

COSC6340: Database Systems

ER modeling

1 Introduction

A new Shipping Company (like DHL, UPS) is developing a new web based system, enabling clients to order and track shipments online. You need to create an ER model for such system.

2 Problem description

In this Online Shipping System, clients can place shipping orders, which at a minimum should include: Client ID, shipment Date, latest delivery date, dispatch address, destination address, person receiving the order, delivery employee, route locations, type of cargo, weight, size, among other attributes described in more detail below.

Consider that customers need to sign up for shipping service the first time. They will provide at least the following information: first name, middle name, last name, address, phone number, email address. Then, the system immediately generates a Client ID number.

Before placing the order, the service price is displayed. The price will depend both on city dispatch/destination and the weight of the shipment. Shipment orders can be paid by credit card, ATM card, gift card, or check. When the client has placed the order, he receives a tracking number by email in a few seconds.

Clients will be able to track shipments. They can track a specific shipment using the tracking number, or all shipments per client using his client number. A client can have more than one shipment running. Consider that a shipment may be returned to the client (for instance, the recipient is not available anymore, moved and so on). The information displayed when clients track their shipments are: Tracking number. Locations - Location identifies a shipment company's shipping, local branch and intermediate locations. Shipping and delivery date-time to such location. Dropping the package at the closest branch from the shipping address (the customer picks it up here). Whether the shipment is being returned and reason.

Hint: Address is a composite attribute and should be split into several attributes (city, number, street, ZIP, etc). Addresses should be reused and referenceable when possible for different purposes.

3 Items to be solved

Your ER model is required to support the following information content:

- Create a new client account.
- Place a shipping order.
- Weight in pounds, size in cubic feet.

- date/time shipping, intermediate location and final delivery.
- Send multiple items in a single order (bundle shipments)
- Check order price.
- Leave package at customer address (default) or leave it at closest branch. Only when customer moved return it to originating address.
- Handle three types of payment (check, credit card, gift card).
- Track client's shipments just with client ID.
- Check for returned items.
- Name and truck # of employee making delivery

For the design of the diagram, you can include all the entities and attributes that you consider may describe the system in the most accurate way, but you will have to justify these decisions (including binary or n-ary relationships) as part of the ER diagram documentation described below. You also should keep in mind that the diagram should reduce the entities, attributes and relationships to the minimum.

1. List of all potential attributes based on the company description given above; list any additional attributes that may be required.
2. List initial entities in your design and group attributes into entities. Explain to which objects in the real world each entity corresponds to.
3. Design a first conceptual ER diagram using the book diagram notation.
4. Additional points will be given if you indicate the PK for each entity (simple/composite) and all FKs per entity.
5. Convert the ER model to a relational ER model using the simplified notation seen in class. You have you use the ERWin tool to create your ER model and it will be limited to 25 entities (trial version at <http://ca.com/us/smb/collateral.aspx?cid=72121&cct=19506>).
6. Explain how you solve M-N relationships and composite attributes. Explain any n-ary relationships, involving three or more entities.
7. Explain the main differences between the ER model and UML (used for OO programming).
8. Explain how you would handle changes to the ER model when new attributes or new entities are added. What are the implications?
9. Investigate potential solutions to an ER diagram that has too many entities (hundreds) and too many attributes (thousands).

4 Requirements

The assignment will be graded based on the completeness of the ER diagram, well defined relationships (ready to be mapped to relational tables). After presenting the ER diagram you should summarize justifications for main relationships in the diagram, especially for an entity that has multiple N:1 relationships. Explain well cases where there are M:N relationships. Also you should consider the following points for your report:

- Team homework; since design is based only on the team member's opinion, I expect ER models to be different between teams.
- Include TWO versions of the ER diagram: a first one where there are M:N relationships purely ER entities at the conceptual/logical level, and a second one where all relationships are 1:N, or N:1 which can be mapped directly to relational tables (physical model).
- Explain 1:N, M:N relationships and conversion to 1:N,M:1 in the last part.
- Diagrams can be done on any diagram tool, use EER notation (do not use old ER notation).
- Try to fit your diagram in one page. If there are too many attributes show only the entity name and the keys inside the boxes.
- All text must be written in a word processor. Use single space and 1 inch margins.

Please submit your work by the due date to the TA, a single PDF or DOC file with the ER model with the embedded diagram. Every homework should be sent by one of the team members in a zip file with the following name convention (*COSC6340 – ERmodel# – lastname_team_member_1 – lastname_team_member_2*). Send your email ONLY TO THE TA. You are encouraged to post questions in the Google newsgroup. A reasonably well done model will receive full credit. A copied homework, poor/short ER model or a document without explaining M:N, 1:N relationships will incur on a penalty between 10% and 20% of the grade of Project 1.