Grand Valley State University
www.gvsu.edu

Software Engineering
Design Patterns (3)
MVC & MVP

Erik Fredericks // frederer@gvsu.edu

Adapted from materials provided by Byron DeVries, Jagadeesh Nandigam

MVC // MVP

MVC (Model-View-Controller)

- Motivation
- MVC Class Structure
- Division of Labor within MVC
- Example

MVP (Model-View-Presenter)

- Motivation
- MVP Class Structure
- Division of Labor within MVP
- Example

MVC pattern

Pattern Category: Architectural

Intent: Decoupling major components in a user interface.

Problem addressed: Coupling of model and/or business logic within a GUI.

State/data of an application:

- should be agnostic of user interface
- should be logically independent of how it is displayed to the user

Solution: Divide the application into three components (Model, View, Controller) for modeling of the domain, the presentation, and the user inputs.

MVC pattern

Implementation:

- Model expresses application behavior related to the problem domain, without consideration for the user interface.
- View is any output representation of the information within the model
- Controller converts input to be used within the problem domain (i.e., model)

MVC pattern

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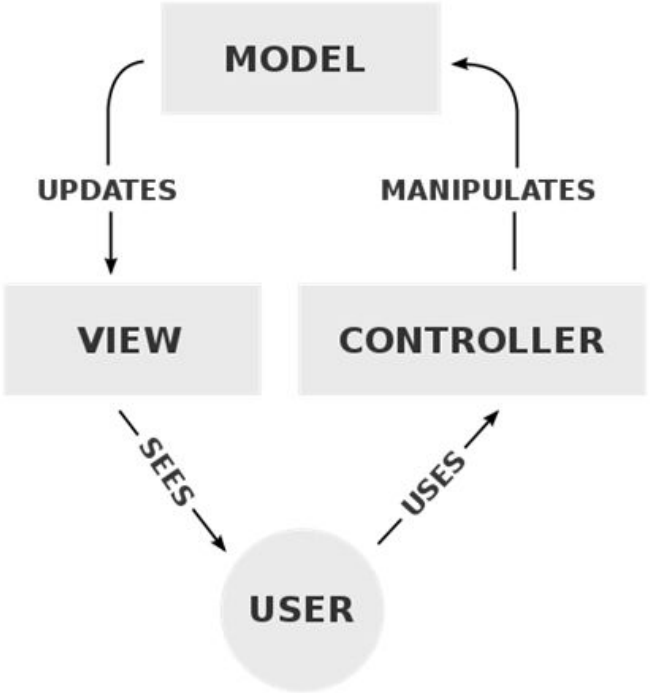
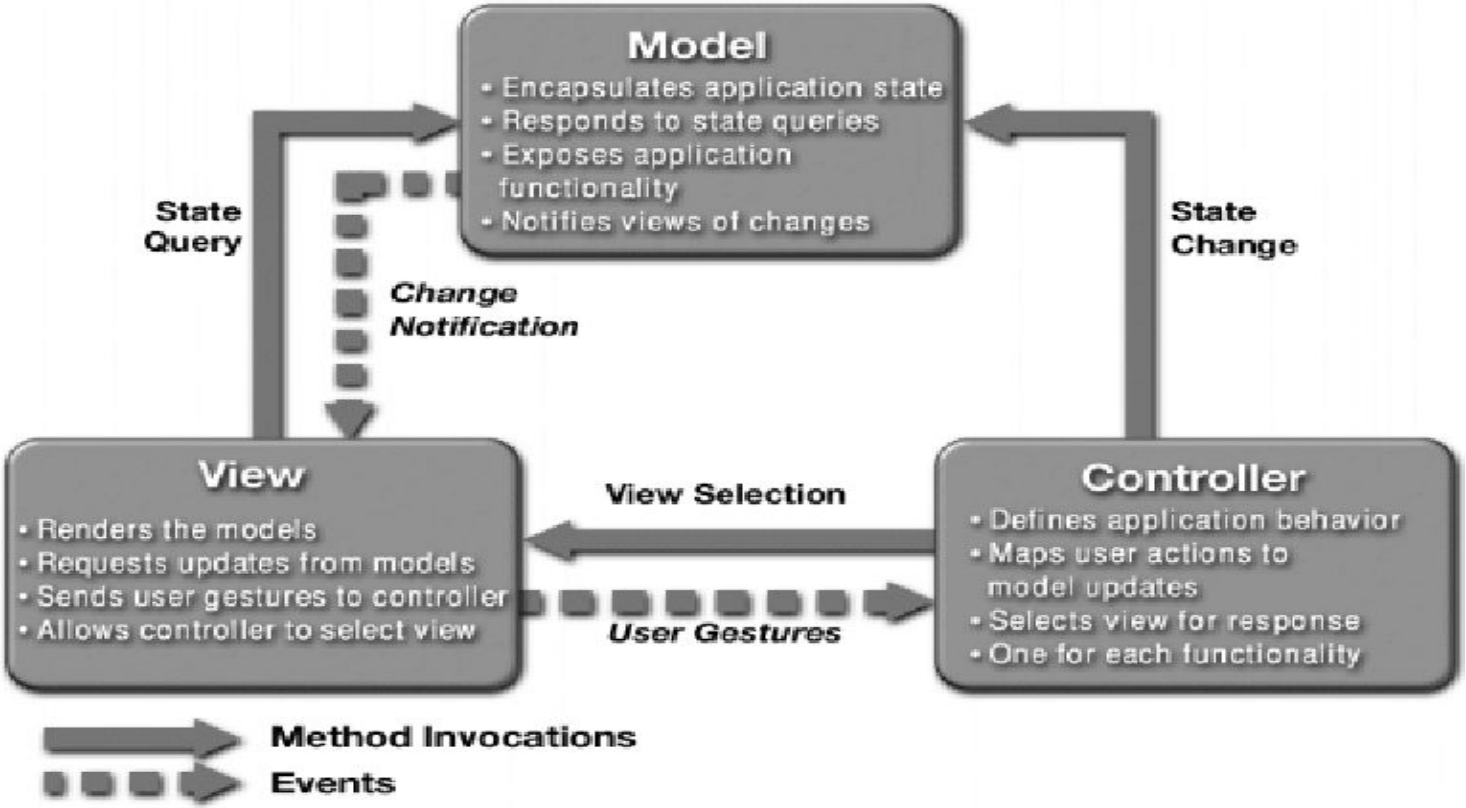



Model
• Encapsulates application state
• Responds to state queries
• Exposes application functionality
• Notifies views of changes
State Query
Change Notification
State Change
View
• Renders the models
• Requests updates from models
• Sends user gestures to controller
• Allows controller to select view
View Selection
User Gestures
Controller
• Defines application behavior
• Maps user actions to model updates
• Selects view for response
• One for each functionality
Method Invocations
Events

MVC pattern

Model:

- Manages application data/state
- Expresses application behavior/functionality
- Responds to instructions to change (usually from the controller)
- Responds to requests for information about its state (usually from the view)
- Notifies views (and controllers) of changes (if model is not passive).

View:

- Renders the contents of the model for the user
- Sends user gestures/actions to controller
- Requests information from model
- Allows controller to select view

MVC pattern

Controller:

- Translates user actions into operations on the model
- Manages application behavior
- Commands the view to change as appropriate

MVC pattern

- The model **knows only about itself**. That is, the source code of the model has **no references to either the view or controller**.
- An object can act as a model for **more than one MVC triad at a time**.
- The model may be totally ”unaware” of the existence of either the view or the controller and of its participation in an MVC triad.
- The model object may see a **view or controller** object merely as **an observer** object if state change notifications are required.
- Both view and controller know about the model.
- The **view and controller** are specifically designed to **work together**. Each view is associated with a unique controller and vice versa.

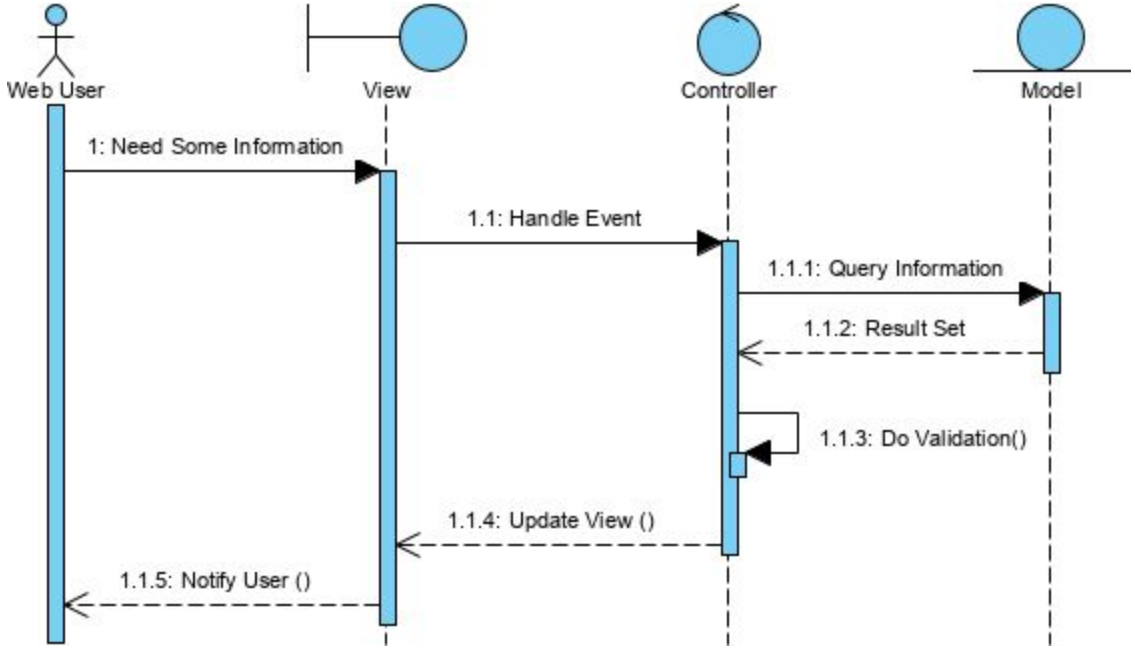
MVC pattern

Consequences (Advantages):

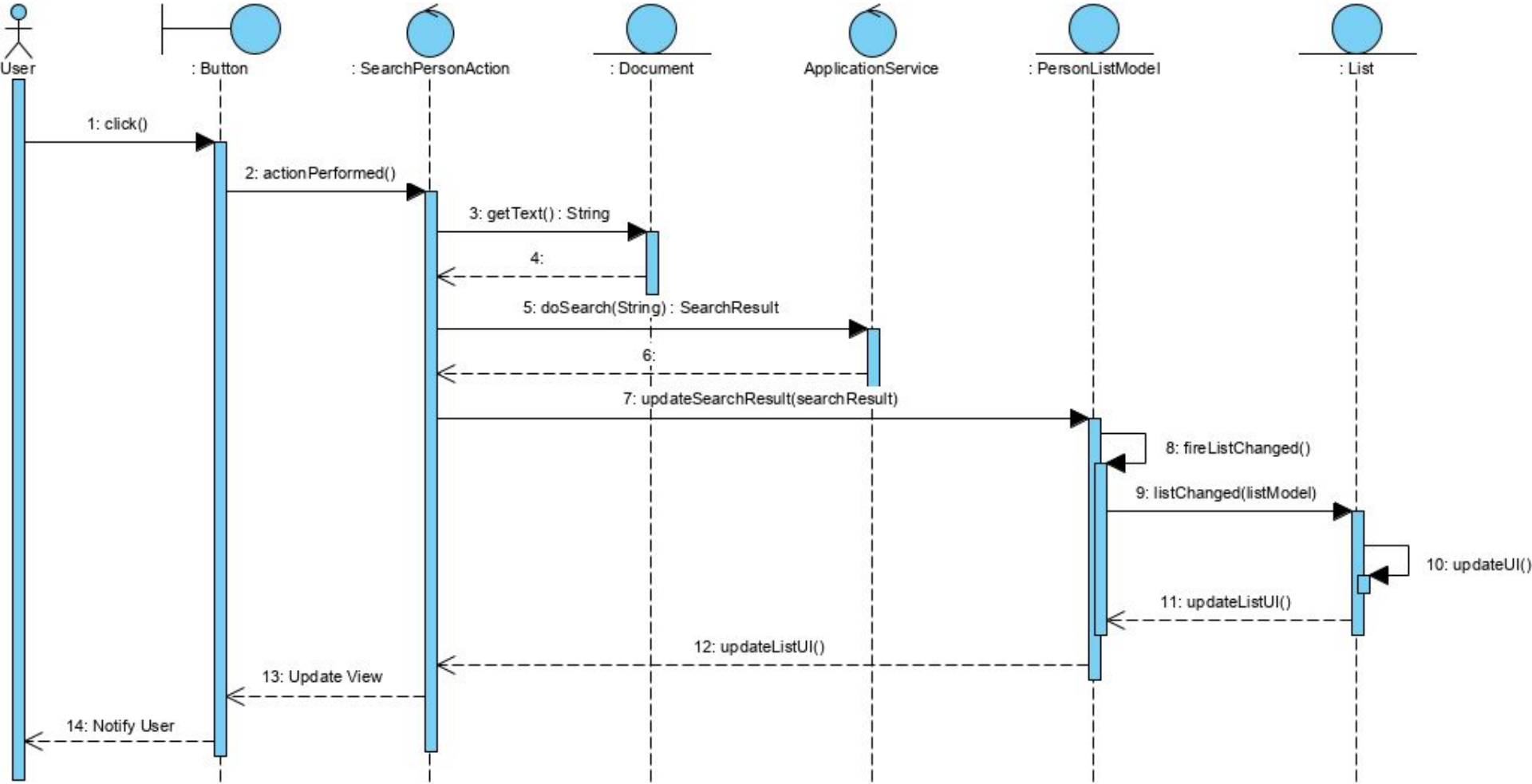
- Multiple developers can work on the application simultaneously due to the decoupling
- Higher cohesion (i.e., similar things together) and lower coupling (i.e., less forced connections between dissimilar things)
- Models can have multiple views

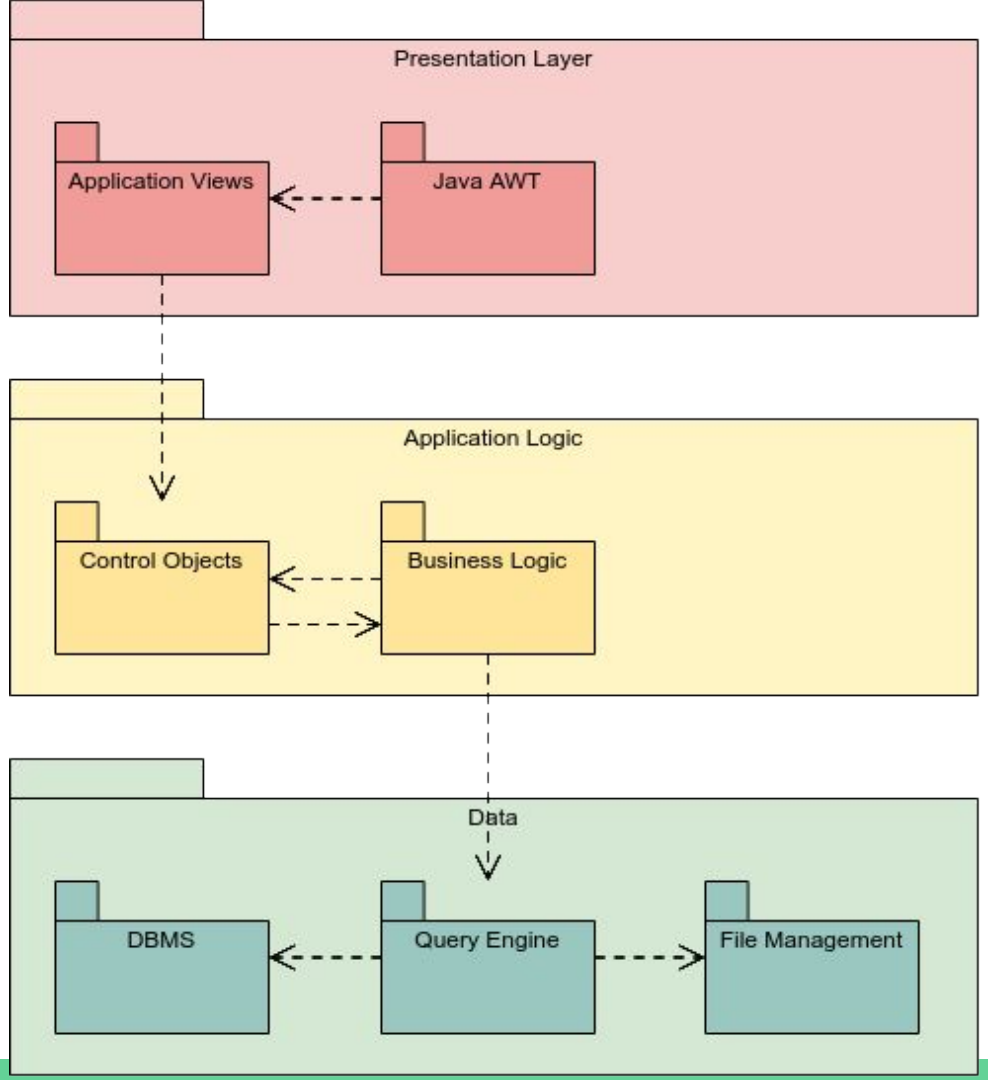
Consequences (Disadvantages):

- Harder to navigate code due to additional layers of abstraction
- Requires maintenance of multiple artifacts
- Steeper learning curve, requires knowledge in multiple areas

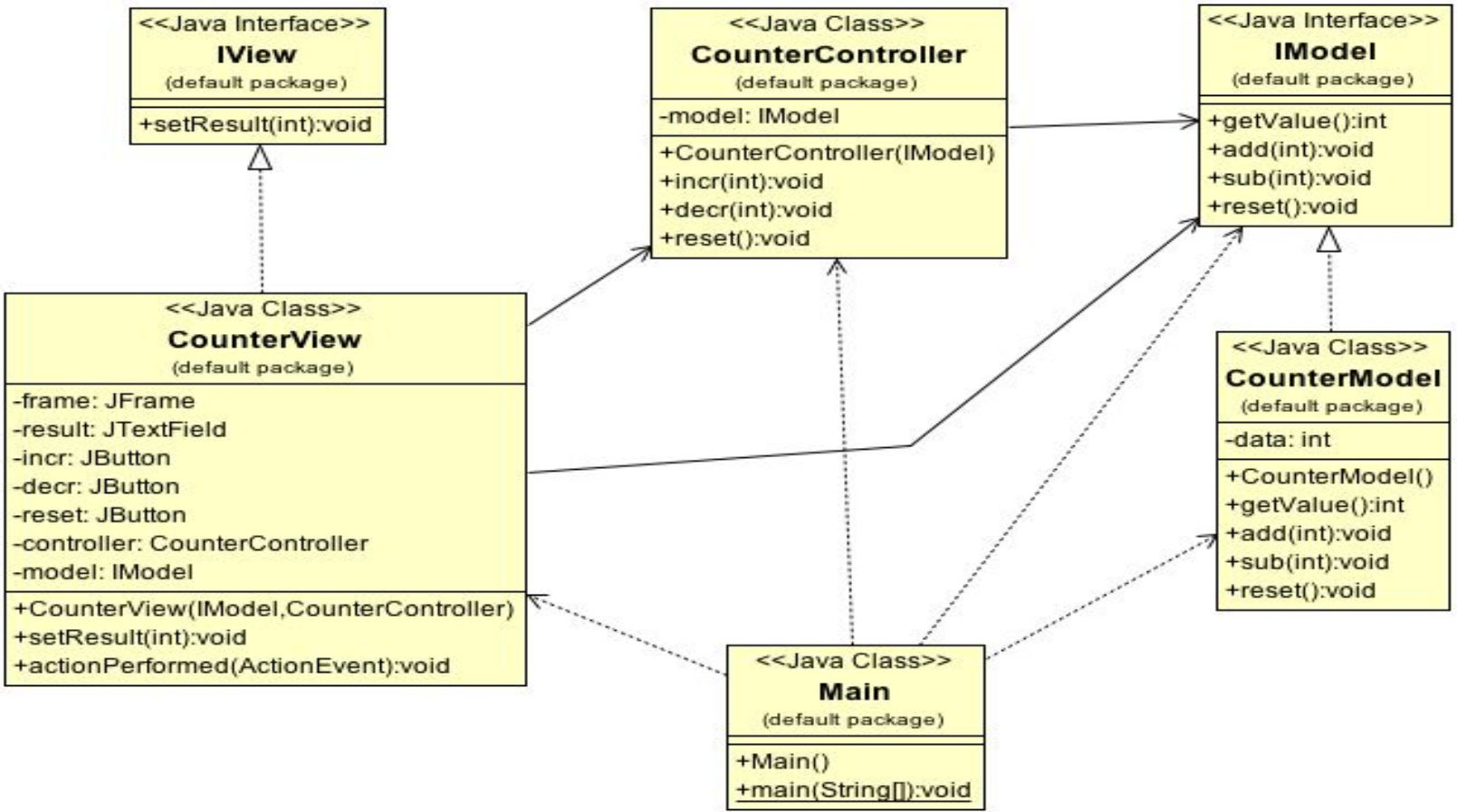


% visual paradigm


User
: Button
: SearchPersonAction
: Document
ApplicationService
: PersonListModel
: List
1: click()
2: actionPerformed()
3: getText() : String
4:
5: doSearch(String) : SearchResult
6:
7: updateSearchResult(searchResult)
8: fireListChanged()
9: listChanged(listModel)
10: updateUI()
11: updateListUI()
12: updateListUI()
13: Update View
14: Notify User


Presentation Layer
Application Views
Java AWT
Application Logic
Control Objects
Business Logic
Data
DBMS
Query Engine
File Management

MVC Demo


<<Java Interface>>
IView
(default package)
+setResult(int):void
<<Java Class>>
CounterController
(default package)
-model: IModel
+CounterController(IModel)
+incr(int):void
+decr(int):void
+reset():void
<<Java Interface>>
IModel
(default package)
+getValue():int
+add(int):void
+sub(int):void
+reset():void
<<Java Class>>
CounterView
(default package)
-frame: JFrame
-result: JTextField
-incr: JButton
-decr: JButton
-reset: JButton
-controller: CounterController
-model: IModel
+CounterView(IModel,CounterController)
+setResult(int):void
+actionPerformed(ActionEvent):void
<<Java Class>>
CounterModel
(default package)
-data: int
+CounterModel()
+getValue():int
+add(int):void
+sub(int):void
+reset():void
<<Java Class>>
Main
(default package)
+Main()
+main(String[]):void


MVP

MVP pattern

Pattern Category: Architectural

Intent: Decoupling major components in a user interface & make sure view is completely passive.

Problem addressed: Coupling of model and/or business logic within a GUI.
State/data of an application:
should be agnostic of user interface
should be logically independent of how it is displayed to the user

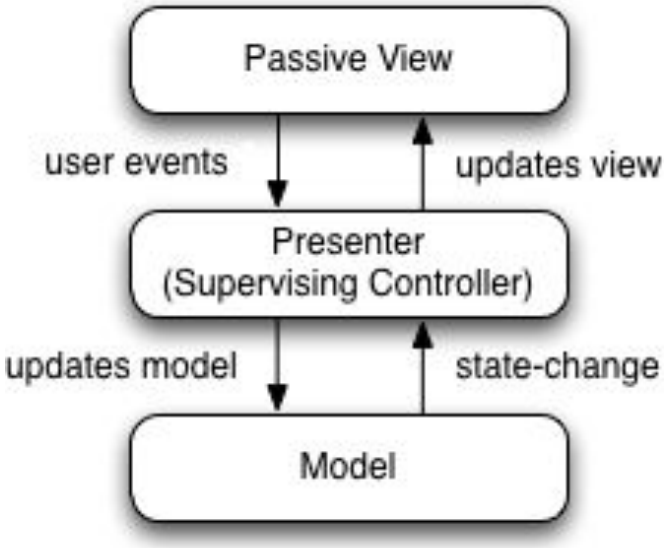
Solution: View and Model are fully decoupled and unaware of each other.

Implementation:

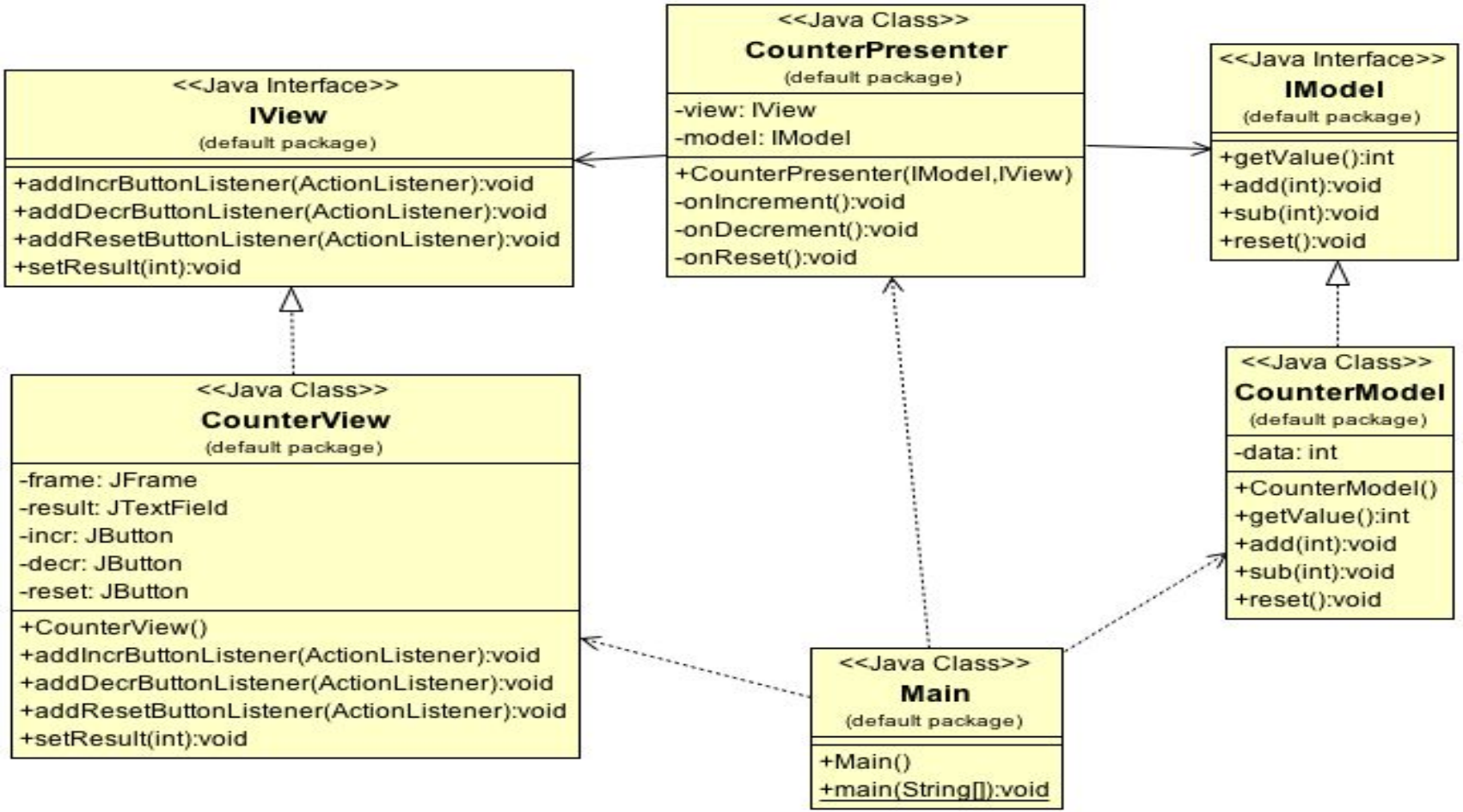
- *Model* manages data/state and expresses application behavior/functionality.

- *View* is very passive, thin, and shallow.
  - Provides data to presenter
  - Routes events to presenter
  - Obtains data from the presenter

- *Presenter* acts as both view and model.
  - Bulk of application logic resides here
  - Fully decouples view & model



MVP Demo


<<Java Interface>>
IView
(default package)
+addIncrButtonListener(ActionListener):void
+addDecrButtonListener(ActionListener):void
+addResetButtonListener(ActionListener):void
+setResult(int):void
<<Java Class>>
CounterPresenter
(default package)
-view: IView
-model: IModel
+CounterPresenter(IModel,IView)
-onIncrement():void
-onDecrement():void
-onReset():void
<<Java Interface>>
IModel
(default package)
+getValue():int
+add(int):void
+sub(int):void
+reset():void
<<Java Class>>
CounterView
(default package)
-frame: JFrame
-result: JTextField
-incr: JButton
-decr: JButton
-reset: JButton
+CounterView()
+addIncrButtonListener(ActionListener):void
+addDecrButtonListener(ActionListener):void
+addResetButtonListener(ActionListener):void
+setResult(int):void
<<Java Class>>
CounterModel
(default package)
-data: int
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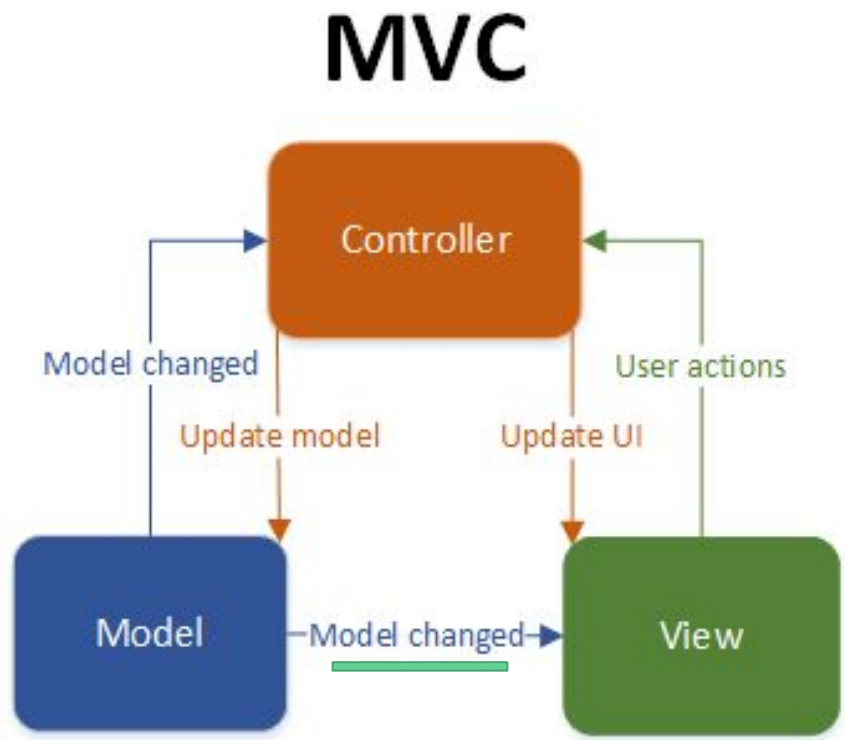
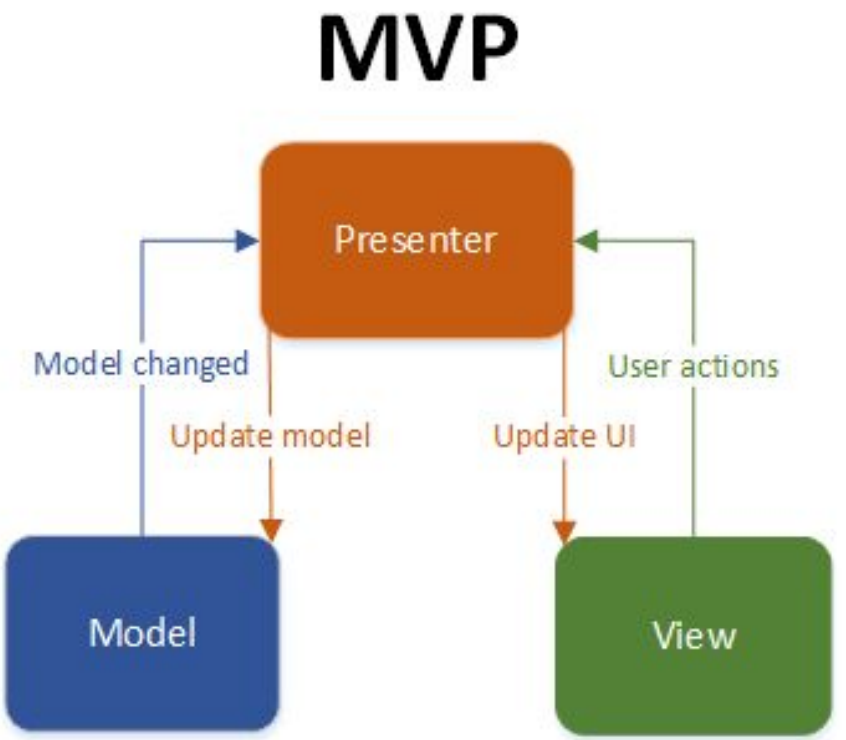
<<Java Class>>
Main
(default package)
+Main()
+main(String[]):void


MVC
Controller
Model changed
Update model
Update UI
User actions
Model
Model changed
View


MVP
Presenter
Model changed
Update model
Update UI
User actions
Model
View

(Python)

https://www.giacomodebidda.com/mvc-pattern-in-python-introduction-and-basicmodel/

https://www.tutorialspoint.com/python_design_patterns/python_design_patterns_model_view_controller.htm

MVC Demo ➜ Flask!
MVP Demo ➜ self-guided!
https://medium.com/cr8resume/make-you-hand-dirty-with-mvp-model-view-presenter-eab5b5c16e42

MVC vs MVP

Which is better?