Aviation Flight Delay Analytics

SQL and Power BI Analytics Portfolio Project

Aviation Flight Delay Analytics Report

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Executive Summary

This project analyzes commercial flight delay performance using a structured Business Intelligence workflow. The objective was to understand delay behavior across airports, weekdays, distances, and peak travel periods. Using a star schema model in MySQL and interactive dashboards in Power BI, the project identifies operational bottlenecks and performance trends. The analysis highlights that flight distance alone does not determine efficiency and that airport congestion and scheduling patterns play a major role in delays.

Introduction

Flight delays impact airline operations, passenger satisfaction, and overall transportation efficiency. This project was developed as a portfolio-level analytics case study to demonstrate real-world BI practices, including data modeling, SQL analysis, and dashboard reporting. The focus is on transforming raw flight data into actionable operational insights.

Data Collection

The data for this analysis was gathered from kaggle spanning 5000 records of US flight data.

Methodology

A star schema was designed to improve analytical performance and reporting clarity. The model consists of dimension tables for airports and dates, and a central fact table containing delay metrics. SQL was used to perform aggregations, ranking, and analytical filtering. Power BI was used to build a professional multi-page dashboard following a corporate aviation theme.

Data Analysis

Key metrics analyzed include:

- **Airport Performance**: DTW (Detroit) is the worst performing airport recording 69 min avg delay.
- **Flight Performance**: Nearly 50% of the flights are delayed across all airports
- **Best Day**: July 06, 2016 is recorded as the best performing day by only having 6 min avg delay per flight

Visuals, such as bar graphs and Donut charts, were used to compare performance across airports and highlight areas requiring attention.

Findings and Insights

The analysis revealed the following:

- **Low-performing Airports**: Although DTW (Detroit) was the high delaying airport, it came out because of the fact the most part of the flight it runs is within the country. This short distance flights didn't give the opportunity to reduce the delay in air unlike other international bound airports like Los Angeles and New York.
- **Peak Periods**: The concentration of delays from Thursday to Monday suggests that passenger travel behavior, rather than distance alone, plays a critical role in congestion-driven flight inefficiency.

- **Ground Operation Inefficiency**: Several flights showed substantial arrival delays even after departure recovery, indicating inefficiencies in taxiing, gate availability, and turnaround coordination.

Recommendations

Based on the findings, the following strategies are recommended:

- Optimizing ground handling workflows can reduce delays significantly.
- Weekend travel delays reflect insufficient peak-demand readiness and require targeted operational capacity improvements.
- Previous flight delay impact suggests that schedule management require significant improvement.

Conclusion

This flight delay analysis highlights actionable operational insights and improvement opportunities across airport and scheduling processes. By implementing the recommended strategies, airlines and airports can reduce congestion, improve punctuality, and enhance overall passenger experience.