LibVault

Conceptual Modeling

Version 1

3/16/2025

1. Introduction

1.1 Project Overview

LibVault is a relational database system designed to execute library operations efficiently and in a user-friendly manner. It allows for the organization of loanable items, enforces borrowing policies, tracks user memberships, and generates reports in a manner that is useful for both staff and the clientele.

1.2 Scope

LibVault's Library Management System will cover library operations such as Book & Digital Media Management, Membership Management, Borrowing & Returns, and Reservations & Notifications. It will automate tracking of loans, returns, and overdue items, while also generating reports to support data-driven decision-making. The program will include the creation of an ER model, a relational schema, and an SQL-based database with realistic records. However, the project does not include the development of a front-end user interface or integration with external library systems at this stage.

1.3 Glossary

- **Database Management System (DBMS):** Software used to create and manage databases, ensuring structured data storage and retrieval.
- **ER Model (Entity-Relationship Model):** A diagram representation of entities and their relationships in a database.
- **SQL (Structured Query Language):** A programming language used for managing and querying relational databases.
- **Primary Key:** A unique identifier for a record in a database table.
- **ISBN (International Standard Book Number):** A unique identifier assigned to books and other publications.
- **Role-Based Access Control (RBAC):** A security model that restricts access based on user roles.
- **Overdue Tracking:** The process of monitoring items that have not been returned by their due date.
- **Reservations:** A system that allows patrons to place holds on unavailable items.
- **SSL/TLS (Secure Sockets Layer/Transport Layer Security):** Cryptographic protocols that provide secure communication over a network.
- **SSH (Secure Shell):** A network protocol that allows secure access to remote computers.

2. ER Modeling Components

2.1 Entities, Attributes, Constraints

Media:

- **Attributes**:
    - Title - String
    - Author - String
    - ISBN - String
    - Media ID - String
    - Publication Year - Number
    - Genre - String
    - Availability Status - String
    - Type: String
- **Constraints**:
    - ISBN Must be Unique - Primary Key
    - Publication Year Must be a Valid Year
    - Genre Must be from a Select Set Genres
        - Fiction, Non-fiction, Drama, etc…
    - Availability Status Must be from Predefined Statuses
        - Available, On Hold, Reserved
    - Entity - Strong

Client:

- **Attributes**:
    - Member ID - Number
    - Name - String
    - Phone Number - String
    - Membership Type - String
    - Account Status - String
- **Constraints**:
    - Member ID Must be Unique - Primary Key
    - Phone Number Must be a Valid Phone Number
    - Membership Type Must be from a Predefined Set of Memberships
        - Regular, Student, Administrator
    - Availability Status Must be from Predefined Statuses
        - Active, Suspended
    - Entity - Strong

Report:

- **Attributes**:
    - Report ID - String
    - Overdue Fee - Number

- **Constraints**:

        - Report ID Must be Unique - Primary Key
        - Entity - Weak

Reservation:

- **Attributes**:
    - Reservation ID - String
    - Reservation Date - String
    - Expiration Date - String
- **Constraints**:
    - Reservation ID Must be Unique - Primary Key
    - Reservation date must be before expiration date
    - Maximum of 10 Checked out Media
    - Entity - Weak

2.2 Define Relationships

Client and Reservation (Makes)

Relationship: A client can borrow multiple media items, and each media item when on loan is associated with one active reservation.
Multiplicity:

- Client to Reservation: **One-to-Many**

Constraints:

- A client is limited to 10 reservations

Reservation and Media (Reserves)

Relationship: Each reservation has one associated Media component that it reserves.
Multiplicity:

- Reservation to Media: **One-to-Many (1..N)**
- Media to Reservation: **Many-to-Many (M..N)**

Constraints:

- Any media item may only be borrowed once at a given time, changing its availability

Client and Media (Purchases)

Relationship: Clients may purchase any amount of Media from the database
Multiplicity:

- Client to Media: **One-to-Many (1..N)**

Constraints:

- Any media item may only be purchased once from the database

Client and Report (Generates)

Relationship: A Client may generate any amount of reports and any given time
Multiplicity:

- Client to Report: **One-to-Many (1..N)**

Constraints:

- Reports must analyze all active reservations

Report and Reservation (Analyzes)

Relationship: Each report analyzes all available reservations.
Multiplicity:

- Report to Analyzes: **1-to-1**
- Analyzes to Reservations: **Many-to-Many**

Constraints:

- Each reservation must be analyzed in any given report.
- A report must track reservations at the time of generation.

User Interfaces and Roles

Library Staff

Relationship: Staff members have permissions to manage inventory, process transactions, and generate reports.
Multiplicity:

- Library Staff to Transactions: **One-to-Many (1..N)**
- Library Staff to Reports: **One-to-Many (1..N)**

Clients

Relationship: Clients interact with the system through borrowing, purchasing, reserving, and payment of fees.
Multiplicity:

- Clients to Borrowing Transactions: **One-to-Many (1..N)**
- Clients to Reservations: **One-to-Many (1..N)**

3. ER Model

In file named `LibVault - ER Model.pdf` within the same directory, but an image has also been attached to this document below: