Formatting Bound Data

Agenda

- StringFormat
- Data Converters
- Data Templates
  - DataTriggers

FORMATTING BOUND DATA WITH STRINGFORMAT

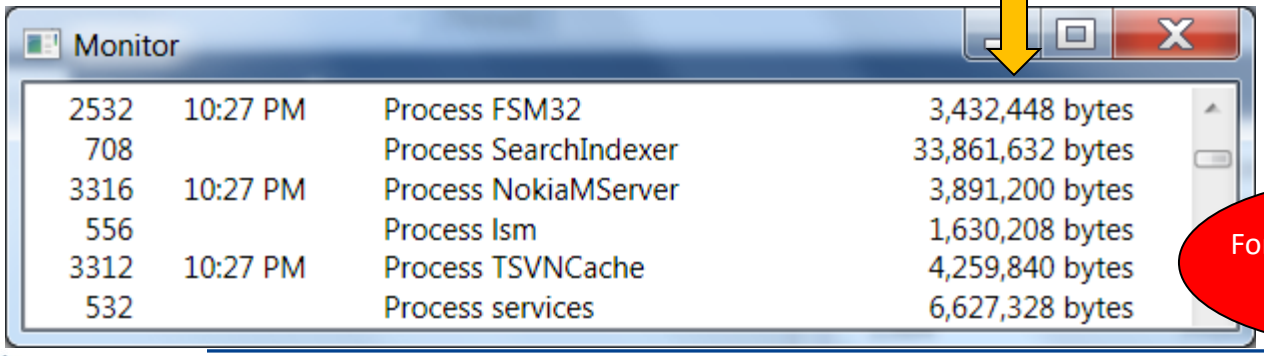
Use of StringFormat

- When you have some data, you can make it look much better by adding some simple formatting

```
<TextBlock Text="{Binding Path=WorkingSet,
                          StringFormat=N0}"
    />
```

- Or if you want to add some text:

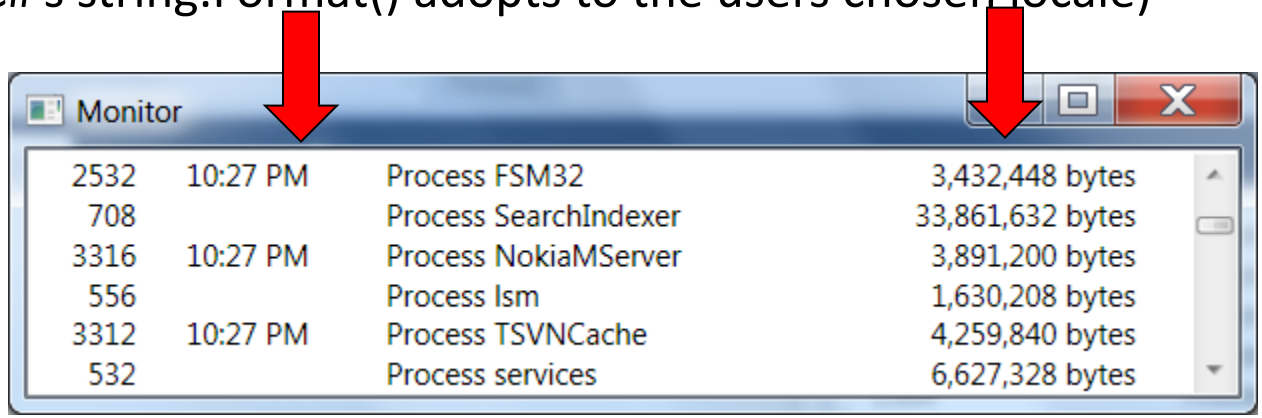
```
<TextBlock Text="{Binding Path=WorkingSet,
                          StringFormat=\{0:N0\} bytes}"
    />
```



Formatting bound data
Demo 01

StringFormat Limitations

- XAML's StringFormat has a very serious limitation:
  - It assumes use of US culture!
  - (C#'s string.Format() adopts to the users chosen locale)



- To avoid this you must either
  - implement your own converter in C#, or
  - **you can and some code to your App class that fixes the problem:**

```
Thread.CurrentThread.CurrentUICulture = Thread.CurrentThread.CurrentCulture;
FrameworkElement.LanguageProperty.OverrideMetadata(typeof(FrameworkElement),
                new
FrameworkPropertyMetadata(XmlLanguage.GetLanguage(CultureInfo.CurrentCulture.
Name)));
```

DATA CONVERTERS

Data Converters

- A data converter is a chunk of code that converts one value into another
  - E.g. we can take a number like 3723264 and convert it to 3 MiB,
  - or we could take the same number and, via some algorithm, convert it to a color
- Data converters add a huge amount of power to what you can do with XAML
- To create a data converter, you create a class that implements the `IValueConverter` interface

- Advice:
  - Don't reinvent the wheel …
  - You can find many converters on the Internet
  - E.g. https://github.com/kentcb/WPFConverters

Data Converter Example

```
class NumberToFormattedTextValueConverter : IValueConverter
{
  public object Convert(object value, Type targetType,
                        object parameter,
                        System.Globalization.CultureInfo culture)
  {
    Int64 size = System.Convert.ToInt64(value);
    size = size / 1024;
    if (size < 1024)
      return size.ToString() + " KiB";
    else
      return (size / 1024).ToString() + " MiB";
  }

  public object ConvertBack(object value, Type targetType,
                            object parameter,
                            System.Globalization.CultureInfo culture)
  {
    throw new NotImplementedException();
  }
}
```

```
class NumberToFormattedTextValueConverter : IValueConverter
{
  public object Convert(object value, Type targetType,
                        object parameter,
                        System.Globalization.CultureInfo culture)
  {
    Int64 size = System.Convert.ToInt64(value);
    string units = (parameter != null) ? parameter.ToString() : "IEC";

    switch (units)
    {
      case "IEC":
           size = size / 1024;
           if (size < 1024)
             return size.ToString() + " KiB";
           else
             return (size / 1024).ToString() + " MiB";
      case "BINARYSI":
             size = size / 1024;

                    if (size < 1024)
                        return size.ToString() + " KB";
                    else
                        return (size / 1024).ToString() + " MB";
      case "SI":
      …
```

Formatting bound data
Demo 02

DATA TEMPLATES

Control ContentPresenter Algorithm

1. If Content is of type UIElement, then add it to the display tree
2. **If ContentTemplate/ItemTemplate is set, use that to create a UIElement instance and add it to the display tree**
3. If ContentTemplateSelector is set, use that to find a template, use the template to create a UIElement instance, and add it to the display tree
4. If the data type of Content has a data template associated with it, use that to create a UIElement instance
5. If the data type of Content has a TypeConverter instance associated with it that can convert to type UIElement, convert Content and add it to the display tree
6. If the data type of Content has a TypeConverter instance associated with it that can convert to a string, wrap Content in TextBlock and add it to the display tree
7. Finally, call ToString on Content, wrap it in TextBlock, and add it to the display tree

Data Templates

- A DataTemplate is a class in the WPF framework that we use to specify the visualization of some data objects
  - a data template is a tree of elements to expand in a particular context
- **We use data templates to provide an application with the capability to render nonvisual objects**
- DataTemplate objects are particularly useful when you are binding an ItemsControl such as a ListBox to an entire collection

```
<ListBox.ItemTemplate>
  <DataTemplate>
    <TextBlock Text="{Binding Path=ProcessName}"/>
  </DataTemplate>
</ListBox.ItemTemplate>
```

The binding mechanism assumes that we want to bind to whatever object we have available - in this case, the Process object in the current row of the ListBox

Data Template Example

- You will typically use a Panel of some kind as the top level element on a data template

```
<ListView.ItemTemplate>
  <DataTemplate>
    <WrapPanel>
      <TextBlock Text="{Binding Path=Id}" MinWidth="80" />
      <TextBlock Text="{Binding Path=ProcessName}"
MinWidth="180" />
      <TextBlock>
        <TextBlock.Text>
          <Binding Path="WorkingSet" />
        </TextBlock.Text>
      </TextBlock>
    </WrapPanel>
  </DataTemplate>
</ListView.ItemTemplate>
```

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TEMPLATES BASED ON TYPE

- If you have a list of different types of objects you can specify a DataType for your DataTemplates

```
<DataTemplate DataType="{x:Type io:Directory}">
```

- When a DataTemplate is needed for the specified type, the template targeted at that type will automatically be picked up

```
<Window xmlns:local="clr-namespace:TicTacToe">
  <Window.Resources>
    <Style TargetType="{x:Type Button}">
      <Setter Property="HorizontalContentAlignment" Value="Stretch" />
      <Setter Property="VerticalContentAlignment" Value="Stretch" />
    </Style>

    <DataTemplate DataType="{x:Type io:Directory}">
       ...
    </DataTemplate>

    <DataTemplate DataType="{x:Type io:File}">
       ...
    </DataTemplate>
```

DATATRIGGERS

DataTriggers

- DateTemplates have a DataTriggers property that can be used to set one ore more data triggers
- A data trigger is based on a data value of some kind
  - E.g. if a particular threshold is passed, then your text turns red

```
<DataTemplate.Triggers>
   <DataTrigger Binding="{Binding Path=PriorityClass}" Value="High">
       <Setter TargetName="wrapPanel1" Property="Background">
           <Setter.Value>
               <LinearGradientBrush>
                  <GradientStop Color="Salmon" Offset="0" />
                  <GradientStop Color="Salmon" Offset="0.4" />
                  <GradientStop Color="White" Offset="1" />
               </LinearGradientBrush>
           </Setter.Value>
       </Setter>
   </DataTrigger>
</DataTemplate.Triggers>
```

Smart use of DataTrigger

- The fact that you can only do a single comparison for a trigger may seem like a serious limitation
  - but it can be over come by use of binding and a converter
- E.g. if we want to highlight rows that have a memory size greater than a certain size, we can create an IsLargeValueConverter that checks for a particular value and returns true if the size is larger

```
<DataTrigger Binding="{Binding Path=WorkingSet64,
             Converter={StaticResource isLarge},
             ConverterParameter=40000000}"
             Value="true" >
   <Setter TargetName="wrapPanel1" Property="Background">
      <Setter.Value>
         <SolidColorBrush Color="RosyBrown" />
      </Setter.Value>
   </Setter>
</DataTrigger>
```

```
public class IsLargeValueConverter : IValueConverter
{
    public object Convert(object value, Type targetType, object parameter
                          System.Globalization.CultureInfo culture)
    {
            Int64 convertedValue = System.Convert.ToInt64(value);
            Int64 threshold = System.Convert.ToInt64(parameter);
            if (convertedValue > threshold)
                return true;
            return false;
        }
```

Demo 03