Database Answers

A Tourist Guide to London for Data Modellers

Buckingham Palace with Royal Guards in traditional red Uniforms

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First, I would like to say thank you to these kind people for their valuable comments on early drafts of this book.

USA:
Vickie Comrie

Other parts of the world:
Andy Cheng, Chengdu, China

Welcome

We have produced this book in response to a number of requests from visitors to our Database Answers Web site.

It incorporates a selection from our Library of over 1,000 data models that are featured on the Web site:

- http://www.databaseanswers.org/data_models/index.htm

I hope you enjoy this book and would be very pleased to have your comments at barryw@databaseanswers.org.

Barry Williams
Principal Consultant
Database Answers Ltd
London
England

1. Introduction

1.1 Our Approach

We have combined a Tourist Guide to London with a Tutorial in Data Modelling.

If you want to put the Photos from your trip online, you can use Flickr :-

- http://www.flickr.com/

Or maybe you want to keep track of your itinerary on your Facebook page :-

- https://www.facebook.com/

1.2 Basic Concepts

The basic concepts are important because the relational theory is very powerful and provides a sound theoretical foundation for databases that have become essential since their first appearance in the early 1970s.

They were the creation of a brilliant research scientist called Ted Codd, who was working for an IBM Research Lab at the time. It is reported that he faced internal criticism initially because it was considered that his new idea would affect sales of established IBM database products.

It is the foundation for so many activities:

It provides a vehicle for communication among a wide variety of interested parties, including management, developers, data analysts, DBAs and more.

A physical database can easily be generated from a data model using a commercial data modeling tool.

1.3 What Will I learn ?

You will learn:

- How some real-life Data Model are created.
- The important design principles involved
- What some typical data model look like

This book is divided into three Sections :

A. Beginners Level

Topics covered include :-

- Primary and Foreign Keys
- Primary and Foreign Keys
- One-to-Many and Many-to-Many Relationships

B. Intermediate Level

Topics covered include :-

- Hierarchies
- Inheritance
- Rabbits-Ears

C. Advanced Level

Topics covered include :-

- Design Patterns
- Enterprise Data Models
- Master and Reference Data

We will follow two young tourists as they visit London, which is a city with a tremendous history and is very popular with tourists looking for a unique

combination of history and contemporary activities in fashion, design, pop music and so on.

Our tourists are Dimple, a young girl who likes sightseeing and ice cream, and Toby, Dimple's older brother, who likes sightseeing and designing data models.

1.4 Why is Data Modelling important ?

Data modeling is important because it is the foundation for so many activities:

It provides a vehicle for communication among a wide variety of interested parties, including management, developers, data analysts, DBAs and more.

A physical database can easily be generated from a data model using a commercial data modeling tool.

A. Beginner's Level

A.1 Let's get started

[Toby]: We have just arrived in London. How do you feel ?

[Dimple]: Toby, It's great being in London, which has so many things to see and enjoy.

[Toby]: I'm glad you like it, Dimple. What would you like to do today?

[Dimple]: Toby, we have come to London, and I would like to see as many of the tourist attractions as we can. Then I would like to do some shopping, take a trip to Richmond Park and Kew Gardens and I would like to finish up at Starbucks in Heathrow airport.

[Toby]: OK. Let's go.

A.2 People in London

[Dimple] Wow, Toby, look at the people.

[Toby] Yes, Dimple, when we look around there are people, shops, banks and so on!

So we can start thinking about our data model.

A.3 Starting our Data Model

[Dimple]: How do we get started?

[Toby]: Well, we know that we have people and places.

The simplest start is to call all these places **establishments**.

Then we have different kinds of establishments.

And we have people - local people, tourists, students, people passing through, people working here, people here on business and so on.

[Dimple]: Hmmm - so how do we translate what we know to help us get started with our data model?

[Toby]: Let's start a diagram with people and establishments.

This simple diagram is going to grow into a data model.

A.3.1 Identifiers and Primary Keys

[Dimple]: Toby, I am one of these people so how do I create a unique identity for myself to make me different from everybody else?

[Toby]: We will give every person a **unique identifier** and every establishment its own unique identifier.

When we use these we call them **Primary Keys**, and show them in the diagram with a **PK** on the left-hand side.

[Dimple]: That sounds good, Toby, but I don't know what it means.

[Toby]: Well, Dimple, let's look at how we use these identifiers...

We have found Tiffany's in Bond Street, the main fashion street in London where we can see some customers outside the shop.

So, in other words, we have one customer, and one establishment, which is the shop.

So we can create a people record with a person ID of 1 and an Establishments record for the store, with an Establishment ID of 1.

- **Customers outside Tiffany's in London** – http://www.tiffany.co.uk/

A.3.2 Relationships and Foreign Keys

[Toby]: Dimple, now we can add some interesting details because we know that one person can visit many establishments.

We also know that one establishment is visited by many tourists.

Then we call this a **many-to-many relationship** between people and establishments.

To make it easier for you to understand I have expanded the **many-to-many relationship** into two different things, which are called **one-to-many relationships**.

[Dimple]: So Toby, is that like saying that one person can make many visits to many establishments?

[Toby]: Yes, Dimple - that's great - and we can also say that one establishment can have visits from many people.

At this point, we can show how all these boxes are related, and that is a very big step, because it takes us to the idea of 'relationships'.

We can call these boxes **tables** - or **entities** if we want to speak to professional data modelers.

A table simply stores data about one particular kind of 'Thing of Interest'.

For example, people or establishments.

Each record in a table will be identified by its own unique identifier, which we call the *Primary Key*.

It is not usually easy to find a specific item of data already in the table that will always be unique.

For example, in the States, social security numbers (SSNs) are supposed to be unique, but (for various legitimate reasons) that is not always the case.

Also, foreign visitors and tourists will not have SSNs.

Therefore, it is best practice to create a new field just for this purpose.

This will be what is called an **auto-increment** data type, which will be generated automatically by the Database Management System (DBMS) at run-time.

This is called a **surrogate key** and it does not have any other purpose.

It is simply a key that stands for something else.

It is a meaningless integer that is generated automatically by the database management software, such as Oracle or SQL Server. The values are usually consecutive integers, starting with 1,2,3,4 and so on.

Now we can see how useful our identifiers can be because we can include the person and establishment identifiers in our visits table.

Then the Person_ID field becomes a link to a record for a person in the Person Table.

This link is what is called a **Foreign Key** and we can see it's shown with '**FK**' on the left-hand side.

A.3.3 Staff, Establishments and Derived Fields

[Dimple]: Toby, how do we specify that staff must work in some establishment?

[Toby]: Dimple, that's a very good question.

Fortunately, the answer is very easy.

We add a one-to-many relationship between the staff and establishment entities

In English, we would say that every member of staff must work in one establishment and every establishment can employ many members of staff.

In the diagram, we show this with a **Foreign Key** by the Establishment_ID field in the staff entity.

So if we look closely at the staff entity, we will see **'FK'** by the Establishment_ID field.

[Dimple]: OK, that sounds good, and I can see how the identifiers are very important.

[Toby]: I am glad to hear it, Dimple.

There is one more thing I have to say.

We are learning data modeling and one important thing about data modeling is that it has to follow a set of **rules**.

These rules help us to produce good data models and so they are very important.

One of the rules is that we cannot include any bits of data that can be derived from any other bits of data.

For example, we usually want to know how many people work in a shop or cafe.

Therefore we include a **staff count** field with the establishment.

But when it comes to finding the value that goes in here, we will count the records in the Staff Table for each establishment.

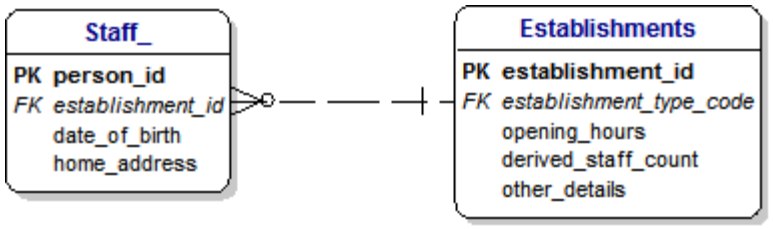
Therefore, it's a **derived field** and we call it a name that starts with 'derived_' to make things clear.

This is because, according to the rules, we should not include derived fields in our data model at this early stage.

I have shown it here simply as an example because it is a situation that occurs quite often so it’s good to recognize it when you see it.

Does that sound sensible, Dimple?

[Dimple]: I suppose so, Toby. But I've got a headache, can we go to Starbucks now?


Staff_
PK person_id
FK establishment_id
date_of_birth
home_address
Establishments
PK establishment_id
FK establishment_type_code
opening_hours
derived_staff_count
other_details

A.4 Shops

A.4.1 Bond Street

This is listed among the five most expensive Stores in the world and is described as "home to one of the most sophisticated, popular in the past auction houses Sotheby's, and the place where you can buy Asprey or Cartier branded watch for $ 50,000".

- http://ubah-ubah.blogspot.co.uk/2011/05/1_17.html

If you are wondering, the top of the list of five is Saks Fifth Avenue in New York.

Here is the link to the Bond Street Web Site :-

- http://www.bondstreet.co.uk/

This is another view of Bond Street, which is considered to be the smartest shopping Street in London.

A.4.2 Burlington Arcade

Here we see shoppers in the fashionable Burlington Arcade in London's West End, which is a short walk from Bond Street.

A.4.3 Harrods

Harrods is considered to be the most fashionable store in London and gifts from Harrods are always appreciated in any country in the world.

- http://www.harrods.com/

A.4.4 Selfridges

Selfridges is my favourite Store in London because it has a tremendous range of goods on display.

It was founded by an American (Gordon Selfridge from Ripon, Wisconsin) in 1909.

Here is a very readable Blog about Selfridges :-

- http://blog.holidaynights.co.uk/the-dashing-mr-selfridge/

And here is the official Selfridges Web Site :-

- http://www.selfridges.com/

And here is Selfridges in the old days :-

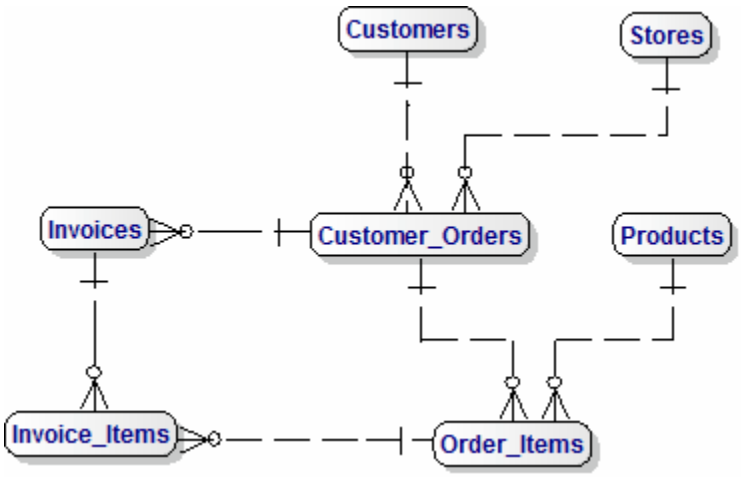
A.4.5 Starbucks

At this stage, we notice that Starbucks Products are displayed in a hierarchy that we will discuss later.

A.4.6 Data Model

This Model is on this page of our Database Answers Web Site :-

- http://www.databaseanswers.org/data_models/customers_and_products_generic/index.htm



A.4.7 Things that shops sell

In this Section we will discuss Products and Product Types

[Dimple]: Toby, when we go into a shop we want to buy something.

There are often hundreds and hundreds of possibilities.

How do we deal with all that in our little data model?

[Toby]: Well Dimple, it's really quite easy. It's like all our modeling where we look for simple patterns that cover many situations.

[Dimple]: Hmm - I don't know what that means. Maybe if you showed me I might understand it.

[Toby]: OK.

Everything that we buy is called a product, and all we have to do is simply define the type of each product - such as a coffee, muffin or a newspaper.

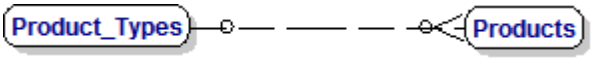
Then we draw a little box called *Products* and say that every product has a type.

In other words, there is a relationship between the *Products* and *Product_Types* boxes.

The lines are called **relationships** and they are very important in data modeling.

We are now creating an **Entity-Relationship Diagram** or '**ERD**'.

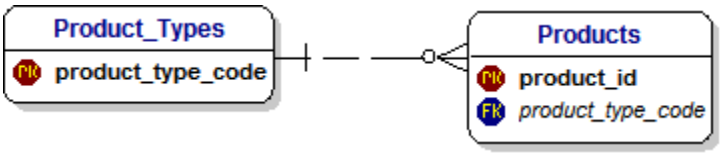
This diagram shows only a line for the relationship:



The symbol at the products end is called *crow's feet* and it shows the *many* end.

The short straight line at the Product_Types end shows the *one* end.

In other words, this line shows a one-to-many relationship.



Dimple, let me explain about the dotted line. It means that the relationship results in a foreign key in the Products Table. This is shown by the 'FK' symbol next to the ***product_type_code*** field and it means that there is a link back to the Product_Types.

However, the primary key is only the Product_ID, and of course, this is shown by the 'PK' symbol next to the **Product_ID** field.

Later, when we talk about inheritance, we will use a straight line, in contrast to this dotted line here. This is to show that the foreign key field is also a primary key.

I have to say something a bit difficult about primary keys right now.

In the Products Table, we have to allow for a very large number of products being stored.

Therefore we use an ID field for the primary key.

We then create this ID field automatically as a number (called an auto-increment integer).

This number has no meaning and is simply used to identify each record uniquely among possibly millions or hundreds of millions.

However, things are different for **type** fields.

These are what we call enumerated data and are typically reference data.

They are always relatively small in number and we choose a code for the primary key because we can create them and review them manually.

It also helps us to create a code that we can use and refer to, in contrast to the ID fields that have no meaning.

Typical examples would be:

Sizes – Small, Medium and Large where we are accustomed to seeing S,M and L.

Gender – Male and Female, where we use M, F and U for Unknown.

A.4.8 Shops – People, Establishments and IDs

[Dimple]: Toby, with so many tourists, shops and things to buy, how do we keep track of everything?

[Toby]: Well, Dimple, by this time, everything has its own identifier that is used wherever they need to keep track.

[Dimple]: OK, that sounds sensible. And do we use these identifiers in a database?

[Toby]: Yes, Dimple, and in this diagram, we can see that we can use the unique identifiers, which are shown as 'PK', for Primary Keys

There are always lots and of people visiting London.

When we look at this typical street scene, we can see shoppers, stallholders, workers and local people.

We usually know different things about the stallholders and workers than the things we know about the tourists.

For example, we will probably know the gender of everybody just by looking at them.

For workers, we will might also know things related to their employment, such as their date of birth and their home address.

In data modelling we have a very powerful approach that we call **inheritance** that we can use here.

If we want to describe this in English, we would say that staff inherit the People_Type_Code and gender from the parent entity of people and, in addition, they have a date of birth and home address.

For tourists, we don't know much, except for the date of their visit and, if they buy something in a shop using a credit card, then the shop would know the credit card details.

Does that make sense, Dimple?

[Dimple]: I think so, Toby.

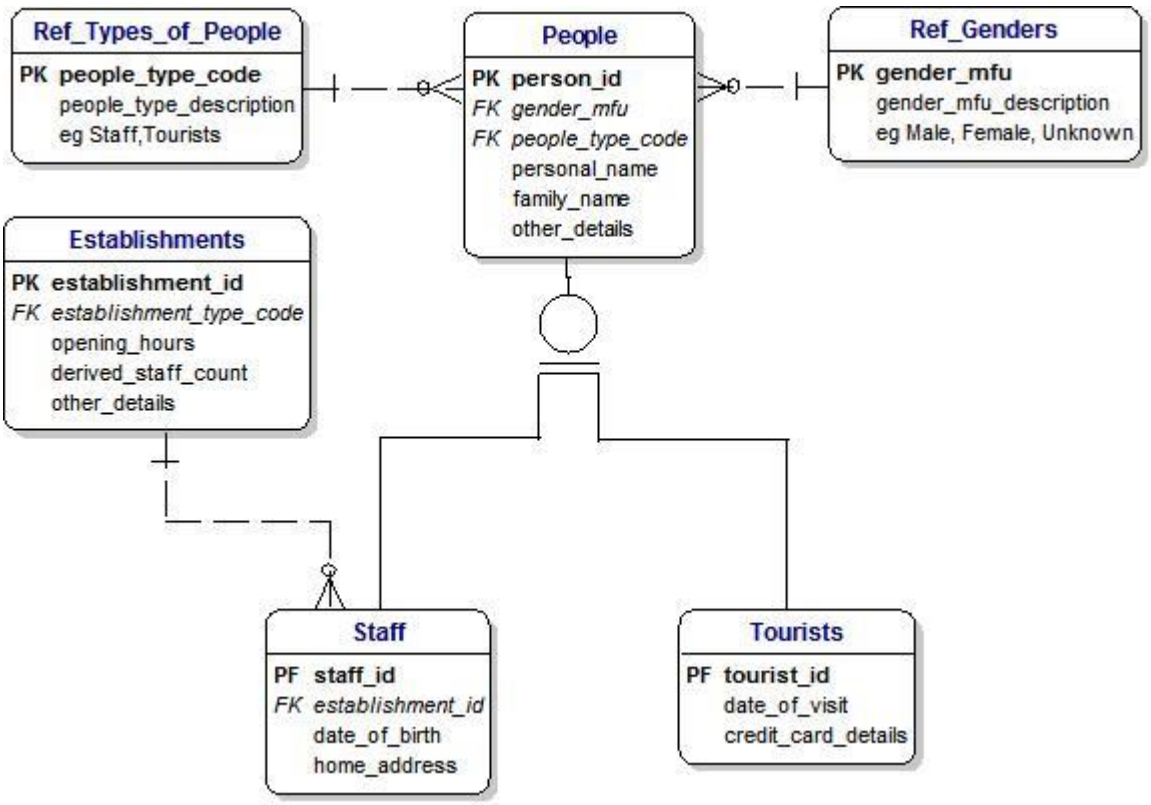
Is it like saying that we inherit having two arms and two legs from our parents because they have two arms and two legs, but that we have also have things that are just us?

[Toby]: Yes, Dimple - that's great - let's take a break and do some shopping!

[Dimple]: I like the sound of that, Toby. Can I have an ice cream?

[Toby]: Yes, of course, Dimple – this diagram shows we are doing well.

It show inheritance between people and the two different types of people:



A.5 Street Markets

There are two excellent Street Markets in London that are worth a look if you like browsing in the bustle of a popular Market where you might find a great bargain.

A.5.1 Camden Market

Camden Market is 'funky' and anything you buy here will give you instant 'street cred'.

This photo of Camden Market conveys the laid-back atmosphere and is available courtesy of Wikimedia

- http://commons.wikimedia.org/wiki/File:Camden_markets_entrance.JPG

And here is a photo (courtesy of Horst Michael Lechner) by the water, showing the size of Camden Market :-

A.5.2 Portobello Market

Portobello Market in West London is one of the most famous street markets in the world. It is a popular destination for Londoners and tourists alike.

Portobello Road goes straight through the heart of Notting Hill, the trendy area of London made famous by the film.

Portobello Market stretches for around two miles, and on a crowded Saturday it can take quite a while to walk from end to end.

It is more up-market and a food place to look for art, paintings and jewellery.

Here is the link to the Portobello Web Site

- http://www.portobellomarket.org/

A.6 Types of People and Establishments

[Toby] Dimple, if we think about what we have seen, we realise that we have seen lots of People and lots of Shops.

Therefore, we can have a simple Data Model showing People and Establishments.

What do you think ?

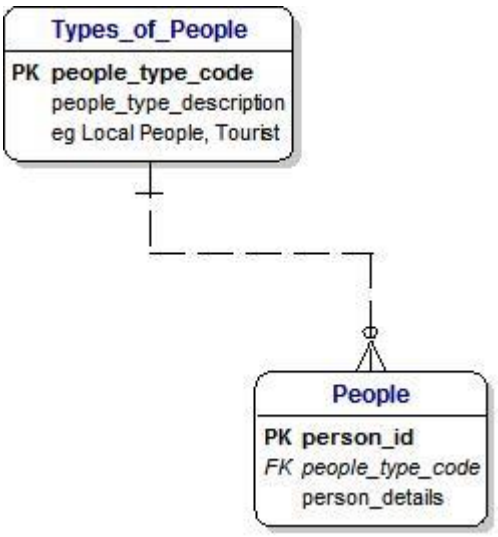
[Dimple]: Toby, that sounds OK.

I guess we can deal with types of people the same way, can we?

[Toby]: Yes, Dimple, and types of establishments as well.

[Dimple]: OK, that sounds sensible. And do they use these identifiers in a database?

[Toby]: Yes, and what is even better is that the database will automatically generate a new unique identifier for you and your visits and purchases if you want to get a refund later.



[Dimple]: Toby, that looks OK.

I guess we can deal with types of establishments the same way, can we?

[Toby]: Yes, Dimple.

[Dimple]: OK, that sounds sensible. And do they use these identifiers in a database?

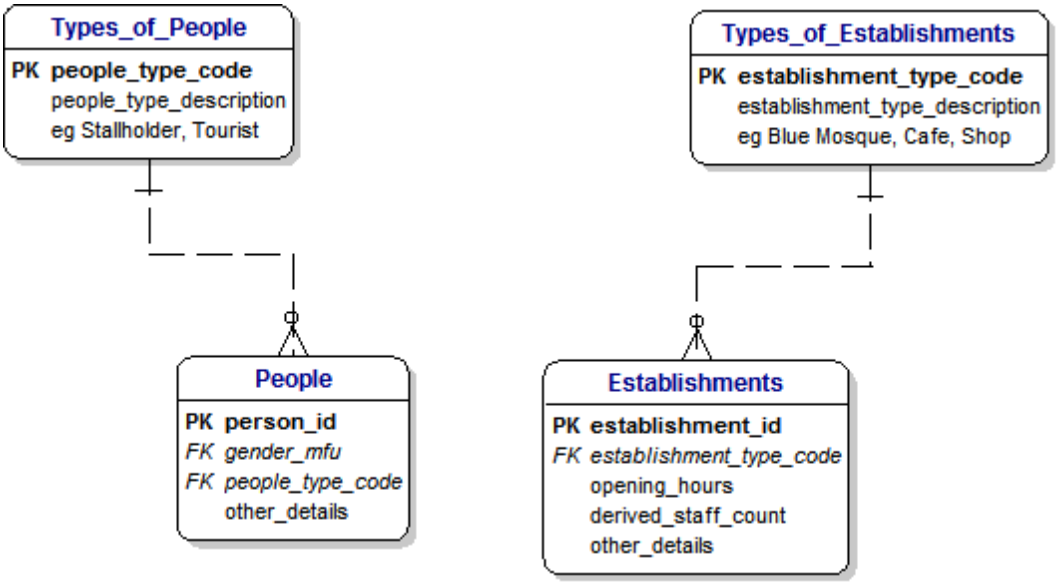
[Toby]: Yes, and we can use our new unique identifier for you and your visits and purchases in case we want to keep track of things.

Like maybe you want to get a refund later so we need to get your details from the database.

[Toby]: Before we move on, let's talk about establishments.

In London, there are many different kinds of establishments, like shops, banks, cafes, restaurants, hotels, hospitals, garages and so on.

But when we think about these things, we find that we can simply fit them into our definition of establishments and identify them as different types of establishments.



A.6.2 Phase 1 Data Model for Tourist Attractions

This is how we can show what we have learned so far.

We know we are mainly interested in Tourist Attractions and that we have different Types of Attractions.

A.6.2.1 The 'Is-A' Test

We apply what is called an 'Is-A' test to identify other Tourist Attractions.

We can say that 'A Shop is a Tourist Attraction', and we can also say that 'A Street ,Market is a Tourist Attraction'.

Therefore, at this stage, we have a Phase 1 Data Model that starts with a Tourist Attraction and a table to record the different Types of Attraction – of which we have only two at this point.

A.6.2.2 The 'Has-A' Test

We can also apply what is called an 'Has-A' test.

This helps us to identify the data that Tourist Attractions have in common.

For example, we know that every Tourist Attraction has a Location.

This is very important because, of course, we need to know how to get to each Attraction so we need to know its Location.

We create a separate Location in our Model, so that, for instance, if we plan to visit several

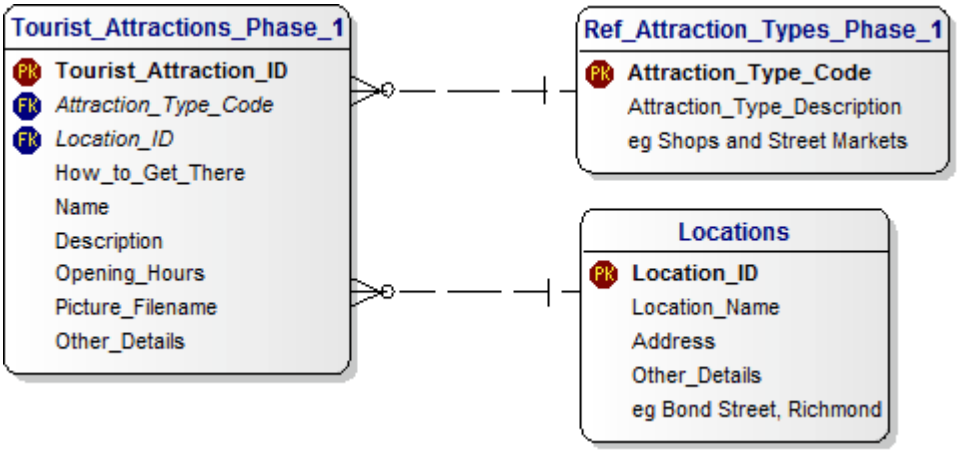
Shops in Bond Street, they simply share the same Location.

By applying our 'Has-A' Test, we have also decided that Locations all have this data in common :-

- Name, Description, How to get there, Opening Hours.

Therefore, we put all this data in the Location.

So we have a Phase 1 Model that looks like this :-



After we look at some more Tourist Attractions we add to our Data Model and achieve what is shown in Section A.6.

A.7 Parks and Gardens

A.7.1 Hampstead Heath

Hampstead is an easy ride on the Tube (London's Underground Train) from central London.
When you get there, you will find its calm and tranquil surroundings a welcome change from the hustle and bustle of anywhere else in London.

A.7.2 Kew Gardens

Kew Gardens are a UNESCO World Heritage Site.

They were created in 1759, the influential Kew Gardens were designed by Capability Brown and others for scientific study.

- http://www.kew.org/

This shows the Japanese Garden that was constructed in 1910 by a Japanese University expert.

A.7.3 Richmond Park

Richmond is the largest of the eight Royal Parks in London.
Getting there is an easy ride on the Tube (the London Underground train) but getting to the Park would require a taxi or a bus.

This shows deer in Richmond Park in winter.

- http://www.royalparks.org.uk/parks/richmond-park/

Dimple]: Toby, with so many tourists, stalls, shops and things to buy, how do we keep track of everything?

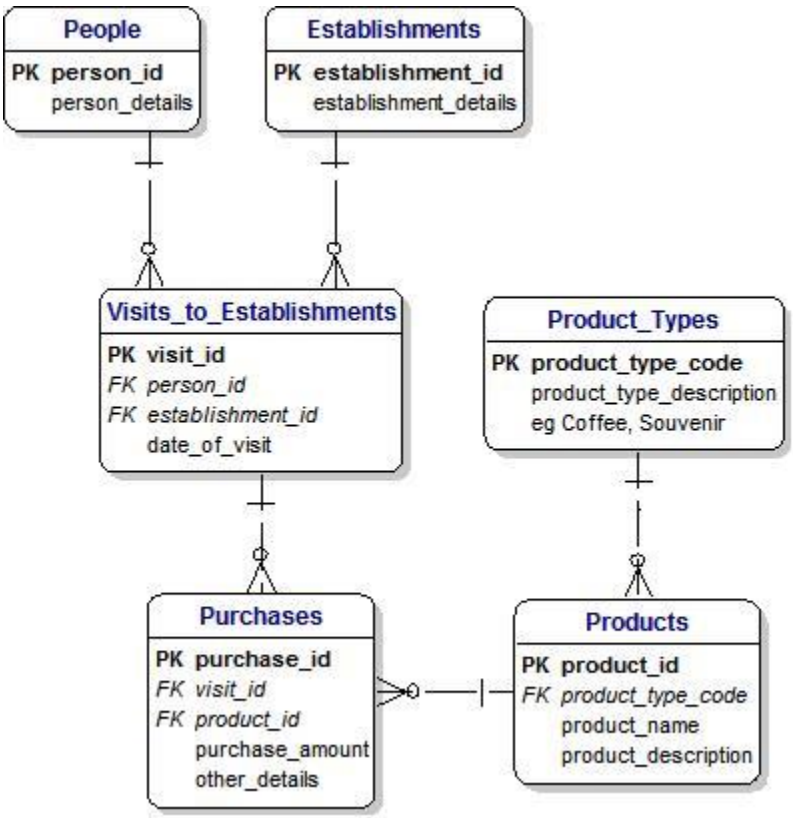
[Toby]: Well, Dimple, by this time, everything has its own identifier that we can use whenever we need to keep track of individual people or purchases or products.

[Dimple]: OK, that sounds sensible. And do we use these identifiers in a database?

[Toby]: Yes, Dimple, and in this diagram, we can see that we can use the unique identifiers that are shown as 'PK,' for primary keys.

We can see that we have a PK for every entity or table so we can be pretty sure we can get from any table to any other table.

This is called *navigating* around the data model and is a good test for a well-designed data model.



A.8 Royal Residences

A.8.1 Buckingham Palace

Buckingham Palace was built in 1705.

It is open to the public each year for most of August and September.

Here is the link to the Wikipedia entry:-

- http://en.wikipedia.org/wiki/Buckingham_palace

Here we can see Royal Guards in traditional red Uniforms which is a very popular Tourist Attraction.

A.8.2 Tower of London

The construction of this Castle was begun by William the Conqueror in 1066.

It is officially known as Her Majesty's Royal Palace and Fortress but is more commonly known as the Tower of London

It is a very striking building and is a symbol of power and additions by King Henry III and King Edward I in the 13th century made the castle one of the most influential buildings of its kind in England.

Here is a link to the Wikipedia entry :-

- http://en.wikipedia.org/wiki/Tower_of_London

A.8.3 Windsor Castle

This is the Queen's 'getaway' residence and is located just outside in London

A trip to Windsor Castle makes a great day out from London.

The Castle was constructed almost 1000 years ago and has been continually occupied during that time.

Close to the Castle is Windsor Park where you will find wide-open space and groups of deer roaming freely.

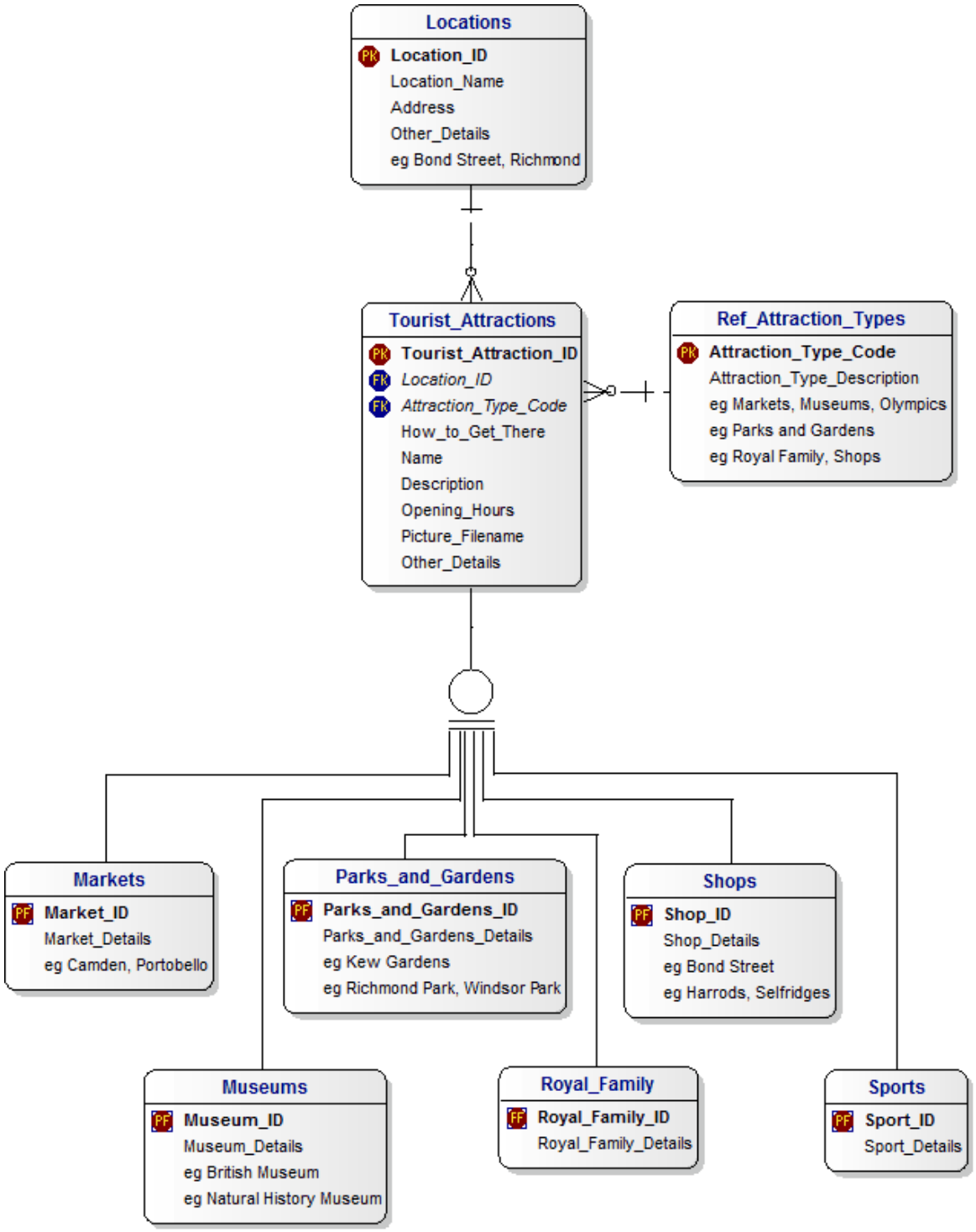
Here is the Wkipedia entry for Windsor Great Park :-

- http://en.wikipedia.org/wiki/Windsor_Great_Park

And here is a photo from the Wikipedia entry of Deer crossing the Long Walk to Windsor Castle :-

A.9 The Final Data Model

At this point, we have thought about Royal Residences, Shops and this is how it looks in a data model, showing how Inheritance is used :-



You can see that the model is much more compact and when you are accustomed to looking at data models and know what to look for, it tells you a lot in a small diagram.

If we want to describe this in English, we would say that staff inherit the People_Type_Code and gender from the parent entity of people, and in addition, they have a date of birth and home address.

For tourists, we don't know much, except for the date of their visit, and maybe, if they buy something in a shop using a credit card, then the shop would know the credit card details.

Does that make sense, Dimple?

[Dimple]: I think so, Toby.

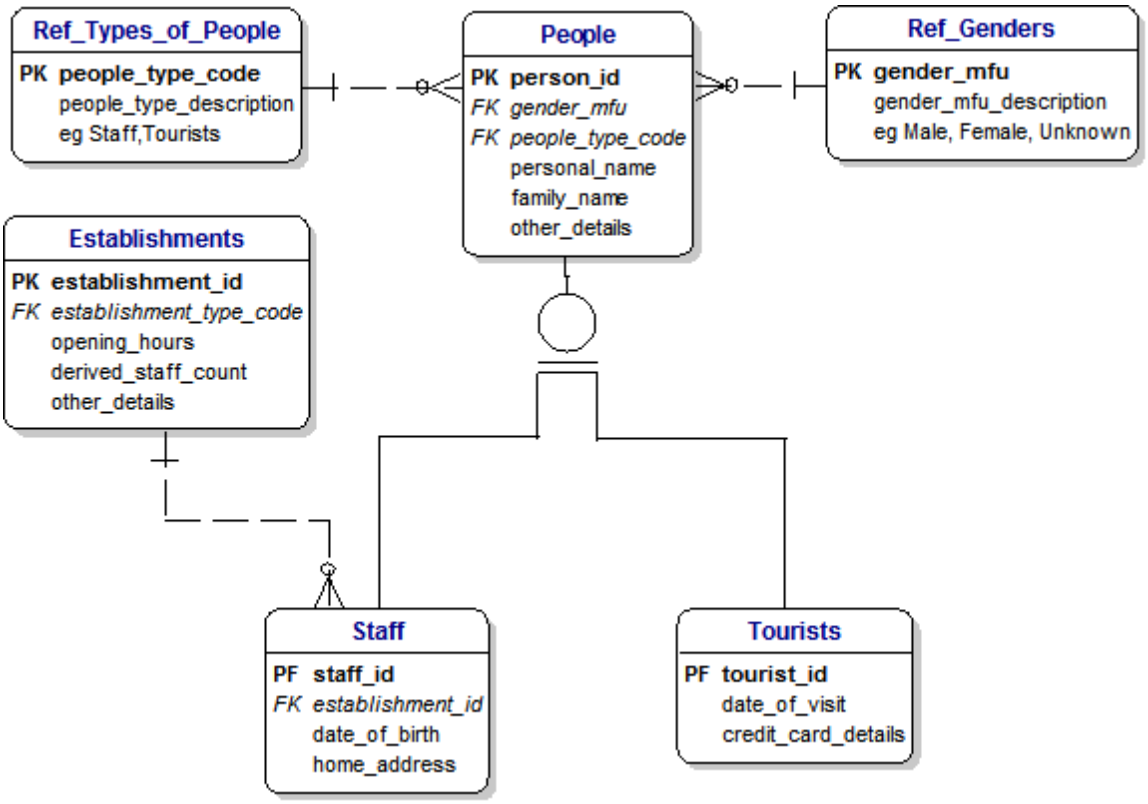
Is it like saying that we inherit having two arms and two legs from our parents because they have two arms and two legs, but that we have also have things that are just us?

[Toby]: Yes, Dimple - that's great - let's take a break and do some shopping!

[Dimple]: I like the sound of that, Toby. Can I have an ice cream?

[Toby]: Yes, of course, Dimple – this diagram shows we are doing well.

It shows inheritance between people and the two different types of people:



We can see a field marked as 'PF' in the tables for staff and tourists.

This is unusual because it means a field that is a **P**rimary Key in the three tables and also a **F**oreign Key to the People Table.

Therefore, if your first record was a member of staff, then we would have a record in the People Table with a Person_ID of 1 and a record in the staff table with a Staff_ID of 2.

Similarly, if our second record was a tourist, we would have a record in the Person Table with a Person_ID of 2 and a record in the tourist table with a Staff_ID of 3.

B. Intermediate Level

B.1 Starbucks and Hierarchies

We stop for a coffee at one of the two Starbucks as a break from our shopping .

This menu board at Starbucks shows lots of products

We know that they are organized into groups, like food and drink, and each of these has more groups and so on, right down to the particular product, like caramel macchiato or a panini.

This top-down organization is called a **hierarchy** and appears all over the place.

Luckily we can show this very easily and neatly in our data model.

[Dimple]: Toby, when we look closely at the menu board to try to decide what to order we can see lots of possibilities. But after a while we can see a pattern that helps us decide.

How do we deal with all that in our little data model?

[Toby]: Well Dimple, it's really quite easy.

We define something called a **hierarchy**.

Hierarchies are very common and simply mean any situation where there are parents, children, grandchildren and so on.

If we look at the Starbucks menu board on the right-hand side we can see a simple example of 'espresso' and under it a number of different drinks.

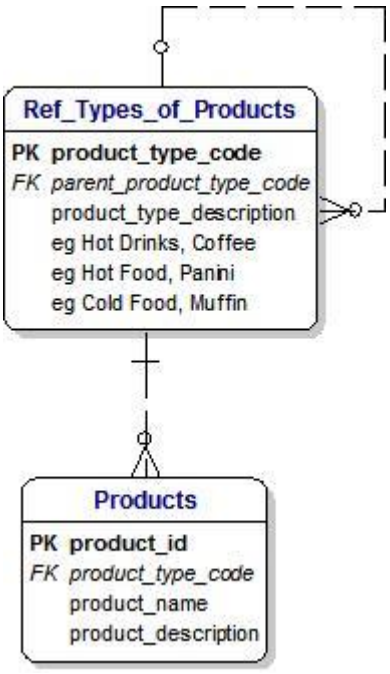
My favorite is caramel macchiato.

So in this case, the top-level of our hierarchy is a product category called espresso, and the next level down is a product called caramel macchiato.

[Dimple]: OK. That sounds logical.

[Toby]: Finally, we show this hierarchy by a dotted line in the top-right hand corner in the entity called *'Ref_Types_of_Products'.*

This is formally called a *Self-referencing*, *recursive* or *reflexive* relationship and is informally called **Rabbit's Ears**.



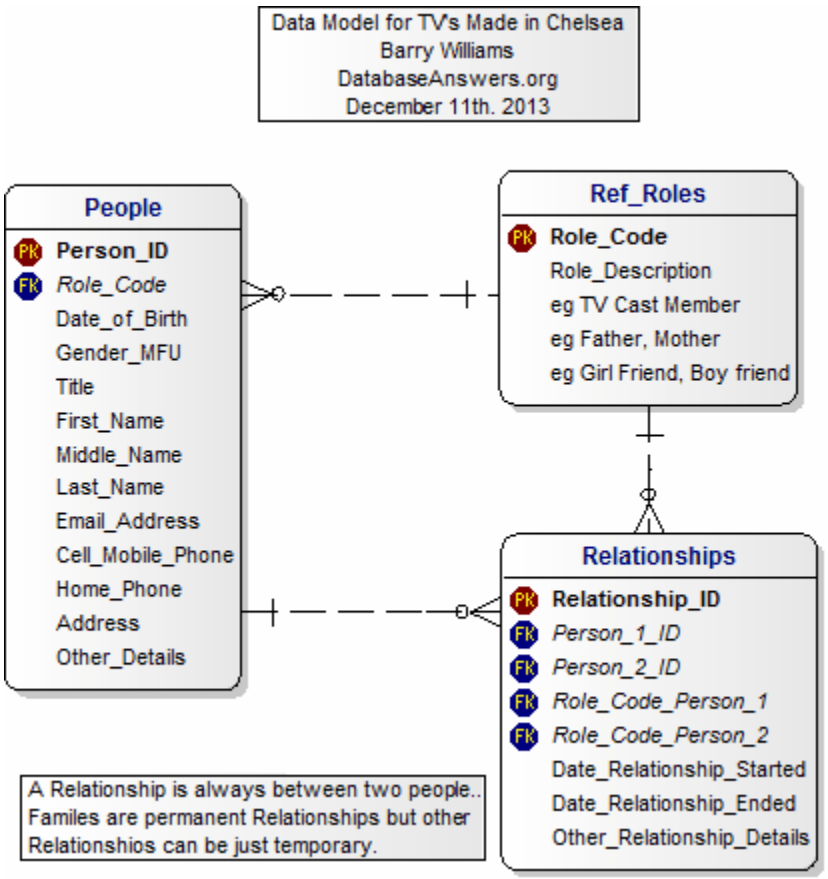
B.2 Relationships in Chelsea

This Section discusses Relationships as shown in a Reality TV Show called "Made in Chelsea".

It is featured in our Database Answers Web Site :-

- http://www.databaseanswers.org/data_models/tv_made_in_chelsea/index.htm

The Data Model reflects the fact that the underlying relationships cam be modelled quite simply.



B.3 Tourist Attractions and Inheritance

[Toby]: Dimple, let's take a closer look at the different types of tourist attractions we can find in London.

[Dimple]: OK, Toby. I hope I don't have to think too much because I might get a headache?

[Toby]: No, Dimple, I will do the thinking and talking and all you have to do is nod your head when you understand.

[Dimple]: OK, Toby. I promise to do that.

[Toby]: We already said that we have a lot of people visiting the tourist attractions.

There are lots of different tourist attractions and it is interesting to think about what they have in common and what they have that makes them different.

[Dimple]: OK, Toby. How do we get started.

In data modeling we have a very powerful approach that we call **inheritance** that we can use here.

In this section we look at different kinds of tourist attractions and how we can use them to talk about inheritance.

All attractions have some characteristics in common, such as:

- Name
- Description
- Location
- Opening Hours
- Address
- Contact Details
- Directions for how to get there

In addition, specific categories of attractions have some additional data of their own.

Some of these can simply be included in the description, but some others justify being added as specific names fields.

For example:

- Churches
    - Religious Denomination
    - Special awards, e.g. UNESCO World Heritage Site
- Christmas Decorations

- Hotels
    - Number of Rooms
    - Number of Non-Smoking Rooms
- Museums
    - Exhibitions from Time to Time
- Restaurants
    - Type of Food
    - No-Smoking Area (Yes/No)
    - Licensed to Serve Alcohol
    - Stars or Other Awards
- Royal Family
    - Family Tree
    - Royal Residences
- Shops
    - No Additional Data

B.3.1 Christmas Lights in Regents Street

Every Christmas, Regents Street, which is one of the busiest and most popular shopping streets in London, is decorated with an outstanding array of lights.

They are always switched on by a celebrity with London connections, such as Barbara Windsor.

B.4 The Royal Family

The royal family plays a very important part in British society.

It is one of the things that makes Britain unique and the British people are very proud of their royal tradition.

B.4.1 Social History of the Royal Family

The United Kingdom has a very strong tradition of royalty and aristocracy although in recent times this tradition has changed to keep pace with modern times.

We can see this in the education of members of the Royal Family.

The present Queen was educated privately with Tutors, then the next generation, Prince Charles was sent to Gordonstoun, a Boarding School in Scotland.

Then Prince Charles sent t his sons to boarding school were they were able to mix with a range of young people.

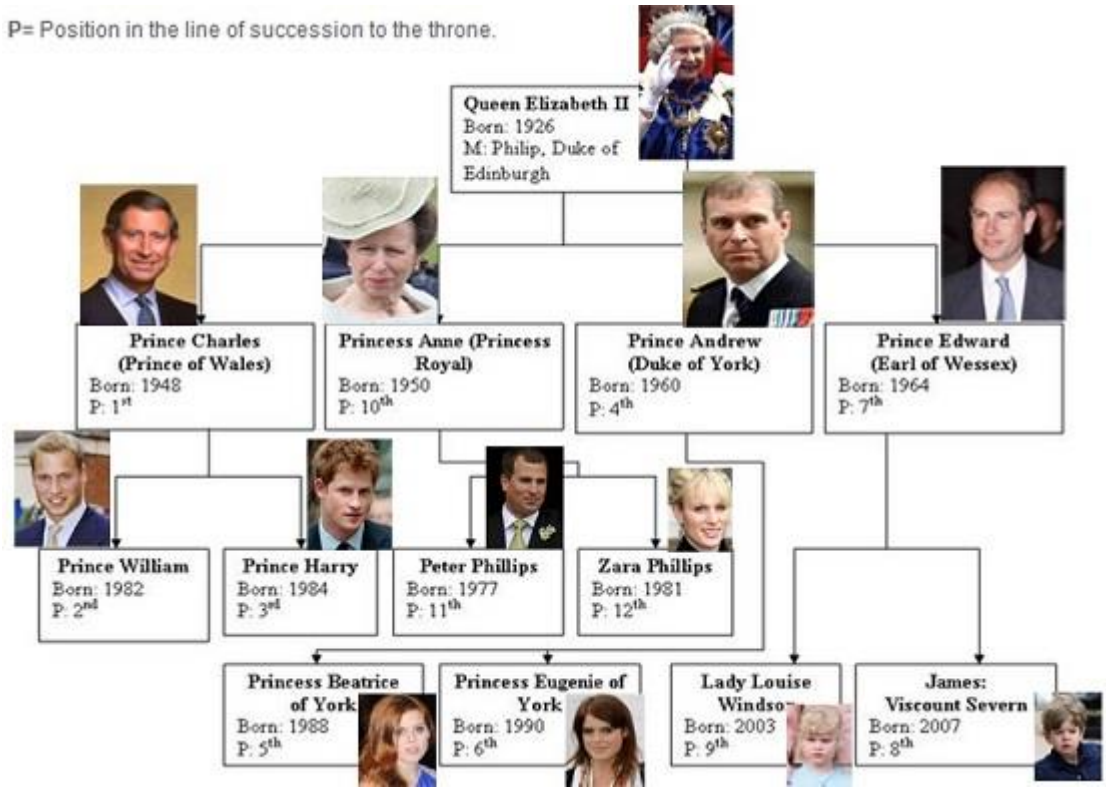
B.4.2 The Royal Family on the Balcony

The Royal Family gather to celebrate the Queen's Birthday on the Balcony of Buckingham Palace.

We can see Her Royal Highness Queen Elizabeth the Second on the left, Prince Philip in the middle and the Duke and Duchess of Cambridge on the right.

B.4.3 The Royal Family Tree (Rabbits-Ear)

The Royal Family tree looks like this:-

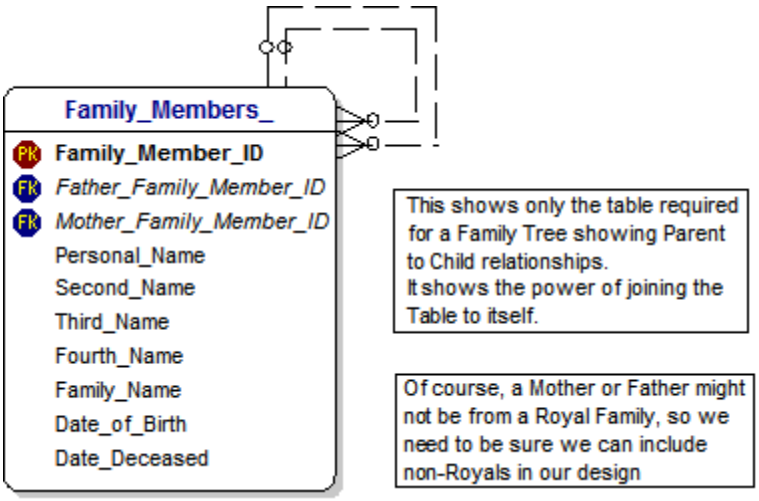


B.4.3.1 Simple Data Model

This is a simple model that covers direct relationships from children to parents.

The royal family can be shown in a data model as a **hierarchy**.

This means we can show it very simply in one table with a relationship to itself.

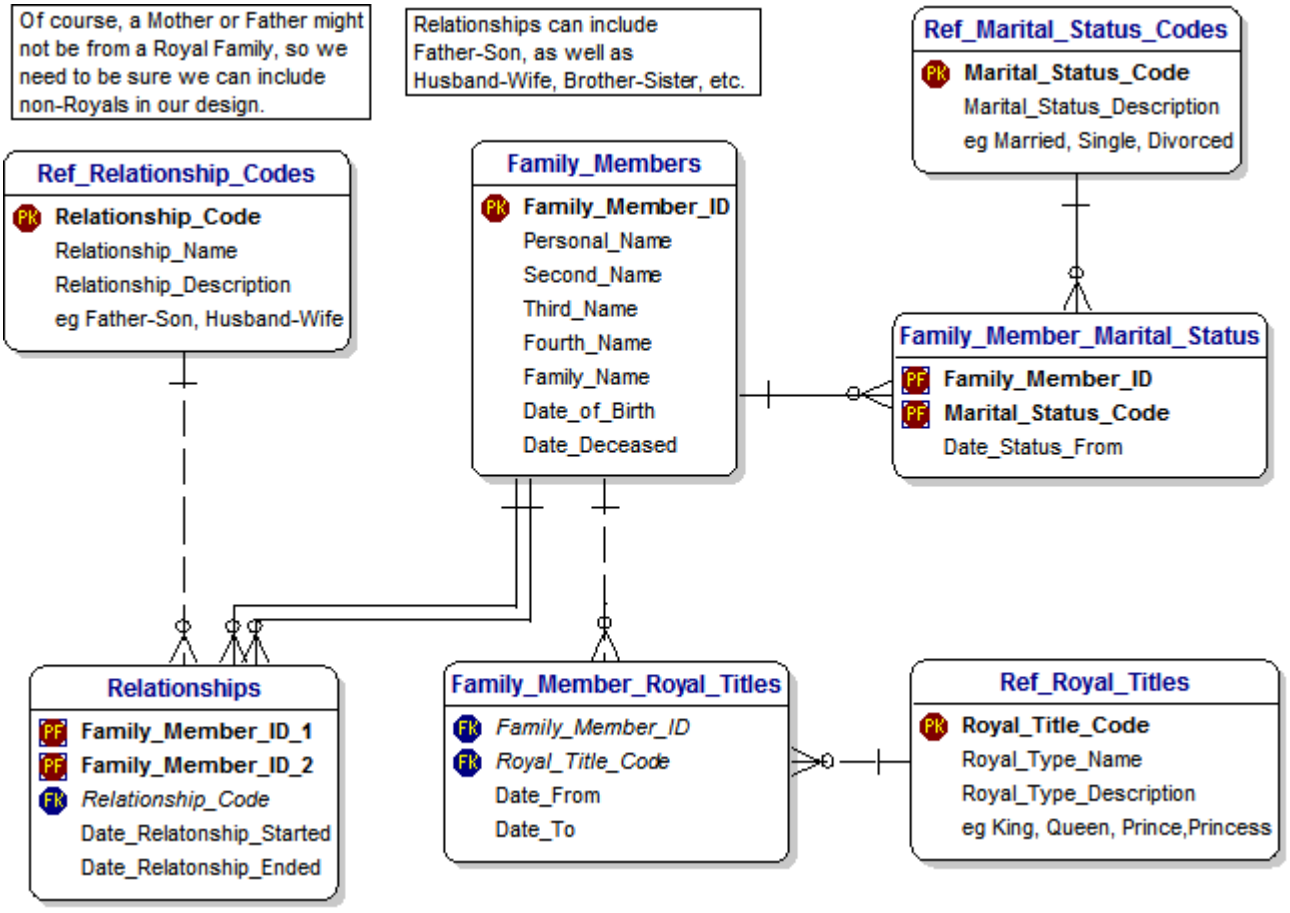


You can check out the Genealogy and Family Tree data model on our Database Answers Web site:

- http://www.databaseanswers.org/data_models/genealogy/index.htm

B.4.3.2 Complex Data Model

This is a complex model that includes **relationships** to provide flexible relationships from children to parents, brothers to sisters and husbands to wives.



B.4.4 Royal Life Guards Band

This picture shows the Guards Band playing and marching outside Buckingham Palace.

B.5 Museums

B.5.1 The British Museum

This is a charming and well-run museum featuring local artefacts that serve to emphasise the long history of the region

Here is the museum Web site:

- http://www.britishmuseum.org/

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B.5.2 The Natural History Museum

This is a charming and well-run museum featuring local artefacts that serve to emphasise the long history of the region

Here is the museum Web site:

- http://www.nhm.ac.uk/

Dinosaur in the British Museum estimated to be 200 million years old.

B.5.3 The National Maritime Museum

This picture shows the National Maritime Museum (the world's largest) which is just outside London in Greenwich, and celebrates a Pavilion that was commissioned in 1616 by Anne, the wife of King James I.

Here is the link to the Web Site :-

- http://www.rmg.co.uk/aerial-view-of-maritime-greenwich

B.6 Music Festivals

B.6.1 Hyde Park Music Festival

The Music Festival in London's Hyde Park is an annual event that has gone through to a number of changes over the years but has always been very successful.

started in 1971 by two high school students.

It attracts rock music fans from around the world and features world-class performers like the Rolling Stones.

And here is what Wikipedia has to say:

- http://en.wikipedia.org/wiki/Hyde_Park_Calling

The photo shows thousands of fans enjoying the last night of the festival.

B.6.2 Notting Hill Carnival

Notting Hill Carnival is a musical celebration that takes place every year in August over two days.

It is led by members of the Caribbean population so Reggae is the most popular music.

The carnival has attracted up to 1.5 million people in the past, putting it among the largest street festivals in Europe.

Here's an interesting Wikipedia entry :-

- http://en.wikipedia.org/wiki/Notting_Hill#Carnival

B.7 Sports

B.7.1 Chelsea Football (Soccer) Club

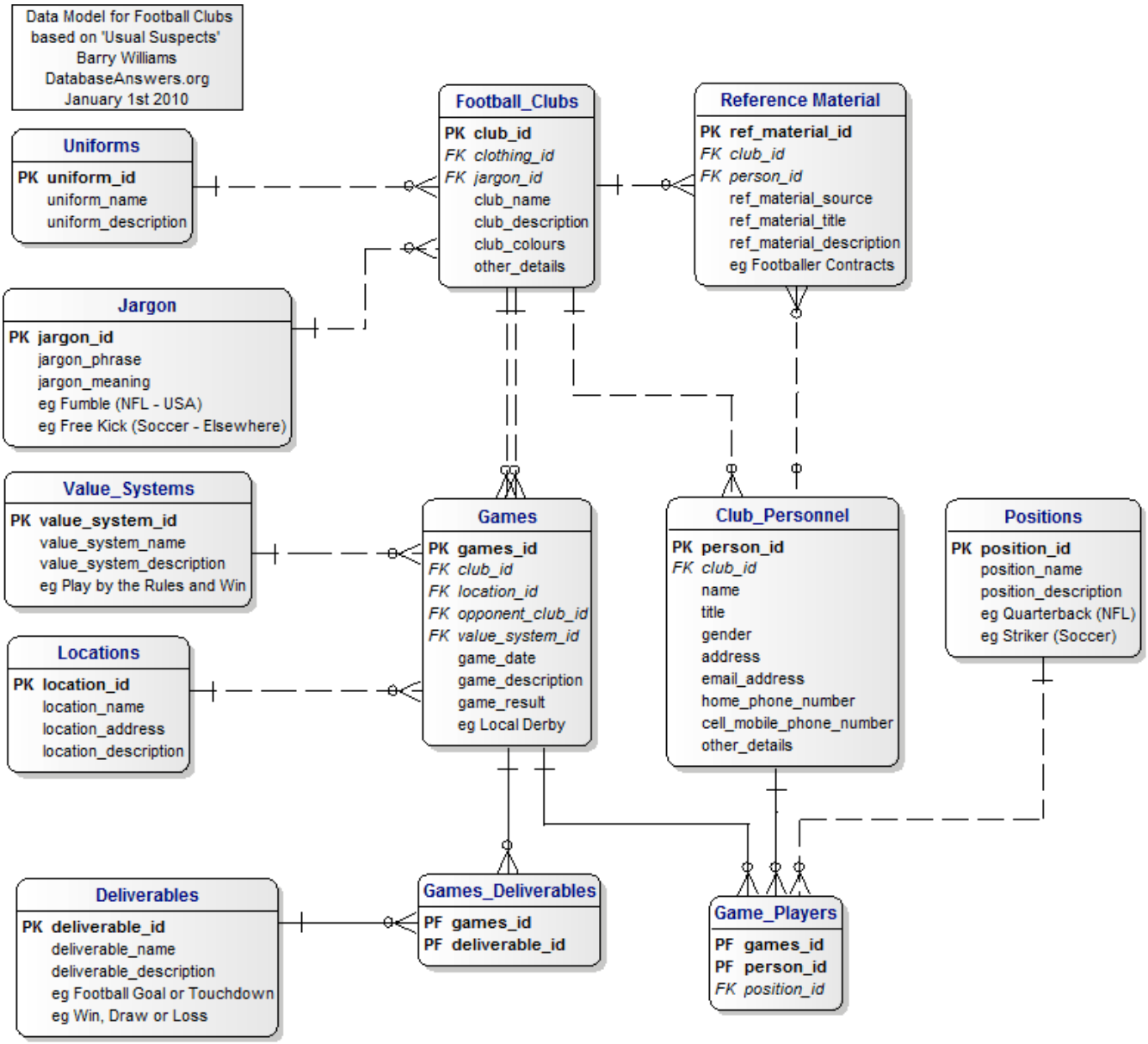
If you are a Chelsea fan, you might be interested in taking a tour of the ground and the Museum :-

- http://www.chelseafc.com/stadium-tours

Here is a photo of the current manager, Jose Mourinho.

And here is the Football Club Data Model (showing the Chelsea team from 1905) which is on this page of my Web Site :-

- http://www.databaseanswers.org/data_models/football_clubs/index.htm



B.7.2 The Olympics

The 2012 Olympic Games took place in July and August in London making London the first city to hold the modern games three times.

This photo shows the Olympic Park at night, and is included courtesy of the University of Connecticut :-

- http://www.uconnlondon.org.uk/summer-2012-olympics-in-london.html

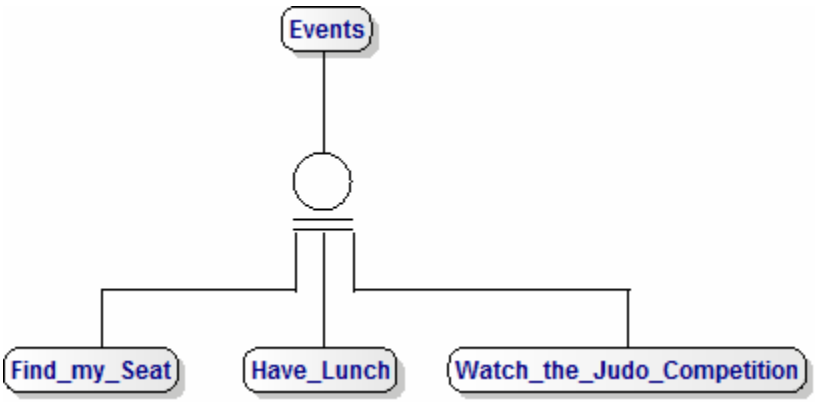
B.7.3 Judo at the Olympics

I have a Third-Degree Black Belt in Judo, which I achieved after a six-month stay in Tokyo.

I was very pleased to watch the Judo at the London Olympics and even more pleased to see Gemma Gibbons of the UK throw Audrey Tcheumeo of France on her way to a Silver Medal.

And here is the Data Model, which is on this page of my Web Site :-

- http://www.databaseanswers.org/data_models/a_day_at_the_olympics/index.htm



B.7.4 Data Model for Judo and Football

When we think about the Data Model, we realise that Judo and Football are both Sports.

In other worlds, we can have an Entity called Sports and then say that Judo 'Is-A' Sport and Football 'Is-A' Sport.

We know that both Sports involve Training and having a Standing.

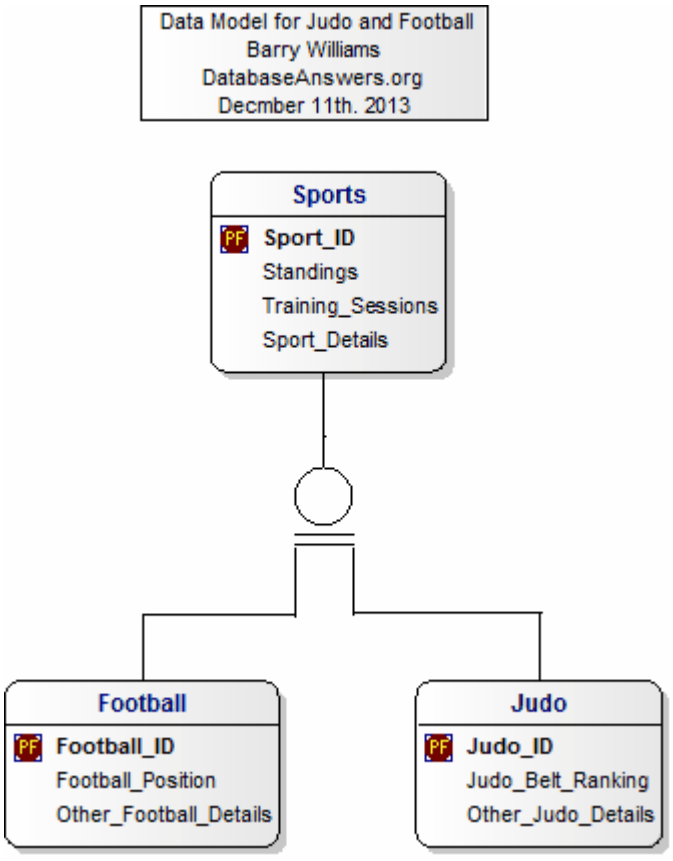
Although the Standing are similar a\t the high level, the details are different.

Therefore at this point, we simply record the fact the Standing will be recorded for each Sport.

In Football, a Player will usually play in a designated position , such as Goalkeeper.

In Judo, each participant will have a Belt of a designated colour or Grade, such as a Third-Degree Black Belt.

Therefore, at this early stage, our Data Model uses Inheritance to show the common data and the specific data :-



B.8 Travel around London

B.8.1 Heathrow Express

The Heathrow Express takes just 15 minutes to travel from Heathrow Airport to Paddington Station in West London.

- https://www.heathrowexpress.com/

B.8.2 The Tube (Underground Train)

The Tube is a very important part of the life for any Londoner.

It was the first commercial underground train service in the world.

On 9 January 2013, London Underground celebrated 150 years since the first underground journey anywhere in the world, took place on the Metropolitan Railway.

Here is a link to the page that celebrates that anniversary

- http://www.tfl.gov.uk/corporate/projectsandschemes/25979.aspx

B.8.3 Shipping

If we have brought so many things on our trip to London that we need to ship them back home, then we would be interested in finding out what shipping services are available.

Fortunately, that is made easy for us by London's very active shipping services.

- http://www.shippinginnovation.com/london-shipping-week/

B.8.4 Intermodal Transport

This Data Model shows how Inheritance is used to clarify the relationship between the three different modes of transport that we have shown above.

C. Advanced Level

C.1 Design Patterns

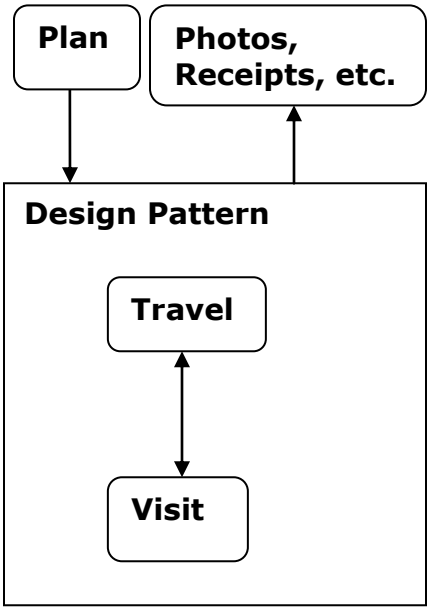
Design patterns are a very powerful technique when creating data models because they represent a common solution to a range of similar requirements.

In this example, we use a Design Pattern for travelling to visit Tourist Attractions.

The arrow between the arrow between Travel and Visit is double-headed because Tourists travel to make a Visit and then when the Visit is over, they travel back.

The difference between the out and back journeys is when Tourists return, they can bring with them various things, such as Photos, Receipts, Souvenirs and so on.

They might also take photos on smartphones and upload them direct to Facebook or Flickr.

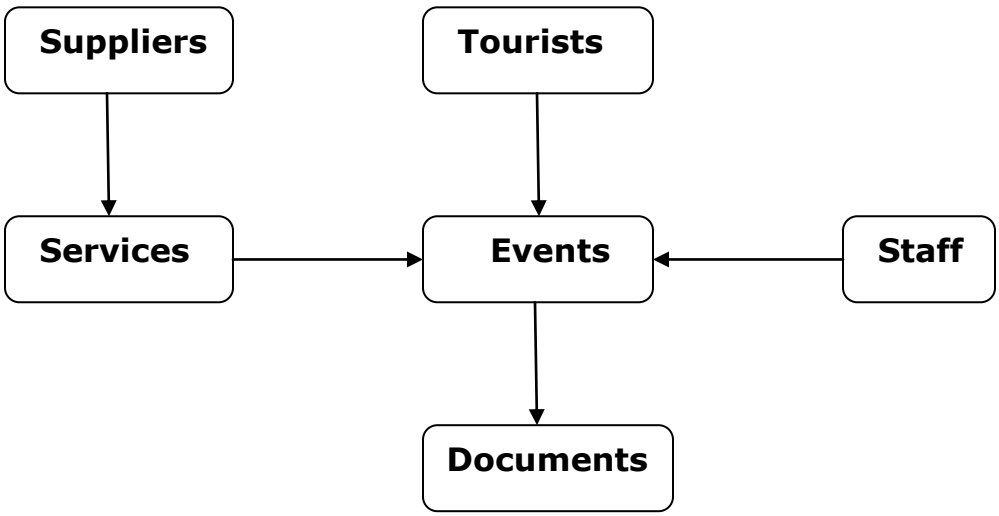


C.1.1 Enterprise Data Model

We can transform our Design Pattern into a Data Model in the following way :-

1. Analysing how 'I*s*-A' applies (discussed in an earlier Section) we identify that Travel is an Event and making a Visit is also an Event
2. Making a Plan is also an Event.
3. We can classify Photos, Receipts and so on as Documents.
4. Tickets are also Documents.
5. When we make a Visit, we might use an Automated Ticketing System or we might receive assistance from staff of an Organisation.

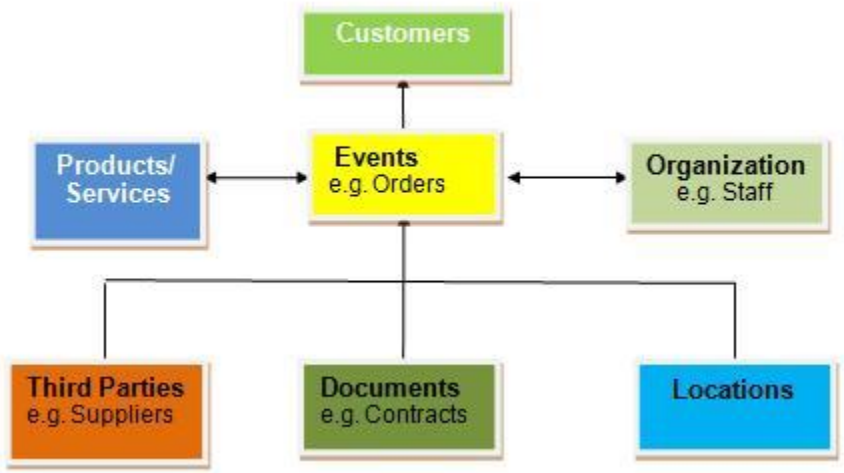
In this way, we design our Enterprise Data Model as follows :-



C.1.2 User-Friendly Data Model

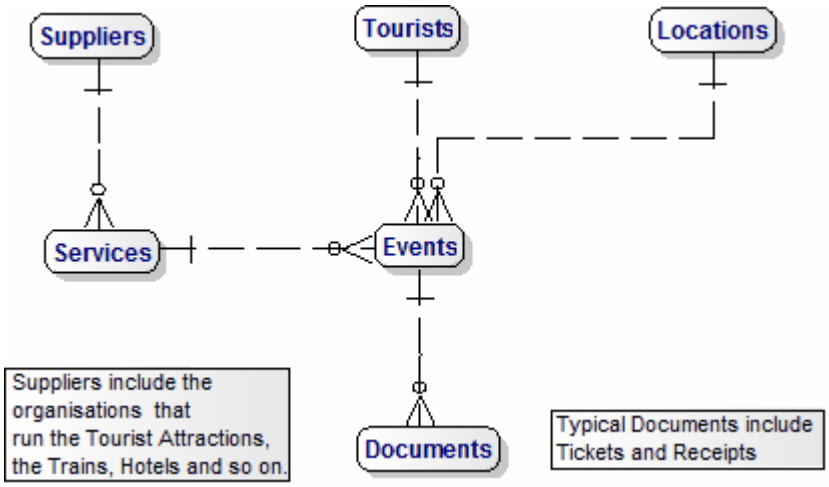
This shows how our Design Pattern looks as a Data Model.

This Design Pattern is a **canonical** data model which is the smallest model that can be designed that provides useful functionality and can be used for transforming data for loading into a data warehouse



C.1.3 Entity-Relationship Diagram (ERD)

This shows how our Design Pattern looks as an Entity-Relationship Diagram (ERD) Data Model which is what professional Data Modellers produce in the course of their work.



[Toby]: Dimple, this bit is quite hard-going so if you want to take a rest, that's OK.

[Dimple]: OK, Toby, I will just sit quietly and watch the people ;0)

[Toby]: People make reservations every day all around the world.

These reservations have a lot in common:

The basic data include a date and time, a specific facility, like a hotel, an airline seat, a theatre and so on.

This means that we can identify what they have in common and what they have that is different and specific to the type of reservation.

C.2 Reference Data

[Toby]: Dimple, you can see that I am using a Gender Table and People Types Table.

I have given them both names that begin with 'Ref_' to make it clear that they are reference data.

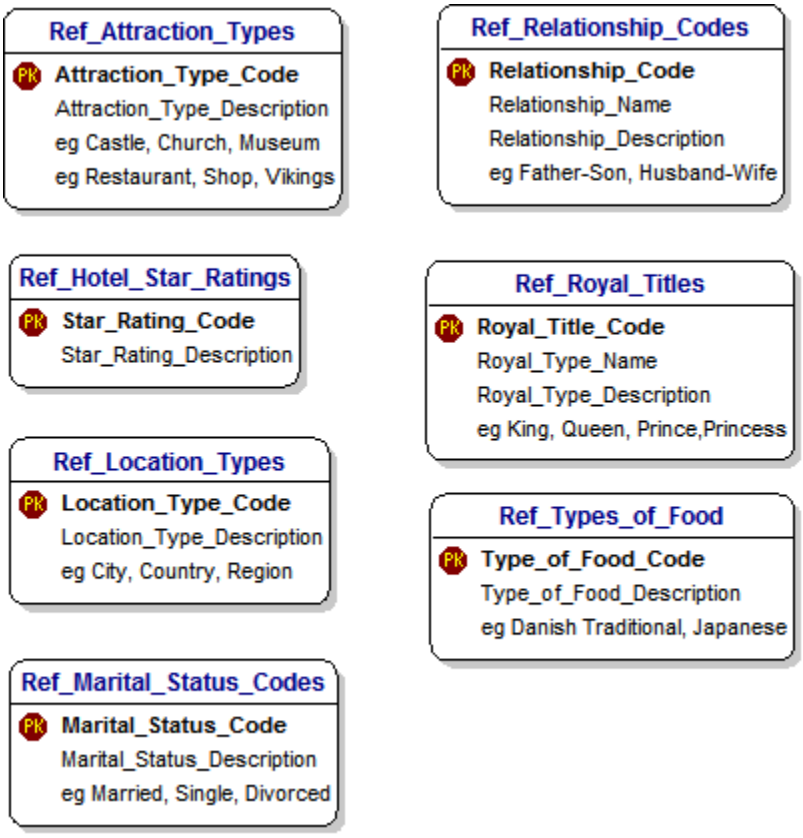
This means that the values don't change much and I can use them to define what the valid values can be.

This is a technique that professional data modelers use but we don't need to worry about it today.

[Dimple]: I'm glad to hear it, Toby!

Although it isn’t difficult to understand and it seems like a good idea.

[Toby]: In our small example, we have only four kinds of reference data altogether - gender, types of establishment, people and products.



C.3 Enterprise Data Models - Bringing it all Together

[Toby]: Dimple, if we bring together everything we have talked about, we will see that we have quite a good data model that any professional would be proud of.

[Dimple]: OK, Toby. Do you think I will understand it?

[Toby]: Let me help you by making a list of the **business rules** for our model:

- People can be either local residents, staff or tourists.
- There are a number of establishments of different types.
- Tourists can make visits to establishments and make purchases.
- Staff assist the tourists when they make a purchase.
- A purchase involves one or more products.

[Toby]: OK, Dimple - we have a very nice data model and now we can take the break I promised you.

[Dimple]: That's great, Toby - can we go to Starbucks?

[Toby]: Sure, but before we do I should say something about **PF**, which appears in the Staff Table.

It's unusual and it's called **PF** because it means a field that is a **P**rimary **K**ey in the Staff Table and a **F**oreign **K**ey to the People Table.

[Dimple]: Hmmm, I've got a headache, Toby - can we please go to Starbucks?

[Toby]: OK, Dimple. You've been a very good girl and you deserve a break.

You can admire what we have created, which is this very professional-looking data model.

C.4 Farewell to Starbucks in Heathrow

[Toby]: Dimple, I've got some wonderful news for you.

[Dimple]: I'm glad to hear it, Toby - what is it?

[Toby]: I have found Starbucks at Heathrow Airport here in London, so you can have your favorite things to eat or drink ;)

[Dimple]: Toby, are you teasing me?

[Toby]: No, Dimple – we can make a visit when we take our flight back home after our interesting and enjoyable visit to London.

[Dimple]: Wow - that's great, so I can have my favorite muffin.

Starbucks in Terminal 3 at Heathrow Airport :-

Starbucks in Heathrow Airport

C.5 What have we learned?

In this e-Book, we have learned how to enjoy being a Tourist and also think like a data modeler and how to gradually put together a data model in our heads.

We know that if we get in the habit of doing this regularly it gets easier and more natural and soon we will be seeing the world around us as pieces of a data model that we can fit together like a jigsaw puzzle.

(This is the back cover.)

Barry Williams is the founder and principal consultant with Database Answers.

His company has been providing advice and assistance to a wide range of blue-chip clients for over 20 years.

His particular interest is in advancing the role of data models as a way of improving communication between the business user community and data management professionals.

As part of this role he publishes best practice on his Database Answers Web site at

http://www.databaseanswers.org/