

# IBM Technical Contest

National Level Database Designing

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# The Problem Statement

- Consider an Airline Company, AIRCONNECT.
- It was launched as a Low-Cost carrier in 2005. Now it is emerging as one of the market leaders.
- Need for a renewed database structure.

# 1. Gathering Requirements

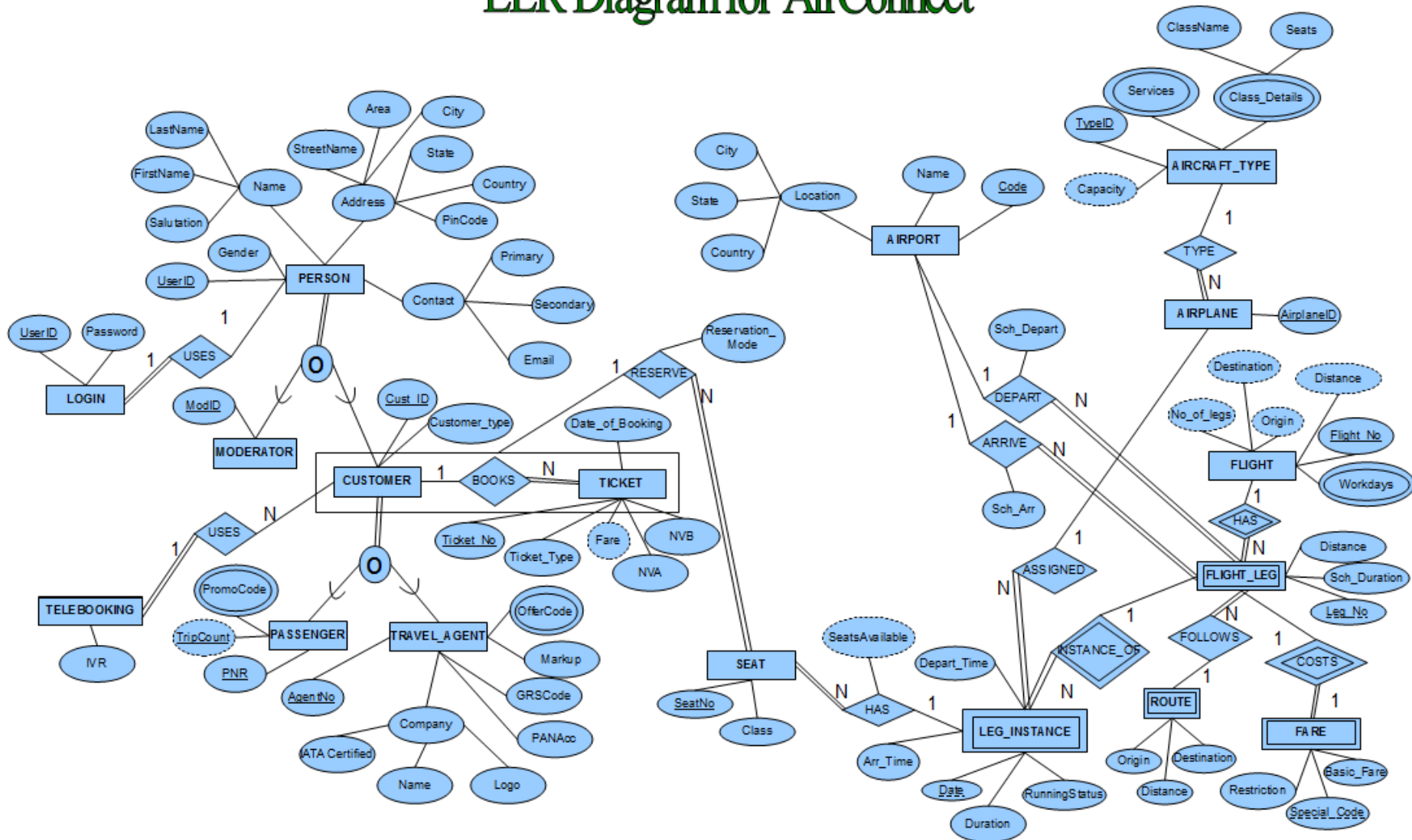
- **Collection** of details about existing airline reservation systems.
- **Experiencing** the usage of the different sales channels available.
- **Planning** the non-functional requirements to enhance performance, reliability and robustness.

## 2. Requirements Analysis

- **Analysis** of the collected information to extract the required details, constraints, necessities etc.
- **Identification of entities.**
  - Categorization
  - Noun Phrase method
- **Deduction of relationships** among the entities in terms of Functional Dependencies.
- Generation of **new entities** (based on relationships).
- Identification of **attributes** from the requirements.

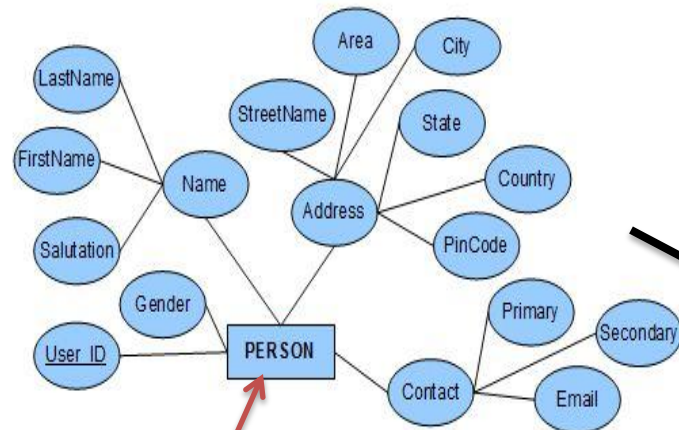
# Conceptual Schema

## EER Diagram for AirConnect



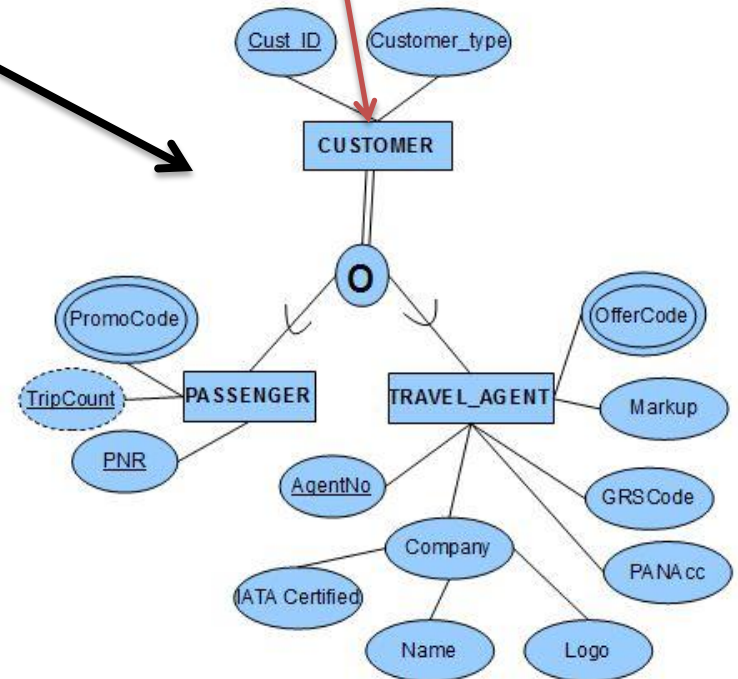
# Mandatory Features

All details related to Customers - **PASSENGER, TRAVEL\_AGENT**



Person – Base Entity : Has all the details like Name, Address, etc.

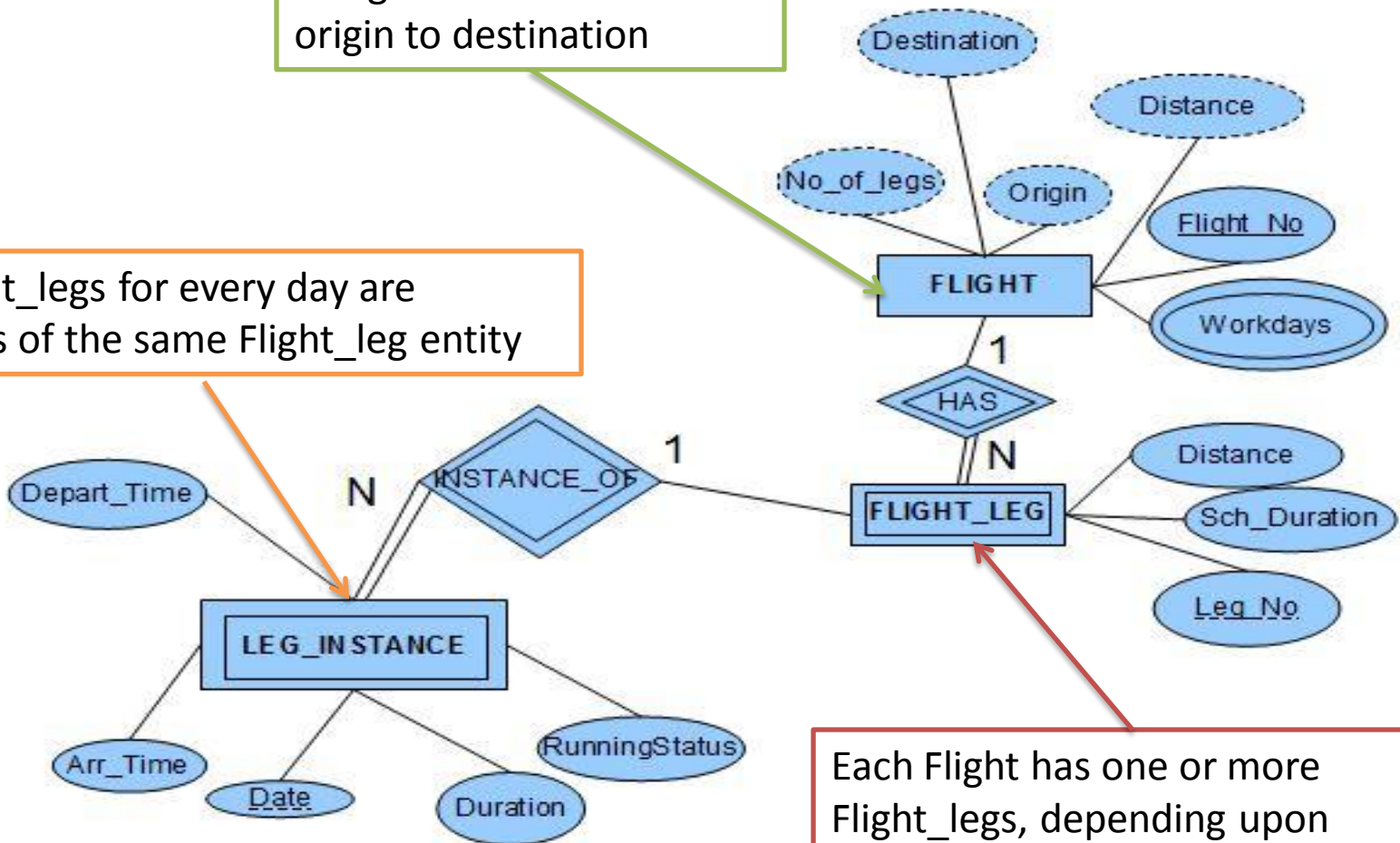
Customer Details – Derived :  
Further specializes to Passenger  
and Travel Agent



## All details related to Flight - FLIGHT, FLIGHT\_LEG, LEG\_INSTANCE

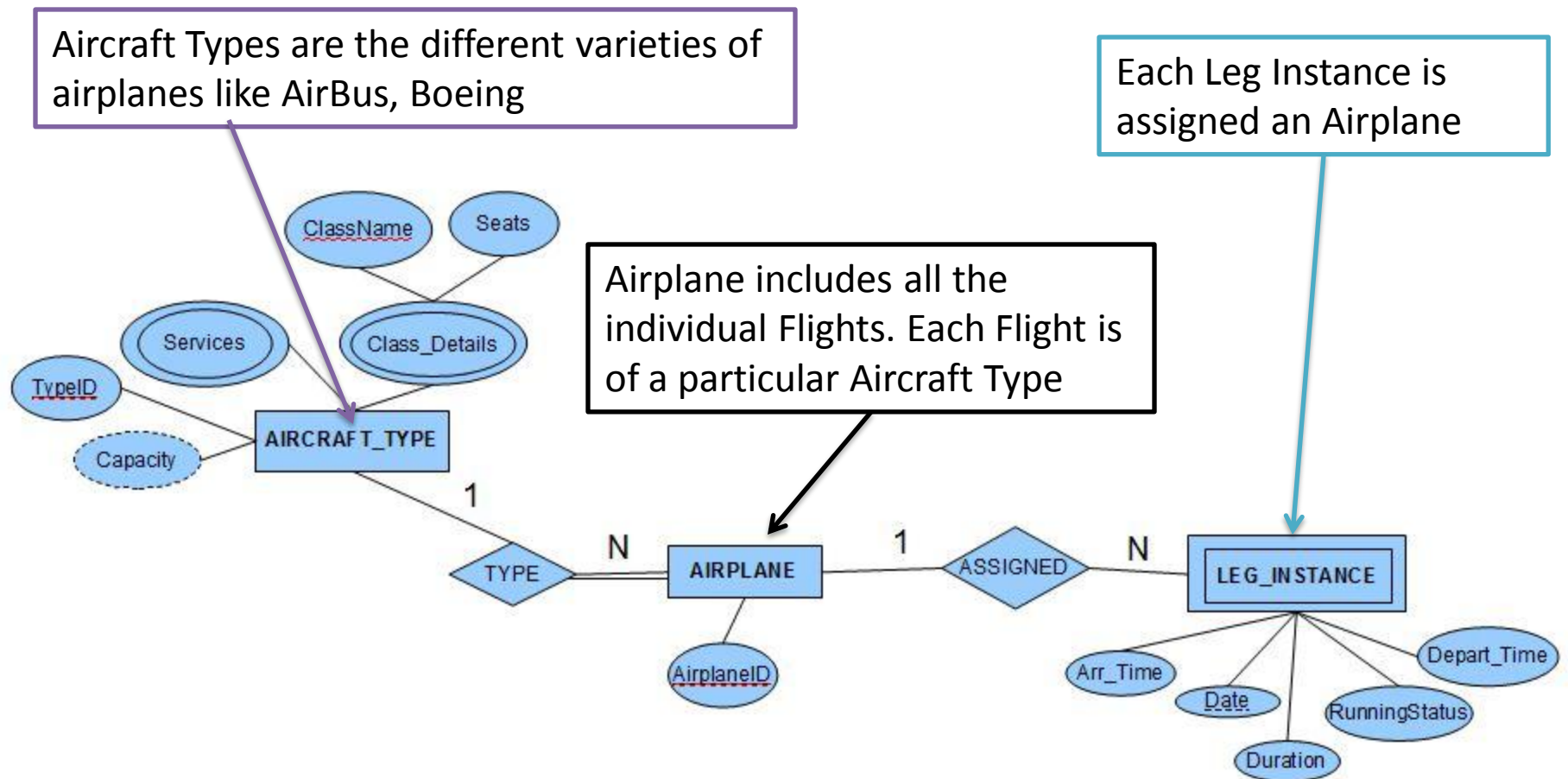
A Flight is a travel from origin to destination

The Flight\_legs for every day are instances of the same Flight\_leg entity



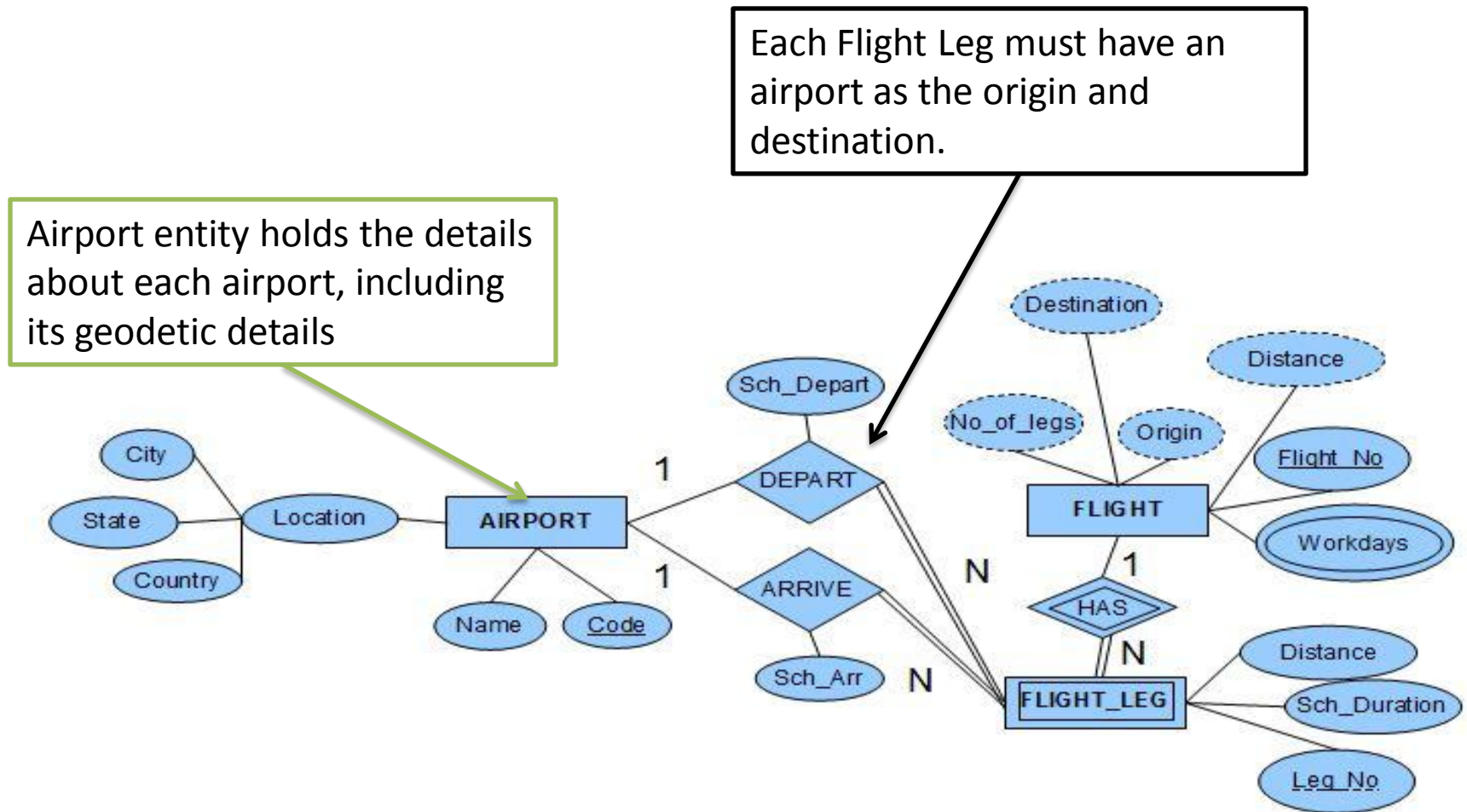
Each Flight has one or more Flight\_legs, depending upon number of intermediate stops

- Details about Airplane : AIRCRAFT\_TYPE, AIRPLANE, LEG\_INSTANCE

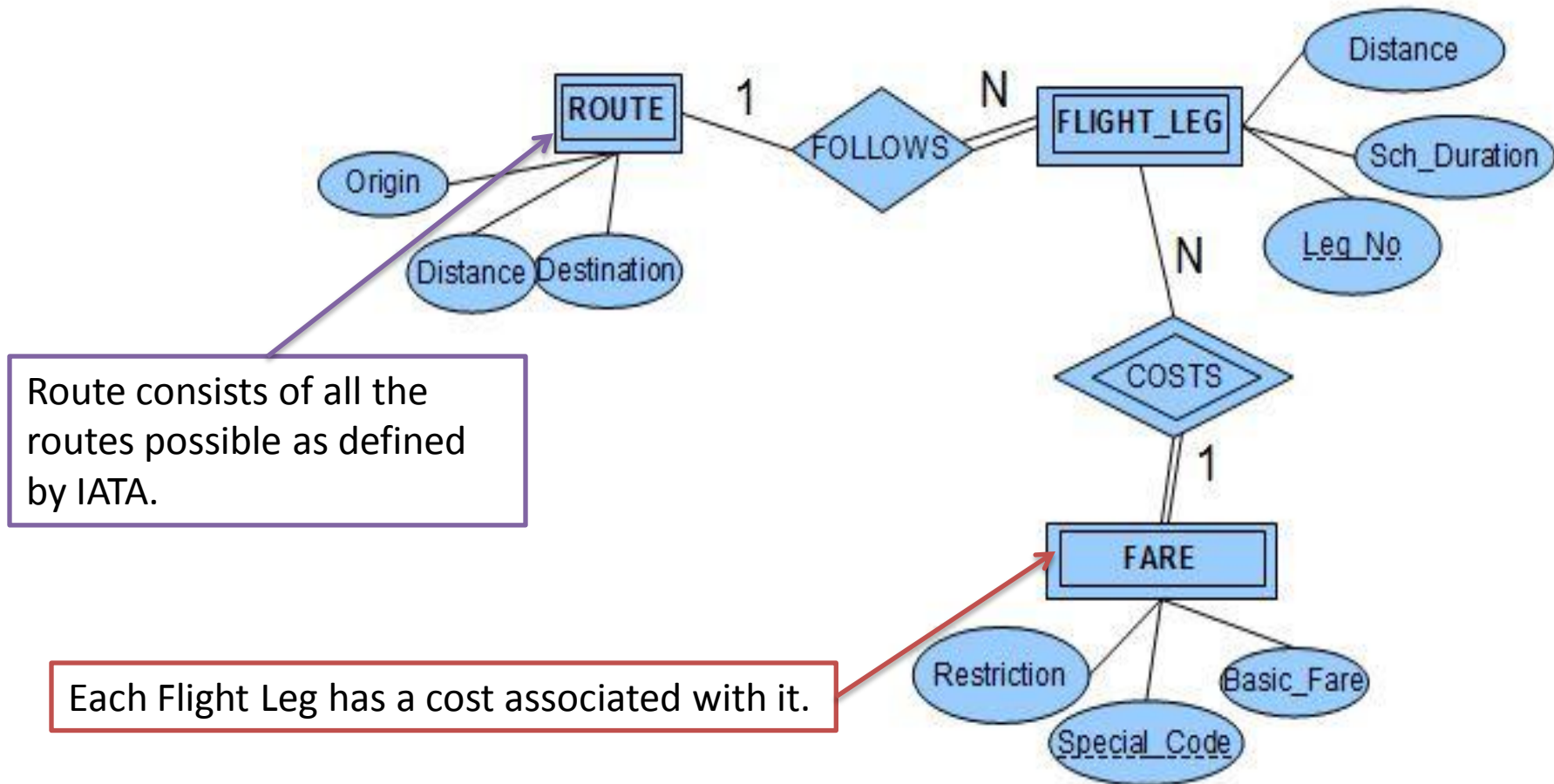




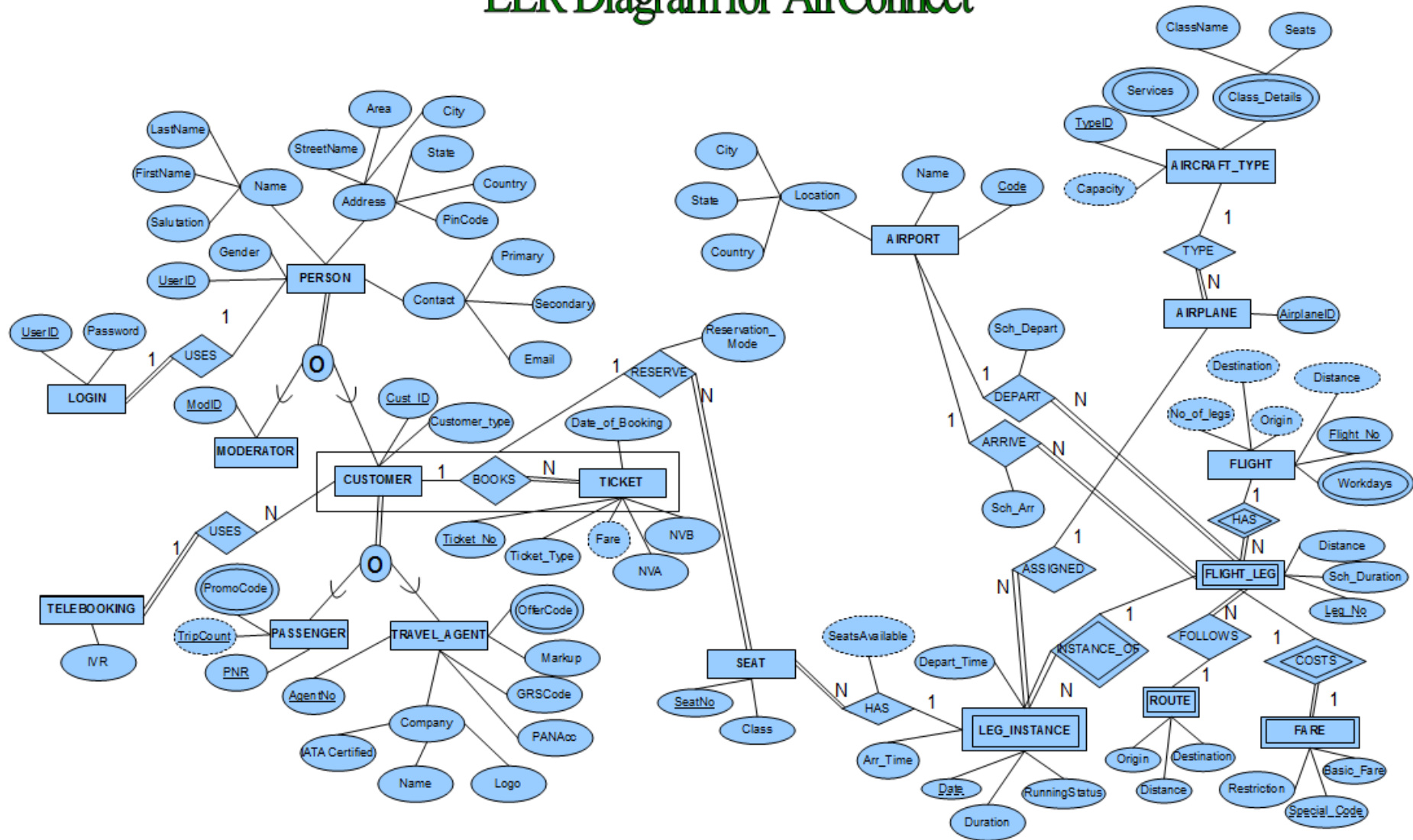
## Airports – AIRPORT



- Origins and Destination – **ROUTE**



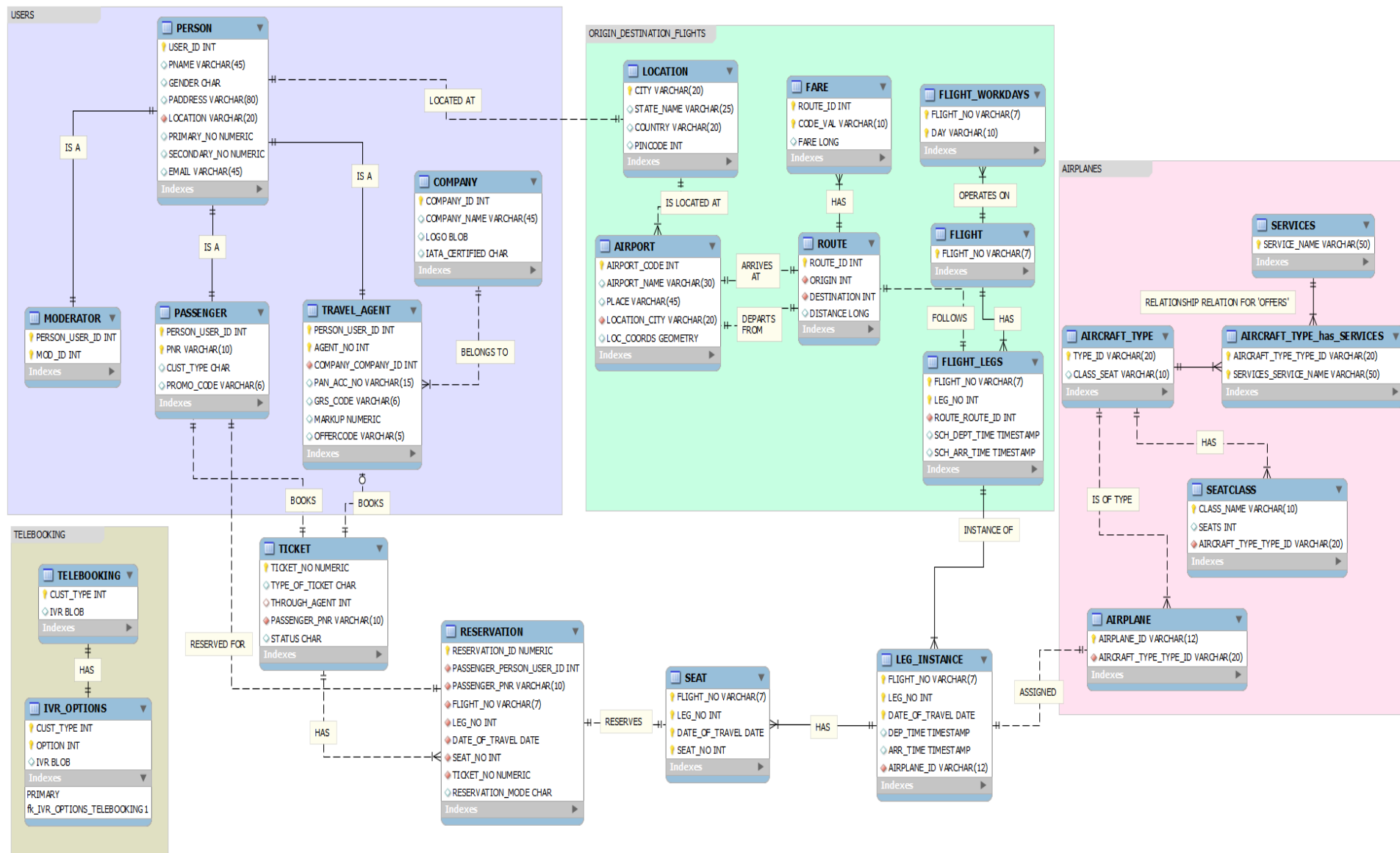
# EER Diagram for AirConnect



# Systematically convert the EER model to a relational schema

- First make a flat conversion of attributes → fields.
- Propagate keys based on participation constraints.
- Normalization.

# Relational Schema



# Database Design

- Choice of ORM – Why not RM.
- Better support for composition of services.
- ER vs EER :
  - Extensibility
  - Need for Aggregation
- OOM based ORDBMS – Oracle 11g R2

# Efficiency

- Selection of Data model – ORDMS.
- Creation of correct indices.
  - Spatial Indices
  - Organizational Indices (for nested relations)
- Indexing specific fields to enable faster JOINS.

# Innovation

- Automated distance/fare calculation using Spatial Features.
- Promoting Flight Services using Data Mining.
- Find airports in proximity during emergency situations.
- Using Ad-hoc queries to generate Demographic details.

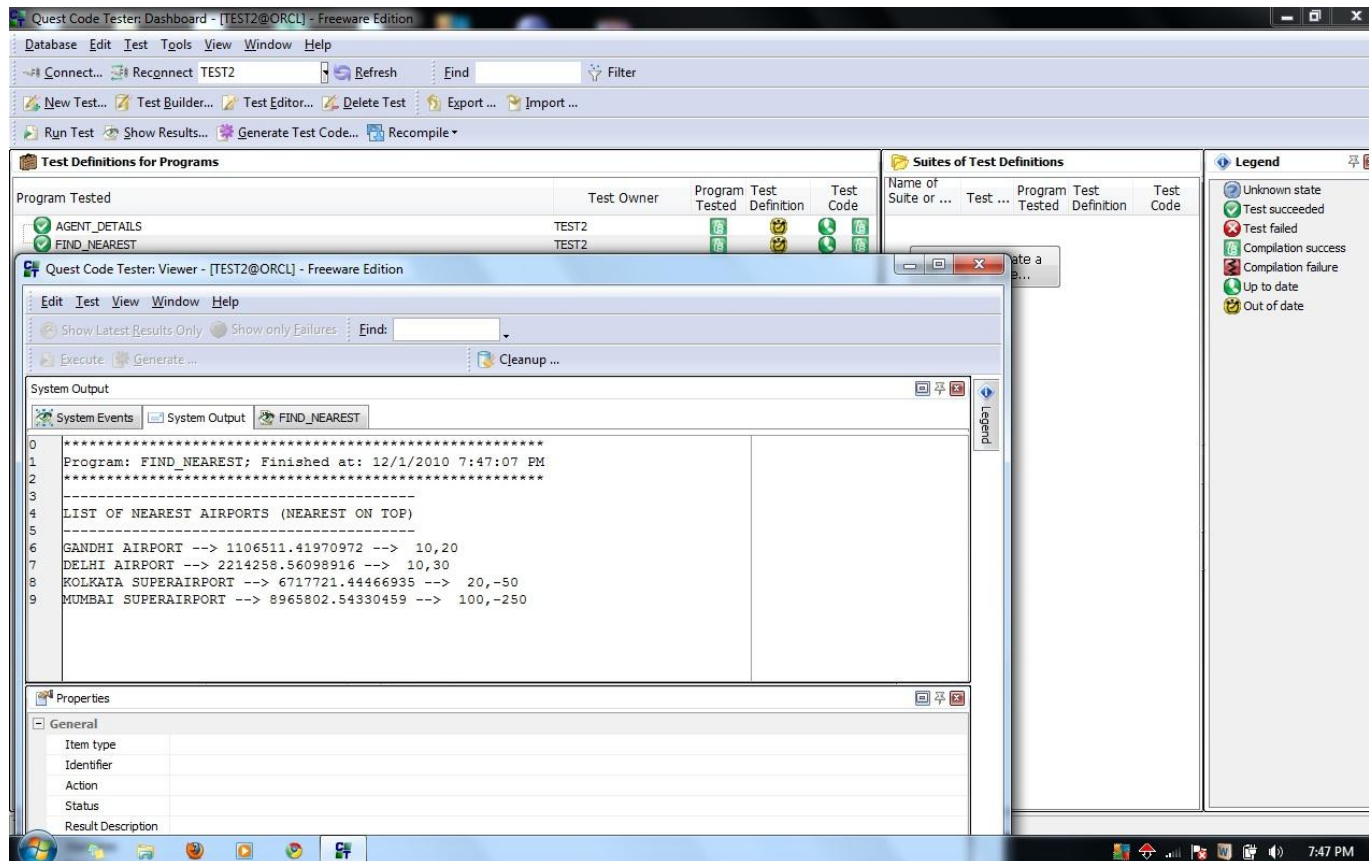


# Security

- Access Control with tuple-level and field-level granularity.
- Role Based Access Control
  - Separate set of privileges for Passenger, Travel Agent and Moderator
- Sensitive Data are encrypted using SHA-1 hashing algorithm.
- Monitoring DBA and restricting privilege escalation.

# Presence of Bugs in SQL

- Extensively tested my system and ensured it satisfies all the considered requirements.
- Tested using the tool **QUEST CODE TESTER FOR ORACLE**



# Extendibility

- Class – Sub Class relationship.
- Hierarchical structure enables addition of extra features.
- Relations are properly normalized.

# Best Practices

- Adapted SDLC for arriving at the design.
- Requirements Analysis – 5 rounds of discussion with the users and travel agents.
- Visited websites to understand the existing Internet Booking implementations.
- Booked a Ticket in SpiceJet using TeleBooking to understand the Telebooking system.
- Documentation of every SDLC stage.

# References

1. *Fundamentals of DATABASE SYSTEMS*, Fifth Edition -Ramez Elmasri, Shamkant B. Navathe
2. *An Introduction to Database Systems* - C. J. Date
3. Maruthi Air Links Pvt. Ltd – Chennai.
4. Amadeus Global Reservation System
5. [www.spicejet.com](http://www.spicejet.com)
6. [www.flykingfisher.com](http://www.flykingfisher.com)

## SDLC stages in this project :

1. Requirements Gathering - Users, Travel Agents.
2. Requirements Specification Document.
3. Requirements Analysis – Documented
4. Conceptual Design : EER Model.
5. EER to Schema Mapping.
6. Implementation using Oracle 11g.
7. Testing using Quest Code Tester.

THANK you!

