Database Design: Conceptual Model and ER Diagramming

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INFO 257: Database Management

Announcements

- Questions?
- Everyone enrolled? Come see me at break.
- Nametags [Name, Project Ideas]
- Assignment 2a released.
  - Assignment 1 and 2a questions?
- Everybody on Piazza?
- Class Structure
  - Lecture
  - W1 Complete? / W2 SQL sample questions

Note on drawing diagrams

- You will be asked to draw ER (or UML) diagrams for your personal database
- Diagrams should be drawn with a drawing tool or DB Design tool
- There are loads of DB Design tools
  - See, e.g., http://www.databaseanswers.org/modelling_tools.htm
- One that's cross platform (SAAS)
  - https://lucidchart.zendesk.com/hc/en-us/articles/207324096-Get-Started-with-an-Educational-Account
  - https://www.mysql.com/products/workbench/

Lecture Outline

- Developing the Conceptual Model for the Diveshop Database

Developing a Conceptual Model

- Building the Conceptual Model for the Diveshop database

Marine Adventures and Sunken Treasure

Developing a Conceptual Model

- Overall view of the database that integrates all the needed information discovered during the requirements analysis.
- Elements of the Conceptual Model are represented by diagrams, *Entity-Relationship or ER Diagrams*, that show the meanings and relationships of those elements independent of any particular database systems or implementation details.
- Can also be represented using other modeling tools (such as UML)

Developing a Conceptual Model

- We will look at a small business -- a diveshop that offers scuba diving adventure vacations
- **Assume** that we have already done interviews with the business and found out the *following information* about the forms used and types of information kept in files and used for business operations...

Primary Business Operations

- The shop takes orders from customers for dive vacations.
- It ships information about the dive vacation to the customers.
- It rents diving equipment for the divers going on the trips (these may include additional people other than the customer)
- It bills the customer for the vacation and for equipment rental or sales.

Business Operations (cont.)

- It arranges sub-trips to particular dive sites at the primary location
  - *NOTE: This needs expanding – e.g., charter boats, divemasters, local dive companies*
- It provides information about the features of various sites to help customers choose their destinations.
  - Features include sea life found at the location and shipwrecks

Business Operations (cont.)

- Each dive order (or sale or trip) is on an invoice to one customer.
  - Invoices contain:
    - Line items for each type of equipment ordered,
    - Total amount due for the invoice,
    - Customer information:
      - Name, address, phone, credit card info.
    - *Note: could be expanded with particular charter dates and time, dive boats, etc.*
- Information must be kept on inventory of dive equipment.
- There are multiple types of dive equipment:
  - The prices charged for sale or rental are maintained

Business Operations (cont.)

- Destination information includes:
  - Name of the destination
  - information about the location (accommodations, night life, travel cost, average temperatures for different times of the year
- Destinations have associated dive sites
- Dive Sites have associated features
  - Difficulty rating, depth, etc.
  - Sea life
  - Shipwrecks (*as* sites or at sites)
  - *Note: could be expanded to include the boats, etc. that go to specific sites*

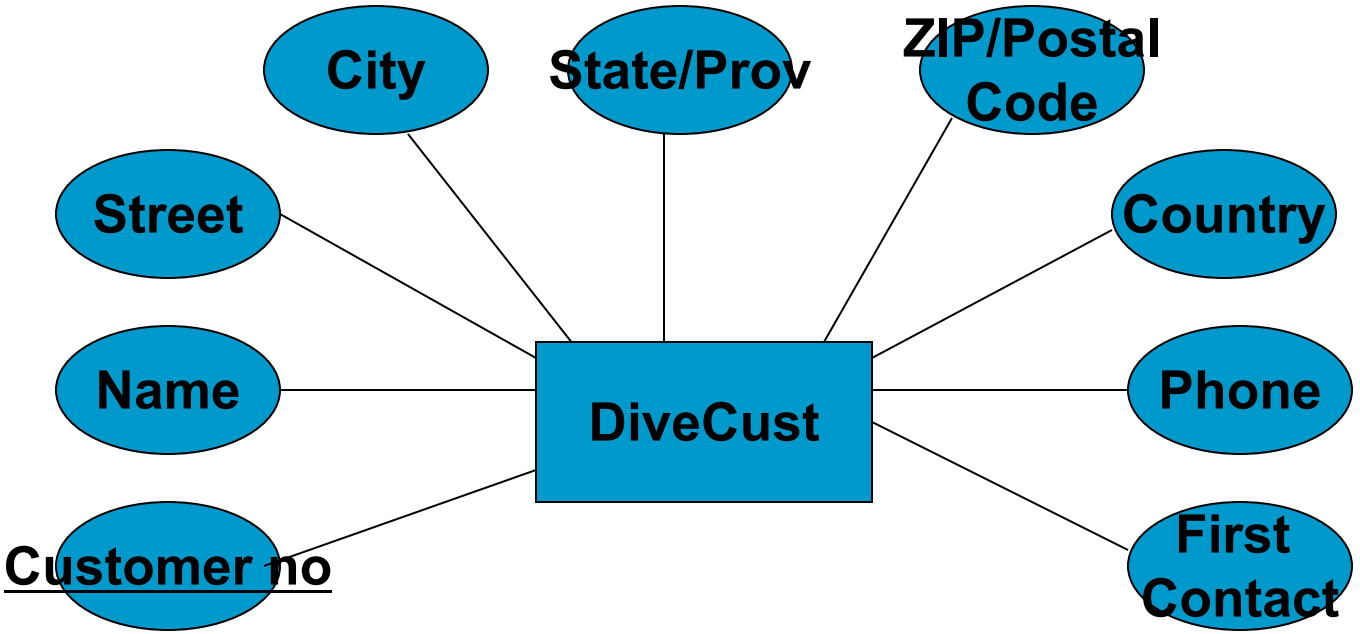
Business Operations (cont.)

- One record is kept for *each* order by a customer and will include the method of payment, total price, and location information. (I.e. Customers may have multiple orders)
- The company needs to know how an order is to be shipped.
- The shop has to keep track of what equipment is on-hand and when replacements or additional equipment is needed

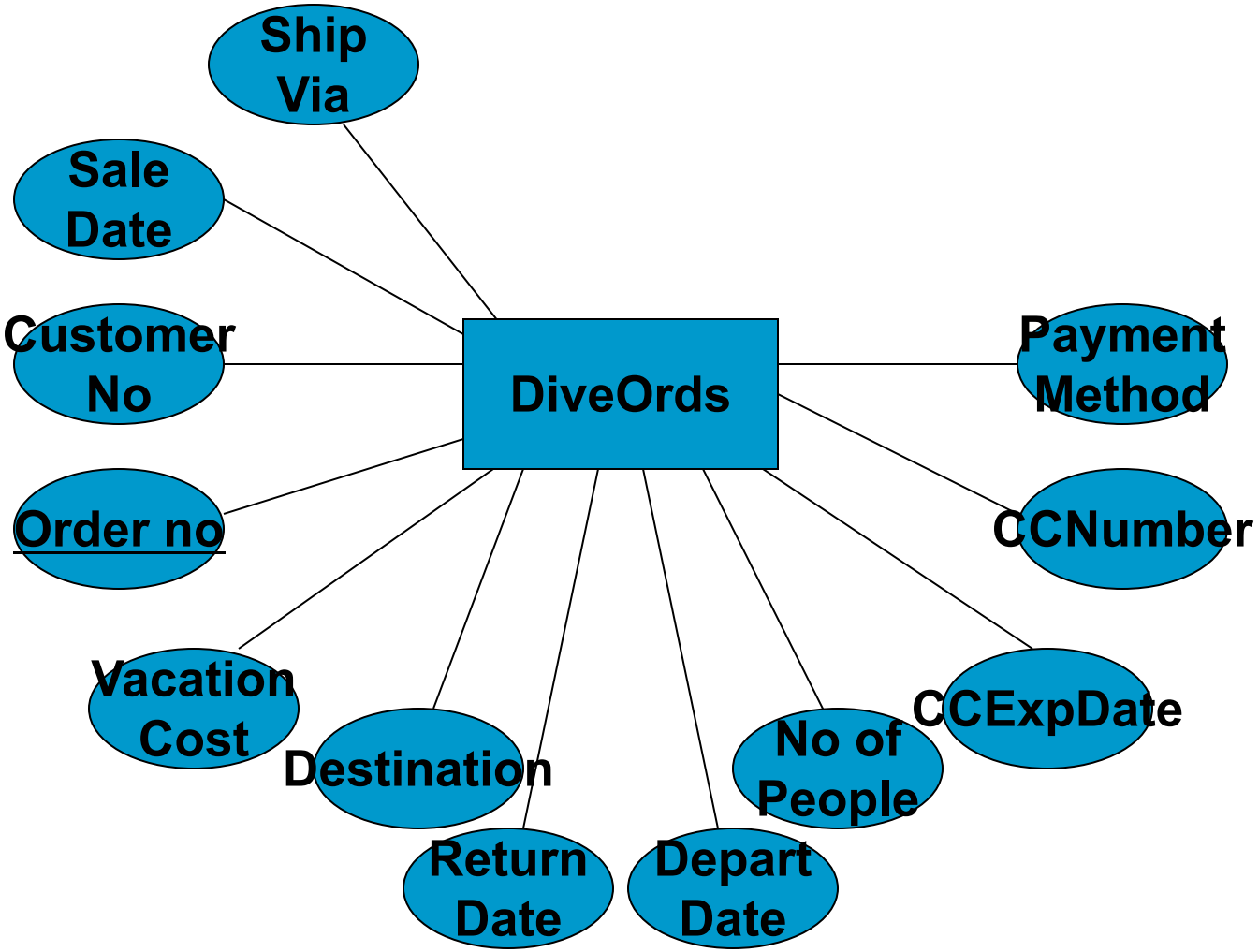
Entities

- Customer
- Dive Order
- Line item
- Shipping information
- Dive Equipment/ Stock/Inventory
- Dive Locations
- Dive Sites
- Sea Life
- Shipwrecks

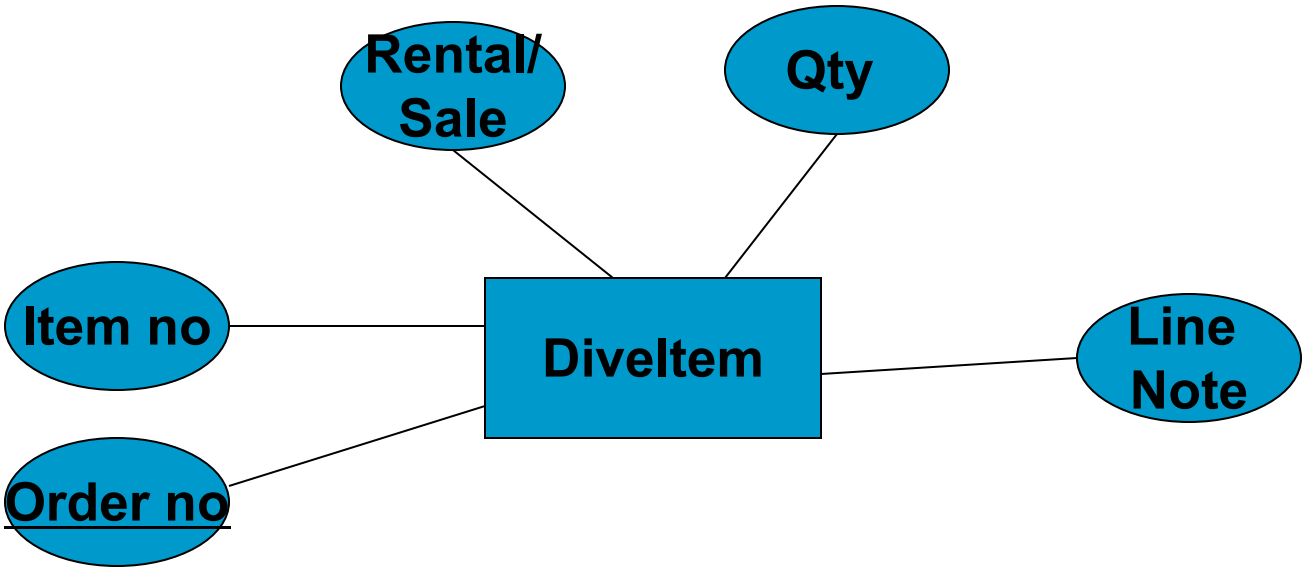
Diveshop Entities: DIVECUST



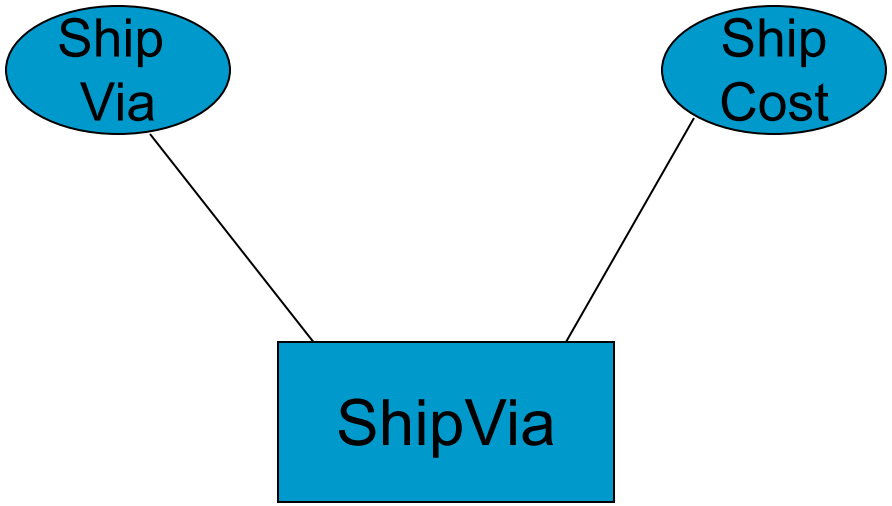
Diveshop Entities: DIVEORDS



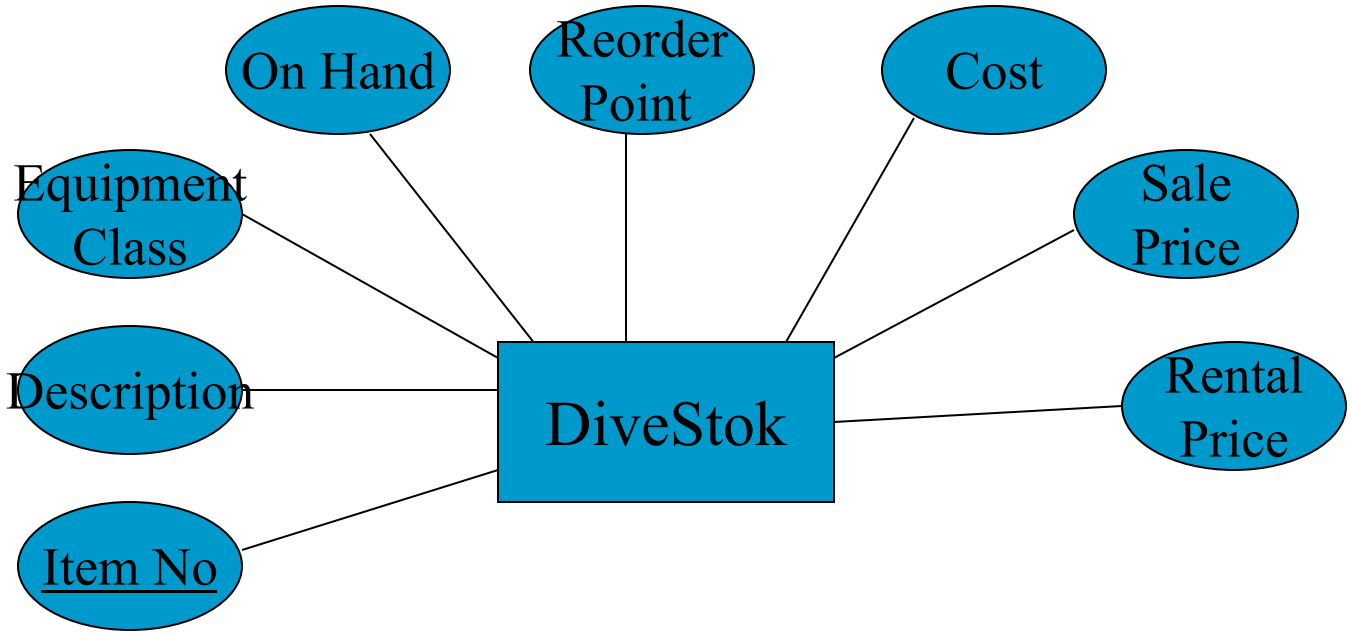
Diveshop Entities: DIVEITEM



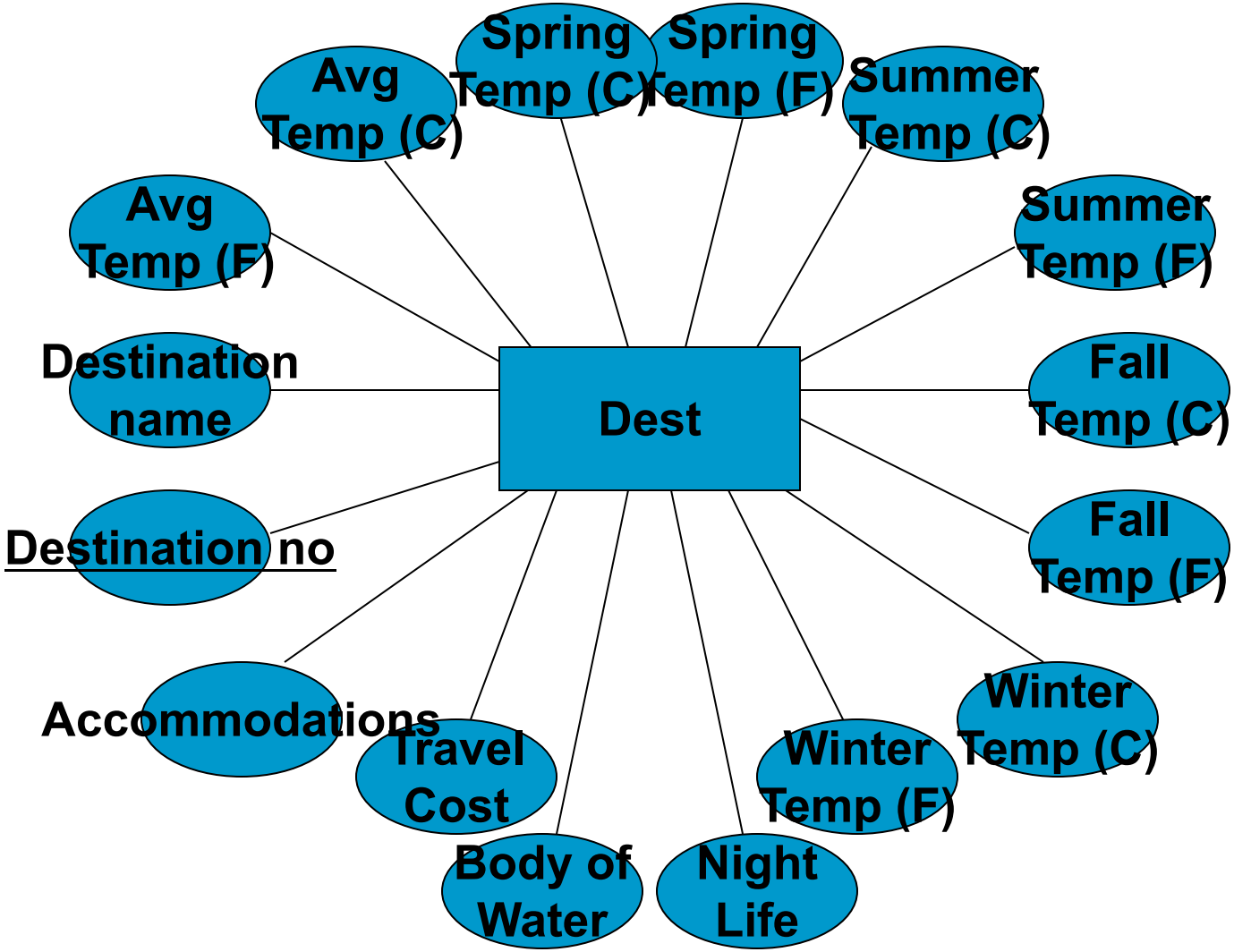
Diveshop Entities: SHIPVIA



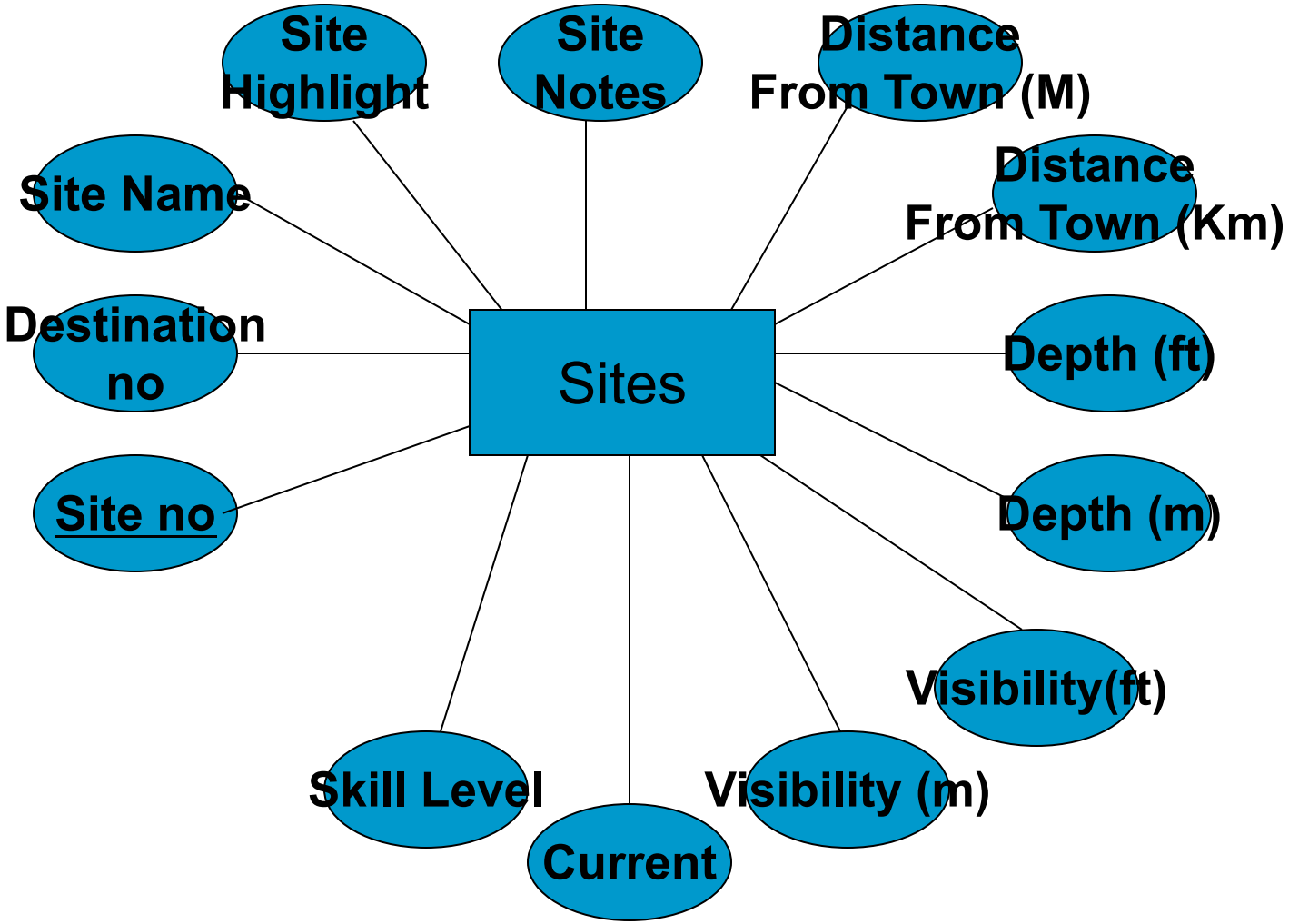
Diveshop Entities: DIVESTOK



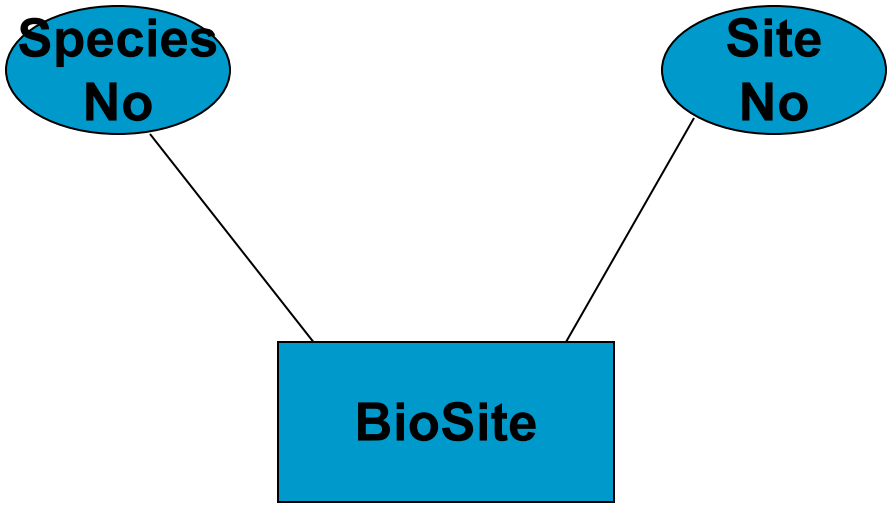
Diveshop Entities: DEST



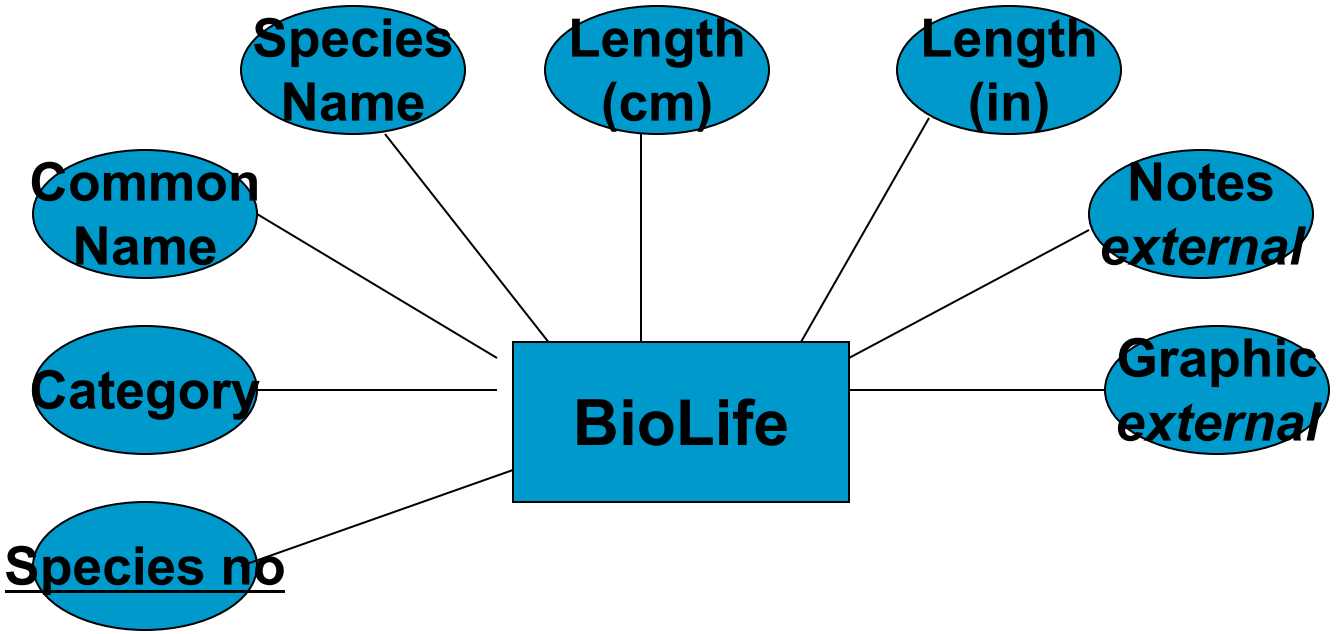
Diveshop Entities: SITES



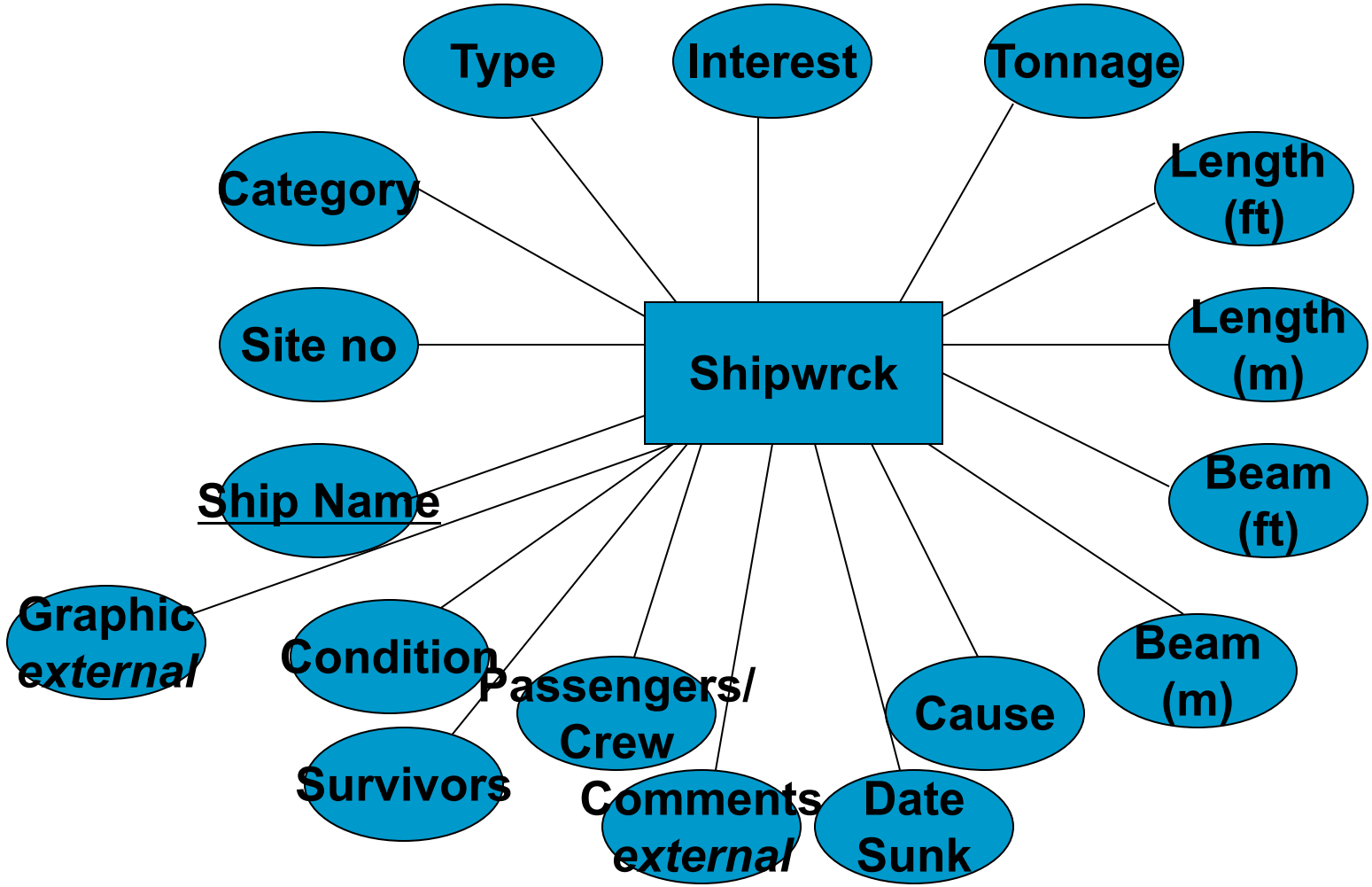
Diveshop Entities: BIOSITE



Diveshop Entities: BIOLIFE



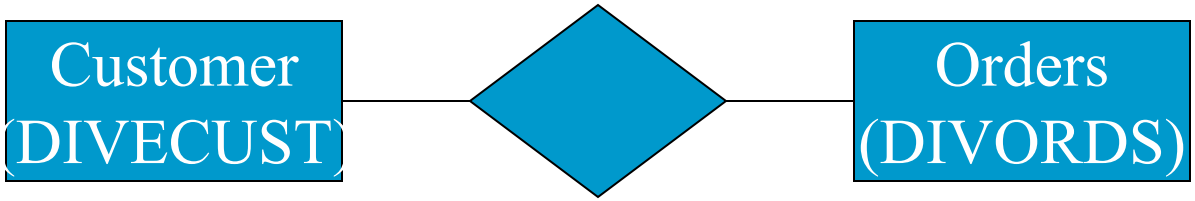
Diveshop Entities: SHIPWRCK



Functional areas

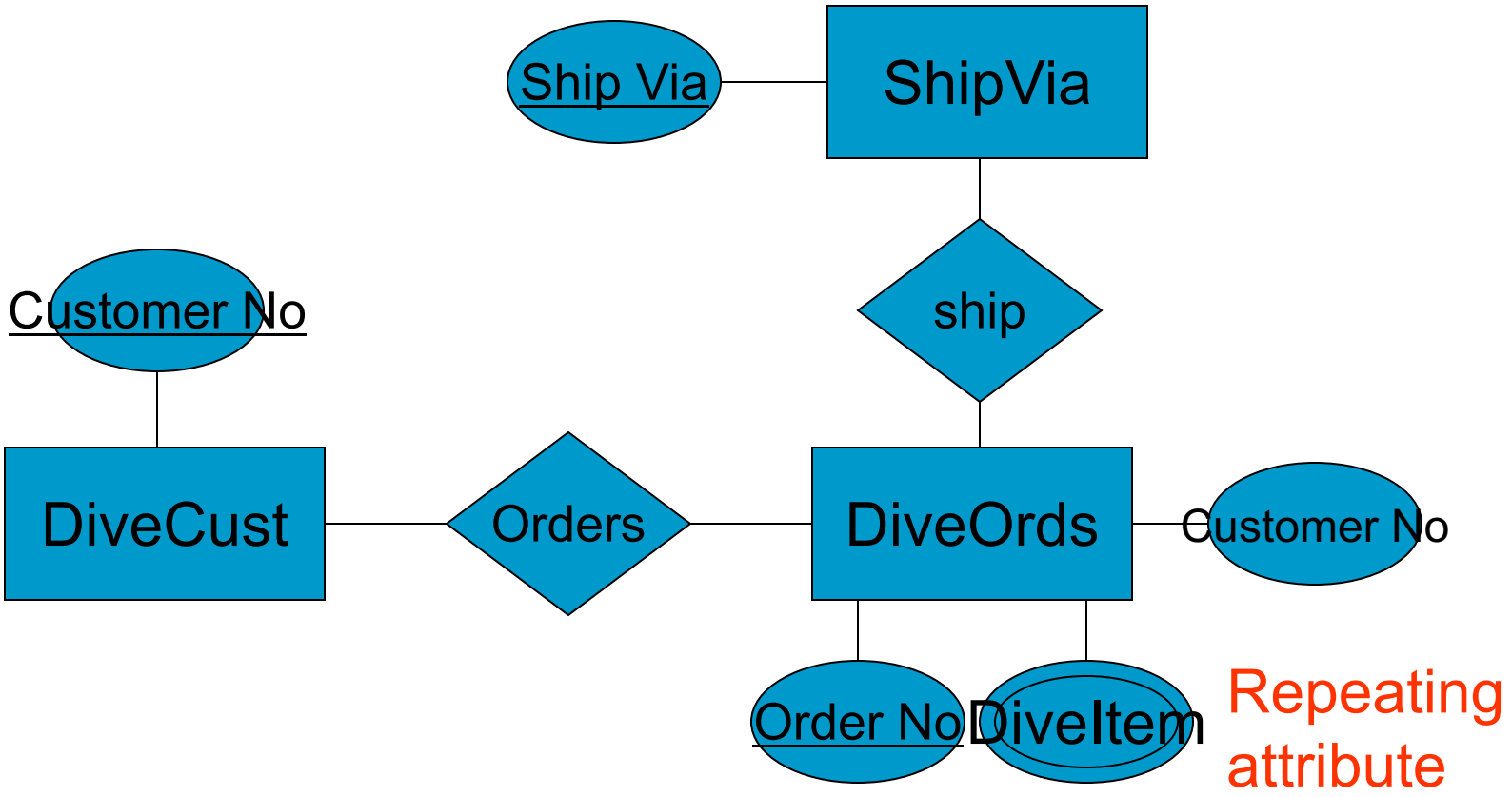
- Ordering
- Inventory
- Supplies
- Shipping
- Billing
- Location/Site Selection
  - We will concentrate on Ordering and Location/Site Selection (these are joined tasks)

Ordering

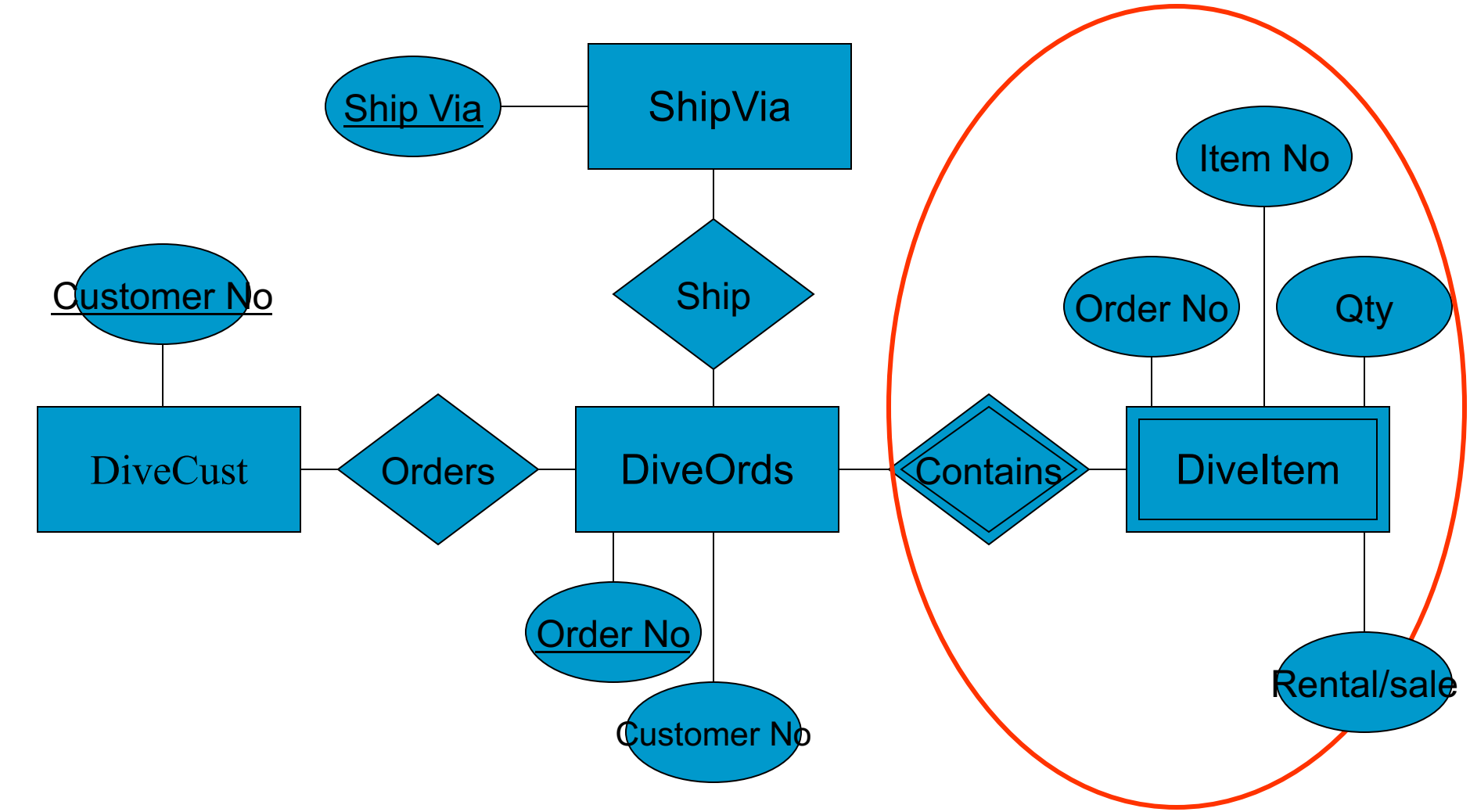


Customers place Orders
Each Order needs Customer information

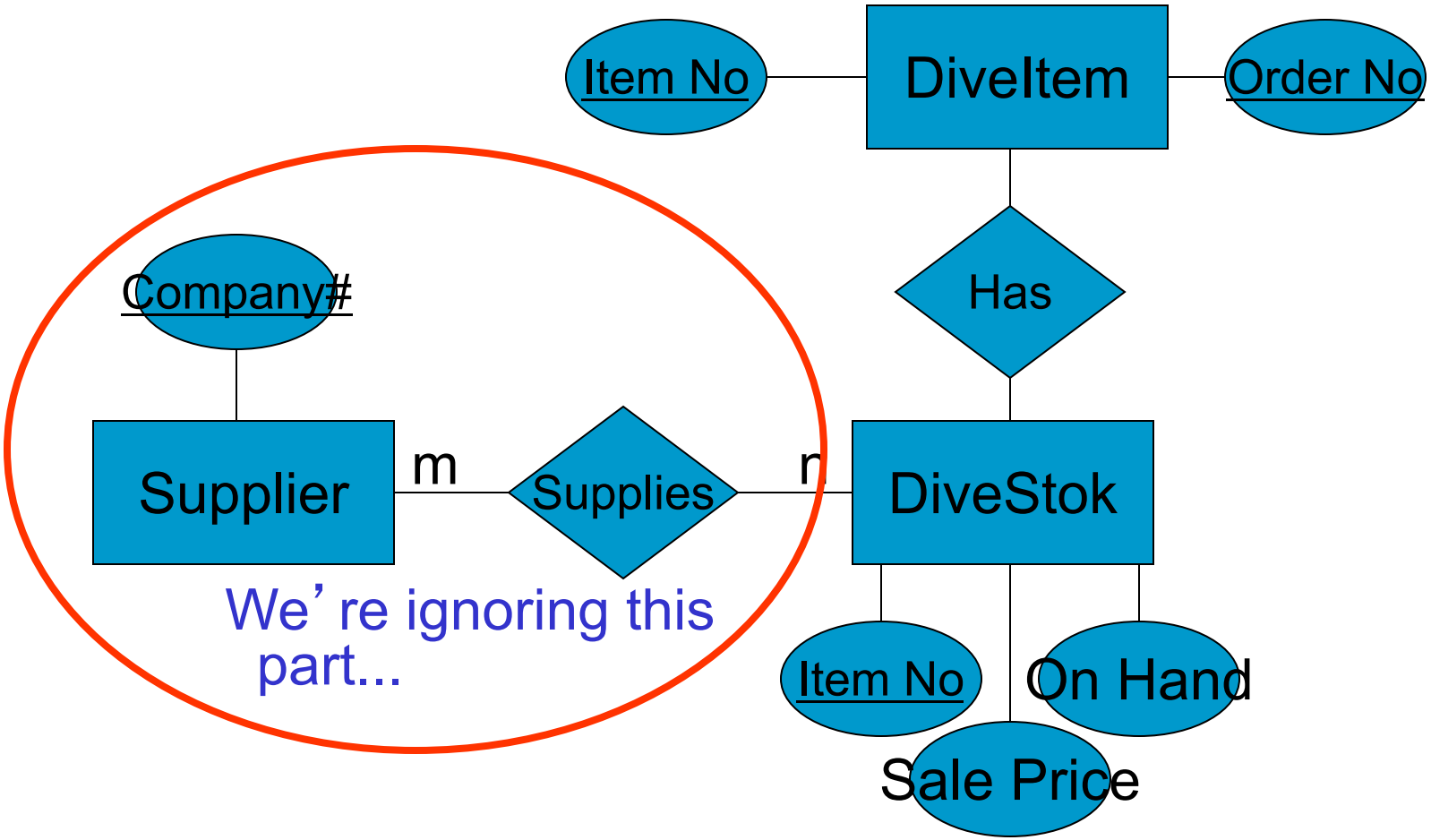
Ordering


Ship Via
ShipVia
ship
Customer No
DiveCust
Orders
DiveOrds
Customer No
Order No
DiveItem
Repeating attribute

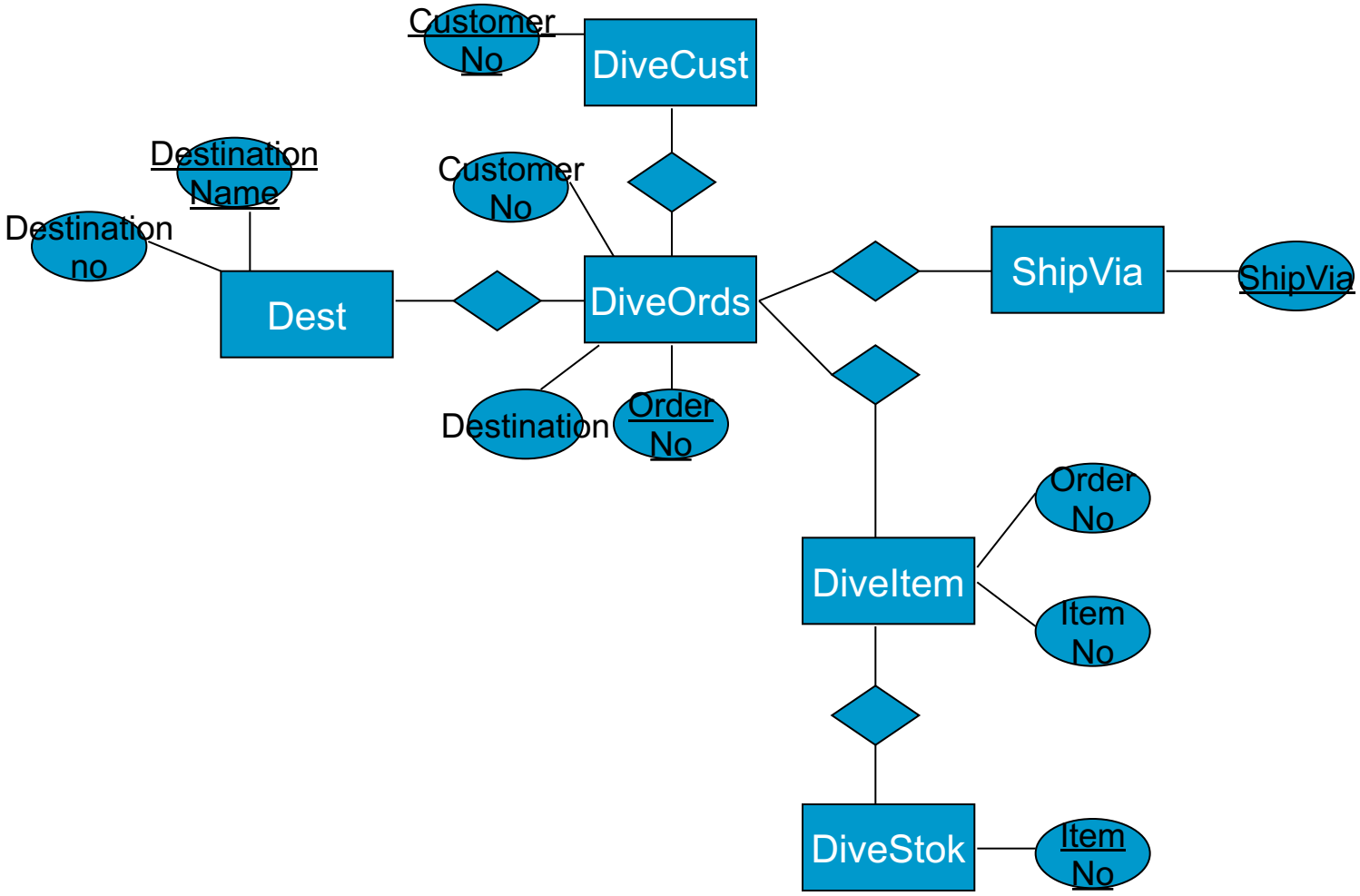
Ordering Normalization



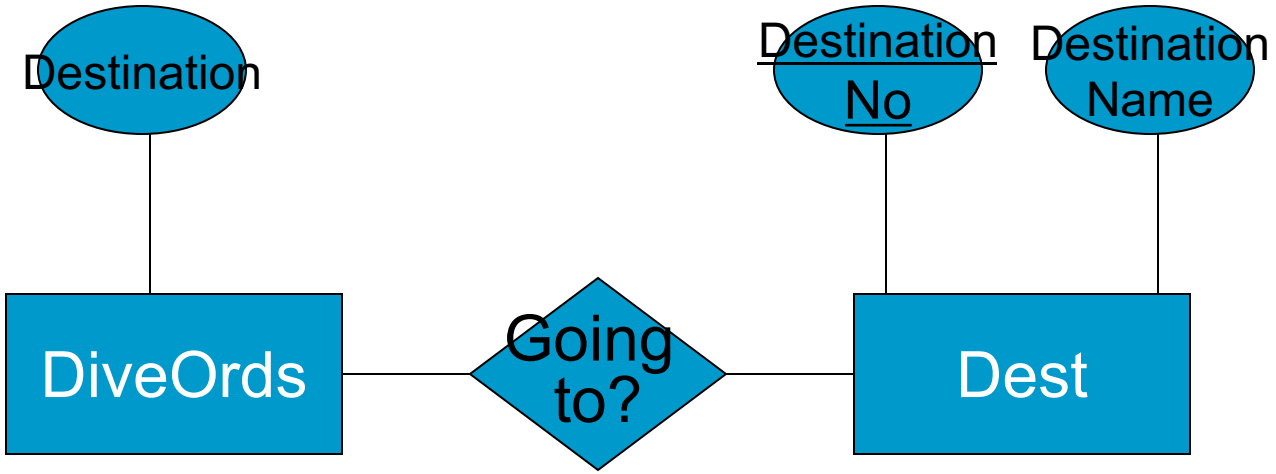
Details of DiveItem



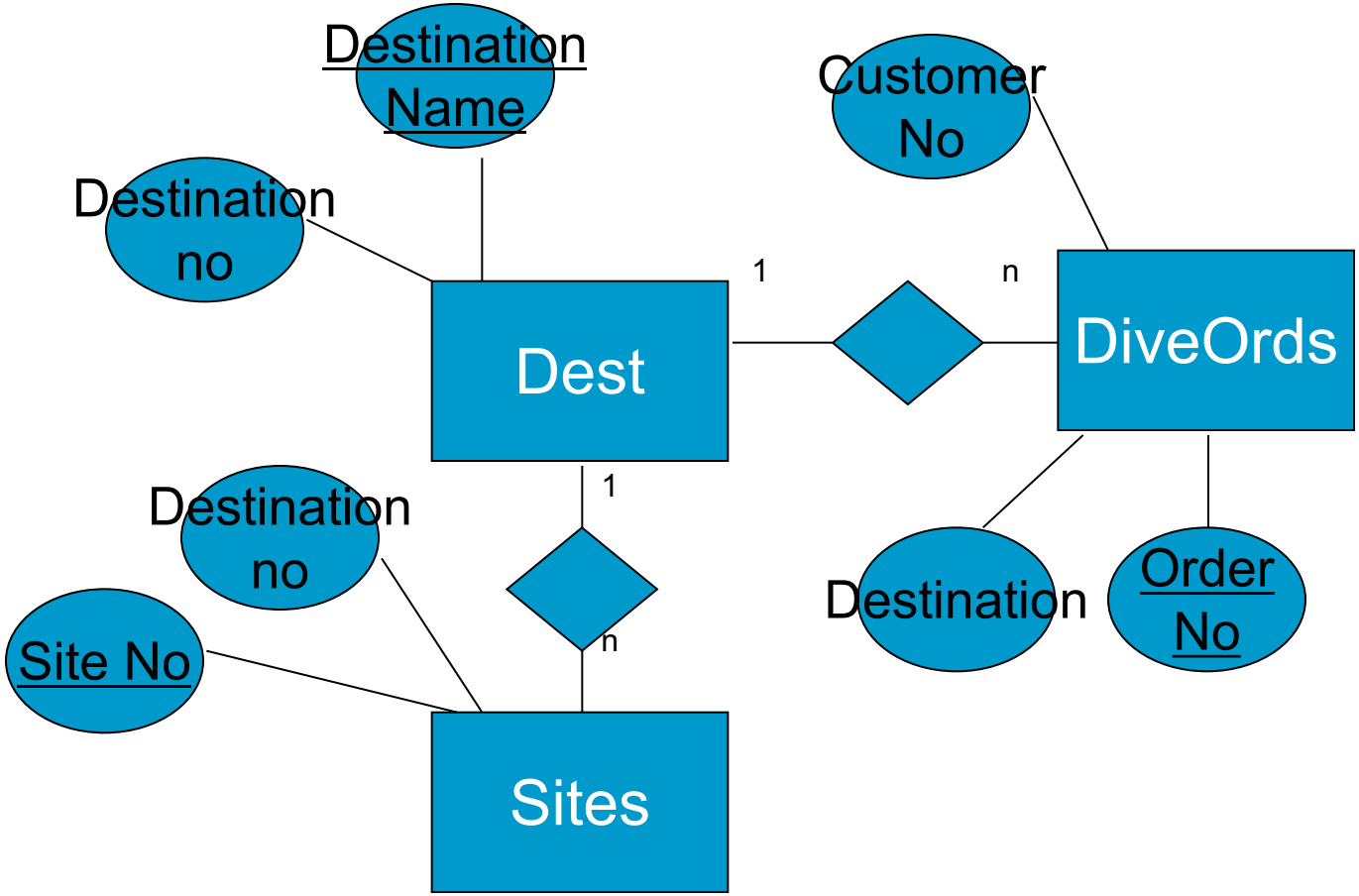
Ordering: Full ER



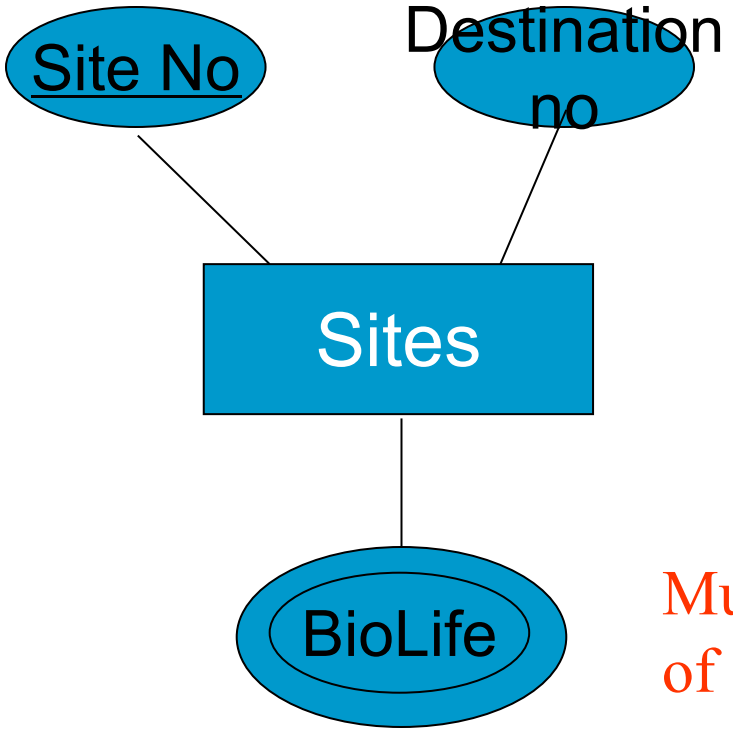
Location/Site Selection



Destination/ Sites

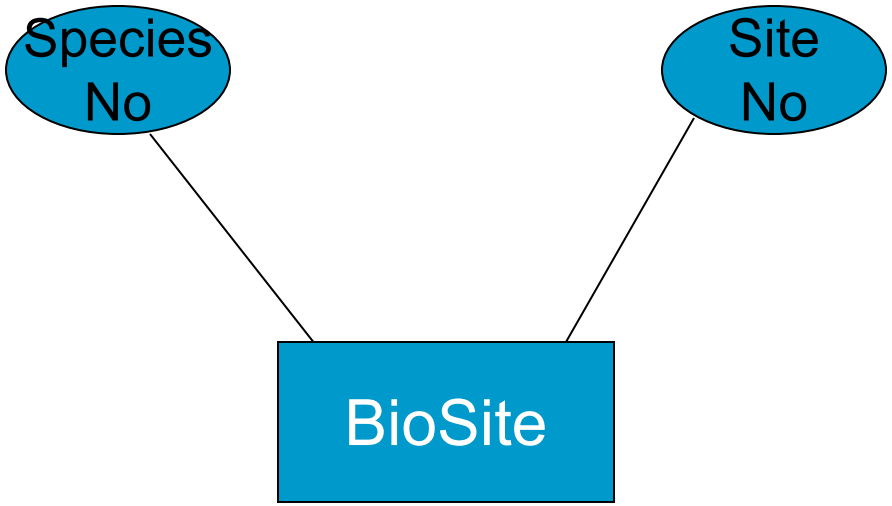


Sites and Sea Life 1

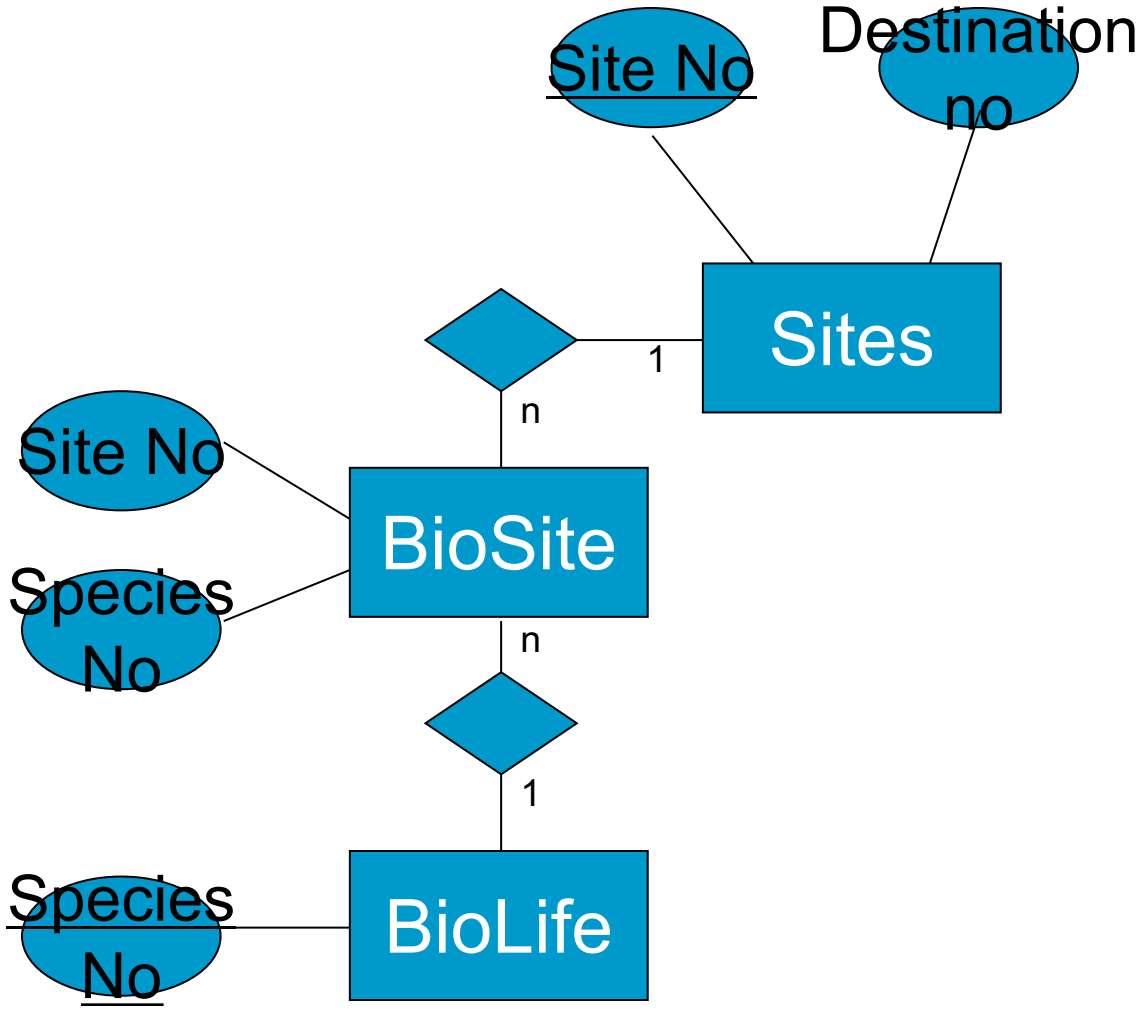


Multiple occurrences of sea life...

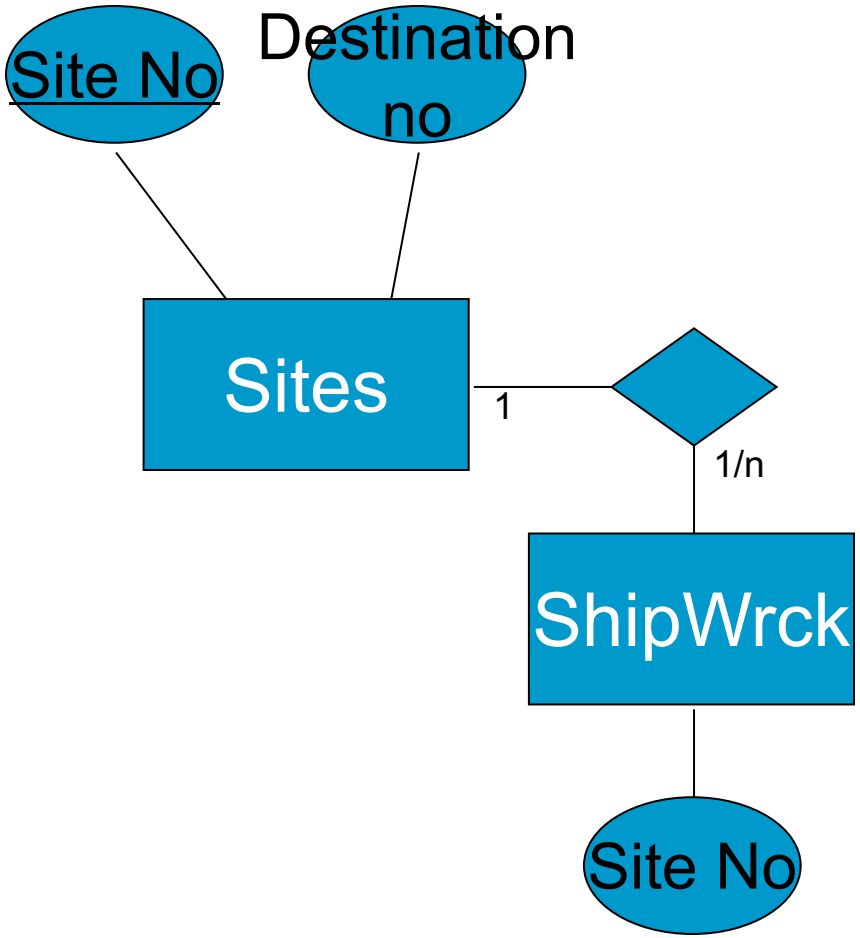
Diveshop ER diagram: BioSite



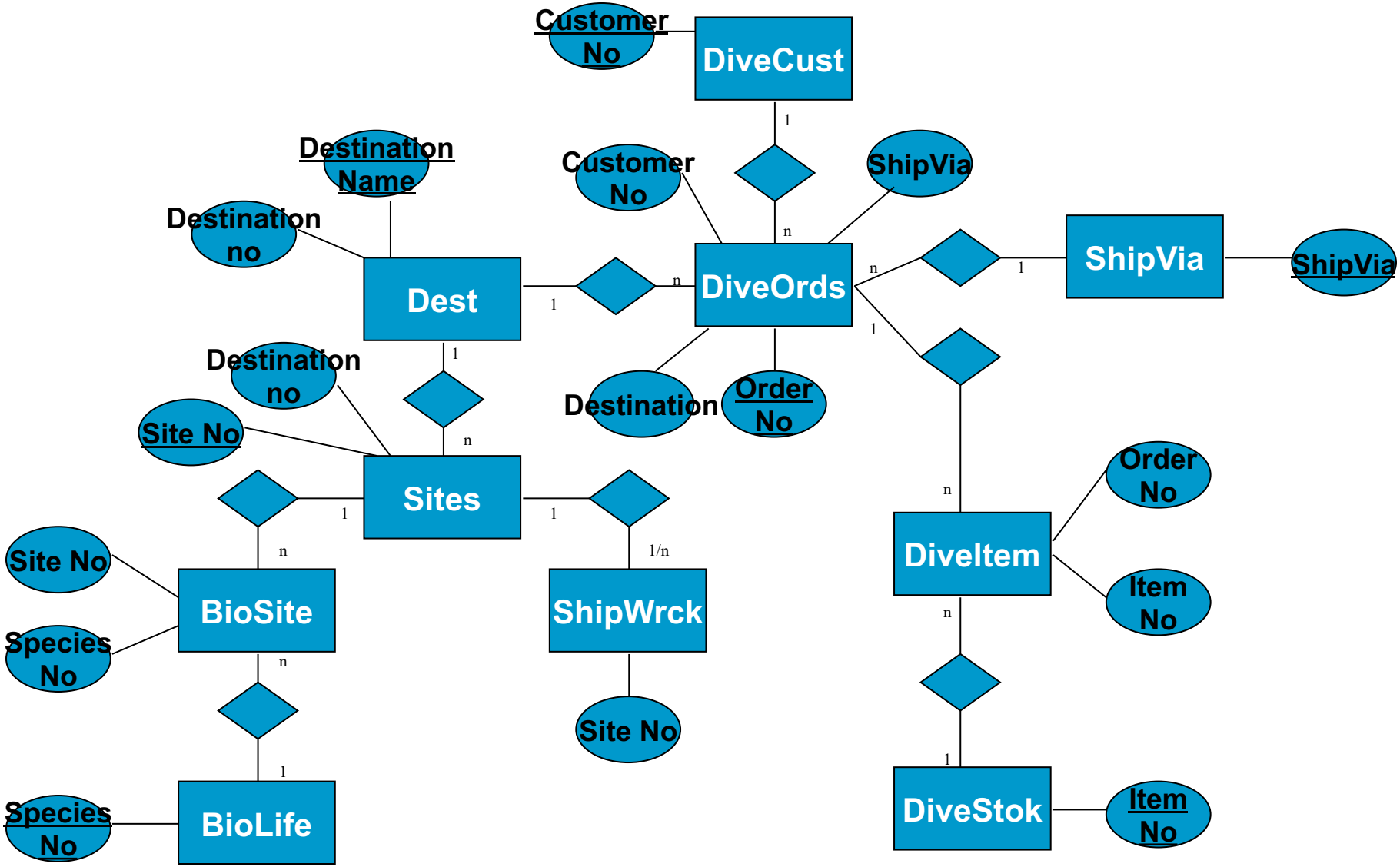
Sites and Sea Life 2



Sites and Shipwrecks



DiveShop ER Diagram



What must be calculated?

- Total price for equipment rental?
- Total price for equipment sale?
- Total price of an order?
  - Vacation price
  - Equipment (rental or sale)
  - Shipping

What is Missing??

- Not really an "enterprise-wide" database
  - No personnel…
    - Sales people
    - Dive masters
    - Boat captains and crew
    - payroll
  - No Local arrangements…
    - Dive Boats
      - Charter bookings?
    - Hotels?
  - Suppliers/Wholesalers for dive equipment
    - Orders for new/replacement equipment
  - No history (only current or last order)

Versions of Diveshop

- MariaDB version of the database is available for download through the class web site
- Also a PostgreSQL version for those with some DBMS experience
  - Note: Would require a new PostgreSQL docker image