Material and some slide content from:
- Krzysztof Czarnecki
- Ian Sommerville
- Head First Design Patterns

MVC / MVP
Dependency Injection

Reid Holmes

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Background

- MVC started w/ Smalltalk-80
- Java UI frameworks & EJBs reignited interest
- Also prevalent in GWT and .NET development

MVC Motivation

- UI changes more frequently than business logic
  - e.g., layout changes (esp. in web applications)
- The same data is often displayed in different ways
  - e.g., table view vs chart view
  - The same business logic can drive both
- Designers and developers are different people
- Testing UI code is difficult and expensive
- Main Goal: Decouple models and views
  - Increase maintainability/testability of system
  - Permit new views to be developed

Model

- Contains application data
    - This is often persisted to a backing store
- Does not know how to present itself
- Is domain independent
- Are often Subjects in the Observer pattern

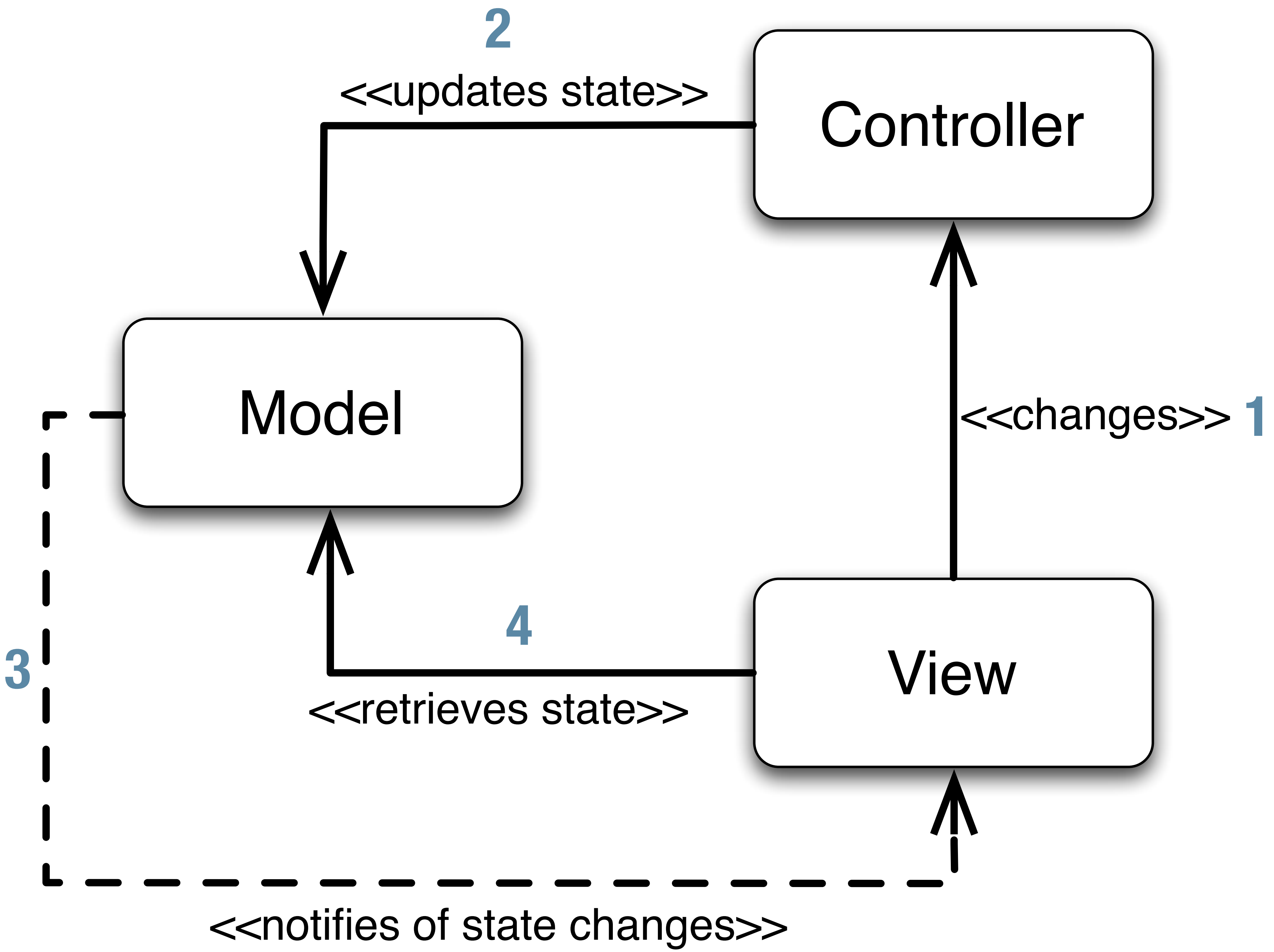
View

- Presents the model to the user
- Allows the user to manipulate the data
- Does not store data
- Is configurable to display different data

Controller

- Glues Model and View together
- Updates the view when the Model changes
- Updates the model when the user manipulates the view
- Houses the application logic
- Loose coupling between Model and others
- View tightly cohesive with its Controller

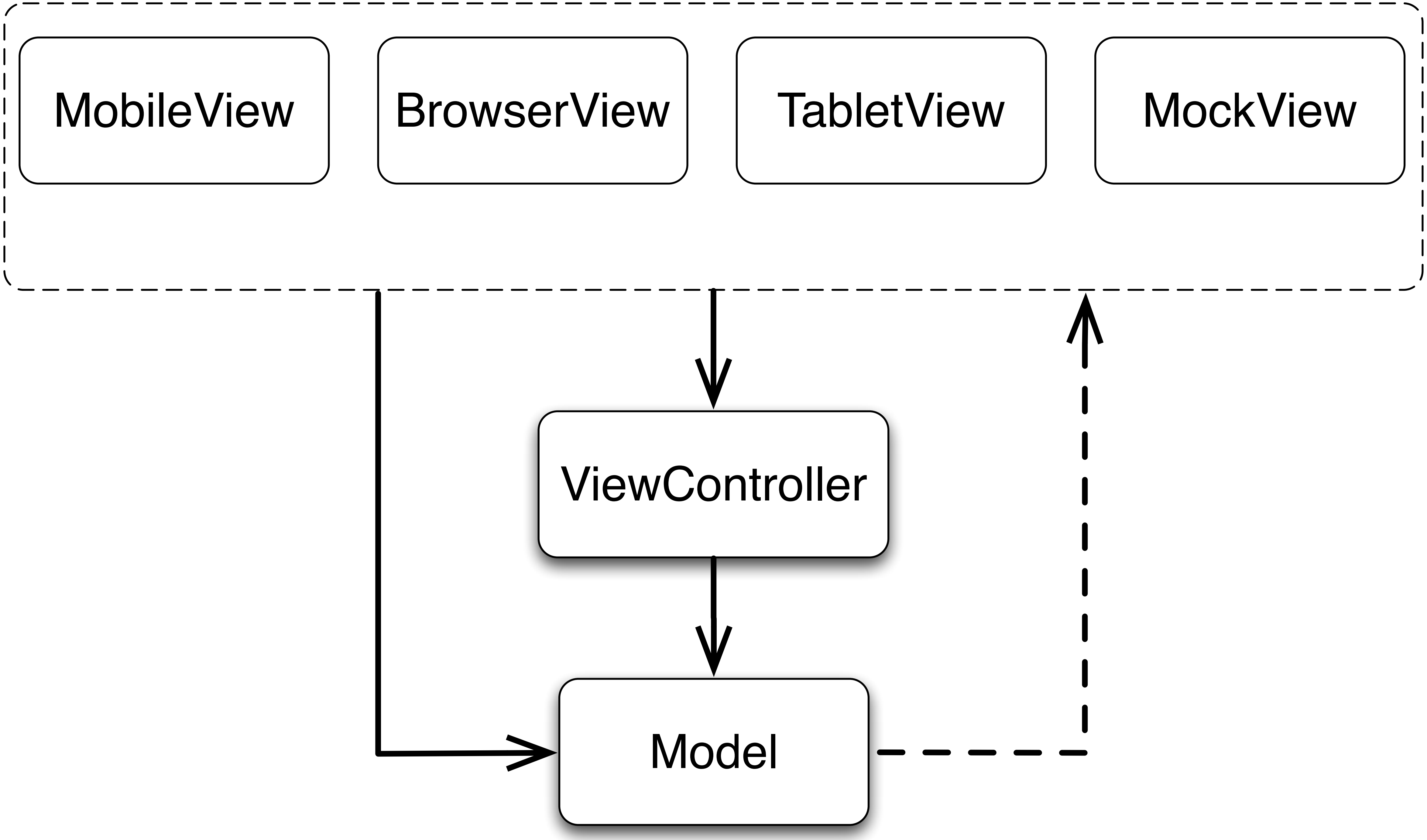
Abstract topology



Concrete topology

```
Factory f = GWT.create(Factory.class);
ViewController c = new ViewController();
View v = f.createView(c);
```

[gwt.xml maps Factory.class
to the right type]



Interaction mechanism

- User interacts with the UI (View)
- UI (View) notifies controller of changes
- Controller handles notifications, processing them into actions that can be performed on the model
- Controller modifies the model as required
- If the model changes, it fires modification events
- The view responds to the modification events

Benefits and tradeoffs

- Pro:
  - Decouple view from model
    - Support multiple views [collaborative views]
    - Maintainability [add new views]
    - Split teams [relieve critical path]
  - Testability [reduce UI testing]
- Con:
  - Complexity [indirection, events]
  - Efficiency [frequent updates, large models]

MVP Motivation

- Take MVC a tiny bit further:
  - Enhance testability
  - Further separate Designers from Developers
- Leveraged by both GWT and .NET

Model

- Contains application data
  - This is often persisted to a backing store
- Does not know how to present itself
- Is domain independent
- Often fires events to an Event Bus

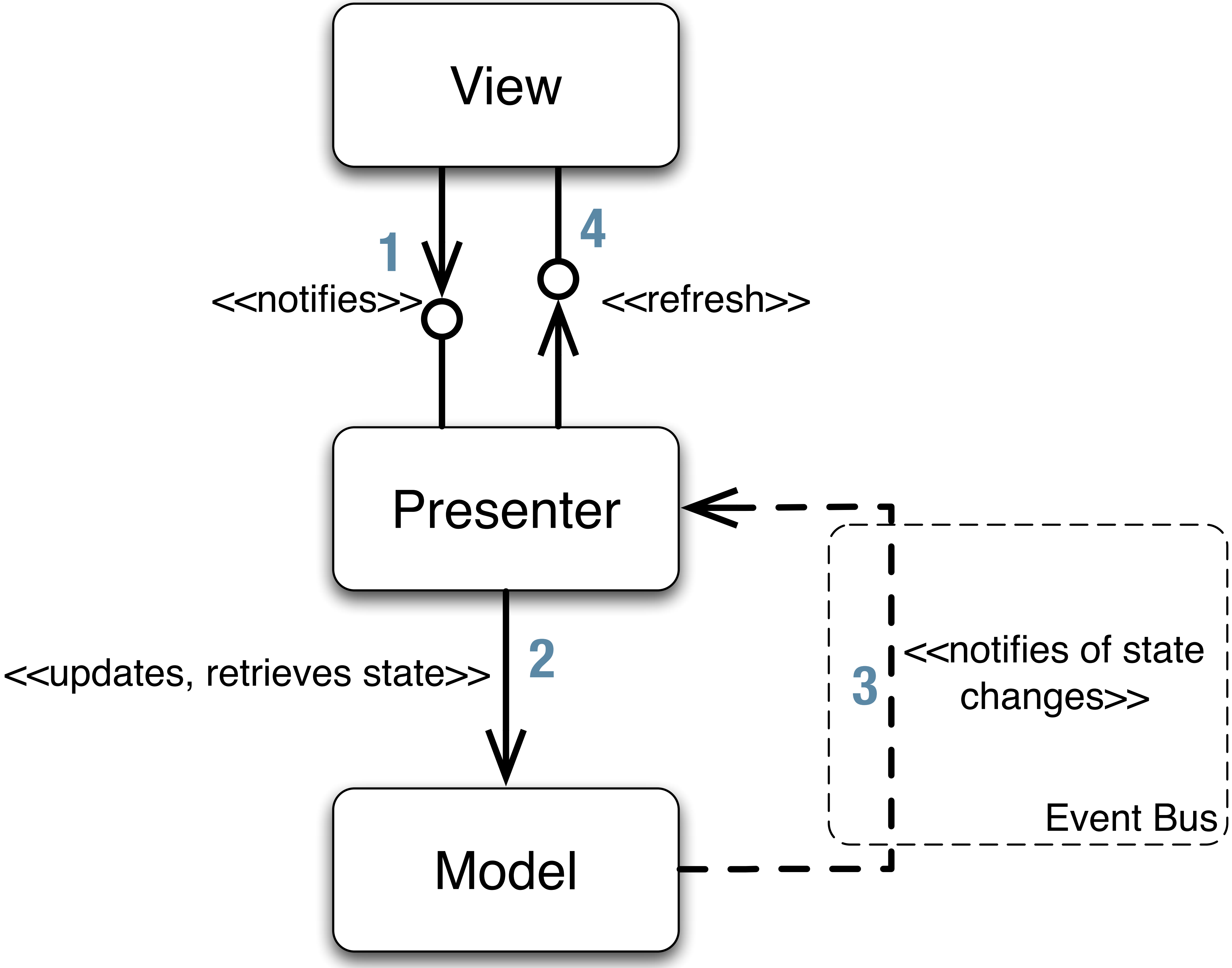
View

- Thin UI front-end for controller
- Does not store data
- Can be interchanged easily
- Does not ever see or manipulate Model objects
- Only interacts with primitives
  - e.g., (setUser(String) instead of setUser(User))

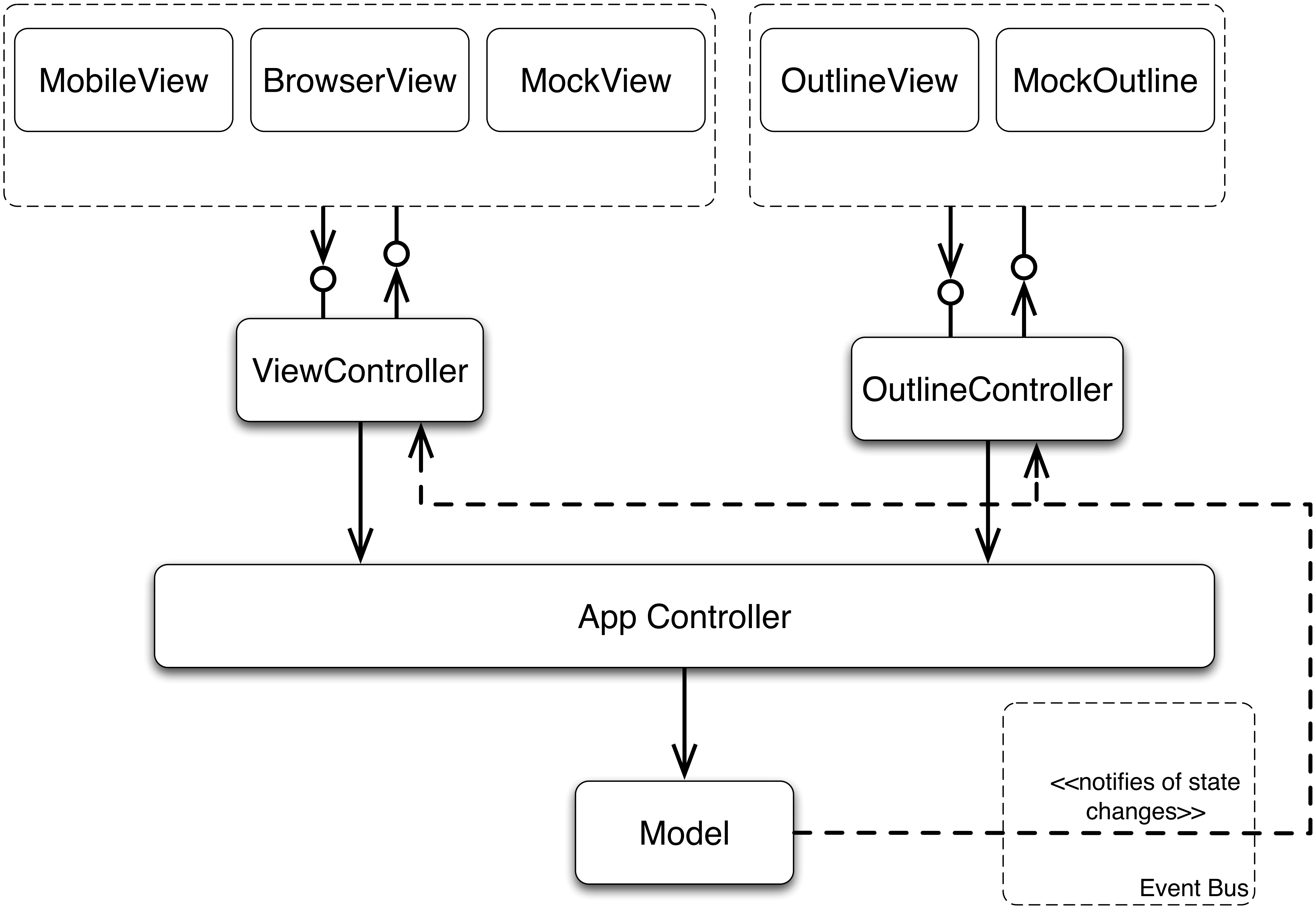
Controller

- Glues Model and View together
- Updates the view when the Model changes
- Updates the model when the user manipulates the view
- Houses the application logic

MVP Topology



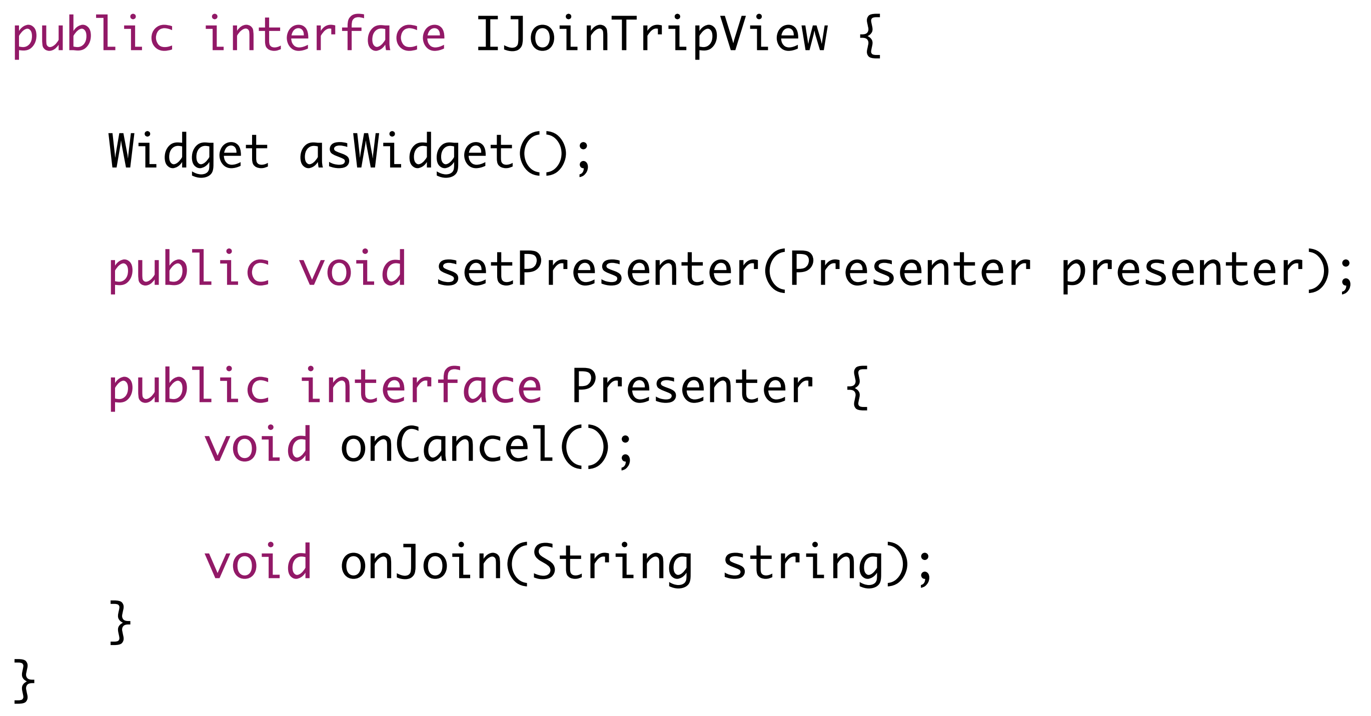
Concrete MVP Topology



Concrete Example

```
Factory f = GWT.create(Factory.class);
AppController ac = new AppController(f);
ac.showMain();
-->
   View v = f.createView(new ViewController());
   Outline o = f.createOutline(new OutlineController());
```

[gwt.xml maps Factory.class to the right type]



```
public interface IJoinTripView {

    Widget asWidget();

    public void setPresenter(Presenter presenter);

    public interface Presenter {
        void onCancel();

        void onJoin(String string);
    }
}
```

Benefits and tradeoffs

- Same as MVC with improved:
  - Decoupling of views from the model
    - Split teams [relieve critical path]
  - Testability [reduce UI testing]
  - A little less complex than MVC [fewer events]

Dependency Injection

- Common problem: ‘how can we wire these interfaces together without creating a dependency on their concrete implementations?’
  - This often challenges the ‘program to interfaces, not implementations ’ design principle
    - Would like to reduce (eliminate) coupling between concrete classes
  - Would like to be able to substitute different implementations without recompiling
    - e.g., be able to test and deploy the same binary even though some objects may vary
  - Solution: separate objects from their assemblers

Goal

- Eliminate initialization statements. e.g.,
  - Foo f = new ConcreteFoo();
- In dependency injection a third party (an injector)
- At a high level dependency injection:
  - **Takes** a set of components (classes + interfaces)
  - **Adds** a set of configuration metadata
  - **Provides** the metadata to an injection framework
  - **Bootstraps** object creation with a configured injector

Credit-card example