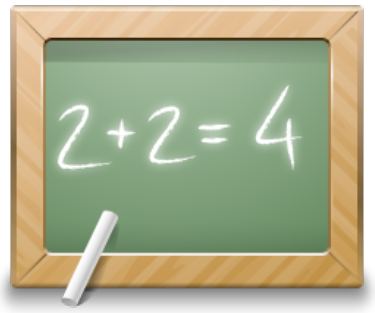
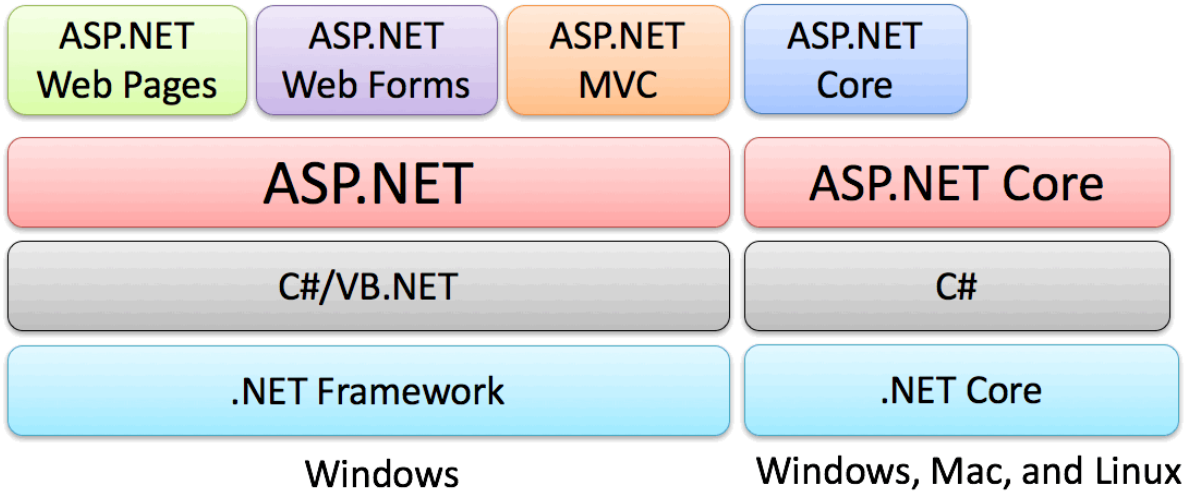
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ASP.NET

Web Programming

Hans-Petter Halvorsen



ASP.NET Web Programming

Hans-Petter Halvorsen

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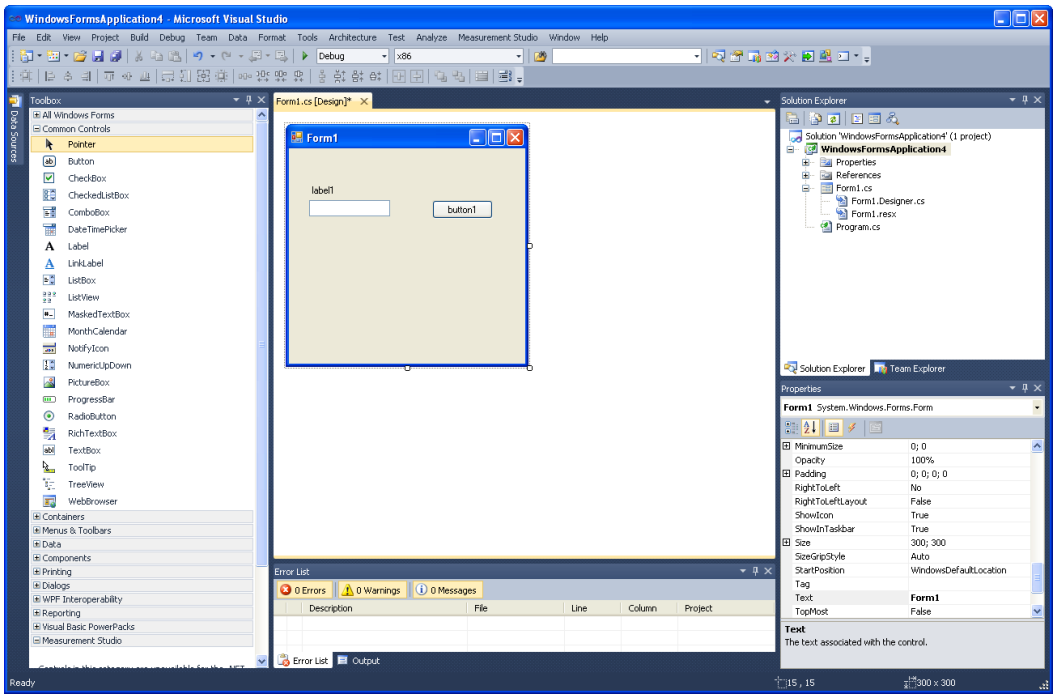
1 Introduction

ASP.NET is a framework for creating web sites, apps and services with HTML, CSS and JavaScript.

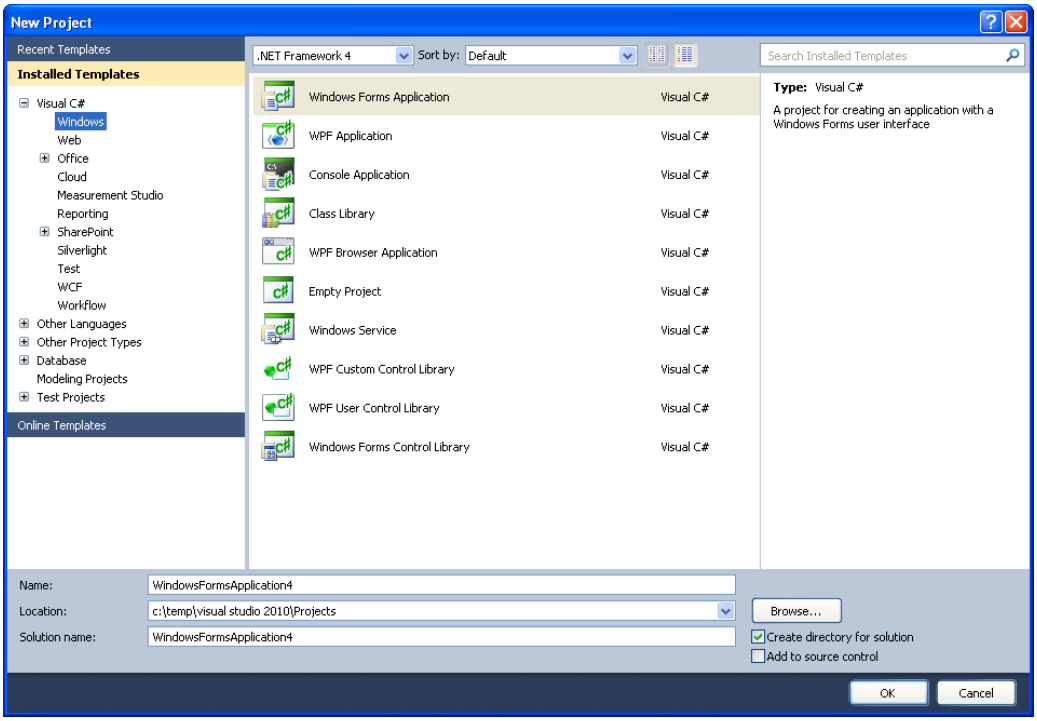
1.1 Visual Studio

Microsoft Visual Studio is an integrated development environment (IDE) from Microsoft. It can be used to develop console and graphical user interface applications along with Windows Forms applications, web sites, web applications, and web services in both native code together with managed code for all platforms supported by Microsoft Windows, Windows Phone, Windows CE, .NET Framework, .NET Compact Framework and Microsoft Silverlight.

Below we see the integrated development environment (IDE) in Visual Studio:



New projects are created from the “New Project” window:



1.2 C#

C# is pronounced “see sharp”. C# is an object-oriented programming language and part of the .NET family from Microsoft. C# is very similar to C++ and Java. C# is developed by Microsoft and works only on the Windows platform.

1.3 .NET Framework

The .NET Framework (pronounced “dot net”) is a software framework that runs primarily on Microsoft Windows. It includes a large library and supports several programming languages which allow language interoperability (each language can use code written in other languages). The .NET library is available to all the programming languages that .NET supports. Programs written for the .NET Framework execute in a software environment, known as the Common Language Runtime (CLR), an application virtual machine that provides important services such as security, memory management, and exception handling. The class library and the CLR together constitute the .NET Framework.

1.4 Object-Oriented Programming (OOP)

Object-oriented programming (OOP) is a programming language model organized around "objects" rather than "actions" and data rather than logic. Historically, a program has been viewed as a logical procedure that takes input data, processes it, and produces output data.

The first step in OOP is to identify all the objects you want to manipulate and how they relate to each other, an exercise often known as data modeling. Once you've identified an object, you generalize it as a class of objects and define the kind of data it contains and any logic sequences that can manipulate it. Each distinct logic sequence is known as a method. A real instance of a class is called an “object” or an “instance of a class”. The object or class instance is what you run in the computer. Its methods provide computer instructions and the class object characteristics provide relevant data. You communicate with objects - and they communicate with each other.

Important features with OOP are:

- Classes and Objects
- Inheritance
- Polymorphism
- Encapsulation

Simula was the first object-oriented programming language. Simula was developed in the 1960s by Kristen Nygaard from Norway.

Java, Python, C++, Visual Basic .NET and C# are popular OOP languages today.

Since Simula-type objects are reimplemented in C++, Java and C# the influence of Simula is often understated. The creator of C++ (1979), Bjarne Stroustrup (from Denmark), has acknowledged that Simula was the greatest influence on him to develop C++.

2 Visual Studio

2.1 Introduction

Home page of Visual Studio: http://www.microsoft.com/visualstudio

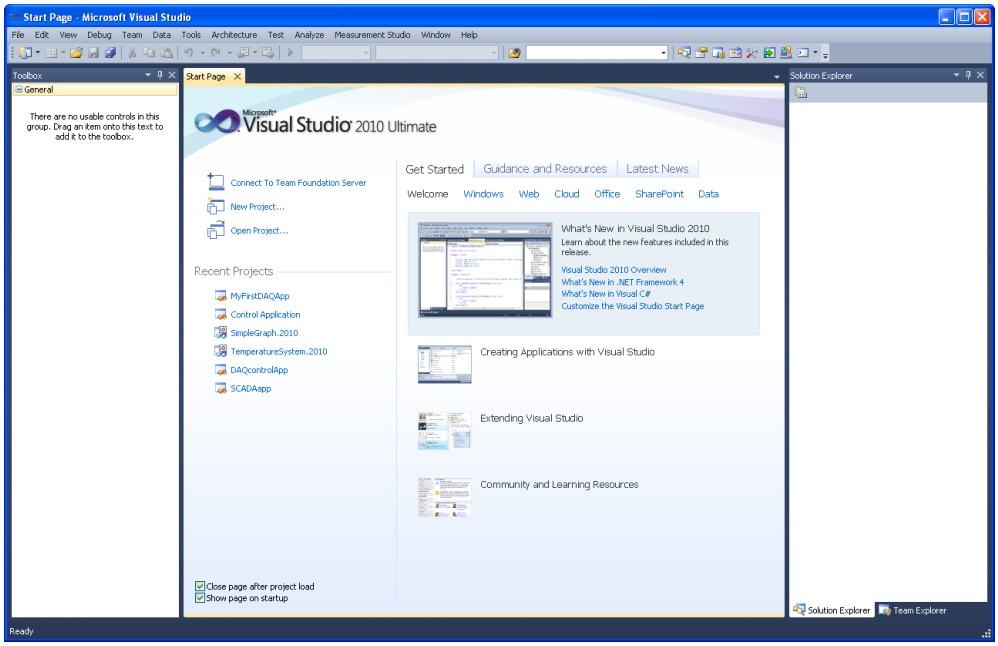
There exist different versions of Visual Studio, such as Visual Studio Express (free), Visual Studio Professional, Visual Studio Premium and Visual Studio Ultimate.

2.2 Getting Started

2.2.1 Integrated Development Environment (IDE)

The Visual Studio product family shares a single integrated development environment (IDE) that is composed of several elements: the Menu bar, Standard toolbar, various tool windows docked or auto-hidden on the left, bottom, and right sides, as well as the editor space. The tool windows, menus, and toolbars available depend on the type of project or file you are working in.

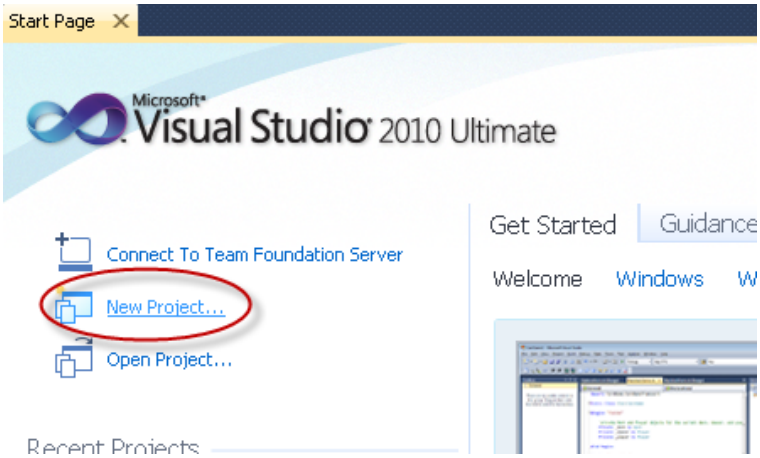
Below we see the Visual Studio IDE (Integrated Development Environment):



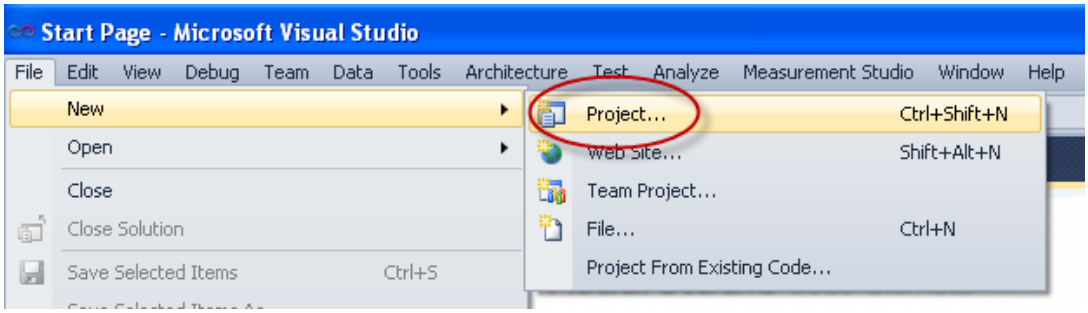
2.2.2 New Project

The first thing you do when you want to create a new application is to create a new project.

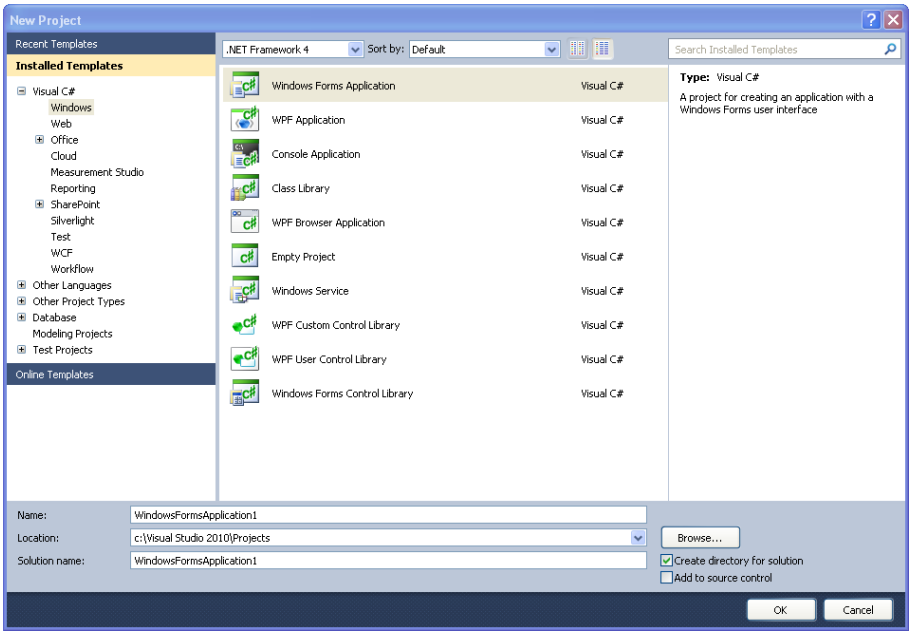
This can be done from the Start Page:



Or from the File menu:



Then the “New Project” window appears:



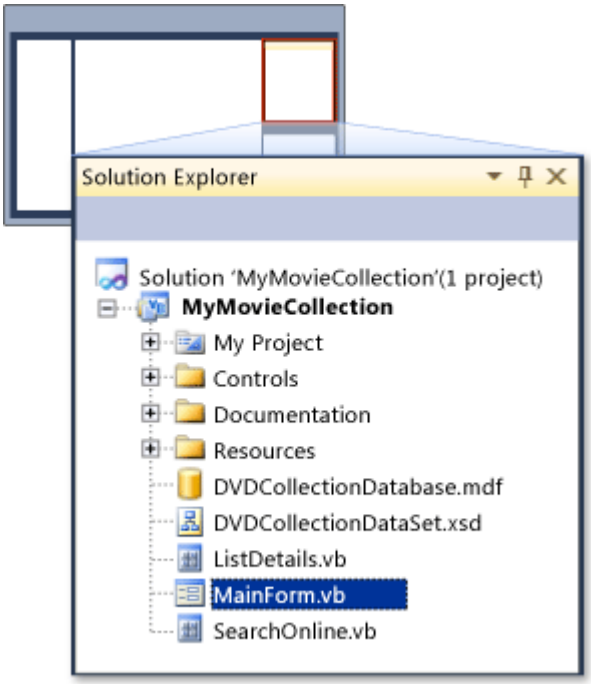
In this window you will select an appropriate template based on what kind of application you want to create, and a name and location for your project and solution.

The most common applications are:

- Windows Form Application
- Console Application
- WPF Application
- ASP.NET Web Application
- Silverlight Application

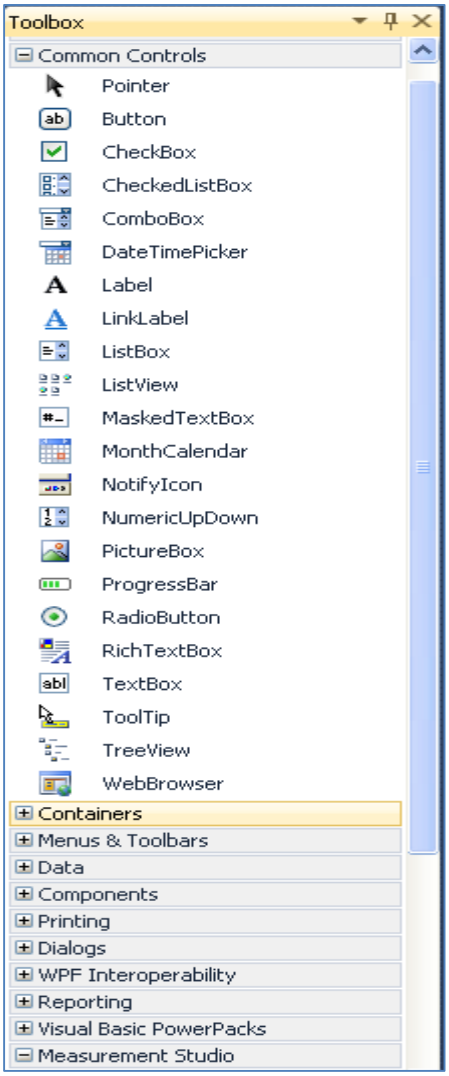
2.2.3 Solution Explorer

Solutions and projects contain items that represent the references, data connections, folders, and files that you need to create your application. A solution container can contain multiple projects and a project container typically contains multiple items.



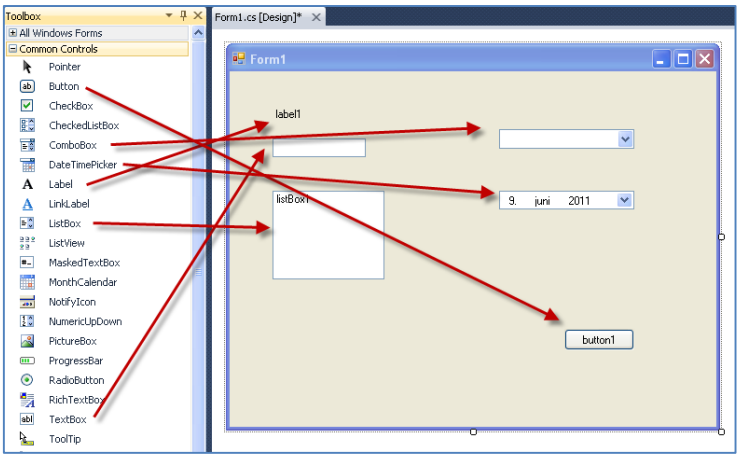
2.2.4 Toolbox

The Toolbox contains all the necessary controls, etc. you need to create your user interface. See Figure below.



The Toolbox contains all the controls, etc. we can use in our user interface.

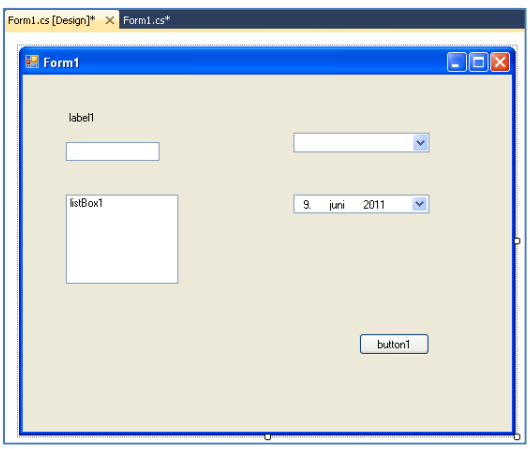
In order to use them in our user interface, we just drag and drop them to the “Form”, as shown below:



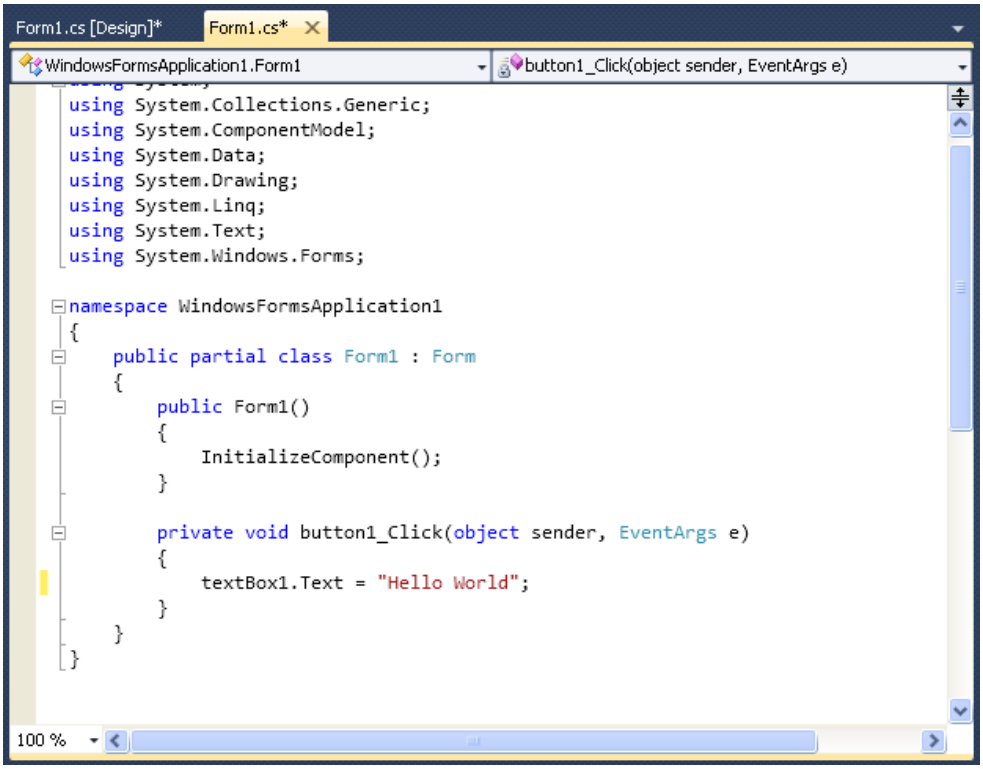
2.2.5 Editors and Designers

Visual Studio has different editors and design tools.

Graphical User Interface Designer:



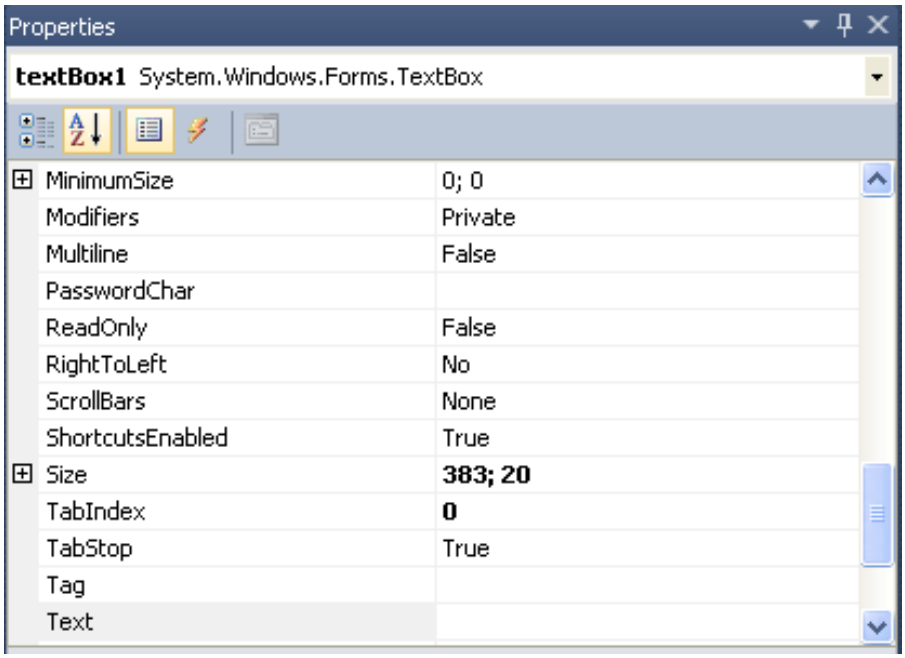
Code Editor:



2.2.6 Properties window

Each control we have on our user interface has lots of Properties we can set.

This is done in the Properties window:

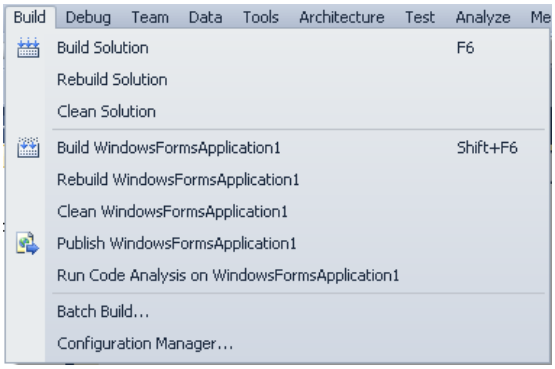


2.2.7 Build and Debug Tools

In Visual Studio we have lots of Build and Debugging Tools.

Build menu:

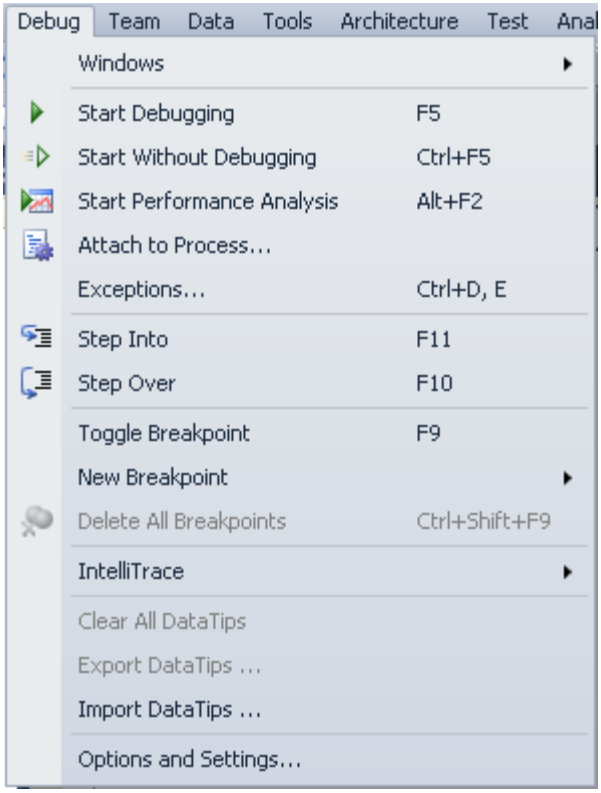
Below we see the **Build** menu:



The most used tool is "**Build Solution**" (Shortcut Key: F6).

Debug menu:

Below we see the **Debug** menu:



The most used tool is "**Start Debugging**" (Shortcut Key: F5).

3 Introduction to Web Programming

3.1 Introduction

Today most of the applications focus on the Internet, where the applications can be viewed in a standard Web Browser. Static Web pages are based on HTML and CSS. In order to create more advanced applications, we need more powerful tools.



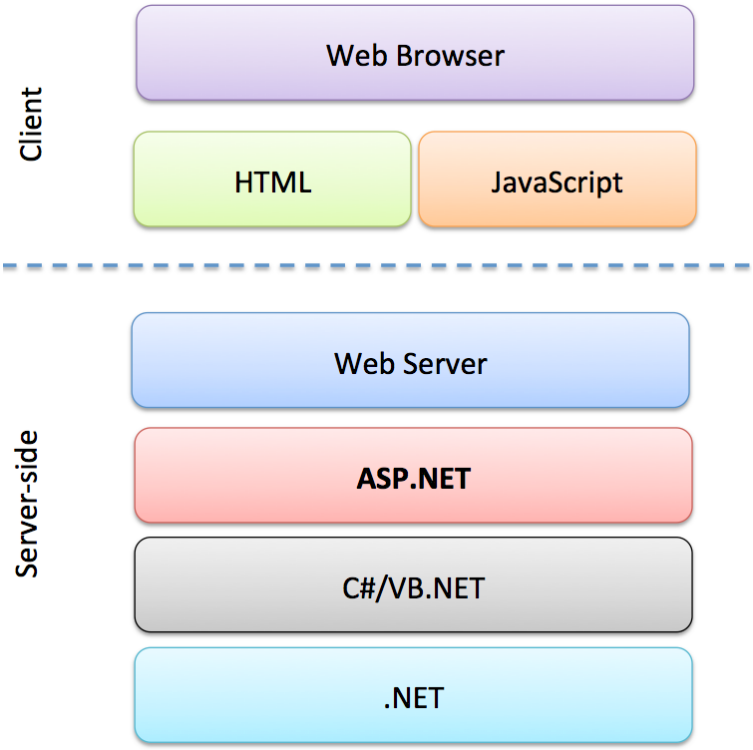
A useful web site for learning more about web development: http://www.w3schools.com

Important frameworks and tools for creating dynamic web pages:

- ASP.NET
- AJAX/ ASP.NET AJAX
- JavaScript

- Silverlight

These frameworks and tools will be explained below.



3.2 Web Browser

The purpose of a web browser is to read HTML documents and compose them into visual or audible web pages. The browser does not display the HTML tags, but uses the tags to interpret the content of the page.

Today we have the following major Web Browsers:

- Internet Explorer (by Microsoft)
- Firefox (by Mozilla)
- Chrome (by Google)
- Safari (by Apple)
- Opera (by Opera from Norway)

3.3 HTML

HTML, which stands for HyperText Markup Language, is the predominant markup language for web pages. HTML is the basic building-blocks of webpages.

HTML is written in the form of HTML elements consisting of tags, enclosed in angle brackets (like <html>), within the web page content. HTML tags normally come in pairs like <h1> and </h1>. The first tag in a pair is the start tag, the second tag is the end tag (they are also called opening tags and closing tags). In between these tags web designers can add text, tables, images, etc.

Below we see a simple a HTML web page:

```
<!DOCTYPE html>
<html>
<body>

<h1>My First Heading</h1>

<p>My first paragraph.</p>

</body>
</html>
```

A useful web site for learning more about HTML: http://www.w3schools.com/html

3.4 CSS

Web browsers can also refer to Cascading Style Sheets (CSS) to define the appearance and layout of text and other material.

The W3C, maintainer of both the HTML and the CSS standards

A useful web site for learning more about CSS: http://www.w3schools.com/css

3.5 JavaScript

JavaScript is an object-oriented scripting language basically used to create dynamic web pages. JavaScript is primarily used in the form of client-side JavaScript, implemented as part of a web browser in order to provide enhanced user interfaces and dynamic websites.

Below we see a simple a HTML web page with JavaScript:

```
<!DOCTYPE html>
<html>
<body>

<h1>My First JavaScript</h1>
<p>Click the button to display the date.</p>
<p id="demo"></p>

<button type="button" onclick="myFunction()">Try it</button>

<script>
function myFunction()
{
  document.getElementById("demo").innerHTML = Date();
}
```

```
</script>

</body>
</html>
```

A useful web site for learning more about JavaScript: http://www.w3schools.com/js

3.6 ASP.NET

ASP.NET is a web application framework developed by Microsoft to allow programmers to build dynamic web sites, web applications and web services.

ASP.NET is part of the Visual Studio package.

It was first released in January 2002 with version 1.0 of the .NET Framework, and is the successor to Microsoft's Active Server Pages (ASP) technology. ASP.NET is built on the Common Language Runtime (CLR), allowing programmers to write ASP.NET code using any supported .NET language, such as C# and VB.NET.

ASP.NET web pages or webpage, known officially as Web Forms], are the main building block for application development. Web forms are contained in files with an ".aspx" extension.

3.7 AJAX/ ASP.NET AJAX

AJAX is an acronym for Asynchronous JavaScript and XML. AJAX is a group of interrelated web development methods used on the client-side to create interactive web applications. With Ajax, web applications can send data to, and retrieve data from, a server asynchronously (in the background) without interfering with the display and behavior of the existing page.

ASP.NET AJAX is a set of extensions to ASP.NET developed by Microsoft for implementing AJAX functionality.

3.8 Silverlight

Microsoft Silverlight is an application framework for writing and running browser plug-ins or other rich internet applications, with features and purposes similar to those of Adobe Flash. The run-time environment for Silverlight is available as a plug-in for most web browsers. Silverlight is also one of the two application development platforms for Windows Phone 7/8.

The latest version is Silverlight 5.0.

Silverlight is based on WPF, so in Silverlight applications, user interfaces are declared in Extensible Application Markup Language (XAML) and programmed using a subset of the .NET Framework.

4Introduction to ASP.NET

4.1 Introduction

ASP.NET is a web application framework developed by Microsoft to allow programmers to build dynamic web sites, web applications and web services.

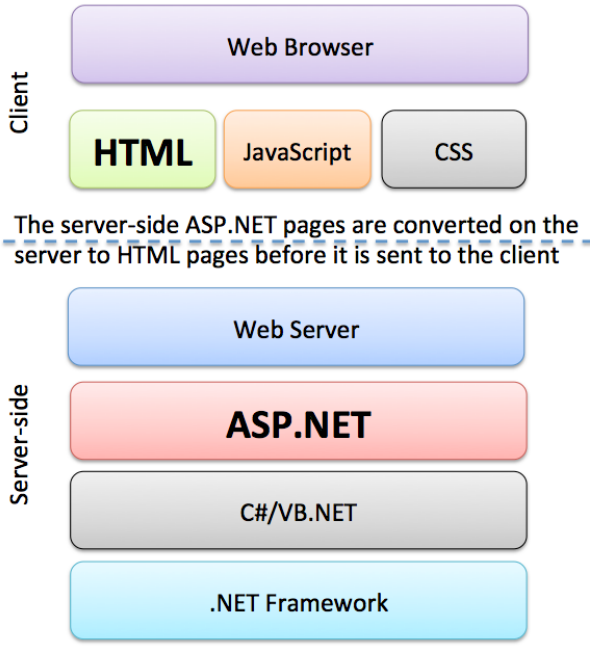
ASP.NET is a framework fro creating web sites, apps and services with HTML, CSS and JavaScript.

Web Site: http://www.asp.net

ASP.NET supports different approaches for making web sites or web pages.

- ASP.NET Web Pages uses a single page model that mixes code and HTML markup.
- ASP.NET SPA (Single Page Application)
- ASP.NET Web Forms uses controls and an event-model for component-based development.
- ASP.NET MVC (Model View Controller) values separation of concerns and enables easier test-driven development.

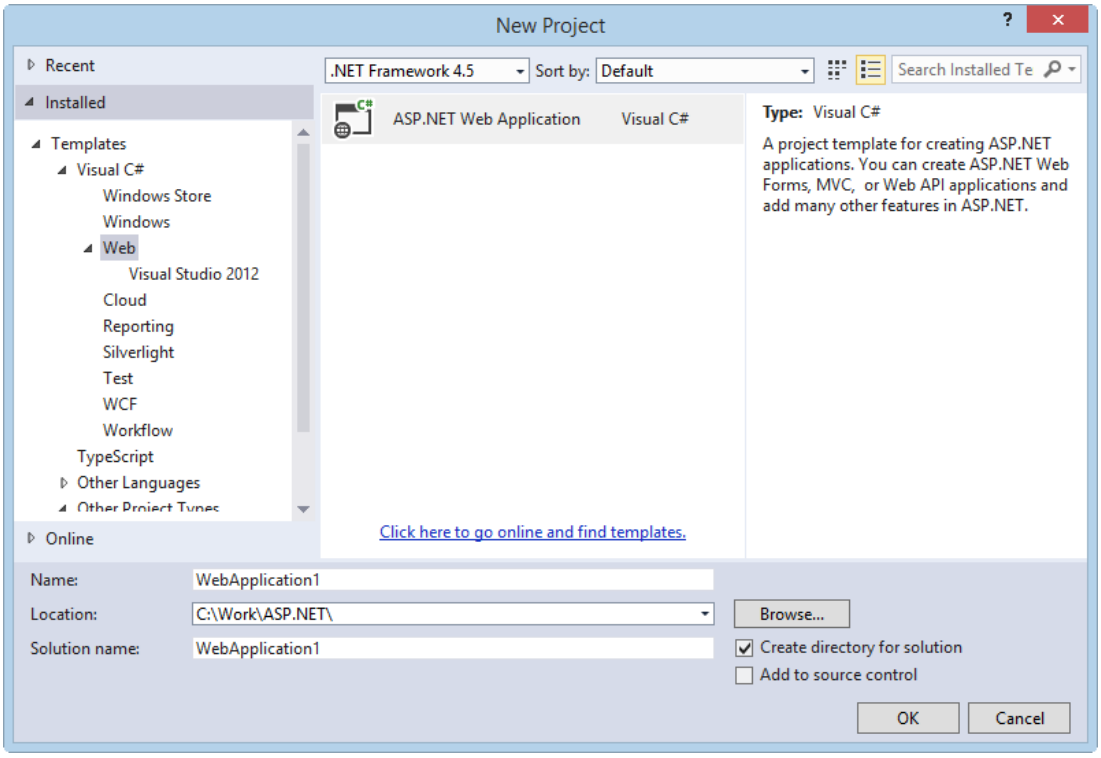
You can mix and match these techniques within one application depending on your needs.



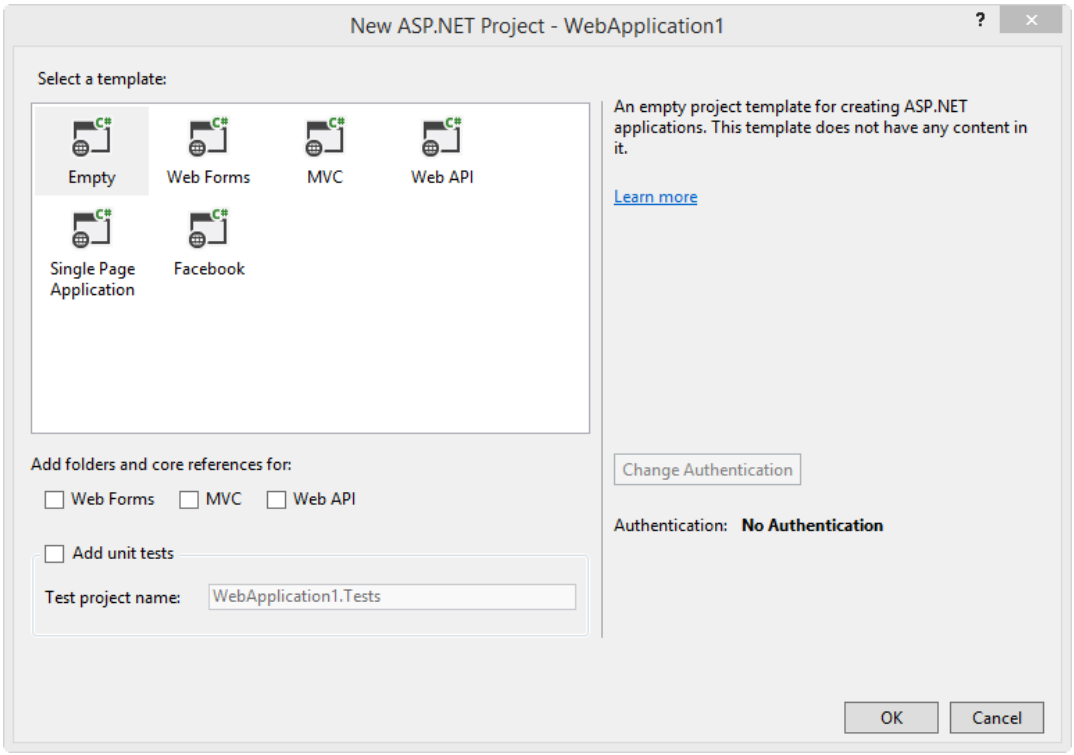
Video: http://www.asp.net/aspnet/overview/making-websites-with-aspnet/making-websites-with-aspnet

New Web Project Dialog:

Select Project Name, Loction and Solution Name.



Next, seelct the template you want to use.



4.2 ASP.NET Web Pages

In ASP.NET Web Pages you include server code directly into the HTML syntax, similar to PHP and Classic ASP.

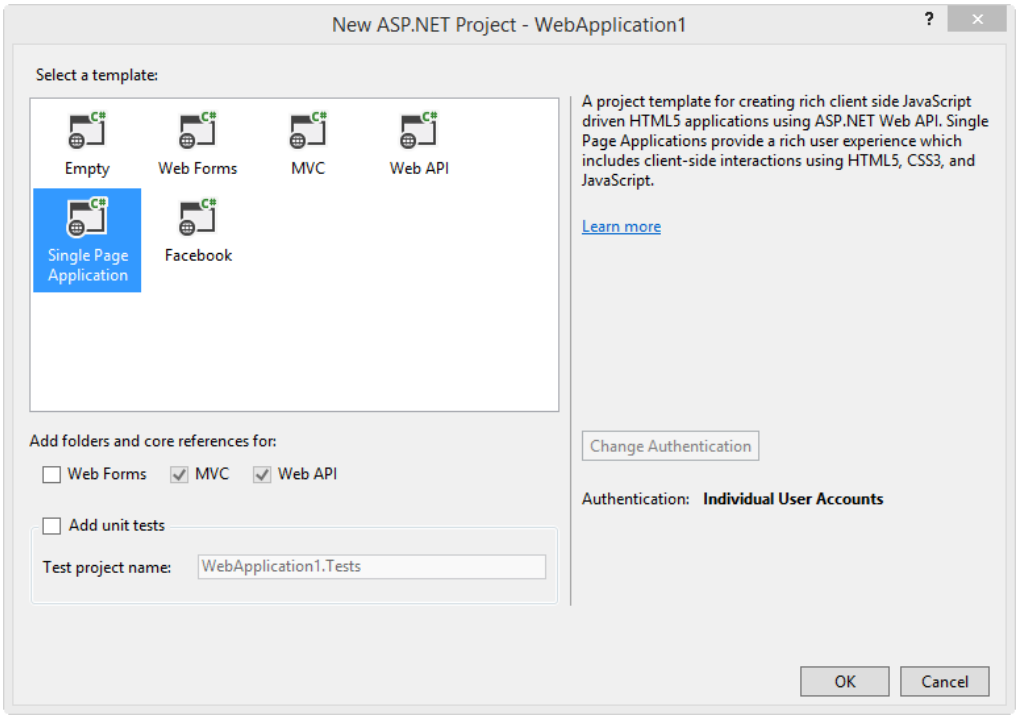
ASP.NET Web Pages uses Singe Page Model (The server-side code is mixed in between the HTML). It uses the the **Razor** syntax (.cshtml files)

A tool called Microsoft WebMatrix is optimized for this development model, but you can also use Visual Studio if you want to.

http://www.w3schools.com/aspnet

4.3 ASP.NET SPA

SPA – Single Page Application



For more information: http://www.asp.net/single-page-application

4.4 ASP.NET MVC

MVC – Model - View – Controller

A new development model where you split your development into 3 parts/components: Models for Data, Views for Display and Controllers for Input.

4.5 ASP.NET Web Forms

ASP.NET is similiar to the desktop development model used in WPF. GUI (*.aspx files) and Code (*.aspx.cs) is separated.

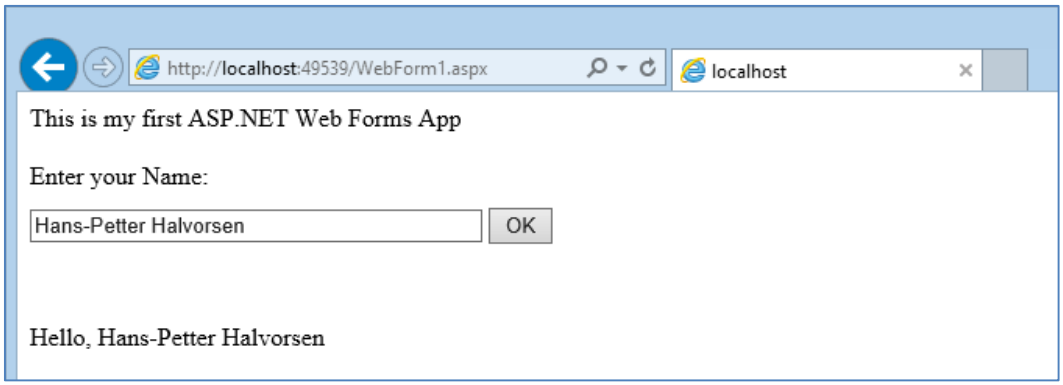
In this document we will focus on ASP.NET Web Forms.

5 ASP.NET Web Forms

The main focus in this tutorial will be ASP.NET Web Forms.

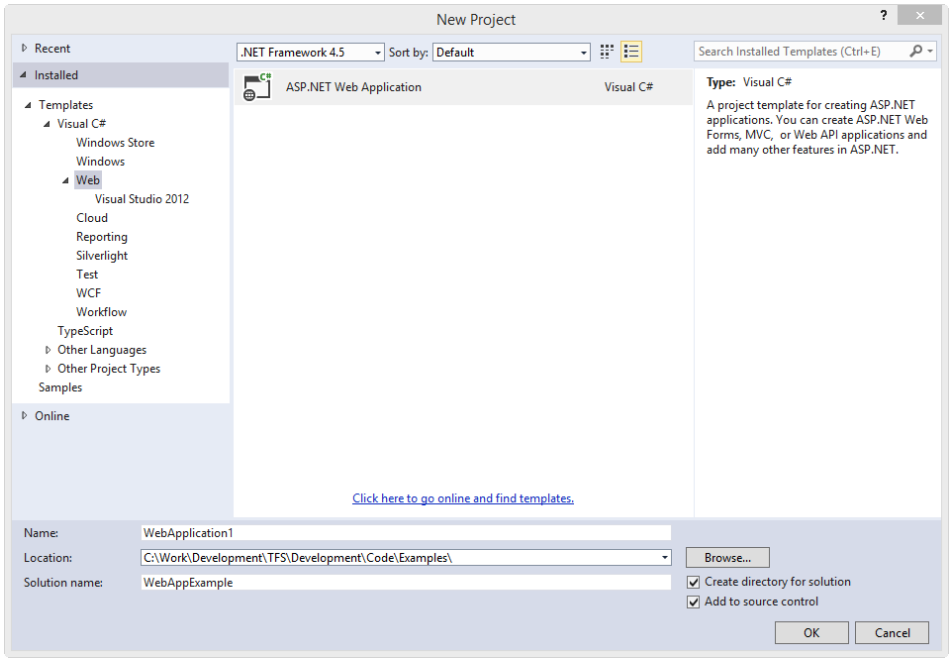
5.1 Hello World Example

When you are finished, your Web App should look something like this:

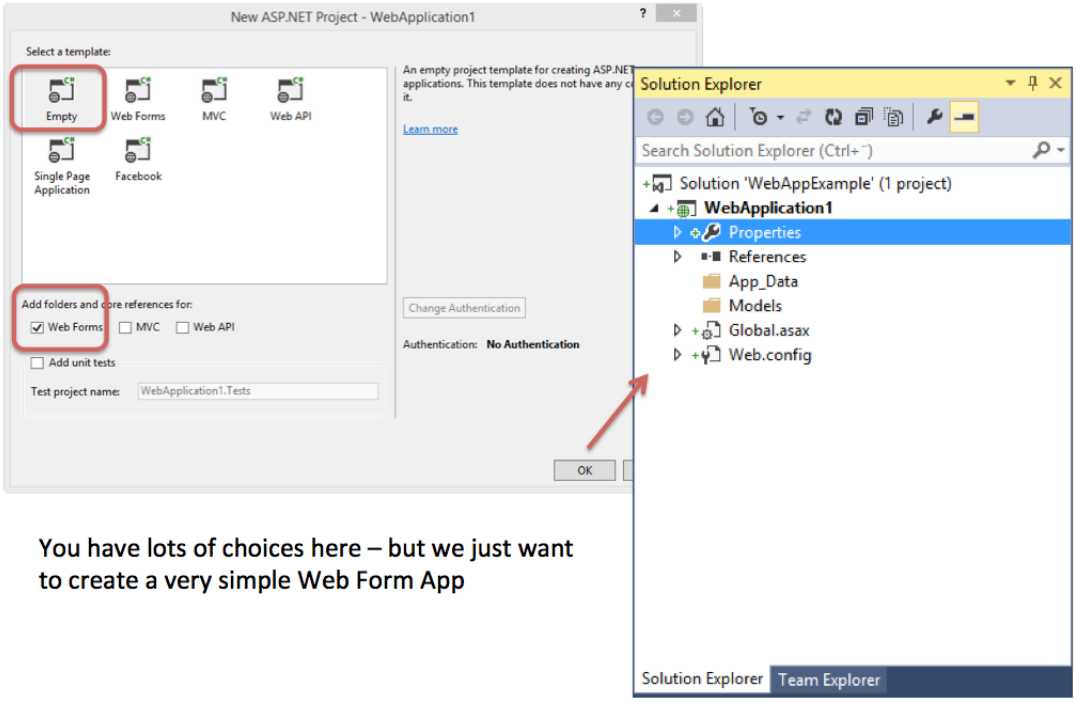


When you enter your Name in the TextBox and click the OK Button, the program should respond with a greetings.

Seelct Create New Project:

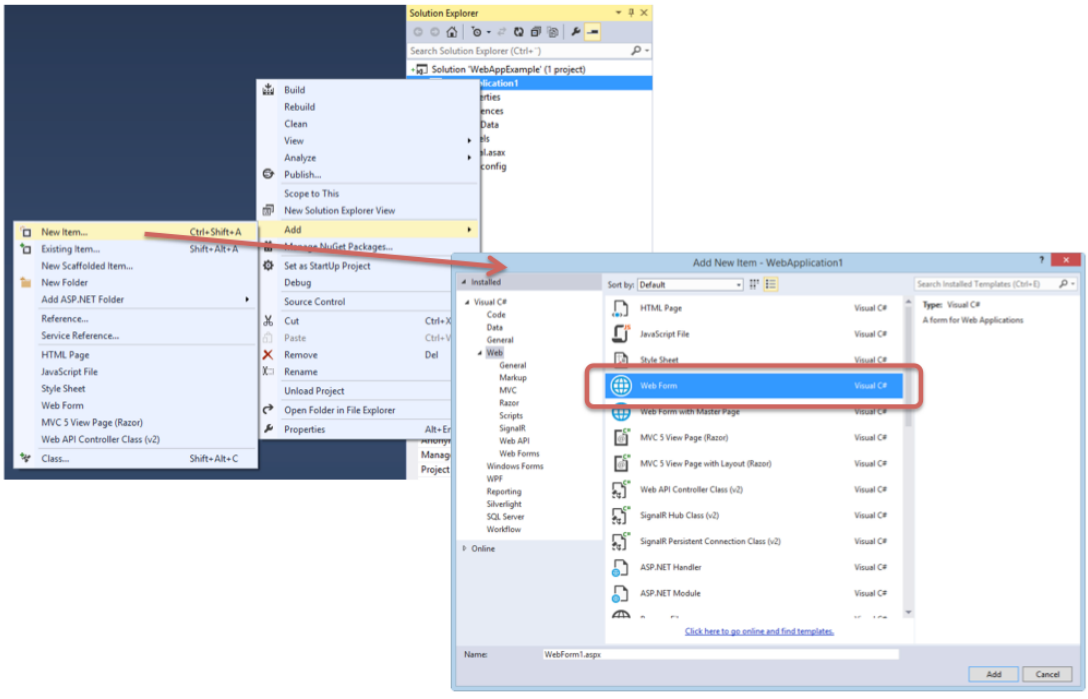


You have lots of choices here – but we just want to create a very simple Web Form App.

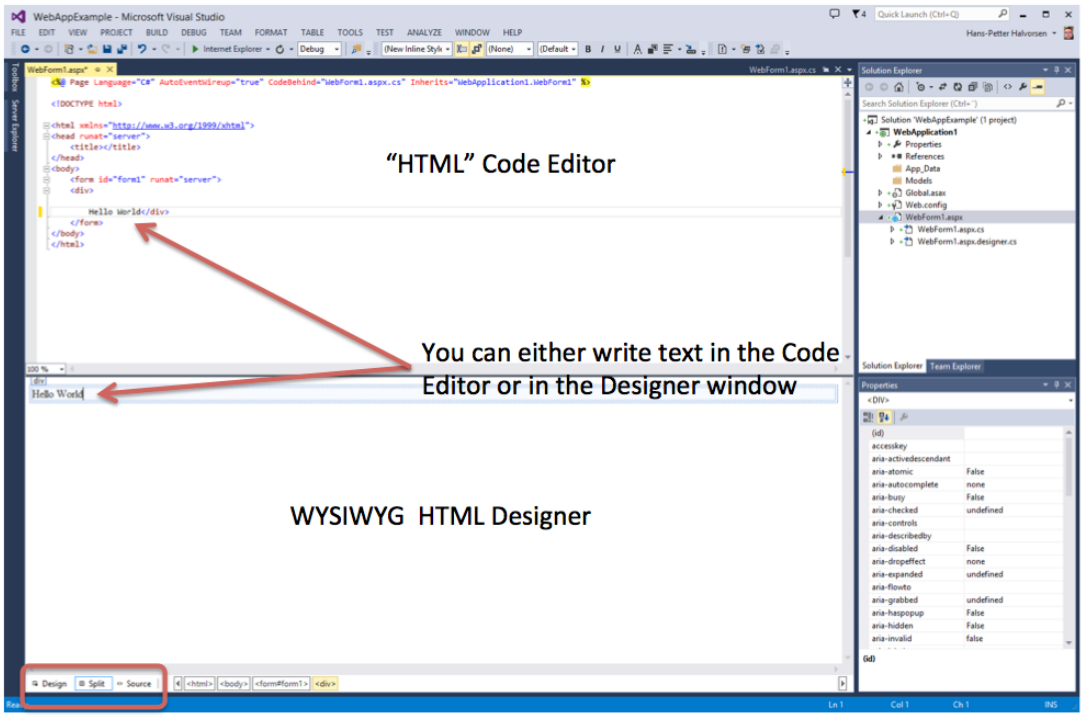


You have lots of choices here – but we just want to create a very simple Web Form App

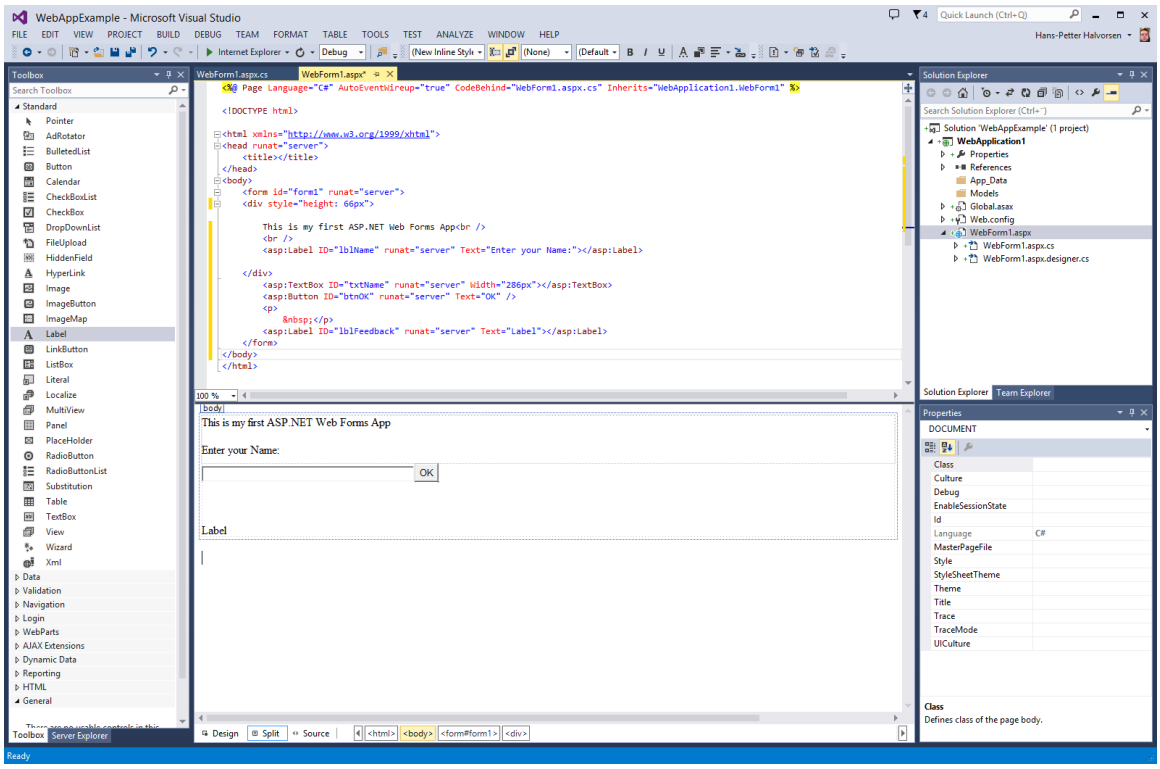
Create New Web Form:



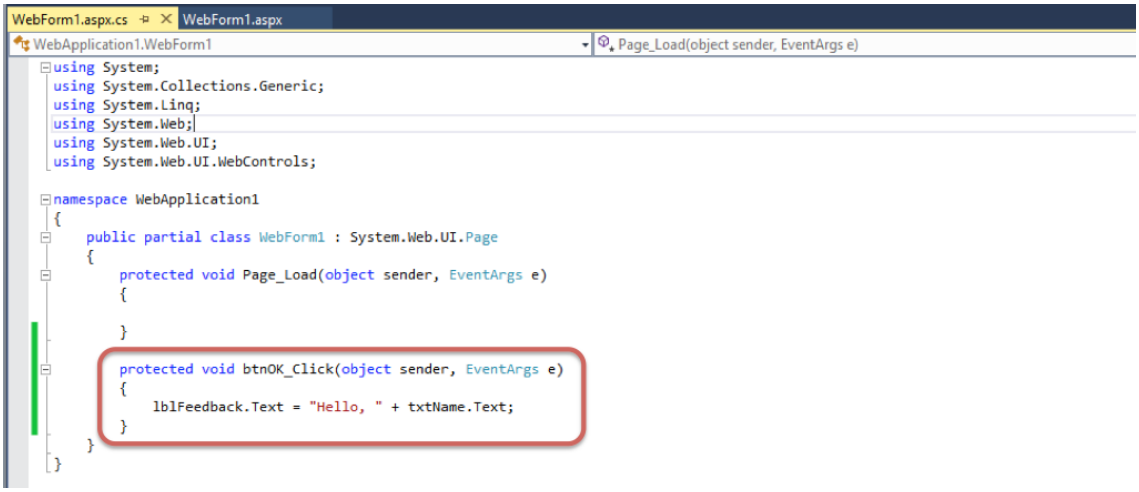
WinForm1.aspx Page: Used to create the GUI/HMI



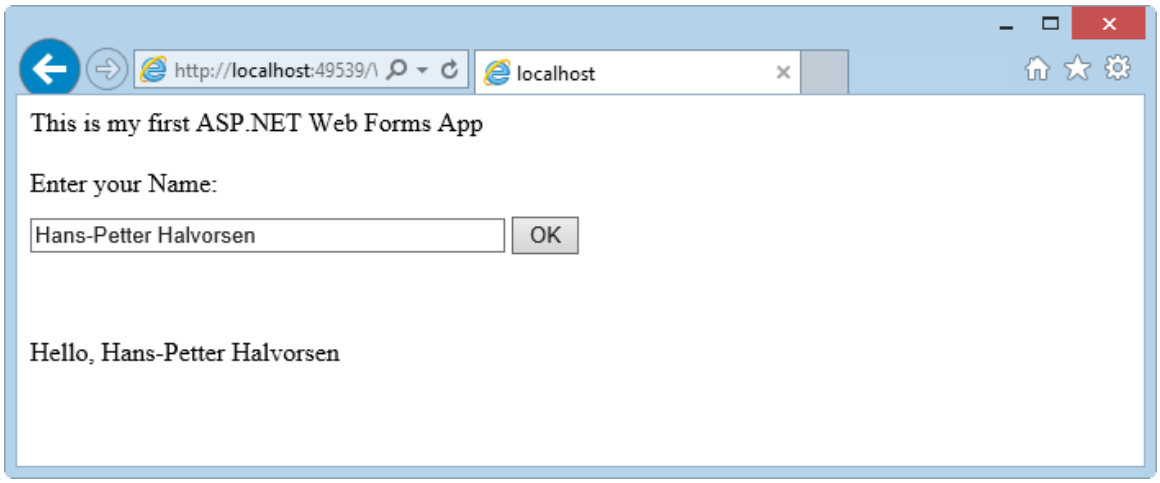
Hello world Example – GUI:



WebForm1.aspx.cs:



Running the Application (F5):



Congratulations, you have created your first ASP.NET Web Forms application.

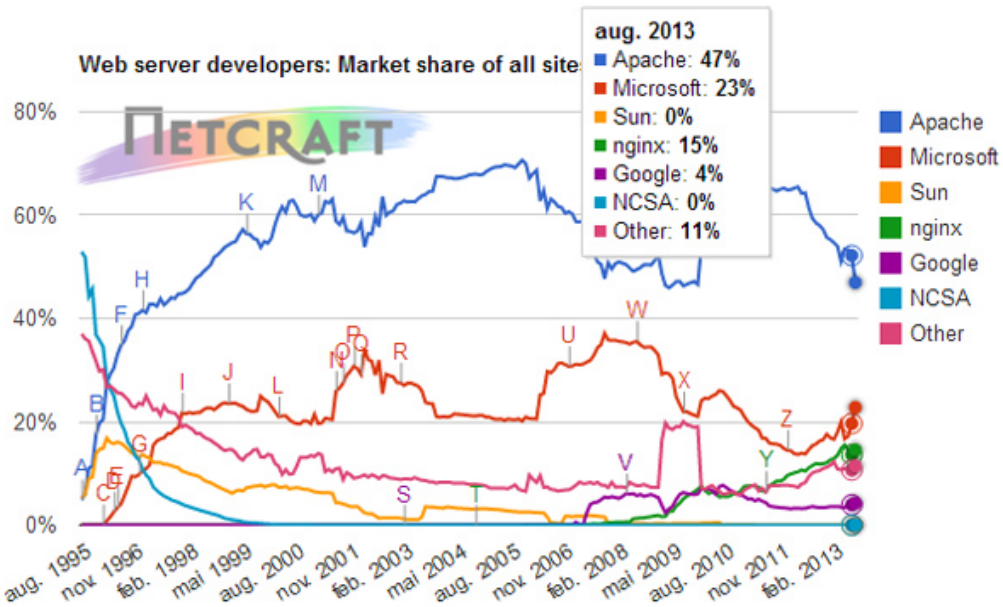
6 Internet Information Services (IIS)

6.1 Web Server

The term web server can refer to either the hardware (the computer) or the software (the computer application) that helps to deliver web content that can be accessed through the Internet.

The most common use of web servers is to host websites, but there are other uses such as gaming, data storage or running enterprise applications.

- IIS - Internet Information Services, Microsoft Windows
- Apache Web Server, Open Source, Cross-platform: UNIX, Linux, OS X, Windows, ...
- Nginx (pronounced "engine x") - Has become very popular latly
- GWS (Google Web Server)
- etc.



7 Working with Databases in ASP.NET

Today, most of the web sites and web pages uses a database to store data that is visible on the web page, e.g. Facebook, Instagram, Twitter, etc.

7.1 Database Systems

There are lots of different database systems, or DBMS – Database Management Systems, such as:

- Microsoft SQL Server
  - Enterprise, Developer versions, etc.
  - Express version is free of charge
- Oracle
- MySQL (Oracle, previously Sun Microsystems) - MySQL can be used free of charge (open source license), Web sites that use MySQL: YouTube, Wikipedia, Facebook
- MariaDB ("The New MySQL")
- Microsoft Access
- IBM DB2
- Sybase
- … lots of other systems

7.1.1 Mirosoft SQL Server

Microsoft is the vendor of SQL Server. We have different editions of SQL Server, where SQL Server Express is free to download and use. We will focus on SQL Server in this tutorial.

7.2 SQL

SQL (Structured Query Language) is a database computer language designed for managing data in relational database management systems (RDBMS).

SQL, is a standardized computer language that was originally developed by IBM for querying, altering and defining relational databases, using declarative statements.

SQL is pronounced /ˌɛs kjuː ˈɛl/ (letter by letter) or /ˈsiːkwəl/ (as a word).

What can SQL do?

- SQL can execute queries against a database
- SQL can retrieve data from a database
- SQL can insert records in a database
- SQL can update records in a database
- SQL can delete records from a database
- SQL can create new databases
- SQL can create new tables in a database
- SQL can create stored procedures in a database
- SQL can create views in a database
- SQL can set permissions on tables, procedures, and views

Even if SQL is a standard, many of the database systems that exist today implement their own version of the SQL language. In this document we will use the Microsoft SQL Server as an example.

Here are some examples of SQL queries:

SQL – Structured Query language

A Database Computer Language designed for Managing Data in Relational Database Management Systems (RDBMS)

Query Examples:

```
• insert into STUDENT (Name , Number, SchoolId)
  values ('John Smith', '100005', 1)

• select SchoolId, Name from SCHOOL

• select * from SCHOOL where SchoolId > 100

• update STUDENT set Name='John Wayne' where StudentId=2

• delete from STUDENT where SchoolId=3
```

We have 4 different Query Types: **INSERT**, **SELECT**, **UPDATE** and **DELETE**

In this Tutorial we will focus on Microsoft SQL Server. SQL Server uses T-SQL (Transact-SQL). T-SQL is Microsoft's proprietary extension to SQL. T-SQL is very similar to standard SQL, but in addition it supports some extra functionality, built-in functions, etc.

In order to use databases in our applications we need to know **Structured Query language (SQL)**. For more information about SQL, see the following Tutorial: Structured Query Language (SQL).

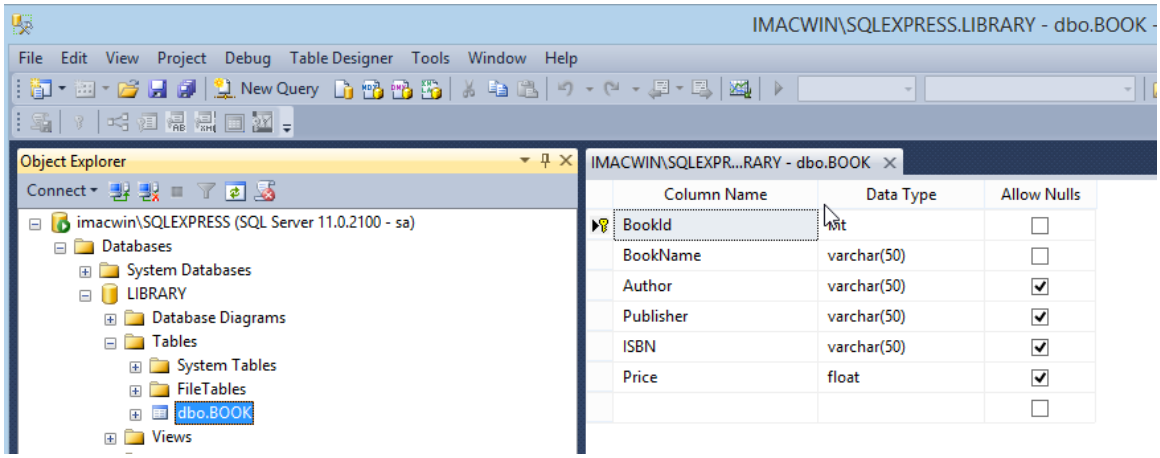
The Tutorials are available from: https://www.halvorsen.blog

7.3 SQL Server + ASP.NET

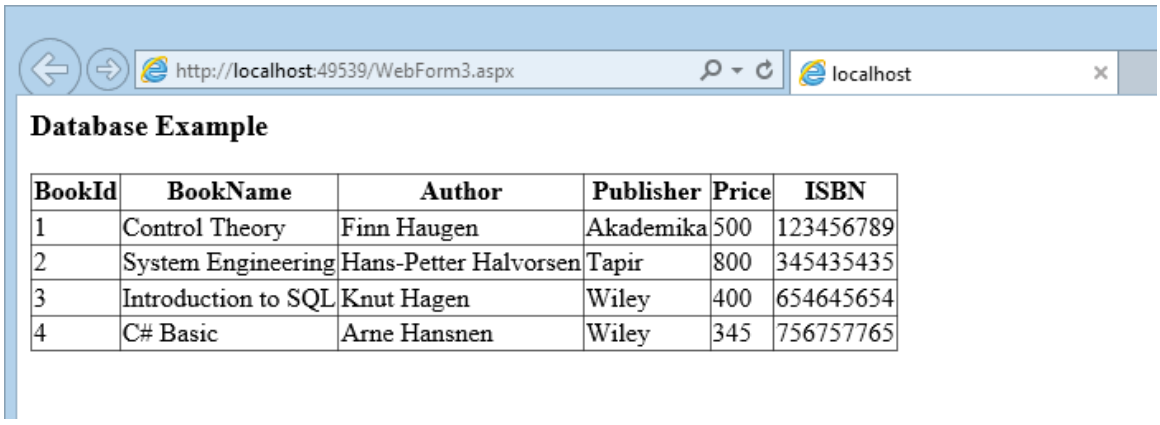
SQL Server + ASP.NET = Powerful Web Applications

7.3.1 Simple Database Examplee

Create a Database called LIBRARY and a BOOK table in SQL Server. Enter some Test data into the BOOK table.

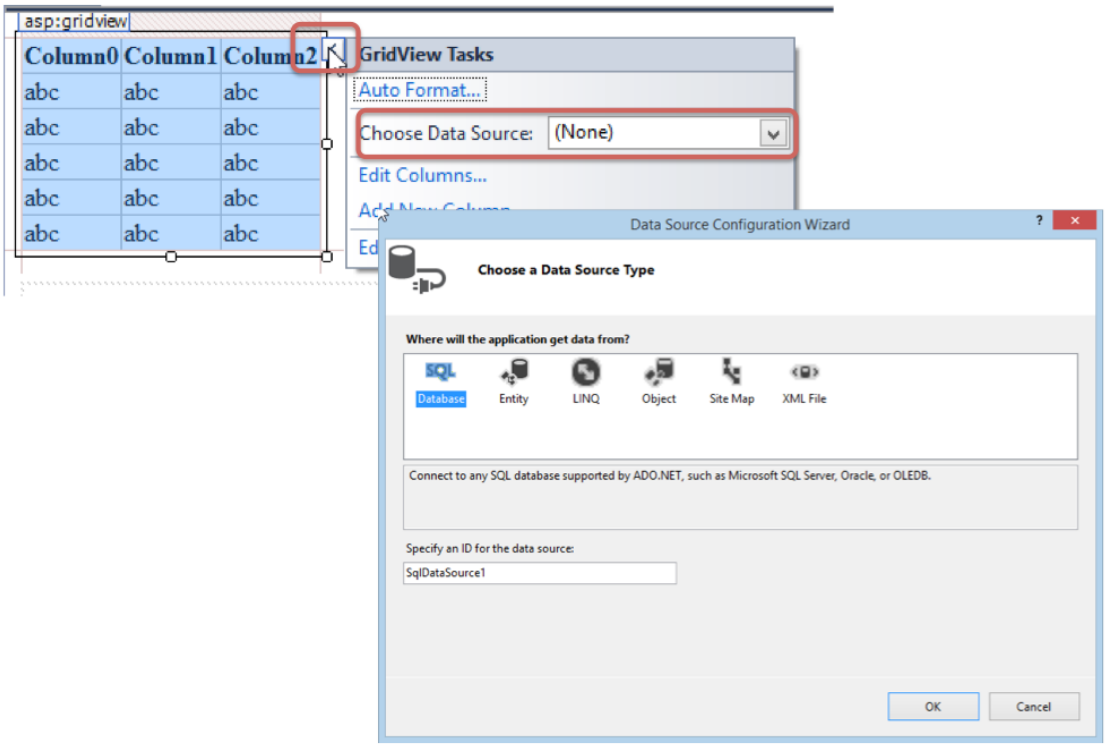


Fill a “GridView” with data from the Database Table (BOOK), as shown below

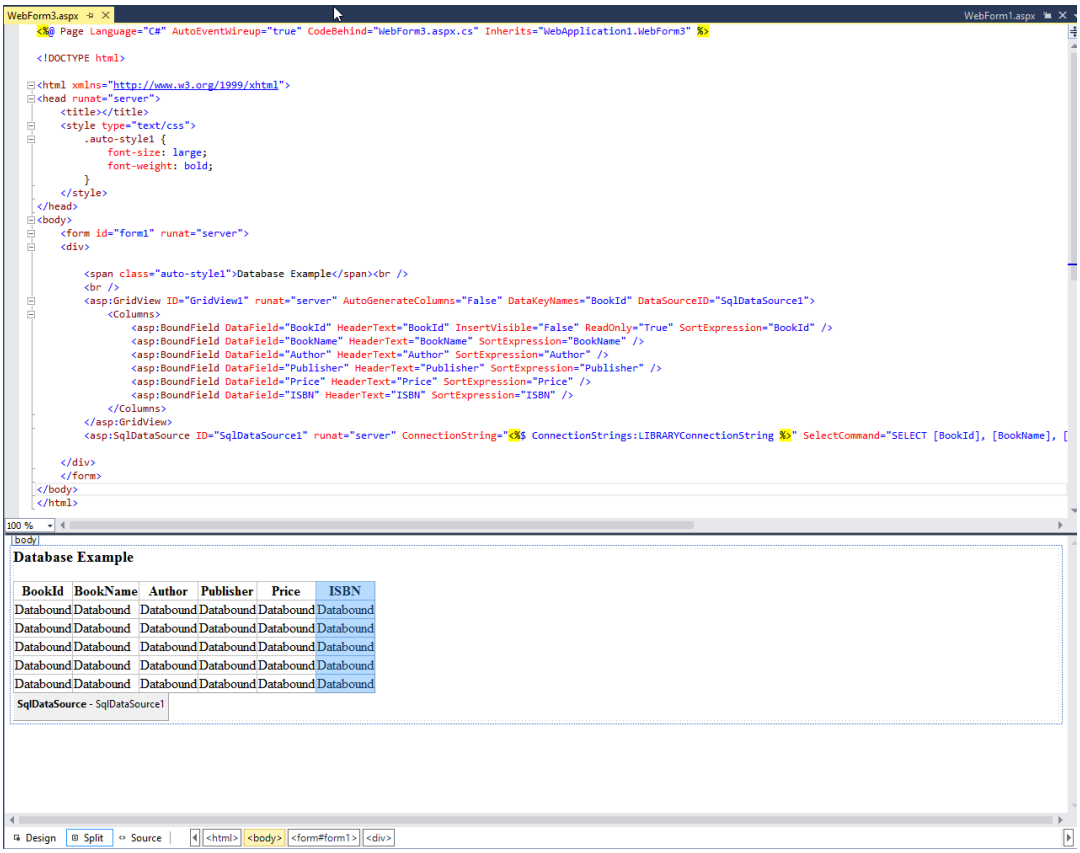


BookId	BookName	Author	Publisher	Price	ISBN
1	Control Theory	Finn Haugen	Akademika	500	123456789
2	System Engineering	Hans-Petter Halvorsen	Tapir	800	345435435
3	Introduction to SQL	Knut Hagen	Wiley	400	654645654
4	C# Basic	Arne Hansnen	Wiley	345	756757765

Use the “Wizard” in order to create all the “magic” you need in your application:



When finishing the “Wizard”, your .aspx page should look something like this



As you see - No Code needed to be written in this example ☺

```
WebForm3.aspx.cs  WebForm3.aspx
WebApplication1.WebForm3                    Page_Load(object sender, EventArgs e)
using System;
using System.Collections.Generic;
using System.Linq;
using System.Web;
using System.Web.UI;
using System.Web.UI.WebControls;

namespace WebApplication1
{
    public partial class WebForm3 : System.Web.UI.Page
    {
        protected void Page_Load(object sender, EventArgs e)
        {

        }
    }
}
```

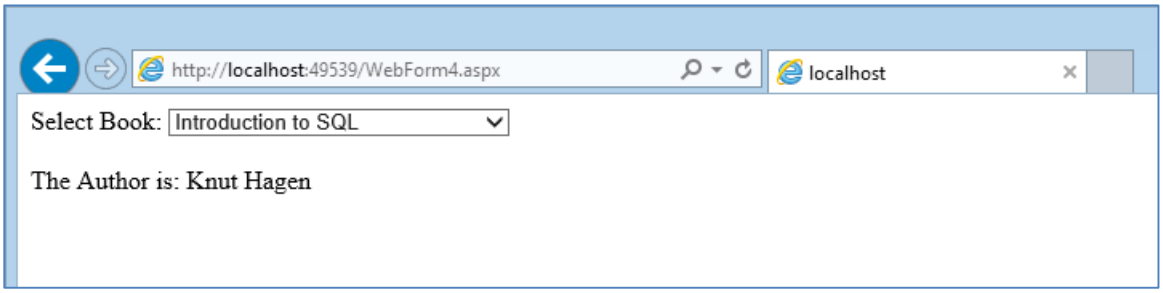
This is OK for quick demos – but for professional applications, you need to use some hardcore ADO.NET or similiar frameworks.

7.4 ADO.NET

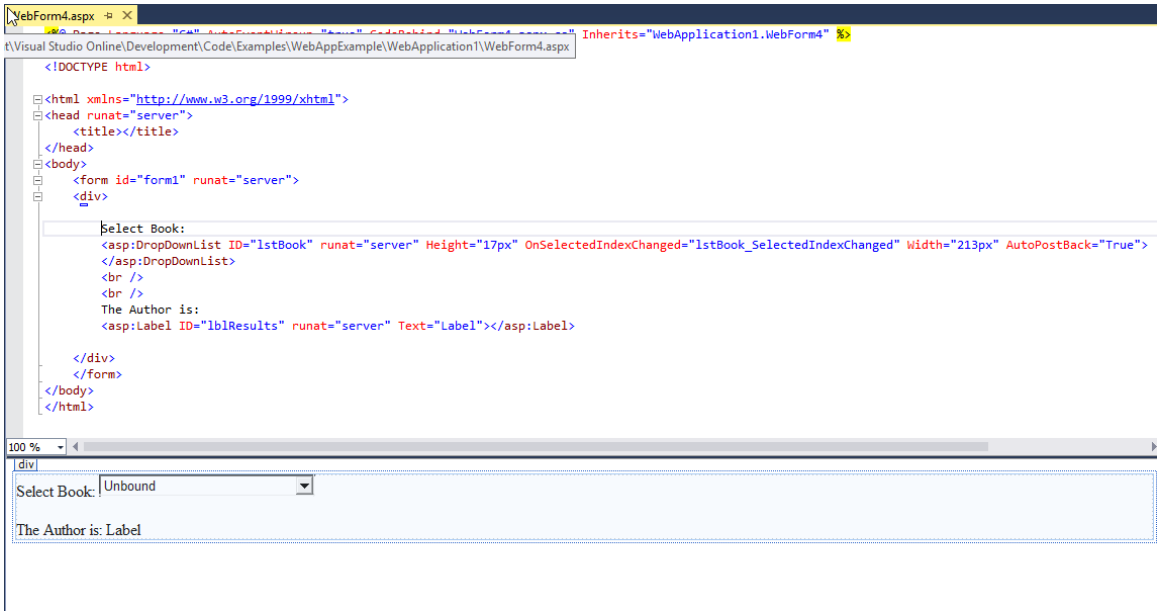
ADO.NET (ActiveX Data Object for .NET) is a set of computer software components that programmers can use to access data and data services. It is a part of the base class library that is included with the Microsoft .NET Framework. It is commonly used by programmers to access and modify data stored in relational database systems, though it can also access data in non-relational sources.

7.4.1 Example

This time: Create everything from scratch using C# code and ADO.NET. Fill a "DropDownList" with Book Names from the Database Print the Author Name based on the selected BookName on the screen, see below.



Your .aspx page should look something like this:



Your .aspx.cs page should look something like this:

```
namespace WebApplication1
{
    public partial class WebForm4 : System.Web.UI.Page
    {

        private string connectionString = WebConfigurationManager.ConnectionStrings["LIBRARYConnectionString"].ConnectionString;

        protected void Page_Load(object sender, EventArgs e)
        {
            if (!IsPostBack)
               {
                    FillBookList();
               }
        }

        protected void lstBook_SelectedIndexChanged(object sender, EventArgs e)
        {

            // Create a Select statement that searches for a record
            // matching the specific author ID from the Value property.
            string selectSQL;
            selectSQL = "SELECT * FROM BOOK ";
            selectSQL += "WHERE BookId='" + lstBook.SelectedItem.Value + "'";

            // Define the ADO.NET objects.
            SqlConnection con = new SqlConnection(connectionString);
            SqlCommand cmd = new SqlCommand(selectSQL, con);
            SqlDataReader reader;

            // Try to open database and read information.
            try
            {
                con.Open();
                reader = cmd.ExecuteReader();
                reader.Read();

                lblResults.Text = reader["Author"].ToString();
                reader.Close();
            }
            catch (Exception err)
            {
                lblResults.Text = "Error getting Data. ";
                lblResults.Text += err.Message;
            }
            finally
            {
                con.Close();
            }
        }
```

The Page_load() method is executed when the Web Page is loaded. In this simple example we put all the code into the Event Handler for the DropDownList. The code could be improved by creating a separate Class where you put this code into a Method.

The **FillBookList** method is as follows:

```
private void FillBookList()
{
    lstBook.Items.Clear();

    string selectSQL = "SELECT BookId, BookName FROM BOOK";

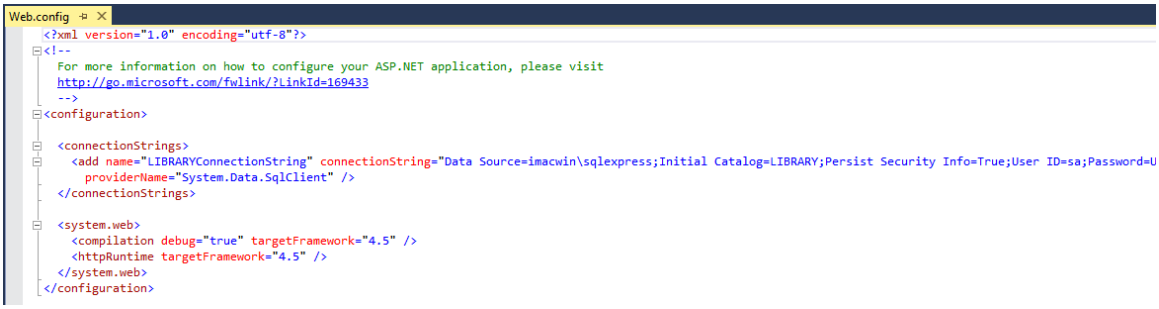
    // Define the ADO.NET objects.
    SqlConnection con = new SqlConnection(connectionString);
    SqlCommand cmd = new SqlCommand(selectSQL, con);
    SqlDataReader reader;

    // Try to open database and read information.
    try
    {
        con.Open();
        reader = cmd.ExecuteReader();

        while (reader.Read())
        {
            ListItem newItem = new ListItem();
            newItem.Text = reader["BookName"].ToString();
            newItem.Value = reader["BookId"].ToString();
            lstBook.Items.Add(newItem);
        }
        reader.Close();
    }
    catch (Exception err)
    {
        lblResults.Text = "Error reading list of names. ";
        lblResults.Text += err.Message;
    }
    finally
    {
        con.Close();
    }
}
```

The code could be improved by creating a separate Class where you create this Method.

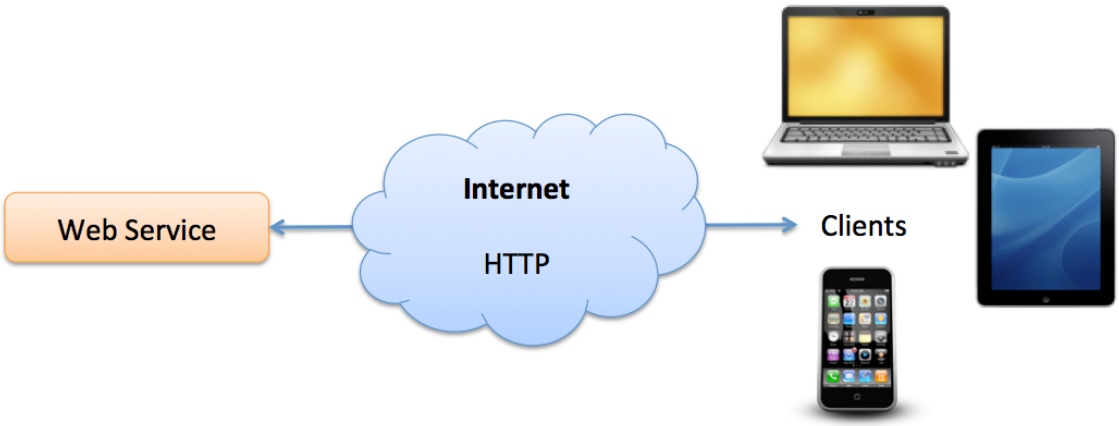
All kind og configuration should be stored in the Web.config file, including Database Connection Strings, etc.



8 Web Services

In order to share data between devices over Internet, Web Services is the solution.

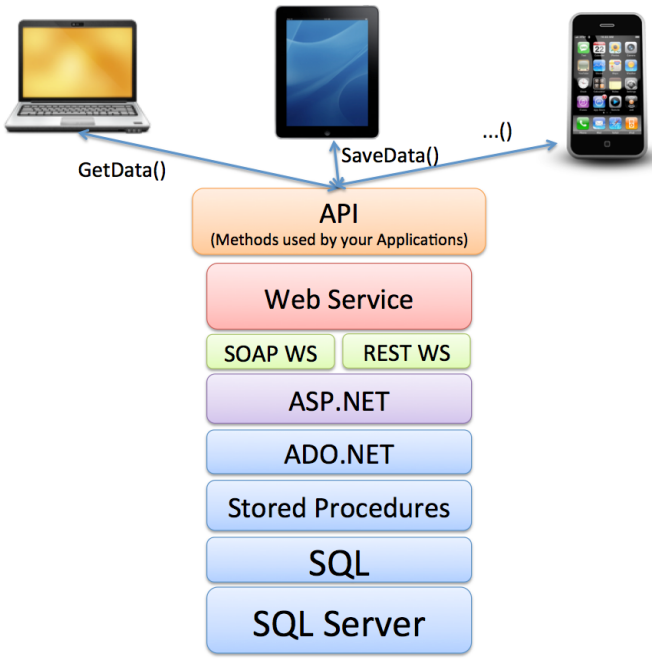
In ASP.NET there are several alternatives for creating such Web Services.



See the Tutorial “Web Services with Examples” for more details.

Visual Studio and ASP.NET has powerful features for creating Web Services:

- ASMX Web Service (Traditional Web Wervice using SOAP)
- ASP.NET Web API (The modern Web Service using REST, Web 2.0)





ASP.NET Web Programming

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