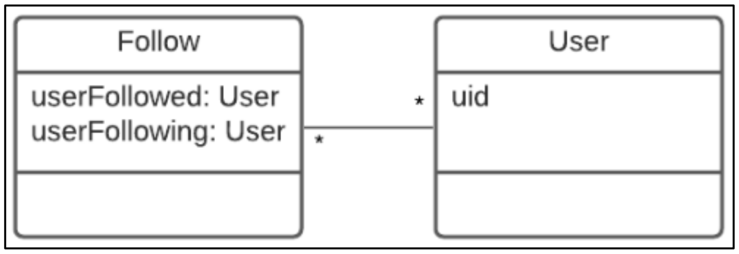
Cesar Guerrero | CS5500 | 10/20/22

DESIGN PHASE

Follows

Use Case	Method /resource/path	Request	Response Body
User follows another user	**POST** /users/:uid/follows/:other-uid	User's PK and PK of the user they want to follow	New Follows JSON
User unfollows another user	**DELETE** /users/:uid/follows/:other-uid	User's PK and PK of the user they want to unfollow	Delete Status
User views a list of other users they are following	**GET** /users/:uid/follower	User's PK	JSON array filled only with follows where the user is the value for **userFollowing**
User views a list of other users that are following them	**GET** /users/:uid/following	User's PK	JSON array filled only with follows where the user is the value for **userFollowed**
Delete all follows associated with a given user	**DELETE** /users/:uid/follows	User's PK	JSON array filled with Delete Statuses for all of the follows that were deleted
User ranks a follow relationship (e.g. Myspace Top Friends)	**PUT** /follows/:fid	Follows PK, Follows JSON in Body	Update Status



The table above was created based on the class diagram to the right. The class diagram describes the relationship between a Follow and a User as a **many to many** relationship. A user can **follow** an infinite amount of people and a user can in turn be **followed** by an infinite amount of people. Given this, let's walk through the RESTful web services we have devised.

Starting with the first use case, given that we are saying that this relationship is **many to many**, in order for a follow to be created, we need to make a **POST** request and we need the primary key for each user. When the record is created, we now have a direct reference to each user which is a good thing! If a change ever occurs to the Follow, we will already have the primary for each user so we can quickly access and update both users accordingly. Now once the Follow is created a JSON of that new Follow record should be returned so that the information within that new record can be used for other tasks as necessary.

Some of the same rationale above applies to the next use case which is the deletion of a follow relationship. If a user decides that they no longer want to follow someone, we will be making a **DELETE** request, but we will still need the primary key for both users. In this case we use the primary key of the user doing the unfollowing to filter through all follows records and then we use the primary key of the user being unfollowed to find the exact follow relationship within the filtered data to delete. Once the deletion occurs, we should return a status update as to whether the unfollow was successful or not.

The next two use cases, viewing all users you follow and viewing all users who follow you, are **GET** requests and they both rely on the primary key for a given user. The user's primary key will allow us to filter through all of the follows data and find only follows records that the user is associated with. Now after this initial filter is when each of the use cases differs. If a user wants to see who they follow, then, as the class diagram denotes, we need to find the follows records where the user is listed as **userFollowing**. On the other hand, if a user wants to see who is following them then we need to find the follows records where the user is listed as **userFollowed**. In both cases the response from the server should be a JSON array filled with the appropriate Follows records.

Our next use case would never be used by a user but would be very helpful for an administrator. In the event that a user account had to be deleted, it would be extremely helpful to remove every Follows record that the user was associated with. To do this we would need to make a **DELETE** request and provide the primary key for a given user. When the request is made the primary key will allow the data to be filtered appropriately. Once all the records were found we could thus delete all of them and return an array of the status of each deletion so that the administrator could verify that allow Follows records were appropriately deleted.

Finally, the last use case is a callback to the days of Myspace. On that social media site, a user could, for better or worse, rank their friends. Thus, if we wanted to implement that feature in our system and allow a user to rank the people that follow them, we would need to make a **PUT** request to the database, and we would need both their primary key as well as a new Follow JSON to update our record. Since we already have a method for finding all the people who follow a given user, we would already have pre-filtered data and would thus just need to know what record we were altering. Once changes to the Follows record occurred, the system should return a status update so that the user knew their change was successful.

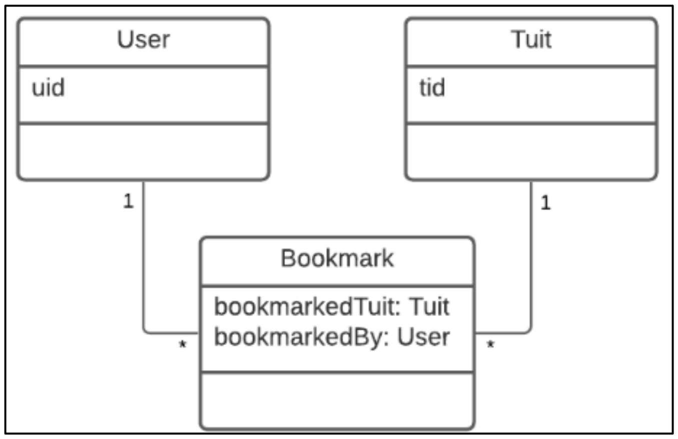
Bookmarks

Use Case	**Method /resource/path**	**Request**	**Response Body**
User bookmarks a Tuit	**POST** /users/:uid/bookmarks/:tid	Users PK and Tuits PK	New Bookmarks JSON
User unbookmarks a Tuit	**DELETE** /users/:uid/bookmarks/:tid	Users PK and Tuits PK	Delete Status
User views a list of Tuits they have bookmarked	**GET** /users/:uid/bookmarks	Users PK	JSON array containing all Bookmarks that the user has created
Get all bookmarks	**GET** /bookmarks	No information needed	JSON array containing all Bookmarks ever created
Update a specific bookmark	**PUT** /bookmarks/:bid	Bookmarks PK, Bookmark JSON in body	Update Status

Following the analysis for the Follows RESTful API, we move right along to the Bookmarks RESTful API. The table above was created using the class diagram shown below. The class diagram shows that Bookmarks are associated with both Users and Tuits. When a bookmark is created it references both the Tuit that was bookmarked as well as the User that bookmarked said Tuit. Additionally, the cardinality shows that a user can have many bookmarks and a Tuit can be bookmarked by many users. Given these ideas, let's walk through the use cases.

Cesar Guerrero | CS5500 | 10/20/22

In the first use case, we are covering how a bookmark is created. First off since we are creating a new record, we know this is a **POST** request. Now, following the class diagram we know that in order to make a Bookmark record we will need a reference to the User and the Tuit. This is accomplished by including the primary key for each resource in the request. Once the request is made, we should, as a result, receive a JSON of the new record so that the information within that new record can be used for other tasks as necessary.



The next use case is deleting a bookmark and since we are removing data, this is a **DELETE** request. Similar to the creation of a bookmark, we are interacting with both the User and Tuit resources so in order to complete our request we need to provide the respective primary keys for each resource. When the deletion request is made having access to the primary keys for each resource allows us to update everything accordingly. As a response to the request, we should simply receive a status update regarding the success of the deletion.

To accomplish the use case of a user viewing all their bookmarks, we will need to perform a **GET** request. Within that request we will also have to include the primary key for the user in question. The database will have a record of all the bookmarks ever created and in order to get the bookmarks pertaining that user we will need to use their primary key to filter accordingly. As a response this request, we should expect to receive a JSON of Bookmarks associated with our user.

For this next use case, we would only ever expect an administrator to use it. To get all of the bookmarks ever created we would need to make a **GET** request, but we would not need to include anything else in our request. This request would ping the database and as a response we should expect to receive a JSON array containing every bookmark record that the database had on file. This request would be very useful for things like data analysis or migration.

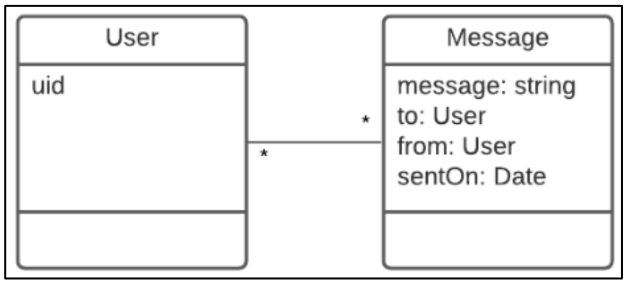
Finally, the last use case would again only really be useful for an administrator. In the event that a specific bookmark record needed to be updated we would need to make a **PUT** request. In that request we would need the primary key as well as a Bookmark JSON to update the bookmark. Unlike earlier use cases, we do not need to include the User primary key or Tuit primary key seeing as how we are only updating the record as opposed to trying to delete it or create a new one. The use case for something like this would be maybe incorporating new “quality of life” information into the bookmark in which case again we need only use the primary key of the bookmark itself. As a direct result of this request, we should expect to receive a status update from the system regarding the changes.

Messages

Use Case	**Method /resource/path**	**Request**	**Response Body**
User sends a message to another user	**POST** users/:uid/messages/:other-uid	Users PK and Primary key of another user, Message JSON in Body	New Message JSON
User views a list of messages they have sent	**GET** users/:uid/messages/sent	Users PK	JSON array filled only with Messages where the user is the value for **from**

User views a list of messages sent to them	**GET** users/:uid/messages/received	Users PK	JSON array filled only with Messages where the user is the value for **to**
User deletes a message	**DELETE** /messages/:mid	Messages PK	Delete Status
User edits a message	**PUT** /messages/:mid	Message PK, Message JSON in Body	Update Status
Get all messages	**GET** /messages	No information needed	JSON array containing all Messages ever created

For our final resource, you will again find that the table above was created based on the class diagram to the right. The relationship between a Message and a User is described as a **many to many**. A User can both receive and send an infinite number of Messages.



For the first use case, we are interested in a user sending a message to another user. Since the message does not yet exist, we will need to perform a **POST** request. Additionally, within that request we will need to include the primary key for the user sending the message, the primary key of the user they are sending a message to, and the actual message you want to send in the body of the request. Assuming the request is successful, the response should be a JSON of the new Message. As with all the other POST requests, having a copy of the created record will help with any housekeeping that the application will need to do.

Now the next two use cases, viewing all Messages a user has sent and viewing all Messages a user has received, will both require a **GET** request. These use cases both involve simply fetching information, but to fetch the correct information we will need to include the primary key for the user in question. The primary key let's us filter through all Messages data and find only the Messages associated with our user. Once those are found, this is where our use cases require different final steps. For the case where a user wants to see Messages they have sent, the system's final filter should be to look for only the Messages where the **from** field is pointing to our user in question. On the other hand, to find the Messages that the use has received, the system's final filter should be to look for only Messages where the **to** field is pointing to our user. Finally in both cases, our expected response should be a JSON array filled with only the appropriately filtered Messages records.

The use case of deleting a Message requires a **DELETE** request. Now there are a few ways to go about deleting a message. For the path we could first filter on the given user then filter on what message they want to delete (sent or received), but that seems a little convoluted. Chances are that if a user is deleting a message, they are doing so from a screen where they already have the messages associated with them, be it sent and/or received. Given that idea, to delete a given message all we need to include is the primary key for the Message. With that in hand we can make our request and the expected response should be a status update on the success of the deletion.

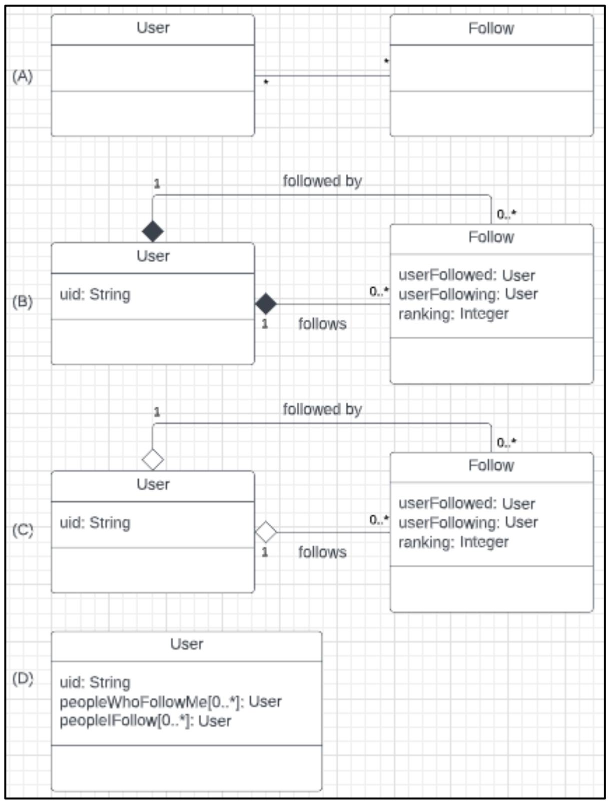
The use case of editing a Message follows the same idea as our previous use case. If a user wishes to edit a Message, that will involve a **PUT** request. We will need the primary key and a Message JSON to update the

Message they wish to edit. Once the request is fulfilled, we should expect to receive a status update in the response.

Similar to a few of the other use cases we have covered, this final use case would only be used by an administrator. Retrieving all the messages ever created on the site would involve a **GET** request and because we want all of them, we don't need to provide any additional information with our request. The given request would find all the Messages stored in the database and we should expect a JSON array containing all of the Messages records.

Implementation PHASE

Follows
For the Follows resource, I came up with the following class diagrams to demonstrate different ways to implement our relationship. Recall that we are trying to relate the idea of users being able to follow and/or be followed by other users.



As you can imagine, **option (A)** is the base option and while it is not useful for implementation, it is useful to just serve as a reminder of the many-to-many relationship we are trying to define.

Options (B) and **(C)** are both very similar in that we have replaced our many-to-many relationship with (2) 1-to-many relationships. This change helps define our relationship a little better as well as allows for the use of this idea in both Relational and Non-Relational Databases. Now as you can see in both cases the Follow resource contains references to (2) different User objects and clearly outlines who is doing the following and who is being followed. This distinction will make filtering through all of the potential Follow resources much easier in the future.

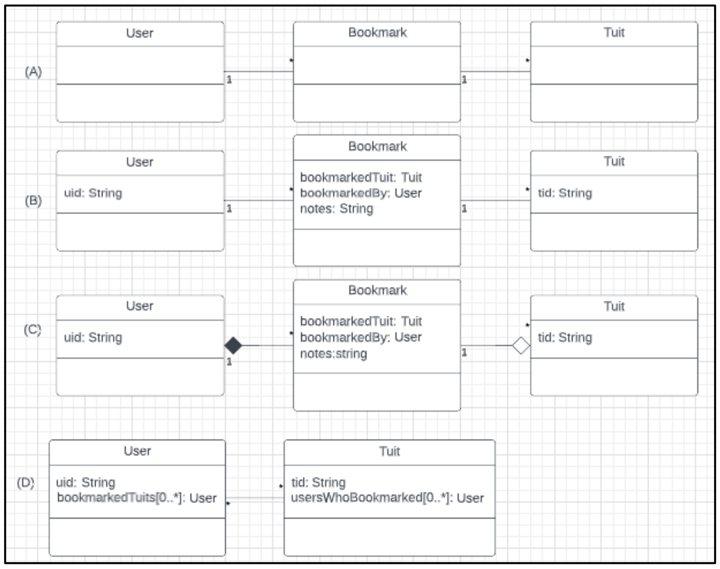
Now these options differ in how they relate a User to a Follow. In **option (B)** we have a composition which means that if one of the Users is deleted, the entire Follow should be deleted. On the other hand, **option (C)** is an aggregation which means that even if one of the Users is deleted, the Follow will still remain. Both options have merit and choosing one of these over the other would come down to what your end goal is.

Finally, **Option (D)** foregoes this idea of even creating a Follow resource to begin with. Instead of creating a new resource, since a follow record just has references to other users, why not just store the references to those users within the User Object itself. Now while this idea is feasible in a Non-Relational Database, we must remember that in a Relational Database this cannot be implemented as arrays are not allowed. Now even though the option is feasible, keeping track of all of the arrays would be a nightmare. If a User followed or unfollowed another user you have to update multiple arrays. Furthermore, what if we wanted to document when the follow occurred? This idea would slowly start falling apart.

Taking everything into account, for our purposes **option (B)** makes the most sense. We want the Follow object to hold all of the references as it makes documenting all of the following/unfollowing easier. Additionally, the reason that we chose **option (B)** over **option (C)** is that if you delete your account, you should absolutely delete all the Follows associated with you. If you don't then Users could potentially claim that they have millions of followers only for the reality to be that none of those accounts even exist.

Bookmarks

For the Bookmarks resource, I came up with the following class diagrams to demonstrate different ways to implement our relationship. Recall that we are trying to relate the idea of a User bookmarking a Tuit so they can easily view that Tuit again later.



Again **option (A)** is the base option and while it is not useful for implementation, it is useful to just serve as a reminder of what we are trying to define. Using a mapping table (Bookmark), we say that a user can have an infinite amount of bookmarks and a Tuit can be bookmarked an infinite amount of times.

The next two options, **option (B)** and **option (C)**, add more more details into the relationship. For these options we want to store a reference to both the Tuit and the User within the Bookmark record itself. Having a reference to both means we can traverse to the other resource as needed and update the Bookmark quickly and efficiently. Since these options contain multiple 1-to-many relationships we can also implement this idea in any type of database, which is always a good thing. Now **option (C)** goes even more into detail and defines the relationship between the User and Bookmark as a composition, and it defines the relationship between the Bookmark and Tuit as an aggregation. These small details are important as it controls what happens when objects are deleted.

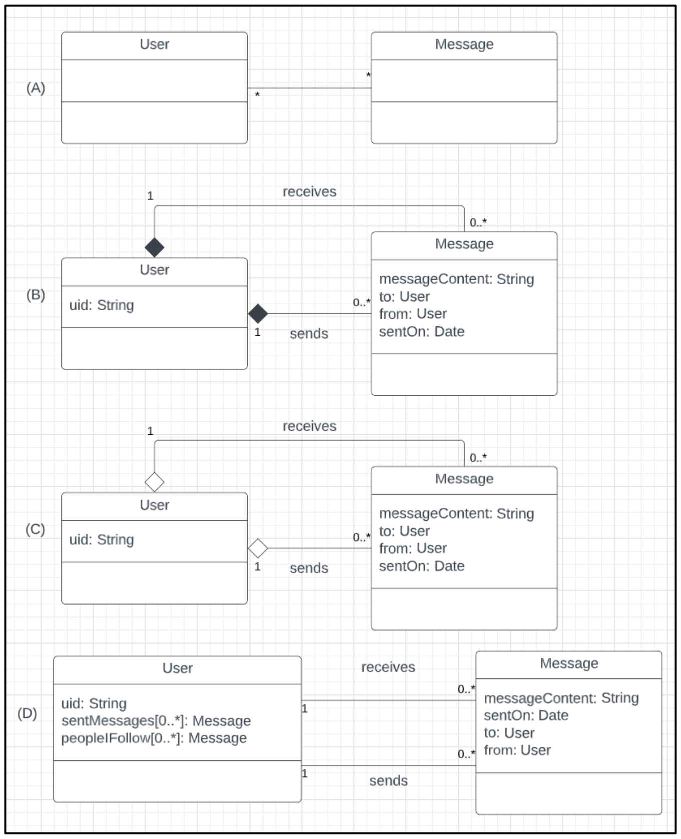
Finally, **Option (D)** foregoes implementing Bookmark as a mapping resource. Rather than store references in a Bookmark resource, this idea focuses on storing Tuits that a User has bookmarked in an array within the User and storing Users who have bookmarked a Tuit in an array within the Tuit. This idea reduces the number of resources we need to create, but it does require keeping the arrays in sync which is not a trivial task.

All things considered, for our purposes we chose **option (C)**. Using a mapping table is more versatile, and it is easier to maintain when the alternative is to use different arrays. Having both reference IDs stored in the same place makes everything easier and if we wanted to add more information to the Bookmark resource, we would not need to change other resources. Finally, it is important to point out that we chose **option (C)** over **option (B)** because including ideas such composition and aggregation will help prevent issues down the line.

Cesar Guerrero | CS5500 | 10/20/22

Messages

For the Messages resource, you will find the various class diagrams on the right. Recall that we are trying to relate the idea of a User messaging another User. As you can imagine, **option (A)** is the base option and while it is not useful for implementation, it is useful to just serve as a reminder of the many-to-many relationship we are trying to define between Users and Messages.



Options (B) and **(C)** are both very similar in that we have replaced our many-to-many relationship with (2) 1-to-many relationships. This change helps define our relationship a little better as well as allows for the use of this idea in both Relational and Non-Relational Databases. Now as you can see in both cases the Message resource contains references to (2) different User objects and clearly outlines who is sending the message and who is receiving it. Furthermore, the Message also takes care to note the message string as well as the date when the message was sent. Like the Follows resource, housing the references to the Users and defining who is doing what will make future filtering easier.

As was the case in the Follows resource, we again have two options that differ in how they are defining the composition/aggregation of the relationship. In **option (B)** we have a composition which means that if one of the Users is deleted, the entire Message should be deleted. On the other hand, **option (C)** is an aggregation which means that even if one of the Users is deleted, the Message will remain. Both options have merit, but in the case of something like sending/receiving a Message, the answer should be obvious as to which should be implemented.

Finally, **Option (D)** again changes our relationship to (2) 1-to-many relationships, but unlike B and C, we also add in array storage. As you can see, in addition to storing User references in the Message, we can potentially store sent/received Message objects within the User object themselves. This added functionality doesn't help our case as we now have to deal with keep everything in sync.

For the Messages resource we decided to go with **option (C)**. Unlike the Follow resource, when implementing Messages, you want to have an **aggregation** as opposed to a **composition.** If someone sends an inappropriate message, we don't want to allow that user to delete the message nor delete their account to try and get rid of the message. Furthermore, we choose **option (C)** as we generally want to store resources in their own objects so we can keep things centralized and add new functionality without breaking everything else.