IFSC 3360: System Analysis and Design

Final Project Report

The Facebook System

By

Brenda Nyangweso
&
Rukshar Parwin

Introduction

Facebook is a popular and free social networking website where multiple registered users interact, upload images, create posts and statuses, and save personal information among other things. Users have the option of making some interactions and data, like posts, public while others can be kept private. Apart from giving users a platform to upload content, it also offers them opportunities to create events then send invites and even sell their properties (Rouse, 2014). However, the scope of this project will only focus on the basic functionalities of the site like posts and comments creation.

This project is simply an attempt to understand the back-end workings of the system that supports the Facebook site. It is a representation of how the Facebook system handles data flow in the seven use case scenarios, which also represent the processes, presented in this project. It breaks down the system into these seven processes and defines three key entities: the Facebook User, the Authentication Service and Other Facebook Users. The use case scenarios are defined as follows: Create Account, Login User, Create Post, Create Comment, Update Profile, Update Dashboard, and Send Friend Request. This project incorporates three main actors who represent the three entities.

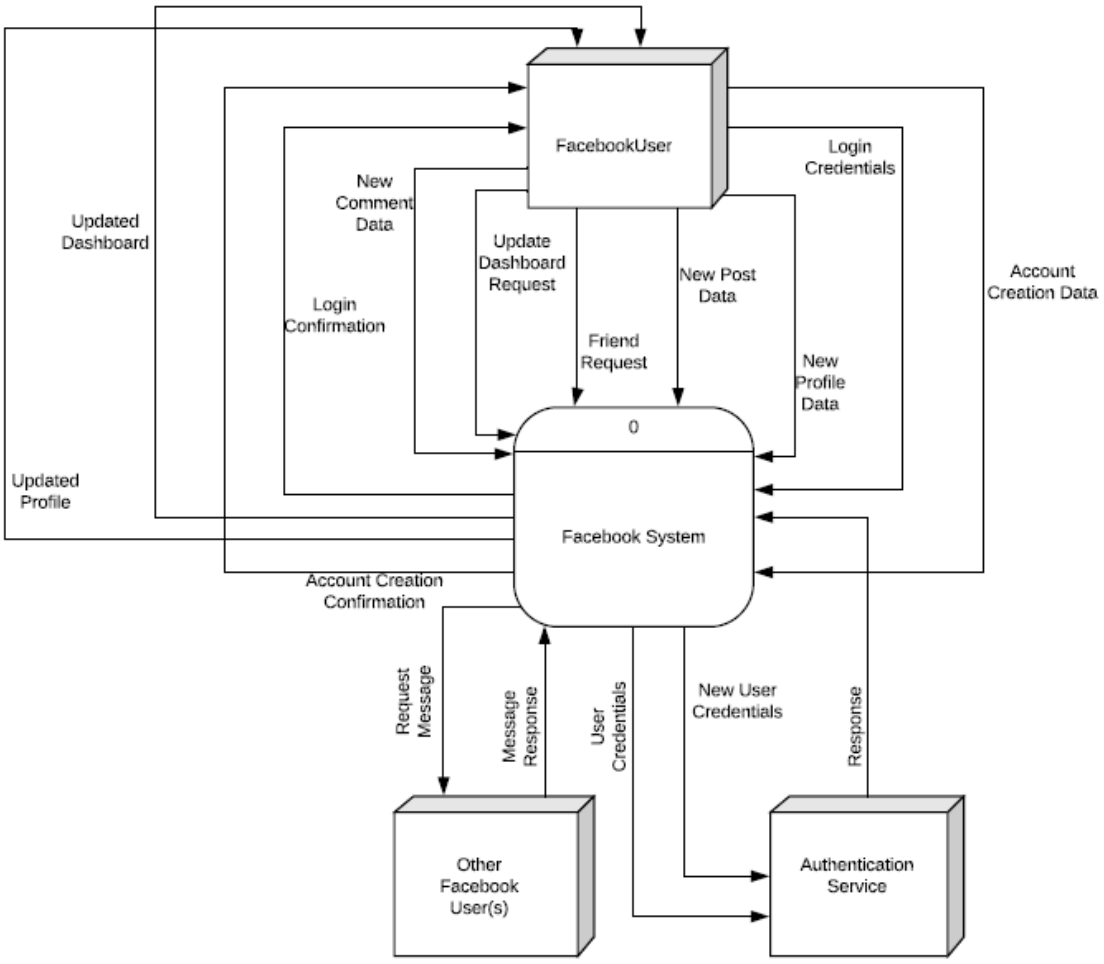
Through the diagrammatic representations of the system included in this report, a concise explanation of how the user sends requests and data to the system, and subsequent system responses is drawn. The system also uses basic error responses and condition-based loops to handle some user mistakes and internal system errors. This project aims to expose the relationships that exist between the system's processes and data stores, and with entities. It defines some system objects and the key parts they play to execute the different processes.

Ultimately, it details the data flow from the user's request to create an account to the user's friend request to other users through the system.

The system acts as a common interface of communication for the entities. It makes data flow between these entities more efficient compared to the alternative of having the entities communicating directly with one another. Without the system's processes the entities would have to access data from one another directly, with little to no assurance of security. Furthermore, it would mean compromising on speed of data access and performance. The system also provides a common and secured storage space for the user's data, with quick access to it when needed by authorized entities and processes. This makes it convenient for the user to simply authorize the system to allow the entities to access her data through processes, rather than providing the same amount of data to a new entity all over again. Also, without the system's support, some functionalities of the site would be non-existent and unnecessary like creating a private account or a profile.

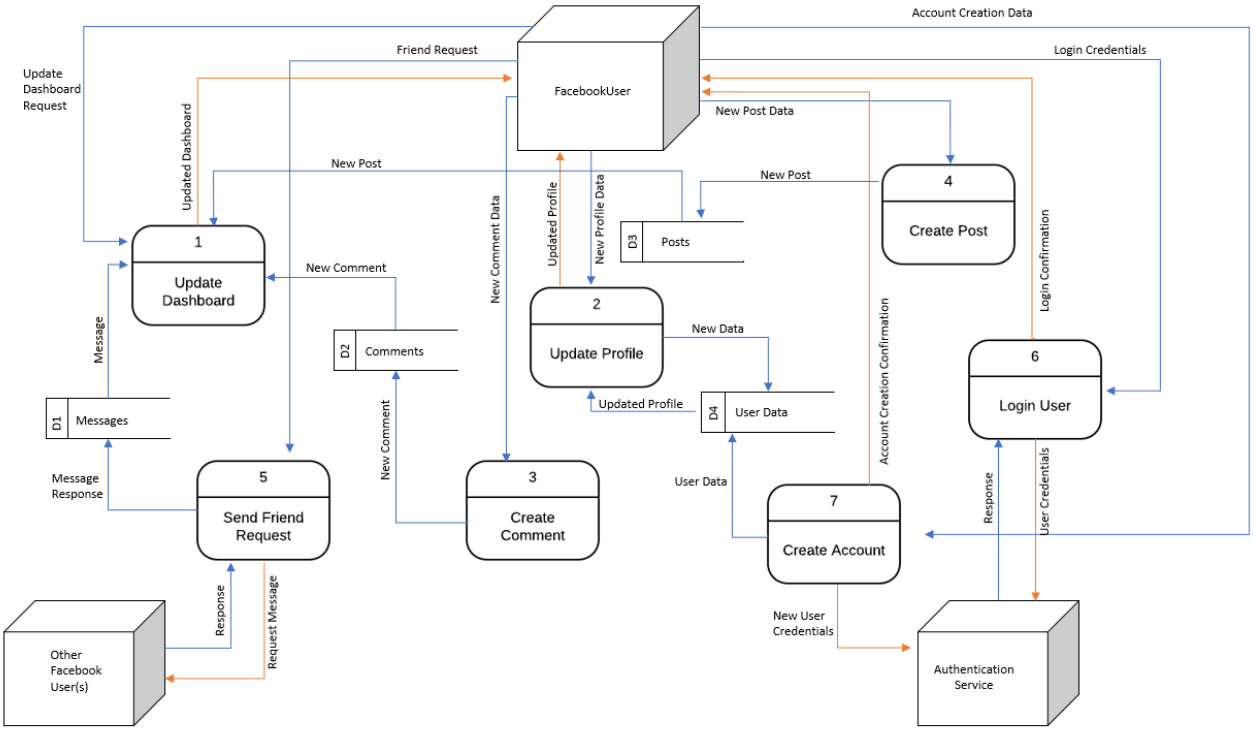
System Requirements Model

The Context Diagram:



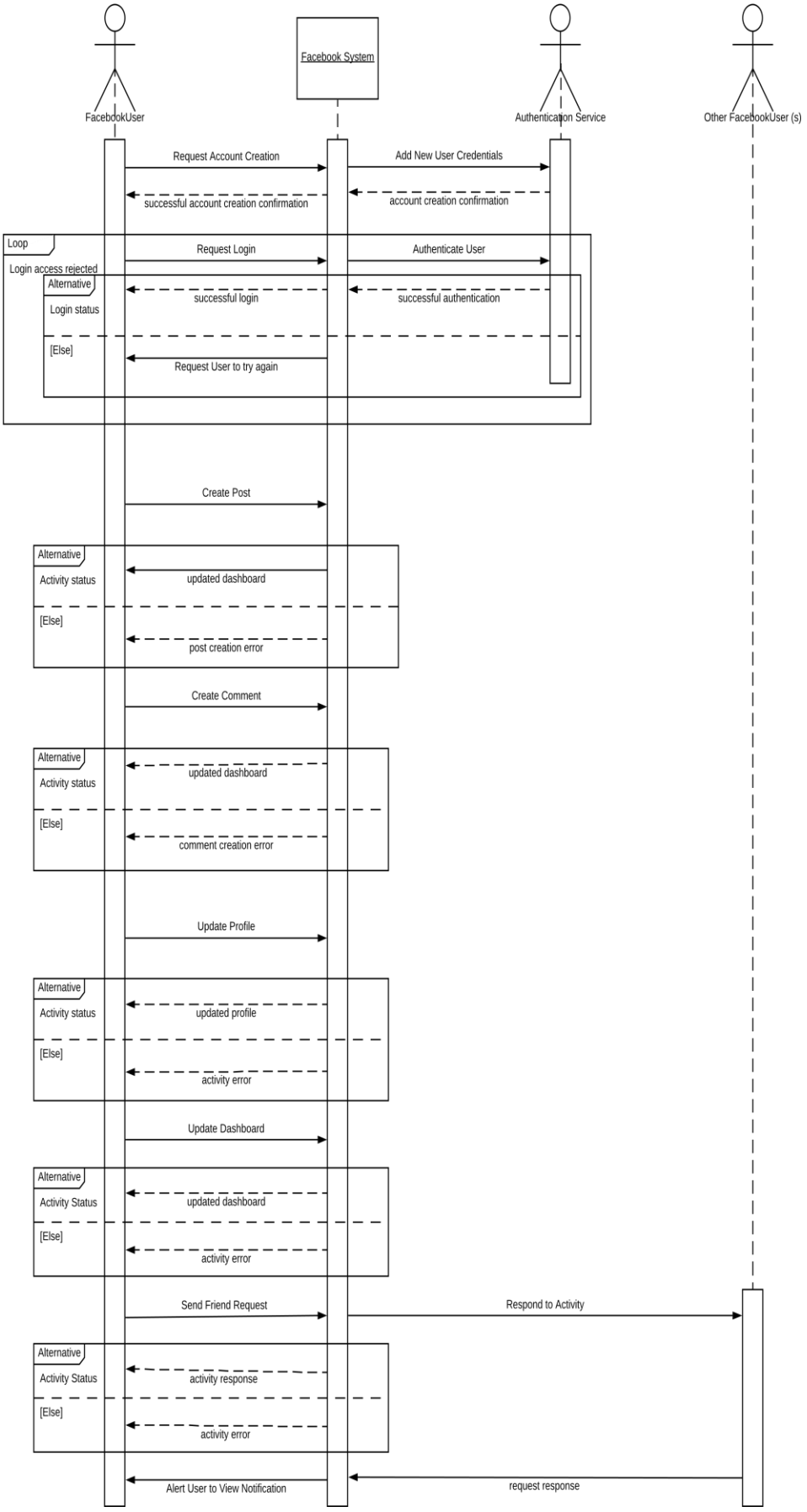
The context diagram briefly introduces the system and the data that is exchanged between the entities. The system is represented by one compound process at the center of the diagram and the arrows show the direction of the flow of the data.

The Data Flow Diagram (DFD) 0 diagram:



The DFD 0 diagram breaks down the compound central process into the seven distinct processes that handle the data from the entities. Each process is represented by a number, 1 – 7, that does not necessarily dictate the order of execution. This diagram introduces the 4 data stores: Posts, Comments, Messages, and User Data. They are numbered D1 to D4.

Data flow into and within the system is represented by blue colored arrows, while data flow out of the system is represented by orange colored arrows. The data that was represented in the context diagram is the same data that is being manipulated in this diagram. The difference is simply the expanded and more detailed view, in this DFD 0 diagram, of the process of its manipulation and its flow.


FacebookUser
Facebook System
Authentication Service
Other FacebookUser (s)
Request Account Creation
Add New User Credentials
successful account creation confirmation
account creation confirmation
Loop
Login access rejected
Request Login
Authenticate User
Alternative
Login status
successful login
successful authentication
[Else]
Request User to try again
Create Post
Alternative
Activity status
updated dashboard
[Else]
post creation error
Create Comment
Alternative
Activity status
updated dashboard
[Else]
comment creation error
Update Profile
Alternative
Activity status
updated profile
[Else]
activity error
Update Dashboard
Alternative
Activity Status
updated dashboard
[Else]
activity error
Send Friend Request
Respond to Activity
Alternative
Activity Status
activity response
[Else]
activity error
Alert User to View Notification
request response

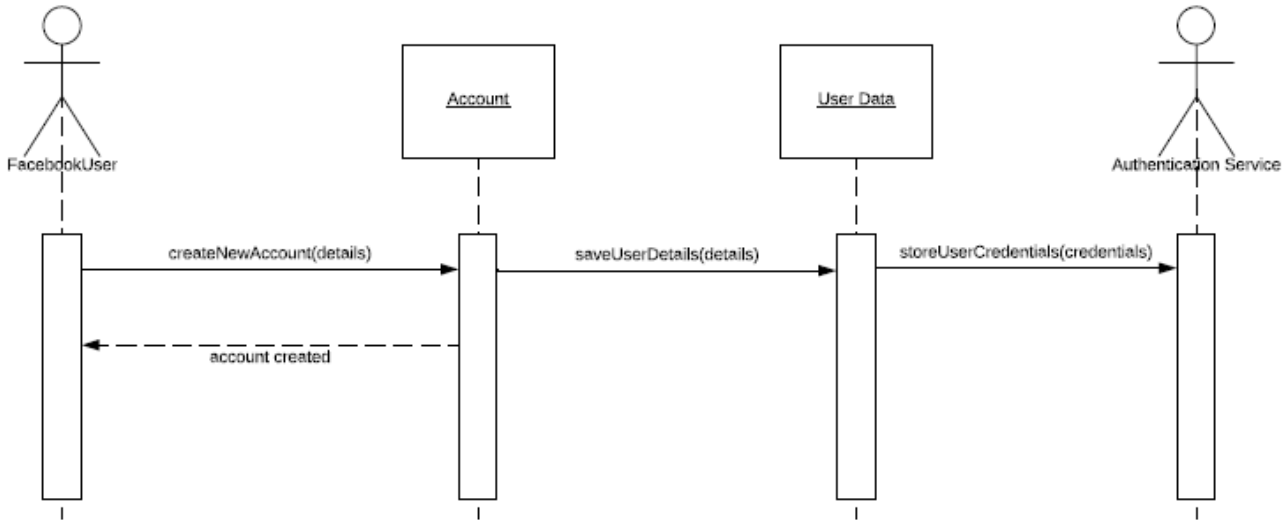
The System Sequence Diagram

The system sequence diagram shows the interaction of the entities with the system in terms of requests and responses. It also incorporates some loops to depict the system's basic error handling capabilities. It showcases all the seven use case scenarios and includes all the actors.

The Use Case Scenarios Sequence Diagrams

The following diagrams show the interactions of the actors and system at the use case level, which is slightly more detailed and tailored to each use case than the System Sequence diagram. These sequence diagrams are organized according to the use case scenarios that they represent and show the interaction between the actors and system objects that handle specific requests.

Create Account Sequence Diagram:

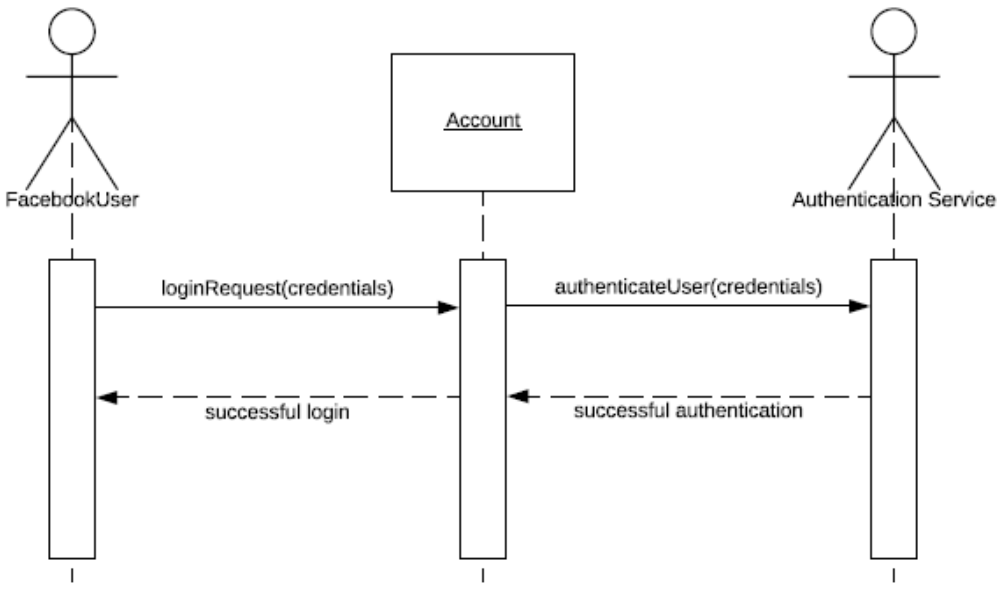


Here the user makes a request to the Facebook system to create a new account and provides the relevant details necessary to create that account.

The system creates the account, represented by the Account object, and initializes a data store, User Data object, to save the user's details. It then sends the user's credentials to the Authentication Service for future authentication for login requests.

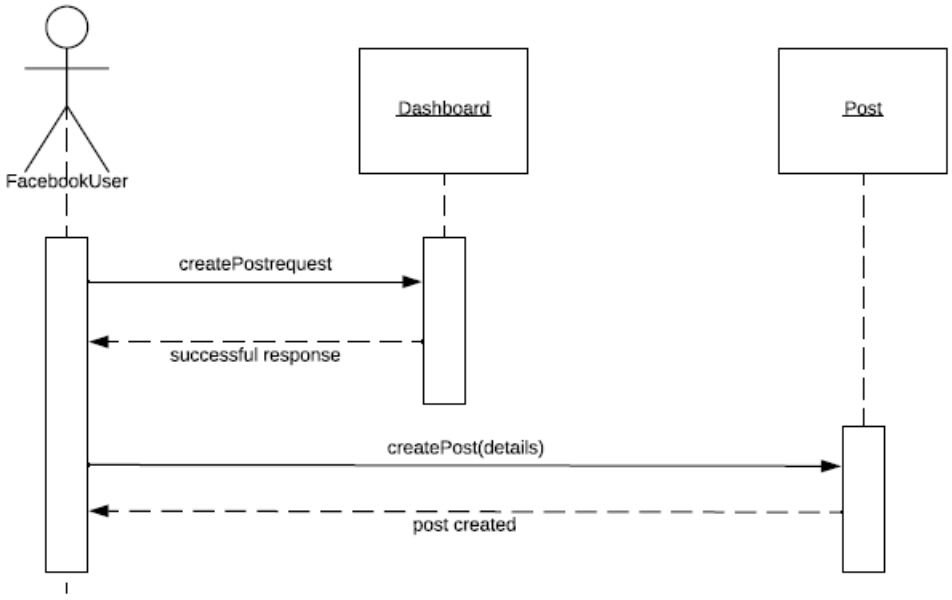
Login User Sequence Diagram:

When the user makes a request to the system to be logged into an account, she provides the credentials for that account. The system sends these credentials to the Authentication Service to be authenticated as a Facebook user. On receiving a successful authentication response from the service, the system grants the user access to the account.



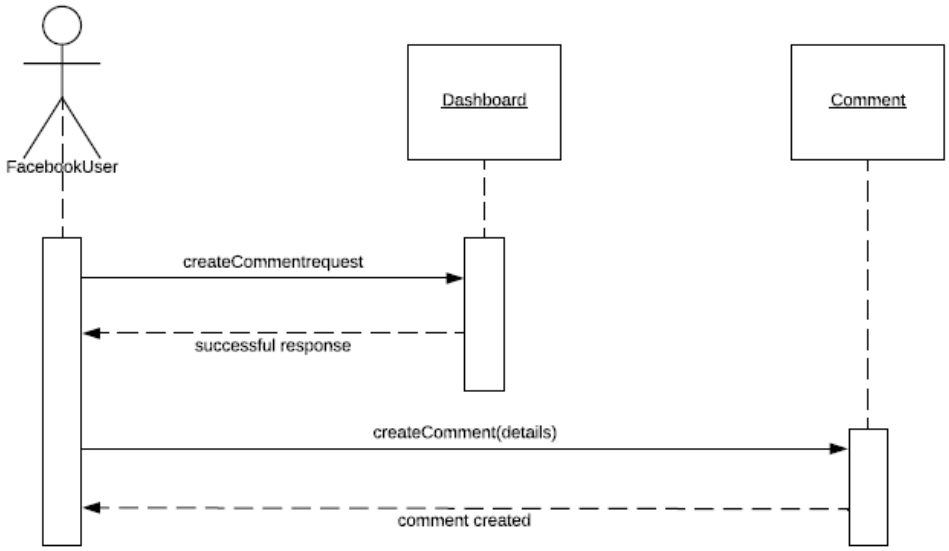
Create Post Sequence Diagram:

A user that is logged in has access to the account's dashboard where she can view statuses, notifications, posts, comments, and other data from other users as well. Through the dashboard, the user has a chance to create a post as well. The user submits the intention to create a post to the dashboard in a request by, perhaps, clicking a button. Once the system grants the request, the user provides the details that are relevant to the post she wants to create in a different request that initializes that post. After the post is created, the user gets a successful response and sees the post on the dashboard.

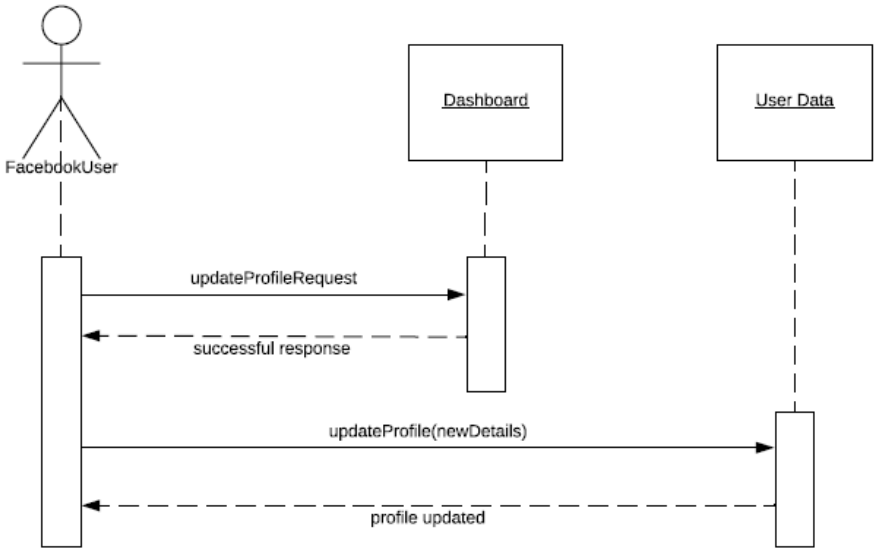


Create Comment Sequence Diagram:

Like the user's request to create a comment, the user submits the intention to comment on a post through a request on the dashboard. After the request is granted, the user provides the details for the comment she wants to create, and the comment is initialized. The user then gets a successful response and sees the comment on the dashboard.



Update Profile Sequence Diagram:

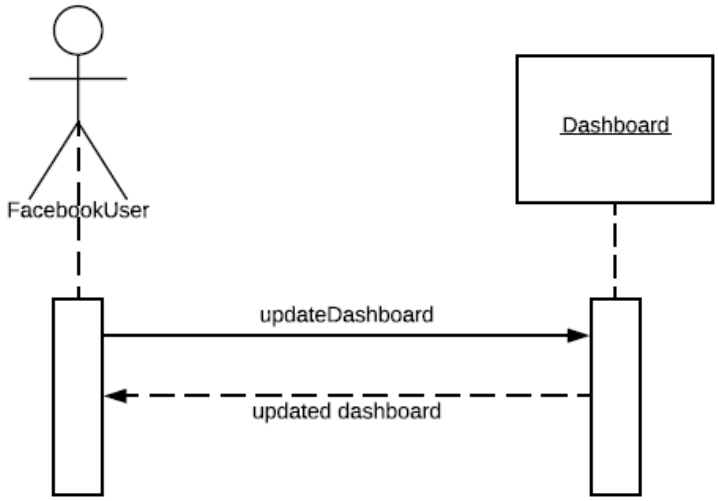


To make updates to the data about the user in the system, she submits a request through the dashboard. After a successful response through the dashboard, she provides the new data and

sends it in a request to the User Data object that was initialized with the account. Once the data has been successfully updated, a response is returned to the user, and the user's profile is updated with the new data.

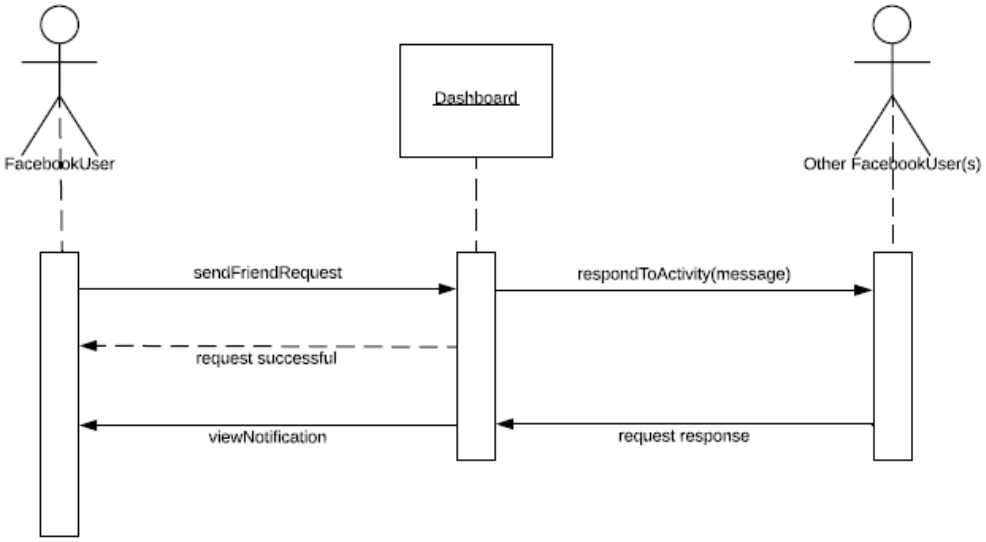
Update Dashboard Sequence Diagram:

For requests like changing the appearance of the dashboard, the user simply makes the specific request to the dashboard object, and a successful response from the system would be the updated dashboard.



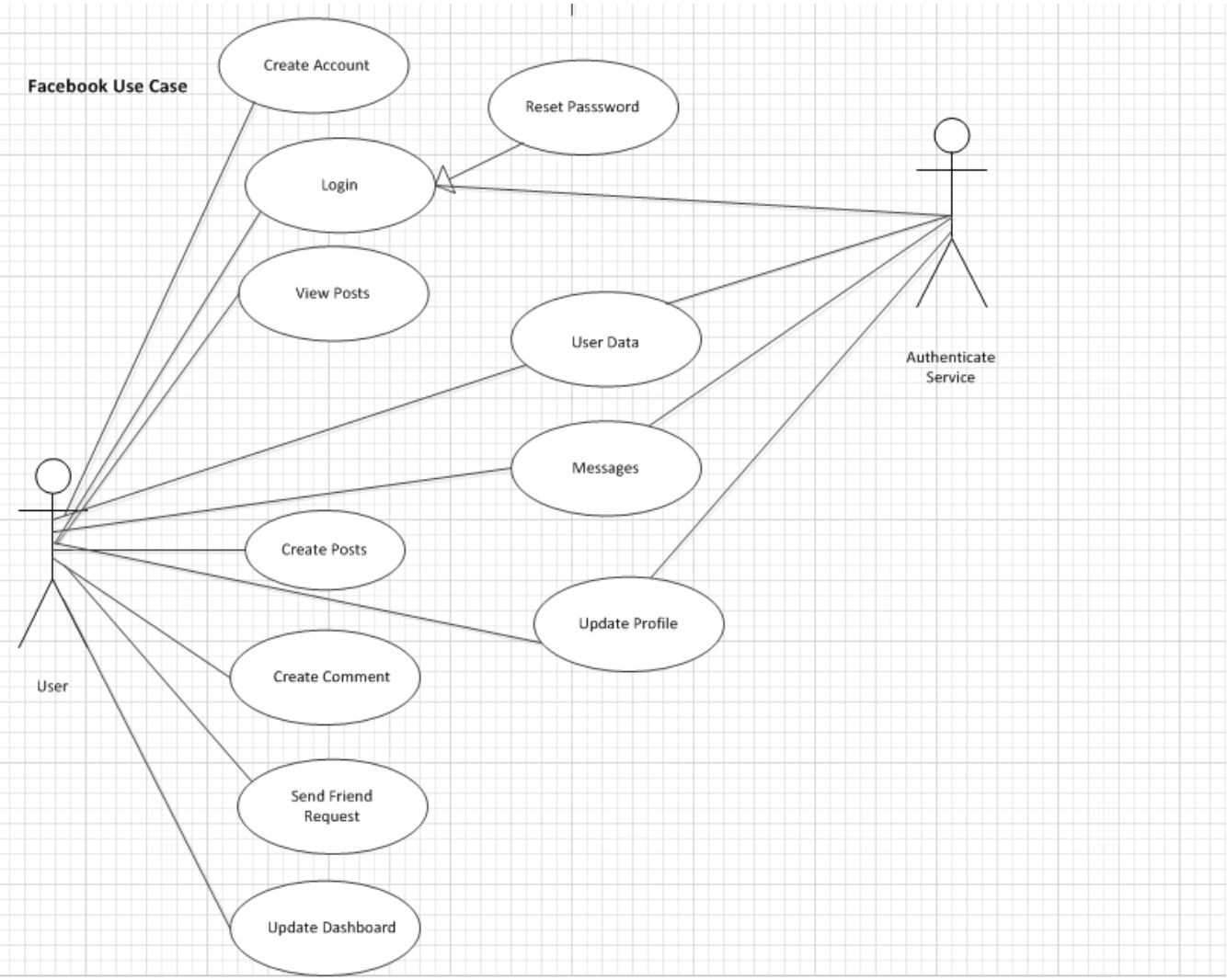
Send Friend Request Sequence Diagram:

When the user sends a friend request through the dashboard to a specific user, the system sends the potential friend a request for a response. Once this request is sent to the other user, the user who made the request gets a successful response from the system. When the other Facebook user finally responds to the request, the system creates a notification for the user depending on that response.



Use Case Diagram

A use case is a list of actions or event steps typically defining the interactions between an actor and a system to achieve a goal. Facebook is an enormous application with a lot of possibilities of different use cases. For this project, we worked on use cases as displayed in the Diagram below.



Create Account Use Case

Name: Create Account

Actor: Facebook User/Authentication Service

Description: Describes how a user creates an account in Facebook.

Successful Scenario:

- ✓ User provides username, password and required information like Name, Gender, date of birth etc. and submits them.
- ✓ Authentication Service validates the provided username is available to use and password meets the requirement and grants account creation.
- ✓ Facebook User account is created.

Alternative Scenario:

- ✓ Facebook User provides username and password and submits them.
  - Authentication Service denies due to incorrect username or password and asks the Facebook User to try again.
- ✓ Facebook User provides username and password and submits them.
  - Facebook User gets a server error message when the service is down and asked to try again later.

Precondition:

- ✓ Facebook User does not have an existing Facebook account.

Postcondition:

- ✓ Facebook User is redirected to the ‘Create Post’ Use Case to make a post on the dashboard.

Login Use Case

Name: Login

Actor: Facebook User/Authentication Service

Description: Describes how a user gains access to their Facebook dashboard to make a post.

Successful Scenario:

- ✓ Facebook User provides username and password and submits them.
- ✓ Authentication Service validates the provided username and password and grants access to the Facebook User's dashboard.
- ✓ Facebook User creates a post.

Alternative Scenario:

- ✓ Facebook User provides username and password and submits them.
  - Authentication Service denies access due to incorrect username or password and asks the Facebook User to try again.
- ✓ Facebook User provides username and password and submits them.
  - Facebook User gets a server error message when the service is down and asked to try again later.

Precondition:

- ✓ Facebook User should have an existing Facebook account.

Postcondition:

- ✓ Facebook User is redirected to the 'Create Post' Use Case to make a post on the dashboard.

Update Profile Use Case

Name: Update Profile

Actor: Facebook User/Authentication Service

Description: Describes how a user updates their Facebook profile.

Successful Scenario:

- ✓ Facebook User provides username and password and submits them.
- ✓ Authentication Service validates the provided username and password and grants access to the Facebook User's dashboard.
- ✓ Facebook User updates profile.

Alternative Scenario:

- ✓ Facebook User provides username and password and submits them.
  - Authentication Service denies access due to incorrect username or password and asks the Facebook User to try again.
- ✓ Facebook User provides username and password and submits them.
  - Facebook User gets a server error message when the service is down and asked to try again later.

Precondition:

- ✓ Facebook User should have an existing Facebook account.

Postcondition:

- ✓ Facebook User is redirected to the Profile updated message after the successful update.

View Post Use Case

Name: View Post

Actor: Facebook User/Authentication Service

Description: Describes how a user views a post in Facebook.

Successful Scenario:

- ✓ User provides username, password and submits them.
  a. Authentication Service validates the provided username and password and grants access to the Facebook User's dashboard.
- ✓ Facebook User views post.

Alternative Scenario:

- ✓ Facebook User provides username and password and submits them.
  - Authentication Service denies due to incorrect username or password and asks the Facebook User to try again.
- ✓ Facebook User provides username and password and submits them.
  - Facebook User gets a server error message when the service is down and asked to try again later.

Precondition:

- ✓ Facebook User should have an existing Facebook account.

Postcondition:

- ✓ Authentication Service updates User Log to record View Post Activity.

Create Post Use Case

Name: Create Post

Actor: Facebook User/Authentication Service

Description: Describes how a user creates a post in Facebook.

Successful Scenario:

- ✓ User provides username, password and submits them.

  b. Authentication Service validates the provided username and password and grants access to the Facebook User's dashboard.

- ✓ Facebook User creates post.

Alternative Scenario:

- ✓ Facebook User provides username and password and submits them.
  - Authentication Service denies due to incorrect username or password and asks the Facebook User to try again.
- ✓ Facebook User provides username and password and submits them.
  - Facebook User gets a server error message when the service is down and asked to try again later.

Precondition:

- ✓ Facebook User should have an existing Facebook account.

Postcondition:

- ✓ Authentication Service updates User Log, and the Created post appears in User Dashboard.

Create Comment Use Case

Name: Create Comment

Actor: Facebook User/Authentication Service

Description: Describes how a user creates a comment in Facebook.

Successful Scenario:

- ✓ User provides username, password and submits them.
  - c. Authentication Service validates the provided username and password and grants access to the Facebook User's dashboard.
- ✓ Facebook User creates comment.

Alternative Scenario:

- ✓ Facebook User provides username and password and submits them.
  - o Authentication Service denies due to incorrect username or password and asks the Facebook User to try again.
- ✓ Facebook User provides username and password and submits them.
  - o Facebook User gets a server error message when the service is down and asked to try again later.

Precondition:

- ✓ Facebook User should have an existing Facebook account.

Postcondition:

- ✓ Authentication Service updates User Log, and the Created comment appears in User Dashboard.

Send Friend Request Use Case

Name: Send Friend Request

Actor: Facebook User/Authentication Service

Description: Describes how a user sends friend request to another Facebook user.

Successful Scenario:

- ✓ Facebook User provides username and password and submits them.
- ✓ Authentication Service validates the provided username and password and grants access to the Facebook User's dashboard.
- ✓ Facebook User sends friend request to another User.

Alternative Scenario:

- ✓ Facebook User provides username and password and submits them.
  - Authentication Service denies access due to incorrect username or password and asks the Facebook User to try again.
- ✓ Facebook User provides username and password and submits them.
  - Facebook User gets a server error message when the service is down and asked to try again later.

Precondition:

- ✓ Facebook User should have an existing Facebook account.

Postcondition:

- ✓ Facebook User is redirected to the message 'Friend Request sent'.

Update Dashboard Use Case

Name: Update Dashboard

Actor: Facebook User/Authentication Service

Description: Describes how a user updates the Dashboard.

Successful Scenario:

- ✓ Facebook User provides username and password and submits them.
- ✓ Authentication Service validates the provided username and password and grants access to the Facebook User's dashboard.
- ✓ Facebook User updates dashboard by adding a comment, picture, video and creating a new post.

Alternative Scenario:

- ✓ Facebook User provides username and password and submits them.
  - Authentication Service denies access due to incorrect username or password and asks the Facebook User to try again.
- ✓ Facebook User provides username and password and submits them.
  - Facebook User gets a server error message when the service is down and asked to try again later.

Precondition:

- ✓ Facebook User should have an existing Facebook account.

Postcondition:

- ✓ Facebook User is redirected to the updated message after the successful update.

Message Use Case

Name: Messages

Actor: Facebook User/Authentication Service

Description: Describes how a user sends a Message.

Successful Scenario:

- ✓ Facebook User provides username and password and submits them.
- ✓ Authentication Service validates the provided username and password and grants access to the Facebook User's dashboard.
- ✓ Facebook User uses 'Send Message' functionality to create a message.
- ✓ Authenticate Service redirects the created message to recipient's message inbox.

Alternative Scenario:

- ✓ Facebook User provides username and password and submits them.
  - Authentication Service denies access due to incorrect username or password and asks the Facebook User to try again.
- ✓ Facebook User provides username and password and submits them.
  - Facebook User gets a server error message when the service is down and asked to try again later.

Precondition:

- ✓ Facebook User should have an existing Facebook account.

Postcondition:

- ✓ Facebook User is redirected to send message page after the successful message.

User Data Use Case

Name: User Data

Actor: Facebook User/Authentication Service

Description: Describes how a user data is stored.

Successful Scenario:

- ✓ Authentication Services logs in Facebook User Activity in User Data Section.
- ✓ This functionality is independent of User Actor. A log is created for each activity of Facebook and is stored as User Data profile.

Alternative Scenario:

- ✓ Facebook User provides username and password and submits them.
  - Authentication Service denies access due to incorrect username or password and asks the Facebook User to try again.
- ✓ Facebook User provides username and password and submits them.
  - Facebook User gets a server error message when the service is down and asked to try again later.

Precondition:

- ✓ Facebook User should have an existing Facebook account.

Class Diagram

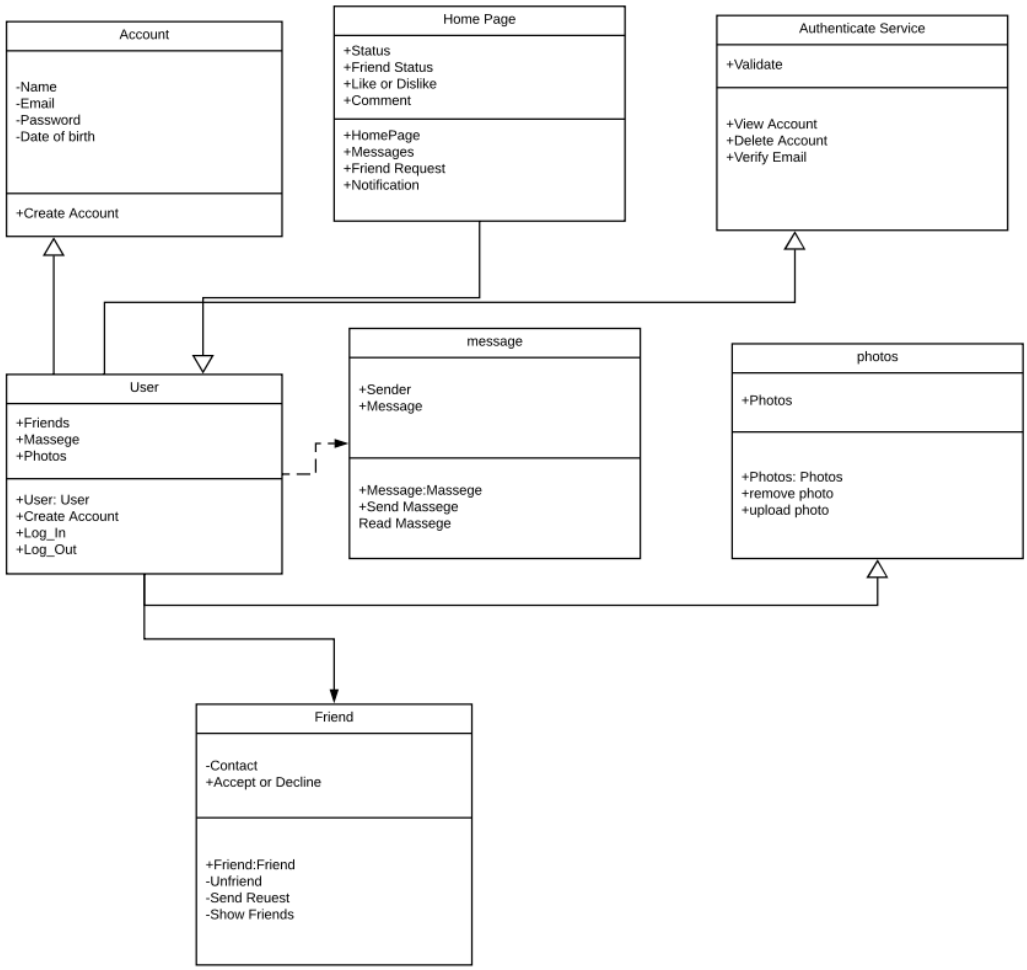
A class is a type of static structure diagram that describes the structure of a system by showing the system's classes, their attributes, operations (or methods), and the relationships among objects.

For this project, we covered Seven Class Diagram for Facebook that discusses Account, User, Friend, Home Page, Messages, Authenticate Services and Photos.

For the 7 Classes mentioned above, we have utilized Directed Association and Realization Association.

Directed Association refers to a directional relationship represented by a line with an arrowhead. The arrowhead depicts a container-contained directional flow.

Realization Association denotes the implementation of the functionality defined in one class by another class. To show the relationship in UML, a broken line with an unfilled solid arrowhead is drawn from the class that defines the functionality of the class that implements the function.



User and Account

- User and Account have Directed Association.
- Account Class stores User Information.
- The arrowhead indicates the container-contained relationship.
- Account Class is container.

User and Home Page

- User and Home Page have Directed Association.
- Here, Home Page stores User Information.
- The arrowhead indicates the container-contained relationship.

- Home Page class is container.

User and Friend

- User and Friend have Directed Association.
- User Class stores Friend Information.
- User will send Friend request, so the arrowhead is pointed to Friend class.

User and Home Page

- User and Message Class has realization relationship.
- In a realization relationship, one entity defines a set of functionalities.
- User will send messages, so the arrowhead is pointed to Message Class.

User and Photos

- User and Photos have Directed Association.
- Here, User Class stores Photo Information.
- The arrowhead indicates the container-contained relationship.
- User will upload/ delete photos, so the arrowhead is pointed to Photo Class.

User and Authenticate Services

- User and Authenticate Service have Directed Association.
- Authenticate Service Class stores User Information.
- The arrowhead indicates the container-contained relationship.
- Authenticate Service Class is container.

Lessons Learnt

Brenda Nyangweso:

If I could do the system analysis again, I would consider exploring other important and more detailed use case scenarios for the Facebook system like searching for people on Facebook or deleting posts. This is because we had some similarities between the execution of some use case scenarios like creating a post and creating a comment. While analyzing these scenarios helped us to save on time, it robbed us of the opportunity to think about completely different processes that might have broadened our understanding of the Facebook system. However, this analysis helped us paint a good picture of what might be going on in the back-end of the Facebook website.

Rukshar Parwin:

The project gave me an opportunity to explore and understand much different functionality that Facebook provides. As a user, I never thought of the functions behind the scene, so this project is an eye-opener to the complexities that involved with simple functions like uploading a Photo or sending a friend request. In my next opportunity for this kind of project, I plan to explore further and build something using the lessons learned from this project. If I have another chance to work on this, I would explore some complex Use Cases like ‘Friend Suggestion’ or ‘People you may know’ to understand its functionality.

Team Description

Project Contributions:

Brenda Nyangweso's:

- Creating the Data Flow Diagrams.
- Creating the Facebook System interaction diagrams.
- Partly in the preparation of the presentations.
- Partly in the writing of this report.

Rukshar Parwin's:

- Creating the Use Case Diagram.
- Creating Class diagrams.
- Partly in the preparation of the presentations.
- Partly in the writing of this report.

Bibliography

Rouse, M. (2014, August). *What is Facebook?* Retrieved November 18, 2018, from WhatIs: https://whatis.techtarget.com/definition/Facebook