

Q1: Domain Model

1. Entity Definitions and Attributes

Hybrid approach of PostgreSQL and MongoDB

1.1 PostgreSQL Entities

- **user:** Stores user account information who are form creator and editors.
 - id (UUID, Primary Key): Unique identifier for a user.
 - username (String, Unique): User's unique username.
 - password_hash (String): Hashed password.
 - email (String): User's email address.
 - registration_date (Timestamp): Registration datetime.
- **permission:** Manages user permissions on documents.
 - id (UUID, Primary Key): Unique identifier for a permission.
 - user_id (UUID, Foreign Key to User): User to whom the permission is granted.
 - document_id (UUID, Foreign Key to Document): Document to which the permission applies.
 - permission_type (Enum: READ, WRITE, ADMIN): Type of permission.
- **respondent_details:** Stores details about respondents (when provided).
 - id (UUID, Primary Key): Unique identifier for a respondent.
 - respondent_data (JSONB): Flexible storage for respondent details (e.g., *"name": "gana", "email": "gana@gmail.com"*).

*Note: PostgreSQL's robust querying capabilities (especially with JSONB) are perfect for analyzing **RespondentDetails.respondentData** data.
- **response:** Stores responses from respondents to forms.
 - id (UUID, Primary Key): Unique identifier for a response.
 - document_version_id (UUID, Foreign Key to Document_Version): Form version to which the response belongs.
 - respondent_id (UUID, Foreign Key to RespondentDetails, Nullable): Respondent who submitted the response. Nullable for anonymous responses.
 - submitted_at (Timestamp): Timestamp of submission.
 - response_data (JSONB): Flexible storage for response data (answers to questions). (e.g: *{"Q1": 5, "Q2": "text answer"}*)

*Note: PostgreSQL's robust querying capabilities (especially with JSONB) are perfect for analyzing **response.response_data** data.

1.2 MongoDB Entities

- **documents:** Represents a form.
 - id (UUID, Primary Key): Unique identifier for a form.
 - title (String): Form title.

- `creationDate` (Timestamp): Form creation date.
- `lastModifiedDate` (Timestamp): Last modified date.
- `ownerUserId` (UUID, Foreign Key to User): User who owns the form.
- `currentCRDTState` (CRDT Data): Current state of the form data.
- **`crdt_operations`**: Stores CRDT operations for real-time collaboration.
 - `id` (UUID, Primary Key): Unique identifier for an operation.
 - `documentId` (UUID, Foreign Key to Document): Form to which the operation applies.
 - `userId` (UUID, Foreign Key to User): User who performed the operation.
 - `operationType` (Enum: INSERT, DELETE, UPDATE): Type of CRDT operation.
 - `operationData` (CRDT Data): Data associated with the operation.
 - `versionVector` (JSON): Version vector for causal order. (e.g: `{S1: 2, S2: 1}`)
 - `timestamp` (Timestamp): Operation timestamp.
- **`document_versions`**: Stores form versions for history and snapshots.
 - `id` (UUID, Primary Key): Unique identifier for a version.
 - `documentId` (UUID, Foreign Key to Document): Form to which the version belongs.
 - `versionNumber` (Integer): Version number.
 - `timestamp` (Timestamp): Version creation timestamp.
 - `userId` (UUID, Foreign Key to User): User who created the version.
 - `snapshot` (CRDT Data): Snapshot of the form data.
- **`document_distributions`**: Stores information about how a form is distributed.
 - `id` (UUID, Primary Key): Unique identifier.
 - `documentVersionId` (UUID, Foreign Key to Document_Version): Form version being distributed.
 - `distributionChannel` (Enum: LINK, EMAIL, EMBED): Distribution channel.
 - `anonymousResponses` (Boolean): Whether responses are anonymous.
 - `distributionLink` (String): Distribution link.
- **`last_processed_version`**: Tracks the last processed CRDT operation for server recovery.
 - `id` (UUID, Primary Key): Unique identifier.
 - `userId` (UUID, Foreign Key to User): User associated with the version vector.
 - `documentId` (UUID, Foreign Key to Document): Document associated with the version vector.
 - `versionVector` (JSON): Last processed version vector.
 - `uniqued` (UUID): Last processed Unique Identifier of the summarised CRDT Operation from Client.
 - `lastProcessedTimestamp` (Timestamp): Timestamp of the last processed version.