Chapter 6: ADO .NET and crystal Report

Introduction to ADO .NET:

Most applications need to handle data, whether it is in the form of a dataset, a text file, or a spreadsheet. The majority of modern-day applications need to deal with various types of databases. Therefore, to access this data the application needs to interact with various databases, such as Microsoft SQL Server, Oracle, Microsoft Access and so on.

What ADO.NET is

ADO.NET is a large set of .NET classes that enable us to retrieve and manipulate data, and update data sources, in very many ways. As an integral part of the .NET framework, it shares many of its features; features such as multi-language support, garbage collection, just-in-time compilation, object-oriented design, and dynamic caching, and is far more than an upgrade of previous versions of ADO. ADO.NET is set to become a core component of any data-driven .NET application or Web Service, and understanding its power will be essential to anyone wishing to utilize .NET data support to maximum effect.
ADO.NET is a part of the .NET framework architecture. It is a model used by .NET applications to communicate with a database for retrieving, accessing, and updating data.

ADO.NET Object Model

In the ADO.NET object model, the data residing in a database is retrieved through a data provider. The data provider is the set of components including the Connection, Command, DataReader, and DataAdapter objects. An application can access data either through a dataset or through a datareader object.

The ADO.NET object model consists of two fundamental components:

- Data Provider
- DataSet

Data Provider

Selecting an appropriate data provider for a client application depends on the type of data source being accessed. There are four .Net data providers available.

1. **SQL Server**: It's used to work specifically with Microsoft SQL Server. It exists in a namespace within the System.Data.SqlClient.
2. **OLE DB**: It's used to work with the OLEDB provider. The System.Data.dll assembly implements the OLEDB .NET framework data provider in the System.Data.OleDb namespace.
3. **ODBC**: To use this type of provider, you must use an ODBC driver. The System.Data.ODBC.dll assembly implements the ODBC .NET framework data provider. This assembly is not part of the Visual Studio .NET installation.
4. **Oracle:** The System.Data.OracleClient.dll assembly implements the Oracle .NET framework data provider in the System.Data.OracleClient namespace. The Oracle client software must be installed on the system before you can use the provider to connect to an Oracle data source.

Data Provider Components

The four key components of a dataprovider are:

1. **Connection:** Used to connect to the data source.

2. **Command:** Used to execute a command against the data source. This component retrieves, inserts, deletes, and modifies data in a data source.
3. **DataReader:** This component retrieves data from a data source in read-only and forward mode.
4. **DataAdapter:** Used to populate a dataset with the data retrived from a database and to update the data source.

DataSet

DataSet is a part of a disconnected architecture. A DataSet is a cached memory of data retrieved from a database. DataSet is present in the System.Data namespace. In order to connect a DataSet to a data source, we need to use a DataAdapter.

Component of ADO .NET:

ADO.NET makes it possible to establish a connection with a data source, send queries and update statements to the data source, and process the results.

ADO.NET has several key components:

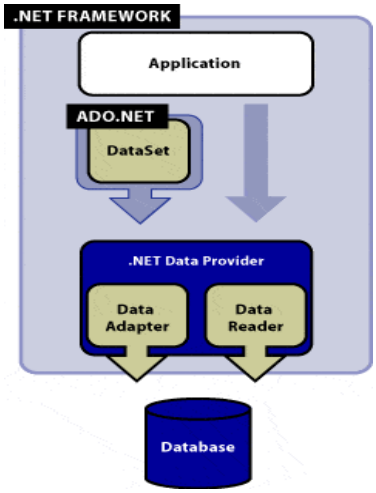
Application or component; processes and calls ADO.NET functions to submit SQL statements and retrieve results.

DataSet; as in-memory cache of data which functions like a disconnected XML data cache. The overall functions of the DataSet closely recall those of an in-memory database. The DataSet is designed to run in the application space wherever the logic requires local data. This helps increase scalability of systems by reducing load on the major database backends and enabling local processing of data across whatever tier the application requires. For flexibility, the DataSet provides XML and relational interfaces of the data to the developer.

DataReader; which provides a direct, read-only SQL interface to the backend. The DataReader is a component of the data provider.

ADO.NET Data Provider; connects an ADO.NET application to the backend data store. The data provider comprises the Connection, Command, DataReader and DataAdapter objects. The data provider supplies connection information through the Connection object.

The following figure shows a scenario in which the application and the ADO.NET data provider are both built with managed code. The application can connect to a database using either a DataSet and a DataAdapter or using a DataReader.



ADO .NET Data Providers:

Data provider is used to connect to the database, execute commands and retrieve the record. It is lightweight component with better performance. It also allows us to place the data into DataSet to use it further in our application.

The .NET Framework provides the following data providers that we can use in our application.

.NET Framework data provider	Description
.NET Framework Data Provider for SQL Server	It provides data access for Microsoft SQL Server. It requires the **System.Data.SqlClient** namespace.
.NET Framework Data Provider for OLE DB	It is used to connect with OLE DB. It requires the **System.Data.OleDb** namespace.
.NET Framework Data Provider for ODBC	It is used to connect to data sources by using ODBC. It requires the **System.Data.Odbc** namespace.
.NET Framework Data Provider for Oracle	It is used for Oracle data sources. It uses the **System.Data.OracleClient** namespace.
EntityClient Provider	It provides data access for Entity Data Model applications. It requires the **System.Data.EntityClient** namespace.
.NET Framework Data Provider for SQL Server Compact 4.0.	It provides data access for Microsoft SQL Server Compact 4.0. It requires the **System.Data.SqlServerCe** namespace.

.NET Framework Data Providers Objects

Following are the core object of Data Providers.

Object	Description
Connection	It is used to establish a connection to a specific data source.
Command	It is used to execute queries to perform database operations.
DataReader	It is used to read data from data source. The DbDataReader is a base class for all DataReader objects.
DataAdapter	It populates a DataSet and resolves updates with the data source. The base class for all DataAdapter objects is the DbDataAdapter class.

.NET Framework Data Provider for SQL Server

Data provider for SQL Server is a lightweight component. It provides better performance because it directly access SQL Server without any middle connectivity layer. In early versions, it interacts with ODBC layer before connecting to the SQL Server that created performance issues.

The .NET Framework Data Provider for SQL Server classes is located in the **System.Data.SqlClient** namespace. We can include this namespace in our C# application by using the following syntax.

```
using System.Data.SqlClient;
```

This namespace contains the following important classes.

Class	Description
SqlConnection	It is used to create SQL Server connection. This class cannot be inherited.
SqlCommand	It is used to execute database queries. This class cannot be inherited.
SqlDataAdapter	It represents a set of data commands and a database connection that are used to fill the DataSet. This class cannot be inherited.
SqlDataReader	It is used to read rows from a SQL Server database. This class cannot be inherited.
SqlException	This class is used to throw SQL exceptions. It throws an exception when an error is occurred. This class cannot be inherited.

.NET Framework Data Provider for Oracle

It is used to connect with Oracle database through Oracle client. The data provider supports Oracle client software version 8.1.7 or a later version. This data provider supports both local and distributed transactions.

Oracle Data Provider classes are located into **System.Data.OracleClient** namespace. We must use both **System.Data.OracleClient** and **System.data** to connect our application with the Oracle database.

```
using System.Data;
using System.Data.OracleClient;
```

Working with Disconnected Data:

Connected Environment

A connected environment is one in which a user or an application is constantly connected to a data source.

Advantages of connected environment:

· Data concurrency issues are easily control (At a time only one user can update the data in database)

· Data is always updated.

Disadvantages of connected environment:

· A constant network connection is required that may lead to network traffic logging.
.Scalability and performance issues in application. (If more than one user connected to database query pro cessing may be slow.)

Disconnected Environment

A disconnected environment is one in which a user is not necessarily connected with a database. Connecti on is required only at the time of retrieval after that connection is close and if data is need to be updated a gain connection will be re established.

Advantages of disconnected environment:

· Multiple applications can simultaneously interact with the database.
· Improve scalability and performance of applications.

Disadvantages of disconnected environment:

· Data is not always updated.
· Data concurrency issues can occur when multiple users are updating the data to the data source.

Working in Disconnected Environment

A disconnected environment is one in which an application is not directly connected to a data source. Dat a is stored in datasets and manipulations are performed there. After the data has been modified in the data set, the changes are updated to the database.

DataSet and DataTables

A dataset is a memory based relational representation of data. It is a part of disconnected environment. A dataset is a disconnected, cached set of records that are retrieved from a database. The dataset acts like a v irtual database containing tables, rows, and columns.

Types of DataSet

· Typed

· Untyped

Typed Dataset

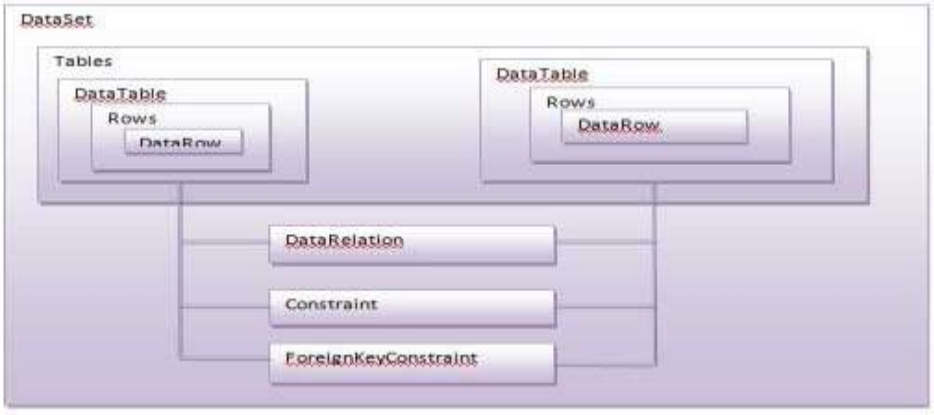
A typed dataset is derived from DataSet class and has an associated XML schema, which is created at the time of creation of the dataset. XML schema contains information about the dataset structure such as the t ables, columns and rows. Data is transferred from a database into a dataset and from the dataset to another component in the XML format.

The XML schema definition language is used to define the elements and attributes of XML documents.

Untyped DataSet

An untyped dataset does not have any associated XML Schema. In an untyped dataset the tables and colu mns are represented as collections. The structure of an untyped dataset is not known during compilation.

DataSet Object Model

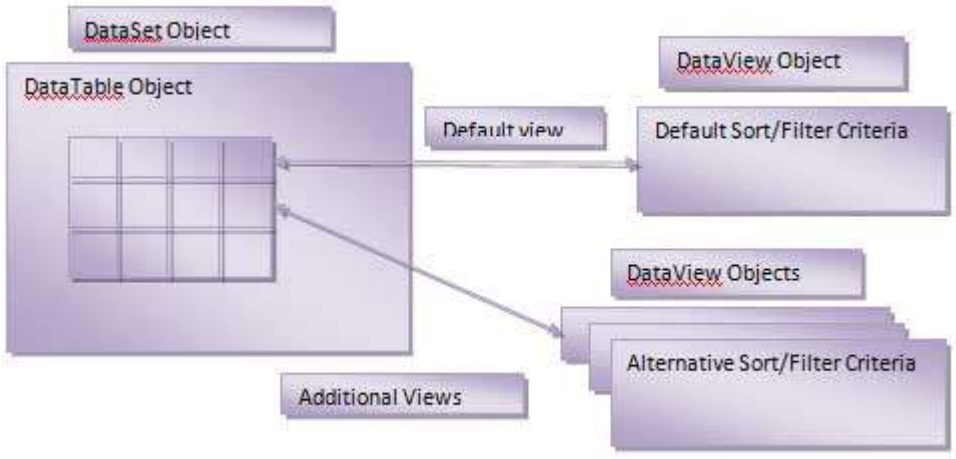


Working with DataViews

A dataview is a part of disconnected environment. The System.Data namespace defines the DataView clas s that enables to create various views of the data stored in a datatable. A dataview can be used to sort or fil ter data in a datatable. It can also be used to add, modify and delete rows in a datatable.

A dataview provides a dynamic view of data stored in a datatable. These dynamic capabilities of the datav iew make it ideal for data binding applications.

DataView object Model



Introduction to Crystal Report, Creating Simple Report by wizard:

Crystal report is a report designer tool to design and generate report from wide range of data source such as database, xml file etc. Crystal Reports allows users to graphically design data connection's and report layout. Users can select and link tables from a wide range of data sources such as MS-Excel spreadsheets, SQL database, Oracle database, and any file system information. Fields from these tables can be placed on the report design surface, and can also be used in custom formulas. Formulas can be evaluated at several phases during report generation as specified by the developer.

There are lots of feature in Crystal Report, from which some are given as follows:

1. Common Standard File Format
2. Embedded Crystal Report Designer
3. Data and .Net Data set Connection
4. Report Viewer
5. Export and Print
6. Report Web Service
7. Crystal Web Service
8. Merge Module Deployment
9. Runtime Support for previous version

Common Standard File Format:

A common standard file format allows for feature-rich reports that contain data retrieval criteria, grouping, summary and parameter linking information. According to this feature Crystal Report generates report in .rpt extension file, which is common standard. The .rpt file consists of a report definition format that contains not only data retrieval criteria, but also grouping, summary, parameter.

Embedded Crystal Report Designer:

Visual studio comes with embedded crystal report designer, basically embedded crystal report designer is GUI application, using collection of wizards and experts, and through which complex report file can be generated quickly and easily.

Data and .Net Data Set Connection:

Data and .Net Data set connection are widely used to connect different types of data source with Crystal Report Designer, i.e. Crystal Report designer can easily interact with any type of data source with available connection.

Report Viewer:

Report Viewer is a control which is widely used to display crystal reports on window form, i.e. we can easily display crystal report on any window form.

Export and Print:

Through the Export wizards we can easily exports or save crystal reports in many extensions such as .pdf, .rpt, .xls, .xlsx, . doc, .docx, .rtf, .csv, .xml and much more. Whereas Print provides an efficient way through which we can print crystal reports.

Report Web Service:

Report Web Services enable any application that can read XML to access and use reports. With the help of report web service we can publish Crystal Reports as web services, i.e. report's interfaces are available in XML and can be transmitted across the internet.

Crystal Service:

Crystal Services allows programmatic access to your reports through a web service. Crystal Service allows user to access a crystal reports as server file through web service.

Merge Module Deployment:

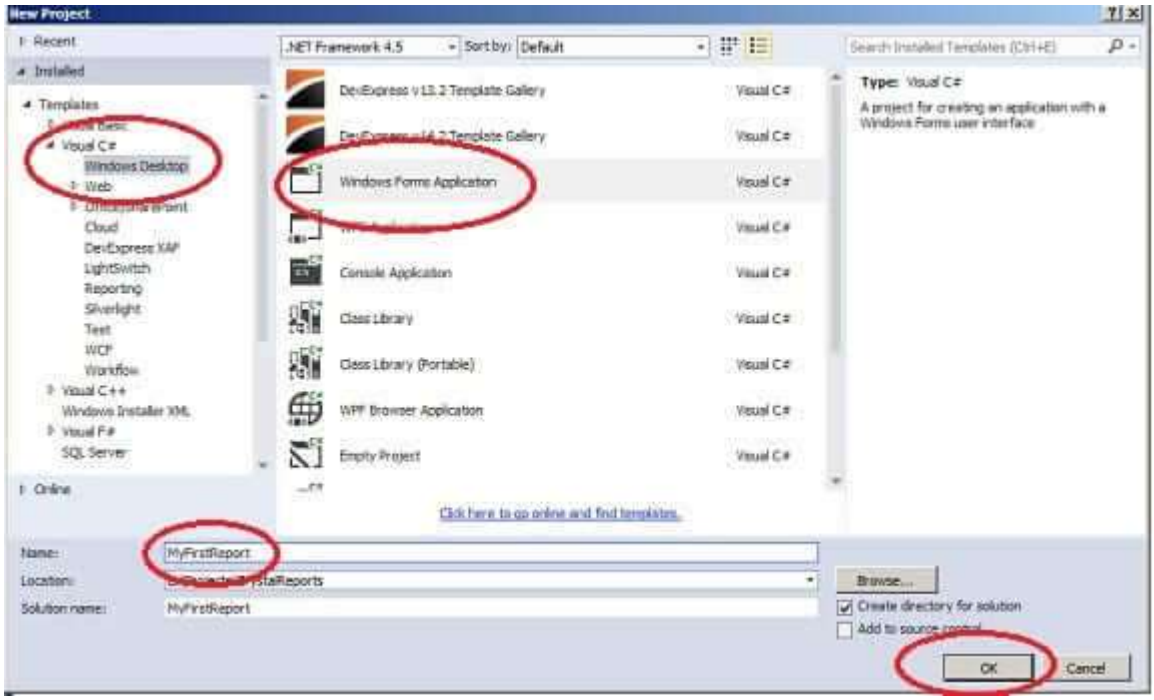
Merge Module deployment ensures that crystal reports component and assemblies are added with deployment project correctly or not.

A merge module is a set of components that are merged with a Windows installer for applications that need them. The components may include a .dll file, resources, registry entries, setup logic, and related files. With all related components stored in a single container, the installer eliminates version conflicts and other common installation problems.

Runtime Support for Previous Version:

Runtime Support for Previous Version provides the feature through which, crystal report project which is created on previous version supported at runtime and no modification require at designing time.

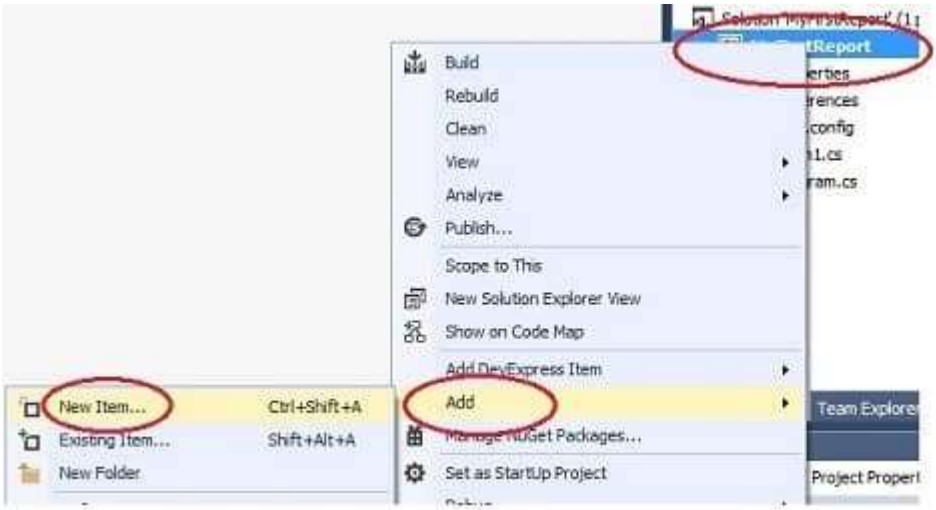
Create a Visual Studio Project



Creating a Project in Visual Studio

1. Open Visual Studio and create a new project.
2. Choose C#.
   If you want to choose VB.NET you can go ahead and choose VB.NET. Designing reports with Crystal Reports is independent of the language or type of application. The steps are the same for both VB.NET & C#. For this Example, I will choose C#
3. Choose Windows Desktop Application.
4. Under Various Application, Template chose Windows Forms Application
5. Enter Name of the Project as **MyFirstReport.** Click OK. Visual C# Project is opened for you.
6. Rename the form as **frmCrystalReport**

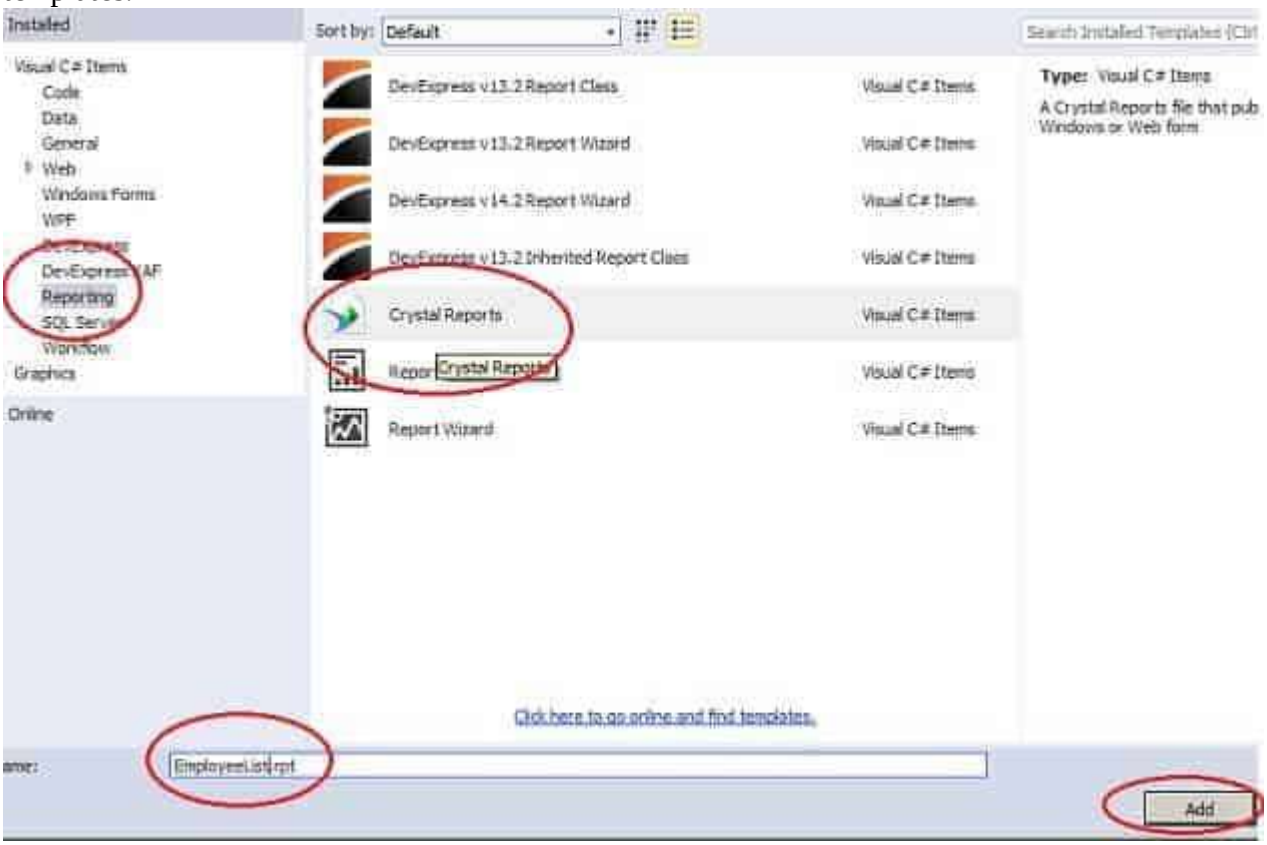
Create a Crystal Report



Now let us create a crystal Report. The following steps will guide you to add the new report

1. Under Solution Explorer select your Project.

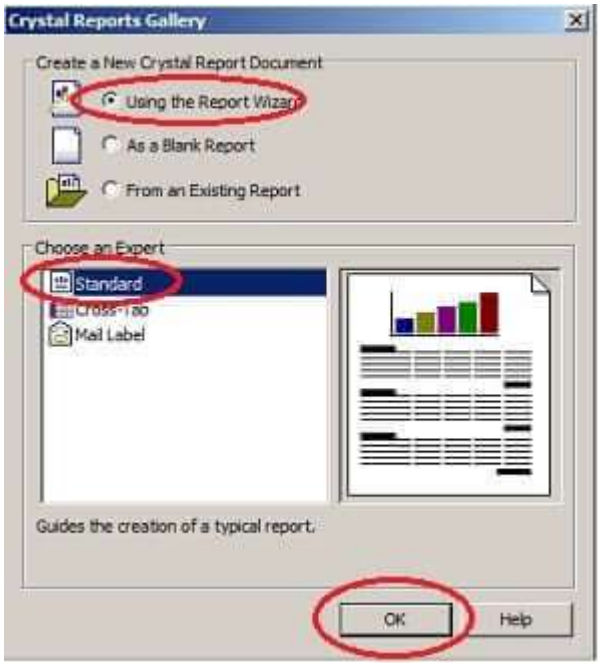
2. Right Click and Add New Item. This displays the list of available templates.



3. Select Reporting Template Group.
4. Scroll down to select the Crystal Report template.
5. Enter the name as **EmployeeList.**
6. Click on Add to Create your first Report. This will take you to Crystal Report Gallery.

Crystal Report Gallery

You can Create Report using the following options



Report Wizard

- **Using a Report Wizard.**
  Selecting this option will open the crystal report wizard which takes you through the various steps to help you in creating the report.
- **As a blank Report.**
  This will open a blank report.
- **From an Existing Report.**
  Here you are asked to select an existing report and the new report use.

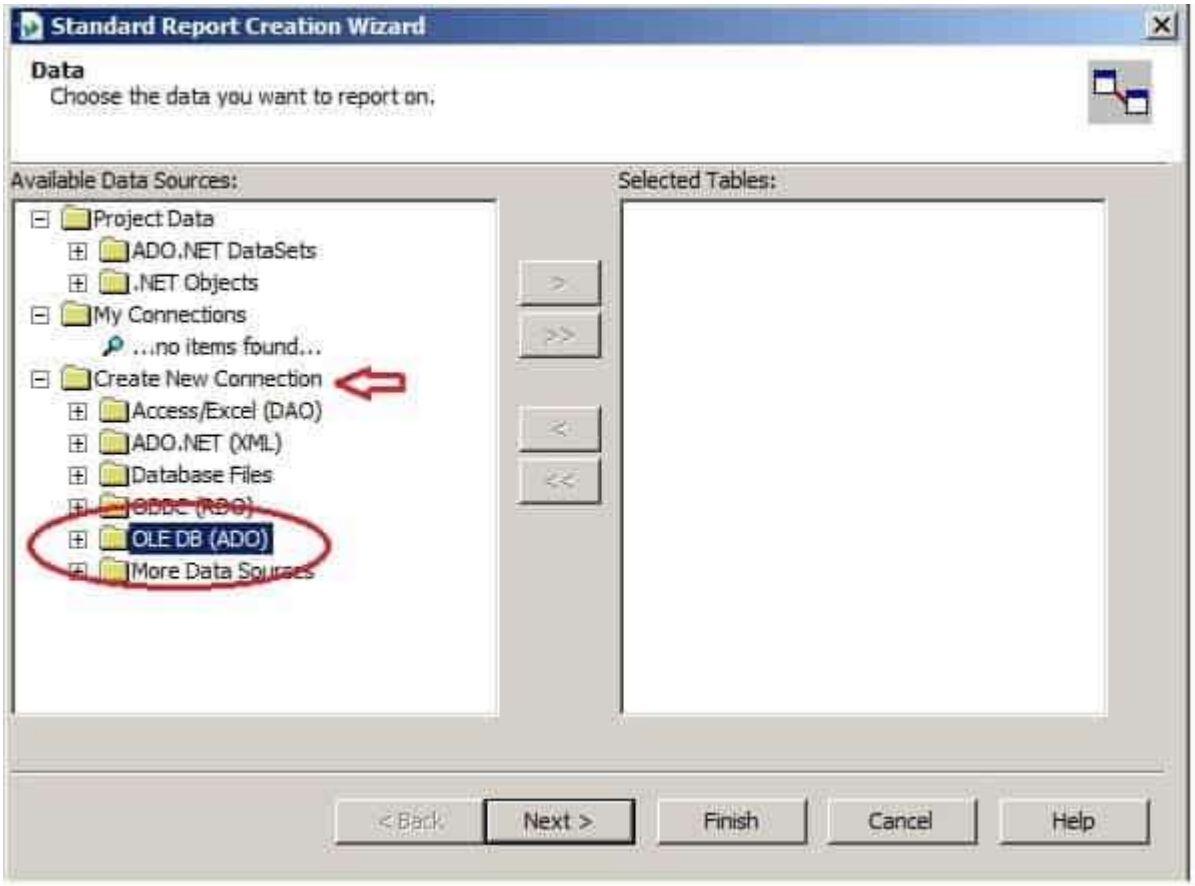
Report Expert.

Crystal Report for Visual Studio comes with three report Experts.

- **Standard Format.**
  This expert will create the standard report.
- **Cross Tab.**
  This expert will create a specialized report known as cross tab report.
- **Mail Label.**
  This expert will create mailing label report where data is displayed in a format that is suitable for use as address labels on envelopes.

In this example let us select Report Wizard and Standard Expert and then click on **next**. You will be taken to the Standard Report Creation wizard.

Standard Report Creation wizard



First dialogue box under this allows you to choose the data source that would be used in the report. It has three options

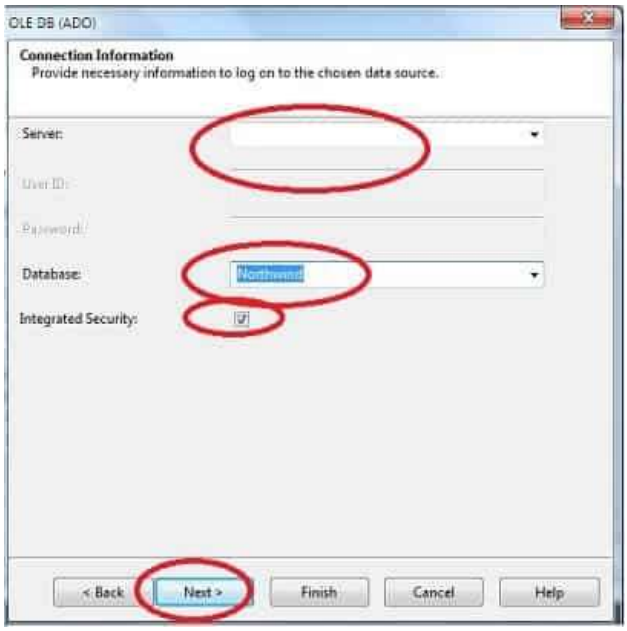
1. **Project Data.**
   This Option lists the data source connections already available in your project.
2. **My Connections.**
   This Option lists the most recently used data source connection so that you can quickly add it your report.
3. Create New Connection.
   This Option allows us to create a new connection to data source.

Let us Select OLE/DB option to connect to our data source. click on the plus sign right next to **OLE/DB** option. This will open the OLE/DB Dialog Box.

OLE/DB Dialog Box.

This Dialog Box Option displays the list of available OLE/DB Providers. Choose the appropriate OLE/DB Provider to connect to your data source.
Let us chose **SQL Server Native Client 11.0** which is used to connect to the SQL Server Database. Click on **next.**

OLE/DB Connection Info Dialog Box.



OLE DB Connection Information

You will then see **OLE/DB Connection Info Dialog Box.** Here you need to input the database credential to connect to the data source.

Input server Name. You can either input the user id and password or choose Integrated security option. If you choose User id and password, then the crystal report will ask you for user id & Password while displaying the report. I will choose Integrated security.

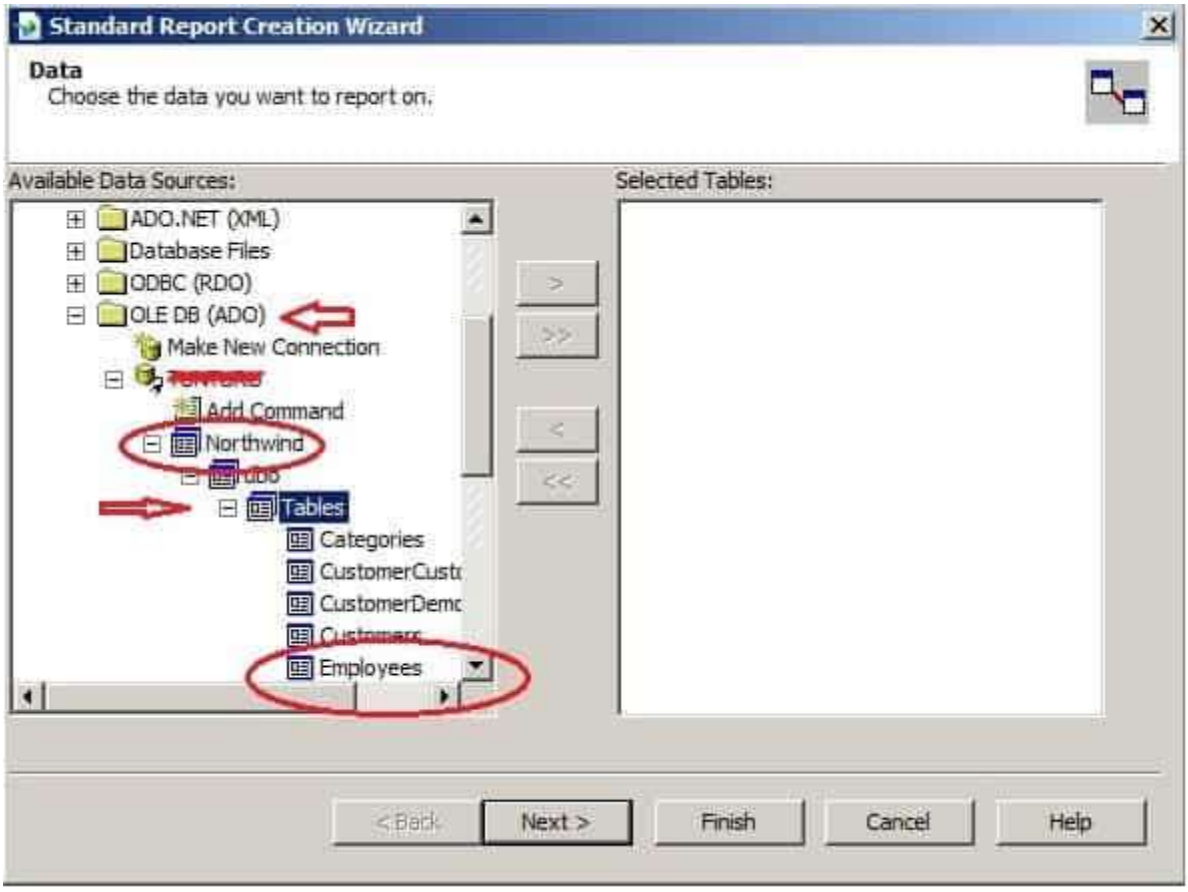
Select the database from the drop-down. select **northwind** database. Click on next when you are done.

OLE/DB Advance Information Dialog Box

OLE DB Advance Information dialogue box

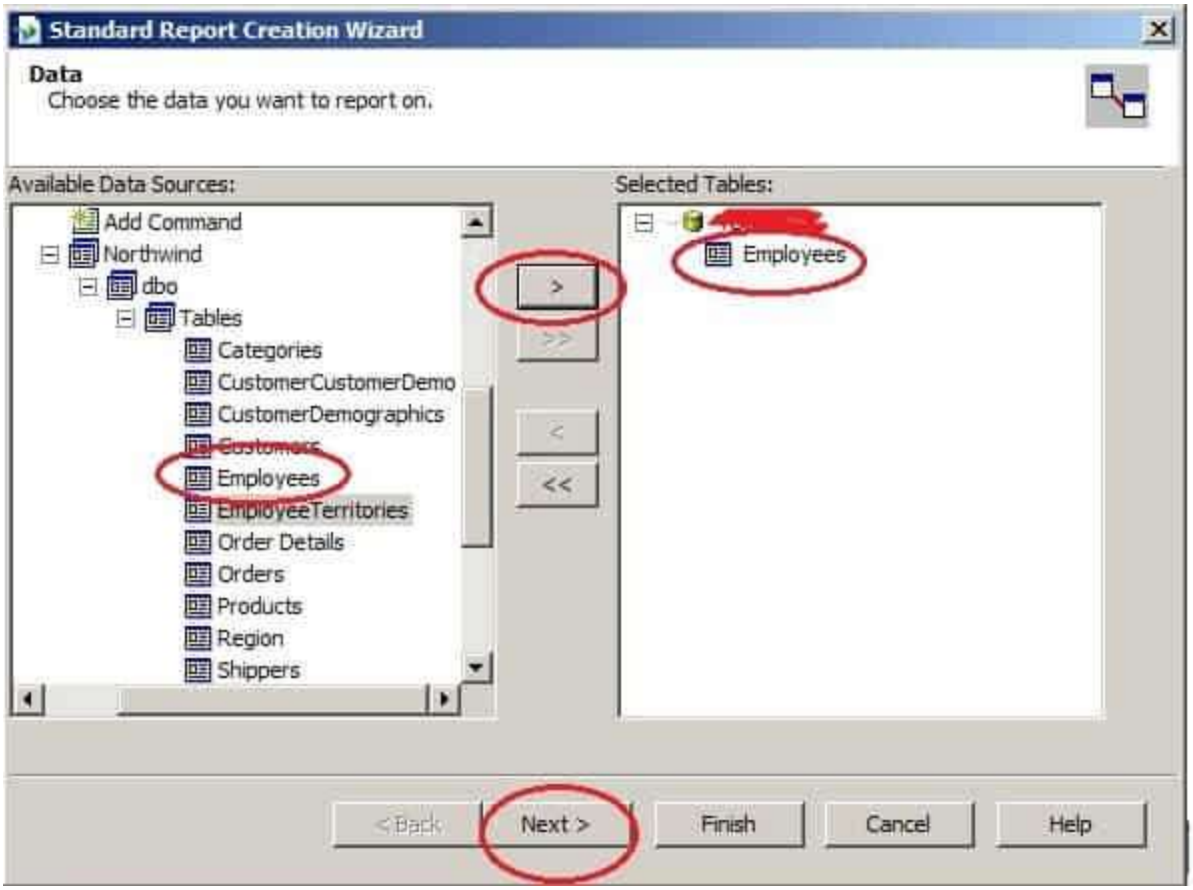
You will then see **OLE/DB Advance Information Dialog Box.** Make appropriate changes if any and click on **Finish** to go back to **Standard Report Creation wizard.**

Standard Report Creation wizard



Northwind data connection we just made is displayed under **OLE/DB** option under **Create the new connection.**

Click on **plus** sign to expand to the database. Any Tables, Stored Procedures, Views under the selected data source connection is automatically displayed under the connection and is available to the report. Select the appropriate the table/Stored Procedures/View which you want in your report.



Employee Table is Selected

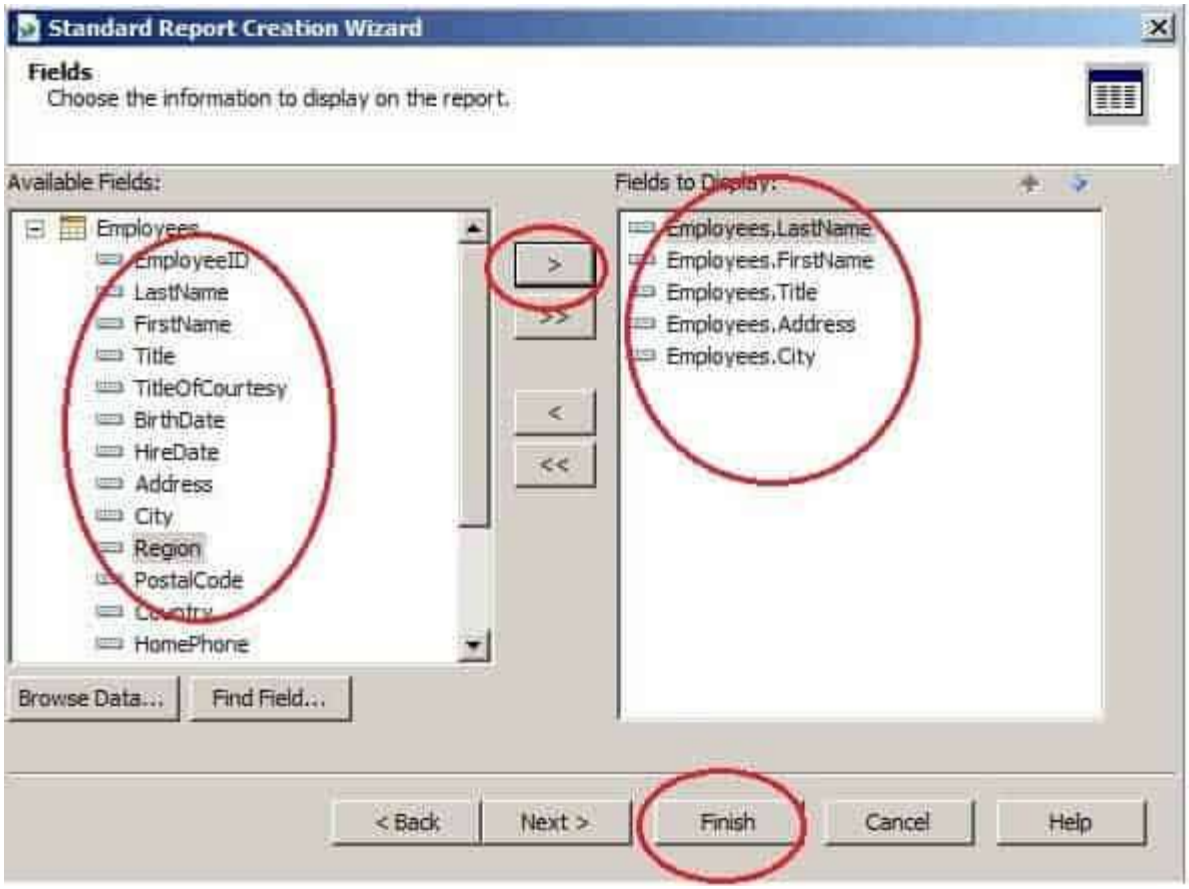
1. Select employees table.
2. Click right arrow key to add the table to the report.

The table will appear in the selected tables box on the right side. You can add more than one table to report. Click on **next.** You will be taken to Fields Dialog box.

Fields Dialog Box.

On the left side, you can see the list of fields from the employee table. These fields are now available to the report. You can select any field just by double-clicking on them. Selected fields will appear on fields to display box on the right side.

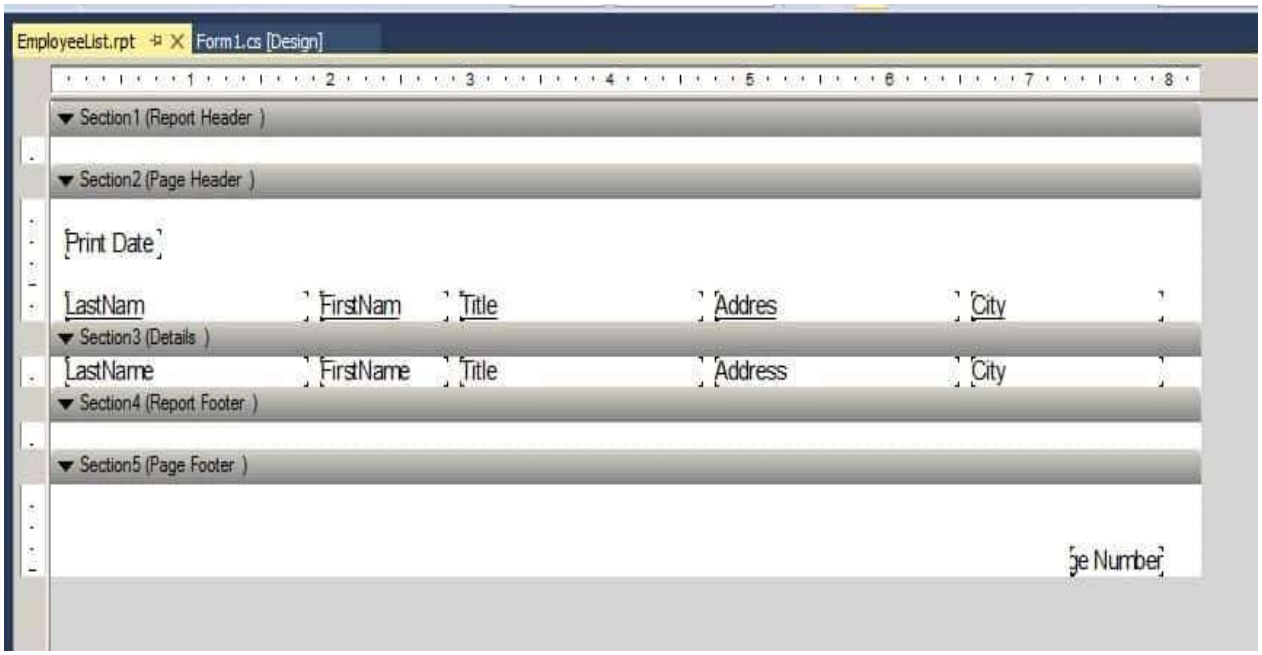
Select any field on the left side box and click on browse data and view the database values of the selected field.



Fields Dialog box

You can hold the control key and select multiple fields at once.

1. Select FirstName, LastName, Title, Address, City.
2. You can then click on right arrow key to add the fields to the report.
3. The fields will appear on the right side box.
4. You can move the field up and down by dragging the fields or using up or down arrow buttons.
5. Place the fields in the order you want them to appear in the Report.
6. Click on **finish**. You will then see the crystal report designer and the report is generated for you.



Created Report