Module 7

"MVVM Design Pattern [Foundation]"

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Agenda

- **What is MVVM?**
- Creating an MVVM Application
- Common Techniques

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ViewModel Pattern History

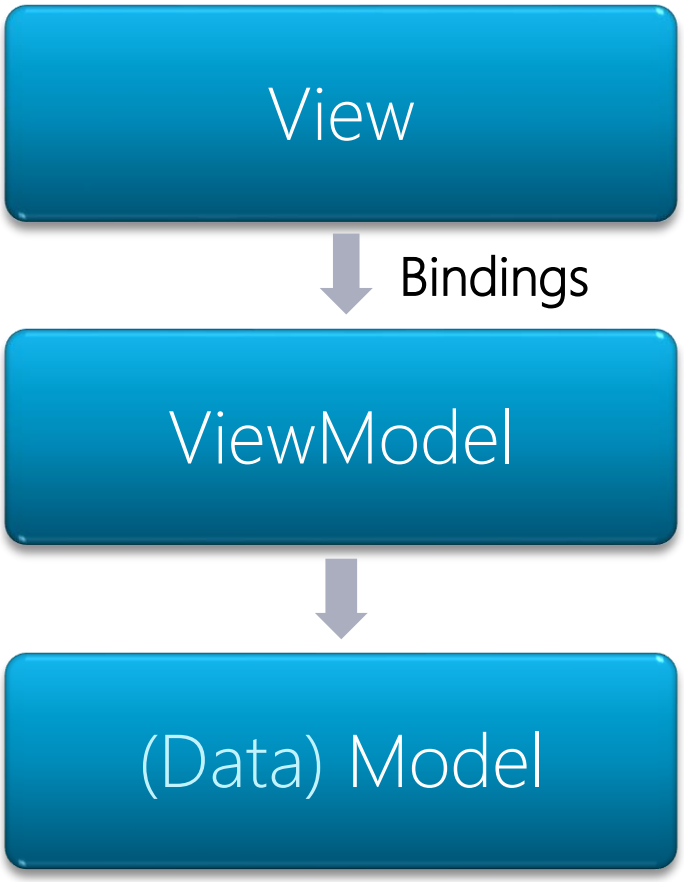
- Presentation Model
  - Martin Fowler 2004
  - Separation pattern
  - Remove state and behavior from the view
  - http://www.martinfowler.com/eaaDev/PresentationModel.html

- Model-View-ViewModel
  - John Gossman 2005
  - Presentation Model specialized to XAML
  - Crucially based on CLR data-binding
  - http://blogs.msdn.com/b/johngossman/archive/2005/10/08/478683.aspx

Model-View-ViewModel Components

- Commonly known as MVVM
- Model
  - Business objects
  - Data
- View
  - Presentation
- ViewModel
  - Abstraction of view, adapter between Model and View
  - View's state and behavior

Model-View-ViewModel



- Separation between presentation and application logic
- The ViewModel is an abstraction of the View
- Depends heavily on **data binding** and **command binding**
- Reflects the architecture of WPF itself
- WPF, Blend etc. are built with MVVM

Goals of MVVM

- Separation of Concern
- Loose coupling
- Maintainability
- Testability
- “Blendability”
- …

Family of Patterns

- MVVM is a set of guidelines open for interpretation

- How to pair view and viewmodel?
- How to process events?
- How to communicate between viewmodels?
- …

- Purists vs. Pragmatics

- MVVM frameworks support these guidelines

Agenda

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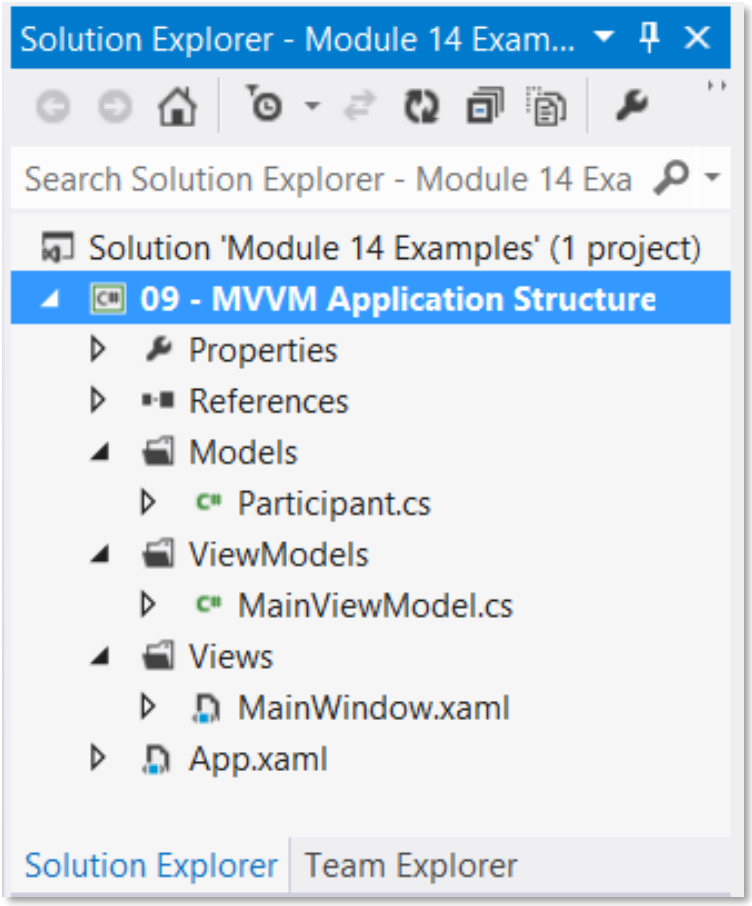
- **Creating an MVVM Application**
- Common Techniques

MVVM Application Structure

- Create a new WPF application
  - `Models`
  - `ViewModels`
  - `Views`



The Model

- Purpose
  - Storing and represent application data and domain objects
  - Raise change notifications
  - Perform validation

```
class Participant : INotifyPropertyChanged, IDataErrorInfo
{
   public string FirstName { ... }
   public string LastName { ... }
   ...
}
```

- Implement
  - `INotifyPropertyChanged`
  - `IDataErrorInfo` (or `INotifyDataErrorInfo`), if needed

The ViewModel

- Purpose
  - Expose data to view by presentation and manipulation
  - Facilitate application interaction logic
  - Respond to user interaction

```
class MainViewModel : INotifyPropertyChanged
{
   public Participant ModelParticipant { ... }
   ...
}
```

- Implement
  - Properties and commands
  - **`INotifyPropertyChanged`** on the exposed properties
    - E.g. the model object

The View

- Purpose
  - Provide user interface controls only
  - Agnostic of data origin

```
<Grid DataContext="{StaticResource MainViewModel}">
   ...
   <TextBlock Grid.Row="0" Grid.Column="0">First Name:</TextBlock>
   <TextBox Grid.Row="0" Grid.Column="1"
            Text="{Binding ModelParticipant.FirstName,
                           ValidatesOnDataErrors=True}"></TextBox>
   ...
</Grid>
```

- Gets updated through **`DataContext`** bindings

Exposing or Mirroring Model Properties?

- There is no common consensus between either
  - Exposing the Model to the View through the ViewModel, or
  - Mirroring the properties of the Model in the ViewModel
- There are pros and cons to both
- The approach we have taken is the simplest

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Pairing up the View and ViewModel

- Different approaches exist
  - XAML — "View First"
  - Code-behind
  - Data Template
  - ViewModel Locator — "ViewModel First"
  - Inversion of Control container
  - …
- Many MVVM frameworks use variations of ViewModel Locator

Communication Between View and ViewModel

- Communication between view and view model is facilitated by binding
  - Events
  - Commands

```
<Button Command="{Binding SaveParticipantCommand}">Save</Button>
```

```
class MainViewModel : INotifyPropertyChanged
{
   public ICommand SaveParticipantCommand
   {
      get { return _saveParticipantCommand; }
   }
   private ICommand _saveParticipantCommand;
   ...
}
```

Agenda

- What is MVVM?
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- **Common Techniques**

RelayCommand

- You will be defining tons of commands
  - Create reusable helper commands as starting points

- `RelayCommand` (a.k.a. `DelegateCommand`)

```
public class RelayCommand : ICommand
{
   private readonly Predicate<object> _canExecute;
   private readonly Action<object> _executeAction;
   ...
   public RelayCommand( Action<object> execute,
                        Predicate<object> canExecute = null )
   {
      ...
   }
}
```

ViewModelBase

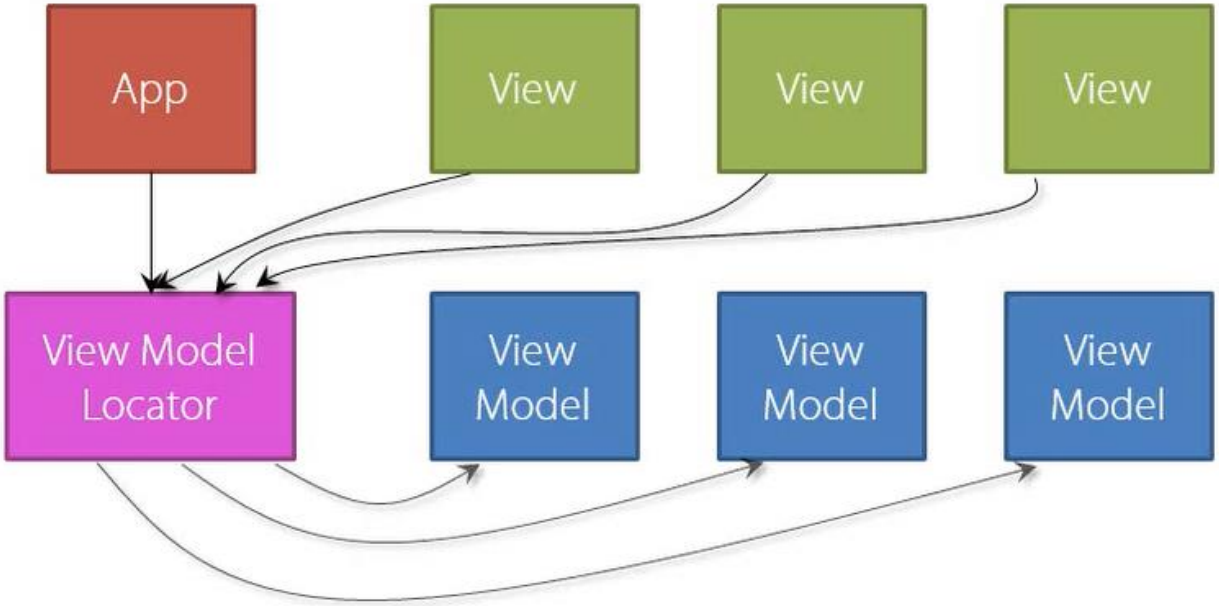
- All view models will always implement
  - **INotifyPropertyChanged**
  - checking and debug features

- Share this code from a common base class

```
public class ViewModelBase : INotifyPropertyChanged
{
    ...
}
```

- Sometimes people similarly define a **ModelBase**
  - A matter of preference

ViewModel Locator Pattern



- ViewModelLocator instance usually defined in **`App.xaml`**
- *Alternative: ViewModel First pattern*

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Composing Views and ViewModels

- "Parallel" and compositional View and ViewModel hierarchies
- Views can be `UserControl` instances
- Create
  - ViewModel from Model
  - Data templates for view models
- ViewModel expose Model objects
  - Directly? ~"Pragmatics"
  - Through individual properties? ~"Purists"

Summary

- What is MVVM?
- Creating an MVVM Application
- Common Techniques


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