The Dimensional Modeling Process

Overview

This lab will introduce the Dimensional Modeling process. Upon completing this lab activity you learn:

- Techniques for profiling data using the SQL Query language.
- The process of high-level dimensional modeling, including:
  - Create a high-level dimensional model diagram (Kimball: fig. 7-3 pp. 304).
  - Create an attribute and metrics list (Kimball: fig. 7-2 pp. 294).
  - Keep track of issues
- The process of detailed dimensional modeling, including:
  - Create a detailed bus matrix (Kimball: fig. 7-7 pp. 315).
  - Documenting the detailed modeling process (Kimball: fig. 7-6 pp. 313).

Lab Requirements

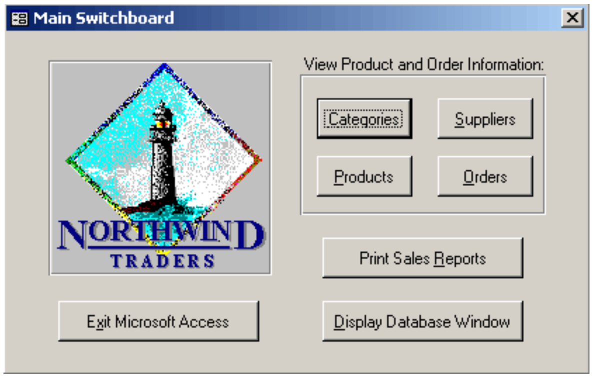
To complete this lab you will need the following:

- Access to the Northwind Database on Microsoft SQL Server 2012. This should be available through your iSchool vSphere login.
- You should connect to your SQL server database before starting this lab.
- The High-Level and Detailed dimensional modeling Excel Workbooks, available in the same place where you got this lab.
- Microsoft Excel 2007 or higher for editing the worksheets

Grading

This lab is worth 8 points total. 4 points for Part 2 and 4 points for part 3. It is accepted up to 1 week late at 50% penalty.

Part 1: The Northwind Traders Case Study

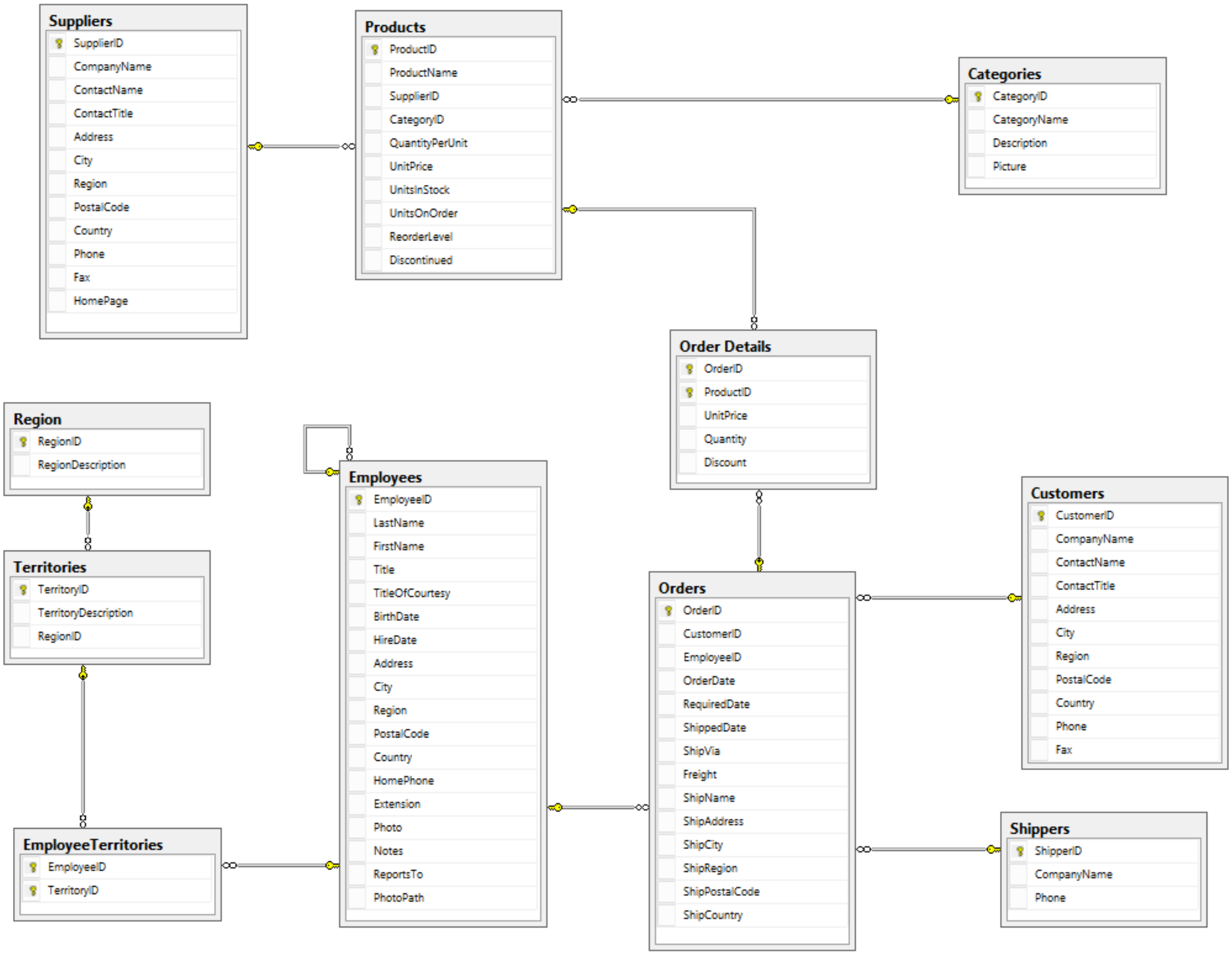


Northwind traders is a fictitious importer and exporter of specialty foods from around the world. It was created by Microsoft as a sample operational database to use with their database products, such as Microsoft Access and SQL Server.

In our class, we'll use this database as a case study for building a data warehouse. Over time you'll need to get very intimate with the Northwind table design and source data as we complete our build out.

The Northwind Data Model

Below is a screen shot of the internal model for the Northwind database. Use this diagram as a reference for understanding the structure of the Northwind data and building your dimensional model designs.



NOTE: You can view this database diagram on-line. It's under the *Database Diagrams* section of your *Northwind* database and is accessible through *SQL Server Management Studio*.

Data Warehouse Business Requirements

As part of the company's Business Intelligence initiative, Northwind would like create data marts with the following goals:

- ***Sales reporting.*** Senior management would like to be able to track sales by customer, employee, product and supplier, with the goal of establishing which products are the top sellers which employees place the most orders, and who are the best suppliers.
- ***Order Fulfillment and Delivery***. There is a need to analyze the order fulfillment process to see if the time between when the order is placed and when it is shipped can be improved

- ***Product Inventory Analysis.*** Management requires a means to track inventory, On Order, and Re-Order levels of products by supplier or category. Inventory levels should be snapshotted daily and recorded into the warehouse for analysis.
- ***Sales Coverage Analysis.*** An Analysis of the employees and the sales territories they cover.

As part of the business requirements, the following Enterprise Bus Matrix was created.

Dimension → Bus. Process ↓	**Order Date**	**Shipped Date**	**Customers**	**Employees**	**Shippers**	**Products**	**Suppliers**	**Territory**
Sales Reporting	X	X	X	X		X	X	
Order Fulfillment	X	X	X	X	X			
Inventory Analysis	X					X	X	
Sales Coverage				X				X

Part 2: Walk-Thru – Sales Reporting

In this part of the lab, we will work together to create a high-level and detailed design for the sales reporting business process. Along the way we'll profile our dimensional data and get a feel for our facts using SQL Queries against the Northwind database.

Part 2.a High Level Design

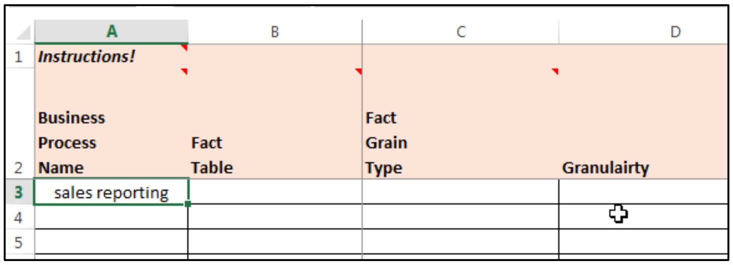
- Connect to your SQL Server using **SQL Server Management Studio** and open the **Northwind** database.
- Open the High-Level-Dimensional-Modeling Excel Workbook, to the **Detailed Bus Matrix** worksheet.

Kimball's 4 Step Modeling process

Kimball's 4 step modeling process walks us through setting the fact grain and identifying the useable dimensions. The Detailed Bus Matrix worksheet is designed to walk you through this process.

Kimball's Step 1: Business Process

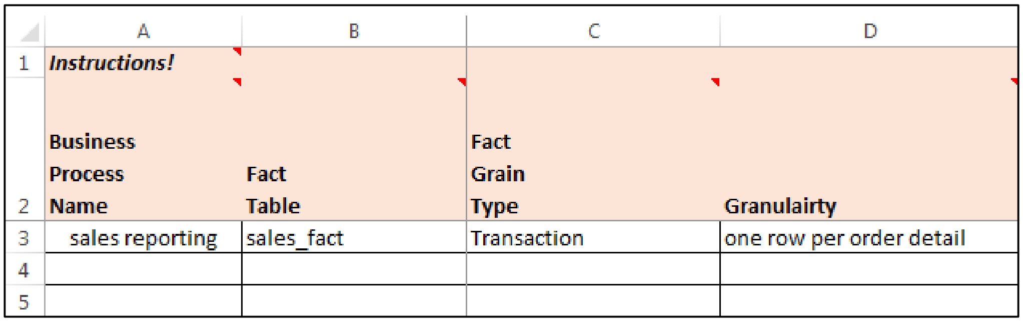
Our business process is **sales reporting**, so we place that in our worksheet:



	A	B	C	D
1	*Instructions!*			
2	Business Process Name	Fact Table	Fact Grain Type	Granulairty
3	sales reporting			
4				
5				

Kimball's Step 2: Declare the grain

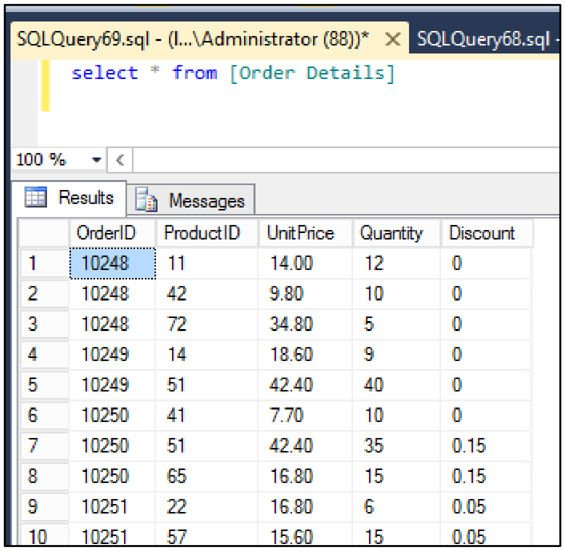
Our next step is to determine the level of grain for the fact table. What does it mean to be a single row in the sales reporting fact table? Well, if you read through the requirements (I know they're vague) you can determine that each row represents the *sale of a product*, or a *line item on an order*. This is a ***transaction*** type fact, and so we update as follows:



	A	B	C	D
1	***Instructions!***			
2	**Business Process Name**	**Fact Table**	**Fact Grain Type**	**Granulairty**
3	sales reporting	sales_fact	Transaction	one row per order detail
4				
5				

At this point you might be wondering: what does order detail look like and how to we know it is what we need? This is where *data profiling* comes into play. Let's take a look.

DO THIS: Switch to your SQL Server, and from **SQL Server Management Studio**, open a new Query window (**Ctrl + N**) and type `select * from [Order Details]` Then press [F5] to execute. You should see results like this →



```
select * from [Order Details]
```

	OrderID	ProductID	UnitPrice	Quantity	Discount
1	10248	11	14.00	12	0
2	10248	42	9.80	10	0
3	10248	72	34.80	5	0
4	10249	14	18.60	9	0
5	10249	51	42.40	40	0
6	10250	41	7.70	10	0
7	10250	51	42.40	35	0.15
8	10250	65	16.80	15	0.15
9	10251	22	16.80	6	0.05
10	10251	57	15.60	15	0.05

Each row in this query output represents the purchase of a product, which according to the requirements is what we need. Furthermore, many products can be part of one order (for example look at OrderID 10248) and therefore through order we can get back to other dimensions like customer and employee.

NOTE: In real life you won't strike gold so easily. You'll have to look at several tables before you can get a clear picture of your fact table grain.

Kimball's Step 3: Identify the dimensions

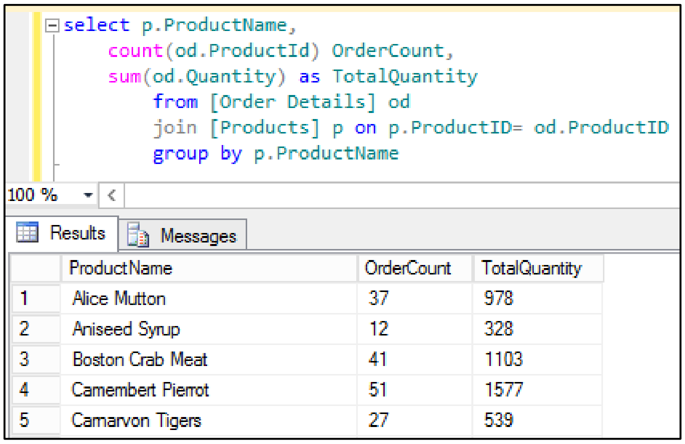
Next we identify the dimensions, but don't take the enterprise bus matrix's word for it. You should explore all possible dimensions and vet each one for yourself and with your stakeholders. The best way to do this when your source data is in a relational database is to *look at the table dependencies for the source of your fact data.*

For example if you review the *database diagram on page 2* of the lab you'll see that the **Order Details** table connects directly to the **Products** table via a foreign key in a *many to one* relationship. Because it appears on multiple orders, **Product** fits the candidacy of a dimension. Once again we can verify this dimension works for us and "rolls up" a couple of our known facts by writing some SQL.

DO THIS: Switch to your SQL Server, and from **SQL Server Management Studio**, open a new Query window (**Ctrl + N)** and type

```
select p.ProductName,
  count(od.ProductId) OrderCount,
  sum(od.Quantity) as TotalQuantity
    from [Order Details] od
    join [Products] p
      on p.ProductID= od.ProductID
    group by p.ProductName
```

Then press [F5] to execute. You should see results like this →



```
select p.ProductName,
    count(od.ProductId) OrderCount,
    sum(od.Quantity) as TotalQuantity
        from [Order Details] od
        join [Products] p on p.ProductID= od.ProductID
        group by p.ProductName
```

	ProductName	OrderCount	TotalQuantity
1	Alice Mutton	37	978
2	Aniseed Syrup	12	328
3	Boston Crab Meat	41	1103
4	Camembert Pierrot	51	1577
5	Carnarvon Tigers	27	539

What you're seeing is a list of Products, along with a count of orders for which that product appears, and a total quantity sold for that product. (There's a lot of details in this SQL statement, so feel free to ask your instructor for an explanation should you need it.)

Important Tip: You should always exercise caution when profiling live systems. Executing SQL queries against production data is usually not a wise decision as you may impact performance negatively. It is important to seek the advice of a Database Administrator prior to embarking your data profiling adventure!

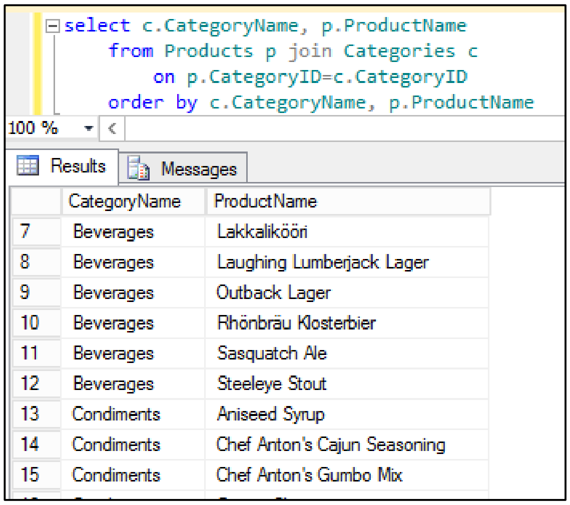
Outrigger Dimensions and Hierarchies

You've probably noticed the **Products** table connects to the **Categories** and **Suppliers** tables in a *many to one* relationship (and thus these two tables are *dependent upon the **Products** table*). This means there's many products in a single category and several products for a single supplier. Situations like this help you discover *hierarchies* you can use in your dimension. Here's the SQL we use to do this:

DO THIS: Switch to your SQL Server, and from **SQL Server Management Studio**, open a new Query window (**Ctrl + N)** and type

```
select c.CategoryName, p.ProductName
       from Products p join Categories c
              on p.CategoryID=c.CategoryID
       order by c.CategoryName, p.ProductName
```

Then press [F5] to execute. You should see results like this →



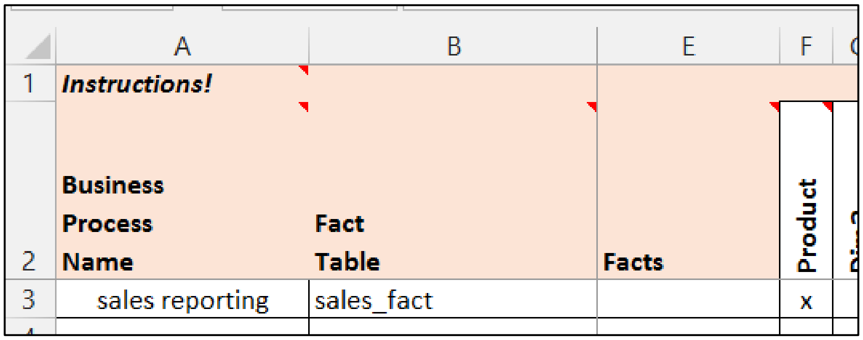
```
select c.CategoryName, p.ProductName
    from Products p join Categories c
        on p.CategoryID=c.CategoryID
    order by c.CategoryName, p.ProductName
```

	CategoryName	ProductName
7	Beverages	Lakkalikööri
8	Beverages	Laughing Lumberjack Lager
9	Beverages	Outback Lager
10	Beverages	Rhönbräu Klosterbier
11	Beverages	Sasquatch Ale
12	Beverages	Steeleye Stout
13	Condiments	Aniseed Syrup
14	Condiments	Chef Anton's Cajun Seasoning
15	Condiments	Chef Anton's Gumbo Mix

Note our use of the order by clause in the SQL statement. This is important as it helps us visually identify the data hierarchy.

In this case, if we determine the hierarchy is useful we can consolidate the attributes we need from it into the product dimension. This makes more sense than including a separate dimension for Category.

Once you've identified a useful dimension, it's time to add it to our **Detailed Bus Matrix** like so:

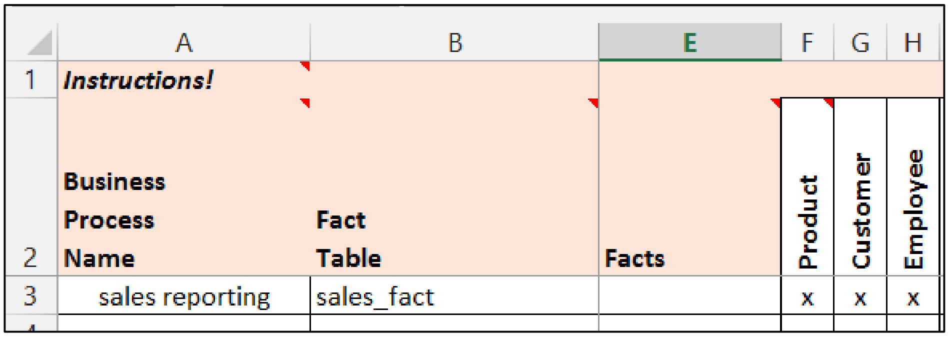


	A	B	E	F	G
1	***Instructions!***				
2	**Business Process Name**	**Fact Table**	**Facts**	**Product**	**Dim2**
3	sales reporting	sales_fact		x	

Rinse, Lather and Repeat

Next we should go back and evaluate the other dependencies among our data once again by looking at the tables connected to our **Orders** and **Order Details** tables. Look for other dimensions which could be useful in our model, and when in doubt you can always check its roll-up capability with some SQL.

Here's a screenshot of the dimensions I've discovered so far:

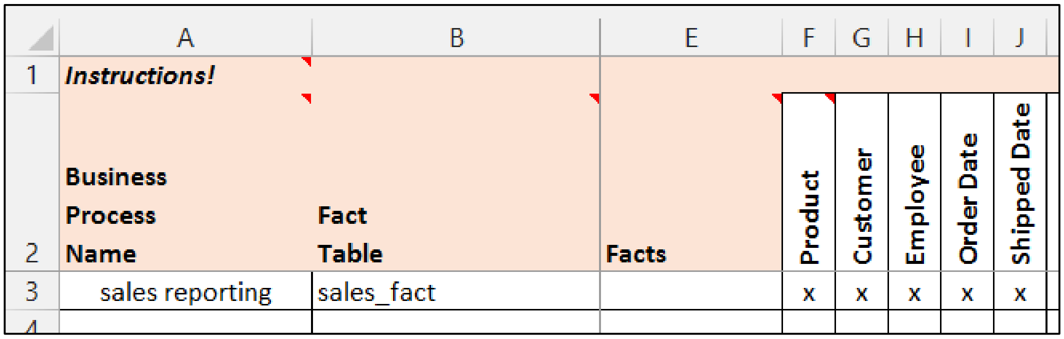


	A	B	E	F	G	H
1	***Instructions!***					
2	**Business Process Name**	**Fact Table**	**Facts**	**Product**	**Customer**	**Employee**
3	sales reporting	sales_fact		x	x	x

Important Tip: It's important to recognize that dimensional modeling is not a formal that can be automated. There's a lot of art that goes with the science. (To quote the pirate's code these are more like guidelines than hard and fast rules ☺).

What about the time dimension?

To identify date and time dimensions, look for dates stored in the tables associated with your fact grain. In our case if you run an SQL query on the **Orders** table you'll see **Order Date** and **Shipped Date**. We'll add both to our model:



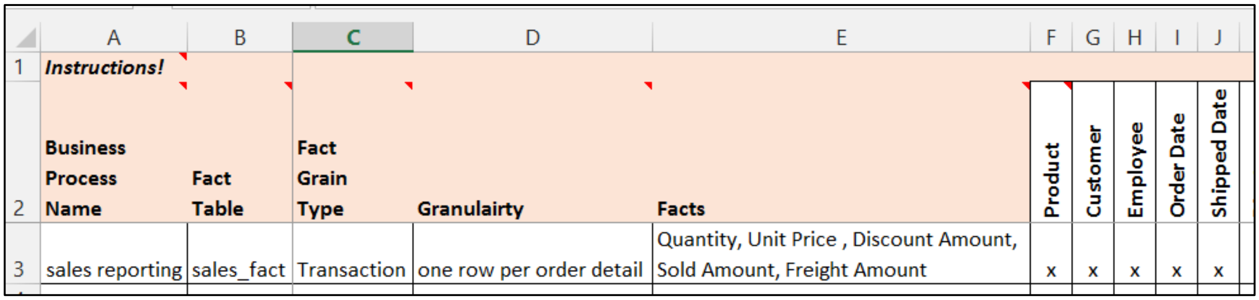
	A	B	E	F	G	H	I	J
1	***Instructions!***							
2	**Business Process Name**	**Fact Table**	**Facts**	**Product**	**Customer**	**Employee**	**Order Date**	**Shipped Date**
3	sales reporting	sales_fact		x	x	x	x	x

Kimball's Step 4: Identity the facts

After you wrap up your dimensions, it's time to identify the facts. From identifying the fact grain of the model you probably already have a few facts in mind, but now's the time to really nail down the facts you need in your model. Like everything else in this step a lot will depend on your requirements.

One important this to recognize is not all facts appear among your source data. Some of the facts you'll need are *derived* by doing a "little math" on some of the source data values. We include the facts we want in the **Detailed Bus Matrix** but explain how they are derived in the **Attributes and Metrics** worksheet. For now, we'll add the following facts to our **Detailed Bus Matrix** and complete it.

- Quantity – (of product sold)
- Unit Price
- Discount amount (unit price * discount)
  Sold Amount (Quanity * Unit Price less discount Amount for each item on order)
- Freight Amount (split evenly among items on the order)



	A	B	C	D	E	F	G	H	I	J
1	***Instructions!***									
2	**Business Process Name**	**Fact Table**	**Fact Grain Type**	**Granulairty**	**Facts**	**Product**	**Customer**	**Employee**	**Order Date**	**Shipped Date**
3	sales reporting	sales_fact	Transaction	one row per order detail	Quantity, Unit Price , Discount Amount, Sold Amount, Freight Amount	x	x	x	x	x

Attributes & Metrics

Now that you've completed the Detailed bus Matrix for your business process, it's time to move down a level of detail in the process. In this next step we will circle back through our dimensions and facts and put together a quick list of **Attributes and Metrics** that we require for our dimensional model this list allows you to get more specific about the needs of your dimensional model.

Completing the **Attributes and Metrics** worksheet is self-explanatory and therefore I will leave it as an exercise for you. As you complete this part, keep the following in mind:

- Start with the dimensions you've identified in your **Detailed Bus Matrix**.
- You can profile for useful dimensional attributes with a SQL query like this:
  ```
  select * from [table_name]
  ```
- Don't forget to explore any hierarchies among your dimensions, as discussed in the previous section.
- Time dimensions are fairly standard. You only need to be detailed about any unique definitions in your time dimensions.
- If your fact is semi-additive, make note in the description.
- If your fact is derived, be sure to explain how it is derived in the description.

When you're done. Save your worksheet before moving on to the next step.

Part 2.b Detailed Design

Congratulations! If you made it this far, you've completed your first High-Level dimensional design. In this next part we will iterate over our dimensional model ***one more time*** to create our **Detailed Dimensional Design**. The goals of this process are to:

1. Create a formal table design, including tables, keys, data types, and indexes so we can create tables and indexes required for our star schemas (ROLAP).
2. Identify data sources of our dimensional model so that we can architect and implement the ETL process in a future phase.

Introducing the Detailed Dimensional Modeling Workbook

The **Detail Dimensional Modeling Workbook** we will use comes from the Kimball Consulting Website http://www.kimballgroup.com. The Workbook contains Excel macros which automate some diagram creation a basic SQL generation. ***We will not use these features, however you are welcome to try them out***.

DO THIS: You should start by **opening the Excel Workbook** and reading the section titled **How to use this tool** under the **Home** worksheet, and then read the **ReadMe** tab. This will give you an overview of how to use this workbook.

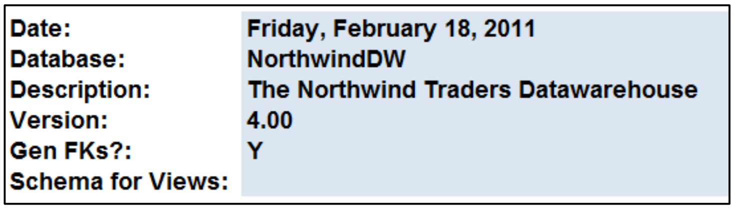
Getting Started

First let's setup the workbook.

DO THIS: Click on the **Home** worksheet, and complete the fields as follows:

- Database: **NorthwindDW**
- Description: **The Northwind Traders Data Warehouse**
- Gen FK's?: **Y**
- Schema For Views: **(leave blank)**

Here's a screenshot of the completed worksheet.



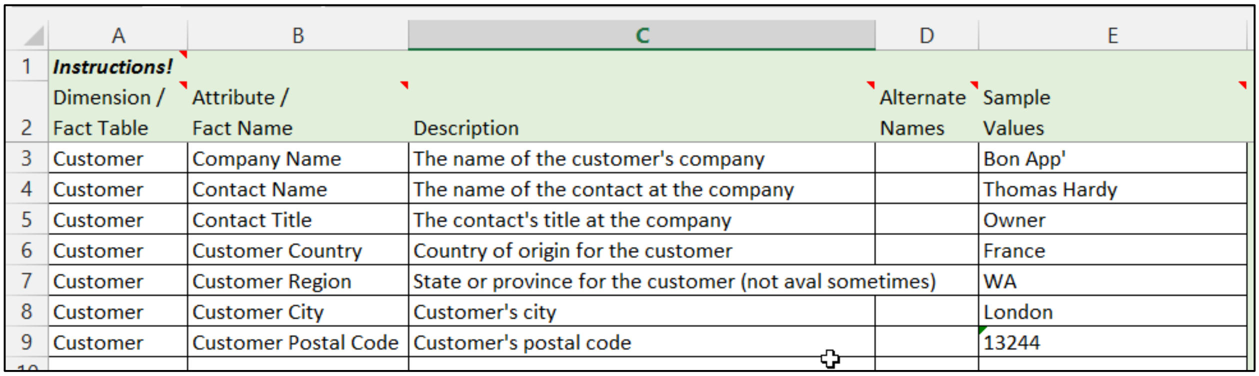
Date:	Friday, February 18, 2011
Database:	NorthwindDW
Description:	The Northwind Traders Datawarehouse
Version:	4.00
Gen FKs?:	Y
Schema for Views:	

We're now ready to start our detailed dimensional design.

Completing the detailed design for the Customer dimension

In this next step, we will complete the detailed dimensional design for the **Customer** dimension of our **Sales Reporting** data mart from part 2.a. The other dimensions will be left as an exercise for you. If you need assistance, refer to the sample detailed design you instructor has provided for you.

To complete the design we will need to refer to the **Attributes & Measures** from the high level design. A screen shot has been included for reference.



	A	B	C	D	E
1	***Instructions!***				
2	Dimension / Fact Table	Attribute / Fact Name	Description	Alternate Names	Sample Values
3	Customer	Company Name	The name of the customer's company		Bon App'
4	Customer	Contact Name	The name of the contact at the company		Thomas Hardy
5	Customer	Contact Title	The contact's title at the company		Owner
6	Customer	Customer Country	Country of origin for the customer		France
7	Customer	Customer Region	State or province for the customer (not aval sometimes)		WA
8	Customer	Customer City	Customer's city		London
9	Customer	Customer Postal Code	Customer's postal code		13244

The process you'll follow to design a dimension or fact table is outlined in **5 Steps:**

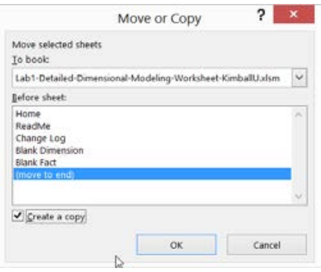
1. Create a new dimension (or fact) worksheet in the workbook.
2. Complete the table definition part of the worksheet.
3. Complete the basic column information.
4. Complete the target table information.
5. Complete the source data information.

Step 1: Create a new dimension worksheet

Let's document the details of this dimension.

DO THIS: Make a copy of the **Blank Dimension** worksheet. ***Right-click*** on it and select ***Move or Copy*** from the menu. When the dialog appears, click ***(move to end)*** and check the ***Create a copy*** checkbox before clicking ***OK***.

You will now have a **Blank Dimension (2)** worksheet. ***Right-click*** on it and select ***rename*** from the menu, then type in **Customer**.



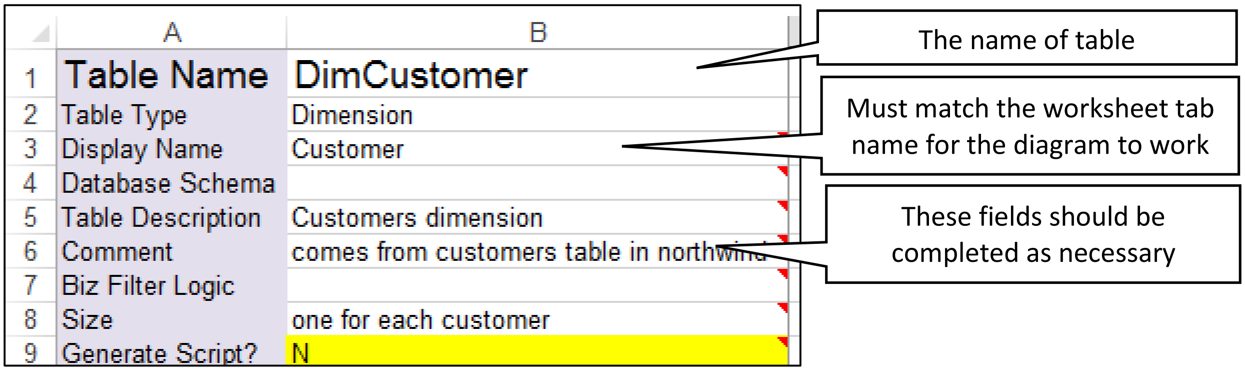
To book: Lab1-Detailed-Dimensional-Modeling-Worksheet-KimballU.xlsm

☑ Create a copy

You should now have your first dimension:

Step 2: Complete the table definition

Our next step is to complete the **table definition** for the customers dimension table. Please complete it as follows:



	A	B
1	Table Name	DimCustomer
2	Table Type	Dimension
3	Display Name	Customer
4	Database Schema	
5	Table Description	Customers dimension
6	Comment	comes from customers table in northwind
7	Biz Filter Logic	
8	Size	one for each customer
9	Generate Script?	N

The name of table

Must match the worksheet tab name for the diagram to work

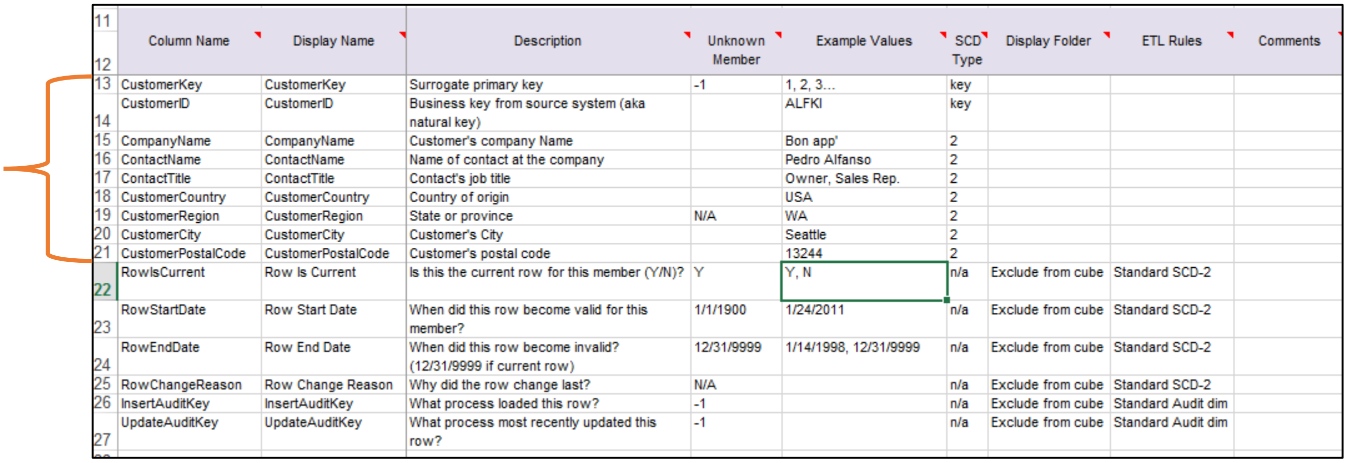
These fields should be completed as necessary

Step 3: Complete the basic column information

Next we complete the basic column definitions using the data from our **Attributes & Measures** from the high level design. Here's an explanation of the first 9 columns:

- **Column Name** → Physical name of column in the table
- **Display Name** → Logical name of column in the table (should match the physical name)
- **Description** → Explanation of the column, for documentation purposes
- **Unknown Member** → What should be used for an unknown value (in place of NULL)
- **Example Values** → What do sample values look like?
- **SCD Type** → Slowly changing dimension type: key (does not change), 1,2,3, or n/a
- **Display Folder** → Provides grouping for similar attributes / facts in a cube design.
- **ETL Rules** → Any special ETL rules, if known at this time.

Fill out your column information to match mine:



11 12	Column Name	Display Name	Description	Unknown Member	Example Values	SCD Type	Display Folder	ETL Rules	Comments
13	CustomerKey	CustomerKey	Surrogate primary key	-1	1, 2, 3…	key			
14	CustomerID	CustomerID	Business key from source system (aka natural key)		ALFKI	key			
15	CompanyName	CompanyName	Customer's company Name		Bon app'	2			
16	ContactName	ContactName	Name of contact at the company		Pedro Alfanso	2			
17	ContactTitle	ContactTitle	Contact's job title		Owner, Sales Rep.	2			
18	CustomerCountry	CustomerCountry	Country of origin		USA	2			
19	CustomerRegion	CustomerRegion	State or province	N/A	WA	2			
20	CustomerCity	CustomerCity	Customer's City		Seattle	2			
21	CustomerPostalCode	CustomerPostalCode	Customer's postal code		13244	2			
22	RowIsCurrent	Row Is Current	Is this the current row for this member (Y/N)?	Y	Y, N	n/a	Exclude from cube	Standard SCD-2	
23	RowStartDate	Row Start Date	When did this row become valid for this member?	1/1/1900	1/24/2011	n/a	Exclude from cube	Standard SCD-2	
24	RowEndDate	Row End Date	When did this row become invalid? (12/31/9999 if current row)	12/31/9999	1/14/1998, 12/31/9999	n/a	Exclude from cube	Standard SCD-2	
25	RowChangeReason	Row Change Reason	Why did the row change last?	N/A		n/a	Exclude from cube	Standard SCD-2	
26	InsertAuditKey	InsertAuditKey	What process loaded this row?	-1		n/a	Exclude from cube	Standard Audit dim	
27	UpdateAuditKey	UpdateAuditKey	What process most recently updated this row?	-1		n/a	Exclude from cube	Standard Audit dim	

NOTE: Included in this detailed design are techniques for dealing with type-2 SCD's and an audit dimension (everything from row 22 and higher in the screenshot). Both of these techniques are covered in the ETL chapters of our course. For now, we can leave these in our design. We'll revisit them later.

Step 4: Target (dimensional table) table definition

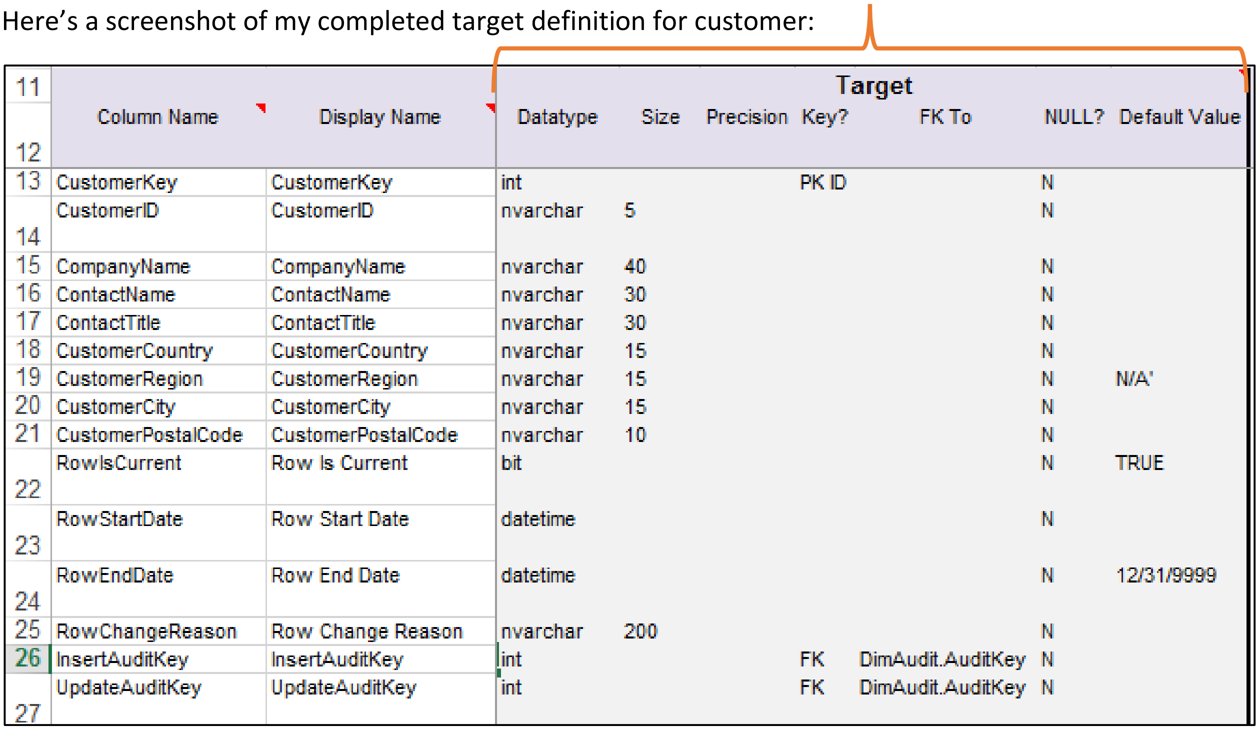
In this next step, you'll define the table definition for our dimension table in our ROLAP star schema. You work here follows along with normal relational table design definitions.

The columns you'll need to complete in this step for each attribute are:

- **Datatype, Size, Precision** – the SQL Server datatype (including size and precision, where appropriate) of the attribute. A good rule of thumb is to check the source data type for reference. It should be noted that data types vary from DBMS to DBMS. SQL server datatype reference can be found at http://msdn.microsoft.com/en-us/library/ms187752.aspx.
- **Key?** – Should be blank if not a key or labeled PK = primary key, PK ID = primary key (with surrogate), or FK = foreign key.
- **FK To** – When you label an attribute as FK, you need to include a dimension table and its primary key as the referencing column.

- **NULL**? – Whether or not the attribute permits null values. This should only be permitted in very rare circumstances. The better design decision is to provide a default value in place of NULL.
- **Default Value** – A value which should be stored in the event there is no value.

Here's a screenshot of my completed target definition for customer:



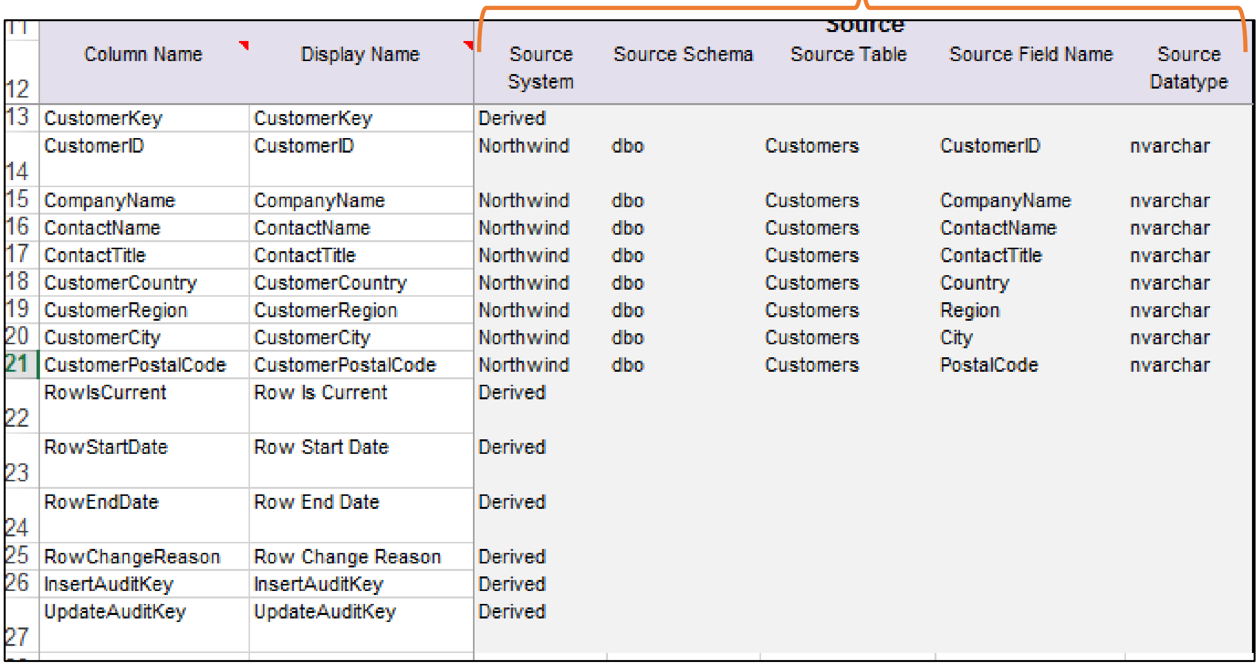
		Target						
Column Name	Display Name	Datatype	Size	Precision	Key?	FK To	NULL?	Default Value
CustomerKey	CustomerKey	int			PK ID		N	
CustomerID	CustomerID	nvarchar	5				N	
CompanyName	CompanyName	nvarchar	40				N	
ContactName	ContactName	nvarchar	30				N	
ContactTitle	ContactTitle	nvarchar	30				N	
CustomerCountry	CustomerCountry	nvarchar	15				N	
CustomerRegion	CustomerRegion	nvarchar	15				N	N/A'
CustomerCity	CustomerCity	nvarchar	15				N	
CustomerPostalCode	CustomerPostalCode	nvarchar	10				N	
RowIsCurrent	Row Is Current	bit					N	TRUE
RowStartDate	Row Start Date	datetime					N	
RowEndDate	Row End Date	datetime					N	12/31/9999
RowChangeReason	Row Change Reason	nvarchar	200				N	
InsertAuditKey	InsertAuditKey	int			FK	DimAudit.AuditKey	N	
UpdateAuditKey	UpdateAuditKey	int			FK	DimAudit.AuditKey	N	

Step 5: Source definition

In this final step you'll complete the source definition, which will assist us as we complete the ETL implementation in a subsequent step. Here's an explanation of the columns you'll need to complete in this step:

- **Source System** – List the source system for the attribute. ***Derived*** implies the attribute is calculated.
- **Source Schema** – If the attribute comes from a specific schema, list it here.
- **Source Table** – State the table the attribute comes from on the source system.
- **Source Field Name** – The column or columns which supply the attribute. If the column is a calculation, specify that here (ex. OrderQty*Price).

Here's a screenshot of my completed target definition for customer:



11			Source				
12	Column Name	Display Name	Source System	Source Schema	Source Table	Source Field Name	Source Datatype
13	CustomerKey	CustomerKey	Derived				
14	CustomerID	CustomerID	Northwind	dbo	Customers	CustomerID	nvarchar
15	CompanyName	CompanyName	Northwind	dbo	Customers	CompanyName	nvarchar
16	ContactName	ContactName	Northwind	dbo	Customers	ContactName	nvarchar
17	ContactTitle	ContactTitle	Northwind	dbo	Customers	ContactTitle	nvarchar
18	CustomerCountry	CustomerCountry	Northwind	dbo	Customers	Country	nvarchar
19	CustomerRegion	CustomerRegion	Northwind	dbo	Customers	Region	nvarchar
20	CustomerCity	CustomerCity	Northwind	dbo	Customers	City	nvarchar
21	CustomerPostalCode	CustomerPostalCode	Northwind	dbo	Customers	PostalCode	nvarchar
22	RowIsCurrent	Row Is Current	Derived				
23	RowStartDate	Row Start Date	Derived				
24	RowEndDate	Row End Date	Derived				
25	RowChangeReason	Row Change Reason	Derived				
26	InsertAuditKey	InsertAuditKey	Derived				
27	UpdateAuditKey	UpdateAuditKey	Derived				

Next Steps

Finish your detailed design by repeating steps 1-5 for your other dimensions and fact table for the sales reporting process. You'll probably have to do a bit of profiling to complete the process. Ask questions if you have them, or if working outside of class time, log your issues to the issues worksheet.

Part 3: On Your Own – Order Fulfillment

After you have finished up the sales reporting design, its time to move on to order fulfillment.

In this part, you will repeat the process outlined in part 2 of the lab for the order fulfillment business process. Here's a set of instructions and guidelines for you to follow:

1) In your high-level modeling Excel workbook:
    a. Revise your **Detailed Bus Matrix** worksheet to include this new business processes. When evaluating your dimensions, don't just take the Enterprise Bus Matrix at its word. Remember to observe the data relationships of the Northwind tables and profile in SQL for other useful dimensions and attributes.
    b. Based on your findings, update the **Attributes & Metrics** worksheet for your new business processes. Remember in the *Enterprise Data Warehouse* we strive for **conformed dimensions** and **consolidated fact tables** so keep a keen eye out for ways you can reuse what you've modeled already.
    c. If you encounter issues, unknowns, or things you just cannot figure out, record them to your issues list.
2) Once you've completed the first part move on to the detailed modeling Excel workbook:
    a. Update any changes to your existing fact and dimension tables. Don't add another customer dimension if there's one already there. Remember we strive for **conformed dimensions** and **consolidated fact tables.**

b. Add new fact and dimensions table designs that you have, basing them on your **Attributes & Metrics** worksheet from the first step.
c. In both cases make sure to be complete in your documentation process, including the target table design for your star schema and information regarding your data source so that you have what is required for the ETL design.
d. Any issues you encounter, such as not knowing how to source your data, should be placed in the issues list (in the other workbook).
e. When you're finished, and both business processes have been modeled at the high and detailed levels, it's time to hand in your work. Attach both files to the Lab Dropbox in our Learning Management System. Good luck!