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.

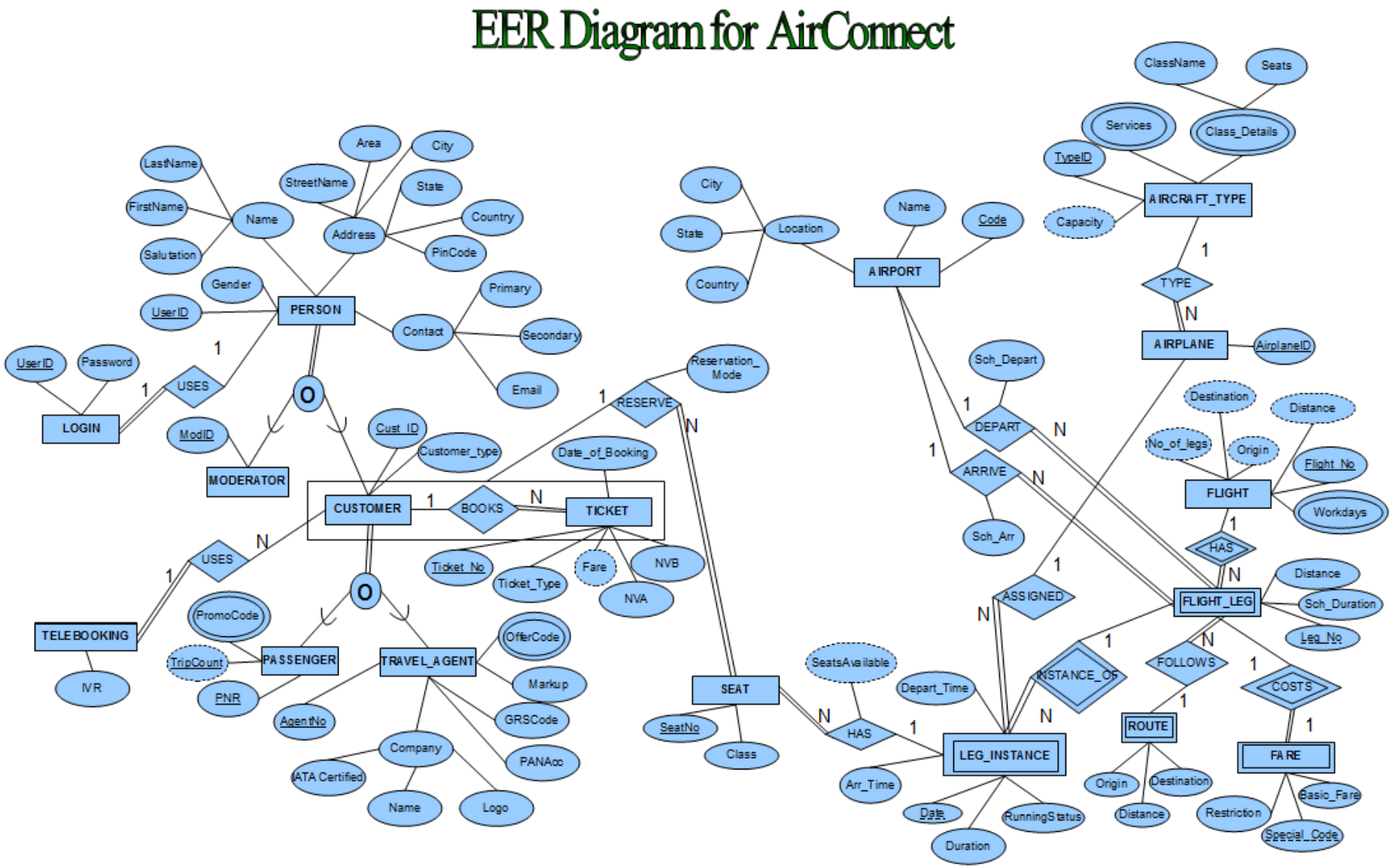
- Identification of entities.
  - Categorization
  - Noun Phrase method

- Deduction of relationships among the entities in terms of Functional Dependencies.

- Generation of new entities (based on relationships).

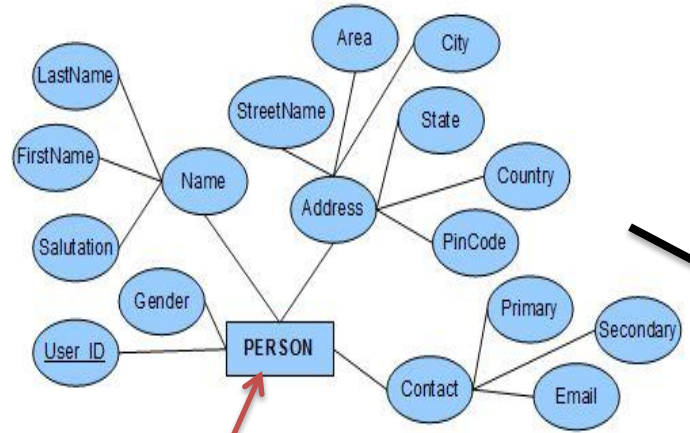
- Identification of attributes from the requirements.

Conceptual Schema



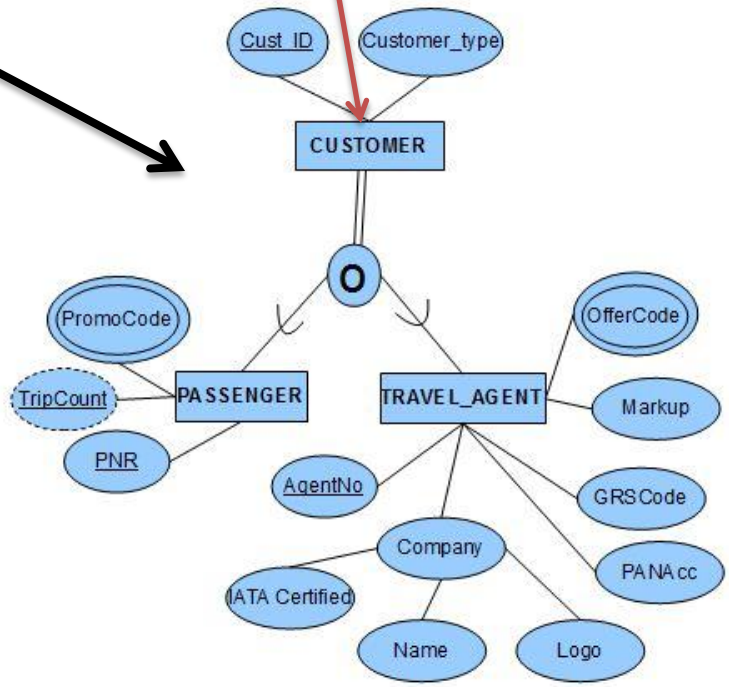
Mandatory Features

All details related to Customers - PASSENGER, TRAVEL_AGENT



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

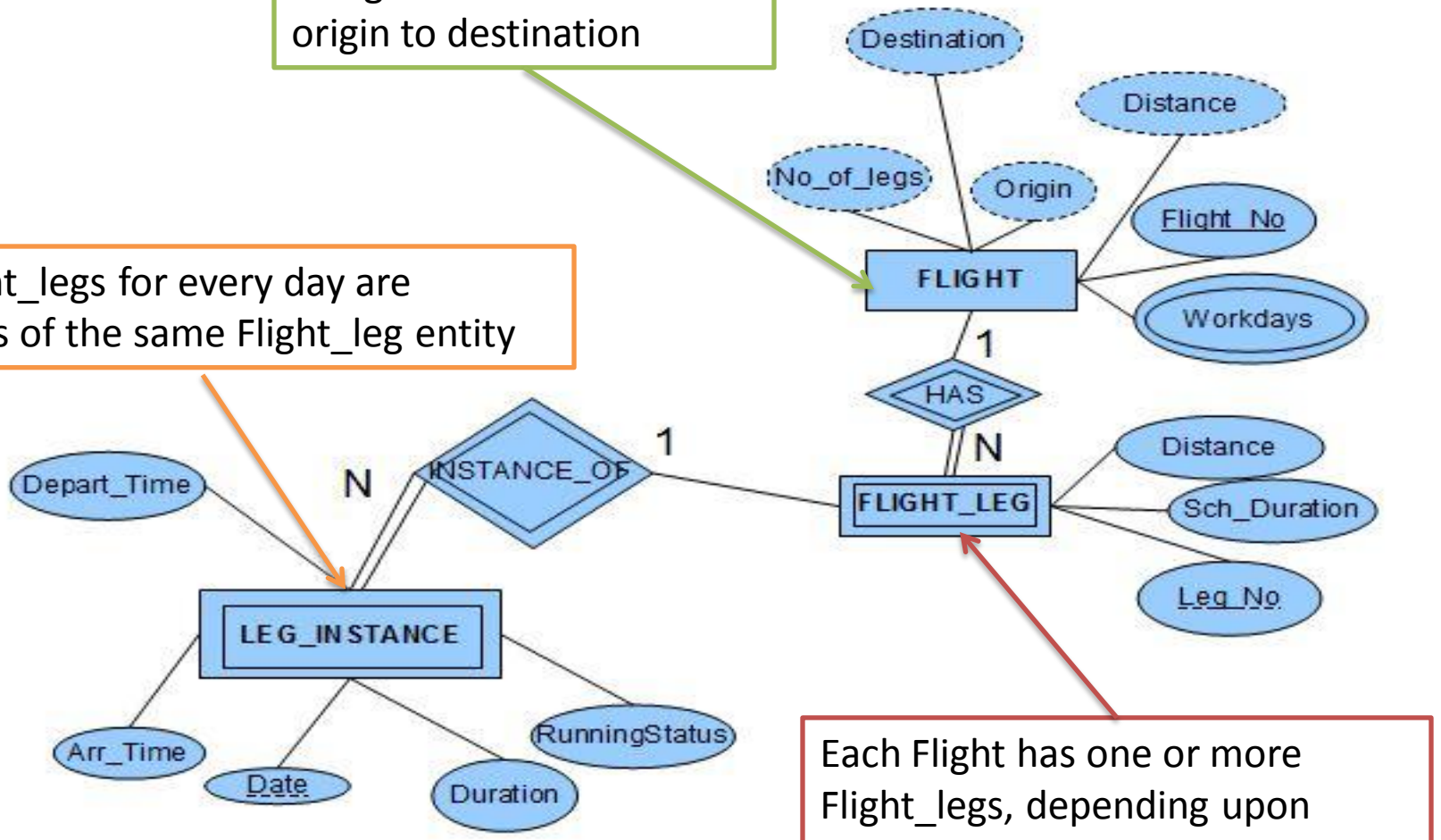
Customer Details – Derived : Further specializes to Passenger and Travel Agent



All details related to Flight - FLIGHT,FLIGHT_LEG, LEG_INSTANCE

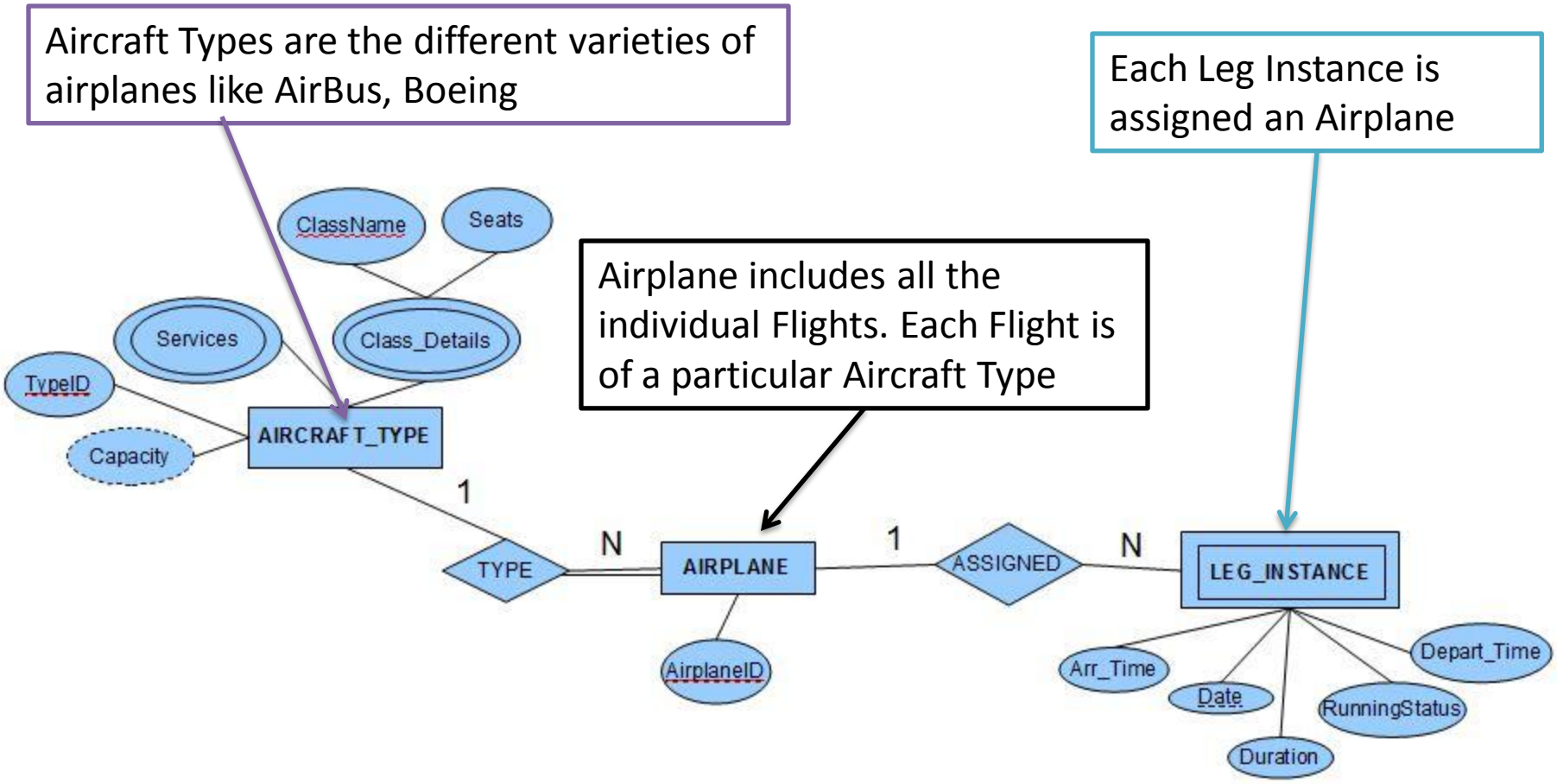
A Flight is a travel from origin to destination

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

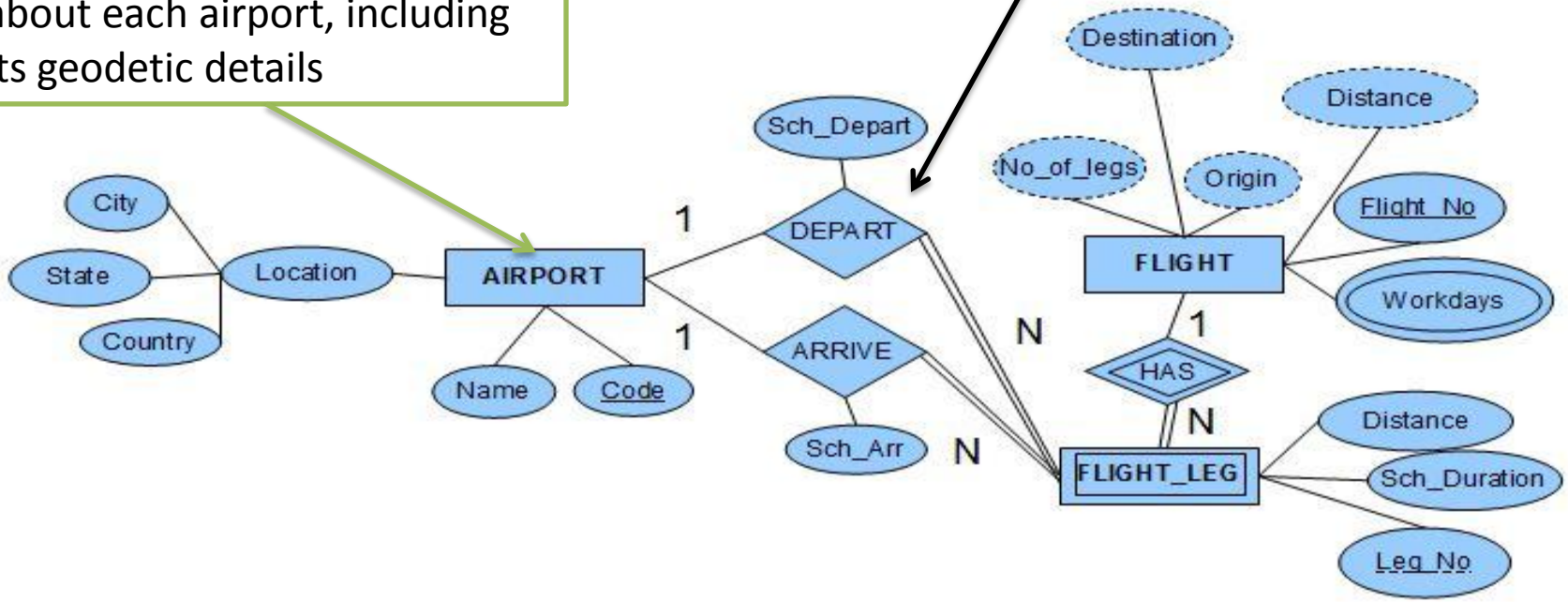
- Details about Airplane : AIRCRAFT_TYPE, AIRPLANE, LEG_INSTANCE



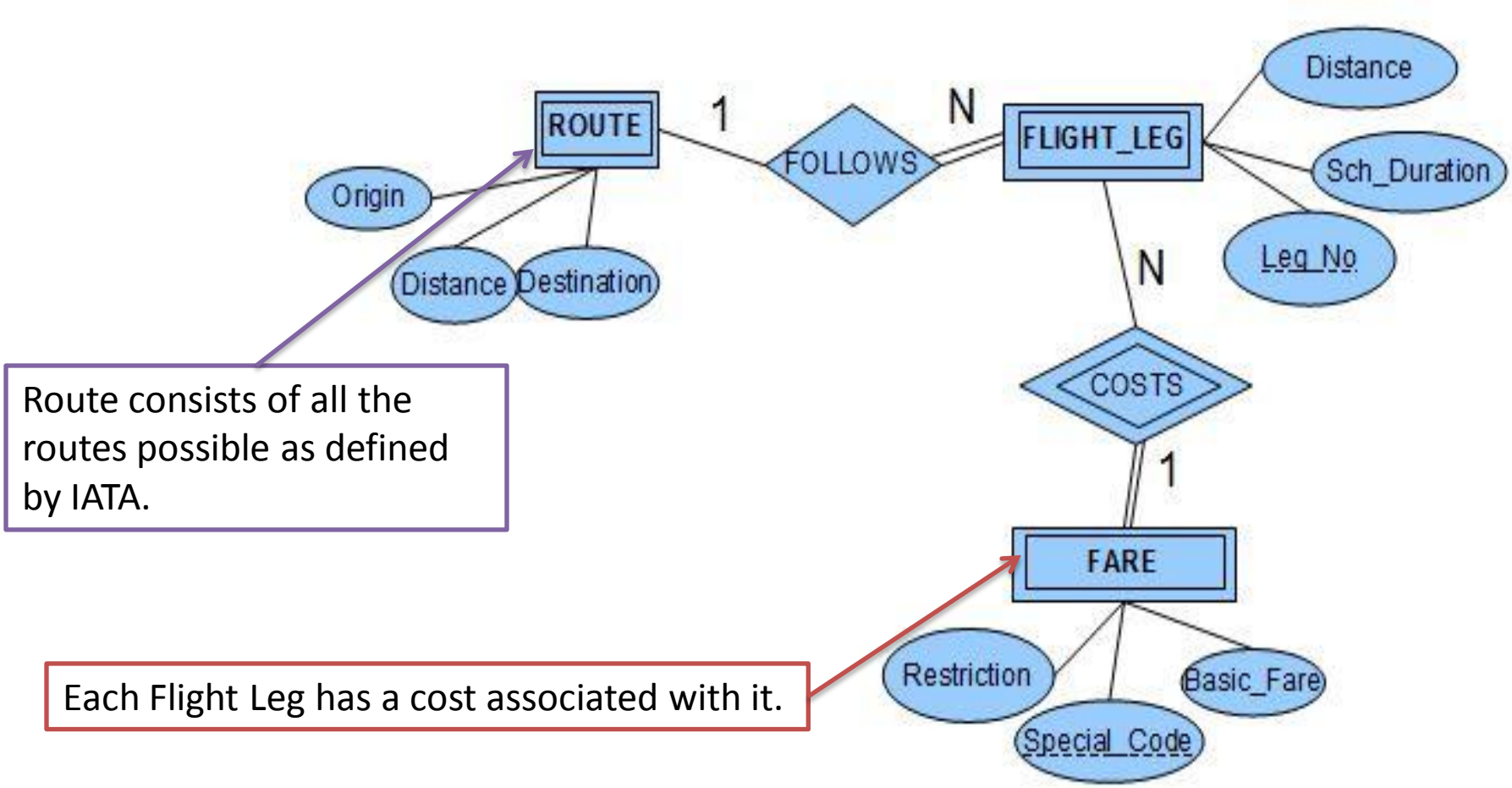
Airports – AIRPORT

Each Flight Leg must have an airport as the origin and destination.

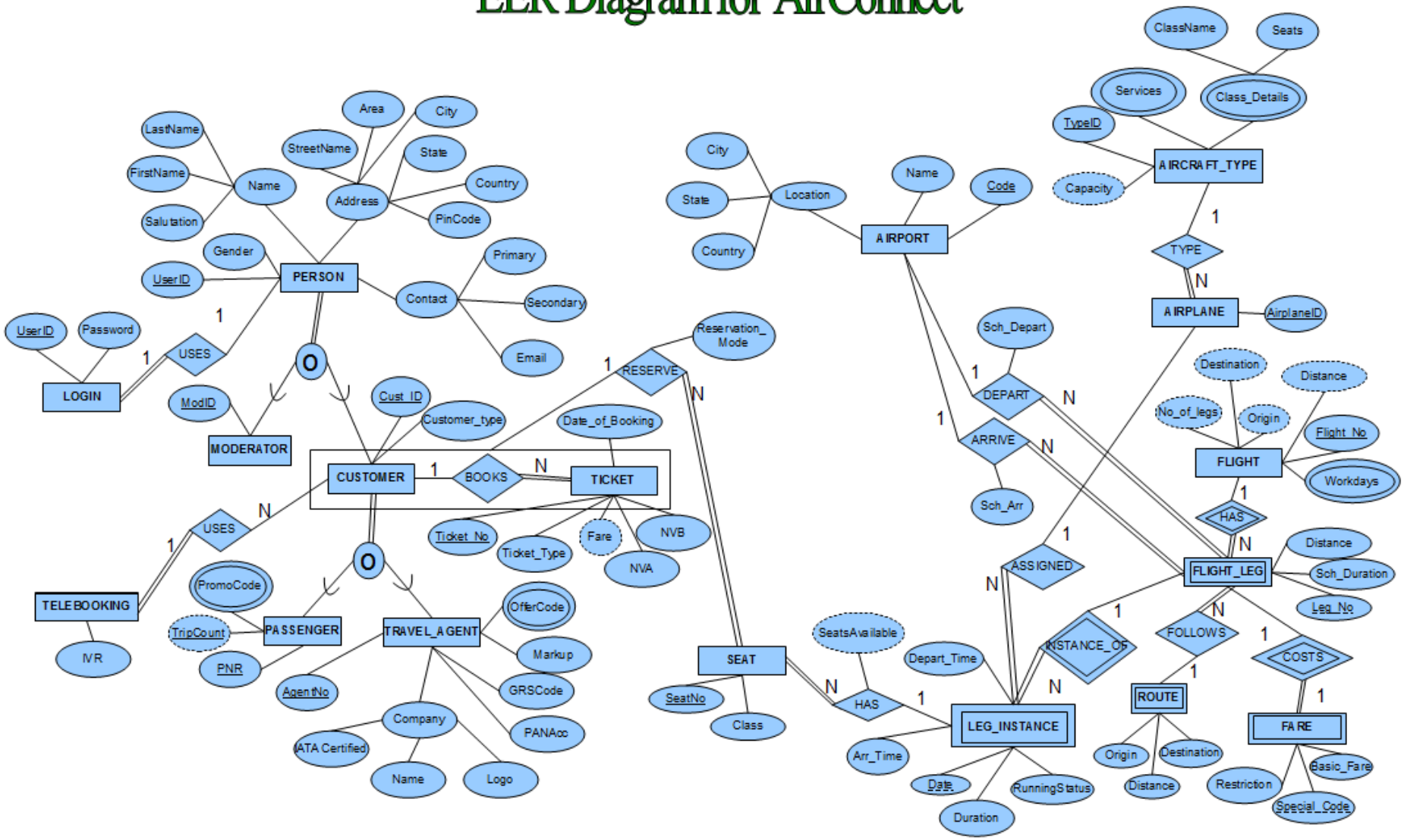
Airport entity holds the details about each airport, including its geodetic details



- Origins and Destination – ROUTE



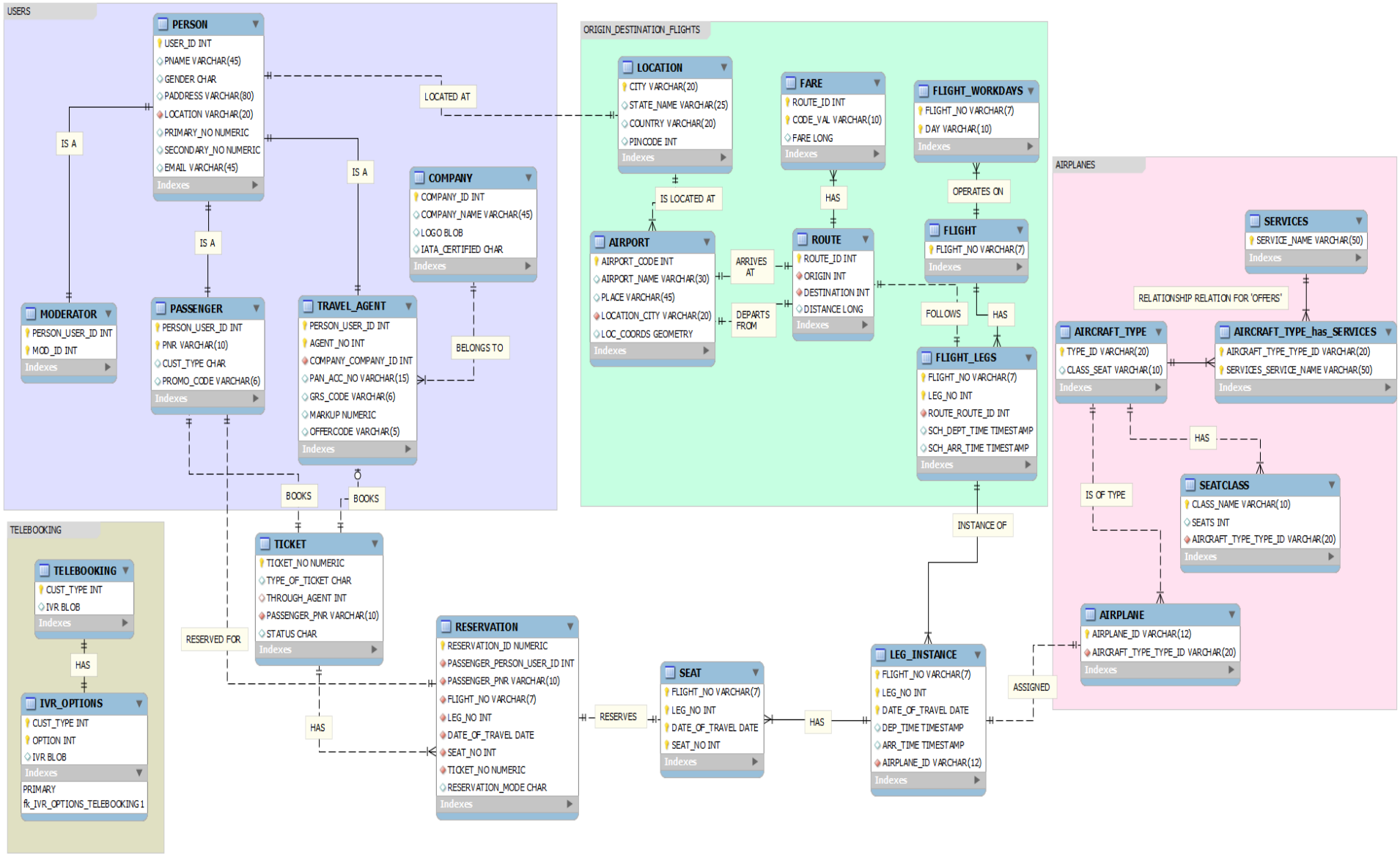
EER Diagram for AirConnect



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

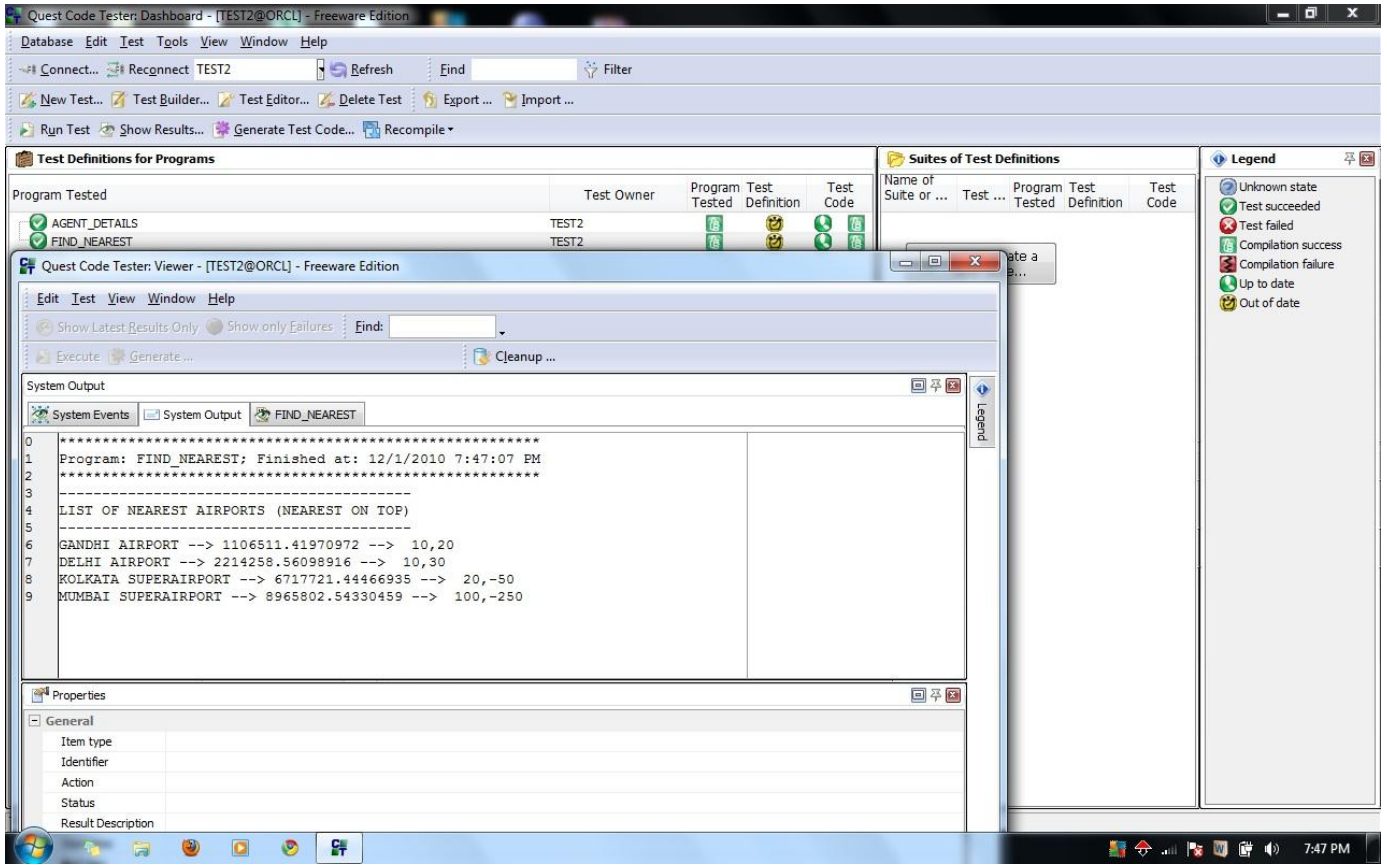
- Automated distance/fare calculation using Spatial Features.
- Promoting Flight Services using Data Mining.
- Find airports in proximity during emergency situations.
- Using Ad-hoc queries to generate Demographic details.

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

6. 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.