

# **SRINIVASAN COLLEGE OF ARTS & SCIENCE**

*(Affiliated Bharathidasan University, Tiruchirappalli)*

**PERAMBALUR – 621 212**



## **Department of Computer Science & Information Technology**

### **COURSE MATERIAL**

**Subject : DISTRIBUTED TECHNOLOGIES**

**Subject Code : P16CS22**

**Class : I M.Sc Computer Science**

**Semester : II**

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## **UNIT-I: INTRODUCTION TO DISTRIBUTED COMPUTING**

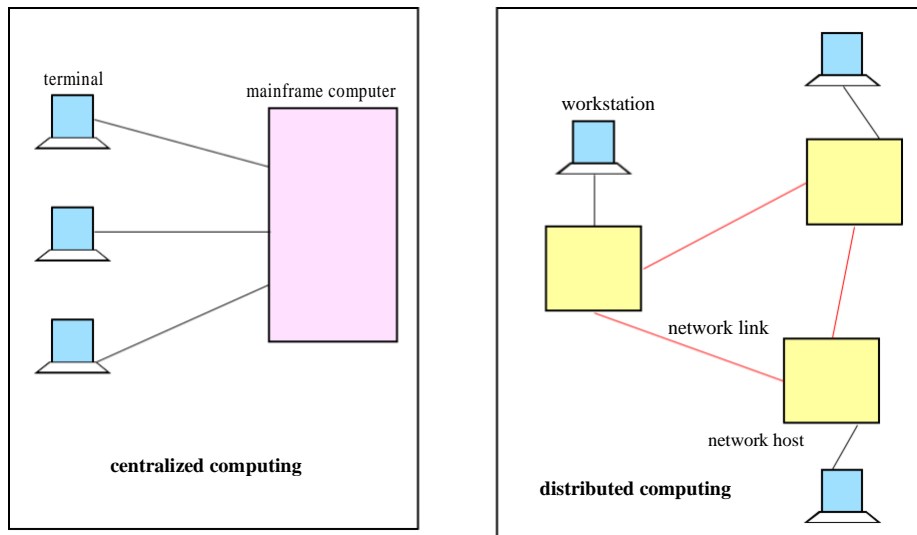
Distributed computing is a field of computer science that studies distributed systems. A distributed system consists of multiple autonomous computers that communicate through a computer network.

A computer program that runs in a distributed system is called a distributed program, and distributed programming is the process of writing such programs

In distributed computing, each processor has its own private memory (distributed memory). Information is exchanged by passing messages between the processors.

The processors in a typical distributed system run concurrently in parallel.

A distributed system is a collection of independent computers, interconnected via a network, capable of collaborating on a task.



Example Distributed systems:

- Internet
- ATM (bank) machines
- Intranets

Goals/Benefits:

- ✓ Resource sharing
- ✓ Scalability
- ✓ Fault tolerance and availability
- ✓ Performance
- ✓ Economics
- ✓ Speed
- ✓ Inherent distribution
- ✓ Reliability
- ✓ Incremental growth

Disadvantages:

- ✓ Software
- ✓ Network
- ✓ More components to fail
- ✓ Security

❖ Parallel computing can be considered a subset of distributed computing

Challenges involved in establishing remote connection

The challenges involved in remote connection are as mentioned below.

- **Heterogeneity**
- **Openness**
- **Security**
- **Scalability**
- **Failure handling**
- **Concurrency**
- **Transparency**

Heterogeneity

- **Different networks, hardware, operating systems, programming languages, developers.**
- **We set up protocols to solve these heterogeneities.**
- **Middleware: a software layer that provides a programming abstraction as well as masking the heterogeneity.**
- **Mobile code: code that can be sent from one computer to another and run at the destination.**

### Openness

- **Make it easier to build and change**
- **The openness of DS is determined primarily by the degree to which new resource-sharing services can be added and be made available for use by a variety of client programs.**
- **Open systems are characterized by the fact that their key interfaces are published.**
- **Open DS are based on the provision of a uniform communication mechanism and published interfaces for access to shared resources.**
- **Open DS can be constructed from heterogeneous hardware and software.**

### Security

- **Security for information resources has three components:**
  - Confidentiality: protection against disclosure to unauthorized individuals.
  - Integrity: protection against alteration or corruption.
  - Availability: protection against interference with the means to access the resources.
- **Two new security challenges:**
  - Denial of service attacks (DoS).
  - Security of mobile code.

### Scalability

- **A system is described as scalable if it remains effective when there is a significant increase in the number of resources and the number of users.**
- **Distributed system should be more reliable than single system.**
- **Challenges:**
  - Controlling the cost of resources or money.

- Controlling the performance loss.
- Preventing software resources from running out
- Avoiding performance bottlenecks.

Failure handling

- **When faults occur in hardware or software, programs may produce incorrect results or they may stop before they have completed the intended computation.**

- **Techniques for dealing with**

failures: - Detecting failures

- Masking failures -

Tolerating failures

- Recovering from failures

- Redundancy

Concurrency

- **There is a possibility that several clients will attempt to access a shared resource at the same time.**

- **Any object that represents a shared resource in a distributed system must be responsible for ensuring that operates correctly in a concurrent environment. Redundancy improves it.**

Transparency

- **Transparency is defined as the concealment from the user and the application programmer of the separation of components in a distributed system, so that the system is perceived as a whole rather than as a collection of independent components.**

- **Eight forms of transparency:**

- Access transparency

- Location transparency

- Concurrency transparency
- Replication transparency
- Failure transparency
- Mobility transparency
- Performance transparency
- Scaling transparency

### Strategies Involved In Remote Computation

#### The Remote Computation System (RCS)

- Today many high performance computers are reachable over some network.
- However, the access and use of these computers is often complicated.
- This prevents many users to work on such machines.
- The Goal of the Remote Computation System (CS) is to provide easy access to modern parallel algorithms on supercomputers for the inexperienced user.
- Wide area computer networks have become a basic part of today's computing infrastructure.
- These networks connect a variety of machines, from workstations to supercomputers, presenting an enormous computing resource.
- Furthermore, sufficient software for solving problems in numerical linear algebra on high performance computers is around today.



- However, the access and the use of these computers and the software is often complicated.
- A major problem for the inexperienced user to exploit such high performance computers is that he has to deal with machine dependent low level details.
- The goal of this project is to make high performance computing accessible to scientists and engineers without the need for extensive training in parallel computing and allowing them to use resources best suited for a particular phase of the computation.
- Also, the emphasis is laid on algorithms for solving problems in numerical linear algebra, the concepts presented here are applicable to any high performance algorithms
- This goal shall be achieved with a remote computation system (RCS), which provides an easy-to-use mechanism for using computational resources remotely.
- The user's view of the RCS is that of an ordinary software library.
- The user calls RCS library routines (e.g. to solve a system of linear equations) within his program running on a workstation.
- In contrast to common libraries, the problem is not necessarily solved on the local workstation, but is dynamically allocated on an arbitrary machine in a given pool of computers, in order to minimize the response time.

- Because RCS is called asynchronously, it allows distributed applications with several solvers running concurrently on different computer platforms.
- The Remote Computation System consists of two components
  - A library of interface routines
  - The run time system.
- The underlying computational software can be any existing scientific package such as LAPACK
- Before running a RCS application, the user first has to start up the RCS run time system.
- RCS is a single user system but multiple RCS applications are allowed per user to run concurrently.
- The server is the core of the RCS. Its task is to accept requests from user's application and to start an appropriate solver on a host in the pool.
- If the remote host is not specified by the user, the server selects the solver-host pair such that the response time is minimized
- Such a selection process has not yet been done in the context of a numerical library.
- In order to make of an optimal choice, the server needs information about
  - The problems which RCS can solve

- The host computers in the pool and their characteristics such as number of processors etc.
- The available computational software (solvers) on each host and their characteristics. For instance, a theoretical model is required to assess its response time
- Dynamic parameters as the current workload on each host and the available communication bandwidth on the network.
- A daemon called monitor on each host is responsible for periodically measuring the dynamic parameters.
- All other information is static and is read from a configuration file at startup time.
- With Remote Desktop, you can have access to a Windows session that is running on your computer when you are at another computer.
- This means, for example, that you can connect to your work computer from home and have access to all of your programs, files, and network resources as though you were sitting at your computer at work.
- You can leave programs running at work and when you get home, you can see your work desktop displayed on your home computer, with the same programs running.
- You can keep your programs running and preserve the state of your Windows session while another user is logged on. When that user logs off, you can reconnect to your session in progress.
- To use Remote Desktop, you need:

- A computer ("host" computer) running Windows XP Professional with Service Pack 2 or Windows Server 2003 with Service Pack 2 ("remote" computer) with a connection to a local area network (LAN) or the Internet.
- A second computer ("client" computer) with access to the LAN via a network connection, modem, or virtual private network (VPN) connection. This computer must have Remote Desktop Connection installed.
- Appropriate user accounts and permissions.

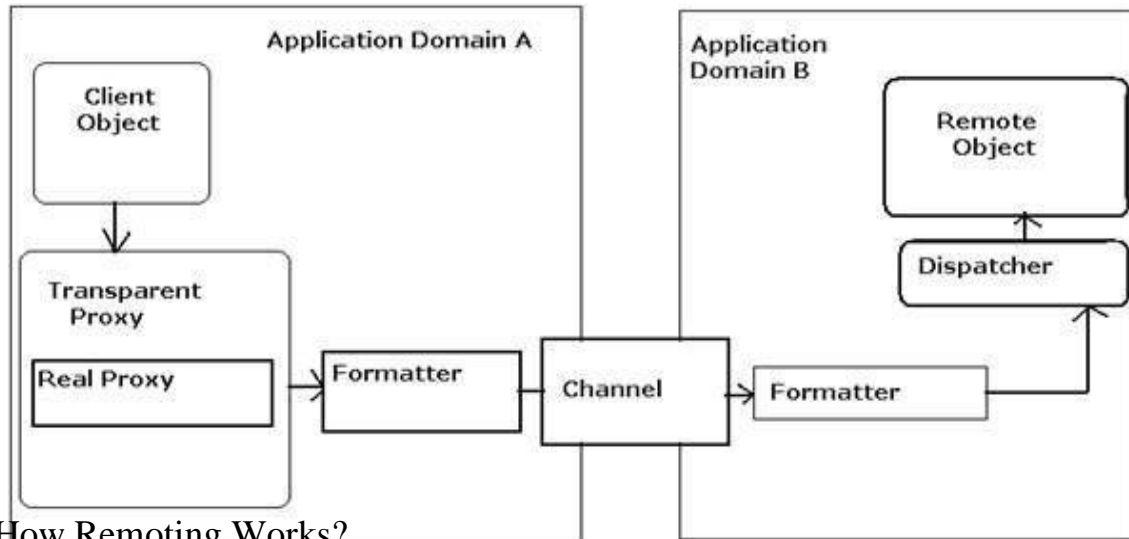
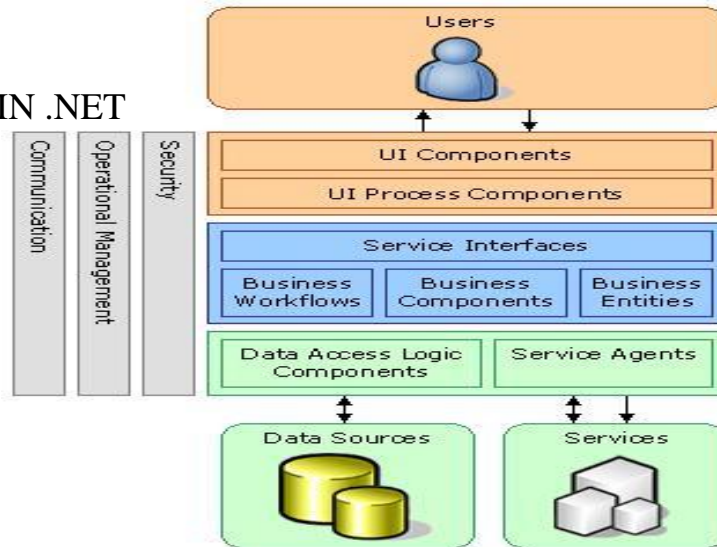
### Distributed Computing Using .NET Remoting

Distributed computing has become the identity of present generation software applications. In past, developers used technologies like DCOM (Distributed Component Object Model) by Microsoft, CORBA (Common Object Request Broker Architecture) by OMG and Java RMI (Remote Method Invocation) by SUN for the same purpose.

Microsoft .Net Remoting is an extensible framework provided by Microsoft .Net Framework, which enables communication across Application Domains (AppDomain).

AppDomain is an isolated environment for executing Managed code. Objects within same AppDomain are considered as local whereas object in a different AppDomain is called Remote object. Microsoft .Net Remoting comes into picture when an application requires communication between different AppDomains.

REMOVING IN .NET



How Remoting Works?

Just like other distribute computing technologies, in .Net Remoting also, client object doesn't make a direct call to the remote object, rather it creates a proxy object of the remoting object and then uses the proxy object to invoke methods of remote object. When the client object calls a method of remote object via proxy, the call is formatted by a formatting object (SOAP,

Binary or any Custom formatter). After formatting the call is transferred to the remote object via proper channel (TCP Channel, HTTP Channel or any Custom channel) where the method is executed. Now the entire process is reversed to return appropriate result to the client object.

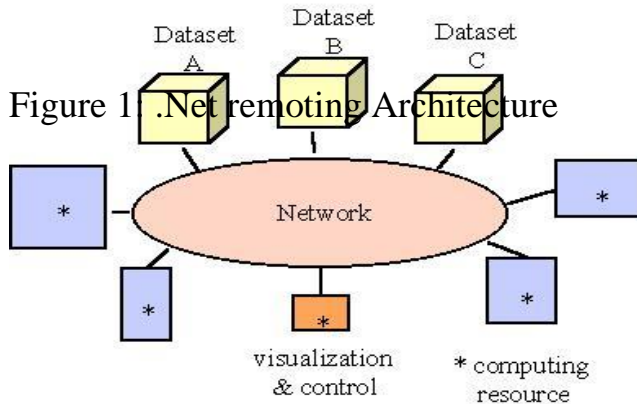


Figure 1: .Net remoting Architecture

### Remote Object

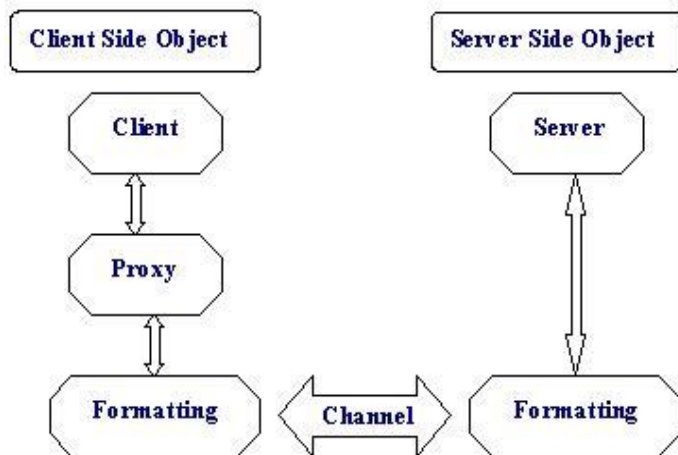
Remote object (Located at server side) is derived from `System.MarshalByRefObject` class which provides required functionality for communicating with an object in different `AppDomain`. Any object that needs to be transferred across `appDomains` has to be passed by value and should implement `ISerializable` interface. An object which doesn't implement `ISerializable` interface can't be transmitted across `appDomains`.

Example:

```
using System;
namespace Employee
{
```

```
public class Employee: MarshalByRefObject
{
//Constructor
public Employee
{
// Implementation details
}
//Other functions will come here
}
}
```

## Proxy Object



This is created when a client object activates a remote object.

We can have two types of remoting objects i.e. Client Activated Object or Server Activated Object.

**Client Activated Object:** Client Activated Remote object is one whose life is controlled by client object. Here one single instance of remote object will exist per client object. Client Activated Object is created using new keyword. Client Activated object can store state information for a specific client.

**Server Activated Object:** Contrary to Client Activated Remote objects, life time for Server Activated Object is controlled by Server. These objects are created when client object calls a method on the proxy object. There are two types of Server Activated Objects i.e. SingleCall and Singleton.

**SingleCall:** They serve only one client request. Once the client request is over, they are subjected to garbage collection. They don't store any state information.

**Singleton:** They serve multiple clients, thereby allowing information sharing between requests. They are stateful objects unlike SingleCall, which is stateless.

*//Creating a new instance of a remote object using new.*

```
Employee Emp = new Employee();
```

*//Creating a new instance of a remote object using CreateInstance.*

```
Employee Emp = (Employee)Activator.CreateInstance(...);
```

**Note:** Above method creates an instance of the remote object based on the parameter passed. For a complete listing of the same, please refer MSDN.



//Retrieving an Existing Instance.

```
Employee Emp = (Employee)Activator.GetObject(  
typeof(Employee), HTTP://[Path]);
```

All the calls to the remote object (at server side) are routed through proxy object. To make things little complicated, there are two types of proxy objects involved in the process i.e. Transparent proxy and Real proxy. Transparent proxy provides the implementation of all public method to Client object which means that client object always talks to Transparent proxy which in turn makes call to Real proxy. Real proxy passes the message to channel object. Developers can customize the Real proxy to include additional functionalities if required.

### Formatters

They encode and decode the message between client application and Remote object. .Net Framework provides SOAP and Binary formatter. It also supports custom formatters (IRemotingFormatter) developed by programmers.

Binary Formatter: System.Runtime.Serialization.Formatters.Binary  
SOAP Formatter: System.Runtime.Serialization.Formatters.Soap

### Channels

They are responsible for transmitting the message over the network. .Net Framework provides HTTPChannel and TCPChannel. It also supports custom channels (IChannel) developed by programmers.

HTTPChannel: System.Runtime.remoting.Channels.Http

TCPChannel: System.Runtime.remoting.Channels.Tcp

By default HTTP Channel uses SOAP Formatter and TCP Channel uses Binary Formatter.

Channels need to be registered with the remoting service as shown below.

```
//Registering a channel
```

```
ChannelServices.RegisterChannel();
```

### Hosting a Remoting Application

Remoting Host is a runtime environment for the remote object i.e. Microsoft IIS Server.

Step By Step: Let's see the entire step once again.

1. Client object registers a channel.
2. Creation of Proxy object (Client activated or Server Activated)
3. Calling the method of remote object via proxy.
4. Client side formatter formats the message and transmits via appropriate channel.
5. Server side formatter reformats the message.
6. The specified function on remote object is executed and the result is returned.
7. Above process of formatting and reformatting is reversed and the result is returned to client object.

Above article explains the basic terms and technology involved in .Net Remoting. It's possible to create complex distributed applications using .Net Remoting. Developers can create their own custom channels and formatters depending on business needs. There is no built in security provided by .Net Remoting framework. The security features need to be provided by the hosting environment.

Distributed Systems in Java:

Java Remote Method Invocation (RMI) allows you to write distributed objects using Java.

RMI provides a simple and direct model for distributed computation with Java objects. These objects can be new Java objects, or can be simple Java wrappers around an existing API. Java embraces the "Write Once, Run Anywhere model. RMI extends the Java model to be run everywhere."

Because RMI is centered on Java, it brings the power of Java safety and portability to distributed computing. You can move behavior, such as agents and business logic, to the part of your network where it makes the most sense. When you expand your use of Java in your systems, RMI allows you to take all the advantages with you.

RMI connects to existing and legacy systems using the standard Java native method interface JNI. RMI can also connect to existing relational database using the standard JDBC package. The RMI/JNI and RMI/JDBC combinations let you use RMI to communicate today with existing servers in non-Java languages, and to expand your use of Java to those servers when it

makes sense for you to do so. RMI lets you take full advantage of Java when you do expand your use.

### Advantages

At the most basic level, RMI is Java's remote procedure call (RPC) mechanism. RMI has several advantages over traditional RPC systems because it is part of Java's object oriented approach. Traditional RPC systems are language-neutral, and therefore are essentially least-common-denominator systems-they cannot provide functionality that is not available on all possible target platforms.

RMI is focused on Java, with connectivity to existing systems using native methods. This means RMI can take a natural, direct, and fully-powered approach to provide you with a distributed computing technology that lets you add Java functionality throughout your system in an incremental, yet seamless way.

The primary advantages of RMI are:

- **Object Oriented:** RMI can pass full objects as arguments and return values, not just predefined data types. This means that you can pass complex types, such as a standard Java hashtable object, as a single argument. In existing RPC systems you would have to have the client decompose such an object into primitive data types, ship those data types, and then recreate a hashtable on the server. RMI lets you ship objects directly across the wire with no extra client code.
- **Mobile Behavior:** RMI can move behavior (class implementations) from client to server and server to client. For example, you can define

an interface for examining employee expense reports to see whether they conform to current company policy. When an expense report is created, an object that implements that interface can be fetched by the client from the server. When the policies change, the server will start returning a different implementation of that interface that uses the new policies. The constraints will therefore be checked on the client side-providing faster feedback to the user and less load on the server-without installing any new software on user's system. This gives you maximal flexibility, since changing policies requires you to write only one new Java class and install it once on the server host.

- **Design Patterns:** Passing objects lets you use the full power of object oriented technology in distributed computing, such as two- and three-tier systems. When you can pass behavior, you can use object oriented design patterns in your solutions. All object oriented design patterns rely upon different behaviors for their power; without passing complete objects-both implementations and type-the benefits provided by the design patterns movement are lost.
- **Safe and Secure:** RMI uses built-in Java security mechanisms that allow your system to be safe when users downloading implementations. RMI uses the security manager defined to protect systems from hostile applets to protect your systems and network from potentially hostile downloaded code. In severe cases, a server can refuse to download any implementations at all.
- **Easy to Write/Easy to Use:** RMI makes it simple to write remote Java servers and Java clients that access those servers. A remote interface is an actual Java interface. A server has roughly three lines of code to declare itself a server, and otherwise is like any other Java object. This

- simplicity makes it easy to write servers for full-scale distributed object systems quickly, and to rapidly bring up prototypes and early versions of software for testing and evaluation. And because RMI programs are easy to write they are also easy to maintain.
- **Connects to Existing/Legacy Systems:** RMI interacts with existing systems through Java's native method interface JNI. Using RMI and JNI you can write your client in Java and use your existing server implementation. When you use RMI/JNI to connect to existing servers you can rewrite any parts of your server in Java when you choose to, and get the full benefits of Java in the new code. Similarly, RMI interacts with existing relational databases using JDBC without modifying existing non-Java source that uses the databases.
  - **Write Once, Run Anywhere:** RMI is part of Java's "Write Once, Run Anywhere" approach. Any RMI based system is 100% portable to any Java Virtual Machine \*, as is an RMI/JDBC system. If you use RMI/JNI to interact with an existing system, the code written using JNI will compile and run with any Java virtual machine.
  - **Distributed Garbage Collection:** RMI uses its distributed garbage collection feature to collect remote server objects that are no longer referenced by any clients in the network. Analogous to garbage collection inside a Java Virtual Machine, distributed garbage collection lets you define server objects as needed, knowing that they will be removed when they no longer need to be accessible by clients.
  - **Parallel Computing:** RMI is multi-threaded, allowing your servers to exploit Java threads for better concurrent processing of client requests.
  - **The Java Distributed Computing Solution:** RMI is part of the core Java platform starting with JDK?? 1.1, so it exists on every 1.1 Java

Virtual Machine. All RMI systems talk the same public protocol, so all Java systems can talk to each other directly, without any protocol translation overhead.

### Passing Behavior

When we described how RMI can move behavior above, we briefly outlined an expense report program. Here is a deeper description of how you could design such a system. We present this to show how you can use RMI's ability to move behavior from one system to another to move computing to where you want it today, and change it easily tomorrow. The examples below do not handle all cases that would arise in the real world, but instead give a flavor for how the problem can be approached.

### Server-Defined Policy

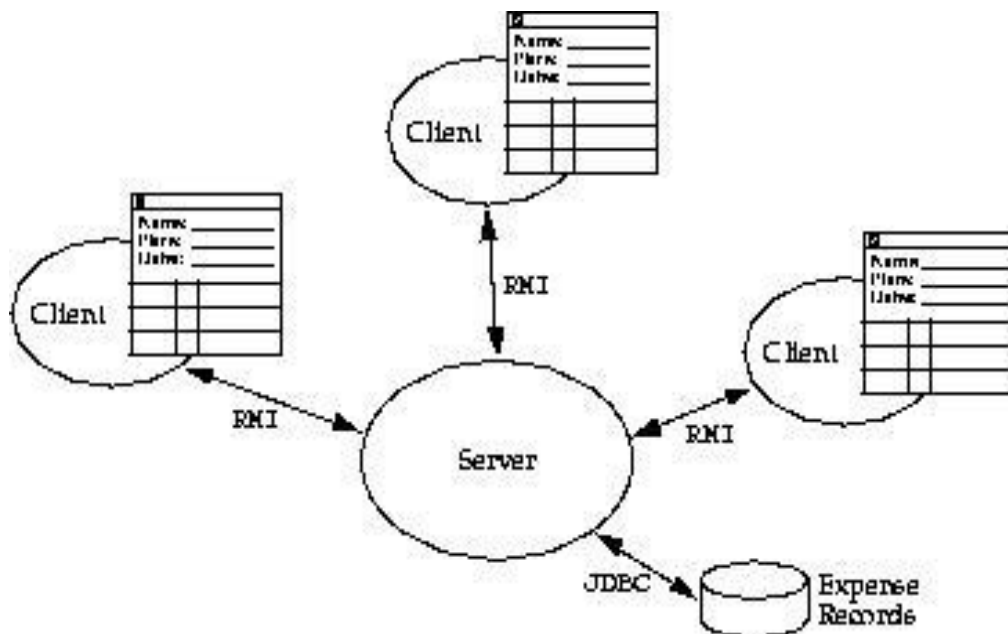


FIGURE 1 An Expense Reporting Architecture

Figure 1 shows the general picture of such a dynamically configurable expense reporting system. A client displays a GUI (graphical user interface) to a user, who fills in the fields of the expense report. Clients communicate with the server using RMI. The server stores the expense reports in a database using JDBC, the Java relational database package. So far this may look like any multi-tier system, but there is an important difference-RMI can download behavior.

Suppose that the company's policies about expense reports change. For example, today the company requires receipts only for expenses over \$20. Tomorrow the company decides this is too lenient-it wants receipts for everything, except for meals that cost less than \$20. Without the ability to download behavior, you have the following alternatives when designing your system for change:

- Install the policy with the client. When the policy changes, this requires updating all clients that contain the policy. You could reduce the problem by installing the client on a handful of server machines and requiring all users to run the client from one of those servers. This still would not completely solve the problem-anyone who leaves the program up and running for days would not be updated, and there are always some people who copy the software to a local disk for efficiency.
- You could have the policy checked by the server when each entry is added to the expense report. This would result in a lot of traffic between client and server, clogging the network and burdening the server. It would also make the system more fragile-a network failure



would halt people in their tracks instead of only affecting them when they actually submit an expense report or start a new one. It would also mean that adding an entry would be slow, since it would require a round trip across the network to the (burdened) server.

- You could have the policy checked by the server when the report is submitted. This lets the user create a lot of bad entries which must then be reported in a batch instead of catching the first error immediately, giving the user a chance to stop making the error. Users need immediate feedback on errors to avoid wasted time.

With RMI you can have the client upload behavior from the server with a simple method invocation, providing a flexible way to offload computation from the server to the clients while providing users with faster feedback. When a user is ready to write up a new expense report, the client asks the server for an object that embodies the current policies for expense reports as expressed via a Policy interface written in Java. The object can implement the policy in any way. If this is the first time that the client's RMI runtime has seen this particular implementation of the policy, RMI will ask the server for a copy of the implementation. Should the implementation change tomorrow, a new kind of policy object will be returned to the client, and the RMI runtime will then ask for that new implementation.

This means that policy is always dynamic. You can change the policy by simply writing a new implementation of the general Policy interface, installing it on the server, and configuring the server to return objects of this new type. From that point on, any new expense reports will be checked against the new policy by every client.

This is a better approach than any static approach because:

- All clients don't need to be halted and updated with new software- software is updated on the fly as needed.
- The server is not burdened with entry checking that can be done locally.
- Allows dynamic constraints because object implementations, not just data, are passed between client and server.
- Lets users know immediately about errors.

Here is the remote interface that defines the methods the client can invoke on the server:

```
import java.rmi.*;
public interface ExpenseServer extends Remote {
    Policy getPolicy() throws RemoteException;
    void submitReport(ExpenseReport report)
        throws RemoteException, InvalidReportException;
}
```

The import statement imports the Java RMI package. All the RMI types are defined in the package `java.rmi` or one of its subpackages. The interface `ExpenseServer` is a normal Java interface with two interesting characteristics

- It extends the RMI interface named `Remote`, which marks the interface as one available for remote invocation.
- All its methods throw `RemoteException`, which is used to signal network and messaging failures. Remote methods can throw any other exception you like, but they must throw at least `RemoteException` so

that you can handle error conditions that only arise in distributed systems. The interface itself supports two methods: `getPolicy` which returns an object that implements the `Policy` interface, and `submitReport` which submits a completed expense request, throwing an exception if the report is malformed for any reason.

The `Policy` interface itself declares a method that lets the client know if it is acceptable to add an entry to the expense report:

```
public interface Policy {  
    void checkValid(ExpenseEntry entry)  
        throws PolicyViolationException;  
}
```

If the entry is a valid one-one that matches current policy-the method returns normally. Otherwise it throws an exception that describes the error. The `Policy` interface is local (not remote), and so will be implemented by an object local to the client-one that runs in the client's virtual machine, not across the network. A client would operate something like this:

```
Policy curPolicy = server.getPolicy();  
start a new expense report  
show the GUI to the user  
while (user keeps adding entries) {  
    try {  
        curPolicy.checkValid(entry); // throws exception if not OK  
        add the entry to the expense report  
    } catch (PolicyViolationException e) {
```

```
        show the error to the user
    }
}
server.submitReport(report);
```

When the user asks the client software to start up a new expense report, the client invokes `server.getPolicy` to ask the server to return an object that embodies the current expense policy. Each entry that is added is first submitted to that policy object for approval. If the policy object reports no error, the entry is added to the report; otherwise the error will be displayed to the user who can take corrective action. When the user is finished adding entries to the report, the entire report is submitted.

## **UNIT-II: ADVANCED ADO.NET**

### **Introduction**

ADO.NET provides consistent access to data sources such as Microsoft SQL Server and XML, as well as to data sources exposed through OLE DB and ODBC. Data-sharing consumer applications can use ADO.NET to connect to these data sources and retrieve, manipulate, and update the data that they contain.

ADO.NET includes .NET Framework data providers for connecting to a database, executing commands, and retrieving results.

ADO.NET is a data-access technology that enables applications to connect to data stores and manipulate data contained in them in various ways. It is based on the .NET Framework and it is highly integrated with the rest of the Framework class library. The ADO.NET API is designed so it can be used from all programming languages that target the .NET Framework, such as Visual Basic, C#, J# and Visual C++.

ADO uses a small set of Automation objects to provide a simple and efficient interface to OLE DB. This interface makes ADO a good choice for developers in higher level languages, such as Visual Basic and VBScript, who want to access data without having to learn the DETAILS of COM and OLE DB.

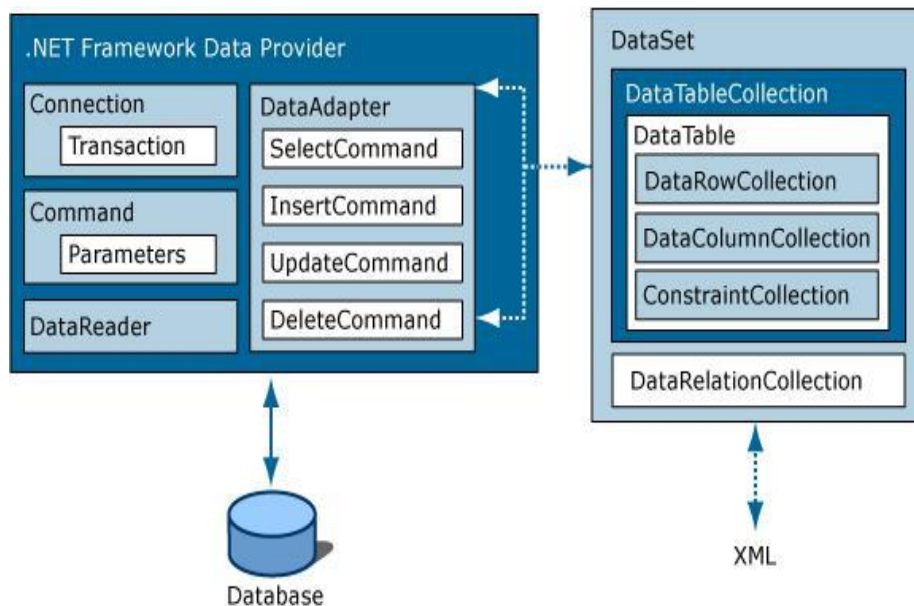
ADO.NET provides functionality to developers writing managed code similar to the functionality provided to native component object model (COM) developers by ActiveX Data Objects (ADO)

Disconnected Data access

ADO.NET Components

There are two components of ADO.NET that you can use to access and manipulate data:

- .NET Framework data providers
  - The DataSet



### 1. NET Framework Data Providers

The NET Framework Data Providers are components that have been explicitly designed for data manipulation and fast, forward-only, read-only access to data.

The Connection object provides connectivity to a data source.

The Command object enables access to database commands to return data, modify data, run stored procedures, and send or retrieve parameter information.

The DataReader provides a high-performance stream of data from the data source. Finally, the DataAdapter provides the bridge between the DataSet object and the data source.

The DataAdapter uses Command objects to execute SQL commands at the data source to both load the DataSet with data, and reconcile changes made to the data in the DataSet back to the data source.

#### *i) The Connection object*

Listed below are the common connection object methods we could work with:

- Open - Opens the connection to our database
- Close - Closes the database connection
- Dispose - Releases the resources on the connection object. Used to force garbage collecting, ensuring no resources are being held after

our connection is used. Incidentally, by using the Dispose method you automatically call the Close method as well.

- State - Tells you what type of connection state your object is in, often used to check whether your connection is still using any resources. Ex. `if (ConnectionObject.State == ConnectionState.Open)`

### ii) The Command Object

- ExecuteReader - Simply executes the SQL query against the database, using the Read() method to traverse through data.
- ExecuteNonQuery – Used whenever you work with SQL stored procedures with parameters.
- ExecuteScalar - Returns a lightning fast single value as an object from your database Ex. `object val = Command.ExecuteScalar();` Then check `if != null.`
- ExecuteXmlReader - Executes the SQL query against SQL Server only, while returning an XmlReader object.
- Prepare – Equivalent to ADO's Command.Prepared = True property. Useful in caching the SQL command so it runs faster when called more than once. Ex. `Command.Prepare();`
- Dispose – Releases the resources on the Command object. Used to force garbage collecting, ensuring no resources are being held after our connection is used. Incidentally, by using the Dispose method you automatically call the Connection object's Close method as well.

### iii) The DataReader Object



- Read – Moves the record pointer to the first row, which allows the data to be read by column name or index position.
- HasRows - HasRows checks if any data exists, and is used instead of the Read method. Ex. if (DataReader.HasRows).
- IsClosed - A method that can determine if the DataReader is closed.
- Next Result - Equivalent to ADO's NextRecordset Method, where a batch of SQL statements are executed with this method before advancing to the next set of data results.
- Close – Closes the DataReader

#### iv) The DataAdapter

Using an adapter, you can read, add, update, and delete records in a data source. To allow you to specify how each of these operations should occur, an adapter supports the following four properties:

- SelectCommand – reference to a command (SQL statement or stored procedure name) that retrieves rows from the data store.
- InsertCommand – reference to a command for inserting rows into the data store.
- UpdateCommand – reference to a command for modifying rows in the data store.
- DeleteCommand – reference to a command for deleting rows from the data store.

## 2. The DataSet

The ADO.NET DataSet is explicitly designed for data access independent of any data source. As a result, it can be used with multiple and differing data

sources, used with XML data, or used to manage data local to the application.

The ADO.NET DataSet contains DataTableCollection and their DataRelationCollection. It represents a collection of data retrieved from the Data Source.

The DataSet contains a collection of one or more DataTable objects made up of rows and columns of data, as well as primary key, foreign key, constraint, and relation information about the data in the DataTable objects.

We can use Dataset in combination with DataAdapter class. The DataSet object offers a disconnected data source architecture. The Dataset can work with the data it contain, without knowing the source of the data coming from. That is, the Dataset can work with a disconnected mode from its Data Source. It gives a better advantage over DataReader, because the DataReader is working only with the connection oriented Data Sources.

In any .NET data access page, before you connect to a database, you first have to import all the necessary namespaces that will allow you to work with the objects required. As we're going to work with SQL Server, we'll first import the namespaces we need. Namespaces in .NET are simply a neat and orderly way of organizing objects, so that nothing becomes ambiguous.

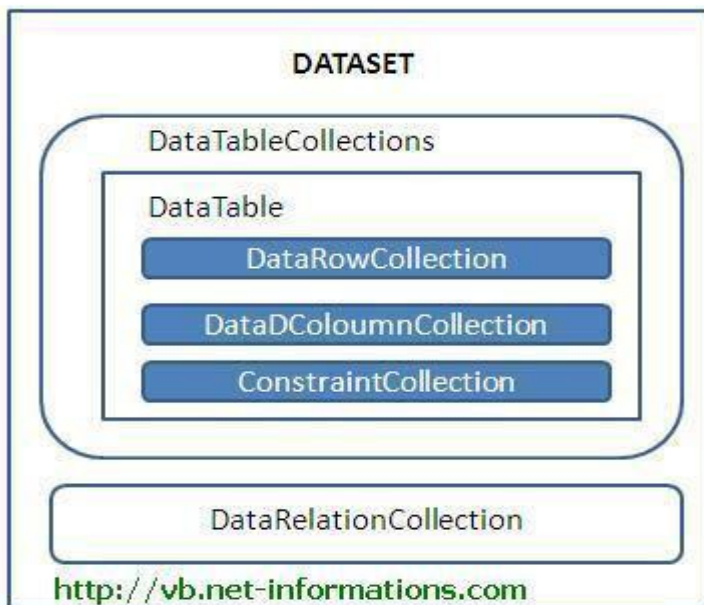
Note

(Namespaces: All the classes are defined in single name called namespaces in ASP.NET.)

Example:

1. `<% @ Import Namespace="System" %> <BR>`
2. `<% @ Import Namespace="System.Data" %> <BR>`
3. `<% @ Import Namespace="System.Data.SqlClient" %>`

The Dataset contains the copy of the data we requested. The Dataset contains more than one Table at a time. We can set up Data Relations between these tables within the DataSet. The data set may comprise data for one or more members, corresponding to the number of rows.



### GridView Control

GridView control is a successor to the ASP.NET 1.X DataGrid control. It provides more flexibility in displaying and working with data from your database in comparison with any other controls. The GridView control enables you to connect to a datasource and display data in tabular format

Its properties like BackColor, ForeColor, BorderColor, BorderStyle, BorderWidth, Height etc.

ProductID	ProductName	UnitPrice	UnitsInStock
1	Dell Studio XPS 8100	999	6
2	Dell Studio XPS 9100	1399	7
3	Dell Inspiron 1545/9176 Laptop	399	6
4	Dell Inspiron M301Z Laptop	599	8
5	HP Envy 13-1100EA Laptop	799	9
6	Motorola A1010	399	4
7	Samsung i710	699	10
8	Nokia N95	499	4
9	HP - Deskjet Printer	599	2
10	Epson - WorkForce 30 Printer	499	9
11	InFocus IN1100	799	9
12	InFocus IN102 Projector	599	9
		<b>8288</b>	<b>83</b>

**Average Price:** 690.67

GridViews support:

- Automatic sorting (click on a column heading to sort by that column)
- Automatic paging (sort of - true paging is only possible if you use more complicated data sources)
- Editing and deleting of data
- Selection of rows

Important properties

Behavior Properties of the GridView Control	
AllowPaging	true/false. Indicate whether the control should support paging.
AllowSorting	true/false. Indicate whether the control should support sorting.
SortExpression	Gets the current sort expression (field name) that determines the order of the row.
SortDirection	Gets the sorting direction of the column sorted currently (Ascending/Descending).
DataSource	Gets or sets the data source object that contains the data to populate the control.
DataSourceID	Indicate the bound data source control to use (Generally used when we are using SqlDataSource or AccessDataSource to bind the data, See 1st Grid example).
AutoGenerateEditButton	true/false. Indicates whether a separate column should be added to edit the record.
AutoGenerateDeleteButton	true/false. Indicates whether a separate column should be added to delete the record.
AutoGenerateSelectButton	true/false. Indicate whether a separate column should be added to select a particular record.
AutoGenerateColumns	true/false. Indicate whether columns are automatically created for each field of the data source. The default is true.

Style Properties of the GridView Control	
AlternatingRowStyle	Defines the style properties for every alternate row in the GridView.
EditRowStyle	Defines the style properties for the row in EditView (When you click Edit button for a row, the row will appear in this style).
RowStyle	Defines the style properties of the rows of the GridView.
PagerStyle	Defines the style properties of Pager of the GridView. (If AllowPaging=true, the page number row appears in this style)
EmptyDataRowStyle	Defines the style properties of the empty row, which appears if there is no records in the data source.
HeaderStyle	Defines the style properties of the header of the GridView. (The column header appears in this style.)
FooterStyle	Defines the style properties of the footer of GridView.
Appearance Properties of the GridView Control	
CellPadding	Indicates the space in pixel between the cells and the border of the GridView.

CellSpacing	Indicates the space in pixel between cells.
GridLines	Both/Horizontal/Vertical/None. Indicates whether GridLines should appear or not, if yes Horizontal, Vertical or Both.
HorizontalAlign	Indicates the horizontal align of the GridView.
EmptyDataText	Indicates the text to appear when there is no record in the data source.
ShowFooter	Indicates whether the footer should appear or not.
ShowHeader	Indicates whether the header should appear or not. (The column name of the GridView)
BackImageUrl	Indicates the location of the image that should display as a background of the GridView.
Caption	Gets or sets the caption of the GridView.
CaptionAlign	left/center/right. Gets or sets the horizontal position of the GridView caption.
State Properties of GridView Control	
Columns	Gets the collection of objects that represent the columns in the GridView.
EditIndex	Gets or sets the 0-based index that identifies the row currently to be edited.
FooterRow	Returns a GridViewRow object that represents

	the footer of the GridView.
HeaderRow	Returns a GridViewRow object that represents the header of the GridView.
PageCount	Gets the number of the pages required to display the records of the data source.
PageIndex	Gets or sets the 0-based page index.
PageIndex	Gets or sets the number of records to display in one page of GridView.
Rows	Gets a collection of GridViewRow objects that represents the currently displayed rows in the GridView.
DataKeyNames	Gets an array that contains the names of the primary key field of the currently displayed rows in the GridView.
DataKeys	Gets a collection of DataKey objects that represent the value of the primary key fields set in DataKeyNames property of the GridView.
Events associated with GridView Control	
PageIndexChanging, PageIndexChanged	Both events occur when the page link is clicked. They fire before and after GridView handles the paging operation respectively.



RowCancelingEdit	Fires when Cancel button is clicked in Edit mode of GridView.
RowCommand	Fires when a button is clicked on any row of GridView.
RowCreated	Fires when a new row is created in GridView.
RowDataBound	Fires when row is bound to the data in GridView.
RowDeleting,RowDeleted	Both events fires when Delete button of a row is clicked. They fire before and after GridView handles deleting operaton of the row respectively.
RowEditing	Fires when a Edit button of a row is clicked but before the GridView handdes the Edit operation.
RowUpdating, RowUpdated	Both events fire when a update button of a row is clicked. They fire before and after GridView control update operation respectively.
Sorting, Sorted	Both events fire when column header link is clicked. They fire before and after the GridView handler the Sort operation respectively.

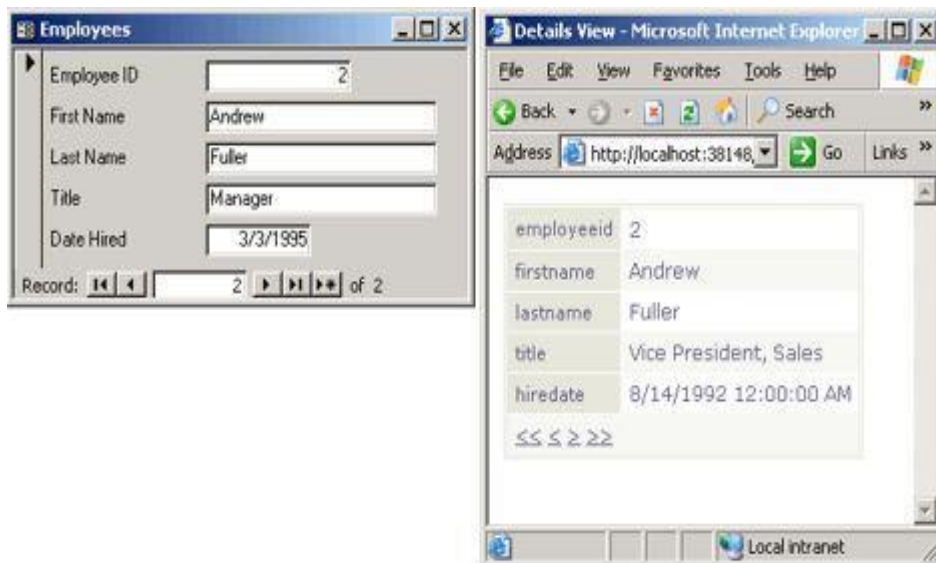
### A DetailsView Control

In ASP.NET 2.0, DetailsView is a data-bound control that renders a single record at a time from its associated data source. It can optionally provide

paging buttons to navigate between records, and a command bar to execute basic operations on the current record (Insert, Update, Delete). DetailsView generates a user interface similar to the Form View of a Microsoft Access database, and is typically used for updating/deleting any currently displayed record or for inserting new records.

The key aspects of a DetailsView control:

- Be a composite control and act as a naming container.
- Be data-bindable to enumerable data sources.
- Support some style properties.
- Provide a navigation bar (pager).
- Support replaceable views of the record fields.
- Provide a command bar for common operations.



Its properties like BackColor, ForeColor, BorderColor, BorderStyle, BorderWidth, Height etc.

Important properties

---

Behavior Properties of the DetailsView Control	
AllowPaging	true/false. Indicate whether the control should support navigation.
DataSource	Gets or sets the data source object that contains the data to populate the control.
DataSourceID	Indicate the bound data source control to use (Generally used when we are using SqlDataSource or AccessDataSource to bind the data, See 1st Grid example).
AutoGenerateEditButton	true/false. Indicates whether a separate column with edit link/button should be added to edit the record.
AutoGenerateDeleteButton	true/false. Indicates whether a separate column with delete link/button should be added to delete the record.
AutoGenerateRows	true/false. Indicate whether rows are automatically created for each field of the data source. The default is true.
DefaultMode	read-only/insert/edit. Indicate the default display mode.
Style Properties of the DetailsView Control	
AlternatingRowStyle	Defines the style properties for every alternate row in the DetailsView.
EditRowStyle	Defines the style properties for the row in

	EditView (When you click Edit button for a row, the row will appear in this style).
RowStyle	Defines the style properties of the rows of the DetailsView.
PagerStyle	Defines the style properties of Pager of the DetailsView. (If AllowPaging=true, the page number row appears in this style)
EmptyDataRowStyle	Defines the style properties of the empty row, which appears if there is no records in the data source.
HeaderStyle	Defines the style properties of the header of the DetailsView. (The column header appears in this style.)
FooterStyle	Defines the style properties of the footer of DetailsView.
Appearance Properties of the DetailsView Control	
CellPadding	Indicates the amount of space in pixel between the cells and the border of the DetailsView.
CellSpacing	Indicates the amount of space in pixel between cells.
GridLines	Both/Horizontal/Vertical/None. Indicates whether GridLines should appear or not, if yes Horizontal, Vertical or Both.
HorizontalAlign	Indicates the horizontal alignment of the

	DetailsView.
EmptyDataText	Indicates the text to appear when there is no record in the data source.
BackImageUrl	Indicates the location of the image that should display as a background of the DetailsView.
Caption	Gets or sets the caption of the DetailsView.
CaptionAlign	left/center/right. Gets or sets the horizontal position of the DetailsView caption.
State Properties of DetailsView Control	
Rows	Gets the collection of objects that represent the rows in the DetailsView.
FooterRow	Returns a DetailsViewRow object that represents the footer of the DetailsView.
HeaderRow	Returns a DetailsViewRow object that represents the header of the DetailsView.
PageCount	Gets the number of the pages required to display the records of the data source.
PageIndex	Gets or sets the 0-based page index.
DataKeyNames	Gets an array that contains the names of the primary key field of the currently displayed rows in the DetailsViewRow.
DataKeys	Gets a collection of DataKey objects that

	represent the value of the primary key fields set in <code>DataKeyNames</code> property of the <code>DetailsViewRow</code> .
Events of the <code>DetailsView</code> Control	
<code>ItemCommand</code>	Fires when any clickable element on the control is clicked.
<code>ItemCreated</code>	Fires after <code>DetailsView</code> fully creates all rows of the record.
<code>ItemDeleting</code> , <code>ItemDeleted</code>	Both event fires when current record is deleted. The first one fires before and other fires after record is deleted.
<code>ItemInserting</code> , <code>ItemInserted</code>	Both event fires when an item is inserted. The first one fires before and second after the item is created.
<code>ItemUpdating</code> , <code>ItemUpdated</code>	Both event fires when an item is updated. The first one fires before and second fires after the record is updated.
<code>ModeChanging</code> , <code>ModeChanged</code>	Both event fires when <code>DetailsView</code> change its display mode. The first one fires before and second fires after display mode is changed.
<code>PageIndexChanging</code> , <code>PageIndexChanged</code>	Both event fires when the <code>DetailsView</code> move to another record. The first one fires before and second fires after page is changed.

### FormView Control

The FormView control is used to display a single record from database. It's greater flexibility is, it displays user-defined templates instead of row fields.

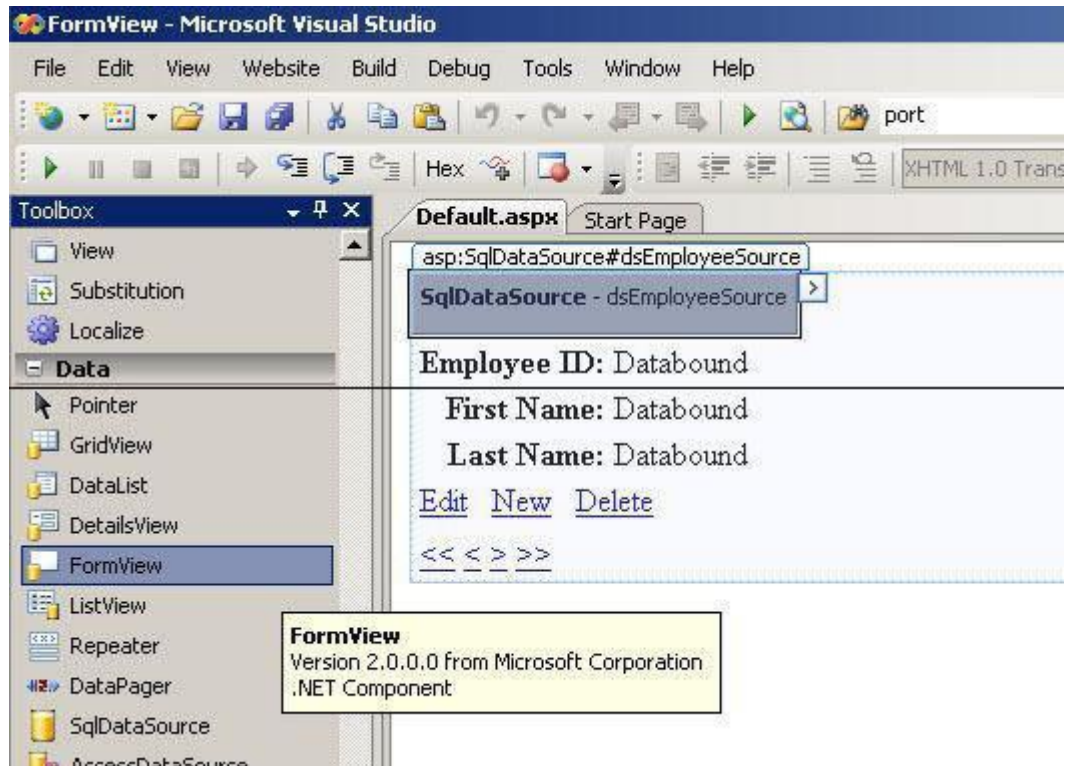
The difference between the FormView and the DetailsView controls is that the DetailsView control uses a tabular layout where each field of the record is displayed as a row of its own. In contrast, the FormView control does not specify a predefined layout for displaying the record. Instead, you create a template containing controls to display individual fields from the record. The template contains the formatting, controls, and binding expressions used to create the form.

The FormView control is typically used for updating and inserting new records, and is often used in master/detail scenarios where the selected record of the master control determines the record to display in the FormView control.

It has the following features:

- Binding to data source controls, such as SqlDataSource and ObjectDataSource.
- Built-in inserting capabilities.
- Built-in updating and deleting capabilities.
- Built-in paging capabilities.
- It's properties, handle events can be set dynamically with FormView object model.
- It can be customized through templates, themes and styles.

- Template are used to display/edit the FormView control.



Its properties like BackColor, ForeColor, BorderColor, BorderStyle, BorderWidth, Height etc.

### Important properties

HeaderTemplate	Displays the content at header row of the template. The header row is displayed at the top of the FormView control when the HeaderText or HeaderTemplate property is set
EmptyDataTemplate	This is used display the content when datasource control does not contain any records. It alerts the ser that datasource has no records.



ItemTemplate	It is used to display the content when Formview is in read-only mode. The item template usually contains controls to display the field values of a record, as well as command buttons to edit, insert, and delete a record.
EditItemTemplate	Displays the content for the data row when the FormView control is in edit mode. This template usually contains input controls and command buttons with which the user can edit an existing record.
InsertItemTemplate	Displays the content for the data row when the FormView control is in insert mode. This template usually contains input controls and command buttons with which the user can add a new record.
PagerTemplate	Displays the content for the pager row displayed when the paging feature is enabled (when the AllowPaging property is set to true). This template usually contains controls with which the user can navigate to another record.
FooterTemplate	The footer row is displayed at the bottom of the FormView control when the FooterText or FooterTemplate property is set. If both the FooterText and FooterTemplate properties are set, the FooterTemplate property takes precedence.

Methods of the FormView Control	
ChangeMode	ReadOnly/Insert/Edit. Change the working mode of the control from the current to the defined FormViewMode type.
InsertItem	Used to insert the record into database. This method must be called when the DetailsView control is in insert mode.
UpdateItem	Used to update the current record into database. This method must be called when DetailsView control is in edit mode.
DeleteItem	Used to delete the current record from database.

ItemCommand	Occurs when a button within a FormView control is clicked. This event is often used to perform a task when a button is clicked in the control.
ItemCreated	Occurs after all FormViewRow objects are created in the FormView control. This event is often used to modify the values of a record before it is displayed.
ItemDeleted	Occurs when a Delete button (a button with its CommandName property set to "Delete") is clicked, but after the FormView control deletes the record from the data source. This event is often used to check the results of the delete operation.
ItemDeleting	Occurs when a Delete button is clicked, but before the FormView control deletes the record from the data source. This event is often used to cancel the delete operation.

ItemInserted	Occurs when an Insert button (a button with its CommandName property set to "Insert") is clicked, but after the FormView control inserts the record. This event is often used to check the results of the insert operation.
ItemInserting	Occurs when an Insert button is clicked, but before the FormView control inserts the record. This event is often used to cancel the insert operation.
ItemUpdated	Occurs when an Update button (a button with its CommandName property set to "Update") is clicked, but after the FormView control updates the row. This event is often used to check the results of the update operation.
ItemUpdating	Occurs when an Update button is clicked, but before the FormView control updates the record. This event is often used to cancel the update operation.
ModeChanged	Occurs after the FormView control changes modes (to edit, insert, or read-only mode). This event is often used to perform a task when the FormView control changes modes.
ModeChanging	Occurs before the FormView control changes modes (to edit, insert, or read-only mode). This event is often used to cancel a mode change.

### Crystal Reports in ASP.NET

Crystal Reports is the standard reporting tool for Visual Studio .NET used to display data of presentation quality. You can display multiple-level totals, charts to analyze data, and much more in Crystal Reports. Creating a Crystal Report requires minimal coding since it is created in Designer interface. It is available as an integrated feature of Microsoft Visual Studio .NET, Borland Delphi, and C#Builder.

#### *Advantages of Crystal Reports*

Some of the major advantages of using Crystal Reports are:

1. Rapid report development since the designer interface would ease the coding work for the programmer.
2. Can extend it to complicated reports with interactive charts and enhance the understanding of the business model
3. Exposes a report object model, can interact with other controls on the ASP.NET Web form
4. Can programmatically export the reports into widely used formats like .pdf, .doc, .xls, .html and .rtf

#### *Implementation Models*

Crystal Reports need database drivers to connect to the data source for accessing data. Crystal Reports in .net support two methods to access data from a data source:

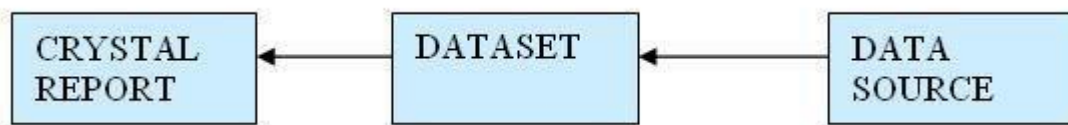
### *The Pull Method*

When this model is used to access data from the data source, the database driver directly retrieves the data from the data source. This model does not require the developer to write code for creating a connection and retrieving data from the data source. It is the Crystal report that manages the SQL commands for connecting by using the specified driver.



### *The Push Method*

When this model is used to access data from data source, the developer writes the code to connect to the data source and retrieve data. The data from the data source is cached in dataset and multiple crystal reports accesses data from the dataset. The performance can be optimized in this manner by using connection sharing and manually limiting the number of records that are passed on to the report.



### Crystal Reports Types

Crystal Report Designer can load reports that are included into the project as well as those that are independent of the project.

### *Strongly-typed Report*

When you add a report file into the project, it becomes a "strongly-typed" report. In this case, you will have the advantage of directly creating an instance of the report object, which could reduce a few lines of code, and cache it to improve performance. The related .vb file, which is hidden, can be viewed using the editor's "show all files" icon in the Solution Explorer.

### *Un-Typed Report*

Those reports that are not included into the project are "un-typed" reports. In this case, you will have to create an instance of the Crystal Report Engine's "ReportDocument" object and manually load the report into it.

### Creating Crystal Reports

You can create a Crystal Report by using three methods:

1. Manually i.e. from a blank document
2. Using Standard Report Expert
3. From an existing report

### *Using Pull Method*

#### Creating Crystal Reports Manually.

We would use the following steps to implement Crystal Reports using the Pull Model:

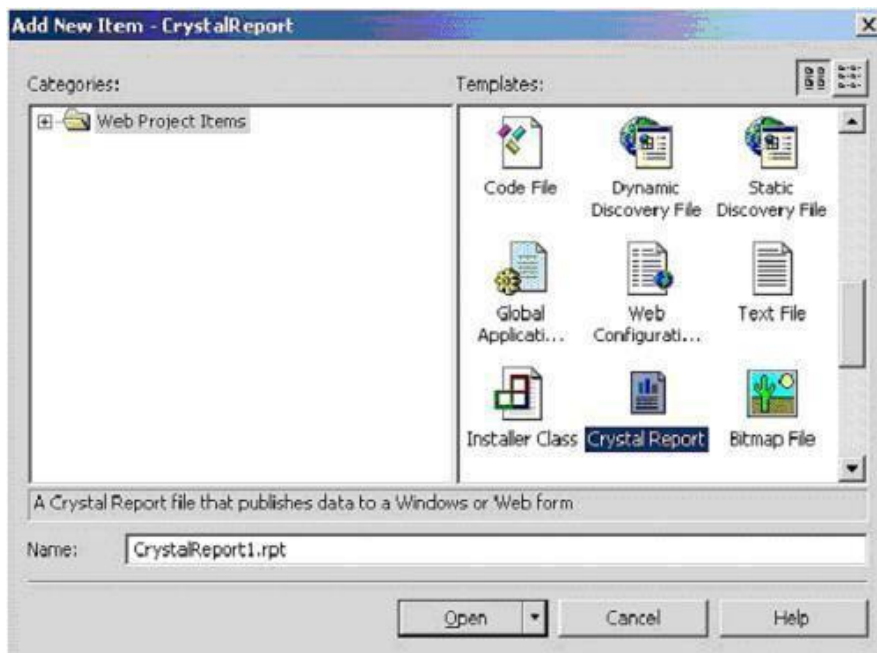
1. Create the .rpt file (from scratch) and set the necessary database connections using the Crystal Report Designer interface.

2. Place a CrystalReportViewer control from the toolbox on the .aspx page and set its properties to point to the .rpt file that we created in the previous step.
3. Call the databind method from your code behind page.

### Creating Crystal Reports

#### I. Steps to create the report i.e. the .rpt file

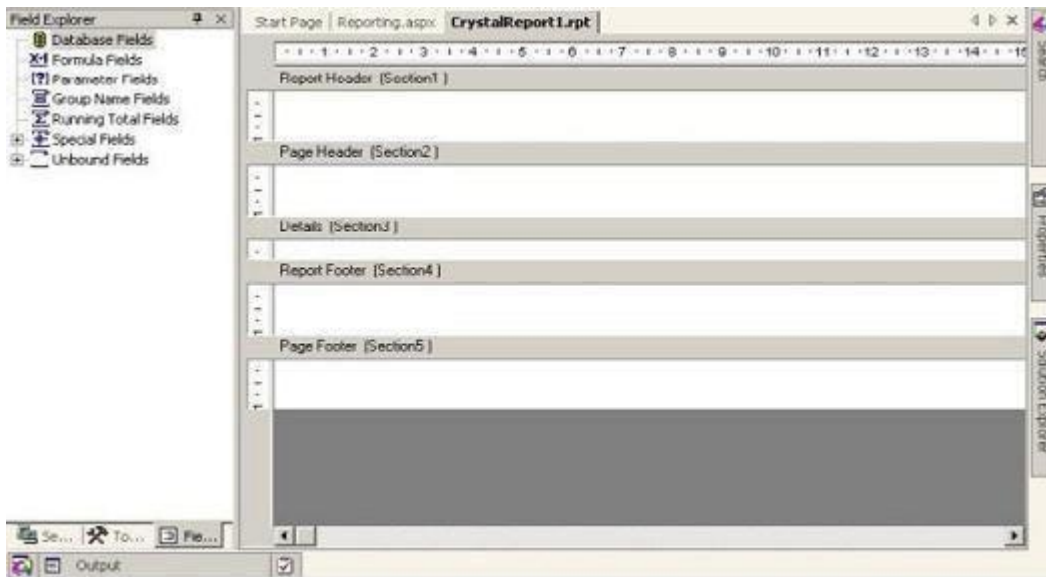
- 1) Add a new Crystal Report to the web form by right clicking on the "Solution Explorer", selecting "Add" --> "Add New Item" --> "CrystalReport".



- 2) On the "Crystal Report Gallery" pop up, select the "As a Blank Report" radio button and click "ok".



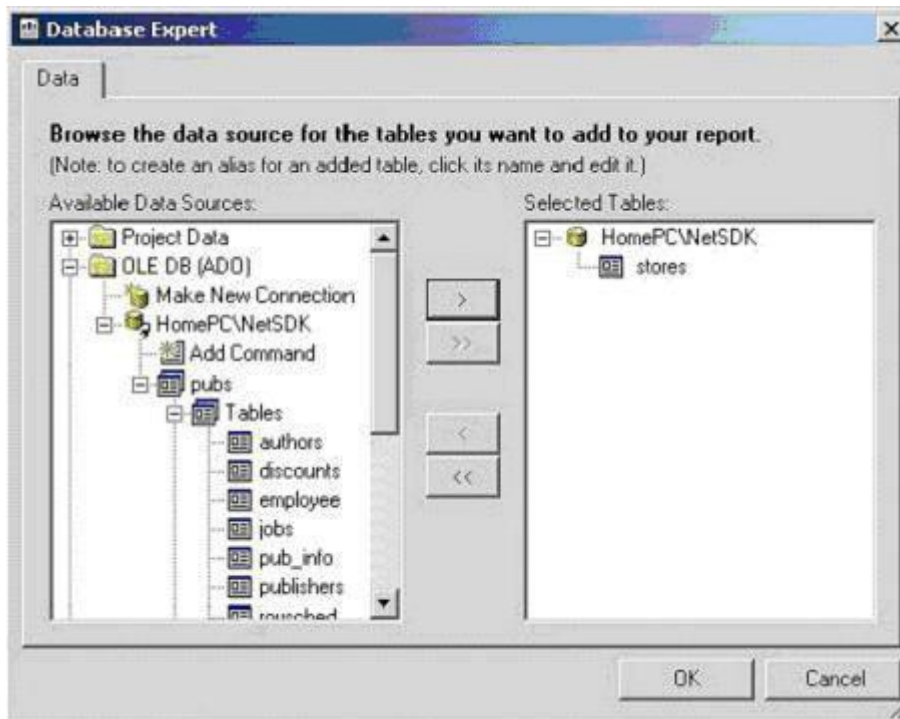
3) This should open up the Report File in the Crystal Report Designer.



4) Right click on the "Details Section" of the report, and select "Database" - "Add/Remove Database".



- 5) In the "Database Expert" pop up window, expand the "OLE DB (ADO)" option by clicking the "+" sign, which should bring up another "OLE DB (ADO)" pop up.
- 6) In the "OLE DB (ADO)" pop up, Select "Microsoft OLE DB Provider for SQL Server" and click Next.
- 7) Specify the connection information.
- 8) Click "Next" and then click "Finish".
- 9) Now you should be able to see the Database Expert showing the table that have been selected.
- 10) Expand the "Pubs" database, expand the "Tables", select the "Stores" table and click on ">" to include it into the "Selected Tables" section.

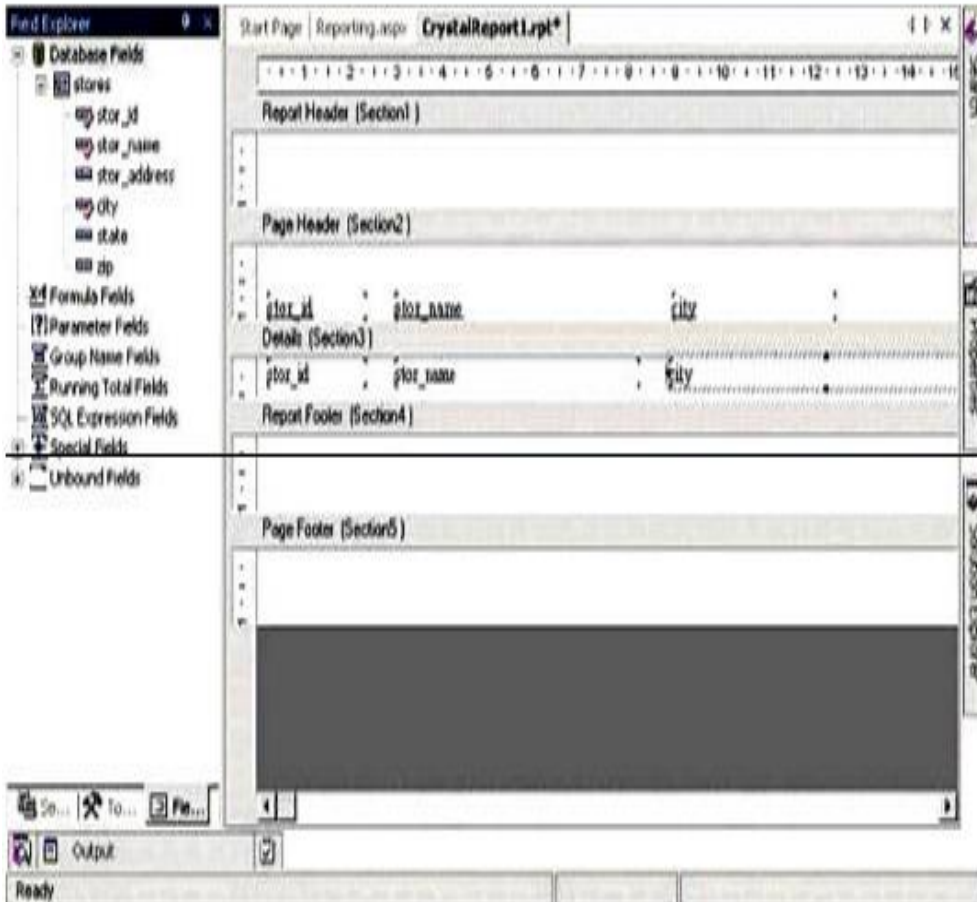


Note: If you add more than one table in the database Expert and the added tables have matching fields, when you click the OK button after adding the tables, the links between the added tables is displayed under the Links tab. You can remove the link by clicking the Clear Links button.

11) Now the Field Explorer should show you the selected table and its fields under the "Database Fields" section, in the left window.

12) Drag and drop the required fields into the "Details" section of the report. The field names would automatically appear in the "Page Header" section of the report. If you want to modify the header text then right click on the text of the "Page Header" section, select "Edit Text Object" option and edit it.

13) Save it.



## Role of ADO.NET in Distributed Applications

The rapid development of web applications makes software development companies review the existing methods of working with data sources and adapt them to the web application specifications. The unpredicted growth of the number of clients makes web developers move from client-server to three-tier architecture, which sometimes brings out problems. Databases are unable to support the unlimited number of active connections limiting the availability of the site and causing losses. The ADO.NET (ActiveX Data Objects) technology can solve these problems and at the same time keep convenience and simplicity of programming.

### Advantages and innovations in ADO.NET technology

- Using the disconnected model for accessing the data. ADO.NET application development technology offers an alternative to a traditional data access model. Normally, client-server applications use the technology of access to the data source where the connection with the base is maintained all the time. However, after the wide spread of the Internet based applications some vulnerabilities of this approach have been discovered. The experience of web developers has shown that the applications with the constant connection with the data source are difficult in scaling. All these problems are produced by the constant connection with database and are solved in ADO.NET. ADO.NET technology makes use of another data access model.

ADO.NET access model establishes the connection only for some limited time when it's necessary to take some actions with the database. Thus, ADO.NET allows sidestepping these limitations of web application development process.

- Data string in the DataSet objects. In general, DataSet is a simplified relational database and can perform the most typical for these bases operations. Owing to ADO.NET application development technology, in contrast to Recordset, we can store several tables in one DataSet as well as the relations between them, perform the operations of selecting, deleting and updating the data. ADO.NET gives an opportunity any minute to get the latest information from the database using the call function FillDataSet. Thus, ADO.NET application development technology makes DataSet extremely convenient for most web applications. ADO.NET application development

technology allows us to extract the data from the base and somehow handle it whenever it is necessary.

- Deep integration with XML. XML, a widely spread language, plays an important role in ADO.NET and brings some more benefits to ADO.NET application development technology in comparison with the traditional approach. It isn't necessary for a programmer working with ADO.NET to have the experience of working with XML or the knowledge about this language. ADO.NET makes all the operations transparent for web developers. XML (eXtensible Markup Language) represents an industrial standard supported by practically any modern platform, which allows transmitting data to any component that can work with XML and can be executed under any operating system. Thus, deep integration of ADO.NET with XML provides .NET application developers with ample opportunities.

Many application developers have already noticed the simplicity and convenience of the ADO.NET technology. ADO.NET application development technology provides an intuitive interface and logical set of objects. All these features make ADO.NET more appealing to .NET web developers.

### UNIT-III ADVANCED ASP.NET

ASP.NET is a Web application framework developed and marketed by Microsoft to allow programmers to build dynamic Web sites, Web applications and Web services. ASP.NET is built on the Common Language Runtime (CLR), allowing programmers to write ASP.NET code using any supported .NET language.

ASP.NET Web pages, known officially as Web Forms are the main building block for application development. Web forms are contained in files with an ".aspx" extension; these files typically contain HTML markup, as well as markup defining server-side Web Controls and User Controls. With ASP.NET Framework 2.0, Microsoft introduced a new *code-behind* model which allows static text to remain on the .aspx page, while dynamic code remains in an .aspx.vb or .aspx.cs or .aspx.fs file (depending on the programming language used).

#### ASP.NET and the .NET Framework

ASP.NET is part of the Microsoft .NET Framework. To build ASP.NET pages, you need to take advantage of the features of .NET Framework, which consists of two parts:

1. The Framework Class Library
2. The Common Language Runtime.

#### Understanding the Framework Class Library

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*The .NET Framework contains more than 13,000 classes you can use when building applications.*

Framework Class Library was designed to make it easier to perform the most common programming tasks. Following are just a few examples of the classes in the framework:

- File class-Enables you to represent a file on your hard drive. You can use the File class to check whether a file exists, create a new file, delete a file, and perform many other file-related tasks.
- Graphics class-Enables you to work with different types of images such as GIF, PNG, BMP, and JPEG. You can use the Graphics class to draw rectangles, arcs, ellipses, and other elements on an image
- Random class-Enables you to generate a random number.
- SmtpClient class-Enables you to send email. You can use the SmtpClient class to send emails that contain attachments and HTML content.

Each class in the Framework can include properties, methods, and events. The properties, methods, and events exposed by a class are the members of a class.

For example, following is a partial list of the members of the SmtpClient class:

- Properties
- Host-The name or IP address of your email server
- Port-The number of the port to use when sending an email message
- Methods

- Send-Enables you to send an email message synchronously
- SendAsync-Enables you to send an email message asynchronously
- Events
- SendCompleted-Raised when an asynchronous send operation completes

For example, the `SmtpClient` class includes two properties named `Host` and `Port`, which enable you to specify the email server and port to use when sending an email message.

The `SmtpClient` class also includes two methods you can use to send an email:

i) `Send()`

ii) `SendAsync()`.

The `Send` method blocks further program execution until the send operation is completed. The `SendAsync()` method, on the other hand, sends the email asynchronously. Unlike the `Send()` method, the `SendAsync()` method does not wait to check whether the send operation was successful.

Finally, the `SmtpClient` class includes an event named `SendCompleted`, which is raised when an asynchronous send operation completes. You can create an event handler for the `SendCompleted` event that displays a message when the email has been successfully sent.



### Understanding Namespaces

All the classes are defined in single name called namespaces in ASP.NET.

For example

1. All the classes related to working with the file system are located in the System.IO namespace.
2. All the classes for working a Microsoft SQL Server database are located in the System.Data.SqlClient namespace.

Before you can use a class in a page, you must indicate the namespace associated with the class. There are multiple ways of doing this.

1. First you can fully qualify a class name with its namespace. For example, because the File class is contained in the System.IO namespace, you can use the following statement to check whether a file exists:

```
System.IO.File.Exists("SomeFile.txt")
```

2. A second option is to import a namespace.

You can add an `<$I<% @ Import % directive><% @ Import %>` directive to a page to import a particular namespace.

```
<% @ Import Namespace="System.Net.Mail" %>
```

ASP.NET gives you the most commonly used namespaces for free:

- System
- System.Collections

- System.Collections.Generic
- System.Collections.Specialized
- System.ComponentModel.DataAnnotations
- System.Configuration
- System.Data.Entity.Linq
- System.Data.Linq
- System.Text
- System.Text.RegularExpressions
- System.Web
- System.Web.Caching
- System.Web.DynamicData
- System.Web.SessionState
- System.Web.Security
- System.Web.Profile
- System.Web.UI
- System.Web.UI.WebControls
- System.Web.UI.WebControls.WebParts
- System.Web.UI.HtmlControls
- System.Xml.Linq

### Understanding the Common Language Runtime

The second part of the .NET Framework is the Common Language Runtime (CLR). The Common Language Runtime is responsible for executing your application code.

When you write an application for the .NET Framework with a language such as C# or Visual Basic .NET, your source code is never compiled

directly into machine code. Instead, the C# or Visual Basic compiler converts your code into a special language named MSIL (Microsoft Intermediate Language).

MSIL looks very much like an object-oriented assembly language. However, unlike a typical assembly language, it is not CPU specific. MSIL is a low-level and platform-independent language.

When your application actually executes, the MSIL code is "just-in-time" compiled into machine code by the JITTER (the Just-In-Time compiler). Normally, your entire application is not compiled from MSIL into machine code. Instead, only the methods that are actually called during execution are compiled.

In reality, the .NET Framework understands only one language: MSIL. However, you can write applications using languages such as Visual Basic .NET and C# for the .NET Framework because the .NET Framework includes compilers for these languages that enable you to compile your code into MSIL.

You can write code for the .NET Framework using any one of dozens of different languages, including the following:

- Ada
- Apl
- Caml
- COBOL
- Eiffel
- Forth

- Fortran
- JavaScript
- Oberon
- PERL
- Pascal
- PHP
- Python
- RPG
- Scheme
- Small Talk

The vast majority of developers building ASP.NET applications write the applications in either C# or Visual Basic .NET.

### *Understanding ASP.NET Controls*

ASP.NET controls are the heart of the ASP.NET Framework. An ASP.NET control is a .NET class that executes on the server and renders certain content to the browser.

The ASP.NET Framework contains over 70 controls. These controls can be divided into eight groups:

- **Standard Controls**—The standard controls enable you to render standard form elements such as buttons, input fields, and labels.
- **Validation Controls**—The validation controls enable you to validate form data before you submit the data to the server. For example, you can use a `RequiredFieldValidator` control to check whether a user entered a value for a required input field.

- Rich Controls—The rich controls enable you to render things such as calendars, file upload buttons, rotating banner advertisements, and multi-step wizards.
- Data Controls—The data controls enable you to work with data such as database data. For example, you can use these controls to submit new records to a database table or display a list of database records.
- Navigation Controls—The navigation controls enable you to display standard navigation elements such as menus, tree views, and bread crumb trails.
- Login Controls—The login controls enable you to display login, change password, and registration forms.
- HTML Controls—The HTML controls enable you to convert any HTML tag into a server-side control.

### *HTML Server Controls*

HTML elements in ASP.NET files are, by default, treated as text. To make these elements programmable, add a `runat="server"` attribute to the HTML element. This attribute indicates that the element should be treated as a server control.

Note: All HTML server controls must be within a `<form>` tag with the `runat="server"` attribute!

Note: ASP.NET requires that all HTML elements must be properly closed and properly nested.

### HTML Server Control Description

<u>HtmlAnchor</u>	Controls an <a> HTML element
<u>HtmlButton</u>	Controls a <button> HTML element
<u>HtmlForm</u>	Controls a <form> HTML element
<u>HtmlGeneric</u>	Controls other HTML element not specified by a specific HTML server control, like <body>, <div>, <span>, etc.
<u>HtmlImage</u>	Controls an <image> HTML element
<u>HtmlInputButton</u>	Controls <input type="button">, <input type="submit">, and <input type="reset"> HTML elements.)

### ASP.NET Pages

The ASP.NET Framework enables you to create two different types of ASP.NET pages.

1. Single-file
2. Code Behind(two-file ASP.NET pages)

#### Single-file

In a single-file ASP.NET page, a single file contains both the page code and page controls. The page code is contained in a <script runat="server"> tag.

#### Code Behind(two-file ASP.NET pages)

you can create a two-file ASP.NET page. A two-file ASP.NET page is normally referred to as a "code-behind" page. In a code-behind page, the page code is contained in a separate file.

Code declaration blocks are lines of code enclosed in <script> tags. They contain the runat=server attribute, which tells ASP.NET that these controls can be accessed on the server and on the client. Optionally you can specify the language for the block. The code block itself consists of the definition of member variables and methods.

Example:

```
<asp:Label  
id="Label1"  
Runat="server" />
```

Note - When using Visual Web Developer, you create a code-behind page by selecting Web Site, Add New Item, selecting the Web Form Item, and checking the Place Code in Separate File check box before adding the page.

### Page Events

Whenever you request an ASP.NET page, a particular set of events is raised in a particular sequence. This sequence of events is called the "page execution lifecycle."

Here is the sequence of events that are raised whenever you request a page:

1. PreInit

2. Init
3. InitComplete
4. PreLoad
5. Load
6. LoadComplete
7. PreRender
8. PreRenderComplete
9. SaveStateComplete
10. Unload

### Advantages of ASP.NET (Features)

1. Separation of Code from HTML  
To make a clean sweep, with ASP.NET you have the ability to completely separate layout and business logic. This makes it much easier for teams of programmers and designers to collaborate efficiently. This makes it much easier for teams of programmers and designers to collaborate efficiently.
2. Support for compiled languages  
developer can use VB.NET and access features such as strong typing and object-oriented programming. Using compiled languages also means that ASP.NET pages do not suffer the performance penalties associated with interpreted code. ASP.NET pages are precompiled to byte-code and Just In Time (JIT) compiled when first requested. Subsequent requests are directed to the fully compiled code, which is cached until the source changes.



### 3. Use services provided by the .NET Framework

The .NET Framework provides class libraries that can be used by your application. Some of the key classes help you with input/output, access to operating system services, data access, or even debugging.

We will go into more detail on some of them in this module.

### 4. Graphical Development Environment

Visual Studio .NET provides a very rich development environment for Web

developers. You can drag and drop controls and set properties the way you do in Visual Basic 6. And you have full IntelliSense support, not only for your code, but also for HTML and XML.

### 5. State management

To refer to the problems mentioned before, ASP.NET provides solutions for session and application state management. State information can, for example, be kept in memory or stored in a database. It can be shared across Web farms, and state information can be recovered, even if the server fails or the connection breaks down.

### 6. Update files while the server is running

Components of your application can be updated while the server is online and clients are connected. The Framework will use the new files as soon as they are copied to the application. Removed or old files that are still in use are kept in memory until the clients have finished.

### 7. XML-Based

### Configuration

### Files

Configuration settings in ASP.NET are stored in XML files that you can easily read and edit. You can also easily copy these to another server, along with the other files that comprise your application.

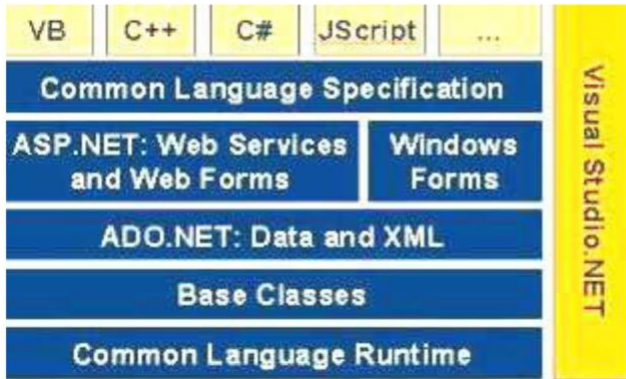
### ASP.NET Overview

Here some point that gives the quick overview of ASP.NET.

- ASP.NET provides services to allow the creation, deployment, and execution of Web Applications and Web Services
- Like ASP, ASP.NET is a server-side technology
- Web Applications are built using Web Forms. ASP.NET comes with built-in Web Forms controls, which are responsible for generating the user interface. They mirror typical HTML widgets like text boxes or buttons. If these controls do not fit your needs, you are free to create your own user controls.
- Web Forms are designed to make building web-based applications as easy as building Visual Basic applications

### ASP.NET Architecture

ASP.NET is based on the fundamental architecture of .NET Framework. Visual studio provide a uniform way to combine the various features of this Architecture.



Architecture is explained from bottom to top in the following discussion.

1. At the bottom of the Architecture is Common Language Runtime. NET Framework common language runtime resides on top of the operating system services. The common language runtime loads and executes code that targets the runtime. This code is therefore called managed code. The runtime gives you, for example, the ability for cross-language integration.
2. .NET Framework provides a rich set of class libraries. These include base classes, like networking and input/output classes, a data class library for data access, and classes for use by programming tools, such as debugging services. All of them are brought together by the Services Framework, which sits on top of the common language runtime.
3. ADO.NET is Microsoft's ActiveX Data Object (ADO) model for the .NET Framework. ADO.NET is not simply the migration of the popular ADO model to the managed environment but a completely new paradigm for data access and manipulation.

ADO.NET is intended specifically for developing web applications.

This is evident from its two major design principles:

1. **Disconnected Datasets**—In ADO.NET, almost all data manipulation is done outside the context of an open database connection.
  2. **Effortless Data Exchange with XML**—Datasets can converse in the universal data format of the Web, namely XML.
4. The 4th layer of the framework consists of the Windows application model and, in parallel, the Web application model. The Web application model—in the slide presented as ASP.NET—includes Web Forms and Web Services. ASP.NET comes with built-in Web Forms controls, which are responsible for generating the user interface. They mirror typical HTML widgets like text boxes or buttons. If these controls do not fit your needs, you are free to create your own user controls.

Web Services brings you a model to bind different applications over the Internet. This model is based on existing infrastructure and applications and is therefore standard-based, simple, and adaptable.

Web Services are software solutions delivered via Internet to any device. Today, that means Web browsers on computers, for the most part, but the device-agnostic design of .NET will eliminate this limitation.

5. One of the obvious themes of .NET is unification and interoperability between various programming languages. In order to achieve this;

- certain rules must be laid and all the languages must follow these rules. In other words we cannot have languages running around creating their own extensions and their own fancy new data types. CLS is the collection of the rules and constraints that every language (that seeks to achieve .NET compatibility) must follow.
6. The CLR and the .NET Frameworks in general, however, are designed in such a way that code written in one language can not only seamlessly be used by another language. Hence ASP.NET can be programmed in any of the .NET compatible.

### AdRotator Control

The AdRotator control is used to display a sequence of ad images. The AdRotator is a special purpose control in ASP.NET that is used to display flashing Banner ads. The control is capable of displaying ads randomly or sequentially as set by the users. Each time the page is refreshed or reloaded a new ad can be displayed to the user. We can also assign priorities to the ads in such a way that certain ads are displayed frequently than others.

AdRotator control is available in ASP.Net to make the task of rotating the advertisement images in a web form quickly and easily.

AdRotator control are used to create a dynamic ads. The AdRotator Control presents ad images each time a user enters or refreshes a webpage. When the ads are clicked, it will navigate to a new Web location. The AdRotator control is used to display a sequence of ad images. The AdRotator control to work we need an Advertisement file (XML file) and some sample images.

Adding the AdRotator web server control to your web application. First, select the AdRotator and drag and drop the control to your web form. Map the XML file which contains the details about each and every ad.

This control uses an XML file to store the ad information. The XML file must begin and end with an <Advertisements> tag. Inside the <Advertisements> tag there may be several <Ad> tags which defines each ad.

The predefined elements inside the <Ad> tag are listed below:

Element	Description
<ImageUrl>	Optional. The path to the image file
<NavigateUrl>	Optional. The URL to link to if the user clicks the ad
<AlternateText>	Optional. An alternate text for the image
<Keyword>	Optional. A category for the ad
<Impressions>	Optional. The display rates in percent of the hits

### *Properties*

Property	Description
<u>AdvertisementFile</u>	Specifies the path to the XML file that contains ad information
AlternateTextField	Specifies a data field to be used instead of the Alt text for an ad
ImageUrlField	Specifies a data field to be used instead of the

	ImageUrl attribute for an ad
KeywordFilter	Specifies a filter to limit ads after categories
NavigateUrlField	Specifies a data field to be used instead of the NavigateUrl attribute for an ad
runat	Specifies that the control is a server control. Must be set to "server"
Target	Specifies where to open the URL
Height	The height of the ad in pixels. This value overrides the default height setting for the AdRotator control.
Width	The width of the ad in pixels. This value overrides the default width setting for the AdRotator control.

The advertisement file is an XML file. The following are some of the elements of this XML file.

XML code that has the details about the ads. The file Ads.xml looks like the code below:

```
<Advertisements>
  <Ad>
    <ImageUrl>adimages/2.jpg</ImageUrl>
    <NavigateUrl>http://cat2.com</NavigateUrl>
    <AlternateText>Cat 2</AlternateText>
    <Impressions>30</Impressions>
  </Ad>
</Advertisements>
```

```
</Ad>  
<Ad>  
  <ImageUrl>adimages/3.jpg</ImageUrl>  
  <NavigateUrl>http://cat3.com</NavigateUrl>  
  <AlternateText>Cat 3</AlternateText>  
  <Impressions>20</Impressions>  
</Ad>
```

Following are the important events of the AdRotator Class:

Events	Description
AdCreated	It is raised once per round trip to the server after creation of the control, but before the page is rendered
DataBinding	Occurs when the server control binds to a data source.
DataBound	Occurs after the server control binds to a data source.
Disposed	Occurs when a server control is released from memory, which is the last stage of the server control lifecycle when an ASP.NET page is requested
Init	Occurs when the server control is initialized, which is the first step in its lifecycle.
Load	Occurs when the server control is loaded into the Page object.



Unload	Occurs when the server control is unloaded from memory.
--------	---

### MultiView Control:

The MultiView control represents a control that acts as a container for groups of View controls.. It creates a set of views and one view is visible at a time. Use View control to create views inside the MutliView control. Add the View controls into a MultiView control.

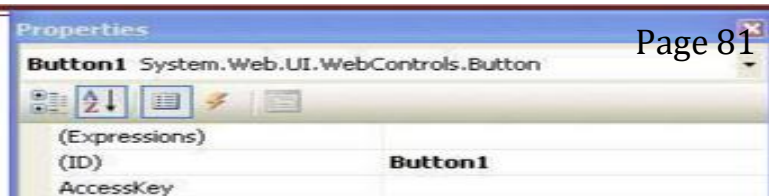
The main advantage of the multiview control is that we can specify the required view only (i.e display the required view only) on a single page.Multiview control helps us to create different views in the same page and display the view as the user clicks the links.

The MultiView control acts as a container for groups of View controls. Each View control in turn contains child controls such as buttons and text boxes.

The MultiView and Wizard controls both allow you to create multiple sections of controls on the same page. The Wizard control has features built in to facilitate its operation such as built-in Next and Prev buttons. With the Multiview control the responsibility to add and code the navigation falls to you.Figure: MultiView controls contain individual View controls

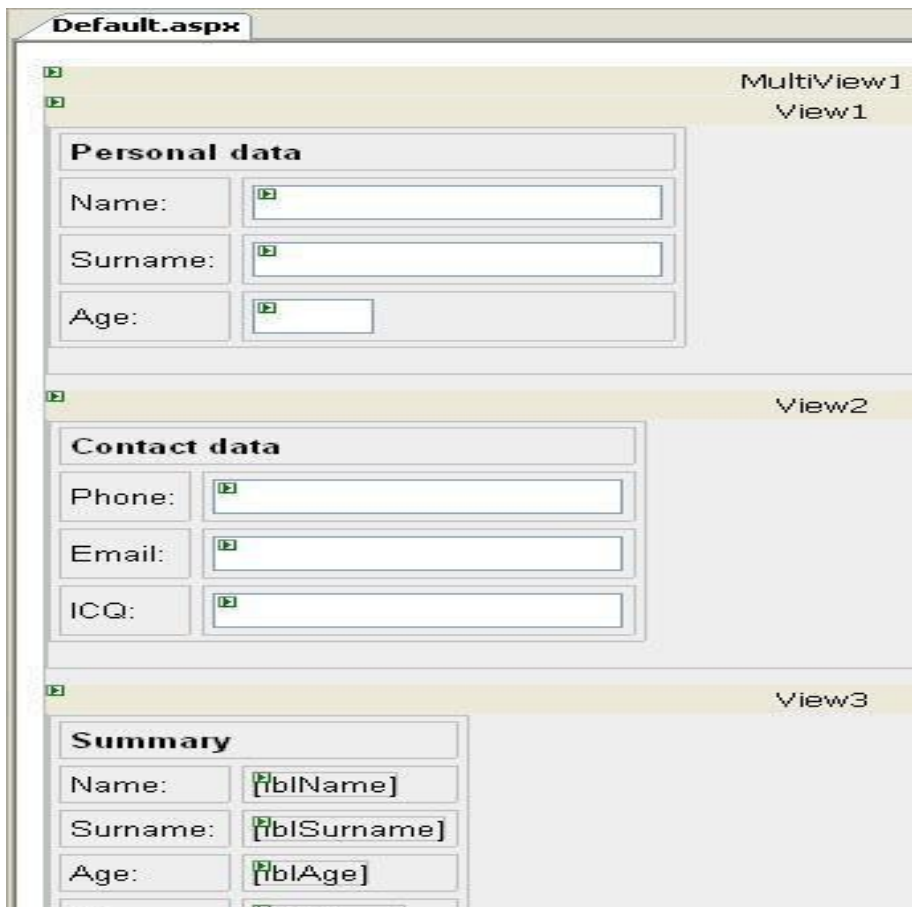
```
Me.MultiView1.ActiveViewIndex = 1
```

```
Me.MultiView1.SetActiveView( )
```



Me.MultiView1.Views(1))

Figure : The NextView CommandName property value advances to the next view.



Properties of the View and MultiView controls

Both the View and MultiView controls are derived from Control class and inherits all its properties, methods and events. The most important property of the View control is Visible property of type Boolean, which sets the visibility of a view.

The MultiView control has the following important properties:

Properties	Description
Views	Collection of View controls within the MultiView
ActiveViewIndex	A zero based index that denotes the active view; if no view is active then the index is -1.

The CommandName attribute of the Button controls associated with the navigation of the MultiView control are associated with some related field of the MultiView control.

For example, if a Button control with CommandName value as NextView is associated with the navigation of the multiview, it automatically navigates to the next view when the button is clicked.

The following table shows the default command names for the above properties:

Properties	Description
NextViewCommandName	NextView

PreviousViewCommandName	PrevView
SwitchViewByIDCommandName	SwitchViewByID
SwitchViewByIndexCommandName	SwitchViewByIndex

The following are the important methods of the MultiView control:

Methods	Description
SetActiveview	Sets the active view
GetActiveview	Retrieves the active view

Every time a view is changed, the page is posted back to the server and a number of events are raised. Some important events are:

Events	Description
ActiveViewChanged	Raised when a view is changed
Activate	Raised by the active view
Deactivate	Raised by the inactive view

Apart from the above mentioned properties, methods and events, multi view control inherits the members of the control and object class.

### Wizard Control

Wizard control eliminates the need to design forms to execute a step by step process in the actual business flow. This simplifies the work of developers to design and write the code. The ASP.NET Wizard control simplifies many of the tasks associated with building a series of forms to collect user data. The control provides a mechanism that allows you to easily build the desired wizard as a collection of steps

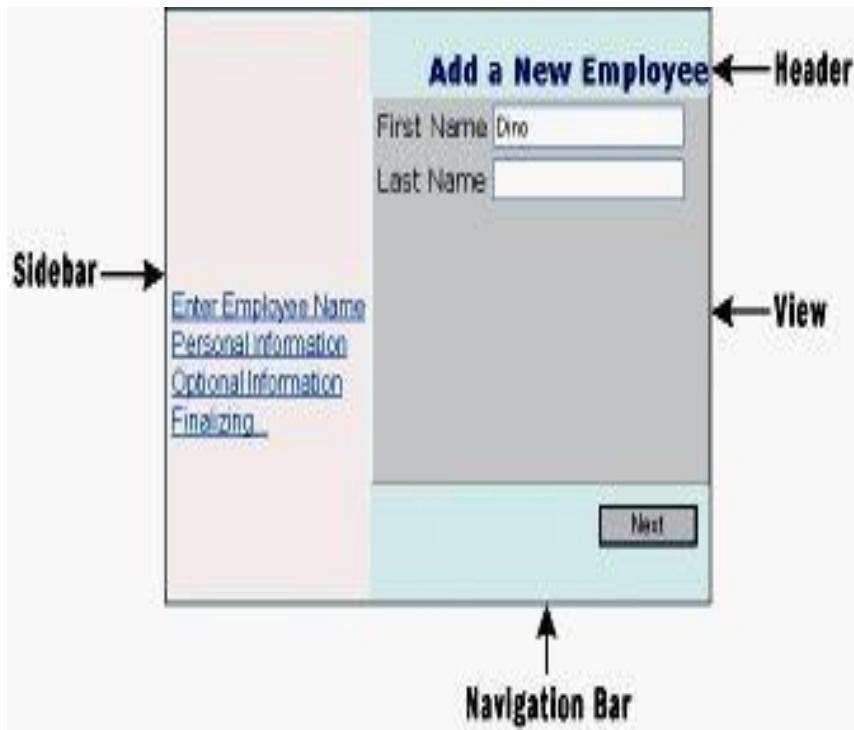
The control provides a mechanism that allows you to easily build the desired wizard as a collection of steps, add a new step, or reorder the steps. You don't have to write any infrastructure whatsoever for navigation or to persist user data between steps.

The Wizard control works much like the MultiView control in that they both contain sections to place controls in. While the sections in a MultiView control are views, the sections in a Wizard control are called steps. The Wizard control has features built in to facilitate its operation such as built-in Next and Prev buttons. With the Multiview control the responsibility to add and code the navigation falls to you.

These steps are stored in the WizardSteps collection. The primary difference between the two controls is that the Wizard control can display links to all of the steps in a sidebar on the left-hand side of the control.

You can add or remove steps from a wizard control by selecting the Add/Remove WizardSteps option from the smart tag Wizard Tasks menu.

Figure : Use the Wizard control to implement step-by-step processes.



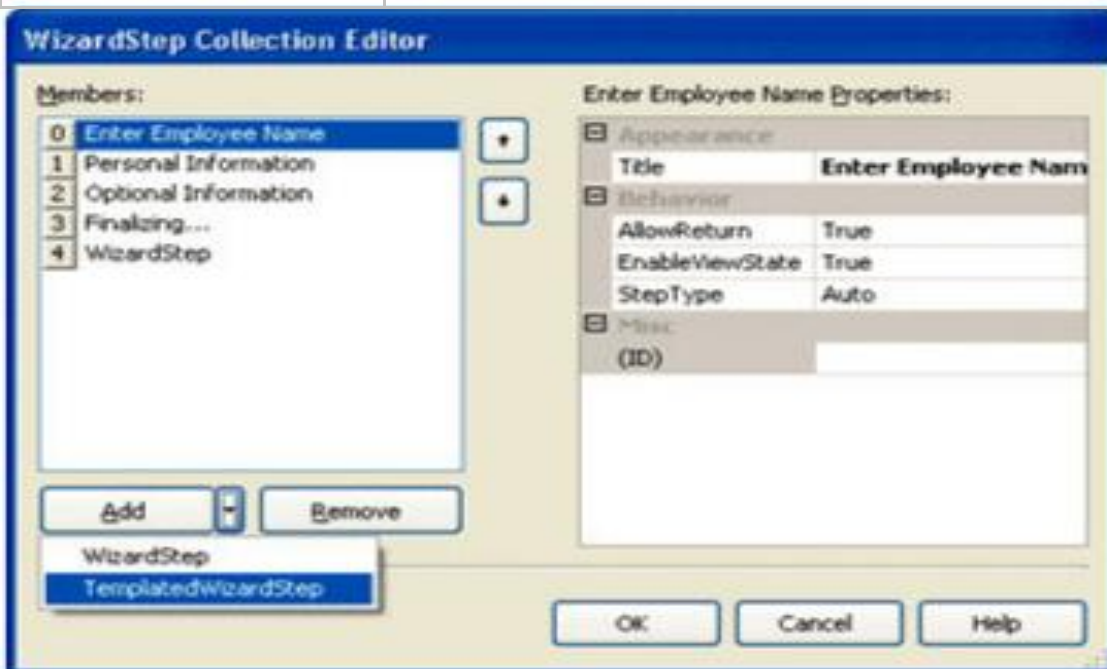
Wizard control properties:

Template	Description
FinishNavigationTemplate	Specifies the navigation bar shown before the last page of the wizard; by default, navigation bar contains the Previous and Finish buttons
HeaderTemplate	Specifies the title bar of the wizard
SideBarTemplate	Used to display content in the left side of the wizard control
StartNavigationTemplate	Specifies the navigation bar for the first view in the wizard; by default, contains only the Next button
StepNavigationTemplate	Specifies the navigation bar for steps other than first, finish, or complete; by default, contains Previous and Next buttons

CancelButtonStyle	Wizard Cancel button
FinishStepButtonStyle	Wizard Finish button
FinishStepPreviousButtonStyle	Wizard Previous button at the finish step
HeaderStyle	Wizard header
NavigationButtonStyle	Navigation buttons
NavigationStyle	Navigation area
NextStepButtonStyle	Wizard Next button
PreviousStepButtonStyle	Wizard Previous button

SideBarButtonStyle	Buttons on the sidebar
StartStepNextButtonStyle	Wizard Next button at the start step
StepStyle	Area where steps are displayed

Property	Description
ActiveStep	Returns the current wizard step object; the object is an instance of the WizardStep class
ActiveStepIndex	Gets and sets the zero-based index of current wizard step
DisplaySideBar	Toggles the visibility of the sidebar; the default value is True
FinishStepButtonText	Gets and sets the text for the Finish button
HeaderText	Gets and sets the title of the wizard
NextStepButtonText	Gets and sets the text for the Next button
PreviousStepButtonText	Gets and sets the text for the Previous button





The wizard ActiveStep property can be set by the ActiveStepIndex="0" of the wizard control. The first form will have the next navigation control.

Setting	Description
Auto	Default setting; forces the wizard to determine how each contained step should be treated.
Complete	The last page that the wizard displays, usually after the wizard has been completed. The navigation bar and the sidebar aren't displayed.
Finish	The last page used for collecting user data. It lacks the Next button, and it shows the Previous and Finish buttons.
Start	The first screen displayed, with no Previous button.
Step	All other intermediate pages, in which the Previous and Next

buttons are displayed.

### Wizard Events -

- `ActiveStepChanged` - This event fires when the control go to a new step.
- `CancelButtonClick` - The cancel button is not shown by default, you can add to every step by `Wizard.DisplayCancelButton` property. This event fires when Cancel button clicked.
- `FinishButtonClick` - This event fires when `FinishButton` clicked.
- `NextButtonClick` - This event fires when Next button clicked on any step.
- `PreviousButtonClick` - This event fires when Previous button clicked on any step.
- `SideBarButtonClick` - This event fires when a button in the sidebar area clicked.

### ImageMap control

The ASP.NET ImageMap control allows you to create an image that has individual regions that users can click, which are called hot spots. Each of these hot spots can be a separate hyperlink or postback event.

### ImageMap Elements:

- The ImageMap control consists primarily of two pieces. The first is an image, which can be a graphic in any standard web graphic format, such as a .gif, .jpg, or .png file.
- The second element is a collection of hotspot controls. Each hotspot control is a different element. For each hotspot control, you define its shape — a circle, rectangle, or polygon — and the coordinates that specify the location and size of the hot spot.

### *Different types of hot spots*

There are three different types of hot spots offered by ImageMap control.

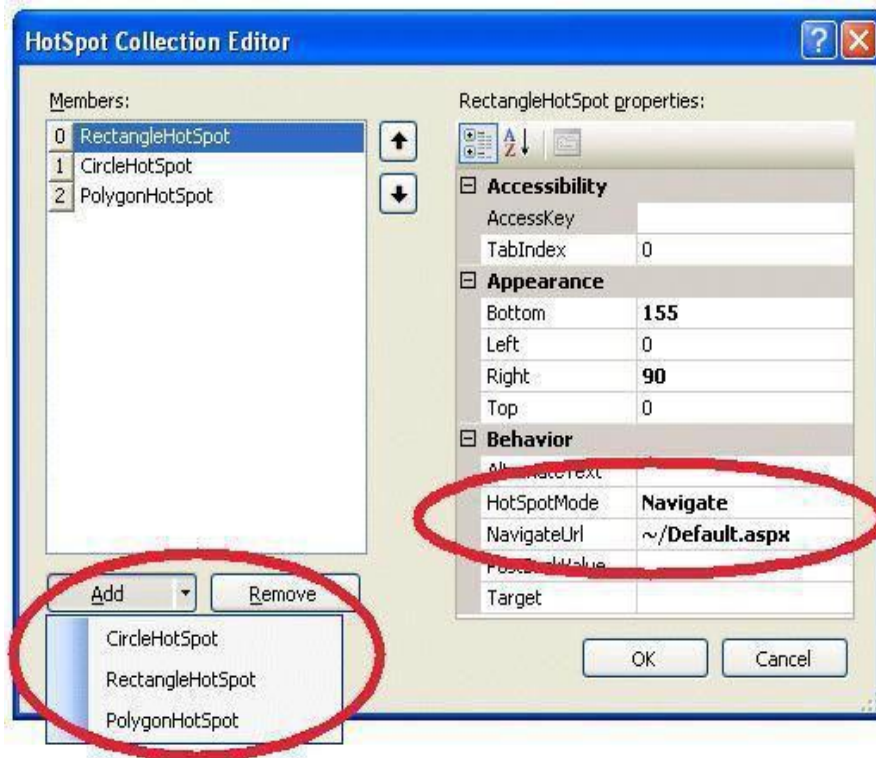
They are:

- CircleHotspot
- RectangleHotspot
- PolygonHotspot

**CircleHotspot:** CircleHotspot defines circle shaped hot spot region in an ImageMap control. To define the region for a circle hot spot, we should define X and Y coordinates for circle as well as radius property which usually is the distance from the center of circle to the edge.

**RectangleHotspot:** RectangleHotspot defines rectangle shaped hot spot region in an ImageMap control. To define the region for a Rectangle hot

spot, we define Top, Bottom, Left and Right coordinates. Similar is the case for the Polygon hot spot.



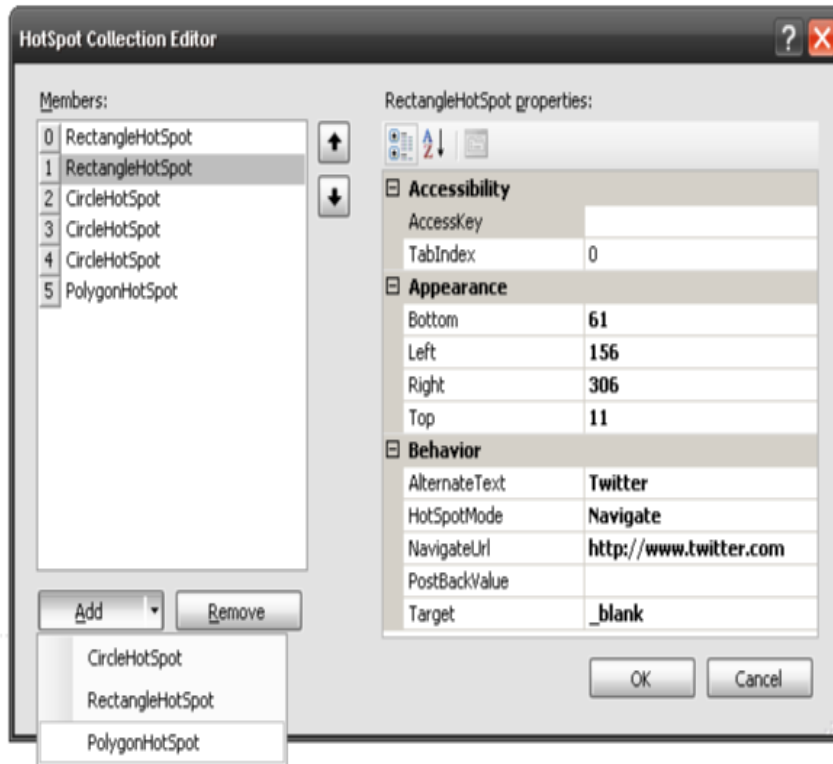
### *Hot spots features*

- There is no limit on number of hotspots each image may contain.
- Each hotspot is characterized by various attributes like shape, location and size.

- Overlapping hotspots are perfectly valid.
- Hot spots are defined using x and y coordinates.
- Hot spots can be assigned Image URL's and are capable of postback.

All these hotspots types have some properties to customize the hotspot region and behavior. We can specify Left, Top, Right and Bottom for Rectangle hotspot and X, Y and Radius properties for Circle hotspot.

Each hot spots can be configured as a hyperlink that goes to a URL that you provide for that hot spot. Alternatively, we can configure the control to perform a postback when a user clicks a hot spot, providing a unique value for each hot spot. The postback raises the ImageMap control's Click event. In the event handler, you can read the unique value that you assign to each hot spot.



Master pages:

ASP.NET master pages allow you to create a consistent layout for the pages in your application. A single master page defines the look and feel and standard behavior that you want for all of the pages (or a group of pages) in your application. You can then create individual content pages that contain the content you want to display. When users request the content pages, they merge with the master page to produce output that combines the layout of the master page with the content from the content page.

### Replaceable Content Placeholders

In addition to static text and controls that will appear on all pages, the master page also includes one or more `ContentPlaceHolder` controls. These placeholder controls define regions where replaceable content will appear. In turn, the replaceable content is defined in content pages.

### Content Pages

You define the content for the master page's placeholder controls by creating individual content pages, which are ASP.NET pages (.aspx files and, optionally, code-behind files) that are bound to a specific master page. The binding is established in the content page's `@ Page` directive by including a `MasterPageFile` attribute that points to the master page to be used.

From the user's perspective, the combined master and content pages are a single, discrete page. The URL of the page is that of the content page.

From a programming perspective, the two pages act as separate containers for their respective controls. The content page acts as a container for the master page. However, you can reference public master-page members from code in the content page.

Note that the master page becomes a part of the content page. In effect, the master page acts in much the same way a user control acts — as a child of the content page and as a container within that page. In this case, however, the master page is the container for all of the server controls that are rendered to the browser.

### Advantages of Master pages

Master pages provide functionality that developers have traditionally created by copying existing code, text, and control elements repeatedly; using framesets; using include files for common elements; using ASP.NET user controls; and so on.

Advantages of master pages include the following:

- They allow you to centralize the common functionality of your pages so that you can make updates in just one place.
- They make it easy to create one set of controls and code and apply the results to a set of pages. For example, you can use controls on the master page to create a menu that applies to all pages.
- They give you fine-grained control over the layout of the final page by allowing you to control how the placeholder controls are rendered.
- They provide an object model that allows you to customize the master page from individual content pages.
- Master pages allow you to create a consistent look and behavior for all the pages (or group of pages) in your web application.
- A master page provides a template for other pages, with shared layout and functionality. The master page defines placeholders for the content, which can be overridden by content pages. The output result is a combination of the master page and the content page.
- The content page contains the content you want to display.



- When users request the content page, ASP.NET merges the pages to produce output that combines the layout of the master page with the content of the content page.

### *Master Page Example*

```
<%@ Master %>
<html>
<body>
<h1>Standard Header For All Pages</h1>
<asp:ContentPlaceHolder id="CPH1" runat="server">
</asp:ContentPlaceHolder>
</body>
</html>
```

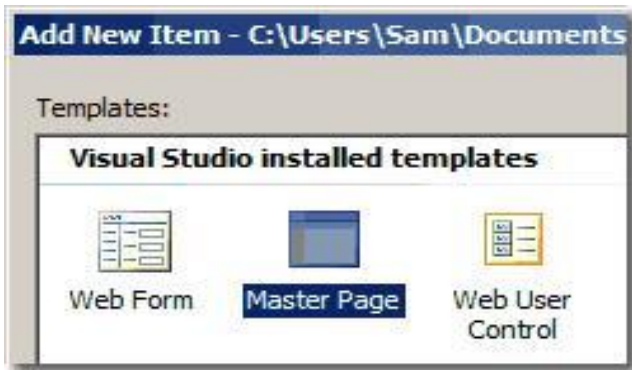
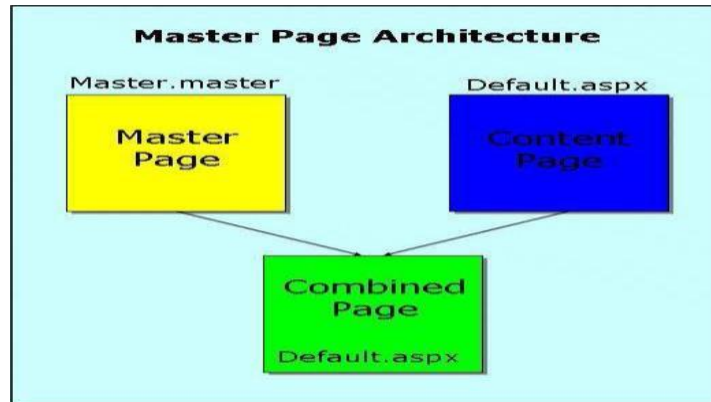


Figure: Master pages combine with content pages to form the rendered page.



A complete master page contains HTML, optional ASP.NET web controls, optional user controls, and one or more required ContentPlaceHolder controls. A ContentPlaceHolder control is a special ASP.NET web container control (`<asp:contentplaceholder>`) responsible for containing the controls placed on a content web page. You will find the ContentPlaceHolder control in the Standard section of the Toolbox. You can place one or more ContentPlaceHolder controls on a master page. All content on a content form is restricted to one of the ContentPlaceHolder controls defined on the content page's master page. The master page content on a content page is grayed out and not editable from within the content page. The only live areas available in the designer are the ContentPlaceHolder controls defined in the master page.

To create a master page you simply create a new page of type master page (see Figure).

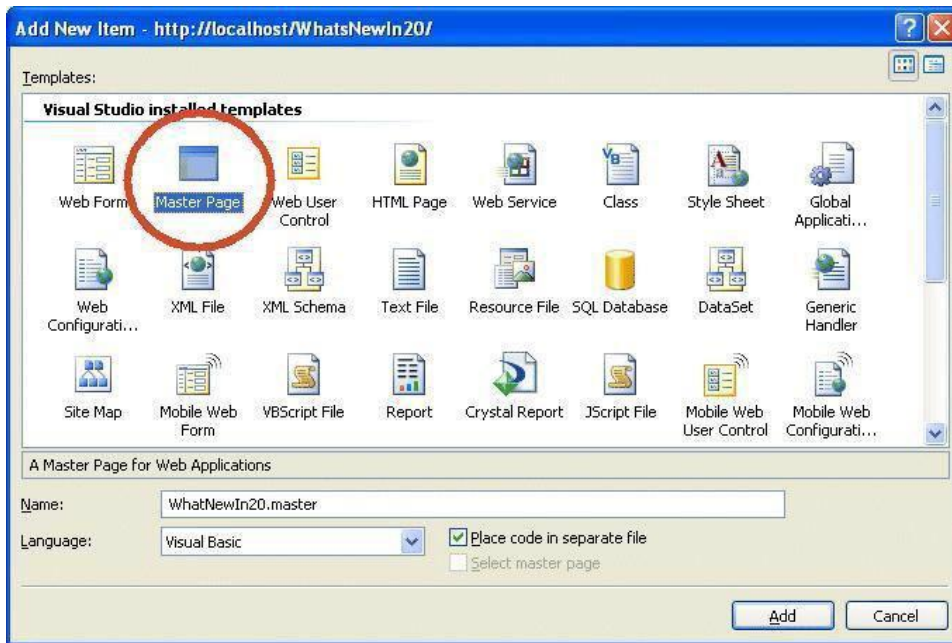


Figure: A master page is comprised of HTML, web controls, and one or more ContentPlaceHolders

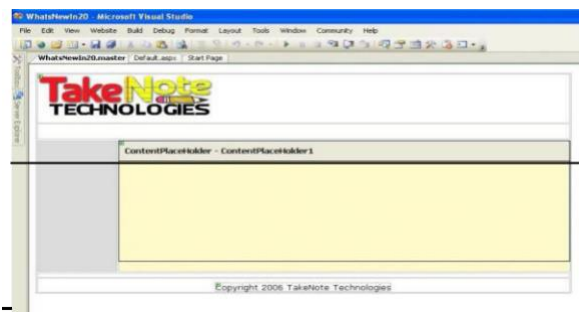
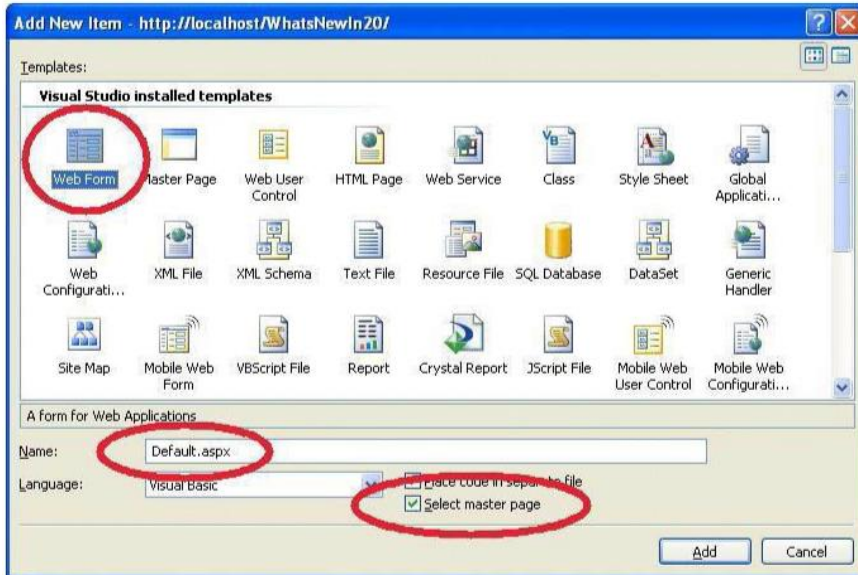


Figure: Check the "Select master page" checkbox to create a content page.



## Site Navigation

You can easily build navigation into your pages by using the following ASP.NET site-navigation controls:

There are three Site Navigation control in asp.net

- SiteMapPath Control
- Menu Control
- Treeview Control

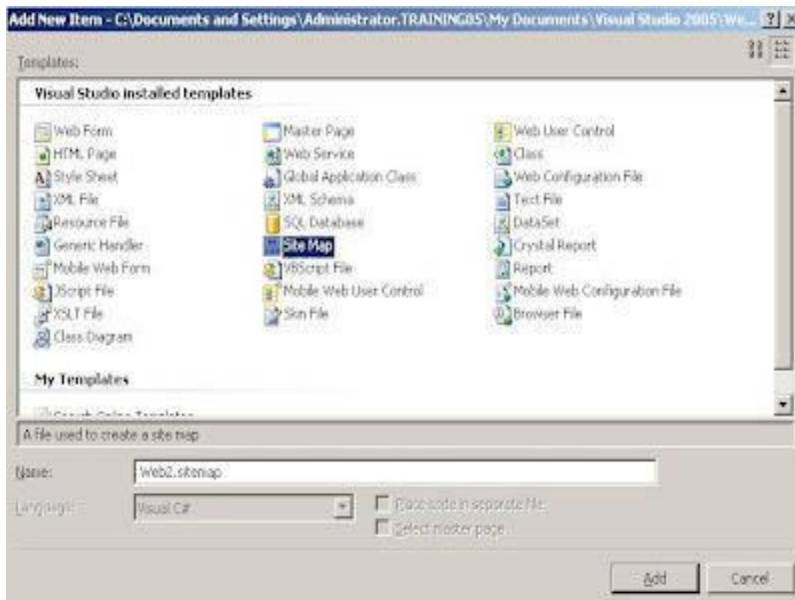
Before using Site Navigation control let go through overview of sitemap, which is used as datasource to assign this control.

## SiteMap

SiteMap file is an XML File, which contains details of navigation that is followed by navigation control.

For Creating Web.SiteMap file

- Right click the project in solution explorer and add new item.
- Select Site Map from the add new item dialog.
- It will create "web.sitemap" file in your root directory



A Sample format of Site Map

```
<siteMapNode url="" title="" description="">
<siteMapNode url="" title="" description="" />
<siteMapNode url="" title="" description="" />
</siteMapNode>
```

Here, siteMapNode contains following properties.  
Url - describes URL to be redirected on node click.  
Title - describes Text to be displayed on node.

Description - describes Text to be displayed as Tooltip.

### SiteMapPath

This control displays a navigation path — which is also known as a breadcrumb or eyebrow — that shows the user the current page location and displays links as a path back to the home page.



The control provides many options for customizing the appearance of the links.

The SiteMapPath control creates navigation mechanism which is generally referred to as *breadcrumb navigation*. This is a linear path defining where the user is currently located in navigation structure. It usually helps end user to know his location in relation to the rest of the site

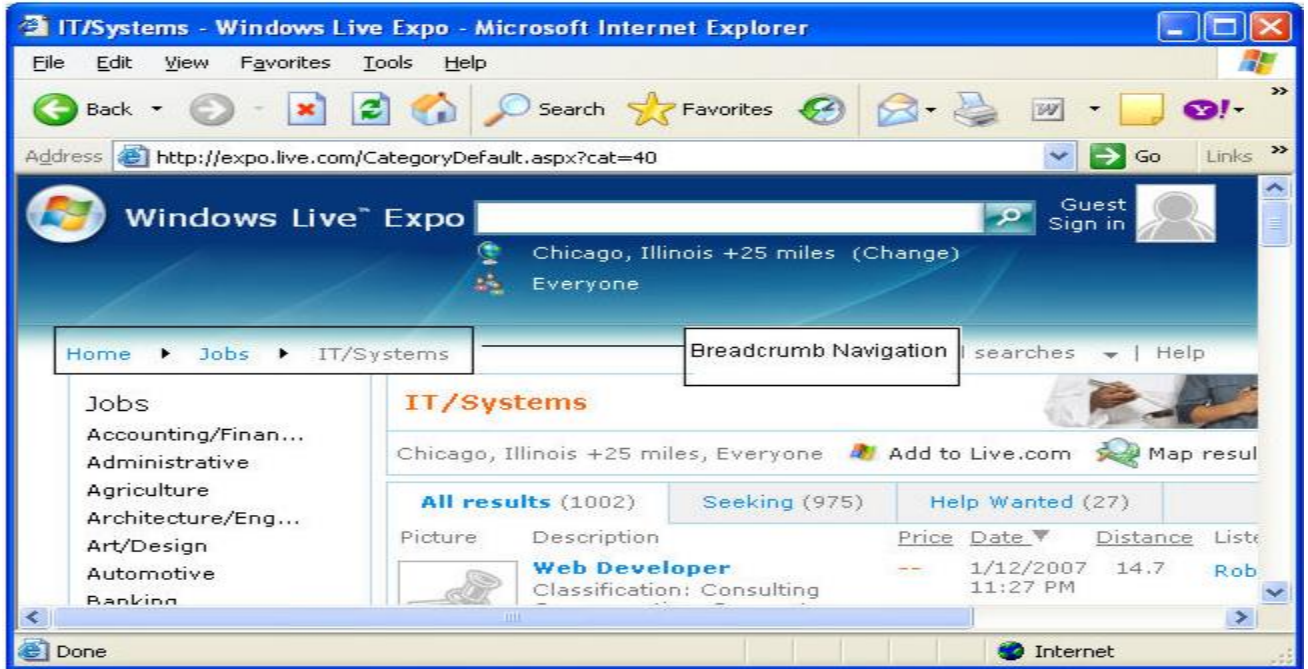


Fig. Breadcrumb navigation in msn website. Surrounded by Black box

The SiteMapPath control creates *breadcrumb navigation* with very little effort on your part.

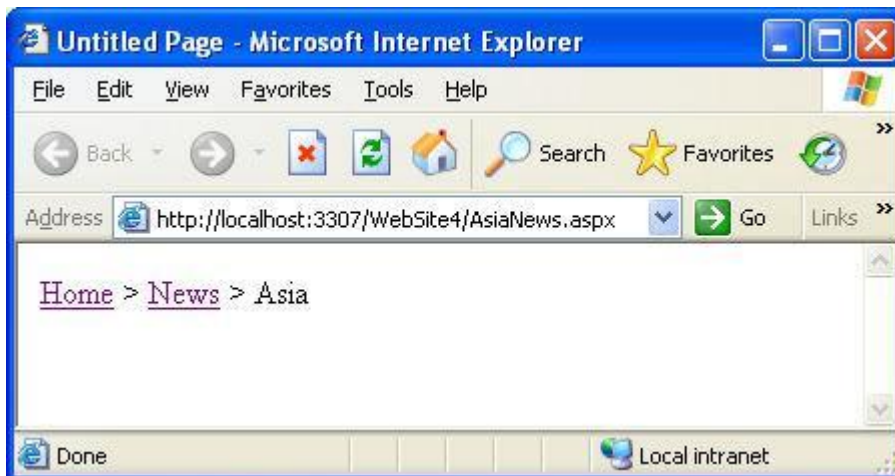
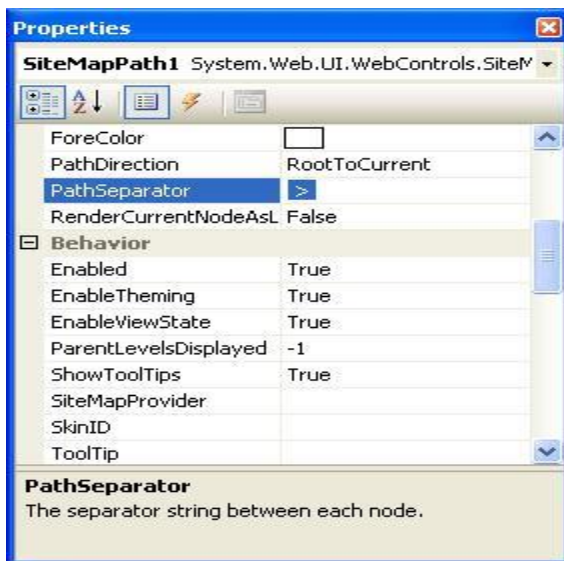


Fig. Output Listing of AsiaNews page displaying breadcrumb navigation

Properties of SiteMapPath Control:

PathSeparator Property:

PathSeparator property defines the element to separate the link elements. By default, (>) greater than symbol is used to separate link elements as shown in above listing



PathDirection Property:

This property changes the direction of the links generated in the output. Possible settings for this property are RootToCurrent and CurrentToRoot. In the above example, I have used default RootToCurrent setting. If we change



the setting to CurrentToRoot you will the output as shown below. I think you got the difference.



Output listing with PathDirection set to CurrentToRoot

Public Properties of SiteMapPath class

**ParentLevelsDisplayed** : It specifies the number of levels of parent nodes and then displays the control accordingly related to the currently displayed node.

**RenderCurrentNodeAsLink** : It specifies whether or not the site navigation node that represents the currently displayed page is rendered as a hyperlink.

**PathSeperator** : It specifies the string that displays the SiteMapPath nodes in the rendered navigation path.

Style properties of the SiteMapPath class

**CurrentNodeStyle** : It specifies the style used for the display text for the current node.

**RootNodeStyle** : It specifies the style for the root node style text.

**NodeStyle** : It specifies the style used for the display text for all nodes in the site navigation path.

- a. **NodeStyle** property: Applies styles to all links in the sitemap uniformly
- b. **RootNodeStyle** property : Applies styles to the root link in the SiteMapPath navigation
- c. **CurrentNodeStyle** property: Gets the style used for the display text for the current node.

**Menu Control:**

Another important navigation control in ASP.NET 3.5 which allows the end user to navigate through a large collection of options(links) with very less effort. This is used to display menu in a web page and used in combination with SiteMapDataSource control for navigating a web site. You can customize the appearance of menu control through styles, user-defined templates and themes.

The Menu control is used to display menus. The menu can be displayed vertically or horizontally. Below are two screenshots showing vertical and horizontal menus:

Horizontal Menu:



Vertical Menu:



For making a menu change its orientation you just need to change the Orientation property of the Menu control to Horizontal or Vertical.

Eg.,

```
Menu.Orientation = Orientation.Vertical;
```

Setting the property to Orientation.Horizontal changes the orientation back to horizontal.

You can set individual properties of the Menu control to specify the size, color, font, and other characteristics of its appearance. In addition, you can apply skins and themes to the Menu control.

Menu control displays two types of menus: a Static menu and Dynamic menu. The static menu is always displayed in menu control. By default, only menu items at the root levels are displayed. You can also display additional menu levels by setting `StaticDisplayLevels` property.

Menu items with a higher level than the value specified by `StaticDisplayLevels` property are displayed in dynamic menu. A Dynamic menu appears only when the user positions the mouse pointer over the parent menu item that contains a Dynamic submenu.

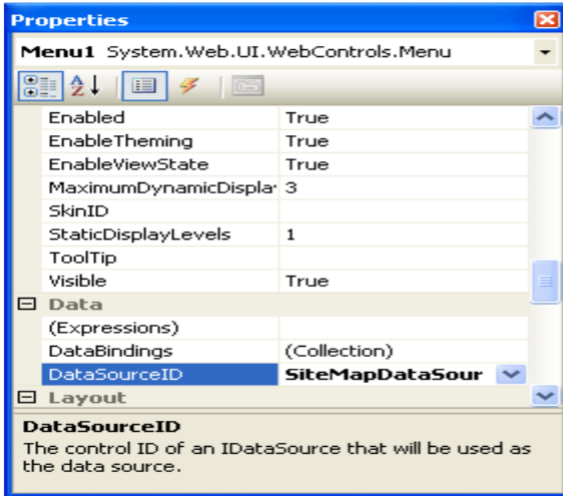
Menu control exposes events such as `MenuItemClick`, `Load`, `UnLoad`, `Prerender`, `DataBound` and certain other events. `MenuItemClick` event enables you to take some action when end user clicks one of the available menu items.

When the user clicks a menu item, the Menu control can either navigate to a linked Web page or simply post back to the server. If the `NavigateUrl` of a menu item is set, the Menu control navigates to the linked page; otherwise, it posts the page back to the server for processing. By default, a linked page is displayed in the same window as menu control.

### Features

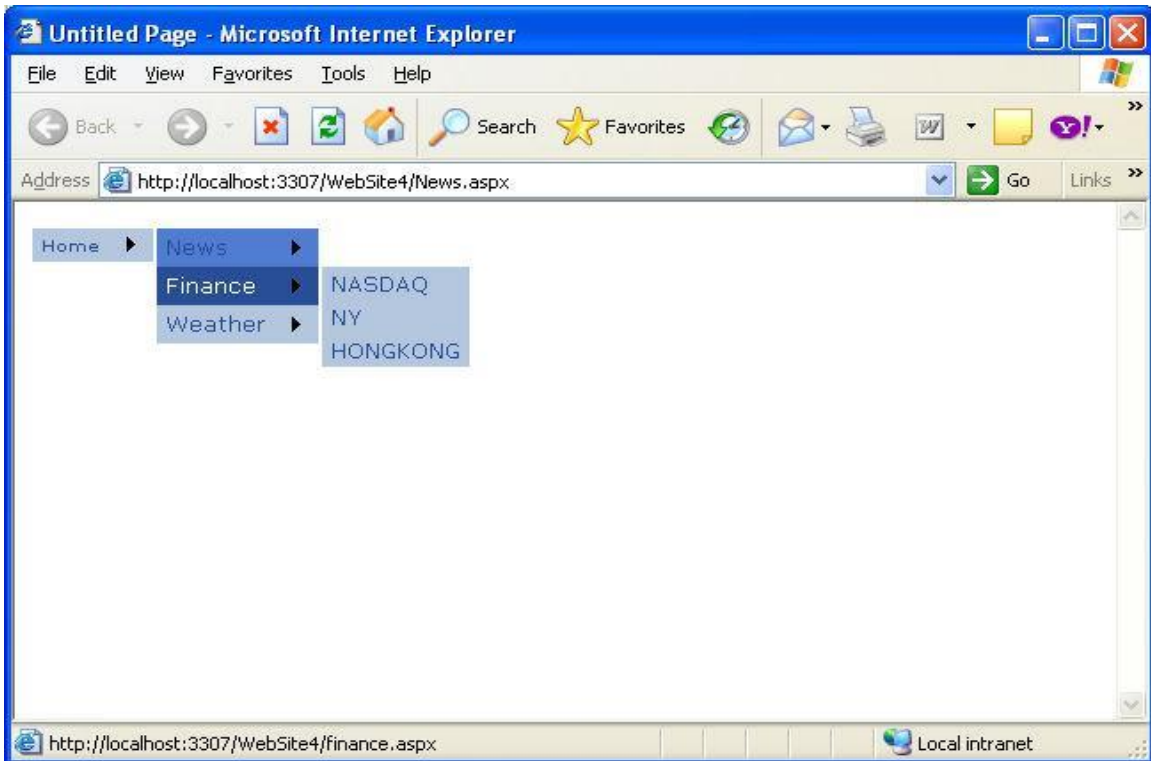
- Multiple menus on a single page are allowed.
- Generated code is dramatically small.
- Support for scrollable menus.
- Support for tooltips.
- Support for client-side and server-side events.
- Colors, sizes, borders and fonts can all be customized to visually integrate with any project.
- Support for icons, background images, separators, user-defined images for submenu arrows.
- Each menu item, submenu, separator can be customized separately.
- Each submenu can be positioned separately.

Drag and drop the menu server control from Navigation Section of Toolbox and similarly drag and drop the SiteMapDataSource control from Data Section of Toolbox and connect the two by using Menu control's DataSourceId property. From this example, you can see that I'm using a SiteMapDataSource control that automatically works with the application's web.sitemap file. DataSourceID property will connect the menu control with SiteMapDataSource control



Menu Control Properties dialog box

Fig.Output listing for Menu Control using SiteMapDataSource control using sitemap xml



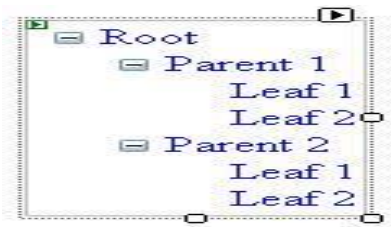
### TreeView Control

TreeView control display data in hierarchical order.

The TreeView control consists of nodes and there are three types of nodes that you can add to a TreeView control.

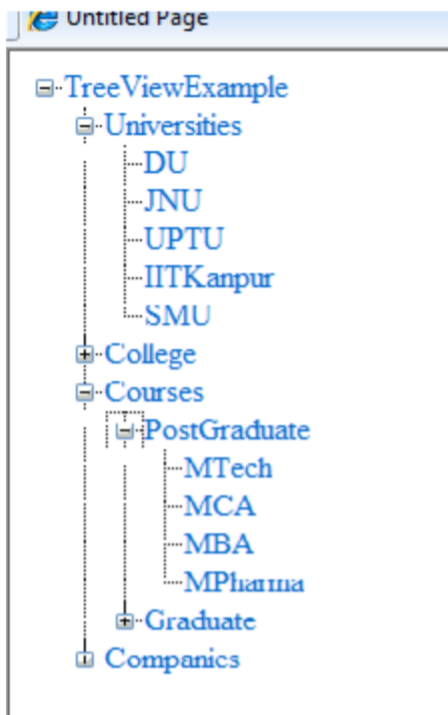
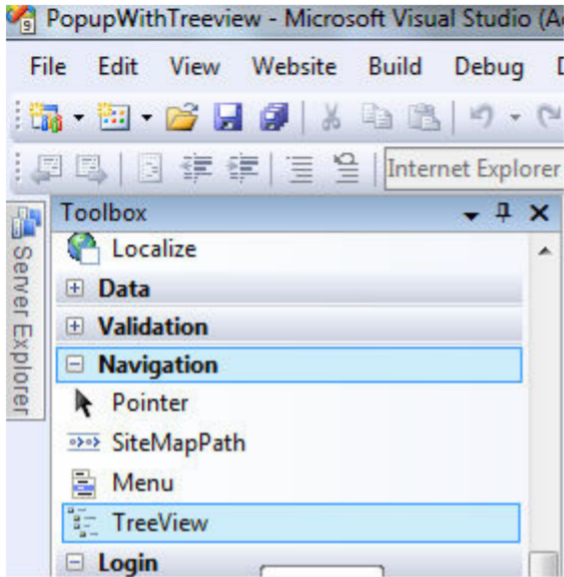
- Root - A root node is a node that has no parent node. It has one or more child nodes.
- Parent - A node that has a parent node and one or more child nodes
- Leaf - A node that has no child nodes

Figure 1: TreeView control structure

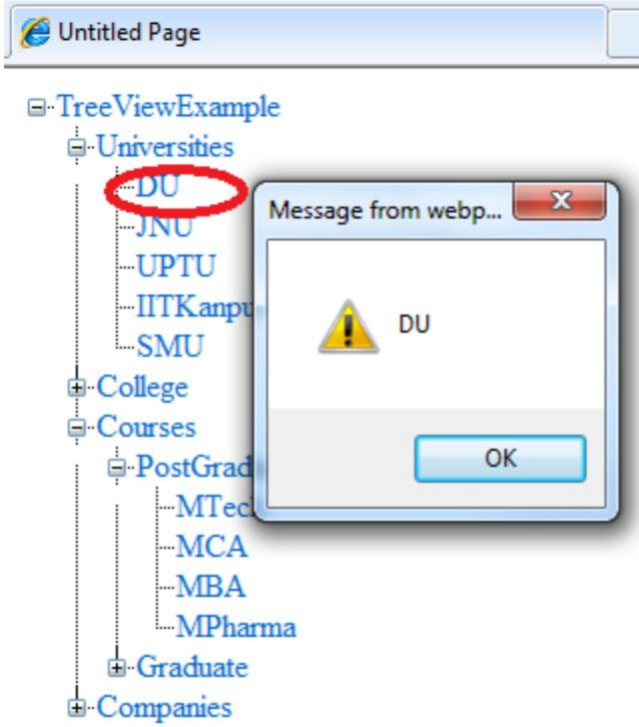


Follow these steps:

Step 1: Open Visual Studio 2008 and drag a TreeView control from the toolbar and drop on page as follows:



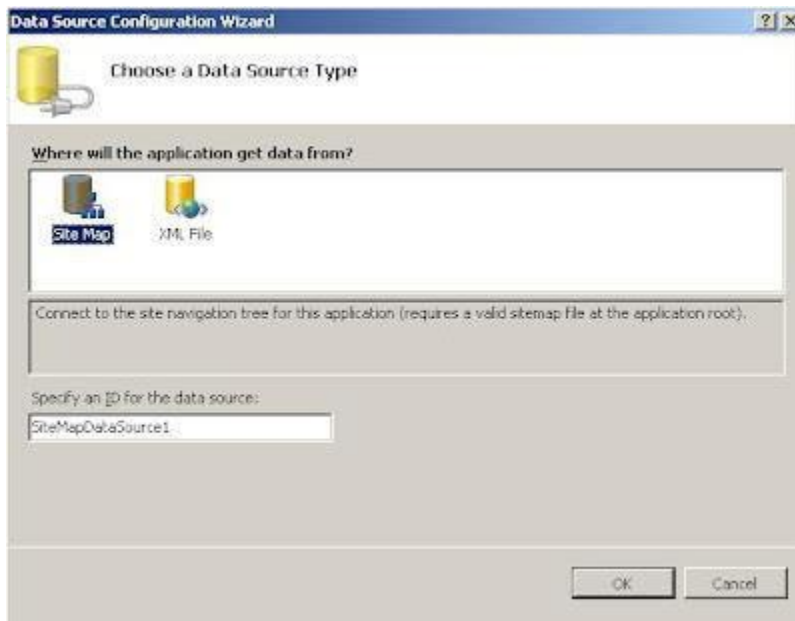




Select "New data source" and select sitemap and press ok.

ASP.NET provides the following hierarchical data source controls.

- **XmlDataSource** - This control allows you to bind to XML data, which can come from a variety of sources such as an external XML file, a DataSet object and so on. Once the XML data is bound to the XmlDataSource control, this control can then act as a source of data for other data-bound controls such as TreeView and Menu. For example, you can use the `<asp:XmlDataSource>` control to represent a hierarchical XML data source.
- **SiteMapDataSource** - This control basically retrieves the site map information from the web.sitemap file.



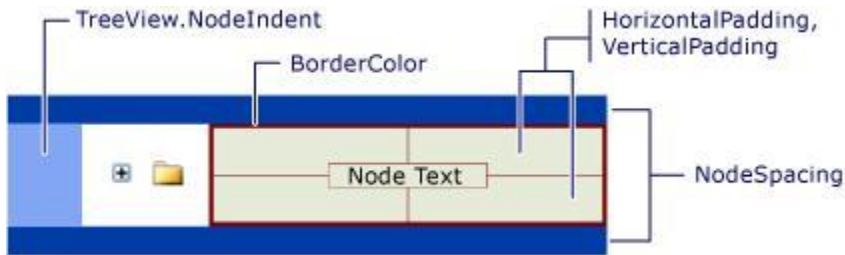


Displaying checkbox with treeview control, you can assign "ShowCheckBox" property of TreeView control to either

- All - Checkbox to all node.
- Root - Checkbox to root node.
- Parent - Checkbox to parent node.
- Leaf - Checkbox to leaf node.
- None - No Checkbox.



TreeNodeStyle Properties



Node Property

**Description**

NodeSpacing

Specifies the amount of vertical spacing between the entire current node and adjacent nodes above and below.

<u>VerticalPadding</u>	Specifies the amount of space rendered on the top and bottom of the <u>TreeNode</u> text.
<u>HorizontalPadding</u>	Specifies the amount space rendered on the left and right of the <u>TreeNode</u> text.
<u>ChildNodesPadding</u>	Specifies the amount of space above and below the child nodes of the <u>TreeNode</u> .
<u>ImageUrl</u>	Specifies the path to the image that displays next to the <u>TreeNode</u> .

### Web Parts

A Web Part, also called a Web Widget, is an ASP.NET server control which is Web Part Pages by users at run time. It can be put into certain places in a web page by end users, after developing by programmer. End users can customize Web Parts pages by changing the page layout, adding and removing Web Parts, editing Web Parts properties, establishing connections between Web Parts, and more.

ASP.NET Web Parts is an integrated set of controls for creating sites that enable end users to modify the content, appearance, and behavior of web pages directly from a browser. The modifications can be applied to all users on the site or to individual users. When users modify pages and controls, the settings can be saved to retain a user's personal preferences across future browser sessions, a feature called personalization. These Web Parts capabilities mean that developers can empower end users to

personalize a web application dynamically, without developer or administrator intervention.

### *Advantages of Web Parts*

- Web Parts allows for personalization of page content. They allow users to move or hide the Web Parts and add new Web Parts changing the page layout.
- Web Parts allows user to export or import Web Parts settings for use in other pages. Web Parts retain the properties, appearance and the data across the pages when imported or exported.
- Web Parts can be assigned role-based access. So you can determine which Web Parts can share by all or which should be hidden for certain roles. This helps us to provide customized content based on security.
- Web Parts can talk to each other. You can utilize the data in one Web Part in another Web Part for different purposes.

### *Web Parts Modes*

The modular and customizable sites that you can build with the new Portal Framework enable you to put the web page that is in view into several modes for the end user. Modes are very powerful in that they enable user to edit Web Parts, delete the Web Parts or customize Web Parts.

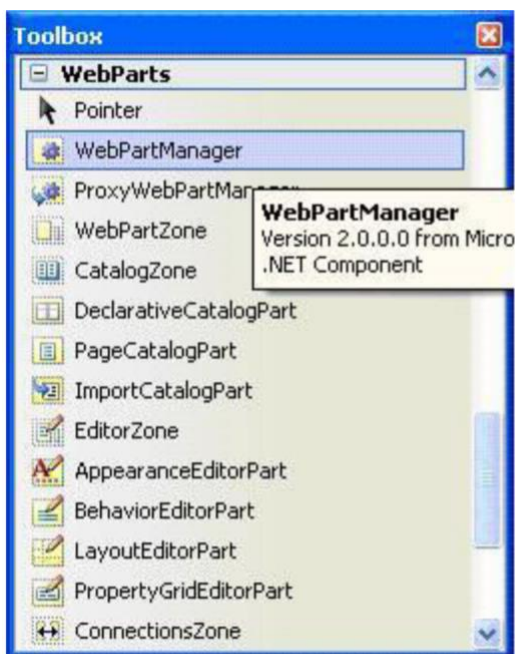
- a) Normal mode: End user cannot edit or move sections of page.
- b) Edit Mode: End user can edit Web Parts on the page including Web Parts title, color or even setting custom properties.

- c) Design Mode: End user can rearrange the order of the pages Web Parts in a WebPartZone.
- d) Catalog Mode: End user enjoys the choice to add new Web Parts or add deleted Web Parts in any WebPartZone on the page.

### Building Web Parts

There are two basic ways to create a Web Part. You can treat any standard Microsoft ASP.NET control as a Web Part or you can build a custom control that derives from the base WebPart class.

You are not required to modify a control in any way to use it as a Web Part. Standard ASP.NET controls (such as the Calendar and GridView controls), Web User Controls, and even custom controls can all be used as Web Parts



### WebPartManager

WebPartManager is the most important of all the Web Part controls, responsible for managing and coordinating all controls inside WebPartZones. The Web Parts framework doesn't work without it, so every page that uses Web Parts must have an instance of WebPartManager declared, and it must be declared before other Web Parts controls. WebPartManager has no UI, so it's not visible on the page. It also exposes a very rich API for adding Web Parts to the page, closing Web Parts, connecting Web Parts, and more.

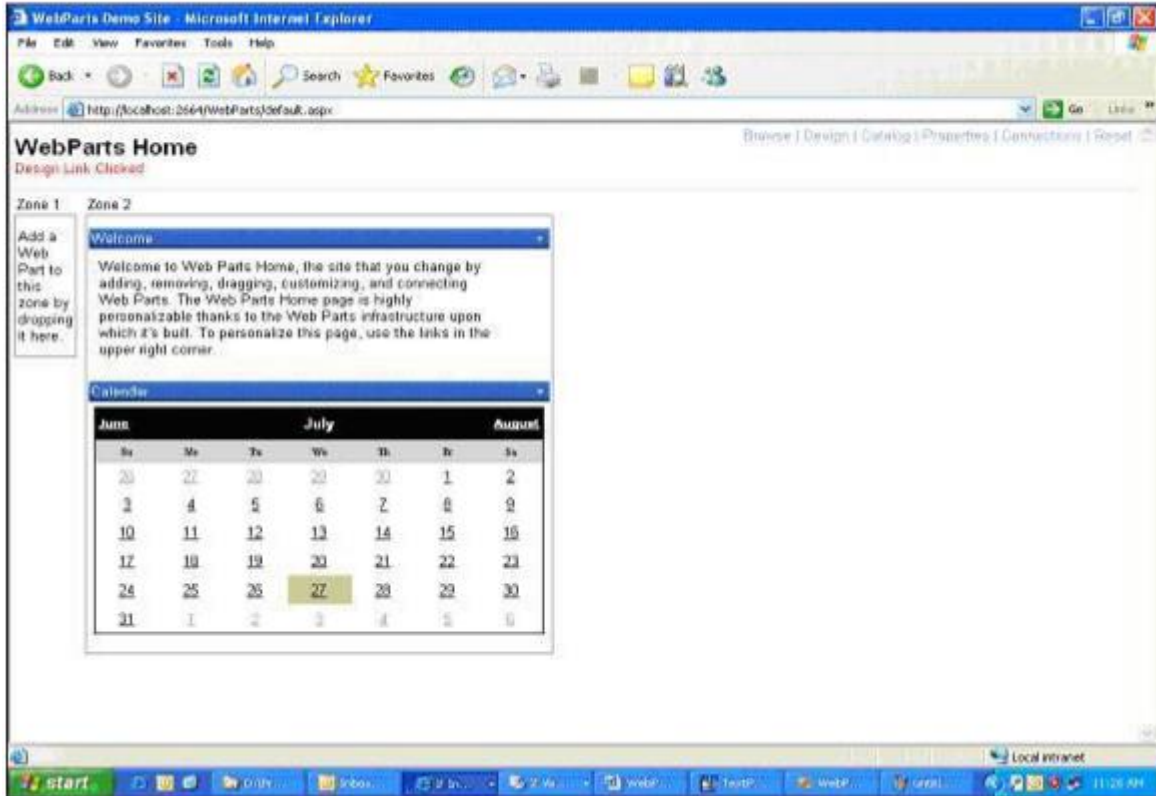
### WebPartZone

WebPartZone is arguably the second most important Web Part control. It's used to define zones, which serve as containers for Web Parts. There is no practical limit to the number of WebPartZones a page can contain, and no limit to the number of Web Parts that a zone can contain. A WebPartZone control can host controls that do not derive from the WebPart class, by wrapping them with a GenericWebPart control at run time.

WebParts 'Welcome' and 'Calendar' are in WebPartZone 1 and WebPartZone 2 respectively in figure below:







User can drag and drop web parts from one WebPartZone to another

WebPartZone in Design mode.

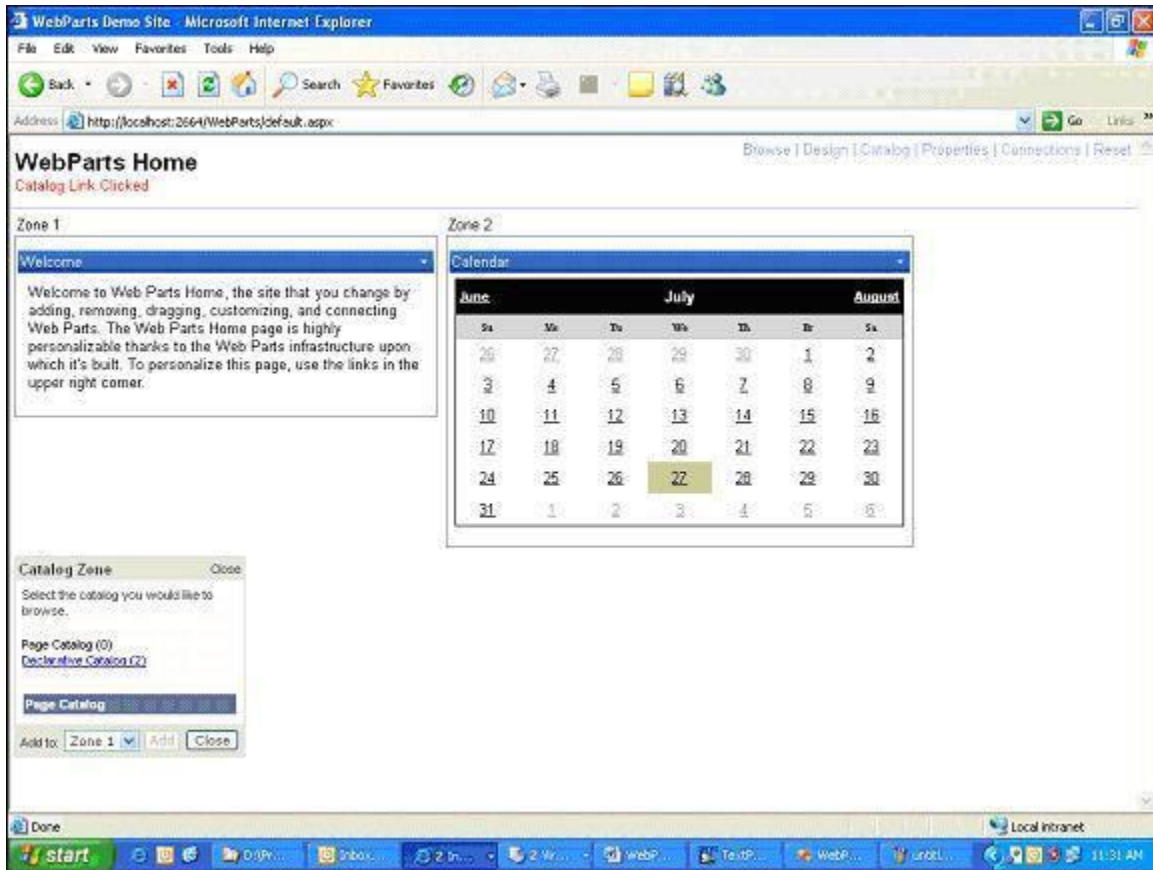
Catalog Zone

One of the chief benefits to building pages from Web Parts is that the content of these pages can be interactively configured by the user. It's a simple matter, for example, to enable users to restore closed Web Parts to the page by including a CatalogZone in the page.

The purpose of the CatalogZone control is to allow end users to customize Web Parts pages by adding Web Parts to them. Web Parts can come from three sources: Web Parts that were previously present in the page but were

closed, Web Parts that don't appear on the page by default but that can be added, and Web Parts imported from .WebPart files.

A CatalogZone control becomes visible only when a user switches a Web page to catalog display mode (CatalogDisplayMode) as shown below:



**CatalogPart:**

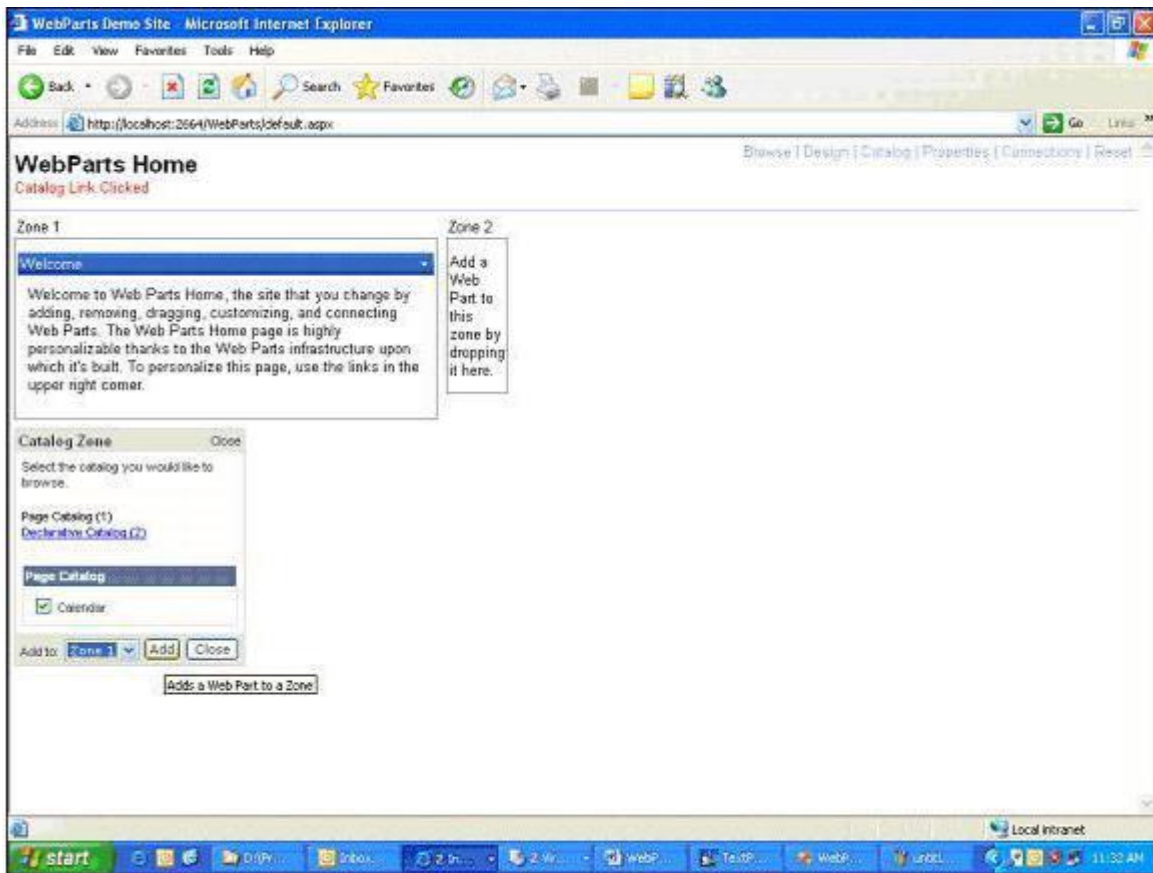
CatalogPart controls provide the UIs for adding Web Parts to the page. A CatalogZone can contain any combination of CatalogParts.

A CatalogZone can contain several types of CatalogPart controls. The following list summarizes the CatalogPart controls provided with the Web Parts control set:

- PageCatalogPart
- DeclarativeCatalogPart
- ImportCatalogPart

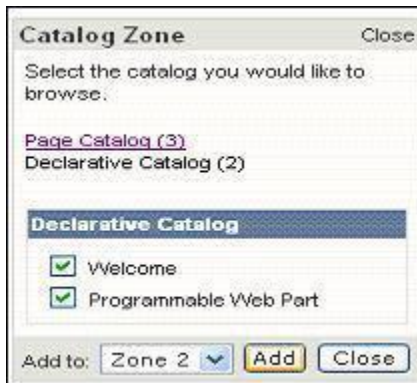
### PageCatalogPart

The PageCatalogPart class serves one very specific purpose on a Web Parts page: it acts as a page catalog to contain any controls previously added to the page that a user has closed, and that the user can add back to the page. Add a PageCatalogPart control to your page if you want to provide users with the flexibility of closing and reopening controls. If your page does not allow users to close controls at all, there is no need to add a PageCatalogPart control to your page.



### DeclarativeCatalogPart

The DeclarativeCatalogPart control provides a way for developers to add a set of server controls declaratively to a catalog on a Web page. A catalog, in the Web Parts control set, is simply a list of WebPart or other server controls that is visible when a page is in catalog display mode. A user can select controls from the list and add them to the Web page, which effectively gives users the ability to change the set of controls and the functionality on a page, as shown below:



### ImportCatalogPart

The ImportCatalogPart control enables users to import a description file that describes settings on a WebPart control or server control that a user wants to add to a Web page. After the user has imported the description file, the WebPart control referenced in the file appears within the ImportCatalogPart control when the page is in catalog mode, and a user can then add the control to the page. User can view the ImportCatalogPart in Catalog Display mode, as shown below. User can browse the web part file and then upload by clicking Upload button.



Editor

Zone

The purpose of the EditorZone control is to allow end users to customize Web Parts pages by editing the properties of the page's Web Parts. Editing UIs are provided by EditorPart controls, which divide Web Part properties

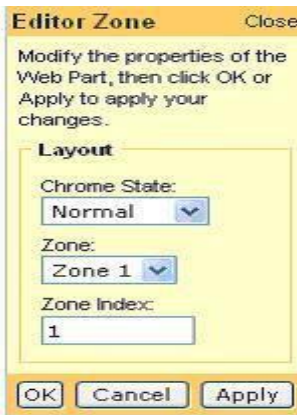
into four categories:

Properties that affect appearance, Properties that affect behavior, Properties that affect layout and Custom properties added by Web Part developers.

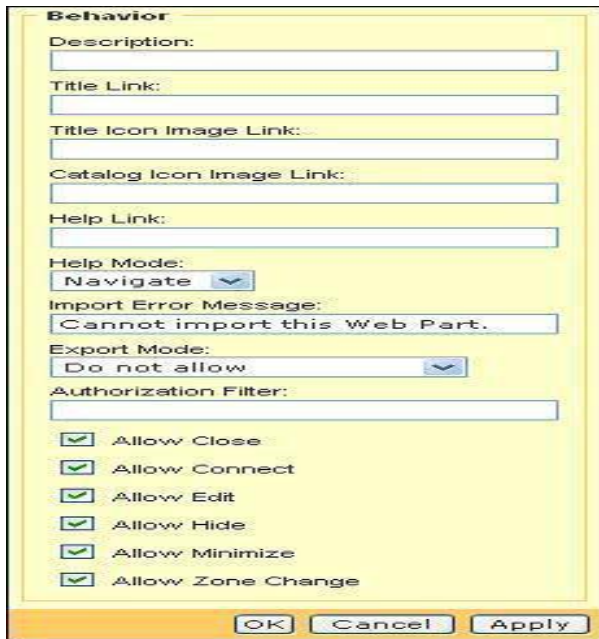
An EditorZone can contain any combination of EditorParts. EditorZones are only visible when the display mode is EditDisplayMode. User can click the Edit verb from webpart to open the Editor Zone.



Editor Zone with AppearanceEditorPart



## Editor Zone with LayoutEditorPart



## Editor Zone with BehaviorEditorPart

Web Parts can and often do implement custom properties to complement the built-in properties provided by the Web Parts framework. A Web Part that shows stock prices, for example, might implement a public property named "Stocks" to enable end users to specify which stock prices are shown. PropertyGridEditorParts provide UIs for editing custom properties. Attributing a property [WebBrowsable] enables that property to appear in a PropertyGridEditorPart. Of course, the PropertyGridEditorPart must be declared in an EditorZone if it's to appear on the page.

### WebPart

### Connection

Connections enable Web Parts to share data. A classic example is a Web Part control that shows the current weather and allows the user to enter a zip code so the weather can be localized. Another Web Part on that page-- perhaps one that shows news headlines--might want that zip code so it, too, can localize content. Rather than require the user to enter the zip code twice, you can connect the two Web Parts so that one can get the zip code from the other. Connections can be defined statically by page developers, or they can be created dynamically by end users. The `ConnectionsZone` control provides a UI for creating connections dynamically.

### Connection

### Provider

Writing a connection provider is no more difficult than writing a method that returns an interface reference and attributing that method [`ConnectionProvider`]. The first parameter to [`ConnectionProvider`] assigns a friendly name to the provider connection point and is displayed by the `ConnectionsZone` UI. The second parameter assigns a unique ID to the provider connection point. A provider can implement multiple provider connection points if desired. Each provider connection point must be assigned a unique ID.

### ConnectionConsumer

Writing a connection consumer is a matter of writing a method that receives an interface reference and attributing that method [`ConnectionConsumer`].

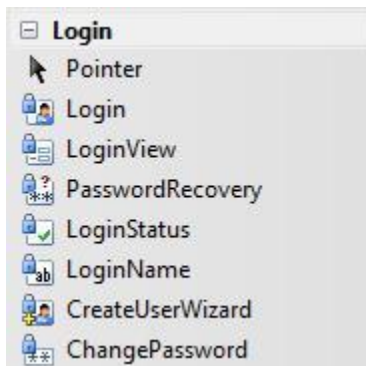


The first parameter to [ConnectionConsumer] assigns a friendly name to the consumer connection point and is displayed by the ConnectionsZone UI. The second parameter assigns a unique ID to the consumer connection point.

## UNIT IV- ADVANCED FEATURES OF ASP.NET

### Security in ASP.NET

The most useful feature available in ASP.NET 3.5 is a suite of seven controls designed to simplify the applications that authenticate users. In Visual Studio 2008, these controls are located in the toolbox under the Login tab.



These seven controls are as follows:

1. “[Login](#)”: Allows the user to log in by entering a user name and password.
2. “[CreateUserWizard](#)”: Allows the user to create a new user account.
3. “[PasswordRecovery](#)”: Allows the user to retrieve a forgotten password.
4. “[ChangePassword](#)”: Allows the user to change his or her password.
5. “[LoginView](#)”: This displays the contents of a template based on the user’s login status.

6. “[LoginStatus](#)”: If the user is logged in, displays a “Logout” link for the user to log out. If the user isn’t logged in, displays a “Login” link that leads to the application’s login page.
7. “[LoginName](#)”: This displays the user’s login name if the user is logged in.

Two aspects of user registration and login security in ASP.NET, and they are:

1. Authentication – The process of determining who a user is, and whether the user really is who he or she claims to be.
2. Authorization – The process of determining whether a particular user, once authenticated, can access a particular Web site page.

Three types of authentication

1. Forms-based authentication:

This method of authentication uses a membership database to store the names and passwords of valid users. In this method, whenever a user attempts to access a restricted or limited access page, ASP.NET automatically redirects the user to a login page, which is normally named “Login.aspx”, which prompts the user to login with a user name and password in order to authenticate that user. The originally requested page is then displayed if the user is valid. This is the most common type of authentication for Web sites that allow public access but require that users create login accounts to access the application.

### 2. Windows-based authentication:

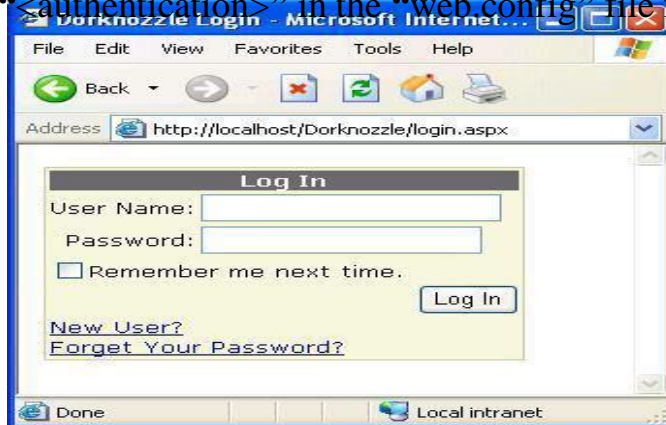
This method of authentication uses the existing Windows accounts to authenticate users. This type of authentication is used mostly for intranet applications, where the users already have valid Windows accounts.

### 3. Passport authentication:

This method of authentication uses Microsoft's Passport service to authenticate users. When you use Passport authentication, a user must have a valid Passport account to access the application. From these three authentication modes, this one is the least used.

### Login control

ASP.NET 2.0's new "Login" control provides you with a more convenient way to let the users of your application log in to you application. The "Login" control should be placed in a page called "Login.aspx" unless you changed the default "<authentication>" in the "web.config" file for the login page.



The “Login” control in its simplest form will look like the following:

```
<asp:Login id="Login1" runat="server" />
```

If you insert wrong username and password then message will show like this:



The screenshot shows a web form titled "Log In". It contains the following elements: a heading "Log In", a prompt "Please enter your user name and password for login.", a "User Name:" label followed by a text box containing "test", a "Password:" label followed by an empty text box, a checkbox labeled "Remember me next time.", a red error message "Your login attempt was not successful. Please try again.", a "Log In" button, and two links: "Register" and "Additional Help".

Note:

- The “Login” control displays text boxes that let the user enter a user name and password.
- If the fields are filled in, the “Login” control uses the membership provider to look up the user name and password in the membership database.
- If the user name and password are valid, the user is logged in and the page requested is displayed else if it is not valid, an error message is displayed and the user will not be logged in to show the requested page.

In ASP.NET, you have the ability to customize your “Login” control by using any of the optional attributes listed below.

Attribute	Description
-----------	-------------

id	The “ID” for the Login control.
runat	runat="Server" is needed for all ASP.NET server controls.
CreateUserText	The text displayed as a link to the register new user page.
CreateUserUrl	The URL to the register new user page.
DestinationPageUrl	The URL of the page for successful log in. If you don't specify this attribute, the page which the user was on before getting to this page is displayed.
DisplayRememberMe	A checkbox, which is a Boolean, to choose whether the Login Control should automatically let the user save his info by saving a cookie and avoid re-logging in.
FailureText	Is the text that will be displayed if the Log in information is not valid. If you do not change this message, a default message “Your login attempt has failed. Please try again” is displayed.
InstructionText	A text displayed underneath the title text providing the user with login information. If you do not change this attribute, the default is an empty string.

LoginButtonText	The Login button text.
Orientation	This specifies the “Horizontal” or “Vertical” layout of the login control. If you do not change this attribute, the default is “Vertical”.
PasswordLabelText	The text for the “Password” field.
PasswordRecoveryImageUrl	The URL for the image used as a link to the recover a lost password page.
PasswordRecoveryText	The text for the recover a lost password page.
PasswordRecoveryUrl	The URL for the recover a lost password page.
RememberMeText	Remember Me check box’s text.
TitleText	The text for the top of the Login control.
UserNameLabelText	The text for the Username label.

### CreateUserWizard control

ASP.NET “CreateUserWizard” control automates the task of entering the information for a new user and creating a record for the user in the membership database. The “CreateUserWizard” control displays text boxes that let the user enter a user name, a password, an e-mail address, a security question, and the answer to the security question.



Note:

- If the user clicks the “SignUp” link, the “CreateUserWizard” control attempts to create a new user account with the information entered by the user into the form.
- If the account is successfully created, the user is logged in to the new account.
- If the account can’t be created, for instance if the account with the same user name already exists, an error message is displayed.

The “CreateUserWizard” control in its simplest form will look like the following:

```
<asp:CreateUserWizard ID="CreateUserWizard1" runat="server">
    <WizardSteps>
        <asp:CreateUserWizardStep runat="server">
        </asp:CreateUserWizardStep>
```



```
<asp:CompleteWizardStep          runat="server">
    </asp:CompleteWizardStep> </WizardSteps>

</asp:CreateUserWizard>
```

In ASP.NET 2.0, you have the ability to customize your “CreateUserWizard” control by using any of the optional attributes listed below.

Attribute	Description
id	The “ID” for the “CreateUserWizard” control
runat	“runat=“Server” is needed for all ASP.NET server controls.
CancelButtonImageUrl	The URL for the image used for the Cancel button.
CancelButtonText	The text for the Cancel button.
CancelDestinationPageUrl	The URL of the page after the Cancel button is clicked.
CompleteStepText	The Complete step text, displayed after a user successfully creates an account. This is only shown after the “LoginCreatedUser” is set to “False”.
ContinueButtonImageUrl	The URL for the Continue button image on the Success page.

ContinueButtonText	The Continue button text on the Success page.
ContinueDestinationPageUrl	The URL of page the user is taken to after clicking the Continue button.
ConfirmPasswordLabelText	The text for the “Password Confirmation” label field.
CreateUserButtonText	The text for the Create User button.
DisableCreatedUser	This is a Boolean check box used to show if the user should be allowed to log in or not. The default, if not specified, is “False”. This can be set to “True” if you want the moderator or administrator to approve their account.
DisplayCancelButton	This is a Boolean, whether to display the Cancel button or not, the default, if not specified, is “False”.
HeaderText	The text for the header of the “CreateUserWizard” control.
InstructionText	The text for the instructions to use the “CreateUserWizard” control.
LoginCreatedUser	This is a Boolean to choose if the new user should be automatically logged into the application, the default, if not specified, is “True”.

PasswordLabelText	The text for the “Password” label field.
QuestionLabelText	The text for the “Security Question” label field.
UserNameLabelText	The text for the “Username” label field.

Note:

- In ASP.NET 2.0, you can apply AutoFormat or the style attributes to customize the appearance of the “CreateUserWizard” control.
- The user is always logging to the application after the register is complete, so if you would prefer not to, you can specify it using the LoginCreatedUser="False" attribute.
- If you want the user account to be automatically deactivated till the administrator or moderator approve it, you can specify it using DisableCreatedUser="True".
- By default, the “CreateUserWizard” control has two steps, the “CreateUserWizardStep” and “CompleteWizardStep” as shown in the code above. You can add steps or even a sidebar with links to each of the steps.
- The “CreateUserWizard” control can send a confirmation e-mail to the new user using two methods;
  - In the “<MailDefinition>” child element

<MailDefinition

From="name@domain.com"

Subject="Subject

Line"

```
BodyFileName="BodyFile.txt">
```

```
</MailDefinition>
```

- In the “MailDefinition” attributes

```
<asp:CreateUserWizard   runat="server"   ID="CreateUserWizard1"
                        MailDefinition-From="name@domain.com"
                        MailDefintion-Subject="Subject"           Line"
                        MailDefinition-BodyFileName="BodyFile.txt" >
</asp:CreateUserWizard>
```

Note:

- The body of the e-mail message will be taken from the file "BodyFile.txt" in the “BodyFileName attribute”.
- This “.txt” file can include “<%UserName%>” and “<%Password%>” so you can put the user’s account name and password into the email.
- For the “<MailDefinition>” child element to work, “<MailSettings>” element in the application’s “web.config” file should be changed into:

```
                                <system.net>
                                <mailSettings>
                                    <smtp>
                                        <network           host="smtp.yourhostnamehere.com"
                                        from="administrator@MyDomain.com"           />
                                    </smtp>
                                </mailSettings>
</system.net>
```

Note:

- The “SMTP” settings for the “network host” and the address “from” should be changed to the one you want to use.

PasswordRecovery control

ASP.NET 2.0’s new “PasswordRecovery” control allows you to easily create a way to retrieve a forgotten password. In this control, the user has to enter their security question and the answer to it. If the values are valid, the password is reset to a random value and that password is emailed to the email address the user provided when registering to the application.

The “PasswordRecovery” control in its simplest form will look like the following:

```
<asp:PasswordRecovery ID="PasswordRecovery1" runat="server">  
</asp:PasswordRecovery>
```



Once users enter valid user names, they must answer their secret questions. In the browser, the page looks like that shown below.



If everything is formatted correctly, the email will be sent and a message will appear to the user similar to this:



The new password can be sent to the user's email account. The "PasswordRecovery" control can send a confirmation e-mail to the new user using two methods:

- In the "<MailDefinition>" child element

```
<asp>PasswordRecovery ID="PasswordRecovery1" runat="server">
    <MailDefinition
        From="name@domain.com"
        Subject="Subject" Line"
        BodyFileName="BodyFile.txt">
    </MailDefinition>
</asp>PasswordRecovery>
```

- In the "MailDefinition" attributes

```
<asp>PasswordRecovery id="PasswordRecovery1" runat="Server"
    MailDefinition-From="name@domain.com"
    MailDefinition-Subject="Subject" Line"
    MailDefinition-BodyFileName="BodyFile.txt" />
</asp>PasswordRecovery>
```

Note:

- The body of the e-mail message will be taken from the file "BodyFile.txt" in the "BodyFileName" attribute.
- This ".txt" file can include "<%UserName%>" and "<%Password%>" so you can put the user's account name and password into the email.

In ASP.NET 2.0, you have the ability to customize your “PasswordRecovery” control by using any of the optional attributes listed below.

Attribute	Description
id	The “ID” for the “PasswordRecovery” control
AnswerLabelText	The text for the “Answer” label field
GeneralFailureText	The text for the “Failure” text field if the password could not be retrieved.
QuestionLabelText	The text for the “Secret Question” label.
SuccessPageUrl	The URL for the Success page if the password has been recovered.
SuccessText	The text for the message if the password retrieval is successful, and this is not displayed if the “SuccessPageUrl” is provided.
UserNameFailureText	The text for incorrect username.
UserNameInstructionText	The text for the instructions for the Username request area.
UserNameLabelText	The text for the “Username” label field.

### ChangePassword control

ASP.NET 2.0’s new “ChangePassword” control gives you the ability to automate the process of a user wanting to change their password. You can



configure the new “ChangePassword” control to accept the username and the password the user wishes to change. You can also configure it such that the user cannot enter his username, but should be logged into the application as a user to change the password. The new “ChangePassword” control also can be configured such that after changing the password, the new password can be e-mailed back to the user.

The “ChangePassword” control in its simplest form will look like the following:

```
<asp:ChangePassword ID="ChangePassword1" runat="server">
  </asp:ChangePassword>
```

The “ChangePassword” control can send a new password e-mail to the user using the “<MailDefinition>” child element. The following is a sample code of how this will look like:

```
<asp:ChangePassword id="ChangePassword1" runat="Server" >
  <MailDefinition
    From="name@domain.com"
    Subject="Subject Line"
    BodyFileName="BodyFile.txt">
  </MailDefinition>
</asp:ChangePassword>
```

Note:

- The body of the e-mail message will be taken from the file "BodyFile.txt" in the “BodyFileName attribute”.

- This “.txt” file can include “<%UserName%>” and “<%Password%>” so you can put the user’s account name and password into the email.

In ASP.NET 2.0, you have the ability to customize your “ChangePassword” control by using any of the optional attributes listed below.

Attribute	Description
id	The “ID” for the “ChangePassword” control
runat	runat="Server" is needed for all ASP.NET server controls.
CancelButtonImageUrl	The URL for the image used for the Cancel button.
CancelButtonText	The text for the Cancel button.
CancelDestinationPageUrl	The URL of the page after the Cancel button is clicked.
ChangePasswordButtonImageUrl	The URL for the Change Password button image on the Success page.
ChangePasswordButtonText	The ChangePassword button text.
ChangePasswordTitleText	The text for the “ChangePassword” title area.
ConfirmNewPasswordLabelText	The text for the “ConfirmPassword” label

	field.
ContinueButtonImageUrl	The URL for the Continue button image.
ContinueButtonText	The Continue button text.
ContinueDestinationPageUrl	The URL of page the user is taken to after clicking the Continue button.
CreateUserText	The text for the “CreateUser” link.
CreateUserUrl	The URL for the CreateUser page.
DisplayUserName	This is a Boolean check box, to indicate if you want the user to enter the username when changing the password or the user to be logged in to the system. If “True”, the “ChangePassword” control can also be used to change the password of an account other than the one to which the user is currently logged in, if “False” they can only change the password of the logged in account.
InstructionText	The text for the instructions to use the “ChangePassword” control.
NewPasswordLabelText	The text for the “New Password” label field.
PasswordHintText	The text displayed for the instruction for

	the new password and its requirements, like how many character, minimum <b>length, etc...</b>
PasswordLabelText	The text displayed for the “Current Password” label field.
PasswordRecoveryText	The text for the “Password Recovery” page link
PasswordRecoveryUrl	The URL for the “Password Recovery” page.
SuccessPageUrl	The URL for the Success page if the password has been changed.
SuccessText	The text for the message if the password change is successful, and this is not displayed if the “SuccessPageUrl” is provided.
UserNameLabelText	The text for the “Username” label field.

Attributes for the “ChangePassword” control

The following is the code for a customized “ChangePassword” control.

```
<asp:ChangePassword id="ChangePassword1" runat="Server"
  ChangePasswordTitleText="Change Your Password<br />"
  PasswordLabelText="Enter your current password:"
  NewPasswordLabelText="Enter the new password:"
```

```
ConfirmNewPasswordLabelText="Confirm the new password:">  
</asp:ChangePassword>
```

Note:

- The “ChangePassword” control requires the user to be logged in to change the password by default. You can change this by specifying the “DisplayUsername=True” attribute. This will display a “Username” textbox, where the user has to enter the valid user name and password to change the password for any user.
- The “ChangePassword” control has two views, and they are:
  - The Initial view – this is the Change Password view including the text boxes for the user to enter the new password.
  - The Success view – displayed when the password change is successful with a confirmation message. The success view is not displayed if the “SuccessPageUrl” is provided, but instead the page in the URL specified will be shown.

LoginView control

ASP.NET 2.0’s new “LoginView” control is a template control. This template control can display the contents of its templates according to the login status of the user. This gives you the ability to customize your content of your web application for the needs of different users.

For example:

The User authentication application should use a “LoginView” control to display a link to the administrator’s page because this page should be only visible to the users with the login status of an “Admin”.

The “LoginView” control does not have any special attributes to customize its appearance or behavior but you can customize the “LoginView” control by using the three types of templates of which each can be coded in as a child element. The three templates are:

1. “Anonymous” template: Displayed if the user isn’t logged in.
2. “LoggedIn” template: Displayed if the user is logged in.
3. “RoleGroup” template: Displayed if the user is logged in and is a member of a particular role group.

The following is a sample code for all the three types of templates of a “LoginView” control.

```
<asp:LoginView      runat="Server"      id="LoginView1">  
    <AnonymousTemplate>
```

The Anonymous Template is displayed for anonymous users.

```
</AnonymousTemplate>
```

```
<LoggedInTemplate>
```

The Logged In Template is displayed for users logged in.

```
</LoggedInTemplate>
```

```
<RoleGroups>
```

```
<asp:RoleGroup      Roles="Admin">
```

```
<ContentTemplate>
```

This Role Groups Template is displayed for admins.

```
</ContentTemplate>
</asp:RoleGroup>
</RoleGroups>

</asp:LoginView>
```

Note:

- The “<RoleGroups>” elements can contain more than one “<RoleGroups>”, these elements can be used alongside the “Anonymous” and the “LoggedIn” templates.

LoginName control

ASP.NET 2.0’s new “LoginName” control is used to display the user’s username which the user logged in to the web application from. If a user is not currently logged into the web application, the “LoginName” control does not display anything.

The “LoginName” control in its simplest form will look like the following:

```
<asp:LoginName ID="LoginName1" runat="server" />
```

If you want a custom message such as a welcome message to be displayed in front of the Username, you can do the following:

```
<asp:LoginName ID="LoginName1" runat="server"
FormatString="Welcome, {0}" />
```

Note:

The “Welcome” text will be added as a prefix to the Username if the user has logged in, and if no user is logged in nothing is displayed.

LoginStatus control

ASP.NET 2.0’s new “LoginStatus” control will display a link for the user to log into or log out of the web application depending on whether the user is logged in or out.

For example:

- If the user is logged in, a link is displayed to Logout
- If the user is not logged in, a link is displayed to Login

The “LoginStatus” control in its simplest form will look like the following:

```
<asp:LoginStatus ID="LoginStatus1" runat="server" />
```

In ASP.NET 2.0, you have the ability to customize your “LoginStatus” control by using any of the optional attributes listed below.

Attribute	Description
id	The “ID” for the “LoginStatus” control
runat	runat=“Server” is needed for all ASP.NET server controls.
LoginImageUrl	The URL for the “Login” link image.
LoginText	The text for the “Login” link.



LogoutAction	The action to do after the user logs out. This can be specified to “Redirect” to redirect the user to a page in the “LogoutPageUrl” attribute, or “RedirectToLoginPage” to redirect the user to the login page, or “Refresh” to refresh the current page.
LogoutImageUrl	The URL for the “Logout” link.
LogoutPageUrl	The URL for the redirect page after a user logs out if the “LogoutAction” attribute specifies “Redirect”.
LogoutText	The text for the “Logout” link.

Attributes for the “LoginStatus” control

### State Management in ASP.NET

Web pages rarely are stand alone. Web applications almost always need to track users who visits multiple pages, whether to provide personalization, store information about a user or to track usage for reporting purposes.

HTTP (Hyper Text Transfer Protocol) is a stateless protocol. When the client disconnects from the server, the ASP.Net engine discards the page objects. This way each web application can scale up to serve numerous requests simultaneously without running out of server memory.

However, there need to be some technique to store the information between requests and to retrieve it when required. This information i.e., the current value of all the controls and variables for the current user in the current session is called the State.

### Types of State Management

1. Client – Side State Management

2. Server – Side State Management

#### Client – Side State Management

Client Side State Management involves storing information either on a Web page or on a Client computer. There are four ways to manage states.

- View State
- Hidden Form Fields
- Cookies
- Query String

#### View State

In this method, the ViewState property that is inherited from the base Control class is used to automatically save the values of the page and of each control prior to rendering of the page. ViewState is implemented with a hidden form field called the `_VIEWSTATE`, which is automatically created in every Web Form page. When ASP.Net executes a Web page on a Web Server, the values stored in the ViewState property of the page and controls on it are collected and formatted into a single encoded string. The encoded string is then assigned to the Value attribute of the hidden form field `_VIEWSTATE` and is sent to the client as a part of the Web page.

#### Hidden Form Fields

In ASP.Net we can use the HTML standard hidden fields in a Web Form to store page-specific information. A hidden field does not render in a Web

browser. However, we can set the properties of the hidden field. When a page is submitted to the server, the content of the hidden field is sent in the HTTP Form collection along with values of other controls.

### Query String

The Query string is a part of the request that appears after the Question mark (?) character in the URL. A query string provides a simple way to pass information from one page to another.

### Cookies

A cookie, also known as an HTTP cookie, web cookie, or browser cookie, is usually a small piece of data sent from a website and stored in a user's ed by the website to notify the website of the user's previous activity.<sup>1</sup> web browser while a user is browsing a website. When the user browses the same website in the future, the data stored in the cookie can be retriev<sup>1</sup>] Cookies were designed to be a reliable mechanism for websites to remember the state of the website or activity the user had taken in the past. This can include clicking particular buttons, logging in, or a record of which pages were visited by the user even months or years ago.

### *Server Side State Management Options*

#### Application State

An ASP.Net application is the collection of all web pages, code and other files within a single virtual directory on a web server. When information is stored in application state, it is available to all the users.

To provide for the use of application state, ASP.Net creates an application state object for each application from the `HTTPApplicationState` class and stores this object in server memory. This object is represented by class file `global.asax`.

Application State is mostly used to store hit counters and other statistical data, global application data like tax rate, discount rate etc and to keep track of users visiting the site.

Application state data is generally maintained by writing handlers for the events:

- `Application_Start`
- `Application_End`
- `Application_Error`
- `Session_Start`
- `Session_End`

Session State:

When a user connects to an ASP.Net website, a new session object is created. When session state is turned on, a new session state object is created for each new request. This session state object becomes part of the context and it is available through the page.

Session state is generally used for storing application data like inventory or supplier list, or a customer record or shopping cart. It can also keep information about the user and his preference and keep track of pending operations.

Sessions are identified and tracked with a 120-bit SessionID, which is passed from client to server and back as cookie or a modified URL. The SessionID is globally unique and random.

The session state object is created from the HttpSessionState class, which defines a collection of session state items.

### Mobile Application Development in ASP.NET

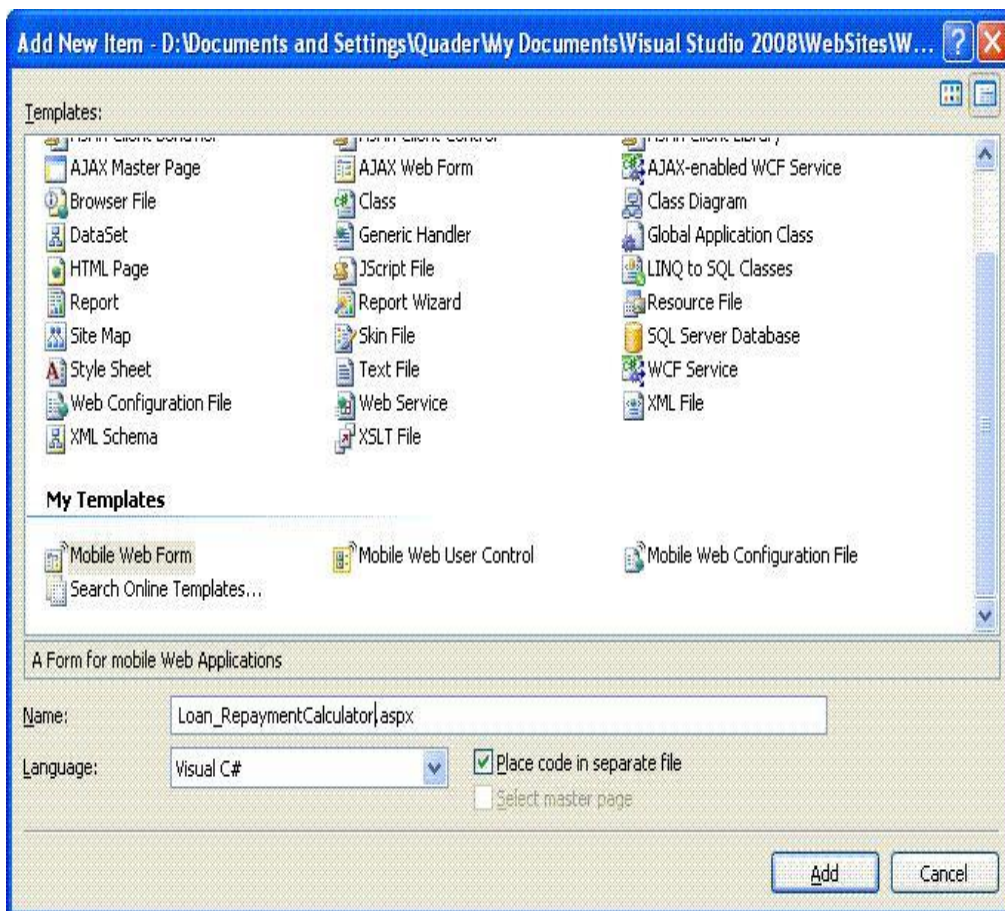
Mobile application development in ASP.NET is similar to traditional ASP.NET web application development. And it is very easy for ASP.NET developer to develop mobile application. All mobile web pages are inherit from MobilePage class which exists in System.Web.UI.MobileControls namespace. ASP.NET exposes a System.Web.Mobile namespace is for specifically to Web development.

### Creating Mobile Web Page in Application

A Default.aspx is added in your solution and it is traditional ASP.NET page which is inherited from System.Web.UI.Page. But you need to create page which inherit from MobilePage class in System.Web.UI.MobileControls namespace. In this demonstration, you will use controls from the System.Web.Mobile namespace that are specifically designed for devices that cannot display as much information as a desktop browser.

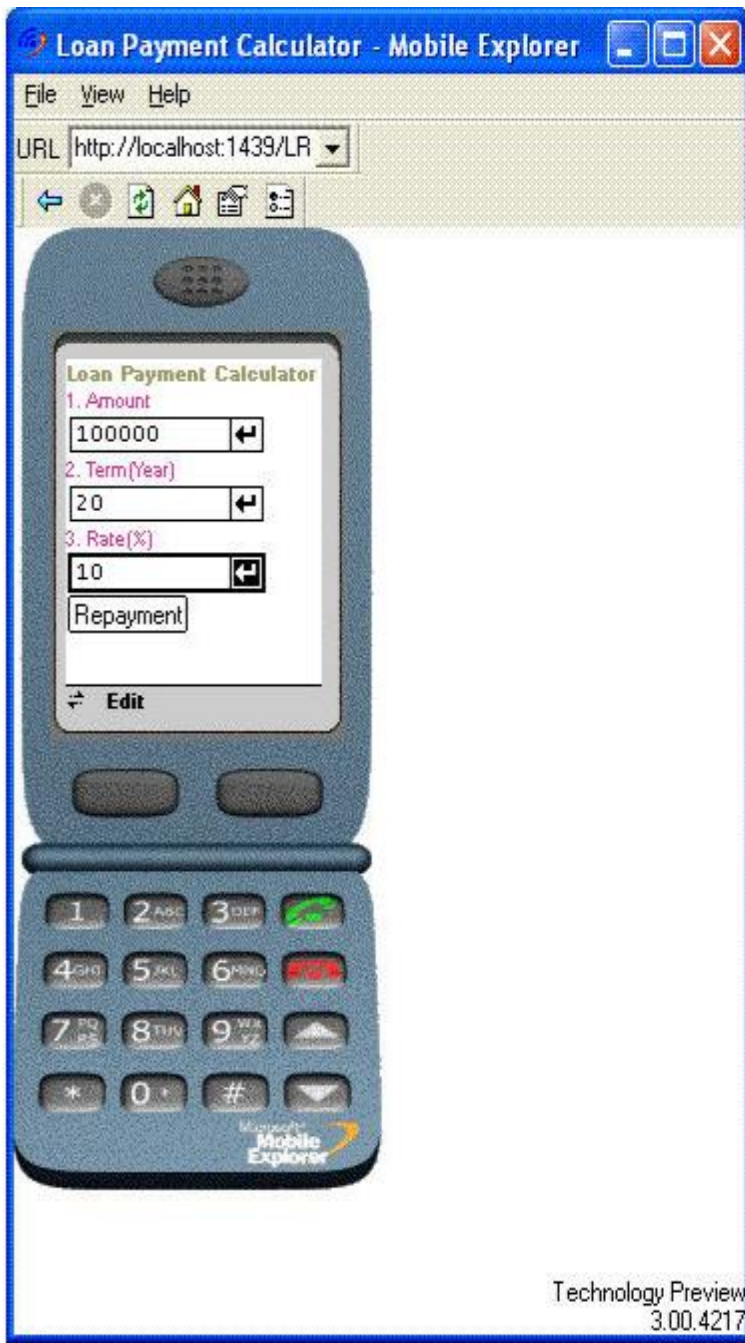
### Creating Mobile Web Page in Application

1. Right-click the Default.aspx page in Solution Explorer and choose Delete.
2. Click OK in the dialog box.
3. Right-click the application in Solution Explorer and choose Add New Item
4. Choose Mobile Web Form under Visual Studio installed templates.



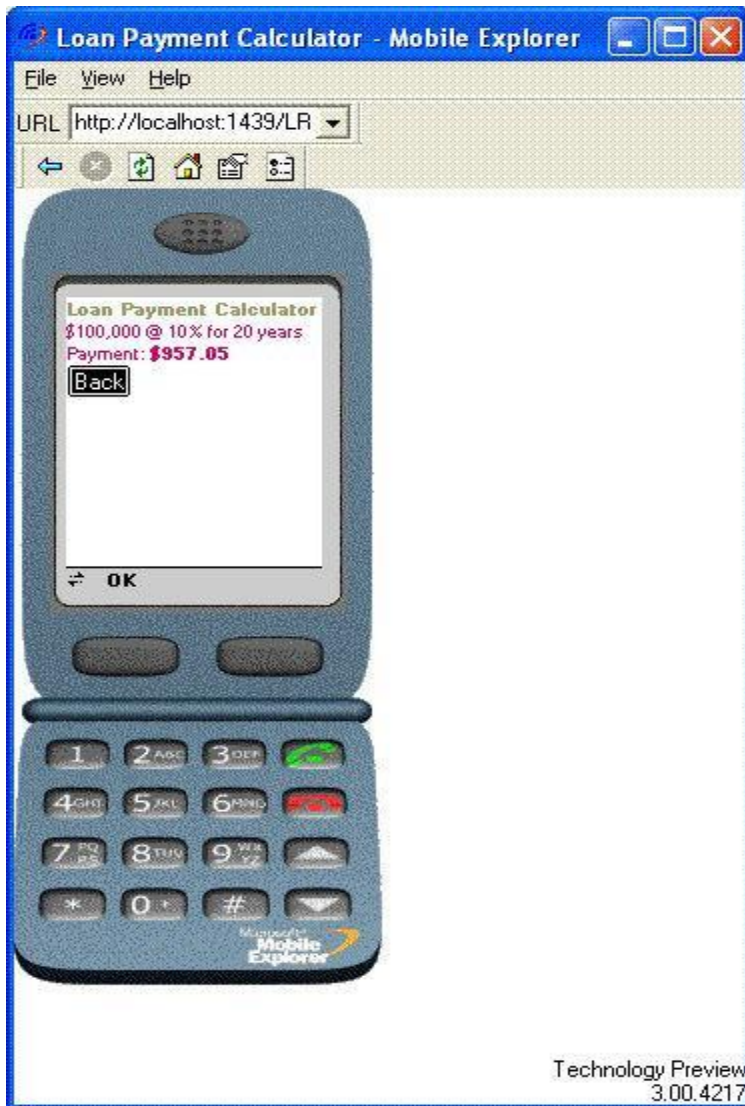
### Test Application

Select Microsoft Mobile Explorer and press F5 to run the application. Microsoft Mobile Explorer Emulator will appear. Click ASP.NET Development Server icon in the system tray to get application URL name and its port. It may be different in your system. In the Microsoft Mobile Explorer Emulator type URL as <http://localhost:1439/LRC/Loan>



RepaymentCalculator.aspx

Enter Amount, Term & Rate. Click on Repayment button in the screen. You will get result like bellow,





## UNIT-V: WEB SERVICES

A Web service is a method of communication between two electronic devices over a network.

A web service is a network accessible interface to application functionality, built

using standard Internet. Web services are services that are made available from a business's Web server for Web users or other Web-connected programs.

Web services sometimes called *application services*. Usually web services including some combination of programming and data, but possibly including human resources.

Web services are software components that expose a service over the web. Technically it is an application that exposes a web-accessible API i.e., you can invoke this application programmatically over the Web Using SOAP protocol. It allows applications to share data and functionality. It can be called across platforms and operating systems regardless of the programming language used by applications. Web services enable 100% interoperability.

Why Web Services?

A significantly lower price point than any other integration technology.

Web services represent a new form of middleware based on XML and the Web. XML and the Web help solve the challenges associated with traditional application-to-application integration.

- Traditional middleware doesn't support heterogeneity.

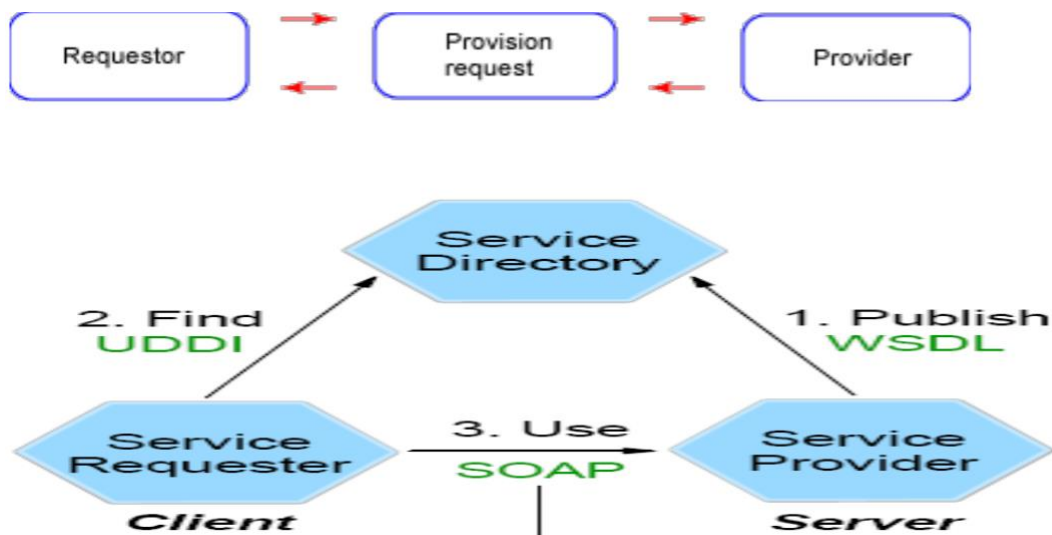
- Traditional middleware doesn't work across the Internet.
- Traditional middleware isn't pervasive.
- Traditional middleware is hard to use.
- Traditional middleware is expensive.
- Traditional middleware maintenance costs are outrageous.
- Traditional middleware connections are hard to reuse.
- Traditional middleware connections are fragile.

Web services address these issues. Web services are platform- and language-independent. You can develop a Web service using any language, and you can deploy it on any platform, from the tiniest device to the largest supercomputer.

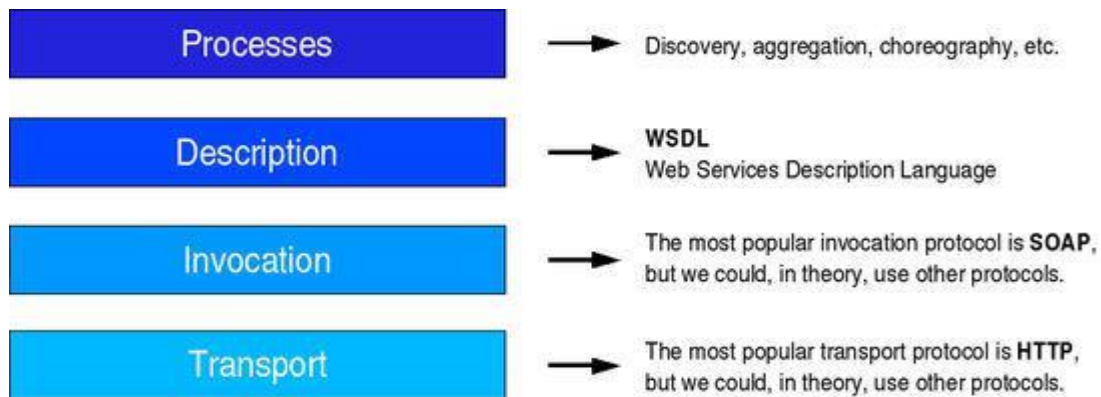
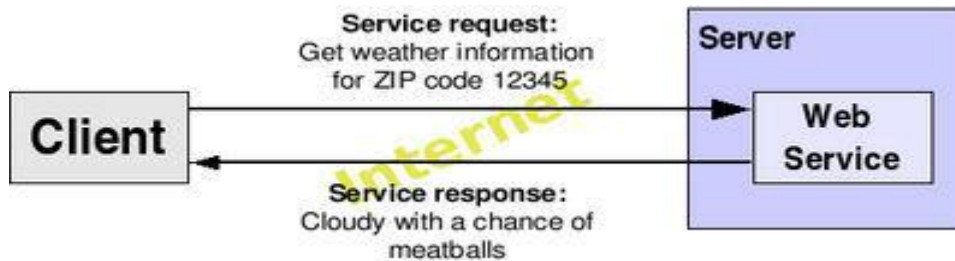
### Web Services Architecture

Web services are generally set up in a typical client/server architecture. The two parts of the run-time are known as the *Requestor* and the *Provider*.

Figure 1: Web services Architecture



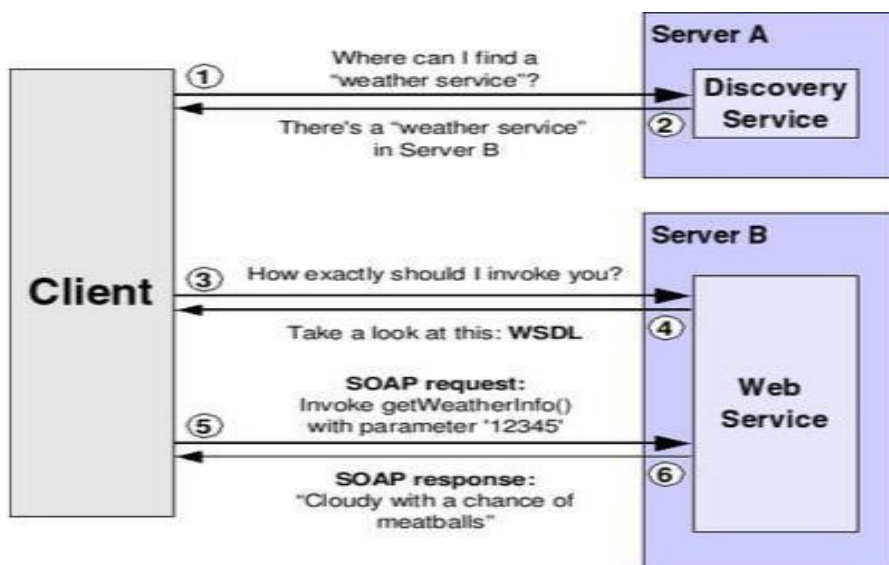
Example: The *clients* (programs that want to access the weather information) would then contact the *Web Service* (in the *server*), and send a *service request* asking for the weather information. The server would return the forecast through a *service response*.



- **Service Processes:** This part of the architecture generally involves more than one Web service. For example, discovery belongs in this part of the architecture, since it allows us to locate one particular service from among a collection of Web services.
- **Service Description:** One of the most interesting features of Web Services is that they are *self-describing*. This means that, once you've located a Web Service, you can ask it to 'describe itself' and tell you what operations it supports and how to invoke it. This is handled by the Web Services Description Language (WSDL).

- **Service Invocation:** Invoking a Web Service (and, in general, any kind of distributed service such as a CORBA object or an Enterprise Java Bean) involves passing messages between the client and the server. SOAP (Simple Object Access Protocol) specifies how we should format requests to the server, and how the server should format its responses. In theory, we could use other service invocation languages (such as XML-RPC, or even some *ad hoc* XML language). However, SOAP is by far the most popular choice for Web Services.
- **Transport:** Finally, all these messages must be transmitted somehow between the server and the client. The protocol of choice for this part of the architecture is HTTP (HyperText Transfer Protocol), the same protocol used to access conventional web pages on the Internet. Again, in theory we could be able to use other protocols, but HTTP is currently the most used one.

Figure.A typical Web Service invocation



1. As we said before, a client may have no knowledge of what Web Service it is going to invoke. So, our first step will be to *discover* a Web Service that meets our requirements. For example, we might be interested in locating a public Web Service which can give me the weather forecast in US cities. We'll do this by contacting a *discovery service* (which is itself a Web service).
2. The discovery service will reply, telling us what servers can provide us the service we require.
3. We now know the location of a Web Service, but we have no idea of how to actually invoke it. Sure, we know it can give me the forecast for a US city, but how do we perform the actual service invocation? The method I have to invoke might be called "string getCityForecast(int CityPostalCode)", but it could also be called "string getUSCityWeather(string cityName, bool isFahrenheit)". We have to ask the Web Service to *describe* itself (i.e. tell us how exactly we should invoke it)
4. The Web Service replies in a language called WSDL.
5. We finally know where the Web Service is located and how to invoke it. The invocation itself is done in a language called SOAP. Therefore, we will first send a *SOAP request* asking for the weather forecast of a certain city.
6. The Web Service will kindly reply with a *SOAP response* which includes the forecast we asked for, or maybe an error message if our SOAP request was incorrect.

Web Services have certain advantages over other technologies:

- Web Services are platform-independent and language-independent, since they use standard XML languages. This means that my client program can be programmed in C++ and running under Windows, while the Web Service is programmed in Java and running under Linux.
- Most Web Services use HTTP for transmitting messages (such as the service request and response). This is a major advantage if you want to build an Internet-scale application, since most of the Internet's proxies and firewalls won't mess with HTTP traffic (unlike CORBA, which usually has trouble with firewalls).

### WEB SERVICE CONVERSATION LANGUAGE

The Web Service Conversation Language (WSCL) proposal defines the overall input and output message sequences for one [web service](#).

Declaring the types of messages that are exchanged and specifying the type of

interaction that a message is used in (e.g. one-way, or bilateral

- Specifies the XML documents being exchanged, and the allowed sequencing of these document exchanges.
- WSCL and WSDL are highly complementary – WSDL specifies how to send messages to a service and WSCL specifies the order in which such message can be sent.

### WSCL INTERFACE COMPONENTS:

There are four main elements of a WSCL specification

---

- Document type descriptions
- Interactions
- Transitions
- Conversations

### Document type descriptions

The interaction between service-consumer and service-provider is achieved through XML document exchange. A conversation definition language must be able to define all the input and output document types

- Specify the types (schemas) of XML documents the service can accept and transmit in the course of a conversation.
- The document schemas are separate XML documents referenced by their URL in the XMLDocumentType elements of the conversation specification
- InboundXMLDocument
- OutboundXMLDocument

hrefSchema - refers to the schema to which the documents corresponds.

id - can be used within the rest of the conversation definition.

Example : An input document that conforms to a purchase order schema defined in PurchasedOrderRQ.xsd.

<InboundXMLDocument

hrefSchema="http://foo.org/PurchasePrderRQ.xsd"

id="PurchaseOrderRQ"

</InboundXMLDocument>

### Interactions

- An interaction is an exchange of documents between a service and its client.
- WSCL only models business level interactions. It only specifies which business level documents are exchanged and does not model how this exchange is carried out by lower-level messaging protocols.

### One-Way Interactions

- Send – the service sends out an outbound document.
- Receive – the service receives an inbound document.
- Two-Way Interactions
- SendReceive – the service sends out an outbound document and then expects to receive an inbound document in reply.
- ReceiveSend – the service receives an inbound document and then sends out an outbound document.
- Empty – does not contain any documents exchanged, but is used only for modeling the start and end of a conversation.

### Transitions

- Transitions specify the ordering relationships between interactions.



- SourceInteraction – precede the DestinationInteraction when the conversation is executed.
- DestinationInteraction – follow the SourceInteraction when the conversation is executed.
- SourceInteractionCondition – an additional condition for the transition. (Optionally)

Example:

<Transition>

<SourceInteraction href="Login"/>

<DestinationInteraction href="Login"/>

<SourceInteractionCondition href="InvalidLoginRS"/>

</Transition>

Conversation

- Conversations list all the interactions and transitions that make up the conversation.
- A conversation contains additional information about the conversation, including the conversation's name and the interaction the conversation can start with and end with.

The Conversation element contains the following two sub elements

- ConversationInteractions list all Interaction elements.
- ConversationTransitions lists all Transition elements.

The Conversation element contains the following attributes:

- initialInteraction and finalInteraction
- name – the name of the conversation
- version(optional) – the version of the conversation.
- targetNamespace(optional) – the namespace of this conversation as it should be used when elements of this conversation are referenced in other XML documents.
- hrefSchema(optional) – the URL of the file containing this conversation definition.
- description(optional)

Example:

```
<?xml version="1.0" encoding="UTF-8"?>

<Conversation name="simpleConversation"

    version="1.01"

    xmlns="http://www.w3.org/2002/02/wsc110"

    initialInteraction="Start"

    finalInteraction="End"

    description="Conversation for a Store Front Service"

    <ConversationInteractions>

        list of all the interactions
```

</ConversationInteractions>

<ConversationTransitions>

list of all the transitions

</ConversationTransitions>

</Conversation>

### SIMPLE OBJECT ACCESS PROTOCOL (SOAP)

SOAP, originally defined as Simple Object Access Protocol, is a protocol specification for exchanging structured information in the implementation of web services in computer networks.

All statements are TRUE for SOAP

- SOAP is acronym for Simple Object Access Protocol
- SOAP is a communication protocol
- SOAP is designed to communicate via Internet
- SOAP can extend HTTP for XML messaging
- SOAP provides data transport for Web services
- SOAP can exchange complete documents or call a remote procedure
- SOAP can be used for broadcasting a message
- SOAP is platform and language independent
- SOAP is the XML way of defining what information gets sent and how

It relies on Extensible markup language (XML) for its message format, and

usually relies on other application layer protocols, most notably Hypertext transfer

protocol (HTTP) and Simple mail transfer protocol (SMTP), for message negotiation and transmission.

SOAP can form the foundation layer of a Web services protocol stack, providing

a basic messaging framework upon which web services can be built. This XML based protocol consists of three parts: an envelope, which defines what is in the message and how to process it, a set of encoding rules for expressing instances of application-defined data types, and a convention for representing procedure calls and responses. SOAP has three major characteristics:

- Extensibility
- Neutrality
- Independence.

### The SOAP Model

The SOAP processing model describes a distributed processing model, its participants, the SOAP nodes and how a SOAP receiver processes a SOAP message. The following SOAP nodes are defined:

- SOAP sender
- SOAP receiver

A SOAP node that accepts a SOAP message.

- SOAP message path

The set of SOAP nodes through which a single SOAP message passes.

- Initial SOAP sender (Originator)

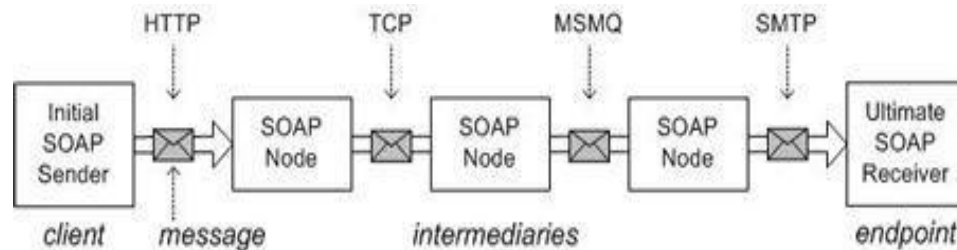
The SOAP sender that originates a SOAP message at the starting point of a SOAP message path.

- SOAP intermediary

A SOAP intermediary is both a SOAP receiver and a SOAP sender and is

targetable from within a SOAP message. It processes the SOAP header blocks targeted at it and acts to forward a SOAP message towards an ultimate SOAP receiver.

Figure . Sophisticated SOAP messaging



- Ultimate SOAP receiver

The SOAP receiver that is a final destination of a SOAP message. It is responsible

for processing the contents of the SOAP body and any SOAP header blocks targeted at it. In some circumstances, a SOAP message might not reach an ultimate SOAP receiver, for example because of a problem at a SOAP intermediary. An ultimate SOAP

receiver cannot also be a SOAP intermediary for the same SOAP message.

### Advantages

- SOAP is versatile enough to allow for the use of different transport protocols.

The standard stacks use HTTP as a transport protocol, but other protocols such as

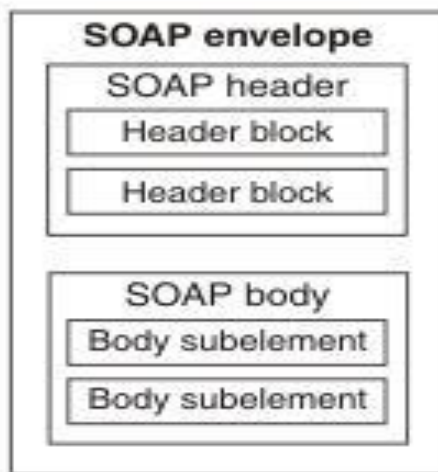
- Since the SOAP model tunnels fine in the HTTP get/response model, it can

easily over existing firewalls and proxies, without modifications to the SOAP

protocol, and can use the existing infrastructure.

### SOAP Message Structure

FIG . ELEMENTS OF A SOAP MESSAGE



A SOAP message is an ordinary XML document containing the following elements.

Envelope:(Mandatory)

Defines the start and the end of the message. The SOAP <Envelope> is the root element in every SOAP message, and contains two child elements, an optional <Header> and a mandatory <Body>. Header:(Optional)

Contains any optional attributes of the message used in processing the message, either at an intermediary point or at the ultimate end point. The SOAP <Header> is an optional sub-element of the SOAP envelope, and is used to pass application-related information that is to be processed by SOAP nodes along the message path.

Body:(Mandatory)

Contains the XML data comprise the message being sent. The SOAP <Body> is a mandatory sub-element of the SOAP envelope, which contains information intended for the ultimate recipient of the message.

Fault: ( Optional ) An optional Fault element that provides information about errors that occurred while processing the message. The SOAP <Fault> is a sub-element of the SOAP body, which is used for reporting errors.

Example message

POST /InStock HTTP/1.1

Host: www.example.org

Content-Type: application/soap+xml; charset=utf-8

Content-Length: 299

SOAPAction: "http://www.w3.org/2003/05/soap-envelope"

```
<?xml version="1.0"?>
<soap:Envelope xmlns:soap="http://www.w3.org/2003/05/soap-envelope">
  <soap:Header>
</soap:Header>
  <soap:Body>
    <m:GetStockPrice xmlns:m="http://www.example.org/stock">
      <m:StockName>IBM</m:StockName>
    </m:GetStockPrice>
  </soap:Body>
</soap:Envelope>
```

### SOAP Envelope Element

The SOAP envelope indicates the start and the end of the message so that the receiver knows when an entire message has been received. The SOAP envelope solves the problem of knowing when you're done receiving a message and are ready to process it. The SOAP envelope is therefore basically a packaging mechanism

SOAP Envelope element can be explained as:

- Every SOAP message has a root Envelope element.
- Envelope element is mandatory part of SOAP Message.
- Every Envelope element must contain exactly one Body element.
- If an Envelope contains a Header element, it must contain no more than one, and it must appear as the first child of the Envelope, before the Body.
- The envelope changes when SOAP versions change.



- The SOAP envelope is specified using the *ENV* namespace prefix and the *Envelope* element.
- The optional SOAP encoding is also specified using a namespace name and the optional *encodingStyle* element, which could also point to an encoding style other than the SOAP one.

Example:

```
<?xml version="1.0"?>
<SOAP-ENV:Envelope
xmlns:SOAP-ENV="http://www.w3.org/2001/12/soap-envelope"
SOAP-ENV:encodingStyle="http://www.w3.org/2001/12/soap-
encoding">
...
Message information goes here
...
</SOAP-ENV:Envelope>
SOAP Header Element
```

The optional Header element offers a flexible framework for specifying additional application-level requirements. For example, the Header element can be used to specify a digital signature for password-protected services; likewise, it can be used to specify an account number for pay-per-use SOAP services.

SOAP Header element can be explained as:

- Header elements are optional part of SOAP messages.

- Header elements can occur multiple times.
- Headers are intended to add new features and functionality
- The SOAP header contains header entries defined in a namespace.
- The header is encoded as the first immediate child element of the SOAP envelope.
- When more than one header is defined, all immediate child elements of the SOAP header are interpreted as SOAP header blocks.

SOAP Header element can have following two attributes

- Actor attribute:  
The SOAP protocol defines a message path as a list of SOAP service nodes. Each of these intermediate nodes can perform some processing and then forward the message to the next node in the chain. By setting the Actor attribute, the client can specify the recipient of the SOAP header.
- MustUnderstand attribute  
Indicates whether a Header element is optional or mandatory. If set to true ie. 1 the recipient must understand and process the Header attribute according to its defined semantics, or return a fault.

Following example shows how to use a Header in the SOAP message.

```
<?xml version="1.0"?>
<SOAP-ENV:Envelope
xmlns:SOAP-ENV="http://www.w3.org/2001/12/soap-envelope"
SOAP-ENV:encodingStyle="http://www.w3.org/2001/12/soap-encoding">
<SOAP-ENV:Header>
```

```
<t:Transaction
xmlns:t="http://www.tutorialspoint.com/transaction/"
SOAP-ENV:mustUnderstand="true">5</t:Transaction>
</SOAP-ENV:Header>
...
...
</SOAP-ENV:Envelope>
```

### SOAP Body Element

The SOAP body is a mandatory element which contains the application-defined XML data being exchanged in the SOAP message. The body must be contained within the envelope and must follow any headers that might be defined for the message. The body is defined as a child element of the envelope, and the semantics for the body are defined in the associated SOAP schema.

The body contains mandatory information intended for the ultimate receiver of the message. For example:

```
<?xml version="1.0"?>
<SOAP-ENV:Envelope
.....
<SOAP-ENV:Body>
  <m:GetQuotation xmlns:m="http://www.tp.com/Quotation">
    <m:Item>Computers</m:Item>
  </m:GetQuotation>
```

```
</SOAP-ENV:Body>
```

```
</SOAP-ENV:Envelope>
```

The example above requests the quotation of computer sets. Note that the `m:GetQuotation` and the `Item` elements above are application-specific elements. They are not a part of the SOAP standard.

Here is the response of above query:

```
<?xml version="1.0"?>
```

```
<SOAP-ENV:Envelope
```

```
.....
```

```
<SOAP-ENV:Body>
```

```
  <m:GetQuotationResponse xmlns:m="http://www.tp.com/Quotation">
```

```
    <m:Quotation>This is Qutation</m:Quotation>
```

```
  </m:GetQuotationResponse>
```

```
</SOAP-ENV:Body>
```

```
</SOAP-ENV:Envelope>
```

### SOAP RPC

Remote procedure calls in SOAP are essentially client-server interactions over HTTP where the request and response comply with SOAP encoding rules.

SOAP RPC handles all the encoding and decoding, even for very complex data types, and binds to the remote object automatically.

SOAP RPC encoding is easiest for the software developer; however, all that ease comes with a scalability and performance penalty.

What is RPC ?

- RPC is a powerful technique for constructing distributed, client-server based
- applications.
- It is based on extending the notion of conventional, or local procedure calling, so
- that the called procedure need not exist in the same address space as the calling
- procedure.
- The two processes may be on the same system, or they may be on different
- systems with a network connecting them.
- By using RPC, programmers of distributed applications avoid the details of the
- interface with the network.
- The transport independence of RPC isolates the application from the physical and
- logical elements of the data communications mechanism and allows the
- application to use a variety of transports.
- RPC makes the client/server model of computing more powerful and easier to

- program. When combined with the ONC RPCGEN protocol compiler clients
- transparently make remote calls through a local procedure interface.

### How RPC Works

An RPC is analogous to a function call. Like a function call, when an RPC is made, the calling arguments are passed to the remote procedure and the caller waits for

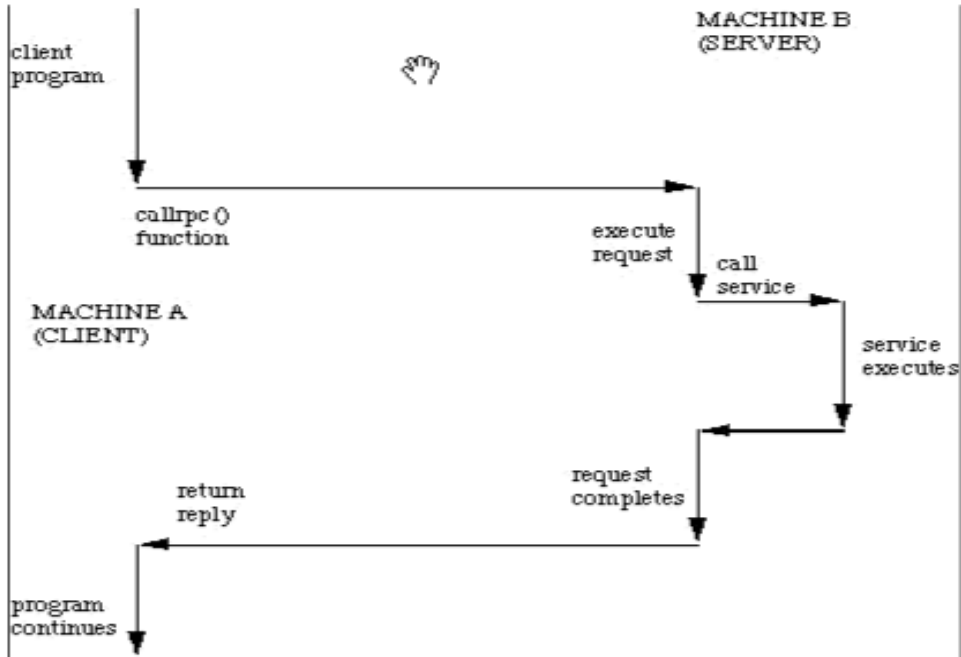
a response to be returned from the remote procedure. Figure 2 shows the flow of activity

that takes place during an RPC call between two networked systems. The client makes a

procedure call that sends a request to the server and waits. The thread is blocked from

processing until either a reply is received, or it times out. When the request arrives, the

server calls a dispatch routine that performs the requested service, and sends the reply to the client. After the RPC call is completed, the client program continues. RPC specifically supports network applications.



There are some problems with this method:

- The command may be slow to execute.
- You require an login account on the remote machine.
- The RPC alternative is to
  - establish an server on the remote machine that can repond to queries.
  - Retrieve information by calling a query which will be quicker than previous approach.
- To develop an RPC application the following steps are needed:
  - Specify the protocol for client server communication
  - Develop the client program
  - Develop the server program

The programs will be compiled separately. The communication protocol is achieved by

generated stubs and these stubs and RPC (and other libraries) will need to be linked in.

### SOAP RPC AND ENCODING

SOAP RPC Presentation defines the following rules to resolve the issues listed

above:

1. The target system should be mapped as the target SOAP node, which should be represented by a URI.
2. The nature of the procedure should be reviewed to see if it can be carried out by other simpler SOAP extensions like SOAP Web Method Feature. See other sections of this book for detail information on other SOAP extensions.
3. The procedure name should be reviewed. If the nature of the procedure is a request for information retrieval, and the procedure name contains resource identifications that are needed to retrieve information, the target SOAP node URI should be extended to include the resource identification parts of the procedure name.
4. Input parameters of the procedure should also be reviewed. If the nature of the procedure is a request for information retrieval, and some input parameters represent resource identifications that are needed to retrieve information, the target SOAP node URI should be extended to include those input parameters.



5. If the nature of the procedure is a request for information retrieval, and the procedure

name and input parameters can be entirely represented in the target SOAP node URI, this

RPC invocation should be carried as a Web method defined in the SOAP Web Method

Feature specification.

6. If a RPC cannot be carried out as a Web method, it should be invoked by as SOAP

message with a SOAP body element. The body element should use SOAP encoding and

contains a single "struct" node representing the procedure name. All input parameters

should be represented as outbound edges originated from this node.

7. The target SOAP node should always return a SOAP message with a SOAP body

element. The body element should use SOAP encoding and contains a single "struct"

node with any label. This node should have on outbound edge labeled as "result"

representing the RPC return value.

8. If there are any output parameters, they should be represented as outbound edges

originated from the node described in rule #7.

9. SOAP header blocks are optional in RPC invocation and response SOAP messages.

**RPC/LITERAL**

The RPC/literal WSDL for this method looks almost the same as the RPC/encoded

WSDL .The use in the binding is changed from *encoded* to *literal*. That's it.

RPC/literal WSDL for myMethod

```
<message name="myMethodRequest">
  <part name="x" type="xsd:int"/>
  <part name="y" type="xsd:float"/>
</message>
<message name="empty"/>
<portType name="PT">
  <operation name="myMethod">
    <input message="myMethodRequest"/>
    <output message="empty"/>
  </operation>
</portType>
<binding .../>
<!-- I won't bother with the details, just assume it's RPC/literal. -->
```

RPC/literal SOAP message for myMethod <soap:envelope>

```
<soap:body>
  <myMethod>
    <x>5</x>
    <y>5.0</y>
  </myMethod>
</soap:body>
</soap:envelope>
```

SOAP DOCUMENT/LITERAL

---

The WSDL for document/literal changes somewhat from the WSDL for RPC/literal. The differences are highlighted in bold in Listing 6.

Document/literal WSDL for myMethod <types>

```
<schema>
<element name="xElement" type="xsd:int"/>
<element name="yElement" type="xsd:float"/>
</schema>
</types>
<message name="myMethodRequest">
<part name="x" element="xElement"/>
<part name="y" element="yElement"/>
</message>
<message name="empty"/>
<portType name="PT">
<operation name="myMethod">
<input message="myMethodRequest"/>
<output message="empty"/>
</operation>
</portType>
<binding .../>
<!-- I won't bother with the details, just assume it's document/literal. --
> Document/literal SOAP message for myMethod <soap:envelope>

<soap:body>
<xElement>5</xElement>
<yElement>5.0</yElement>
```

</soap:body>

</soap:envelope>

### REST ARCHITECTURE

Representational State Transfer (REST) is a new architecture for web services that is having a significant impact on the industry. Most of the new public web services

from large vendors (Google, Yahoo, Amazon, Microsoft) rely on REST as the technology

for sharing and merging information from multiple sources.

REST is not an official standard, but rather an architectural style of networked systems consisting of clients and servers. Clients initiate requests to servers; servers

process requests and return appropriate responses. Requests and responses are built

around the transfer of "representations" of "resources". A resource can be essentially any

coherent and meaningful concept that is addressed. A representation of a resource is

typically a document that captures the current or intended state of a resource.

REST uses standard HTTP it is much simpler in just about every way.

Creating clients, developing APIs, the documentation is much easier to understand.

REST permits many different data formats where as SOAP only permits XML. REST is particularly useful for restricted-profile devices such as

mobile and PDAs. REST'S decoupled architecture, and lighter weight communications between producer and consumer, make REST a popular building style for cloud-based APIs, such as those provided by Amazon, Microsoft, and Google. When Web services use REST architecture, they are called RESTful APIs (Application Programming Interfaces) or REST APIs.

REST architecture involves reading a designated Web page that contains an XML file. The XML file describes and includes the desired content. Once dynamically defined, consumers may access the interface. Every resource is uniquely addressable using a uniform and minimal set of commands (typically using HTTP commands of GET, POST, PUT, or DELETE over the Internet)

REST is often used in mobile applications, social networking Web sites, mashup tools, and automated business processes.

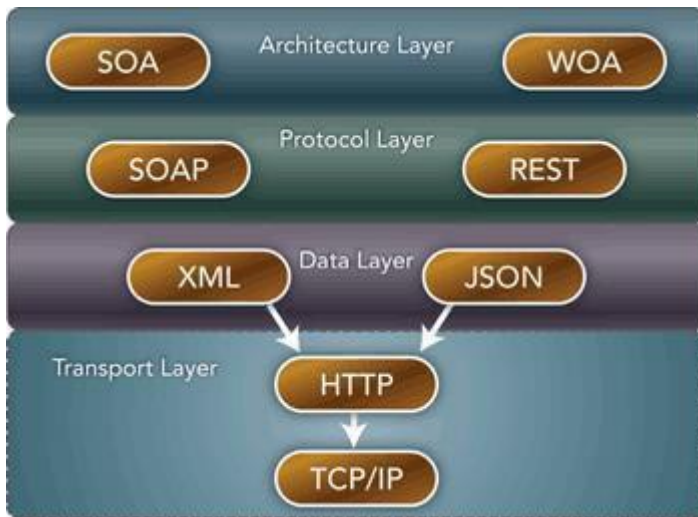
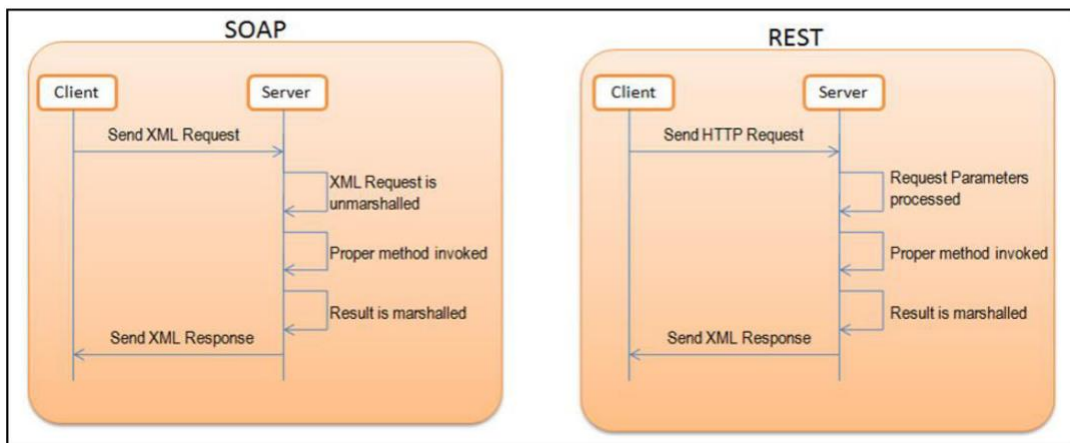


Figure . REST Architecture

- Advantages:
- Fast
- No expensive tools require to interact with the Web service.

- Efficient (SOAP uses XML for all messages, REST can use smaller message formats).
- Scalability to support large numbers of components and interactions among components
- Reliability is the resistance to failure at the system level in the presence of failures within components, connectors, or data<sup>l</sup>
- REST uses a smaller message format than SOAP.
- 



### Features

Every system uses resources. These resources can be pictures, video files, Web pages, business information, or anything that can be represented in a computer-based system. The purpose of a service is to provide a window to

its clients so that they can access these resources. Service architects and developers want this service to be easy to implement, maintainable, extensible, and scalable.

- Representations
- Messages
- URIs
- Uniform interface
- Stateless
- Links between resources
- Caching

### Representations

The focus of a RESTful service is on resources and how to provide access to these resources. A resource can consist of other resources. While designing a system, the first thing to do is identify the resources and determine how they are related to each other. This is similar to the first step of designing a database: Identify entities and relations.

### Messages

The client and service talk to each other via messages. Clients send a request to the server, and the server replies with a response. Apart from the actual data, these messages also contain some metadata about the message.

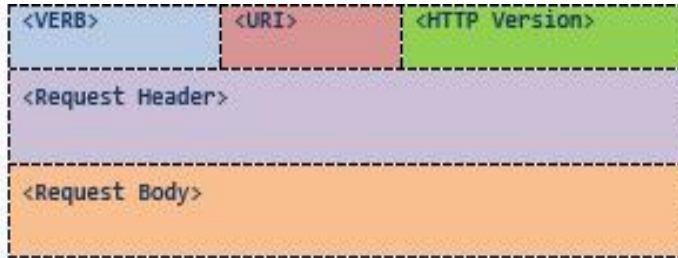


Figure 1: HTTP request format.

<VERB> is one of the HTTP methods like GET, PUT, POST, DELETE, OPTIONS, etc

<URI> is the URI of the resource on which the operation is going to be performed

<HTTP Version> is the version of HTTP, generally "HTTP v1.1" .

### *URI*

REST requires each resource to have at least one URI. A RESTful service uses a directory hierarchy like human readable URIs to address its resources. The job of a URI is to identify a resource or a collection of resources.

### Uniform Interface

RESTful systems should have a uniform interface. HTTP 1.1 provides a set of methods, called verbs, for this purpose. Among these the more important verbs are:



Method	Operation performed on server	Quality
GET	Read a resource.	Safe
PUT	Insert a new resource or update if the resource already exists.	Idempotent
POST	Insert a new resource. Also can be used to update an existing resource.	N/A
DELETE	Delete a resource .	Idempotent
OPTIONS	List the allowed operations on a resource.	Safe
HEAD	Return only the response headers and no response body.	Safe

### Statelessness

A RESTful service is stateless and does not maintain the application state for any client. A request cannot be dependent on a past request and a service treats each request independently. HTTP is a stateless protocol by design and you need to do something extra to implement a stateful service using HTTP.

### Links Between Resources

A resource representation can contain links to other resources like an HTML page contains links to other pages. The representations returned by the service should drive the process flow as in case of a website. When you visit any website, you are presented with an index page. You click one of the links and move to another page and so on.

### Caching

Caching is the concept of storing the generated results and using the stored results instead of generating them repeatedly if the same request arrives in the near future. This can be done on the client, the server, or on any other component between them, such as a proxy server. Caching is a great way of enhancing the service performance, but if not managed properly, it can result in client being served stale results.

Caching can be controlled using these HTTP headers:

Header	Application
Date	Date and time when this representation was generated.
Last Modified	Date and time when the server last modified this representation.
Cache-Control	The HTTP 1.1 header used to control caching.
Expires	Expiration date and time for this representation. To support HTTP 1.0 clients.
Age	Duration passed in seconds since this was fetched from the server. Can be inserted by an intermediary component.

### WEB SERVICES DESCRIPTION LANGUAGE (WSDL)

#### Introduction

---

The WSDL describes services as collections of network endpoints, or ports. The

WSDL specification provides an XML FORMAT for documents for this purpose. The

abstract definitions of ports and messages are separated from their concrete use or

instance, allowing the reuse of these definitions.

A port is defined by associating a network address with a reusable binding, and a

collection of ports defines a service.

WSDL is often used in combination with SOAP and an XML Schema to provide

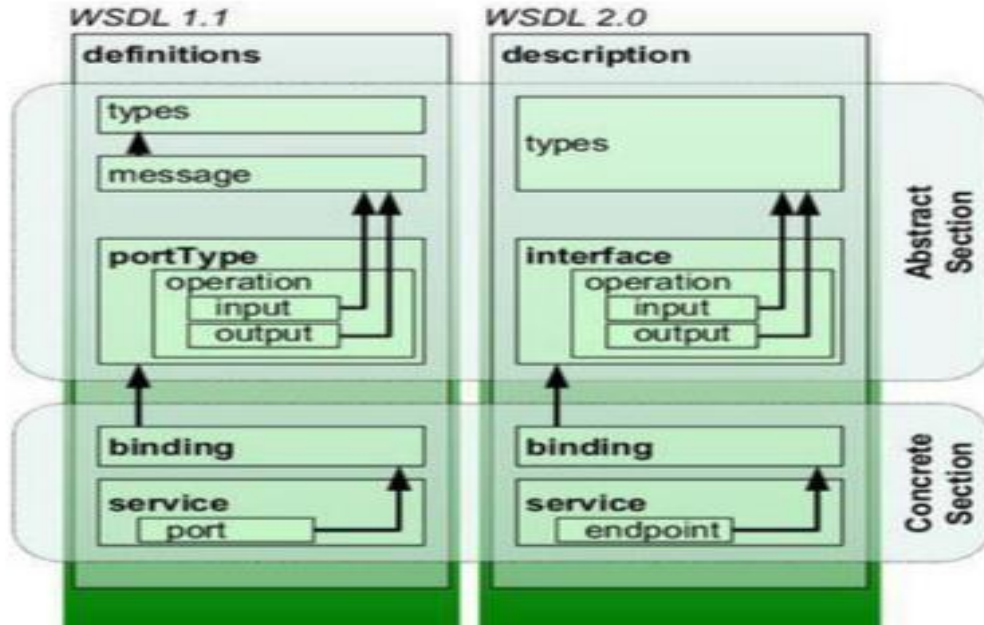
Web services over Internet. A client program connecting to a Web service can read the

WSDL file to determine what operations are available on the server. Any special data

types used are embedded in the WSDL file in the form of XML Schema.

The client can then use SOAP to actually call one of the operations listed in the

WSDL file using XML or HTTP.



A WSDL document is an XML document that adheres to the WSDL XML schema.

The <definitions> element MUST be the root element of all WSDL documents. It

defines the name of the web service, declares multiple namespaces used throughout the

remainder of the document, and contains all the *service* elements described here.

1. The <types> element describes all the data types used between the client and

server. WSDL is not tied exclusively to a specific typing system, but it uses the

W3C XML Schema specification as its default choice. If the service uses only

XML Schema built-in simple types, such as strings and integers, the types element is not required.

2. The <message> element describes a one-way message, whether it is a single

message request or a single message response. It defines the name of the message

and contains zero or more message <part> elements, which can refer to message

parameters or message return values.

3. The <portType> element combines multiple message elements to form a complete one-way or round-trip operation. For example, a portType can combine

one request and one response message into a single request/response operation,

most commonly used in SOAP services. Note that a portType can (and frequently

does) define multiple operations.

4. The <binding> element describes the concrete specifics of how the service will

be implemented on the wire. WSDL includes built-in extensions for defining SOAP services, and SOAP-specific information therefore goes here.

5. The <service> element defines the address for invoking the specified service.

Most commonly, this includes a URL for invoking the SOAP service.

In addition to the six major elements, the WSDL specification also defines the

following utility elements:

The <documentation> element is used to provide human-readable documentation

and can be included inside any other WSDL element.

The <import> element is used to import other WSDL documents or XML Schemas. This

enables more modular WSDL documents. For example, two WSDL documents can

import the same basic elements and yet include their own service elements to make the

same service available at two physical addresses. Note, however, that not all WSDL tools

support the import functionality as of yet.

### Bindings

A binding defines message format and protocol details for operations and messages defined by a particular portType. There may be any number of bindings for a

given portType. The grammar for a binding is as follows:

```
<wsdl:definitions .... >
```

```
<wsdl:binding name="nmtoken" type="qname"> *
```

```
<!-- extensibility element (1) --> * <wsdl:operation
```

```
name="nmtoken"> * <!-- extensibility element (2)
```

```
--> *
```

```
<wsdl:input name="nmtoken"? > ?
```

```
<-- extensibility element (3) -->
</wsdl:input>
<wsdl:output name="nmtoken"? > ?
<-- extensibility element (4) --> *
</wsdl:output>
<wsdl:fault name="nmtoken"> *
<-- extensibility element (5) --> *
</wsdl:fault>
</wsdl:operation>
</wsdl:binding>
</wsdl:definitions>
```

The name attribute provides a unique name among all bindings defined within in the enclosing WSDL document.

A binding references the portType that it binds using the type attribute. This QName value follows the linking rules defined by WSDL . Ports

A port defines an individual endpoint by specifying a single address for a binding.

```
<wsdl:definitions .... >
<wsdl:service .... > *
<wsdl:port name="nmtoken" binding="qname">
* <-- extensibility element (1) --> </wsdl:port>

</wsdl:service>
```

</wsdl:definitions>

The name attribute provides a unique name among all ports defined within in the

enclosing WSDL document.

The binding attribute (of type QName) refers to the binding using the linking rules defined by WSDL Binding extensibility elements (1) are used to specify the address

information for the port.

A port **MUST NOT** specify more than one address.

A port **MUST NOT** specify any binding information other than address information.

### Services

A service groups a set of related ports together:

```
<wsdl:definitions .... >
```

```
<wsdl:service name="nmtoken"> *
```

```
<wsdl:port .... />*
```

```
</wsdl:service>
```

```
</wsdl:definitions>
```

If a service has several ports that share a port type, but employ different bindings

or addresses, the ports are alternatives.



### UNIVERSAL DESCRIPTION DISCOVERY AND INTEGRATION (UDDI)

UDDI is an industry effort started in the September of 2000 by Ariba, IBM, Microsoft, and 33 other companies. Today, UDDI has over 200 community members.

UDDI defines a way to publish and discover information about web services.  
A

UDDI registry cloud or business registry provides "register once, publish everywhere"  
access to information about web services.

UDDI is like a registry rather than like a repository. A registry contains only reference information. For example, the Windows registry contains the name of COM

objects not the entire code (Components). When we invoke a COM object, the system

finds the registry entries and then it redirects execution to the actual binary part for that

COM object. UDDI works the same way. On the other hand repository contains the

actual information itself. For example, a library is a repository of books/information.

A UDDI business registration consists of three components:

- White Pages— address, contact, and known identifiers;
- Yellow Pages— industrial categorizations based on standard taxonomies;

- Green Pages— technical information about services exposed by the business.

### White Pages

White pages give information about the business supplying the service. This includes the name of the business and a description of the business - potentially in multiple languages. Using this information, it is possible to find a service about which some information is already known (for example, locating a service based on the provider's name).

Contact information for the business is also provided - for example the businesses address and phone number; and other information such as the Dun & Bradstreet Universal Numbering System number.

### Yellow Pages

Yellow pages provide a classification of the service or business, based on standard taxonomies. These include the Standard Industrial Classification (SIC), the North American Industry Classification System (NAICS), or the United Nations Standard Products and Services Code (UNSPSC) .

Because a single business may provide a number of services, there may be

several Yellow Pages (each describing a service) associated with one White Page (giving general information about the business).

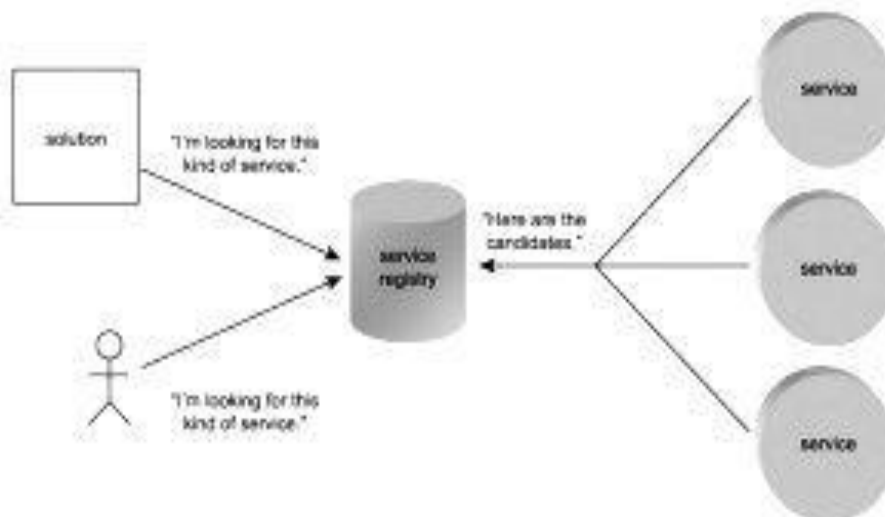
### Green Pages

Green pages are used to describe how to access a Web Service, with information on the service bindings. Some of the information is related to the Web

Service - such as the address of the service and the parameters, and references to

specifications of interfaces[1]. Other information is not related directly to the Web

Service - this includes e-mail, FTP, CORBA and telephone details for the service.



The information provided in a UDDI business registration consists of three components:

white pages of company contact information, yellow pages that categorize businesses by

standard taxonomies, and green pages that document the technical information about services

that are exposed. Figure above demonstrates this concept. A business's white pages may include

basic business information, such as a description of the business in different languages, points of

contact with email addresses and phone numbers, and links to external documents that describe

the business in more detail. The yellow pages describe taxonomies of what kinds of information

the services provide. Finally, the green pages show information on how to do business with the

Web service, listing business rules and specifying how to invoke Web services (the WSDL).

### UDDI Features

- **UDDI is similar to the concepts of DNS and yellow pages**
- **In short, UDDI provides an approach to:**
- **Locate a service**
- **Invoke a service**
- **Manage metadata about a service**
- **UDDI specifies:**
- **Protocols for accessing a *registry* for Web services**
- **Methods for controlling access to the *registry***
- **Mechanism for distributing or delegating records to other *registries***

### UDDI at a Glance

The UDDI is a registry and a protocol for publishing and discovering Web services. As Web services are a standards-based, open, and platform-independent means

of accessing the functional capabilities of other companies, UDDI is the associated

standards-based, open, and platform-independent means of publishing and locating these services.

- **By adopting UDDI, it turns out that convenience for developers,** requirements of

enterprise architects, and underlying business policies are not in opposition

- **UDDI facilitates Web services** software development by providing systematic,

interoperable, standards-based:

- **Management of the development process of web services**

- **Approach for documenting and publishing web services**

- **Organizations and managing of web services across multiple systems and** development teams

- **Documenting interface specification through teams and through time and** for external applications above all in case of change

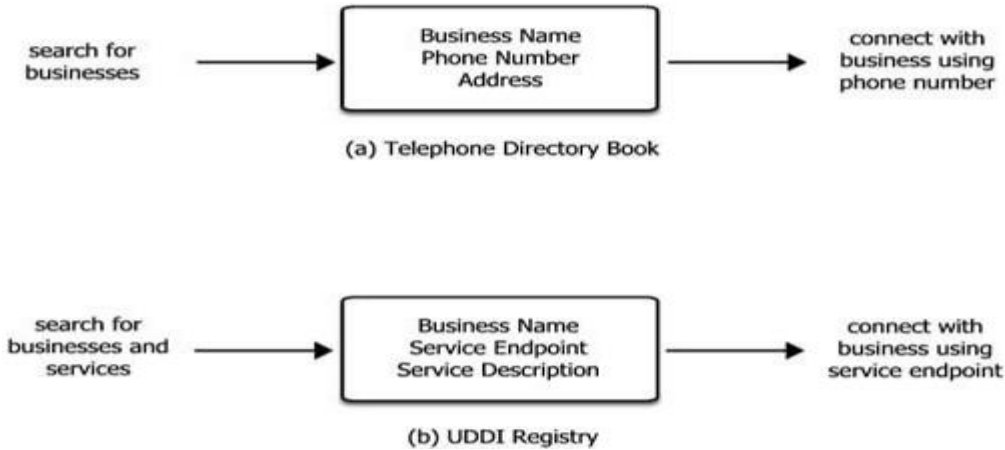
- **UDDI help drive better code reuse and developer productivity (can help** developers - across groups - find a shared service and use that service within their

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Analogies with Telephone Directories

Figure. Similarities between (a) telephone directory books and (b) UDDI registries.



UDDI shares some striking similarities with telephone directories (e.g., yellow

pages). As such, the analogy is an effective vehicle for describing the capabilities

and usefulness of UDDI.

A phone book allows people to search for other people and businesses, get their

contact information, and then directly contact the person or business. Phone books allow

various modes of searching, whether it be an alphabetical listing of people or business names (as in the white pages) or through categories of businesses.

Anyone can view the listings of a phone directory; in fact, the more people who

view and use the phone book, the more valuable it is. However, only the phone company

or its authorized agent publishes the phone book. When adding or updating entries, the

requester must validate his or her identity and provide evidence that he or she has the

right to add or change the information.

The importance of phone books grows as the need to locate more people and businesses increases. When there are just a handful of people and businesses and few

new additions, phone books are not as important. It is easy to keep track of contact

information, or gather the information when necessary. However, as the base of people

and businesses becomes large and there are continuous changes -both in people and

businesses being added or removed from the listings or their contact information change

-phone books become critical. They provide a centralized source for contact information.

UDDI is quite similar. Instead of a directory of telephone directory of Web services that are available from different means of adding new services, removing existing services, and changing the contact (i.e., endpoint) information for services.

### The UDDI Business Registry

The UDDI Business Registry (UBR) is a global implementation of the UDDI

specification. The UBR is a single registry for Web services.

A group of companies operate and host UBR nodes, each of which is an identical

copy of all other nodes. New entries or updates are entered into a single node, but are

propagated to all other nodes.



The UBR is a key element of the deployment of Web services and provides the following capabilities:

- A centralized registration facility at which to publish and make others aware of Web services a company makes available.
- A centralized search facility at which companies that require a particular service can locate businesses that provide that service as well as relevant information about that service.

A small group of companies operate and manage a set of UBR nodes. In July 2002,

the UBR was updated to support version 2 of the UDDI specification.

Initially, IBM,

Microsoft, and SAP comprised the UBR V2, operating 3 UBR nodes. NTT Communications later launched an UBR node to become the fourth UBR V2 node. More

than 10,000 businesses are registered with the initial three UBR nodes, publishing over

7,000 Web services. NTT expects to add another 1,000 businesses within the first

operational year of the fourth UBR node.

Each UBR node provides a Web home page for human-friendly navigation of

the registry as well as information about the use of the registry. Today, most searches for

available Web services are done through human-friendly means: phone conversations

between existing business partners, the home pages of the UBR, Web service aggregator

portals such as [www.xmethods.com](http://www.xmethods.com), or standard Web search engines such as Google.

UBR node home pages also provide other information pertaining to UDDI or to that

particular UBR node. This information includes policies on data replication, publishing

restrictions, and other administrative or usage issues.

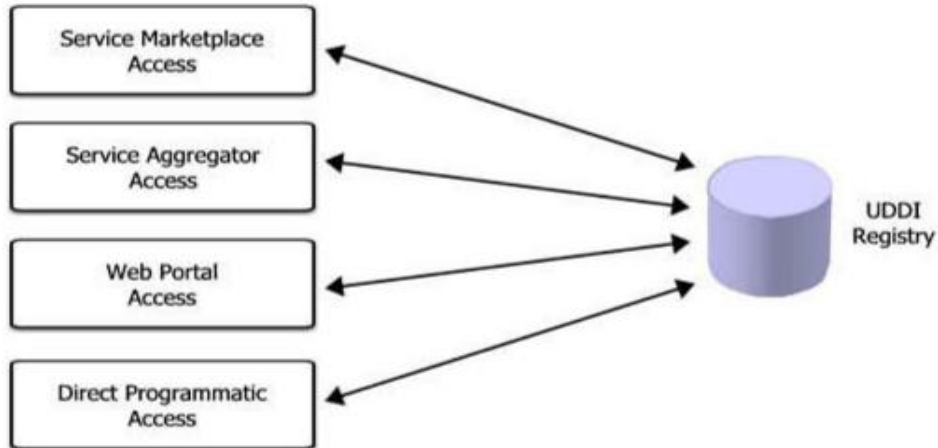
UBR nodes also implement a simple API for direct electronic (computer-to-computer)

access to the contents of the registry. The two most important and relevant features of the APIs are inquiry and publication.

The inquiry API allows searching through the registry for information about businesses, the Web services the business makes available, as well as implementation and interface information for each service.

The publication API allows adding, changing, and deleting business and service information within the registry.

Figure .The various means of accessing an UDDI registry.



The URL access endpoint information of the home page, inquiry API, and publication API of each UBR node is different, and the information for each of the UBR

V2 nodes is listed table1 .The publication API endpoint requires authentication and uses

the HTTPS protocol, while the inquiry API and home page use standard HTTP.

The UBR operators also provide fully functional test environment where companies can develop and test their offerings without affecting other users. Some of these test nodes do not support version 2 of the UDDI specification as yet.

### UDDI under the Covers

### The UDDI Specification

Version 3 is the most recent incarnation of the UDDI specification. Version 3 builds on and expands the foundations laid by versions 1 and 2 of the UDDI

specification, and presents a blueprint for flexible and interoperable Web services

registries. Version 3 also includes a rich set of enhancements as well as additional

features, including improved security and new APIs.

The major documents of the UDDI Version 3 specification are listed in Table -3.

Unlike in previous versions, UDDI Version 3 consolidates the entire specification into

a single document entitled the UDDI Version 3 Published Specification.

This single document contains everything related to UDDI, and also contains all

information necessary for developing a UDDI node, the Web services that are called by a

UDDI node, or a client application that directly interacts with a UDDI registry.

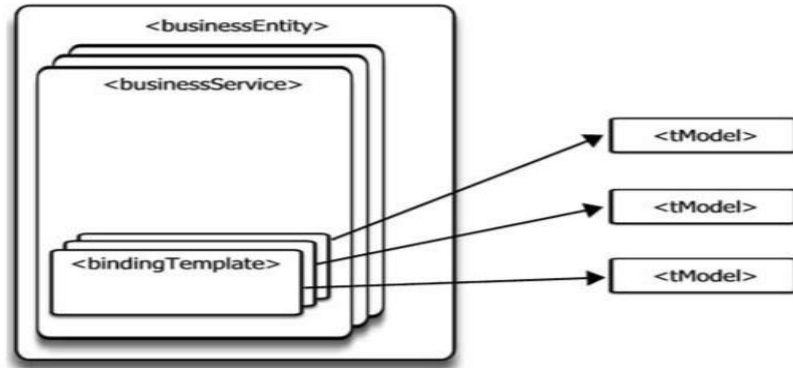
### UDDI Core Data Structures

Information representation within UDDI consists of instances of persistent data

structures that are expressed in XML. It is these data structures that are persistently stored

and managed by UDDI nodes.

Figure .depicts the interrelationships between the core UDDI *data structures*.



The `businessEntity` entity type represents information about service providers

within UDDI. This information includes detailed data about the name of the provider,

contact information, and some other short descriptions of the provider. This information

may also be provided in multiple languages. The `businessEntity` structure does

not necessarily have to refer to a business, but to any type of service provider, such as a department within an organization or a group.

One or more of the `businessService` entity types are contained within a `businessEntity` structure and represents information about the services offered by

that `businessEntity`. The `businessService` entity type does not provide implementation or

technical details, but instead is a logical grouping of Web services and provides

information about the bundled purpose of a set of contained Web services.

### Accessing UDDI

UDDI is itself a Web service and as such, applications can communicate with an

UDDI registry by sending and receiving XML messages. This makes the access both

language and platform independent.

Although it's possible, it is unlikely that programmers will deal with the low-level

details of sending and receiving XML messages. Instead, client-side packages for

different languages and platforms will emerge that facilitate programmatic access to

UDDI.

```
// Create a new UDDIProxy object to
connect to a registry UDDIProxy proxy
= new UDDIProxy ();

// Set the inquiry and publish URLs
proxy.setInquireURL (INQUIRE_URL);
proxy.setPublishURL (PUBLISH_URL);
```

Once we've created the proxy object and set its inquire and publish URLs to the

desired UDDI registry locations, we can use the methods that are defined for the UDDIProxy object to access and set various elements within the registry.

Usually,

programmers will use the `find_business`, `find_service`, and `find_tModel` methods to locate

service providers, services, and tModels, respectively, based on search criteria, such

as name and categories.

The UBR is a powerful resource that brings together thousands of providers and

services in one easy-to-access location. Sifting through this large (and constantly

growing) list to weed out useful providers and services from those that are less than

useful (or completely useless) is the difficult part. Although client-side packages such as

UDDI4J make developing programs to access and interact with UDDI registries easier,

the more important difficulty still remains: how to select the right service and service

provider for a given task.

### How UDDI is Playing Out Conversation Overview

Now that we have an understanding of the need that UDDI aims to fill, some of

the core data structures of UDDI, as well as the variety of the means of communicating

with an UDDI registry, it's worth taking a step back to see how UDDI is really playing

out. How UDDI will truly be used by companies will determine how, when, where, and

why businesses will register their Web services.

Up until now our discussion of UDDI has focused on its analogous behavior with

standard telephone directory books: UDDI provides a listing of businesses and the

services each business offers as well as a means of searching and discovering Web

services to use within consuming applications. Since this usage of UDDI is during the

design of applications, it can be referred to as the design-time use.

But, will people really use the UDDI APIs during design time? Are people using

it today? The answer is not really, and it does not look like it'll change any time in the

foreseeable future. Most developers don't programmatically search UDDI for Web

services to consume .

Will this change in the future? Most likely not, because selecting which service to

consume is difficult. It's not technical issues, but instead business and strategic issues that



make the selection process difficult.

In selecting a Web service to use, there may exist business relationships and legal agreements that have to be honored. This may sometimes involve selecting a technically inferior service in order to meet such obligations. There may be pending customer deals that can be closed by using a particular vendor's Web services. A company may attempt to pressure another company by withholding patronage of the latter company's Web services.

Basically business, strategic, and sometimes political issues come into the service selection process. Replacing human intervention through a programmatic API is usually insufficient, and oftentimes grossly so. Because of the wide mix of issues that are often involved, technologists alone will also be insufficient. Accordingly, business analysts, consultants, and other such people (possibly in conjunction with technologists) will usually be responsible for the Web services selection process. These business analysts and consultants will not use the direct programmatic interface of UDDI to search

for available services, but instead will use more human-friendly means. These include

Web services portals, the home pages provided by some of the UBR node operators, and

standard search engines. Of course, word-of-mouth and other such non-technical means

will also be prevalent . So, for all intents and purposes, UDDI's programmatic API will

probably play a minor role during the design of applications.

### Accessing a Web Service through an ASP.Net Application

Web services signal a new age of trivial distributed application development.

While Web services are not intended nor do they have the power to solve every distributed application problem, they are an easy way to create and consume services over the Internet. One of the design goals for Web Services is to allow companies and developers to share services with other

companies in a simple way over the Internet.

Web services take Web applications to the next level.

Using Web services, your application can publish its function or message to the rest of the world.

Web services use XML to code and decode your data and SOAP to transport it using open protocols.

With Web services, your accounting departments Win 2K servers' billing system can connect with your IT suppliers UNIX server.

Using Web services, you can exchange data between different applications and different platforms.

With Microsoft .NET platform, it is a simple task to create and consume Web Services.

### Simple Steps to Consume a Web Service

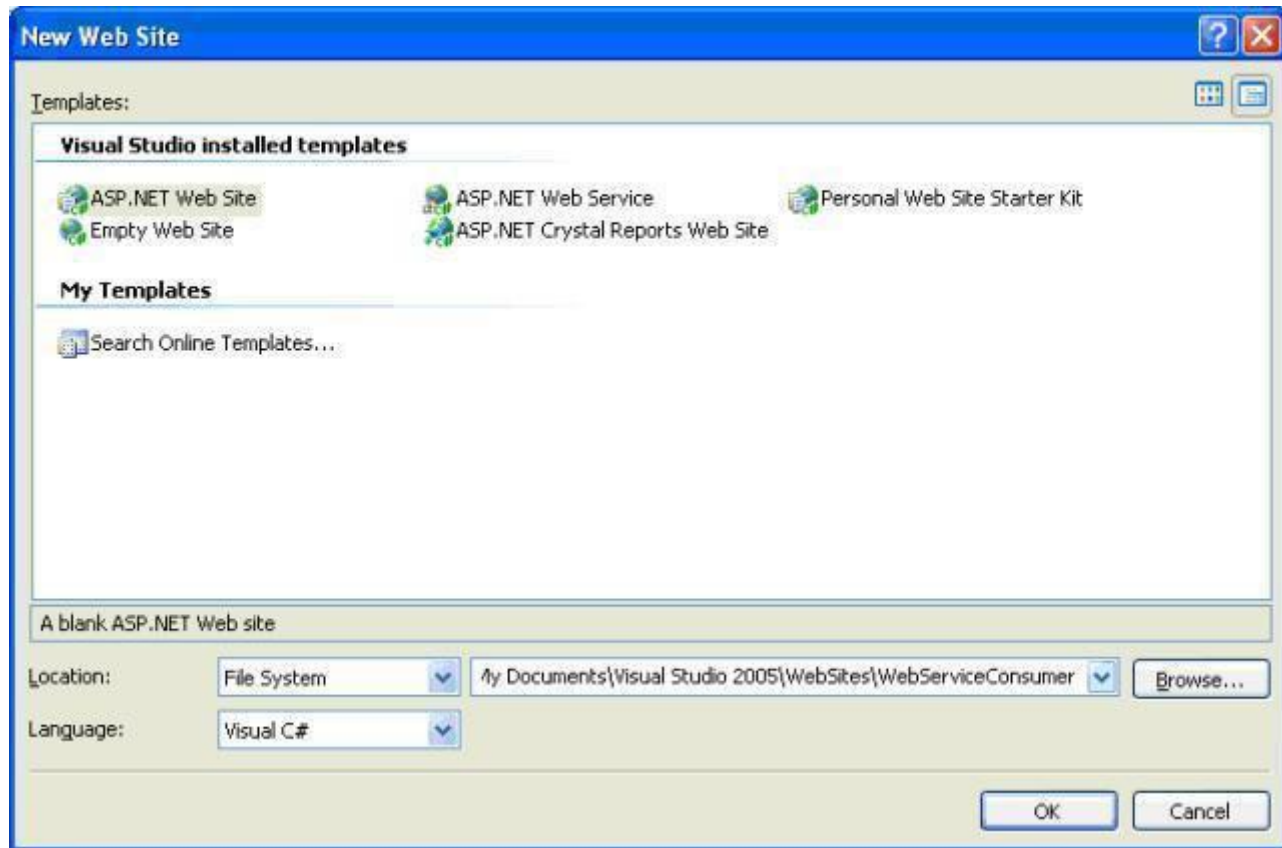
1. Create a Web Site project
2. Add a Web Reference
3. Call the Web services APIs inside the code

#### First Step: Create a Web Site Project

1. To create a new Web Site project, choose New from File menu, then choose Web Site as shown below:



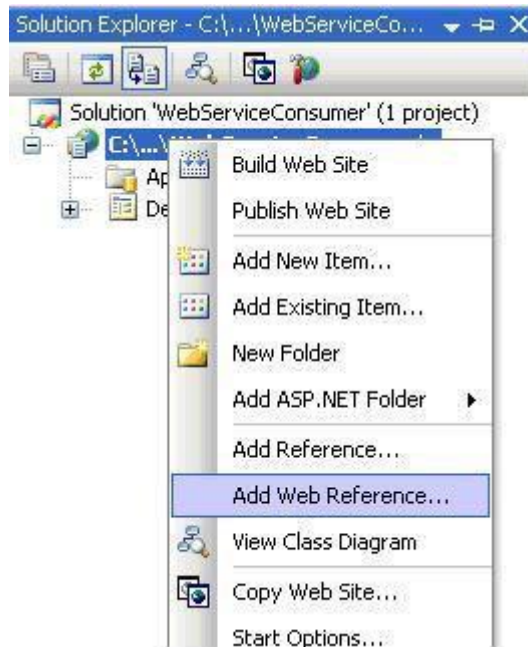
2. Choose ASP.NET Web Site. Name the project and click OK:



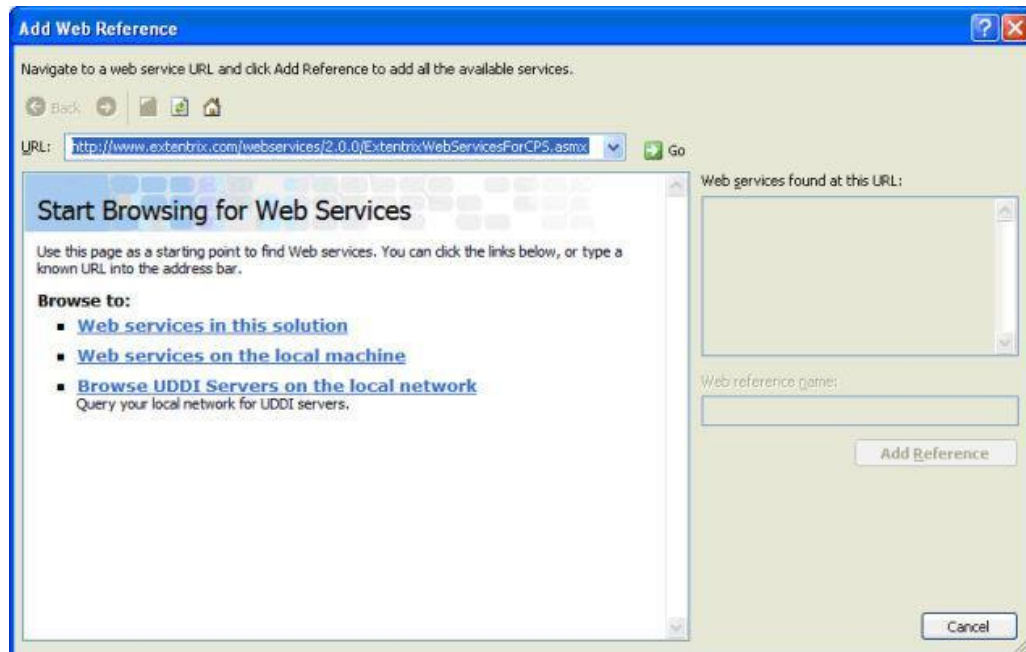
Second Step: Add a Web Reference

After creating the Web Site project, it's time to add a Web reference for our Web service.

1. In the solution explorer, right click the project node, choose Add Web Reference:



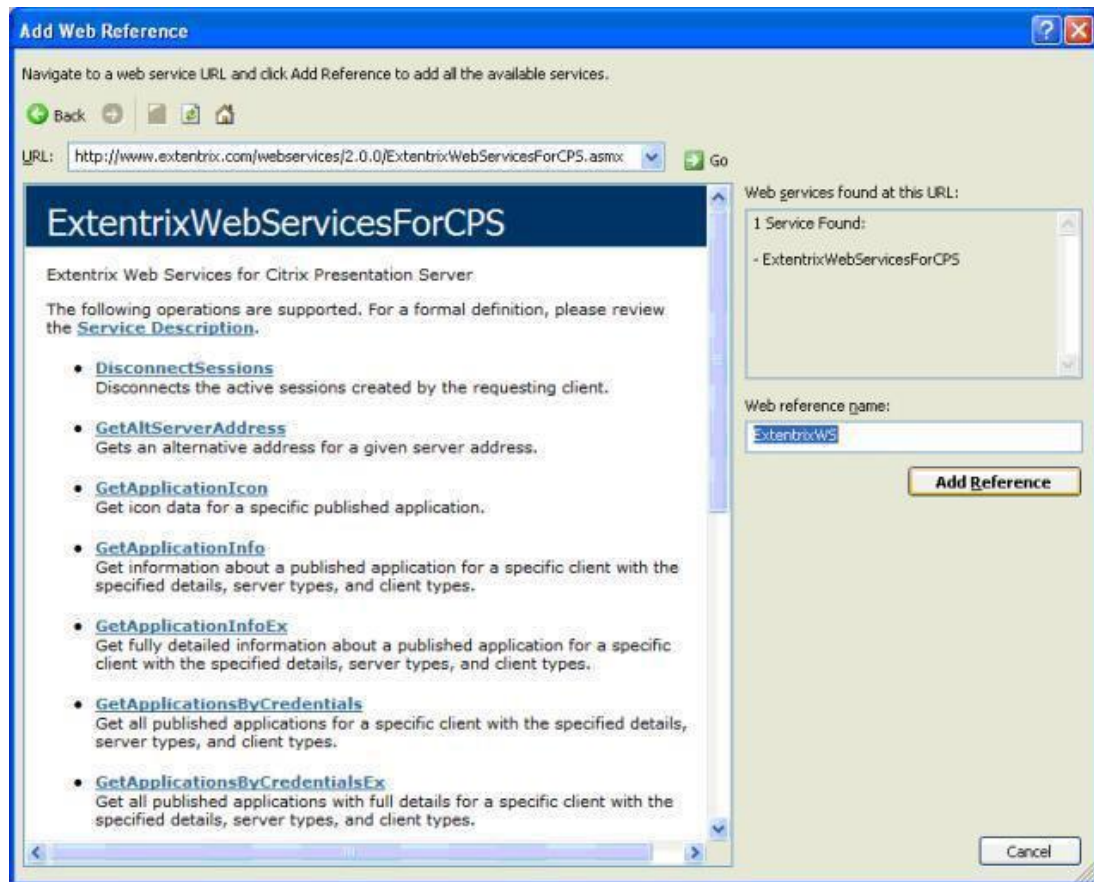
2. A new window with Add Web Reference title will be opened:



In the URL field, insert the URL for the Web service. In this tutorial, as I mentioned before, I'll use the test published Web services from Extentrix: “[Extentrix Web\\_Services 2.0 – Application Edition](http://www.extentrix.com/webservices/2.0.0/ExtentrixWebServicesForCPS.aspx)”.

After clicking the Go button, you will see the Web services APIs.

3. Set a name for your Web service reference in the Web reference name field and click Add Reference:



Third Step: Call the Web Services APIs Inside the Code

After successfully adding to the Web service, now we are ready to call the Web services APIs inside our project.

### REST architecture

REST uses standard HTTP it is much simpler in just about every way. Creating clients, developing APIs, the documentation is much easier to understand.

REST permits many different data formats where as SOAP only permits XML. REST is particularly useful for restricted-profile devices such as mobile and PDAs. REST'S decoupled architecture, and lighter weight communications between producer and consumer, make REST a popular building style for cloud-based APIs, such as those provided by Amazon, Microsoft, and Google. When Web services use REST architecture, they are called RESTful APIs (Application Programming Interfaces) or REST APIs.

REST architecture involves reading a designated Web page that contains an XML file. The XML file describes and includes the desired content. Once dynamically defined, consumers may access the interface. Every resource is uniquely addressable using a uniform and minimal set of commands (typically using HTTP commands of GET, POST, PUT, or DELETE over the Internet)

REST is often used in mobile applications, social networking Web sites, mashup tools, and automated business processes. Advantages:

Fast

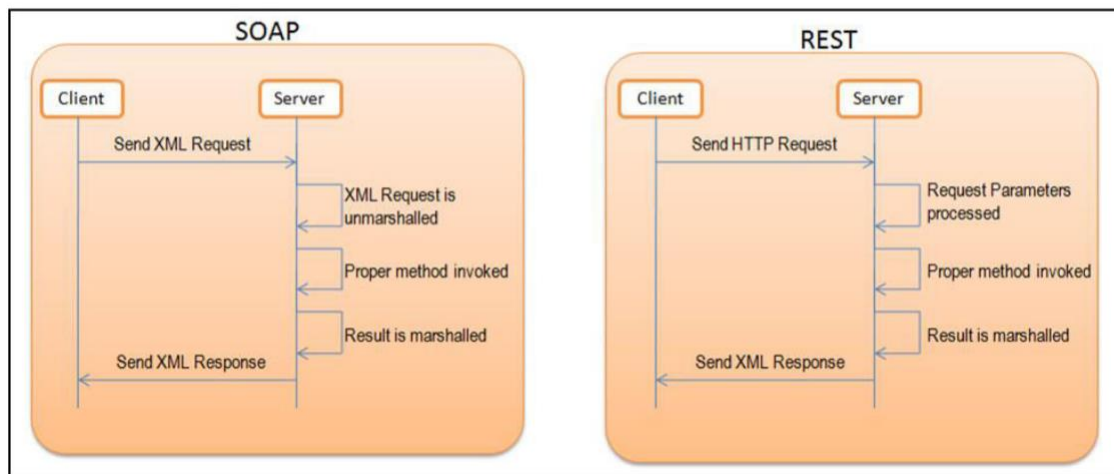
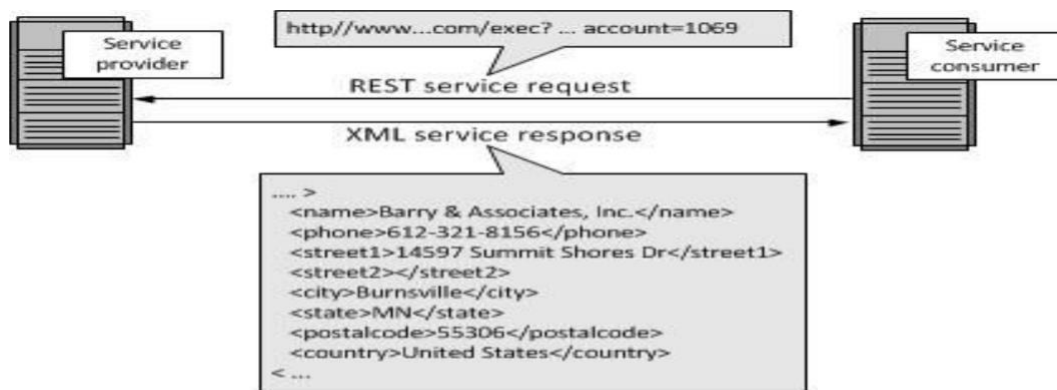
No expensive tools require to interact with the Web service.

Efficient (SOAP uses XML for all messages, REST can use smaller message formats).

Scalability to support large numbers of components and interactions among components

Reliability is the resistance to failure at the system level in the presence of failures within components, connectors, or data<sup>l</sup>

REST uses a smaller message format than SOAP.



Feature

Every system uses resources. These resources can be pictures, video files, Web pages, business information, or anything that can be represented in a computer-based system. The purpose of a service is to provide a window to its clients so that they can access these resources. Service architects and



developers want this service to be easy to implement, maintainable, extensible, and scalable.

- Representations
- Messages
- URIs
- Uniform interface
- Stateless
- Links between resources
- Caching

### Representations

The focus of a RESTful service is on resources and how to provide access to these resources. A resource can consist of other resources. While designing a system, the first thing to do is identify the resources and determine how they are related to each other. This is similar to the first step of designing a database: Identify entities and relations.

### Messages

The client and service talk to each other via messages. Clients send a request to the server, and the server replies with a response. Apart from the actual data, these messages also contain some metadata about the message.

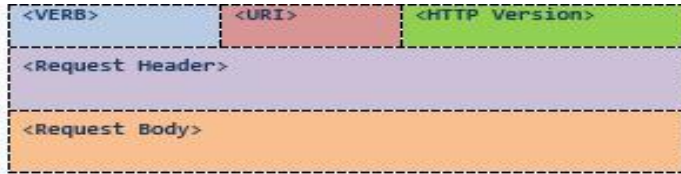


Figure 1: HTTP request format.

<VERB> is one of the HTTP methods like GET, PUT, POST, DELETE, OPTIONS, etc

<URI> is the URI of the resource on which the operation is going to be performed

<HTTP Version> is the version of HTTP, generally "HTTP v1.1" .

## *URI*

REST requires each resource to have at least one URI. A RESTful service uses a directory hierarchy like human readable URIs to address its resources. The job of a URI is to identify a resource or a collection of resources.

## Uniform Interface

RESTful systems should have a uniform interface. HTTP 1.1 provides a set of methods, called verbs, for this purpose. Among these the more important verbs are:

Method	Operation performed on server		Quality
GET	Read a resource.		Safe
PUT	Insert a new resource or update	if the	Idempotent

	resource already exists.	
POST	Insert a new resource. Also can be used to update an existing resource.	N/A
DELETE	Delete a resource .	Idempotent
OPTIONS	List the allowed operations on a resource.	Safe
HEAD	Return only the response headers and no response body.	Safe

### Statelessness

A RESTful service is stateless and does not maintain the application state for any client. A request cannot be dependent on a past request and a service treats each request independently. HTTP is a stateless protocol by design and you need to do something extra to implement a stateful service using HTTP.

### Links Between Resources

A resource representation can contain links to other resources like an HTML page contains links to other pages. The representations returned by the service should drive the process flow as in case of a website. When you visit any website, you are presented with an index page. You click one of the links and move to another page and so on.

### Caching

Caching is the concept of storing the generated results and using the stored results instead of generating them repeatedly if the same request arrives in

the near future. This can be done on the client, the server, or on any other component between them, such as a proxy server. Caching is a great way of enhancing the service performance, but if not managed properly, it can result in client being served stale results.

Caching can be controlled using these HTTP headers:

Header	Application
Date	Date and time when this representation was generated.
Last Modified	Date and time when the server last modified this representation.
Cache-Control	The HTTP 1.1 header used to control caching.
Expires	Expiration date and time for this representation. To support HTTP 1.0 clients.
Age	Duration passed in seconds since this was fetched from the server. Can be inserted by an intermediary component.