Car Wash Tutorial

Walt owns the A1A car wash. This is a drive-in facility where customers can have their cars and vans washed and polished while they wait. The business is expanding unexpectedly quickly, and Walt needs to create a database to keep track of all the information needed to run the car wash.

There are many customers who use the car wash on a regular basis. These customers have at least one vehicle that they bring to be cleaned.

The staff of the car wash use a number of products to clean the vehicle, which are provided by a variety of suppliers. Due to his booming business, Walt may need to open new branches of the car wash to cope with demand.

Note: You may invent a few appropriate attributes for the entities you model.

Please state any assumptions you are making about the entities and relationships

Quick Recap

- ERD
  - Entities & Attributes
    - ➤ {Hint: Identify the Entities and their Attributes to be modeled in the problem. Entities usually nouns and attributes are also nouns but which describe aspects of the entities}
    - ➤ {Hint: Remember to watch out for multivalued and composite attributes}
  - Relationships
    - {Hint: Relationships are usually verbs which connect the (noun) entities}
    - {Hint: Identify the roles of the Entities in the relationships and the cardinalities of the relationships i.e. 1:1, 1:n, N:M and participation constraints i.e. Partial or Total}
    - {Hint: Remember that relationships can have attributes of that relations i.e. which describe that relationship}
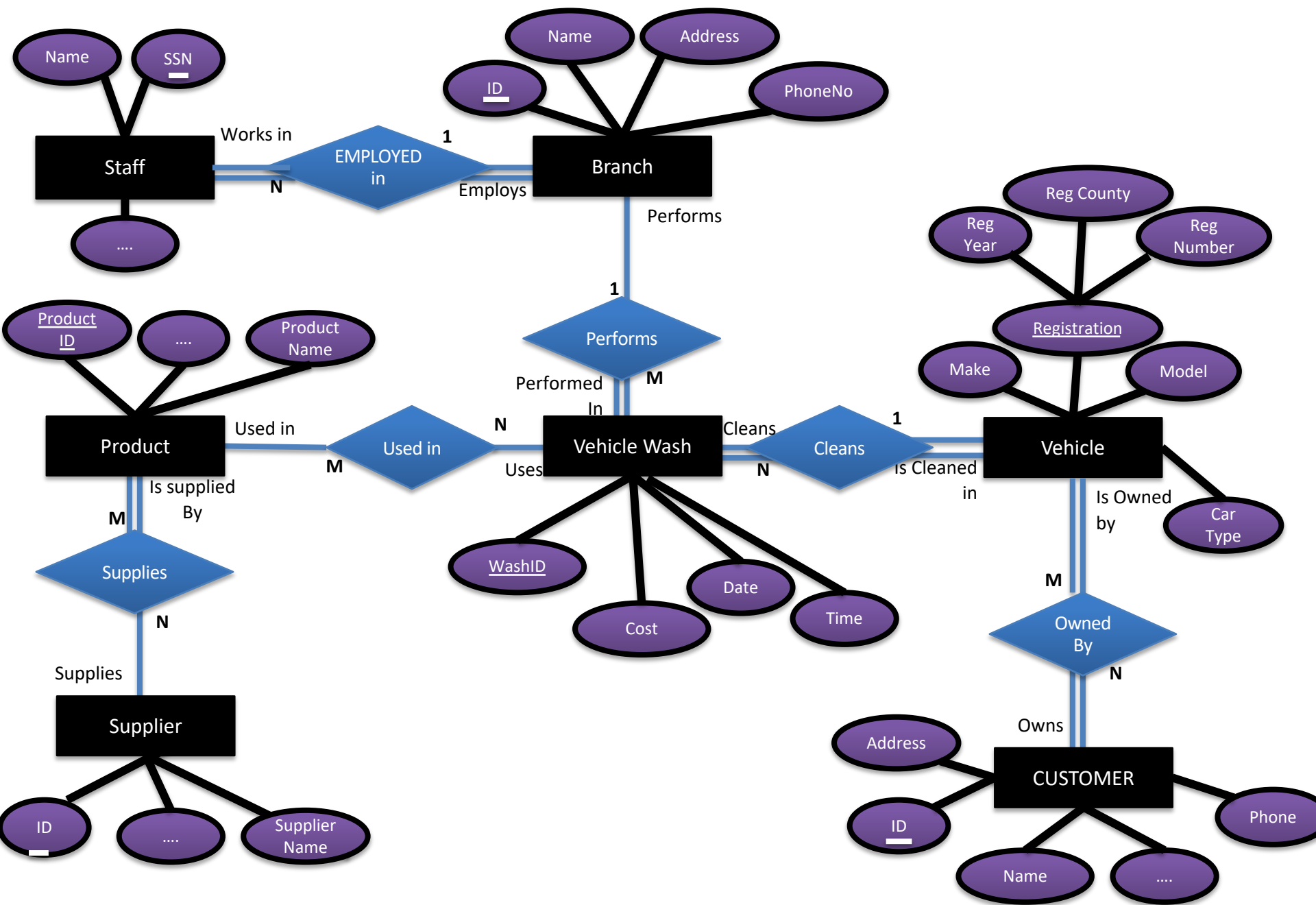
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Mapping to Relational Schema
  - Entities – Tables
    - Attributes – Simple, Composite, Multivalued
  - Relationships – Foreign Keys
    - 1:1, 1:N, N:M

NOTE: There is always multiple ways to model information so its possible to create different schemas for the same problem. Also the assumptions you make about the information will have a direct effect on the model produced. Thus its always best to state the main assumptions being made when modelling information.

Entity-Relationship Diagram for a Vehicle Wash business:

- **Staff** (Name, SSN, ...) — Works in — EMPLOYED in — Branch (N:1, Employs)
- **Branch** (ID, Name, Address, PhoneNo) — Performs (1:M) — Vehicle Wash (Performed In)
- **Product** (Product ID, ..., Product Name) — Used in (M:N) — Vehicle Wash (Uses)
- **Product** — Is supplied By — Supplies (M:N) — Supplier (Supplies)
- **Supplier** (ID, ..., Supplier Name)
- **Vehicle Wash** (WashID, Cost, Date, Time) — Cleans (N:1) — Vehicle (Is Cleaned in)
- **Vehicle** (Registration, Reg County, Reg Year, Reg Number, Make, Model, Car Type) — Is Owned by — Owned By (M:N) — CUSTOMER (Owns)
- **CUSTOMER** (Address, ID, Name, ..., Phone)

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Assumptions Made

- Each vehicle wash as a unique ID. Similarly there are unique Ids for Suppliers, Products, Customers and Branch
- A Vehicle wash can only wash one car (at a time)
- All Vehicle washes must occur in one branch (its not possible for a particular wash of a car to bi-locate in two branches at the same time!)
- A staff member must be employed in a single branch, but branches can employ multiple staff
- All branches have at least one staff member to operate the car wash
- All products have at least one supplier (otherwise the car wash couldn't get the product!)
- Vehicle can be owned by multiple customers and customers can own multiple vehicles
- A vehicle must be owned by at least one customer
- A customer must have at least one vehicle

Mapping to Relational Tables

Staff (<u>SSN</u>, Name, JobTitle, BranchId)

Branch (<u>ID</u>, Name, Address, PhoneNo)

Vehicle (<u>RegYear, RegCounty,RegNumber</u>, Make, Model)

VehicleWash (<u>WashId</u>, Cost, Date, Time, BranchId, RY,RC,RN)

Product (<u>ProductID</u>, ProductName)

ProductsUsed(<u>WashID, ProductID</u>)

Supplier (<u>SupplierID</u>, SupplierName)

Supplies (<u>SupplierID, ProductID</u>)

Cleans (<u>WashID, RegYear,RegCounty,RegNumber</u>)

Customer (<u>CustomerID</u>, Address, Name, Phone)

Owns (<u>VehicleID, CustomerID</u>)

There is a deliberate mistake in the suggested schema. Can you spot it?

Mapping to Relational Model

- The mapping on the previous slide contains **two** solutions to represent the relationship 'Cleans" (between the VehicleWash and Vehicle entities).

1. ***Foreign Key Approach*** *(this approach works for modelling 1:N based relationships):* The 'cleans' relationship is represented by sharing the primary key of Vehicle attribute as a foreign key in the VehicleWash Table. This is possible as there is a 1:N ('cleans') relationship between Vehicle and VehicleWash. The primary key of the table on the '1' side of the relationship (Vehicle) is inserted into (and becomes a foreign key) the table on the 'N' side (WashVehicle)

2. ***Create New Table Approach*** *(this approach is used for N:M relationships):* The 'Cleans' relationships can be represented by a separate table called 'Cleans' which contains the primary key of Vehicle entity and VehicleWash entity.

There is no need to represent it <u>both</u> ways. Using the Foreign Key approach is the simplest. It be more efficient as it doesn't create an extra table (and hence cause an extra join operation for queries that traverse across the tables Vehicle & VehicleWash.

Staff (<u>SSN</u>, Name, JobTitle, BranchId)

Branch (<u>ID</u>, Name, Address, PhoneNo)

Vehicle (<u>RegYear, RegCounty, RegNumber</u>, Make, Model)

VehicleWash (<u>WashId</u>, Cost, Date, Time, BranchId, RY,RC,RN)

Product (<u>ProductID</u>, ProductName)

ProductsUsed(<u>WashID, ProductID</u>)

Supplier (<u>SupplierID</u>, SupplierName)

Supplies (<u>SupplierID, ProductID</u>)

Customer (<u>CustomerID</u>, Address, Name, Phone)

Owns (<u>VehicleID, CustomerID</u>)

This relational schema is now in Boyce Codd normal form