Phase 1

Advanced Database Systems

Club Booking System

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1. Identify Related Data and Workload

Identify Entities and Relationships

#	Entity Name	Description (What data does it hold?)
1	Member	Stores member information such as name, contact details, membership level, and account status.
2	Membership Level	Defines privileges like maximum bookings per day, advance booking window, and accessible facilities.
3	Facility	Represents each club facility (court, room, pool, etc.) with attributes such as name, type, location, availability status, and maintenance notes.
4	Booking	Stores reservation details, including member, facility, date/time, duration, and booking status (confirmed/cancelled).
5	UsageLog	Records real-time facility usage — check-in/check-out times, duration, and member involved.
6	Payment	Logs financial transactions for bookings — amount, payment method, date, and payment status.
7	Staff	Contains staff data such as name, role, and assigned facilities for managing bookings or maintenance.
8	Notification	Holds messages or alerts sent to members (e.g., booking confirmation, cancellation, or maintenance updates).

Generate Workload Table

#	Action	Query Type (Read/ Write)	Entities Involved (Read/Returned)	Frequency (per day/hour)	Priority
1	Member Login & Profile View	Read	Member, MembershipLevel	~200/day	**High**
2	View Available Facilities (Real-time)	Read	Facility, Booking	~150/day	**High**
3	Create Booking Request	Write	Booking, Member, Facility	~80/day	**High**
4	Cancel Booking	Write	Booking, Facility	~20/day	**Medium**
5	List All Bookings for a Member	Read	Booking, Member, Facility	~100/day	**High**
6	Check-In to Facility (Usage Start)	Write	UsageLog, Member, Facility	~70/day	**High**
7	Check-Out of Facility (Usage End)	Write	UsageLog, Facility	~70/day	**High**
8	Send Notification to Member	Write	Notification, Member	~50/day	**Medium**
9	Process Payment for Booking	Write	Payment, Booking, Member	~40/day	**Medium**
10	Generate Usage Statistics for Admin	Read	UsageLog, Facility, Booking	~5/hour	**Medium**

11	Manage Membership Levels	Write	MembershipLevel	~5/day	**Low**
12	Update Facility Availability (Maintenance Only)	Write	Facility, Staff	~10/day	**Medium**
13	Add / Edit Facility	Write	Facility, Staff	~5/day	**Medium**
14	Register New Member	Write	Member, MembershipLevel	~10/day	**Medium**
15	Generate Monthly Usage & Revenue Report	Read	UsageLog, Payment, Facility	~1/day	**Medium**

2. Create a Schema Map (Embed vs. Reference)

Determine the Collections

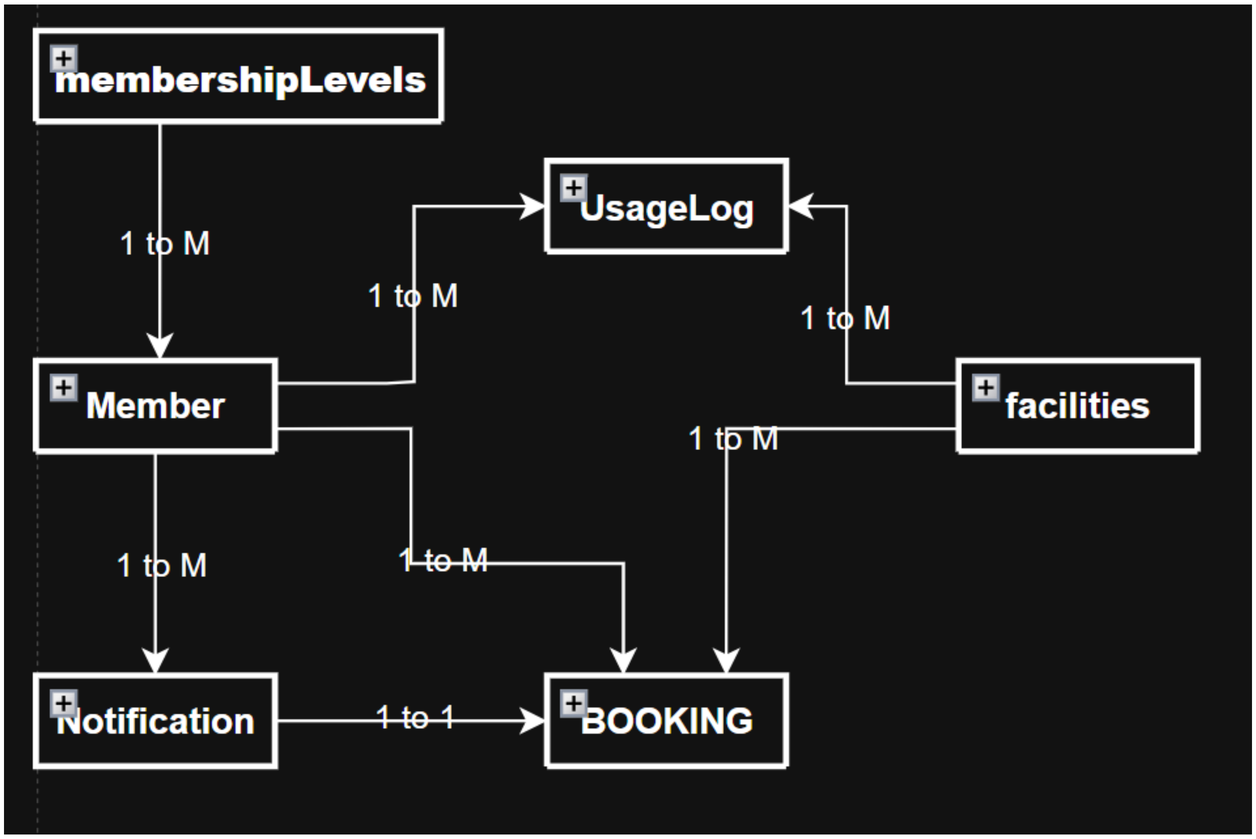
The set of collections below represents the final logical structure of the database, created based on identified entities and workload characteristics.

#	Collection Name	Purpose
1	members	Stores personal and contact information for all club members, along with their assigned membership level and current account status.
2	membershipLevels	Defines all membership tiers and their privileges, including booking limits, advance booking window, and accessible facility types.
3	facilities	Represents each facility (court, room, pool, etc.) with details like type, location, availability, and embedded staff responsible for it.
4	bookings	Stores all reservation details made by members, along with embedded payment information. Tracks facility, timing, and booking status.
5	usageLogs	Records real-time check-in and check-out activity for each facility usage to analyze utilization and generate reports.
6	notifications	Stores system-generated messages sent to members (e.g., booking confirmations, cancellations, or maintenance alerts).

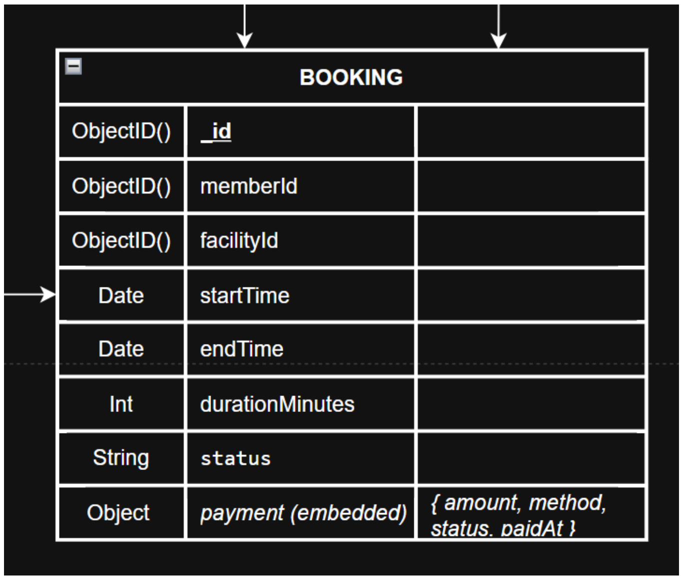
Map the Relations and Justify

Relationship (A to B)	Modeling Choice (Embed/Reference)	Justification (Why?)
Member to MembershipLevel	**Reference** (One-to-Many)	**Reason:** Since membership levels are shared across many members and don't change often, referencing makes more sense than embedding
Booking to Member	**Reference** (Many-to-One)	**Reason:** Members can have multiple bookings, and member information might change independently,
Booking to Facility	**Reference** (Many-to-One)	**Reason:** Each facility can have many bookings pointing to it. Since facilities get updated for maintenance or availability changes
Booking to Payment	**Embed** (One-to-One)	**Reason:** Every booking has exactly one payment associated with it, and payment details are always retrieved together with the booking
UsageLog to Member	**Reference** (Many-to-One)	**Reason:** Usage logs are created constantly throughout the day (~140 check-ins/outs), and members have many usage records over time.
UsageLog to Facility	**Reference** (Many-to-One)	**Reason:** Similar to the member relationship, each facility accumulates many usage logs. Referencing prevents data bloat
Facility to Staff	**Embed** (One-to-Few)	**Reason:** Each facility is managed by a small number of staff members (usually just a few people), and this information is typically viewed together with facility details.
Notification to Member	**Reference** (Many-to-One)	**Reason:** Notifications are sent regularly (~50/day) and pile up over time, while each member receives many notifications.

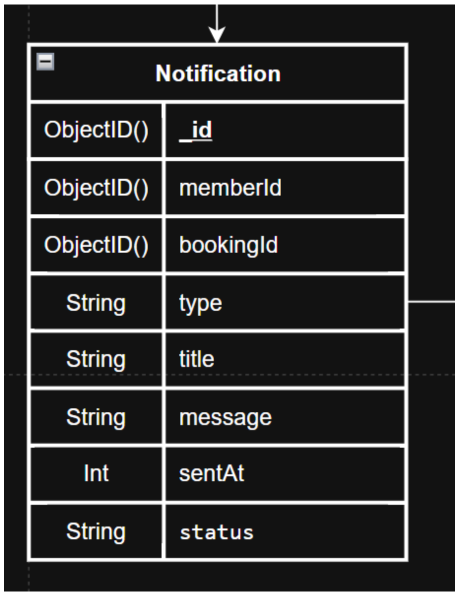
Schema Modeling Diagram



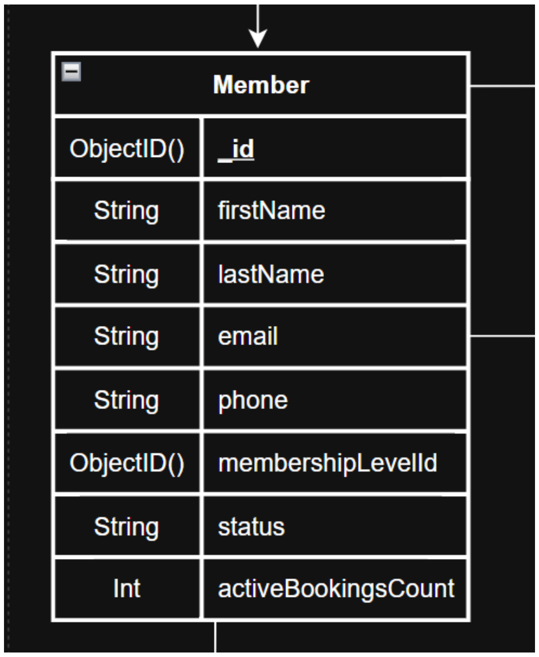
Tables



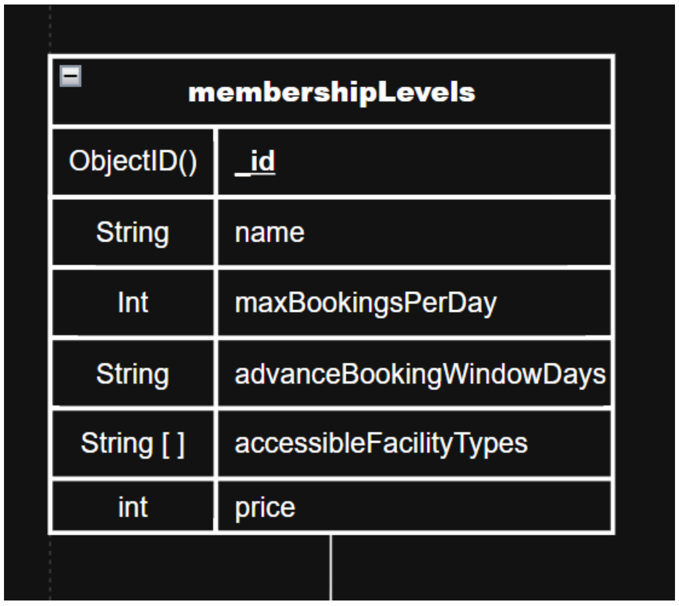
BOOKING		
ObjectID()	_id	
ObjectID()	memberId	
ObjectID()	facilityId	
Date	startTime	
Date	endTime	
Int	durationMinutes	
String	status	
Object	*payment (embedded)*	*{ amount, method, status, paidAt }*



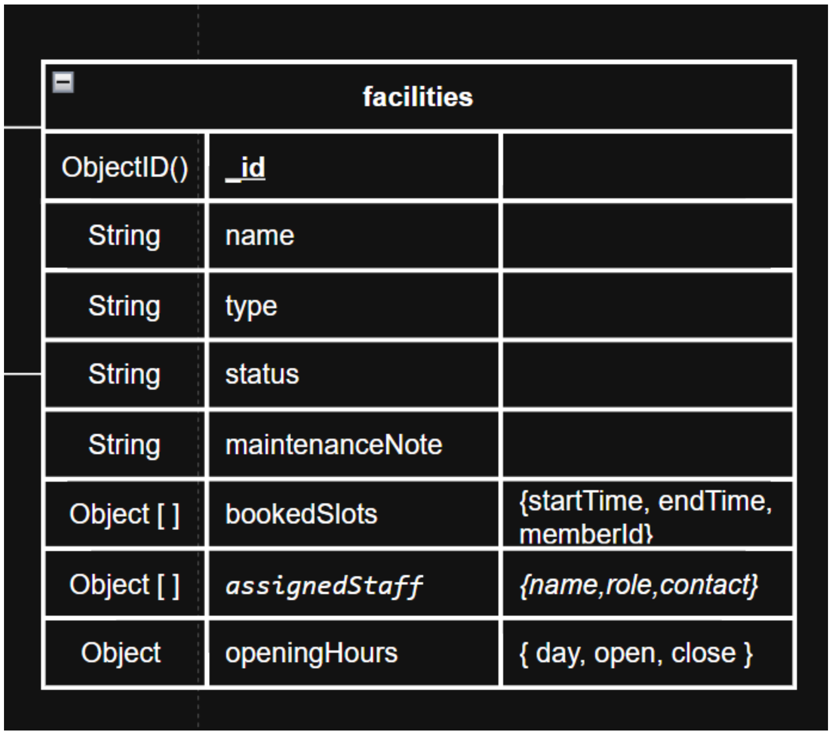
Notification	
ObjectID()	_id
ObjectID()	memberId
ObjectID()	bookingId
String	type
String	title
String	message
Int	sentAt
String	status



Member	
ObjectID()	_id
String	firstName
String	lastName
String	email
String	phone
ObjectID()	membershipLevelId
String	status
Int	activeBookingsCount



membershipLevels	
ObjectID()	_id
String	name
Int	maxBookingsPerDay
String	advanceBookingWindowDays
String [ ]	accessibleFacilityTypes
int	price



facilities		
ObjectID()	_id	
String	name	
String	type	
String	status	
String	maintenanceNote	
Object [ ]	bookedSlots	{startTime, endTime, memberId}
Object [ ]	*assignedStaff*	*{name,role,contact}*
Object	openingHours	{ day, open, close }

3. Conclusion

The final MongoDB schema provides a clean and efficient structure for the Clubs-Sports Booking System. It uses embedding where it improves performance and references where data grows or is shared. The design supports real-time availability, booking rules, and usage tracking, while keeping the system scalable and easy to maintain.