5729d6b0fb7c257026188ea6a2dffa5f5bd4eabe