

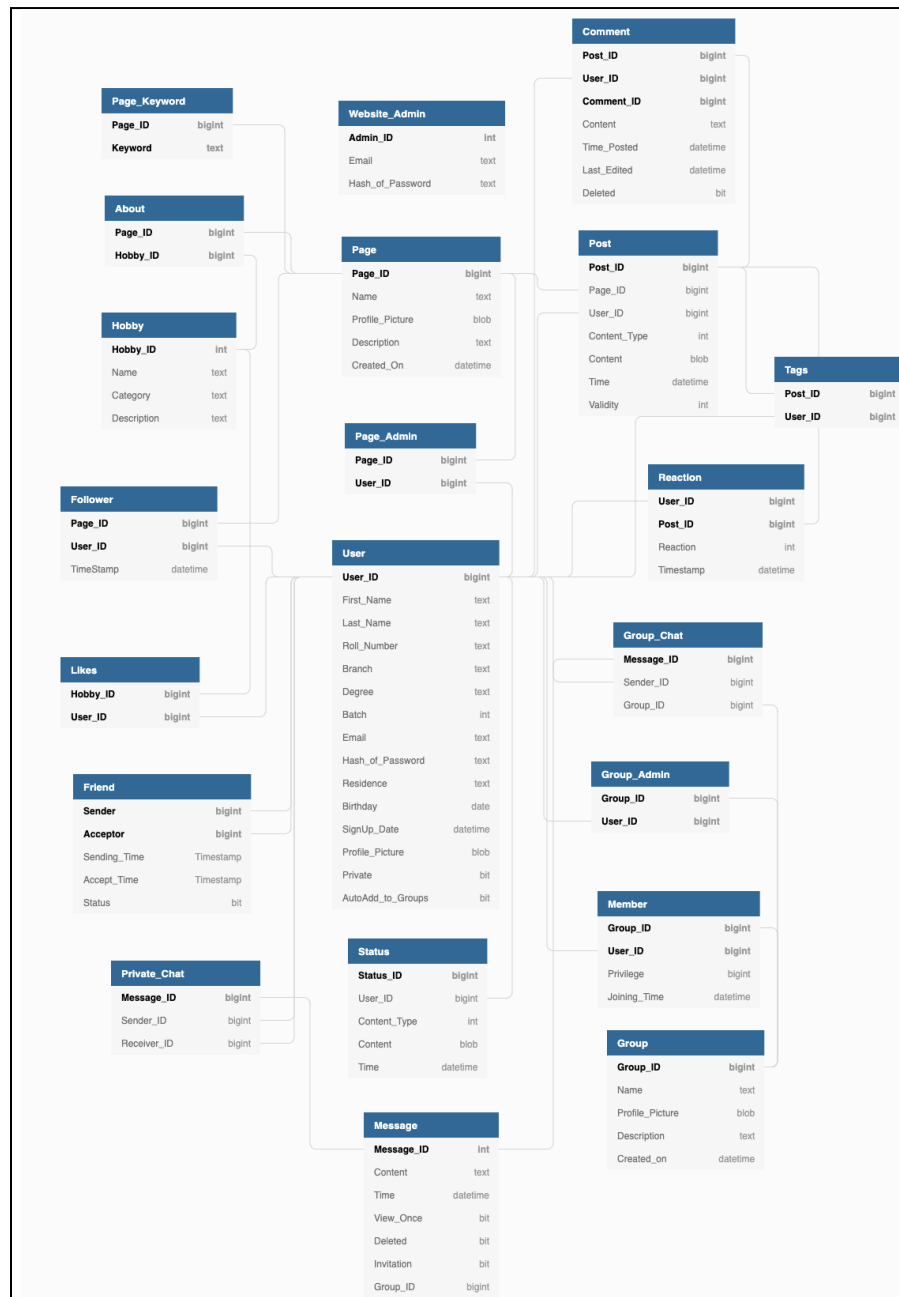
# Design Phase

## Team Details:

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## Part A: Logical Schema



## Part B: Integrity Constraints

| User             | Type     | PK Constraint | SK Constraint | Null Constraint   |
|------------------|----------|---------------|---------------|-------------------|
| User_ID          | bigint   | Yes           | -             | Not               |
| First_Name       | text     | -             | -             | Not               |
| Last_Name        | text     | -             | -             | Can, No Last Name |
| Roll_Number      | text     | -             | -             | Not               |
| Branch           | text     | -             | -             | Not               |
| Degree           | text     | -             | -             | Not               |
| Batch            | int      | -             | -             | Not               |
| Email            | text     | -             | -             | Not               |
| Hash_of_Password | text     | -             | -             | Not               |
| Residence        | text     | -             | -             | Can, Optional     |
| Birthday         | date     | -             | -             | Can, Optional     |
| SignUp_Date      | datetime | -             | -             | Not               |
| Profile_Picture  | blob     | -             | -             | Can, Optional     |
| Private          | bit      | -             | -             | Not               |
| AutoAdd_to_Group | bit      | -             | -             | Not               |

| Message             | Type     | PK Constraint | SK Constraint     | Null Constraint        |
|---------------------|----------|---------------|-------------------|------------------------|
| Message_ID          | bigint   | Yes           | -                 | Not                    |
| Content             | text     | -             | -                 | Not                    |
| Time                | datetime | -             | -                 | Not                    |
| View_Once           | bit      | -             | -                 | Not                    |
| Deleted             | bit      | -             | -                 | Not                    |
| Invitation          | bit      | -             | -                 | Can, May not be Invite |
| Invitation_Group_ID | bigint   | -             | To Group.Group_ID | Can, May not be Invite |

| Page_Keywords | Type   | PK Constraint | SK Constraint   | Null Constraint |
|---------------|--------|---------------|-----------------|-----------------|
| Page_ID       | bigint | Yes           | To Page.Page_ID | Not             |
| Keyword       | text   | -             | -               | Not             |

| Group           | Type     | PK Constraint | SK Constraint | Null Constraint |
|-----------------|----------|---------------|---------------|-----------------|
| Group_ID        | bigint   | Yes           | -             | Not             |
| Name            | text     | -             | -             | Not             |
| Profile_Picture | blob     | -             | -             | Can, Optional   |
| Description     | text     | -             | -             | Can, Optional   |
| Created_on      | datetime | -             | -             | Not             |

| Hobby       | Type   | PK Constraint | SK Constraint | Null Constraint |
|-------------|--------|---------------|---------------|-----------------|
| Hobby_ID    | bigint | Yes           | -             | Not             |
| Name        | text   | -             | -             | Not             |
| Category    | text   | -             | -             | Can, Optional   |
| Description | text   | -             | -             | Can, Optional   |

| Post         | Type     | PK Constraint | SK Constraint   | Null Constraint       |
|--------------|----------|---------------|-----------------|-----------------------|
| Post_ID      | bigint   | Yes           | -               | Not                   |
| Page_ID      | bigint   | -             | To Page.Page_ID | Can, Could be By User |
| User_ID      | bigint   | -             | To User.User_ID | Can, Could be By Page |
| Content_Type | text     | -             | -               | Not                   |
| Content      | blob     | -             | -               | Not                   |
| Time         | datetime | -             | -               | Not                   |
| Validity     | int      | -             | -               | Not                   |

| Page            | Type     | PK Constraint | SK Constraint | Null Constraint |
|-----------------|----------|---------------|---------------|-----------------|
| Page_ID         | bigint   | Yes           | -             | Not             |
| Name            | text     | -             | -             | Not             |
| Profile_Picture | blob     | -             | -             | Can, Optional   |
| Description     | text     | -             | -             | Can, Optional   |
| Created_On      | datetime | -             | -             | Not             |

| Status       | Type     | PK Constraint | SK Constraint   | Null Constraint |
|--------------|----------|---------------|-----------------|-----------------|
| Status_ID    | bigint   | Yes           | -               | Not             |
| User_ID      | bigint   | -             | To User.User_ID | Not             |
| Content_Type | int      | -             | -               | Not             |
| Content      | blob     | -             | -               | Not             |
| Time         | datetime | -             | -               | Not             |

| Website_Admin    | Type   | PK Constraint | SK Constraint | Null Constraint |
|------------------|--------|---------------|---------------|-----------------|
| Admin_ID         | bigint | Yes           | -             | Not             |
| Email            | text   | -             | -             | Not             |
| Hash_of_Password | text   | -             | -             | Not             |

| About    | Type   | PK Constraint | SK Constraint     | Null Constraint |
|----------|--------|---------------|-------------------|-----------------|
| Page_ID  | bigint | Yes           | To Page.Page_ID   | Not             |
| Hobby_ID | bigint | Yes           | To Hobby.Hobby_ID | Not             |

| Tags    | Type   | PK Constraint | SK Constraint   | Null Constraint |
|---------|--------|---------------|-----------------|-----------------|
| Post_ID | bigint | Yes           | To Post.Post_ID | Not             |
| User_ID | bigint | Yes           | To User.User_ID | Not             |

| Follower | Type      | PK Constraint | SK Constraint   | Null Constraint |
|----------|-----------|---------------|-----------------|-----------------|
| Page_ID  | bigint    | Yes           | To Page.Page_ID | Not             |
| User_ID  | bigint    | Yes           | To User.User_ID | Not             |
| Time     | timestamp | -             | -               | Not             |

| Reaction | Type      | PK Constraint | SK Constraint   | Null Constraint |
|----------|-----------|---------------|-----------------|-----------------|
| Post_ID  | bigint    | Yes           | To Post.Post_ID | Not             |
| User_ID  | bigint    | Yes           | To User.User_ID | Not             |
| Reaction | int       | -             | -               | Not             |
| Time     | timestamp | -             | -               | Not             |

| Comment     | Type     | PK Constraint | SK Constraint   | Null Constraint |
|-------------|----------|---------------|-----------------|-----------------|
| Post_ID     | bigint   | Yes           | To Post.Post_ID | Not             |
| User_ID     | bigint   | Yes           | To User.User_ID | Not             |
| Comment_ID  | bigint   | Yes           | -               | Not             |
| Content     | text     | -             | -               | Not             |
| Time_Posted | datetime | -             | -               | Not             |
| Last_Edited | datetime | -             | -               | Not             |
| Deleted     | bit      | -             | -               | Not             |

| Friend       | Type     | PK Constraint | SK Constraint   | Null Constraint      |
|--------------|----------|---------------|-----------------|----------------------|
| Sender       | bigint   | Yes           | To User.User_ID | Not                  |
| Acceptor     | bigint   | Yes           | To User.User_ID | Not                  |
| Sending_Time | bigint   | -             | -               | Not                  |
| Accept_Time  | datetime | -             | -               | Can, Pending Request |
| Status       | datetime | -             | -               | Not                  |

| Likes    | Type   | PK Constraint | SK Constraint     | Null Constraint |
|----------|--------|---------------|-------------------|-----------------|
| Hobby_ID | bigint | Yes           | To Hobby.Hobby_ID | Not             |
| User_ID  | bigint | Yes           | To User.User_ID   | Not             |

| Private_Chat | Type   | PK Constraint | SK Constraint         | Null Constraint |
|--------------|--------|---------------|-----------------------|-----------------|
| Message_ID   | bigint | Yes           | To Message.Message_ID | Not             |
| Sender_ID    | bigint | -             | To User.User_ID       | Not             |
| Receiver_ID  | bigint | -             | To User.User_ID       | Not             |

| Group_Chat | Type   | PK Constraint | SK Constraint         | Null Constraint |
|------------|--------|---------------|-----------------------|-----------------|
| Message_ID | bigint | Yes           | To Message.Message_ID | Not             |
| Sender_ID  | bigint | -             | To User.User_ID       | Not             |
| Group_ID   | bigint | -             | To Group.Group_ID     | Not             |

| Member    | Type      | PK Constraint | SK Constraint     | Null Constraint |
|-----------|-----------|---------------|-------------------|-----------------|
| Group_ID  | bigint    | Yes           | To Group.Group_ID | Not             |
| User_ID   | bigint    | Yes           | To User.User_ID   | Not             |
| Privilege | int       | -             | -                 | Not             |
| Time      | timestamp | -             | -                 | Not             |

| Page_Admin | Type   | PK Constraint | SK Constraint   | Null Constraint |
|------------|--------|---------------|-----------------|-----------------|
| Page_ID    | bigint | Yes           | To Page.Page_ID | Not             |
| User_ID    | bigint | Yes           | To User.User_ID | Not             |

| Group_Admin | Type   | PK Constraint | SK Constraint     | Null Constraint |
|-------------|--------|---------------|-------------------|-----------------|
| Group_ID    | bigint | Yes           | To Group.Group_ID | Not             |
| User_ID     | bigint | Yes           | To User.User_ID   | Not             |

\*In the Post Table, exactly one of User\_ID or Page\_ID is Null (Reason: Post is made either by User or Page)

## Part C: Materialized Views

### 1. Homepage

- a. This view collects the top 'n' posts per user from their friends and the pages they follow. Here, the top denotes sorted by time in descending order.
- b. This view is required to reduce latency on the user side when they open their homepage and to reduce the load on querying these posts since these posts will be frequently accessed.

### 2. Timeline

- a. This view collects the top 'n' posts posted by a user/page. Here, the top denotes sorted by time in descending order.
- b. This view is required to reduce latency on the user side when they open their friend's pages and to reduce the load on querying these posts since these posts will be frequently accessed.

### 3. Reaction\_Count

- a. This view keeps track of the reaction count of different posts.
- b. This view is required since these counts are more or less expected to be static and querying them would increase both latency and load.

### 4. Top\_Comments

- a. This view keeps track of top 'n' comments on different posts.
- b. This view is required since querying for top comments would increase both latency and load.

### 5. Invitations

- a. This view collects the top 'n' friend requests / invitations per user. Here, top denotes sorted by time in descending order.
- b. This view is required since we expect the user to visit their requests page often.

### 6. DM\_Cached\_Messages

- a. This view collects the top 'n' message per (sender, receiver). Here, top denotes sorted by time in descending order.
- b. This view is required to reduce latency on the user side when they open their messages and to reduce the load on querying these messages since the message table is large and we do not expect the user to frequently scroll to old messages.

## 7. Group\_Cached\_Messages

- a. This view collects the top 'n' message per (sender, group). Here, top denotes sorted by time in descending order.
- b. This view is required to reduce latency on the user side when they open their messages and to reduce the load on querying these messages since the message table is large and we do not expect the user to frequently scroll to old messages.

## **Part D: Transactions**

In PostgreSQL, and in Neo4j, each statement is taken to be a transaction by default. We don't foresee any multiple-statement concurrency issues taking place, and hence we won't need any explicitly defined transactions.

## **Part E: DDL**

Because the DDL file is quite large, we have attached a link to the DDL -

[https://docs.google.com/document/d/1arcLIZgp\\_LWEPawD7g\\_JZRYMA5afZdZr0JPvRwRbehA/edit?usp=sharing](https://docs.google.com/document/d/1arcLIZgp_LWEPawD7g_JZRYMA5afZdZr0JPvRwRbehA/edit?usp=sharing)

## **Part F: Transaction and Test**

In PostgreSQL, and in Neo4j, each statement is taken to be a transaction by default. We don't foresee any multiple-statement concurrency issues taking place, and hence we won't need any explicitly defined transactions.

## **Part G: Indexes**

1. Private chat: Sort by (sender, receiver) pair, and then by time in descending order.  
Keeping an index here would massively help in retrieving messages with low latency.
2. Group chat: Sort by (group, sender) pair, and then by time in descending order.
3. Posts: Sort by (user/page), and then by time in descending order.

## Part H: Forms & Technologies

1. Signup / Login
2. Homepage
3. Friend Requests / Recommendations (Includes accepting/rejecting requests)
4. View User Page (Includes sending requests)
5. View Post
6. Create Post as a User
7. Create Post for Page
8. Make comment on post
9. React on post
10. Create Page
11. Edit Page
12. View Page
13. Create Group
14. Add/Remove Members to/from Group
15. Change Description/Profile Picture of Group
16. View Messages
17. Send Message
18. Upload Status

**Backend :** Nodejs

**Frontend :** React

**Databases :** psql + neo4j

## Part I: Business Logic Controller

1. Signup / Login:
  - a. Users either sign up or log in.
  - b. If the password is incorrect while logging in, an error message is displayed.
2. Homepage:
  - a. User is redirected to this page after logging in.
  - b. This displays the posts of the user's friends/followed pages in descending order.
  - c. Each post would have a react and comment option below it.
3. Friend Requests / Recommendations (Includes accepting/rejecting requests) :
  - a. Users can see a list of friend requests and can accept, reject or ignore (by scrolling down) each request.



4. View User Page (Includes sending requests) :
  - a. User clicks on another user's name to navigate to the user's page.
  - b. If the user whose page is being viewed (userB) is not a friend of the user who is viewing the page (userA), then, an option to send friend requests is available. Otherwise, it is replaced by the word "You are Friends".
  - c. user B's posts are visible on this page sorted in descending order.
5. Create Post as a User:
  - a. Select type and upload/write content.
6. Create Post for Page
  - a. Select type and upload/write content.
  - b. If the logged-in user is not an admin of the page, an error message is displayed.
7. Make a comment on post
  - a. Embedded in viewing homepage/user timelines.
  - b. Enter text and submit.
8. React on post
  - a. Click on a react button to react/unreact.
9. Create Page
  - a. Create a page with a name and description.
10. Edit Page
  - a. Change page name and/or description.
11. View Page
  - a. View page and posts posted on that page.
12. Create Group
  - a. Create a group along with a description and/or profile picture.
13. Add/Remove Members to/from Group
  - a. Add members to the group or remove members from the group.
  - b. If the logged-in user is not an admin of the group, then, the above fails.
14. Change Description/Profile Picture of Group
  - a. Change description and or profile pictures of a group.
  - b. If the logged-in user is not an admin of the group, then, the above fails.
15. View Messages
  - a. View a list of past conversations (between users and/or groups).
  - b. Select a conversation from this list and view sent/received messages.
16. Send Message
  - a. View a list of past conversations (between users and/or groups).
  - b. Select a conversation to send a new message.
  - c. Or click on create a new conversation.
17. Upload Status: Select content and upload text/photo/video.