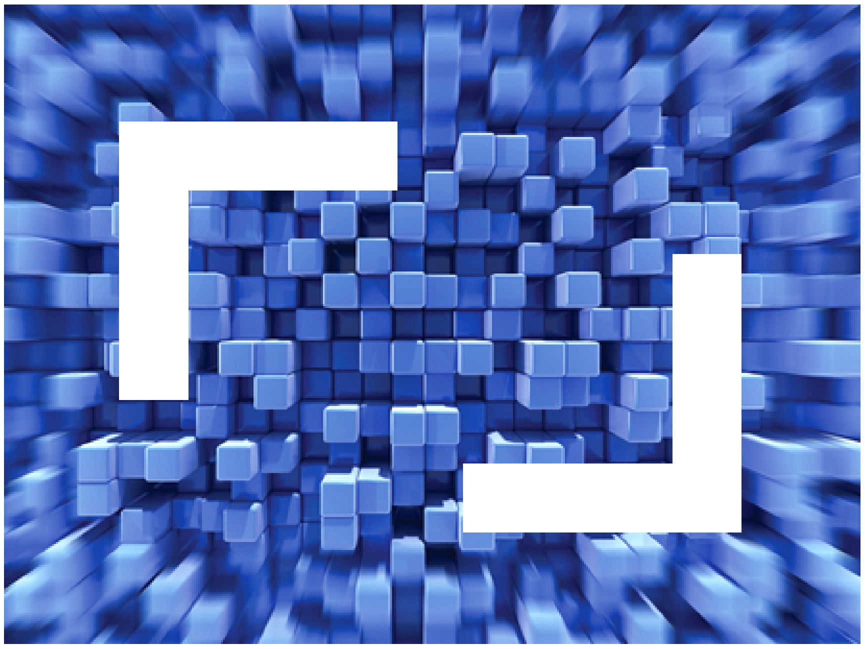

Visual COBOL and COBOL for .NET Language Introduction

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Leading the Evolution™

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Introduction

This document provides a short introduction to Visual COBOL for Visual Studio and the COBOL for .NET language. It introduces basic parts of the development environment, and shows some basic application benefits, features, and enhancements of COBOL for .NET.

The document is split into two parts. In the first part, you create a simple application and get a feel for the Visual COBOL for Visual Studio development environment. The first part ends with an overview of the debugging tools available with Visual COBOL. The second part starts with a small legacy application and progressively introduces Visual COBOL concepts and features into the application. This gives helps you understand how existing code can be migrated to take full advantage of Visual COBOL and COBOL for .NET.

Visual Studio Overview

Visual Studio is an integrated development environment (IDE) used to develop a wide variety of console and graphical user interface (GUI) applications. You can also use it to develop web sites, applications and services in both native and managed code.

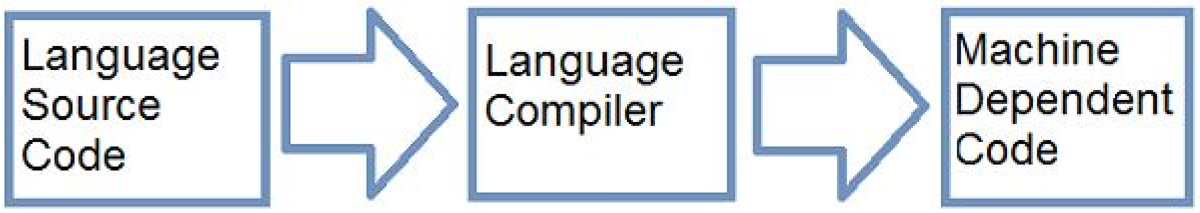
The graphical code editor includes numerous built in tools and accepts plug-ins for additional functionality, from both Microsoft and third party vendors. It supports different programming languages, some built-in, some installed separately. Individual language-specific plug-ins are also available providing language support for a more dedicated development environment. Visual COBOL is one such plug-in.

The COBOL for .NET Language

Visual COBOL for Visual Studio offers COBOL for .NET, which is COBOL with extensions that support the .NET managed framework. The extensions allow Object Oriented (OO) syntax support and access to available .NET class libraries.

Managed and Native Code

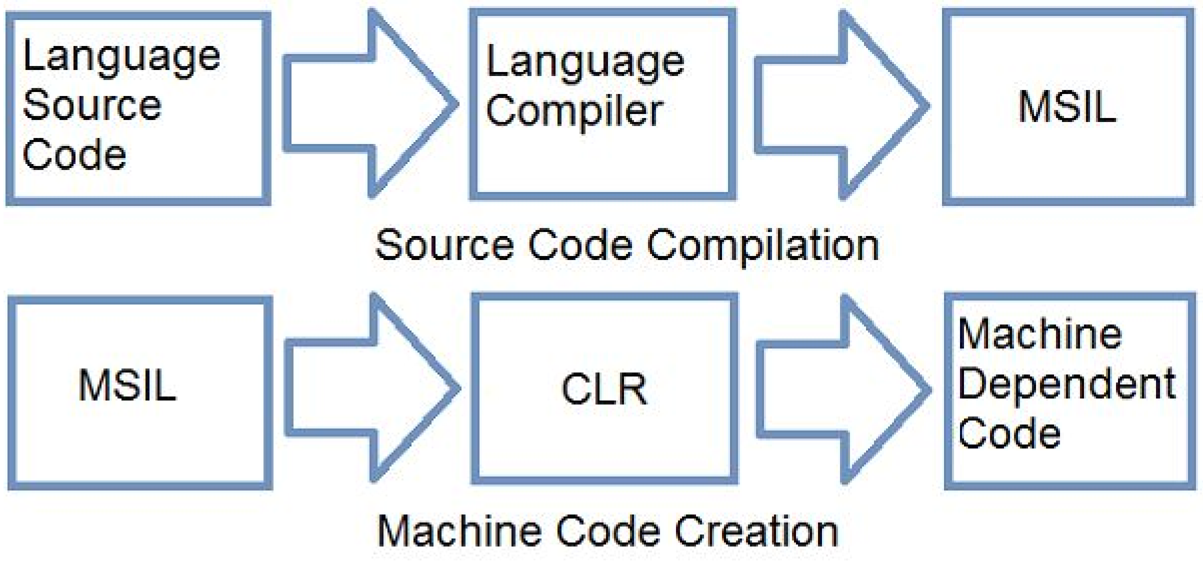
Native code is code that is created and compiled to low-level executable code for a specific microprocessor and operating system. It is not portable to systems with different microprocessors and operating systems.



Machine Code Creation

Managed code is code that executes in a controlled runtime environment. Machines with microprocessor types different from the source code machine cannot execute the code natively without a system to manage code execution. On Windows systems, the controlled environment is the .NET Framework Common Language runtime (CLR).

On windows systems, source code is encoded in the Microsoft Intermediate Language (MSIL). The CLR manages the encoding to MSIL. Any programming language that targets the CLR produces the correct encoding for that language. Before execution, the CLR compiles the MSIL into machine dependent, or native executable code. Because the compiling is done in a managed environment, that managed code can be used by any host machine.



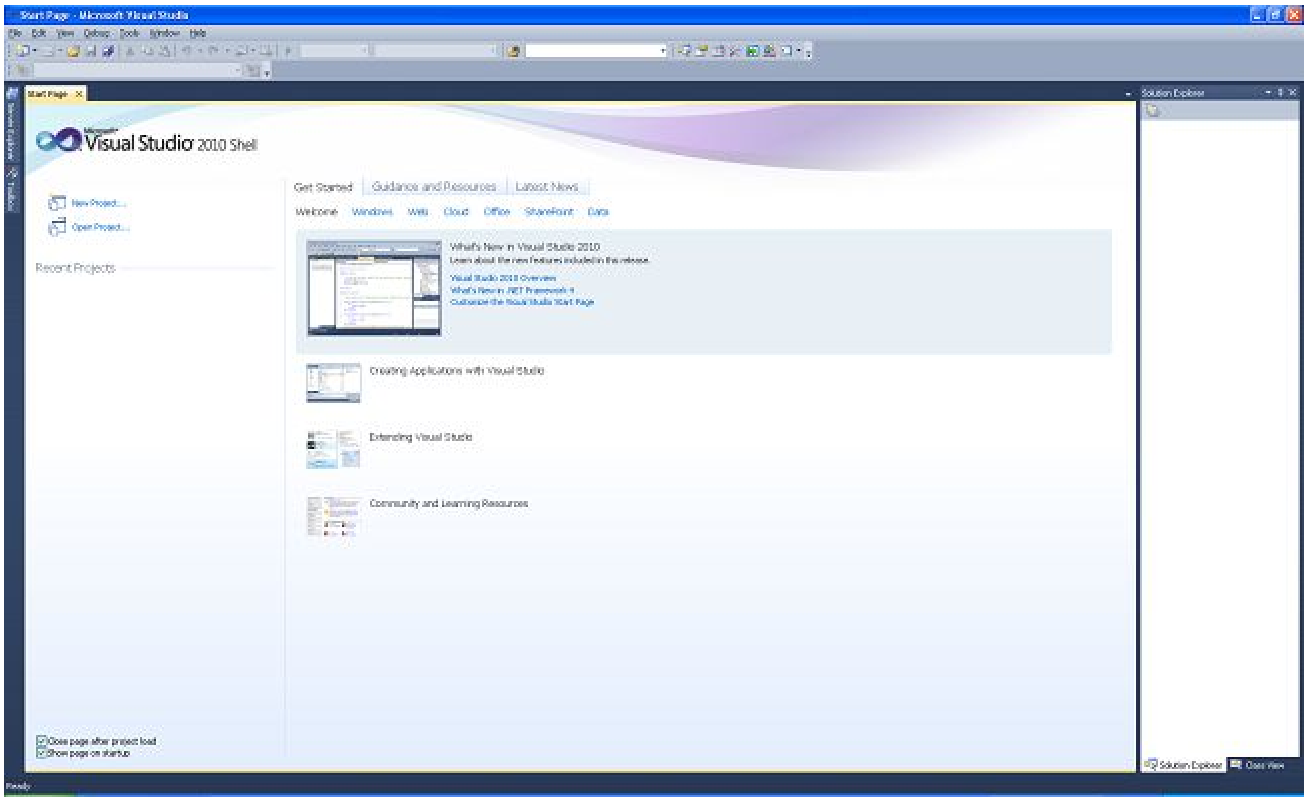
Starting Visual COBOL

Start Visual COBOL for Visual Studio to load the standard libraries and tools used to develop robust and reusable applications using COBOL.

- Click **Start menu > All Programs > Micro Focus Visual COBOL 2010 > Visual COBOL for Visual Studio**.

If prompted to set the environment, choose **General development environment**. The General development environment customizes Visual Studio to work with COBOL projects.

Visual COBOL starts within Visual Studio, and the Visual Studio Start page appears with up-to-date Visual Studio information as follows.


Start Page - Microsoft Visual Studio
File Edit View Debug Tools Window Help
Start Page
Visual Studio 2010 Shell
New Project...
Open Project...
Recent Projects
Get Started
Guidance and Resources
Latest News
Welcome Windows Web Cloud Office SharePoint Data
What's New in Visual Studio 2010
Learn about the new features included in this release.
Visual Studio 2010 Overview
What's New in .NET Framework 4
Customize the Visual Studio Start Page
Creating Applications with Visual Studio
Extending Visual Studio
Community and Learning Resources
Close page after project load
Show page on startup
Solution Explorer
Class View
Ready

Use the **File** menu to open solutions and projects. The Solution Explorer appears in the right-hand pane. The Solution Explorer displays the structure of the opened solution or project.

In the Solution Explorer, double click a file name to display its contents in a separate Code Editor tab.

The **Output** window displays below the Code Editor tab. This is where messages from the Visual Studio Integrated Development Environment (IDE) and compiler appear. The Error List tab in the **Output** window shows any error messages, warnings and other messages that occur during code development or when compiling a solution or project.

Projects and Solutions

A solution is a container holding one or more projects that work together to create an application. A solution file has a **.sln** extension and is a readable text file.

A project is a packaging unit that typically builds a single library or executable. A Managed COBOL project file has a **.cblproj** extension and is a readable text file.

Both solution and project files should not be updated outside of Visual Studio.

A First Console Application

This section shows how to create a managed COBOL console application from supplied templates and extend it to create a traditional Hello World application. It also shows how to build and execute the application with Visual COBOL and how to execute the application from a command prompt.

Creating a Console Application

Follow the steps to create a new solution and new project. The new solution displays in the Solution Explorer. The COBOL program created from a template for the project displays in the Code Editor tab.

1. Click **File** > **New** > **Project**.
   The **New Project** dialog box appears.
2. Click **COBOL** > **Managed** in the Installed Templates pane.
   Available COBOL templates appear in the templates list.
3. Select **Console Application** from the list.
4. Enter `ConsoleHelloWorld` as the name of the project in the **Name** field, and click **OK**.
   Visual Studio creates a new solution and a project in the solution named `ConsoleHelloWorld`, and a new program template named `Program1.cbl`. `Program1.cbl` displays in a Code Editor tab. The current code for `Program1.cbl` is the template code, as shown in the following.

   ```
   program-id. Program1 as "ConsoleHelloWorld.Program1".

   data division.
   working-storage section.

   procedure division.

          goback.

   end program Program1.
   ```
5. Add a statement to this program to display the text "Hello World" when executed.
   To do this, place the cursor after the `procedure division.` line and press **Tab** to move the cursor to the start of Area B (column 12). Add the `display` statement into the program between the `procedure division` and the `goback` statement so the program looks as follows.

   ```
   program-id. Program1 as "ConsoleHelloWorld.Program1".

   data division.
   working-storage section.

   procedure division.
          display "Hello World"
          goback.

   end program Program1.
   ```
6. Click **File** > **Save *Program1.cbl*** to save the code update.

Building and Executing an Application from Visual Studio

Building an application in Visual Studio converts the code to MSIL. You can execute an application in Visual Studio or from a command prompt. When executing an application, the MSIL is compiled by the CLR into the machine code required by the host machine.

1. Click **Build** > **Build *ConsoleHelloWorld***.
   ConsoleHelloWorld is the current project name. The **Output** window shows messages generated during the build.
2. Once the application has built, click **Debug** > **Start without debugging**.
   A console prompt displays the text **Hello World**. You are prompted to press any key to continue. This closes the console prompt.

Building and Executing an Application from a Command Prompt

To execute an application from a command prompt instead of with Visual COBOL, open a Visual COBOL command prompt and enter the command to execute the application.

1. Click **Start menu > All Programs** > **Micro Focus Visual COBOL 2010** > **Visual COBOL Tools** > **Visual COBOL Command Prompt (32-bit)**.
   This opens a command prompt to your document directory by default. From this directory, navigate to the directory containing the application. This directory is *\Visual Studio 2010\Projects \ConsoleHelloWorld\ConsoleHelloWorld\bin\debug* by default. Verify that the application is in this directory.
2. To navigate to the directory containing the application, type `cd \[default document directory] \Visual Studio 2010\Projects\ConsoleHelloWorld\ConsoleHelloWorld\bin\debug` at the command prompt and press **Enter**.
3. Type `ConsoleHelloWorld` and press **Enter**.
   The application starts, displays the text `Hello World` and then ends. The text `Press any key to continue...` does not appear. This text only appears if the application runs in Visual COBOL to allow you to see the console application output after completion.

A First Graphical Application

This section shows how to create a managed COBOL application from a template and use it to create the traditional Hello World application. It also shows how to extend the application by adding user input and button control.

Creating a Graphical Application

Follow these steps to create a new solution for the graphical application.

1. Click **File** > **New** > **Project.**
   The **New Project** dialog box displays.
2. Click **COBOL** > **Managed** in the Installed Templates pane.
   Available COBOL templates appear in the templates list.
3. Select **Windows Forms Application** from the list.
4. Type `WindowsHelloWorld` as the name of the project in the **Name** field and click **OK.**
   Visual Studio creates a new solution and a project in the solution named *WindowsHelloWorld*, and a new program template called `Main.cbl`. It also creates a new form and associated program named `Form1.cbl` and `Form1.Designer.cbl`. The project structure displays in the Solution Explorer, and the `Form1.cbl` form displays in a Code Editor tab.

Adding a Label Control

Use labels to place text on a form that names or titles another control on the form. Label text cannot be edited by a user. This includes labels for text fields, instructions and some warning indicators. Follow these steps to create and place a label on the form.

1. Click **View** > **Toolbox** to display the Toolbox.
2. Drag and drop a **Label** control onto the form.
   This creates a Label control named **label1** containing the text *label1*.
3. In the Solution Explorer, highlight the **Text** property value in the **Appearance** section of the **Properties** pane.
   The **Properties** pane is in the bottom right of the Visual Studio IDE under the Solution Explorer pane by default.

4. Type `Hello World` to change the property value and press **Enter**.
   The property value for the **Label** control updates.

Use instructions in *Building and Executing an Application from Visual Studio* to build and execute the application. This opens a form called *form1* that displays a label named `Hello World`. Click on the **x** in the top-right corner to close the form and stop the application.

Adding a Button Control

A button is a control on a form that a user can click to perform a predetermined task. A click event handler defines the task the button performs. Use the following steps to place a button onto the `Form1.cbl` form.

1. Click **View** > **Toolbox** to display the Toolbox.
2. Drag and drop a **Button** control onto the form.

   Tip: Visual Studio displays line guides when controls are aligned on the page.

3. In the Solution Explorer, highlight the **Text** property value in the **Appearance** section of the **Properties** pane.
4. Type `Say Hello` to change the property value and press **Enter**.
   The property value for the **Button** control updates.

Use instructions in *Building and Executing an Application from Visual Studio* to build and execute the application. The button displays on the form. However clicking the button has no effect as there is currently no click event handler written for it. The next exercise adds the click event handler for the button.

Adding a Click Event Handler

A click event handler is code that executes when a control is clicked. The code can be a single action or several actions, including navigation to a different page. The following steps add the click event handler to the button control.

1. Double-click the button.
   The code for `Form1.cbl` appears. Code for a method named *button1_click* generates and appears in a separate Code Editor tab. The method is given the same name as the button with **_click** appended. This method contains the code to be executed when clicking the button, as shown in the following.

```
working-storage section.

method-id NEW.
procedure division.
    invoke self::InitializeComponent
    goback.
end method.

method-id button1_Click final private.
procedure division using by value sender as object e as type
System.EventArgs.
end method.

end class.
```

2. Add a statement to move **Hello World** into the text property of the label named *label1* previously created. Currently *label1* already contains a value, so this is removed. To do this, place the cursor after the `procedure division` line and press **Enter**.
   This creates a new line and puts the cursor to the start of Area A (column 8).
3. Press the **Tab** key to move the cursor to the start of Area B and type the event handler code as follows.

```
set self::label1::Text to "Hello World"
```

This code moves the text **Hello World** to the **Text** property of the previously created *label1* label. This removes the current *label1* value.

Tip: Visual COBOL uses IntelliSense to suggest text completions as you type. See *Working With IntelliSense* for more information.

The code should be as follows.

```
working-storage section.

method-id NEW.
procedure division.
    invoke self::InitializeComponent
    goback.
end method.

method-id button1_Click final private.
procedure division using by value sender as object e as type
System.EventArgs.
    set self::label1::Text to "Hello World"
end method.

end class.
```

4. Click on the tab labeled **Form1.cbl [Design]** at the top of the code editor to display the form in the Code Editor tab.
5. Click on the **Label** control.
   The control's properties appear in the **Properties** pane.
6. Clear the **Text** property value and press **Enter**.
   The property value updates.

Use instructions in *Building and Executing an Application from Visual Studio* to build and start the application. When started, the form opens and displays a button with the text `Say Hello`. Click the button to cause `Hello World` to display on the form. Click the **x** in the top-right corner to close the form and stop the application.

Adding a Text Box Control

A text box is a control that lets you enter textual content. Follow these steps to place a text box onto the form.

1. Click on *Form1.cbl [Design]* tab to display the form designer window.
2. Click **View** > **Toolbox** to display the Toolbox.
3. Drag and drop a **Text box** control onto the form.
   A text box control is added to the form.

Use instructions in *Building and Executing an Application from Visual Studio* to build and execute the application, which displays a text box and a button. At this point, no matter what you enter into the text box, nothing is done with it.

Tying it all Together

The application now has **Label**, **Button** and **Text box** controls and a click event handler. All that remains is to display a text label for the entry field and add an event to the button to do something with the entry field. To do this, perform the following steps.

1. Add a **Label** control to the form.
   Place the label near the text box to give the user an indication of what to type into the text box.

2. In the Solution Explorer, highlight the **Text** property value in the **Appearance** section of the **Properties** pane.
3. Type `First Name` to change the property value and press **Enter**.
   The property value for the **Label** control updates.
4. Double-click the **Button** control.
   The code for `Form1.cbl` appears. This code contains the click event handler for the button that was updated in the exercise to add a click event handler, but with an additional method for the new label as shown in the following.

```
working-storage section.

method-id NEW.
procedure division.
    invoke self::InitializeComponent
    goback.
end method.

method-id button1_Click final private.
procedure division using by value sender as object e as type
System.EventArgs.
    set self::label1::Text to "Hello " & self::textBox1::Text
end method.

method-id label2_Click final private.
procedure division using by value sender as object e as type
System.EventArgs.
end method.

end class.
```

5. Replace the previously added code so it reads as follows:

```
set self::label1::Text to "Hello " & self::textBox1::Text
```

   This concatenates the constant text *Hello* and the contents of the text box *textBox1*, and places the results into the *label1* label when clicking the button.

Build and execute the application to display a text box labeled `First Name` and a button. Type `Fred` into the text box and click the button. The text `Hello Fred` appears.

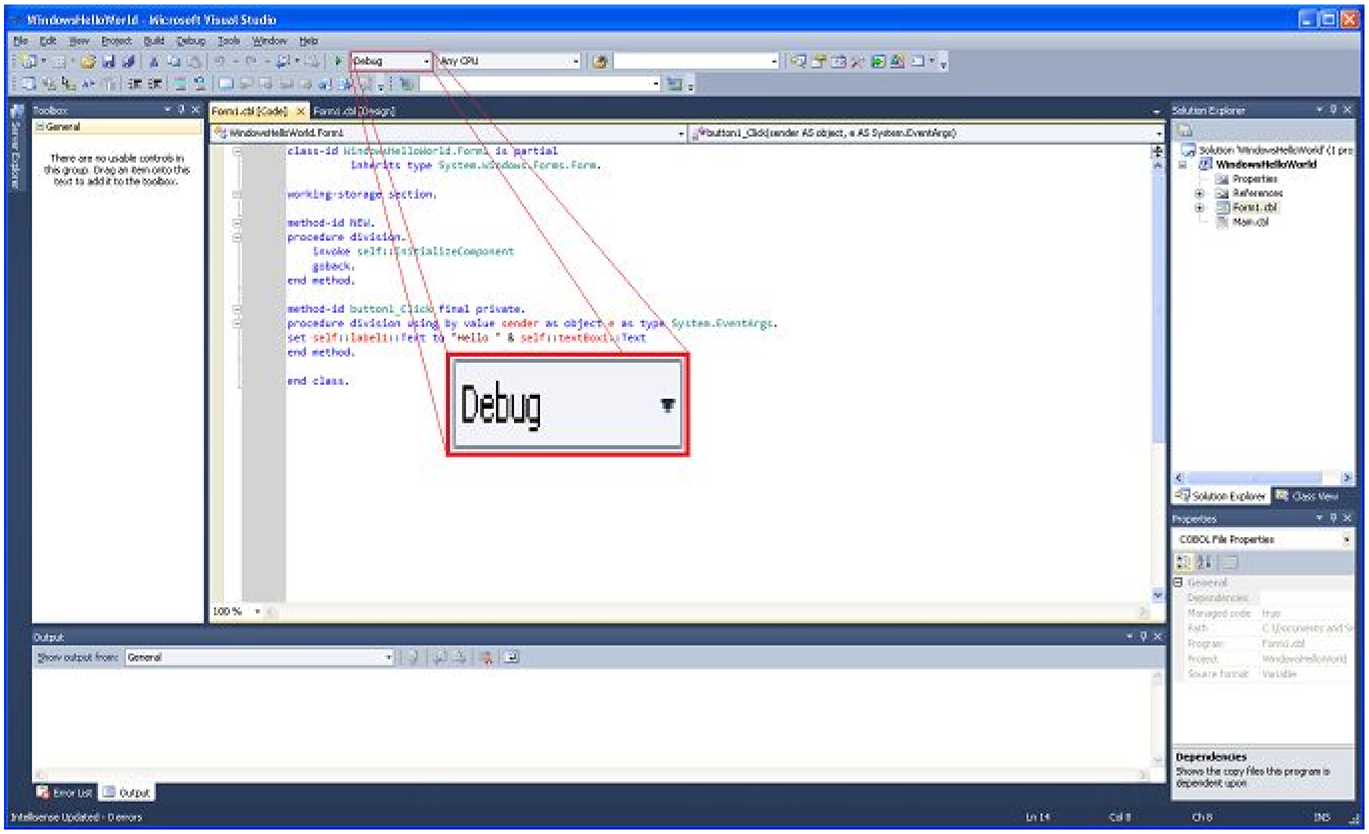
Overview of Visual COBOL Debugging

Writing and building an application like the Hello World example is very simple. The chance of creating an error by spelling a word incorrectly is low, especially with the dynamic checking being done by IntelliSense within Visual COBOL.

As an application gets more complex the likelihood of an application error gets higher very quickly. Visual COBOL provides tools to help the cause of these errors should they occur. This section shows how to build and run using debugging and how to use the debugging features.

Building for Debug

To debug an application, ensure that the debug configuration is selected. The **Solution Configurations** listbox on the Visual Studio toolbar shows the current configuration type. To change the configuration, select the appropriate option from the list box.



```
class-id WindowsHelloWorld.Form1 is partial
         inherits type System.Windows.Forms.Form.

working-storage section.

method-id NEW.
procedure division.
    invoke self::InitializeComponent
    goback.
end method.

method-id button1_Click final private.
procedure division using by value sender as object e as type System.EventArgs.
set self::label1::Text to "Hello " & self::textBox1::Text
end method.

end class.
```

Executing with Debug

Visual COBOL provides a wide variety of application debugging tools that let you to track down any application errors. These tools are available during the application execution when execution is configured for debugging. To configure for debugging:

1. Click **Debug** > **Start Debugging.**
   Visual COBOL automatically rebuilds the application if any source has changed since the previous build, and the application starts.
2. (optional) Set breakpoints to make the application stop at specific points during execution.

Breakpoints

A breakpoint is a placeholder placed in the source code. When a breakpoint is encountered during application execution, the application pauses and the line containing the breakpoint highlights. While the application is paused you can retrieve information about current variables, set additional breakpoints or interrogate application behavior.

Tip: Pausing the application during debug execution is also known as break mode.

Setting a Breakpoint

Perform the following steps to set a breakpoint:

1. Click the line where you want to pause the application execution.
2. Click **Debug** > **Toggle Breakpoint**.
   A breakpoint is created. A red dot displays in the left margin next to the code line where execution is set to pause.

Note: If a breakpoint is set on a non-executing code line, the application pauses at the next executing code line.

Disabling a Breakpoint

While debugging you might want to ignore a set breakpoint, but keep it in place for later use. This cannot be done by using the menu options at the top of the Visual COBOL window, but instead via the context menu as follows:

1. Right-click on the line of code beside the breakpoint to display the context menu.
2. Select **Breakpoint** > **Disable Breakpoint**.
   The selected breakpoint disables as indicated by the red circle in the left margin. To re-enable a breakpoint select **Breakpoint** > **Enable Breakpoint** from the context menu.

Removing a Breakpoint

Once you have no further use for a breakpoint, remove it by doing the following.

1. Select the breakpoint by clicking on the corresponding code line.
2. Click **Debug** > **Toggle Breakpoint**.
   The selected breakpoint is removed. Repeating these steps alternatively sets and removes a breakpoint.

Debug Navigation

Dynamically interrogating and monitoring data movement during application execution is a powerful and useful feature within the Visual COBOL environment. The current line of execution displays in the Code Editor tab during application debugging. As the application executes, the display steps into or over the methods as directed, highlighting the next line of code to be executed. The list below shows the navigational options available during debugging.

- Stepping Over (**Debug** > **Step Over**)

  Executes the current line and progresses to the next line of code in the current code block. Any methods the debugger encounters execute completely. If the end of the code block is reached, control returns to the calling block.
- Stepping Into (**Debug** > **Step Into**)

  Executes one code command at a time. For a simple numeric operation, the debugger behaves as if **Step Over** is being used. For more complex code, the debugger passes control to any called method and executes its first code line, steps through the rest of the method before returning to the calling method. The Code Editor tab shows the executing code line.
- Stepping Out (**Debug** > **Step Out**)

  Completes the current method and stops at the next line of the calling method.
- Restarting the debugger (**Debug** > **Restart**)

  Restarts debugging at the first line of the application.
- Stopping the debugger (**Debug** > **Stop Debugging**)

  Terminates the debugger.
- Setting the next statement.

  Allows you to set the next statement to be executed. To do this, right-click the line of code to be executed and select **Set Next Statement**.

Migrating to Managed Code

This part of the Language Introduction illustrates some of the major benefits of using COBOL with Windows forms when the application is built as managed code. It shows how to take advantage of tools and techniques to speed up your software development and produce efficient and powerful platform-independent applications.

Using a simplified procedural console application, the next sections show the capabilities and benefits of using COBOL as part of a managed solution. As you progress through the sections, the code adds supported Object Oriented (OO) syntax to access available extensions.

The sections use a sample solution named *CblDemoSolution*, which contains a project named *CblDemoProject. CblDemoProject* contains programs which relate to the following sections, starting with *CblDemo1*. The project also includes a class definition named *Person*, which is used in the final section. To execute the programs, ensure that the startup object is set correctly for the project. To change the startup object, see *Changing the Startup Object* in the appendix.

The CblDemo1 Sample Application

CblDemo1 is a console application that asks for name, date of birth and today's date and displays the number of days until your next birthday. It is a complete application in that it can be executed.

Use this sample application to complete exercises in this section. The solution has been left deliberately poor in design so it can be extended with your own functionality. The application is reproduced below in its entirety for ease of reference without complete code formatting. Comments are excluded to simplify maintenance and readability.

```
IDENTIFICATION DIVISION.
PROGRAM-ID. CblDemo1.
ENVIRONMENT DIVISION.
DATA DIVISION.
WORKING-STORAGE SECTION.
01 today.
    03 today-month   PIC 99.
    03 today-day     PIC 99.
01 dob.
    03 dob-month     PIC 99.
    03 dob-day       PIC 99.
01 test-date.
    03 test-month    PIC 99.
    03 test-day      PIC 99.
01 max-month         PIC 99.
01 max-days          PIC 99.
01 total-days        PIC 999.
01 full-name         PIC X(30).
01 display-output    PIC X(60).
01 greeting-output   PIC X(60).
01 show-non-usage    PIC X(12).
01 txt1              PIC X(10) value "Hello Mr ".
01 diff-output.
    03 txt2          PIC X(11) value " you have ".
    03 output-days   PIC ZZ9.
    03 txt3          PIC X(40) value " days until next birthday".

PROCEDURE DIVISION.
    DISPLAY "Enter your full name"
    ACCEPT full-name
    DISPLAY "Enter your date of birth in mmdd format"
    ACCEPT test-date
    PERFORM validate-test-date
    MOVE test-date TO dob
    DISPLAY "Enter the date today in mmdd format"
    ACCEPT test-date
    PERFORM validate-test-date
    MOVE test-date TO today
    PERFORM add-day-difference
    PERFORM add-mth-difference UNTIL (max-month = DOB-month)
    MOVE total-days TO output-days
    STRING txt1, full-name DELIMITED BY SIZE INTO greeting-output
    DISPLAY greeting-output
    STRING full-name, diff-output DELIMITED BY SIZE INTO display-output
    DISPLAY display-output
    STOP RUN
    .

validate-test-date SECTION.
    IF (test-day = 0)
        STOP "Invalid day field"
        STOP RUN
    END-IF.
    IF ((test-month = 0) OR (test-month > 12))
        STOP "Invalid month field"
        STOP RUN
    END-IF.
    MOVE test-month TO max-month.
    PERFORM set-max-days.
    IF (test-day > max-days)
       STOP "Invalid day field"
       STOP RUN
    END-IF
    .

add-day-difference SECTION.
    MOVE today-month TO max-month
    PERFORM set-max-days
    IF (DOB-day = today-day)
        MOVE ZERO TO total-days
    ELSE
        IF (DOB-day > today-day)
            COMPUTE total-days = DOB-day - today-day
        ELSE
            COMPUTE total-days = (max-days - today-day) + DOB-day
            PERFORM increment-test-month
        END-IF
    END-IF
    .

add-mth-difference SECTION.
    PERFORM set-max-days
    ADD max-days TO total-days
    PERFORM increment-test-month
    .

increment-test-month SECTION.
    ADD 1 TO max-month
    IF (max-month > 12)
        MOVE 1 TO max-month
    END-IF
    .

unused SECTION.
EXIT SECTION.
```

```
set-max-days SECTION.
    EVALUATE max-month
        WHEN  1 MOVE 31 TO max-days
        WHEN  2 MOVE 28 TO max-days
        WHEN  3 MOVE 31 TO max-days
        WHEN  4 MOVE 30 TO max-days
        WHEN  5 MOVE 31 TO max-days
        WHEN  6 MOVE 30 TO max-days
        WHEN  7 MOVE 31 TO max-days
        WHEN  8 MOVE 31 TO max-days
        WHEN  9 MOVE 30 TO max-days
        WHEN 10 MOVE 31 TO max-days
        WHEN 11 MOVE 30 TO max-days
        WHEN 12 MOVE 31 TO max-days
    END-EVALUATE
    .

END PROGRAM CblDemo1.
```

Native Code Support

Existing native COBOL code can be built and executed in Visual COBOL without additional changes. This means rapid migration of existing application code to the new environment, since an application can quickly run alongside original applications.

With Visual COBOL, some procedural COBOL coding syntax is no longer required for applications to run. Redundant lines are still recognized but are ignored during the application build. In *CblDemo1*, some redundant lines of code have been included as an illustration and are listed below, but will be removed elsewhere in this document.

- IDENTIFICATION DIVISION
- ENVIRONMENT DIVISION
- DATA DIVISION
- WORKING-STORAGE SECTION

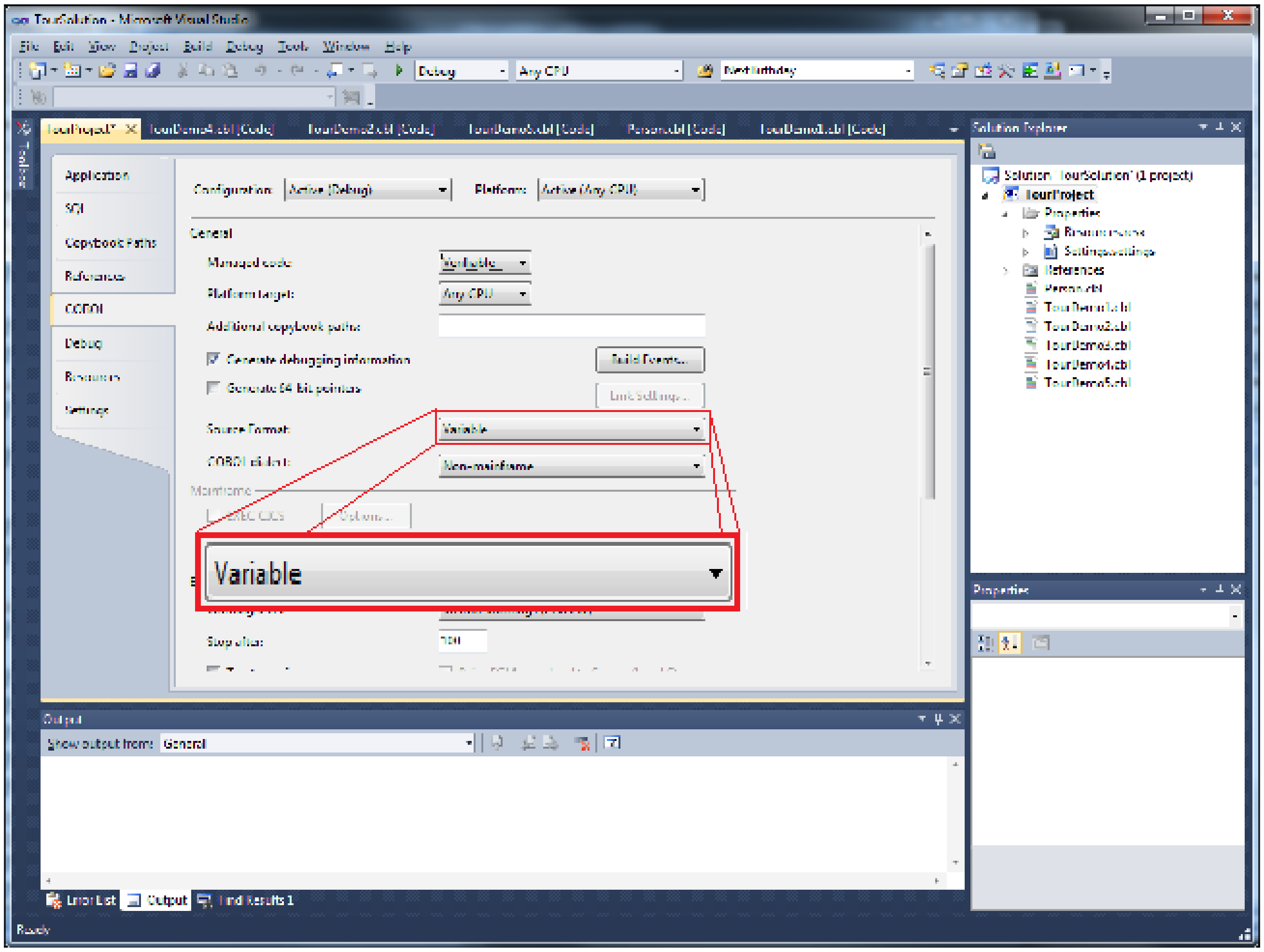
COBOL Margins

Visual COBOL displays the set COBOL margins. A gray margin for the sequence number and the indicator displays when the format is set as `Variable`. An additional margin displays to the right when the format is set as `Fixed`.

Changing COBOL Margins

The following steps show you how to change COBOL margins inVisual COBOL:

1. Right-click on the project in the Solution Explorer and select **Properties**.
   The project properties display in the **Properties** page.
2. In the **Properties** page, select the **COBOL** tab.
   The COBOL tab properties appear.
3. Use the **Source Format** list box to select the appropriate COBOL margin type.
   This sets the displayed margins for COBOL code in Visual COBOL.


TourSolution - Microsoft Visual Studio
File Edit View Project Build Debug Tools Window Help
TourProject* TourDemo4.cbl [Code] TourDemo2.cbl [Code] TourDemo5.cbl [Code] Person.cbl [Code] TourDemo1.cbl [Code]
Application
SQL
Copybook Paths
References
COBOL
Debug
Resources
Settings
Solution Explorer
Solution 'TourSolution' (1 project)
TourProject
Properties
References
Person.cbl
TourDemo1.cbl
TourDemo2.cbl
TourDemo3.cbl
TourDemo4.cbl
TourDemo5.cbl
Properties
Output
Error List
Output
Find Results 1
Ready

Configuration: Active (Debug)
Platform: Active (Any CPU)

General
Managed code: Verifiable
Platform target: Any CPU
Additional copybook paths:
☑ Generate debugging information
☐ Generate 64 bit pointers
Source Format: Variable
COBOL dialect: Non-mainframe
Stop after: 100

Show output from: General

Use the **Source Format** setting to specifying margin settings instead of the `SOURCEFORMAT` compiler directive.

Unused Member Identification

Visual COBOL helps you quickly find unused variables and sections in COBOL code.

By default, unused variable names in Visual COBOL appear in gray text. The text color changes to red by default for variable names used in the application.

Variable name text color can help to determine which variables can be removed completely. *CblDemo1* includes an example of an unused variable name called *show-non-usage*.

Identify an unused section by hovering the cursor over the section name. This displays a ToolTip indicating the number of references. If *No References* displays in the ToolTip, then the section is a candidate for removal. *CblDemo1* includes the section *unused* with no references.

Working with Data Types and Namespaces

This section describes available managed code data types and briefly discusses what namespaces are and how they are used. This section also:

- Uses *CblDemo1* to show the `DateTime` data type and how to optimize `DateTime` functionality.
- Uses *CblDemo3* to show the `String` data type and how to optimize `String` functionality.

In the sample solution, *CblDemo2* contains the completed code based on `DateTime` data type exercises completed in this section. *CblDemo3* contains the completed code based on `String` data type exercises completed in this section. See the Changing the Startup Object appendix for information on starting the programs.

COBOL Data Types

Managed COBOL supports both .NET data types as well as traditional COBOL data types. Frequently used types like Strings and Integers have synonyms in COBOL. You can reference other types using the keyword TYPE followed by the type name as shown.

```
01 dob                  type DateTime.
01 display-output            String.
```

See the appendix for a data type reference chart.

.NET Data Types

The .NET framework has strong data types. This means objects of one type cannot be freely exchanged with another type, and implicit and explicit conversions allow for data conversion. All data types derive from a `System.Object` data type, which can be assigned any object or variable.

Namespaces

A namespace is a grouping containing related data types.

A namespace references its available classes and methods. For example, the field *dob* is defined as being of type `DateTime` which is grouped into the namespace *System*:

```
01 dob                type System.DateTime.
```

The .NET Framework includes a variety of namespaces such as Accessibility, System.Data, System, System.IO, and System.Runtime. All namespaces include related classes and methods.

Visual COBOL imports the namespace `System` by default, so there is no need to prefix classes from this namespace. This means the example above can also be written as:

```
01 dob                type DateTime.
```

Removing Namespace Prefixing

Add namespaces directly to your project properties so that you don't need to type the fully qualified namespace when developing code. The `System` namespace is included by default. To add other namespaces to your project properties:

1. Right-click on the project name in the Solution Explorer and select **Properties**.
   The project properties display in the **Properties** page.
2. In the **Properties** page, select the **References** tab.
   The **References** tab properties appear.
3. Scroll down to the **Imported Namespaces** list.
   This list contains all available namespaces.
4. Select the check box next to each namespace in the list to directly import into the project build.
   This indicates whether the namespace is directly imported in the project build. Namespaces not selected require the full namespace prefixing in code.

Simplify your code by removing namespace prefixes included in the **Imported Namespaces** list. Use the **Imported Namespaces** project setting to add namespace to a project, as it supercedes the `$SET ILUSING` compiler directive.

DateTime Data Type

In the *CblDemo1* sample application, the *today* and *dob* fields in the data definition can be replaced by the `System.DateTime` data type to provide standard date and time functionality. Since the `System` namespace is included in the imported namespaces list by default, the data definition for *today* and *dob* can be replaced with simply `DateTime`. Types derived from `System.Object` must be declared at level 01. Since `DateTime` does not have a synonym in COBOL, the `type` keyword must precede it.

In the sample application, the variable *today* contains the current date. The value is initialized using the built-in `DateTime` method `Today()`.

The following shows the changed variable definitions:

```
01 today                type DateTime value type DateTime::Today().
01 dob                  type DateTime.
01 test-date.
    03 test-month       PIC 99.
    03 test-day         PIC 99.
01 max-month            PIC 99.
01 max-days             PIC 99.
01 total-days           PIC 999.
01 full-name            PIC X(10).
01 display-output       PIC X(60).
01 greeting-output      PIC X(60).
01 txt1                 PIC X(10) value "Hello Mr ".
01 diff-output.
    03 txt2             PIC X(11) value " you have ".
    03 output-days      PIC ZZ9.
    03 txt3             PIC X(40) value " days until next birthday".
```

In this example, a variable derived from `System.Object` provides the contents of the variable by default.

You can use data types of a namespace to replace standard variable data definitions without having to make further updates to existing procedure division code.

Since retrieving the current date for input is no longer required, the lines of code in the sample application that previously defined the *today* and *dob* fields can be removed.

DateTime Object Initialization

The *dob* field is assigned the `DateTime` object value using validated variables as parts of a constructor. A constructor is a method that is called when it's object is initialized, and is typically used to initialize the object's parameters.

In the sample application, the year parameter is provided by the *year* field from the *today* object as shown below:

```
set dob to new type DateTime(today::Year, test-month, test-day)
```

Note: Commas separating the parameters are optional.

DateTime Object Comparison

`DateTime` objects provide a range of methods allowing for date and time manipulation and comparison. Using the difference between the *today* and *dob* fields can be obtained in a much simpler way.

To ensure that negative results are not returned, compare dates to ensure that the *dob* field contains a value that is not less than the value in *today*. The `DateTime` object provides a `CompareTo()` method which returns zero if the dates are identical and +1 or -1 to indicate a difference.

The `DateTime` object provides methods which add and subtract individual elements of a date, automatically adjusting the other elements to ensure that the date remains valid.

In the demonstration application the year is incremented by one if the *dob* date is less than today's date to ensure that it is in the future. The method to be used is `AddYears()` which accepts an integer as a parameter.

In the following line, the `if` statement equates to true if *today* is greater than *dob*. If true, the year element of *dob* increments by one.

```
if today::CompareTo(dob) > 0
      set dob to dob::AddYears(1)
end-if.
```

Use `CompareTo()` method as a condition to a `perform` statement to write a single section to determine the number of days between two `DateTime` objects, as shown in the following.

```
perform add-to-total until today::CompareTo(dob) = 0
```

The *add-to-total* section increments the variable *total-days* and *today*. The `add` statement increments the *total-days* variable. The `AddDays()` method increments the day element of the *today* variable.

```
add-to-total SECTION.
    add 1 to total-days
    set today to today::AddDays(1).
```

With the *add-to-total* section in place, the sections *add-day-difference*, *dd-mth-difference* and *increment-test-month* are now redundant and can be removed.

String Data Type

You can change the sample application to take advantage of more managed COBOL features. Change the `PIC X` variable definition for `display-output` to use the `string` data type to improve string manipulation.

String Data Type Additions

In the *CblDemo3* sample application, you can replace the *`display-output`* variable in the data definition with the `System.String` data type to provide standardized text manipulation functionality. You can also convert the constant text variables to show that initial values have not changed. Types derived from `System.Object` must be declared at level `01`, so the group variable *diff-output* can be removed. You can also remove the *output-days* variable created to display the zero suppressed number of days as it is no longer required.

Defining variables as type `String` removes the need to know the length of the constant. The object automatically sizes to store the variable.

Note: `String` has a synonym in COBOL so does not need to be preceded with the `type` keyword.

The following shows the changed variable definitions, with *temp1* and *greeting-output* added for later use:

```
01 today               type DateTime value type DateTime::Today().
01 dob                 type DateTime.
01 test-date.
    03 test-month      PIC 99.
    03 test-day        PIC 99.
01 max-month           PIC 99.
01 max-days            PIC 99.
01 total-days          PIC 999.
01 temp1               PIC 99.
01 full-name           PIC X(30).
01 display-output      String.
01 greeting-output     String.
01 txt1                String value "Hello Mr ".
01 txt2                String value " you have ".
01 txt3                String value " days until next birthday".
```

Defining variables as type `String` does not require updates to procedure division code. This is because a variable derived from `System.Object` provides the contents of the variable by default.

The sample application copies text captured from the console into the `String` field `display-output` to take advantage of available methods.

String Functionality

Defining the variables as type `String` does not require amendments to procedure division code as default behavior of a variable derived from `System.Object` provides the contents of the variable.

The sample application copies the text captured from the console into the `String` field `display-output` to take advantage of available methods.

Displaying The Surname

The application displays an informal salutation. This exercise shows how to change this to display a surname.

The application displays the contents of the field *txt1* followed by the surname and lastly a comma (,). Assuming that the surname is the last part of the full name preceded by a space character, the position of the space just before the surname needs to be found.

The `String` object lets you use a method to retrieve a substring. To set up the code to take advantage of this method, first set up the *display-output* variable to receive the substring. The `Trim()` method removes all leading and trailing spaces from the string. Use the statement shown below to populate the *greeting-output* variable with the substring.

```
set display-output to full-name
set greeting-output to display-output(???:)::Trim()
```

The example still needs to determine the start position of the surname. Use the `String` object to determine the last occurrence of a provided Unicode character. To do this, use the `LastIndexOf()` method with the first position of the string set to zero. The method takes two parameters separated by a colon (:). The first parameter is the start position of the substring, with one being the first position in the original string. The second parameter is the length of the string to retrieve. If not provided, the remainder of the string is returned.

Use this to populate the *temp1* variable so that the final space character position is just before the surname. Increment the *temp1* variable value by one to give the surname start position.

```
set display-output to full-name
set temp1 to display-output::Trim()::LastIndexOf(' ')
set greeting-output to display-output(temp1 + 1:)::Trim()
```

To display the information, use the `display` keyword followed by the variables in sequence:

```
set display-output to full-name
set temp1 to display-output::Trim()::LastIndexOf(' ')
set greeting-output to display-output(temp1 + 1:)::Trim()
display txt1 greeting-output ","
```

Displaying the First Name

Now that the code is updated to display the surname, this exercise shows how to update the code with managed COBOL to display the following in order:

- The first name
- The *txt2* variable value
- The number of days until the next birthday
- The *txt3* variable value.

It is assumed that no leading spaces have been entered.

The previous exercise uses the `substring` method to display the surname as part of the salutation. This exercise uses it to retrieve the first name from the beginning of the string. The exercise assumes no leading spaces are entered in the string.

With the length of the first name string to be determined, the `display` statement is as follows:

```
display display-output(1:???) txt2 total-days txt3
```

Use the `IndexOf`() method to determine the position of the first provided Unicode character, with the first position of the string being zero. Locating the string's first space position gives the length of the first name. The following populates the *`temp1`* variable with the first space in the *`display-output`* string:

```
set temp1 to display-output::IndexOf(' ')
```

Putting these two statements together results in displaying the first name with the contents of *txt2*, *total-days* and *txt3* as shown below:

```
set temp1 to display-output::IndexOf(' ')
display display-output(1:temp1) txt2 total-days txt3
```

The `display` statement concatenation accepts numeric and string values.

Error Capture

This section looks at the basic error capturing in the sample application and shows how use the `Try` statement to enhance error capturing. Deciding what to do once an error is captured typically depends on the application. This exercise displays a message when capturing an error.

Note: *CblDemo4* contains completed code once for changes discussed in this section. To execute the program see Changing the Startup Object appendix.

The *validate-test-date* section in the sample application validates that the supplied birth day and month are in range. It validates that the birth day is not zero and that the birth month is a number from 1 to 12. The *set-max-days* then retrieves the maximum days in the birth month and validates that the entered birth day is within range:

```
validate-test-date SECTION.
    IF (test-day = 0)
        STOP "Invalid day field"
        STOP RUN
    END-IF
    IF ((test-month = 0) OR (test-month > 12))
        STOP "Invalid month field"
        STOP RUN
    END-IF
    MOVE test-month TO max-month.
    PERFORM set-max-days
    IF (test-day > max-days)
        STOP "Invalid day field"
        STOP RUN
    END-IF
    .
```

The section *set-max-days* is straightforward code. However, it contains no code to manage leap year determination:

```
set-max-days SECTION.
    EVALUATE max-month
        WHEN  1 MOVE 31 TO max-days
        WHEN  2 MOVE 28 TO max-days
        WHEN  3 MOVE 31 TO max-days
        WHEN  4 MOVE 30 TO max-days
        WHEN  5 MOVE 31 TO max-days
        WHEN  6 MOVE 30 TO max-days
        WHEN  7 MOVE 31 TO max-days
        WHEN  8 MOVE 31 TO max-days
        WHEN  9 MOVE 30 TO max-days
        WHEN 10 MOVE 31 TO max-days
        WHEN 11 MOVE 30 TO max-days
        WHEN 12 MOVE 31 TO max-days
    END-EVALUATE
    .
```

This is an acceptable way to handle errors. However, the `DateTime` data type also validates the entered values as the data type is created, including leap year determination, and throws an exception if they are in error.

Exception Handling With The DateTime Data Type

The following code line in the sample application creates a `DateTime` instance from user-supplied information:

```
set dob to new type DateTime(today::Year test-month test-day)
```

In the preceding code line, *validate-test-date* validates that the supplied information is in range. Replace this line using data returned from the `DateTime` data type. The validation is stored as an `ArgumentException` data type, with zero indicating success. The code includes a line that sets the `ArgumentException` data type to a variable access the validation result.

```
01 argException      type ArgumentException.
```

Wrapping the constructor in a `try` statement informs the application to check the validation result. If any exceptions are raised, the first `catch` statement matching the thrown exception executes. The `catch` statement below uses the variable result to tell the application what to do when the user supplied data causes an exception.

```
try
    set dob to new type DateTime(today::Year test-month test-day)
catch argException
    display "I couldn't understand your date entry"
    display argException::Message
    stop run
end-try
```

The above code replaces the functionality provided by *validate-test-date* and *set-max-days* so that code can be removed. The redundant variables *max-month* and *max-days* can also be removed.

Working With Classes

The sample application contains functions and information useful to other applications. But rather than copying code everywhere it's functionality is required, create a class containing the functionality. The class can then be used by other applications.

Note: In the sample solution, *CblDemo5* and the class *Person* contain the completed code based on exercises completed in this section. See the Changing the Startup Object appendix for information on starting the programs.

Creating a Class

A class is a type definition containing fields and methods, usually representing a tangible thing or action. Since the sample application includes code that creates, stores and displays information about an individual, create the *Person* class for that information.

1. Right-click on the project name in the Solution Explorer window and select **Add** > **New Item...**. The **Add New Item** window appears.
2. Click **COBOL Items** > **Managed** in the Installed Templates pane, then select **COBOL Class** from the list.
3. Type `Person.cbl` in the Name field. The Name indicates both the name of the file and class to create. This denotes the name of the file and class being created.

4. Click **Add** to create a file called *Person.cbl* containing the empty *Person* class template. The class template is very similar to the program template and contains an empty method.

```
class-id CblSolution.Person.

working-storage section.

method-id InstanceMethod.
local-storage section.
procedure division.

    goback.
end method.

end class.
```

5. Remove *CblSolution* from the class identifier located on the first line of the class template.
   The solution name prefixes to the class identifier by default to ensure unique class names across the an application. This is not required for the sample application and can be removed.

Populating the Class

Copy the relevant fields and functionality from existing code to the *Person* class. Ensure only to copy relevant code to avoid confusion when using the class in other applications.

1. Copy the relevant variables into the class.
   In the COBOL code, *dob* and *full-name* directly relate to a person. Copy these into the class, converting the full name to a `String` data type to ensure correct sizing, as shown in the following.

```
working-storage section.
01 full-name   string.
01 dob         type DateTime.
```

2. Update the code to allow access to the attributes.
   Class variables (also known as attributes) include a property that indicates variable accessability outside the class. The property is set to `private` by default. This indicates no external access. To allow access to the variables outside the class, set the property to `public` and name it for referencing as shown in the following.

```
working-storage section.
01 full-name   string public property as "FullName".
01 dob         type DateTime public property as "DateOfBirth".
```

3. Create a constructor to allow the class fields to be used.
   A constructor is a method that instantiates and initializes the fields defined in the class. To ensure that the *Person* class always contains a name and date of birth, supply these values as parameters in the constructor as shown in the following. Without the parameters, the method throws an error which can be captured by the `Try` statement.

```
method-id New public.
procedure division using by value fullname as string
                                  birthday as type DateTime.
    set full-name to fullname
    set dob to birthday
    goback.
end method.
```

4. Remove the default method.
   Creating a class also creates a method template. The method template is not required, so remove the following code.

```
method-id InstanceMethod.
local-storage section.
procedure division.
    goback.
end method.
```

The *Person* class that contains the full name and date of birth of a person, which can only be successfully created if both the full name and date of birth are provided.

Adding Methods to the Class

Now that the *Person* class is available, create a method for the functionality that relates to a person. The functionality that relates to a person is as follows:

1. Number of days until next birthday functionality.
   The application currently takes the date of birth and adds the birth year to ensure the stored date is the next birthday. Then the current date is incremented until the two dates match, incrementing a counter in parallel. Create a method that provides the next birthday, then use that date to determine the number of days until the next birthday.

   The following shows a method that provides the next birthday. It defines a local variable called *today* which provides today's date. It also defines a temporary variable called *return-value*. Because this is part of the method definition and includes the variable type, the run-time automatically creates this variable. Change the `set` statement from the original code to use *return-value*:

   ```
   method-id NextBirthday.
   01 today             type DateTime value type DateTime::Today().
   procedure division returning return-value as type DateTime.
       set return-value to new DateTime(today::Year, dob::Month, dob::Day)
   end method.
   ```

   This method provides the date of the next birthday. Create a second method used compare it with the current date and return the number of days.

   To do this create a variable to provide today's date. A temporary variable is created to populate the number of days. To use the method `NextBirthday()` defined in the current class, prefix it with the keyword `self`. This provides a `DateTime` object containing the date of the next birthday. `DateTime` has the method `Subtract` that returns the difference between it's contents and a provided `DateTime` object as a `TimeSpan` object. The `TimeSpan` object has a method to return the number of days. As a result, the method is coded as follows.

   ```
   method-id DaysUntilBirthday.
   01 today             type DateTime value type DateTime::Today().
   procedure division returning return-value as binary-long.
       set return-value to self::NextBirthday()::Subtract(today)::Days
   end method.
   ```

   Since there are two methods created that containing the *today* local variable, it might be tempting to make this a field on the class so it can be re-used. As it stands, the variable value is the actual date and time when the method is used. If moved, the value must be re-initialized before it can be used with confidence. Another alternative could be to define *DateTime* as part of the method call, which results in the following code.

   ```
   method-id DaysUntilBirthday.
   procedure division returning return-value as binary-long.
       set return-value to
           self::NextBirthday()::Subtract(type DateTime::Today())::Days
   end method.
   ```
2. Surname functionality.
   The application extracts the entered surname and displays it as part of a phrase. As the surname is always part of the a person's name, Create a method to return it as a `String`. The offset needs to be determined, so define a temporary variable to hold the offset. Then use it to evaluate the data to return. To do this, use existing lines of code from the application and update it to populate the temporary variable:

   ```
   method-id FamilyName.
   01 temp1             PIC 99.
   procedure division returning return-value as type String.
       set temp1 TO full-name::Trim()::LastIndexOf(' ')
   ```

```
    set return-value to full-name(temp1 + 1:)::Trim()
end method.
```

3. **3.** First name functionality.
   As with the surname, the sample application extracts entered first name and displays it as part of a phrase. Create a method to return the first name as a `String`Use existing code from the sample application as a basis:

```
method-id FirstName.
01 temp1             PIC 99.
procedure division returning return-value as type String.
    set temp1 TO full-name::IndexOf(' ')
    set return-value to full-name(1:temp1)
end method.
```

You can combine the two lines above for efficiency as shown in the following, keep the code as two lines for readability:

```
method-id FirstName.
procedure division returning return-value as type String.
    set return-value to full-name(1:full-name::IndexOf(' '))
end method.
```

Using the Person Class

With the *Person* class created, update the application to access it.

1. Create a variable to store the instance of the class.

```
01 person1           type Person.
```

2. Change the variable *test-date* to accept the birth year and associated prompt.
Now that we are going to store a persons' date of birth we need to accept it from the user.

3. Instantiate the variable in the code.
This is done in the same way as the *dob* variable and similarly can be wrapped up in error handling code. The *Person* class constructor requires a `DateTime` object as the second argument, so we pass in an instance of `DateTime` created using the information supplied by the user as shown:

```
try
    set person1 to new type Person(full-name
                   new DateTime(test-year test-month test-day))
catch argException
    display "Invalid arguments provided"
    display argException::Message
    stop run
end-try
```

4. Replace application code with class methods.
All code that determines the first name, family name and number of days until the next birthday can be replaced with the appropriate methods from the *Person* class and the now redundant section *add-to-total* can also be removed.

5. Tidy up defined variables.
With some of the functionality moved into the *Person* class and the resultant code simplified, variables defined in the demonstration application can now be reviewed and redundant definitions removed.

Further Application Enhancements

Now that the code for the sample application has been simplified and functionality moved into a class, enhancing is much easier to do. Redundant code and variables have been removed.

By introducing classes to provide standard methods, new applications are easier and quicker to write. You can update your existing applications to use the new class as the opportunity presents itself, steadily moving code towards more efficiency in development.

With the updated sample application, the text constants are contained in three variables. These variables could be removed, replacing them with the quoted string directly in the code, or the strings themselves could be provided via a second class. The console application itself could be completely replaced with a Windows application now that the functionality has been moved to a class.

The greeting text **"Hello Mr "** indicates that the application has been written assuming that the user will always be a man; however the application could ask the user to enter their gender. The *Person* class could then have a new method written to provide the formal greeting, allowing the text to simply read **"Hello"**.

You can extend the demonstration application further with the suggestions above, or with additional functionality of your own design. Below is the final console application code:

```
PROGRAM-ID. CblDemo5.
01 person1           type Person.
01 test-date.
    03 test-year     PIC 9999.
    03 test-month    PIC 99.
    03 test-day      PIC 99.
01 full-name         PIC X(30).
01 txt1              String value "Hello Mr ".
01 txt2              String value " you have ".
01 txt3              String value " days until next birthday".
01 argException      type ArgumentException.

PROCEDURE DIVISION.
    display "Enter your full name"
    accept full-name
    display "Enter your date of birth in yyyymmdd format"
    accept test-date
    try
        set person1 to new type Person(full-name
                       new DateTime(test-year test-month test-day))
    catch argException
        display "Invalid arguments provided"
        display argException::Message
        stop run
    end-try
    display txt1 & person1::familyName() & ","
    display person1::firstName() & txt2 & person1::daysUntilBirthday() & txt3
    stop run
    .

END PROGRAM CblDemo5.
```

Here is the final code for the *Person* class:

```
class-id Person.
01 full-name              string   public property as "FullName".
01 dob               type DateTime public property as "DateOfBirth".

method-id New public.
procedure division using by value fullname as string
                                  birthday as type DateTime.
    set full-name to fullname
    set dob to birthday
    goback.
end method.

method-id NextBirthday.
01 today              type DateTime value type DateTime::Today().
```

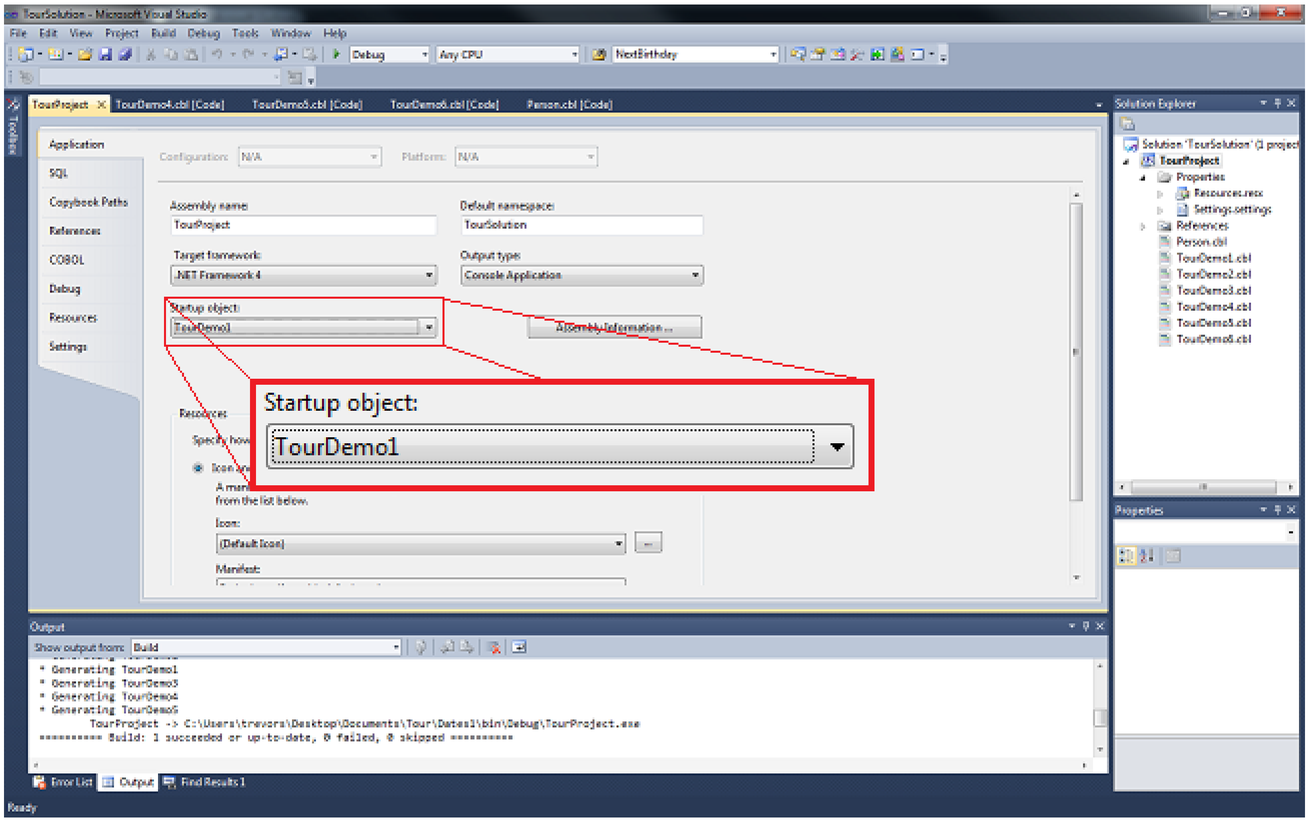
```
procedure division returning return-value as type DateTime.
    set return-value to new DateTime(today::Year, dob::Month, dob::Day)
end method.

method-id DaysUntilBirthday.
procedure division returning return-value as binary-long.
    set return-value to self::NextBirthday()::Subtract(type
DateTime::Today())::Days
end method.

method-id FamilyName.
01 temp1                  PIC 99.
procedure division returning return-value as type String.
    set temp1 TO full-name::Trim()::LastIndexOf(' ')
    set return-value to full-name(temp1 + 1:)::Trim()
end method.

method-id FirstName.
procedure division returning return-value as type String.
    set return-value to full-name(1:full-name::IndexOf(' '))
end method.
end class.
```

Appendix

Changing the Startup Object

The startup object of a project is the entry point when the application begins. When you create a project this is initially set to the program template that is created at the same time. You might want to change this because, for example, you are replacing the user interface from console to Windows. By switching the startup object between the two programs you will be able to check that functionality is maintained between the existing and new programs. The following steps show you how to change the startup object:

1. Right-click on the project within the Solution Explorer.
   The project properties are displayed in the Properties Page.
2. Select **Application** from the left tab list.
   The properties in the application tab are brought to the foreground in the Properties Page.
3. Select the object from the list box labeled **Startup object**.
   The next time the application executes it will begin with the selected object.



Configuration: N/A   Platform: N/A

Assembly name: TourProject
Default namespace: TourSolution
Target framework: .NET Framework 4
Output type: Console Application
Startup object: TourDemo1

Show output from: Build

```
* Generating TourDemo1
* Generating TourDemo3
* Generating TourDemo4
* Generating TourDemo5
        TourProject -> C:\Users\trevors\Desktop\Documents\Tour\Dates1\bin\Debug\TourProject.exe
========== Build: 1 succeeded or up-to-date, 0 failed, 0 skipped ==========
```

Data Type Reference

The table below shows the equivalent data types between legacy and current COBOL. In addition the data types recognized within the .NET environment have been included. We strongly recommend you use the current COBOL usage as this is recognized in both the Java Virtual Machine (JVM) and .NET environments.

Current COBOL	Legacy COBOL	.NET Class
binary-char	pic s9(2) comp-5	System.SByte
binary-char unsigned	pic 9(2) comp-5	System.Byte
binary-short	pic s9(4) comp-5	System.Int16
binary-short unsigned	pic 9(4) comp-5	System.UInt16
binary-long	pic s9(9) comp-5	System.Int32
binary-long unsigned	pic 9(9) comp-5	System.UInt32
binary-double	pic s9(18) comp-5	System.Int64
binary-double unsigned	pic 9(18) comp-5	System.UInt64
character		System.Char
float-short	comp-1	System.Single
float-long	comp-2	System.Double
condition-value		System.Boolean
decimal		System.Decimal
object		System.Object

string	System.String

Working with IntelliSense

IntelliSense® is the general term for the prompts that appear when the cursor hovers code, and for the visual indicators that assist to speed code development. Visual COBOL makes full use of IntelliSense, providing instant feedback and increased productivity. The main features of IntelliSense include the following.

Variable information	Placing the cursor over a variable displays a tooltip with information about the variable, including number of times reference, type of variable and length.
Error highlighting	Code is constantly recompiled in the background, which detects anything that would cause a build error. Spellings are checked and suggested corrections are given. Variable validation confirms that the variable has been defined.
Colorization	As you type the code it is validated and color coded. The statements, variables, constants and section names all have different assigned colors that can be customized.
Word completion	As you type statements, lists of variables display to assist in sentence completion. To access the lists, right-click in the code editor to select the option **Suggest Word**.
Code snippets	These are templates of common sections of code that are generated and pasted directly into the code. To inset a code snippet, right-click at the point where the snippet is to be inserted and select **Insert Snippet**. Double-click to select the snippet required from the provided list.