



QAD Enterprise Applications

Training Guide

QAD Data Warehouse Designer

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Data Warehouse Designer Version 3.4

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Contents

Tutorial 1 - Basic Star Schema Fact Table	3
1.1 Purpose and Roadmap	4
1.2 The First Step	6
1.2.1 Logging In	6
1.2.2 Switching Between Databases	8
1.3 Repository Defaults	10
1.4 Tablespace (FileGroup) Defaults	11
1.5 Table Name Defaults	11
1.6 Creating a Connection	12
1.7 Loading Source Tables	17
1.8 Building Dimensions	21
1.9 Creating Dimension Views	29
1.10 Defining the Staging Table	33
1.11 Including Dimension Links	37
1.12 Creating a Fact Table	48
1.13 Switching to Diagrammatical View	53
1.14 Producing Documentation	56
1.15 Data Store Objects (Optional)	57
 Tutorial 2 - Rollup Fact Tables, ASCII File Loads, Aggregates	 63
2.1 Purpose and Roadmap	64
2.2 Making a Connection to Windows	67
2.3 Loading Tables from Flat Files	70
2.4 Creating Stage Tables	75
2.5 Creating Fact Tables	77
2.6 Rollup / Combined Fact Table	79
2.7 Aggregate Tables	82
2.8 Creating a Customer Aggregate	84
 Tutorial 3 - Scheduling and Dependencies	 89
3.1 Purpose and Roadmap	90
3.2 Creating and Scheduling a Job	91
3.3 Adding Tasks	92
3.4 Task Dependencies	95
3.5 Editing a Scheduled Job	96
3.6 Job Results	98
3.7 Diagrammatical View for Jobs	100
 Tutorial 4 - Complex Dimensions and Hierarchies	 103
4.1 Purpose and Roadmap	104
4.2 Creating a Slowly Changing Dimension	105

4.3 Multiple Source Table Dimension	112
4.4 Creating a Dimension Hierarchy	120

Tutorial 5 - Analysis Services Cubes	123
---	------------

5.1 Purpose and Roadmap	124
5.2 Creating an OLAP Cube Object	125
5.3 Adding a Measure Group	152
5.4 Cube Connections for Other Databases	164

Tutorial 6 - KPI fact table	169
------------------------------------	------------

6.1 Purpose and Roadmap	170
6.2 The KPI Dimension	171
6.3 Defining the KPI Fact Table	172
6.4 Creating the KPI Fact Table and Procedure	178
6.5 The KPI Parameters	180
6.6 Defining a KPI	181
6.7 Defining the Activity KPI	186

C H A P T E R 1

Tutorial 1 - Basic Star Schema Fact Table

In This Chapter

1.1 Purpose and Roadmap.....	4
1.2 The First Step.....	6
1.3 Repository Defaults	10
1.4 Tablespace (FileGroup) Defaults	11
1.5 Table Name Defaults	11
1.6 Creating a Connection.....	12
1.7 Loading Source Tables.....	17
1.8 Building Dimensions	21
1.9 Creating Dimension Views	29
1.10 Defining the Staging Table	33
1.11 Including Dimension Links.....	37
1.12 Creating a Fact Table	48
1.13 Switching to Diagrammatical View	53
1.14 Producing Documentation.....	56
1.15 Data Store Objects (Optional).....	57

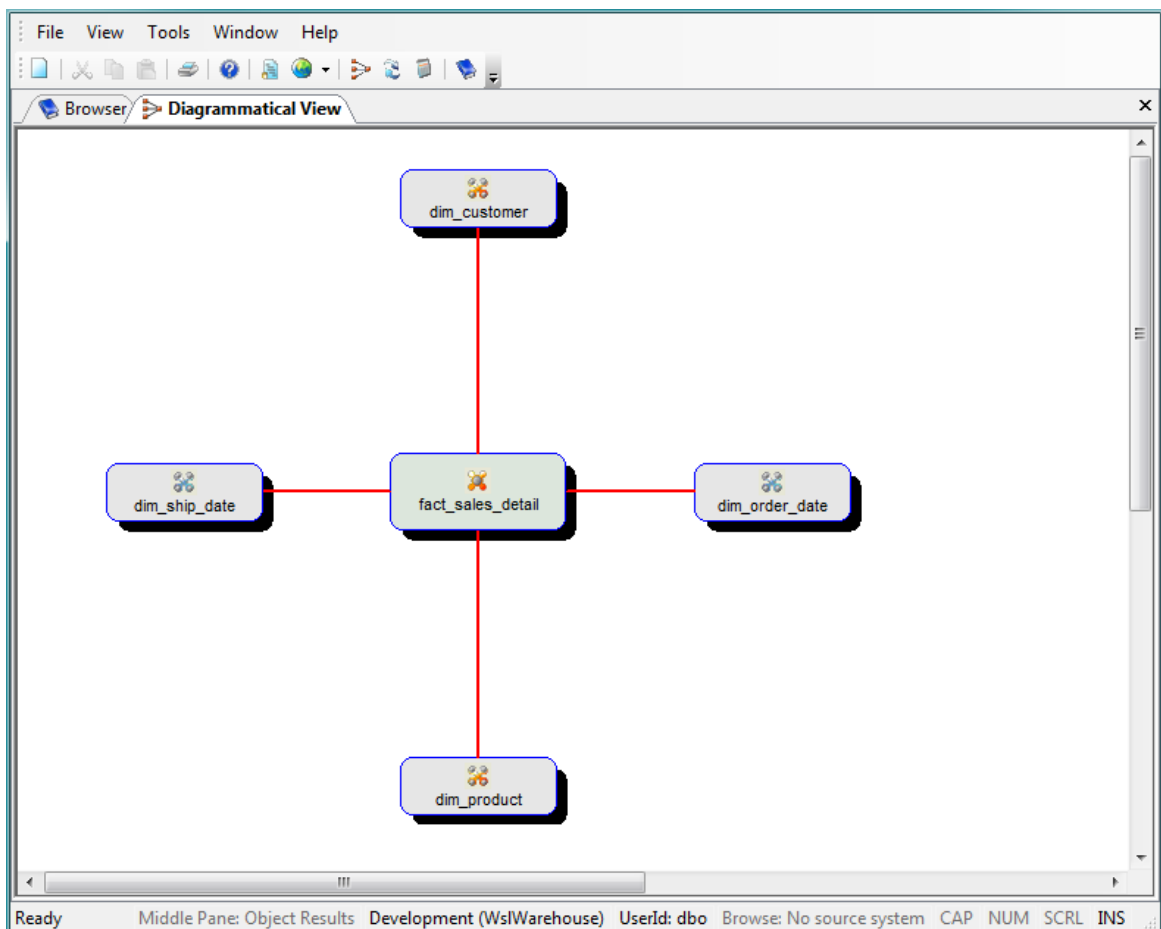
1.1 Purpose and Roadmap

Purpose

This tutorial is designed to introduce you to the basic objects used by QAD Data Warehouse Designer. At the end of the tutorial you will have built a simple dimensional analysis area of a data warehouse.

The tutorial will build the star-schema shown below. This star-schema comprises a central fact table, `fact_sales_detail`, joined to four dimension tables. Data will be loaded from tables in another Sql Server database, Oracle schema or DB2 schema.

In the process of creating this star-schema you will learn to create load, stage, fact and dimension tables. You will also see how data flows from the data source, through the different tables enroute to its fact or dimension table destination.



Tutorial Environment

This tutorial has been completed using Microsoft SQL Server. All of the features illustrated in this tutorial are available in SQL Server, Oracle and DB2 (unless otherwise stated). Any differences in usage of QAD Data Warehouse Designer between these databases are highlighted.

Tutorial Roadmap

This tutorial works through a number of steps. These steps and the relevant section within the chapter are summarized below to assist in guiding you through the tutorial.

Step in Tutorial	Section
Setup the WhereScape tool ▪ Install QAD ▪ Set-up tablespace defaults ▪ Set-up default prefixes for tables ▪ Create connection (to data source)	▪ The First Step ▪ Logging In ▪ Tablespace Defaults ▪ Table Name Defaults ▪ Creating a Connection
Create and load the load tables for ▪ Customer ▪ Product ▪ Order_line ▪ Order_header	Loading Source Tables
Create (and update from load tables) the following dimension tables ▪ Dim_customer ▪ Dim_product	Building Dimensions
Create dimensions for ▪ Dim_order_date ▪ Dim_ship_date These are views on the dim_date table	Creating Dimension Views
Create the stage_sales_detail table ▪ Create stage table using columns from load_order_line and load_order_header ▪ Specify join condition ▪ Include links to the following dimensions (dim_customer, dim_product, dim_order_date, dim_ship_date)	Defining the Staging Table Including Dimension Links
Create the fact_sales_detail table	Creating a Fact Table
View the WhereScape generated documentation	Switching to Diagrammatical View Producing Documentation

1.2 The First Step

The first step

To get started you need to follow the steps in the QAD Setup Administrator to create the required environment. The basic steps in this process are:

Oracle and IBM DB2 data warehouse

- 1 Install the QAD product suite.
- 2 Create a database schema for the QAD metadata repository.
- 3 Install the QAD metadata repository.

SQL Server data warehouse

- 1 Install the QAD product suite onto a PC.
- 2 Use the Quick Start option in the Setup Administrator utility to load the metadata and repository.

Note: See the Installation and Administration Guide for these procedures. For Oracle this tutorial assumes source data resides in the wtutorial schema and that the metadata has been loaded under the dssadm schema which has select access to the tutorial tables. For SQL Server it assumes that the data warehouse is in the WslWarehouse database and that the source data resides in the WslTutorial database. For DB2 it assumes that the data warehouse is in the QAD Data Warehouse Designer schema.

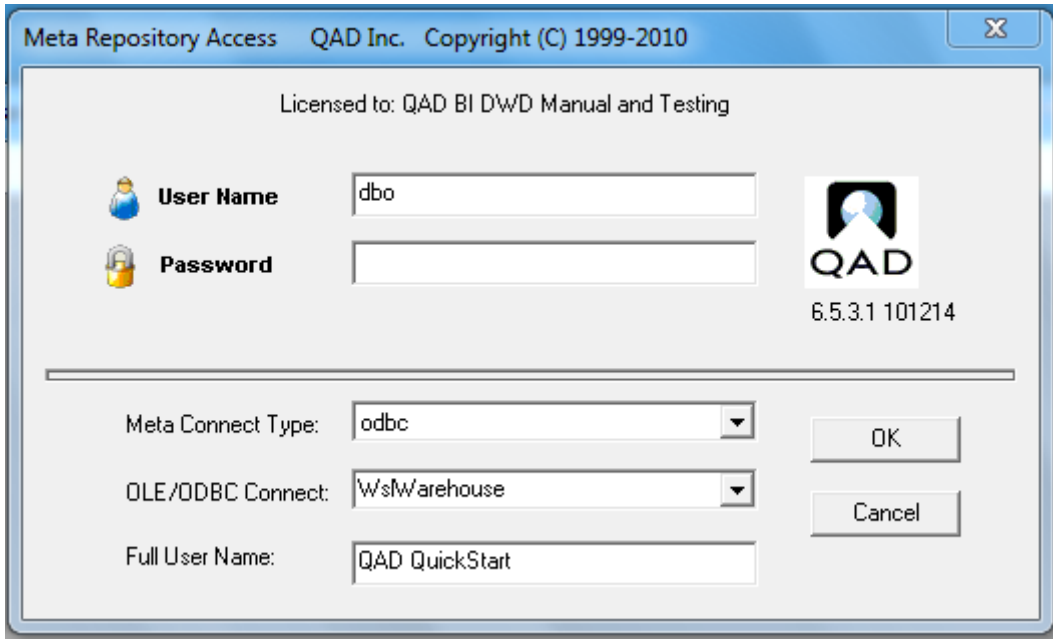
You are now ready to **log on** (see "**1.2.1 Logging In**" on page 6) to the repository you have created.

1.2.1 Logging In

Having completed the first step, and using QAD Data Warehouse Designer, you can now log on to the repository you have created .

To log in:

- 1 Click QAD Data Warehouse Designer from the Start menu. The Access Control screen displays. See sample screen below:

The image shows a Windows-style dialog box titled "Meta Repository Access" with a subtitle "QAD Inc. Copyright (C) 1999-2010". The license text "Licensed to: QAD BI DWD Manual and Testing" is displayed at the top. On the left, there are two input fields: "User Name" with a user icon and "Password" with a lock icon. The "User Name" field contains the text "dbo". To the right of these fields is the QAD logo and the version number "6.5.3.1 101214". Below a horizontal separator line, there are three more input fields: "Meta Connect Type:" with a dropdown menu showing "odbc", "OLE/ODBC Connect:" with a dropdown menu showing "WslWarehouse", and "Full User Name:" with a text field containing "QAD QuickStart". On the right side of the dialog, there are two buttons: "OK" and "Cancel".

- 2 For SQL Server, the username and password are those required to logon to the database server. If a trusted connection is being used enter "dbo" as the username and leave the password blank. For Oracle the username and password are those of the user under which the metadata repository has been loaded. See **Switching Between Databases** (see "1.2.2 Switching Between Databases" on page 8) for details on logging into IBM DB2.

Note: The metadata repository and data warehouse tables must reside under the same schema for Oracle and DB2. For SQL Server, the metadata repository and data warehouse tables must reside under dbo.

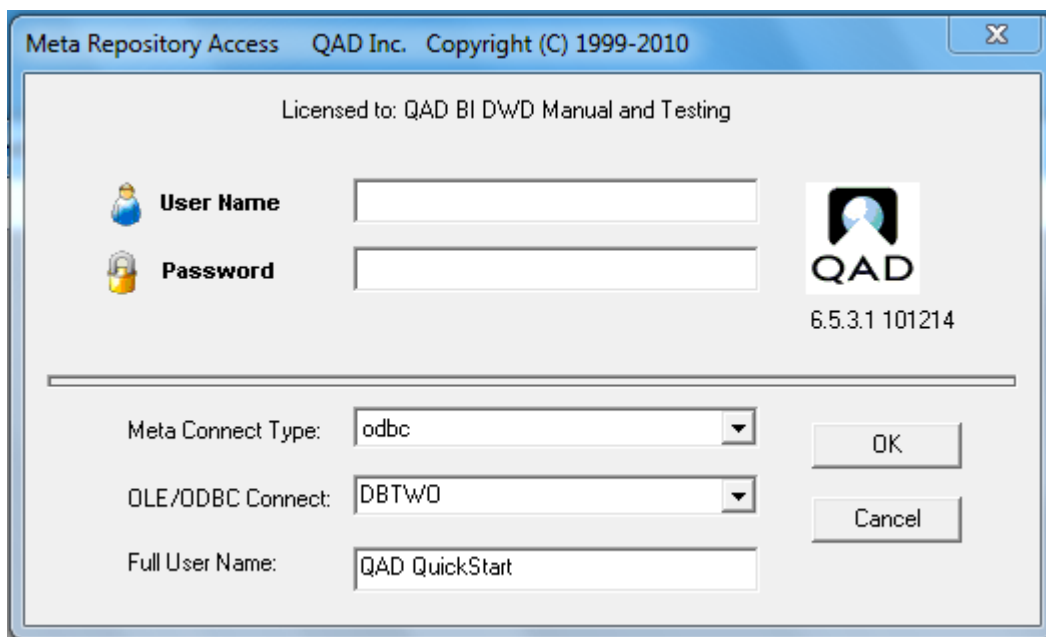
- 3 ODBC is the only supported connection method. Enter the ODBC connection for your database. This connection must have been established prior to logon. Refer to the Installation and Administrator Guide if no such connection exists.
- 4 The Full User Name is the name that will be associated with any procedures, tables, etc, and scheduled jobs that are created from within QAD Data Warehouse Designer. Normally this would be your full name.
- 5 Click OK. The Browser screen displays.

You are now ready to proceed to the next step where you define the **Repository Defaults** (see "1.3 Repository Defaults" on page 10).

1.2.2 Switching Between Databases

Signing into QAD Data Warehouse Designer for the first time uses the standard logon dialog with User Name and Password but excluding the Metadata Schema. After clicking OK, QAD Data Warehouse Designer connects and determines the type of relational database management system (RDBMS) being connected to. If the RDBMS is IBM DB2 then the Metadata Schema is also required.

The following sample logon screen shows the details entered for IBM DB2 for an operating system authenticated connection:

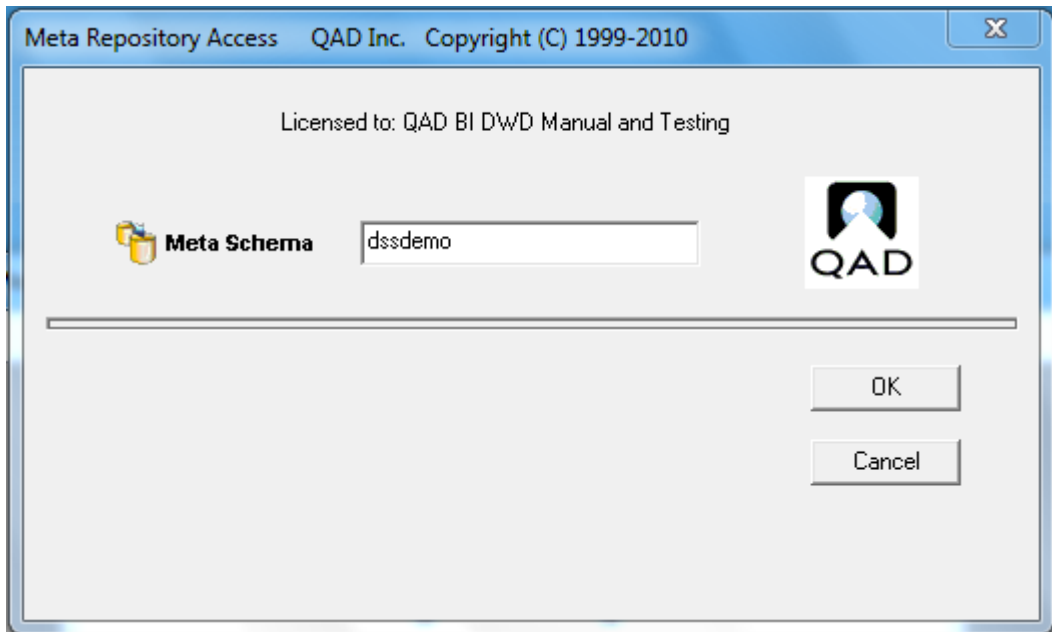


The image shows a Windows-style dialog box titled "Meta Repository Access QAD Inc. Copyright (C) 1999-2010". Inside the dialog, it says "Licensed to: QAD BI DWD Manual and Testing". There are two input fields: "User Name" with a person icon and "Password" with a lock icon. To the right of these fields is the QAD logo and the version number "6.5.3.1 101214". Below a horizontal separator line, there are three more fields: "Meta Connect Type:" with a dropdown menu showing "odbc", "OLE/ODBC Connect:" with a dropdown menu showing "DBTWO", and "Full User Name:" with a text box containing "QAD QuickStart". On the right side of the dialog, there are "OK" and "Cancel" buttons.

Field	Value
User Name	
Password	
Meta Connect Type	odbc
OLE/ODBC Connect	DBTWO
Full User Name	QAD QuickStart

Note: A user name and password will be required if operating system authentication is not being used.

The Metadata Schema will then be requested if DB2 is detected:



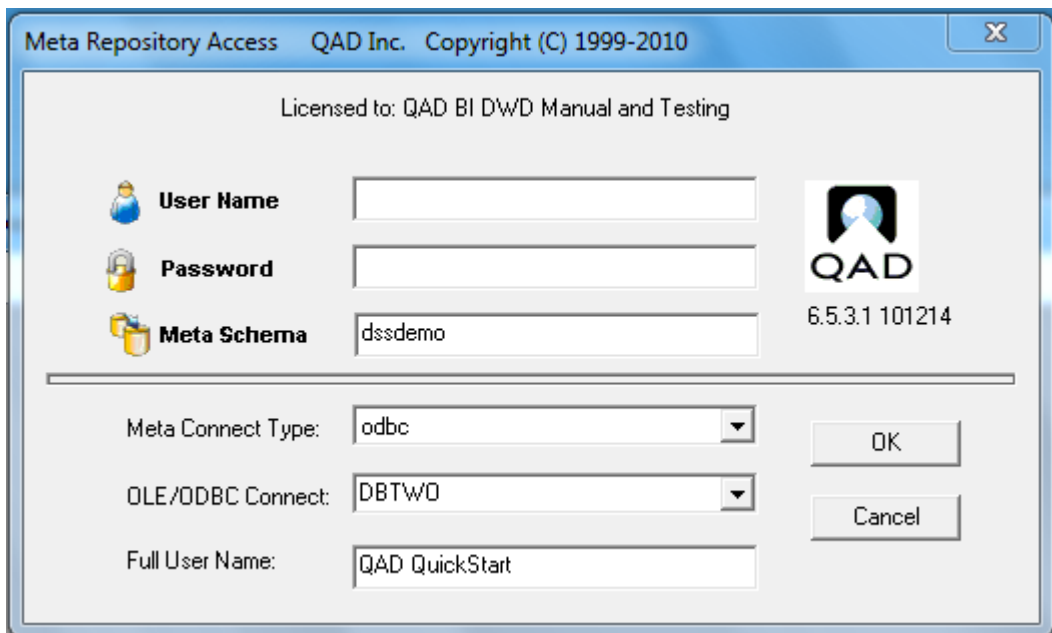
Meta Repository Access QAD Inc. Copyright (C) 1999-2010

Licensed to: QAD BI D\WD Manual and Testing

 **Meta Schema**



Subsequent connections to DB2 will have the Metadata Schema included in the logon dialog:



Meta Repository Access QAD Inc. Copyright (C) 1999-2010

Licensed to: QAD BI D\WD Manual and Testing

 **User Name**

 **Password**

 **Meta Schema**

 6.5.3.1 101214

Meta Connect Type:

OLE/ODBC Connect:

Full User Name:

Ignore the Metadata Schema field if connecting to an Oracle or SQL Server repository after successful connecting to DB2.

Note: QAD Data Warehouse Designer reverts to the standard logon dialog (without the Metadata Repository field) after a successful connection to an Oracle or SQL Server repository.

1.3 Repository Defaults

Before you begin to create the data warehouse, you can choose the defaults for the repository.

- 1 From the Tools menu, select Options and then the Repository tab.

Click on the Dim Views visualized as a separate object group check box.

The screenshot shows the 'Options' dialog box with the 'Repository' tab selected. The 'Repository name' is 'Development', 'Repository type' is 'Develop', and 'Data Warehouse schema' is 'dbo'. The 'Dim Views visualized as a separate object group' checkbox is checked. The 'Look and Feel Settings' section includes 'Object Tree Color', 'Browse Color', 'Look and Feel style' (Visual Studio 2005), 'Window Tabs located at top of screen' (checked), 'Scheduler result line colors enabled' (checked), and a 'Reset Look+Feel' button. The 'Override path for backup executable' and 'Override path for restore executable' fields are empty, each with a 'Browse' button. The 'SSIS Version' is set to 'SSIS 2008'. The 'Versioning' section includes 'Automated Version Creation' with checkboxes for various events (all checked except 'on Connect Save'), 'Check Out / Check In' (unchecked), and 'Default retention period' (1 Year, 0 Months). The 'Version to disk' section includes 'Table version path', 'Script version path', and 'Procedure version path', each with a 'Browse' button. The 'OK' and 'Cancel' buttons are at the bottom.

- 2 Choose OK.

You are now ready to proceed to the next step where you define the **Tablespace (FileGroup) Defaults** (see "**1.4 Tablespace (FileGroup) Defaults**" on page 11)

1.4 Tablespace (FileGroup) Defaults

Before you begin to create the data warehouse, you can choose the defaults for the tablespaces (filegroups for SQL Server). There is no need to change the defaults for this tutorial.

- 1 From the **Tools** menu, select **Options** and then the **Filegroup** tab.

Make the appropriate tablespace/filegroup choice for each option.

Note: The default table space or filegroup for the user will be used if no settings are selected.

You are now ready to proceed to the next step where you define the **Table Name Defaults** (see "**1.5 Table Name Defaults**" on page 11).

1.5 Table Name Defaults

Before you begin to create the data warehouse, you can choose the defaults for the table names. There is no need to change the defaults for this tutorial, and the examples given reflect the default naming convention.

- 1 From the **Tools** menu, select **Options** and then the **Naming (Local)** or **Naming (Global)** tab.

Alter the default table naming convention if required.

- 2 If no changes are made, the default table names will be:

- **load_** load tables with data copied from a source system
- **stage_** tables for manipulating and transforming data prior to publishing
- **dim_** dimension tables
- **fact_** fact tables, detail, rollup and snapshot
- **agg_** aggregate or summary tables built from fact tables
- **olap_** Analysis Services Olap cubes built from stage or fact tables

You are now ready to proceed to the next step **Creating a Connection** (see "**1.6 Creating a Connection**" on page 12).

1.6 Creating a Connection

In order to populate the metadata repository, connections need to be made to the source data. There must also be a connection to the data warehouse itself. This section describes how to make two new connections.

Note: The following two connections should have been automatically created. They should however be validated to ensure they are correct for the environment.

The first connection is to the source system. For Oracle this is the user within your Oracle database, for SQL Server the database, that contains the tutorial tables and for DB2 this is another schema within your database.

The second connection will be to the data warehouse tables.



TIP: In order to utilize the drag and drop features there must always be a connection to the data warehouse itself.

How to make a connection

- 1 Click on and highlight the **Connection** object group in the left pane. This selects the object group to be worked on.
- 2 Select **File | New**, or use the right mouse button and choose **New Object**. A dialog box displays with the Object Type defaulted to Connection. Name your connection. In this instance type *Tutorial (OLTP)*, and select **Add**. A Properties box will display:

SQL Server:

If running a SQL Server data warehouse then proceed as follows.

In the Properties box, complete the details as below, and then select **Update**:

- The ODBC source is the ODBC connection which has been defined to connect to the database. In this case the ODBC connection to the database that holds the tutorial tables.

- The Provider name identifies the type of connection that SQL Server will make in the case of a linked server. In this case it is not required as we are using tutorial tables in a SQL Server database on the same server.
- The Database ID (SID) is the SQL Server database name of the database being connected to. In this case the SID of the tutorial database.
- The Database Link ID is a SQL Server linked server link to connect from the data warehouse database to the source system database.

Note: This link is only required if the source database is on a different server from the data warehouse database. For the purposes of this tutorial, the database link ID is not required as the tutorial data is usually loaded into a database on the same server as the metadata.

- The Extract User ID and password are the username and password required to logon to the tutorial database. If a trusted connection is being used then set the Extract User ID to "dbo".
- The Admin User ID and password are the administrator logon to the source location (tutorial). These can be left blank for the tutorial.

Tutorial (OLTP) definition

Connection Properties | Notes

Data Warehouse ☐

Connection Name

Connection Type

ODBC Source

Provider Name

Database ID (SID)

Database Link ID

Extract User ID Password

Admin User ID Password

SSIS Connect String

Data Type Mapping Set

Oracle:

If running an Oracle data warehouse then proceed as follows.

In the Properties box, complete the details as below, and then select **Update**:

- The ODBC source is the ODBC connection which has been defined to connect to the database. In this case the ODBC connection to the database that holds the tutorial tables.
- The Database ID (SID) is the Oracle SID of the database being connected to. In this case the SID of the tutorial database.
- The Database Link ID is an Oracle database link to connect from the data warehouse database to the source system database.

Note: This link is only required if the source database is different to the data warehouse database. For the purposes of this tutorial, the database link ID is not required as the tutorial data is usually loaded into the same database as the metadata.

- The Extract User ID and password are the username and password for the schema where the source tables reside. For the tutorial this is the user where the tutorial files have been loaded.
- The Admin User ID and password are the administrator logon to the source location (tutorial). These can be left blank for the tutorial.

Tutorial (OLTP) definition

Connection Properties | Notes

Data Warehouse ☐

Connection Name ?

Connection Type

ODBC Source

Provider Name

Database ID (SID)

Database Link ID

Extract User ID Password

Admin User ID Password

SSIS Connect String

Data Type Mapping Set

IBM DB2:

If running an IBM DB2 data warehouse then proceed as follows.

In the Properties box, complete the details as below, and then select **Update**:

- The ODBC source is the ODBC connection which has been defined to connect to the database. In this case the ODBC connection to the database that holds the tutorial tables.
- The Database ID (SID) is not used.
- The Database Link ID is not used.

- The Extract User ID and password are the username and password required to logon to the tutorial database. If an operating system authenticated connection is being used then leave the Extract User ID and Password blank.
- The Admin User ID and password are the administrator logon to the source location (tutorial). These can be left blank for the tutorial.

DataWarehouse definition

Connection Properties | Notes

Data Warehouse ☒

Connection Name

Connection Type

ODBC Source

Work Directory

Database ID (SID)

Database Link ID

Extract User ID Password

Admin User ID Password

SSIS Connect String

Data Type Mapping Set
☐ As a cube data source

Provider Type

Server

Database

- 3 To confirm that you have connected to the system correctly, select **Source Tables** from the **Browse** menu, or click on one of the browse icons from the main tool bar or right hand pane tool bar.
 - Select the connection you want to view, in this instance **Tutorial (OLTP)**, and click OK. For SQL Server the schema must be set to **dbo**. For Oracle the schema should be the tutorial schema.
 - A third pane on the right hand side, displays showing the tables contained under the tutorial source system.
- 4 Repeat steps 1 through 3 to create the connection for the Data Warehouse.
 - The Connection name will be **Data Warehouse**

- Enter an extract user id (we have used **dssadm**) and a password (we have used **ws1**) for the metadata repository. For a SQL Server trusted connection set the extract user id to **dbo**.

You have now created two database connections, one to the source system (**Tutorial**), and one to the **Data Warehouse**.

You are now ready to proceed to the next step - **Loading Source Tables** (see "**1.7 Loading Source Tables**" on page 17).

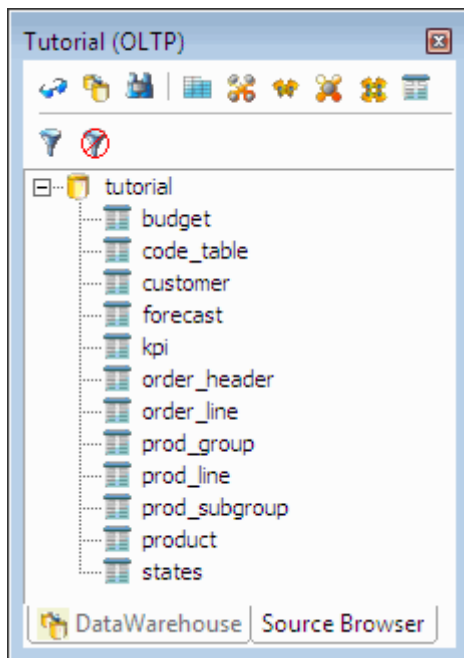
1.7 Loading Source Tables

In this step you will load data from the tutorial source system into load tables in the data warehouse. Dragging and dropping from the source system (using the previously defined connection) will create the metadata. You will then be prompted to create and load the tables which will create the physical tables in the data warehouse, and then load the data.

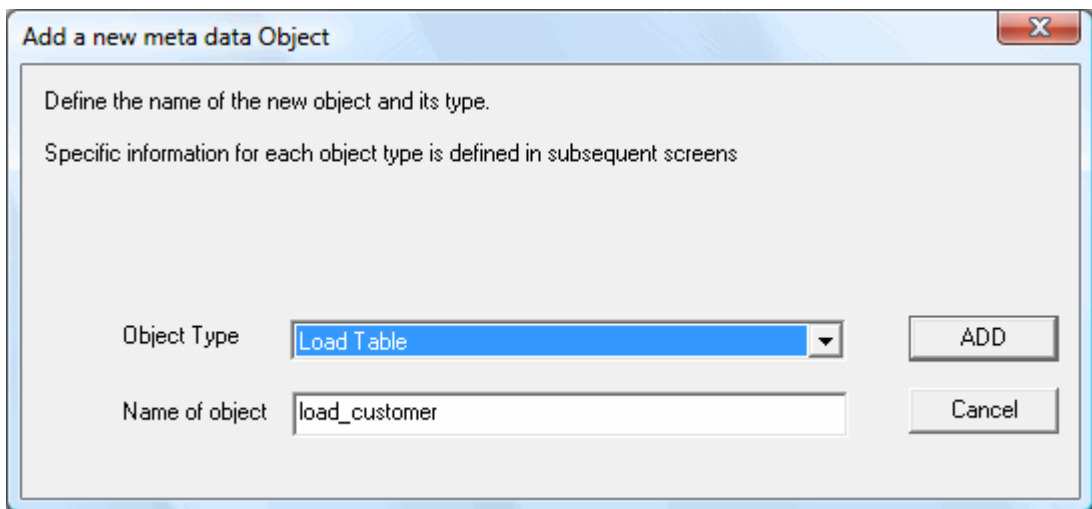


TIP: Ensure that your source system is displayed in the right hand pane of the screen, by selecting **Source Tables** from the **Browse** menu, then **Tutorial (OLTP)** from the **Connection List**. For SQL Server the schema must be **dbo**. For Oracle the schema should be the tutorial schema. Click OK.

- 1 Double click on the Load Table object group on the Object Tree in the left pane. The first column heading in the middle pane should read *Load Table Name*.
- 2 Expand the source table Object Tree in the right pane:



- 3 Then click on **customer** and drag this table into the middle pane - placing it anywhere in the pane. A dialog box displays with the name of the object defaulted to **load_customer**.



- 4 Click **Add** and the following table definition will display:

load_customer table definition

Properties | Source Mapping | Storage | Notes

Load Table Name: load_customer

Short name. Must be unique and no more than 22 chars long: load_customer

Description:

Connection: Tutorial (OLTP)

Load Type: Database link load

Database Link:

Script Name:

Pre-load Action: Truncate

Pre-load Sql:

Table Properties Clauses:
(e.g. Partition) PARALLEL NOLOGGING

Post Load Procedure:

Date table structure last updated: 2010-03-23 12:34:11

Date created in database:

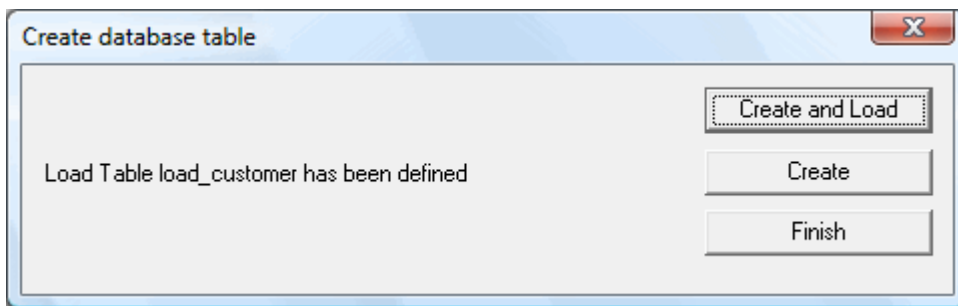
Date last updated in database:

OK Cancel Apply

Note: For the purposes of this tutorial, all the necessary details have been automatically created, so select OK. See the Loading Data chapter for explanations of the load parameters.

Note: In IBM DB2, short names are limited to 12 characters.

- 5 A dialog box displays showing that the load table `load_customer` has been defined and asks if you want to create and load the table:



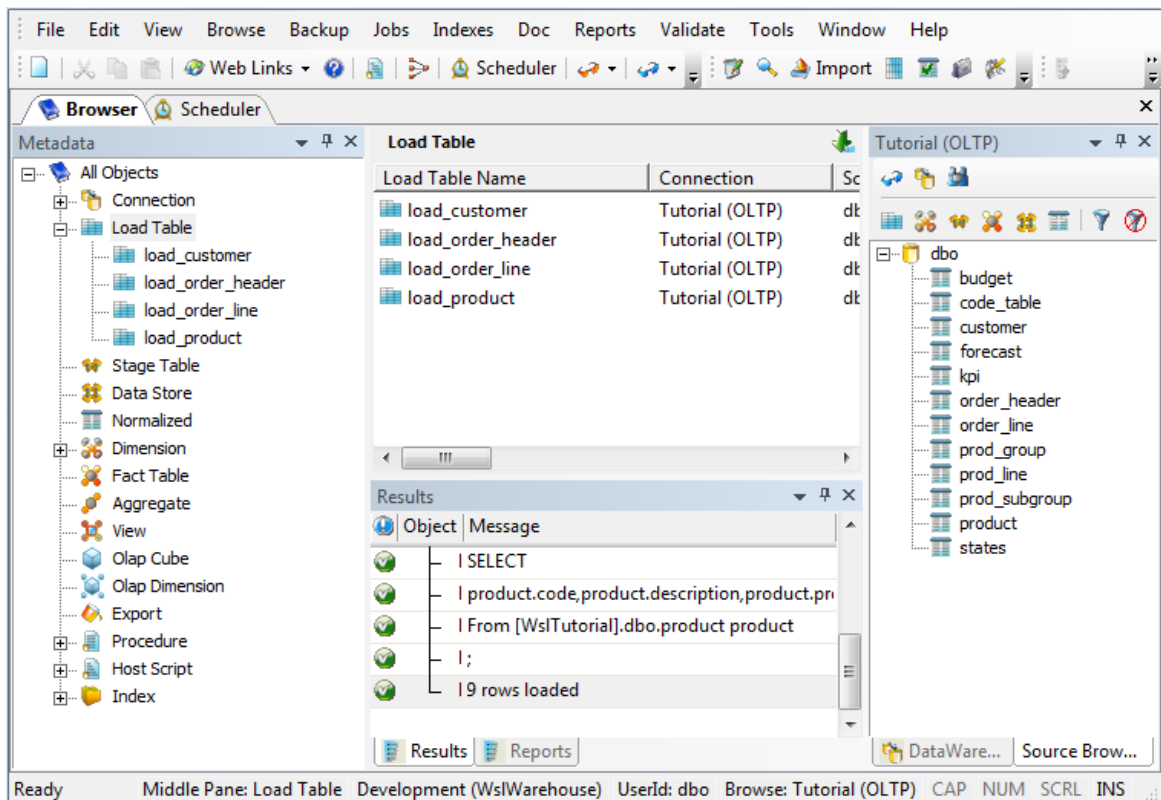
- 6 Select **Create and Load**. This will create the physical tables in the data warehouse and load the data.
- 7 Results will be posted in the results pane. Note that the Load Table object group in the left pane now has a dependent/child.



TIP: Remember to double click on the left pane Load Table object group between loading each of the source tables to ensure that you are reassigning the target, rather than adding to the columns in the middle pane.

- 8 Repeat this process (steps 2 - 7) for the source tables **product**, **order_header**, and **order_line**.

Double click the Load Table group in the left hand pane. Your QAD Data Warehouse Designer screen should look like this when you have finished:



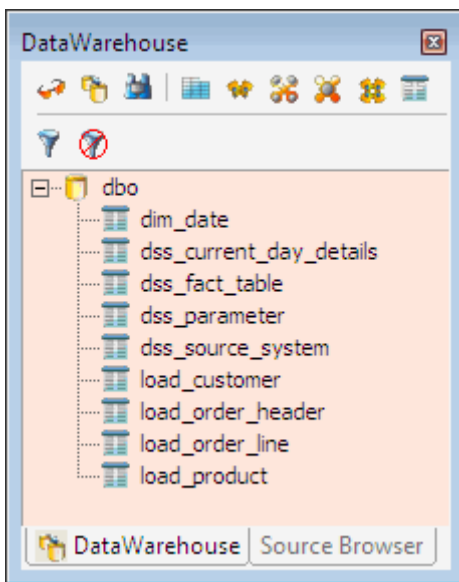
You are now ready to proceed to the next step - **Building Dimensions** (see "**1.8 Building Dimensions**" on page 21).

1.8 Building Dimensions

The necessary source tables have been loaded into the data warehouse. Now the dimensions of the data warehouse can be built. When building dimensions you will be prompted for how you would like the dimension managed. QAD Data Warehouse Designer generates code for normal, slowly changing, previous value and date ranged dimensions. You will also be prompted for the business (or natural) key of the dimension. This is needed so QAD Data Warehouse Designer knows when to add new dimensional records.

- 1 Change the right pane view to show the Data Warehouse tables by selecting DataWarehouse from the Browse menu OR click the tab along the bottom of the source window.

Note: For SQL Server the Data Warehouse schema must be **dbo**.

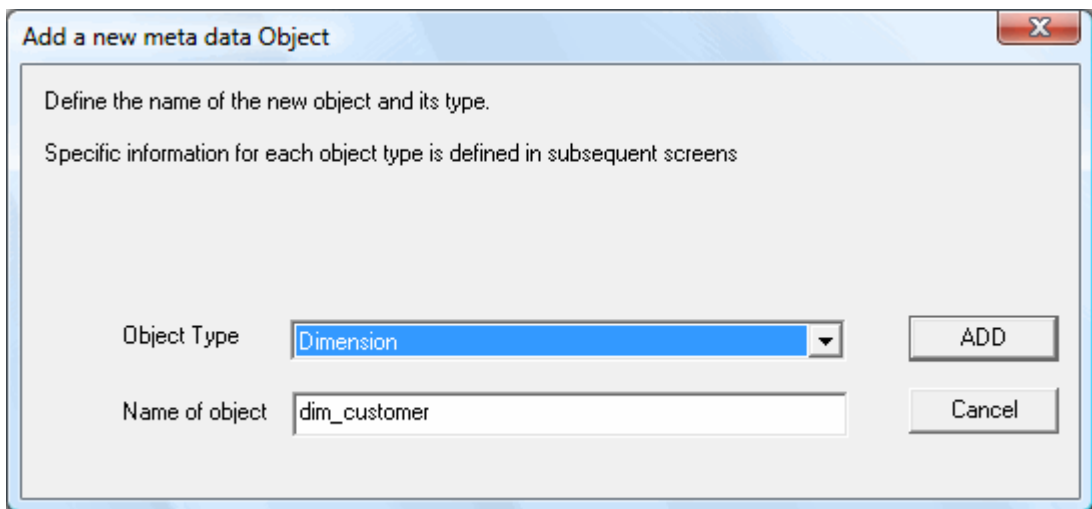


Note: From this point on, all work is performed within the data warehouse.

- 2 Double click on the **Dimension** object group in the object tree in the left pane. The first column of the middle pane now reads *Dimension Name*.

Note: You will see that some dimensions have already been created for you.

- 3 Click and drag the **load_customer** table from the data warehouse schema in the right pane into the middle pane. A dialog box displays defaulting the name of the object to **dim_customer**:



Add a new meta data Object

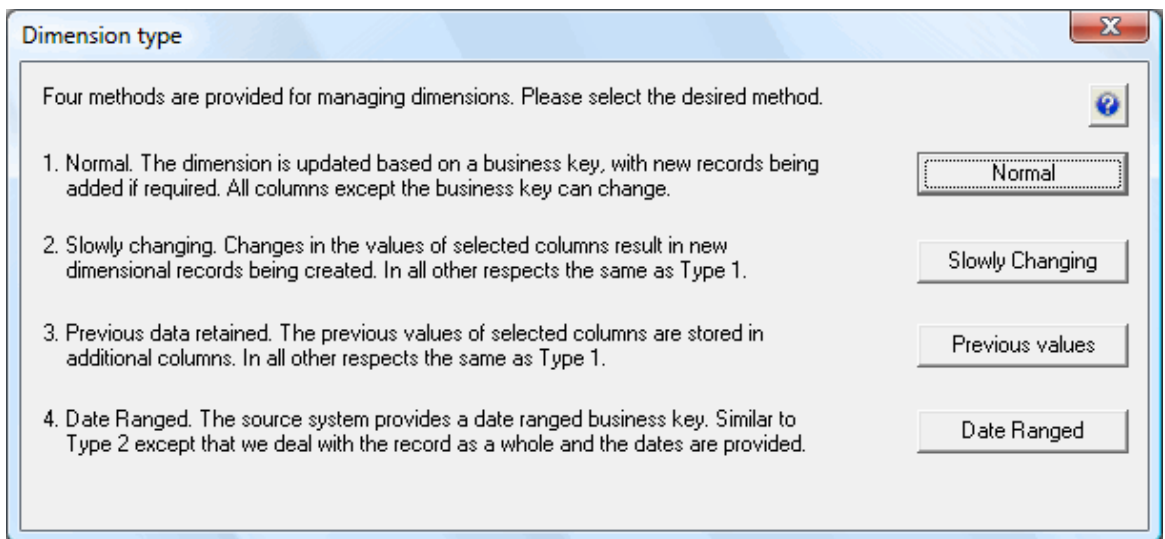
Define the name of the new object and its type.

Specific information for each object type is defined in subsequent screens

Object Type:

Name of object:

- 4 Click Add. A dialog box displays asking how you want the dimension managed. Select Normal:



Dimension type

Four methods are provided for managing dimensions. Please select the desired method.

1. Normal. The dimension is updated based on a business key, with new records being added if required. All columns except the business key can change.

2. Slowly changing. Changes in the values of selected columns result in new dimensional records being created. In all other respects the same as Type 1.

3. Previous data retained. The previous values of selected columns are stored in additional columns. In all other respects the same as Type 1.

4. Date Ranged. The source system provides a date ranged business key. Similar to Type 2 except that we deal with the record as a whole and the dates are provided.

- 5 A table definition displays with all the necessary defaults completed.
- Make one change - Select (Build Procedure...) from the Update Procedure drop-down list box. This will generate procedures to get surrogate (artificial) keys based on the business key and to update the dimension.

dim_customer table definition

Properties | Storage | Language Mapping | Purpose | Concept | Grain | Examples | Usage | Notes

Table Name:

Short name. Must be unique and no more than 22 chars long:

Business Display Name (EUL): Table Type:

Description:

Update Procedure:

Custom Procedure:

Table Properties clauses: (e.g. Partition)

Get Key Function: Mnemonic (EUL):

Date table structure last updated:

Date created in database:

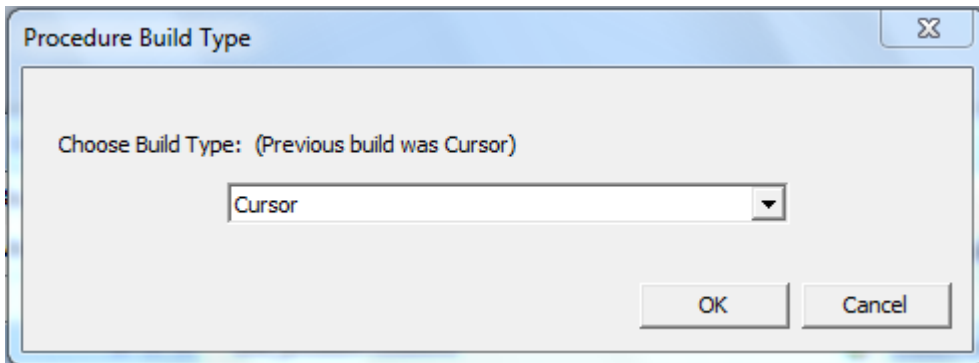
Date last updated in database:

- 6 Select OK. A dialog box displays confirming the dimension table `dim_customer` has been defined and asking if you want to create and load the table.

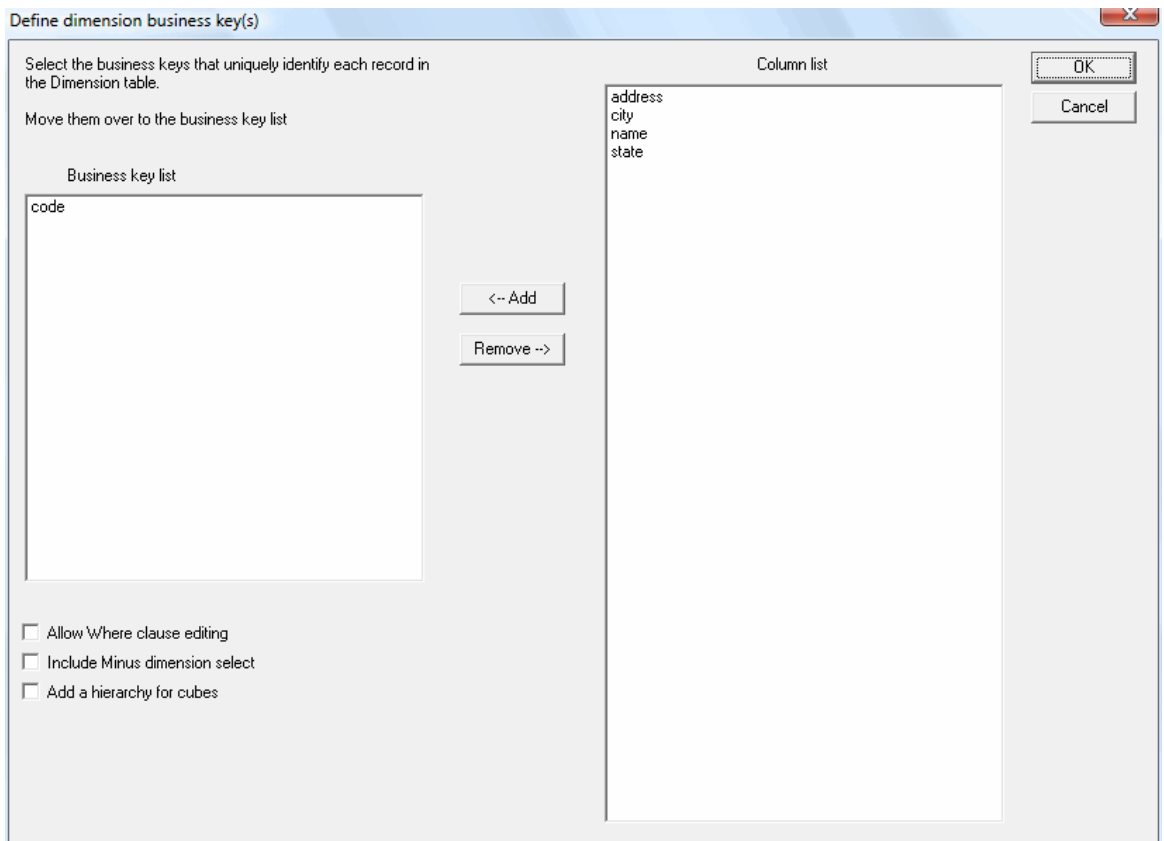
Create database table

Dimension dim_customer has been defined.

- 7 Select Create and Load.
- 8 A Procedure Build Type dialog will appear. Select Cursor.



- 9 Define the Business Key (see below). The business (natural) key is the unique identifier for the dimensional record. Select Code, <--Add, and click OK.



- 10 The procedure results display and can be reviewed.

Note: The Dimension Table object group in the left pane now has added `dim_customer` as a dependent/child.

- 11 Repeat this same process (steps 2 through 9) for the load table `load_product`. The business key will be 'code'.



TIP: Remember to double click on the left pane Dimension Table object group between loading each of the above dimension tables.

Double click `Dimension` in the left pane. The QAD Data Warehouse Designer screen should look like this:

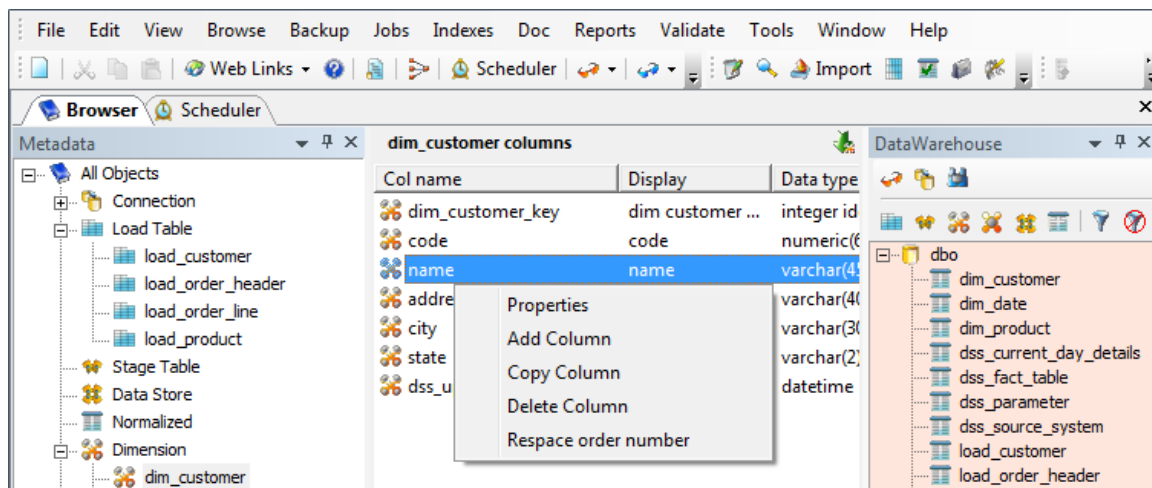
The screenshot displays the QAD Data Warehouse Designer application. The interface is divided into several panes:

- Metadata (Left Pane):** Shows a tree view of objects. The `Dimension` folder is selected, showing a list of dimension tables: `dim_customer`, `dim_date`, `dim_product`, `dss_fact_table`, and `dss_source_system`.
- Dimension (Middle Pane):** A table listing the dimension tables with their names, short names, and types.
- DataWarehouse (Right Pane):** Shows the schema structure, including the `dbo` database and various tables like `dim_customer`, `dim_date`, `dim_product`, `dss_current_day_details`, `dss_fact_table`, `dss_parameter`, `dss_source_system`, `load_customer`, `load_order_header`, `load_order_line`, and `load_product`.
- Results (Bottom Pane):** Displays messages from the database engine. The messages indicate that the `dim_product_idx_A` was created, the procedure completed, and that 1 `dim_product` record was updated, with 9 new records and 0 records updated.

The status bar at the bottom shows: Ready Middle Pane: Dimension Development (WslWarehouse) UserId: dbo Browse: DataWarehouse CAP NUM SCRL INS

Note: Analysis Services does not like 'name' as a column name. For dim_customer it will therefore be necessary to change the column name from 'name' to 'cname'.

- 1 Click on the dim_customer object in the left hand pane to display the dim_customer columns in the middle pane.
- 2 When positioned on the column 'name' in the middle pane, right click and select 'Properties' from the drop down menu.



- 3 Change the column name from 'name' to 'cname' as shown below. Click OK to leave the properties page.

Column definition

Column Properties | Transformation | Language Mapping

Table: dim_customer

Column name: cname

Business display name: cname

Data type: varchar(45)

Format:

Column order: 30

Default Value:

Nulls: ☒

End User Layer Display: ☒

Numeric: ☐

Additive: ☐

Attribute: ☒

Key Type (0,A,B,C,...): ☐

Artificial Key: ☐

Primary Business Key: ☐

Source table: load_customer

Source column: name

Business Definition: Source strategy: (max 2048 chars.)

The full name of the customer. Forms a hierarchy with city and state.

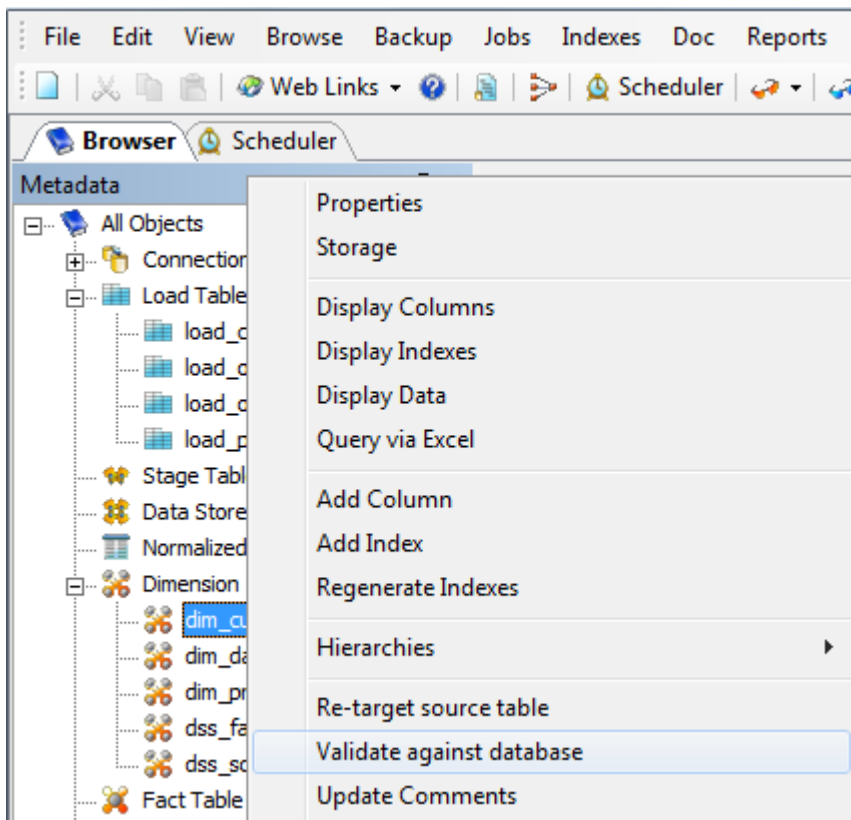
The value shown below is loaded in this column for the 'Invalid Join' record. When empty NULL is used.

Zero key value: Unknown

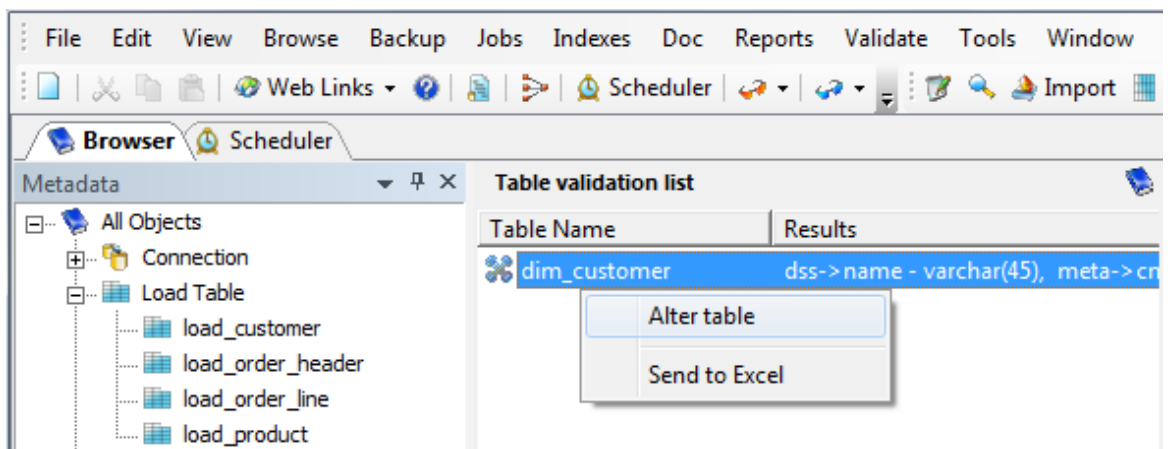
Update Update < Update >

OK Cancel Apply

- 4 Right click on the dim_customer object in the left hand pane and choose 'Validate against Database'.



- 5 The results in the centre pane will show that the metadata has been changed to 'cname' while the column name in the database is still 'name'.
- 6 Right click on dim_customer in the centre pane and select 'Alter table' from the drop down list.



- 7 A warning dialog will appear, displaying the table and column name to be altered. Select 'Alter Table'.
- 8 A dialog will appear confirming that dim_customer has been altered. Select OK.

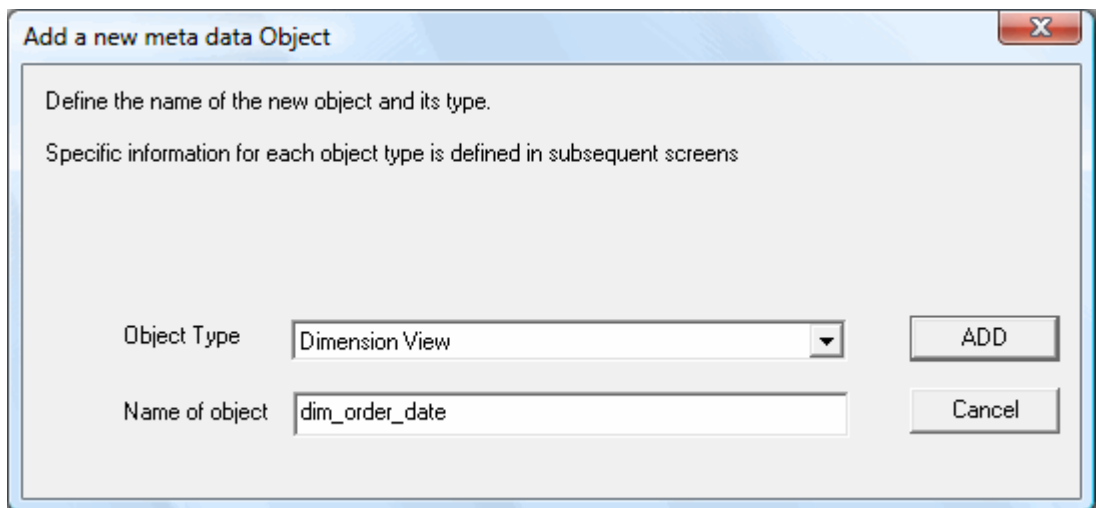
You are now ready to proceed to the next step - *creating dimension views* (see "*1.9 Creating Dimension Views*" on page 29).

1.9 Creating Dimension Views

A dimension view is a database view of a dimension table. It may be a full or partial view. It is typically used in such cases as date dimensions where multiple date dimensions exist for one fact table.

In this step you will create dimension views from an existing dimension. In many cases dimension views are built as part of the end user layer, but creating them in the data warehouse means they are available regardless of the end user tools used. This process is essentially the same as creating a dimension, but you are creating a view of an existing dimension, in this instance, `dim_date`.

- 1 After double clicking on Dimension in the left pane, click and drag `dim_date` from the right pane into the center pane.
 - The dialog box that displays defaults the object type to a dimension view, and names the dimension view `dim_date_view`.
 - Because we want to create two dimension views from the same source, `dim_date`, we need to change this dimension view name to one that is more meaningful, specifically `dim_order_date`:



- Make this change, and click **Add**.
- 2 The `dim_order_date` view property defaults have all been completed as necessary so click **OK**.

dim_order_date table definition

Properties | Storage | Purpose | Concept | Grain | Examples | Usage | Notes

Table Name:

Short Name. Must be unique and no more than 22 chars long:

Business Display Name (EUL): Table Type:

Description:

Table Properties clauses:
(e.g. Partition)

Where Clause:

Get Key Function:

Mnemonic (EUL):

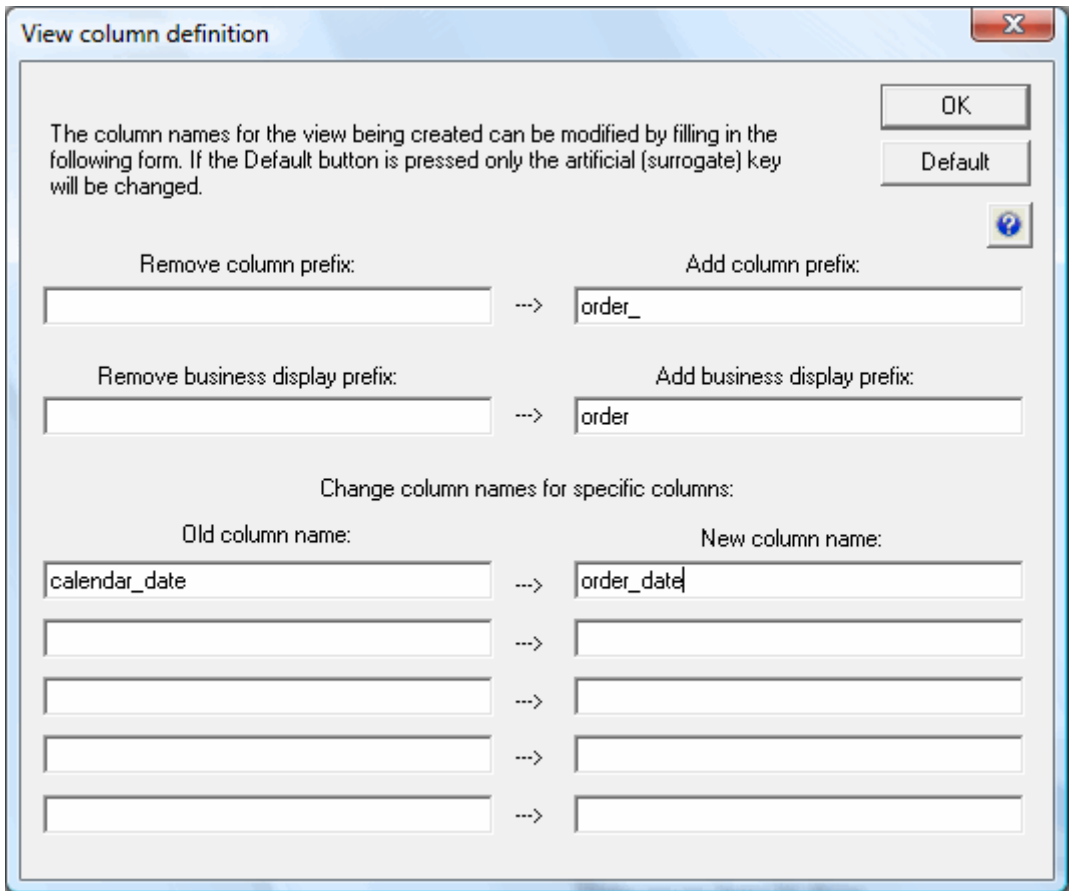
Date table structure last updated:

Date created in database:

Date last updated in database:

OK Cancel Apply

- 3 A dialog box displays to provide a means of re-mapping some of the column names in the view if required. Ensure `calendar_date` is being renamed to `order_date`. Click the OK button.



The dialog box titled "View column definition" contains instructions and input fields for modifying column names. It includes buttons for "OK", "Default", and a help icon. The instructions state: "The column names for the view being created can be modified by filling in the following form. If the Default button is pressed only the artificial (surrogate) key will be changed."

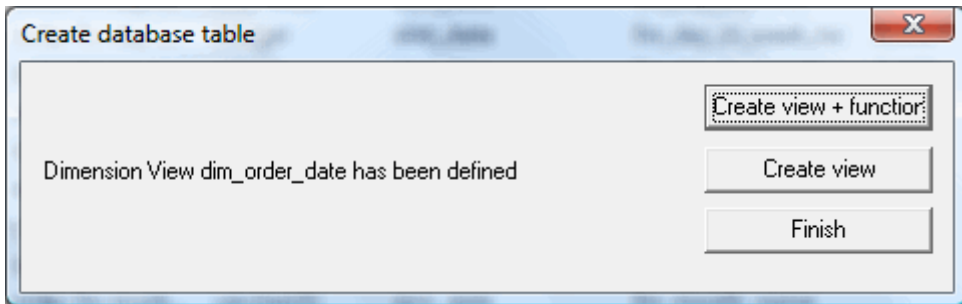
Remove column prefix: ---> Add column prefix:

Remove business display prefix: ---> Add business display prefix:

Change column names for specific columns:

Old column name:		New column name:
calendar_date	--->	order_date
	--->	
	--->	
	--->	
	--->	

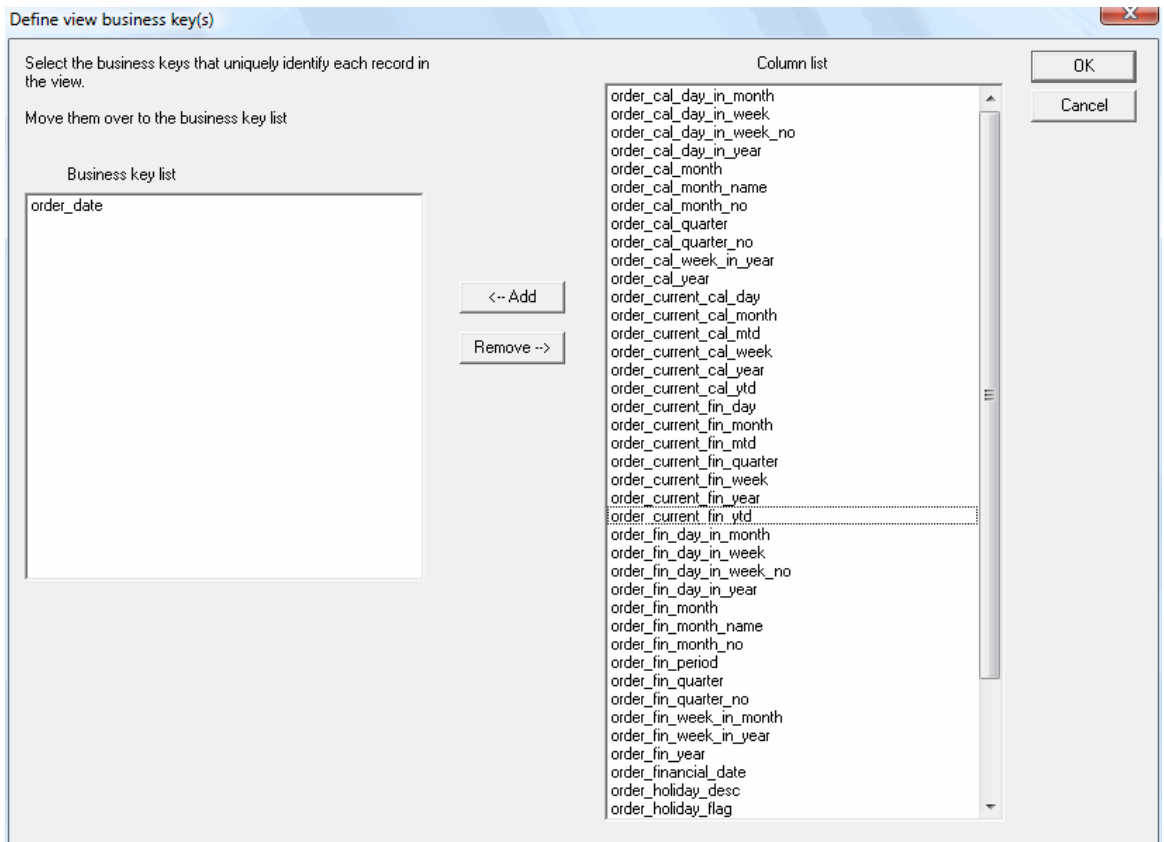
- 4 A dialog box displays indicating that the dimension view `dim_order_date` has been defined and asks if you want to create the view now:



The dialog box titled "Create database table" displays the message "Dimension View `dim_order_date` has been defined". It includes a button labeled "Create view + function" (which is highlighted with a dashed border), a "Create view" button, and a "Finish" button.

Select **Create view + function**. A dialog box will confirm that view `dim_order_date` has been created.

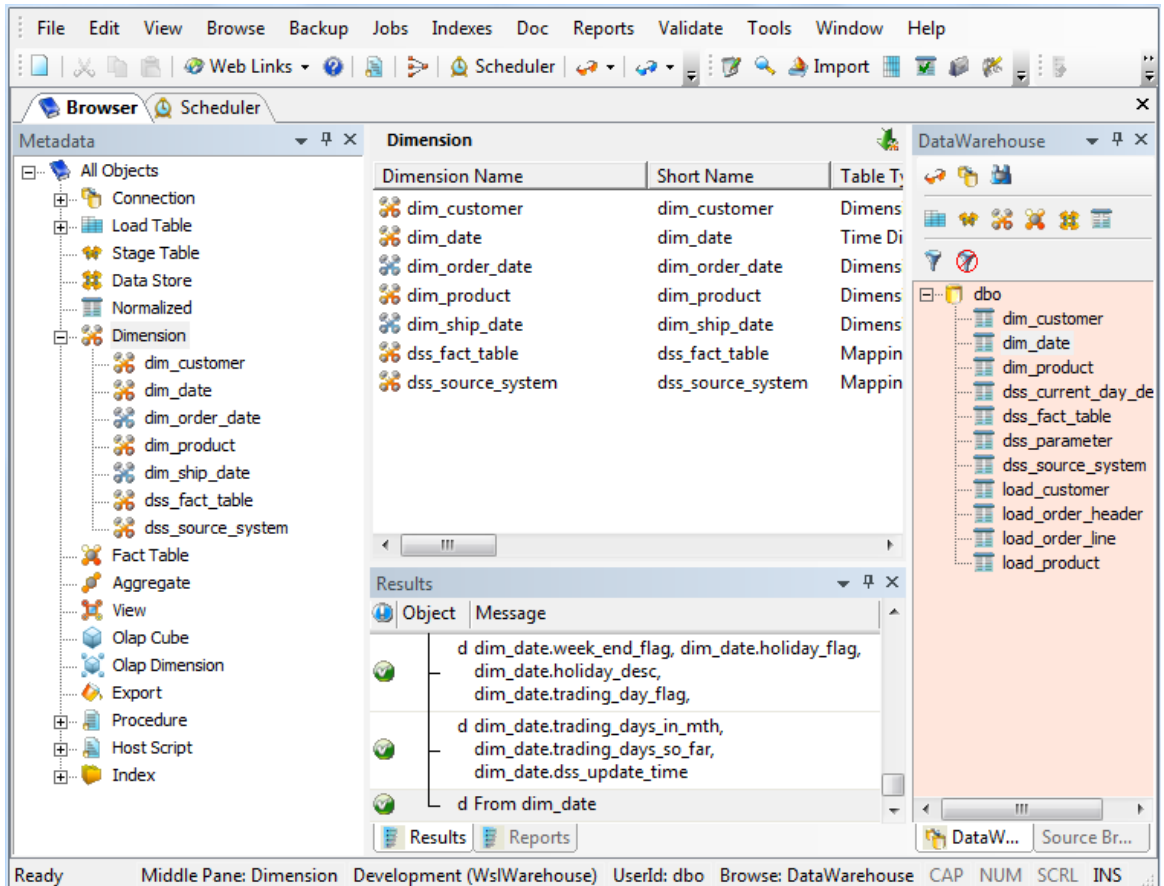
- 5 Select a business (natural) key for the dimension view `dim_order_date`. Choose `order_date` as below, and click <--Add. Click OK.



Note: The Dimension Table object group `dim_order_date` icon in the left pane is a slightly different color to denote that this is a dimension view.

- 6 Repeat steps (1) to (5) to create the dimension view `dim_ship_date`.

In the left pane, double click on Dimension. The QAD Data Warehouse Designer screen should look like this:



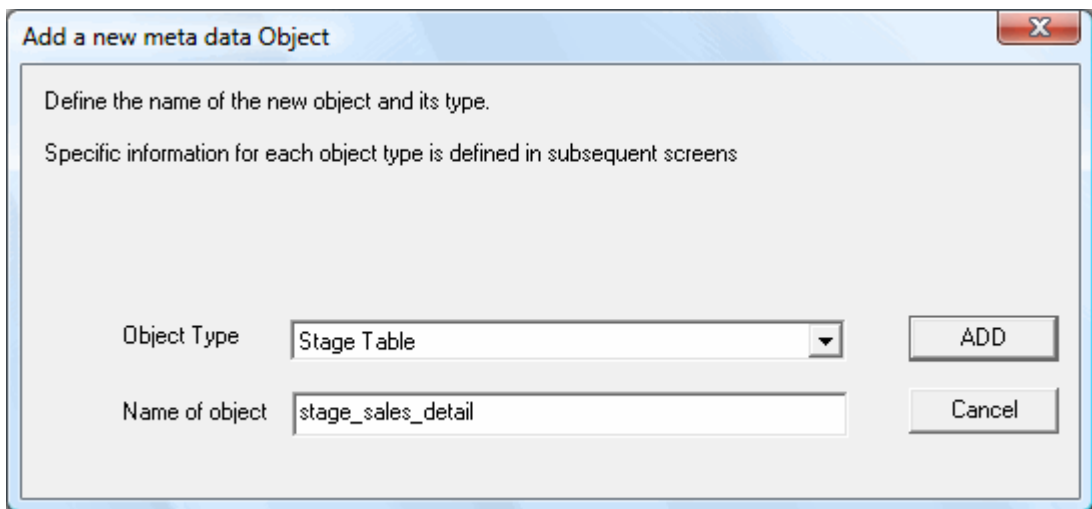
You are now ready to proceed to the next step - **Defining the Staging Table** (see "1.10 Defining the Staging Table" on page 33).

1.10 Defining the Staging Table

In this step you will create a stage table from two load tables. A stage table is used to build the format of the fact table, and generally contains changed or new data that will be added to the fact table. As stage tables contain dimensional keys, they should be defined after the dimensions.

Note: The source of data for the stage table will be the load tables `load_order_line` and `load_order_header`.

- 1 Double click on the Stage Table object group in the object tree in the left pane to create a stage table target. The first column heading in the middle pane reads *Stage Table Name*.
- 2 Click and drag the `load_order_line` table from the right hand pane data warehouse schema. Drop it in the middle pane. A dialog box displays defaulting the name of the object to `stage_order_line`. To make it a more meaningful name, change the name of the object to `stage_sales_detail` and click Add.



Add a new meta data Object

Define the name of the new object and its type.

Specific information for each object type is defined in subsequent screens

Object Type: Stage Table

Name of object: stage_sales_detail

ADD Cancel

- 3 A table definition displays with all the necessary defaults completed.

stage_sales_detail table definition

Properties | Storage | Notes

Table Name:

Short Name. Must be unique and no more than 22 chars long:

Table Type:

Description:

Update Procedure:

Custom Procedure:

Table Properties clauses:
(e.g. Partition)

Date table structure last updated:

Date created in database:

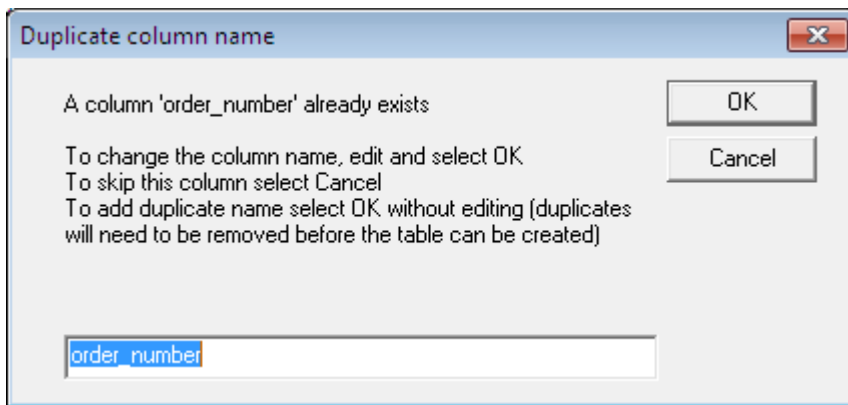
Date last updated in database:

4 Select OK.

Note: The Stage Table object group in the left pane now has a dependent/child.

5 To add the remaining information from the second load table, click on stage_sales_detail in the left pane. Next drop load_order_header from the right pane into the middle pane. A message is displayed with options to create a "New table" or to "Add columns". Choose "Add columns".

QAD Data Warehouse Designer detects duplicated columns. As both load_order_header and load_order_line have the *order number* field, the following is displayed:

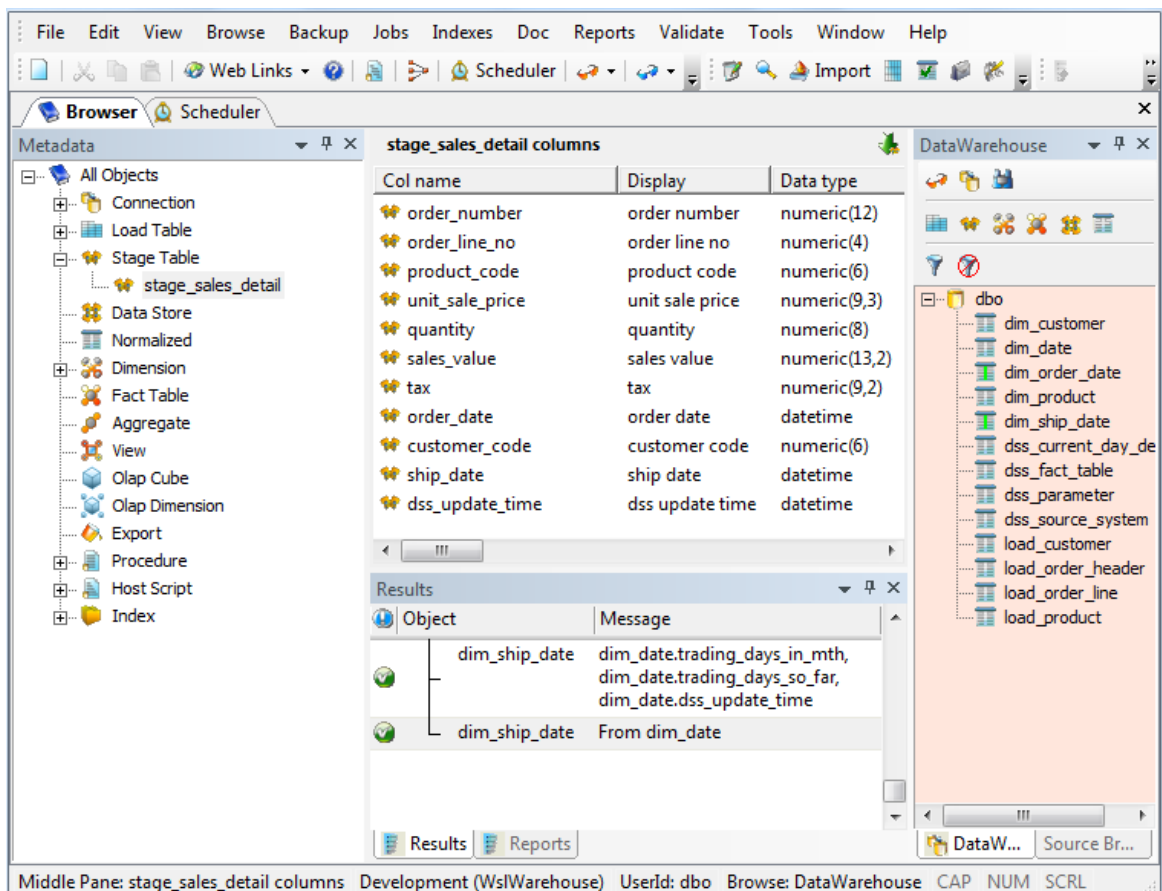


Click **Cancel** to exclude the second instance of order_number.

Note: If the second instance of order_number is required, then click OK.

This combines data from two load tables (load_order_header and load_order_line) into one stage table.

The QAD Data Warehouse Designer screen should now look like the sample below. In the center pane under *Src Table* you can see the source of each of the columns.



You are now ready to proceed to the next step - ***Including Dimension Links*** (see "***1.11 Including Dimension Links***" on page 37).

1.11 Including Dimension Links

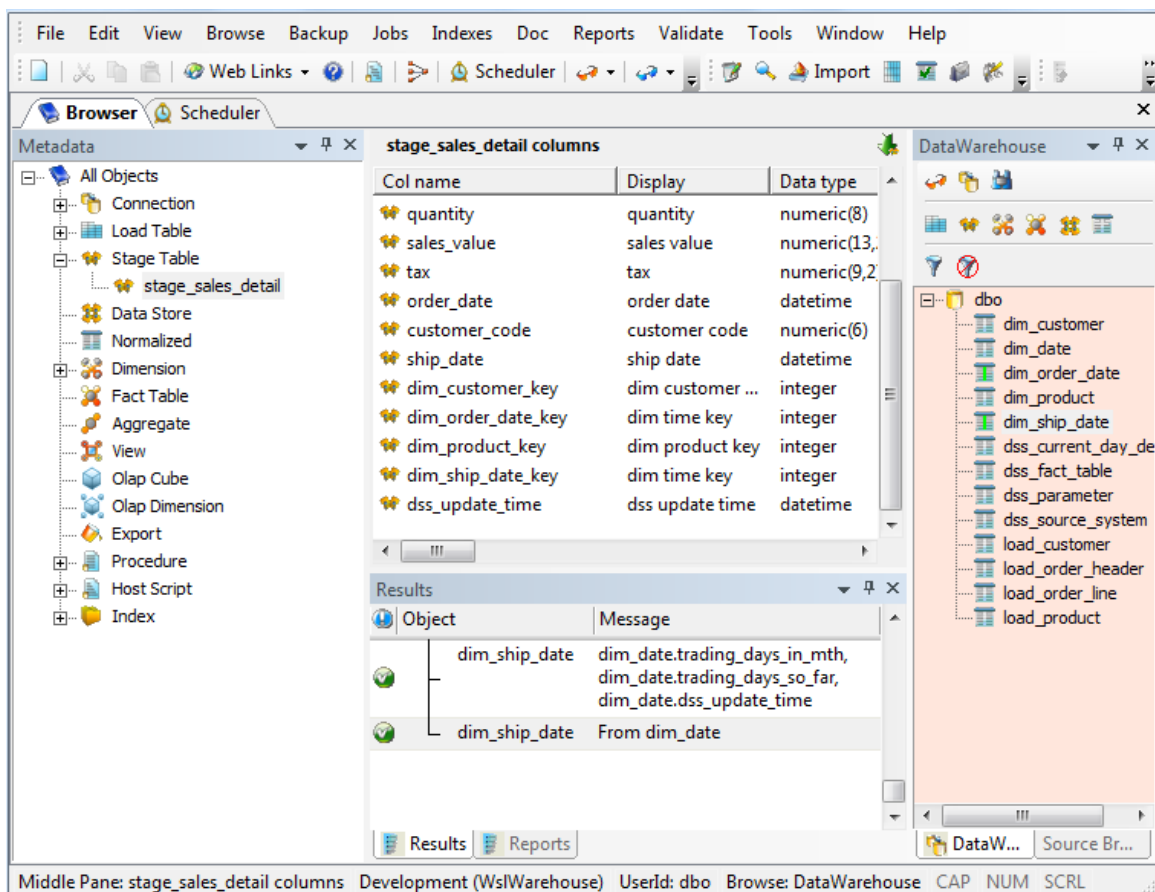
The dimension links that allow us to create the fact-like star schema now need to be included:



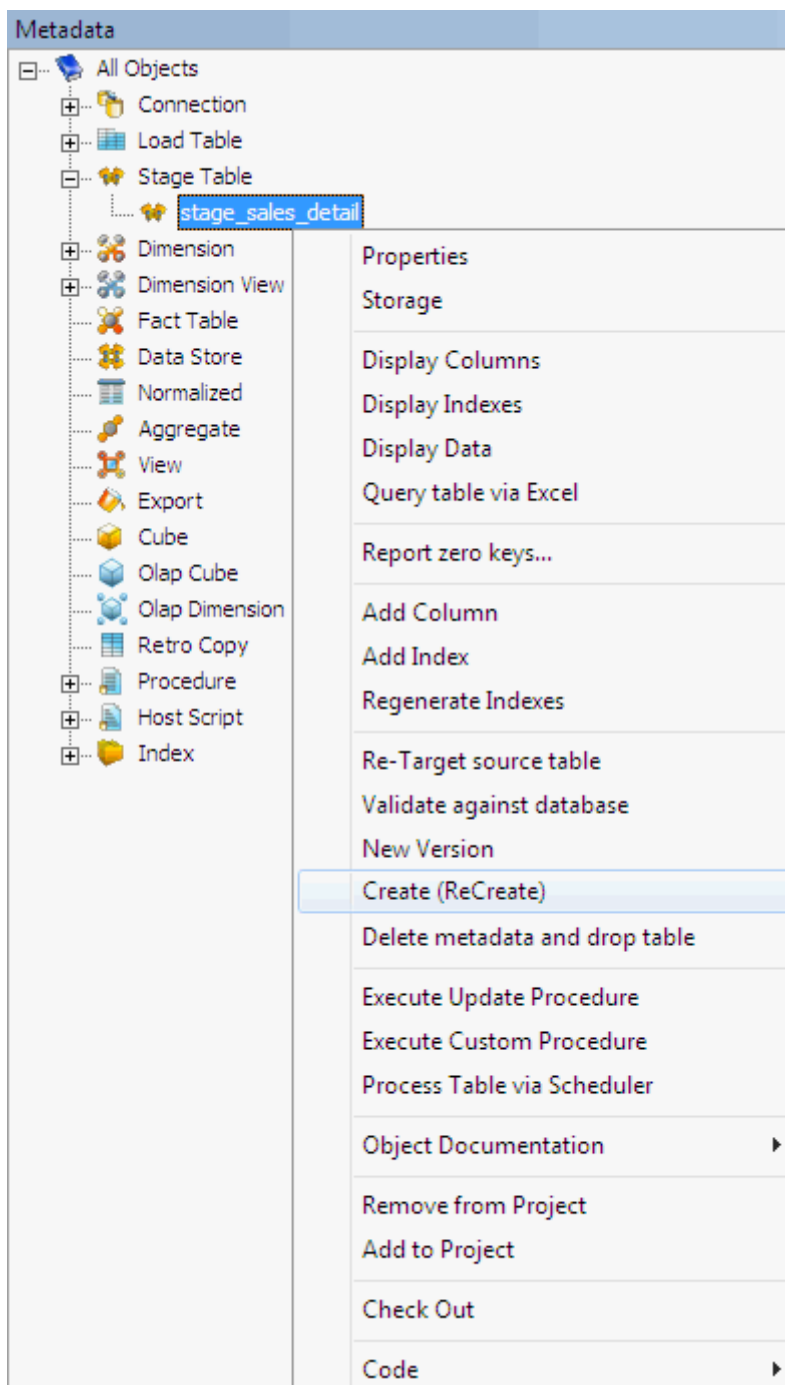
TIP: Because changes have been made within the data warehouse, you need to refresh the source table view in the right pane. Click the **Browse** menu then **Refresh**, or position the cursor in the right most pane and press **F5** or **Ctrl-R (^R)**, or click on one of the tool bar refresh buttons.

- 1 In the left pane, click on the **stage_sales_detail** table in the Stage Table object group. The middle pane should display the contents of this stage table.
- 2 Drag each of the following dimensions from the right pane into the stage table in the center pane:
 - **dim_customer**
 - **dim_order_date**
 - **dim_product**
 - **dim_ship_date**

This adds the dimension keys from each dimension to the stage table. The QAD Data Warehouse Designer screen should now look like this:



- The stage table metadata has been defined, but the stage tables has not been created. To create the stage table in the data warehouse, click on the stage table **stage_sales_detail**, then right click the mouse, select **Create (ReCreate)**:



Note: The table must exist in the data warehouse before we can proceed to the next step. If the table has not been physically created then the procedure in step 5 will fail to compile.

- 4 Double click on the stage table to select Properties.

5 Under *Update Procedure*, choose (Build Procedure...)

stage_sales_detail table definition

Properties | Storage | Notes

Table Name: stage_sales_detail

Short name. Must be unique and no more than 22 chars long: stage_sales_detail

Table Type: Stage

Description:

Update Procedure: (Build Procedure...) Rebuild Regenerate Cursor Update

Custom Procedure:

Table Properties clauses:
(e.g. Partition)

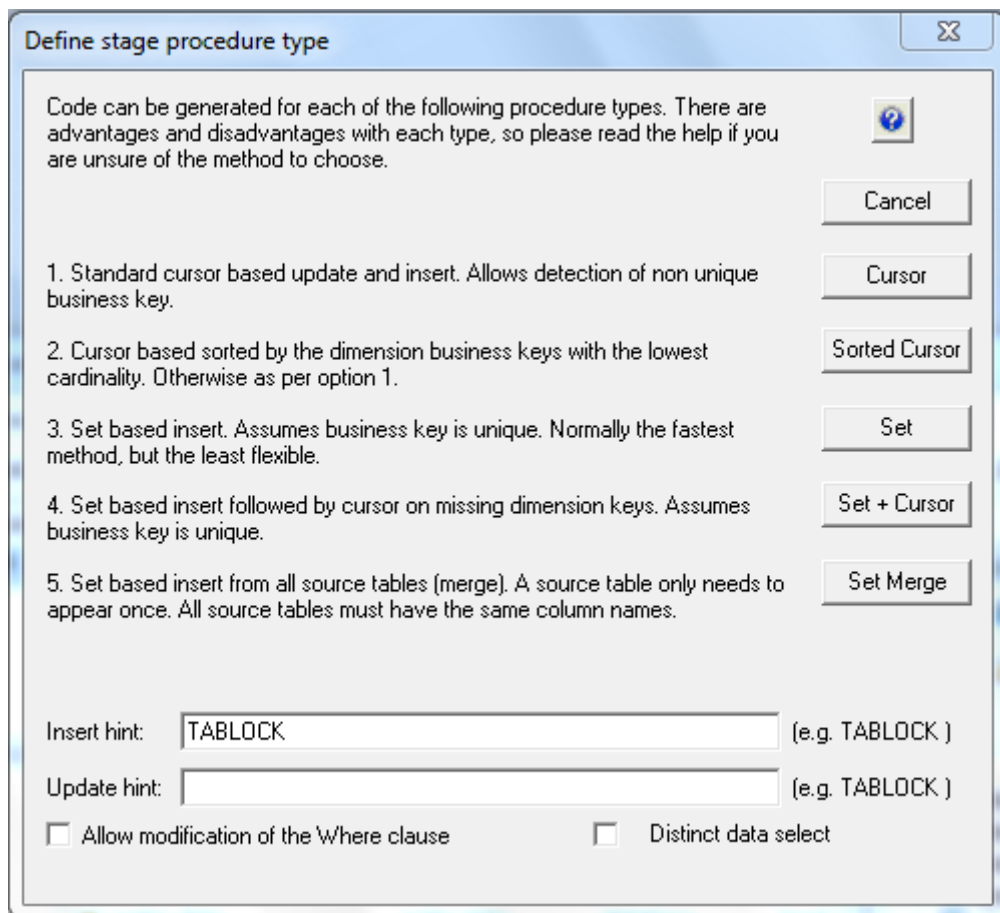
Date table structure last updated: 2006-01-05 14:04:32.000

Date created in database: 2010-10-20 17:21:17.420

Date last updated in database: 2010-10-20 17:21:17.420

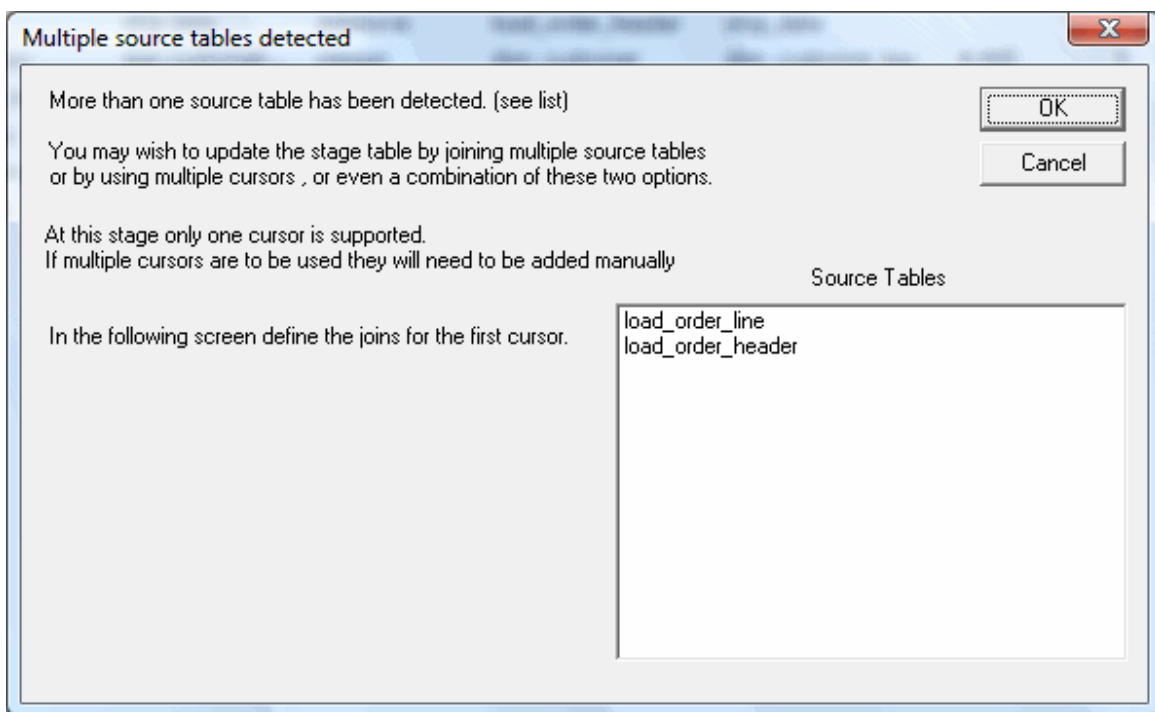
OK Cancel Apply

6 This will create an update stage procedure. Click OK.**7** Select the **Cursor** based procedure generation from the stage procedure type dialog box:



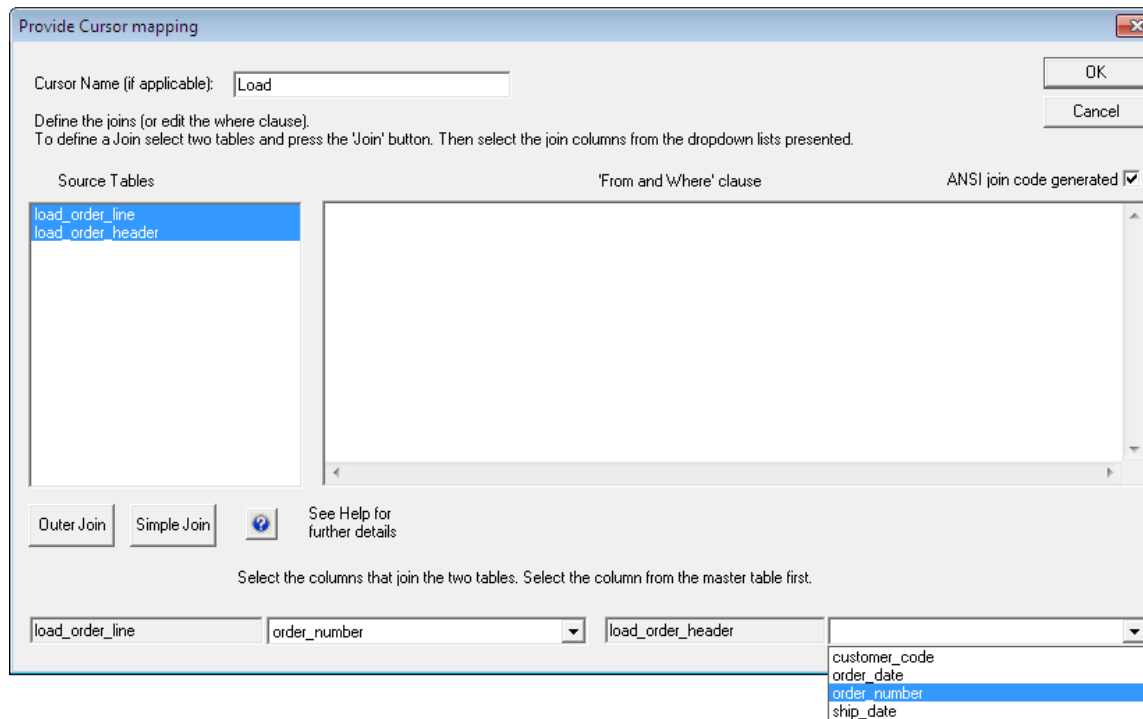
Note: When building an Oracle data warehouse, this dialog has an additional option for bulk bind procedures. See Staging generating the update procedure for more information.

- 8 Click OK on the parameters screen.
- 9 A dialog box will display indicating that multiple source tables have been detected.



- 10** Select OK and then highlight the source tables `load_order_line` and `load_order_header` which are to be joined by `order_number`.
 - With the two tables highlighted click **Outer Join**. See the chapter on Staging data for an explanation of the join types and options.

- Select **order number** from the **load_order_line** empty drop-down list box at the bottom of the screen. Then select **order number** from the **load_order_header** drop-down list box.



The dialog box titled "Provide Cursor mapping" is shown. It has a "Cursor Name (if applicable):" field with the value "Load". Below this is a text area with instructions: "Define the joins (or edit the where clause). To define a Join select two tables and press the 'Join' button. Then select the join columns from the dropdown lists presented." There are two main panes: "Source Tables" on the left and "'From and Where' clause" on the right. The "Source Tables" pane contains a list with "load_order_line" and "load_order_header". The "'From and Where' clause" pane is empty. At the bottom, there are buttons for "Outer Join", "Simple Join", and a help icon with the text "See Help for further details". Below these buttons is a text prompt: "Select the columns that join the two tables. Select the column from the master table first." There are two dropdown menus. The first dropdown is labeled "load_order_line" and has "order_number" selected. The second dropdown is labeled "load_order_header" and has a list of options: "customer_code", "order_date", "order_number" (highlighted), and "ship_date".

Cursor Name (if applicable): Load

Define the joins (or edit the where clause).
To define a Join select two tables and press the 'Join' button. Then select the join columns from the dropdown lists presented.

Source Tables

load_order_line
load_order_header

'From and Where' clause

ANSI join code generated ☒

Outer Join Simple Join See Help for further details

Select the columns that join the two tables. Select the column from the master table first.

load_order_line order_number load_order_header

customer_code
order_date
order_number
ship_date

- This will create a join statement in the right hand window:

Provide Cursor mapping

Cursor Name (if applicable):

Define the joins (or edit the where clause).
To define a Join select two tables and press the 'Join' button. Then select the join columns from the dropdown lists presented.

Source Tables:

'From and Where' clause:

```
FROM load_order_line
LEFT OUTER JOIN load_order_header
ON load_order_line.order_number = load_order_header.order_number
```

ANSI join code generated ☒

 See Help for further details

Select the columns that join the two tables. Select the column from the master table first.

- Click OK.
- 11** You need to match the dimension business keys with the business keys in the stage table. This associates the correct dimensional record to each stage table record. A dialog box displays for each dimensional join:
- For the dim_customer, select customer_code. Click <--Add:

Dimension Business Key definition

Business Keys for dim_customer

Select the business key from the staging table that matches each business key for this dimension.

Move them over to the business key list. They must be in the correct order to match the dimension business keys.

Dimension business keys

code

Stage business key list

customer_code

Stage table column list

customer_code
order_date
order_line_no
order_number
product_code
quantity
sales_value
ship_date
tax
unit_sale_price

<-- Add

Remove -->

dim_customer

☐ No warning if dimension joins do not succeed

☐ Automatically add a new entry if no valid dimension record.

☐ Write detail log message when no dimension record match.

Enter a text string and press Add Text to add a static business key

Add Text

Click OK.

- For dim_product, select product_code. Click <--Add. Click OK.
- The business key for dim_ship_date has the same column name in the stage table and the dimension view, allowing QAD Data Warehouse Designer to automatically move ship_date to the left hand side. Click OK to progress to dim_order_date, where order_date has also been automatically chosen. Click OK again.

- 12** You must now select the business keys to uniquely identify each record in the staging table itself. This essentially defines the business key we will be using in the fact table, and as such defines the grain of the fact table. For this example the grain is order line. Select order_number and order_line_no. Click <--Add. Click OK. (See sample screen below.)

Define staging business key(s)

Select the business keys that uniquely identify each record in the Staging table.

Move them over to the business key list

Business key list

order_number
order_line_no

<-- Add

Remove -->

Column list

customer_code
order_date
product_code
quantity
sales_value
ship_date
tax
unit_sale_price

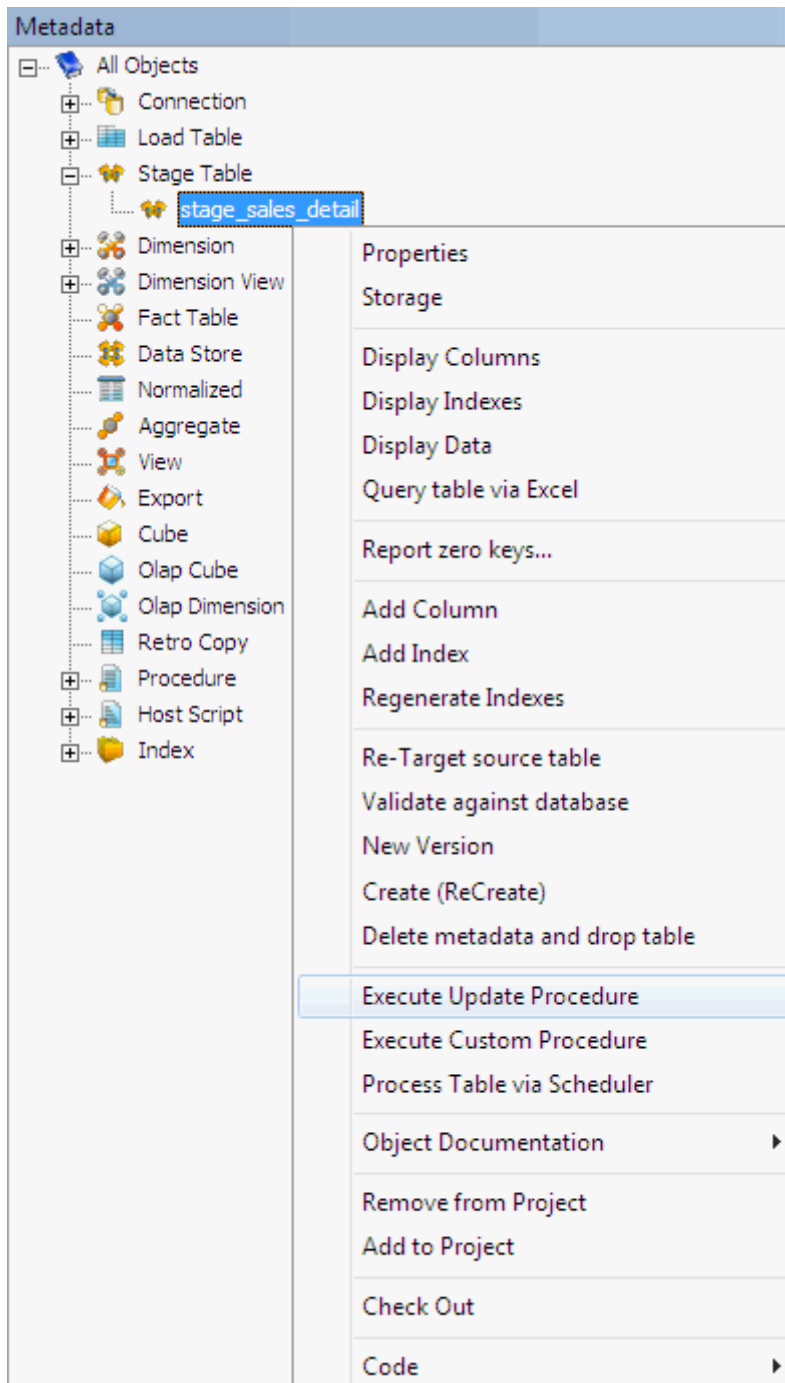
☒ Include update statement

OK

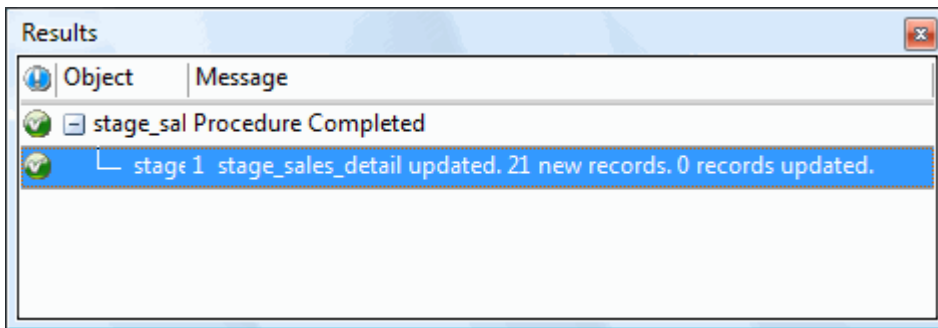
Cancel

- 13** QAD Data Warehouse Designer now builds and compiles the update procedure. The results pane shows any indexes that were created.

- 14 The final step is the population of the stage table. Click on the stage table `stage_sales_detail`, right click and select **Execute Update Procedure**:



15 Output from the stage table has being updated can now be seen in the **Results** window:



You are now ready to proceed to the next step - **Creating a Fact Table** (see "**1.12 Creating a Fact Table**" on page 48).

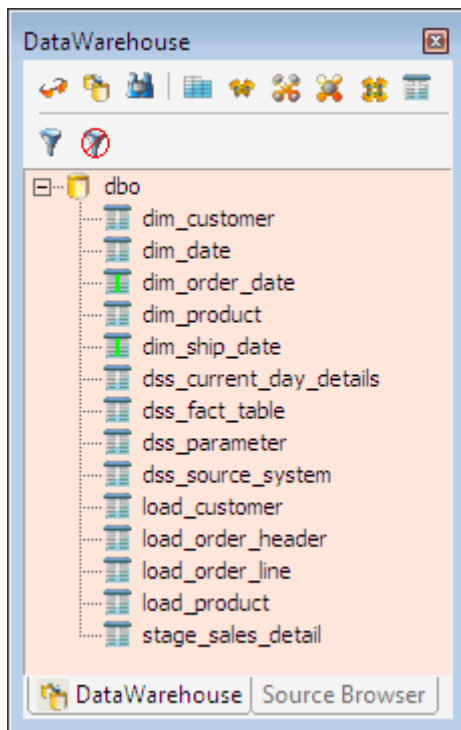
1.12 Creating a Fact Table

In this step you will create a fact table.

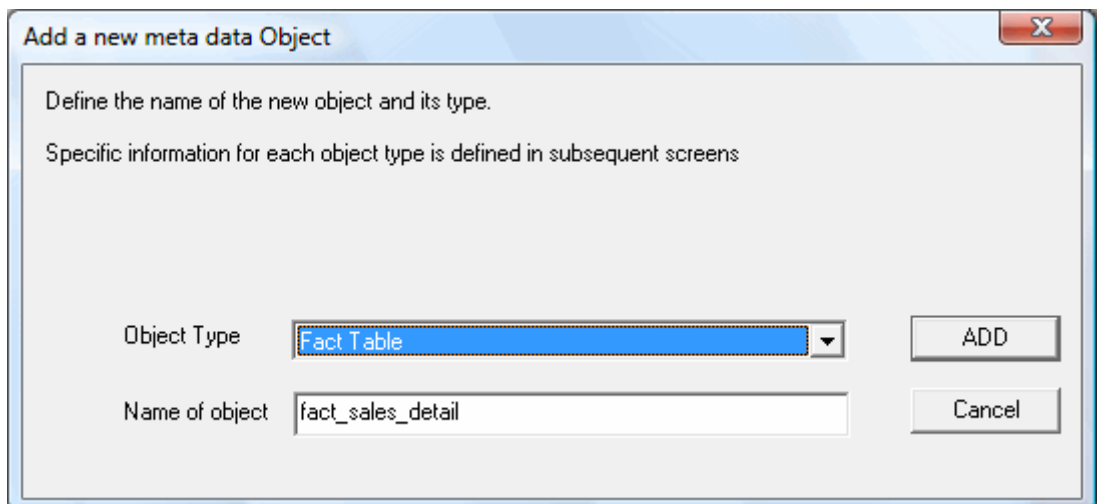
Create a drop target by double clicking on the Fact Table object group in the left pane, then refresh the source table browser (right hand pane).

To create the fact table:

- 1** Browse the data warehouse connection again (or refresh the data warehouse connection):



- 2 Drag the stage table `stage_sales_detail` over from the right pane into the middle pane. The following dialog is displayed:



- 3 Click **Add**. The `fact_sales_detail` table properties screen will appear. Select (Build Procedure...) in the update procedure drop down and click **OK**:

fact_sales_detail table definition

Properties | Storage | Language Mapping | Purpose | Concept | Grain | Examples | Usage | Notes

Table Name: fact_sales_detail

Short name. Must be unique and no more than 22 chars long: fact_sales_detail

Business Display Name (EUL): fact_sales_detail Table Type: Detail

Description:

Update Procedure: (Build Procedure...) Rebuild Cursor Based Update

Custom Procedure:

Table Properties clauses:
(e.g. Partition)

Get Key Function:

Mnemonic (EUL):

Date table structure last updated: 2006-01-05 14:05:43.000

Date created in database: 2010-10-20 17:21:17.460

Date last updated in database: 2010-10-20 17:21:17.460

OK Cancel Apply

- 4 Select Create and Load to create and load the table now:

Create database table

Fact Table fact_sales_detail has been defined

Create and Load

Create

Finish

- 5 Select the Business Key for the fact table. Choose `order_number` and `order_line_number`. Click <--Add then OK:

Define fact business key(s)

Select the business keys that uniquely identify each record in the Fact table. Move them over to the Business key list.

NOTE: Set based updates can only be selected if no business keys are defined.

Business key list

order_number
order_line_no

<-- Add

Remove -->

Column list

customer_code
dim_customer_key
dim_order_date_key
dim_product_key
dim_ship_date_key
order_date
product_code
quantity
sales_value
ship_date
tax
unit_sale_price

☐ Set based insert

☐ Allow Where clause editing

☐ Group by dimension keys

☐ Include delete before insert

Insert hint: TABLOCK (e.g. TABLOCK)

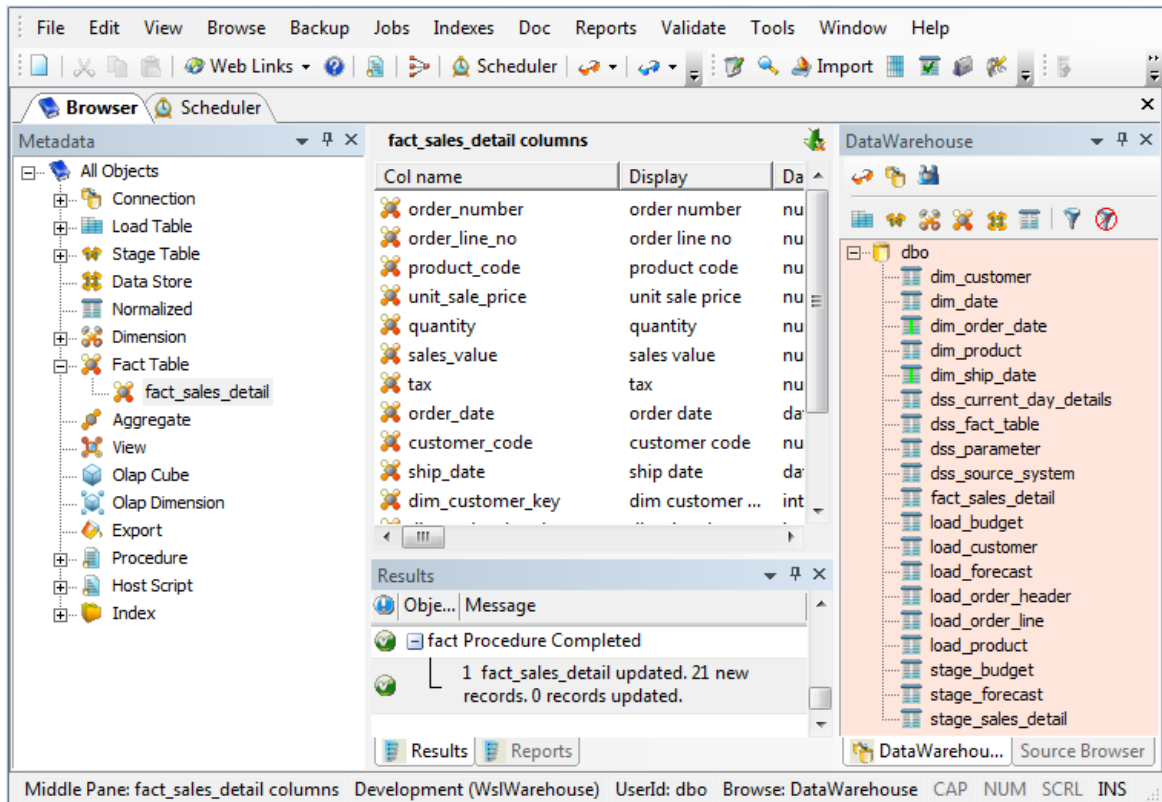
Update hint: (e.g. TABLOCK)

OK

Cancel

- 6 Output from the fact table being created and updated can now be seen in the Results window.

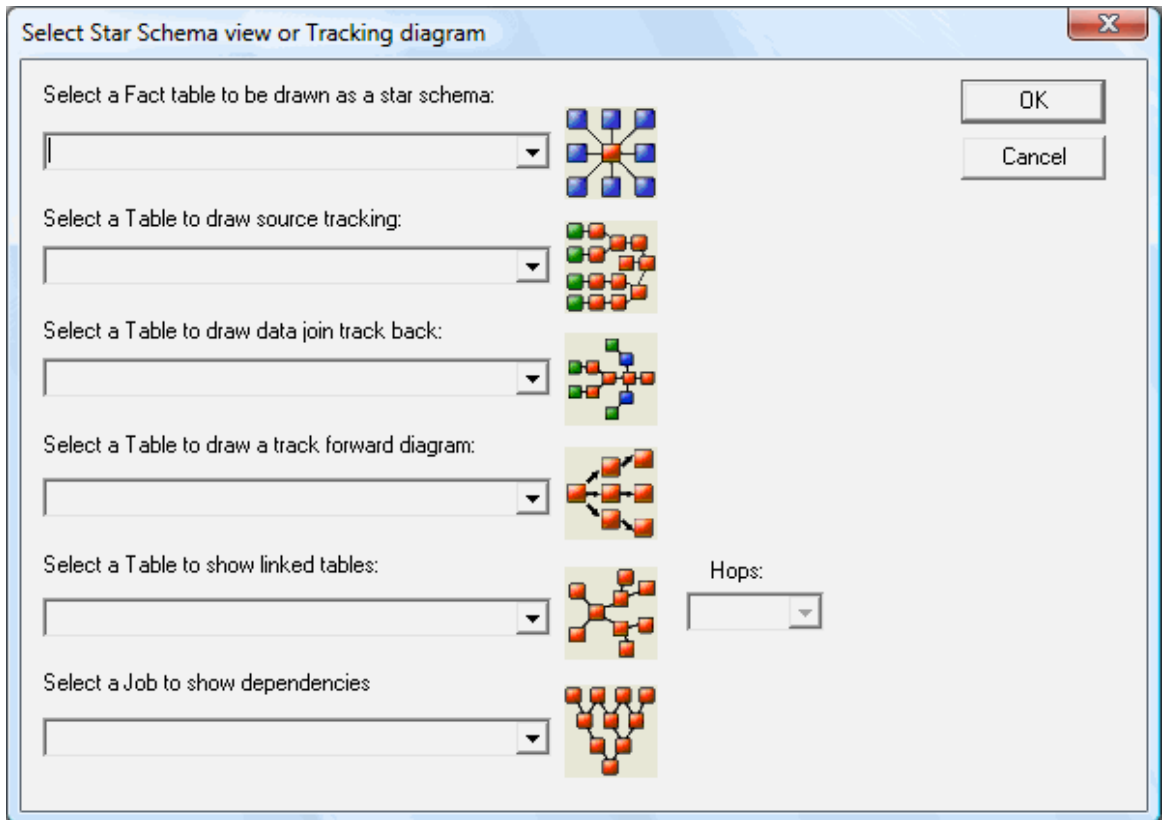
Your QAD Data Warehouse Designer screen should look something like this:



You are now ready to proceed to the next step - **Switching to Diagrammatical View** (see "1.13 Switching to Diagrammatical View" on page 53).

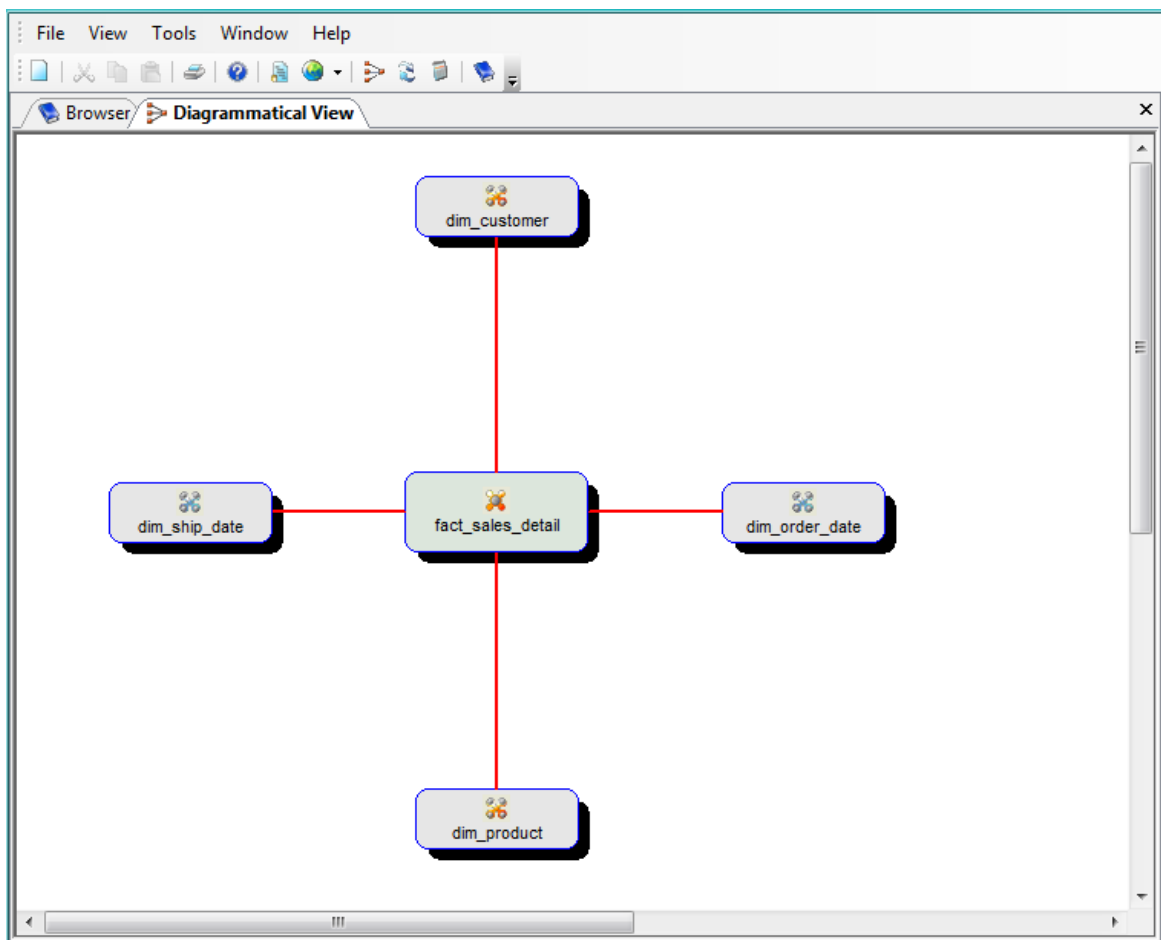
1.13 Switching to Diagrammatical View

QAD Data Warehouse Designer provides the ability to diagrammatically view the data warehouse you have created. To switch to the diagrammatical view, click on the  button. Click the button again to bring up the diagram selector box. Select a fact table to be drawn as a star schema from the drop-down list box – in this instance `fact_sales_detail`:



Click OK.

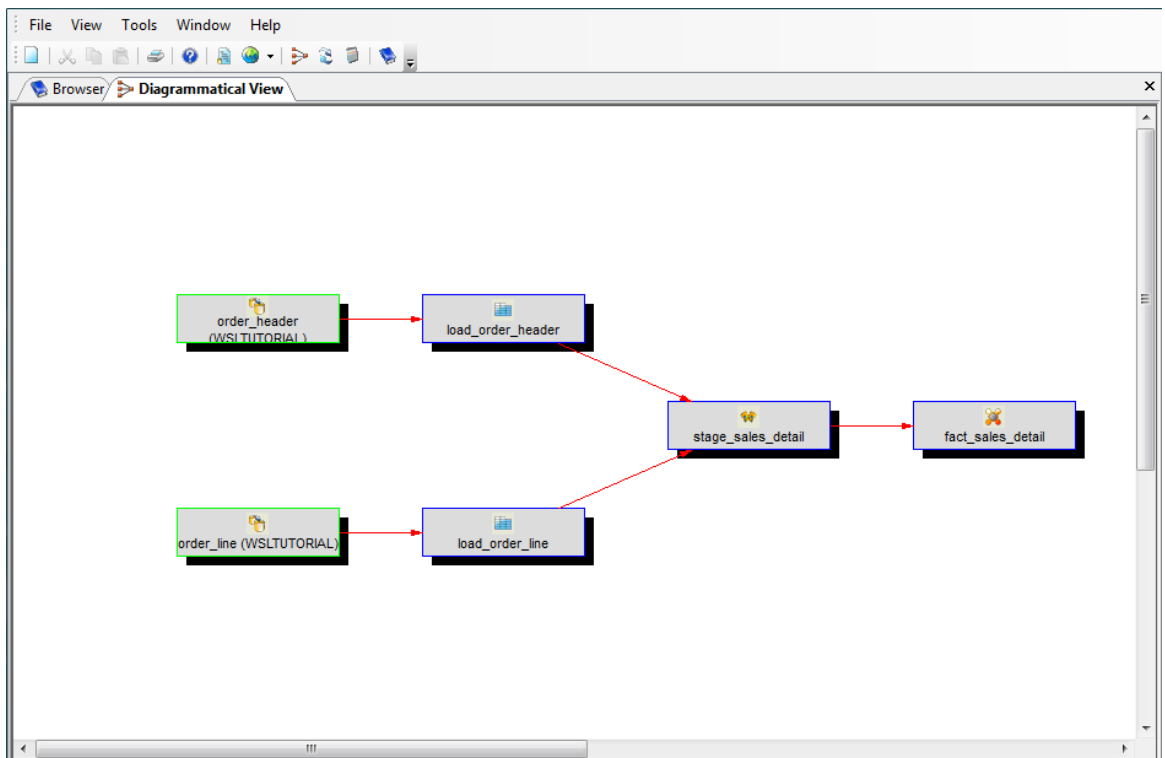
The diagram looks like this:



TIP: To view the source tracking of the **fact_sales_detail** table, click once more on the button, and choose the **fact_sales_detail** table from the second drop-down list box.



The diagram looks like this:



TIP: To close the diagrammatic view click on the Browser Window icon at the right-hand end of the toolbar.

You are now ready to proceed to the next step - **Producing Documentation** (see "1.14 Producing Documentation" on page 56).

1.14 Producing Documentation

QAD Data Warehouse Designer also provides the ability to produce user and technical documentation. This is obviously of more value if the descriptive data has been entered against the columns and tables in the data warehouse, which we have not done during this tutorial.

To view the documentation for the components of the data warehouse, select Doc from the menu, then Create Documentation. Select a file path (directory) under which to save the HTML files that will be produced. The next screen allows for the inclusion of a banner and user defined links:

Documentation Creation Options

User and technical documentation will be created in HTML format in the destination directory. OK

To use a custom look and feel add your own MainStyle.css file into the destination directory. Cancel

Documentation title (e.g. Data Warehouse):

Do you want to link in any custom HTML pages? ☐ Links

Do you want to include current file group usage?
It will take longer to create the documentation. ☒ Sizes

How would you like the columns sorted? ☒ Column Order ☐ Column Name ☐ Business Name

Do you want to include shadows on the diagram boxes? ☒ Shadow

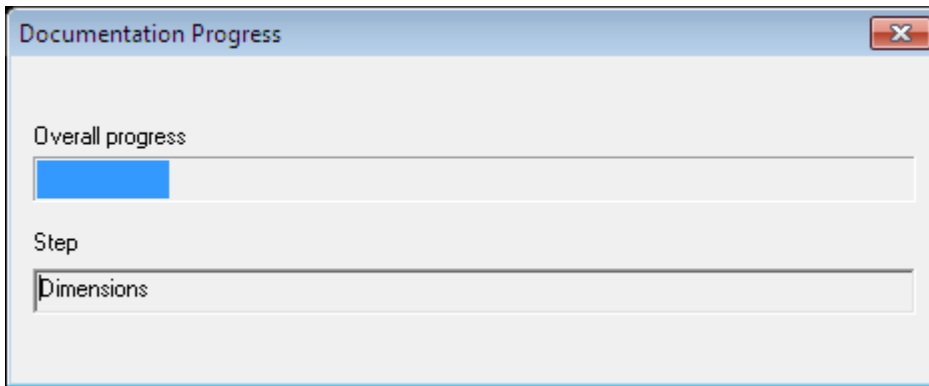
Do you want to create impact analysis on load tables?
It will take longer to create the documentation. ☒ Impact

Do you want to replace the existing style sheet?
Do not tick this box if you utilize a custom style sheet. ☐ Replace Style Sheet

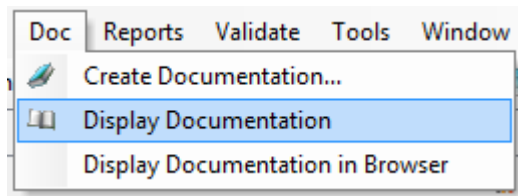
Do you wish to limit the complexity of the diagrams?
Select the maximum number of process steps to display in the source diagrams.

Leave these options unchecked and click OK to proceed.

The documentation runs:



TIP: To view the documentation select Doc, Display Documentation:



You are now ready to proceed to the next step - **Data Store Objects** (see "**1.15 Data Store Objects (Optional)**" on page 57)

1.15 Data Store Objects (Optional)

Data Store objects are used to provide a persistent storage of load tables. These objects are not licensed for every installation and hence this section is optional.

- 1 Browse the Data Warehouse in the right hand pane.
- 2 Double click the data store object in the left hand pane.
- 3 Drag `load_product` from the right hand pane into the middle pane.

- 4 Accept the default name of `ds_product` and click ADD.
- 5 Click the Rebuild button.

The screenshot shows the 'ds_product table definition' dialog box. It has a tabbed interface with 'Properties' selected. The 'Table Name' field contains 'ds_product'. The 'Short name. Must be unique and no more than 22 chars long' field also contains 'ds_product'. The 'Business Display Name (EUL):' field contains 'ds_product'. The 'Table Type' dropdown is set to 'Data Store'. The 'Description' field is empty. The 'Update Procedure' dropdown is set to '*** Create New Procedure ***'. The 'Custom Procedure' dropdown is empty. The 'Table Properties clauses: (e.g. Partition)' field is empty. The 'Get Key Function' dropdown is empty. The 'Mnemonic (EUL):' field is empty. The 'Date table structure last updated:' field contains '2010-08-18 13:18:10.077'. The 'Date created in database:' field is empty. The 'Date last updated in database:' field is empty. At the bottom right, there are 'OK', 'Cancel', and 'Apply' buttons. In the middle right, there are 'Rebuild' and 'Regenerate' buttons.

- 6 Click Create and Load.

The screenshot shows the 'Create database table' dialog box. It has a message area on the left that says 'Data Store ds_product has been defined'. On the right, there are three buttons: 'Create and Load', 'Create', and 'Finish'.

- 7 Select the options as shown below and click OK.

Define Data Store procedure type and options

Procedure Types

Procedure type: Set Previous build was : Set

Build Options

☐ Process in batch

☐ Distinct data select

☐ Include delete before insert

☐ Include initial load insert

☒ Include update statement

☒ Changed rows only Except (e.g. TABLOCK)

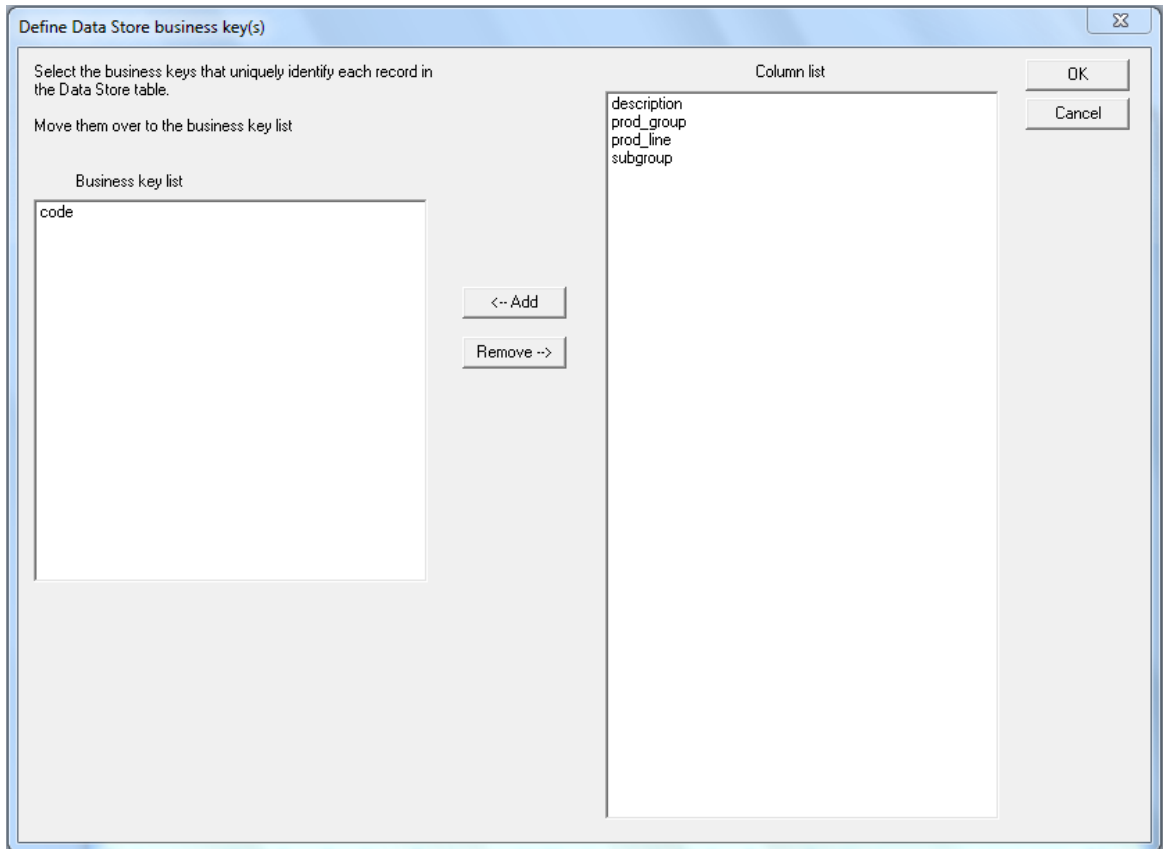
Update hint: TABLOCK (e.g. TABLOCK)

☒ Include insert statement

☒ New rows only Except (e.g. TABLOCK)

Insert hint: TABLOCK (e.g. TABLOCK)

OK Cancel

8 Select `code` as the business key and click OK.

The dialog box is titled "Define Data Store business key(s)". It contains instructions: "Select the business keys that uniquely identify each record in the Data Store table." and "Move them over to the business key list".

On the left is a "Business key list" containing the text "code".

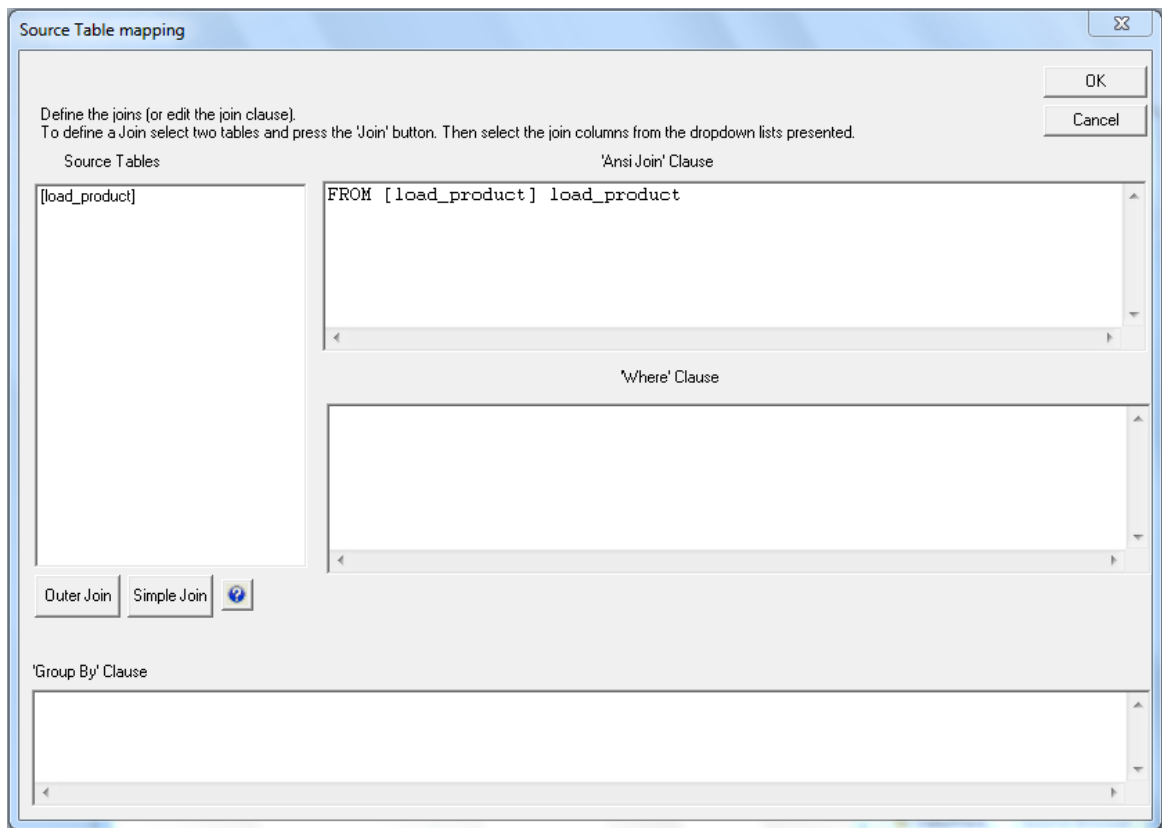
On the right is a "Column list" containing the following items:

- description
- prod_group
- prod_line
- subgroup

Between the two lists are two buttons: "<-- Add" and "Remove -->".

On the far right are two buttons: "OK" and "Cancel".

- 9 Click OK for Source Table mapping.



The dialog box is titled "Source Table mapping" and has a close button in the top right corner. It contains the following elements:

- Instructions:** "Define the joins (or edit the join clause). To define a Join select two tables and press the 'Join' button. Then select the join columns from the dropdown lists presented."
- Source Tables:** A list box on the left containing "[load_product]".
- 'Ansi Join' Clause:** A text area on the right containing the SQL snippet "FROM [load_product] load_product".
- 'Where' Clause:** An empty text area below the 'Ansi Join' clause.
- Buttons:** "Outer Join", "Simple Join", and a help icon (question mark in a circle) are located below the Source Tables list.
- 'Group By' Clause:** An empty text area at the bottom of the dialog.

At the top right, there are "OK" and "Cancel" buttons.

- 10 Data should now be loaded into the the ds_product table.
Repeat the exercise for order_line, order_header and customer.

CHAPTER 2

Tutorial 2 - Rollup Fact Tables, ASCII File Loads, Aggregates

Before you start on this chapter you should have:

- Completed *Tutorial 1 - Basic Star Schema Fact Table* (on page 3)
- Successfully completed *Creating a Fact Table* (see "*1.12 Creating a Fact Table*" on page 48)

This chapter deals with fine tuning the data warehouse by creating roll-up fact tables and aggregates. It also includes loading an ascii file into a new load table.

In This Chapter

2.1 Purpose and Roadmap.....	64
2.2 Making a Connection to Windows.....	67
2.3 Loading Tables from Flat Files	70
2.4 Creating Stage Tables	75
2.5 Creating Fact Tables	77
2.6 Rollup / Combined Fact Table	79
2.7 Aggregate Tables	82
2.8 Creating a Customer Aggregate	84

2.1 Purpose and Roadmap

Purpose

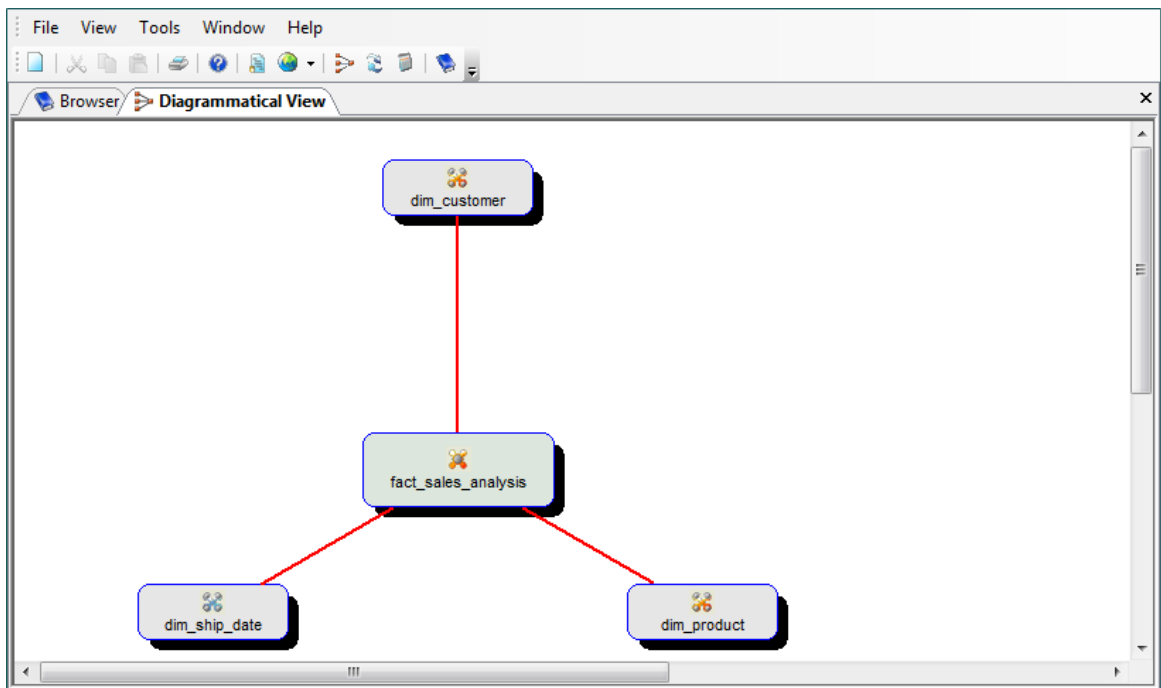
This tutorial will walk you through the process to:

- Load data from flat files (in Tutorial 1 source data was obtained via database links)
- Create a rollup fact table that allows users to see budgeted, forecast, and actual sales amounts and quantities broken down by customer, product and month
- Create separate aggregate tables that summarize data in the rollup table by (i) product and (ii) customer

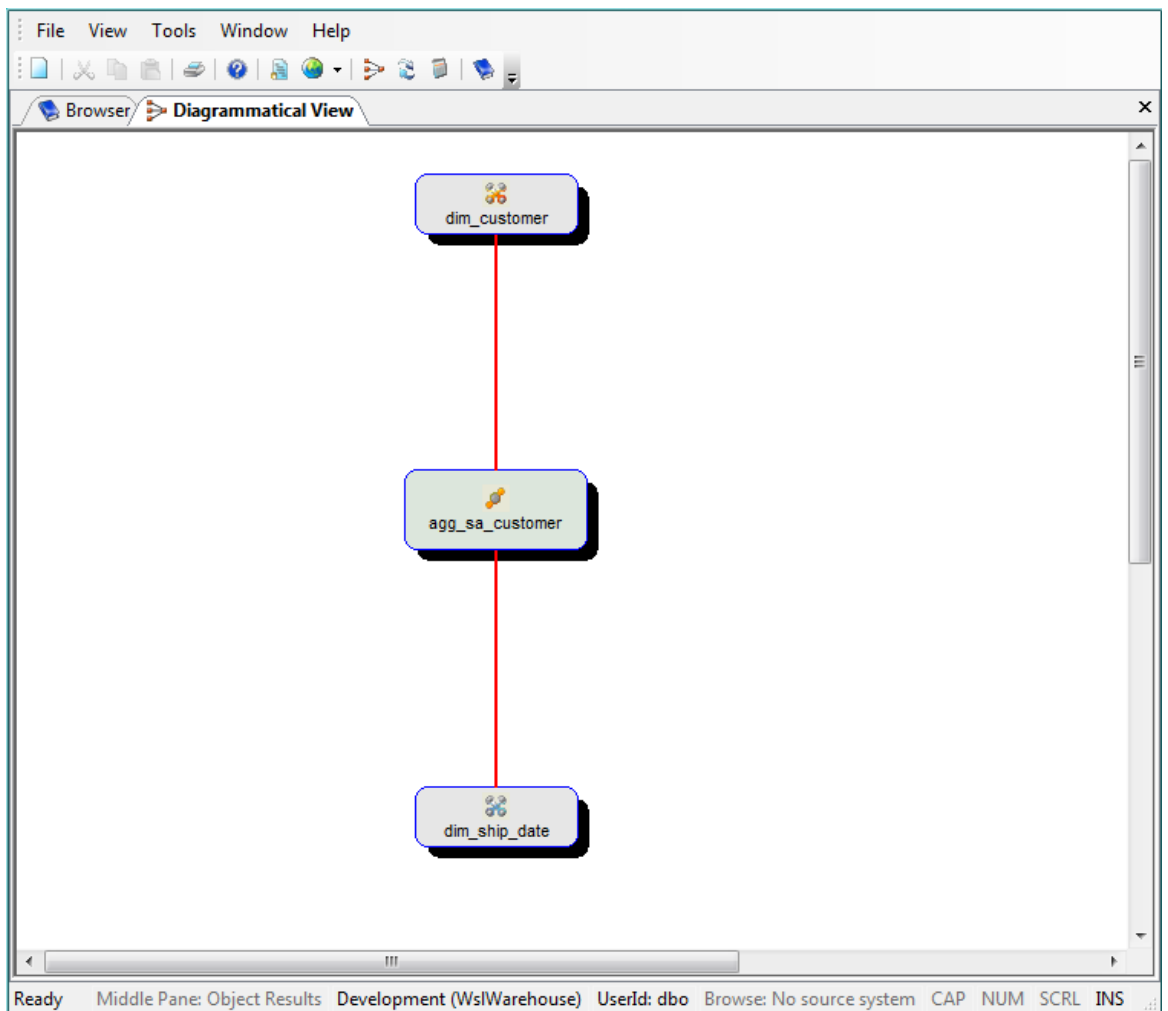
In short, this tutorial loads budget and forecast data from flat files into their own load, stage and fact tables. This data is then combined with data from the fact_sales_detail table (created in Tutorial 1) and summarized to create a new rollup fact table, fact_sales_analysis. Further summarization is done on the rollup table to create two separate aggregate tables.

The following are diagrams showing (i) the rollup table, fact_sales_analysis and (ii) the customer aggregate table, agg_sa_customer that will be created as part of this tutorial.

Rollup:



Aggregate:



Tutorial Environment

This tutorial has been completed using IBM DB2. All of the features illustrated in this tutorial are available in SQL Server, Oracle and DB2 (unless otherwise stated). Any differences in usage of QAD Data Warehouse Designer between these databases are highlighted.

Tutorial Roadmap

This tutorial works through a number of steps. These steps and the relevant section within the chapter are summarized below to assist in guiding you through the tutorial.

Step in Tutorial	Section
Create a new connection to allow data to be loaded in from flat files on C: drive.	Making a Connection to Windows
Create (and load) the data for - load_budget - load_forecast Note: Data is loaded from flat files on C: drive	Loading Tables from Flat Files
Create the following stage tables - stage_budget - stage_forecast Stage table creation entails using corresponding load tables and including links to the following dimensions: (dim_customer, dim_product, dim_date)	Creating Stage Tables
Create the following fact tables - fact_budget - fact_forecast	Creating Fact Tables
Create the rollup fact table, fact_sales_analysis This rollup combines forecast, budget and sales data from fact_budget, fact_forecast and fact_sales_detail tables respectively. The data is rolled-up (grouped) by product, customer and month. Note that dimension keys are used for the rollup.	Rollup/Snapshot Fact Tables
Create product aggregate (agg_sa_product) table. This aggregate summarizes fact_sales_analysis data by product	Aggregate Tables
Create customer aggregate (agg_sa_customer) table. This aggregate summarizes fact_sales_analysis data by customer.	Creating a Customer Aggregate

This tutorial starts with the section ***Making a Connection to Windows*** (see "2.2 ***Making a Connection to Windows***" on page 67).

2.2 Making a Connection to Windows

This follows a similar process to the earlier ***connections*** (see "1.6 ***Creating a Connection***" on page 12) made, but differs in that the connection is within the PC.

Note: The following connection should have been automatically created. It should however be validated to ensure that it is correct for the environment.

- 1 Log on to QAD Data Warehouse Designer.
- 2 In the left pane, double click on the **Connection** object group.
- 3 Select **File | New**, or right click the **Connection** object and select **New Object**.
- 4 Enter **Windows** in the 'Name of Object' text box and select **Add**.
- 5 Enter the Connection properties as below:

Connection properties

Field	Description
Connection Name	Windows
Connection Type	Windows
Host Name	Not required
Work Directory	Required. Must be an existing valid directory on the PC, e.g. c:\temp
Database id (SID)	For Oracle, the appropriate SID for your metadata installation, e.g. ORCL. For SQL Server and DB2 leave this field blank.
Database home directory	This is only required for Oracle and if the Database SID is in a non-default directory
Windows User ID	Leave blank
Windows Password	Leave blank
Dss User ID	For Oracle, this is dssadm (the data warehouse username). This is the database logon for SQL Server and DB2. It should be dbo if a trusted connection is being used for SQL Server. If an OS authenticated user is being used for DB2 this should be left blank.

Dss password	For Oracle, this is wsl (the data warehouse password). This is the database password for SQL Server and DB2. It should be left blank if a trusted connection is being used for SQL Server or if an OS authenticated user is being used for DB2.
--------------	---

Sample SQL Server properties:

The screenshot shows a 'Windows definition' dialog box with two tabs: 'Connection Properties' and 'Notes'. The 'Connection Properties' tab is active. It contains the following fields:

- Data Warehouse:** A checkbox that is currently unchecked.
- Connection Name:** A text box containing 'Windows'.
- Connection Type:** A dropdown menu showing 'Windows'.
- Host Name:** A text box that is empty.
- Work Directory:** A text box containing 'c:\temp'.
- Database ID (SID):** A text box that is empty.
- Database Server:** A text box that is empty.
- Windows User ID:** A text box that is empty.
- Password:** A text box that is empty.
- DSS User ID:** A text box containing 'dbo'.
- Password:** A text box that is empty.
- Data Type Mapping Set:** A dropdown menu showing '(Default)'.

At the bottom of the dialog box are three buttons: 'OK', 'Cancel', and 'Apply'.

Sample Oracle properties:

The screenshot shows a 'Windows definition' dialog box with two tabs: 'Connection Properties' and 'Notes'. The 'Connection Properties' tab is active. It contains the following fields and controls:

- Data Warehouse:** A checkbox that is currently unchecked.
- Connection Name:** A text field containing 'Windows'.
- Connection Type:** A dropdown menu with 'Windows' selected.
- Host Name:** A text field that is empty.
- Work Directory:** A text field containing 'c:\temp'.
- Database ID (SID):** A text field containing 'ORCL'.
- Database Server:** A text field that is empty.
- Windows User ID:** A text field that is empty.
- Password:** A text field that is empty.
- DSS User ID:** A text field containing 'dssdemo'.
- Password:** A text field containing '***'.
- Data Type Mapping Set:** A dropdown menu with '(Default)' selected.

At the bottom right of the dialog box are three buttons: 'OK', 'Cancel', and 'Apply'.

Sample DB2 properties:

Windows definition

Connection Properties | Notes

Data Warehouse ☐

Connection Name Windows

Connection Type Windows

Host Name

Work Directory c:\temp

Database ID (SID)

Database Server

Windows User ID Password

DSS User ID Password

Data Type Mapping Set (Default)

OK Cancel Apply

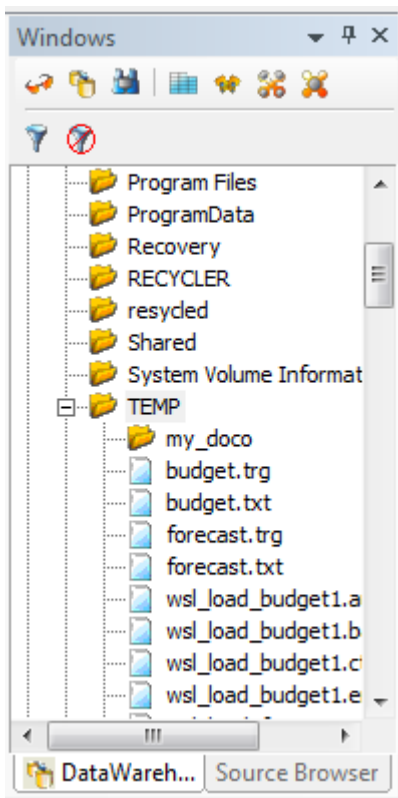
You are now ready to proceed to the next step - **Loading Tables from Flat files** (see "2.3 Loading Tables from Flat Files" on page 70)

2.3 Loading Tables from Flat Files

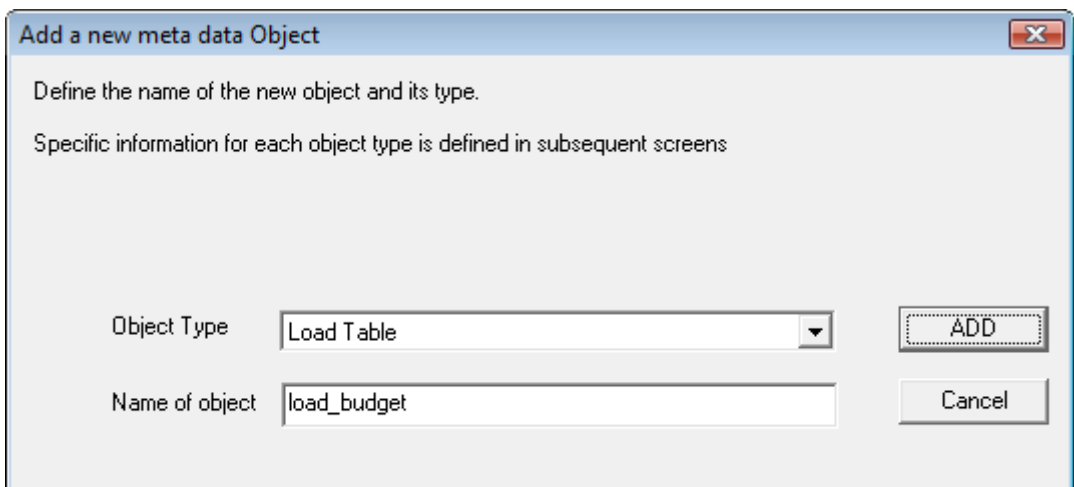
In this step you will parse and load a file from Windows into a load table in the data warehouse.

- 1 Double click on the **Load Table** object group in the left pane. This will list all load tables in the middle pane and make the middle pane a drop target for new load tables.

- 2 Browse to the Windows connection in the right pane by selecting **Browse | Source Tables** from the menu strip at the top of the screen. Select **Windows** as the Connection. Leave the Schema field blank. Click OK.



- 3 Navigate to c:\Program Files\QAD\Tutorial folder, click on **budget.txt** and drag it into the middle pane. Rename the object **load_budget** (i.e. remove the **_txt** suffix):



- 4 Click **ADD**.

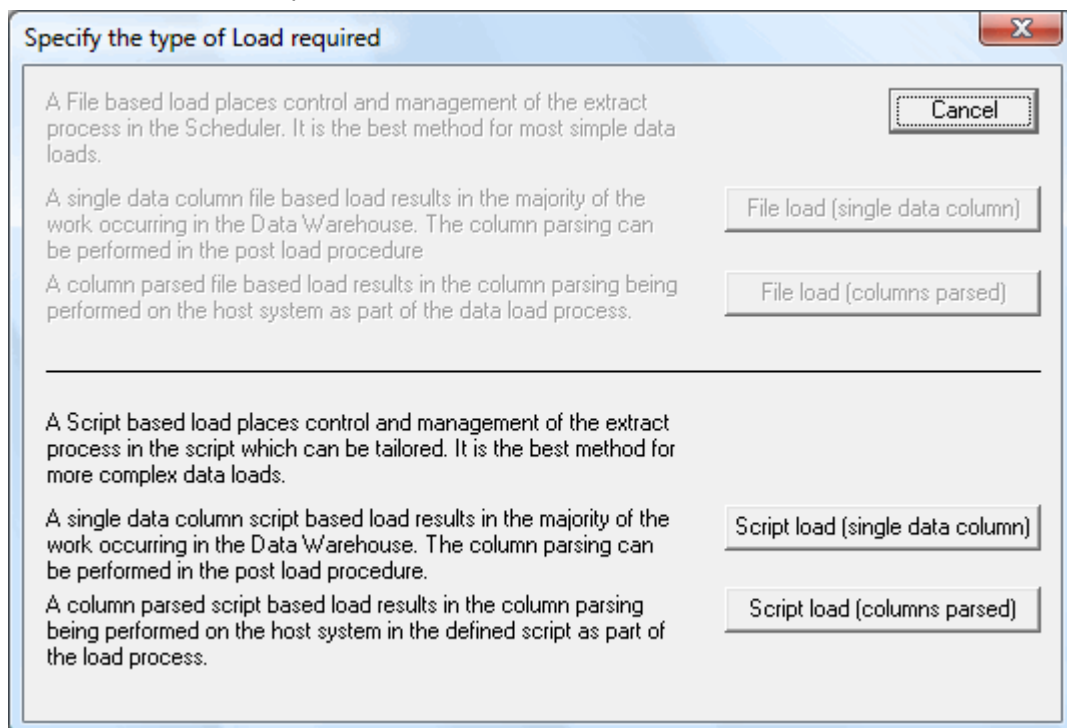
Specifying the load type

You must now specify the type of load you require from the four options given:

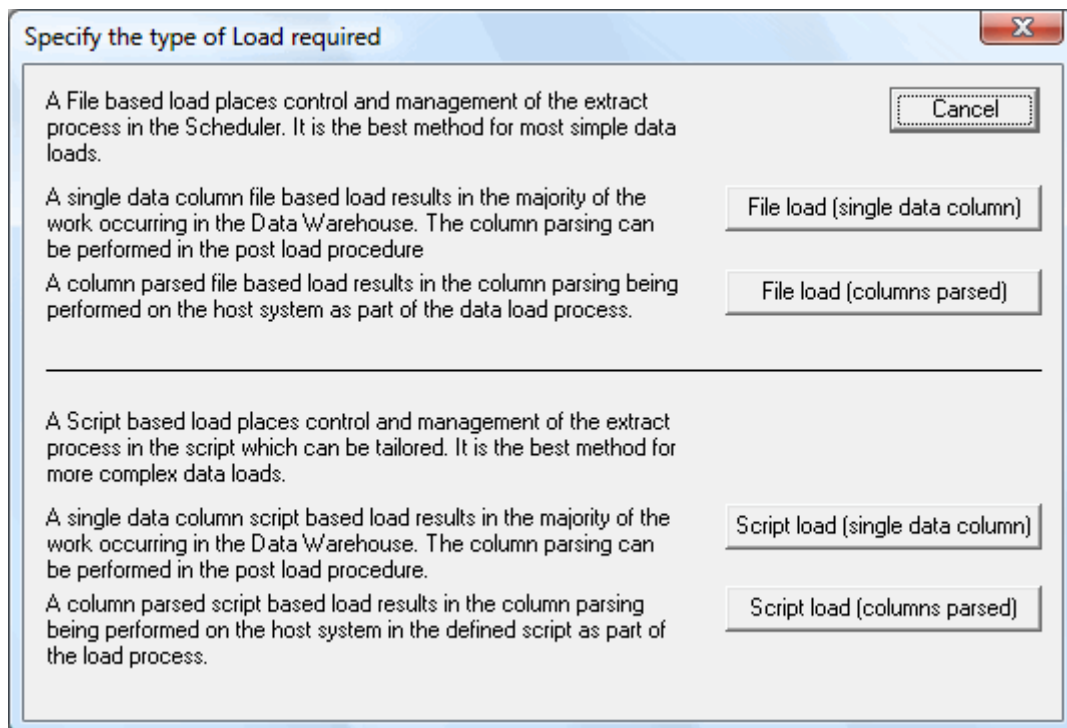
- File load (single data column)
- File load (columns parsed)
- Script load (single data column)
- Script load (columns parsed)

For more information on load types see the section on flat file loads in the loading data chapter.

- 1 For this tutorial select **Script Load Columns Parsed**:



Note: For SQL Server and Oracle, file loads are also available in this dialog:



Specify the type of Load required

A File based load places control and management of the extract process in the Scheduler. It is the best method for most simple data loads.

A single data column file based load results in the majority of the work occurring in the Data Warehouse. The column parsing can be performed in the post load procedure

A column parsed file based load results in the column parsing being performed on the host system as part of the data load process.

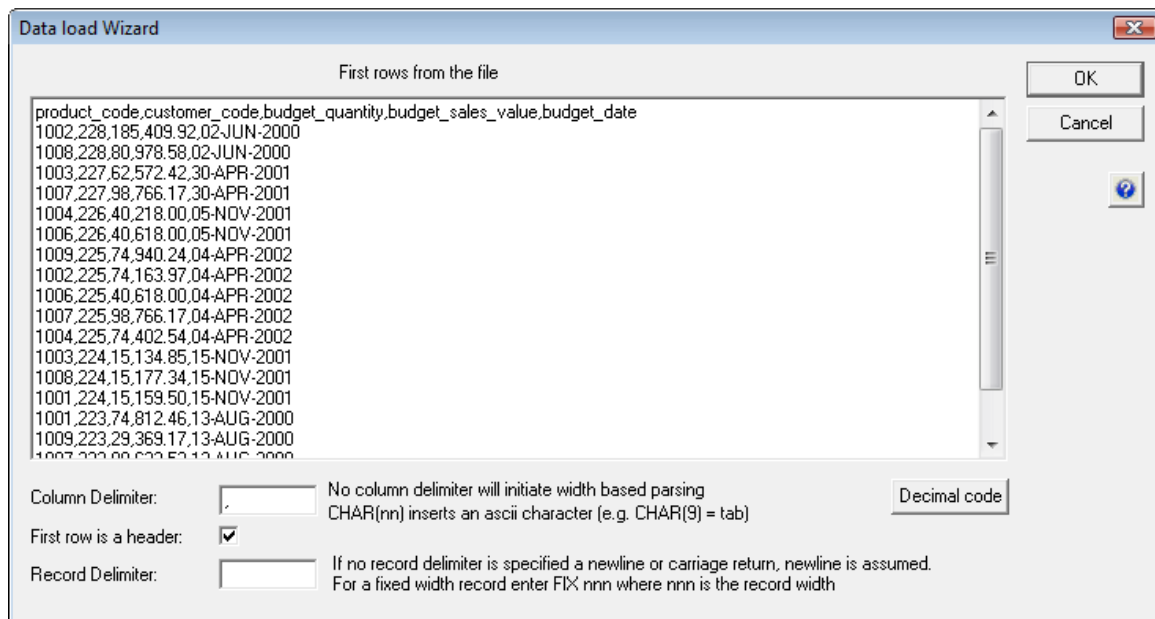
A Script based load places control and management of the extract process in the script which can be tailored. It is the best method for more complex data loads.

A single data column script based load results in the majority of the work occurring in the Data Warehouse. The column parsing can be performed in the post load procedure.

A column parsed script based load results in the column parsing being performed on the host system in the defined script as part of the load process.

Buttons: Cancel, File load (single data column), File load (columns parsed), Script load (single data column), Script load (columns parsed)

- 2 From the definition dialog that displays select OK.
- 3 From the data load wizard enter a comma (,) in the Column Delimiter field
- 4 As the first row is a header, place a check in the box and click OK:



Data load Wizard

First rows from the file

```
product_code,customer_code,budget_quantity,budget_sales_value,budget_date
1002,228,185,409.92,02-JUN-2000
1008,228,80,978.58,02-JUN-2000
1003,227,62,572.42,30-APR-2001
1007,227,98,766.17,30-APR-2001
1004,226,40,218.00,05-NOV-2001
1006,226,40,618.00,05-NOV-2001
1009,225,74,940.24,04-APR-2002
1002,225,74,163.97,04-APR-2002
1006,225,40,618.00,04-APR-2002
1007,225,98,766.17,04-APR-2002
1004,225,74,402.54,04-APR-2002
1003,224,15,134.85,15-NOV-2001
1008,224,15,177.34,15-NOV-2001
1001,224,15,159.50,15-NOV-2001
1001,223,74,812.46,13-AUG-2000
1009,223,29,369.17,13-AUG-2000
```

Column Delimiter: , No column delimiter will initiate width based parsing
CHAR(nn) inserts an ascii character (e.g. CHAR(9) = tab)

First row is a header: ☒

Record Delimiter: If no record delimiter is specified a newline or carriage return, newline is assumed.
For a fixed width record enter FIX nnn where nnn is the record width

Buttons: OK, Cancel, Decimal code

- 5 QAD Data Warehouse Designer uses the header row as suggested column names. For each column confirm the name and data type:

Data load Wizard - Column definition

Column Data	File Data
product_code	product_code, customer_code, budget_quantity, budget_sales_value, budget_date
1002	1002, 228, 185, 409.92, 02-JUN-2000
1008	1008, 228, 80, 978.58, 02-JUN-2000
1003	1003, 227, 62, 572.42, 30-APR-2001
1007	1007, 227, 98, 766.17, 30-APR-2001
1004	1004, 226, 40, 218.00, 05-NOV-2001
1006	1006, 226, 40, 618.00, 05-NOV-2001
1009	1009, 225, 74, 940.24, 04-APR-2002
1002	1002, 225, 74, 163.97, 04-APR-2002
1006	1006, 225, 40, 618.00, 04-APR-2002
1007	1007, 225, 98, 766.17, 04-APR-2002
1004	1004, 225, 74, 402.54, 04-APR-2002
1003	1003, 224, 15, 134.85, 15-NOV-2001
1008	1008, 224, 15, 177.34, 15-NOV-2001

Display decimal character values ☐

Column Name:

Business Display Name:

Data Type: ☒ Nulls

Conversion:

Business Definition:

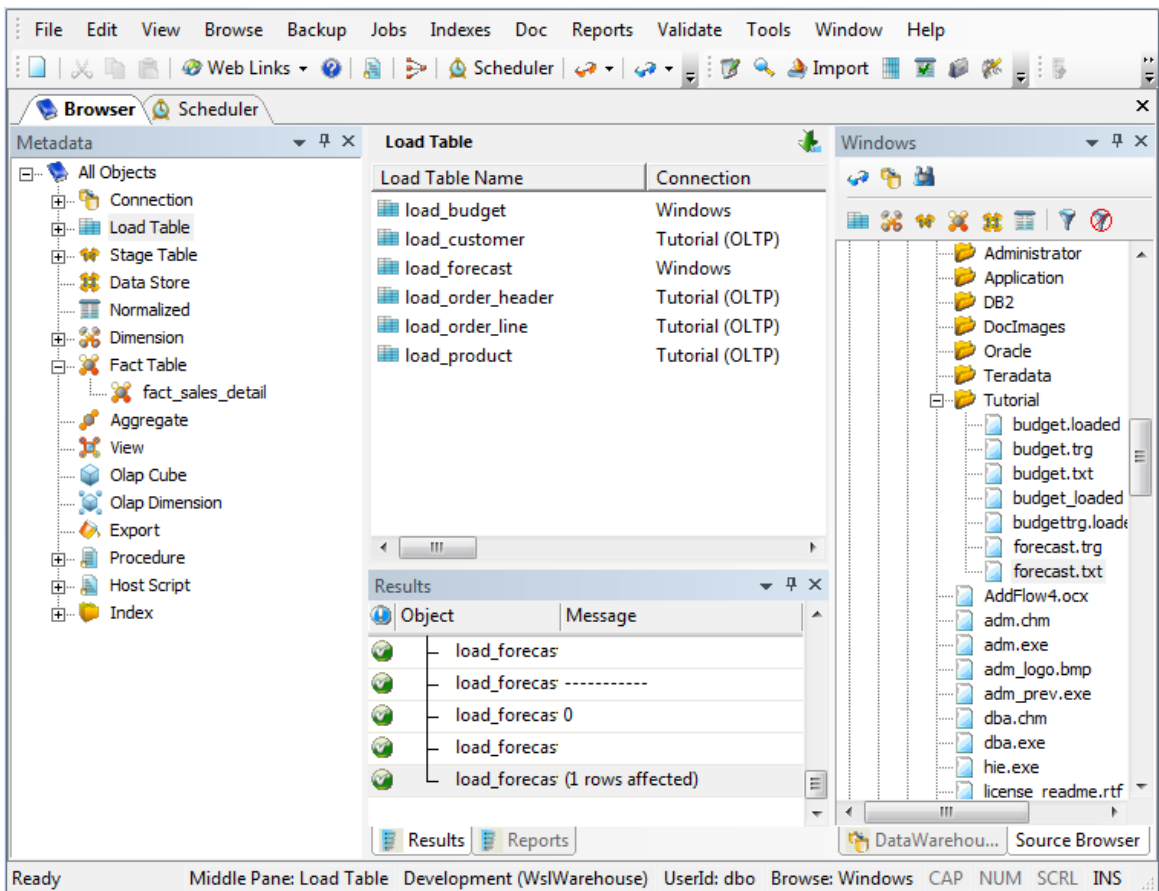
Add Cancel Back

- 6 You may have to change it to a more appropriate value. Click **Add**.
- 7 Click **OK** for the DB2 Load cannot skip header rows dialog.
- 8 Click **OK** for the New Script Create dialog.
- 9 Select **Yes** on the prompt to create and load the table now.

Note: Loading files with a header row into DB2 will result in an error message.

- 10 Repeat steps (1) to (9) for the `forecast.txt` file to create and load the table `load_forecast`.

11 The results display:



You are now ready to proceed to the next step - **Creating Stage Tables** (see "2.4 Creating Stage Tables" on page 75).

2.4 Creating Stage Tables

Two separate stage tables need to be created for **load_budget** and **load_forecast**. This is the same as the procedure from the first tutorial for **Defining the Staging Table** (see "1.10 Defining the Staging Table" on page 33).

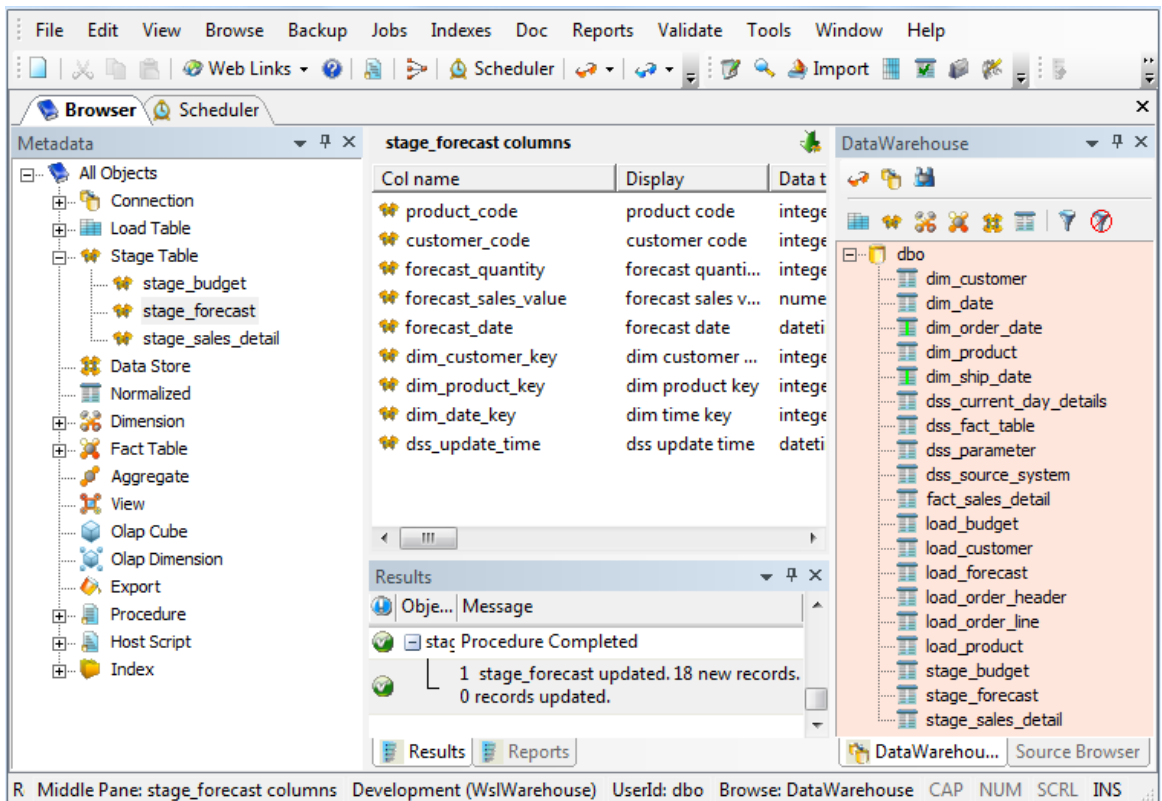
- 1 Double click the **stage table** object group in the left hand pane. This will list the existing stage table in the middle pane.
- 2 Browse to the data warehouse **Browse/Source Tables** or click on the orange glasses in the toolbar.
- 3 Drag the table **load_budget** from the right hand pane to the middle pane and drop.
- 4 Click **Add** to add the stage table called **stage_budget**. Click **OK** on the properties screen.
- 5 Repeat steps (1) through (4) for the table **load_forecast** to create **stage_forecast**.

Once the stage tables have been defined, bring the following keys from the right pane into both new tables. Click the stage table name in the left hand pane to list the stage table columns in the middle pane. This also makes the middle pane a drop target for new columns:

Note: Repeat the following procedure for `stage_budget` and `stage_forecast`.

- `dim_customer_key`
 - `dim_product_key`
 - `dim_date_key`
- 1** Now in the left pane, right click on `stage_budget`, then select **Create (ReCreate)**.
 - 2** Again, in the left pane, right click on `stage_budget`, then select **Properties**.
 - 3** In the Update Procedure field select (Build Procedure...). Click OK.
 - 4** Select **Cursor** as the update procedure type.
 - 5** SQL Server data warehouse users will now see an additional join screen. This screen is presented even though no joins are required. This screen allows the selection of either a 'Where' based join or an ANSI standard join. The default will be ANSI standard join. Click OK to proceed.
 - 6** Select the dimension keys:
 - `dim_customer` - customer code
 - `dim_product` - product code
 - `dim_date` - budget/forecast date (depending on which stage table you are working on).Click <--Add, then OK for each one.
 - 7** Now define the business keys. Add `customer_code`, `product_code`, and `budget/forecast_date` to the business key list, and click OK.
 - 8** For each stage table, right click in the left pane, and select **Execute Update Procedure**.

Your QAD Data Warehouse Designer screen should look like this when you have finished:



You are now ready to proceed to the next step - **Creating Fact Tables** (see "2.5 Creating Fact Tables" on page 77) for these two new stage tables.

2.5 Creating Fact Tables

- 1 Double click the **Fact Table** object group in the left pane.
- 2 Refresh the Data Warehouse source tables in the right pane (F5).
- 3 Click and drag **stage_budget** into the middle pane. Accept the name **fact_budget**. Click **Add**.
- 4 Choose (Build Procedure...) from the update procedure drop down list and click **OK**.
- 5 Click **Create and Load** when asked if you wish to create and load the table now.
- 6 Select the Business Key definitions. Add **customer_code**, **product_code**, and **budget_date**.

Define fact business key(s)

Select the business keys that uniquely identify each record in the Fact table. Move them over to the Business key list.

NOTE: Set based updates with business keys defined will build a merge update.

Business key list

budget_date
customer_code
product_code

<-- Add
Remove -->

Column list

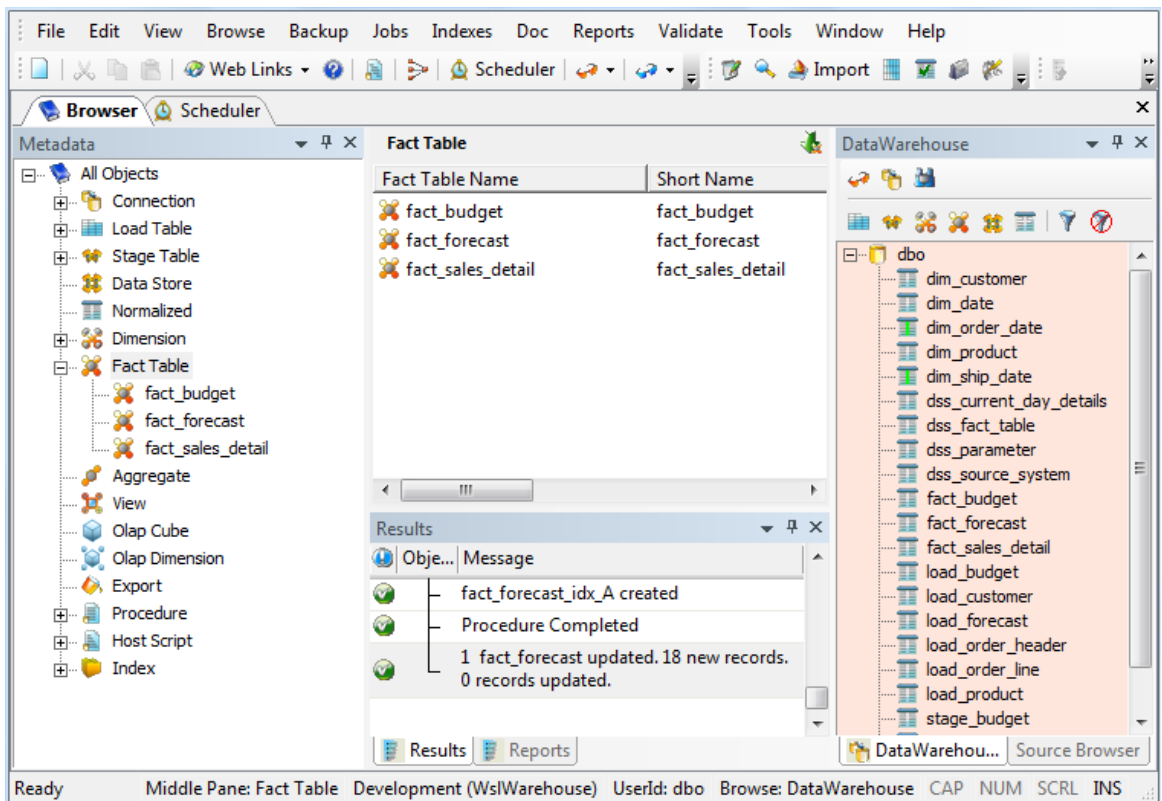
budget_quantity
budget_sales_value
dim_customer_key
dim_date_key
dim_product_key

☐ Set based insert
☐ Allow Where clause editing
☐ Group by dimension keys
☐ Minimal logging (if possible)
☐ Include delete before insert

OK
Cancel

- 7 Click OK.
- 8 Repeat steps (1) to (7) stage_forecast to create fact_forecast (with a business key of customer_code, product_code, and forecast_date).

Your QAD Data Warehouse Designer screen should look like this when you have finished:



You are now ready to proceed to the next step - **Rollup / Snapshot Fact Table** (see "2.6 Rollup / Combined Fact Table" on page 79)

2.6 Rollup / Combined Fact Table

A rollup table enables the viewing and combining of different levels of granularity in the data, such as sales, budget and forecast detail. The result is that the end user can compare, for example, sales against budget against forecast on a monthly basis.

- 1 Click on the Fact Table object in the left pane and refresh the Data Warehouse connection in the right pane.
- 2 Click and drag `fact_sales_detail` to the middle pane, and change the new object name to `fact_sales_analysis`.

Note: Do not make any changes to the table definition and click **Finish** when asked if you want to create and load the table now.

- 3 Because this level of granularity is no longer required, *delete* the following columns:
 - `customer_code`
 - `product_code`
 - `order_date`

- ship_date
- dim_order_date_key
- unit_sale_price
- order_number
- order_line_no

Note: A new column has appeared - dss_fact_table_key. This is used to identify which fact table has populated a row in the rollup fact table and should not be removed. The dss_update_time field must also be present to record the time that the record was updated in the data warehouse

- 4 In the left pane click the **fact_sales_analysis** table. In the right pane open **fact_budget** and drag **budget_quantity** and **budget_sales_value** into the middle pane (within **fact_sales_analysis**).
- 5 In the right pane open **fact_forecast** and drag **forecast_quantity** and **forecast_sales_value** into the middle pane (within **fact_sales_analysis**).
- 6 In the left pane, right click on **fact_sales_analysis** and select **Create (ReCreate)**.
- 7 In the left pane, again right click on **fact_sales_analysis** and select **Properties**. In the Update Procedure field select (Build Procedure...) and then click OK.
- 8 Rollup tables are rolled up via a dimensional hierarchy. You will be given the opportunity to specify what to roll up on. From the dialog "Define rollup date dimension and column" select the following then click OK:
 - Date dimension - **dim_ship_date**
 - Rollup column - **ship_cal_month**:

Define Rollup date dimension and column

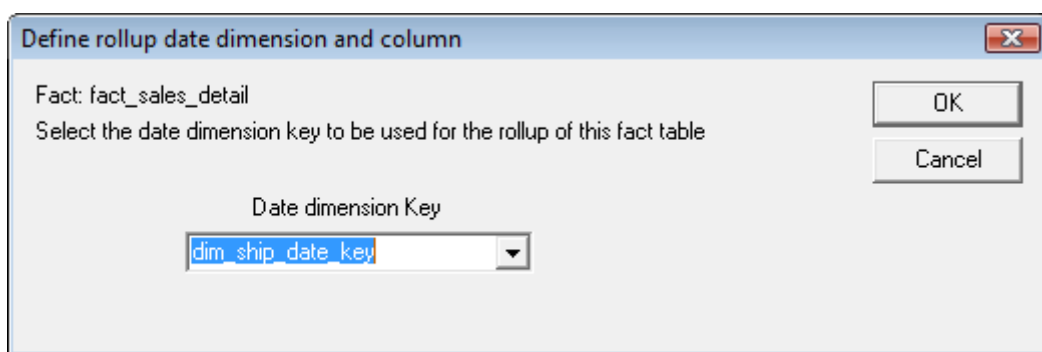
Identify the Date dimension that will be used as the basis for the rollup.
Then select the column that this fact table rolls up to (e.g. Cal_Month)
If no date rollup is required, Select the date dimension key as the rollup column.

Date Dimension: **dim_ship_date**

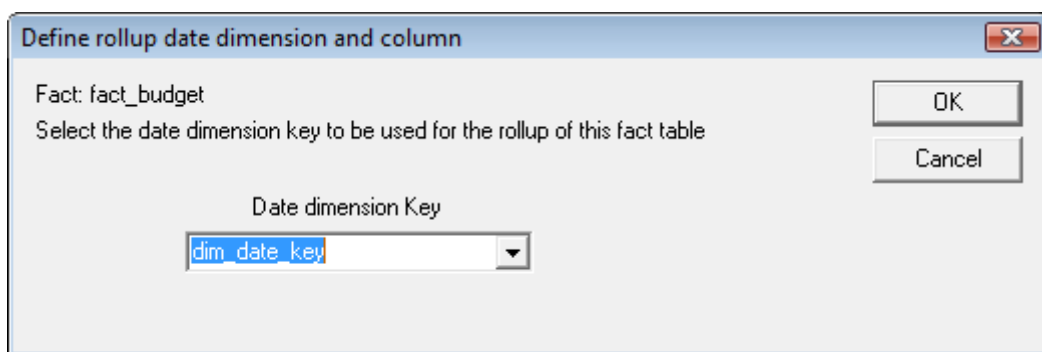
Rollup Column: **ship_cal_month**

OK Cancel

- 9 Now select the date dimension for each of the detail tables. For **fact_sales_detail**, choose **dim_ship_date_key** and click OK:



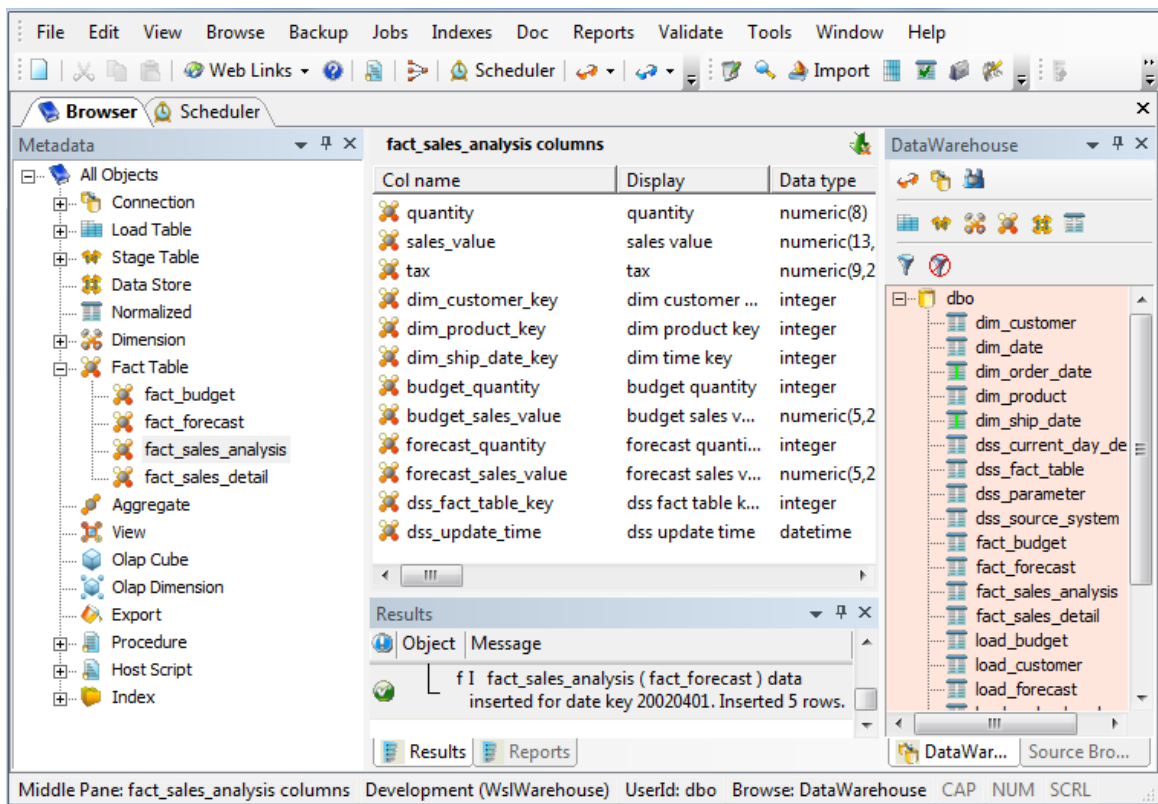
For fact_budget choose **dim_date_key** and click OK:



Finally for fact_forecast again choose **dim_date_key** and click OK. This is required so QAD Data Warehouse Designer knows which dimension to use to rollup each of these detail fact tables.

- 10 Populate the fact rollup table by clicking the right mouse button on **fact_sales_analysis** and choosing Execute Update Procedure.

Your QAD Data Warehouse Designer screen should look like this when you have finished:



You are now ready to proceed to the next step - **Aggregate Tables** (see "2.7 Aggregate Tables" on page 82)

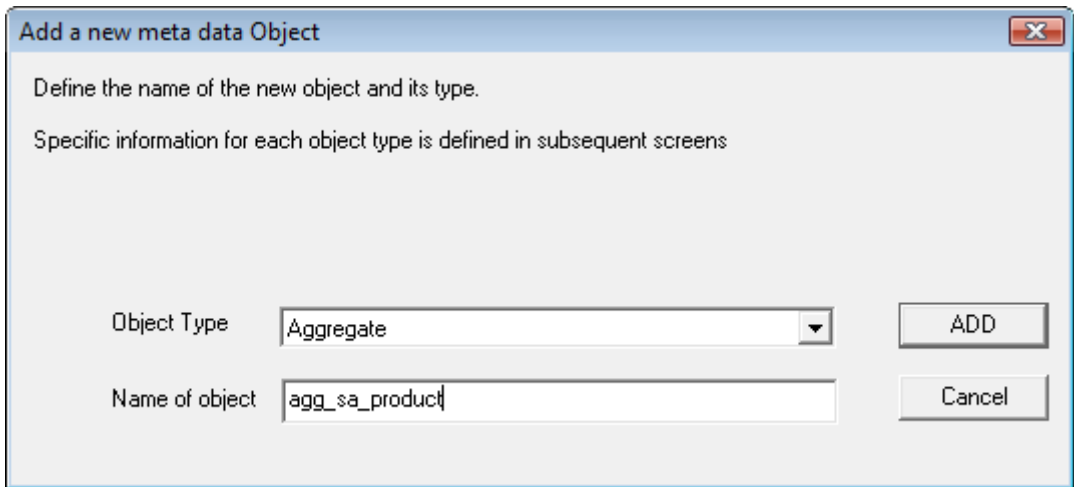
2.7 Aggregate Tables

Aggregate tables are used to improve performance. They provide a subset of the main fact table which the end user tools can navigate for a faster query time. An aggregate is typically created by the deletion of items that don't make sense when summarized and by deleting one or more of the dimension keys.



TIP: It is common practice to create two or more aggregate tables for large fact tables.

- 1 Double Click on the **Aggregate** object group in the left pane. Refresh the Data Warehouse source table in the right pane (F5).
- 2 From the right pane drag **fact_sales_analysis** into the middle pane, changing the name to **agg_sa_product**.



Add a new meta data Object

Define the name of the new object and its type.

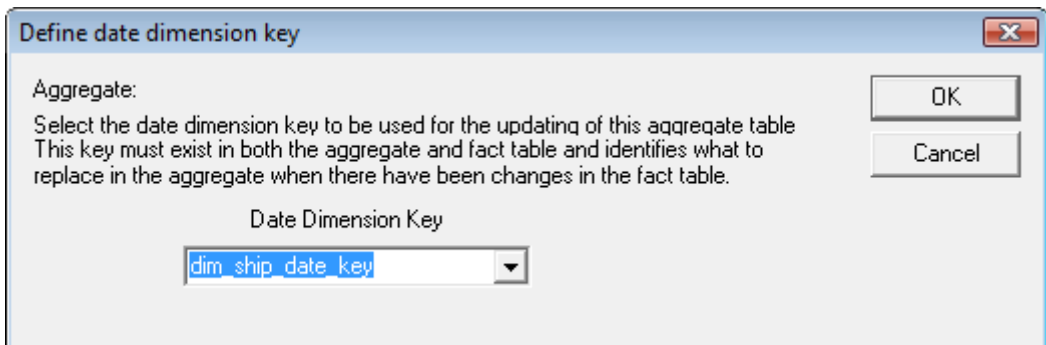
Specific information for each object type is defined in subsequent screens

Object Type: Aggregate

Name of object: agg_sa_product

Buttons: ADD, Cancel

- 3 Click Add, then click OK from the Properties dialog.
- 4 Delete `dss_fact_table_key` so that data can be summarized from various source fact tables. Also delete `dim_customer_key` and `dss_update_time`.
- 5 Create the aggregate table.
- 6 In the left pane right click `agg_sa_product` and select **Properties**. Select (Build Procedure...) in the Update Procedure field.
- 7 Select `dim_ship_date_key` as the date dimension key



Define date dimension key

Aggregate:

Select the date dimension key to be used for the updating of this aggregate table
This key must exist in both the aggregate and fact table and identifies what to replace in the aggregate when there have been changes in the fact table.

Date Dimension Key: dim_ship_date_key

Buttons: OK, Cancel

- 8 Click OK and update the table.

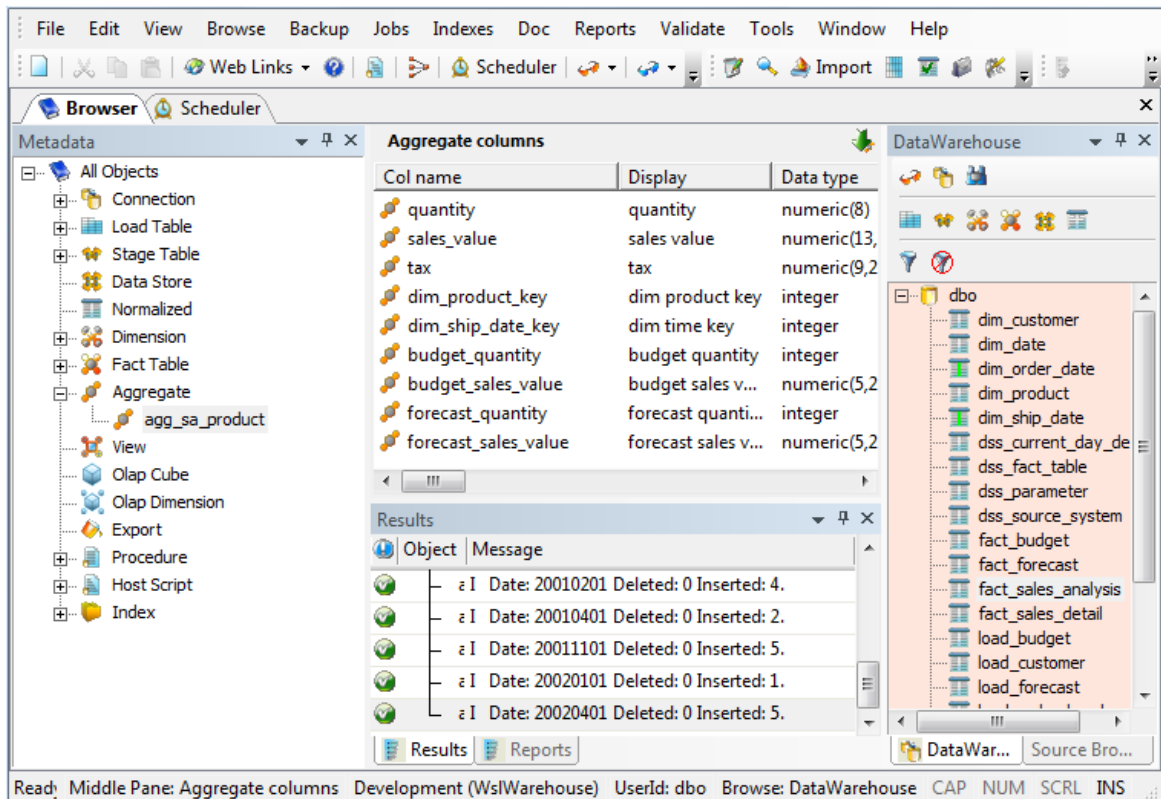


TIP: For Oracle data warehouses. If you receive an "insufficient privileges" notification in the Procedure Results, you need to grant the following privileges to the data warehouse user:

- * Create materialized view
- * Query rewrite

If you are unable to do this for any reason, contact your database administrator.

Your QAD Data Warehouse Designer screen should look like this when you have finished:

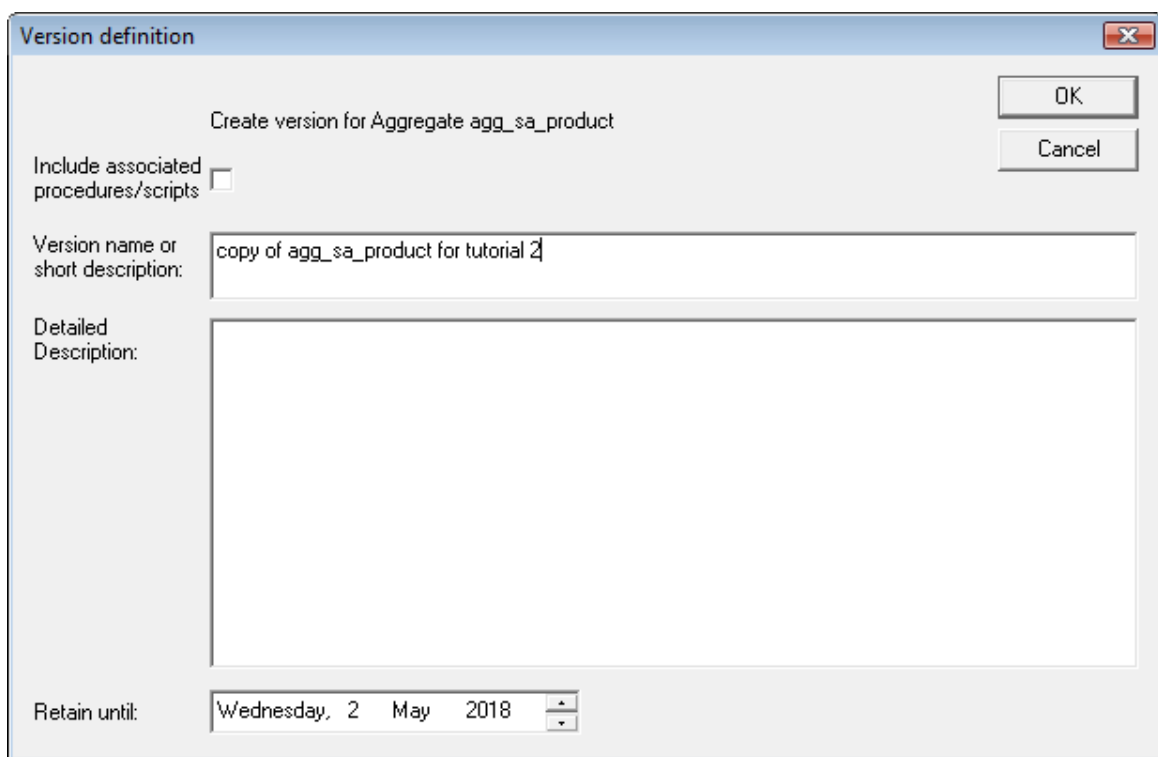


You are now ready to proceed to the next step - **Creating a Customer Aggregate** (see "2.8 Creating a Customer Aggregate" on page 84)

2.8 Creating a Customer Aggregate

This aggregate uses an alternative process to that described in **Aggregate Tables**. For this process we will create a version of the product aggregate table's metadata and create a new aggregate from this version.

- 1 With the right mouse button, click on `agg_sa_product` and select Version Control / New Version.
- 2 The following screen displays.



The image shows a 'Version definition' dialog box. At the top, it says 'Create version for Aggregate agg_sa_product'. There are 'OK' and 'Cancel' buttons in the top right. Below that is a checkbox labeled 'Include associated procedures/scripts'. The 'Version name or short description:' field contains the text 'copy of agg_sa_product for tutorial 2'. The 'Detailed Description:' field is a large empty text area. At the bottom, the 'Retain until:' field shows a date picker set to 'Wednesday, 2 May 2018'.

Version definition

Create version for Aggregate agg_sa_product

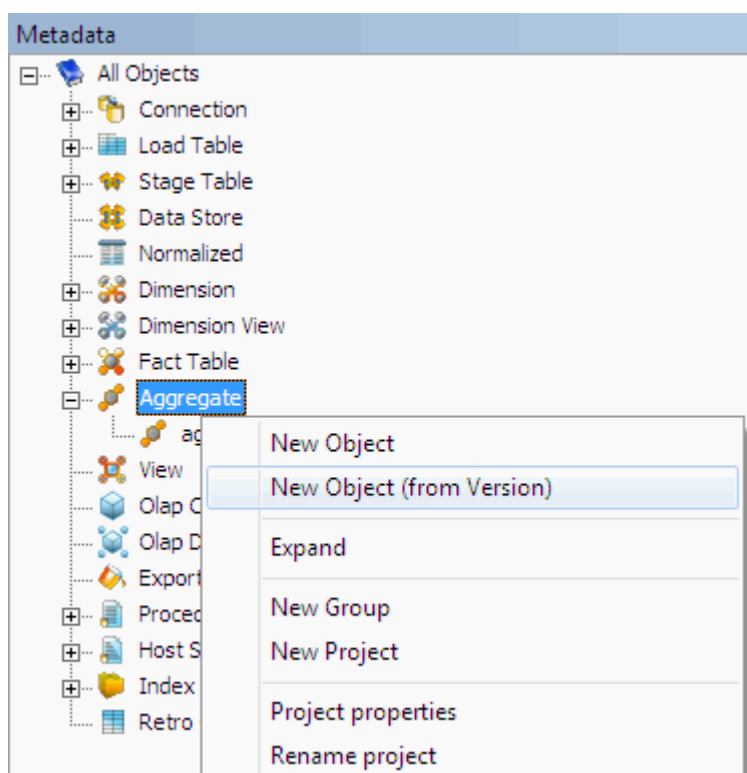
Include associated procedures/scripts ☐

Version name or short description: copy of agg_sa_product for tutorial 2

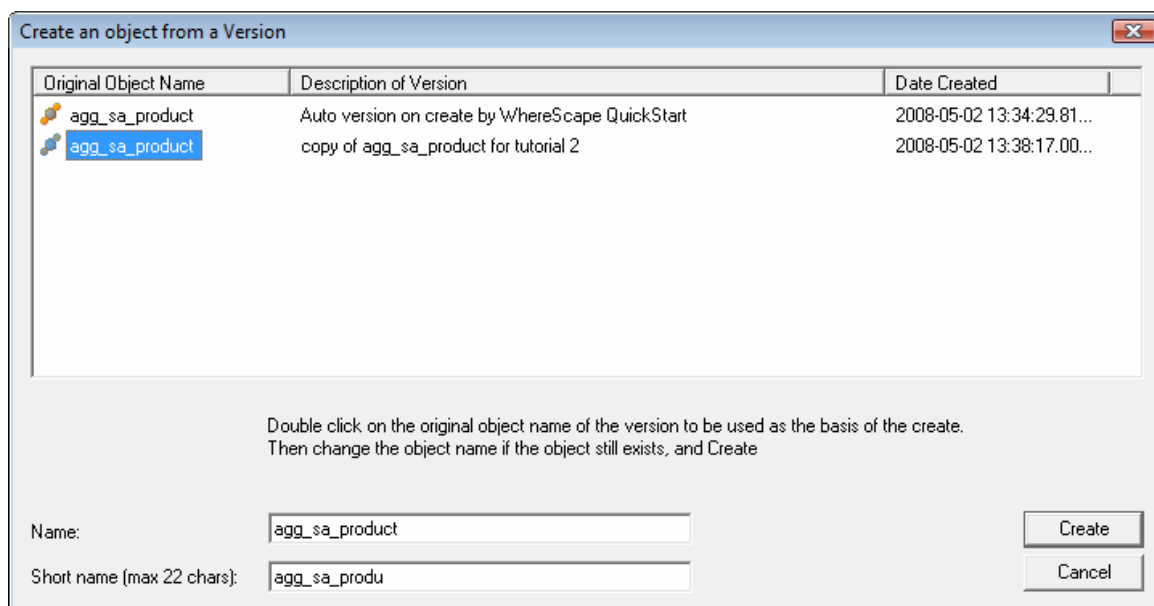
Detailed Description:

Retain until: Wednesday, 2 May 2018

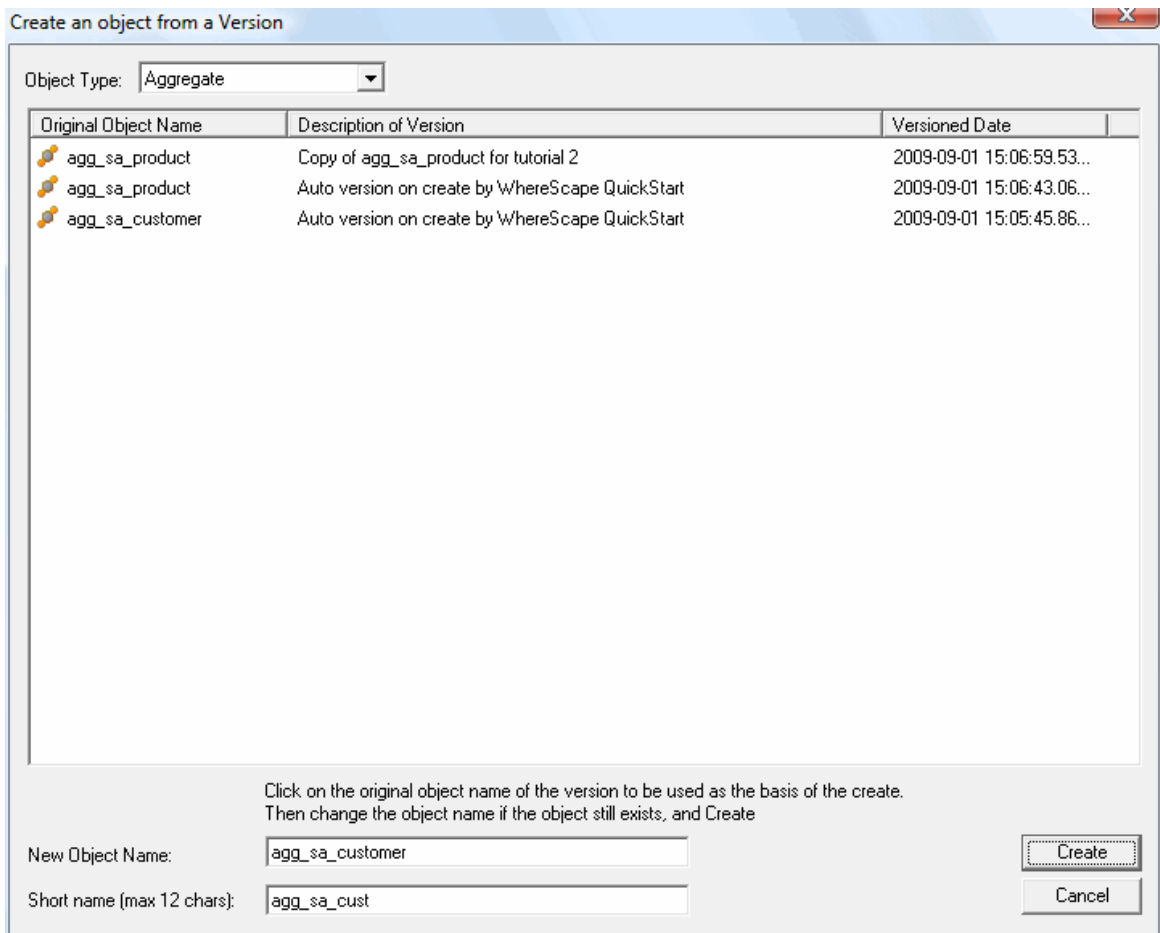
- 3 Enter a name for the new version and click OK.
- 4 In the left pane, right click on **Aggregate** and select **New Object (from Version)**:



- 5 Double click on the name `agg_sa_product` to select it.



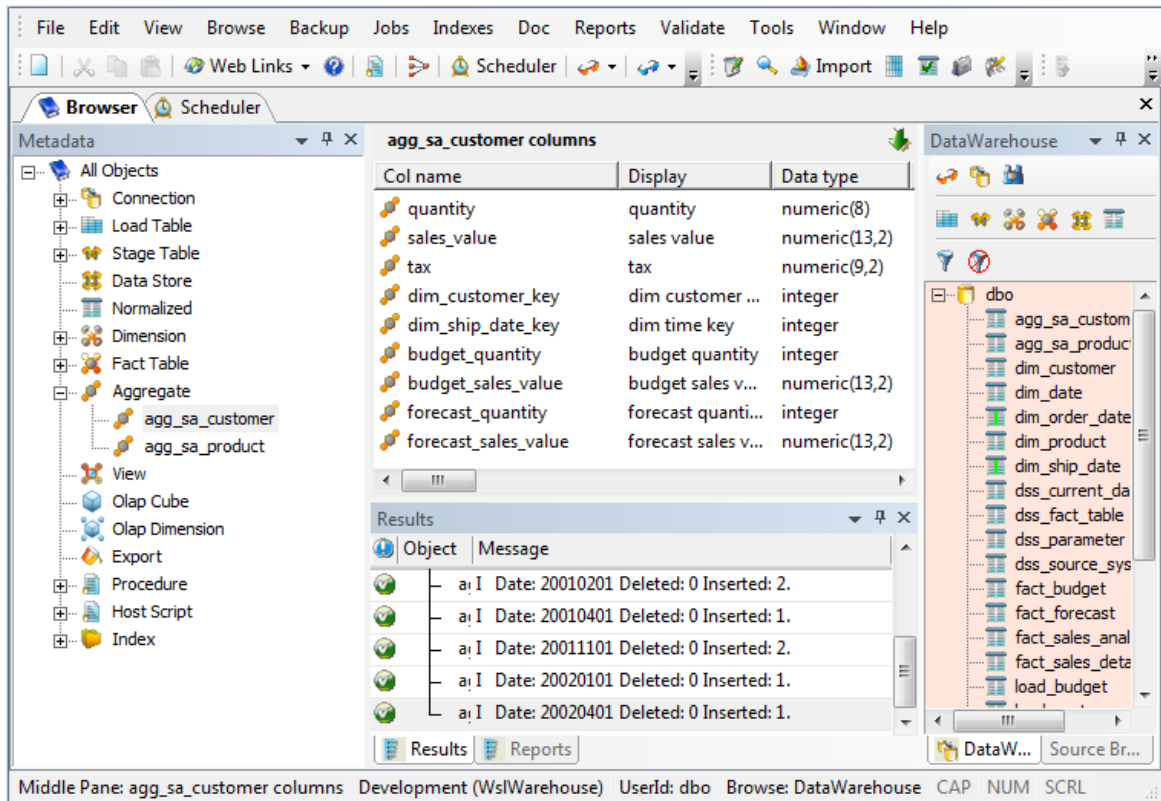
- 6 Change the name and short name to `agg_sa_customer`. Click Create.



Note: Short names are used by QAD Data Warehouse Designer to derive names for associated objects (such as index, procedures, cursor, etc). The table short name is limited in size to 22 characters in Oracle and SQL Server and to twelve characters in DB2. It must be unique.

- 7 Select the new **agg_sa_customer** table in the left pane.
- 8 Delete the **dim_product_key** column, as this will be a customer and not a product based aggregate.
- 9 Browse to the Data Warehouse and from the **fact_sales_analysis** table, drag **dim_customer_key** into the middle pane.
- 10 In the left pane right click **agg_sa_customer** and select **Create (ReCreate)**.
- 11 In the left pane right click **agg_sa_customer** and select **Properties**. For the Update Procedure field select (Build Procedure...).
- 12 Select **dim_ship_date_key** as the date dimension and click on OK.
- 13 Update the table using the right mouse menu from the table name.

Your QAD Data Warehouse Designer screen should look like this when you have finished:



CHAPTER 3

Tutorial 3 - Scheduling and Dependencies

Before you start on this chapter you should have:

- Completed *Tutorial 1 - Basic Star Schema Fact Table* (on page 3)
- Successfully completed *Creating a Fact Table* (see "*1.12 Creating a Fact Table*" on page 48)

This chapter deals with the scheduling of the data warehouse objects created in the first tutorial.

We will cover the scheduling of a job and the editing of both the dependencies and the job.

In This Chapter

3.1 Purpose and Roadmap.....	90
3.2 Creating and Scheduling a Job.....	91
3.3 Adding Tasks	92
3.4 Task Dependencies	95
3.5 Editing a Scheduled Job	96
3.6 Job Results	98
3.7 Diagrammatical View for Jobs.....	100

3.1 Purpose and Roadmap

Purpose

The scheduler allows jobs (e.g. data loads and updates) to be run in background mode and/or at a pre-determined time.

In this tutorial you will learn (i) how to set-up jobs and their associated job tasks (ii) create task dependencies, and (iii) view job results.

This tutorial focuses on creating a job to update the fact_sales_detail star-schema created in Tutorial 1.

Tutorial Environment

This tutorial has been completed using Oracle. All of the features illustrated in this tutorial are available in SQL Server, Oracle and DB2 (unless otherwise stated). Any differences in usage of QAD Data Warehouse Designer between these databases are highlighted.

Tutorial Roadmap

Step in Tutorial	Section
Create a new job for 'Daily Update'.	Creating and Scheduling a Job
Add tasks to ▪ Load load_customer ▪ Load load_order_header ▪ Load load_order_line ▪ Load load_product ▪ Update dim_customer ▪ Update dim_date ▪ Update dim_product ▪ Update stage_sales_detail ▪ Update fact_sales_detail ▪ Analyze fact_sales_detail.	Creating and Scheduling Tasks
Setup task dependencies so that an analyze of fact_sales_detail occurs after the table has been updated.	Task Dependencies
Modify scheduling and runtime options (that is, edit the job properties).	Editing a Scheduled Job
Check job results.	Job Results

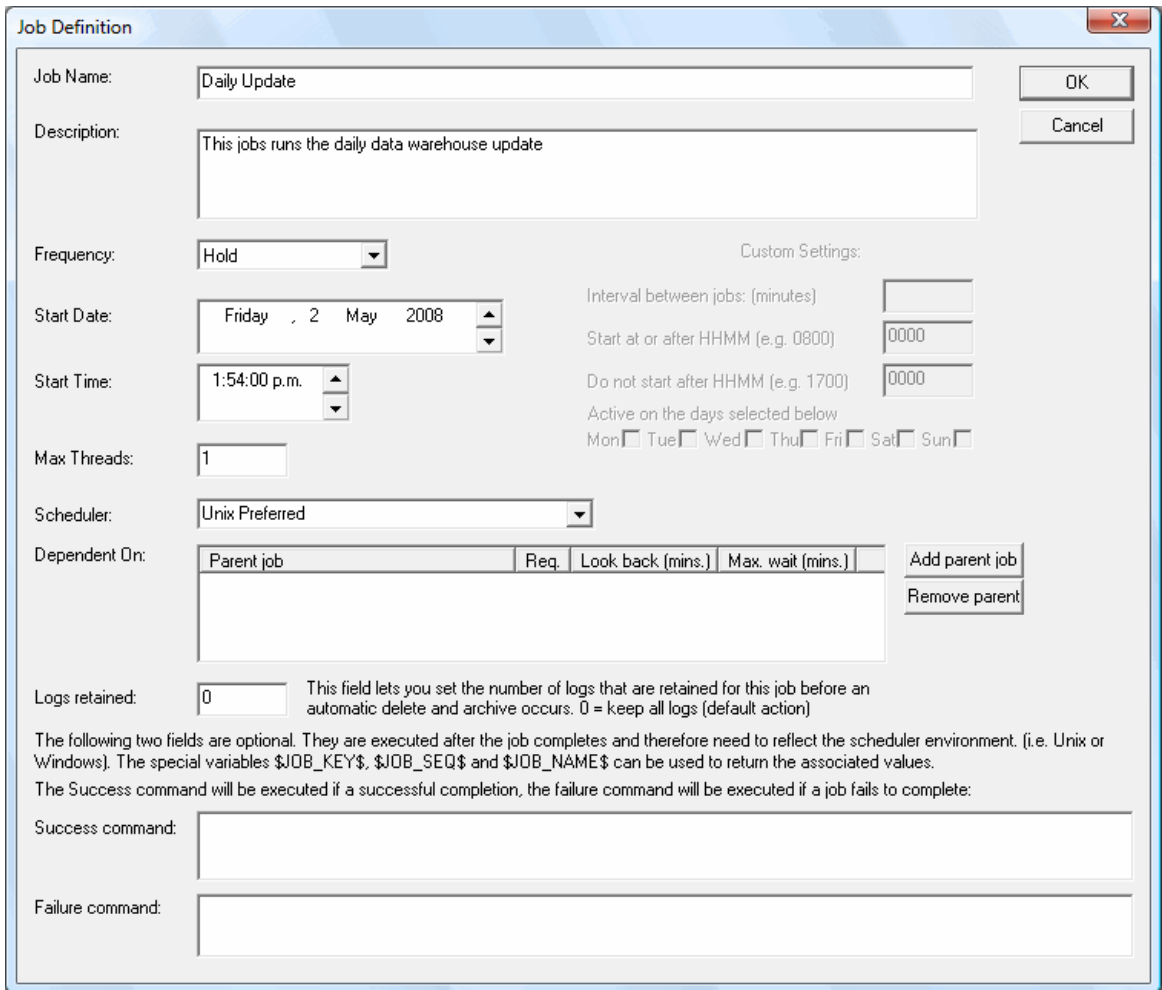
The tutorial starts with the **Creating and Scheduling a Job** (see "3.2 Creating and Scheduling a Job" on page 91) section.

3.2 Creating and Scheduling a Job

To schedule a job click on the scheduler window button . This will open the scheduler window. A new job can be initiated by selecting the File / New Job menu option.

The new job dialog will appear.

- 1 Change the job name to 'Daily Update'



The image shows a 'Job Definition' dialog box with the following fields and options:

- Job Name:** Daily Update
- Description:** This jobs runs the daily data warehouse update
- Frequency:** Hold
- Start Date:** Friday, 2 May 2008
- Start Time:** 1:54:00 p.m.
- Max Threads:** 1
- Scheduler:** Unix Preferred
- Dependent On:** Parent job
- Custom Settings:**
 - Interval between jobs: (minutes)
 - Start at or after HHMM (e.g. 0800)
 - Do not start after HHMM (e.g. 1700)
 - Active on the days selected below
 - Mon ☐ Tue ☐ Wed ☐ Thu ☐ Fri ☐ Sat ☐ Sun ☐
- Logs retained:** 0
- Success command:**
- Failure command:**

Buttons: OK, Cancel, Add parent job, Remove parent.

This field lets you set the number of logs that are retained for this job before an automatic delete and archive occurs. 0 = keep all logs (default action)

The following two fields are optional. They are executed after the job completes and therefore need to reflect the scheduler environment. (i.e. Unix or Windows). The special variables \$JOB_KEY\$, \$JOB_SEQ\$ and \$JOB_NAME\$ can be used to return the associated values.

The Success command will be executed if a successful completion, the failure command will be executed if a job fails to complete:

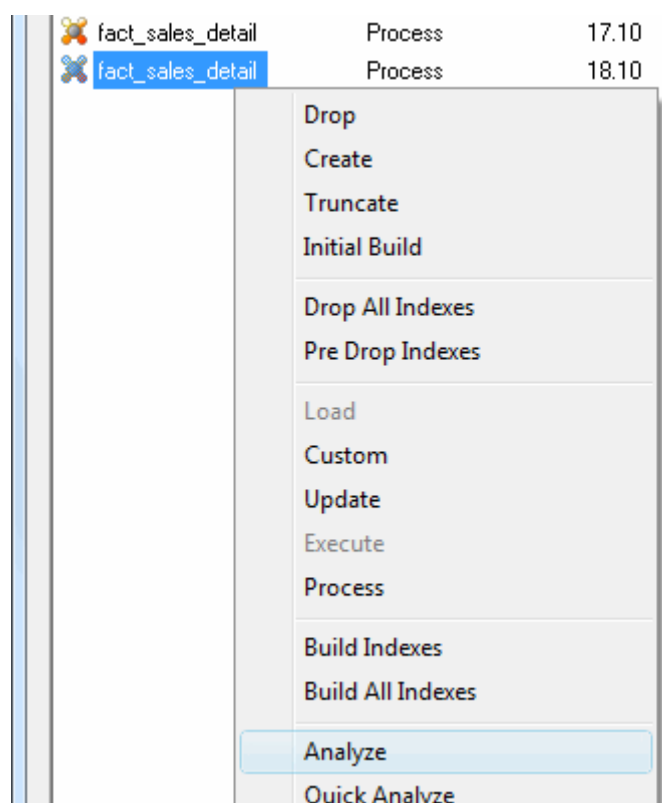
- 2 Click OK.

You are now ready to proceed to the next step - **task selection** (see "3.3 Adding Tasks" on page 92).

3.3 Adding Tasks

The task selection window contains an object tree in the right hand pane. Objects are selected from this tree and added to the scheduled list of tasks in the left hand pane. Perform the following actions to schedule an update of our fact table and dimensions.

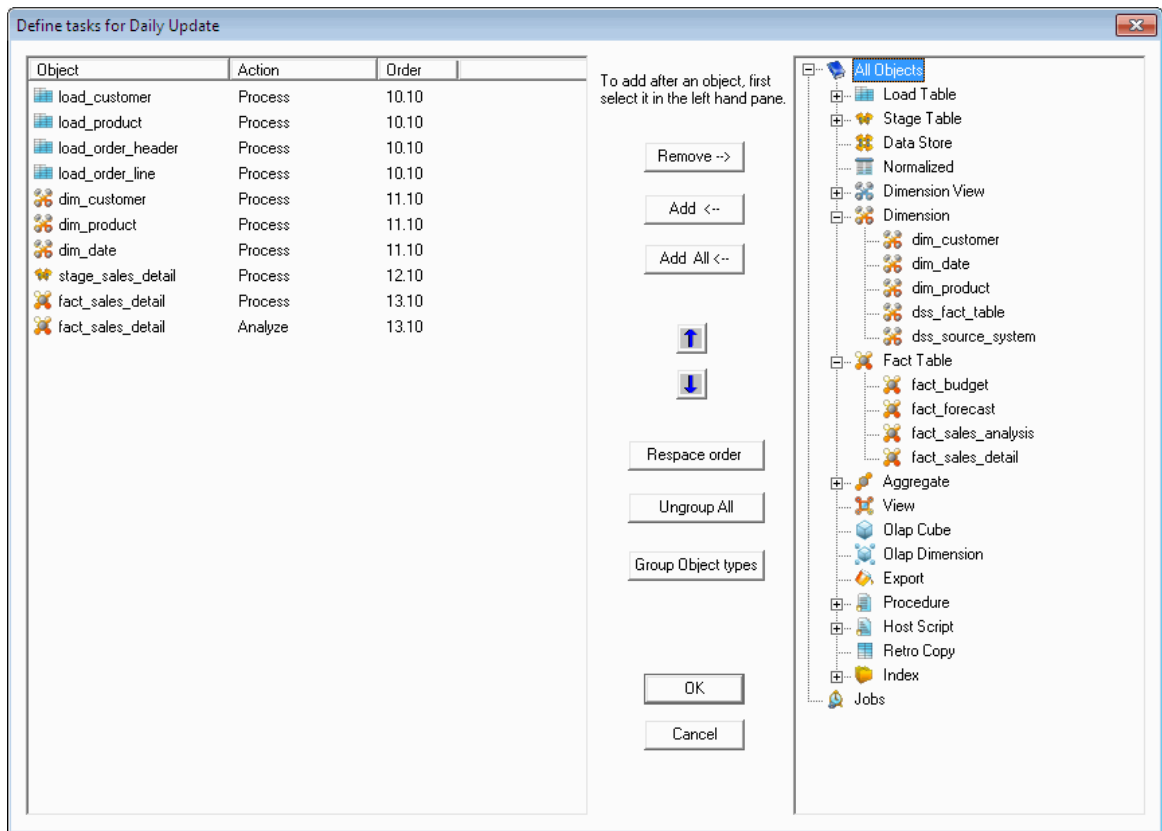
- 1** Open the object tree by double clicking on the **All Objects** project in the right hand pane.
- 2** Double click on the **Load Table** object group.
- 3** Double click on **load_product**, **load_customer**, **load_order_line** and **load_order_header**. Note that as each object is double clicked it is added to the left hand pane.
- 4** Double click on the **Dimensions** object group.
- 5** Double click on **dim_customer**, **dim_date** and **dim_product**. As each object is double clicked it is added to the left hand pane. We do not add the date views since they do not alter, only the underlying date dimension does.
- 6** Double click on the **Stage Table** object group to expand it and then double click on **stage_sales_detail** to add this object to the left hand pane.
- 7** Double click on the **Fact Table** object group to expand it and then double click on **fact_sales_detail** to add this object to the left hand pane.
- 8** Double click again on **fact_sales_detail** to add a second copy of this object to the left hand pane.
- 9** Position on the second **fact_sales_detail** object in the left hand pane and use the right mouse to bring up the pop-up menu. Select the **Analyze** option from this menu:



The 'Order' column defines the basic dependencies of the tasks. If the two numbers are the same, then the tasks can run at the same time. In this example no tasks will run at the same time. The job will process the tasks sequentially.

Click the 'Group object types' button. You will note that the order number for tasks of the same type now have the same two numbers. This will allow objects of the same type to run concurrently. (i.e. all the load tables can be processed at the same time if there are sufficient processing threads).

Your task selection window should now look like the following:



Notice that the tasks all have an action of Process with the exception of the last task which is set to 'Analyze'.

The fact table fact_sales_detail has two actions. The first will process and update the table, the second will analyze the table. At present these two actions can run at the same time. They should however be sequential. We could alter the order of the second task by using the right mouse menu option 'Increase the order'. This would be the normal method, but we will leave these two tasks with the same order and address the sequence of events in the next section.

Choose OK to close.

You are now ready to proceed to the next step - **Task Dependencies** (see "3.4 Task Dependencies" on page 95).

3.4 Task Dependencies

A scheduled job that is in a 'Hold' or 'Waiting' state can have its task dependencies altered. To alter the dependencies for our newly defined job proceed as follows:

- 1 Click on the 'All Jobs' button in the toolbar. Our daily update job will be displayed in the top pane.
- 2 Position over the job name 'Daily Update' and using the right mouse pop-up menu select Edit Dependencies. A list of the current task dependencies will be displayed. You will see that the final two dependencies are from stage_sales_detail to each of the fact table tasks:

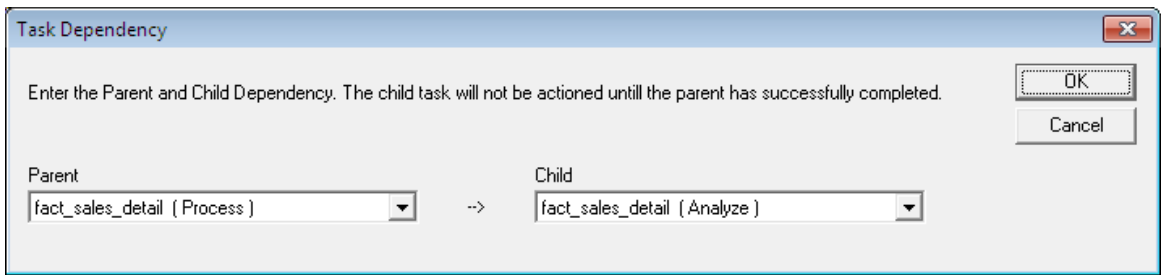
Parent Task	Parent Action	Map	Child Task	Child Action
load_customer	Process	-->	dim_customer	Process
load_customer	Process	-->	dim_date	Process
load_customer	Process	-->	dim_product	Process
load_order_header	Process	-->	dim_customer	Process
load_order_header	Process	-->	dim_date	Process
load_order_header	Process	-->	dim_product	Process
load_order_line	Process	-->	dim_customer	Process
load_order_line	Process	-->	dim_date	Process
load_order_line	Process	-->	dim_product	Process
load_product	Process	-->	dim_customer	Process
load_product	Process	-->	dim_date	Process
load_product	Process	-->	dim_product	Process
dim_customer	Process	-->	stage_sales_detail	Process
dim_date	Process	-->	stage_sales_detail	Process
dim_product	Process	-->	stage_sales_detail	Process
stage_sales_detail	Process	-->	fact_sales_detail	Process
stage_sales_detail	Process	-->	fact_sales_detail	Analyze

- 3 Position on the 'Parent task' for the last dependency and using the pop-up right mouse menu select Modify Dependency:

dim_product	Process	-->	stage_sales_detail	Process
stage_sales_detail	Process	-->	fact_sales_detail	Process
stage_sales_detail	Process	-->	fact_sales_detail	Analyze

Add Dependency
Modify Dependency
Delete Dependency

- 4 Change the Parent task from `stage_sales_detail (Process )` to `fact_sales_detail (Process )`. Click OK to record the change. An example of this change is shown in the screen shot below:



- 5 Examine the new dependency list and see that the fact processing will now occur after the stage processing and the fact analyze will occur after the fact processing.

We are now ready to release the job, which is done in the next section - ***Editing a Scheduled Job*** (see "3.5 ***Editing a Scheduled Job***" on page 96).

3.5 Editing a Scheduled Job

Our job is now all set-up and ready to be released. We need to edit the job and change it from a held job to one that the scheduler can action. Proceed as follows:

- 1 Click on the 'All Jobs' button in the toolbar. Our daily update job will be displayed in the top pane. Note that it is in an 'On Hold' state.
- 2 Position over the job name 'Daily Update' and using the right mouse pop-up menu select **Edit Job**. The job definition screen will re-appear.
- 3 Change the **Frequency** to 'Once and Hold'. This will result in the job being run and then a copy of the job being placed back in an 'On Hold' state so that it may be rescheduled for some future processing. Note that other options exist under Frequency including 'Daily', 'Custom' etc.
- 4 Change the **Start Time** to be 2 minutes from now.
- 5 Change the **Max Threads** counter to 2. This will allow two tasks to run concurrently. This may not be a big help here, as the run should be very quick.

Job Definition

Job Name: OK

Description: Cancel

Frequency: Custom Settings:

Start Date: Interval between jobs: (minutes)

Start Time: Start at or after HHMM (e.g. 0800)

Max Threads: Do not start after HHMM (e.g. 1700)

Scheduler: Active on the days selected below

Dependent On:

Parent job	Req.	Look back (mins.)	Max. wait (mins.)

Add parent job
Remove parent

Logs retained: This field lets you set the number of logs that are retained for this job before an automatic delete and archive occurs. 0 = keep all logs (default action)

The following two fields are optional. They are executed after the job completes and therefore need to reflect the scheduler environment. (i.e. Unix or Windows). The special variables \$JOB_KEY\$, \$JOB_SEQ\$ and \$JOB_NAME\$ can be used to return the associated values.

The Success command will be executed if a successful completion, the failure command will be executed if a job fails to complete:

Success command:

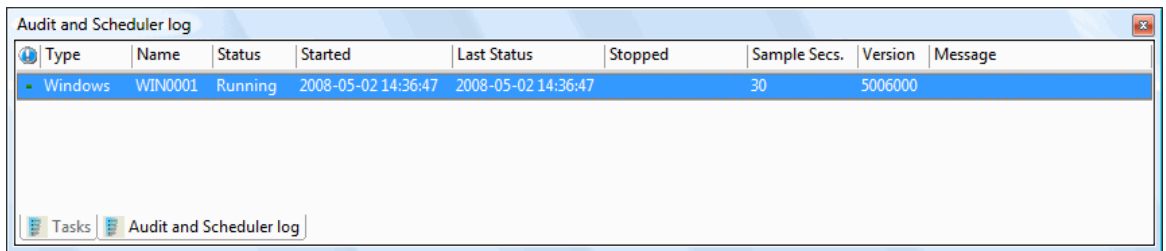
Failure command:

- 6 Click OK to save the changes.
- 7 Click on the 'All Jobs' button in the toolbar. Our daily update job will be displayed in the top pane. Note that its state should now be 'Waiting' or maybe 'Running'. If the job is in the 'Running' state we can double click on the Job name to see the state of the individual tasks.



TIP: If you don't need to change a job and wish to run it immediately, choose **Start the Job** from the job's popup menu.

- 8 If the job does not go into a 'Running' state after 30 seconds, check that a scheduler is running by clicking on the 'Scheduler Status' in the scheduler menu:



Type	Name	Status	Started	Last Status	Stopped	Sample Secs.	Version	Message
Windows	WIN0001	Running	2008-05-02 14:36:47	2008-05-02 14:36:47		30	5006000	

9 If no schedulers are running, refer to the Setup and Administration Guide on how to start a scheduler.

We are now ready to proceed to the next section - **job results** (see "**3.6 Job Results**" on page 98).

3.6 Job Results

Once a job has completed, or in fact while it is running, we can check on the results of each of the tasks by proceeding as follows:

- 1 Click on the 'All Jobs' button in the toolbar. Our daily update job will be displayed in the top pane. Note that if the job has started or is completed there will be two entries. One is in an 'On Hold' state and one is in a 'Completed', 'Running' or 'Failed' state.
- 2 Position over the job with name 'Daily Update' and in a 'Completed', 'Running' or 'Failed' state and double click the left mouse button. The individual tasks within the job will be displayed.
- 3 Position on the fact_sales_detail task with action Process and double click the left mouse button. The messages returned from this task will now be displayed. These messages should include information on any indexes dropped and created.

Your QAD Data Warehouse Designer screen should look like this when you have finished:

The screenshot shows the QAD Data Warehouse Designer interface with the Scheduler tab selected. The interface includes a menu bar (File, View, Auto, Monitor, Logs, Jobs, Scheduler, Tools, Window, Help) and a toolbar with icons for various actions. A 'Job Name Filter' is set to '%'. The 'Jobs' section displays a table of scheduled jobs, and the 'Tasks' section displays a table of tasks associated with the selected job.

Jobs Table:

Job	Status	Seq	Start	Finish	Elap...	OK	Info	De...	Warn	Error	Who
Daily Update	On Hold	28	2010-09-15 11:...								WQ
Daily Update	Comple...	29	2010-09-15 11:...	2010-09-15 11:...	00:00	10	26				WQ

Tasks Table:

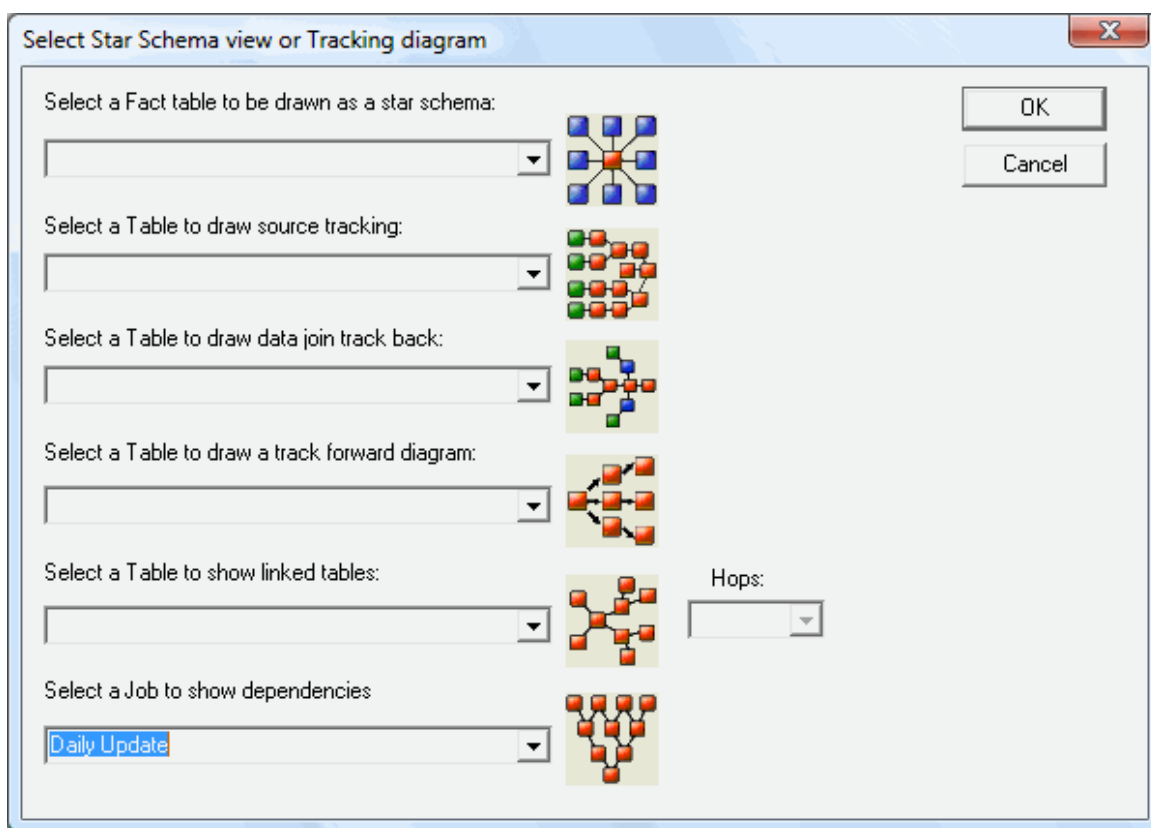
Task	Acti...	Status	Seq	Start	Finish	El...	I...	D...	W..	Result
load_customer	Proc...	Co...	29	2010-09-1...	2010-09-1...	00...	4			6 rows loaded into load_customer
load_order_h...	Proc...	Co...	29	2010-09-1...	2010-09-1...	00...	4			9 rows loaded into load_order_header
load_order_li...	Proc...	Co...	29	2010-09-1...	2010-09-1...	00...	4			21 rows loaded into load_order_line
load_product	Proc...	Co...	29	2010-09-1...	2010-09-1...	00...	4			9 rows loaded into load_product
dim_customer	Proc...	Co...	29	2010-09-1...	2010-09-1...	00...	2			dim_customer updated. 0 new records. 6 records...
dim_product	Proc...	Co...	29	2010-09-1...	2010-09-1...	00...	2			dim_product updated. 0 new records. 9 records ...
dim_date	Proc...	Co...	29	2010-09-1...	2010-09-1...	00...	2			Date Dimension updated from Jan 6 1997 12:00...
stage_sales_...	Proc...	Co...	29	2010-09-1...	2010-09-1...	00...	2			stage_sales_detail updated. 21 new records. 0 rec...
fact_sales_de...	Proc...	Co...	29	2010-09-1...	2010-09-1...	00...	2			fact_sales_detail updated. 0 new records. 21 reco...

The bottom status bar indicates: Database time at last action was 11:35:05 Development (WslWarehouse) UserId: dbo Browse: No source system CAP NUM

We are now ready to proceed to the next section - **Diagrammatical View for Jobs** (see "3.7 **Diagrammatical View for Jobs**" on page 100)

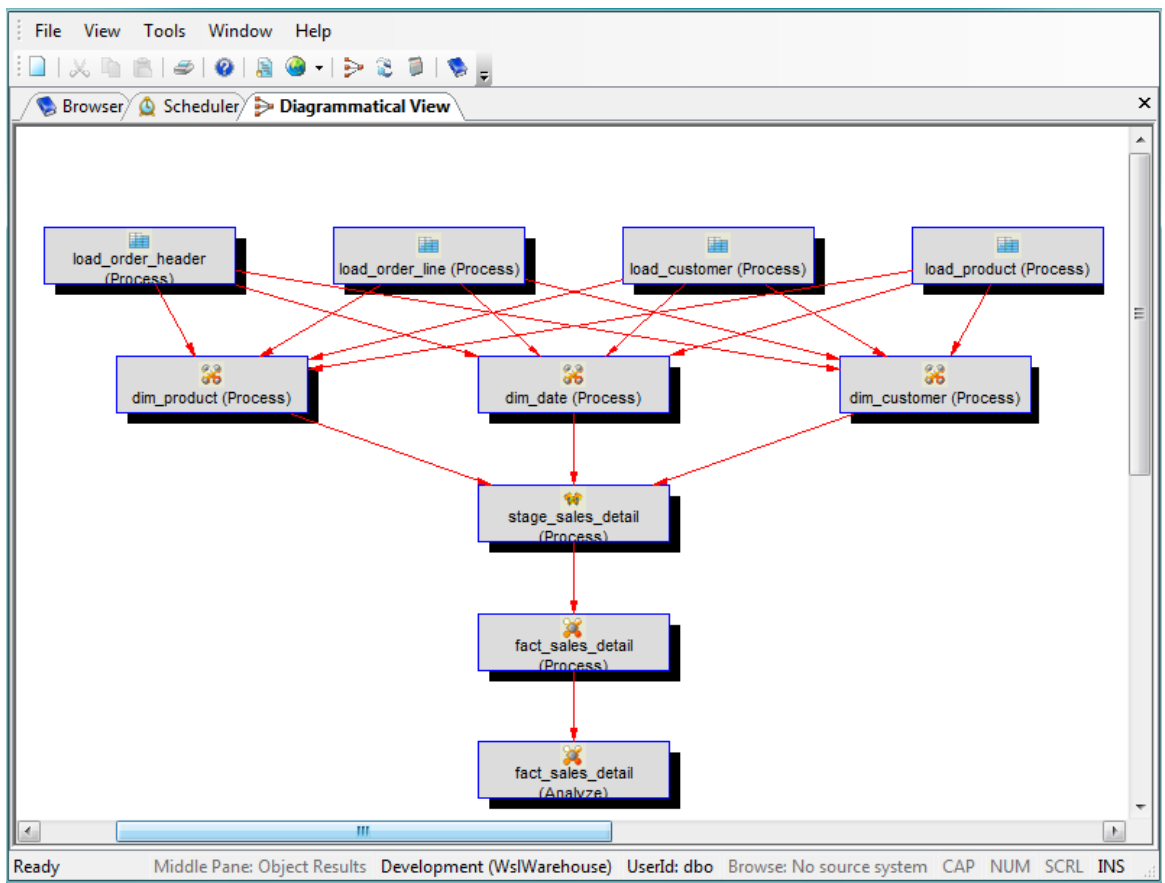
3.7 Diagrammatical View for Jobs

QAD Data Warehouse Designer provides the ability to diagrammatically view the job dependencies for the job you have created. To switch to the diagrammatical view, click on the  button. Click the button again to bring up the diagram selector box. Select a the job name from the Select a Job to show dependencies drop-down list box – in this instance Daily Update:



Click OK.

The diagram looks like this:



CHAPTER 4

Tutorial 4 - Complex Dimensions and Hierarchies

Before you start on this chapter you should have:

- Completed ***Tutorial 1 - Basic Star Schema Fact Table*** (on page 3)
- Successfully completed ***Creating a Fact Table*** (see "**1.12 Creating a Fact Table**" on page 48)

This chapter deals with fine tuning the data warehouse by creating complex dimensions and hierarchies.

In This Chapter

4.1 Purpose and Roadmap.....	104
4.2 Creating a Slowly Changing Dimension.....	105
4.3 Multiple Source Table Dimension	112
4.4 Creating a Dimension Hierarchy.....	120

4.1 Purpose and Roadmap

Purpose

This tutorial will walk you through the process to:

- Create a slowly changing dimension
- Creating a complex dimension with multiple table sources
- Adding hierarchies to a dimension for external maintenance and for use in Analysis Services cubes.

In short, this tutorial alters the existing customer and product dimensions. The customer dimension is converted to a slowly changing dimension and the product dimension has its content enriched from additional data sources. Hierarchies are built on all dimensions that will be used in the next tutorial.

Tutorial Environment

This tutorial has been completed using Oracle. All of the features illustrated in this tutorial are available in SQL Server, Oracle and DB2 (unless otherwise stated). Any differences in usage of QAD Data Warehouse Designer between these databases are highlighted.

Tutorial Roadmap

This tutorial works through a number of steps. These steps and the relevant section within the chapter are summarized below to assist in guiding you through the tutorial.

Step in Tutorial	Section
Convert the customer dimension to a slowly changing dimension.	Creating a slowly changing dimension
Add additional data sources to the product dimension	Multiple source table dimension
Create hierarchies for the following tables: ▪ dim_date ▪ dim_customer ▪ dim_product	Creating a dimension hierarchy

This tutorial starts with the section ***Creating a slowly changing dimension*** (see "4.2 ***Creating a Slowly Changing Dimension***" on page 105)

4.2 Creating a Slowly Changing Dimension

The process of creating a slowly changing dimension is largely the same as creating a normal dimension. Two additional questions are asked during the dimension creation process when the 'Slowly changing dimension' button is chosen during the dimension create. In this section we will cover the more common scenario of changing an existing normal dimension to a slowly changing dimension.

The dimension `dim_customer` created in tutorial one will be changed to a slowly changing dimension.

- 1 Using the right mouse menu when positioned on the object `dim_customer` select **Properties**.
- 2 On the dimension properties change the 'Update procedure' drop down to select (Build Procedure...).
- 3 Use the 'Table Type' drop down to select 'Changing Dimension':

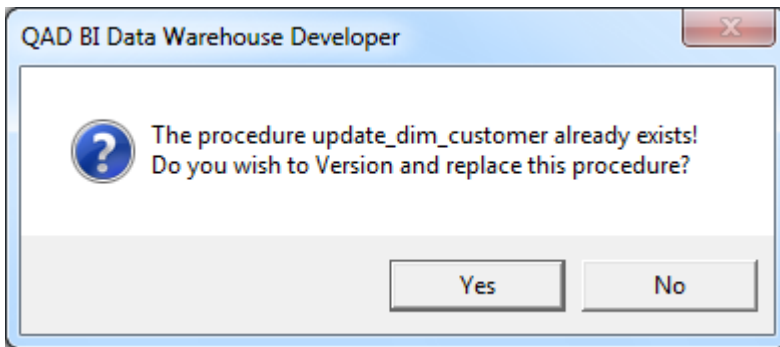
The screenshot shows the 'dim_customer table definition' dialog box with the following fields and values:

- Table Name:** `dim_customer`
- Short Name. Must be unique and no more than 22 chars long:** `dim_customer`
- Business Display Name (EUL):** `dim_customer`
- Description:** (Empty text area)
- Update Procedure:** `update_dim_customer` (with **Edit** and **Rebuild** buttons)
- Custom Procedure:** (Empty dropdown)
- Table Properties clauses: (e.g. Partition)** (Empty text area)
- Get Key Function:** `get_dim_customer_key` (with **Edit** button)
- Date table structure last updated:** `2005-11-17 14:36:00`
- Date created in database:** `2007-11-23 11:55:01`
- Date last updated in database:** `2007-11-23 11:55:01`
- Mnemonic (EUL):** (Empty text field)
- Table Type:** `Changing Dimension` (selected from the dropdown menu)

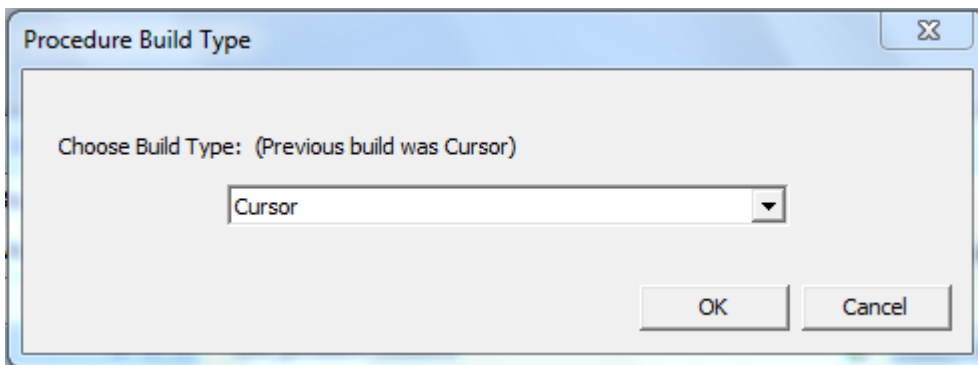
At the bottom of the dialog are **OK**, **Cancel**, and **Apply** buttons.

- 4 Click **OK** to leave the properties page.

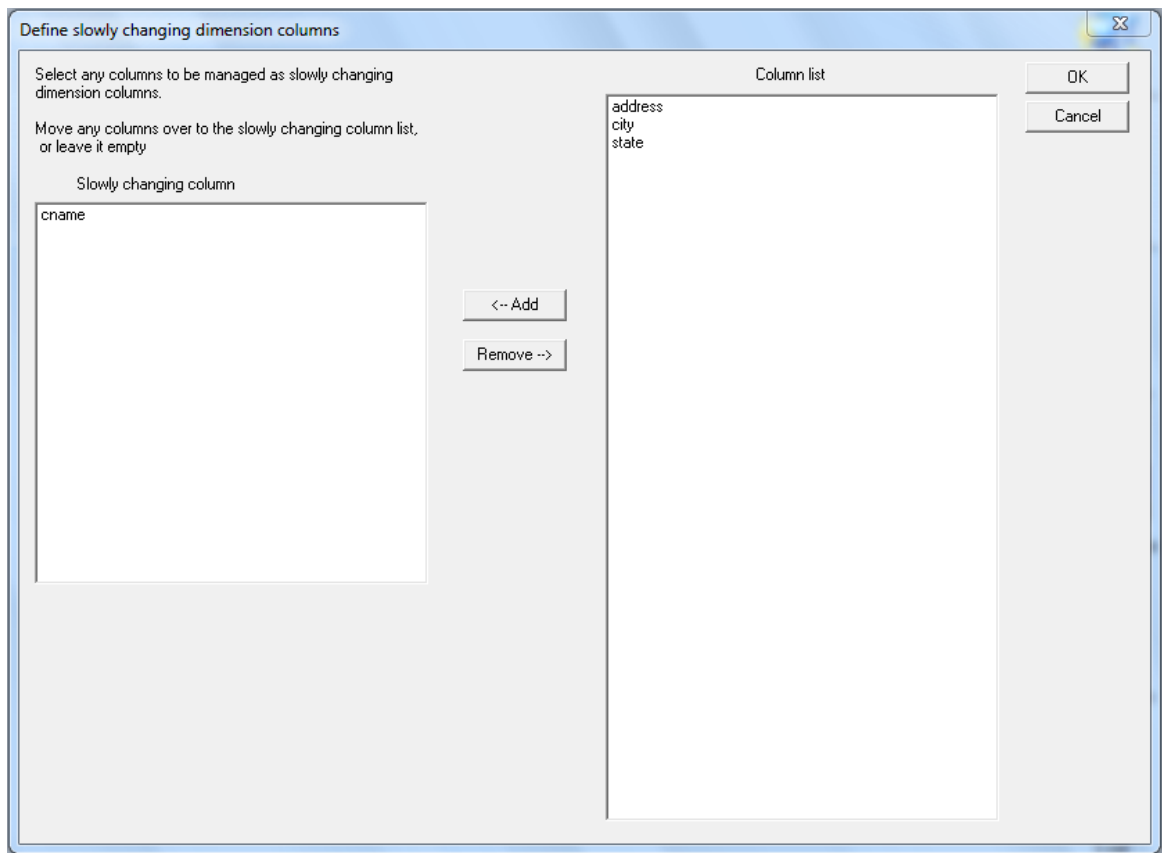
- 5 You will be asked if you wish to version and replace the update and get key procedures. Answer Yes to both prompts.



- 6 A Procedure Build Type dialog will appear. Select Cursor.

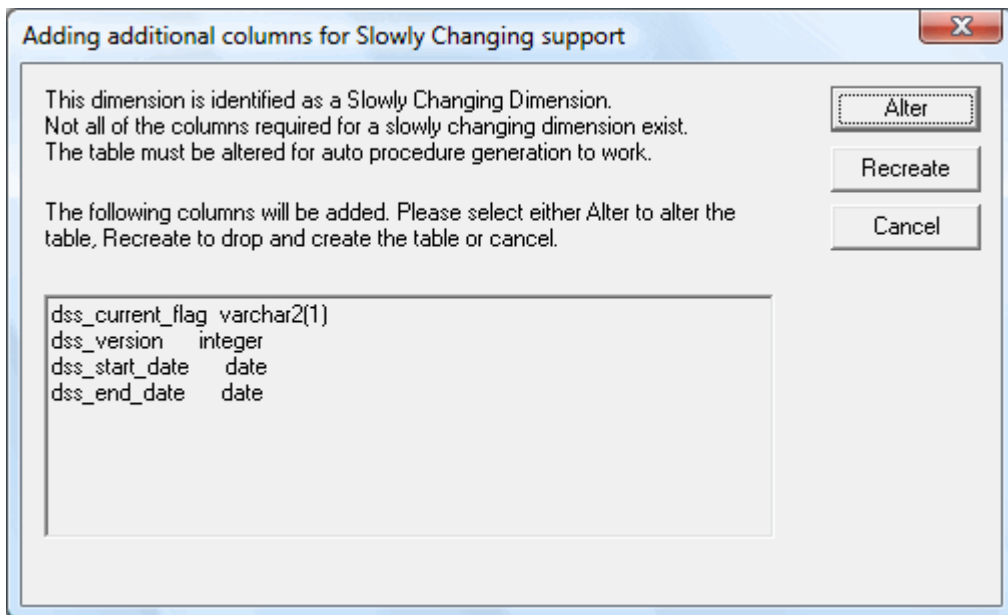


- 7 The 'Define dimension business key(s)' dialog will be presented. The existing business key 'code' should already be the default value so click OK to proceed to the next screen.
- 8 The 'Define slowly changing dimension columns' dialog will now be presented. Multiple columns can be selected to be handled as slowly changing. Select 'name' and add it to the list of slowly changing columns. Double click on the column 'cname':

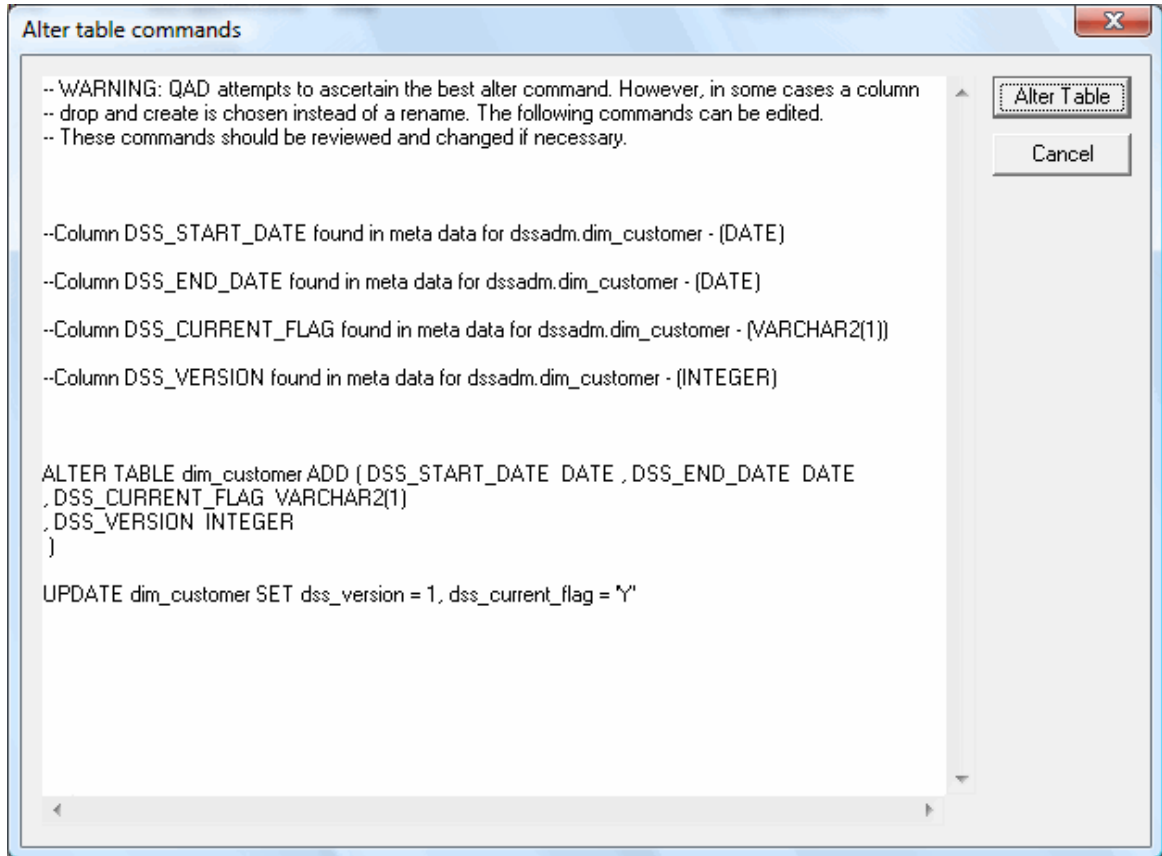


- 9 Click OK. Refer to the Dimensions chapter for an explanation of slowly changing dimensions.

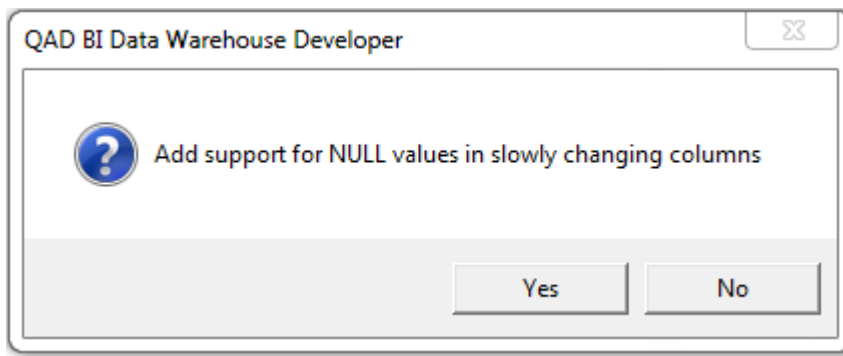
- 10** A dialog box will appear indicating that a number of additional columns will need to be added to the dimension table in order to support a slowly changing model. The table can be Altered (i.e. the columns added to the table) or re-created. As we have fact tables that use this dimension we cannot re-create the table. To do so would make all of the joins in the fact tables to this dimension invalid. Therefore we will alter the dimension. Click the 'Alter' button.



- 11** A dialog will now be presented with the SQL commands that will be executed to add the new columns and set default values for the `dss_version` and `dss_current_flag` columns. Click the 'Alter Table' button to alter the table in the database. It is worth noting that whenever a database table is altered from within QAD Data Warehouse Designer the SQL commands should be reviewed. These commands can be changed if a different result is required.



- 12** A message box will appear informing you that the table was altered in the database. Click OK.
- 13** A dialog box will appear asking if you want to allow NULL support for the slowly changing columns. The normal response would be No. Refer to the Dimensions chapter for a detailed explanation. Click the 'No' button.

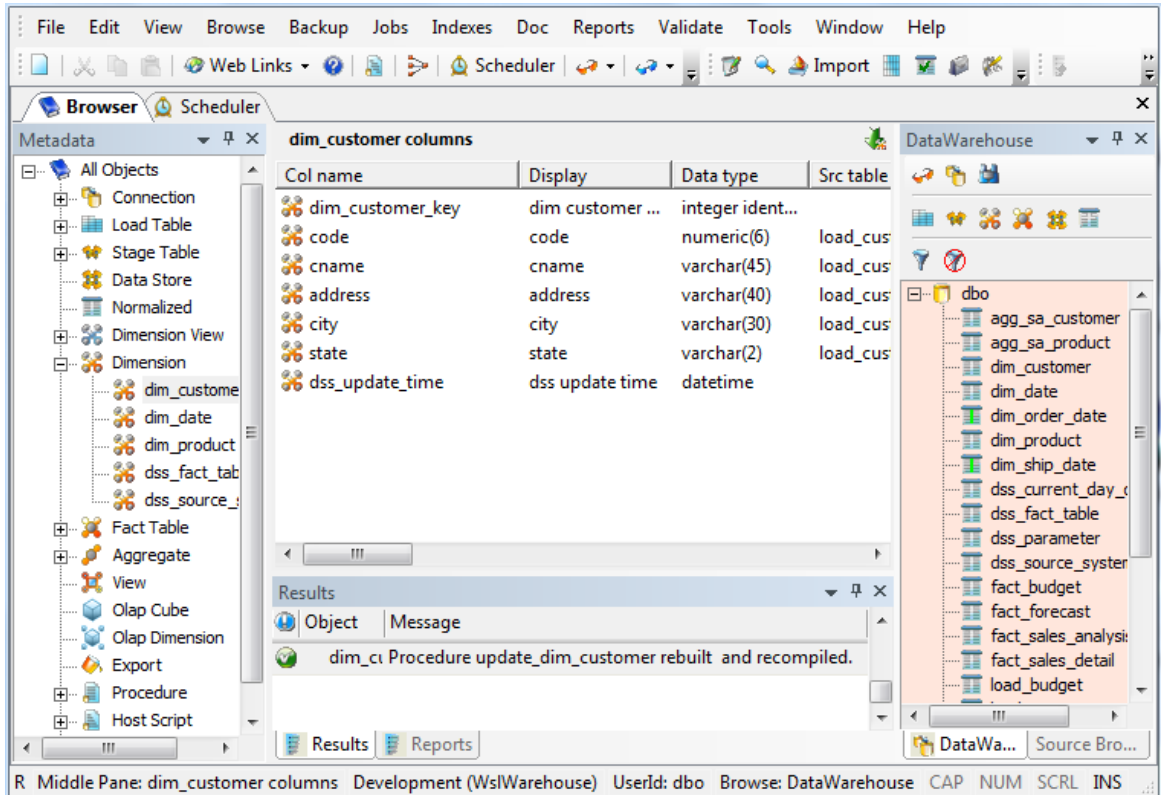


- 14** The results dialog will show the indexes that were created / re-created for the dimension.

Note: there is a new index with a suffix of _SC to support the slowly changing dimension.

The dimension has now been converted to a slowly changing dimension. If a customer now has a name change a new version of the customer record will be created to allow the tracking of the customer by both the old and new name.

Your QAD Data Warehouse Designer screen should look like this when you have finished:



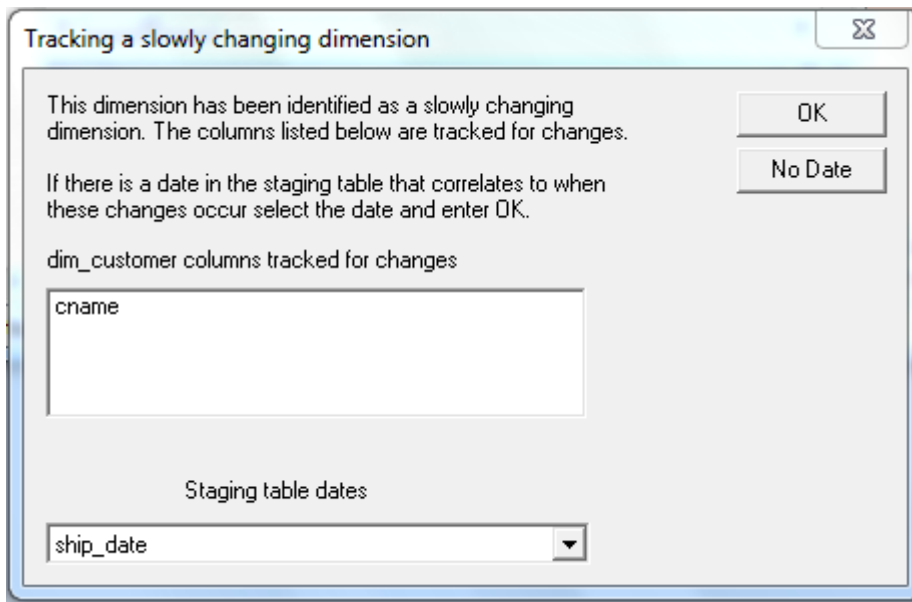
Note: This conversion to a slowly changing dimension has changed the get key function for the dimension. This function is called from the stage tables that use this dimension. We must now rebuild the update procedures for the stage tables that use this dimension.

Rebuild Stage Update Procedures

As the customer dimension is used in the stage tables stage_sales_detail, stage_budget and stage_forecast we will need to rebuild these procedures. Proceed as follows:

- 1 Select the stage_sales_detail table and using the right mouse menu choose Properties.
- 2 Use the 'Update procedure' drop down to select (Build Procedure...).
- 3 Click OK to leave the properties page.
- 4 Answer YES to the procedure versioning question.
- 5 Select Cursor for the procedure type.
- 6 Click OK on the screen informing of multiple source tables.
- 7 Accept the previous entries by clicking OK on the cursor mapping screen.

- 8 Click OK on the business key join for each of the dimensions. The previously chosen business key should be the default value provided.
- 9 An additional dialog will appear after the customer dimension join. Select **ship_date** from the date list and click OK.



- 10 Click OK on any other dimension joins and the business key from the stage table.
- 11 The update procedure will now be rebuilt to handle the fact that the customer dimension is now slowly changing. Repeat steps (1) through (10) for the other stage tables **stage_budget** and **stage_forecast**. Use the dates **budget_date** and **forecast_date** to track the dimension changes.

You have successfully converted the dimension **dim_customer** to a slowly changing dimension, and made all dependent changes.

You are now ready to proceed to the next section - **Multiple Source Table Dimension** (see "4.3 Multiple Source Table Dimension" on page 112)

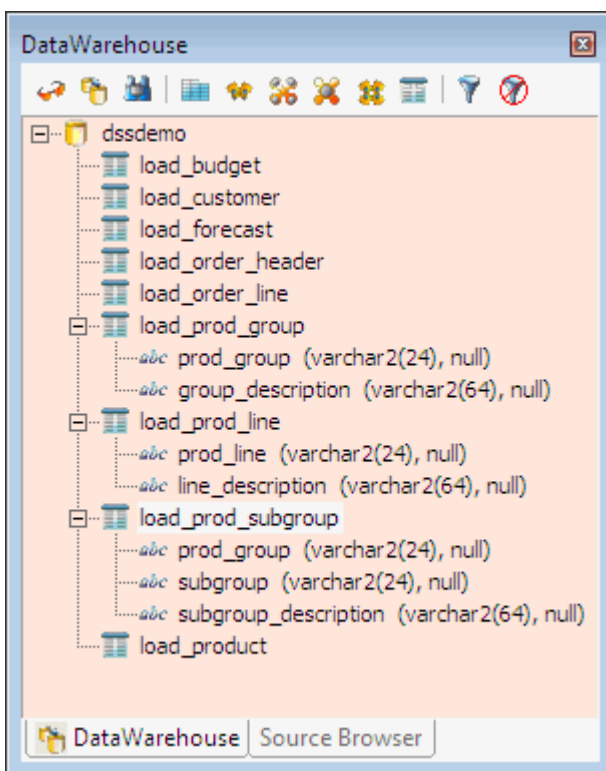
4.3 Multiple Source Table Dimension

Dimensions typically get their information from multiple sources. A common scenario is to have a series of codes that relate to the dimension. The description of these codes are often stored in a code lookup table. The following example will clarify the practice of producing a dimension from multiple source tables.

The dimension **dim_product** created in tutorial one will be enhanced to provide additional descriptions for the code values already present.

- 1 Browse to the tutorial connection that was created in tutorial one. Click on the blue glasses or select the Browse/Source tables menu option. The tutorial tables should now be shown in the right hand pane.
- 2 We need to acquire a number of additional source tables from the tutorial database. Double click on the **Load Table object group** in the left hand pane. This will list all the load tables in the middle pane and make the middle pane a drop target for additional load tables.

- 3 Select the **prod_group** table from the right hand pane and holding the left mouse down drag to the middle pane. Click **Add** to add the new object and then **OK** on the properties screen. Select the 'Create and Load' button.
- 4 Repeat steps (2) and (3) above to bring in and load from the **prod_subgroup** and **prod_line** tables.
- 5 In the left hand pane click on **dim_product**. This will display all of the dimension columns in the middle pane and make the middle pane a drop target for additional dimension columns. We will be adding descriptions to it.
- 6 Browse to the Data Warehouse connection. The right hand pane should now show the data warehouse tables. You can position the mouse in this right hand pane and select the right menu option 'Filter - Load' to restrict the display to just load tables.
- 7 Expand **load_prod_group**, **load_prod_subgroup** and **load_prod_line** by double clicking on each table name.



- 8 Drag **group_description** from **load_prod_group** into the middle pane. This will add it to the product dimension columns.
- 9 Drag **subgroup_description** from **load_prod_subgroup** into the middle pane. This will add it to the product dimension columns.
- 10 Drag **line_description** from **load_prod_line** into the middle pane. This will add it to the product dimension columns.

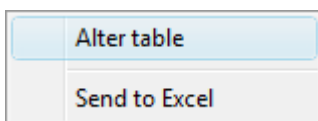
- 11 Review the product columns displayed in the middle pane. Expand the 'source table' column to see that we now have four different tables that contribute to the dimension:

dim_product columns				
Col name	Display	Data type	Src table	Src column
 dim_product_key	dim product key	integer		dim_product_key
 code	code	number(6)	load_product	code
 description	description	varchar2(64)	load_product	description
 prod_line	prod line	varchar2(24)	load_product	prod_line
 prod_group	prod group	varchar2(24)	load_product	prod_group
 subgroup	subgroup	varchar2(24)	load_product	subgroup
 group_description	group descript...	varchar2(64)	load_prod_group	group_description
 subgroup_description	subgroup desc...	varchar2(64)	load_prod_subgroup	subgroup_description
 line_description	line description	varchar2(64)	load_prod_line	line_description
 dss_update_time	dss update time	date		dss_update_time

- 12 Using the right mouse menu when positioned on the object **dim_product** in the left hand pane select **Validate against database**. This option will compare the metadata as displayed within QAD Data Warehouse Designer with the physical table **dim_product** as it exists in the database. We have added new columns to the metadata in the steps above, but the physical table has not been changed. A message will appear in the middle pane as follows:

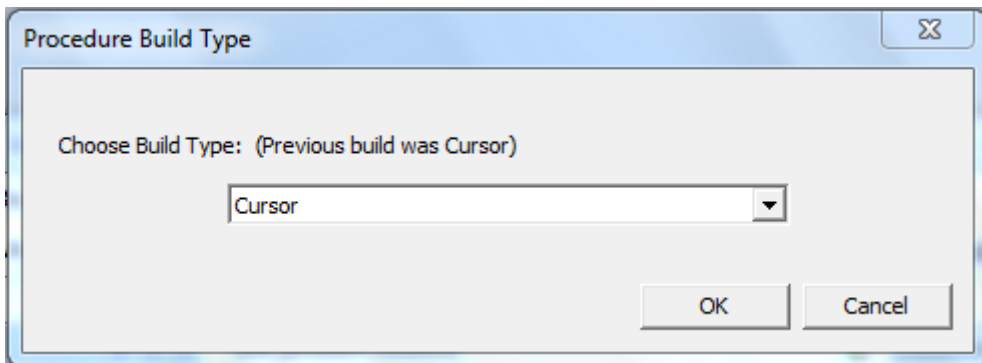
Table validation list	
Table Name	Results
 dim_product	meta->GROUP_DESCRIPTION - varchar2(64), meta->SUBG

- 13 We now need to alter the physical table in the database. The message in the middle pane shows that the metadata has additional columns not present in the dss table. We alter the table by positioning on the **dim_product** name in the middle pane and using the right mouse 'Alter Table' menu option:

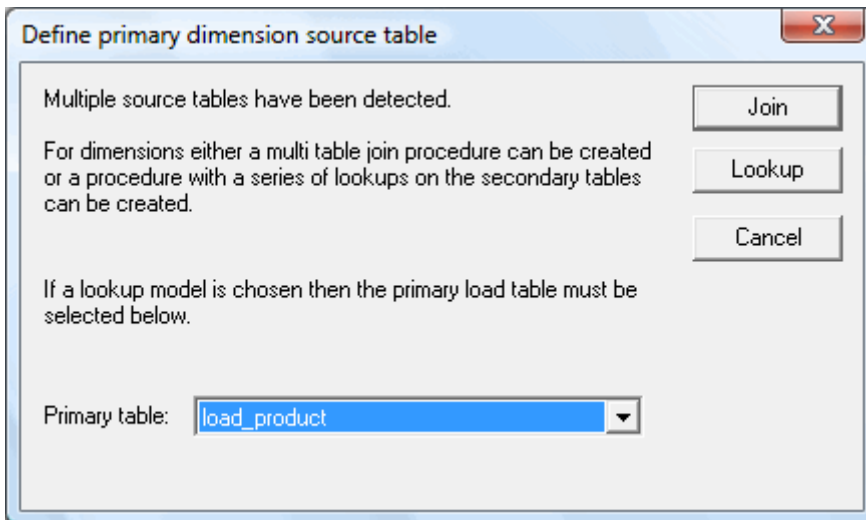


- 14 An alter table commands dialog will appear with the SQL commands that will be used to alter the database table. Click the 'Alter Table' button.
- 15 A message will display advising that the table was altered. Click OK to clear the message.
- 16 Using the right mouse menu when positioned on the object **dim_product** in the left hand pane select **Properties**.
- 17 Click **Rebuild**.

- 18 A Procedure Build Type dialog will appear. Select Cursor.



- 19 A dialog will now appear asking you to define the primary source table and to choose between a join of the source tables or a series of lookups. Refer to the Dimensions chapter for an explanation on these two choices. The `load_product` should have been selected as the primary source table. If it has not been selected then select it. Click the **Lookup** button.



- 20 The 'Define dimension business key(s)' dialog will be presented. The existing business key 'code' should already be the default value so click OK to proceed to the next screen.

- 21** The Dimension lookup definition screen should now appear. Two drop down boxes are available. The left hand drop down shows the columns for the table chosen as the primary source table. The right hand drop down shows the columns for the source table we wish to lookup. There is a reminder above the left hand drop down informing you which table is being looked up.

Dimension lookup table definition

Create the condition that defines the lookup from our primary table to the lookup table.

Select columns from each table that are used in the join and add them to the where clause

NOTE: Lookup for group_description

Multiple lookups required on this table ☐

Post Update ☐

load_product

load_prod_group

prod_group

prod_group

Add Join

Where Clause for the lookup

WHERE prod_group = @v_load_prod_group

Dimension lookup table definition ✕

Create the condition that defines the lookup from our primary table to the lookup table.

Select columns from each table that are used in the join and add them to the where clause

NOTE: Lookup for line_description

load_product load_prod_line

prod_line prod_line

Add Join

'Where' Clause for the lookup

WHERE prod_line = @v_load_prod_line

OK

Cancel

Multiple lookups required on this table ☐

Post Update ☐

Dimension lookup table definition

Create the condition that defines the lookup from our primary table to the lookup table.

Select columns from each table that are used in the join and add them to the where clause

NOTE: Lookup for subgroup_description

Multiple lookups required on this table ☐

Post Update ☐

load_product

load_prod_subgroup

subgroup

subgroup

Add Join

'Where' Clause for the lookup

```
WHERE prod_group = @v_load_prod_group
AND subgroup = @v_load_subgroup
```

Although not being used at this point there are a number of features in these dialogs which are worth noting. The first is that there is a check box to allow a table to be the source of multiple lookups. This would be used where a generic code table was used to lookup descriptions and we would need to make multiple lookups on the same table to get different descriptions. The second is that procedure variables are available in the drop down list of the primary load table. Using this feature it is possible to make lookups that are dependent on the results from previous lookups. This is done by selecting the columns that would have been populated by the earlier lookups.

The lookups require that a join be defined for the two tables involved. The relevant joins for our example are as follows. Step through the dialog boxes making these joins. First select the column from each drop down list and then click the 'Add Join' button.

Lookup table	Primary src (load_product)	Lookup column
load_prod_group	prod_group	prod_group
load_prod_subgroup	prod_group prod_subgroup	prod_group prod_subgroup
load_prod_line	prod_line	prod_line

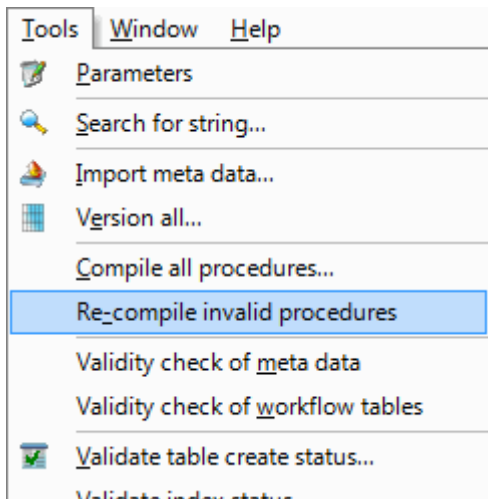
Note: The load_prod_subgroup lookup will require two joins. After each join is made click the OK button to move to the next dialog.

- 22 Once the lookups have been completed the procedure will be generated and the results dialog will show the indexes that were created / re-created.
- 23 Using the right mouse menu when positioned on the object **dim_product** in the left hand pane select **Execute Update Procedure**. The dimension will now be refreshed.
- 24 Using the right mouse menu when positioned on the object **dim_product** in the left hand pane select **Display Data**. Provided the lookups were done correctly, the descriptions should now be populated.

Oracle Procedure Invalidation

If running this as a tutorial in an *Oracle Data Warehouse* then the procedures update_stage_sales_detail, update_stage_budget and update_stage_forecast will have been invalidated. These procedures all use the function get_dim_product_key. This function was re-compiled as part of the process above, but has not changed in structure.

Select the menu option Tools/Re-compile invalid procedures:



Click Yes to proceed. The three procedures will be re-validated and the results shown in the middle pane.

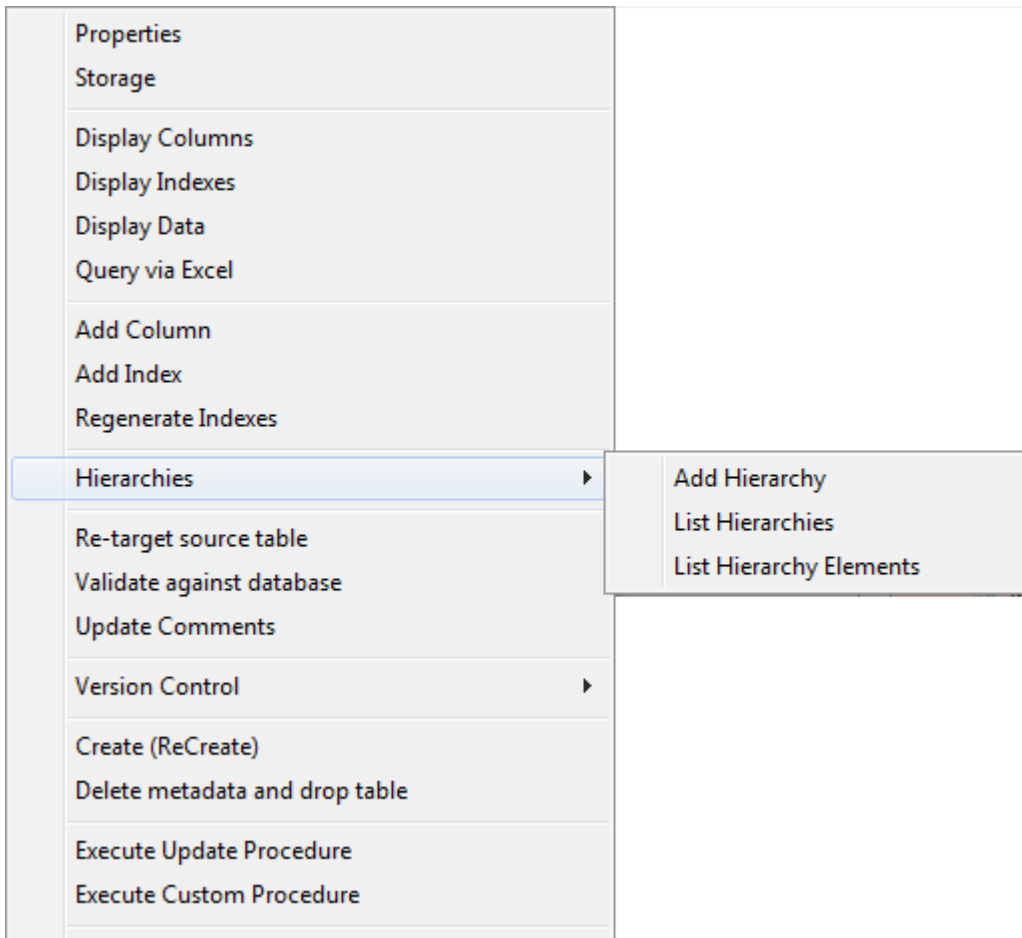
You are now ready to proceed to the next section - ***Creating a Dimension Hierarchy*** (see "***4.4 Creating a Dimension Hierarchy***" on page 120)

4.4 Creating a Dimension Hierarchy

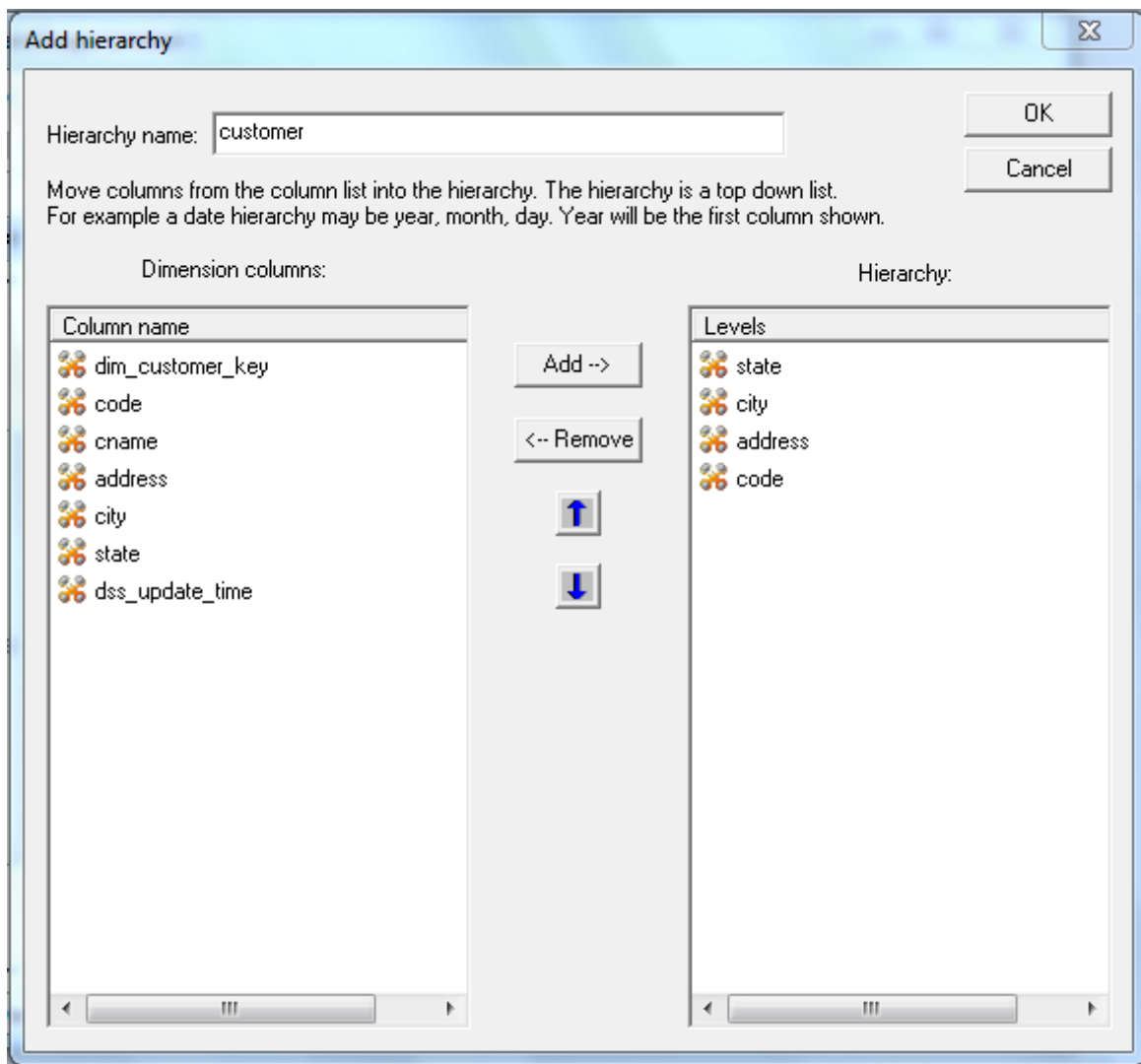
Dimensions often have a number of hierarchical levels. An example is the date dimension which has a natural hierarchy of year, month and day. QAD Data Warehouse Designer allows the definition of a hierarchy against a dimension. A dimension may have multiple hierarchies defined. These dimension hierarchies are used in the generation of Analysis Services cubes. Every dimension in a cube must have a hierarchy with at least one element in it. Hierarchies can also be accessed and the underlying data maintained with the Hierarchy maintenance utility shipped with the enterprise version of QAD Data Warehouse Designer. This utility allows a user to maintain a hierarchy structure in a different database or schema so that the data warehouse can use this structure as input to the dimension. See the hierarchy section in the Dimension chapter for more details.

We will add a hierarchy to the dimensions `dim_product` and `dim_customer` created in the first tutorial. We will also check that a hierarchy exists for the date dimension and if not present add one.

- 1 Using the right mouse menu when positioned on the object `dim_customer` in the left hand pane and select Hierarchies / List Hierarchies.

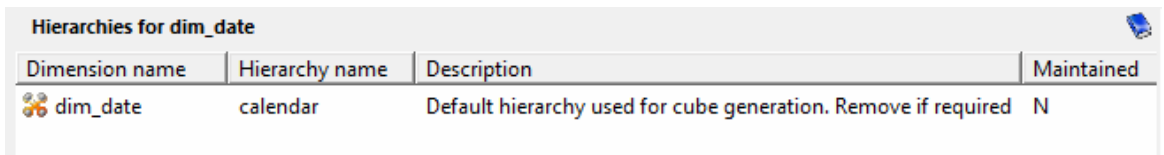


- 2 A list of any existing hierarchies will be shown in the middle pane. Initially there are no hierarchies defined.
- 3 Using the right mouse menu when positioned on the object `dim_customer` in the left hand pane and select Hierarchies / Add Hierarchy.
- 4 A dialog will appear asking for a hierarchy name and the hierarchy elements. Enter `customer` for the name and add `state`, `city`, `address` and `code` as hierarchy elements. Click OK to exit the add hierarchy dialog.



- 5 Repeat steps (1) through (4) for `dim_product` defining a top down hierarchy of `line_description`, then `group_description`, `subgroup_description`, and `code`.

- 6 Check to see if a hierarchy exists for `dim_date`. If no hierarchy exists then add a top down hierarchy of `cal_year`, `cal_month` and `calendar_date`.



Dimension name	Hierarchy name	Description	Maintained
 dim_date	calendar	Default hierarchy used for cube generation. Remove if required	N

As mentioned above these hierarchies are utilized by other processes within the data warehouse. In this case we will use the hierarchies created in the building of Analysis Services cubes in the next tutorial.

C H A P T E R 5

Tutorial 5 - Analysis Services Cubes

Before you start on this chapter you should have:

- Completed ***Tutorial 1 - Basic Star Schema Fact Table*** (on page 3)
- Completed ***Tutorial 2 - Rollup Fact Tables, ASCII File Loads, Aggregates*** (on page 63)
- Completed ***Tutorial 4 - Complex Dimensions and Hierarchies*** (on page 103)

This chapter deals with fine tuning the data warehouse by adding Analysis Services cubes.

In This Chapter

5.1 Purpose and Roadmap.....	124
5.2 Creating an OLAP Cube Object.....	125
5.3 Adding a Measure Group	152
5.4 Cube Connections for Other Databases	164

5.1 Purpose and Roadmap

Purpose

This tutorial will walk you through the process to:

- Create an analysis services cube.

In short, this tutorial uses existing fact tables to generate a "multi-measure group cube" based on fact_sales_detail and fact_budget. It also shows you how to query the cube.

Tutorial Environment

This tutorial has been completed using Microsoft SQL Server. All of the features illustrated in this tutorial are available in SQL Server, Oracle and DB2 (unless otherwise stated) using Analysis Services Cubes. Any differences in usage of QAD Data Warehouse Designer between these databases are highlighted. Refer to ***Cube Connections for Other Databases*** (see "**5.4 Cube Connections for Other Databases**" on page 164) for more information on configuring the DataWarehouse connection for Oracle or DB2 data warehouses.

Tutorial Roadmap

This tutorial works through a number of steps. These steps and the relevant section within the chapter are summarized below to assist in guiding you through the tutorial.

Step in Tutorial	Section
Create an Analysis Services cube from fact_sales_detail	Creating a Cube Object
Add a measure group to the cube based on fact_budget	Adding a Measure Group object

This tutorial starts with the section ***Creating an OLAP Cube Object*** (see "**5.2 Creating an OLAP Cube Object**" on page 125)

5.2 Creating an OLAP Cube Object

The process of creating a cube object is largely the same as creating any other data warehouse object. By dragging a fact or aggregate table into an OLAP Cube drop target an OLAP Cube and OLAP Dimensions are defined.

OLAP Cubes are more complex than some other objects in QAD Data Warehouse Designer, primarily due to the functionality available in Microsoft Analysis Services.

This tutorial covers creating a basic cube. Refer to the chapter on Analysis Services Cubes in the QAD Data Warehouse Designer User Guide for more information.

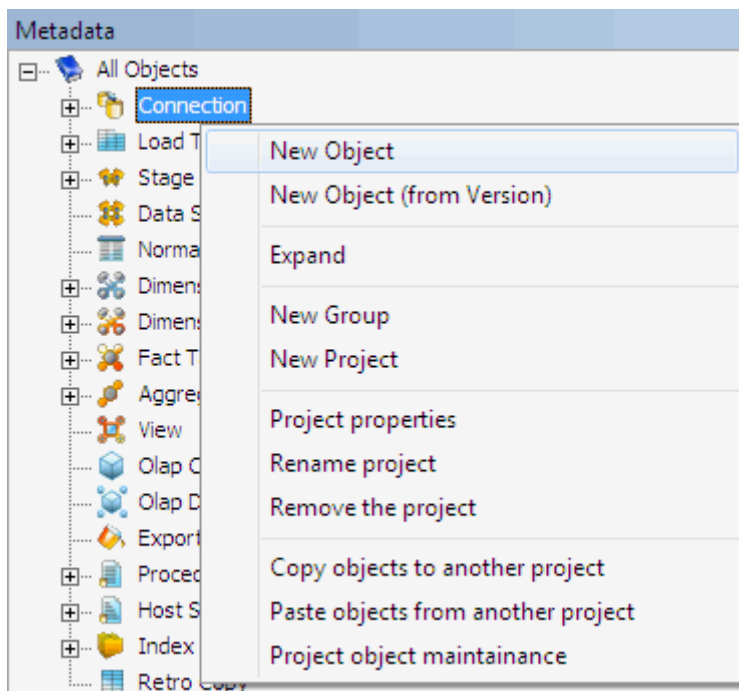
In this step we will create an OLAP Cube from the *fact_sales_detail* table. Before we start we need to have access to a Microsoft Analysis Services server with appropriate security rights to create an OLAP database.

Analysis Services is supplied with Microsoft SQL Server. You will also need to know the name of this server.

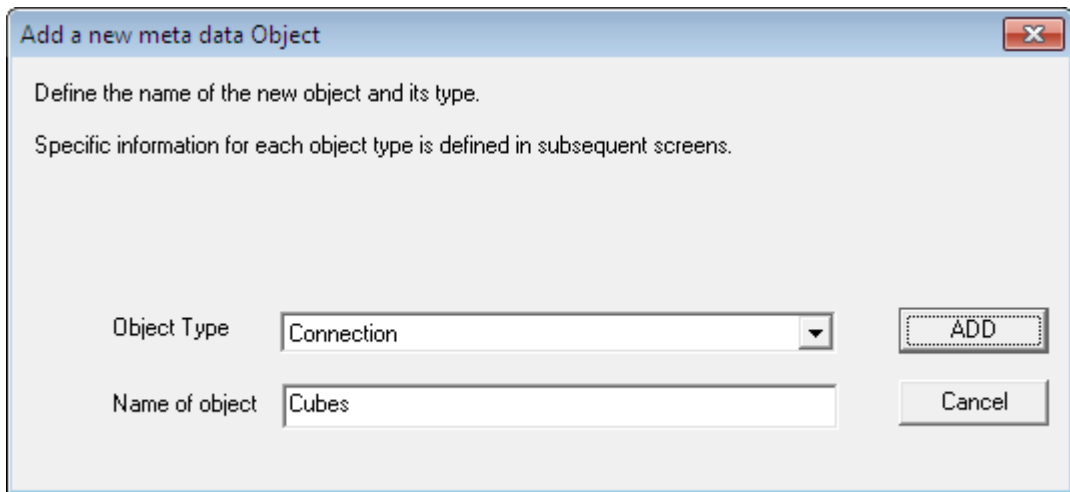
NOTE: This tutorial is only possible if an Analysis Services server is available

If the Analysis Services server is located on another machine then the Analysis Services client software will need to be loaded onto the computer running QAD Data Warehouse Designer.

- 1 Create a new **connection** for the Analysis Services server. Position on the 'Connection' object group in the left hand pane and using the right mouse menu select **New Object** as follows:



Enter a name of *Cubes* for the connection and click **Add**:



Add a new meta data Object

Define the name of the new object and its type.

Specific information for each object type is defined in subsequent screens.

Object Type:

Name of object:

ADD **Cancel**

- 2 The connection properties screen will now appear. Select the connection type: **Microsoft Analysis Server 2005+**. Enter the **name** of the server for the Analysis Server. Leave the username and password blank. Enter the server and database details for your Analysis Services server. A sample is shown next:

The screenshot shows a 'Connection Properties' dialog box with two tabs: 'Connection Properties' and 'Notes'. The 'Connection Properties' tab is active. It contains the following fields:

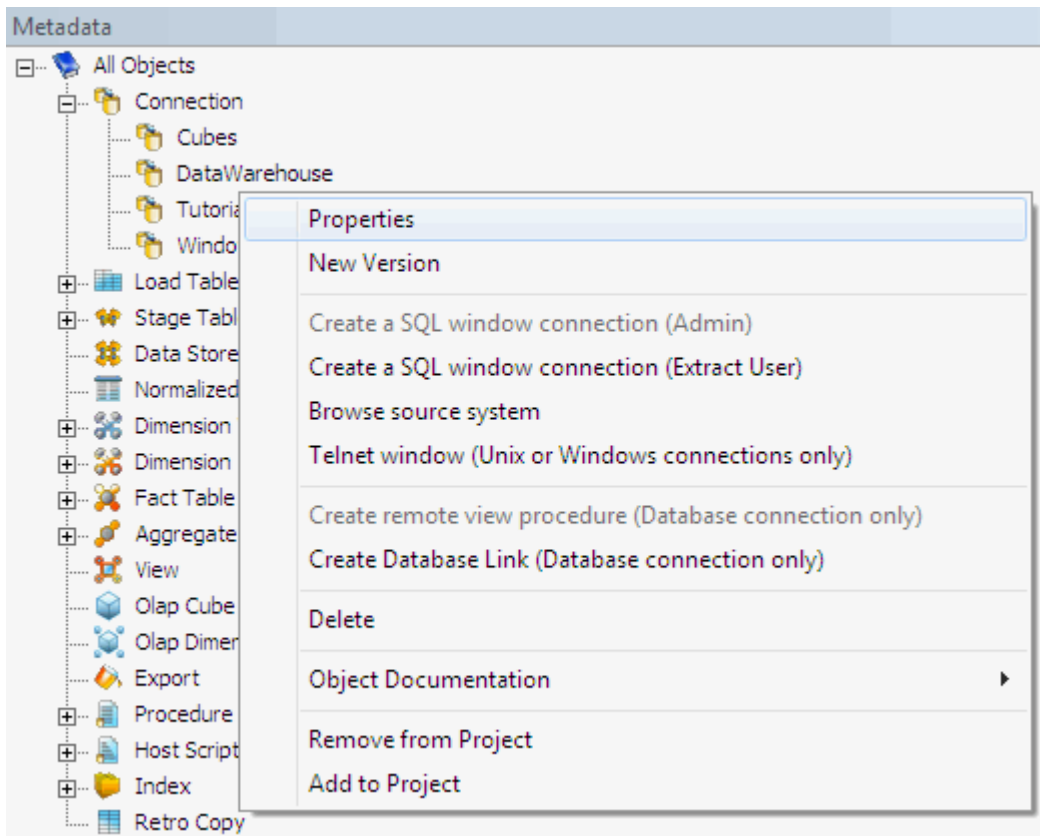
- Data Warehouse:** A checkbox that is currently unchecked.
- Connection Name:** A text box containing the value 'Cubes'.
- Connection Type:** A dropdown menu showing 'Microsoft Analysis Server 2005+'.
- Analysis Server 2005+:** A text box containing the value 'SERVER\SQLSERVER'.
- Analysis Server User ID:** An empty text box.
- Password:** An empty text box.

At the bottom right of the dialog box are three buttons: 'OK', 'Cancel', and 'Apply'.

Then click OK.

NOTE: Microsoft Analysis Services 2005 and 2008 use "Microsoft Analysis Server 2005+".

- 3 Expand the Connection object group in the left hand pane and using the right mouse menu select **Properties** for the *DataWarehouse* connection:



- 4 The properties dialog will now show some additional columns at the bottom of the screen. These are required so that the data warehouse can be used as a source for the Analysis Services cubes. Some other fields are determined by the type of relation database being used for the data warehouse. These fields are:

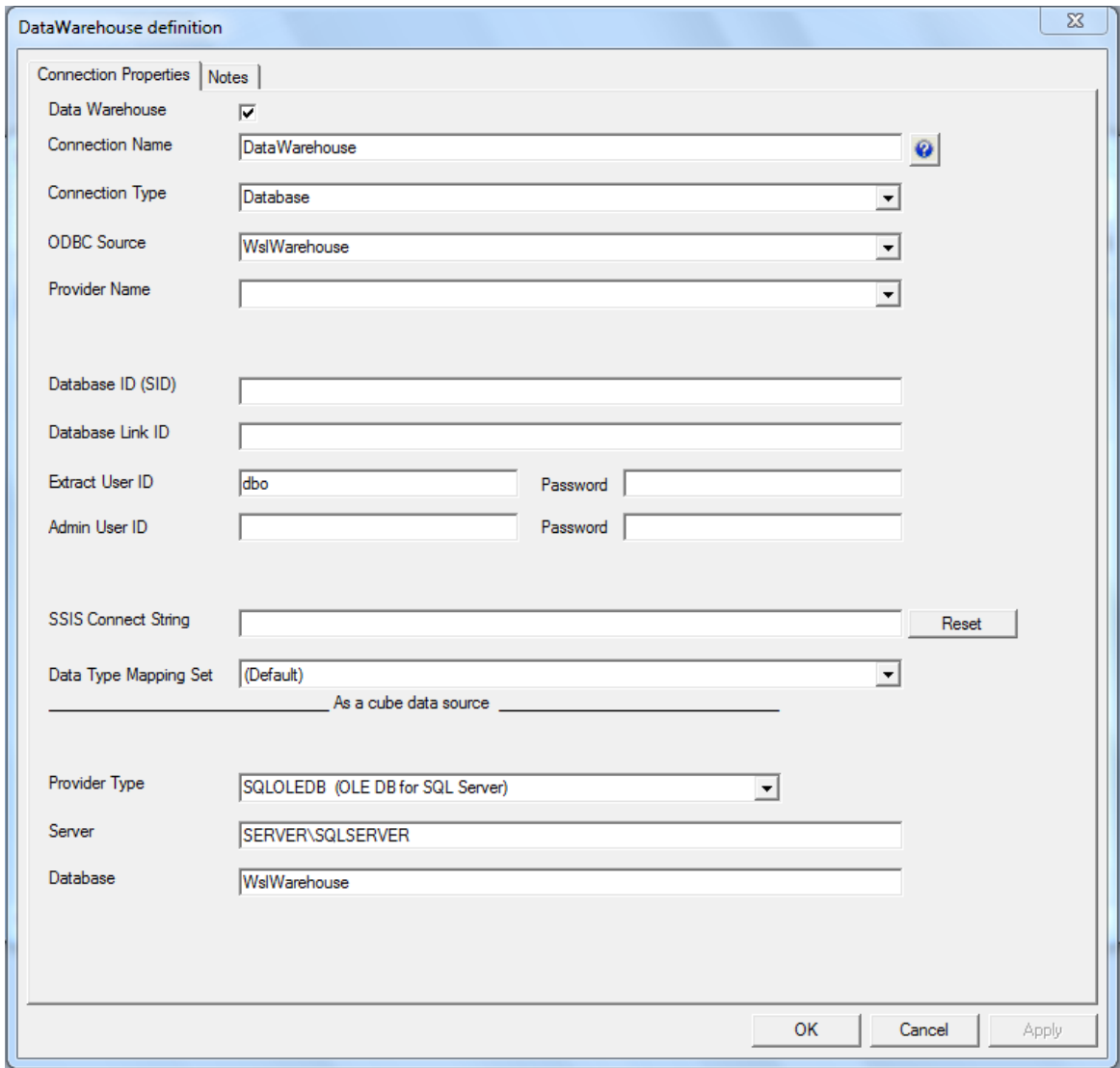
- Provider type
- Server
- Database

For a SQL Server data warehouse:

- Set Provider Type to *SQLOLEDB*
- Set Server to the SQL Server *server name*
- Set Database to the SQL Server *database name*

See **Cube Connections for Other Databases** (see "5.4 Cube Connections for Other Databases" on page 164) for more details on Oracle and DB2.

A SQL Server sample is shown next:



The image shows a 'DataWarehouse definition' dialog box with two tabs: 'Connection Properties' and 'Notes'. The 'Connection Properties' tab is active. It contains the following fields and controls:

- Data Warehouse:** A checkbox that is checked.
- Connection Name:** A text box containing 'DataWarehouse' and a help icon.
- Connection Type:** A dropdown menu set to 'Database'.
- ODBC Source:** A dropdown menu set to 'WslWarehouse'.
- Provider Name:** A dropdown menu.
- Database ID (SID):** A text box.
- Database Link ID:** A text box.
- Extract User ID:** A text box containing 'dbo'.
- Password:** A text box next to the Extract User ID.
- Admin User ID:** A text box.
- Password:** A text box next to the Admin User ID.
- SSIS Connect String:** A text box with a 'Reset' button to its right.
- Data Type Mapping Set:** A dropdown menu set to '(Default)'. Below it is a checkbox labeled 'As a cube data source'.
- Provider Type:** A dropdown menu set to 'SQLOLEDB (OLE DB for SQL Server)'.
- Server:** A text box containing 'SERVER\SQLSERVER'.
- Database:** A text box containing 'WslWarehouse'.

At the bottom right, there are three buttons: 'OK', 'Cancel', and 'Apply'.

Then click OK.

- 5 Now you need to browse the *DataWarehouse* connection to see available fact tables. From the **Browse** menu, select *DataWarehouse* then **Change Connection**. The following dialog displayed:

List Source tables Connection

Connection: DataWarehouse

Schema (Blank for all schemas): dbo

Filter (Blank for all tables, views):

Show Tables: ☒ Views: ☒ System tables, etc.: ☐

Group:

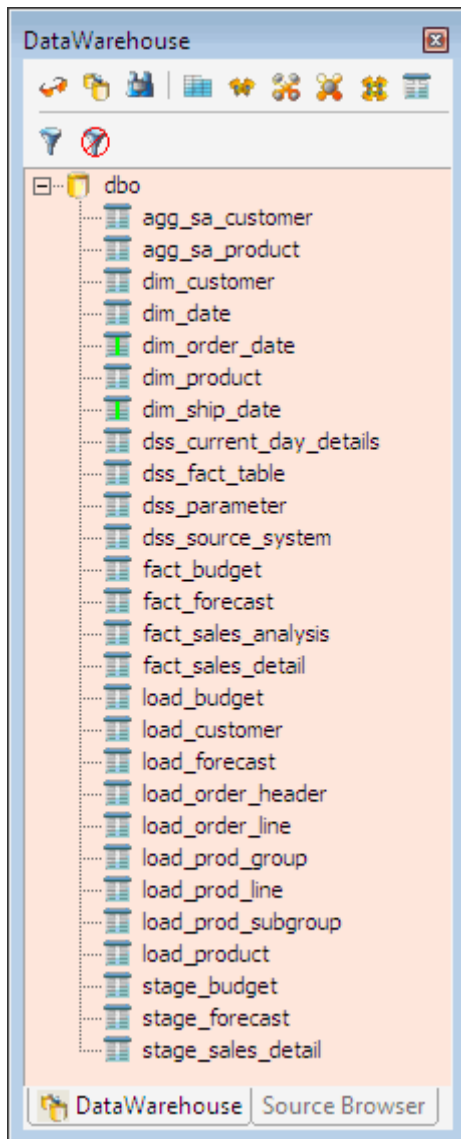
Project:

OK Cancel Refresh current connection

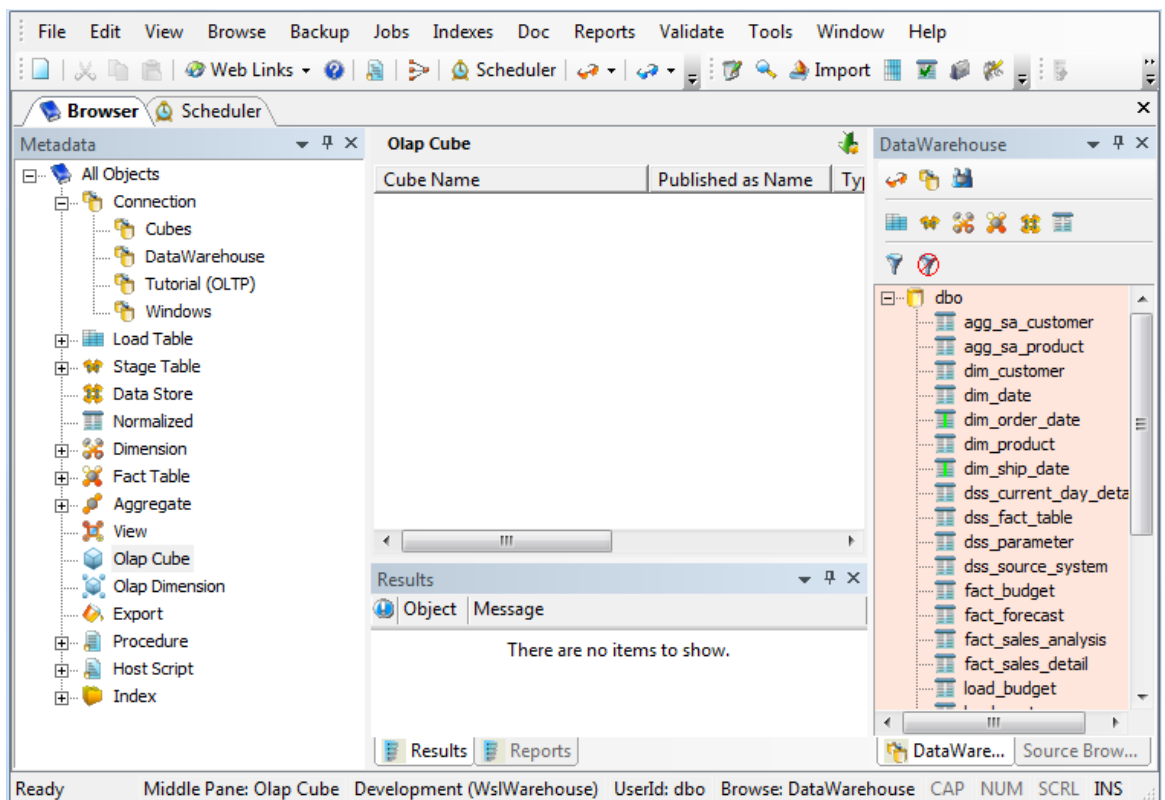
Choose *DataWarehouse* from the **Connection** drop down and click OK.

NOTE: For SQL Server the Data Warehouse schema must be **dbo**.

The following browse pane is displayed:

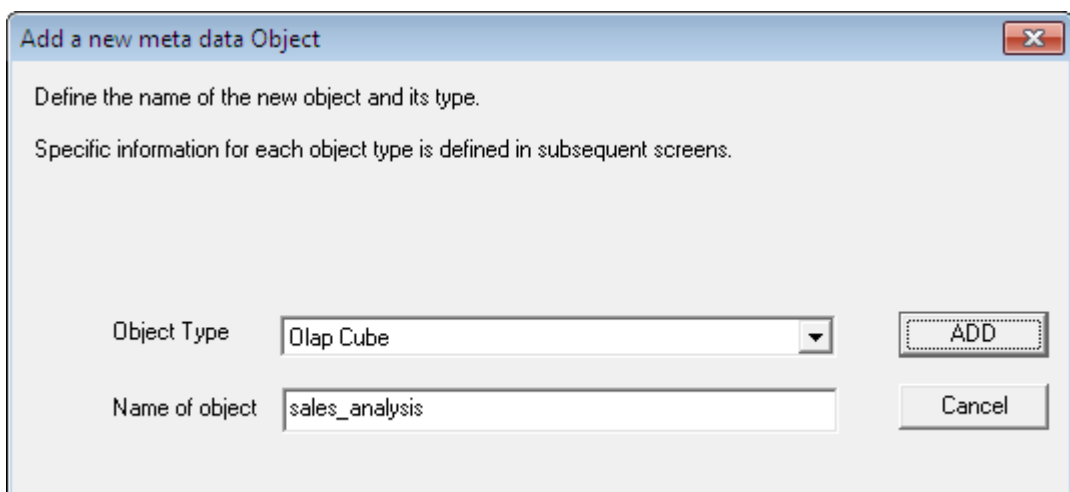


- 6 Double click on the OLAP Cube object group in the left hand pane to list all cubes in the middle pane. This makes the middle pane a drop target for cubes. Your screen should now look like this:



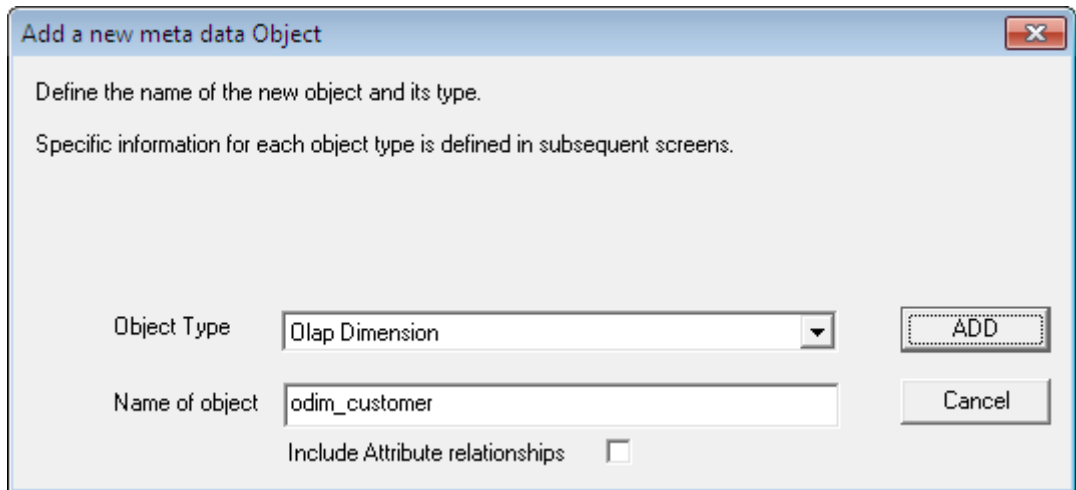
NOTE: As OLAP Cubes have not been created yet, the middle pane is empty.

- 7 Drag *fact_sales_detail* from the browser (right hand pane) and drop it into the middle to create a new OLAP Cube object. Give the OLAP Cube a name of *sales_analysis* as follows:



Click ADD.

- 8 QAD Data Warehouse Designer will now cycle through each dimension associated with that fact table and will create an OLAP Dimension object for each, displaying the following dialog first:



Add a new meta data Object

Define the name of the new object and its type.

Specific information for each object type is defined in subsequent screens.

Object Type:

Name of object:

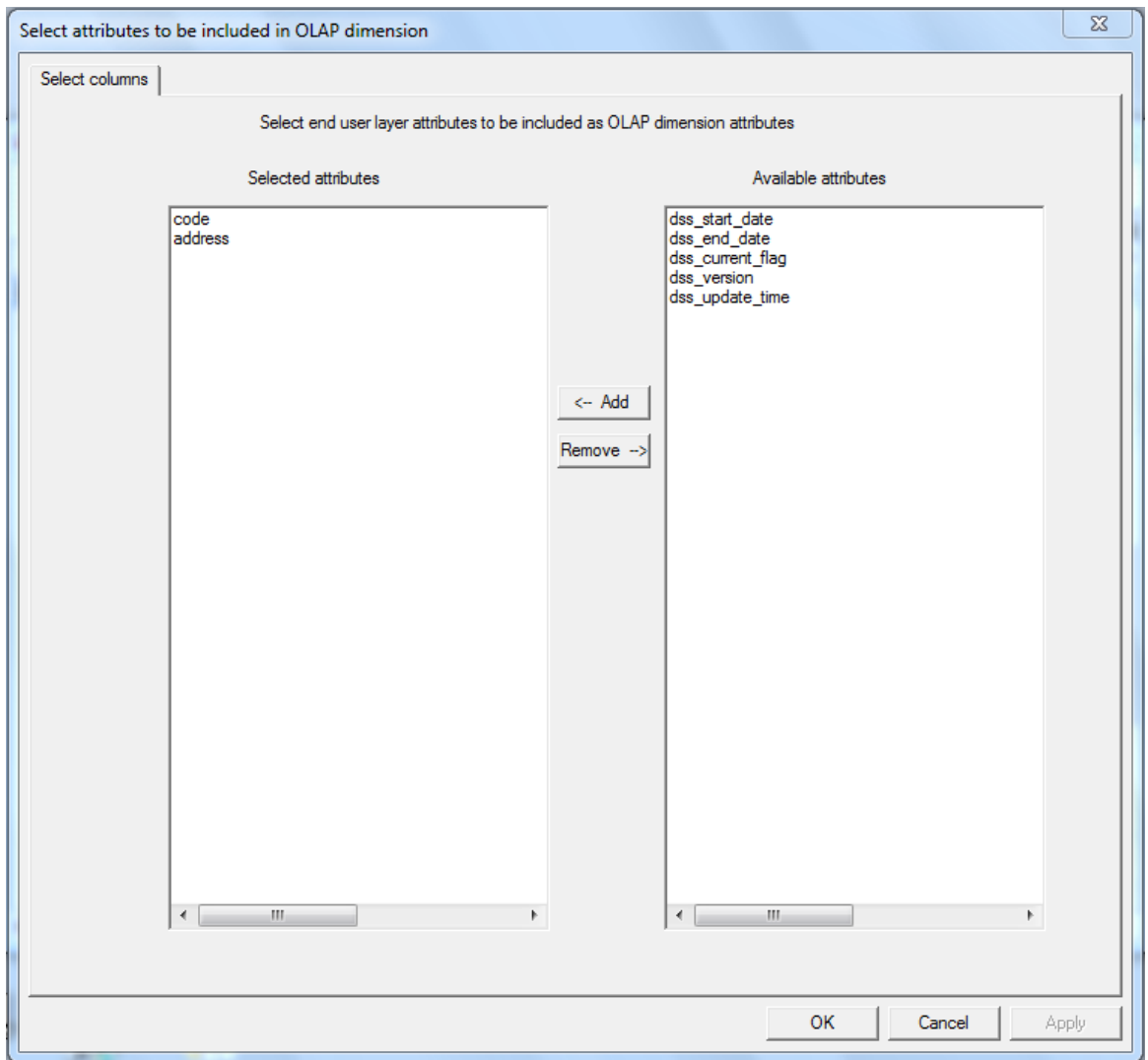
Include Attribute relationships ☐

Add **Cancel**

NOTE: If you wish to include Attribute Relationships in Analysis Services for this dimension, click on the Include Attribute relationships check box.

Click ADD for the *Customer* dimension.

The following dialog appears, prompting you to select the attributes to be included in the *Customer* OLAP dimension.



The attributes available for selection are in the right hand column. To select an attribute, click on the attribute in the right hand column and choose 'Add'. This will move the attribute to the left hand column.

To de-select an attribute, click on the attribute in the left hand column and choose 'Remove'. This will move the attribute to the right hand column.

- 9 Repeat step 8 for the remaining OLAP Dimensions:

Add a new meta data Object ✕

Define the name of the new object and its type.
Specific information for each object type is defined in subsequent screens.

Object Type ADD

Name of object Cancel

Include Attribute relationships ☐

Add a new meta data Object ✕

Define the name of the new object and its type.
Specific information for each object type is defined in subsequent screens.

Object Type ADD

Name of object Cancel

Include Attribute relationships ☐

Add a new meta data Object ✕

Define the name of the new object and its type.
Specific information for each object type is defined in subsequent screens.

Object Type ADD

Name of object Cancel

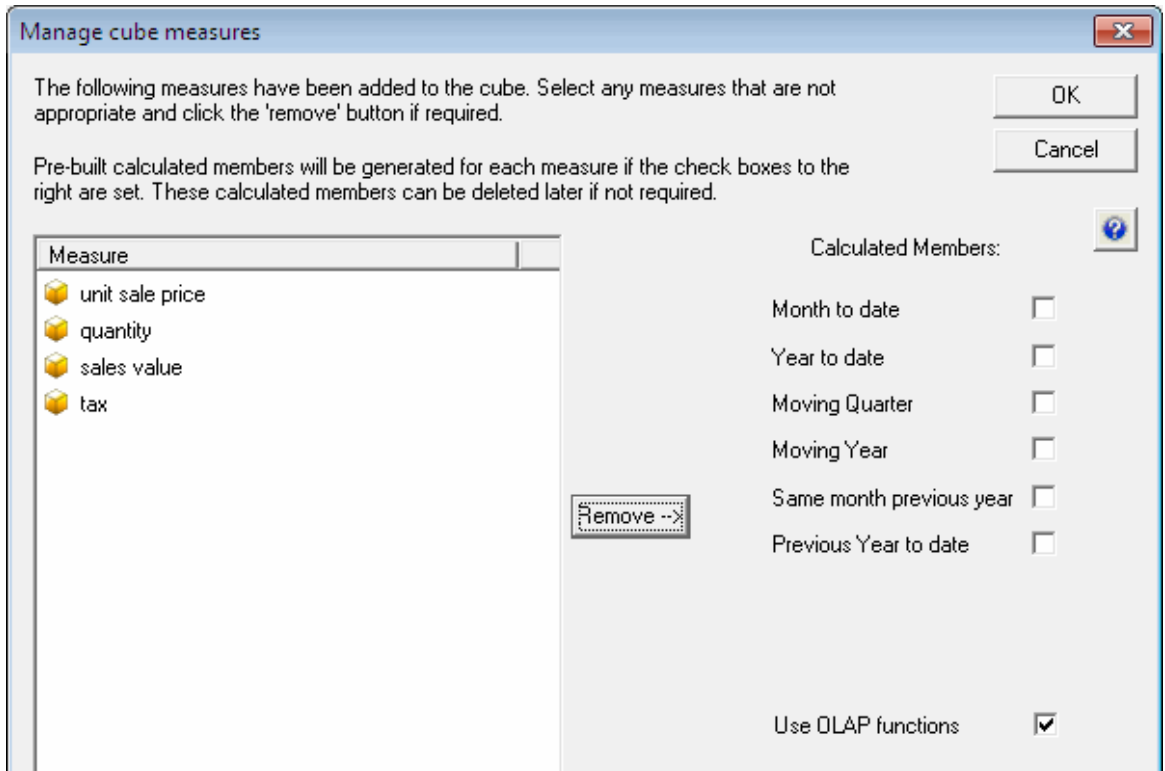
Include Attribute relationships ☐

- 10** The **Manage cube measures** dialog is displayed next. Remove all non-measure columns (that is, columns that cannot be aggregated) from the **Measure** list by highlighting them and clicking the **Remove** button.

The columns to remove are:

- Order Number
- Order Line No
- Product Code
- Customer Code

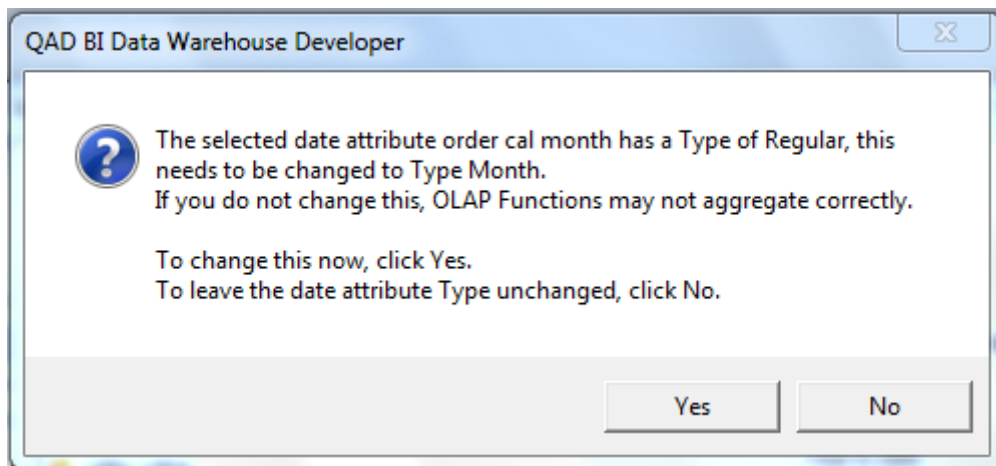
At this stage, your dialog should look like this:



- 11** Choose to create some date based calculated members using OLAP functions by selecting the **Month to date**, **Year to date**, and the **Use OLAP functions** check boxes. The calculated measures drop downs are now displayed. Select the required **date hierarchy** information. Specifically:

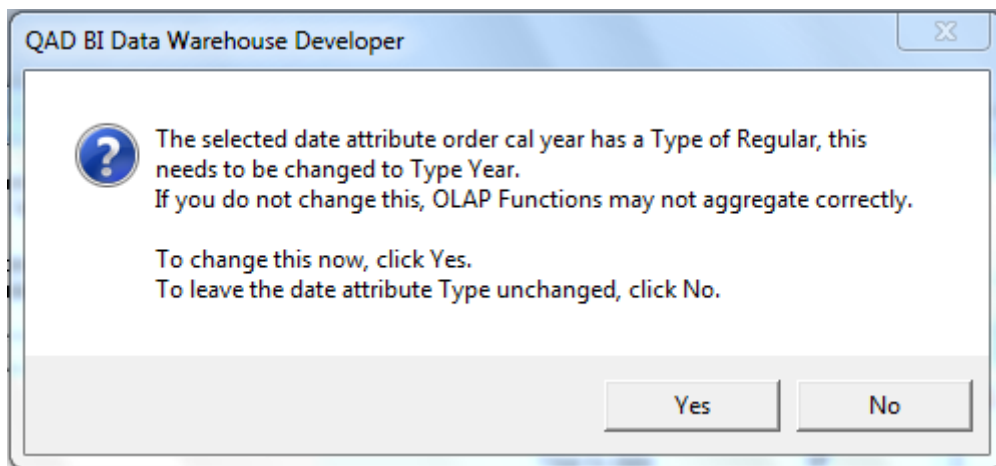
- for **Date dim**, select *dim_order_date*
- for **Dim hie**, select *calendar*
- for **Month level**, select *order cal month*
- for **Year level**, select *order cal year*

After selecting the **Month level**, you will be asked to confirm changing the **attribute type** to **Months** for the *order cal month* attribute in Analysis Services as follows:



Click Yes.

Similarly, selecting the Year level, you will be asked to confirm changing the attribute type to *Years* for the the *order cal year* attribute in Analysis Services as follows:



Again, click Yes.

Your Manage cube measures dialog should now look like this:

Manage cube measures

The following measures have been added to the cube. Select any measures that are not appropriate and click the 'remove' button if required.

Pre-built calculated members will be generated for each measure if the check boxes to the right are set. These calculated members can be deleted later if not required.

OK Cancel

Measure

- unit sale price
- quantity
- sales value
- tax

Remove -->

Calculated Members:

- Month to date ☒
- Year to date ☒
- Moving Quarter ☐
- Moving Year ☐
- Same month previous year ☐
- Previous Year to date ☐

Use OLAP functions ☒

Dimension and level information for calculated members:

Date dim: dim_order_date

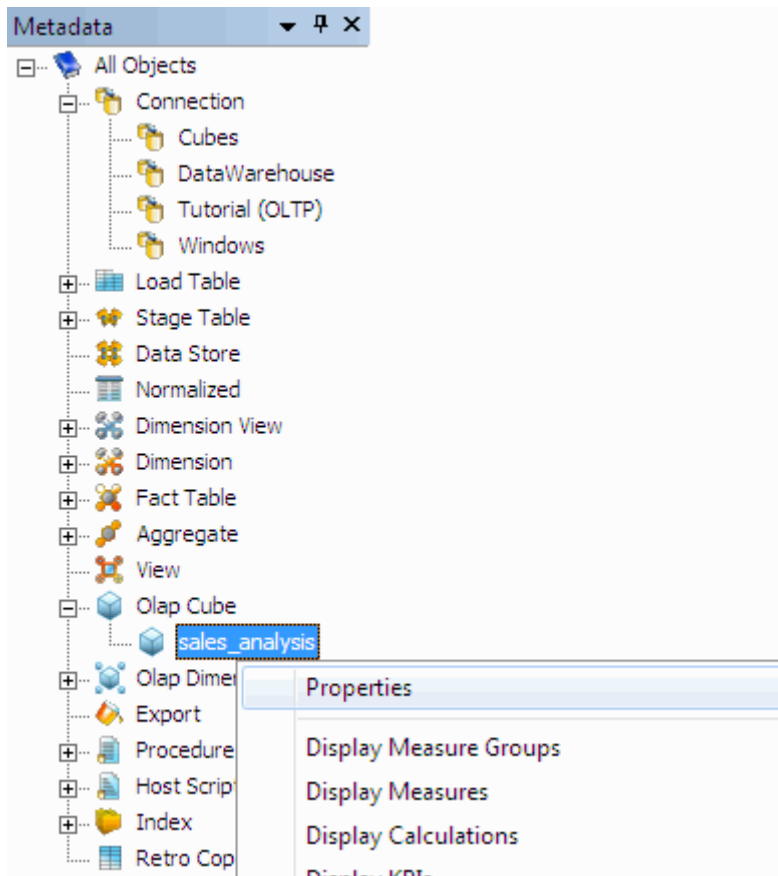
Date hie: calendar

Month level: order cal month

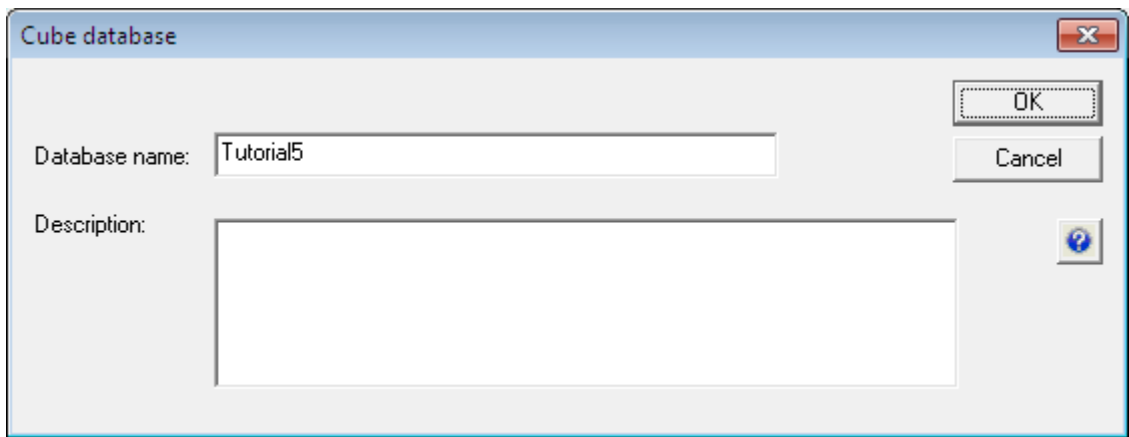
Year level: order cal year

Click OK to complete definition of the cube.

- 12** Right click on the OLAP Cube *sales_analysis* in the left pane and choose Properties as follows:



- 13** Click on the down arrow for the Cube Database name field and choose the option (Define New Cube Database), which will bring up the Cube database dialog box. Enter a new cube Database name of *Tutorial5* as follows:



A screenshot of a Windows-style dialog box titled "Cube database". The dialog has a light blue title bar with a close button (X) in the top right corner. The main area is light gray. On the left, there are two labels: "Database name:" and "Description:". The "Database name:" label is followed by a text input field containing the text "Tutorial5". The "Description:" label is followed by a large, empty text area. On the right side of the dialog, there are two buttons: "OK" and "Cancel", both with dashed borders. Below the "Cancel" button is a small square button with a blue question mark icon. The dialog box is shown against a white background.

Now click OK.

Change the Cube publish name to be *sales_analysis* and the Cube database connection to be *Cubes* as follows:

Cube sales_analysis definition

OLAP Cube Properties | Language Mapping | Purpose | Concept | Grain | Examples | Usage | Notes

Internal cube name: sales_analysis

Cube publish name: sales_analysis

Cube description:

Cube database connection: (Analysis services connect) Cubes

Cube database name: Tutorial5

Data source connection: (Data Warehouse) DataWarehouse

Data source provider type: SQLOLEDB

Data source server: SSERVER

Data source database: WslWarehouse

Post create XML/A Script: Edit

Post update XML/A Script: Edit

Processing mode: Regular

Processing priority: 0

Update dimensions: ☒

Storage mode: Molap

Default measure:

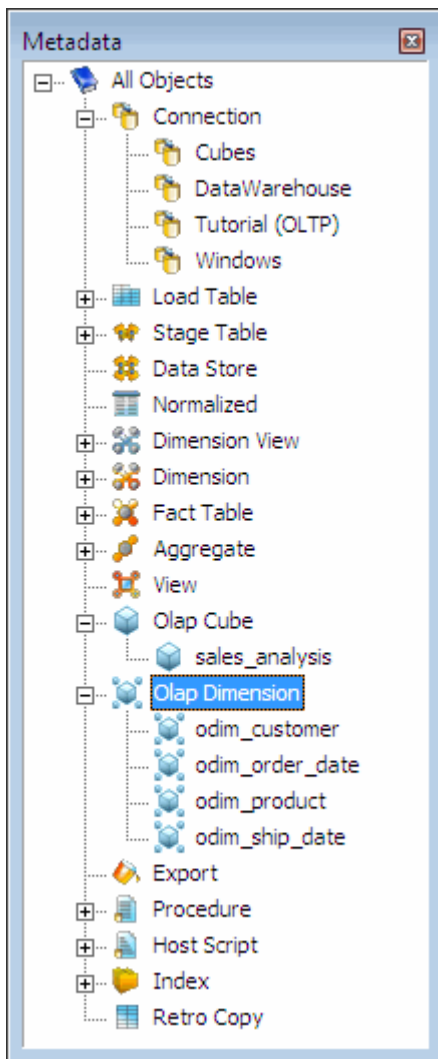
Estimated rows: 0

Visible: True

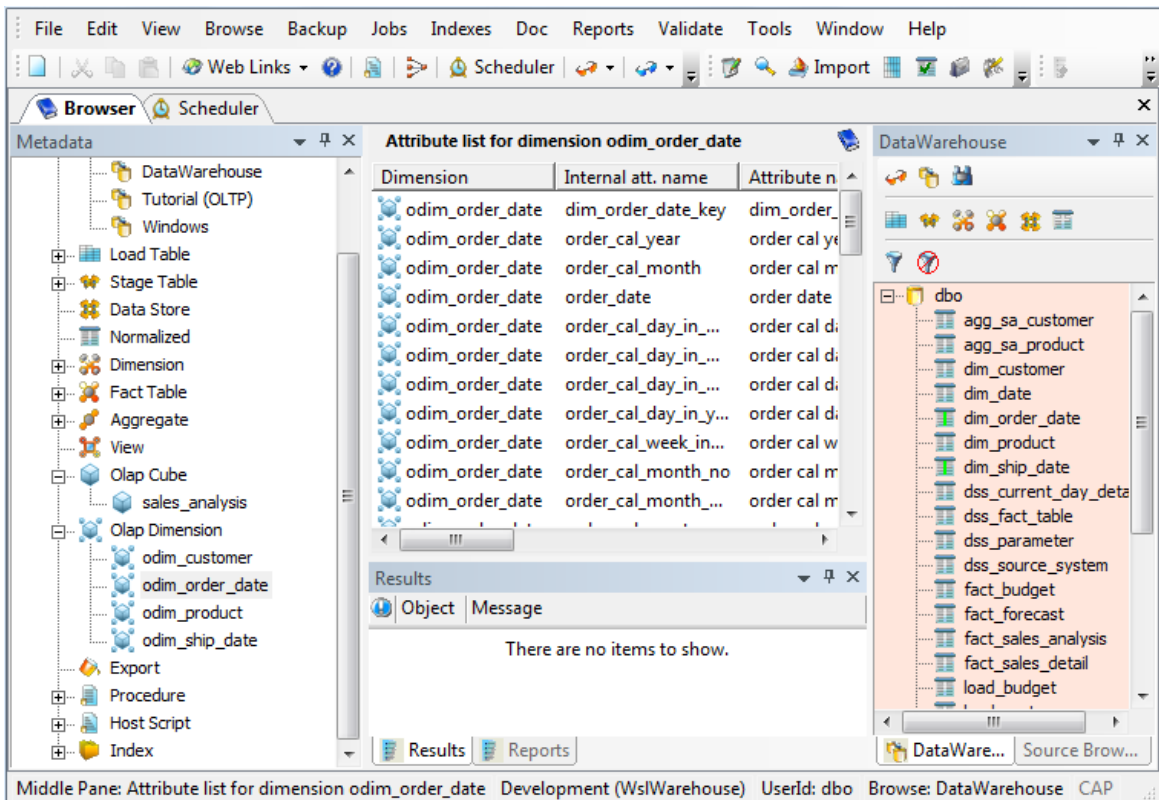
OK Cancel Apply

Click OK to close the *Cube sales_analysis definition* dialog and save the changes you've made.

- 14** You now need to check that the date dimension supports using OLAP functions. Expand the OLAP Dimension object type in the left hand pane to display the four OLAP Dimensions. Your object tree should contain the following OLAP Dimensions:



- 15** Click on the *odim_order_date* OLAP Dimension in the left pane to show the dimension attributes in the middle pane as below:



- 16 Right click on the *order_cal_month* attribute choose **Properties**. This displays the **Attribute Properties** dialog. Check the **Type** is set to *Months*. If it is not set to *Months*, change it. It needs to look like this:

Dimension odim_order_date attribute definition

Attribute Properties | Language Mapping

Dimension name: odim_order_date

Internal attribute name: order_cal_month

Published name: order cal month

Description: The calendar month representation. Format YYYYMM. Example: 200206.

Estimated count: 1

Member names unique: False

Hierarchy visible: True

Hierarchy enabled: True

Hierarchy optimized state: FullyOptimized

Order by: Key

Order by attribute:

Type: Months

Usage: Regular

Key Column: dim_order_date

Name Column: dim_order_date

order_cal_month

order_cal_month

Update

Update <

Update >

OK

Cancel

Apply

Click OK.

Repeat the process for the *order_cal_year* attribute, checking the **Type** is set to the *Years* and changing it if it is not. It needs to look like this:

Dimension odim_order_date attribute definition

Attribute Properties | Language Mapping

Dimension name: Update

Internal attribute name: Update <

Published name: Update >

Description:

Estimated count:

Member names unique:

Hierarchy visible:

Hierarchy enabled:

Hierarchy optimized state:

Order by:

Order by attribute:

Type:

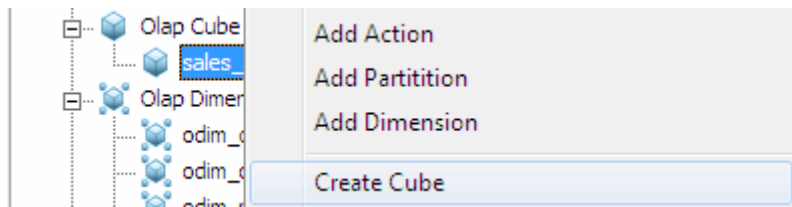
Usage:

Key Column:

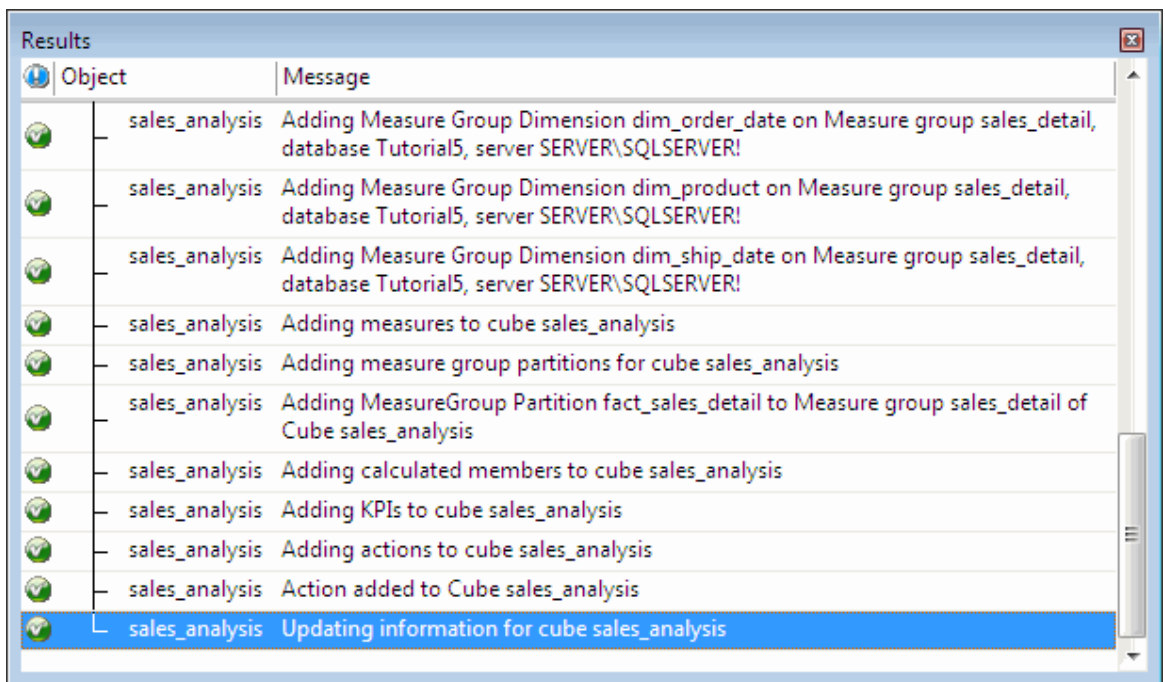
Name Column:

OK Cancel Apply

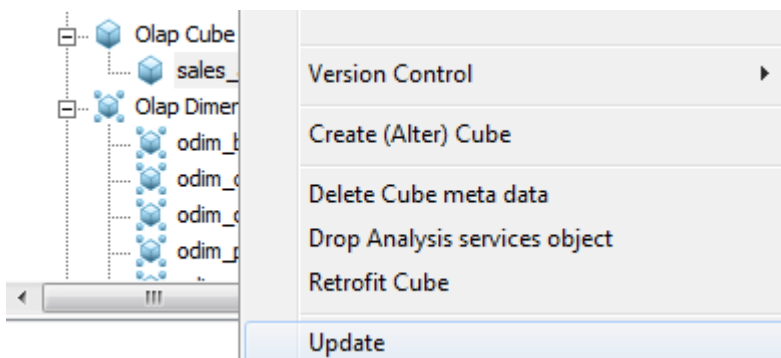
- 17** To create the cube in Analysis Services, right Click the *sales_analysis* cube in the left hand pane and choose **Create Cube** as follows:



This will open the WSL Cube executable that connects to Analysis Services to create the *sales_analysis* cube structure. You will see the successful completion in the results pane:



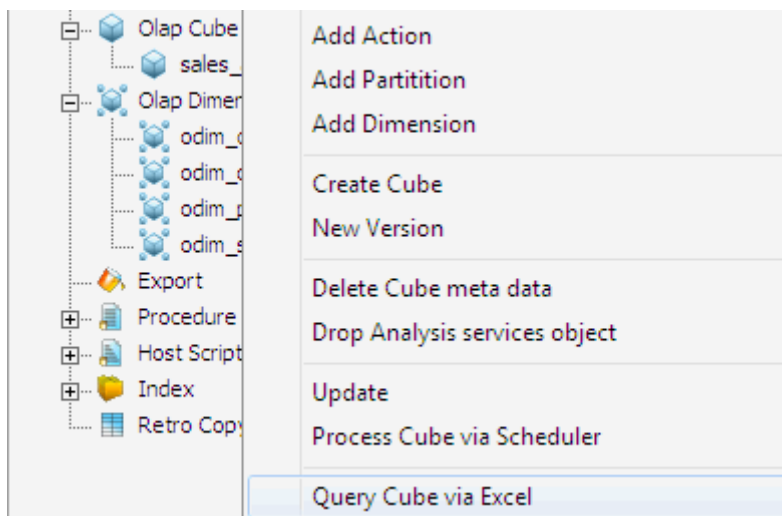
- 18** To process the cube *sales_analysis* in Analysis Services right click the *sales_analysis* cube in the left hand pane and choose **Update** as follows:



This will open the WSL Cube executable to process data into the cube structure. Once the cube is processed it can be viewed. Again, you will see the successful completion in the results pane:

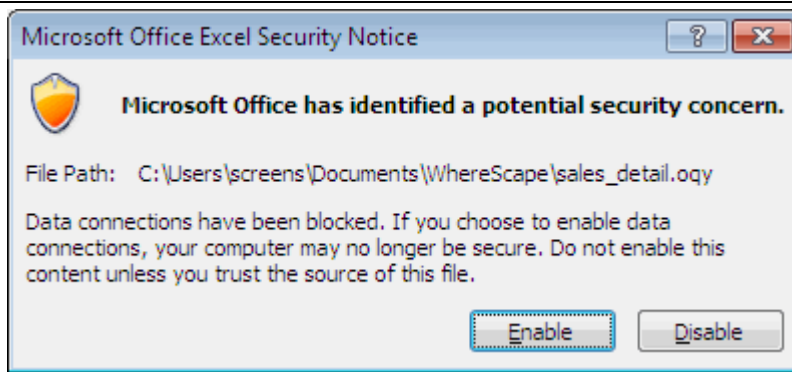
Results		
Object	Message	
sales_analysis	process completed successfully	
sales_analysis	WslCube10 BETA Version 6.0.6.OLAP (Build 100127)	
sales_analysis	Processing (Default) dim dim_customer in database Tutorial5 on server SERVER\SQLSERVER	
sales_analysis	Processing (Default) dim dim_order_date in database Tutorial5 on server SERVER\SQLSERVER	
sales_analysis	Processing (Default) dim dim_product in database Tutorial5 on server SERVER\SQLSERVER	
sales_analysis	Processing (Default) dim dim_ship_date in database Tutorial5 on server SERVER\SQLSERVER	
sales_analysis	Processing Cube sales_analysis, database Tutorial5, server SERVER\SQLSERVER	
sales_analysis	Processing partitions (One partition only/Full process) for cube measuregroup sales_detail in database Tutorial5 on server SERVER\SQLSERVER	
sales_analysis	Processing (One partition only/Full process) partition fact_sales_detail of cube sales_analysis.	

- 19 To view the cube in Excel right click the *sales_analysis* cube in the left hand pane and choose Query cube Via Excel as follows:



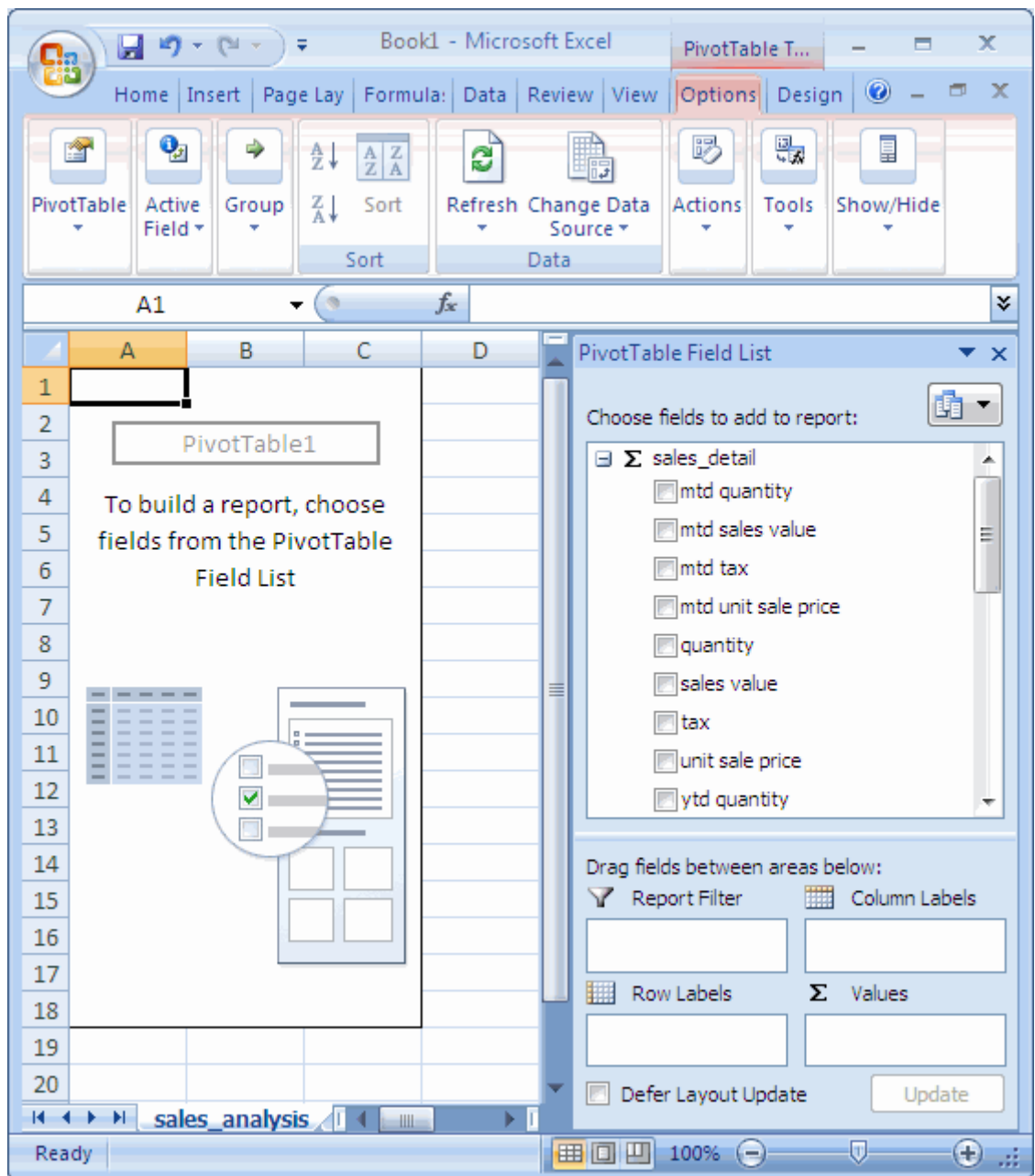
This will open Excel if it is installed.

NOTE: If Excel displays the following dialog box, click Enable:



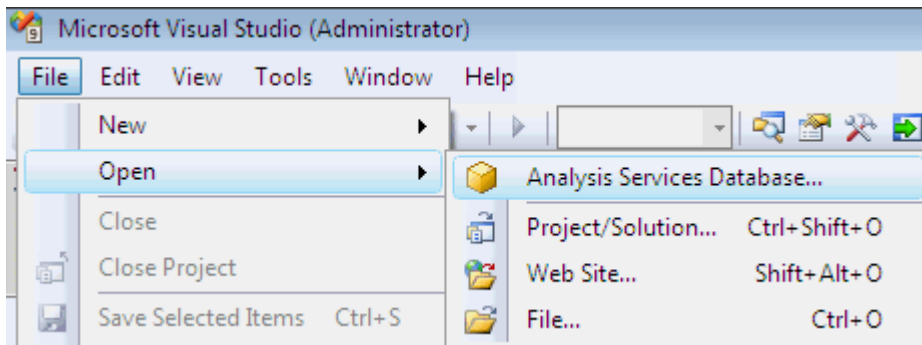
This message may not be displayed.

Excel then opens a connection to the cube for querying in a pivot table:

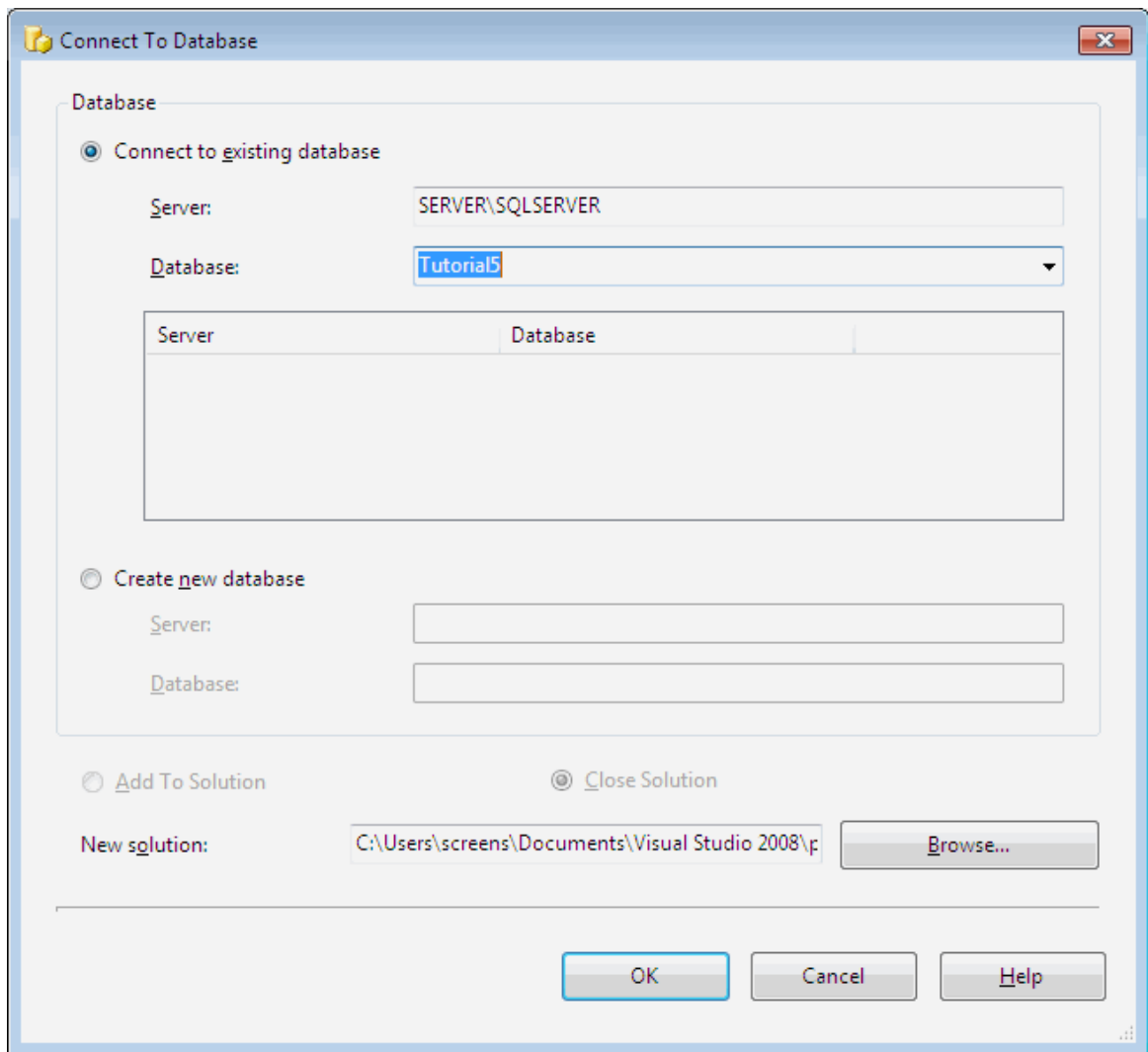


NOTE: In order for Excel to open the cube the OQY file extension in Windows explorer needs to be associated with Excel.

- 20** In addition, the cube structure can be opened in the Microsoft Business Intelligence Development Studio (BIDS). Open BIDS from the start menu in Windows. Then choose Open, Analysis Services Database as follows:

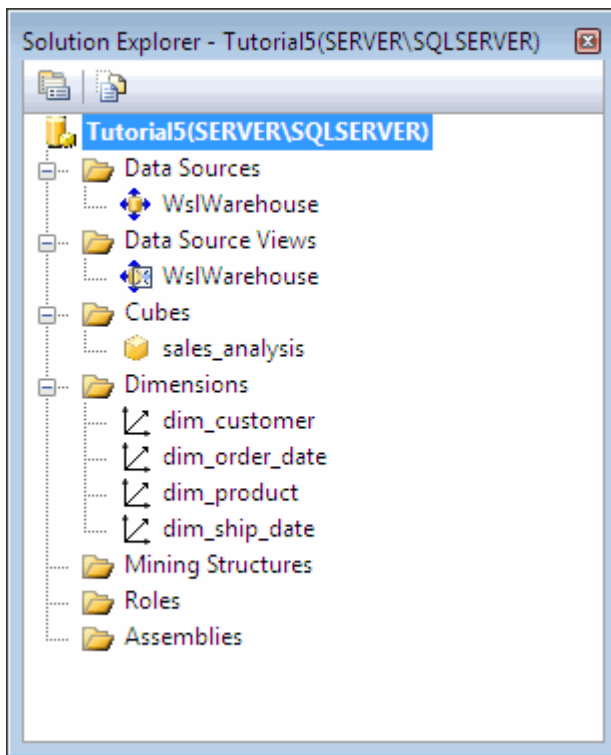


- 21** Choose the server and Tutorial5 cube database. A sample is shown:



Click OK.

This now displays the cube database definition from the Analysis Services server:



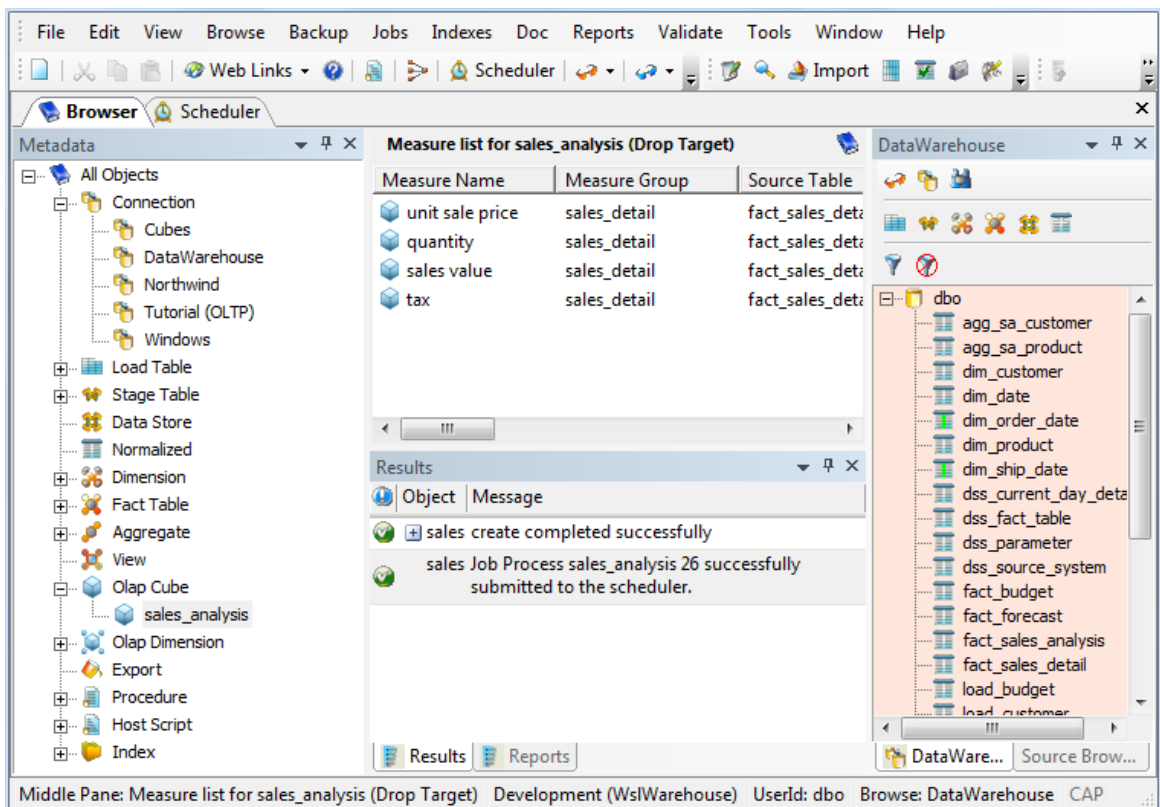
Close BIDS when finished.

You are now ready to proceed to the next section - ***Adding a Measure Group*** (see "5.3 Adding a Measure Group" on page 152)

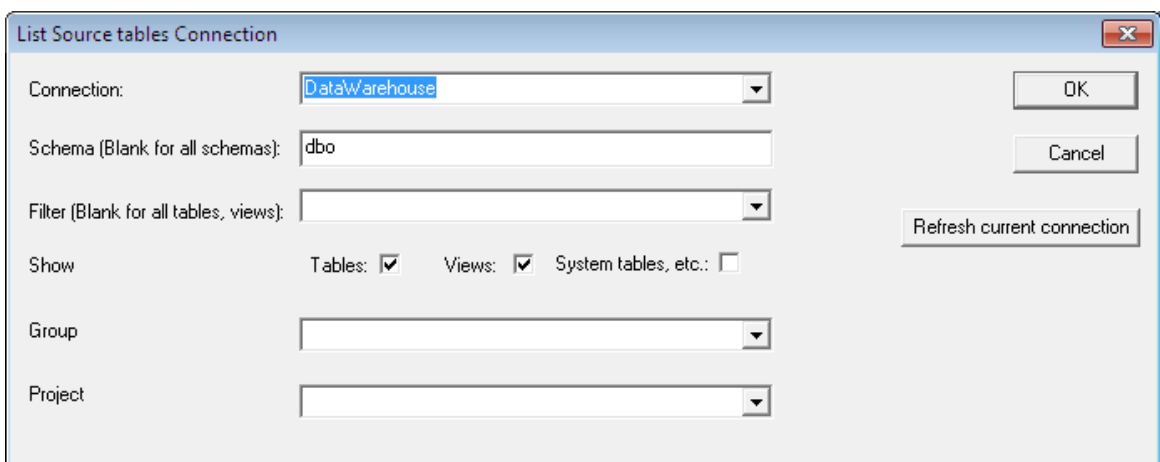
5.3 Adding a Measure Group

A cube can contain multiple Measure Groups. In QAD Data Warehouse Designer, a Measure Group relates to a relational star schema. The cube ties Measure Groups together through shared dimensions that are conformed in the relational data warehouse. Measure Groups can be added to an existing cube by dragging additional fact tables into the cube.

- 1 Click on the OLAP Cube *sales_analysis* in the left hand pane to show the Measures associated with the cube. Your screen should look like this:



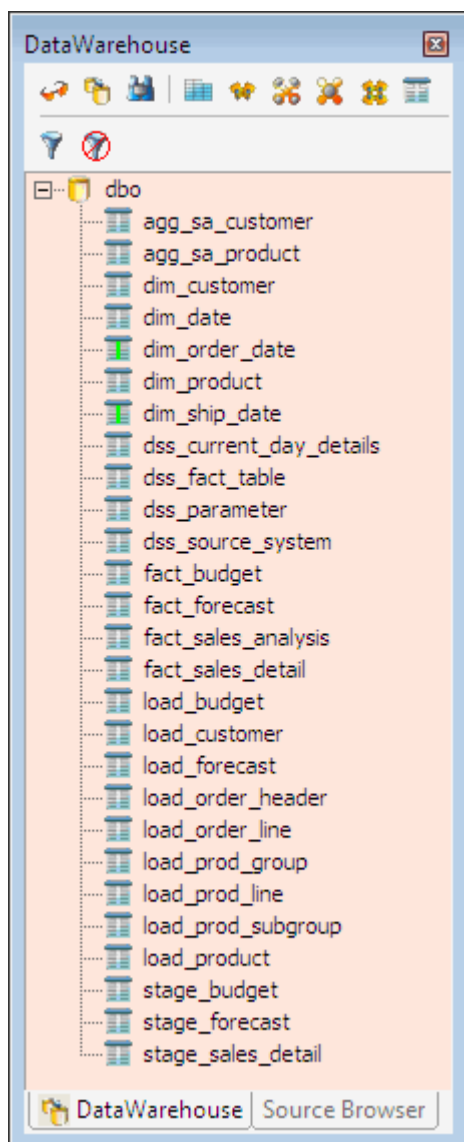
- Now you need to browse the *DataWarehouse* connection to see available fact tables. From the **Browse** menu, select *DataWarehouse* then **Change Connection**. The following dialog displayed:



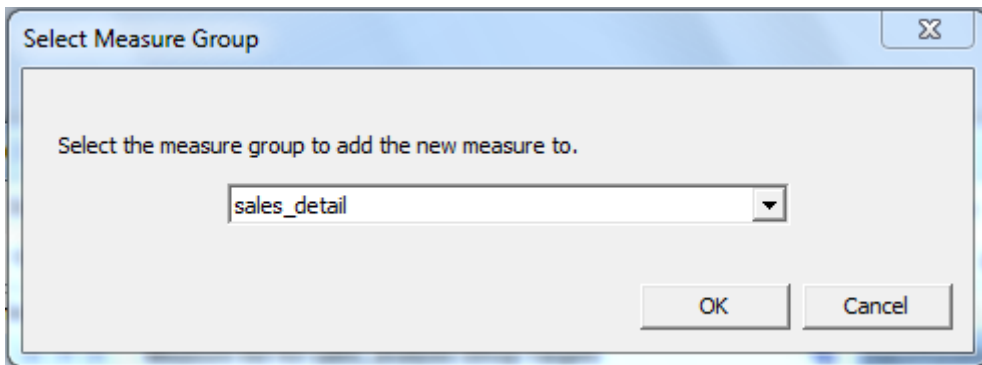
Choose *DataWarehouse* from the **Connection** drop down and click **OK**.

NOTE: For SQL Server the Data Warehouse schema must be **dbo**.

The following browse pane is displayed:

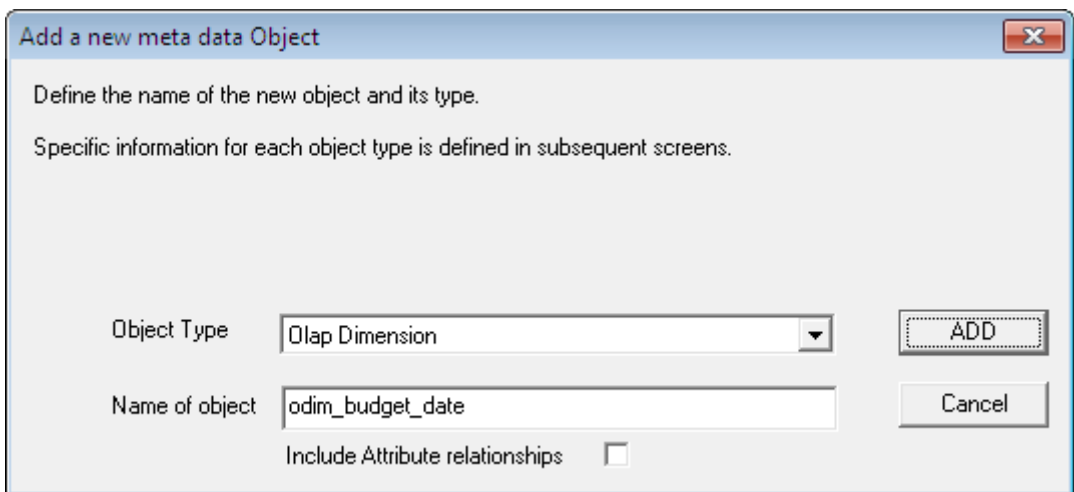


- 3 Drag the *fact_budget* table into the middle pane. The following dialog will appear:



Select Cancel.

- 4 QAD Data Warehouse Designer will confirm that it is OK to add a new OLAP Dimension for the date dimension. Change the Name of object to *odim_budget_date*.

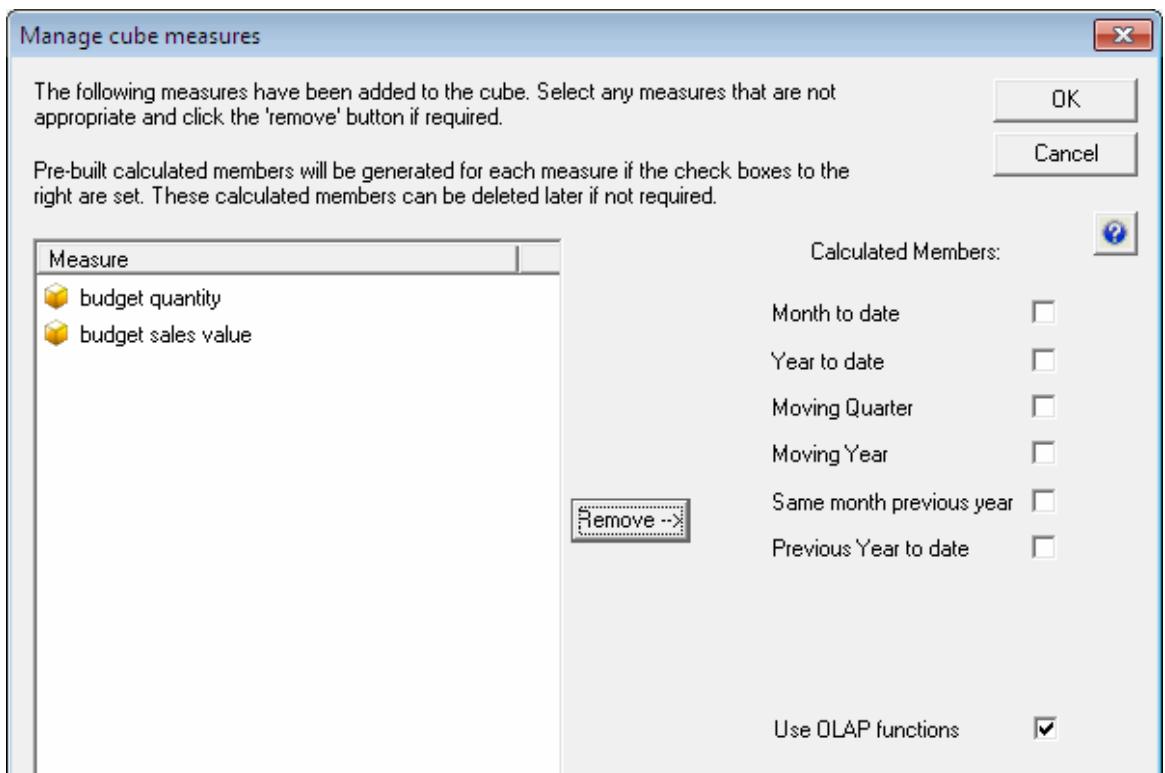


Then click ADD.

NOTE: If you wish to include Attribute Relationships in Analysis Services for this dimension, click on the Include Attribute relationships check box.

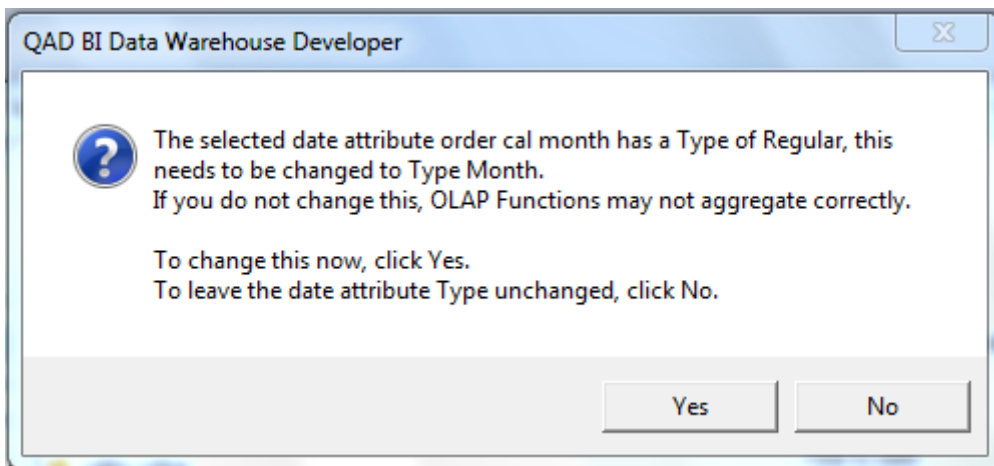
- 5 The Adding cube measures dialog is displayed next. Remove all non-measure columns (that is, columns that cannot be aggregated) from the Measure list by highlighting them and clicking the Remove button. The columns to remove are:
 - Product Code
 - Customer Code

At this stage, your dialog should look like this:



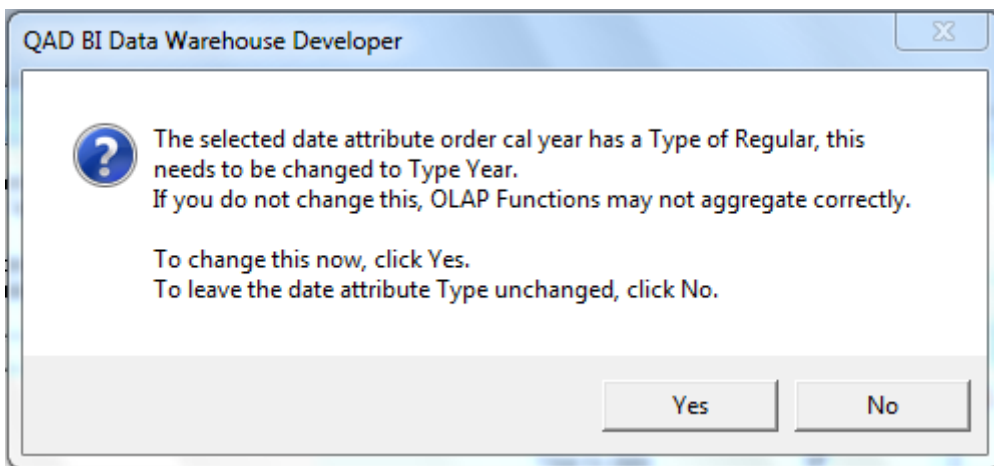
- 6 Choose to create some date based calculated members using OLAP functions by selecting the **Month to date**, **Year to date**, and the **Use OLAP functions** check boxes. The calculated measures drop downs are now displayed. Select the required **date hierarchy** information. Specifically:
- for Date dim, select *Date Dimension*
 - for Dim hie, select *calendar*
 - for Month level, select *cal month*
 - for Year level, select *cal year*

After selecting the **Month level**, you will be asked to confirm changing the **attribute type** to **Months** for the the *cal month* attribute in Analysis Services as follows:



Click Yes.

Similarly, selecting the Year level, you will be asked to confirm changing the attribute type to *Years* for the the *cal year* attribute in Analysis Services as below:



Again, click Yes.

Your Manage cube measures dialog should now look like this:

Manage cube measures

The following measures have been added to the cube. Select any measures that are not appropriate and click the 'remove' button if required.

Pre-built calculated members will be generated for each measure if the check boxes to the right are set. These calculated members can be deleted later if not required.

Measure

- budget quantity
- budget sales value

Remove -->

Calculated Members:

- Month to date ☒
- Year to date ☒
- Moving Quarter ☐
- Moving Year ☐
- Same month previous year ☐
- Previous Year to date ☐

Use OLAP functions ☒

Dimension and level information for calculated members:

Date dim: Date dimension

Date hie: calendar

Month level: cal month

Year level: cal year

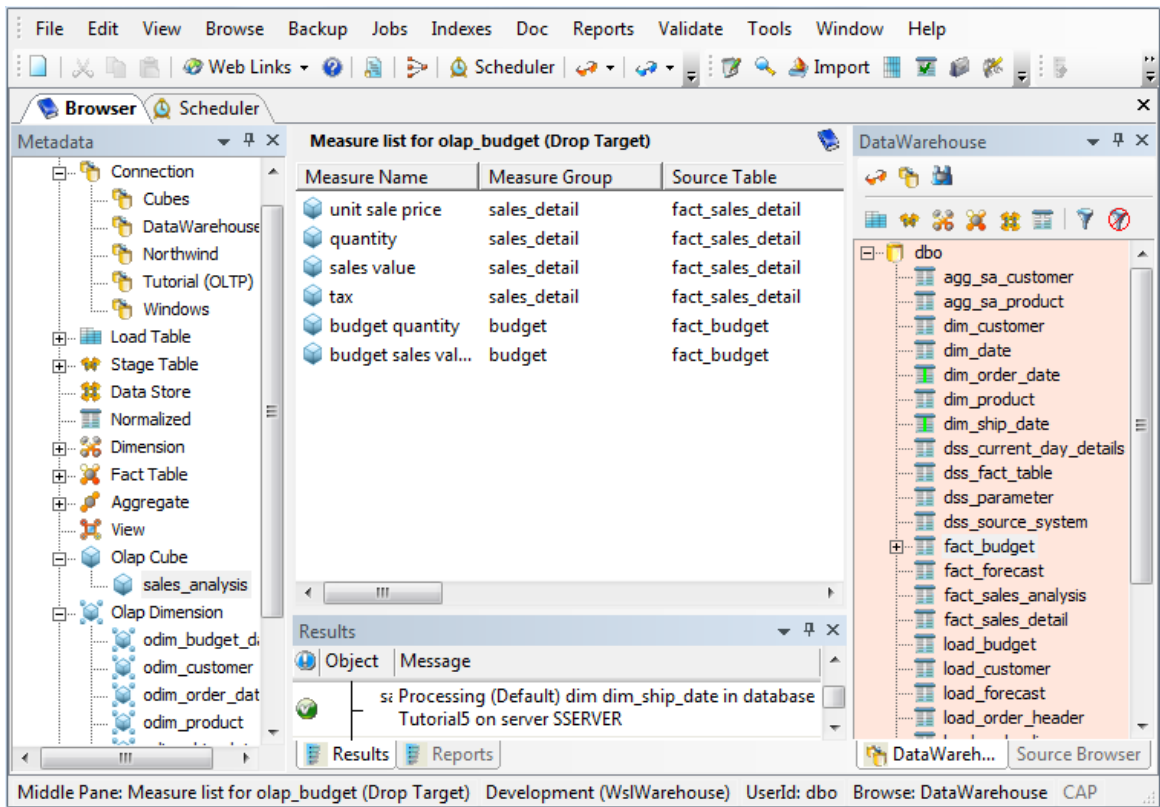
OK

Cancel

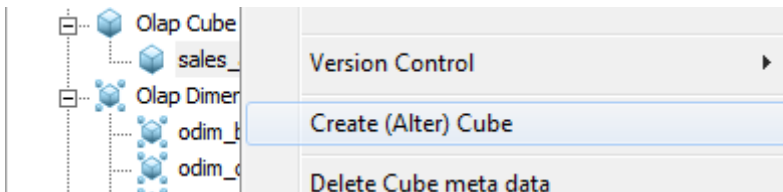
?

Click OK to complete definition of the cube.

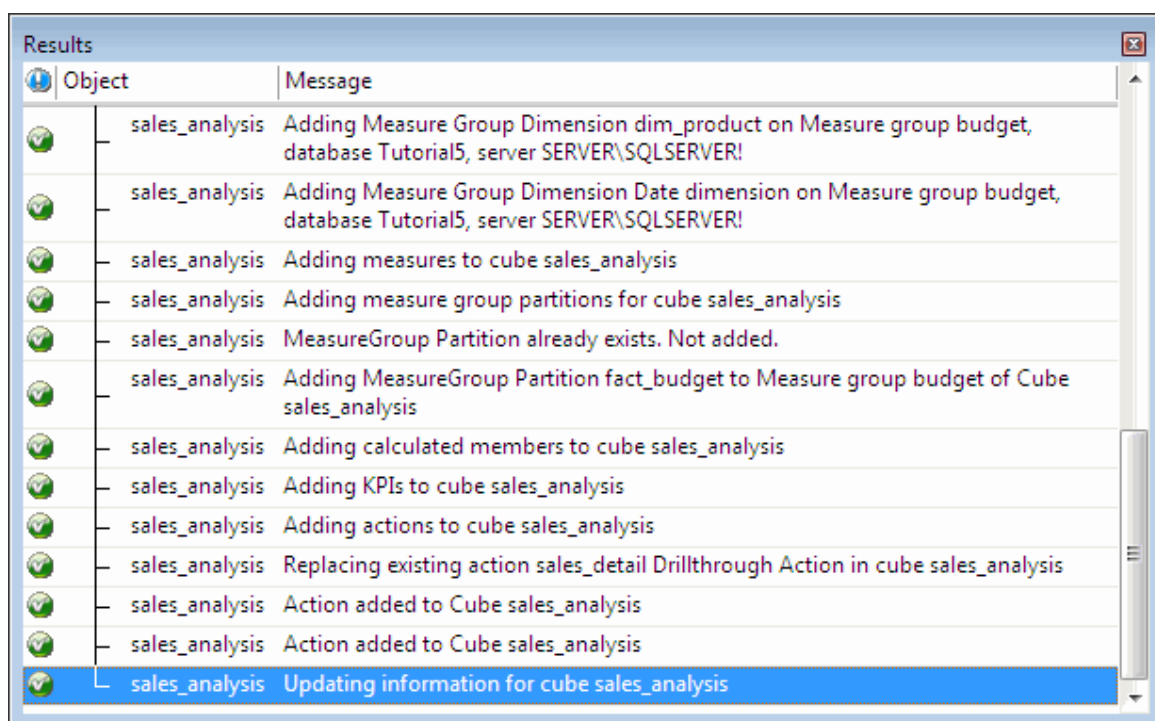
- Click on the OLAP Cube *sales_analysis* in the left hand pane to show the updated Measures associated with the cube. You should now see measures from both fact tables in the middle pane:



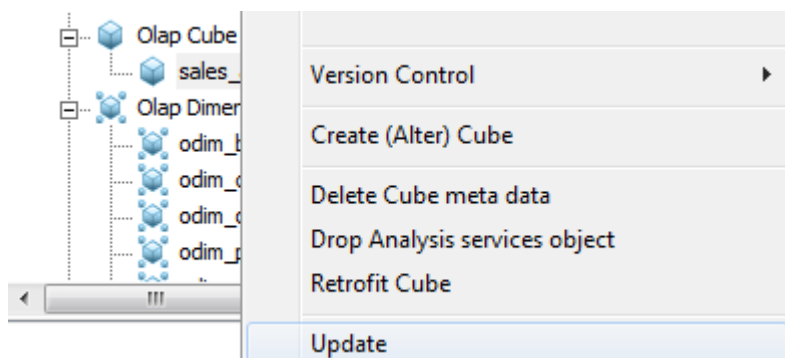
- 8 To apply the changes made in the QAD Data Warehouse Designer metadata to Analysis Services, right click the **sales_analysis** OLAP Cube in the left hand pane and choose **Create (Alter) Cube** as below:



This will open the WSL Cube executable that connects to Analysis Services to create the **sales_analysis** cube structure. You will see the successful completion in the results pane:



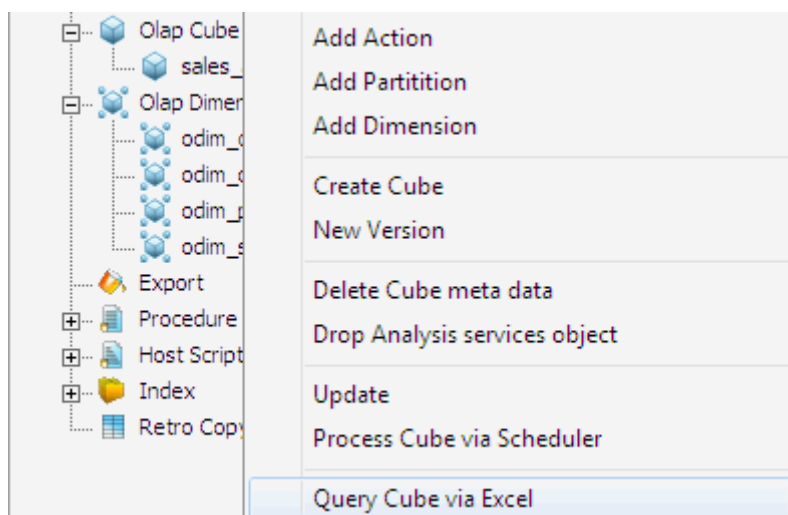
- 9 Next, reload the OLAP Cube in Analysis Services. Do this by right clicking on the *sales_analysis* cube in the left hand pane and choosing **Update** as follows:



This will open the WSL Cube executable to process data into the cube structure. Once the cube is processed it can be viewed. Again, you will see the successful completion in the results pane:

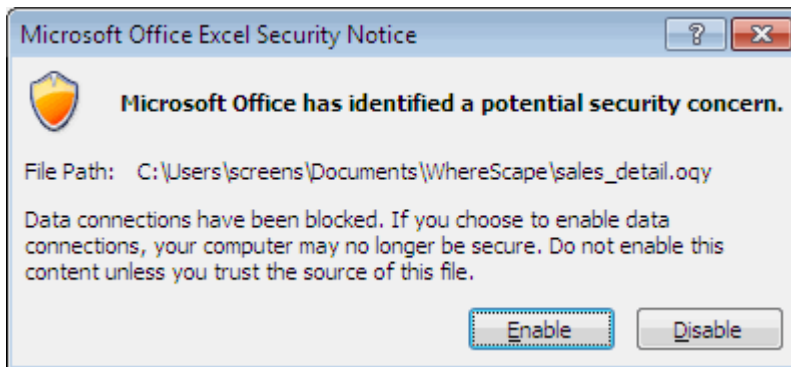
Results		
Object	Message	
sales_analysis	process completed successfully	
sales_analysis	WslCube10 BETA Version 6.0.6.OLAP (Build 100127)	
sales_analysis	Processing (Default) dim dim_customer in database Tutorial5 on server SERVER\SQLSERVER	
sales_analysis	Processing (Default) dim dim_order_date in database Tutorial5 on server SERVER\SQLSERVER	
sales_analysis	Processing (Default) dim dim_product in database Tutorial5 on server SERVER\SQLSERVER	
sales_analysis	Processing (Default) dim dim_ship_date in database Tutorial5 on server SERVER\SQLSERVER	
sales_analysis	Processing (Default) dim Date dimension in database Tutorial5 on server SERVER\SQLSERVER	
sales_analysis	Processing Cube sales_analysis, database Tutorial5, server SERVER\SQLSERVER	
sales_analysis	Processing partitions (One partition only/Full process) for cube measuregroup sales_detail in database Tutorial5 on server SERVER\SQLSERVER	
sales_analysis	Processing (One partition only/Full process) partition fact_sales_detail of cube sales_analysis.	
sales_analysis	Processing partitions (One partition only/Full process) for cube measuregroup budget in database Tutorial5 on server SERVER\SQLSERVER	
sales_analysis	Processing (One partition only/Full process) partition fact_budget of cube sales_analysis.	

- 10 To view the cube in Excel, right click the *sales_analysis* cube in the left hand pane and choose Query cube Via Excel like this:



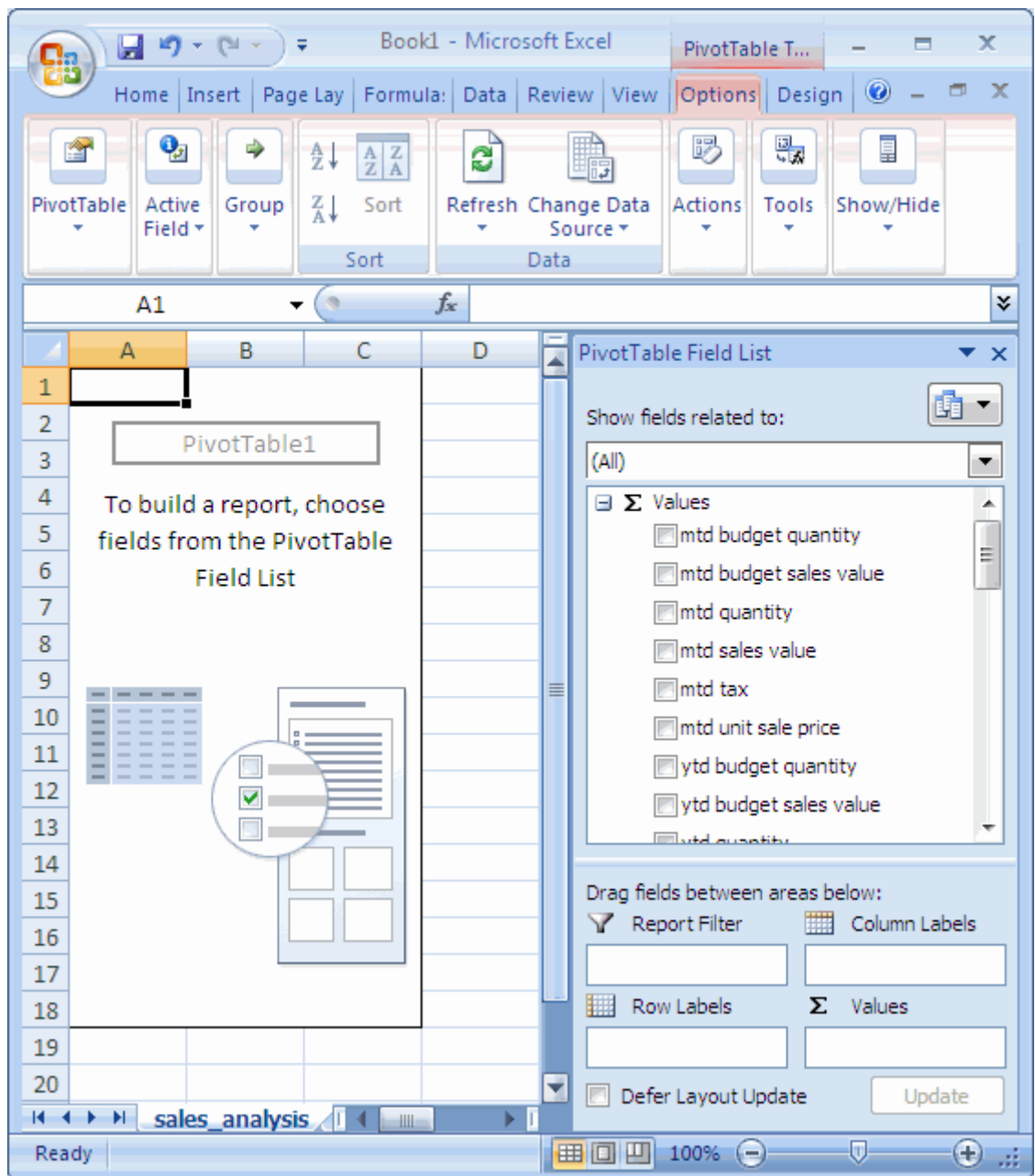
This will open Excel if it is installed.

NOTE: If Excel displays the following dialog box, click Enable:



This message may not be displayed.

Excel then opens a connection to the cube for querying in a pivot table:



NOTE: the two measure groups are now displayed in the Field list.

You are now ready to proceed to the next section - **Cube Connections for Other Databases** (see "5.4 Cube Connections for Other Databases" on page 164)

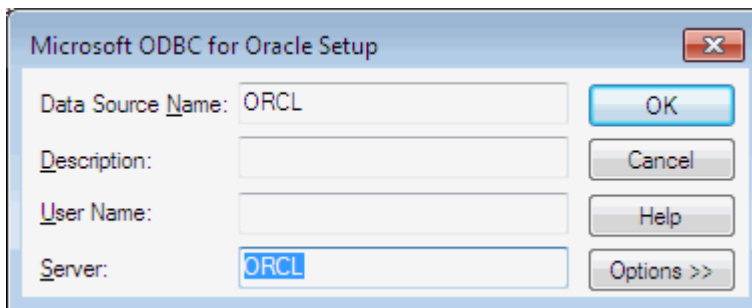
5.4 Cube Connections for Other Databases

This tutorial has been completed using Microsoft SQL Server as the data warehouse database. If you wish to use Oracle or DB2, the data warehouse connections need to be set differently as follows.

This section shows how to configure the DataWarehouse connection for either an Oracle or a DB2 data warehouse database.

Oracle Configuration

- Select *MSDAORA* for the Provider Type
- Enter the oracle "TNS Server Name" for the **Server**, specifically the **Server** field in the ODBC set up screen shown:



- Enter the data warehouse "schema" for the Database field

Here is an Oracle example:

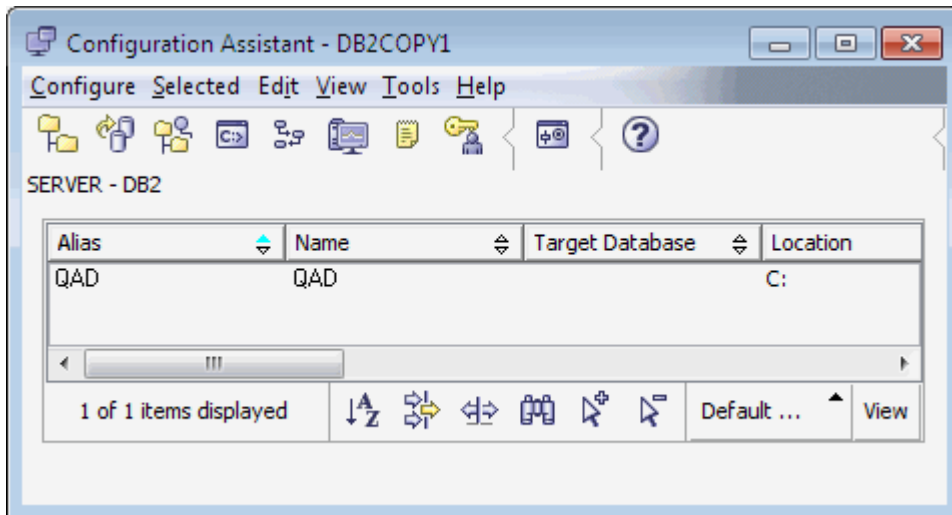
The screenshot shows the "DataWarehouse definition" dialog box with the "Connection Properties" tab selected. The dialog contains the following fields and controls:

- Data Warehouse:** A checkbox that is checked.
- Connection Name:** A text box containing "DataWarehouse" with a help icon to its right.
- Connection Type:** A dropdown menu set to "Database".
- ODBC Source:** A dropdown menu set to "ORCL".
- Database ID (SID):** A text box containing "ORCL".
- Database Link ID:** An empty text box.
- Extract User ID:** A text box containing "dssdemo".
- Password:** A text box containing three asterisks "***".
- Admin User ID:** An empty text box.
- Password:** An empty text box.
- SSIS Connect String:** An empty text box with a "Reset" button to its right.
- Data Type Mapping Set:** A dropdown menu set to "(Default)". Below it is a checkbox labeled "As a cube data source" which is currently unchecked.
- Provider Type:** A dropdown menu set to "MSDAORA (OLE DB for Oracle)".
- Server:** A text box containing "ORCL".
- Database:** A text box containing "dssdemo".

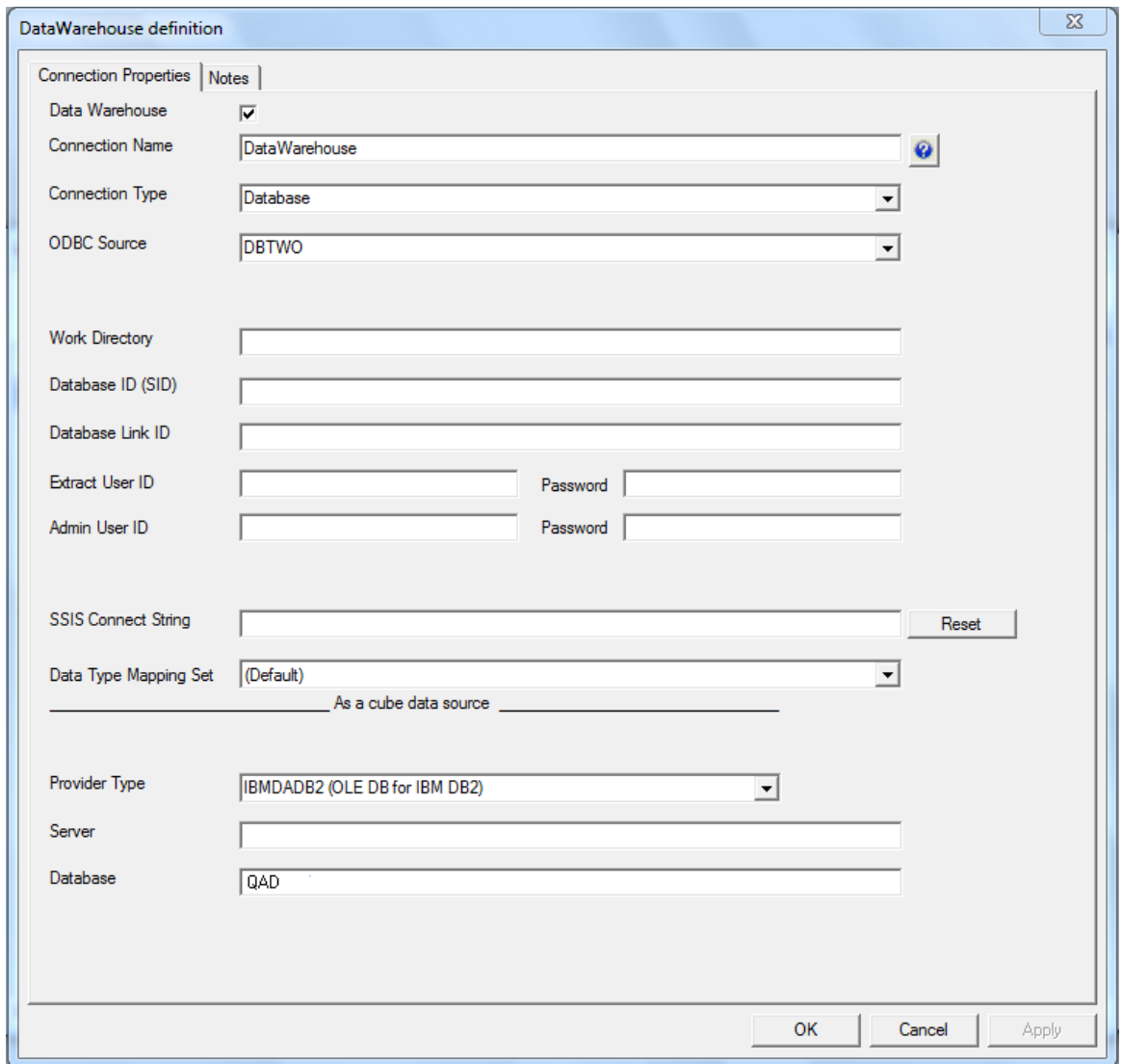
At the bottom of the dialog are three buttons: "OK", "Cancel", and "Apply".

DB2 Configuration

- Select *IBMDADB2* for the Provider Type
- The *Server* field is left empty for DB2
- Enter the database server alias for the *Database* field, specifically the alias field for the IBM DB2 connection in the following DB2 Configuration Assistant screen:



Here is an IBM DB2 example:



The image shows a 'DataWarehouse definition' dialog box with two tabs: 'Connection Properties' and 'Notes'. The 'Connection Properties' tab is active. It contains the following fields and controls:

- Data Warehouse:** A checkbox that is checked.
- Connection Name:** A text box containing 'DataWarehouse'.
- Connection Type:** A dropdown menu set to 'Database'.
- ODBC Source:** A dropdown menu set to 'DBTWO'.
- Work Directory:** An empty text box.
- Database ID (SID):** An empty text box.
- Database Link ID:** An empty text box.
- Extract User ID:** An empty text box.
- Password:** An empty text box.
- Admin User ID:** An empty text box.
- Password:** An empty text box.
- SSIS Connect String:** An empty text box with a 'Reset' button to its right.
- Data Type Mapping Set:** A dropdown menu set to '(Default)'. Below it is a checkbox labeled 'As a cube data source' which is unchecked.
- Provider Type:** A dropdown menu set to 'IBMDADB2 (OLE DB for IBM DB2)'.
- Server:** An empty text box.
- Database:** A text box containing 'QAD'.

At the bottom right of the dialog are three buttons: 'OK', 'Cancel', and 'Apply'.

CHAPTER 6

Tutorial 6 - KPI fact table

Before you start on this chapter you should have:

- Completed ***Tutorial 2 - Rollup fact tables, ASCII file loads, aggregates*** (on page 63)

This chapter will cover the definition of a Key Performance Indicator (KPI) fact table. The fact tables built as part of the first two tutorials are used in this process.

In This Chapter

6.1 Purpose and Roadmap.....	170
6.2 The KPI Dimension	171
6.3 Defining the KPI Fact Table	172
6.4 Creating the KPI Fact Table and Procedure.....	178
6.5 The KPI Parameters	180
6.6 Defining a KPI	181
6.7 Defining the Activity KPI.....	186

6.1 Purpose and Roadmap

Purpose

KPI fact tables are designed to assist in the answering of difficult business questions. The star schema design does not support an easy means of answering questions that wish to compare current month values with the same period last year, or current month with year to date values. In many cases it is possible to build such measures into monthly rollup fact tables, but in some instances even that design does not provide an adequate solution. KPI fact tables are a very specific type of fact table and are narrowly focused to handle these complex comparative queries.

In this tutorial you will learn how to:

- (i) set-up a KPI dimension
- (ii) create a KPI fact table
- (iii) define individual KPIs

This tutorial relies upon the tables created in the previous tutorials.

Tutorial Environment

This tutorial has been completed using IBM DB2. All of the features illustrated in this tutorial are available in SQL Server, Oracle and DB2 (unless otherwise stated). Any differences in usage of QAD Data Warehouse Designer between these databases are highlighted.

Tutorial Roadmap

Step in Tutorial	Section
Create a dimension to support the KPI fact table	The KPI dimension
Define the columns of the KPI fact table including the measures and the specific dimensions required.	Defining the KPI fact table
Create the KPI fact table and build a procedure used to update the fact table.	Creating the KPI fact table
Create and initialize the parameters used to establish the update window for the fact table.	The KPI parameters
Define a simple KPI	Defining a KPI
Define a KPI that does year to date calculations for each month.	Defining the Activity KPI

The tutorial starts with '*The KPI Dimension*' (see "**6.2 The KPI Dimension**" on page 171).

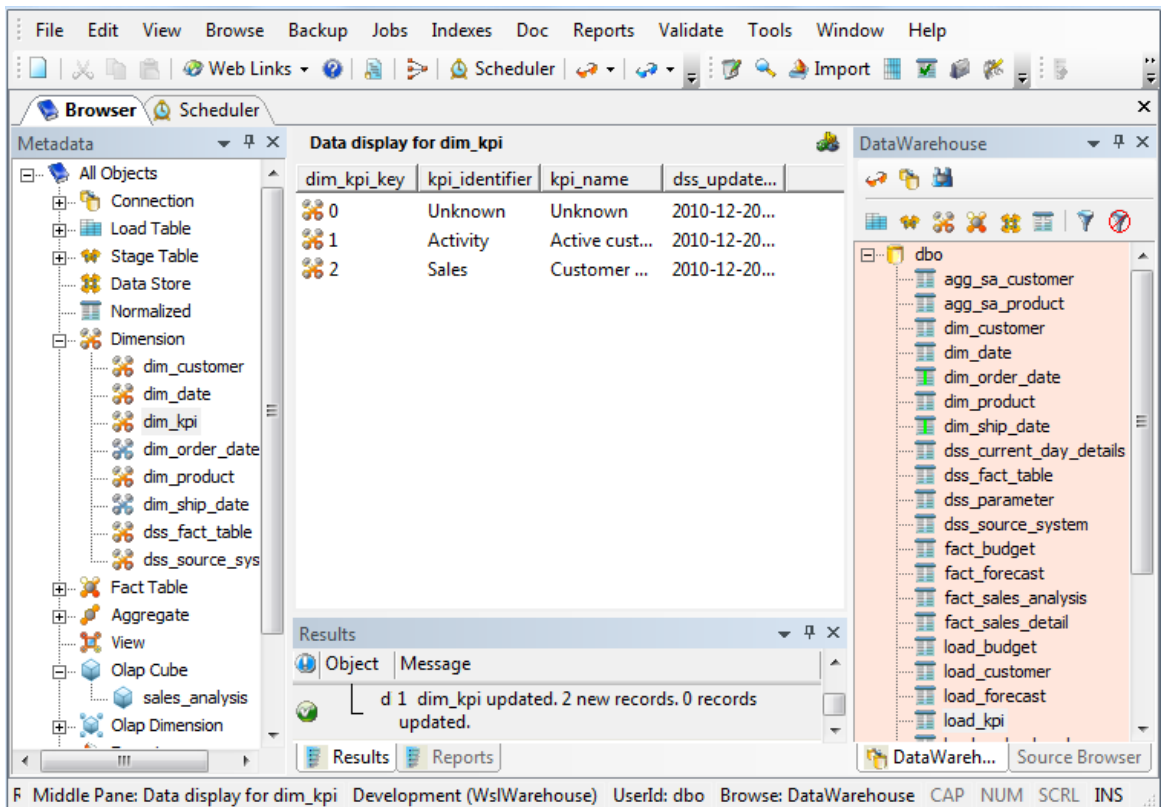
6.2 The KPI Dimension

The KPI dimension essentially provides a record of each KPI or statistic we are tracking. There should be one row in this table for each such element. The KPI fact table requires that this dimension contain at the least an artificial dimension key and a business key. We will refer to the business key as the KPI Identifier.

The KPI dimension can be created from the KPI table distributed with the other tutorial tables:

- 1 Double click on the 'Load Table' object group in the left hand pane to create a drop target in the middle pane.
- 2 Browse to the tutorial tables and drag the table 'KPI' into the middle pane. Accept the default name of load_kpi. Create and load the table.
- 3 Double click on the 'Dimension' object group in the left hand pane to create a dimension drop target in the middle pane.
- 4 Browse to the data warehouse and drag the newly created 'load_kpi' table into the middle pane. Accept the default name of dim_kpi and proceed to create and populate a Normal dimension as per the examples in the first tutorial. The business key is kpi_identifier.
- 5 Right click on dim_kpi and select Execute Update Procedure.

Your QAD Data Warehouse Designer screen should look like this when you have finished:

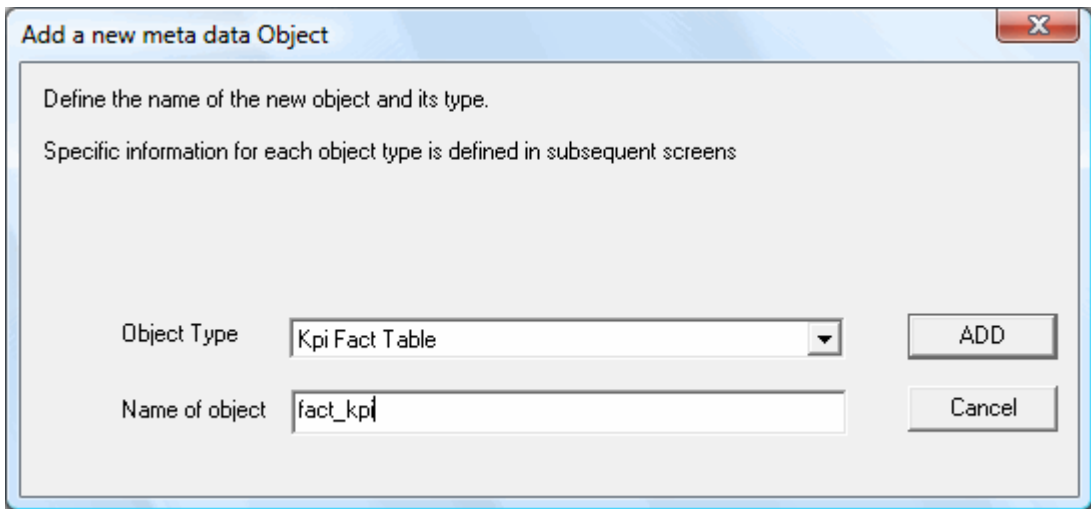


You are now ready to proceed to the next section - *Defining the KPI Fact Table* (see "6.3 Defining the KPI Fact Table" on page 172).

6.3 Defining the KPI Fact Table

A KPI fact table is normally created manually. We will, however, use the drag and drop functionality to acquire the dimension key settings. Proceed as follows:

- 1 Double click on the 'Fact Table' object group in the left hand pane. This will display a list of fact tables in the middle pane and create a fact table drop target.
- 2 Browse to the data warehouse and double click on `dim_date` to expand the tree and display the columns.
- 3 Drag the column `dim_date_key` from the right hand (browse) pane into the middle pane. The "Add a new object" dialog will appear defaulting to a fact table called `fact_date`. Change the object type to Kpi fact table and the table name to `fact_kpi`.



- 4 Click ADD to add the new object and OK on the properties screen.
- 5 Use the right mouse menu on the column named 'dim_date_key' in the middle pane and select the properties of this column. Under the column type select 'date dimension key' and enter 0 for the default value. Click OK. This identifies this column as the date dimension column to be used during the definition of the individual KPIs.

Column definition

Column Properties | Transformation | Purpose | Concept | Grain | Examples | Usage | Notes

Table: Fact Table

Column name: dim_date_key

Business display name: dim time key

Data type: integer

Format: ###0

Column order: 10

Nulls: ☐

Numeric: ☒

Additive: ☒

Attribute: ☐

Column Type (KPIs only): Date dimension key

Default Value (KPIs): 0

End User Layer Display: ☐

Dimension Join: ☒ Manual Dimension Join: ☐

Key Type (D,A,B,C.): 2

Artificial Key: ☐

Primary Business Key: ☐

Note: When the Dimension Join flag is set then the contents of Source column denotes the foreign key. Business definition denotes the join.

Source table: dim_date

Source column: dim_date_key

Business Definition:
Source strategy:
(max 2048 chars.)

Generated key for the date dimension. Nominal format is YYYYMMDD, but DD equal to 0 and greater than 31 permitted for special date handling.

Update

Update <

Update >

OK Cancel Apply

- 6 Drag the column `dim_kpi_key` from the `dim_kpi` table in the right hand pane into the column list in the middle pane.
- 7 Use the right mouse menu on the column named '`dim_kpi_key`' in the middle pane and select the properties of this column. Under the column type select 'Kpi dimension key' and enter 0 for the default value.

Column definition

Column Properties | Transformation | Purpose | Concept | Grain | Examples | Usage | Notes

Table: Fact Table Update

Column name: dim_kpi_key Update <-

Business display name: dim kpi key Update >-

Data type: integer

Format: ###0

Column order: 20

Nulls: ☒

Numeric: ☒

Additive: ☐

Attribute: ☐

Column Type (KPIs only): Kpi dimension key

Default Value (KPIs): 0

End User Layer Display: ☐

Dimension Join: ☒ Manual Dimension Join: ☐

Key Type (0,A,B,C..): 2

Artificial Key: ☐

Primary Business Key: ☐

Note: When the Dimension Join flag is set then the contents of Source column denotes the foreign key. Business definition denotes the join.

Source table: dim_kpi

Source column: dim_kpi_key

Business Definition:
Source strategy:
(max 2048 chars.)
Generated artificial key

OK Cancel Apply

- 8 Drag the column `dim_customer_key` from the `dim_customer` table in the right hand pane into the column list in the middle pane.
- 9 Use the right mouse menu on the column named '`dim_customer_key`' in the middle pane and select the properties of this column. Under the column type select 'Dimension key' and enter 0 for the default value.

Column definition

Column Properties | Transformation | Purpose | Concept | Grain | Examples | Usage | Notes

Table: Fact Table Update

Column name: dim_customer_key Update <

Business display name: dim customer key Update >

Data type: integer

Format: ###0

Column order: 30

Nulls: ☒

Numeric: ☒

Additive: ☐

Attribute: ☐

Column Type (KPIs only): Dimension key

Default Value (KPIs): 0

End User Layer Display: ☐

Dimension Join: ☒ Manual Dimension Join: ☐

Key Type (D,A,B,C.): 2

Artificial Key: ☐

Primary Business Key: ☐

Note: When the Dimension Join flag is set then the contents of Source column denotes the foreign key. Business definition denotes the join.

Source table: dim_customer

Source column: dim_customer_key

Business Definition:
Source strategy:
(max 2048 chars.)
Generated artificial key

OK Cancel Apply

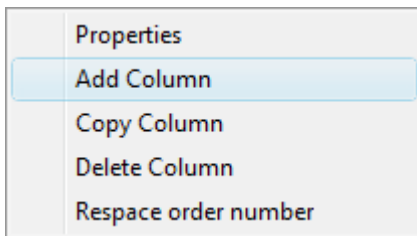
At this point we have defined the new KPI fact table and have added three columns to it, namely `dim_date_key`, `dim_kpi_key` and `dim_customer_key`. For the purposes of this tutorial these will be the only dimensions we will utilize.

We will now define the measures of the KPI fact table. KPI fact tables contain four types of measure. These measure types are month to date, year to date, same month last year, and previous year to date. These measures will have different meanings depending on the KPI being evaluated. They are by necessity, therefore very generic. Typically just a count and a dollar value. Note, that all measures must allow nulls. Although the resultant record will not contain nulls, the KPI update procedure makes multiple passes in order to update the fact table and needs the ability to insert nulls during the process. Proceed as follows to create quantity and sales measures for each of the types defined above.

- 1 Click on the 'fact_kpi' table name to refresh the column display in the middle pane. These columns are listed:

fact_kpi columns				
Col name	Display	Data type	Src table	Src column
 dim_date_key	dim time key	integer	dim_date	dim_date_key
 dim_kpi_key	dim kpi key	integer	dim_kpi	dim_kpi_key
 dim_customer_key	dim customer ...	integer	dim_customer	dim_customer_key

- 2 Use the right mouse menu on 'fact_kpi' and select 'Add Column'.



- 3 Enter `mtd_quantity` for the column and business names. Enter `integer` for the data type. Select 'Month to date measure' for the column type and set a default value of 0. The Nulls check box must be set. Update the column properties:

Column definition

Column Properties | Transformation

Table: fact_kpi

Column name: mtd_quantity

Business display name: mtd_quantity

Data type: integer

Format:

Column order: 40

Nulls: ☒

Numeric: ☐

Additive: ☐

Attribute: ☐

Column Type (KPIs only): Month to date measure

Default Value (KPIs): 0

End User Layer Display: ☒

Dimension Join: ☐ Manual Dimension Join: ☐

Key Type (D,A,B,C.): ☐

Artificial Key: ☐

Primary Business Key: ☐

Note: When the Dimension Join flag is set then the contents of Source column denotes the foreign key. Business definition denotes the join.

Source table:

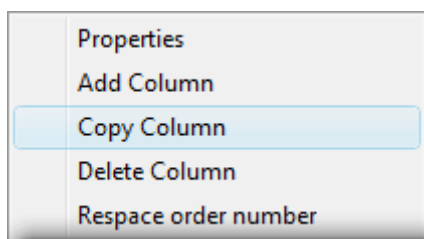
Source column:

Business Definition:
Source strategy:
(max 2048 chars.)

Update

OK Cancel Apply

- 4 Repeat step 2 and 3 using the column name **mtd_sales** with a data type of **number(13,2)** for Oracle, or **numeric(13,2)** for SQL Server and DB2.
- 5 Position on the **mtd_quantity** column and use the right mouse menu option 'Copy Column' to copy the column.



Change the properties of the copied column to be **ytd_quantity** and the column type to 'Year to date measure'.

- 6 Repeat step 5 for **mtd_sales** to create **ytd_sales**.

- 7 Repeat steps 5 and 6 to create `prev_month_quantity` and `prev_month_sales` using a column type of 'Last year same month measure'
- 8 Repeat steps 5 and 6 to create `prev_ytd_quantity` and `prev_ytd_sales` using a column type of 'Prev year to date measure'.

The resultant set of columns should be named as follows with the column type as shown (SQL Server).

Note: Oracle should have `number(13,2)` instead of `numeric(13,2)`.

fact_kpi columns									
Col name	Display	Data type	Src table	Src column	Nulls	Key...	Col Type	Default Value	
 dim_date_key	dim time key	integer	dim_date	dim_date_key	N	2	Date dimension key	0	
 dim_kpi_key	dim kpi key	integer	dim_kpi	dim_kpi_key	Y	2	Kpi dimension key	0	
 dim_customer_key	dim customer key	integer	dim_customer	dim_customer_key	Y	2	Dimension key	0	
 mtd_quantity	mtd_quantity	integer			Y		Month to date measure	0	
 ytd_quantity	ytd_quantity	integer			Y		Year to date measure	0	
 prev_month_quantity	prev_month_quantity	integer			Y		Last year same month measure	0	
 prev_ytd_quantity	prev_ytd_quantity	integer			Y		Previous year to date measure	0	
 mtd_sales	mtd_sales	numeric(13,2)			Y		Month to date measure	0	
 ytd_sales	ytd_sales	numeric(13,2)			Y		Year to date measure	0	
 prev_month_sales	prev_month_sales	numeric(13,2)			Y		Last year same month measure	0	
 prev_ytd_sales	prev_ytd_sales	numeric(13,2)			Y		Previous year to date measure	0	

Note: The column order is important. For example if we have mtd quantity and sales in that order then the prev month, prev ytd and ytd figures also need quantity first followed by sales. If this order is not adhered to then the generated procedure will load the wrong values into the wrong columns.

The KPI fact table has now been defined and can be created.

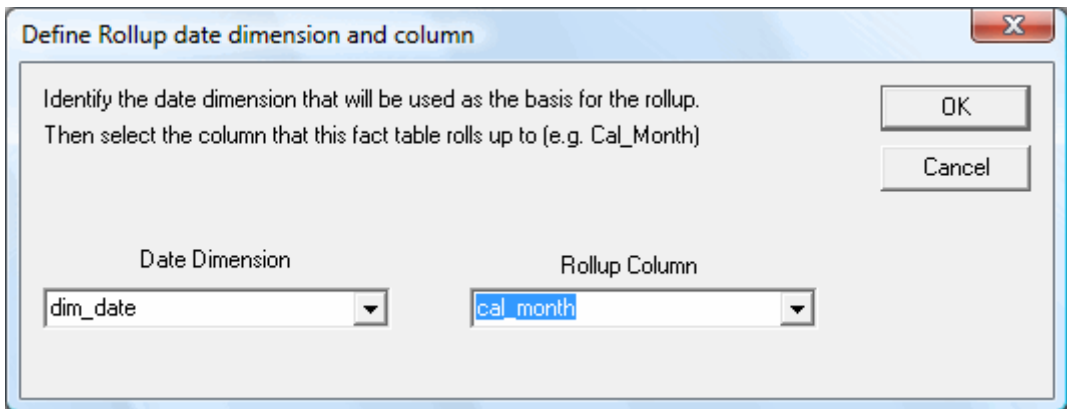
You are now ready to proceed to the next section - '**Creating the KPI Fact Table and Procedure**' (see "6.4 **Creating the KPI Fact Table and Procedure**" on page 178).

6.4 Creating the KPI Fact Table and Procedure

Once defined the KPI fact table can be created and the update procedure built.

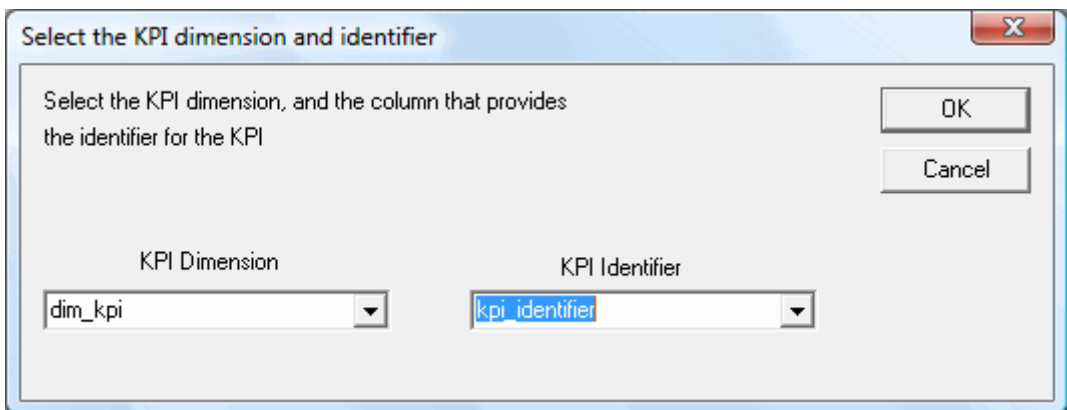
- 1 Create the KPI fact table by selecting the 'Create/ReCreate' menu option when positioned over the `fact_kpi` table name.
- 2 Alter the properties of the table and select (Build Procedure...) from the 'Update procedure' drop list. Enter OK to update the properties.
- 3 A dialog box will prompt for a period start parameter. This parameter along with the subsequent period end parameter define what period(s) will be processed when the KPI fact table is updated. These parameters must be defined, so accept the default `FACT_KPI_START` and `FACT_KPI_END` parameter names. See **The KPI Parameters** (see "6.5 **The KPI Parameters**" on page 180) for a description of these parameters.

- 4 A date dimension and month rollup column are prompted for. Select `dim_date` and `cal_month`:



The dialog box is titled "Define Rollup date dimension and column". It contains the following text: "Identify the date dimension that will be used as the basis for the rollup. Then select the column that this fact table rolls up to (e.g. Cal_Month)". There are two dropdown menus: "Date Dimension" with "dim_date" selected, and "Rollup Column" with "cal_month" selected. There are "OK" and "Cancel" buttons on the right.

- 5 Two subsequent prompts require a year rollup column and a date column. Select `cal_year` and `calendar_date` to match these prompts. Enter the KPI dimension and identifier as `dim_kpi` and `kpi_identifier`:



The dialog box is titled "Select the KPI dimension and identifier". It contains the following text: "Select the KPI dimension, and the column that provides the identifier for the KPI". There are two dropdown menus: "KPI Dimension" with "dim_kpi" selected, and "KPI Identifier" with "kpi_identifier" selected. There are "OK" and "Cancel" buttons on the right.

- 6 The procedure will now be built and compiled.

You are now ready to proceed to the next section - *The KPI Parameters* (see "6.5 The KPI Parameters" on page 180).

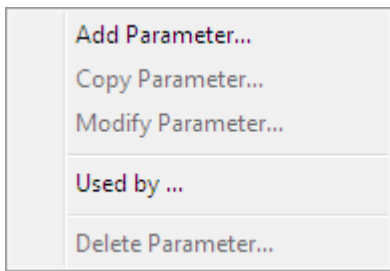
6.5 The KPI Parameters

During the procedure creation phase of the KPI fact table we are prompted for parameters used to define the period start and period end. These parameters are read by the update procedure whenever a KPI is updated, and are used to ascertain what time periods are being processed.

If the parameters do not exist then the default of the current and previous months is used. It would however be normal practice to create and maintain these parameters. A procedure called 'daily_date_roll' is shipped with the metadata. This procedure updates a number of parameters to reflect the current date. It is designed to be run every night. Normally we would alter this procedure and include the setting of our KPI period parameters to perhaps the current and previous months.

For the tutorial we will create these parameters and set dates to cover the full range of tutorial data.

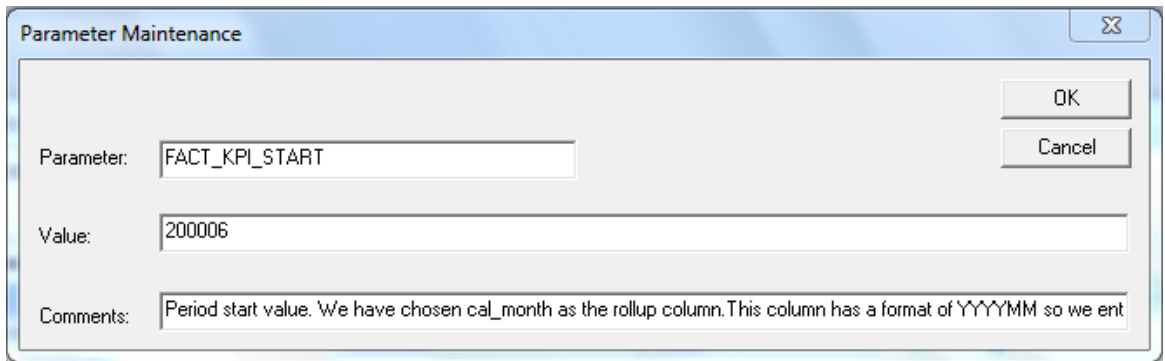
- 1 Select the **Tools/Parameters** menu option. This displays the current parameters in the middle pane.
- 2 Right mouse in the middle pane and choose the 'Add parameter' menu option:



- 3 Enter the values from the following table for the period start parameter and then repeat step 2 and enter the values for the period end parameter.

Parameter	Value	Comments
FACT_KPI_START	200006	Period start value. We have chosen cal_month as the rollup column. This column has a format of YYYYMM so we enter 200006 for June/ 2000
FACT_KPI_END	200204	Period end value. April/2002 for tutorial

Sample parameter:



The screenshot shows a 'Parameter Maintenance' dialog box with the following fields:

- Parameter:** FACT_KPI_START
- Value:** 200006
- Comments:** Period start value. We have chosen cal_month as the rollup column. This column has a format of YYYYMM so we ent

Buttons: OK, Cancel

Once the parameters have been created we can define the KPI.

You are now ready to proceed to the next section - **Defining a KPI** (see "6.6 Defining a KPI" on page 181).

6.6 Defining a KPI

We will now define two KPIs. The dimension we have created dim_kpi has two KPIs. These are firstly an Activity KPI, which shows the number of active customers and the value of sales during a month. Secondly a Sales KPI, which shows the number of sales and the value of the sales by customer by month. The process for creating the two KPIs is similar, but there is a difference in complexity. In the Sales KPI we can simply add up all the monthly sales counts and values to achieve year to date values. However, we cannot add the number of active customers in each month to acquire the year to date activity count, as a customer may have been active in more than one month, but we only want to recognize that customer once.

We will do the simpler Sales KPI first followed by the Activity KPI.

Sales KPI

- 1 Use the right mouse menu when positioned over the fact_kpi table and select 'Add Kpi':

Properties
Storage
Display Columns
Display Indexes
Display KPI's
Display data
Add Column
Add Index
Add KPI
Validate against database
Create script to test all KPI's

- 2 Populate the dialog box as per the following example. The Kpi Identifier must match the value in the KPI dimension. In this case it must be 'Sales'. The Kpi Name and Description are not matched to the dimension, and can be used here for internal definition of the KPI. The **active** check box should be set, so that this particular KPI will be processed when we update the KPI fact table. For the 'Month to date update columns' we select the `mtd_quantity`, `mtd_sales`, and `dim_customer_key`. The 'Year to date update columns' are left blank to allow the update procedure to automatically handle these values.

KPI definition

Properties | Mtd Statement | Ytd Statement | Procedural Block

KPI Identifier: Sales

KPI Name: Customer sales (quantity and value)

Active: ☒

Description: Provides a count and dollar value of sales in a particular month. The customer dimension is used to allow analysis by customer if required.

Month to Date Update columns: mtd_quantity,mtd_sales,dim_customer_key

Select Columns

Year to Date Update columns:

Select YTD Cols

OK Cancel Apply

- 3 Once the dialog above is completed click OK to add the KPI. Selecting the 'Display Kpi's' right mouse menu option when positioned on the `fact_kpi` table will now display our newly defined KPI:

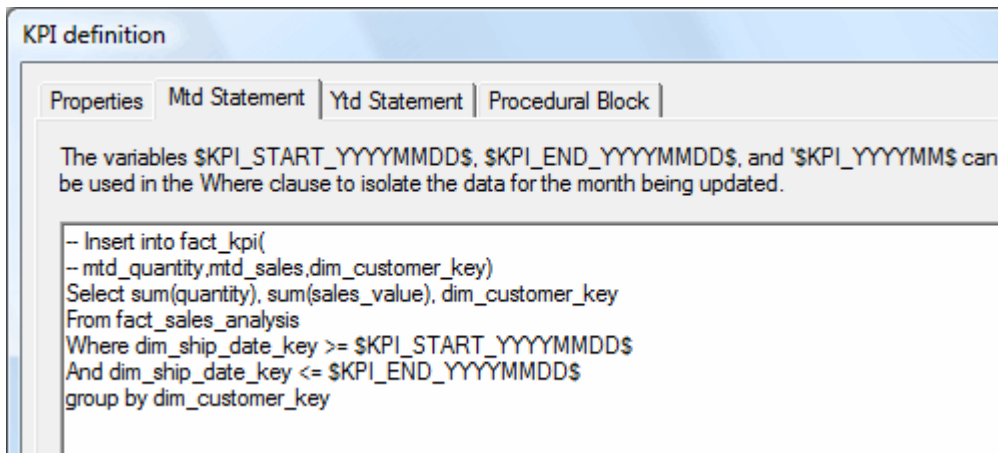
KPI list for fact_kpi				
Id	Name	Active	Method	Description
Sales	Customer sales (qnantity and value)	Enabled	Statement	Provides a count and dollar val

There are three additional tabs on the dialog box as shown in the screen shot above. These tabs allow the definition of a month to date statement, a year to date statement and a procedural block. In this example we will be defining a month to date statement. A procedural block can be used when the KPI is too complex to be performed as a single SQL statement and procedural language is required.

We will now proceed to create the SQL statement required to perform the month to date update.

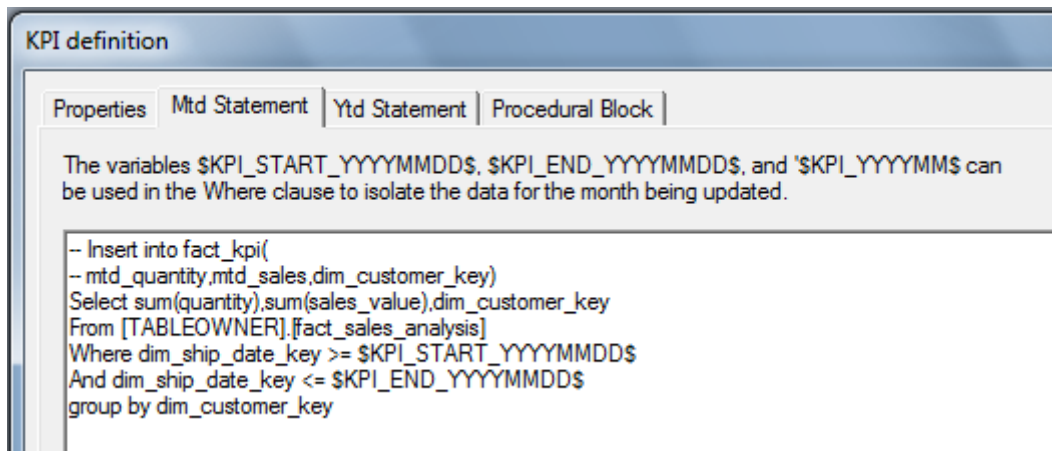
- 1 Use the right mouse menu when positioned on the Sales KPI and select 'Modify Kpi'. Then choose the 'Mtd Statement' tab. You will note that there are two comment lines at the top of the edit window. These comments show the order in which information is to be added, and hence the order in which the Mtd select statement must return its information.
- 2 Enter the statement as shown below. Note, that no trailing semi-colon is required. When done click OK to complete the definition of the KPI.

```
-- Insert into fact_kpi(
-- mtd_quantity,mtd_sales,dim_customer_key)
Select sum(quantity),sum(sales_value),dim_customer_key
From fact_sales_analysis
Where dim_ship_date_key >= $KPI_START_YYYYMMDD$
And dim_ship_date_key <= $KPI_END_YYYYMMDD$
group by dim_customer_key
```

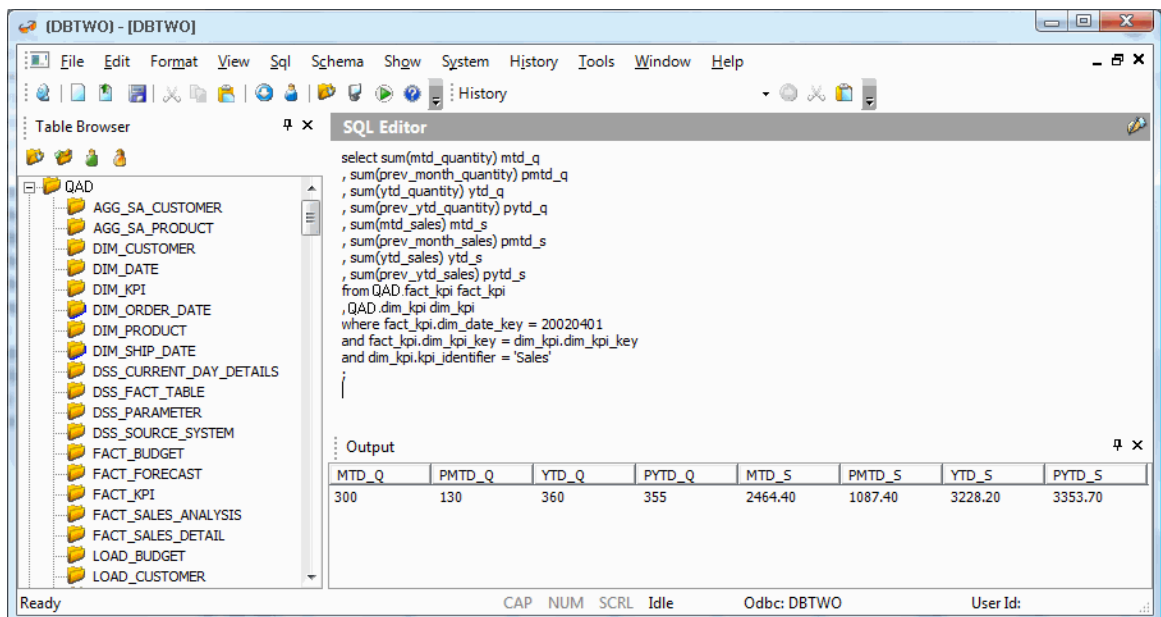


For DB2, enter the statement as shown below.

```
-- Insert into fact_kpi(
-- mtd_quantity,mtd_sales,dim_customer_key)
Select sum(quantity),sum(sales_value),dim_customer_key
From [TABLEOWNER].[fact_sales_analysis]
Where dim_ship_date_key >= $KPI_START_YYYYMMDD$
And dim_ship_date_key <= $KPI_END_YYYYMMDD$
group by dim_customer_key
```



- 3 The KPI has now been defined and we can update the KPI fact table in the normal manner, or by selecting 'Update (run)' when positioned over the KPI in the middle pane. This will execute the KPI table update procedure in foreground. If all goes well the procedure will report the processing of 23 months, and will add a number of records.
- 4 We would normally examine the fact table through an end user tool, but the following SQL statement can be used to see the results. The screen shot below shows the normal output from this select statement.



You are now ready to proceed to the next section - **'Defining the Activity KPI'** (see "6.7 Defining the Activity KPI" on page 186)

6.7 Defining the Activity KPI

The Activity KPI is similar to the Sales KPI, except that it will require the definition of a year to date statement. We will create the KPI by copying the first KPI to show the use of this copy capability.

Activity KPI

- 1 Use the right mouse menu when positioned over the Sales KPI and select 'Insert copy'.
- 2 Position over the second (copy of) Sales KPI and select 'Properties' from the right mouse menu.
- 3 Change the Kpi Identifier to 'Activity', and the name and definition as per the example screen below.
- 4 Click the 'Select Columns' button and remove the `dim_customer_key` entry.
- 5 Click the 'Select YTD Cols' button and add `ytd_quantity` and `ytd_sales`.

The completed properties screen should look as follows:

The screenshot shows the 'KPI definition' dialog box with the 'Properties' tab selected. The dialog has four tabs: 'Properties', 'Mtd Statement', 'Ytd Statement', and 'Procedural Block'. The 'Properties' tab contains the following fields:

- KPI Identifier:** A text box containing the word 'Activity'.
- KPI Name:** A text box containing 'Customer activity (counts and value)'.
- Active:** A checkbox that is checked.
- Description:** A large text area containing the text 'Provides a count of active customers in a particular month, together with total sales'.
- Month to Date Update columns:** A text box containing 'mtd_quantity,mtd_sales'. Below this text box is a button labeled 'Select Columns'.
- Year to Date Update columns:** A text box containing 'ytd_quantity,ytd_sales'. Below this text box is a button labeled 'Select YTD Cols'.

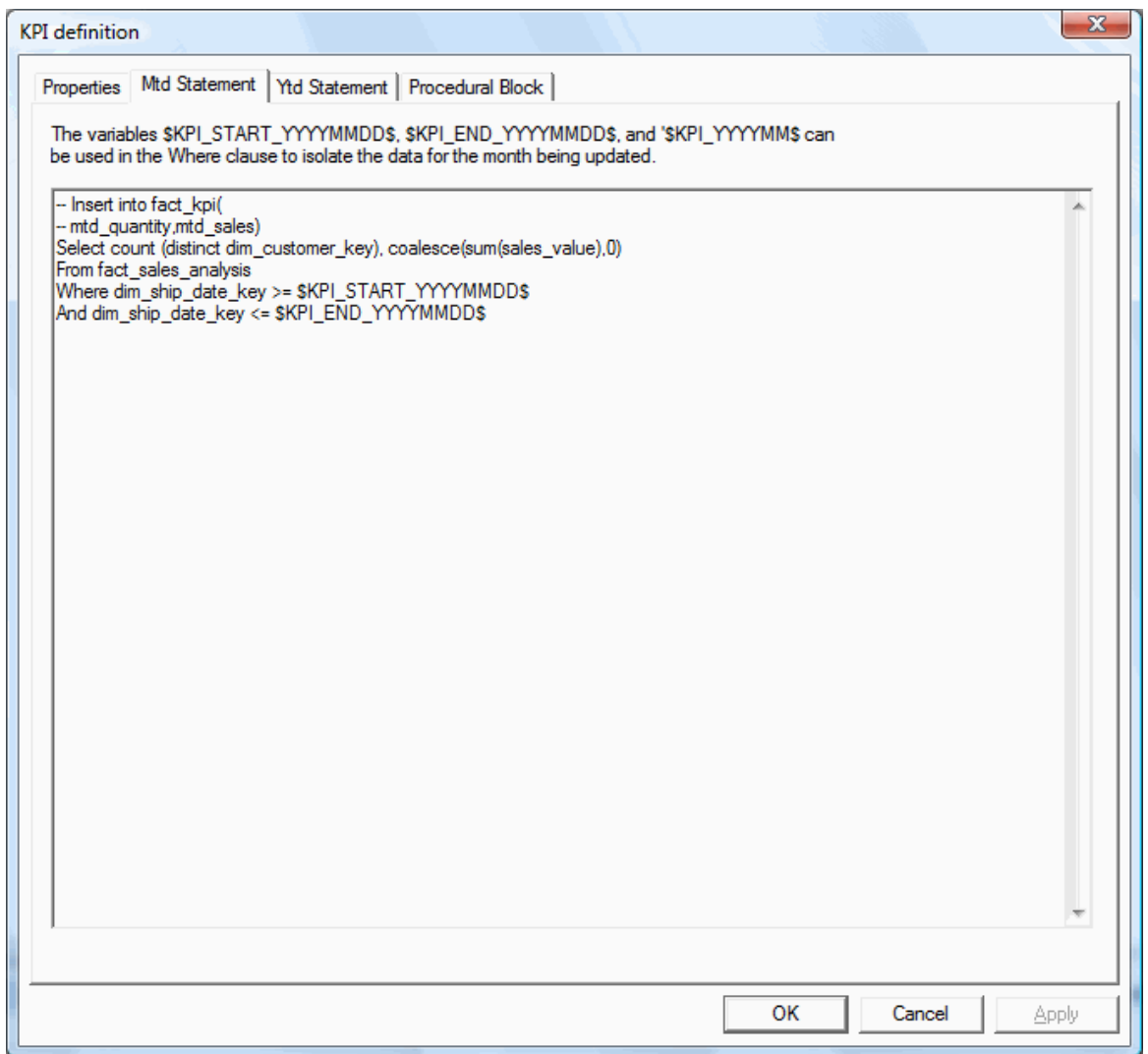
At the bottom right of the dialog are three buttons: 'OK', 'Cancel', and 'Apply'.

Once the dialog above is completed click **OK** to modify the KPI.

We will now proceed to modify the SQL statement required to perform the month to date update.

- 1** Use the right mouse menu when positioned on the Activity KPI and select 'Modify Kpi'. Then choose the 'Mtd Statement' tab.
- 2** Replace the statement with the statement as shown below. Note, that no trailing semi-colon is required.

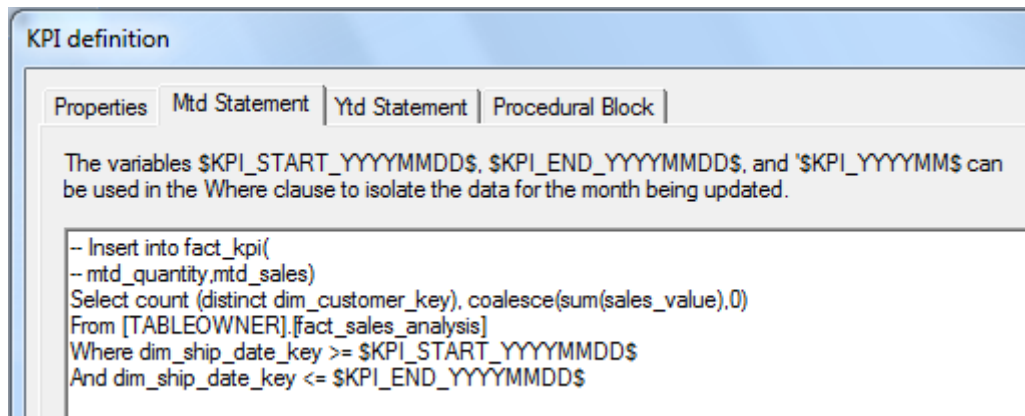
```
-- Insert into fact_kpi(  
-- mtd_quantity,mtd_sales)  
Select count (distinct dim_customer_key), coalesce(sum(sales_value),0)  
From fact_sales_analysis  
Where dim_ship_date_key >= $KPI_START_YYYYMMDD$  
And dim_ship_date_key <= $KPI_END_YYYYMMDD$
```



For DB2 enter the statement as below.

```
-- Insert into fact_kpi(  
-- mtd_quantity,mtd_sales)  
Select count (distinct dim_customer_key), coalesce(sum(sales_value),0)  
From [TABLEOWNER].[fact_sales_analysis]  
Where dim_ship_date_key >= $KPI_START_YYYYMMDD$
```

And dim_ship_date_key <= \$KPI_END_YYYYMMDD\$

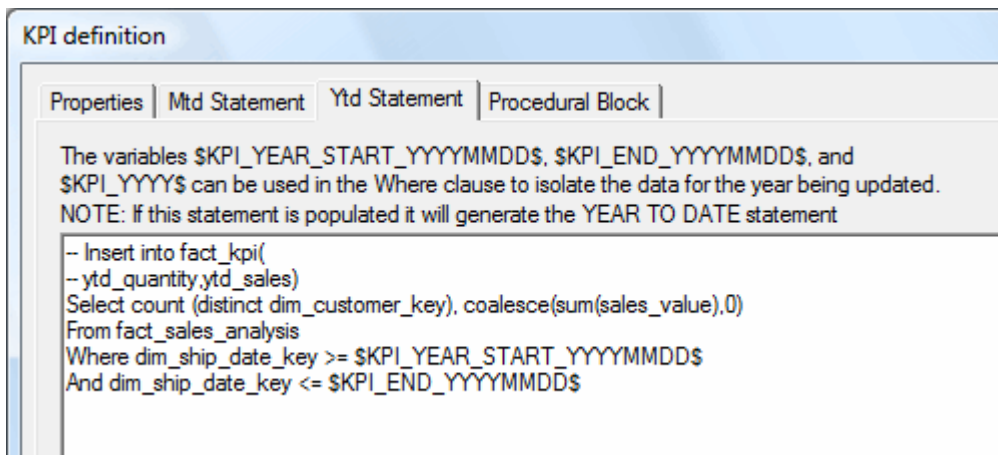


Note: For an Oracle data warehouse replace the `coalesce(` with a `nvl(` in the statement above. For a SQL Server data warehouse replace the `coalesce(` with an `isnull(` in the statement above.

We now need to define the year to date statement, to ensure we do not count the same customer twice. Proceed as follows:

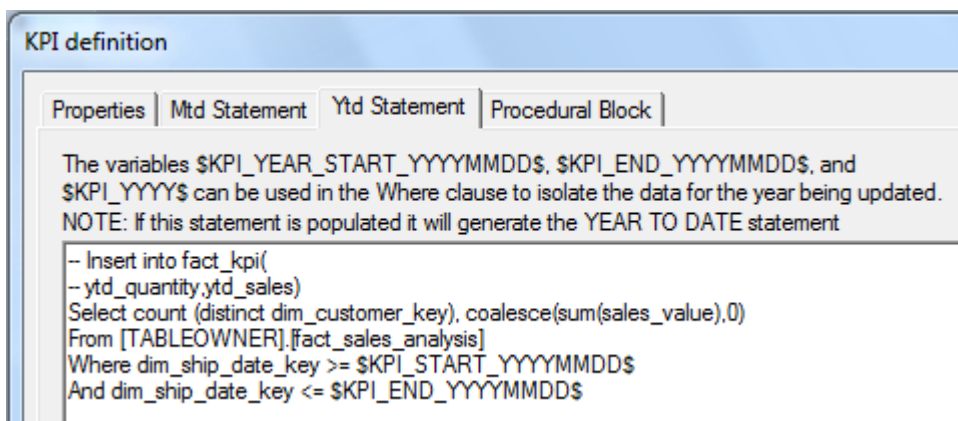
- 1 Choose the Ytd Statement tab.
- 2 Insert the statement as shown below. Note, that no trailing semi-colon is required. When done click OK to complete the definition of the KPI.

```
-- Insert into fact_kpi(
-- ytd_quantity,ytd_sales)
Select count (distinct dim_customer_key), coalesce(sum(sales_value),0)
From fact_sales_analysis
Where dim_ship_date_key >= $KPI_START_YYYYMMDD$
And dim_ship_date_key <= $KPI_END_YYYYMMDD$
```



For DB2 enter the statement as below.

```
-- Insert into fact_kpi(
-- ytd_quantity,ytd_sales)
Select count (distinct dim_customer_key), coalesce(sum(sales_value),0)
From [TABLEOWNER].[fact_sales_analysis]
Where dim_ship_date_key >= $KPI_START_YYYYMMDD$
And dim_ship_date_key <= $KPI_END_YYYYMMDD$
```



Note: For an Oracle data warehouse replace the `coalesce(` with a `nvl(` in the statement above. For a SQL Server data warehouse replace the `coalesce(` with an `isnull(` in the statement above.

The KPI has now been defined and can be updated as per the Sales KPI. An end user tool is required to adequately examine the results.