Architectural Patterns

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Overview

Intro

- Architectural patterns are higher-level than those previously discussed
- They are about making the code:
  - Scalable, maintainable
  - Enable adding new features quickly
  - Help avoid spaghetti code, or "*crossing the streams*"
  - Easier to testing using mock objects

Model View Controller

- Divide the application into three interconnected parts
- Separates the information from the way it is handled, and the way it is presented
- Popular in using both GUI and web applications

Model View Controller

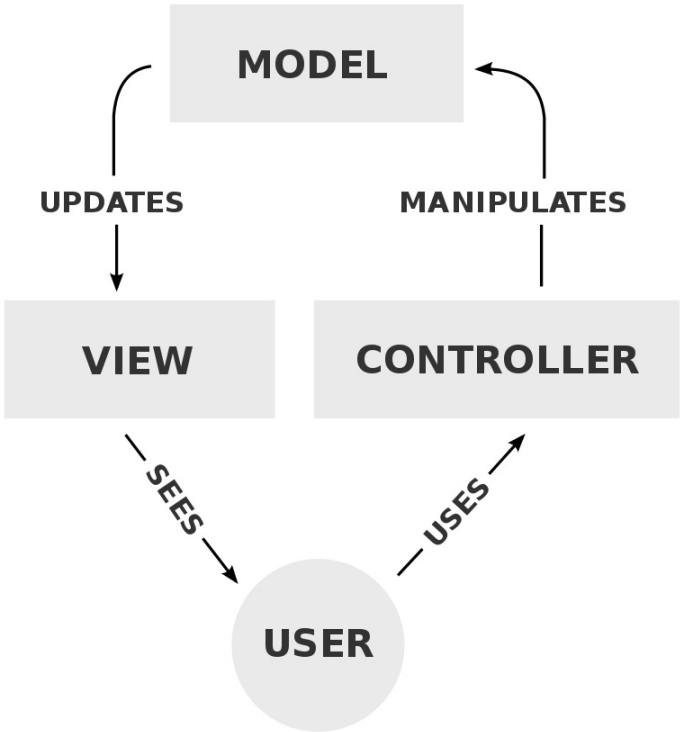


Figure: https://en.wikipedia.org/wiki/Model%E2%80%93view%E2%80%93controller

Model View Controller

Model

- Central component of the pattern
- It carries the data, manages the logic
- POJO implementation

View

- Representation of the information (GUI, table, chart, etc.)
- The same model can have several different representations (views)

Controller

- Accepts user input, controls the data flow
- Commands both the view and the model

Model View Controller

- The *Model* stores data that is retrieved according to commands from the *Controller* and displayed in the *View*
- The *View* generates new output to the User based on changes in the *Model*.
- The *Controller* can send commands to the Model to update its state (e.g. editing a document).
- *Controller* can also send commands to its associated *View* to change the presentation of the *Model* (e.g. scrolling through a document, movement of document)

Model View Controller

+ Promote simultaneous development
+ High cohesion
  - Enables logical grouping of related controller actions together
  - Views for a given model are also grouped together
+ Low coupling
+ Ease of modification, due to separated responsibilities (easier to enforce the single responsibility principle)

Model View Controller

- Code navigability can be made complex given new abstraction layers and the decomposition criteria of MVC
- Multi-artefact consistency, as feature decomposition can lead to scattering
- Learning curve, as in some cases multiple technologies might be required (e.g. Model 2 - `https://www.javatpoint.com/model-1-and-model-2-mvc-architecture`)

Model View Controller

MVC source code

git:/examples/architecture/mvc

Model View Presenter

A variation of model-view-controller

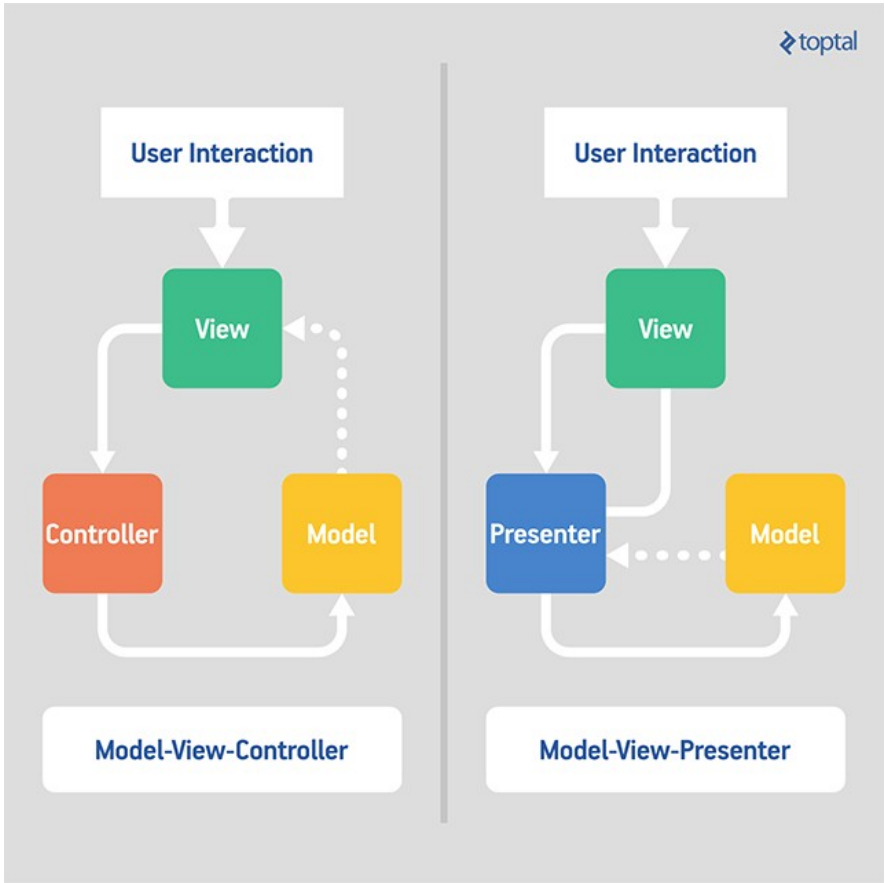


Figure: from `https://medium.com/cr8resume/make-you-hand-dirty-with-mvp-model-view-presenter-eab5b5c`

Model View Presenter

When compared with MVC

- (Usually) passive View, which renders the UI and routes user input
- The **Presenter** acts as both-ways intermediary between *View* and *Model*
  - Handles user event
  - Retrieves data from models
  - Formats it for display in view
- Each *View* generally has its own *Presenter*
- *Model* is actually an entity that includes business logic and which can update the "proper" model itself

A (kind of) sequence diagram

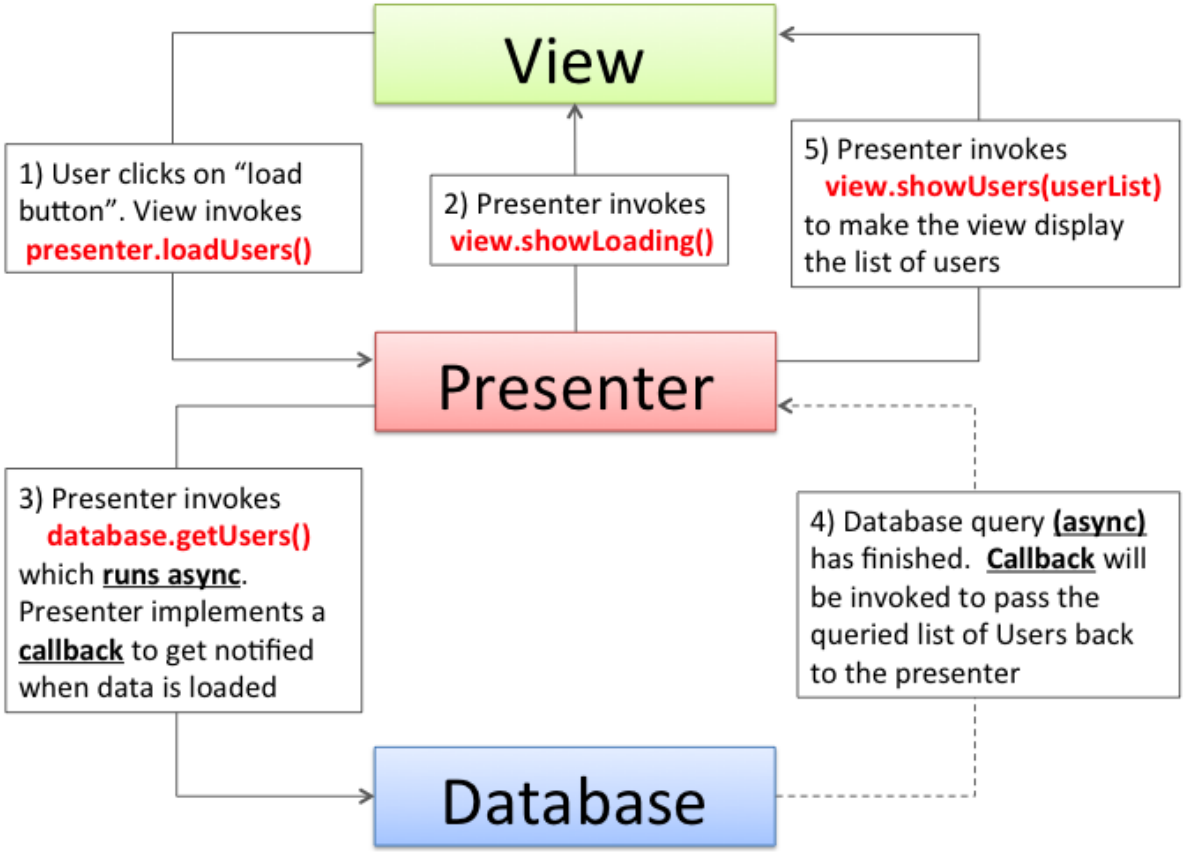


Figure: from `https://github.com/rahulabrol/Messanger`

Model View Presenter

Model

- Holds data that will be used by view
- Collection of classes that represent the business model and process it

View

- Has a reference to *Presenter* and asks it to do work
- Decoupled from the *Model*

Model View Presenter

Presenter

- Coordinates events between the *View* and *Model*
- Responds to view requests, updates the view

Model View Presenter

Testing - MVP *should* make testing easier than MVC

- **View** - test rendering logic and interaction with *Presenter* (which can be mocked)
- **Presenter** - test that the view invokes the correct model method (mock both *Model* and *View*)
- **Model** - test the business logic, mock the data source and *Presenter*

Model View Presenter

+ Complex tasks are divided into smaller tasks
+ Less complicated objects, fewer bugs, easier debugging
+ Easier to test
- Boilerplate code to wire the layers
- Model cannot be reused and is tied to specific use cases
- View and Presenter are tied to data objects since they share the same type of object with the Model

Model View Presenter

Example

git:/examples/architecture/mvp

Model View View-Model

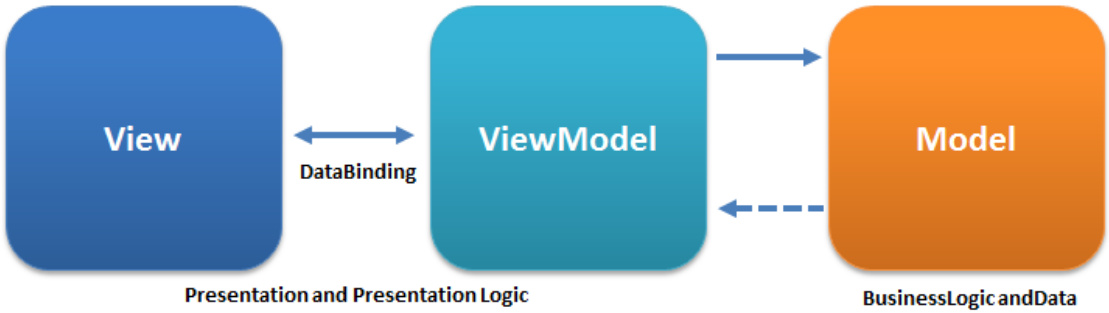


Figure: from `https://en.wikipedia.org/wiki/Model%E2%80%93view%E2%80%93viewmodel`

- Separate development of the GUI (using source code or a markup language - XAML) from its back-end and business logic
- Invented by Microsoft architects to simplify GUI event-driven development
- Developed to take advantage of the data-binding mechanisms in WPF by removing GUI-code from the view itself

Model View View-Model

- Allows late-breaking changes to the user interface (component layout, dimensions, presentations) without affecting application code
- The *View* is the only component that is platform-specific
- The *ViewModel* acts as a value converter between data model objects and GUI components
- ViewModel can act as a mediator between GUI components and its back-end

Model View View-Model

The **Model**

- Can be the domain model itself, or the data access layer that represents content
- No references should appear to either *View* or *ViewModel*

The **View**

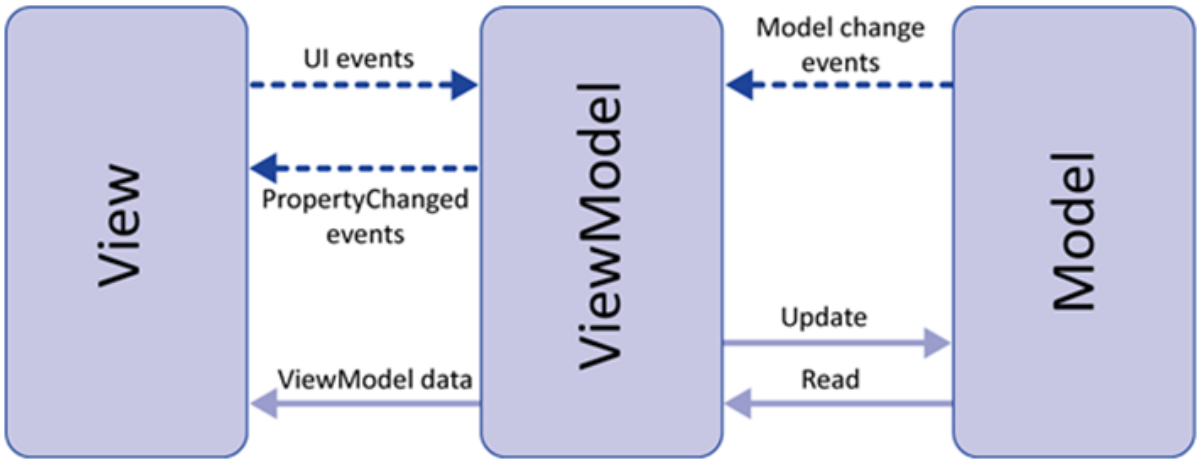
- Platform-specific code for the user interface
- May not reference the *Model*
- Bidirectional binding to *ViewModel*
  - Communication to ViewModel is represented by Commands from the View to the ViewModel
  - Communication from ViewModel is represented via the data binding and the update of the data from the ViewModel

Model View View-Model

The **ViewModel**

- Abstraction of the *View* exposing public properties and commands to facilitate communication between *View* and *Model*
- References the Model, might reference the View
- Abstraction of View's code-behind, reusable code when modifying the *View*

Model View View-Model



- **View** - **ViewModel**: communication is called Data Binding (bidirectional)
- **ViewModel** - **Model**: communication is done via Notifications (bidirectional)

Model View View-Model

+ Reduce the amount of code-behind and dependency between it and view-specific code
+ Model does not change to support a View
+ Separate designers from coders by separating GUI code from code-behind, reducing development time
- Create more files
- Simple tasks can be more complicated
- Lack of standardization, most specific to Windows Presentation Foundation (WPF)