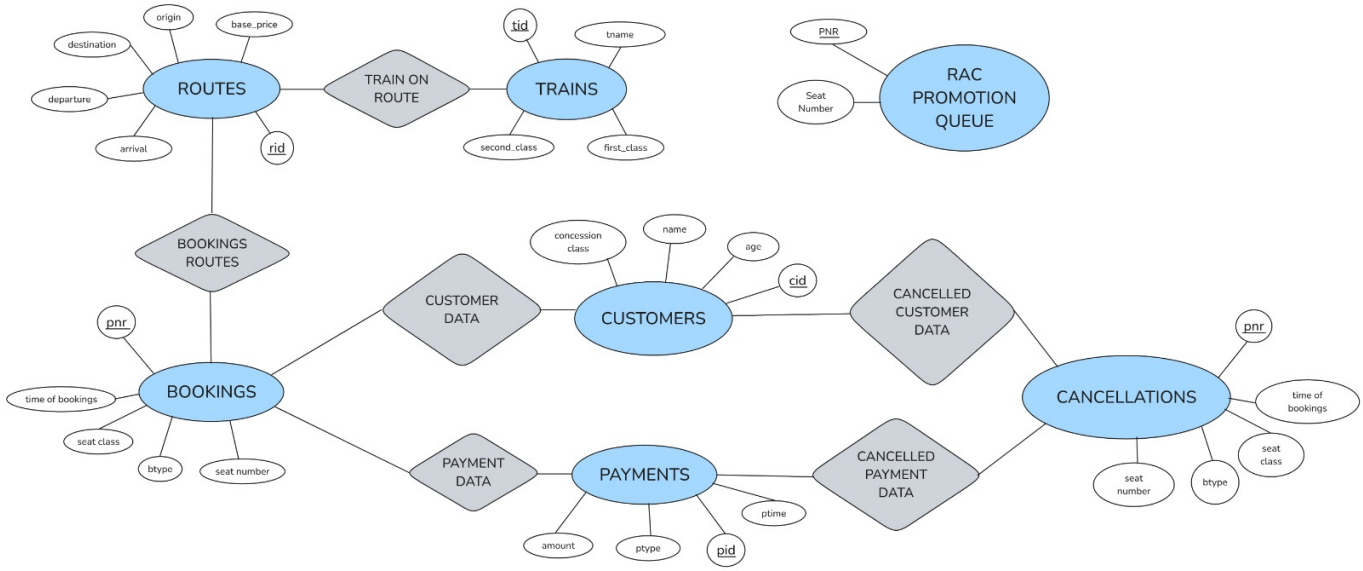
Train Reservation System Database Documentation

ER Diagram



Schema Documentation

This section documents the database tables and their structure.

Tables

Trains

- **Attributes**: `tid` (PK, auto_increment), `tname`, `first_class`, `second_class`
- **Description**: Stores information about trains including their unique ID, name, and number of seats available in first and second class.

Routes

- **Attributes**: `rid` (PK, auto_increment), `tid` (FK), `origin`, `dest`, `departure`, `arrival`, `base_price`
- **Description**: Contains route information for trains including origin/destination cities, departure/arrival times, and base ticket price.

Customers

- **Attributes**: `cid` (PK, auto_increment), `cname`, `concession_class`, `age`
- **Description**: Stores customer information including name, age, and eligibility for fare concessions (like senior citizen).

Payments

- **Attributes**: `pid` (PK), `ptype`, `amount`, `ptime`

- **Description**: Records payment transactions with payment ID, payment method, amount paid, and timestamp.

Bookings

- **Attributes**: `pnr` (PK, auto_increment), `cid` (FK), `pid` (FK), `btype`, `seat_class`, `seat_number`, `time_of_booking`
- **Description**: Stores ticket booking details with PNR number, customer reference, booking type (normal/RAC), seat information, and timestamp.

BookingsRoutes

- **Attributes**: `pnr`, `rid` (FK)
- **Description**: Junction table linking bookings to routes, allowing tickets to include multiple route segments.

Cancellations

- **Attributes**: Same as Bookings plus `refund_id`
- **Description**: Records cancelled bookings with similar fields as Bookings plus additional refund tracking information.

RACPromotionQueue

- **Attributes**: `pnr`, `seat_number`
- **Description**: Temporary table used to manage waiting list promotions when seats become available through cancellations.

Queries Documentation

This section documents the stored procedures, functions, and triggers.

Procedures

QueryPNRStatus

- **Signature**: `QueryPNRStatus(IN _pnr INT)`
- **Description**: Retrieves the status of a booking by PNR number, showing customer name, train name, seat details, and booking status.

TrainScheduleLookup

- **Signature**: `TrainScheduleLookup(IN _tid INT)`
- **Description**: Displays the complete schedule for a specific train, including all origins, destinations, and timing details.

TrainDateQuery

- **Signature**: `TrainDateQuery(IN train_id INT, IN d DATE)`

- **Description**: Lists all passengers traveling on a specific train on a given date, useful for generating passenger manifests.

QueryRACCustomers

- **Signature**: `QueryRACCustomers(IN _tid INT)`
- **Description**: Retrieves all waitlisted (RAC) passengers for a particular train, helping to manage the waiting list.

PeriodRevenue

- **Signature**: `PeriodRevenue(IN s DATE, IN e DATE)`
- **Description**: Calculates total revenue from ticket bookings over a specified date range for financial reporting.

QueryCancellations

- **Signature**: `QueryCancellations(IN refunded BOOL)`
- **Description**: Retrieves cancellation records filtered by refund status, supporting refund processing workflows.

GenItemizedBill

- **Signature**: `GenItemizedBill(IN _cid INT, IN _rid INT, IN _seat_class VARCHAR(40))`
- **Description**: Generates a detailed bill for a ticket including base price and applicable discounts based on seat class and concession status.

FindDirectRoutes

- **Signature**: `FindDirectRoutes(IN city1 VARCHAR(40), IN city2 VARCHAR(40))`
- **Description**: Lists all direct train routes between two specified cities to assist with travel planning.

CreateBooking

- **Signature**: `CreateBooking(IN _cid INT, IN _pid VARCHAR(40), IN _ptype VARCHAR(40), IN _amount INT, IN _btype VARCHAR(40), IN _seat_class VARCHAR(40), IN _seat_number VARCHAR(40))`
- **Description**: Creates a new booking record with payment information and returns the generated PNR number.

InsertBookingRoute

- **Signature**: `InsertBookingRoute(IN _pnr INT, IN _rid INT)`
- **Description**: Associates a booking with a specific route, supporting multi-leg journeys.

InsertTrain

- **Signature**: `InsertTrain(IN _tname VARCHAR(40), IN _first_class INT, IN _second_class INT)`
- **Description**: Adds a new train to the system with name and seat capacity information for different classes.

InsertCustomer

- **Signature**: `InsertCustomer(IN _cname VARCHAR(40), IN _concession_class VARCHAR(40), IN _age INT)`
- **Description**: Registers a new customer with name, age, and concession eligibility details.

InsertRoute

- **Signature**: `InsertRoute(IN _tid INT, IN _origin VARCHAR(40), IN _dest VARCHAR(40), IN _departure DATETIME, IN _arrival DATETIME, IN _base_price INT)`
- **Description**: Creates a new route entry with train ID, location information, timing, and base pricing details.

Functions

AvailableSeatQuery

- **Signature**: `AvailableSeatQuery(routeid INT, seat_num INT)`
- **Description**: Checks if a specific seat is available on a given route, returning 1 if available, 0 if occupied.

GetTrainCancelTotalRefund

- **Signature**: `GetTrainCancelTotalRefund(_tid INT)`
- **Description**: Calculates the total refund amount required when cancelling an entire train service.

BusiestRoute

- **Signature**: `BusiestRoute()`
- **Description**: Identifies the route with the highest number of booked passengers, useful for capacity planning.

GetClassNumAvailableSeats

- **Signature**: `GetClassNumAvailableSeats(_rid INT, _seat_class VARCHAR(40))`
- **Description**: Returns the number of available seats for a specific class on a given route.

Triggers

AfterBookingsDelete

- **Description**: Activates when bookings are deleted, moving them to the Cancellations table and handling RAC promotions.

- **Functionality**: Manages refund eligibility based on cancellation timing and promotes waitlisted tickets when seats become available.

Normalization

This section evaluates the normalization levels of each table in the database schema.

Normalization Analysis by Table

Trains

- **1NF**: ✅ All attributes are atomic and table has a primary key (`tid`).
- **2NF**: ✅ All non-key attributes (`tname`, `first_class`, `second_class`) are fully dependent on the primary key.
- **3NF**: ✅ No transitive dependencies exist; all attributes directly depend on the primary key.
- **BCNF**: ✅ Every determinant is a candidate key.

Routes

- **1NF**: ✅ All attributes are atomic and table has a primary key (`rid`).
- **2NF**: ✅ All non-key attributes fully depend on the primary key.
- **3NF**: ✅ No obvious transitive dependencies.
- **BCNF**: ✅ Every determinant is a candidate key.

Customers

- **1NF**: ✅ All attributes are atomic and table has a primary key (`cid`).
- **2NF**: ✅ All non-key attributes (`cname`, `concession_class`, `age`) fully depend on the primary key.
- **3NF**: ✅ No transitive dependencies exist.
- **BCNF**: ✅ Every determinant is a candidate key.

Payments

- **1NF**: ✅ All attributes are atomic and table has a primary key (`pid`).
- **2NF**: ✅ All non-key attributes fully depend on the primary key.
- **3NF**: ✅ No transitive dependencies exist.
- **BCNF**: ✅ Every determinant is a candidate key.

Bookings

- **1NF**: ✅ All attributes are atomic and table has a primary key (`pnr`).
- **2NF**: ✅ All non-key attributes fully depend on the primary key.
- **3NF**: ✅ No obvious transitive dependencies, as cid and pid are foreign keys representing relationships rather than transitive dependencies.
- **BCNF**: ✅ Every determinant is a candidate key.

BookingsRoutes

- **1NF**: ✅ All attributes are atomic.
- **2NF**: ✅ This is a junction table linking bookings to routes with no non-key attributes.

- **3NF**: ✅ No non-key attributes means no transitive dependencies.
- **BCNF**: ✅ The combination of pnr and rid effectively forms the primary key.

Cancellations

- **1NF**: ✅ All attributes are atomic and table has a primary key (`pnr`).
- **2NF**: ✅ All non-key attributes fully depend on the primary key.
- **3NF**: ✅ No transitive dependencies.
- **BCNF**: ✅ Every determinant is a candidate key.

RACPromotionQueue

- **1NF**: ✅ All attributes are atomic and table has a primary key (`pnr`).
- **2NF**: ✅ This is a temporary queue table with just two fields where seat_number depends on pnr.
- **3NF**: ✅ No transitive dependencies.
- **BCNF**: ✅ Every determinant is a candidate key.