ComponentOne

Chart for Windows Phone

Corporate Headquarters
ComponentOne LLC
201 South Highland Avenue
3rd Floor
Pittsburgh, PA 15206 · USA

Internet: **info@ComponentOne.com**

Web site: **http://www.componentone.com**

Sales

E-mail: sales@componentone.com

Telephone: 1.800.858.2739 or 1.412.681.4343 (Pittsburgh, PA USA Office)

This manual was produced using ComponentOne Doc-To-Help™.

Table of Contents

ComponentOne Chart for Windows Phone Overview

Visualize your data and add professional-grade charts to your mobile apps with one control. **ComponentOne Chart™ for Windows Phone** supports all popular chart types including bar, column, line, area, pie, and more. Take your data visualization to the next level today.

The following main classes are included in the **C1.Phone.Chart.dll** assembly:

- **C1Chart:** A full-featured charting tool that supports several chart types, built-in color palettes, and special effects including animations, zooming, and panning.
- **C1ChartLegend:** A companion control used to display legends that describe the data series in a **C1Chart** control.

For a list of the latest features added to **ComponentOne Studio for Windows Phone**, visit What's New in Studio for Windows Phone.

Installing Studio for Windows Phone

The following sections provide helpful information on installing **ComponentOne Studio for Windows Phone**.

Studio for Windows Phone Setup Files

The **ComponentOne Studio for Windows Phone** installation program will create the following directory: **C:\Program Files\ComponentOne\Studio for Windows Phone**. This directory contains the following subdirectories:

Bin	Contains copies of ComponentOne binaries (DLLs, EXEs, design-time assemblies).
Help	Contains documentation for all Studio components and other useful resources including XAML files.

Samples

Samples for the product are installed in the **ComponentOne Samples** folder by default.

Windows Vista and Windows 7 path: C:\Users\<username>\Documents\ComponentOne Samples\Studio for Windows Phone

See the Studio for Windows Phone Samples topic for more information about each sample.

System Requirements

System requirements for **ComponentOne Studio for Windows Phone** include the following:

- Microsoft Visual Studio 2010
- Microsoft Expression Blend 4
- Microsoft Windows Phone SDK
- Visual Basic for Windows Phone Developer Tools (if using Visual Basic)

Installing Demonstration Versions

If you wish to try **ComponentOne Studio for Windows Phone** and do not have a serial number, follow the steps through the installation wizard and use the default serial number.

The only difference between unregistered (demonstration) and registered (purchased) versions of our products is that the registered version will stamp every application you compile so a ComponentOne banner will not appear when your users run the applications.

Uninstalling Studio for Windows Phone

To uninstall **ComponentOne Studio for Windows Phone**:

1. Open the **Control Panel** and select **Programs and Features**.
2. Select **ComponentOne Studio for Windows Phone** and click the **Remove** button.
3. Click **Yes** to remove the program.

Technical Support

ComponentOne offers various support options. For a complete list and a description of each, visit the ComponentOne Web site at http://www.componentone.com/Support.

Some methods for obtaining technical support include:

- **Online Support via HelpCentral**
  ComponentOne HelpCentral provides customers with a comprehensive set of technical resources in the form of FAQs, samples, Version Release History, Articles, searchable Knowledge Base, searchable Online Help and more. We recommend this as the first place to look for answers to your technical questions.
- **Online Support via our Incident Submission Form**
  This online support service provides you with direct access to our Technical Support staff via an online incident submission form. When you submit an incident, you'll immediately receive a response via e-mail confirming that you've successfully created an incident. This email will provide you with an Issue Reference ID and will provide you with a set of possible answers to your question from our Knowledgebase. You will receive a response from one of the ComponentOne staff members via e-mail in 2 business days or less.
- **Peer-to-Peer Product Forums and Newsgroups**
  ComponentOne peer-to-peer product forums and newsgroups are available to exchange information, tips, and techniques regarding ComponentOne products. ComponentOne sponsors these areas as a forum for users to share information. While ComponentOne does not provide direct support in the forums and newsgroups, we periodically monitor them to ensure accuracy of information and provide comments when appropriate. Please note that a ComponentOne User Account is required to participate in the ComponentOne Product Forums.
- **Installation Issues**
  Registered users can obtain help with problems installing ComponentOne products. Contact technical

support by using the online incident submission form or by phone (412.681.4738). Please note that this does not include issues related to distributing a product to end-users in an application.

- **Documentation**
  ComponentOne documentation is installed with each of our products and is also available online at HelpCentral. If you have suggestions on how we can improve our documentation, please email the Documentation team. Please note that e-mail sent to the Documentation team is for documentation feedback only. Technical Support and Sales issues should be sent directly to their respective departments.

Note: You must create a ComponentOne Account and register your product with a valid serial number to obtain support using some of the above methods.

Redistributable Files

ComponentOne Studio for Windows Phone is developed and published by ComponentOne LLC. You may use it to develop applications in conjunction with Microsoft Visual Studio or any other programming environment that enables the user to use and integrate the control(s). You may also distribute, free of royalties, the following Redistributable Files with any such application you develop to the extent that they are used separately on a single CPU on the client/workstation side of the network:

- C1.Phone.dll
- C1.Phone.Chart.dll
- C1.Phone.Extended.dll
- C1.Phone.Gauge.dll
- C1.Phone.Imaging.dll
- C1.Phone.Maps.dll
- C1.Phone.Pdf.dll
- C1.Phone.PdfViewer.sll
- C1,Phone.RichTextBox.dll
- C1.Phone.RichTextBox.ApplicationBar.dll
- C1.Phone.RichTextBox.RtfFilter.dll

Site licenses are available for groups of multiple developers. Please contact Sales@ComponentOne.com for details.

About This Documentation

Acknowledgements

ComponentOne

If you have any suggestions or ideas for new features or controls, please call us or write:

Corporate Headquarters

ComponentOne LLC
201 South Highland Avenue
3rd Floor
Pittsburgh, PA 15206 • USA

412.681.4343
412.681.4384 (Fax)

http://www.componentone.com

ComponentOne Doc-To-Help

This documentation was produced using ComponentOne Doc-To-Help® Enterprise.

Assemblies and Controls

ComponentOne Studio for Windows Phone includes several assemblies. This increases the granularity of the studio and helps to decrease the size of applications that do not use all the controls available in the studio.

C1.Phone.Chart.dll

The **C1.Phone.Chart.dll** assembly contains the **C1Chart** control and its auxiliary classes.

The following main classes are included in the **C1.Phone.Chart.dll** assembly:

- **C1Chart:** A full-featured charting tool that supports several chart types, built-in color palettes, and special effects including animations, zooming, and panning.
- **C1ChartLegend:** A companion control used to display legends that describe the data series in a **C1Chart** control.

Studio for Windows Phone Samples

If you just installed **ComponentOne Studio for Windows Phone**, open Visual Studio 2010 and load the **Samples.sln** solution located in the **C:\Documents and Settings\<username>\My Documents\ComponentOne Samples\Studio for Windows Phone** or **C:\Users\<username>\Documents\ComponentOne Samples\Studio for Windows Phone** folder. This solution contains all the samples that ship with this release. Each sample has a readme.txt file that describes it and two projects named as follows:

<SampleName>	Windows Phone project (client-side project)

Introduction to Windows Phone

The following topics detail information about getting started with Windows Phone, including Windows Phone resources, and general information about templates and deploying Windows Phone files.

Windows Phone Resources

This help file focuses on **ComponentOne Studio for Windows Phone**. For general help on getting started with Windows Phone, we recommend the following resources:

- http://www.silverlight.net

  The official Silverlight site, with many links to downloads, samples, tutorials, and more for developing applications for Windows Phone.

- http://create.msdn.com/en-us/education/quickstarts

  Windows Phone development Quick Starts on App Hub. These tutorials are great if you're new (or even not-so-new) to Windows Phone development.

- http://www.silverlight.net/learn/tutorials/jesse-liberty/windows-phone-7-tutorials/

  Jesse Liberty's Windows Phone 7 Tutorials. Jesse Liberties Silverlight tutorials are also a great resource.

- http://msdn.microsoft.com/en-us/library/ff402535(v=vs.92).aspx

  Windows Phone Development documentation on MSDN. This page includes links to the fundamentals as well as more in-depth how-tos.

Windows Phone 7 Emulator

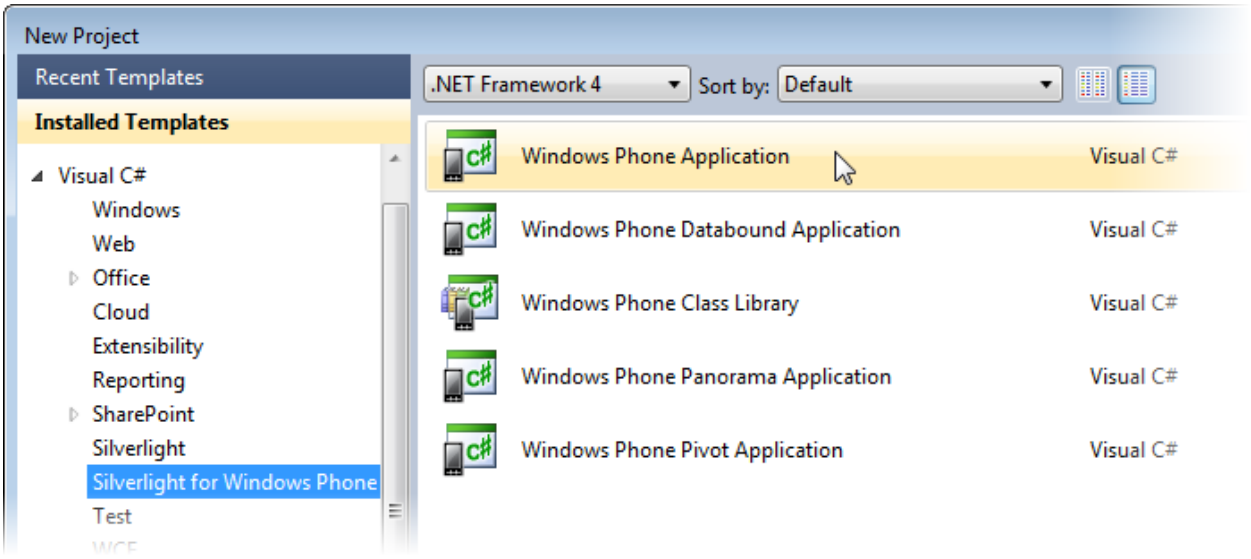
You can use the Windows Phone 7 Emulator to run Windows Phone 7 applications on your development machine. If you've installed the Windows Phone Development Tools, you should be able to access the emulator by clicking the **Start** button and then **All Programs** | **Windows Phone Developer** | **Tools Windows Phone 7 Emulator**. When you debug a Windows Phone application, it should appear displayed in the Windows Phone 7 Emulator application by default.

The menu below the screen includes the **Back**, **Start**, and **Search** buttons. The menu displayed at the right of the screen in the image above, includes the **Close**, **Minimize**, **Rotate Right**, **Rotate Left**, **Expand**, and **Zoom** buttons. While the emulator is not a perfect representation of the touch interaction possible with the Windows Phone, it works well to test and debug Windows Phone applications.

Creating a New Windows Phone Project

The following topic details how to create a new Windows Phone project in Microsoft Visual Studio 2010. Complete the following steps to create a new Windows Phone project in Microsoft Visual Studio 2010:

1. Select **File | New | Project** to open the **New Project** dialog box in Visual Studio 2010.
2. In the **Project types** pane, expand the **Visual Basic** or **Visual C#** node and select **Silverlight for Windows Phone**.
3. Choose **Windows Phone Application** in the **Templates** pane.



4. Name the project, specify a location for the project, and click **OK**.

   A new project will be created with the name you specified.

Adding Studio for Windows Phone Components to a Project

This topic details how you can add the **Studio for Windows Phone** components to the Toolbox, add controls to a project, and to add references to the **Studio for Windows** Phone assemblies. When the **Studio for Windows Phone** controls are in the Visual Studio Toolbox, you can easily add them to a project at design time.

Manually Adding Studio for Windows Phone Controls to the Toolbox

To add the **ComponentOne Studio for Windows Phone** controls to the Toolbox, complete the following steps:

1. Open the Visual Studio IDE (Microsoft Development Environment). Make sure the Toolbox is visible (select **Toolbox** in the **View** menu, if necessary) and right-click the Toolbox to open its context menu.
2. To make Studio for Windows Phone components appear on their own tab in the Toolbox, select **Add Tab** from the context menu and type in the tab name, **C1Phone**, for example.
3. Select **File | New | Project** to open the **New Project** dialog box in Visual Studio 2010.
4. In the **Project types** pane, expand the **Visual Basic** or **Visual C#** node and select **Silverlight for Windows Phone**.
5. Right-click the tab where the component is to appear and select **Choose Items** from the context menu.
6. The **Choose Toolbox Items** dialog box opens.
7. In the dialog box, select the **Windows Phone Components** tab. Sort the list by **Namespace** (click the **Namespace** column header) and check the check boxes for all components belonging to the C1.Phone, C1.Phone.Chart, and C1.Phone.Extended namespaces. Note that there may be more than one component for each namespace.
8. Name the project, specify a location for the project, and click **OK**.

   A new project will be created with the name you specified.

Adding Studio for Windows Phone Controls to the Application

To add **ComponentOne Studio for Windows Phone** controls to the application, complete the following steps:

1. Add controls to the Visual Studio Toolbox.
2. Double-click a control or drag it onto your form.

Adding Assembly References in Code

To add a reference to the **ComponentOne Studio for Windows Phone** assemblies, complete the following steps:

3. Select the **Add Reference** option from the **Project** menu of your project.
4. Select the **ComponentOne Studio for Windows Phone** assemblies from the list on the **.NET** tab or browse to find the C1.Phone.dll, C1.Phone.Chart.dll, and C1.Phone.Extended.dll files and click **OK**.
5. Select **View | Code** to open Code View. At the top of the file, add the following **Imports** statements (**using** in C#):

```
Imports C1.Phone
Imports C1.Phone.Chart
Imports C1.Phone.Extended
```

Adding XAML References

To add a XAML reference to the **ComponentOne Studio for Windows Phone** assemblies, complete the following steps:

1. Add the XAML namespace to the `<phone:PhoneApplicationPage>` tag by adding `xmlns:c1="clr-namespace:C1.Phone;assembly=C1.Phone"` so it appears similar to the following:

```
<phone:PhoneApplicationPage  x:Class="C1WP7.MainPage"
xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
xmlns:phone="clr-
namespace:Microsoft.Phone.Controls;assembly=Microsoft.Phone"
xmlns:shell="clr-
namespace:Microsoft.Phone.Shell;assembly=Microsoft.Phone"
xmlns:d="http://schemas.microsoft.com/expression/blend/2008"
xmlns:mc="http://schemas.openxmlformats.org/markup-compatibility/2006"
mc:Ignorable="d" d:DesignWidth="480" d:DesignHeight="768"
FontFamily="{StaticResource PhoneFontFamilyNormal}"
FontSize="{StaticResource PhoneFontSizeNormal}"
Foreground="{StaticResource PhoneForegroundBrush}"
SupportedOrientations="Portrait" Orientation="Portrait"
shell:SystemTray.IsVisible="True">
```

Basic Windows Phone Application

When you initially create a new Windows Phone application, the XAML view for the application will appear similar to the following:

```
<phone:PhoneApplicationPage  x:Class="C1WP7.MainPage"
xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
xmlns:phone="clr-
namespace:Microsoft.Phone.Controls;assembly=Microsoft.Phone"
xmlns:shell="clr-
namespace:Microsoft.Phone.Shell;assembly=Microsoft.Phone"
xmlns:d="http://schemas.microsoft.com/expression/blend/2008"
xmlns:mc="http://schemas.openxmlformats.org/markup-compatibility/2006"
mc:Ignorable="d" d:DesignWidth="480" d:DesignHeight="768"
FontFamily="{StaticResource PhoneFontFamilyNormal}"
```

```
FontSize="{StaticResource PhoneFontSizeNormal}"
Foreground="{StaticResource PhoneForegroundBrush}"
SupportedOrientations="Portrait" Orientation="Portrait"
shell:SystemTray.IsVisible="True">

    <!--LayoutRoot is the root grid where all page content is placed-->
    <Grid x:Name="LayoutRoot" Background="Transparent">
        <Grid.RowDefinitions>
            <RowDefinition Height="Auto"/>
            <RowDefinition Height="*"/>
        </Grid.RowDefinitions>

        <!--TitlePanel contains the name of the application and page
title-->
        <StackPanel x:Name="TitlePanel" Grid.Row="0"
Margin="12,17,0,28">
            <TextBlock x:Name="ApplicationTitle" Text="MY APPLICATION"
Style="{StaticResource PhoneTextNormalStyle}"/>
            <TextBlock x:Name="PageTitle" Text="page name" Margin="9,-
7,0,0" Style="{StaticResource PhoneTextTitle1Style}"/>
        </StackPanel>

        <!--ContentPanel - place additional content here-->
        <Grid x:Name="ContentPanel" Grid.Row="1"
Margin="12,0,12,0"></Grid>
    </Grid>

    <!--Sample code showing usage of ApplicationBar-->
    <!--<phone:PhoneApplicationPage.ApplicationBar>
        <shell:ApplicationBar IsVisible="True" IsMenuEnabled="True">
            <shell:ApplicationBarIconButton
IconUri="/Images/appbar_button1.png" Text="Button 1"/>
            <shell:ApplicationBarIconButton
IconUri="/Images/appbar_button2.png" Text="Button 2"/>
            <shell:ApplicationBar.MenuItems>
                <shell:ApplicationBarMenuItem Text="MenuItem 1"/>
                <shell:ApplicationBarMenuItem Text="MenuItem 2"/>
            </shell:ApplicationBar.MenuItems>
        </shell:ApplicationBar>
    </phone:PhoneApplicationPage.ApplicationBar>-->

</phone:PhoneApplicationPage>
```

If you've worked in Silverlight before you'll note that it appears very similar to a standard Silverlight application. The **LayoutRoot** of the application is a Grid. By default when you create an application, it creates a **TitlePanel** and a **ContentPanel** containing panels and **TextBlock**s.

The markup that is commented out displays a default **ApplicationBar**. The **ApplicationBar** provides a menu system in Windows Phone. The Application Bar is displayed as a row of between one and four icon buttons along the bottom of the phone's screen. The icon buttons are used to provide users with quick access to an application's most common tasks.

Rotating Your Application

By default you application will not rotate when the Windows Phone is rotated. By default the **SupportedOrientations** property is set to **Portrait**, meaning the application is only displayed in portrait mode. Set the **SupportedOrientations** property to **PortraitOrLandscape** so that the application rotates when the phone rotates. For example, in XAML add `SupportedOrientations="PortraitOrLandscape"` to the `<phone:PhoneApplicationPage>` tag:

```
<phone:PhoneApplicationPage  x:Class="C1WP7.MainPage"
xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
xmlns:phone="clr-
namespace:Microsoft.Phone.Controls;assembly=Microsoft.Phone"
xmlns:shell="clr-
namespace:Microsoft.Phone.Shell;assembly=Microsoft.Phone"
xmlns:d="http://schemas.microsoft.com/expression/blend/2008"
xmlns:mc="http://schemas.openxmlformats.org/markup-compatibility/2006"
mc:Ignorable="d" d:DesignWidth="480" d:DesignHeight="768"
FontFamily="{StaticResource PhoneFontFamilyNormal}"
FontSize="{StaticResource PhoneFontSizeNormal}"
Foreground="{StaticResource PhoneForegroundBrush}"
SupportedOrientations="PortraitOrLandscape" Orientation="Portrait"
shell:SystemTray.IsVisible="True">
```

The Windows Phone has three orientation states: portrait and landscape (left or right). Your application may not appear as you would like it to when the phone is rotated. An easy solution for this is to create a templates to customize how your application will appear in portrait and landscape modes. You can us the **OrientationChanged** event to set the behavior of the application when the orientation of the Windows Phone changes from portrait to landscape and back.

For more information and details, see the following Help Topic on MSDN: How to: Handle Orientation Changes on Windows Phone.

ComponentOne Chart for Windows Phone Overview

Visualize your data and add professional-grade charts to your mobile apps with one control. **ComponentOne Chart™ for Windows Phone** supports all popular chart types including bar, column, line, area, pie, and more. Take your data visualization to the next level today.

Getting Started

Get started with the following topics:

- Key Features (page 19)
- Quick Start (page 20)
- Task-Based Help (page 118)

Key Features

ComponentOne Chart for Windows Phone includes several key features, such as:

- **30+ Chart Types**

  Get the exact chart representation you need for your phone application by choosing from over 30 popular 2D chart types. Available chart types include line, scatter, bar, column, pie, area, stacked and many more. See Chart Types (page 47) for a full listing of supported charts.

- **Chart Legends**

  Create a separate chart legend using the **C1ChartLegend** control that connects to the chart through one property. This design provides maximum flexibility when styling and positioning the legend.

- **Data Labels**

  Display relative data values over chart elements as labels. Display static labels or display labels when the user touches a plot element.

- **Animation**

  Add animation storyboards to the various elements of the chart. For example, animate plot elements as they load or when the user interacts with them.

- **Combine Chart Types**

  Combine multiple, different chart types into one chart. Just set the **ChartType** property on each data series to achieve your desired combination.

- **Multiple Plot Areas**

  Stack multiple plot areas horizontally and vertically. Split multiple data series into different plot areas to increase readability and analysis of multiple data sets, while sharing common chart parts such as axes, legends and titles.

- **Customizable Axes**

  C1Chart gives you many axis options such as time display, logarithmic scales, axis panning, custom axis labels and support for multiple axes. Display multiple, dependent axes on the top, bottom, left, or right of the chart by simply adding to the chart's Axes collection.

- **Aggregate Views**

  By just setting one property you can view calculated aggregates for your charted data. **Aggregation** options include **Sum**, **Count**, **Average**, **Minimum**, **Maximum**, **Variance** and **Standard** Deviation.

- **Flexible Data Binding**

  Bind the control to a collection of business objects, or XML file by setting a few properties. Set the data source at the chart level or for each data series within the chart. The entire chart structure including data series, axes, and plot areas can be declaratively bound to in XAML, enabling popular design patterns such as MVVM.

- **Predefined Color Palettes**

  C1Chart includes 22 built-in color palettes including Metro and Office color schemes. Or customize your palette precisely in code.

- **Lighting and Shadow Effects**

  Create borders with lighting effects and add soft or hard shadows behind plot elements.

Chart for Windows Phone Quick Start

The following quick start guide is intended to get you up and running with **Chart for Windows Phone**. In this quick start, you'll start in Visual Studio to create a new project with a C1Chart control.

Step 1 of 3: Creating an Application with a C1Chart Control

In this step, you'll create a Windows Phone application in Visual Studio using **Chart for Windows Phone**.

Complete the following steps:

1. In Visual Studio 2010, select **File | New | Project** to open the **New Project** dialog box.
2. In the **New Project** dialog box, select a language in the left pane, and in the templates list select **Windows Phone Application**. Enter a **Name** for your project and click **OK**. The **New Windows Phone Application** dialog box will appear.
3. Click **OK** to close the **New Windows Phone Application** dialog box and create your project.
4. Right-click the project in the Solution Explorer and select **Add Reference**.
5. In the **Add Reference** dialog box, locate and select the **C1.Phone.dll** assembly and select **OK**.
6. Add the XAML namespace to the `<phone:PhoneApplicationPage>` tag by adding `xmlns:c1chart="clr-namespace:C1.Phone.Chart;assembly=C1.Phone.Chart"` so it appears similar to the following:

```
<phone:PhoneApplicationPage  x:Class="C1WP7.MainPage"
xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml" xmlns:phone="clr-
namespace:Microsoft.Phone.Controls;assembly=Microsoft.Phone"
xmlns:shell="clr-namespace:Microsoft.Phone.Shell;assembly=Microsoft.Phone"
xmlns:c1chart="clr-namespace:C1.Phone.Chart;assembly=C1.Phone.Chart"
xmlns:d="http://schemas.microsoft.com/expression/blend/2008"
xmlns:mc="http://schemas.openxmlformats.org/markup-compatibility/2006"
mc:Ignorable="d" d:DesignWidth="480" d:DesignHeight="768"
FontFamily="{StaticResource PhoneFontFamilyNormal}"
FontSize="{StaticResource PhoneFontSizeNormal}"
Foreground="{StaticResource PhoneForegroundBrush}"
SupportedOrientations="Portrait" Orientation="Portrait"
shell:SystemTray.IsVisible="True">
```

7. Edit the **TitlePanel** content to change the text in the **TextBlock** controls. It will appear similar to the following:

```
<!--TitlePanel contains the name of the application and page title-->
<StackPanel x:Name="TitlePanel" Grid.Row="0" Margin="12,17,0,28">
    <TextBlock x:Name="ApplicationTitle" Text="ComponentOne Studio for
Windows Phone" Style="{StaticResource PhoneTextNormalStyle}"/>
    <TextBlock x:Name="PageTitle" Text="Chart" Margin="9,-7,0,0"
Style="{StaticResource PhoneTextTitle1Style}"/>
</StackPanel>
```

8. In the XAML window of the project, place the cursor between the `<Grid x:Name="ContentPanel"></Grid>` tags and click once.
9. Add the following XAML markup cursor between the `<Grid x:Name="ContentPanel"></Grid>` tags to add a C1Chart control to the application:

```
<Grid x:Name="ContentPanel">
<c1chart:C1Chart x:Name="C1Chart1" Margin="15,0,0,0"></c1chart:C1Chart>
</Grid>
```

The chart appears empty since it currently does not contain data.

What You've Accomplished

You've successfully created a Windows Phone application containing a C1Chart control. In the next step, you will Step 2 of 3: Adding Data to the Chart (page 21), you will add the data for **C1Chart**.

Step 2 of 3: Adding Data to the Chart

In the last step, you added the **C1Chart** control to the application. In this step, you will add a **DataSeries** object and data for it.

To add data to the chart programmatically in the code behind file

1. Select **View** | **Code** to open the code editor.
2. Add the **C1.Phone.C1Chart** namespace directive
   - Visual Basic

     ```
     Imports C1.Phone.Chart
     ```

   - C#

     ```
     using C1.Phone.Chart;
     ```

3. Add the following code in the **MainPage** contructor to create a Bar chart:
   - Visual Basic

     ```
     ' Clear previous data
     C1Chart1.Data.Children.Clear()
     ' Add Data
     Dim ProductNames As String() = {"Hand Mixer", "Stand Mixer", "Can
     Opener", "Toaster", "Blender", "Food Processor", _
     "Slow Cooker", "Microwave"}
     Dim PriceX As Integer() = {80, 400, 20, 60, 150, 300, _
     130, 500}

     ' create single series for product price
     Dim ds1 As New DataSeries()
     ds1.Label = "Price X"

     'set price data
     ds1.ValuesSource = PriceX
     ```

```
' add series to the chart
C1Chart1.Data.Children.Add(ds1)

' add item names
C1Chart1.Data.ItemNames = ProductNames

' Set chart type
C1Chart1.ChartType = ChartType.Bar
```

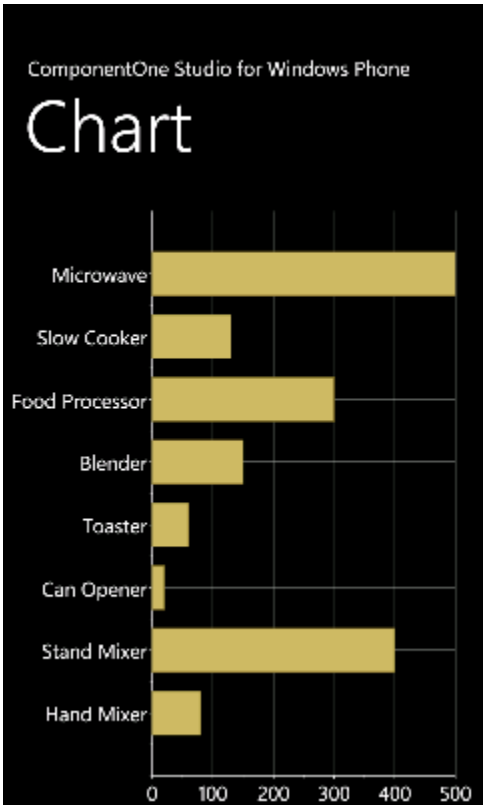
- C#

```
// Clear previous data
   C1Chart1.Data.Children.Clear();

   // Add Data
   string[] ProductNames = { "Hand Mixer", "Stand Mixer", "Can Opener",
"Toaster", "Blender", "Food Processor", "Slow Cooker", "Microwave" };
   int[] PriceX = { 80, 400, 20, 60, 150, 300, 130, 500 };

   // create single series for product price
   DataSeries ds1 = new DataSeries();
   ds1.Label = "Price X";

   //set price data
   ds1.ValuesSource = PriceX;

   // add series to the chart
   C1Chart1.Data.Children.Add(ds1);

   // add item names
   C1Chart1.Data.ItemNames = ProductNames;

   // Set chart type
   C1Chart1.ChartType = ChartType.Bar;
```

In the next step, Step 3 of 3: Format the Axes (page 23), you'll learn how to customize the axes programmatically

What You've Accomplished

You have successfully added data to **C1Chart** so when you run your application the string values appear on the Y-axis like the following:



In the next step you will add a ChartView object so you can customize the X-Axis.

Step 3 of 3: Format the Axes

In this step, you will add a ChartView object so you can customize the X-Axis.

To format the axes for Chart for Silverligh programmatically in the code behind file

Add the following code in the **Public MainPage()** class to format the chart axes:

- Visual Basic

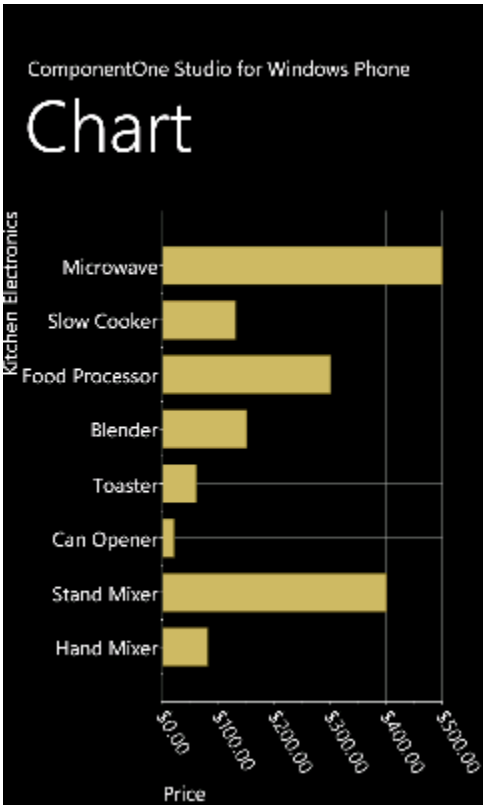
```
' set axes titles
   C1Chart1.View.AxisY.Title = New TextBlock(New Run("Kitchen
Electronics"))
   C1Chart1.View.AxisX.Title = New TextBlock(New Run("Price"))

   ' set axes bounds
   C1Chart1.View.AxisX.Min = 0
   C1Chart1.View.AxisX.Max = 500
   C1Chart1.View.AxisX.MajorUnit = 20

   ' Financial formatting
   C1Chart1.View.AxisX.AnnoFormat = "c"

   ' axis annotation rotation
   C1Chart1.View.AxisX.AnnoAngle = "60"
```

- C#

```
// set axes titles
   C1Chart1.View.AxisY.Title= new TextBlock() { Text = "Kitchen
Electronics" };
   C1Chart1.View.AxisX.Title = new TextBlock() { Text = "Price" };

   // set axes bounds
   C1Chart1.View.AxisX.Min = 0;
   C1Chart1.View.AxisX.Max = 500;
   C1Chart1.View.AxisX.MajorUnit = 20;

   // financial formatting
   C1Chart1.View.AxisX.AnnoFormat = "c";

   // axis annotation rotation
   C1Chart1.View.AxisX.AnnoAngle=60;
```

What You've Accomplished

You have successfully formatted the Chart Axes so when you run your application the new format for the axis annotation is applied to the chart.



Congratulations! You've completed the **Chart for Windows Phone** quick start and created a chart application, added data to the chart, set the axes bounds, formatted the axes annotation, and customized the appearance of the chart.

Chart for Windows Phone Top Tips

The following top tips for **Chart for Windows Phone** will help you when you use the **C1Chart** control.

Tip 1: Use the BeginUpdate()/EndUpdate methods to improve performance

When performing a massive update of the chart properties or the data values, put the update code inside a **BeginUpdate()/EndUpdate()** block.

This improves performance since the redrawing occurs only once after a call of the **EndUpdate()** method.

For example:

- Visual Basic

```
' start update
  C1Chart1.BeginUpdate()

  Dim nser As Integer = 10, npts As Integer = 100
  For iser As Integer = 1 To nser
    ' create data arrays
    Dim x(npts - 1) As Double, y(npts - 1) As Double
    For ipt As Integer = 0 To npts - 1
      x(ipt) = ipt
      y(ipt) = (1 + 0.05 * iser) * Math.Sin(0.1 * ipt + 0.1 * iser)
    Next
    ' create data series and add it to the chart
    Dim ds = New XYDataSeries()
    ds.XValuesSource = x
    ds.ValuesSource = y
    C1Chart1.Data.Children.Add(ds)
  Next

  ' set chart type
  C1Chart1.ChartType = ChartType.Line

  ' finish update
  C1Chart1.EndUpdate()
```

- C#

```
// start update
  c1Chart1.BeginUpdate();

  int nser = 10, npts = 100;
  for (int iser = 0; iser < nser; iser++)
  {
    // create data arrays
    double[] x = new double[npts], y = new double[npts];
    for (int ipt = 0; ipt < npts; ipt++)
    {
      x[ipt] = ipt;
      y[ipt] = (1 + 0.05 * iser) * Math.Sin(0.1 * ipt + 0.1 * iser);
    }

    // create data series and add it to the chart
    XYDataSeries ds = new XYDataSeries();
    ds.XValuesSource = x; ds.ValuesSource = y;
    c1Chart1.Data.Children.Add(ds);
```

```
  }

  // set chart type
  c1Chart1.ChartType = ChartType.Line;

  // finish update
  c1Chart1.EndUpdate();
```

Tip 2: Use the line or area chart type for large data arrays

The line and area charts provide the best performance when you have a lots of data values.

To get better performance, enable built-in optimization for large data by setting the attached property, **LineAreaOptions.OptimizationRadius**. For example:

- Visual Basic
```
LineAreaOptions.SetOptimizationRadius(C1Chart1, 1.0)
```
- C#
```
LineAreaOptions.SetOptimizationRadius(c1Chart1, 1.0);
```

It's recommended you use small values 1.0 - 2.0 as radius. A larger value may affect the accuracy of the plot.

Tip 3: Update the appearance and behavior of a plot element using the DataSeries.PlotElementLoaded event

When any plot element (bar,column,pie, etc) is loaded it fires the PlotElementLoaded event. During this event you have access to the plot element properties as well as to the corresponding data point.

The following code sets the colors of points depending on its y-value. For example:

- Visual Basic
```
' create data arrays
  Dim npts As Integer = 100
  Dim x(npts - 1) As Double, y(npts - 1) As Double
  For ipt As Integer = 0 To npts - 1
    x(ipt) = ipt
    y(ipt) = Math.Sin(0.1 * ipt)
  Next

  ' create data series
  Dim ds = New XYDataSeries()
  ds.XValuesSource = x
  ds.ValuesSource = y

  ' set event handler
  AddHandler ds.PlotElementLoaded, AddressOf PlotElement_Loaded

  ' add data series to the chart
  C1Chart1.Data.Children.Add(ds)

  ' set chart type
  C1Chart1.ChartType = ChartType.LineSymbols

...

  ' event handler
  Sub PlotElement_Loaded(ByVal sender As Object, ByVal args As EventArgs)
    Dim pe = CType(sender, PlotElement)
    If Not TypeOf pe Is Lines Then
      Dim dp As DataPoint = pe.DataPoint
```

```
      ' normalized y-value(from 0 to 1)
      Dim nval As Double = 0.5 * (dp.Value + 1)
      ' fill from blue(-1) to red(+1)
      pe.Fill = New SolidColorBrush(Color.FromRgb(CByte(255 * nval), _
       0, CByte(255 * (1 - nval))))
    End If
  End Sub
```

- C#

```
// create data arrays
  int npts = 100;
  double[] x = new double[npts], y = new double[npts];
  for (int ipt = 0; ipt < npts; ipt++)
  {
    x[ipt] = ipt;
    y[ipt] = Math.Sin(0.1 * ipt);
  }

  // create data series
  XYDataSeries ds = new XYDataSeries();
  ds.XValuesSource = x; ds.ValuesSource = y;

  // set event handler
  ds.PlotElementLoaded += (s, e) =>
    {
      PlotElement pe = (PlotElement)s;
      if (!(pe is Lines)) // skip lines
      {
        DataPoint dp = pe.DataPoint;

        // normalized y-value(from 0 to 1)
        double nval = 0.5*(dp.Value + 1);

        // fill from blue(-1) to red(+1)
        pe.Fill = new SolidColorBrush(
          Color.FromRgb((byte)(255 * nval), 0, (byte)(255 * (1-nval))));
      }
    };

  // add data series to the chart
  c1Chart1.Data.Children.Add(ds);

  // set chart type
  c1Chart1.ChartType = ChartType.LineSymbols;
```

Tip 4: Data point labels and tooltips

To create a data point label or tooltip, you should set the data template for the PointLabelTemplate or PointTooltipTemplate property.

The following sample code shows the index for each data point.

XAML:

```
<c1chart:C1Chart Name="c1Chart1" ChartType="XYPlot">
  <c1chart:C1Chart.Data>
    <c1chart:ChartData>
      <!-- source collection -->
```

```
      <c1chart:ChartData.ItemsSource>
        <PointCollection>
          <Point X="1" Y="1" />
          <Point X="2" Y="2" />
          <Point X="3" Y="3" />
          <Point X="4" Y="2" />
          <Point X="5" Y="1" />
        </PointCollection>
      </c1chart:ChartData.ItemsSource>

      <c1chart:XYDataSeries SymbolSize="16,16"
        XValueBinding="{Binding X}" ValueBinding="{Binding Y}">
        <c1chart:XYDataSeries.PointLabelTemplate>
          <DataTemplate>
            <!-- display point index at the center of point symbol  -->
            <TextBlock
c1chart:PlotElement.LabelAlignment="MiddleCenter"
                       Text="{Binding PointIndex}" />
          </DataTemplate>
        </c1chart:XYDataSeries.PointLabelTemplate>
      </c1chart:XYDataSeries>
    </c1chart:ChartData>
  </c1chart:C1Chart.Data>
</c1chart:C1Chart>
```

The data context of element created from the template is set to the instance of DataPoint class which contains information about the corresponding data point.

Tip 5: Save chart as image

The following method saves chart image as png-file.

- Visual Basic

```
Sub Using stm = System.IO.File.Create(fileName)
    C1Chart1.SaveImage(stm, ImageFormat.Png)
End Using
```

- C#

```
using (var stm = System.IO.File.Create(fileName))
   {
    c1Chart1.SaveImage(stm, ImageFormat.Png);
   }
```

Tip 6: Printing chart

The following code prints the specified chart on the default printer with the default settings. For example:

- Visual Basic

```
Dim pd = New PrintDialog()
  pd.PrintVisual(C1Chart1, "chart")
```

- C#

```
new PrintDialog().PrintVisual(c1Chart1, "chart");
```

Tip 7: Mixing Cartesian chart types

You can easily mix different chart types on the same Cartesian plot using the ChartType property.

The following code creates three data series: the first is area, the second is step, and the third has the default chart type (line).

- Visual Basic

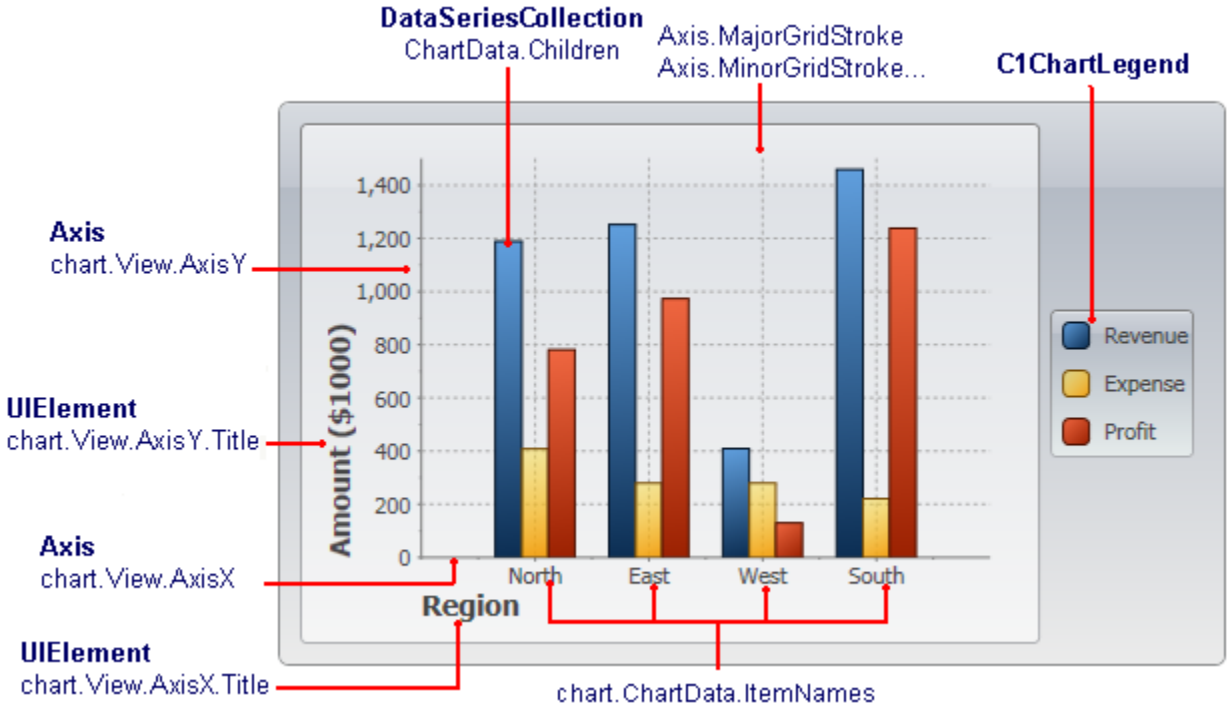
```
Dim nser As Integer = 3, npts As Integer = 25
  For iser As Integer = 1 To nser
    ' create data arrays
    Dim x(npts - 1) As Double, y(npts - 1) As Double
    For ipt As Integer = 0 To npts - 1
      x(ipt) = ipt
      y(ipt) = (1 + 0.05 * iser) * Math.Sin(0.1 * ipt + 0.1 * iser)
    Next
    ' create data series and add it to the chart
    Dim ds = New XYDataSeries()
    ds.XValuesSource = x
    ds.ValuesSource = y
    C1Chart1.Data.Children.Add(ds)
  Next

  'default chart type
  C1Chart1.ChartType = ChartType.Line

  ' 1st series
  C1Chart1.Data.Children(0).ChartType = ChartType.Area

  ' 2nd series
  C1Chart1.Data.Children(1).ChartType = ChartType.Step
```

- C#

```
int nser = 3, npts = 25;
  for (int iser = 0; iser < nser; iser++)
  {
    // create data arrays
    double[] x = new double[npts], y = new double[npts];
    for (int ipt = 0; ipt < npts; ipt++)
    {
      x[ipt] = ipt;
      y[ipt] = (1 + 0.05 * iser) * Math.Sin(0.1 * ipt + 0.1 * iser);
    }

    // create data series and add it to the chart
    XYDataSeries ds = new XYDataSeries();
    ds.XValuesSource = x; ds.ValuesSource = y;
    c1Chart1.Data.Children.Add(ds);
  }

  //default chart type
  c1Chart1.ChartType = ChartType.Line;

  // 1st series
  c1Chart1.Data.Children[0].ChartType = ChartType.Area;

  // 2nd series
  c1Chart1.Data.Children[1].ChartType = ChartType.Step;
```

C1Chart Concepts and Main Properties

In order to create and format charts using the **C1Chart** control, it is useful to understand how the main properties map into chart elements. The diagram below illustrates this:



The steps involved in creating a typical chart are:

1. Choose the chart type (ChartType property)
   C1Chart supports about 30 chart types, including Bar, Column, Line, Area, Pie, Radial, Polar, Candle, and several others. The best chart type depends largely on the nature of the data, and will be discussed later.
2. Set up the axes (AxisX and **chart.View.AxisY** properties)
   Setting up the axes typically involves specifying the axis title, major and minor intervals for the tick marks, content and format for the labels to show next to the tick marks.
3. Add one or more data series (**chart.Data.Children** collection)
   This step involves creating and populating one **DataSeries** object for each series on the chart, then adding the object to the **chart.Data.Children** collection. If your data contains only one numeric value per point (Y coordinate), use regular **DataSeries** objects. If the data contains two numeric values per point (X and Y coordinates), then use **XYDataSeries** objects instead.
4. Adjust the chart's appearance using the **Palette** property.
   The **Palette** property allows you to select one of over 20 built-in color palettes used to specify colors for the data series.

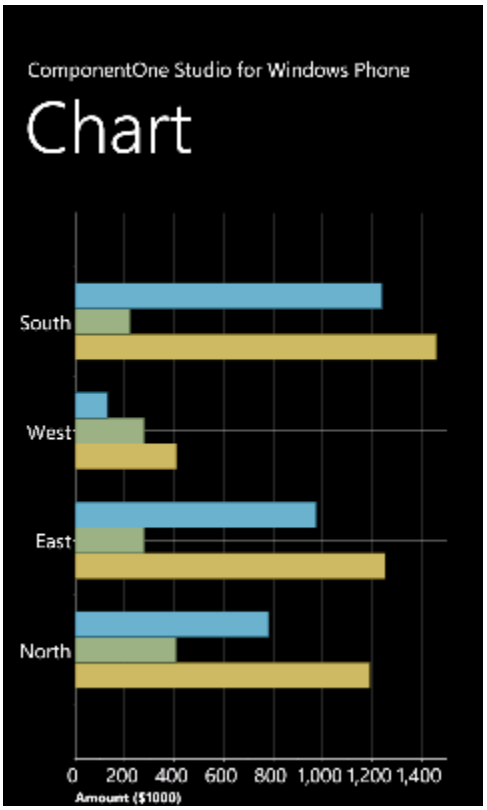
Common Usage for Basic 2D Charts

This chapter describes the common usage of the basic chart types such as Bar, Pie, and X-Y Plot charts. It also provides a sample code for each chart type. The samples are simple and concise, and focus on the main aspects of each common chart type. The distribution package includes a lot of sophisticated samples that show details and advanced features not discussed in this quick walkthrough.

This section describes how to create basic chart types, including the selection of chart type, adding the data, formatting, and adding titles to the chart axes.

Simple Charts

The simplest charts are those in which each data point has a single numeric value associated with it. A typical example would be a chart showing sales data for different regions, similar to the following chart:



Before we can create any charts, we need to generate the data that will be shown as a chart. Here is some code to create the data we need.

Note: There is nothing chart-specific in this code, this is just some generic data. We will use this data to create the Time Series and XY charts as well in the next topics.

- C#

```
// Simple class to hold dummy sales data
public class SalesRecord
```

```
{
  // Properties
  public string Region  { get; set; }
  public string Product { get; set; }
  public DateTime Date  { get; set; }
  public double Revenue { get; set; }
  public double Expense { get; set; }
  public double Profit  { get { return Revenue - Expense; } }
  // Constructor 1
  public SalesRecord(string region, double revenue, double expense)
  {
    Region = region;
    Revenue = revenue;
    Expense = expense;
  }
  // Constructor 2
  public SalesRecord(DateTime month, string product,    double revenue,
double expense)
  {
    Date = month;
    Product = product;
    Revenue = revenue;
    Expense = expense;
  }
}
// Return a list with one SalesRecord for each region
List<SalesRecord> GetSalesPerRegionData()
{
  var data = new List<SalesRecord>();
  Random rnd = new Random(0);
  foreach (string region in "North,East,West,South".Split(','))
  {
    data.Add(new SalesRecord(region, 100 + rnd.Next(1500),
rnd.Next(500)));
  }
  return data;
}
// Return a list with one SalesRecord for each product,// Over a period of
12 months
List<SalesRecord> GetSalesPerMonthData()

{
  var data = new List<SalesRecord>();
  Random rnd = new Random(0);
  string[] products = new string[] {"Widgets", "Gadgets", "Sprockets" };
  for (int i = 0; i < 12; i++)
  {
    foreach (string product in products)
    {
      data.Add(new SalesRecord(
        DateTime.Today.AddMonths(i - 24),
        product,
        rnd.NextDouble() * 1000 * i,
        rnd.NextDouble() * 1000 * i));
      }
    }
    return data;
```

```
}
```

Note that the **SalesData** class is public. This is required for data-binding.

We will follow the following four main steps in creating a chart:

Step 1) Choose the chart type:

The following code clears any existing series, then sets the chart type:

- C#

```
public MainPage()
{
    InitializeComponent();
    // Clear current chart
    c1Chart1.Reset(true);
    // Set chart type
    c1Chart1.ChartType = ChartType.Bar;
}
```

Step 2) Set up the axes:

We will start by by obtaining references to both axes. In most charts, the horizontal axis (X) displays labels associated with each point, and the vertical axis (Y) displays the values. The exception is the Bar chart type, which displays horizontal bars. For this chart type, the labels are displayed on the Y axis and the values on the X:

Next we will assign titles to the axes. The axis titles are **UIElement** objects rather than simple text. This means you have complete flexibility over the format of the titles. In fact, you could use complex elements with buttons, tables, or images for the axis titles. In this case, we will use simple **TextBlock** elements created by a **CreateTextBlock** method described later.

We will also configure the value axis to start at zero, and to display the annotations next to the tick marks using thousand separators:

- C#

```
// configure label axis
Axis labelAxis = c1Chart1.View.AxisX;
labelAxis.Title = CreateTextBlock("Region", 14, FontWeights.Bold);

// configure value axis
c1Chart1.View.AxisX.Title = CreateTextBlock("Amount ($1000)", 14,
FontWeights.Bold);
c1Chart1.View.AxisX.AutoMin = false;
c1Chart1.View.AxisX.Min = 0;
c1Chart1.View.AxisX.MajorUnit = 200;
c1Chart1.View.AxisX.AnnoFormat = "#,##0 ";
```

Step 3) Add one or more data series

We start this step by retrieving the data using the method listed earlier:

- C#

```
// get the data
var data = GetSalesPerRegionData();
```

Next, we want to display the regions along the label axis. To do this, we will use a Linq statement that retrieves the **Region** property for each record. The result is then converted to an array and assigned to the ItemNames property.

- C#

```
// Show regions along label axis
c1Chart1.Data.ItemNames = (from r in data select r.Region).ToArray();
```

Note how the use of LINQ makes the code direct and concise. Things are made even simpler because our sample data contains only one record per region. In a more realistic scenario, there would be several records per region, and we would use a more complex Linq statement to group the data per region.

Now we are ready to create the actual **DataSeries** objects that will be added to the chart. We will create three series: "Revenue", "Expenses", and "Profit":

- C#

```
// Add Revenue series
var ds = new DataSeries();
ds.Label = "Revenue";
ds.ValuesSource = (from r in data select r.Revenue).ToArray();
c1Chart1.Data.Children.Add(ds);
// Add Expense series
ds = new DataSeries();
ds.Label = "Expense";
ds.ValuesSource = (from r in data select r.Expense).ToArray();
c1Chart1.Data.Children.Add(ds);
// Add Profit series
ds = new DataSeries();
ds.Label = "Profit";
ds.ValuesSource = (from r in data select r.Profit).ToArray();
c1Chart1.Data.Children.Add(ds);
```

For each series, the code creates a new **DataSeries** object, then sets its **Label** property. The label is optional; if provided, it will be displayed in any **C1ChartLegend** objects associated with this chart. Next, a Linq statement is used to retrieve the values from the data source. The result is assigned to the **ValuesSource** property of the data series object. Finally, the data series is added to the chart's Children collection.

Once again, note how the use of LINQ makes the code concise and natural.

Step 4) Adjust the chart's appearance

Recall that we used a **CreateTextBlock** helper method when setting up the axes. Here is the method definition:

- C#

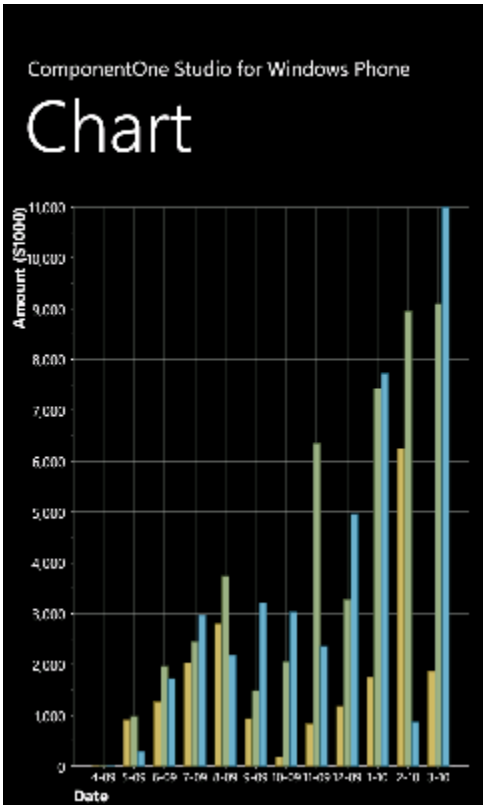
```
TextBlock CreateTextBlock(string text, double fontSize, FontWeight
fontWeight)
{
    var tb = new TextBlock();
    tb.Text = text;
    tb.FontSize = fontSize;
    tb.FontWeight = fontWeight;
    return tb;
}
```

This concludes the code that generates simple value charts. You can test it by invoking the changing to value of the ChartType property to any of the remaining simply chart type values: **Bar**, **AreaStacked**, and **Pie** to create charts of different types. Note, if you change the **ChartType** to **Column**, you will need display the labels on the Y-Axis so you will use **AxisY**.

Note: By default the chart displays a legend describing the series. To remove the C1ChartLegend, delete the following XAML: <c1chart:C1ChartLegend />

Time-Series Charts

Time-series charts display time along the X-axis. This is a very common type of chart, used to show how values change as time passes.



Most time-series charts show constant time intervals (yearly, monthly, weekly, daily). In this case, the time-series chart is essentially identical to a simple value type chart like the one described above. The only difference is that instead of showing categories along the X axis, the chart will show dates or times. (If the time intervals are not constant, then the chart becomes an XY chart, described in the next section.)

Before we can create any charts, we need to generate the data that will be shown as a chart. Here is some code to create the data we need.

Note: There is nothing chart-specific in this code, this is just some generic data. We will use this data to create the Time Series and XY charts as well in the next topics.

- C#

```
TextBlock CreateTextBlock(string text, double fontSize, FontWeight
fontWeight)
{
    var tb = new TextBlock();
    tb.Text = text;
    tb.FontSize = fontSize;
    tb.FontWeight = fontWeight;
    return tb;
}
// Simple class to hold dummy sales data
public class SalesRecord
{
  // Properties
  public string Region  { get; set; }
  public string Product { get; set; }
  public DateTime Date  { get; set; }
```

```
  public double Revenue { get; set; }
  public double Expense { get; set; }
  public double Profit  { get { return Revenue - Expense; } }
  // Constructor 1
  public SalesRecord(string region, double revenue, double expense)
  {
    Region = region;
    Revenue = revenue;
    Expense = expense;
  }
  // Constructor 2
  public SalesRecord(DateTime month, string product,    double revenue,
double expense)
  {
    Date = month;
    Product = product;
    Revenue = revenue;
    Expense = expense;
  }
}
// Return a list with one SalesRecord for each region
List<SalesRecord> GetSalesPerRegionData()
{
  var data = new List<SalesRecord>();
  Random rnd = new Random(0);
  foreach (string region in "North,East,West,South".Split(','))
  {
    data.Add(new SalesRecord(region, 100 + rnd.Next(1500),
rnd.Next(500)));
  }
  return data;
}
// Return a list with one SalesRecord for each product,// Over a period of
12 months
List<SalesRecord> GetSalesPerMonthData()

{
  var data = new List<SalesRecord>();
  Random rnd = new Random(0);
  string[] products = new string[] {"Widgets", "Gadgets", "Sprockets" };
  for (int i = 0; i < 12; i++)
  {
    foreach (string product in products)
    {
      data.Add(new SalesRecord(
DateTime.Today.AddMonths(i - 24),
product,
rnd.NextDouble() * 1000 * i,
rnd.NextDouble() * 1000 * i));
      }
    }
    return data;
}
```

Note that the **SalesData** class is public. This is required for data-binding.

We will now walk through the creation of some time-series charts.

Step 1) Choose the chart type:

The code clears any existing series, then sets the chart type:

- C#

```
public MainPage()
{
    InitializeComponent();
    // Clear current chart
    c1Chart1.Reset(true);
    // Set chart type
    c1Chart1.ChartType = ChartType.Column;
}
```

Step 2) Set up the axes:
We will start by obtaining references to both axes, as in the previous sample. Recall that the Bar chart type uses reversed axes (values are displayed on the Y axis):

- C#

```
//Get axes
Axis valueAxis = c1Chart1.View.AxisY;
Axis labelAxis = c1Chart1.View.AxisX;
if (c1Chart1.ChartType == ChartType.Bar)
{
    valueAxis = c1Chart1.View.AxisX;
    labelAxis = c1Chart1.View.AxisY;
}
```

Next we will assign titles to the axes. The axis titles are **UIElement** objects rather than simple text. This We will set up the axis titles using the **CreateTextBlock** method, the same way we did before. We will also set up the annotation format, minimum value, and major unit. The only difference is we will use a larger interval for the tick marks between values:

- C#

```
// configure label axis
labelAxis.Title = CreateTextBlock("Date", 16, FontWeights.Bold);
labelAxis.AnnoFormat = "M-yy";
labelAxis.FontSize = 12;

// configure value axis
valueAxis.Title = CreateTextBlock("Amount ($1000)", 16, FontWeights.Bold);
valueAxis.AnnoFormat = "#,##0 ";
valueAxis.MajorUnit = 1000;
valueAxis.FontSize = 14;

valueAxis.AutoMin = false;
valueAxis.Min = 0;
```

Step 3) Add one or more data series
This time, we will use the second data-provider method defined earlier:

- C#

```
// get the data
var data = GetSalesPerMonthData();
```

Next, we want to display the dates along the label axis. To do this, we will use a Linq statement that retrieves the distinct **Date** values in our data records. The result is then converted to an array and assigned to the ItemsSource property of the label axis.

- C#

```
c1Chart1.Data.ItemNames = (from r in data select r.Date.ToString("M-
yy")).Distinct().ToArray();
```

Note that we used the **Distinct** LINQ operator to remove duplicate date values. That is necessary because our data contains one record per product for each date.

Now we are ready to create the actual **DataSeries** objects that will be added to the chart. Each series will show the revenue for a given product. This can be done with a Linq statement that is slightly more elaborate than what we used before, but provides a good practical example of the power provided by Linq:

- C#

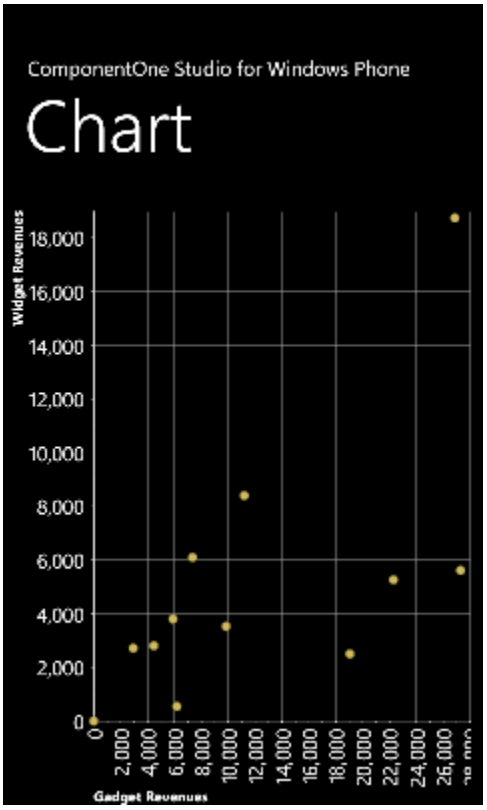
```
// add one series (revenue) per product
var products = (from p in data select p.Product).Distinct();
foreach (string product in products)
{
    var ds = new DataSeries();
    ds.Label = product;
    ds.ValuesSource = (
      from r in data
      where r.Product == product
      select r.Revenue).ToArray();
    c1Chart1.Data.Children.Add(ds);
}
```

The code starts by building a list of products in the data source. Next, it creates one **DataSeries** for each product. The label of the data series is simply the product name. The actual data is obtained by filtering the records that belong to the current product and retrieving their **Revenue** property. The result is assigned to the **ValuesSource** property of the data series as before.

This concludes the code that generates our time-series charts. You can test it by running it and changing the ChartType property to Bar, Column, AreaStacked, or Pie to create charts of different types. You would probably never display a time-series chart as a pie. The pie chart completely masks the growth trend that is clearly visible in the other charts.

XY Charts

XY charts (also known as scatter plots) are used to show relationships between variables. Unlike the charts we introduced so far, in XY charts each point has two numeric values. By plotting one of the values against the X axis and one against the Y axis, the charts show the effect of one variable on the other.



Before we can create any charts, we need to generate the data that will be shown as a chart. Here is some code to create the data we need.

Note: There is nothing chart-specific in this code, this is just some generic data. We will use this data to create the Time Series and XY charts as well in the next topics.

- C#

```
TextBlock CreateTextBlock(string text, double fontSize, FontWeight
fontWeight)
{
    var tb = new TextBlock();
    tb.Text = text;
    tb.FontSize = fontSize;
    tb.FontWeight = fontWeight;
    return tb;
}
// Simple class to hold dummy sales data
public class SalesRecord
{
  // Properties
  public string Region  { get; set; }
  public string Product { get; set; }
  public DateTime Date  { get; set; }
  public double Revenue { get; set; }
  public double Expense { get; set; }
  public double Profit  { get { return Revenue - Expense; } }
  // Constructor 1
  public SalesRecord(string region, double revenue, double expense)
```

```
  {
    Region = region;
    Revenue = revenue;
    Expense = expense;
  }
  // Constructor 2
  public SalesRecord(DateTime month, string product,    double revenue,
double expense)
  {
    Date = month;
    Product = product;
    Revenue = revenue;
    Expense = expense;
  }
}
// Return a list with one SalesRecord for each region
List<SalesRecord> GetSalesPerRegionData()
{
  var data = new List<SalesRecord>();
  Random rnd = new Random(0);
  foreach (string region in "North,East,West,South".Split(','))
  {
    data.Add(new SalesRecord(region, 100 + rnd.Next(1500),
rnd.Next(500)));
  }
  return data;
}
// Return a list with one SalesRecord for each product,// Over a period of
12 months
List<SalesRecord> GetSalesPerMonthData()

{
  var data = new List<SalesRecord>();
  Random rnd = new Random(0);
  string[] products = new string[] {"Widgets", "Gadgets", "Sprockets" };
  for (int i = 0; i < 12; i++)
  {
    foreach (string product in products)
    {
      data.Add(new SalesRecord(
DateTime.Today.AddMonths(i - 24),
product,
rnd.NextDouble() * 1000 * i,
rnd.NextDouble() * 1000 * i));
      }
    }
    return data;
}
```

Note that the **SalesData** class is public. This is required for data-binding.

We will continue our **C1Chart** tour using the same data we created earlier, but this time we will create XY charts that show the relationship between revenues from two products. For example, we might want to determine whether high **Widget** revenues are linked to high **Gadgets** revenues (perhaps the products work well together), or whether high **Widget** revenues are linked to low **Gadgets** revenues (perhaps people who buy one of the products don't really need the other).

To do this, we will follow the same steps as before. The main differences are that this time we will add **XYDataSeries** objects to the chart's **Data.Children** collection instead of the simpler **DataSeries** objects. The Linq statement used to obtain the data is also a little more refined and interesting.

Step 1) Choose the chart type:
The code clears any existing series, then sets the chart type:

- C#

```
public MainPage()
{
    InitializeComponent();
    // Clear current chart
    c1Chart1.Reset(true);
    // Set chart type
    c1Chart1.ChartType = ChartType.XYPlot;
}
```

Step 2) Set up the axes:
Since we're now creating XY series, we have two value axes (before we had a label axis and a value axis). We will attach titles and formats to both axes as we did before. We will also set the scale and annotation format as before. We will also use the AnnoAngle property to rotate the annotation labels along the X axis so they don't overlap:

- C#

```
// get axes
var yAxis = c1Chart1.View.AxisY;
var xAxis = c1Chart1.View.AxisX;

// configure Y axis
yAxis.Title = CreateTextBlock("Widget Revenues", 14, FontWeights.Bold);
yAxis.AnnoFormat = "#,##0 ";
yAxis.AutoMin = false;
yAxis.Min = 0;
yAxis.MajorUnit = 2000;
yAxis.AnnoAngle = 0;

// configure X axis
xAxis.Title = CreateTextBlock("Gadget Revenues", 14, FontWeights.Bold);
xAxis.AnnoFormat = "#,##0 ";
xAxis.AutoMin = false;
xAxis.Min = 0;
xAxis.MajorUnit = 2000;
xAxis.AnnoAngle = -90; // rotate annotations
```

Step 3) Add one or more data series
Once again, we will use the second data-provider method defined earlier:

- C#

```
// get the data
var data = GetSalesPerMonthData();
```

Next, we need to obtain XY pairs that correspond to the total revenues for **Widgets** and **Gadgets** at each date. We can use Linq to obtain this information directly from our data:

- C#

```
// group data by sales date
var dataGrouped = from r in data
  group r by r.Date into g
  select new
  {
    Date = g.Key, // group by date
```

```
    Widgets = (from rp in g // add Widget revenues
      where rp.Product == "Widgets"
      select g.Sum(p => rp.Revenue)).Single(),
    Gadgets = (from rp in g // add Gadget revenues
      where rp.Product == "Gadgets"
      select g.Sum(p => rp.Revenue)).Single(),
  };

// sort data by widget sales
var dataSorted = from r in dataGrouped
orderby r.Gadgets
select r;
```

The first LINQ query starts by grouping the data by **Date**. Then, for each group it creates a record containing the **Date** and the sum of revenues within that date for each of the products we are interested in. The result is a list of objects with three properties: **Date**, **Widgets**, and **Gadgets**. This type of data grouping and aggregation is a powerful feature of LINQ.

The second Linq query simply sorts the data by **Gadget** revenue. These are the values that will be plotted on the X axis, and we want them to be in ascending order. Plotting unsorted values would look fine if we displayed only symbols (**ChartType = XYPlot**), but it would look messy if we chose other chart types such as **Line** or **Area**.

Once the data has been properly grouped, summarized, and sorted, all we need to do is create one single data series, and assign one set of values to the ValuesSource property and the to the XValuesSource property:

- C#

```
// create the new XYDataSeries
var ds = new XYDataSeries();

// set series label (displayed in a C1ChartLegend)
ds.Label = "Revenue:\r\nWidgets vs Gadgets";

// populate Y values
ds.ValuesSource = (
from r in dataSorted
select r.Widgets).ToArray();

// populate X values
ds.XValuesSource = (
from r in dataSorted
select r.Gadgets).ToArray();

// add the series to the chart
c1Chart1.Data.Children.Add(ds);
```

You can test it by running the program and changing the ChartType property to XYPlot, LineSymbols, or Area to create charts of different types. The most appropriate chart type in this case is the first, an **XYPlot**. The chart shows a positive correlation between **Gadget** and **Widget** revenues.

This concludes the basic charting topic. You already have the tools you need to create all types of common charts.

Formatting Charts

The previous section introduced the Theme that you can use to select the appearance of your charts quickly and easily. The Theme and Palette properties offer a long list of built-in options that were carefully developed to provide great results with little effort from developers.

In most applications, you will choose the combination of settings for the **Theme** and **Palette** properties that is closest to the feel you want for your application, then customize a few items if necessary. Items you may want to customize include:

1. **Axis titles**: The axis titles are **UIElement** objects. You can customize them directly, and with complete flexibility. The chart samples used in the Common Usage for Basic 2D Charts (page 31) topic uses the **TextElement** objects, but you could use many other elements, including panels such as **Border** and **Grid** objects. For more information on axis titles, see Axis Title (page 76).
2. **Axis**: The chart samples used in the Common Usage for Basic 2D Charts (page 31) topic shows how you can customize axis scale, annotation angle, and annotation format. All these are accessible through the **Axis** object exposed by the AxisX and AxisY properties. For more information on C1Chart's axis, see Axes (page 74).

   The **C1Chart** control has the usual Font properties that determine how annotations are displayed along both axes (**FontFamily**, **FontSize**, etc). If you need more control over the appearance of the annotations, the Axis object also exposes an **AnnoTemplate** property that can be used to customize annotations even further.
3. **Grid lines**: Grid lines are controlled by the **Axis** properties. There are properties for the major and minor grid lines (MajorGridStrokeThickness, MajorGridStrokeThickness, MinorGridStrokeThickness, MinorGridStrokeThickness, and so on). For more information on grid lines, see Axis Grid Lines (page 79).
4. **Tick Marks**: Tick marks are also controlled by the **Axis** properties. There are properties for the major and minor ticks (MajorTickStroke, MajorTickThickness, MinorTickStroke, MinorTickThickness, and so on). For more information on tick marks, see Axis Tick Marks (page 77).

Specialized Charts

There are a few specialized chart types that are slightly different from the ones described so far. These are described in the following sections.

Financial Charts

C1Chart implements two types of financial chart: **Candle** and **HighLowOpenClose**. Both are commonly used to display variations in stock prices over a period of time.

The difference between common chart types and financial charts is that **Candle** and **HighLowOpenClose** charts require a special type of data series object, the **HighLowOpenCloseSeries**. In this type of data series, each point corresponds to a period (typically one day) and contains five values:

- Time
- Price at the beginning of period (Open)
- Price at the end of period (Close)
- Minimum price during period (Low)
- Maximum price during period (High)

To create financial charts you need to provide all these values. For example, if the values were provided by the application as collections, then you could use the code below to create the data series:

- C#

```
// Create data series
HighLowOpenCloseSeries ds = new HighLowOpenCloseSeries();
ds.XValuesSource = dates; // Dates are along x-axis
ds.OpenValuesSource = open;
ds.CloseValuesSource = close;
ds.HighValuesSource = hi;
ds.LowValuesSource = lo;
```

```
// Add series to chart
chart.Data.Children.Add(ds);

// Set chart type
chart.ChartType = isCandle
  ? ChartType.Candle
  : ChartType.HighLowOpenClose;
```

Another option is to use data-binding. For example, if the data is available as a collection of **StockQuote** objects such as:

- C#

```
public class Quote
{
  public DateTime Date { get; set; }
  public double Open { get; set; }
  public double Close { get; set; }
  public double High { get; set; }
  public double Low { get; set; }
}
```

Then the code that creates the data series would be as follows:

- C#

```
// Create data series
HighLowOpenCloseSeries ds = new HighLowOpenCloseSeries();

// Bind all five values
ds.XValueBinding = new Binding("Date"); // dates are along x-axis
ds.OpenValueBinding = new Binding("Open");
ds.CloseValueBinding = new Binding("Close");
ds.HighValueBinding = new Binding("High");
ds.LowValueBinding = new Binding("Low");

// Add series to chart
chart.Data.Children.Add(ds);

// Set chart type
chart.ChartType = isCandle
  ? ChartType.Candle
  : ChartType.HighLowOpenClose;
```

Note that the **SymbolSize.Width** property of the data series can be used to change the width of the chart symbols.

Gantt Charts

C1Chart implements Gantt charts, which show tasks organized along time.

Gantt charts use data series objects of type HighLowSeries. Each data series represents a single task, and each task has a set of start and end values. Simple tasks have one start value and one end value. Tasks that are composed of multiple sequential sub-tasks have multiple pairs of start and end values.

To demonstrate Gantt charts, let us start by defining a **Task** object:

- C#

```
class Task
{
```

```
  public string Name { get; set; }
  public DateTime Start { get; set; }
  public DateTime End { get; set; }
  public bool IsGroup { get; set; }
  public Task(string name, DateTime start, DateTime end, bool isGroup)
  {
    Name = name;
    Start = start;
    End = end;
    IsGroup = isGroup;
  }
}
```

Next, let us define a method that creates a set of **Task** objects that will be shown as a Gantt chart:

- C#

```
Task[] GetTasks()
{
  return new Task[]
  {
    new Task("Alpha", new DateTime(2008,1,1), new DateTime(2008,2,15),
true),
    new Task("Spec", new DateTime(2008,1,1), new DateTime(2008,1,15),
false),
    new Task("Prototype", new DateTime(2008,1,15), new
DateTime(2008,1,31), false),
    new Task("Document", new DateTime(2008,2,1), new DateTime(2008,2,10),
false),
    new Task("Test", new DateTime(2008,2,1), new DateTime(2008,2,12),
false),
    new Task("Setup", new DateTime(2008,2,12), new DateTime(2008,2,15),
false),

    new Task("Beta", new DateTime(2008,2,15), new DateTime(2008,3,15),
true),
    new Task("WebPage", new DateTime(2008,2,15), new DateTime(2008,2,28),
false),
    new Task("Save bugs", new DateTime(2008,2,28), new
DateTime(2008,3,10), false),
    new Task("Fix bugs", new DateTime(2008,3,1), new DateTime(2008,3,15),
false),
    new Task("Ship", new DateTime(2008,3,14), new DateTime(2008,3,15),
false),
  };
}
```

Now that the tasks have been created, we are ready to create the Gantt chart:

- C#

```
private void CreateGanttChart()
{
  // Clear current chart
  c1Chart1.Reset(true);

  // Set chart type
  c1Chart1.ChartType = ChartType.Gantt;

  // Populate chart
```

```
  var tasks = GetTasks();
  foreach (var task in tasks)
  {
    // Create one series per task
    var ds = new HighLowSeries();
    ds.Label = task.Name;
    ds.LowValuesSource = new DateTime[] { task.Start };
    ds.HighValuesSource = new DateTime[] { task.End };
    ds.SymbolSize = new Size(0, task.IsGroup ? 30 : 10);

    // Add series to chart
    c1Chart1.Data.Children.Add(ds);
  }

  // Show task names along Y axis
  c1Chart1.Data.ItemNames =
    (from task in tasks select task.Name).ToArray();

  // Customize Y axis
  var ax = c1Chart1.View.AxisY;
  ax.Reversed = true;
  ax.MajorGridStroke = null;

  // Customize X axis
  ax = c1Chart1.View.AxisX;
  ax.MajorGridStrokeDashes = null;
  ax.MajorGridFill = new SolidColorBrush(Color.FromArgb(20, 120, 120,
120));
  ax.Min = new DateTime(2008, 1, 1).ToOADate();
}
```

After clearing the **C1Chart** and setting the chart type, the code enumerates the tasks and creates one **HighLowSeries** for each. In addition to setting the series Label, LowValuesSource and HighValuesSource properties, the code uses the SymbolSize property to set the height of each bar. In this sample, we define some tasks as "Group" tasks, and make them taller than regular tasks.

Next, we use a LINQ statement to extract the task names and assign them to the ItemNames property. This causes **C1Chart** to display the task names along the Y axis.

Finally, the code customizes the axes. The Y axis is reversed so the first task appears at the top of the chart. The axes are configured to show vertical grid lines and alternating bands.

The final result looks like this:

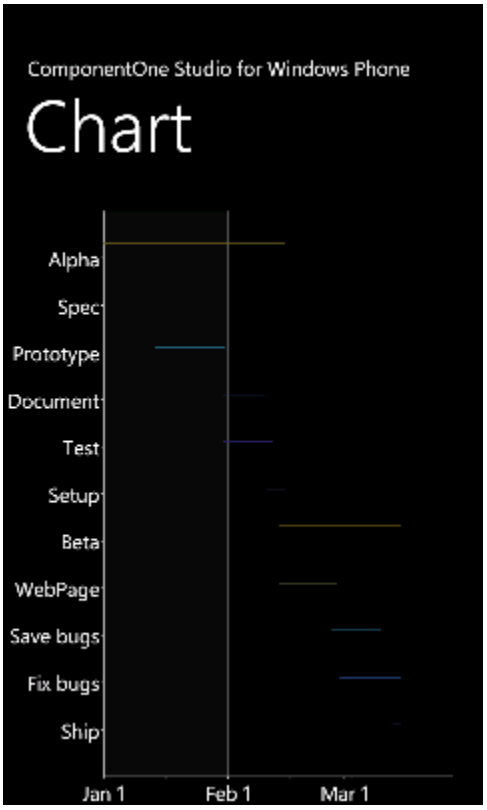


Chart Types

This section introduces all of the specific chart types available in C1Chart.

Using built-in types is the simplest way to set up the chart's appearance. For example, to set up a stacked bar chart, specify the corresponding string in the ChartType property:

```
<c1chart:C1Chart ChartType="BarStacked">
   ...
</c1chart:C1Chart>
```

The available chart types are specified by the members of enumeration ChartType.

The list of available built-in chart types is presented in the table below.

Name in gallery
Area
AreaSmoothed
AreaStacked
AreaStacked100pc
Bar
BarStacked
BarStacked100pc

Bubble
Candle
Column
ColumnStacked
ColumnStacked100pc
Gantt
HighLowOpenClose
Line
LineSmoothed
LineStacked
LineStacked100pc
LineSymbols
LineSymbolsSmoothed
LineSymbolsStacked
LineSymbolsStacked100pc
Pie
PieDoughnut
PieExploded
PieExplodedDoughnut
PolarLines
PolarLinesSymbols
PolarSymbols
Polygon
PolygonFilled
Radar
RadarFilled
RadarSymbols
Step
StepArea
StepSymbols
XYPlot
Area3D

Area3DSmoothed
Area3DStacked
Area3DStacked100pc
Bar3D
Bar3DStacked
Bar3DStacked100pc
Pie3D
Pie3DDoughnut
Pie3DExploded
Pie3DExplodedDougnut
Ribbon

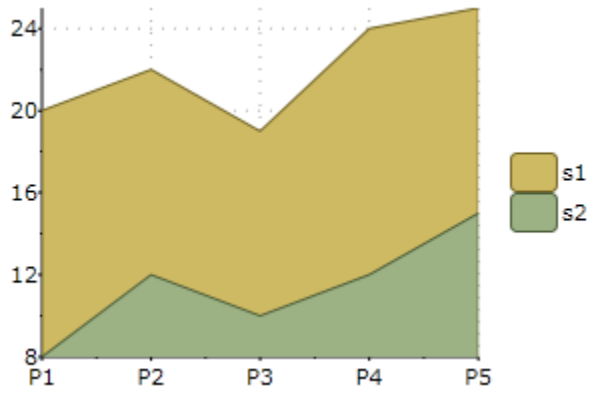
Area Charts

An Area chart draws each series as connected points of data, filled below the points. Each series is drawn on top of the preceding series. The series can be drawn independently or stacked. **Chart for Windows Phone** supports the following types of Area charts:

- AreaSmoothed
- AreaStacked
- AreaStacked100pc

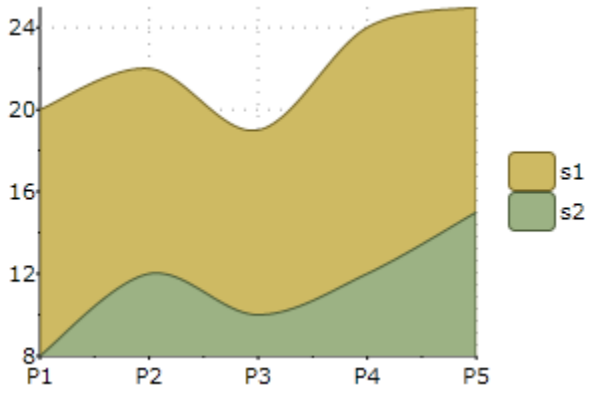
Area

The following image represents the Area chart when you set the ChartType property to **Area**:



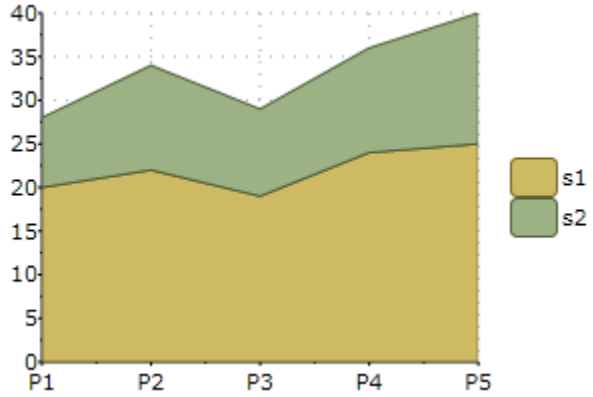
Area Smoothed

The following image represents the Area Smoothed chart when you set the ChartType property to **AreaSmoothed**:



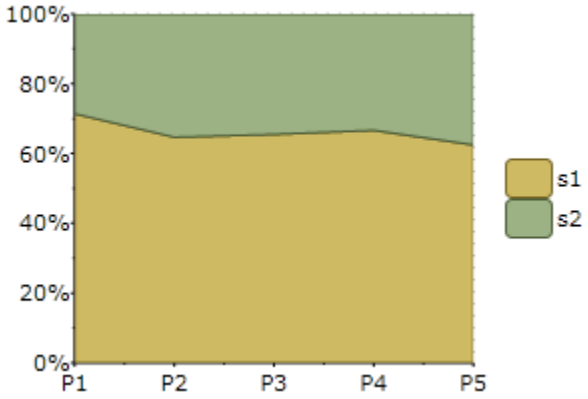
Area Stacked

The following image represents the Area Stacked chart when you set the ChartType property to **AreaStacked**:



Area Stacked 100 Percent

The following image represents the Area Stacked 100 Percent chart when you set the ChartType property to **AreaStacked100pc**:



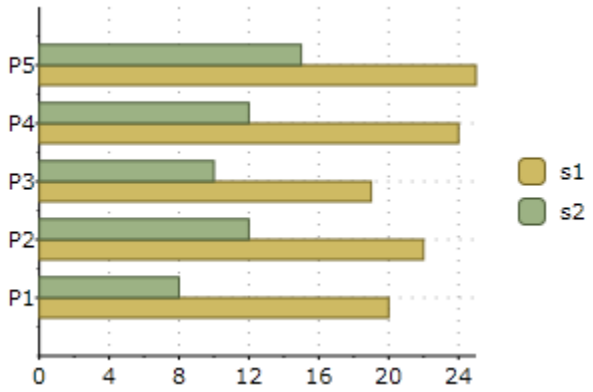
Bar Charts

Chart for Windows Phone supports the following types of Bar charts:

- Bar
- BarStacked
- BarStacked100pc

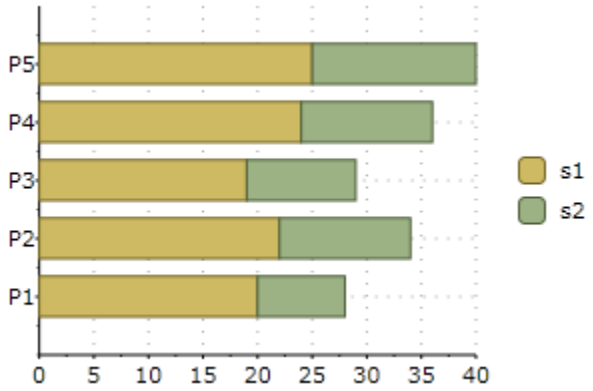
Bar

The following image represents the Bar chart when you set the ChartType property to **Bar**:



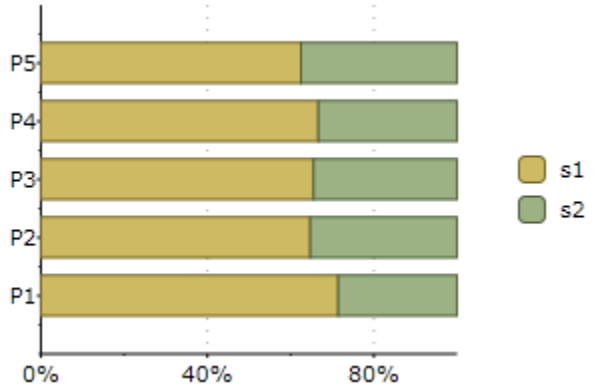
Bar Stacked

The following image represents the Bar Stacked chart when you set the ChartType property to **BarStacked**:



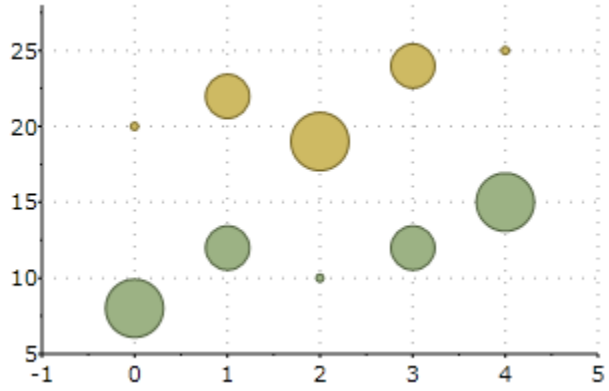
Bar Stacked 100 Percent

The following image represents the Bar Stacked 100 Percent chart when you set the ChartType property to **BarStacked100pc**:



Bubble Charts

The following image represents the Bubble chart when you set ChartType property to **Bubble**:



The following XAML code creates a Bubble chart:

```
<c1chart:C1Chart ChartType="Bubble" c1chart:BubbleOptions.MinSize="5,5"
       c1chart:BubbleOptions.MaxSize="30,30"
       c1chart:BubbleOptions.Scale="Area">

             <c1chart:C1Chart.Data>
      <c1chart:ChartData>
        <c1chart:BubbleSeries Values="20 22 19 24 25" SizeValues="1 2 3
2 1" />
        <c1chart:BubbleSeries Values="8 12 10 12 15" SizeValues="3 2 1
2 3"/>
      </c1chart:ChartData>
    </c1chart:C1Chart.Data>
  </c1chart:C1Chart>
```

Financial Charts

C1Chart implements two types of financial chart: **Candle** and **HighLowOpenClose**. Both are commonly used to display variations in stock prices over a period of time.

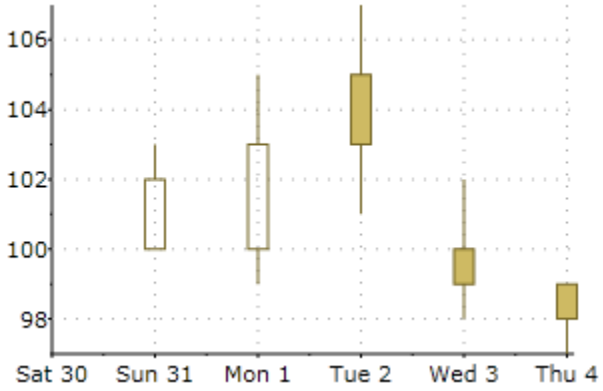
A **Candle** chart is a special type of **HiLoOpenClose** chart that is used to show the relationship between the open and close as well as the high and low. Like, **HiLoOpenClose** charts, **Candle** charts use the same price data (time, high, low, open, and close values) except they include a thick candle-like body that uses the color and size of the body to reveal additional information about the relationship between the open and close values. For example, long transparent candles show buying pressure and long filled candles show selling pressure.

The Candle chart is made up of the following elements: candle, wick, and tail. The candle or the body (the solid bar between the opening and closing values) represents the change in stock price from opening to closing. The thin lines, wick and tail, above and below the candle depict the high/low range. A hollow candle or transparent candle indicates a rising stock price (close was higher than open). In a hollow candle, the bottom of the body represents the opening price and the top of the body represents the closing price. A filled candle indicates a falling stock price (open was higher than close). In a filled candle the top of the body represents the opening price and the bottom of the body represents the closing price.

Candle Chart

The following image represents the Candle chart when you set ChartType property to **Candle** and specifiy the data values for the XValuesSource, OpenValuesSource, CloseValuesSource, HighValuesSource, and LowValuesSource, like the following:

```
<c1chart:C1Chart ChartType="Candle">
    <c1chart:C1Chart.Data>
      <c1chart:ChartData>
        <c1chart:HighLowOpenCloseSeries
            XValues="1 2 3 4 5"
           HighValues="103 105 107 102 99"
           LowValues="100 99 101 98 97"
           OpenValues="100 100 105 100 99"
           CloseValues="102 103 103 99 98"
         />
      </c1chart:ChartData>
    </c1chart:C1Chart.Data>
  </c1chart:C1Chart>
```

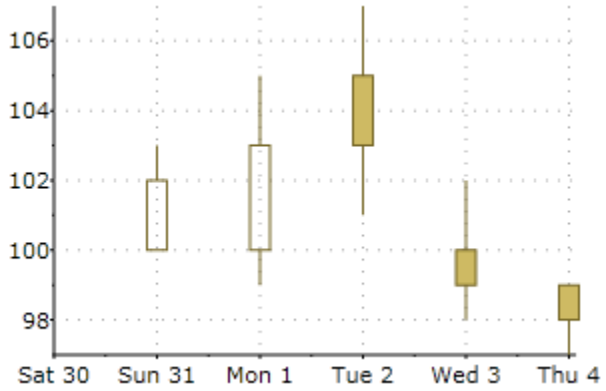


HighLowOpenClose Chart

The following image represents the **HighLowOpenClose** chart when you set ChartType property to **HighLowOpenClose** and specifiy the data values for the XValuesSource, OpenValuesSource, CloseValuesSource, HighValuesSource, and LowValuesSource, like the following:

```
<c1chart:C1Chart ChartType="HighLowOpenClose">
    <c1chart:C1Chart.Data>
```

```
      <c1chart:ChartData>
        <c1chart:HighLowOpenCloseSeries
            XValues="1 2 3 4 5"
           HighValues="103 105 107 102 99"
           LowValues="100 99 101 98 97"
           OpenValues="100 100 105 100 99"
           CloseValues="102 103 103 99 98"
         />
      </c1chart:ChartData>
    </c1chart:C1Chart.Data>
  </c1chart:C1Chart>
```



The difference between common chart types and financial charts is that **Candle** and **HighLowOpenClose** charts require a special type of data series object, the **HighLowOpenCloseSeries**. In this type of data series, each point corresponds to a period (typically one day) and contains five values:

- Time
- Price at the beginning of period (Open)
- Price at the end of period (Close)
- Minimum price during period (Low)
- Maximum price during period (High)

To create financial charts you need to provide all these values.

For example, if the values were provided by the application as collections, then you could use the code below to create the data series:

- C#

```
// create data series
HighLowOpenCloseSeries ds = new HighLowOpenCloseSeries();
ds.XValuesSource = dates; // dates are along x-axis
ds.OpenValuesSource = open;
ds.CloseValuesSource = close;
ds.HighValuesSource = hi;
ds.LowValuesSource = lo;

// add series to chart
chart.Data.Children.Add(ds);

// set chart type
chart.ChartType = isCandle
```

```
  ? ChartType.Candle
  : ChartType.HighLowOpenClose;
```

Another option is to use data-binding. For example, if the data is available as a collection of **StockQuote** objects such as:

- C#

```
public class Quote
{
  public DateTime Date { get; set; }
  public double Open { get; set; }
  public double Close { get; set; }
  public double High { get; set; }
  public double Low { get; set; }
}
```

Then the code that creates the data series would be as follows:

- C#

```
// create data series
HighLowOpenCloseSeries ds = new HighLowOpenCloseSeries();

// bind all five values
ds.XValueBinding = new Binding("Date"); // dates are along x-axis
ds.OpenValueBinding = new Binding("Open");
ds.CloseValueBinding = new Binding("Close");
ds.HighValueBinding = new Binding("High");
ds.LowValueBinding = new Binding("Low");

// add series to chart
chart.Data.Children.Add(ds);

// set chart type
chart.ChartType = isCandle
  ? ChartType.Candle
  : ChartType.HighLowOpenClose;
```

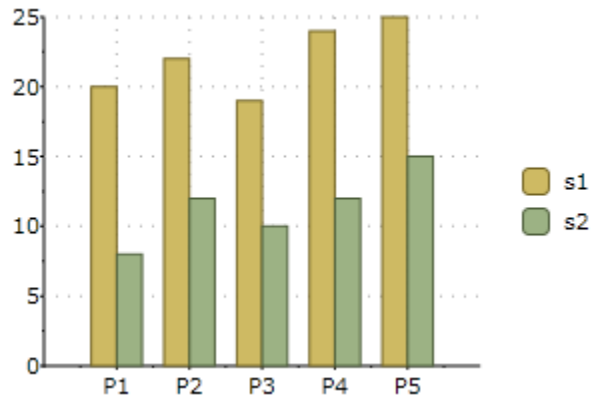
Column Charts

Chart for Windows Phone supports the following types of Column charts:

- Column
- ColumnStacked
- ColumnStacked100pc

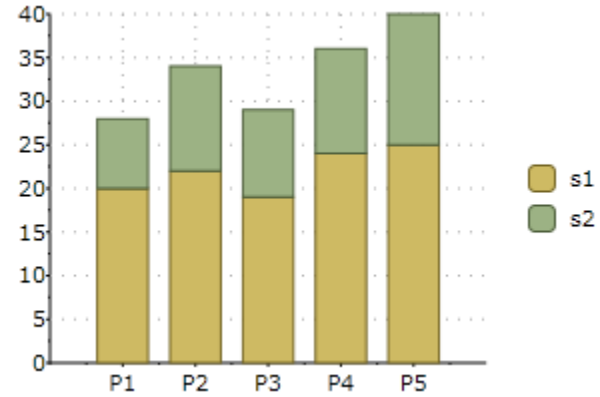
Column

The following image represents the Column chart when you set the ChartType property to **Column**:



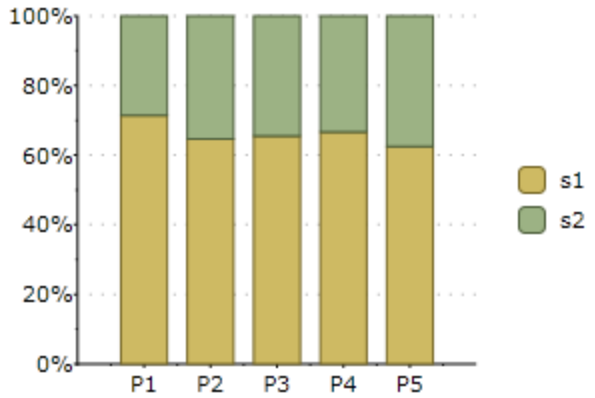
Column Stacked

The following image represents the Column Stacked 100% when you set the ChartType property to **ColumnStacked**:



Column Stacked 100%

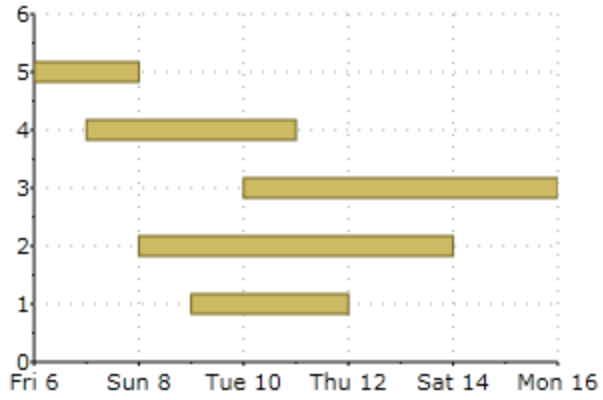
The following image represents the Column Stacked 100% when you set the ChartType property to **ColumnStacked100pc**:



Gantt Charts

Gantt charts use data series objects of type **HighLowSeries**. Each data series represents a single task, and each task has a set of start and end values. Simple tasks have one start value and one end value. Tasks that are composed of multiple sequential sub-tasks have multiple pairs of start and end values.

The following image represents a Gantt chart when the following code is used:



To demonstrate Gantt charts, let us start by defining a **Task** object:

- C#

```
class Task
{
  public string Name { get; set; }
  public DateTime Start { get; set; }
  public DateTime End { get; set; }
  public bool IsGroup { get; set; }
  public Task(string name, DateTime start, DateTime end, bool isGroup)
  {
    Name = name;
    Start = start;
    End = end;
    IsGroup = isGroup;
  }
}
```

Next, let us define a method that creates a set of **Task** objects that will be shown as a Gantt chart:

- C#

```
Task[] GetTasks()
{
  return new Task[]
  {
    new Task("Alpha", new DateTime(2008,1,1), new DateTime(2008,2,15),
true),
    new Task("Spec", new DateTime(2008,1,1), new DateTime(2008,1,15),
false),
    new Task("Prototype", new DateTime(2008,1,15), new
DateTime(2008,1,31), false),
    new Task("Document", new DateTime(2008,2,1), new DateTime(2008,2,10),
false),
```

```
    new Task("Test", new DateTime(2008,2,1), new DateTime(2008,2,12),
false),
    new Task("Setup", new DateTime(2008,2,12), new DateTime(2008,2,15),
false),

    new Task("Beta", new DateTime(2008,2,15), new DateTime(2008,3,15),
true),
    new Task("WebPage", new DateTime(2008,2,15), new DateTime(2008,2,28),
false),
    new Task("Save bugs", new DateTime(2008,2,28), new
DateTime(2008,3,10), false),
    new Task("Fix bugs", new DateTime(2008,3,1), new DateTime(2008,3,15),
false),
    new Task("Ship", new DateTime(2008,3,14), new DateTime(2008,3,15),
false),
  };
}

Now that the tasks have been created, we are ready to create the Gantt
chart:
private void CreateGanttChart()
{
  // clear current chart
  c1Chart.Reset(true);

  // set chart type
  c1Chart.ChartType = ChartType.Gantt;

  // populate chart
  var tasks = GetTasks();
  foreach (var task in tasks)
  {
    // create one series per task
    var ds = new HighLowSeries();
    ds.Label = task.Name;
    ds.LowValuesSource = new DateTime[] { task.Start };
    ds.HighValuesSource = new DateTime[] { task.End };
    ds.SymbolSize = new Size(0, task.IsGroup ? 30 : 10);

    // add series to chart
    c1Chart.Data.Children.Add(ds);
  }

  // show task names along Y axis
  c1Chart.Data.ItemNames =
    (from task in tasks select task.Name).ToArray();

  // customize Y axis
  var ax = c1Chart.View.AxisY;
  ax.Reversed = true;
  ax.MajorGridStroke = null;

  // customize X axis
  ax = c1Chart.View.AxisX;
  ax.MajorGridStrokeDashes = null;
  ax.MajorGridFill = new SolidColorBrush(Color.FromArgb(20, 120, 120,
120));
```

```
  ax.Min = new DateTime(2008, 1, 1).ToOADate();
}
```

After clearing the **C1Chart** and setting the chart type, the code enumerates the tasks and creates one HighLowSeries for each. In addition to setting the series **Label**, **LowValuesSource** and **HighValuesSource** properties, the code uses the SymbolSize property to set the height of each bar. In this sample, we define some tasks as "Group" tasks, and make them taller than regular tasks.

Next, we use a LINQ statement to extract the task names and assign them to the ItemNames property. This causes **C1Chart** to display the task names along the Y axis.

Finally, the code customizes the axes. The Y axis is reversed so the first task appears at the top of the chart. The axes are configured to show vertical grid lines and alternating bands.

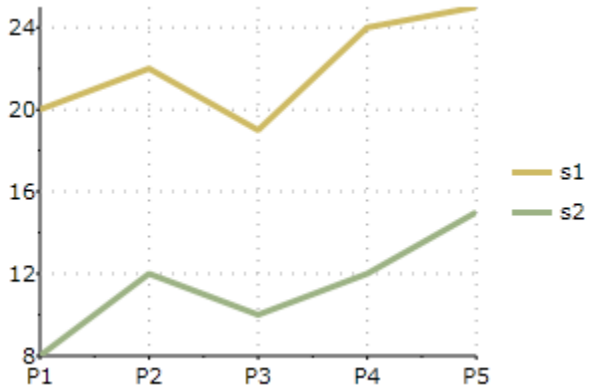
Line Charts

Chart for Windows Phone supports the following types of Line charts:

- Line
- LineSmoothed
- LineStacked
- LineStacked100pc
- LineSymbols
- LineSymbolsSmoothed
- LineSymbolsStacked
- LineSymbolsStacked100pc

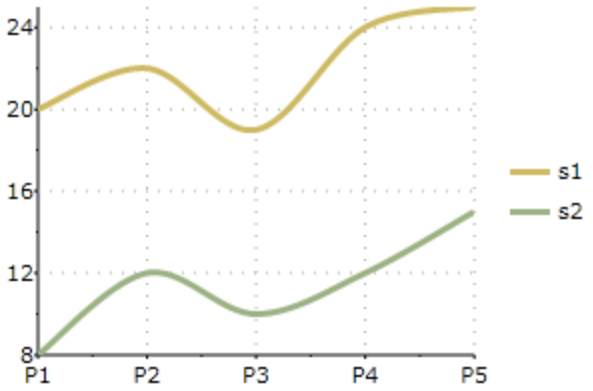
Line

The following image represents the Line chart when you set the ChartType property to **Line**:



Line Smoothed

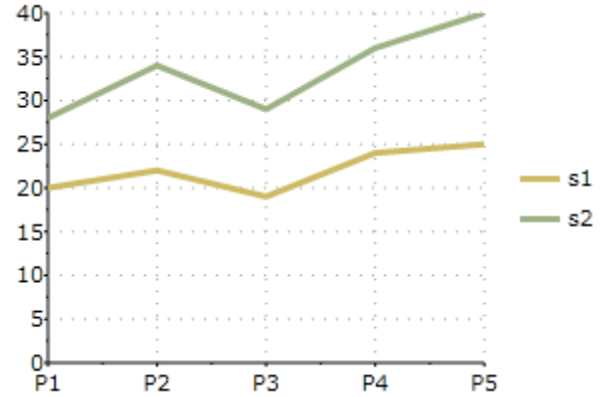
The following image represents the Line Smoothed chart when you set the ChartType property to **LineSmoothed**:



Line Stacked

Select the LineStacked member from the ChartType enumeration to create a specific stacking Line chart.. Stacking charts represent the data by stacking the values for each series on top of the values from the previous series.

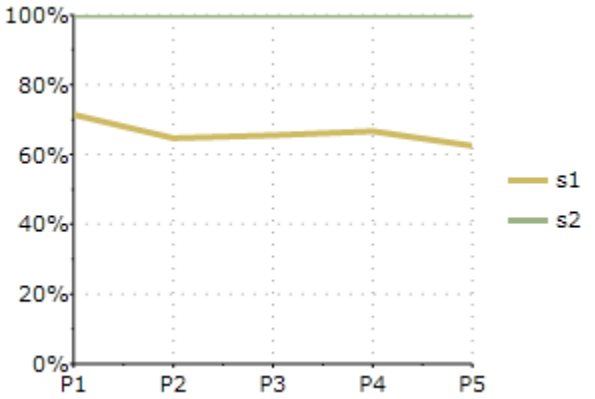
The following image represents the Line Stacked chart when you set the ChartType property to **LineStacked**:



Line Stacked 100%

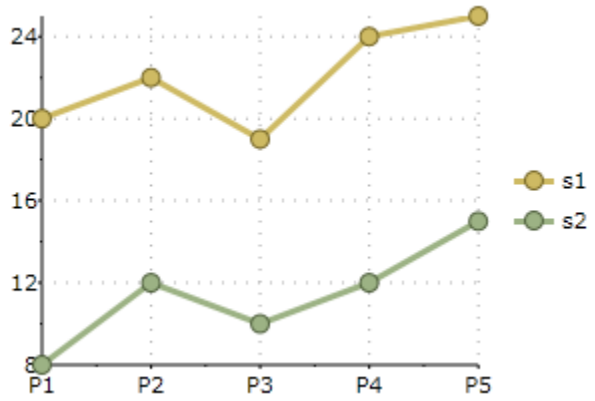
Select the **LineStacked100pc** member from the ChartType enumeration to create a specific stacking Line chart. Stacking charts represent the data by stacking the values for each series on top of the values from the previous series.

The following image represents the Line Stacked 100% chart when you set the ChartType property to **LineStacked100pc**:



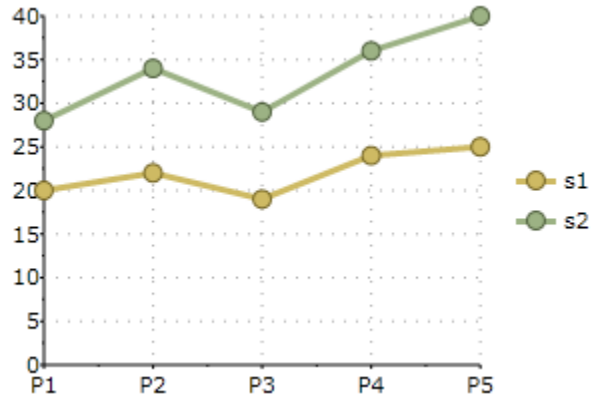
Line Symbols

The following image represents the Line Symbols when you set the ChartType property to **LineSymbols**:



Line Symbols Stacked

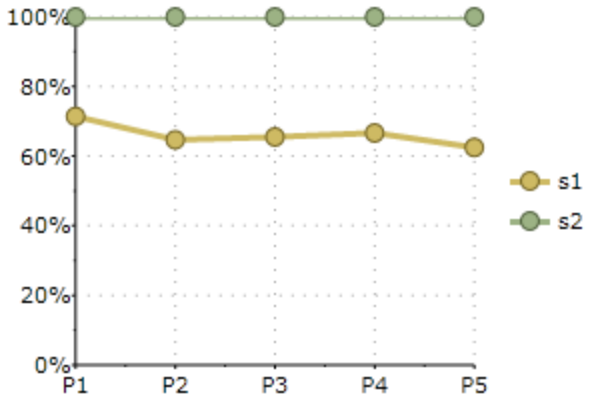
The following image represents the Line Symbols Stacked chart when you set the ChartType property to **LineSymbolsStacked**:



Line Symbols Stacked 100%

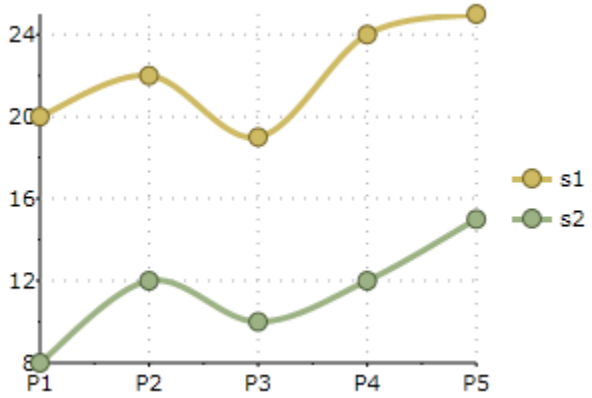
Select the **LineSymbolsStacked100pc** member from the ChartType enumeration to create a specific stacking Line chart. Stacking charts represent the data by stacking the values for each series on top of the values from the previous series.

The following image represents the Line Stacked 100% chart when you set the ChartType property to **LineSymbolsStacked100pc**:



Line Symbols Smoothed

The following image represents the Line Symbols Smoothed when you set the ChartType property to **LineSymbolsSmoothed**:



Pie Charts

Pie charts are commonly used to display simple values. They are visually appealing and often displayed with 3D effects such as shading and rotation.

Pie charts have one significant difference when compared to other **C1Chart** chart types in Pie charts; each series represents one slice of the pie. Therefore, you will never have Pie charts with a single series (they would be just circles). In most cases, Pie charts have multiple series (one per slice) with a single data point in each series. **C1Chart** represents series with multiple data points as multiple pies within the chart.

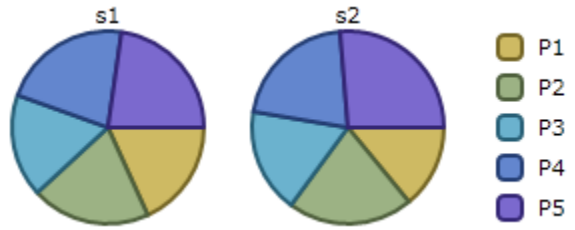
Chart for Windows Phone supports the following types of Pie charts:

- Pie
- Dougnut Pie

- Exploded Pie
- Exploded Doughnut Pie

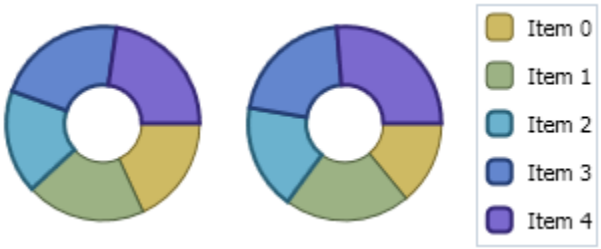
Pie

The following image represents the **Pie** chart when you set the ChartType property to **Pie**:



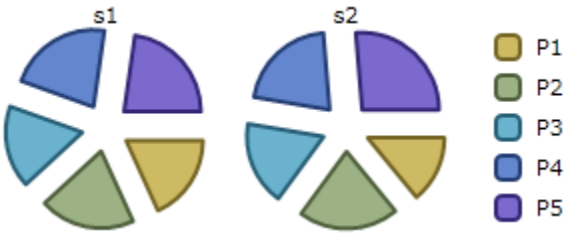
Doughnut Pie

The following image represents the **Doughnut Pie** chart when you set the ChartType property to **PieDoughnut**.



Exploded Pie

The following image represents the **Exploded Pie** chart when you set ChartType property to **PieExploded**:



Exploded Doughnut Pie

The following image represents the **Exploded Pie** chart when you set ChartType property to **PieExplodedDoughnut**.

Special Pie Chart Properties

Pie charts are quite different from the other chart types since they do not follow the concept of a two-dimensional grid or axes. Altering the diameter of the pie or the properties of the exploding slices can be accomplished with the properties of the Pie class.

Starting Angle

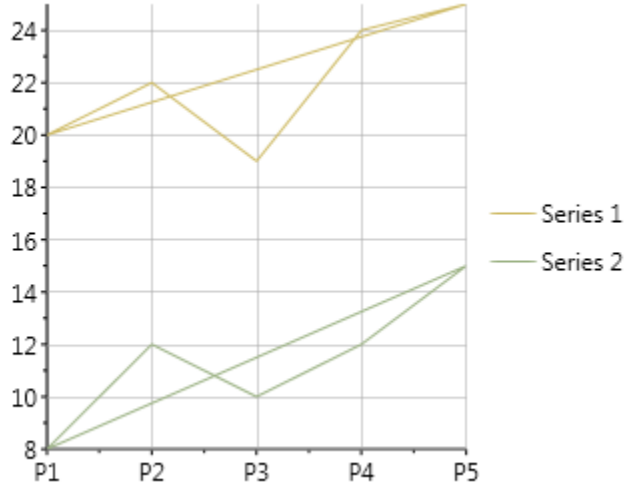
Use the **PieOptions.StartingAngleAttached** property to specify the angle at which the slices for the first series start. The default angle is 0 degrees. The angle represents the arc between the most clockwise edge of the first slice and the right horizontal radius of the pie, as measured in the counter-clockwise direction.

Exploding Pies

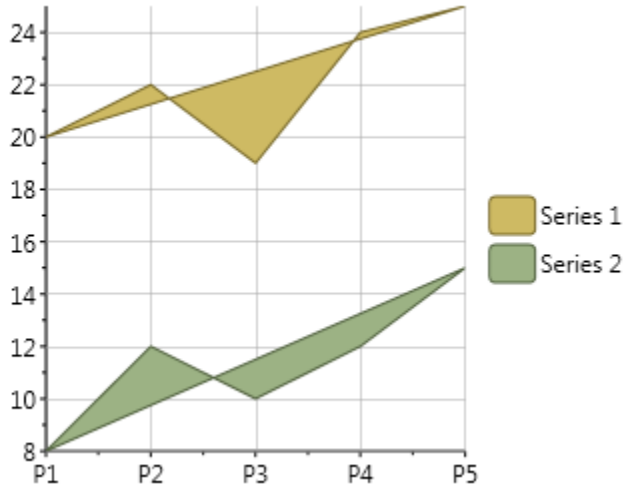
A slice of a Pie chart can be emphasized by exploding it, which extrudes the slice from the rest of the pie. Use the Offset property of the series to set the exploded slice's offset from the center of the pie. The offset is measured as a percentage of the radius of the pie.

Polygon Charts

The following image represents the **Polygon** chart when you set ChartType property to **Polygon**:



The following image represents the **Polygon Filled** chart when you set ChartType property to **PolygonFilled**:



Polar and Radar Charts

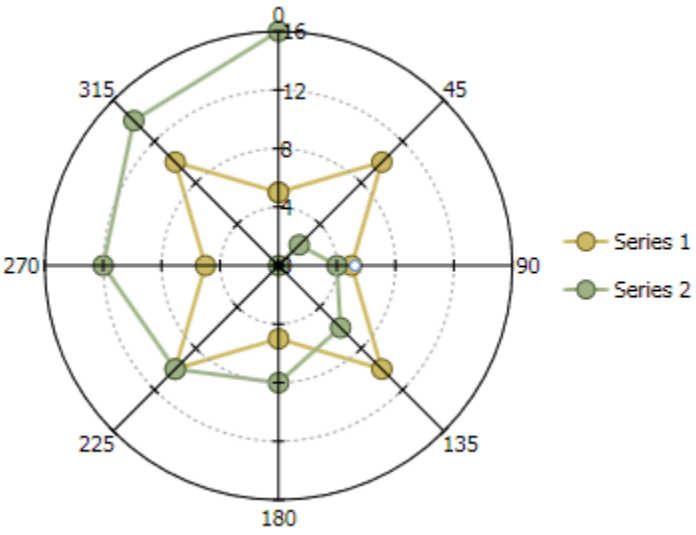
Polar Charts

A Polar chart draws the x and y coordinates in each series as (theta,r), where theta is amount of rotation from the origin and r is the distance from the origin. Theta may be specified in either degrees (default) or radians. Since the X-axis is a circle, the X-axis maximum and minimum values are fixed.

Polar charts can not be combined with any other chart type in the same chart area.

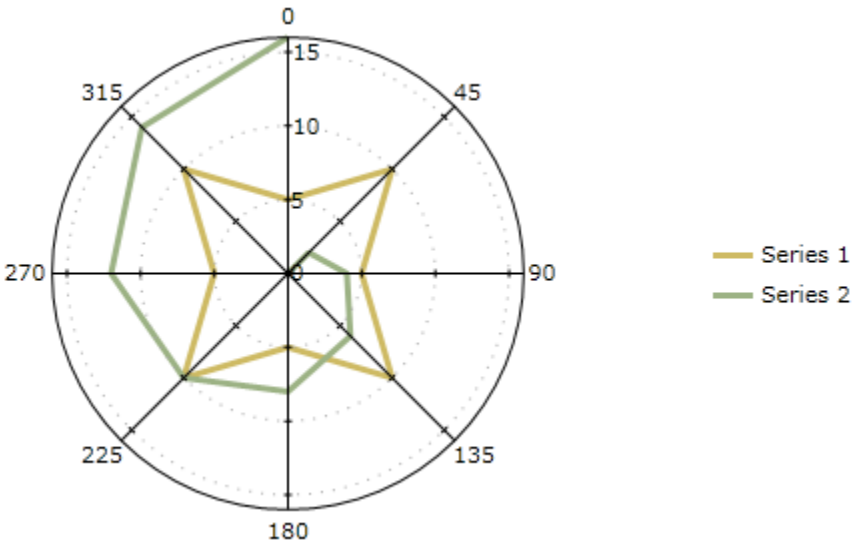
The following images represents the different types of Polar charts when you set ChartType property to **PolarLinesSymbol**, **PolarLines**, **PolarSymbols** and specifiy the data values for the XYDataSeries, like the following:

```
<c1chart:C1Chart Name="c1Chart1" ChartType="PolarLinesSymbols">
  <c1chart:C1Chart.Data>
   <c1chart:ChartData>
    <c1chart:XYDataSeries Label="Series 1" Values="5 10 5 10 5 10 5 10
5"
                                XValues="0 45 90 135 180 225 270 315
0"/>
    <c1chart:XYDataSeries Label="Series 2" Values="0 2 4 6 8 10 12 14
16"
                               XValues="0 45 90 135 180 225 270 315
0"/>
   </c1chart:ChartData>
  </c1chart:C1Chart.Data>
  <c1chart:C1ChartLegend/> </c1chart:C1Chart>
```



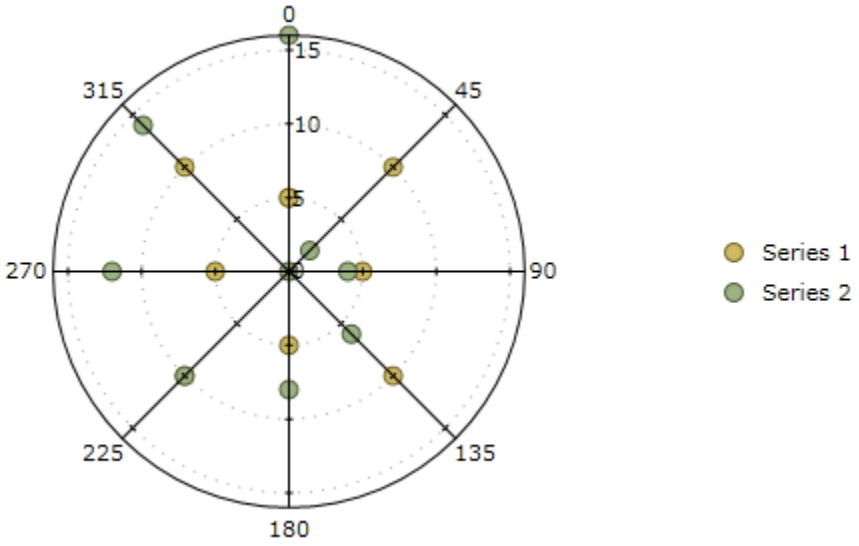
The following image represents the Polar chart with symbols and lines when you set ChartType property to **PolarLines**.

```
<c1chart:C1Chart Name="c1Chart1" ChartType="PolarLines">
  <c1chart:C1Chart.Data>
   <c1chart:ChartData>
    <c1chart:XYDataSeries Label="Series 1" Values="5 10 5 10 5 10 5 10
5"
                                XValues="0 45 90 135 180 225 270 315
0"/>
    <c1chart:XYDataSeries Label="Series 2" Values="0 2 4 6 8 10 12 14
16"
                               XValues="0 45 90 135 180 225 270 315
0"/>
   </c1chart:ChartData>
  </c1chart:C1Chart.Data>
  <c1chart:C1ChartLegend/> </c1chart:C1Chart>
```



The following image represents the Polar chart when you set ChartType property to **PolarSymbols**.

```
<c1chart:C1Chart Name="c1Chart1" ChartType="PolarSymbols">
  <c1chart:C1Chart.Data>
   <c1chart:ChartData>
    <c1chart:XYDataSeries Label="Series 1" Values="5 10 5 10 5 10 5 10
5"
                                XValues="0 45 90 135 180 225 270 315
0"/>
    <c1chart:XYDataSeries Label="Series 2" Values="0 2 4 6 8 10 12 14
16"
                               XValues="0 45 90 135 180 225 270 315
0"/>
   </c1chart:ChartData>
  </c1chart:C1Chart.Data>
  <c1chart:C1ChartLegend/> </c1chart:C1Chart>
```

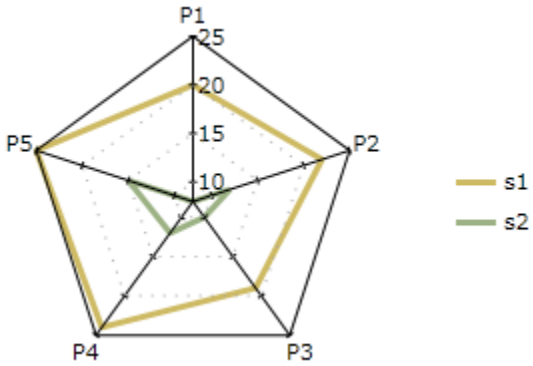


Radar Charts

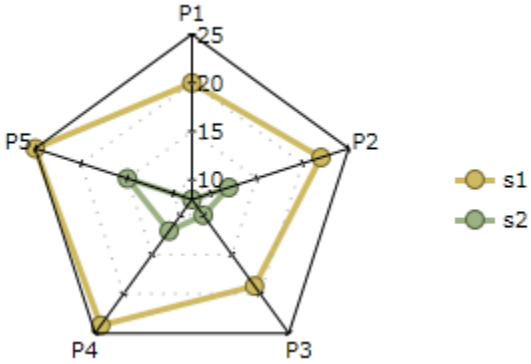
A Radar chart is a variation of a Polar chart. A Radar chart draws the y value in each data set along a radar line. If the data has n unique points, then the chart plane is divided into n equal angle segments, and a radar line is drawn (representing each point) at n/360 degree increments. By default, the radar line representing the first point is drawn vertically (at 90 degrees).

The labels for radar chart can be set using ItemNames property. These labels are located at end of each radial line.

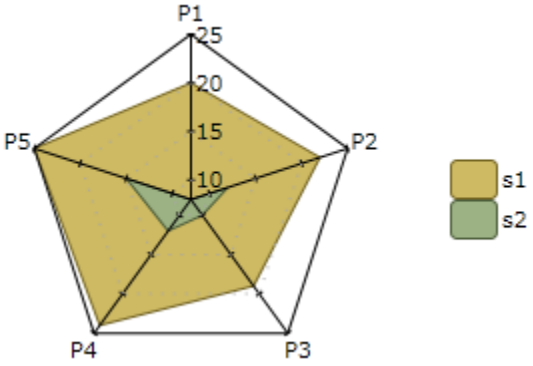
The following image represents the Radar chart when you set ChartType property to **Radar**.



The following image represents the Radar chart with symbols when you set ChartType property to **RadarSymbols**.



The following image represents the filled Radar chart when you set ChartType property to **RadarFilled**.



Special Polar and Radar Chart Properties

The Polar and Radar charts has special properties to chart the degrees of the Radar, set the starting angle, create filled radar chart.and whether or not to use flat Y coordinate gridlines for radar charts.

Setting the Starting Angle

The **PolarRadarOptions.StartingAngle Attached** property of the PolarRadarOptions class sets the starting angle for Polar and Radar charts. The default setting for this property is 0. Setting this property to a value other than 0 will move the origin of the chart counter-clockwise by the specified degrees. For instance, setting the **PolarRadarOptions.StartingAngle Attached** property to 90, the Polar or Radar chart rotates 90 degrees in the counter-clockwise direction.

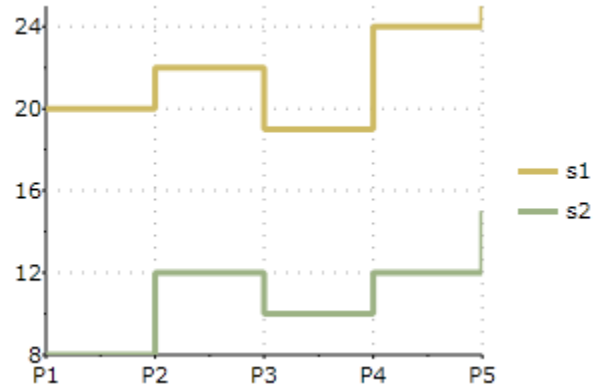
Step Chart

A **Step** chart is a form of a **XY Plot** chart. **Step** charts are often used when Y values change by discreet amounts, at specific values of X with a sudden change of value. A simple, everyday example would be a plot of a checkbook balance with time. As each deposit is made, and each check is written, the balance (Y value) of the check register changes suddenly, rather than gradually, as time passes (X value). During the time that no deposits are made, or checks written, the balance (Y value) remains constant as time passes.

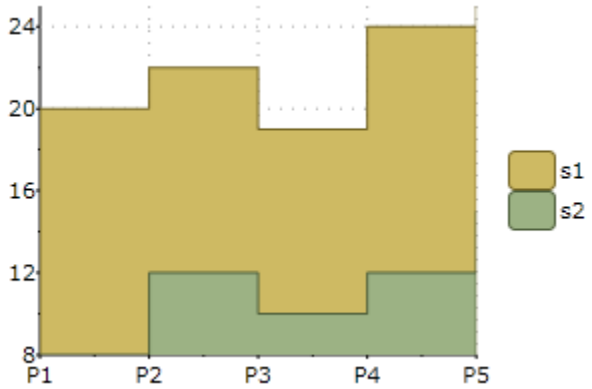
Similar to Line and XY plots, the appearance of the step chart can be customized by using the Connection and Symbol properties for each series by changing colors, symbol size, and line thickness. Symbols can be removed entirely to emphasize the relationship between points or included to indicate actual data values. If data holes are present, the step chart behaves as expected, with series lines demonstrating known information up to the X value of the data hole. Symbols and lines resume once non-hole data is again encountered.

As with most XY style plots, step charts can be stacked when appropriate.

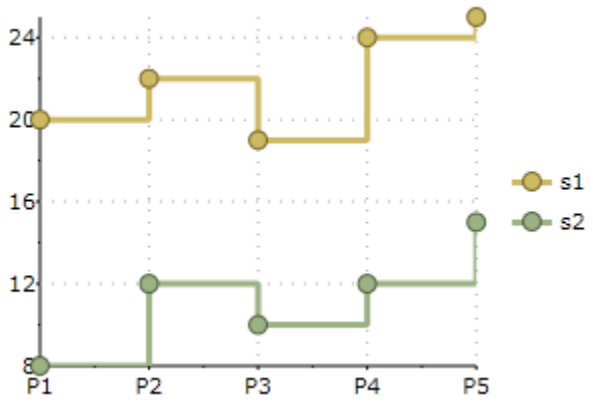
The following image represents the Step chart when you set ChartType property to **Step**.



The following image represents the Step chart with symbols when you set ChartType property to **StepArea**.



The following image represents the filled Step chart when you set ChartType property to **StepSymbols**.



XYPlot Chart

The XYPlot is also known as a Scatter plot chart. For more information on the XYPlot chart see XY Charts (page 38).

The following image represents the XYPlot chart when you set ChartType property to **XYPlot**:

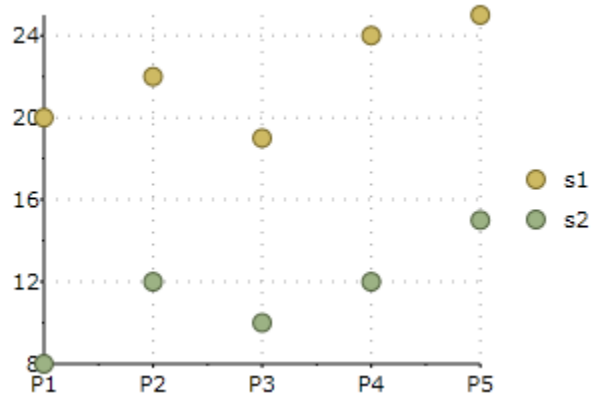


Chart Data Series

One of the more important objects in **C1Chart** is the data series. The data series contains all of the data to be included in the chart and many important data-related properties.

Chart Data Series Types

C1Chart provides the following dataseries classes to effectively handle different data types:

- BubbleSeries
- DataSeries
- HighLowOpenCloseSeries
- HighLowSeries
- XYDataSeries
- **XYZDataSeries**

The **Label** property in the DataSeries class represents the label for the Series name in the Chart Legend.

There are several DataSeries classes inherited from the same base class DataSeries, each of them combines several data sets depending on appropriate data nature. For instance, the XYDataSeries provides two sets of data values that correspond to x- and y-coordinates. The list of available data series classes is presented in the table below.

Class	Values properties	Value binding property
DataSeries	Values, ValuesSource	ValueBinding
XYDataSeries	Values, ValuesSource XValues, XValuesSource	ValueBinding XValueBinding
HighLowSeries	Values, ValuesSource XValues, XValuesSource HighValues, HighLowSeries.HighValuesSource LowValues, HighLowSeries.LowValuesSource	ValueBinding XValueBinding HighValueBinding LowValueBinding
HighLowOpenCloseSeries	Values, ValuesSource XValues, XValuesSource HighValues, HighLowSeries.HighValuesSource LowValues, HighLowSeries.LowValuesSource OpenValues, HighLowOpenCloseSeries.OpenValuesSource CloseValues, HighLowOpenCloseSeries.CloseValuesSource	ValueBinding XValueBinding HighValueBinding LowValueBinding OpenValueBinding CloseValueBinding

Each data series class may have its own default template for plotting, for instance HighLowOpenCloseSeries displays financial data as a set of lines that mark high, low, open and close values.

Chart Data Series Appearance

The appearance of each data series is determined by three groups of properties in the DataSeries class: **Symbol**, **Connection**, and **ConnectionArea**. These properties affect different parts of the chart depending on the chart type.

The **Symbol** properties determine the shape, size, outline, and fill properties of the symbols drawn at each data point. They apply to chart types that display symbols, including **Line**, **Area**, and **XYPlot** charts. The Symbol properties also control the appearance of bars in **Bar** and **Column** charts.

The **Connection** properties determine the outline and fill properties of the lines drawn between pairs of data points. They apply to all collection of points for data series. For line charts the connection is the line which connects points, for area charts the connection is the area including the outline below the data points.

Differences Between DataSeries and XYDataSeries

DataSeries has only one logical set of data values - Values(y-values).

In this case x-values are generated automatically(0,1,2...), also you can specify text labels for x-axis using **Data.ItemNames** property.

XYDataSeries has two sets of data values - Values(y-values) and XValues.

Chart Panel

The ChartPanel is a container for the UI elements (ChartPanelObjects) that can be positioned using data coordinates. The ChartPanel object includes two unique properties: Chart and Children. The Chart gets or sets the parent chart and the Children property gets the collection of child elements.

To use chart panel with chart it's necessary to add the panel to the Layers collection of ChartView:

```
<c1chart:C1Chart x:Name="chart">
   <c1chart:C1Chart.View>
     <c1chart:ChartView>
       <c1chart:ChartView.Layers>
         <c1chart:ChartPanel >
          <!-- ChartPanelObjects -->
         </c1chart:ChartPanel>
       </c1chart:ChartView.Layers>
     </c1chart:ChartView>
   </c1chart:C1Chart.View>
</c1chart:C1Chart>
```

The ChartPanelObject class defines the element of the chart panel. The ChartPanelObject includes three unique properties: Action, Attach, and DataPoint properties.

Using **HorizontalAlignment** / **VerticalAlignment** properties it's possible to adjust relative position to the element and the related data point property, DataPoint. The **Content** property of the ChartPanelObject can be set to any UIElement.

The following XAML defines text label with its left-bottom corner at x=0, y=0 in data coordinates:

```
   <c1chart:ChartPanelObject DataPoint="0,0"
VerticalAlignment="Bottom">
       <TextBlock Text="Zero"/>
   </c1chart:ChartPanelObject>
```

Note: It is not necessary to specify both coordinates. If the coordinate is set to double.NaN then the element does not have specific x- or y- coordinates.

We can create horizontal marker at y=0. Note that the **HorizontalAlignment** property is set to **Stretch** and the element fills the width of the plot area.

```
   <!-- horizontal line -->
   <c1chart:ChartPanelObject DataPoint="NaN,0"
HorizontalAlignment="Stretch">
     <Border BorderBrush="Red" BorderThickness="0,2,0,0"
Margin="0,-1,0,0" />
   </c1chart:ChartPanelObject>
```

The following sample here creates a vertical marker:

```
   <!-- vertical line -->
   <c1chart:ChartPanelObject DataPoint="0,NaN"
VerticalAlignment="Stretch">
     <Border BorderBrush="Red" BorderThickness="2,0,0,0"
Margin="-1,0,0,0" />
   </c1chart:ChartPanelObject>
```

Mouse Interaction with ChartPanel

The ChartPanel panel has support of mouse interaction. The ChartPanelAction enumeration specifies possible action for the chart panel objects. The ChartPanelAction enumeration includes the following members:

Member name	Description
None	No action.
MouseMove	Follow mouse.
LeftMouseButtonDrag	Can be dragged with left mouse button.
RightMouseButtonDrag	Can be dragged with right mouse button.

Using the Action property we can make a draggable element or element that follows the mouse pointer. For examplle, adding Action to the previous sample we get the marker that can be moved by user.

```
   <!-- vertical line -->
   <c1chart:ChartPanelObject DataPoint="0,NaN"
VerticalAlignment="Stretch"
   Action="LeftMouseButtonDrag" >
     <Border BorderBrush="Red" BorderThickness="3,0,0,0"
Margin="-1.5,0,0,0" />
   </c1chart:ChartPanelObject>
```

Using data binding it's easy to add label that shows the current coordinate:

```
   <!-- vertical line with coordinate label -->
   <c1chart:ChartPanelObject x:Name="xmarker" DataPoint="0,NaN"
VerticalAlignment="Stretch"
       Action="LeftMouseButtonDrag">
     <Border BorderBrush="Red" BorderThickness="3,0,0,0"
Margin="-1.5,0,0,0" >
       <TextBlock
         Text="{Binding RelativeSource={RelativeSource Self},
         Path=Parent.Parent.DataPoint.X,StringFormat='x=0.0;x=-0.0'}"
/>
     </Border>
   </c1chart:ChartPanelObject>
```

The property Attach allows to stick the possible positions of the element to the nearest data point. It can be attached to the single coordinate(X or Y) or both coordintates(XY).

Chart View

The ChartView object represents the area of the chart that contains data (excluding the titles and legend, but including the axes). The View property returns a ChartView object with the following main properties:

Property	Description
Axes	Gets the axis collection. Stores x, y, and z axes. These axes are responsible for the chart range (minimum, maximum, unit, and linear/logarithmic scale) and the appearance of the axis lines, grid lines, tick marks and axis labels.
AxisX, AxisY, **ChartView.AxisZ**	Each of these properties returns Axis objects that allow you to customize the appearance of the chart axes.
ChartView.Margin	Returns a Margin object that allows you to specify the distance between the chart area and the plot area. The axes labels are displayed in this space.
PlotRect	Returns a Rect object that controls the appearance of the area inside the axes.

ChartView.Style	Contains properties that set the color and border of the chart area.

Axes

The axes are represented by sub-properties of the View property: AxisX and AxisY. Each of these properties returns an Axis object with the following main properties:

- Layout, Style, and Value properties

  The following properties below represent the layout and style of the axes in **C1Chart**:

Property	Description
Position	Allows you to set the position of the axis. For example, you may want to display the X-axis above the data instead of below. For more information see Axis Position (page 76).
Reversed	Allows you to reverse the direction of the axis. For example, you can show Y values going down instead of up. For more information see Inverted and Reversed Chart Axes (page 80).
Title	Sets a string to display next to the axis (this is typically used to describe the variable and units being depicted by the axis). For more information see Axis Title (page 76).
Foreground	Gets or sets the foreground brush of the axis.
AxisLine	Gets or sets the axis line. The axis line connects the points on the plot that correspond to the Min and Max of the axis.
IsTime	Gets or sets whether the axis represents time values.
Scale	Gets or sets the scale of the axis.
MinScale	Gets or sets the minimal scale of the axis.

- Annotation properties

  The following properties below represent the format for the annotation of the axes in **C1Chart**:

Property	Description
ItemsSource	Gets or sets the source for axis annotations.
AnnoFormat	A set of predefined formats used to format the values displayed next to the axis.
AnnoAngle	Allows you to rotate the values so they take up less space along the axis. For more information see Axis Annotation Rotation (page 82).
AnnoTemplate	Gets or sets the template for axis annotation.

- Scaling Tickmark and Gridline properties

  The following properties represent the scaling, tickmarks, and gridline styles and function for the axes in **C1Chart**:

Property	Description
AutoMin, AutoMax	Determine whether the minimum and maximum values for the axis should be calculated automatically. For more information see Axis

	Bounds.
Min, Max	Set the minimum and maximum values for the axis (when AutoMin and AutoMax are set to False). For more information see Axis Bounds (page 79).
MajorUnit, MinorUnit	Set the spacing between the major and minor tickmarks (when the AutoMajor and AutoMinor properties are set to False).
MajorGridFill	Gets or sets the fill based of the major grid. The MajorGridFill enables you to create a striped plot appearance.
MajorGridStroke, MinorGridStroke	Gets or sets the brush of the major/minor grid lines.
MajorGridStrokeDashes, MinorGridStrokeDashes	Gets or sets the dash pattern of the major/minor grid lines.
MajorGridStrokeThickness, MinorGridStrokeThickness	Gets or sets the thickness of the major/minor grid lines.
MajorTickHeight, MinorTickHeight	Gets or sets the major/minor tick height.
MajorTickStroke, MinorTickStroke	Gets or sets the major/minor tick stroke.
MajorTickThickness, MinorTickThickness	Gets or sets the major/minor tick thickness.

Axis Lines

The axis lines are lines that appear horizontally from the starting value to the ending value for the Y-Axis and vertically from the starting value to the ending value for the X-Axis.

You can use either the **Axis.Foreground** or the **ShapeStyle.Stroke** property to apply color to the axis line. Note that the **Axis.Foreground** property overrides the **ShapeStyle.Stroke** property.

Property	Description
Foreground	Gets or sets the foreground brush of the axis.
Stroke	Gets or sets the stroke brush of the shape.
StrokeThickness	Gets or sets the stroke thickness of the shape.

Dependent Axis

The IsDependent allows to link the auxiliary axis with one from the main axes(AxisX or AxisY, depending on AxisType). The dependent axis always has the same minimum and maximum as the main axis.

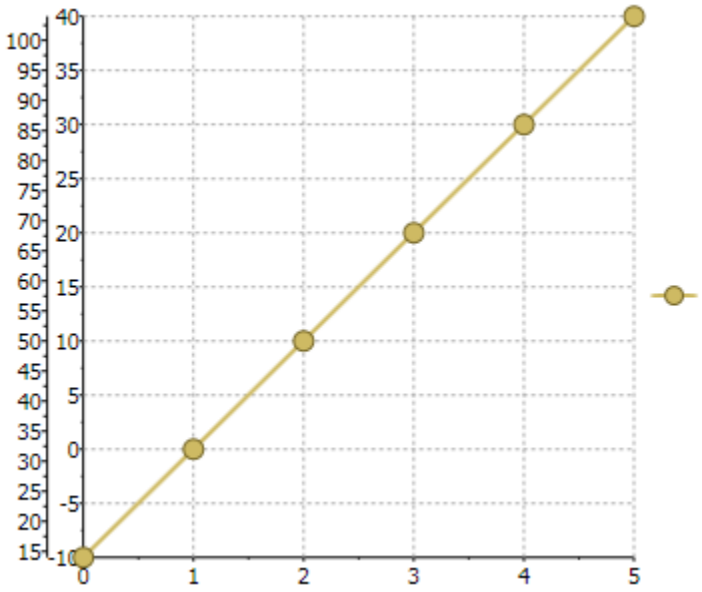
New property DependentAxisConverter and delegate Axis.AxisConverter specifies function that is used to convert coordinate from main axis to the dependent axis.

The following code creates a depepdent Y-Axis:

```
c1Chart1.Reset(true);

        c1Chart1.Data.Children.Add(
```

```
          new DataSeries() { ValuesSource = new double[] { -10, 0, 10,
20, 30, 40 } });
        c1Chart1.ChartType = ChartType.LineSymbols;

        Axis axis = new Axis() { AxisType = AxisType.Y, IsDependent
=true};

        // Celsius -> Fahrenheit
        axis.DependentAxisConverter = (val) => val * 9 / 5 + 32;

        c1Chart1.View.Axes.Add(axis);
```

The following image displays the dependent (leftmost) Y-Axis that shows values in Fahrenheits corresponding to the Celsius on the main Y-axis:



Axis Position

You can specify the axis position by setting the Position property to near or far values. For vertical axis **Axis.Position.Near** corresponds to the left and **Axis.Position.Far** corresponds to the right. For horizontal axis **Axis.Position.Near** corresponds to bottom and **Axis.Position.Far** corresponds to the top.

Axis Title

Adding a title to an axis clarifies what is charted along that axis. For example if your data includes measurements its helpful to include the unit of measurement (grams, meters, liters, etc) in the axis title. Axis titles can be added to **Area**, **XY-Plot**, **Bar**, **HiLoOpenClose** or **Candle** charts.

The axis titles are **UIElement** objects rather than simple text. This means you have complete flexibility over the format of the titles. In fact, you could use complex elements with buttons, tables, or images for the axis titles.

To set the Axis Title programmatically

```
// Set axes titles
   c1Chart1.View.AxisY.Title= new TextBlock() { Text = "Kitchen
Electronics" };
   c1Chart1.View.AxisX.Title = new TextBlock() { Text = "Price" };
```

To set the Axis Title using XAML code

```
<c1chart:C1Chart >
      <c1chart:C1Chart.View>
        <c1chart:ChartView>
          <c1chart:ChartView.AxisX>
            <c1chart:Axis>
              <c1chart:Axis.Title>
                <TextBlock Text="Price" TextAlignment="Center"
Foreground="Crimson"/>
              </c1chart:Axis.Title>
            </c1chart:Axis>
          </c1chart:ChartView.AxisX>
          <c1chart:ChartView.AxisY>
            <c1chart:Axis>
              <c1chart:Axis.Title>
                <TextBlock Text="Kitchen Electronics"
TextAlignment="Center" Foreground="Crimson"/>
              </c1chart:Axis.Title>
            </c1chart:Axis>
          </c1chart:ChartView.AxisY>
        </c1chart:ChartView>
      </c1chart:C1Chart.View>
    </c1chart:C1Chart>
```

Axis Tick Marks

The chart automatically sets up the axis with both major and minor ticks. Customizing the tick spacing or attributes is as easy as manipulating a set of properties.

The MajorUnit and MinorUnit properties set the state of the Axis' tick marks. To eliminate clutter in a chart, you can display fewer labels or tick marks on the category (x) axis by specifying the intervals at which you want categories to be labeled, or by specifying the number of categories that you want to display between tick marks.

Major Tick Overlap

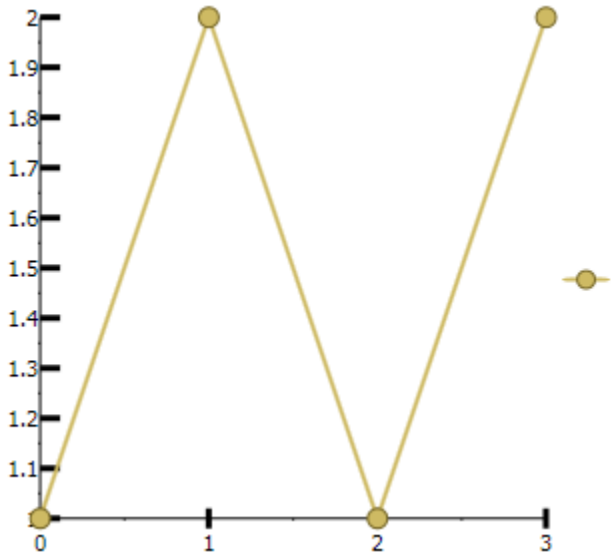
You can determine the overlap value for the major tick mark by specifying a value range from 0 to 1 for the MajorTickOverlap property. The default value is 0, which means there is no overlap. When the overlap is 1, the whole tick is inside the plot area. As you increase the MajorTickOverlap value for the X-Axis, the tick mark moves up and down as you descrease the value. As you increase the MajorTickOverlap value for the Y-Axis the tick mark moves to the left.

- C#

```
c1Chart1.Reset(true);

c1Chart1.Data.Children.Add(
new DataSeries() { ValuesSource = new double[] { 1, 2, 1, 2 } });

c1Chart1.ChartType = ChartType.LineSymbols;

c1Chart1.View.AxisX.MajorGridStrokeThickness = 0;
c1Chart1.View.AxisX.MajorTickThickness = 3;
c1Chart1.View.AxisX.MajorTickHeight = 10;
c1Chart1.View.AxisX.MajorTickOverlap = 0;

c1Chart1.View.AxisY.MajorGridStrokeThickness = 0;
c1Chart1.View.AxisY.MajorTickThickness = 3;
```

```
c1Chart1.View.AxisY.MajorTickHeight = 10;
c1Chart1.View.AxisY.MajorTickOverlap = 0;
```

The following image displays the MajorTickOverlap value as zero:



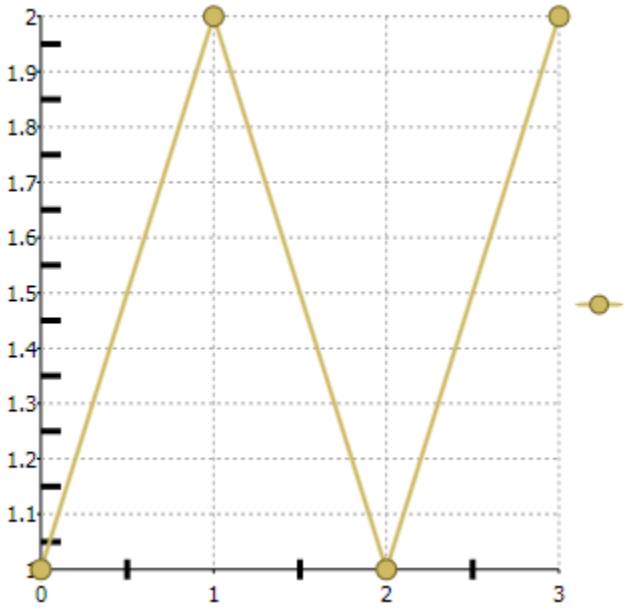
Minor Tick Overlap

You can determine the overlap value for the minor tick mark by specifying a value range from 0 to 1 for the MinorTickOverlap property. The default value is 0 which, means there is not overlap. When the overlap is 1, the whole tick is inside the plot area.

- C#

```
c1Chart1.Reset(true);

c1Chart1.Data.Children.Add(
new DataSeries() { ValuesSource = new double[] { 1, 2, 1, 2 } });

c1Chart1.ChartType = ChartType.LineSymbols;
c1Chart1.View.AxisX.MinorGridStrokeThickness = 0;
c1Chart1.View.AxisX.MinorTickThickness = 3;
c1Chart1.View.AxisX.MinorTickHeight = 10;
c1Chart1.View.AxisX.MinorTickOverlap = .5;

c1Chart1.View.AxisY.MinorGridStrokeThickness = 0;
c1Chart1.View.AxisY.MinorTickThickness = 3;
c1Chart1.View.AxisY.MinorTickHeight = 10;
c1Chart1.View.AxisY.MinorTickOverlap = 1;
```

The following image depicts a MinorTickOverlap set to "1":



Axis Grid Lines

Grid lines are lines that appear perpendicular with major/minor tick marks at unit major/minor intervals. Grid lines can help improve the readability of the Chart when you are looking for exact values.

To paint or fill the major/minor grid lines

You can apply a color to major/minor grid lines using the MajorGridStroke/MinorGridStroke properties. A fill color can be applied in between each value of the major/minor grid lines using the **Axis.MajorGridFill/Axis.MinorGridFill** properties.

To set the dash pattern for major/minor grid lines

You can set the dash pattern for major/minor grind lines using the MajorGridStrokeDashes/MinorGridStrokeDashes property.

To set the thickness for major/minor grid lines

You can specifiy the thickness for major/minor grid lines using the MajorGridStrokeThickness/MinorGridStrokeThickness properties.

To set the fill for major grid lines

You can apply a fill for the major gridlines using the MajorGridFill property.

Axis Bounds

Normally a graph displays all of the data it contains. However, a specific part of the chart can be displayed by fixing the axis bounds.

The chart determines the extent of each axis by considering the lowest and highest data value and the numbering increment. Setting the Min and Max, AutoMin, and AutoMax properties allows the customization of this process.

Axis Min and Max

Use the Min and Max properties to frame a chart at specific axis values. If the chart has X-axis values ranging from 0 to 100, then setting Min to 0 and Max to 10 will only display the values up to 10.

The chart can also calculate the Min and Max values automatically. If the AutoMax and AutoMin properties are set to **True** then the chart automatically formats the axis numbering to fit the current data set.

Inverted and Reversed Chart Axes

When a data set contains X or Y values which span a large range, sometimes the normal chart setup does not display the information most effectively. Formatting a chart with a vertical Y-axis and axis annotation that begins at the minimum value can sometimes be more visually appealing if the chart could be inverted or the axes reversed. Therefore, C1Chart provides the Inverted property and the Reversed property of the axis.

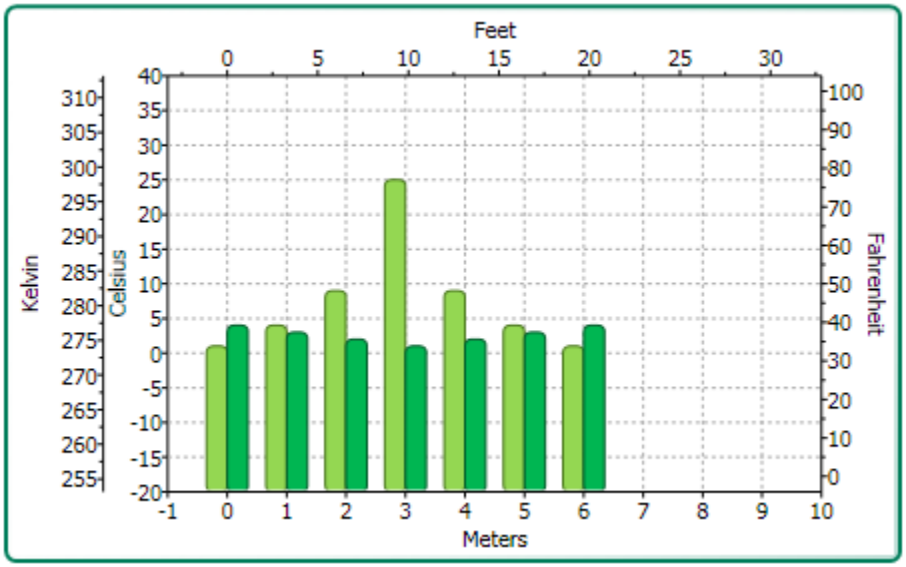
Setting the Reversed property of the ChartView to **True** will reverse the axes. This means that the Max side of the axis will take the place of the Min side of the axis, and the Min side of the axis will take the place of the Max side of the axis. Initially, the chart displays the Minimum value on the left side of the X-axis, and on the bottom side of the Y-axis. Setting the Reversed property of the Axis, however will juxtapose these Maximum and Minimum values.

Multiple Axes

Multiple axes are commonly used when you have the following:

- Two or more Data Series that have mixed types of data which make the scales very different
- Wide range of data values that vary from Data Series to Data Series

The following chart uses five axes to effectively display the length and temperature in both metric and non-metric measurements:



You can add multiple axes to the chart by adding a new Axis object and then specifying its type (X, Y, or Z) for the Axis.AxisType property.

The following XAML code shows how to add multiple Y-axes to the chart:

```
<c1chart:C1Chart Margin="0" Name="c1Chart1">
  <c1chart:C1Chart.View>
    <c1chart:ChartView>
      <!-- Auxiliary y-axes -->
      <c1chart:Axis Name="ay2" AxisType="Y" Position="Far" Min="0"
Max="10" />
      <c1chart:Axis Name="ay3" AxisType="Y" Position="Far" Min="0"
Max="20" />
      <c1chart:Axis Name="ay4" AxisType="Y" Position="Far" Min="0"
Max="50" />
    </c1chart:ChartView>
```

```
  </c1chart:C1Chart.View>
  <c1chart:C1Chart.Data>
    <c1chart:ChartData>
      <c1chart:DataSeries Values="1 2 3 4 5" />
      <c1chart:DataSeries AxisY="ay2" Values="1 2 3 4 5" />
      <c1chart:DataSeries AxisY="ay3" Values="1 2 3 4 5" />
      <c1chart:DataSeries AxisY="ay4" Values="1 2 3 4 5" />
    </c1chart:ChartData>
  </c1chart:C1Chart.Data>
</c1chart:C1Chart>
```

Axes Annotation

The annotation along each axis is an important part of any chart. The chart annotates the axes with numbers based on the data/values entered into the **BubbleSeries**, **DataSeries**, **HighLowOpenCloseSeries**, **HighLowSeries**, or **XYDataSeries** objects. Annotation for the Axes will always display basic text without any formatting applied to them.

The chart automatically produces the most natural annotation possible, even as chart data changes. The following Annotation properties can be modified to perfect this process:

Property	Description
AnnoFormat	A set of predefined formats used to format the values displayed next to the axis.
AnnoAngle	Gets or sets the rotation angle of axis annotation. This allows you to rotate the values so they will take up less space along the axis.
AnnoTemplate	Gets or sets the template for the axis annotation. This is useful for building custom annotations.
ItemsSource	Gets or sets the source for axis annotations.

Axis Annotation Format

You can control the annotation formatting for the values on the X or Y axis using the AnnoFormat property.

Setting the AnnoFormat property to a .NET Framework composite format string will format the data entered into the property. For more information on the standard numeric format strings that you can use for the Axis.AnnoFormat property see Standard Numeric Format Strings. For more information on the

DateTime Format Strings

The DateTime format strings are divided into two categories:

- Standard Date Time Format Strings
- Custom Date Time Format Strings

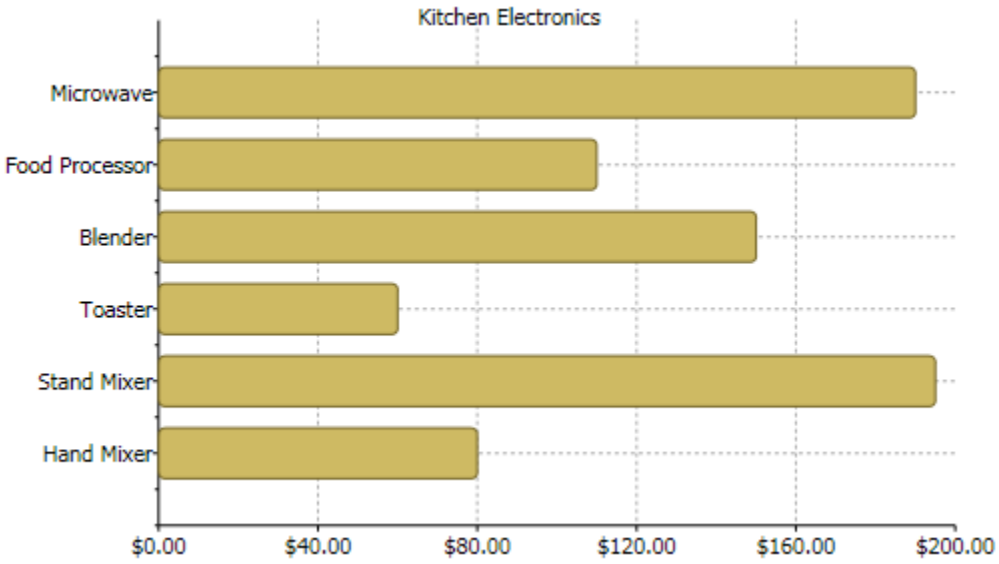
Numeric Format Strings

- Standard Numeric Format Strings
- Custom Numeric Format Strings

Custom Numeric Format Strings

You can also customize your format strings by using the custom numeric format strings.

To use the AnnoFormat property simply specifiy a standard or custom format string for it. For example the following Bar chart's AnnoFormat property is set to "c" to change the whole values to currency format.



- XAML

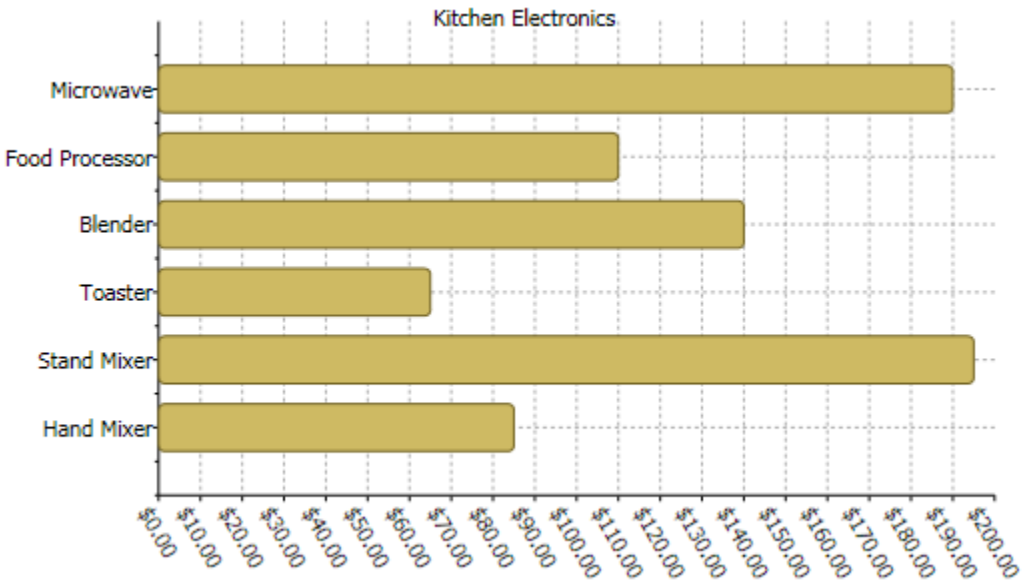
```
<c1chart:C1Chart.View>
    <c1chart:ChartView>
        <c1chart:ChartView.AxisX>
            <c1chart:Axis Min="0" AnnoFormat="c" AutoMin="false"
AutoMax="false" Max="200" />
        </c1chart:ChartView.AxisX>
    </c1chart:ChartView>
</c1chart:C1Chart.View>
```

- C#

```
// Financial formatting
c1Chart1.View.AxisX.AnnoFormat = "c";
c1Chart1.View.AxisX.Min = 0;
```

Axis Annotation Rotation

Use the AnnoAngle property to rotate the axis annotation counterclockwise from the specified number of degrees. This property is especially useful if the X-axis is crowded with annotation. Rotating the annotations +/- 30 or 60 degrees allows a much larger number of annotations in a confined space on horizontal axes. By utilizing the AnnoAngle property, the X-axis annotation does not overlap, as shown below:



- XAML

```
<c1chart:C1Chart.View>
    <c1chart:ChartView>
        <c1chart:ChartView.AxisX>
            <c1chart:Axis Min="0" MajorUnit="10" AnnoFormat="c"
AutoMin="false" AutoMax="false" Max="200" AnnoAngle="60"  />
        </c1chart:ChartView.AxisX>
    </c1chart:ChartView>
</c1chart:C1Chart.View>
```

- C#

```
// Financial formatting
c1Chart1.View.AxisX.AnnoFormat = "c";
c1Chart1.View.AxisX.Min = 0;
c1Chart1.View.AxisX.AnnoAngle = "60";
```

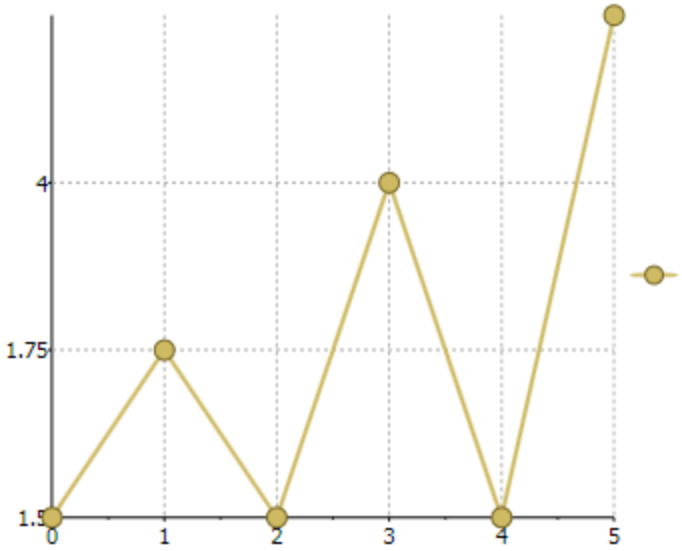
Custom Axis Annotation

In some situations you may need to create custom axis annotation. The following scenarios can be useful for creating custom axis annotation:

- When the ItemsSource property is a collection of numbers or DateTime values the chart uses these values as axis labels. The following code uses the ItemsSource property to create the custom Y-axis labels:
  - C#

```
c1Chart1.Reset(true);
    c1Chart1.Data.Children.Add(
          new DataSeries() { ValuesSource = new double[] { 1, 2, 1, 3,
1, 4 } });
    c1Chart1.ChartType = ChartType.LineSymbols;
    c1Chart1.View.AxisY.ItemsSource = new double[] { 1.25, 1.5, 1.75, 4
};
```

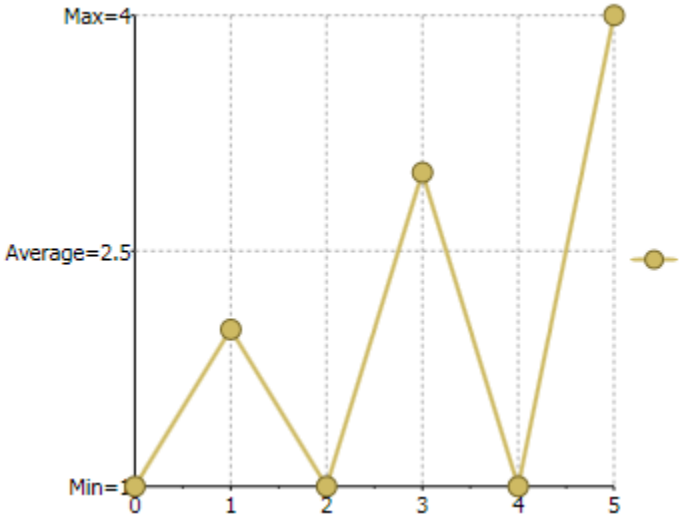
  Here is what the chart appears like after adding the preceding code:



- When the ItemsSource property is a collection of KeyValuePair<object, double> or KeyValuePair<object, DateTime> the chart creates axis label based on the provided pairs of values. For example, the following code uses the KeyValuePair to create the custom axis annotation for the Y axis:
  - C#

```
c1Chart1.Reset(true);
c1Chart1.Data.Children.Add(
    new DataSeries() { ValuesSource = new double[] { 1, 2, 1, 3, 1, 4 }
});
c1Chart1.ChartType = ChartType.LineSymbols;

c1Chart1.View.AxisY.ItemsSource = new List<KeyValuePair<object,double>>
    { new KeyValuePair<object,double>("Min=1", 1),
    new KeyValuePair<object,double>("Average=2.5", 2.5),
    new KeyValuePair<object,double>("Max=4", 4)};
```

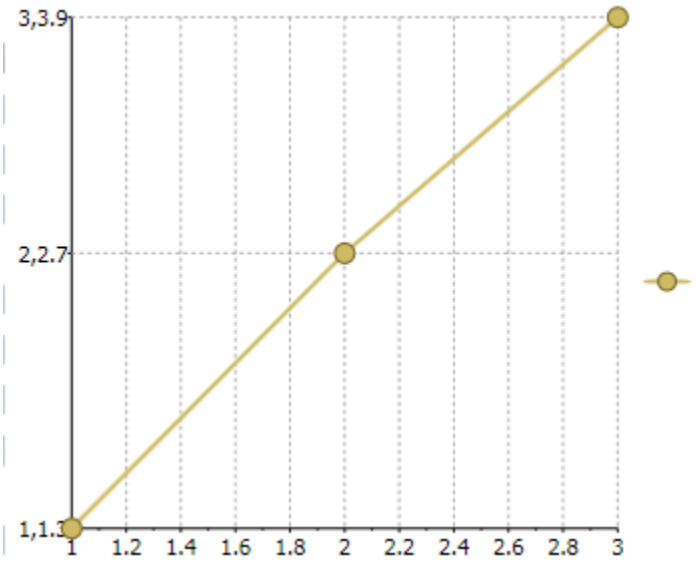
Here is what the chart appears like after adding the preceding code:



- You can use the ItemsValueBinding and ItemsLabelBinding properties to create axis labels using arbitrary collection as data source, like in the following code:
  - C#

```
c1Chart1.Reset(true);

Point[] pts = new Point[] { new Point(1, 1.3), new Point(2, 2.7), new
Point(3, 3.9) };
c1Chart1.DataContext = pts;
c1Chart1.ChartType = ChartType.LineSymbols;

c1Chart1.View.AxisY.ItemsSource = pts;
c1Chart1.View.AxisY.ItemsValueBinding = new Binding("Y");
c1Chart1.View.AxisY.ItemsLabelBinding = new Binding();
```

  Here is what the chart appears like after adding the preceding code:

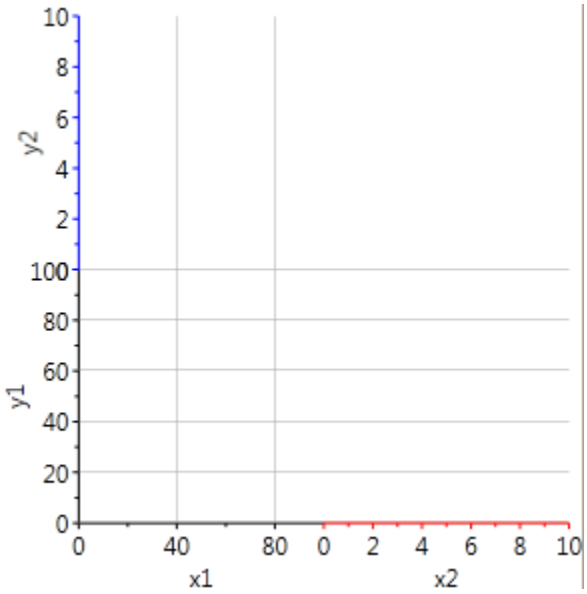


Plot Area

The data is plotted in the plot area of the chart. The Plot area is the part of the plot limited by axes and containing all plot elements (bars, columns, lines etc.). Previously, the chart can have only one plot area but now it's possible to have several ones in the same chart.

Usually plot areas are created automatically based on PlotareaIndex property. By default it's 0 and the new plot area is not created for the additional axis. Axis is just added for example, at the left of main y-axis or at the bottom of the main x-axis. But if you set PlotAreaIndex = 1 the new axis is added on the same line as the main axis. For x-axis the auxiliary axis will be at the right and for y-axis - at the top.

The following example illustrates the new axis added on the same line as the main axis:




```
<c1chart:C1Chart x:Name="chart" >
  <c1chart:C1Chart.View>
    <c1chart:ChartView>
      <!-- Main axes  -->
      <c1chart:ChartView.AxisX>
        <c1chart:Axis Min="0" Max="100" Title="x1" />
      </c1chart:ChartView.AxisX>
      <c1chart:ChartView.AxisY>
        <c1chart:Axis Min="0" Max="100" Title="y1" />
      </c1chart:ChartView.AxisY>

      <!-- Auxiliary axis at the right of main x-axis -->
      <c1chart:Axis x:Name="x2" Title="x2" PlotAreaIndex="1"
         AxisType="X" Min="0" Max="10" />

      <!-- Auxiliary axis at the top of main x-axis -->
      <c1chart:Axis x:Name="y2" Title="y2" PlotAreaIndex="1"
         AxisType="Y" Min="0" Max="10" />

    </c1chart:ChartView>
  </c1chart:C1Chart.View>
</c1chart:C1Chart>
```

To add the data you need to specify the name of the axis (**DataSeries.AxisX/AxisY**) and the data will be plotted along the auxiliary axis.

Plot Area Size

The **PlotArea** size can be specified using the **ColumnDefinitions** and **RowDefinitions** collections in the class **PlotAreaCollection**. The approach is similar to working with the standard grid control. The first collection contains column attributes(widths). The second collection is for the row(height). By default, the plot areas have the same width and the same height.

The following examples show how to programatically specify the size of the plot area:

- C#

```
// widths
```

```
// the width of first plot area is default(fill available space)
chart.View.PlotAreas.ColumnDefinitions.Add(new
PlotAreaColumnDefinition());
// the width of second plot area is constant 100 px
chart.View.PlotAreas.ColumnDefinitions.Add(new PlotAreaColumnDefinition()
  { Width= new GridLength(100) });
// heights
// the height of first plot area is 1*
chart.View.PlotAreas.RowDefinitions.Add(new PlotAreaRowDefinition()
  { Height = new GridLength(1, GridUnitType.Star) });
// the height of second plot area is 2*
chart.View.PlotAreas.RowDefinitions.Add(new PlotAreaRowDefinition()
  { Height = new GridLength(2, GridUnitType.Star) });
```

Plot Area Appearance

You can modify the PlotArea's appearance by using the **Background** and **Stroke/StrokeThickness** properties for the border of the plot area. The plot areas are referenced by using the row/column (the same as the elements in the grid).

The following sample shows how to modify the Plot Area appearance:

```
    <c1chart:ChartView.PlotAreas>
      <!-- row=0 col=0 -->
      <c1chart:PlotArea Background="#10FF0000" Stroke="Red" />
      <!-- row=1 col=0 -->
      <c1chart:PlotArea Row="1" Background="#1000FF00" />
      <!-- row=0 col=1 -->
      <c1chart:PlotArea Column="1" Background="#100000FF" />
      <!-- row=1 col=1 -->
      <c1chart:PlotArea Row="1" Column="1" Background="#10FFFF00"
Stroke="Yellow" />
    </c1chart:ChartView.PlotAreas>
```

Data Aggregation

Data aggregation can be used on the entire **C1Chart** control through the Aggregate property or used on individual series through the Aggregate property.

Data aggregation is when data is gathered and is reflected in a summary form. Commonly, aggregation is used to collect more information about specific groups based on certain variables such as geographic location, income, and age.

C1Chart enables you to use aggregate functions for a grouped data by specifying it when the DataSeries is created. For each **DataSeries** you can choose from one of the following functions using the **Aggregate** enumeration:

Member name	Description
None	Raw values (no aggregation).
Sum	Calculates the sum of all values for each point.
Count	Number of values for each point.
Average	Average of all values for each point.
Minimum	Gets the minimum value for each point.

Maximum	Gets the maximum value for each point.
Variance	Gets the variance of the values for each point (sample).
VariancePop	Gets the variance of the values for each point (population).
StandardDeviation	Gets the standard deviation of the values for each point (sample).
StandardDeviationPop	Gets the standard deviation of the values for each point (population).

Data Labels

Data labels are labels associated with data points on the chart. They can be useful on some charts by making it easier to see which series a particular point belongs to, or its exact value.

C1Chart supports data labels. Each data series has a PointLabelTemplate property that specifies the visual element that should be displayed next to each point. The PointLabelTemplate is usually defined as a XAML resource, and may be assigned to the chart from XAML or from code.

You can add a DataTemplate to determine both visual aspects of how the data is presented and how data binding accesses the presented data.

To define the PointLabelTemplate as a XAML resource you can create a Resource Dictionary, add the DataTemplate resource to your Resource Dictionary and then in your Window.xaml file you can access the DataTemplate resource.

To add a new resource dictionary:

1. In Solution Explorer, right-click your project, point to Add, and then select Resource Dictionary. The Add New Item dialog box appears.
2. In the Name text box, name the dictionary Resources.xaml and click the Add button.
3. Resources.xaml is added to the project and opens in the code editor.

To create a label you need to create the label template and assign the PointLabelTemplate to the template.

When rendering the plot for each data point the label is created based on the specified template. The **DataContext** property of the label is set to the current **DataPoint** instance that provides information about the point. When using data binding it makes it easier to display this information in the label.

Here is the sample of a label template that displays the value of the point.

```
<DataTemplate x:Key="lbl">
   <TextBlock Text="{Binding Path=Value}" />
</DataTemplate>
```

After you define a resource, you can reference the resource to be used for a property value by using a resource markup extension syntax that specifies the key name

To assign the template to the data series set the PointLabelTemplate property to the following:

```
<c1chart:DataSeries PointLabelTemplate="{StaticResource lbl}" />
```

Since it is a standard data template, the complex label can be built, for example, the next sample template defines the data label for the XY chart which shows both coordinates of the data point.

It uses the standard grid with two columns and two rows as a container. The x-value of the point is obtained with indexer of the DataPoint class. The indexer allows getting the values for the data series classes which support several data sets, such as XYDataSeries class.

```
<DataTemplate x:Key="lbl">
   <!-- Grid 2x2 with black border  -->
   <Border BorderBrush="Black">
         <Grid>
               <Grid.ColumnDefinitions>
                     <ColumnDefinition />
                     <ColumnDefinition />
               </Grid.ColumnDefinitions>
               <Grid.RowDefinitions>
                     <RowDefinition />
                     <RowDefinition />
               </Grid.RowDefinitions>
               <!-- x-coordinate -->
               <TextBlock Text="X=" />
               <TextBlock Grid.Column="1" Text="{Binding Path=[XValues]}" />
               <!-- y-coordinate -->
               <TextBlock Grid.Row="1" Text="Y=" />
               <TextBlock Grid.Row="1" Grid.Column="1" Text="{Binding
Path=Value}" />
         </Grid>
   </Border>
</DataTemplate>
```

When displaying the numerical data value often it is necessary to format the output value. With the static class Format you can specify standard .Net format string inside the XAML code. For example, the sample code uses converter to format percentage value.

```
<DataTemplate x:Key="lbl1">
   <TextBlock Text="{Binding Path=PercentageSeries,
         Converter={x:Static c1chart:Converters.Format},
         ConverterParameter=#.#%}"/>
</DataTemplate>
```

End User Interaction

C1Chart contains built-in tools that simplify the implementation of interactive behaviors for the end user. The end user can explore, rotate and zoom chart using combinations of mouse and shift keys.

The control center for interactive features is the Actions property of C1Chart. The Action object has several properties that allow customization of the interface. All of the properties can be set in XAML or programmatically through the Actions collection.

The following list reveals the supported chart actions:

- Scale action increases or decreases the scale of chart along the selected axis or axes. The ScaleAction class represents the scale action.

  Note: The zoom is not applicable for the chart's axis if the MinScale property is equal to 1.0. The MinScale property specifies the minimum scale that can be set for the axis.

- Translate action provides the opportunity to scroll through the plot area. The TranslateAction class represents the translate action.

  Note: You will not be available to translate along the axis if the Axis.Scale property is equal to 1.

- Zoom action allows the user to select rectangular area for viewing.

The scaling, translation and zooming are available only for chart with Cartesian axes.

The Action object provides a set of properties that help to customize the action's behavior.

- The **MouseButton** and **Action.Modifiers** properties specify the mouse button and key (ALT, CONTROL or SHIFT) combination that will invoke the execution of the action.

Data-Binding

This section describes data binding.

The steps required to create data bound charts are identical to the ones we mentioned in the earlier topics

1. Choose the chart type (ChartType property).
2. Set up the axes (AxisX and AxisY properties).
3. Add one or more data series (Children collection).
4. Adjust the chart's appearance using the Theme and Palette properties.

   The only difference is in step 3. When you create data-bound charts, you need to set the ItemsSource property to the collection of items that contain the data you want to chart. Then, use the **dataSeries.ValueBinding** property to specify which property of the items contains the values to be plotted.

For example, here is the code we used before to generate the Sales Per Region chart (not data-bound):

- *C#*

```
// Get the data
var data = GetSalesPerRegionData();

// Show regions along label axis
c1Chart1.Data.ItemNames = (
from r in data
select r.Region).ToArray();

// Add Revenue series
var ds = new DataSeries();
ds.Label = "Revenue";
ds.ValuesSource = (from r in data select r.Revenue).ToArray();
c1Chart1.Data.Children.Add(ds);
// Add Expense series
ds = new DataSeries();
ds.Label = "Expense";
ds.ValuesSource = (from r in data select r.Expense).ToArray();
c1Chart1.Data.Children.Add(ds);
// Add Profit series
ds = new DataSeries();
ds.Label = "Profit";
ds.ValuesSource = (from r in data select r.Profit).ToArray();
c1Chart1.Data.Children.Add(ds);
```

Here is the data-bound version of the code (changes are highlighted). The result is identical:

- C#

```
// Get the data
var data = GetSalesPerRegionData();
c1Chart1.Data.ItemsSource = data;

// Show regions along label axis
c1Chart1.Data.ItemNameBinding = new Binding("Region");

// Add data series
foreach (string series in "Revenue,Expense,Profit".Split(','))
{
    var ds = new DataSeries();
    ds.Label = series;
    ds.ValueBinding = new Binding(series);
    c1Chart1.Data.Children.Add(ds);
}
```

The data-bound version of the code is even more compact than the original. The three series are created in a loop, taking advantage of the fact that the names of the properties we want to chart are the same as the names we want to use for each data series.

You can assign any object that implements the **IEnumerable** interface to the **ItemsSource** property. This includes simple lists as shown above and LINQ queries.

Data Labels and ToolTips

Data labels (also called data marker labels) are labels associated with data points. They can be useful on some charts by making it easier to see which series a particular point belongs to, or its exact value.

C1Chart supports data labels. Each data series has a PointLabelTemplate property that specifies the visual element that should be displayed next to each point. The PointLabelTemplate is usually defined as a XAML resource, and may be assigned to the chart from XAML or from code.

Going back to our previous example, let us add a simple label to each of the three data series. The first step would be to define the template as a resource in the **MainPage.xaml** file:

```
<UserControl x:Class="ChartIntro.MainPage"
  xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
  xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
  xmlns:c1chart="clr-namespace:C1.Phone.Chart;assembly=C1.Phone.Chart">

  <!-- DataTemplate for chart labels -->
  <UserControl.Resources>
    <DataTemplate x:Key="chartLabel">
      <Border
        c1chart:PlotElement.LabelAlignment="MiddleCenter"
        Opacity="0.5" Background="White" CornerRadius="20"
        BorderBrush="Black" BorderThickness="2" Padding="4">
        <TextBlock
          Text="{Binding Value}"
          Foreground="Black" FontSize="16"/>
      </Border>
    </DataTemplate>
  </UserControl.Resources>

  <!-- Main grid -->
  <Grid x:Name="LayoutRoot" Background="White" Margin="10" >
    <!—no changes here -->
  </Grid>
```

```
</UserControl>
```

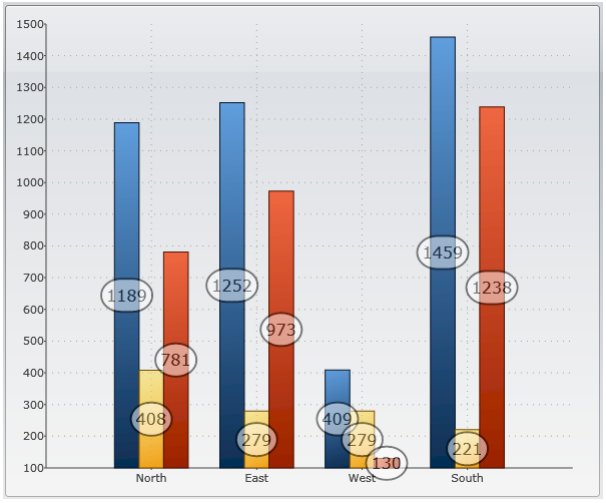
This resource defines how to obtain a data label for each point. Note that the template contains a **TextBlock** element with the **Text** property set to "{Binding Value}". This causes the text to be bound to the value of the associated data point. Also note that the **LabelAlignment** property is used to determine where the label should be positioned relative to the data point on the chart.

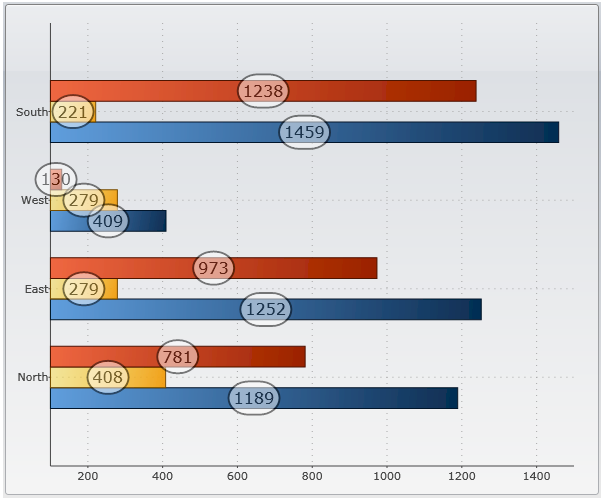
In order to use the new template, we need to modify the code in the **MainPage.xaml.cs** file as follows:

```
// Get the data
var data = GetSalesPerRegionData();
c1Chart1.Data.ItemsSource = data;

// Show regions along label axis
c1Chart1.Data.ItemNameBinding = new Binding("Region");

// Add data series
foreach (string series in "Revenue,Expense,Profit".Split(','))
{
  var ds = new DataSeries();
  ds.Label = series;
  ds.ValueBinding = new Binding(series);
  ds.PointLabelTemplate = Resources["chartLabel"] as DataTemplate;
  c1Chart1.Data.Children.Add(ds);
}
```

The only change is one extra line of code that sets the PointLabelTemplate property to the resource defined in XAML.

Here is what the chart looks like after adding the labels:





You are not limited to showing a single value in each data label. **C1Chart** provides a DataPointConverter class that you can use to create more sophisticated bindings for your label templates. The converter is declared and used as a resource, along with the template.

For example, here is a revised version of the resource in the XAML file:

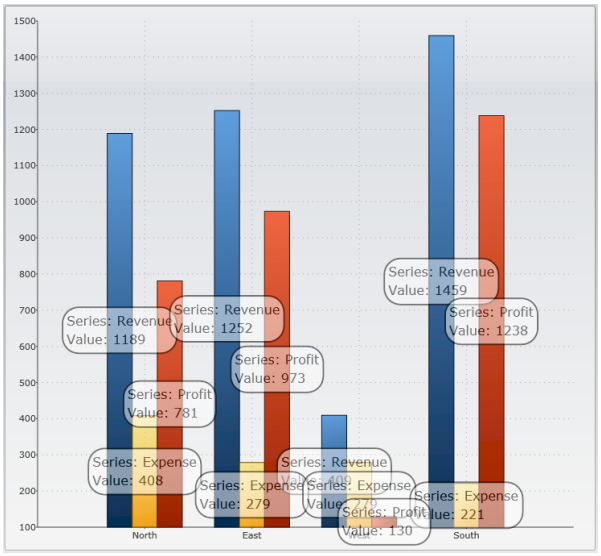
```
<UserControl x:Class="ChartIntro.MainPage"
  xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
  xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
  xmlns:c1chart="clr-namespace:C1.Phone.Chart;assembly=C1.Phone.Chart">
```

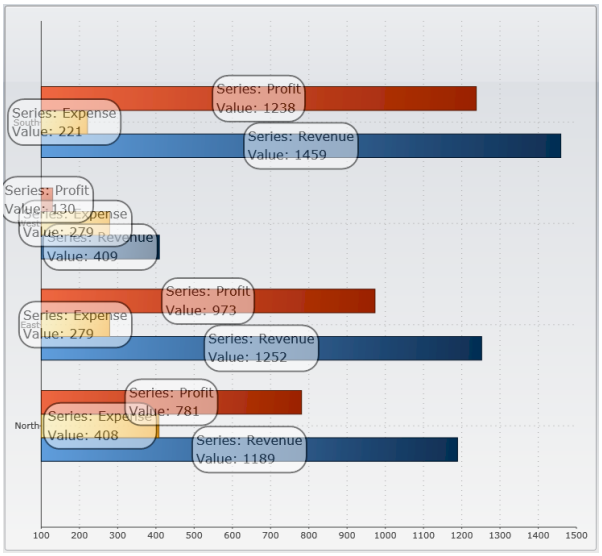
```
  <!-- DataTemplate for chart labels -->
  <UserControl.Resources>
    <c1chart:DataPointConverter x:Key="dataPointConverter" />
    <DataTemplate x:Key="chartLabel">
      <Border
        c1chart:PlotElement.LabelAlignment="MiddleCenter"
        Opacity="0.5" Background="White" CornerRadius="20"
        BorderBrush="Black" BorderThickness="2" Padding="4">
        <TextBlock
         Text="{Binding
         Converter={StaticResource dataPointConverter},

ConverterParameter='{#SeriesLabel}{#NewLine}{#Value:$#,##0.00}'}"
         Foreground="Black" FontSize="16"/>
      </Border>
    </DataTemplate>
  </UserControl.Resources>

  <!-- Main grid -->
  <Grid x:Name="LayoutRoot" Background="White" Margin="10" >
    <!—no changes here -->
  </Grid>
</UserControl>
```

Notice the change in the binding for the **Text** property. This version specifies the converter and a converter parameter. The parameter is a string that contains keywords that will be replaced with data from the point that the label is bound to. The sample uses the **#SeriesLabel**, **#NewLine**, and **#Value** keywords. Other valid keywords are **#YValue**, **#PointIndex**, and **#SeriesIndex**.

The parameter also supports the usual .NET formatting syntax. The sample formats values as currencies with a currency symbol, thousand separators, and two decimals.

This is what the chart looks like after changing the template:





Advanced Topics

The following advanced topics detail using animations, zooming and panning, specialized charts, and XAML.

Animation

Each DataSeries in a chart is composed of PlotElement objects that represent each individual symbol, connector, area, pie slice, and so on in the series. The specific type of PlotElement depends on the chart type.

You can add animations to your charts by attaching **Storyboard** objects to the plot elements. This is usually done in response to the **DataSeries.Loaded** event, which fires after the PlotElement objects have been created and added to the data series.

OnLoad Animations

For example, the code below creates a 'fade-in' animation that causes each point in the data series to slowly appear, building the chart gradually:

```
void AnimateChart()
{
  // Build chart as usual
  SalesPerRegionAreaStacked_Click(this, null);

  // Make all series transparent and attach event handler
  // to make them visible gradually
  foreach (DataSeries ds in c1Chart1.Data.Children)
  {
    ds.Opacity = 0;
    ds.Loaded += ds_Loaded;
  }
}
```

The code starts by generating a chart as usual, and then loops through the DataSeries setting their **Opacity** to zero. This way, the chart will appear blank when it loads.

The code also attaches a handler to the **Loaded** event. This is where the animations will be added to each PlotElement. Here is the implementation:

```
// Animate each PlotElement after it has been loaded
void ds_Loaded(object sender, EventArgs e)
{
  PlotElement plotElement = sender as PlotElement;
  if (plotElement != null)
  {
    // Create storyboard to animate PlotElement
    Storyboard sb = new Storyboard();
    Storyboard.SetTarget(sb, plotElement);

    // Add Opacity animation to storyboard
    DoubleAnimation da = new DoubleAnimation();
    da.SetValue(Storyboard.TargetPropertyProperty, new
PropertyPath("Opacity"));
    da.Duration = new Duration(TimeSpan.FromSeconds(2));
    da.To = 1;
    sb.Children.Add(da);

    // Offset BeginTime for each series and point within series
    double seconds = 2;
```

```
    var dp = plotElement.DataPoint;
    if (dp != null && dp.PointIndex > -1)
    {
      seconds = dp.SeriesIndex + dp.PointIndex * 0.1;
    }
    da.BeginTime = TimeSpan.FromSeconds(seconds);

    // Start storyboard
    sb.Begin();
  }
}
```

This event handler gets called once for each PlotElement that is generated. The code creates a **Storyboard** object for each PlotElement and uses it to gradually change the opacity of the element from zero to one (completely transparent to completely solid).

Notice how the code uses the DataPoint property to determine which series and which data point the plot element belongs to, and then sets the **BeginTime** property of the animation to cause each plot element to become visible at different times. This way, the points appear one at a time, instead of all at once.

Notice also that the code tests the PointIndex property to make sure it is greater than -1. This is because some plot elements do not correspond to individual points, but rather to the whole series. This is the case for **Area** elements for example.

This code can be used for all chart types. You can use it to slowly show plot symbols, lines, pie slices, and so on.

OnMouseOver Animations

You can also create animations that execute when the user moves the mouse over elements. To do this, use the Loaded event as before, but this time attach event handlers to each **PlotElement**'s mouse event instead of creating the animations directly.

For example:

```
void AnimatePoints()
{
  // Build chart as usual
  SalesPerMonthLineAndSymbol_Click(this, null);

  // Handle event when plot elements are created
  foreach (DataSeries ds in c1Chart1.Data.Children)
  {
    ds.Loaded += ds_Loaded;
  }
}

// Attach mouse event handlers to each plot element
// as they are created
void ds_Loaded(object sender, EventArgs e)
{
  PlotElement pe = sender as PlotElement;
  if (pe != null && pe.DataPoint.PointIndex > -1)
  {
    pe.MouseEnter += pe_MouseEnter;
    pe.MouseLeave += pe_MouseLeave;
  }
}

// Execute animations when the mouse enters or leaves
// each plot element
```

```
void pe_MouseEnter(object sender, MouseEventArgs e)
{
  AnimateDataPoint(sender as PlotElement, 3, 0.2);
}
void pe_MouseLeave(object sender, MouseEventArgs e)
{
  AnimateDataPoint(sender as PlotElement, 1, 1);
}
```

This code attaches event handlers that get called when the mouse enters or leaves each plot element. Both handlers call the **AnimateDataPoint** method, which increases the scale quickly when the mouse is over the element and restores it slowly when the mouse leaves the element.

Here is the implemenation of the **AnimateDataPoint** method:

```
void AnimateDataPoint(PlotElement plotElement, double scale, double duration)
{
  // Get/create scale transform for the PlotElement
  var st = plotElement.RenderTransform as ScaleTransform;
  if (st == null)
  {
    st = new ScaleTransform();
    plotElement.RenderTransform = st;
    plotElement.RenderTransformOrigin = new Point(0.5, 0.5);
  }

  // Create Storyboard and attach it to transform
  var sb = new Storyboard();
  Storyboard.SetTarget(sb, st);

  // Animate X and Y scales
  foreach (string prop in new string[] { "ScaleX", "ScaleY" })
  {
    var da = new DoubleAnimation();
    da.To = scale;
    da.Duration = new Duration(TimeSpan.FromSeconds(duration));
    da.SetValue(Storyboard.TargetPropertyProperty, new PropertyPath(prop));
    sb.Children.Add(da);
  }

  // Start animation
  sb.Begin();
}
```

Zooming and Panning

The **C1Chart** control has features that make it easy to add zooming and panning to charts. These features enable users to select specific ranges of data to see details that are hidden in charts that show all the data at once.

Zooming and Panning with Two Charts

Good examples of zooming and panning charts can be found in the "Google Financial" site and in the "Stock Portfolio" sample included with the **ComponentOne Studio for Windows Phone**. Both applications show two charts. The bottom chart displays all the data available, and includes a range selector that allows users to pick the range they are interested in. The top chart displays data for the selected range only, allowing users to zero-in on interesting parts of the chart.

To implement this type of application using **C1Chart**, you would add two charts and a range slider to the page (or to a user control). For example:

```
<UserControl x:Class="ChartIntro.ZoomChart"
  xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
  xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
  xmlns:c1="clr-namespace:C1.Phone;assembly=C1.Phone"
  xmlns:c1chart="clr-namespace:C1.Phone.Chart;assembly=C1.Phone.Chart"
  Loaded="ZoomChart_Loaded" >

  <Grid x:Name="LayoutRoot" Background="White">
    <Grid.RowDefinitions>
      <RowDefinition Height="4*" />
      <RowDefinition Height="*" />
    </Grid.RowDefinitions>

    <!-- Main chart (shows selected range) -->
    <c1chart:C1Chart x:Name="_c1MainChart" />

    <!-- Zoom chart (shows entire data range) -->
    <c1chart:C1Chart x:Name="_c1ZoomChart" Grid.Row="1" />

    <!-- Range slider (selects a range from the zoom chart) -->
    <c1:C1RangeSlider x:Name="_slider" Grid.Row="1"
VerticalAlignment="Bottom"
         Minimum="0" Maximum="1" ValueChange="0.1"
         LowerValueChanged="_slider_ValueChanged"
         UpperValueChanged="_slider_ValueChanged" />
  </Grid>
</UserControl>
```

The XAML creates the controls and specifies two event handlers. The first event handler, **ZoomChart_Loaded**, is invoked when the page loads, and is responsible for initializing the charts:

```
// Draw main and zoom charts when the control loads
void ZoomChart_Loaded(object sender, RoutedEventArgs e)
{
  DrawChart(_c1MainChart);
  DrawChart(_c1ZoomChart);
}

// Draw a chart with some random data
void DrawChart(C1Chart chart)
{
  chart.Theme = ChartTheme.DuskGreen;
  chart.ChartType = ChartType.LineSymbols;

  var ds = new DataSeries();
  ds.ValuesSource = CreateData(100);
  chart.Data.Children.Add(ds);
}

// Create some random data for the chart
double[] CreateData(int cnt)
{
  var rnd = new Random(0);
  double[] data = new double[cnt];
  int last = 0;
  for (int i = 0; i < data.Length; i++)
  {
    int next = rnd.Next(0, 50);
```

```
    data[i] = last + next;
    last = next;
  }
  return data;
}
```

The code is similar to the one used in the first sections, when we introduced the basic **C1Chart** concepts. The routine that creates the chart is called twice, once to create the main chart above and once to create the zoom chart below it.

The next event handler is called when the user modifies the range using the range slider control. The event handler is responsible for updating the range displayed by the main chart:

```
// Update visible range in main chart when the slider changes
private void _slider_ValueChanged(object sender, EventArgs e)
{
  if (_c1MainChart != null)
  {
    Axis ax = _c1MainChart.View.AxisX;
    ax.Scale = _slider.UpperValue - _slider.LowerValue;
    ax.Value = _slider.LowerValue / (1 - ax.Scale);
  }
}
```

The event handler uses the Scale and **Axis.Value** properties to display the range selected by the user.

The Scale property determines *how much data* is shown on the chart. When **Scale** = 1, all data available is displayed; when **Scale** = 0.5, only half the data is displayed.

The Value property determines *what portion of the data* is displayed. When Value = 0, the initial part of the data is displayed; when Value = 1, the final part is displayed.

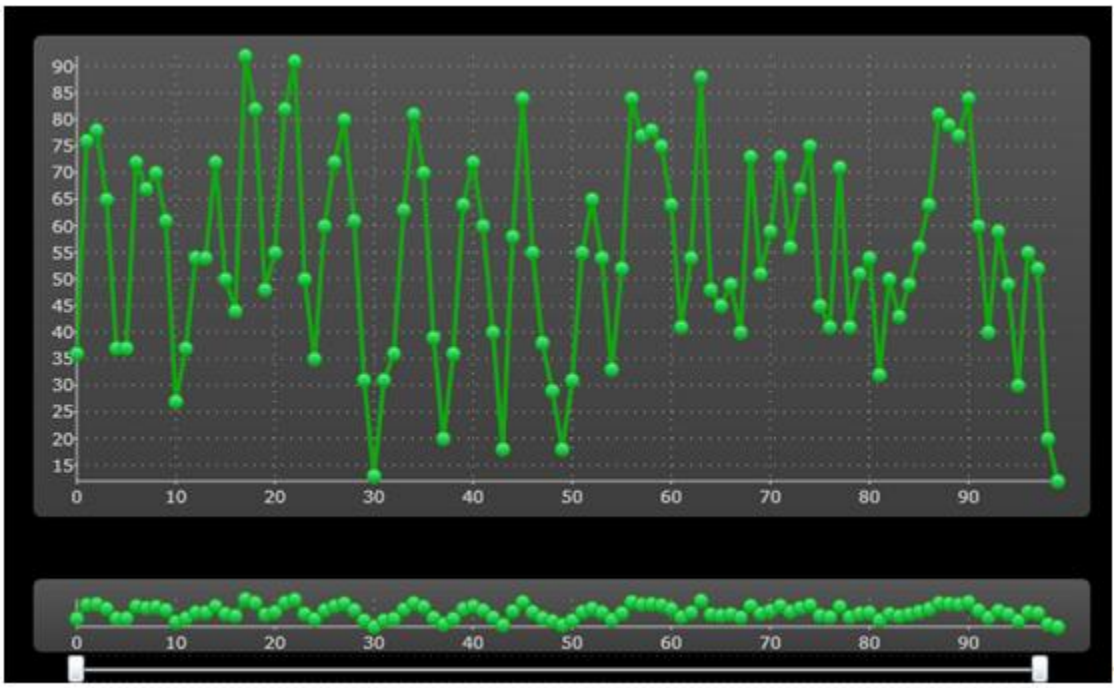
These properties are convenient but not strictly necessary. You could achieve the same results by setting the Max and Min properties on the axis. The advantage of using Scale and Value is that they work over a fixed range between zero and one, which makes the code simpler.

If you run the application now, you will see that it works correctly, but the range slider is aligned with the chart edges. We would like to align it with the edges of the plot area instead, so the relationship between the slider and the x axis is obvious to the user. Here is the code that aligns the range slider to the x axis:

```
// Set slider size to match the length of the x axis
protected override Size MeasureOverride(Size availableSize)
{
  Size sz = base.MeasureOverride(availableSize);
  _slider.Width = _c1MainChart.View.PlotRect.Width;
  return sz;
}
```

The code overrides the **MeasureOverride** method to set the width of the slider to match the width of the chart's plot rectangle (exposed by the PlotRect property).

If you run the project now, the result should look similar to the image below:



You can use the range slider below the bottom chart to select the range you are interested in. For example, if you dragged the slider's lower value to 55 and the upper value to 65, the upper chart would show the detail as in the image below:

You could improve this application by changing the template used by the range slider control. This is demonstrated in the "StockPortfolio" sample included with the **ComponentOne Studio for Windows Phone**.

Zooming and Panning with a Single Chart

You can also implement zooming and panning using a single chart. The easiest way to achieve this is to use the Actions property and the built-in mouse actions. **C1Chart** includes built-in actions for zooming, scaling, and panning the chart with the mouse.

The code below shows how you can add mouse actions to a **C1Chart** control:

```
// Show chart as usual
SalesPerRegionBar_Click(this, null);

// Add zoom action to mouse drag
c1Chart1.Actions.Add(new ZoomAction());

// Add scale action to control-mouse drag
c1Chart1.Actions.Add(new ScaleAction() { Modifiers = ModifierKeys.Control });

// Add pan action to shift-mouse drag
c1Chart1.Actions.Add(new TranslateAction() { Modifiers = ModifierKeys.Shift
});
```

Once the actions have been added to the **Actions** collection, you can use the mouse to perform the following actions:

- **Zoom**: Use the mouse to select a portion of the chart. When you release the mouse button, the chart will zoom in on the selected portion of the chart. This action allows you to zoom in but not to zoom out.
- **Scale**: Press the control button and move the mouse up or down to scale the chart interactively.
- **Pan**: Press the shift button and move the mouse to pan the display and see different portions of the chart without modifying the scale.

All built-in actions work by automatically setting the **Scale** property on each axis. You can limit or disable the actions by setting the **MinScale** property to one for either axis.

Attaching Elements to Data Points

In previous sections, we discussed how you can customize the appearance of data series and individual data points. We also discussed how you can add data labels and tooltips to charts.

In some cases, however, you may need to add custom elements and position them relative to specific data points. For example, the Google Financials site displays charts with labels attached to specific data points. The labels relate the data points to significant news that affected the values on the chart.

This can be done easily with **C1Chart** using the PointFromData method. This method converts a specific point from chart coordinates to client coordinates, which you can use to position elements over the chart.

For example:

```
// Custom elements used to indicate maximum and minimum values
Ellipse _minMark, _maxMark;

// Create chart and initialize custom elements
void CustomElementChart()
{
  // Create chart as usual
  BuildSalesPerRegionChart(ChartType.LineSymbols);

  // Create min/max custom elements
  _minMark = new Ellipse()
  _minMark.Width = _minMark.Height = 45;
  _minMark.Stroke = new SolidColorBrush(Colors.Blue);
```

```
  _minMark.Fill = new SolidColorBrush(Color.FromArgb(64, 0, 0, 255));

  _maxMark = new Ellipse()
  _maxMark.Width = _maxMark.Height = 45;
  _maxMark.Stroke = new SolidColorBrush(Colors.Red);
  _maxMark.Fill = new SolidColorBrush(Color.FromArgb(64, 255, 0, 0));

  // Add custom elements to the chart
  c1Chart1.View.Children.Add(_minMark);
  c1Chart1.View.Children.Add(_maxMark);

  // Reposition custom elements when chart layout changes
  c1Chart1.LayoutUpdated += c1Chart1_LayoutUpdated;
}
```

The code starts by creating a chart as usual. Then it creates two **Ellipse** elements that will be used to indicate the minimum and maximum values on the chart. The custom elements are added to the View canvas. Finally, the code adds an event handler to the chart's **LayoutUpdated** event. The event handler is responsible for positioning the custom elements over data points on the chart whenever the chart layout changes (for example, when the chart is resized).

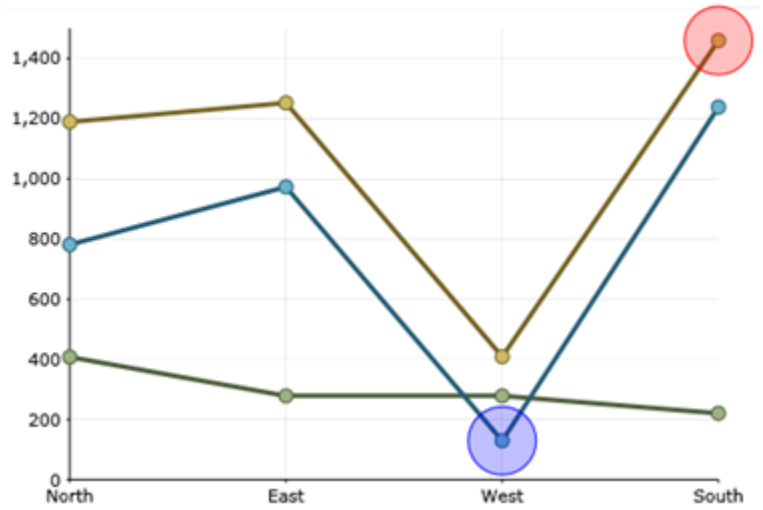
Here is the code for the event handler:

```
void c1Chart1_LayoutUpdated(object sender, EventArgs e)
{
  // Find minimum and maximum values
  int imax = 0, imin = 0;
  double ymin = double.MaxValue, ymax = double.MinValue;
  foreach (DataSeries ds in c1Chart1.Data.Children)
  {
    double[] values = ds.ValuesSource as double[];
    for (int i = 0; i < values.Length; i++)
    {
      if (values[i] > ymax)
      {
        ymax = values[i];
        imax = i;
      }
      if (values[i] < ymin)
      {
        ymin = values[i];
        imin = i;
      }
    }
  }

  // Position custom element over minimum
  Point ptMin = c1Chart1.View.PointFromData(new Point(imin, ymin));
  Canvas.SetLeft(_minMark, ptMin.X - _minMark.Width / 2);
  Canvas.SetTop(_minMark, ptMin.Y - _minMark.Height / 2);

  // Position custom element over maximum
  Point ptMax = c1Chart1.View.PointFromData(new Point(imax, ymax));
  Canvas.SetLeft(_maxMark, ptMax.X - _maxMark.Width / 2);
  Canvas.SetTop(_maxMark, ptMax.Y - _maxMark.Height / 2);
}
```

The event handler starts by scanning all the data series to find the maximum and minimum values on the chart and their index along the X axis.

Once these values have been found, the event handler calls the **PointFromData** method to convert the data coordinates into pixel coordinates within the chart's plot area. Finally, it calls the **SetLeft** and **SetTop** methods to position the custom elements so the center of the ellipses coincides with the point on the chart.

The result looks like the image below:



The red marker is positioned over the maximum value and the blue over the minimum. The position of the markers is updated automatically when the chart is resized.

Using XAML

In this document, we have created several charts using C# code. But you can also create charts entirely in XAML and using Blend or Visual Studio. The advantage of doing this is you can create charts interactively and see the effect of each change immediately.

To show how this works, open a project that contains a reference to the **C1.Phone.Chart** assembly and add new Windows Phone user control named "XamlChart" to the project. Then open the XAML file in Visual Studio or Blend and copy or type the following content into it:

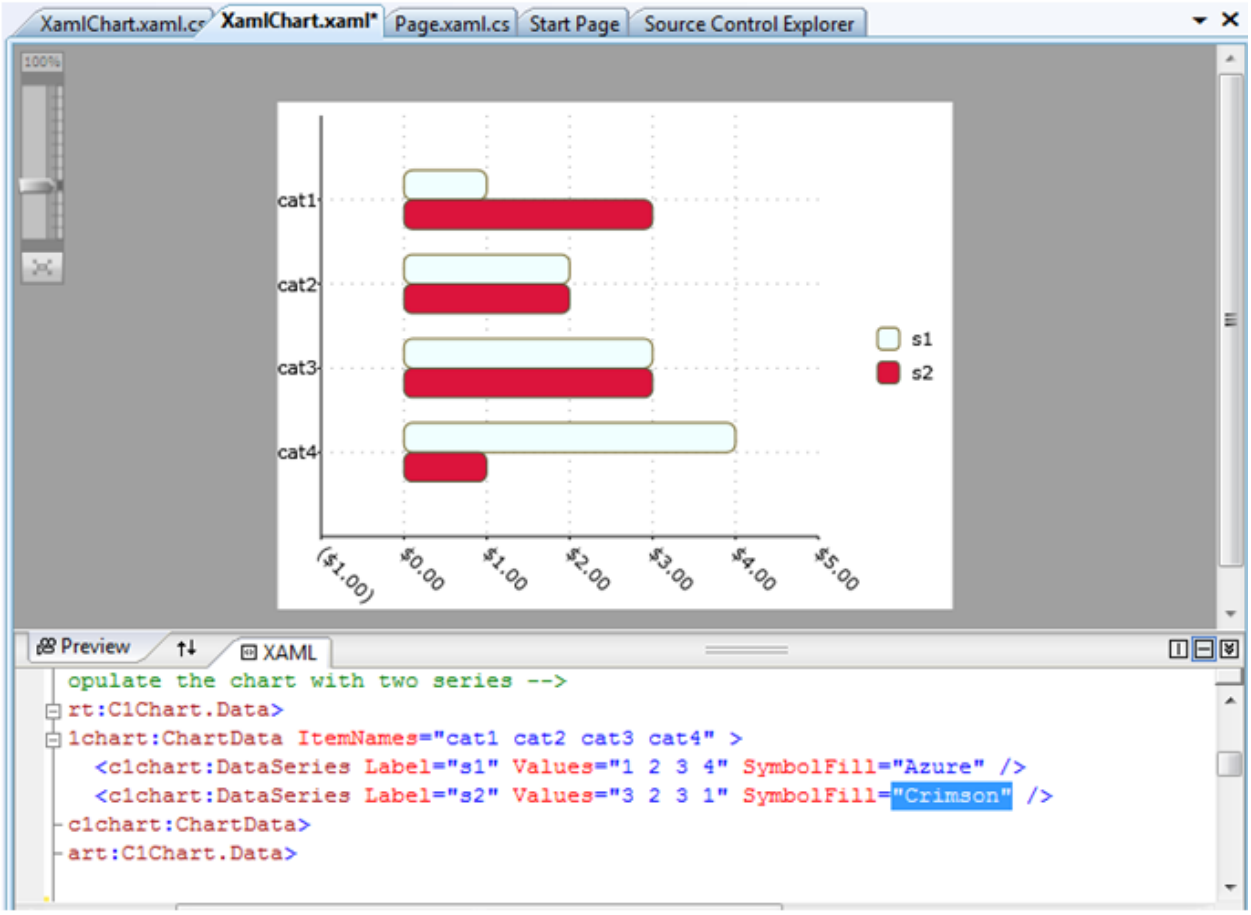
```
<UserControl x:Class="ChartIntro.XamlChart"
  xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
  xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
  xmlns:c1chart="clr-namespace:C1.Phone.Chart;assembly=C1.Phone.Chart"
  xmlns:c1="clr-namespace:C1.Phone;assembly=C1.Phone"
  Width="400" Height="300">
  <Grid x:Name="LayoutRoot" Background="White">

  <!-- Create chart, specify type -->
  <c1chart:C1Chart x:Name="chart0" ChartType="Bar" >

    <!-- Populate the chart with two series -->
    <c1chart:C1Chart.Data>
      <c1chart:ChartData ItemNames="cat1 cat2 cat3 cat4" >
        <c1chart:DataSeries Label="s1" Values="1 2 3 4" SymbolFill="Azure" />
        <c1chart:DataSeries Label="s2" Values="3 2 3 1" SymbolFill="Crimson"
/>
```

```
      </c1chart:ChartData>
    </c1chart:C1Chart.Data>

    <!-- Configure axes -->
    <c1chart:C1Chart.View>
      <c1chart:ChartView>
        <c1chart:ChartView.AxisX>
          <c1chart:Axis Min="-1" Max="5" AnnoFormat="c" AnnoAngle="45"
MajorUnit="1"/>
        </c1chart:ChartView.AxisX>
        <c1chart:ChartView.AxisY>
          <c1chart:Axis Reversed="True"/>
        </c1chart:ChartView.AxisY>
      </c1chart:ChartView>
    </c1chart:C1Chart.View>
  </c1chart:C1Chart>

  <!-- Add a legend -->
  <c1chart:C1ChartLegend />

  </Grid>
</UserControl>
```

If you edit this code in Visual Studio's split window, you will be able to see the effect of each change you make as you type it. This makes it easy to experiment with different settings to get the results you want.

Notice that you can edit most chart elements directly in XAML, including the data series and the axes.

The image below shows the interactive editing process within Visual Studio:



This is a convenient way to get the chart set up. At run time, you would use code to provide the actual chart data by setting the **ItemNames** and **ValuesSource** property on each data series as we did in earlier examples. For example:

```
public XamlChart()
{
  // Initialize control
  InitializeComponent();

  // Set item names and series values
  chart0.Data.ItemNames = GetItemNames(10);
  foreach (DataSeries ds in chart0.Data.Children)
  {
    ds.ValuesSource = GetSeriesData(10);
  }
}

string[] GetItemNames(int count)
{
  string[] names = new string[count];
  for (int i = 0; i < count; i++)
  {
    names[i] = string.Format("item {0}", i);
  }
  return names;
```

```
}
Random _rnd = new Random();
double[] GetSeriesData(int count)
{
  double[] values = new double[count];
  for (int i = 0; i < count; i++)
  {
    values[i] = _rnd.Next(0, 5);
  }
  return values;
}
```

The code replaces the dummy data we used at design time the actual data. The final result is shown below:

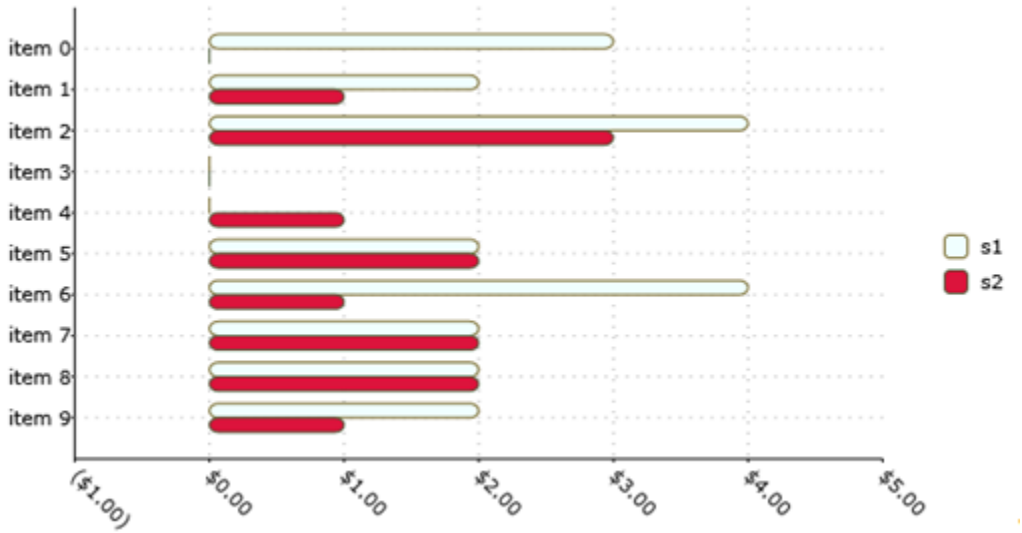


Chart for Windows Phone Appearance

The following topics detail how to customize the C1Chart control's appearance. Themes allow you to customize the appearance of the chart and take advantage of Windows Phone's XAML-based styling. You can also use templates to format and layout the control and to customize the control's actions.

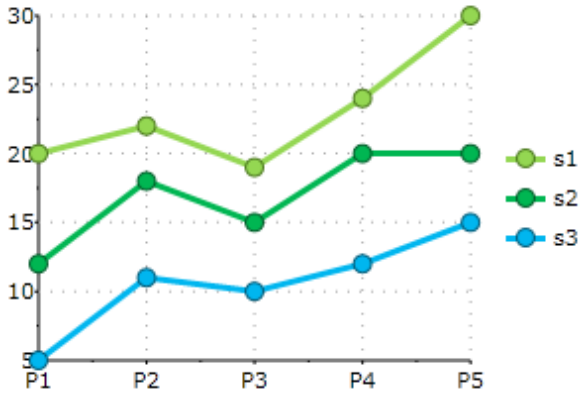
Data Series Color Palette

The data series color scheme can be selected by using the Palette property. By default, C1Chart uses the Palette.**Custom** setting which specifies the standard color generation. The remaining options mimic the color themes of Microsoft Office.

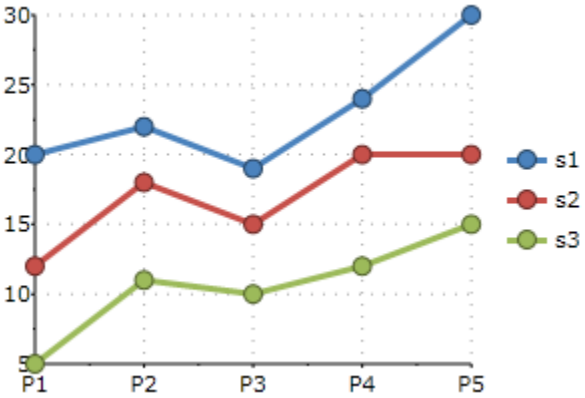
Available color schemes for the data series are listed below:

Color Generation Setting	Description or Preview
Default	By default, C1Chart uses the Palette.Default.

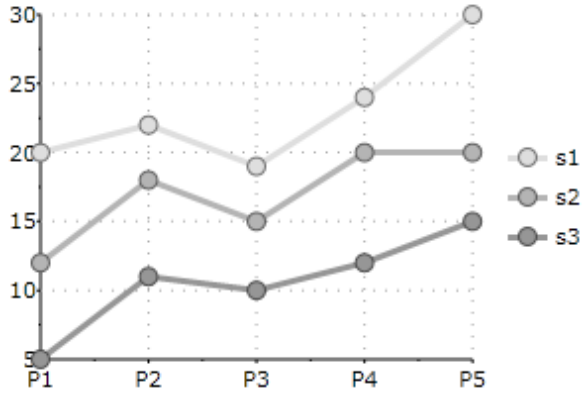
Standard



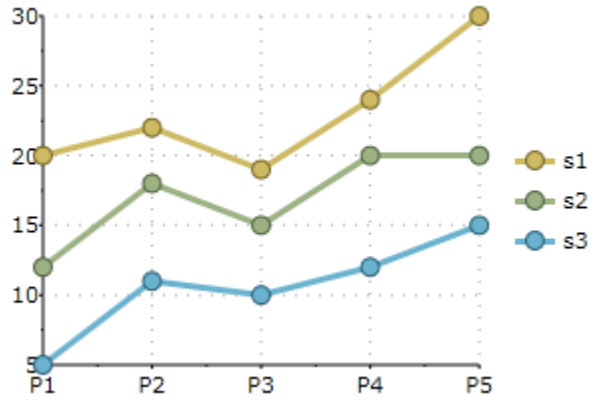
Office



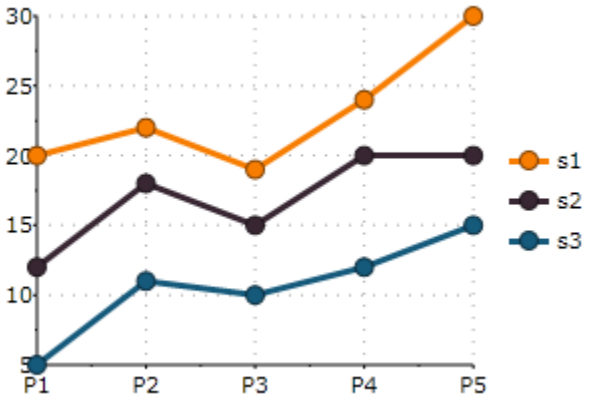
GrayScale



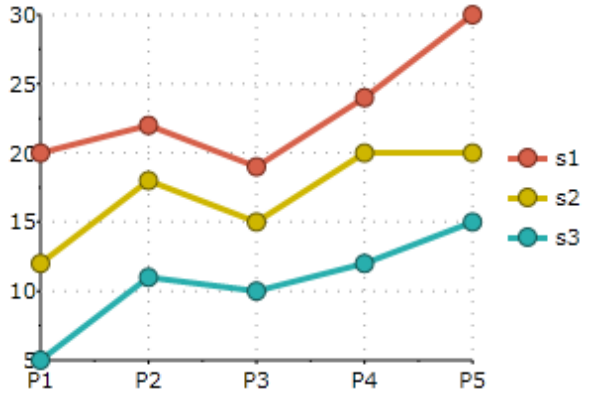
Apex



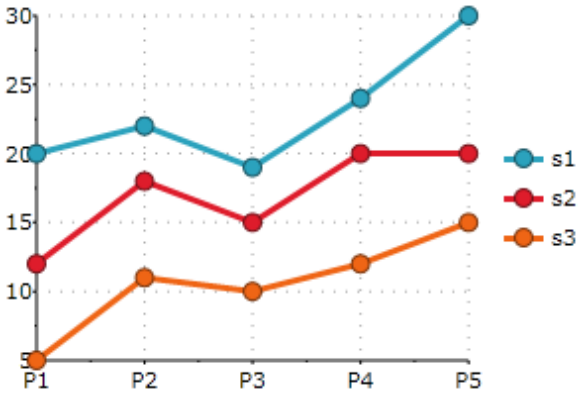
Aspect



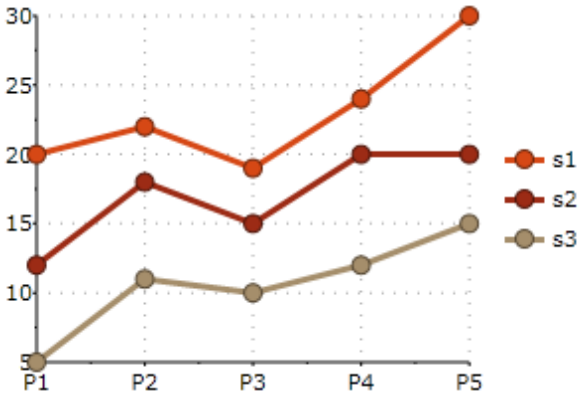
Civic



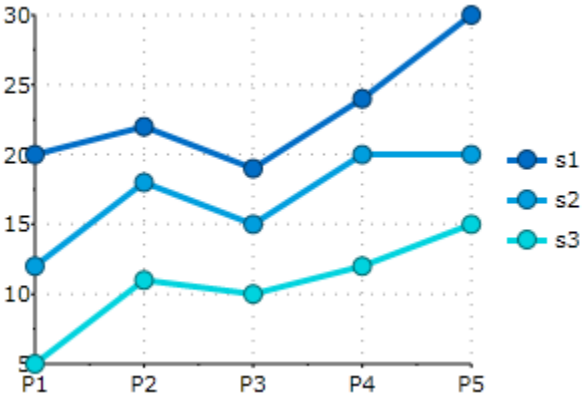
Concourse



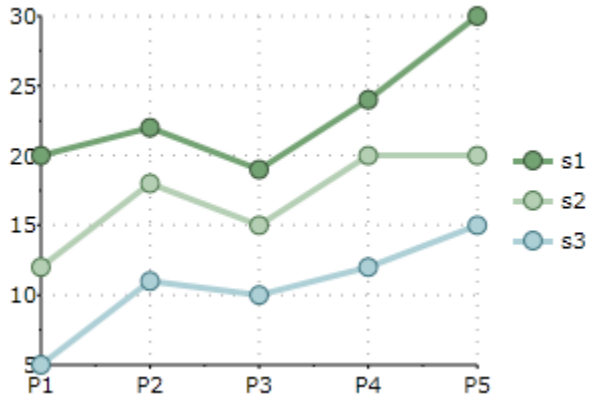
Equity



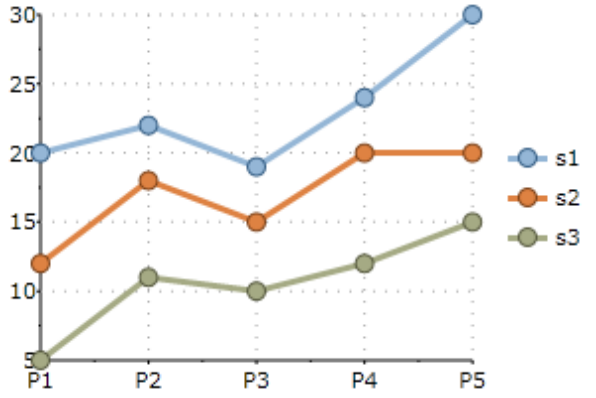
Flow



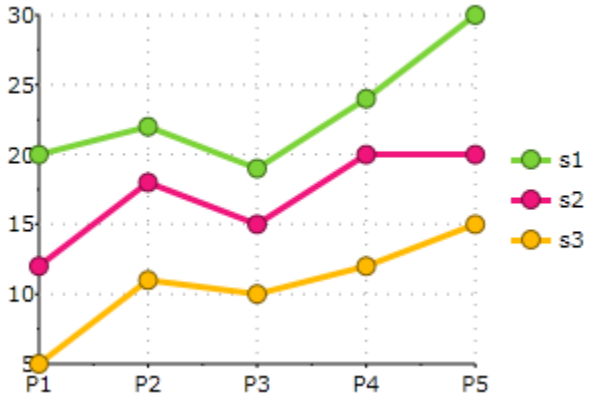
Foundry



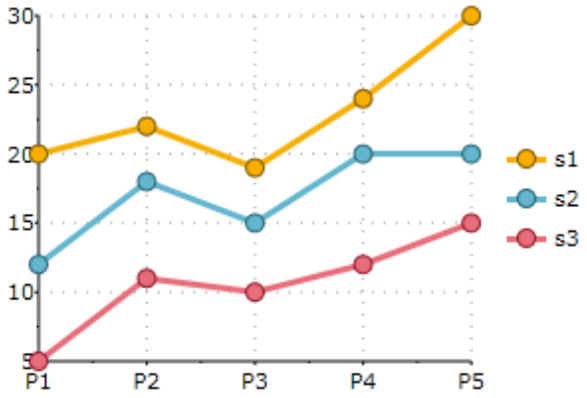
Median



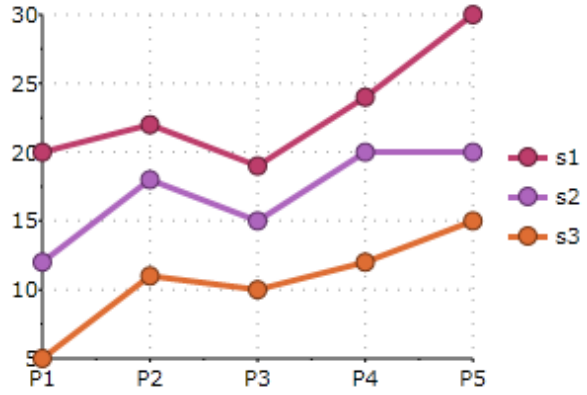
Metro



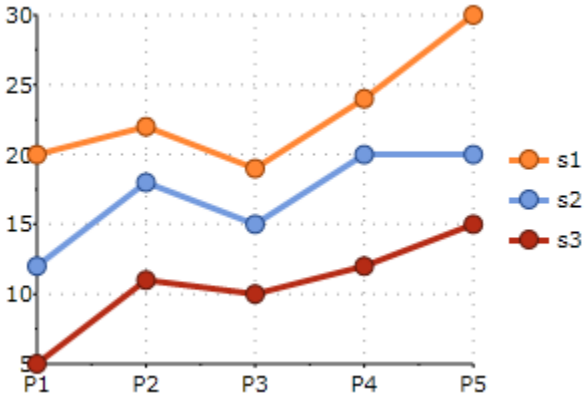
Module



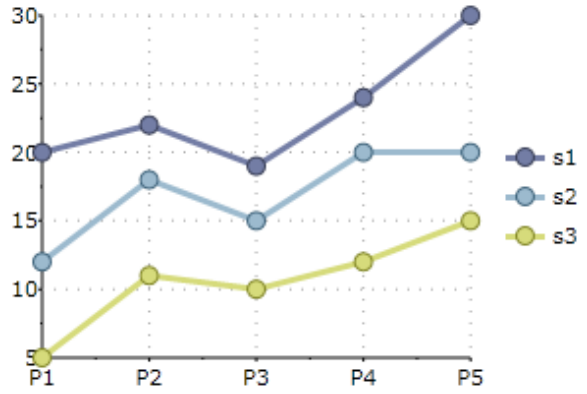
Opulent



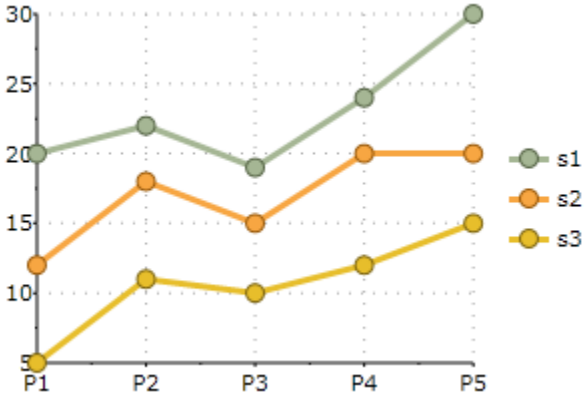
Oriel



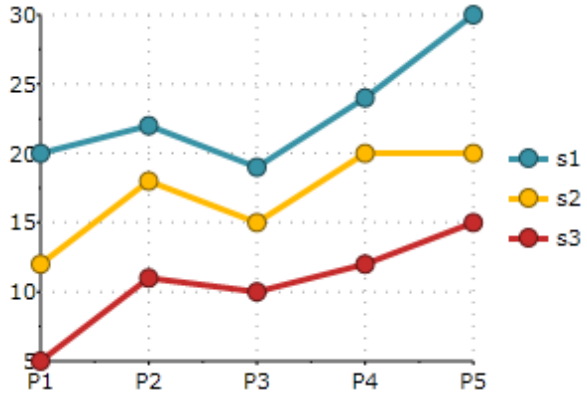
Origin



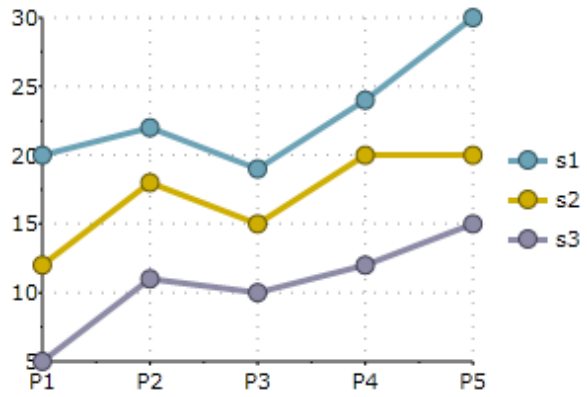
Paper



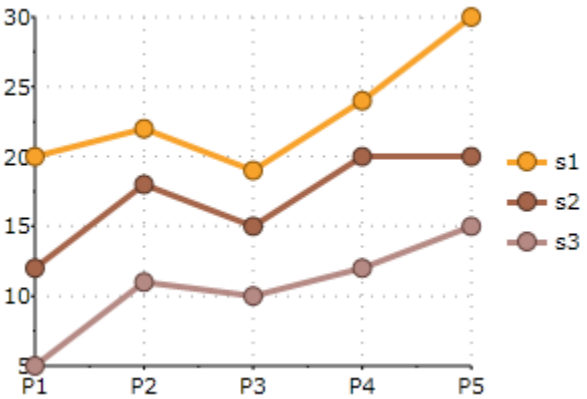
Solstice



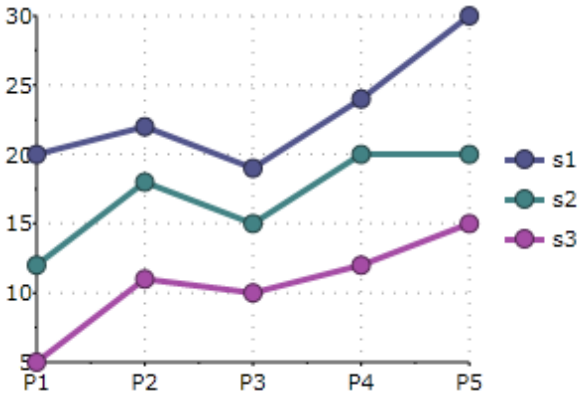
Technic



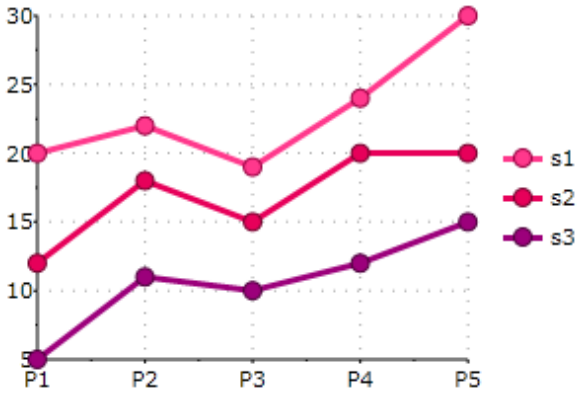
Trek



Urban



Verve



Visual Effects

Visual Effects is a tool used for visually enhancing the 2D C1Chart control's border effect and shadow effect for the data series. Any existing project can use the new features provided by this tool. The chart's appearance can dramatically improve in a few simple steps using visual effects.

Limitation

Visual effects rendering may not work effectively in case of very complex and large data arrays or when highest performance is required.

C1Chart provides a VisualEffect class which is the base class. The following classes are derived from the **VisualEffect** class:

- BorderEffect – Defines the border effect for the data series. This class enables you to modify the border style, light direction, and thickness of the border.
- ShadowEffect – Defines the shadow effect for the data series. This class enables you modify the shadow color, shadow depth, light direction of the shadow, shadow opacity, and softness.
- VisualEffectGroup – Defines the visual effect that consists from the several effects.

Border Effects

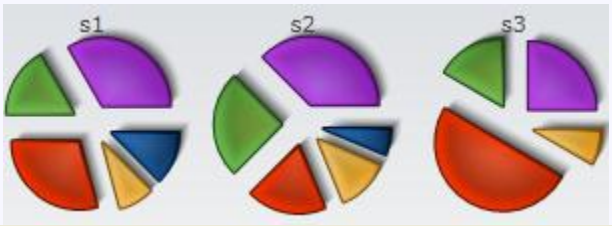
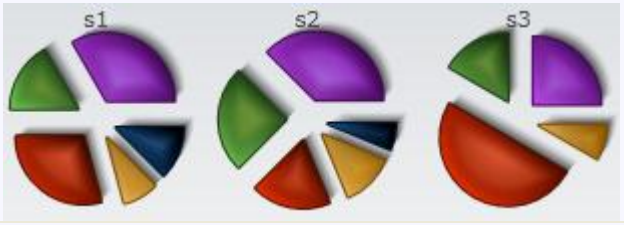
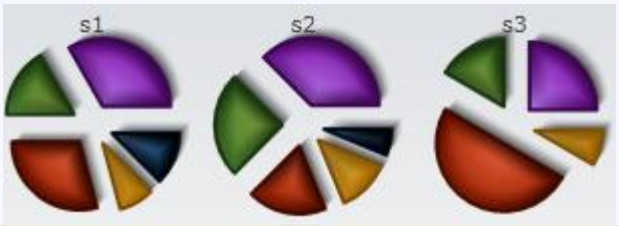
You can control the light angle, saturation, and transparency of the light source of the data series using the **BorderEffects** class. The **BorderEffects** class includes the follow properties:

Property	Description
BorderStyle	Gets or sets the border style.
LightAngle	Gets or sets the light direction.
Thickness	Gets or sets the thickness of the border.

BorderStyle Property

You can achieve a brightening or darkening effect on the data series using the BorderEffect.BorderStyle property. The BorderEffect.BorderStyle property provides three options: light, dark, and combo. The Light value will make the current data series color appear lighter in color. The Dark value produces a dark color effect for the current data series color. The Combo value produces a combination of the light and dark values for the current data series color.

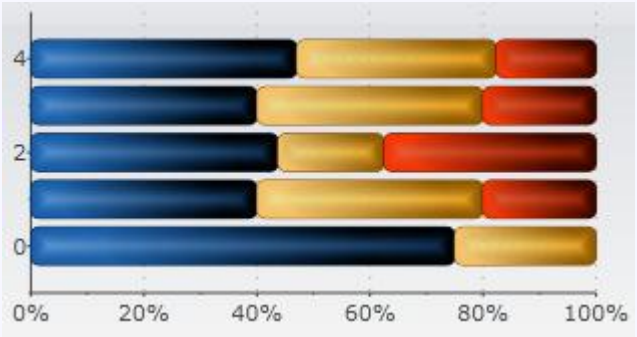
The following table illustrates the effects of each value for the BorderEffect.BorderStyle property:

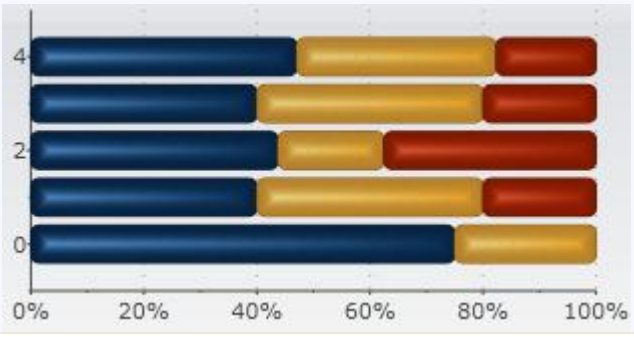
Value	Result
BorderStyle.Light	
BorderStyle.Combo	
BorderStyle.Dark	

LightAngle Property

You can change the angle of the visual rendering within the data series by setting its **LightAngle** property to a different degree. The value of the **LightAngle** property ranges from -180 to 180 degrees.

The following table illustrates the data series with a LightAngle value of 53 degrees and the data seires with a no LightAngle applied to it:

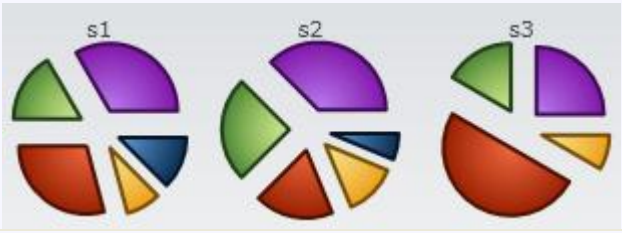
Value	Result
53 degree angle	

None	

Thickness Property

As you increase the **Thickness**, the light source within each series gradually decreases. When the Thickness property is set to a value higher than 25 the gradient light effects are not as noticeable.

The following table illustrates the effects of the various values for the BorderEffect.Thickness property:

Numerical Value	Result
0	
10	
25	

Shadow Effects

You can create shadow effects for the data series using the ShadowEffects class. The ShadowEffects class includes the following properties:

Property	Description
Color	Gets or sets the shadow color.
Depth	Gets or sets the shadow depth.

LightAngle	Gets or sets the light direction.
Opacity	Gets or sets the shadow opacity (0-1).
Softness	Gets or sets the shadow softness. 0 is sharp shadow and 1 is soft shadow.

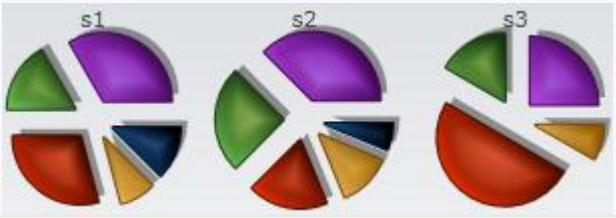
Color Property

You can apply any color to the shadow using the Color property.

Depth Property

You can use the Depth property to determine the depth of the shadow. Increasing the Depth value will make the shadow wider and appear further away from its associated object. Decreasing the Depth value will make the shadow narrower and appear closer to its associated object.

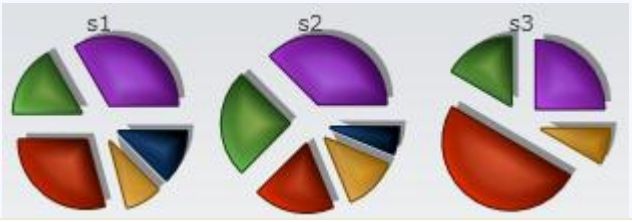
The following table illustrates the effects of the Depth property when set to different values.

Value	Result
5	
10	

LightAngle Property

You can change the angle of the visual rendering for the shadow by setting its **LightAngle** property to a different degree. The value of the **LightAngle** property ranges from -180 to 180 degrees.

The following table illustrates the data series with a LightAngle value of 44 degrees and the data seires with a no LightAngle applied to it:

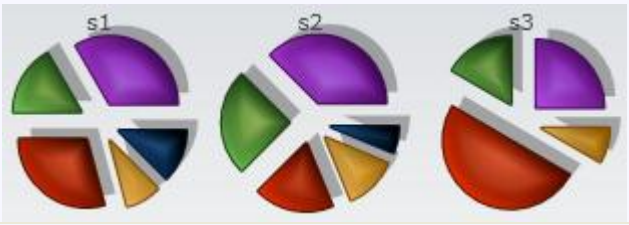
Value	Result
44 degrees	

None	

Opacity Property

The Opacity property controls the opacity level for the shadow. You can darken the shadow around the data series by increasing value of the Opacity property. The numerical values range from 0.0 to 1.0. A value of 0 produces no color and a value of 1.0 produces a dark solid color.

The following table illustrates the data series with an **Opacity** value of 0.3 and the data series with an Opacity value of 1:

Value	Result
0.3	
1.0	

Softness Property

To make the shadow effects on the dataseries appear softer use the Softness property. A value of 0 will produce a sharp shadow that will make the shadow appear further from its associated object. A value of 1 will produce a soft shadow and make the shadow appear closer to its associated object.

The following table illustrates the data series with a Softness value of 0 and the data seires with a Softness value of 1:

Value	Result
0	

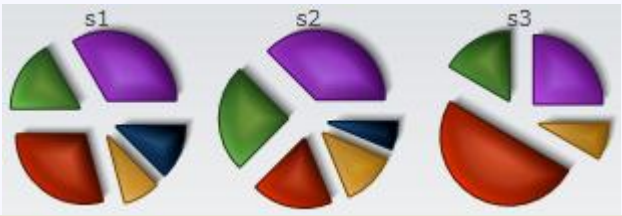
1	

Chart for Windows Phone Task-Based Help

The task-based help assumes that you are familiar with programming in Visual Studio .NET and know how to use the C1Chart control in general. If you are unfamiliar with the **ComponentOne Chart for Windows Phone** product, please see the **Chart for Windows Phone** Quick Start first.

Each topic in this section provides a solution for specific tasks using the **ComponentOne Chart for Windows Phone** product.

Each task-based help topic also assumes that you have created a new Windows Phone project.

Axis Tasks

The following topics show how to customize the appearance of the chart axes.

Setting the Color of the Axis Labels using the Axis.AnnoCreated Event

The following topic shows how to set the color of the AxisY labels depending upon its values:

- Visual Basic

```
chart.View.AxisY.AnnoCreated += Function(s, e)
Dim label = DirectCast(e.Label, TextBlock)
If e.Value >= 0 Then
      label.Foreground = Brushes.Red
Else
      label.Foreground = Brushes.Blue
End If

End Function
```

- C#

```
chart.View.AxisY.AnnoCreated += (s, e) =>
{
var label = (TextBlock)e.Label;
if (e.Value >= 0)
label.Foreground = Brushes.Red;
else
label.Foreground = Brushes.Blue;
};
```

Change the Rendering Mode Method

High performance bitmap rendering can be applied to line and symbol chart types using the **DataSeries.RenderMode** property to change the rendering method.

Pie Chart Tasks

The following topics include tasks for the Pie Charts.

Adding Offset for Even Slices

To add offset for even slices use the PieSlice class and its Offset property to control the radial offeset of slice from the original position:

- Visual Basic

```
Dim ds = New DataSeries() With { _
      Key .ValuesSource = New Double() {1, 2, 2, 1, 2, 1, _
            2} _
}
ds.PlotElementLoaded += Function(s, e)
Dim slice = TryCast(s, PieSlice)
If slice IsNot Nothing Then
      ' add offset for even slices
      If (slice.DataPoint.PointIndex Mod 2) Is 0 Then
            slice.Offset = 15
      End If
End If

End Function

chart.Data.Children.Add(ds)
chart.ChartType = ChartType.Pie
```

- C#

```
var ds = new DataSeries() { ValuesSource = new double[] { 1, 2, 2, 1, 2,
1, 2 } };
ds.PlotElementLoaded += (s, e) =>
{
var slice = s as PieSlice;
if (slice != null)
{
// add offset for even slices
if ((slice.DataPoint.PointIndex % 2) == 0)
slice.Offset = 15;
}
};

chart.Data.Children.Add(ds);
chart.ChartType = ChartType.Pie;
```

Radar Chart Tasks

The following topics include tasks for the Radar charts.

Adding Different Radial Axes on the Same Radar Plot

To add an auxiliary axis for the second(index=1) data point on the radar plot, complete the following:

- Visual Basic

```
' add auxiliary axis for second(index=1) data point.
chart.View.Axes.Add(New Axis() With { _
      Key .AxisType = AxisType.Y, _
```

```
      Key .RadarPointIndices = New Integer() {1} _
})
```

- C#

```
// add auxiliary axis for second(index=1) data point.
chart.View.Axes.Add(
new Axis() { AxisType= AxisType.Y, RadarPointIndices=new int[] {1} });
```

Controlling the Appearance of the Axes Labels on the Radar Chart

To control the appearance of the axes labels on the Radar chart, use the Axis.RadarLabelVisibility property. There are three available options that specify in its corresponding enumeration:

- RadarLabelVisibility.First - the annotation labels appears only on the first radial axis(default).
- RadarLabelVisibility.All - the annotation labels appears only on each radial axis(default).
- RadarLabelVisibility.None – No labels. The property has effect only on radar charts.

Stacked Chart Tasks

The following topics include tasks for the Stacked charts.

Adding Five Points to the Data Series

The following topic shows how to add different points to the XYDataSeries in a ColumnStacked chart:

- Visual Basic

```
' 5 points
Dim ds1 = New XYDataSeries() With { _
      Key .XValuesSource = New Double() {1, 2, 3, 4, 5}, _
      Key .ValuesSource = New Double() {1, 1, 1, 1, 1} _
}
chart.Data.Children.Add(ds1)

' 3 points
Dim ds2 = New XYDataSeries() With { _
      Key .XValuesSource = New Double() {1, 3, 5}, _
      Key .ValuesSource = New Double() {1, 1, 1} _
}
chart.Data.Children.Add(ds2)

chart.ChartType = ChartType.ColumnStacked
```

- C#

```

// 5 points
var ds1 = new XYDataSeries()
{
XValuesSource = new double[]{ 1, 2, 3, 4, 5},
ValuesSource = new double[] { 1, 1, 1, 1, 1}
};
chart.Data.Children.Add(ds1);

// 3 points
var ds2 = new XYDataSeries()
{
XValuesSource = new double[] { 1, 3, 5 },
ValuesSource = new double[] { 1, 1, 1 }
```

```
};
chart.Data.Children.Add(ds2);

chart.ChartType = ChartType.ColumnStacked;
```

Inheriting Data Context from the Parent Chart

The chart axes and series can inherit data context from the parent chart like the following scenario:

XAML chart definition:

```
<c1:C1Chart Name="chart" ChartType="Column" >
<c1:C1Chart.Data>
<c1:ChartData>
<c1:DataSeries SymbolFill="{Binding Brush1}" Values="1,2,3,4" />
<c1:DataSeries SymbolFill="{Binding Brush2}" Values="4,3,2,1" />
</c1:ChartData>
</c1:C1Chart.Data>
<c1:C1Chart.View>
<c1:ChartView>
<c1:ChartView.AxisX>
<c1:Axis Max="{Binding XMax}" />
</c1:ChartView.AxisX>
<c1:ChartView.AxisY>
<c1:Axis Max="{Binding YMax}" />
</c1:ChartView.AxisY>
</c1:ChartView>
</c1:C1Chart.View>
</c1:C1Chart>
```

where data context is

```
public class ChartDataContext
{
public Brush Brush1 { get; set; }
public Brush Brush2 { get; set; }

public double XMax { get; set; }
public double YMax { get; set; }
}
```

```
// set data context
chart.DataContext = new ChartDataContext()
{
Brush1 = new SolidColorBrush(Colors.Red),
Brush2 = new SolidColorBrush(Colors.Blue),
XMax = 10,
YMax = 10
};
```

Adding a ScrollBar to C1Chart

You can add a scrollbar to C1Chart by linking the chart axis with the standard scrollbar like the following:

- XAML

```
<Grid x:Name="LayoutRoot">
    <Grid.RowDefinitions>
      <RowDefinition />
      <RowDefinition Height="Auto" />
    </Grid.RowDefinitions>
    <c1chart:C1Chart x:Name="chart" ></c1chart:C1Chart>
    <ScrollBar x:Name="sb" Orientation="Horizontal" Grid.Row="1" />
</Grid>
```

- C#

```
// create some data
      int npts = 1000;
      double[] x = new double[npts], y = new double[npts];
      for (int i = 0; i < npts; i++)
      {
        x[i] = i; y[i] = 100 * Math.Sin(0.1 * i) * Math.Cos(0.01 * i);
      }

      // add data to the chart
      chart.Data.Children.Add(new XYDataSeries() { XValuesSource = x,
ValuesSource = y });
      chart.ChartType = ChartType.Line;

      // setup axis
      double xscale = 0.05; // show only 1/20 of the full data range
      chart.View.AxisX.Min = 0; chart.View.AxisX.Max = npts-1;
      chart.View.AxisX.Scale = xscale;

      sb.Minimum = 0; sb.Maximum = 1;
      sb.SmallChange = 0.5*xscale; sb.LargeChange = xscale;
      sb.ViewportSize = 1.0 / (1.0 - xscale) - 1.0;
      // connect axis with toolbar
      sb.ValueChanged += (s, e) => chart.View.AxisX.Value = sb.Value;
```

Rotating the Chart Labels in the X-Axis

To change the label rotation for the X-Axis, use the **AnnoAngle** property like the following:

```
AxisX.AnnoAngle = -90
```

Creating a Custom Axis Label to Set the Mark at the Middle of the Year

Use custom axis labels to set the mark at the middle of year like in the following code:

- Visual Basic

```
chart.View.AxisX.ItemsSource = New DateTime() {New DateTime(2006, 1,
1).AddDays(0.5 * 365), New DateTime(2007, 1, 1).AddDays(0.5 * 365)}
```

- C#

```
chart.View.AxisX.ItemsSource = new DateTime[]
   {
     new DateTime(2006,1,1).AddDays(0.5*365),
     new DateTime(2007,1,1).AddDays(0.5*365),
     //...
   };
```

Breaking Chart Lines when the Y-Value is Null

To break the chart lines when the Y-Value is null, use the following code:

- Visual Basic

```
dataSeries.Display = SeriesDisplay.ShowNaNGap
```

- C#

```
dataSeries.Display = SeriesDisplay.ShowNaNGap;
```

Exporting the Chart Image to the PDF on the Client

To export the chart image to the PDF on the client, use the following code:

- Visual Basic

```
Private Sub Button_Click(ByVal sender As Object, ByVal e As
RoutedEventArgs)
    Dim wb As New WriteableBitmap(chart, Nothing)
    Dim doc As New C1PdfDocument()
    doc.Compression = CompressionLevelEnum.BestSpeed
    doc.DrawImage(wb, New Rect(New Point(), doc.PageSize),
ContentAlignment.TopLeft, Stretch.None)

    Dim sfd As New SaveFileDialog()
    If sfd.ShowDialog() = True Then
        Using stream = sfd.OpenFile()
            doc.Save(stream)
        End Using
    End If
End Sub
```

- C#

```
private void Button_Click(object sender, RoutedEventArgs e)
{
   WriteableBitmap wb = new WriteableBitmap(chart, null);
   C1PdfDocument doc = new C1PdfDocument();
   doc.Compression = CompressionLevelEnum.BestSpeed;
   doc.DrawImage(wb, new Rect(new Point(),doc.PageSize),
ContentAlignment.TopLeft, Stretch.None);

   SaveFileDialog sfd = new SaveFileDialog()
   {
      DefaultExt = "pdf",
      Filter = "Pdf files (*.pdf)|*.pdf",
   };
   if (sfd.ShowDialog() == true)
   {
     using (var stream = sfd.OpenFile())
     {
        doc.Save(stream);
     }
   }
}
```

Adding Data Values to a Pie Chart

The following code adds data values to a Pie chart:

- Visual Basic

```
Dim names As String() = New String() {"Apples", "Oranges", "Peaches"}
Dim values As Double() = New Double() {20R, 10R, 7R}

Dim ds As New DataSeries()
chart.Data.Children.Add(ds)

chart.Data.ItemNames = names
chart.ChartType = ChartType.Pie
```

- C#

```
string[] names = new string[] { "Apples", "Oranges", "Peaches"};
double[] values = new double[] { 20.0, 10.0, 7.0 };

DataSeries ds = new DataSeries() { ValuesSource = values};
chart.Data.Children.Add(ds);

chart.Data.ItemNames = names;
chart.ChartType = ChartType.Pie;
```

Converting DataSet to DataSeries

You can convert the DataSet to DataSeries using just one DataSeries like the following:

- XAML

```
C1Chart1.Theme = ChartTheme.Office2003Classic
```

- Visual Basic

```
Dim dt As New DataTable()
dt.Columns.Add("Name", GetType(String))
dt.Columns.Add("Value", GetType(Double))
dt.Rows.Add("Apples", 20R)
dt.Rows.Add("Oranges", 10R)
dt.Rows.Add("Peaches", 7R)

chart.Data.ItemNameBinding = New Binding("Name")
chart.Data.Children.Add(New DataSeries())
chart.Data.ItemsSource = dt.DefaultView
chart.ChartType = ChartType.Pie
```

- C#

```
DataTable dt = new DataTable();
dt.Columns.Add("Name", typeof(string));
dt.Columns.Add("Value", typeof(double));
dt.Rows.Add("Apples", 20.0);
dt.Rows.Add("Oranges", 10.0);
dt.Rows.Add("Peaches", 7.0);

chart.Data.ItemNameBinding = new Binding("Name");
chart.Data.Children.Add(new DataSeries() { ValueBinding = new
Binding("Value") });
chart.Data.ItemsSource = dt.DefaultView;
```

```
chart.ChartType = ChartType.Pie;
```

Finding the Default Color Used for the Series

When defining a series programmatically you can find out what series color will be drawn in using the Loaded event, like the following:

- C#

```
DataSeries ds = new DataSeries() { ValuesSource = new double[] { 1, 2, 3 }
};
ds.Loaded += (s, e) => // fired for each plot element in data series
{
    PlotElement pe = (PlotElement)s;
    SolidColorBrush sb = pe.Fill as SolidColorBrush;
    if( sb!=null)
        Debug.WriteLine(sb.Color);
};

chart.Data.Children.Add(ds);
```

Setting Custom Colors in DataSeries.Loaded Event

You can set different colors for the data point in the same series using the Loaded event like the following:

- C#

```
DataSeries ds = new DataSeries()
 {
   ValuesSource = new double[] {-2, -1, 1, 2, 2, 1, -1, -3 }
 };

SolidColorBrush red = new SolidColorBrush(Colors.Red);
SolidColorBrush blue = new SolidColorBrush(Colors.Blue);

ds.Loaded += (s, e) =>
   {
     PlotElement pe = s as PlotElement;
     if (pe != null &&
       pe.DataPoint.PointIndex >= 0) // only points
     {
       // set color depending on point value
       if (pe.DataPoint.Value >= 0)
         pe.Fill = red;
       else
         pe.Fill = blue;
     }
   };

chart.Data.Children.Add(ds);
chart.ChartType = ChartType.LineSymbols;
```

Showing Trend Marks in C1Chart

The following example code shows how to use the trend indicators in the chart with triangles used as arrows:

- Visual Basic

```
chart.ChartType = ChartType.LineSymbols
```

```
Dim values As Double() = New Double() {1, 4, 3, 2, 4, 7}

Dim ds As New DataSeries()

ds.Loaded += Function(sender, args) Do
    Dim rp As RPolygon = TryCast(sender, RPolygon)

    If rp IsNot Nothing Then
        Dim pi As Integer = rp.DataPoint.PointIndex
        If pi > 0 Then
            'rotate triangle and change its color
            If values(pi) > values(pi - 1) Then
                rp.RenderTransform = New RotateTransform()
                rp.RenderTransformOrigin = New Point(0.5, 0.5)
                rp.Fill = New SolidColorBrush(Colors.Green)
            ElseIf values(pi) < values(pi - 1) Then
                rp.RenderTransform = New RotateTransform()
                rp.RenderTransformOrigin = New Point(0.5, 0.5)
                rp.Fill = New SolidColorBrush(Colors.Red)
            End If
        End If
    End If
End Function

chart.Data.Children.Add(ds)
```

- C#

```
chart.ChartType = ChartType.LineSymbols;

double[] values = new double[] { 1, 4, 3, 2, 4, 7 };

DataSeries ds = new DataSeries()
{
  ConnectionStroke = new SolidColorBrush(Colors.DarkGray),
  ConnectionStrokeThickness=1,
  Symbol = new RPolygon(),
  SymbolSize = new Size(18,12),
  ValuesSource = values
};

ds.Loaded += (sender, args) =>
  {
    RPolygon rp = sender as RPolygon;

    if (rp != null)
    {
      int pi = rp.DataPoint.PointIndex;
      if (pi > 0)
      {
        //rotate triangle and change its color
        if ( values[pi] > values[pi-1] )
        {
          rp.RenderTransform = new RotateTransform() { Angle = -90 };
          rp.RenderTransformOrigin = new Point(0.5, 0.5);
          rp.Fill = new SolidColorBrush(Colors.Green);
        }
```

```
        else if (values[pi] < values[pi - 1])
        {
          rp.RenderTransform = new RotateTransform() { Angle = 90 };
          rp.RenderTransformOrigin = new Point(0.5, 0.5);
          rp.Fill = new SolidColorBrush(Colors.Red);
        }
      }
    }
  };

chart.Data.Children.Add(ds);
```

Placing the Chart Annotations on Top

To place the chart annotations on top, use the following code:

- Visual Basic

```
chart.View.AxisX.Position = AxisPosition.Far
```

- C#

```
chart.View.AxisX.Position = AxisPosition.Far;
```

Display DataSeries Label as Tooltip on Mouseover in Line Chart

To display DataSeries label as a tooltip on mouseover in a Line chart, use the following code:

- C#

```
DataSeries ds = new DataSeries()
{
   ValuesSource = new double[] { 1, 2, 3, 2 },
   ConnectionStrokeThickness = 5
};
ds.Loaded += (s, e) =>
{
  PlotElement pe = s as PlotElement;
  if (pe != null)
    pe.MouseEnter += (sender, ea) =>
     {
       Debug.WriteLine("Series index = {0}", pe.DataPoint.SeriesIndex);
     };
};

chart.Data.Children.Add(ds);
chart.ChartType = ChartType.Line;
```

Showing the X-Values in the ToolTip

To show the x-values in the ToolTip, use the following XAML and then the Visual Basic or C# code that creates the chart and uses the template:

- XAML

```
<c1chart:C1Chart x:Name="chart">
   <c1chart:C1Chart.Resources>
      <DataTemplate x:Key="tt">
        <StackPanel Orientation="Vertical">
          <!-- XAsString returns xvalue that is formatted similar to x-
axis -->
```

```
          <TextBlock Text="{Binding XAsString}" />
          <TextBlock Text="{Binding Y}" />
        </StackPanel>
      </DataTemplate>
    </c1chart:C1Chart.Resources>
</c1chart:C1Chart>
```

- Visual Basic

```
Dim cnt As Integer = 20
Dim x As DateTime() = New DateTime(cnt - 1) {}
Dim y As Double() = New Double(cnt - 1) {}
Dim rnd As New Random()
For i As Integer = 0 To cnt - 1
    x(i) = DateTime.Today.AddDays(-i)
    y(i) = rnd.NextDouble() * 100
Next

chart.Data.Children.Add(New XYDataSeries())

chart.View.AxisX.IsTime = True
chart.ChartType = ChartType.LineSymbols
```

- C#

```
int cnt = 20;
  DateTime[] x = new DateTime[cnt];
  double[] y = new double[cnt];
  Random rnd = new Random();
  for (int i = 0; i < cnt; i++)
  {
     x[i] = DateTime.Today.AddDays(-i);
     y[i] = rnd.NextDouble() * 100;
  }

  chart.Data.Children.Add(new XYDataSeries()
  {
     XValuesSource = x, ValuesSource = y,
     PointTooltipTemplate = (DataTemplate)chart.Resources["tt"]
  });

  chart.View.AxisX.IsTime = true;
  chart.ChartType = ChartType.LineSymbols;
```

Creating Wrap Around Text Blocks for Large Number of Series

To create wrap around text blocks for large number of series use the following XAML and then use the Visual Basic or C# code:

- XAML

```
<c1chart:C1Chart x:Name="chart">
      <c1chart:C1ChartLegend Position="Top">
        <c1chart:C1ChartLegend.ItemsPanel>
          <ItemsPanelTemplate>
            <c1:C1WrapPanel ItemHeight="20" ItemWidth="80"/>
          </ItemsPanelTemplate>
        </c1chart:C1ChartLegend.ItemsPanel>
      </c1chart:C1ChartLegend>
</c1chart:C1Chart>
```

- Visual Basic

```
For i As Integer = 0 To 19
    chart.Data.Children.Add(New DataSeries())
Next
```

- C#

```
for (int i = 0; i < 20; i++)
   chart.Data.Children.Add(new DataSeries() { Label = "s " + i.ToString()
});
```

Creating a Mouse Move Event for Chart with Multiple Lines

You can use the **PlotElement.MouseEnter** event to create a mouse move event for chart with multiple lines like the following:

- C#

```
Lines lines = new Lines() { StrokeThickness = 4 };
lines.MouseEnter += (s, e) =>
{
   // fires when mouse is over the lines
   Debug.WriteLine("MouseEnter");
   // show coordinates
   ...
};
dataSeries.Connection = lines;
```