

Frequent Flyer Behavior and Loyalty Analysis Documentation

Reservation Tracking Fact Table

1. Business Process

The accumulated snapshot fact table captures the **entire lifecycle of airline reservations**, tracking multiple events from booking to flight completion. It provides a historical view of key reservation milestones, enabling analysis of booking patterns, cancellations, upgrades, and customer behavior over time.

2. The Grain

The grain of this fact table is at the **reservation level**, with each row representing a **single reservation** and tracking key business process stages. It records cumulative updates as the reservation progresses from creation to confirmation, flight completion, and feedback.

3. Dimensions

The fact table is surrounded by dimension tables that add contextual details:

Passenger_DIM Table (Passenger Dimension)

This table stores information about passengers, providing details for analytics related to passenger demographics.

- **Passenger_ID** : Unique identifier for each passenger.
- **Passenger_key** : Unique identifier for each passenger.
- **age_category**: Categorization of the passenger's age (e.g., child, adult, senior).
- **Gender**: The passenger's gender (Male, Female, Other).
- **occupation**: The passenger's profession or job category.
- **nationality**: The country of citizenship of the passenger.
- **membership_status**: Indicates whether the passenger is a loyalty program member (Yes/No).
- **loyalty_tier**: The level of loyalty membership (e.g., Silver, Gold, Platinum).
- **city**: The city where the passenger resides.
- **Country**: The country of residence of the passenger.
- **Start_Date**: The date when the passenger was added to the system.
- **End_Date**: The date when the passenger's profile became inactive.
- **Date_DIM** – Tracks time-based attributes for reservation events (e.g., reservation date, flight date, ticket confirmation date).

- **Country-Specific Date Outrigger** – Provides additional context about workdays, holidays, and seasons relevant to the reservation.

4. Identifying the Facts

Reservation_Tracking_fact Table (Accumulated Snapshot Fact Table)

This table tracks the different stages of a reservation process, maintaining historical changes.

- **Reservation_tracking_id** : Unique identifier for each reservation record.
- **ticket_id (FK)**: Foreign key linking to the ticket issued for the reservation.
- **Passenger_id (FK)**: Foreign key linking to the passenger who made the reservation.
- **Fare_class**: The category of fare purchased (e.g., Economy, Business, First Class).
- **Reservation_date**: The date when the reservation was initially made.
- **Reservation_cancel_date**: The date when the reservation was canceled (if applicable).
- **Reservation_upgrade**: Indicates whether the reservation was upgraded (Yes/No).
- **Ticket_confirm_date**: The date when the reservation was confirmed.
- **Ticket_upgrade_date**: The date when the ticket was upgraded to a higher class.
- **Flight_date**: The scheduled departure date of the flight.
- **Flight_Feedback**: Feedback provided by the passenger regarding their flight experience.

Operational Metrics

- **Total Reservations** → Cumulative count of reservations in progress.
 - **Total Cancellations** → Number of canceled reservations.
 - **Total Upgrades** → Count of reservations that were upgraded.
 - **Total Confirmations** → Count of reservations that reached the confirmation stage.
 - **Total Completed Flights** → Number of reservations that resulted in completed flights.
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Flight Activity Fact Table

1. Business Process

The **flight activity fact table** captures the entire lifecycle of a flight trip, tracking multiple events from departure to arrival. It provides a historical view of key flight milestones, enabling analysis of passenger bookings, seat occupancy, fuel consumption, and flight performance over time.

2. The Grain

The **grain** of this fact table is at the **trip level**, with each row representing a single flight trip. It records cumulative updates as the flight progresses from departure to arrival, including timestamps, seat occupancy, and fuel consumption.

3. Dimensions

The fact table is surrounded by dimension tables that add contextual details:

Dim_Crew (Crew Dimension)

- **crew_ID (PK):** Unique identifier for each crew member.
- **crew_key:** Internal key for crew identification.
- **full_name:** Full name of the crew member.
- **DOB:** Date of birth.
- **Gender:** The gender of the crew member.
- **role_description_scd_1:** The role of the crew member (pilot, flight attendant, etc.).
- **status_marital_scd_1:** Marital status of the crew member.
- **city:** City where the crew member is based.
- **country:** Country where the crew member is based.

Dim_Airport (Airport Dimension)

- **Airport_Code (PK):** Unique identifier for each airport.
- **Airport_key:** Internal key for airport identification.
- **Airport_Name:** Name of the airport.
- **City:** The city where the airport is located.
- **Country:** The country where the airport is located.

Dim_Airplane (Airplane Dimension)

- **Airplane_id (PK):** Unique identifier for each airplane.
- **Airplane_key:** Internal key for airplane identification.

- **model:** The model of the airplane.
- **capacity:** Maximum passenger capacity.
- **manufacturer:** The company that manufactured the airplane.
- **business_seats, economy_seats, first_class_seats:** The number of available seats per class.
- **max_range_km:** Maximum range of the airplane in kilometers.
- **max_speed_kmh:** Maximum speed in km/h.
- **fuel_consumption:** Estimated fuel consumption for the airplane.
- **Activity_status_current:** Current operational status of the airplane.
- **Activity_status_old:** Historical status of the airplane.

Dim_Date (Date Dimension)

- **Date_Id (PK):** Unique identifier for each date.
- **Date:** Actual date value.
- **Full Date Description:** A formatted string describing the date (e.g., "Monday, 12th March 2024").
- **Day of the Week:** The name of the day (e.g., Monday, Tuesday).
- **Day Number in Calendar Month:** Day position within the month (1-31).
- **Day Number in Calendar Year:** Day position within the year (1-365 or 1-366 for leap years).
- **Calendar Week Number in Year:** Week number in the year (1-52).
- **Calendar Month Name:** Name of the month (e.g., January, February).
- **Calendar Month Number in Year:** Month position in the year (1-12).
- **Calendar Quarter:** Quarter of the year (Q1, Q2, Q3, Q4).
- **Calendar Year-Quarter:** Concatenation of year and quarter (e.g., "2024-Q1").
- **Calendar Year:** The year value (e.g., 2024).
- **Day Number in Fiscal Month:** Day position within the fiscal month (1-30 or 1-31).
- **Last Day in Fiscal Month Indicator:** A flag (Yes/No) to indicate whether the date is the last day of the fiscal month.
- **Fiscal Month:** Name of the fiscal month.
- **Fiscal Month Number in Year:** The fiscal month's position in the fiscal year (1-12).

- **Fiscal Year-Month:** Concatenation of the fiscal year and month (e.g., "2024-03").
- **Fiscal Quarter:** Fiscal quarter value (e.g., Q1, Q2, Q3, Q4).
- **Fiscal Year-Quarter:** Concatenation of fiscal year and fiscal quarter (e.g., "2024-Q1").
- **Fiscal Year:** The fiscal year value (e.g., 2024).

Country-Specific Date Outtrigger

- **Country-key (PK):** Unique country-specific identifier.
- **Date.Key (FK):** Foreign key linking to the Date Dimension.
- **Country Name:** Name of the country.
- **Civil Holiday Flag, Religious Holiday Flag:** Indicators for holidays.
- **Civil Holiday Name, Religious Holiday Name:** Names of holidays.
- **Workday Indicator:** Indicates whether the date is a working day.
- **Season Name:** Identifies the season associated with the date.

4. Identifying the Facts

The **Flight Activity Fact Table** (Trip-Level Snapshot Fact Table) tracks key details about each flight.

- **Flight_id (PK):** Unique identifier for each flight trip.
- **Arrival_date / Arrival_time:** The scheduled arrival date and time.
- **Actual_arrival_date / Actual_arrival_time:** The actual recorded arrival date and time.
- **Departure_date / Departure_time:** The scheduled departure date and time.
- **Actual_departure_date / Actual_departure_time:** The actual recorded departure date and time.
- **Actual_duration:** The total flight duration.
- **Booked_seats:** Total seats booked for the flight.
- **Occupied_seats (buses, eco, first):** Number of occupied seats per class.
- **Empty_seats (buses, eco, first):** Number of unoccupied seats per class.
- **Fuel_consumption:** Fuel consumption recorded for the trip.
- **Distance_in_miles:** Distance covered by the flight.
- **Crew_count:** Total number of crew members on board.
- **Baggage_weight:** Total baggage weight handled.

- **Captain_id (FK):** The captain assigned to the flight.
- **Departure_airport_id (FK):** The departing airport.
- **Arrival_airport_id (FK):** The destination airport.
- **Airplane_id (FK):** The airplane used for the flight.

5. Operational Metrics

- **Total Flights** → Count of completed flight trips.
 - **Total Delayed Arrivals** → Number of flights arriving later than scheduled.
 - **Total On-Time Arrivals** → Number of flights arriving on time.
 - **Total Empty Seats** → Count of unoccupied seats.
 - **Total Fuel Consumed** → Total fuel consumption for flights.
 - **Total Distance Flown** → The cumulative distance covered by all flights.
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Loyalty & Overnight Stay Fact Table

1. Business Process

The **Loyalty & Overnight Stay fact tables** capture key events related to **passenger loyalty programs** and **overnight stays** at airports. These fact tables help analyze **passenger rewards**, **promotion impacts**, and **overnight stay trends** due to layovers, delays, or planned stopovers.

2. The Grain

- **Loyalty Program Fact Table:** The grain is at the **passenger loyalty transaction level**, with each row representing a single instance of loyalty points accumulation or redemption.
- **Overnight Stay Fact Table:** The grain is at the **overnight stay event level**, where each row represents a single overnight stay event for a passenger at an airport.

3. Dimensions

The fact tables are surrounded by dimension tables that provide contextual details:

Dim_Promotion (Promotion Dimension)

- **promotion_id (PK):** Unique identifier for each promotion.
- **promotion_key:** Internal key for tracking promotions.
- **description:** Description of the promotion.
- **name:** Name of the promotion.

- **promotion_category:** Category of the promotion (e.g., discount, bonus points, free upgrade).
- **Assigned_tier:** Loyalty tier eligible for the promotion (e.g., Silver, Gold, Platinum).

Passenger_DIM (Passenger Dimension)

- **Passenger_ID (PK):** Unique identifier for each passenger.
- **Passenger_key :** Unique identifier for each passenger.
- **End_Date:** The date when the passenger's record became inactive.
- **Start_Date:** The date when the passenger joined the system.
- **Country:** Country of residence.
- **city:** City of residence.
- **loyalty_tier:** Passenger's loyalty program tier.
- **membership_status:** Indicates whether the passenger is an active loyalty program member (Yes/No).
- **nationality:** Passenger's nationality.
- **occupation:** Passenger's occupation.
- **Gender:** Passenger's gender (Male, Female, Other).
- **age_category:** Age group classification (e.g., child, adult, senior).

Dim_Date (Date Dimension)

- **Date_Id (PK):** Unique identifier for each date.
- **Date:** Actual date value.
- **Full Date Description:** A formatted string describing the date (e.g., "Monday, 12th March 2024").
- **Day of the Week:** The name of the day (e.g., Monday, Tuesday).
- **Day Number in Calendar Month:** Day position within the month (1-31).
- **Day Number in Calendar Year:** Day position within the year (1-365 or 1-366 for leap years).
- **Calendar Week Number in Year:** Week number in the year (1-52).
- **Calendar Month Name:** Name of the month (e.g., January, February).

- **Calendar Month Number in Year:** Month position in the year (1-12).
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- **Calendar Year-Quarter:** Concatenation of year and quarter (e.g., "2024-Q1").
- **Calendar Year:** The year value (e.g., 2024).
- **Day Number in Fiscal Month:** Day position within the fiscal month (1-30 or 1-31).
- **Last Day in Fiscal Month Indicator:** A flag (Yes/No) to indicate whether the date is the last day of the fiscal month.
- **Fiscal Month:** Name of the fiscal month.
- **Fiscal Month Number in Year:** The fiscal month's position in the fiscal year (1-12).
- **Fiscal Year-Month:** Concatenation of the fiscal year and month (e.g., "2024-03").
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- **Fiscal Year-Quarter:** Concatenation of fiscal year and fiscal quarter (e.g., "2024-Q1").
- **Fiscal Year:** The fiscal year value (e.g., 2024).

Country-Specific Date Outtrigger

- **Country-key (PK):** Unique country-specific identifier.
- **Date.Key (FK):** Foreign key linking to the Date Dimension.
- **Country Name:** Name of the country.
- **Civil Holiday Flag, Religious Holiday Flag:** Indicators for public and religious holidays.
- **Civil Holiday Name, Religious Holiday Name:** Names of the holidays.
- **Workday Indicator:** Specifies whether the date is a working day.
- **Season Name:** Identifies the season associated with the date.

Dim_Airport (Airport Dimension)

- **Airport_Code (PK):** Unique identifier for each airport.
- **Airport_key:** Internal key for airport identification.
- **Airport_Name:** Name of the airport.
- **City:** City where the airport is located.
- **Country:** Country where the airport is located.

4. Identifying the Facts

The **Loyalty Program Fact Table** and **Overnight Stay Fact Table** store key transactional details.

Loyalty_program_fact (Loyalty Transactions)

- **loyalty_id (PK):** Unique identifier for each loyalty transaction.
- **Points_type:** Type of points transaction (earn, redeem, bonus).
- **Points:** Number of points earned or redeemed.
- **Fare_base:** Base fare associated with the transaction.
- **Operation_Type:** Type of operation (e.g., flight, hotel booking, upgrade).
- **Promotion_id (FK):** Foreign key linking to the promotion applied.
- **Passenger_id (FK):** Foreign key linking to the passenger.
- **date (FK):** Foreign key linking to the date of the transaction.

OverNight_stay_fact (Overnight Stay Events)

- **StayID (PK):** Unique identifier for each overnight stay event.
- **stay_key:** Internal key for tracking stays.
- **Duration:** Duration of the overnight stay.
- **StayLocation_Type:** Type of stay location (e.g., airport lounge, hotel, waiting area).
- **Passenger_id (FK):** Foreign key linking to the passenger.
- **Date_id (FK):** Foreign key linking to the date of stay.
- **Airport_code (FK):** Foreign key linking to the airport where the stay occurred.

5. Operational Metrics

- **Total Loyalty Points Earned** → Sum of points accumulated by passengers.
- **Total Loyalty Points Redeemed** → Sum of points used for rewards.
- **Total Loyalty Transactions** → Count of loyalty transactions.
- **Total Promotions Applied** → Number of promotions used in loyalty transactions.
- **Total Overnight Stays** → Count of overnight stays recorded.
- **Average Stay Duration** → Average duration of overnight stays.
- **Most Frequent Stay Location Type** → Most commonly used location for overnight stays.
- **Total Stays per Airport** → Breakdown of overnight stays by airport.