Customize Layouts

Introduction

- .NET MAUI layout panels help you create consistent user interfaces for your application across a wide range of devices.

- Designing a user interface that's consistent across multiple devices is difficult because devices can be different sizes and have different pixel densities.
- Think about the different devices that are available: mobile, tablet, desktop, and so on.
- How do we create a user interface that looks similar on each?

- .NET MAUI provides layout panels to help you build consistent user interfaces.
- The layout panel is responsible for sizing and positioning the views of its children.

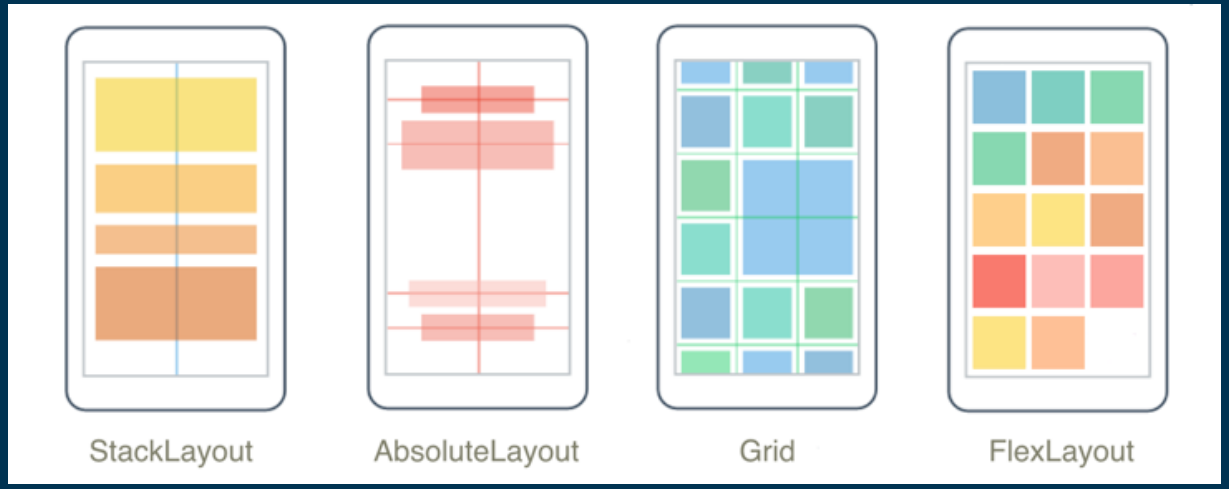
What is a Layout Panel?

- A layout panel is a .NET MAUI container that holds a collection of child views and determines their size and position.
- The layout panels automatically recalculate when the app size changes; for example, when the user rotates the device.

- **Note:**
  - The term view or child view refers to a control placed on a layout panel.
  - A view can be a label, a button, an entry field, or any other type of visual element supported by .NET MAUI.

What is a Layout Panel?

- .NET MAUI has multiple layout panels that you can choose from.
- Each panel manages its child views differently.

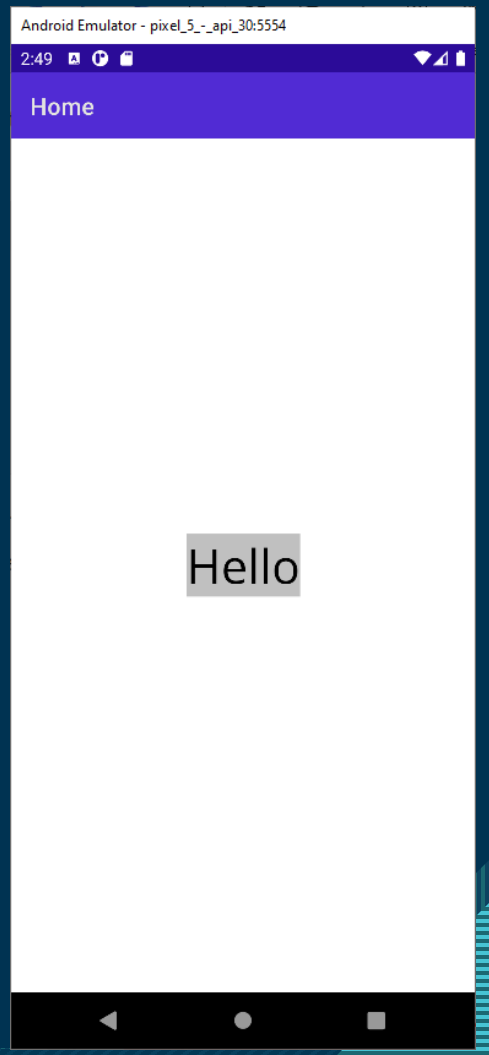


- `StackLayout`: arranges its child views in a single row or column.
  - In addition to `StackLayout`, there's also a new optimized `VerticalStackLayout` and `HorizontalStackLayout` when you don't need to change orientation.
- `AbsoluteLayout`: arranges its child views by using x and y coordinates.
- `Grid`: arranges its child views in cells that are created from the intersection of rows and columns.
- `FlexLayout`: arranges its child views like a `StackLayout` except that you can wrap them if they don't fit into a single row or column.

Default Size of a View

- If you don't specify the size of a view, it grows automatically to be exactly large enough to fit around its content.
- For example, consider this XAML:

```
<Label
    Text="Hello"
    BackgroundColor="Silver"
    VerticalOptions="Center"
    HorizontalOptions="Center"
    FontSize="40"/>
```

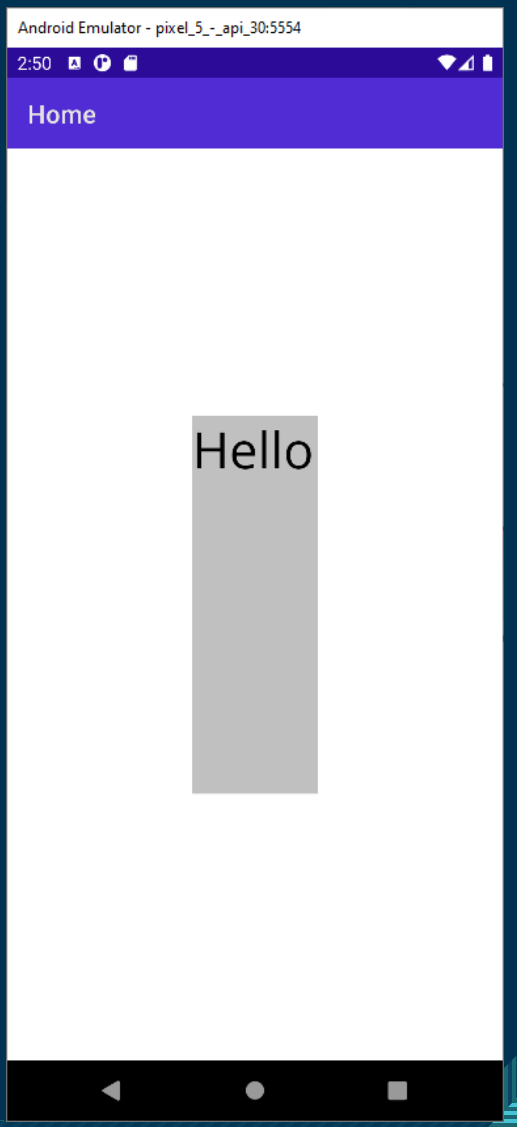


- It defines a label to display the word Hello on a silver background.
- Because you're not specifying the size, the label is automatically sized to fit around the word Hello.

Specify the Size of a View

- The `View` base class defines two properties that influence the size of a view:
  - `WidthRequest`: lets you specify the width
  - `HeightRequest`: lets you specify the height

```
<Label
    Text="Hello"
    BackgroundColor="Silver"
    VerticalOptions="Center"
    HorizontalOptions="Center"
    WidthRequest="100"
    HeightRequest="300"
    FontSize="40"/>
```



Specify the Size of a View

- One thing that's worth noting is the names of these properties.
- Both properties contain the word request.
- This word means the layout panel might not respect them at runtime.
- The layout panel reads these values during its sizing calculations and tries to accommodate the requests if it can.
- If there's not enough space, the layout panel is allowed to ignore the values.

Size Units

- When you set `WidthRequest` and `HeightRequest`, you use literal values like `100`.
- At the .NET MAUI level, these values don't have units.
  - They're not points or pixels.
  - They're just values of type double.

- .NET MAUI passes these values to the underlying operating system at runtime.
- It's the operating system that provides the context needed to determine what the numbers mean.

- On iOS, the values are called points.
- On Android, they're density-independent pixels.

Specify the Position of a View

- The `View` base class has two properties that you use to set the position of a view:
  - `VerticalOptions`
  - `HorizontalOptions`

- These settings influence how the view is positioned within the layout panel.
- You can specify that you want the view to align to one of the four edges of the layout panel.
- Or, that you want it to occupy the entire layout panel.

Exercise: Explore Alignment Options

- In this exercise, you use a .NET MAUI application to see the effect of the four primary alignment options when applied to a view contained in a `Grid`.
- You don't write code in the exercise.
- Instead, you use the provided solution and select buttons to change the layout options of a label.

- This module uses the .NET 8.0 SDK.
- Ensure that you have it installed.

- Clone or download the exercise repo from GitHub:
  - https://github.com/microsoftdocs/mslearn-dotnetmaui-customize-xaml-pages-layout
  - Open the starter solution from the exercise1/Alignment folder by using Visual Studio.

Exercise: Explore Alignment Options

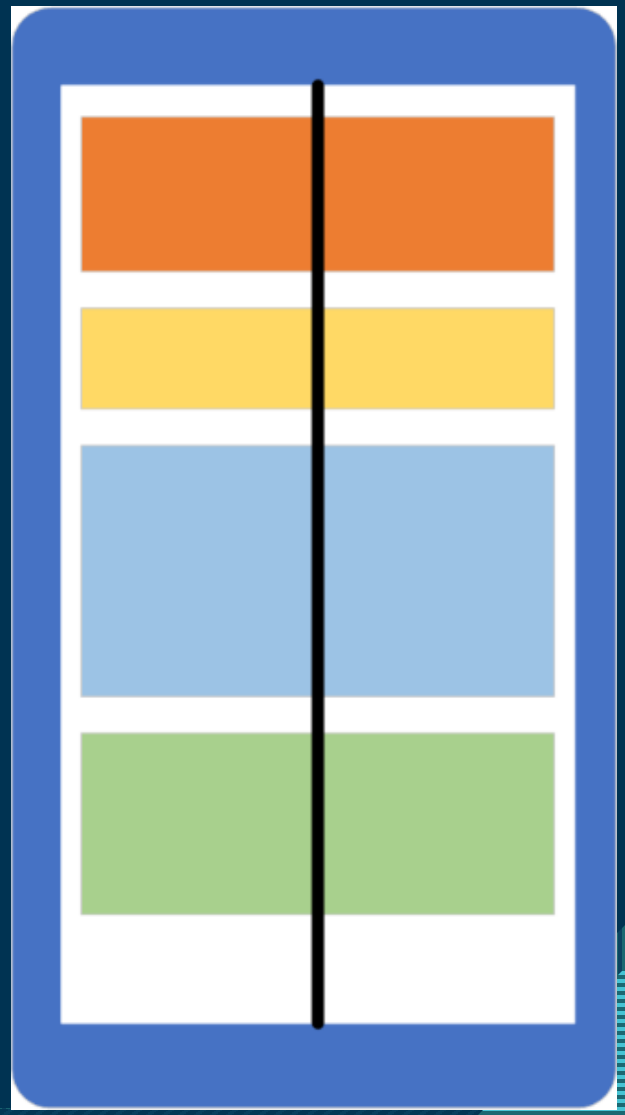
- Run the app to test `LayoutOptions` and see how the different layout options change the size and position of the label.
- Test the app by interacting with the buttons that change the horizontal and vertical `LayoutOptions`.

- This image shows what happens if you select Center for both the `Horizontal` and `Vertical` alignment options.

Arrange Views with StackLayout

- `StackLayout` is a layout container that organizes its child views left-to-right or top-to-bottom.
- The direction is based on its `Orientation` property, and the default value is top-to-bottom.

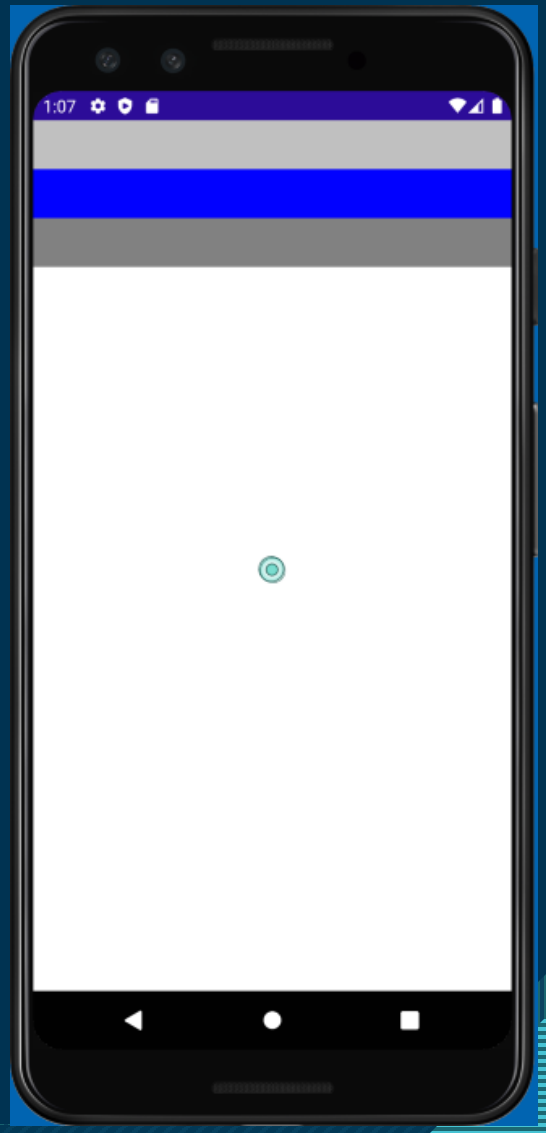
- `VerticalStackLayout` and `HorizontalStackLayout` are the preferred layouts to use when you know that your orientation isn't going to change, because they're optimized for performance.



How to Add Views to a StackLayout

- You can add child views inside the `StackLayout` tag.
- It automatically positions the views in a vertical list.

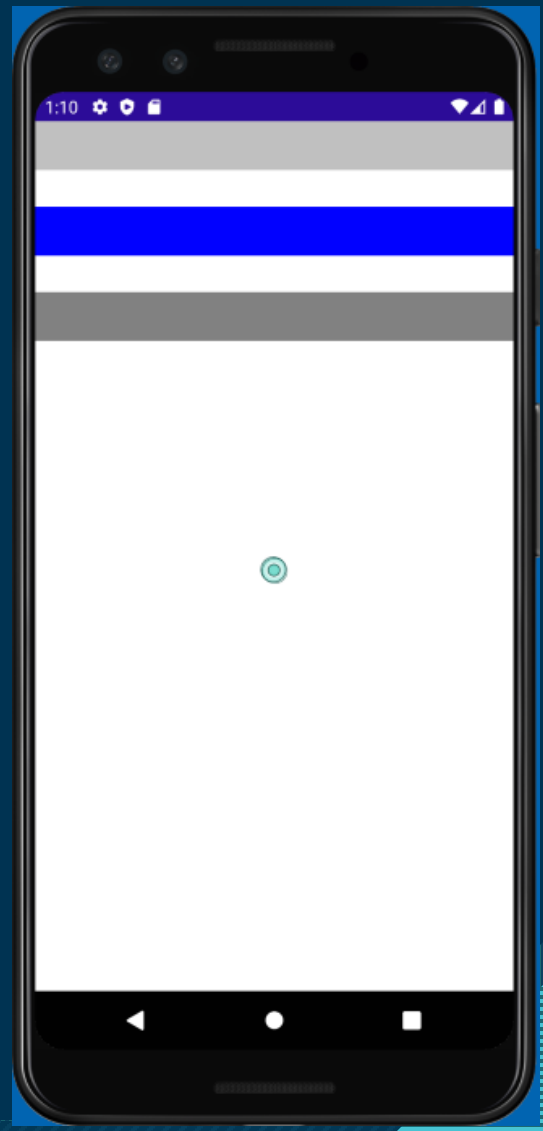
```
<StackLayout>
    <BoxView Color="Silver" />
    <BoxView Color="Blue" />
    <BoxView Color="Gray" />
</StackLayout>
```



How to Change the Space Between Views in a StackLayout

- It's common to want some space between the children of a `StackLayout`.
- `StackLayout` lets you control the space between each child by using the `Spacing` property.
- The default value is zero units, but you can set it to whatever looks good to you.

```
<StackLayout Spacing="30">
    <BoxView Color="Silver" />
    <BoxView Color="Blue" />
    <BoxView Color="Gray" />
</StackLayout>
```

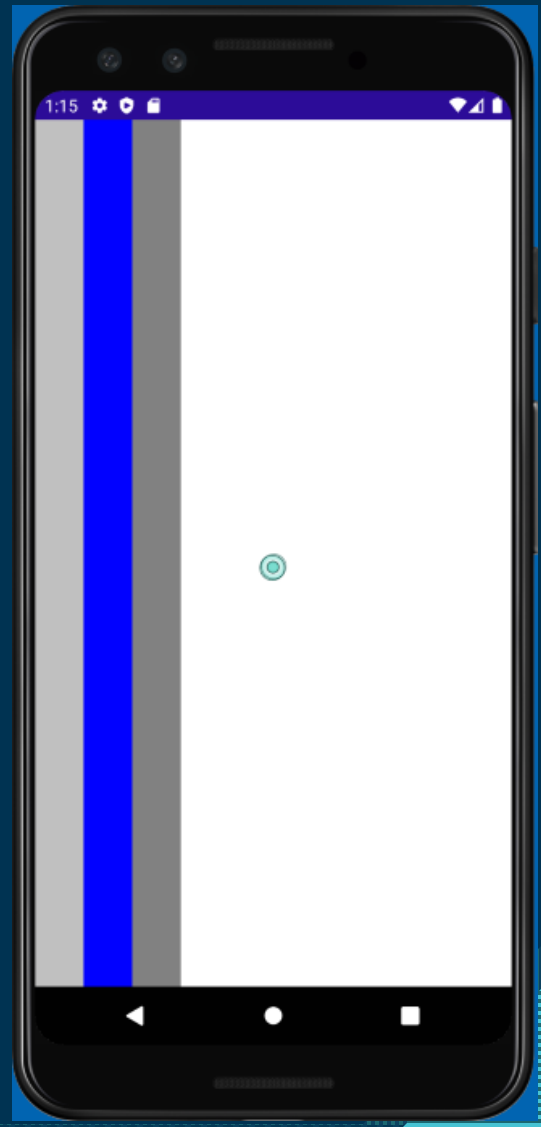


How to Set the Orientation of a StackLayout

- `StackLayout` lets you arrange children in either a column or a row.
- You control this behavior by setting its `Orientation` property.
- So far, we've been showing only a vertical `StackLayout`.

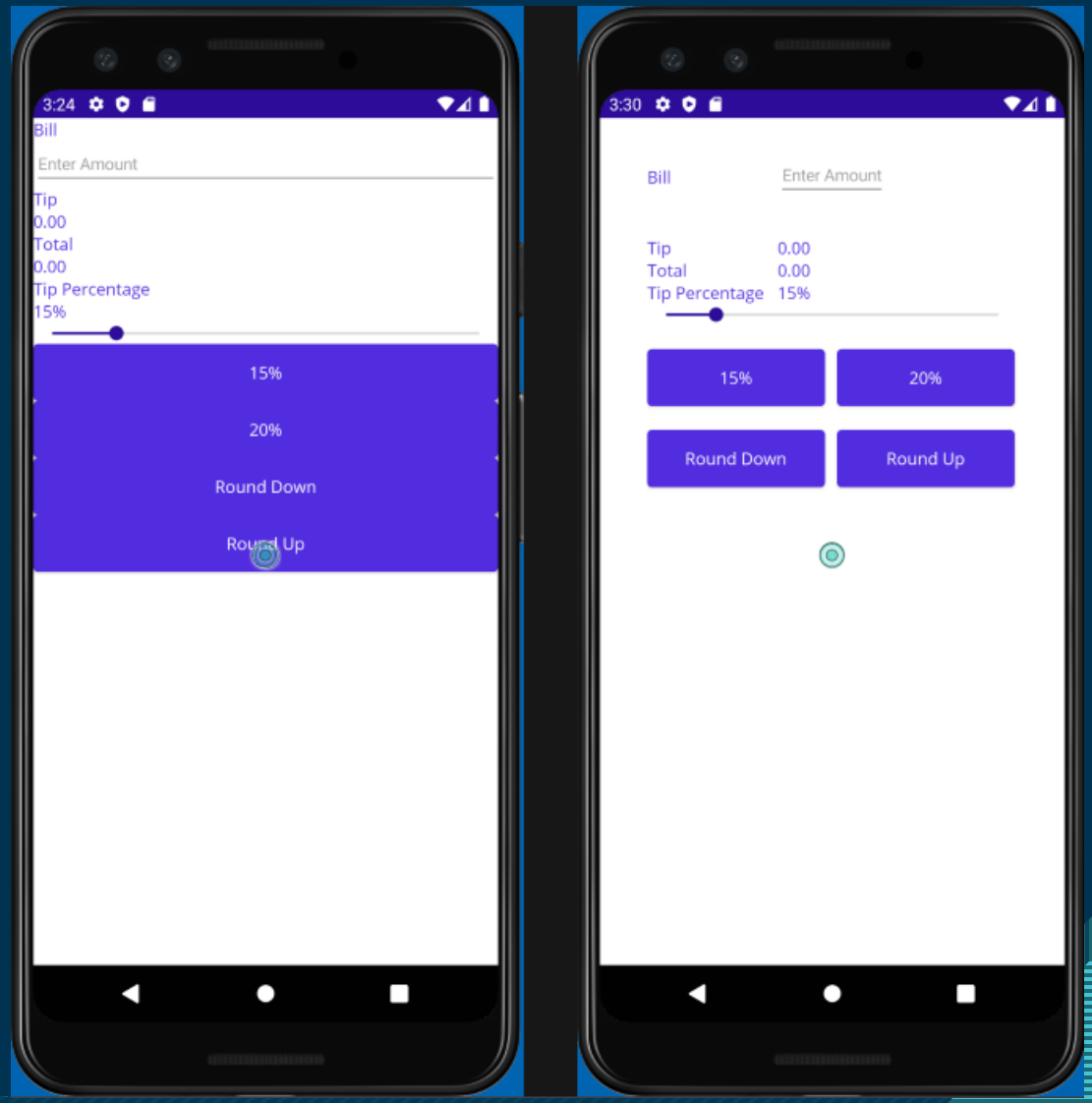
- `Vertical` is the default.

```
<StackLayout Orientation="Horizontal">
    <BoxView Color="Silver" WidthRequest="40"/>
    <BoxView Color="Blue" WidthRequest="40"/>
    <BoxView Color="Gray" WidthRequest="40"/>
</StackLayout>
```



Exercise: Use StackLayout to Build a User Interface

- In this exercise, you use nested `StackLayout` containers to arrange the views in your User Interface (UI).
- The first screenshot shows the layout implemented by the starter project, and the second one shows the layout for the completed project.
- Your job is to use `StackLayout` containers and `LayoutOptions` to turn the starter project into the completed version.



Exercise: Explore the Starter Solution

- The starter solution contains a fully functional tip calculator app.
- Start by exploring the UI to understand what the app does.
- Using Visual Studio, open the starter solution in the exercise2/TipCalculator folder in the repo that you cloned at the start of the previous exercise.
- Build and run the app on your preferred operating system.
- Enter a number into the text box and use the app to see how it works.
- Experiment with the tip amount buttons and the slider.
- When you're finished, close the app.

Exercise: Explore the Starter Solution

- Open MainPage.xaml. Notice that all the views are placed into one `VerticalStackLayout`.

```
<ContentPage xmlns="http://schemas.microsoft.com/dotnet/2021/maui"
             xmlns:x="http://schemas.microsoft.com/winfx/2009/xaml"
             xmlns:local="clr-namespace:TipCalculator"
             x:Class="TipCalculator.MainPage">
    <VerticalStackLayout>
        <Label Text="Bill" />
        <Entry x:Name="billInput" Placeholder="Enter Amount" Keyboard="Numeric" />

        <Label Text="Tip"   />
        <Label x:Name="tipOutput" Text="0.00" />

        <Label Text="Total" />
        <Label x:Name="totalOutput" Text="0.00" />

        <Label Text="Tip Percentage" />
        <Label x:Name="tipPercent" Text="15%" />
        <Slider x:Name="tipPercentSlider" Minimum="0" Maximum="100" Value="15" />

        <Button Text="15%" Clicked="OnNormalTip" />
        <Button Text="20%" Clicked="OnGenerousTip" />

        <Button x:Name="roundDown" Text="Round Down" />
        <Button x:Name="roundUp"   Text="Round Up" />
    </VerticalStackLayout>
</ContentPage>
```

Exercise: Fix the UI

- Now that you saw the app run, you can make it look better by adding `HorizontalStackLayout` containers.
- The goal is to make the app look like the screenshot at the start of the lab.
- Open the MainPage.xaml file.
- Add 40 units of padding and 10 units of spacing to the `VerticalStackLayout`.

```
<VerticalStackLayout Padding="40" Spacing="10">
```

Exercise: Fix the UI

- Add a `HorizontalStackLayout` to group the `Label` that says Bill with the `Entry` field below it.
- Set the `Spacing` property to 10.
- Set the `WidthRequest` of the Bill `Label` to 100 and the `VerticalOptions` property to Center.
- These changes ensure that the label is aligned vertically with the `Entry` field.

```
<HorizontalStackLayout Spacing="10">
    <Label Text="Bill" WidthRequest="100" VerticalOptions="Center"/>
    <Entry ... />
</HorizontalStackLayout>
```

Exercise: Fix the UI

- Add another `HorizontalStackLayout` to group the `Label` that says Tip with the `Label` named tipOutput.
- Set the `Spacing` property to `10`, and the `Margin` property to `0,20,0,0`.
- Set the `WidthRequest` of the Tip `Label` to `100`.

```
<HorizontalStackLayout Margin="0,20,0,0" Spacing="10">
    <Label Text="Tip" WidthRequest="100" />
    <Label .../>
</HorizontalStackLayout>
```

Exercise: Fix the UI

- Use a `HorizontalStackLayout` to group the `Label` that says Total with the `Label` named totalOutput.
- Set the `Spacing` property to 10.
- Set the `WidthRequest` of the Total `Label` to 100.

```
<HorizontalStackLayout Spacing="10">
    <Label Text="Total" WidthRequest="100"  />
    <Label .../>
</HorizontalStackLayout>
```

Exercise: Fix the UI

- Add another `HorizontalStackLayout` to group the `Label` that says Tip Percentage with the `Label` named tipPercent.
- Set the `VerticalOptions` property of this `HorizontalStackLayout` to `End` and set the `Spacing` property to `10`.
- Set the `WidthRequest` of the Tip Percentage `Label` to `100`.

```
<HorizontalStackLayout VerticalOptions="End" Spacing="10">
    <Label Text="Tip Percentage" WidthRequest="100"/>
    <Label ... />
</HorizontalStackLayout>
```

Exercise: Fix the UI

- Use a `HorizontalStackLayout` to group the `Button` with the caption `15%` and the `Button` with the caption `20%`.
- Set the `Margin` property of this `StackLayout` to `0,20,0,0`, and the `Spacing` property to `10`.

```
<HorizontalStackLayout  Margin="0,20,0,0" Spacing="10">
    <Button Text="15%" ... />
    <Button Text="20%" ... />
</HorizontalStackLayout>
```

Exercise: Fix the UI

- Add a final `HorizontalStackLayout` to group the `Button` with the caption, Round Down and the `Button` with the caption, Round Up.
- Set the `Margin` property of this `StackLayout` to `0,20,0,0`, and the `Spacing` property to `10`.

```
<HorizontalStackLayout Margin="0,20,0,0" Spacing="10">
    <Button ... Text="Round Down" />
    <Button ... Text="Round Up" />
</HorizontalStackLayout>
```

Exercise: Fix the UI

- On all four button controls, set the `HorizontalOptions` property to `Center` and the `WidthRequest` property to `150`.
- For example:

```
<Button Text="15%" WidthRequest="150" HorizontalOptions="Center" ... />
```

Exercise: Fix the UI

- The complete XAML markup for the content page should look like this:

```
<?xml version="1.0" encoding="utf-8" ?>
<ContentPage xmlns="http://schemas.microsoft.com/dotnet/2021/maui"
             xmlns:x="http://schemas.microsoft.com/winfx/2009/xaml"
             xmlns:local="clr-namespace:TipCalculator"
             x:Class="TipCalculator.MainPage">
    <VerticalStackLayout Padding="40" Spacing="10">
        <HorizontalStackLayout Spacing="10">
            <Label Text="Bill" WidthRequest="100" VerticalOptions="Center" />
            <Entry x:Name="billInput" Placeholder="Enter Amount" Keyboard="Numeric" />
        </HorizontalStackLayout>
        <HorizontalStackLayout Margin="0,20,0,0" Spacing="10">
            <Label Text="Tip"  WidthRequest="100" />
            <Label x:Name="tipOutput" Text="0.00" />
        </HorizontalStackLayout>
        <HorizontalStackLayout Spacing="10">
            <Label Text="Total" WidthRequest="100"/>
            <Label x:Name="totalOutput" Text="0.00" />
        </HorizontalStackLayout>
        <HorizontalStackLayout VerticalOptions="End" Spacing="10">
            <Label Text="Tip Percentage" WidthRequest="100"/>
            <Label x:Name="tipPercent" Text="15%" />
        </HorizontalStackLayout>
        <Slider x:Name="tipPercentSlider" Minimum="0" Maximum="100" Value="15" />
        <HorizontalStackLayout Margin="0,20,0,0" Spacing="10">
            <Button Text="15%" Clicked="OnNormalTip" WidthRequest="150" HorizontalOptions="Center"/>
            <Button Text="20%" Clicked="OnGenerousTip"  WidthRequest="150" HorizontalOptions="Center"/>
        </HorizontalStackLayout>
        <HorizontalStackLayout Margin="0,20,0,0" Spacing="10">
            <Button x:Name="roundDown" Text="Round Down" WidthRequest="150" HorizontalOptions="Center"/>
            <Button x:Name="roundUp"   Text="Round Up" WidthRequest="150" HorizontalOptions="Center"/>
        </HorizontalStackLayout>
    </VerticalStackLayout>
</ContentPage>
```

Exercise: Examine the Results

- Run the app again and look at the differences in the UI.
- Verify that the controls are aligned correctly and are properly sized and spaced.

Arrange Views with Grid

- A `Grid` is a layout panel that consists of rows and columns.
- You place views in the cells that are created from the intersection of the rows and columns.
- For example, if you create a `Grid` that has three columns and two rows, there are six cells available for views.

How to Specify the Rows and Columns of a Grid

- When you create a `Grid`, you can define each row and column individually.
- Every `Grid` has a collection of `RowDefinition` and `ColumnDefinition` objects that define the shape of the grid.
- You populate these collections with instances of `RowDefinition` and `ColumnDefinition`, each representing a row or column in your UI.

- `RowDefinition` has a property called `Height` and `ColumnDefinition` has a property called `Width`.

What is GridLength?

- The data type for the `Width` and `Height` properties is `GridLength`.
- You can set it to one of these values:
  - Absolute value
  - `Auto`
  - Star (`*`)

Absolute

- Absolute specifies that the row or column should be fixed in size.

```
<RowDefinition Height="100" />
```

Auto

- `Auto` automatically sizes the row or column to fit your child views.
- The `Grid` scans all child views in that row or column, selects the largest view, and then makes the row or column large enough to fit that child.

```
<RowDefinition Height="Auto" />
```

Star

- Star (*) gives you proportional sizing.
- In proportional sizing, the total available space and the ratio that each row or column asks for determines the size.
- In conversation, people often call this star sizing instead of proportional sizing.
- Use the * symbol to represent star sizing.

```
<RowDefinition Height="2*" />
```

Grid Collections

- After you define the rows and columns by using `RowDefinition` and `ColumnDefinition`, you can add them to a `Grid`.
- You use the `RowDefinitions` and `ColumnDefinitions` collection properties of the `Grid`.

```
<Grid>
    <Grid.RowDefinitions>
        <RowDefinition Height="100" />
        <RowDefinition Height="Auto" />
        <RowDefinition Height="1*" />
        <RowDefinition Height="2*" />
    </Grid.RowDefinitions>
    ...
</Grid>
```

- This definition can be shortened to:

```
<Grid RowDefinitions="100, Auto, 1*, 2*">
    ...
</Grid>
```

Row and Column Default Size

- The default for rows and columns is 1* size.

```
<Grid>
    <Grid.RowDefinitions>
        <RowDefinition />
        <RowDefinition />
        <RowDefinition />
    </Grid.RowDefinitions>
    <Grid.ColumnDefinitions>
        <ColumnDefinition />
        <ColumnDefinition />
    </Grid.ColumnDefinitions>
    ...
</Grid>
```

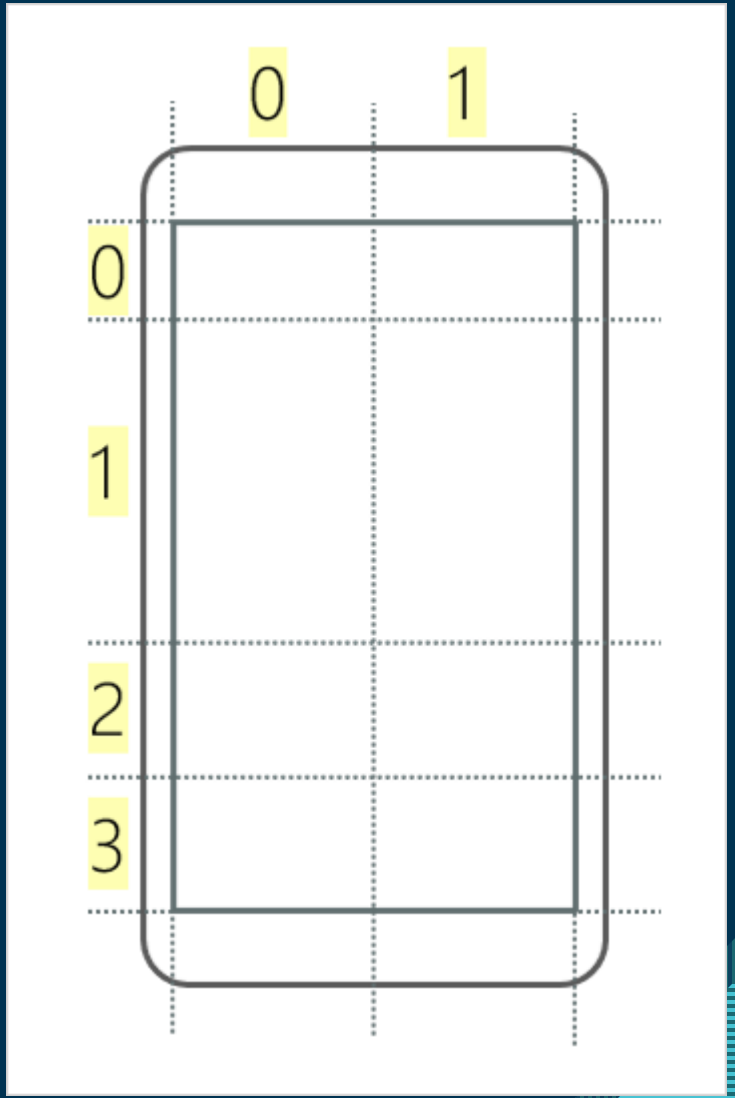
- This definition can be shortened to:

```
<Grid RowDefinitions="*, *, *" ColumnDefinitions="*, *">
    ...
</Grid>
```

How to Add Views to a Grid

- When you add a view to a `Grid`, you add it to a specific cell.
- You use a combination of a row number and a column number to identify a cell.
- The numbering of rows and columns starts at zero.

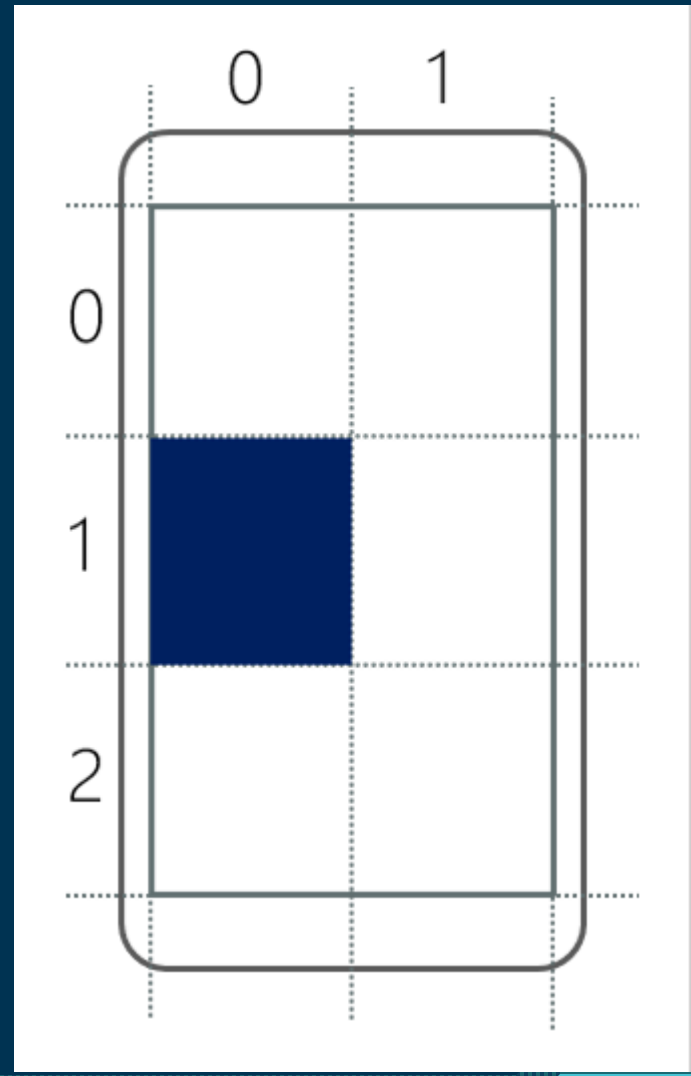
- For example, if we wanted to add a view to the bottom-right cell, we'd say the view's position was row 3 column 1.



Add a View to a Grid by using Attached Properties

- Attached properties are a collection of key-value pairs that is part of a view.
- When you add a view to a `Grid`, you specify the row and column.
- By using attached properties, you can add a key-value pair with the key `Grid.Row` and a value that specifies the row number.

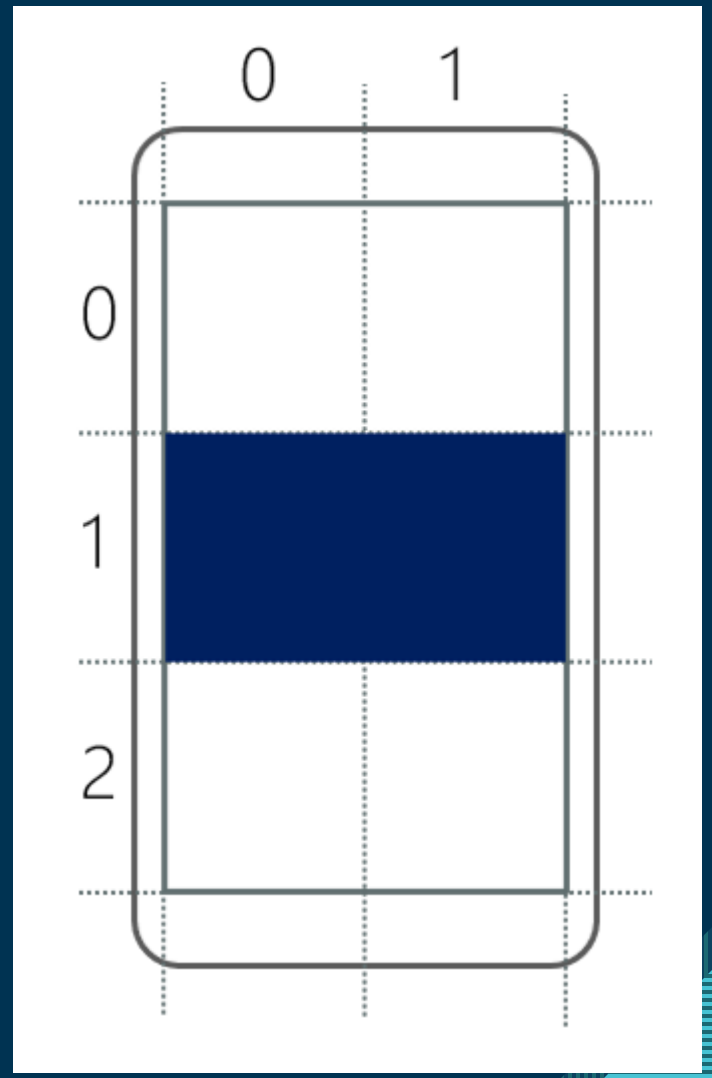
```
<Grid RowDefinitions="*, *, *" ColumnDefinitions="*, *">

    <BoxView Grid.Row="1" Grid.Column="0" Color="Navy" />

</Grid>
```



How to Make a View Span Multiple Rows or Columns

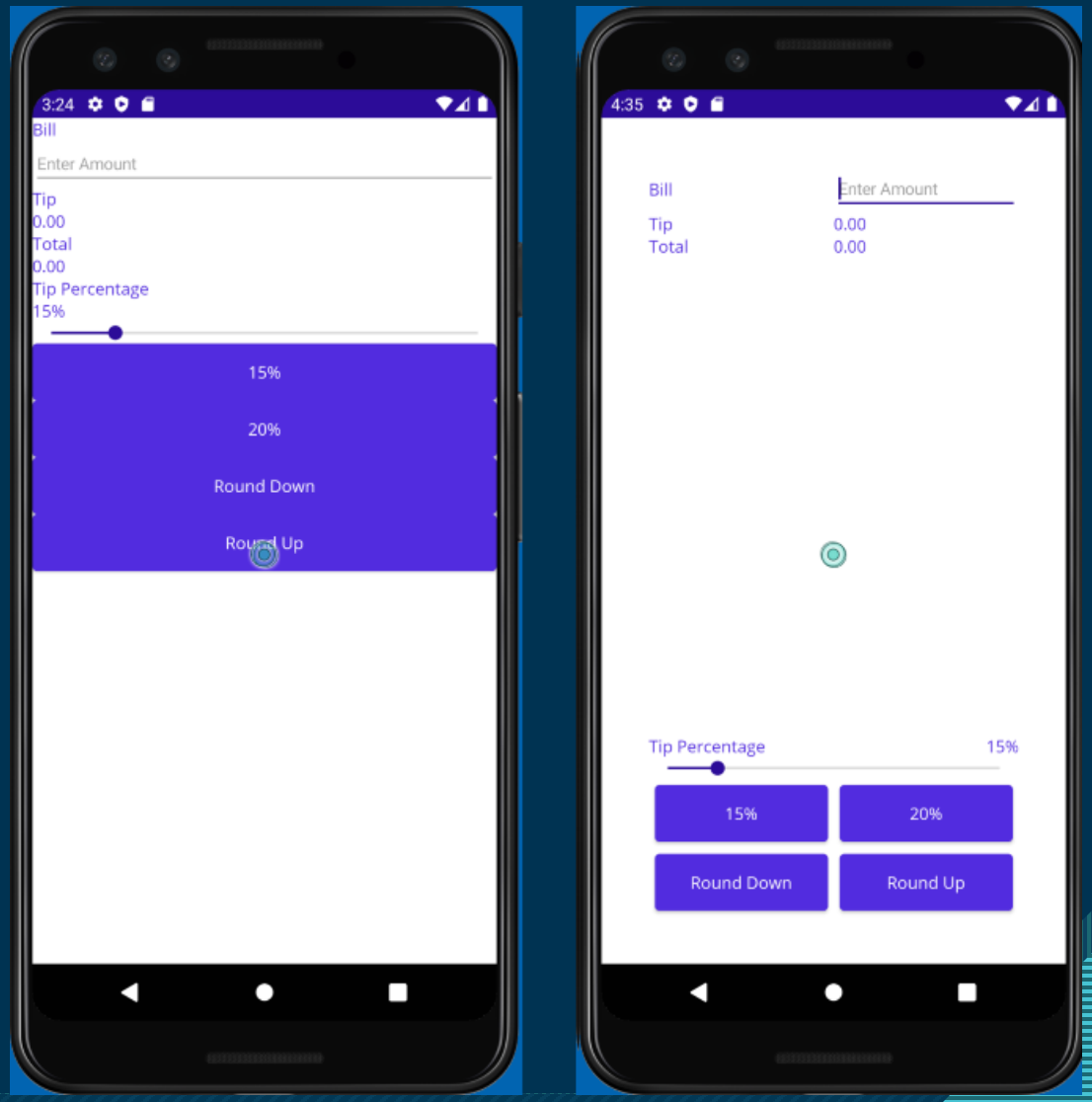
- There are two more attached properties you should be aware of: `Grid.RowSpan` and `Grid.ColumnSpan`.
- These properties specify how many rows or columns the view should occupy.

```
<Grid RowDefinitions="*, *, *" ColumnDefinitions="*, *">

    <BoxView Grid.Row="1" Grid.Column="0" Grid.ColumnSpan="2" Color="Navy" />

</Grid>
```



Exercise: Use Grid to Build a User Interface

- In this exercise, you use a `Grid` to arrange the views in your User Interface (UI).
- You start with another version of the TipCalculator project and adjust it to make the UI more intuitive.
- You also move the buttons to the bottom of the page.
- This time you use a `Grid` layout rather than using `VerticalStackLayout` and `HorizontalStackLayout`.



Exercise: Open the Starter Solution

- The starter solution contains a fully functional tip calculator app.
- Using Visual Studio, open the starter solution in the exercise3/TipCalculator folder in the repo that you cloned at the start of the previous exercise.

Exercise: Open the Starter Solution

- Open MainPage.xaml. Notice that all the views are displayed using one `VerticalStackLayout` panel.

```
<?xml version="1.0" encoding="utf-8" ?>
<ContentPage xmlns="http://schemas.microsoft.com/dotnet/2021/maui"
             xmlns:x="http://schemas.microsoft.com/winfx/2009/xaml"
             xmlns:local="clr-namespace:TipCalculator"
             x:Class="TipCalculator.MainPage">

    <VerticalStackLayout>

        <Label Text="Bill" />
        <Entry x:Name="billInput" Placeholder="Enter Amount" Keyboard="Numeric" />

        <Label Text="Tip"   />
        <Label x:Name="tipOutput" Text="0.00" />

        <Label Text="Total" />
        <Label x:Name="totalOutput" Text="0.00" />

        <Label Text="Tip Percentage" />
        <Label x:Name="tipPercent" Text="15%" />
        <Slider x:Name="tipPercentSlider" Minimum="0" Maximum="100" Value="15" />

        <Button Text="15%" Clicked="OnNormalTip" />
        <Button Text="20%" Clicked="OnGenerousTip" />

        <Button x:Name="roundDown" Text="Round Down" />
        <Button x:Name="roundUp"   Text="Round Up" />

    </VerticalStackLayout>

</ContentPage>
```

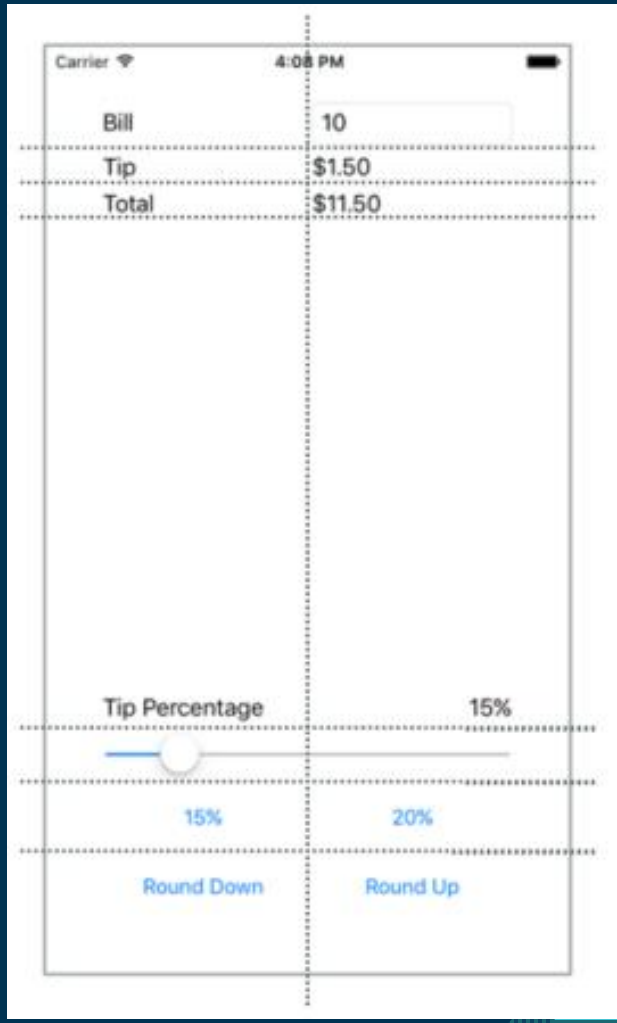
Exercise: Create a Grid Layout

- Change the layout panel from `VerticalStackLayout` to `Grid` with padding of 40 units.
- Define seven rows and two columns for the `Grid`.
- Make all the rows Auto size except the fourth row.
- The fourth row should use Star so it gets all the remaining space available in the grid.
- Use Star sizing for both columns.

```
<Grid RowDefinitions="Auto, Auto, Auto, *, Auto, Auto, Auto"
      ColumnDefinitions="*, *"
      Padding="40">
    ...
</Grid>
```

Exercise: Position the Views in the Cells

- Add settings for `Grid.Row` and `Grid.Column` to each of the views to assign them to the appropriate cell in the `Grid`.
- Use this screenshot to help you determine where each view should be placed.



- The following example shows how to set the position for the Bill `Label`, and the billInput `Entry` view:

```
...
<Label Text="Bill" Grid.Row="0" Grid.Column="0"/>
<Entry x:Name="billInput" Placeholder="Enter Amount"
Keyboard="Numeric" Grid.Row="0" Grid.Column="1"/>
...
```

Exercise: Position the Views in the Cells

- Align the Bill `Label` and `Entry` by setting the `VerticalOptions` property to Center on the `Label`.

- Add a setting for `Grid.ColumnSpan` to the `Slider` so it spans two columns.

```
<Slider ... Grid.ColumnSpan="2" ... />
```

Exercise: Position the Views in the Cells

- Locate the `Label` with the text Tip Percentage.
- Set it so that it occupies the lower-left position in its rectangle.

```
<Label Text="Tip Percentage" VerticalOptions="End" HorizontalOptions="Start" ... />
```

Exercise: Position the Views in the Cells

- Locate the `Label` named tipPercent.
- Set it so that it occupies the lower-right position in its rectangle.

```
<Label x:Name="tipPercent" VerticalOptions="End" HorizontalOptions="End" ... />
```

- Set the `Margin` property for all four buttons to `5`.

Exercise: Position the Views in the Cells

- The complete XAML markup for the page should look like this:

```
<ContentPage xmlns="http://schemas.microsoft.com/dotnet/2021/maui"
             xmlns:x="http://schemas.microsoft.com/winfx/2009/xaml"
             xmlns:local="clr-namespace:TipCalculator"
             x:Class="TipCalculator.MainPage">
    <Grid RowDefinitions="Auto, Auto, Auto, *, Auto, Auto, Auto"
          ColumnDefinitions="*, *"
          Padding="40">
        <Label Text="Bill" VerticalOptions="Center" Grid.Row="0" Grid.Column="0"/>
        <Entry x:Name="billInput" Placeholder="Enter Amount" Keyboard="Numeric" Grid.Row="0" Grid.Column="1"/>
        <Label Text="Tip" Grid.Row="1" Grid.Column="0"/>
        <Label x:Name="tipOutput" Text="0.00" Grid.Row="1" Grid.Column="1"/>
        <Label Text="Total" Grid.Row="2" Grid.Column="0"/>
        <Label x:Name="totalOutput" Text="0.00" Grid.Row="2" Grid.Column="1"/>
        <Label Text="Tip Percentage" VerticalOptions="End" HorizontalOptions="Start" Grid.Row="3" Grid.Column="0"/>
        <Label x:Name="tipPercent" Text="15%" VerticalOptions="End" HorizontalOptions="End" Grid.Row="3" Grid.Column="1"/>
        <Slider x:Name="tipPercentSlider" Minimum="0" Maximum="100" Value="15" Grid.Row="4" Grid.Column="0" Grid.ColumnSpan="2"/>
        <Button Text="15%" Clicked="OnNormalTip" Margin="5" Grid.Row="5" Grid.Column="0"/>
        <Button Text="20%" Clicked="OnGenerousTip" Margin="5" Grid.Row="5" Grid.Column="1"/>
        <Button x:Name="roundDown" Margin="5" Text="Round Down" Grid.Row="6" Grid.Column="0"/>
        <Button x:Name="roundUp"   Margin="5" Text="Round Up" Grid.Row="6" Grid.Column="1"/>
    </Grid>
</ContentPage>
```

Exercise: Examine the results

- Run the application and look at the differences in the UI.
- You used a `Grid` to improve the aesthetics of an existing UI.
- `Grid` is more powerful than `StackLayout`.
- In particular, `Grid` makes it far easier to align views across rows.

Thank You

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References

Material has been taken as is from:

- Microsoft Official Documentation:
  - https://learn.microsoft.com/en-us/training/modules/customize-xaml-pages-layout/