Google™ 09 I/O

GWT App Architecture Best Practices

Ray Ryan
28 May 2009

What are we talking about?

- How to organize a nontrivial GWT application
- Particular focus on client side
- Lessons learned from new AdWords UI

If you remember nothing else...

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- Get browser history right, and get it right early

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  Dependency Injection plus
  Model / View / Presenter
  for the win!

Demo new AdWords UI

Three major themes

1. Embrace asynchrony
2. Always be decoupling
3. Strive to achieve statelessness

Embrace Asynchrony

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- Everything might require an async call sometimes
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```
class Contact {
  String name;
  List<ContactDetail> details;

  List<ContactDetail> getContactDetails() {
    return details;
  }

  String getName() {
    return name;
  }
}
```

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✗

Remember what that **A** in **A**JAX is for

- Everything might require an async call sometimes
- So assume it does all the time

```
class Contact {
  String name;
  ArrayList<ContactDetailId> detailIds;

  ArrayList<ContactDetailId> getDetailIds() {
    return detailIds;
  }

  String getName() {
    return name;
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}
```

✓

Command Pattern to make async tolerable

- Leverage point for
  - Caching
  - Batching
  - Centralize failure handling
- Lays the groundwork for
  - GWT.runAsync()
  - Undo / Redo
  - Gears / HTML5 DB

Use Command pattern RPC

```
/** The name Command is taken */
interface Action<T extends Response> { }

interface Response { }

interface ContactsService extends RemoteService {
  <T extends Response> T execute(Action<T> action);
}

interface ContactsServiceAsync {
  <T extends Response> void execute(Action<T> action,
      AsyncCallback<T> callback);
}
```

Command style RPC example

Write an Action…

```
class GetDetails implements Action<GetDetailsResponse> {
  private final ArrayList<ContactDetailId> ids;

  public GetDetails(ArrayList<ContactDetailId> ids) {
    this.ids = ids;
  }

  public ArrayList<ContactDetailId> getIds() {
    return ids;
  }
}
```

Command style RPC example

…and its response…

```
class GetDetailsResponse implements Response {
  private final ArrayList<ContactDetail> details;

  public GetDetailsResponse(ArrayList<ContactDetail> details) {
    this.details = details;
  }

  public ArrayList<ContactDetail> getDetails() {
    return new ArrayList<ContactDetail>(details);
  }
}
```

Command style RPC example

…plus convenience callback

```
abstract class GotDetails implements
    AsyncCallback<GetDetailsResponse> {

  public void onFailure(Throwable oops) {
    /* default appwide failure handling */
  }

  public void onSuccess(GetDetailsResponse result) {
    got(result.getDetails());
  }

  public abstract void got(ArrayList<ContactDetail> details);
}
```

Command style RPC example

Make it go

```
void showContact(final Contact contact) {
  service.execute(new GetDetails(contact.getDetailIds()),
    new GotDetails() {
      public void got(ArrayList<ContactDetail> details) {
        renderContact(contact);
        renderDetails(details);
      }
  });
}
```

Always be decoupling

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With the combination of

- An event bus
- MVP pattern for your custom widgets
- Dependency injection of app-wide services

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Easy rejiggering of the app

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Easy to defer pokey DOM operations

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Easy unit testing

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With the combination of

- An event bus
- MVP pattern for your custom widgets
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You get...

Easy rejiggering of the app

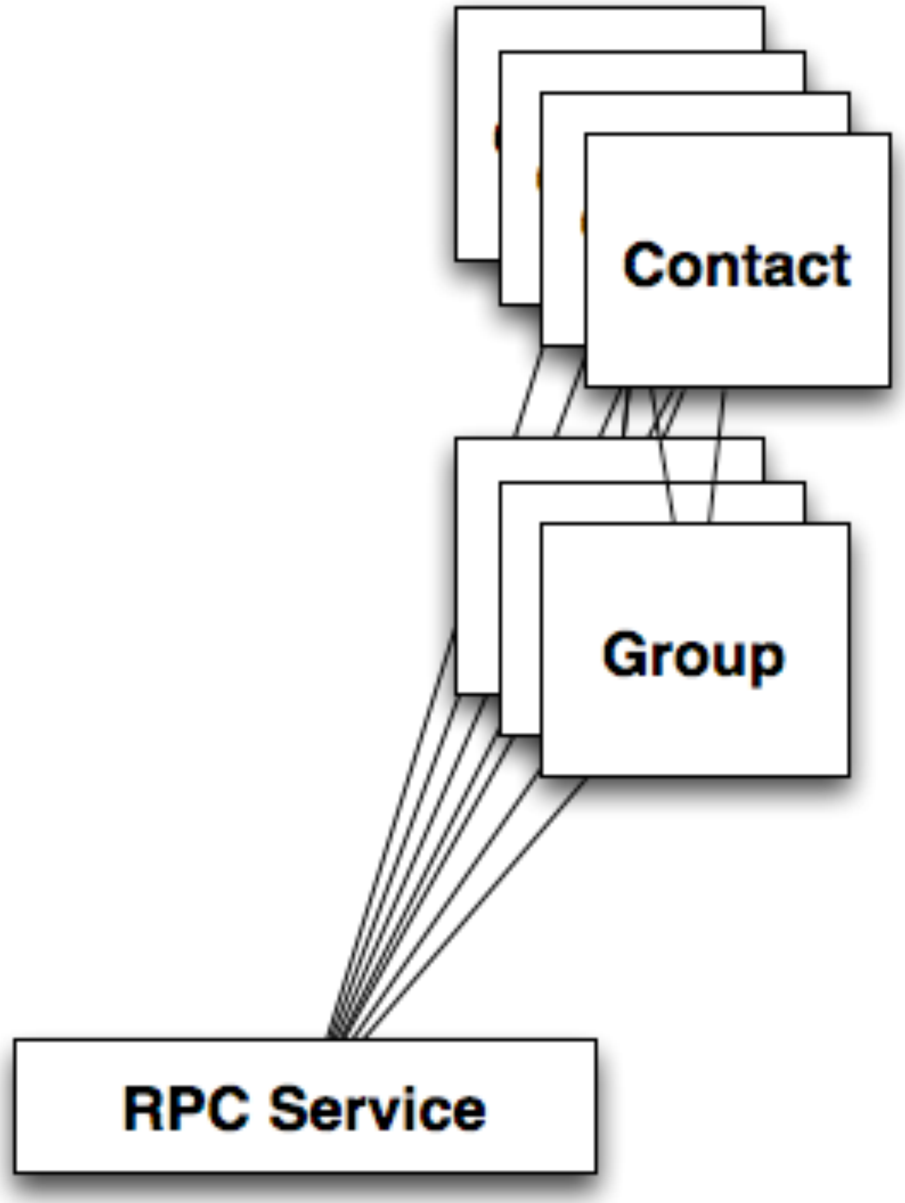
Easy to defer pokey DOM operations

Easy unit testing

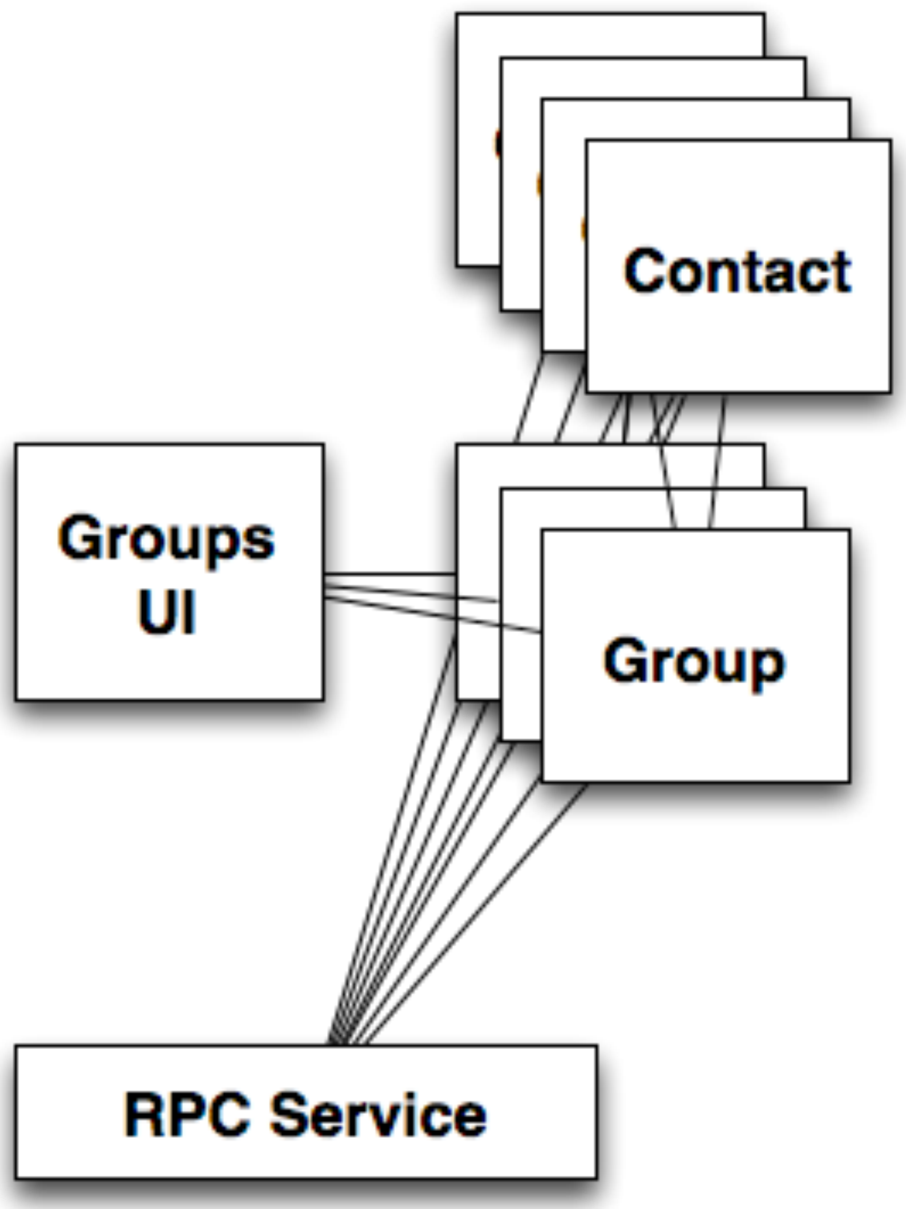
Fast test execution

Decoupling via event bus

Coupling



Coupling



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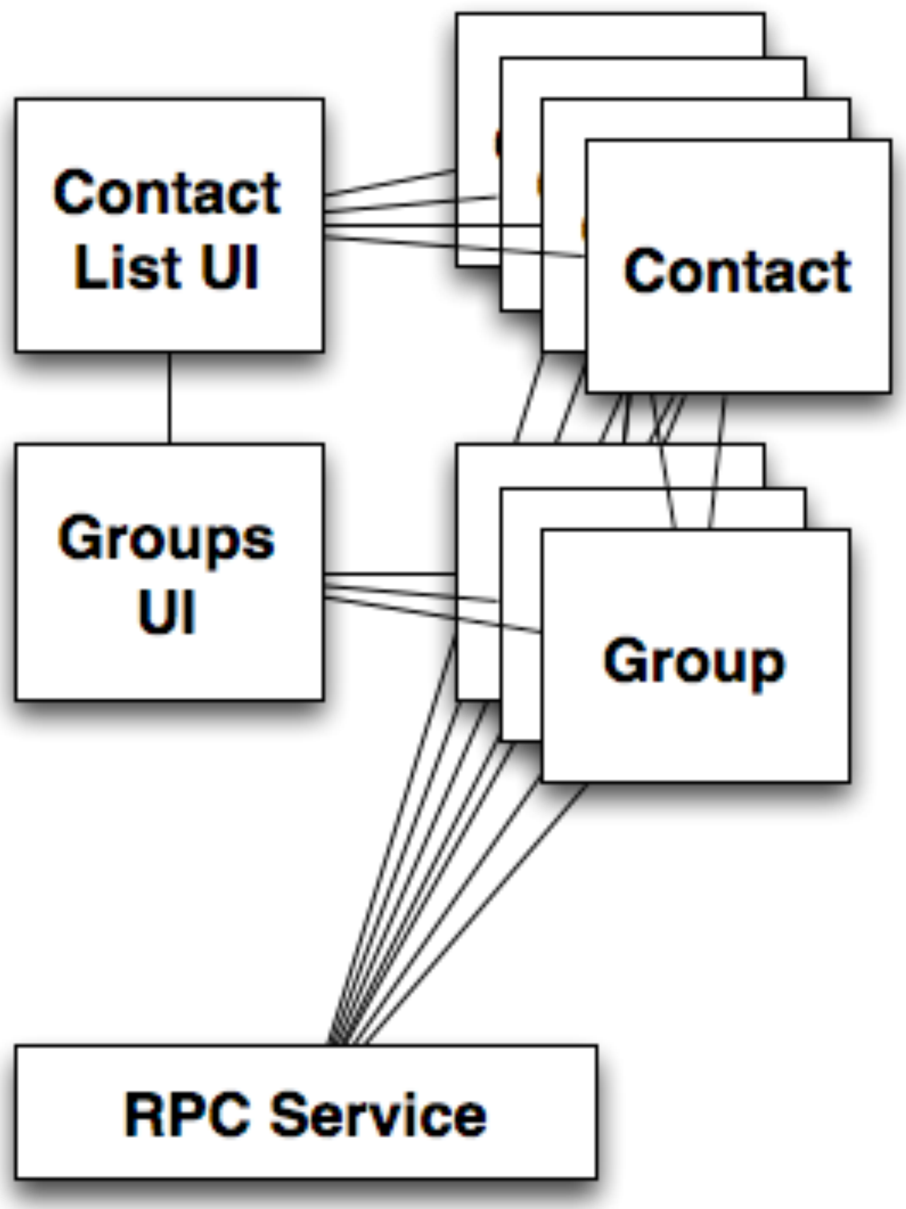

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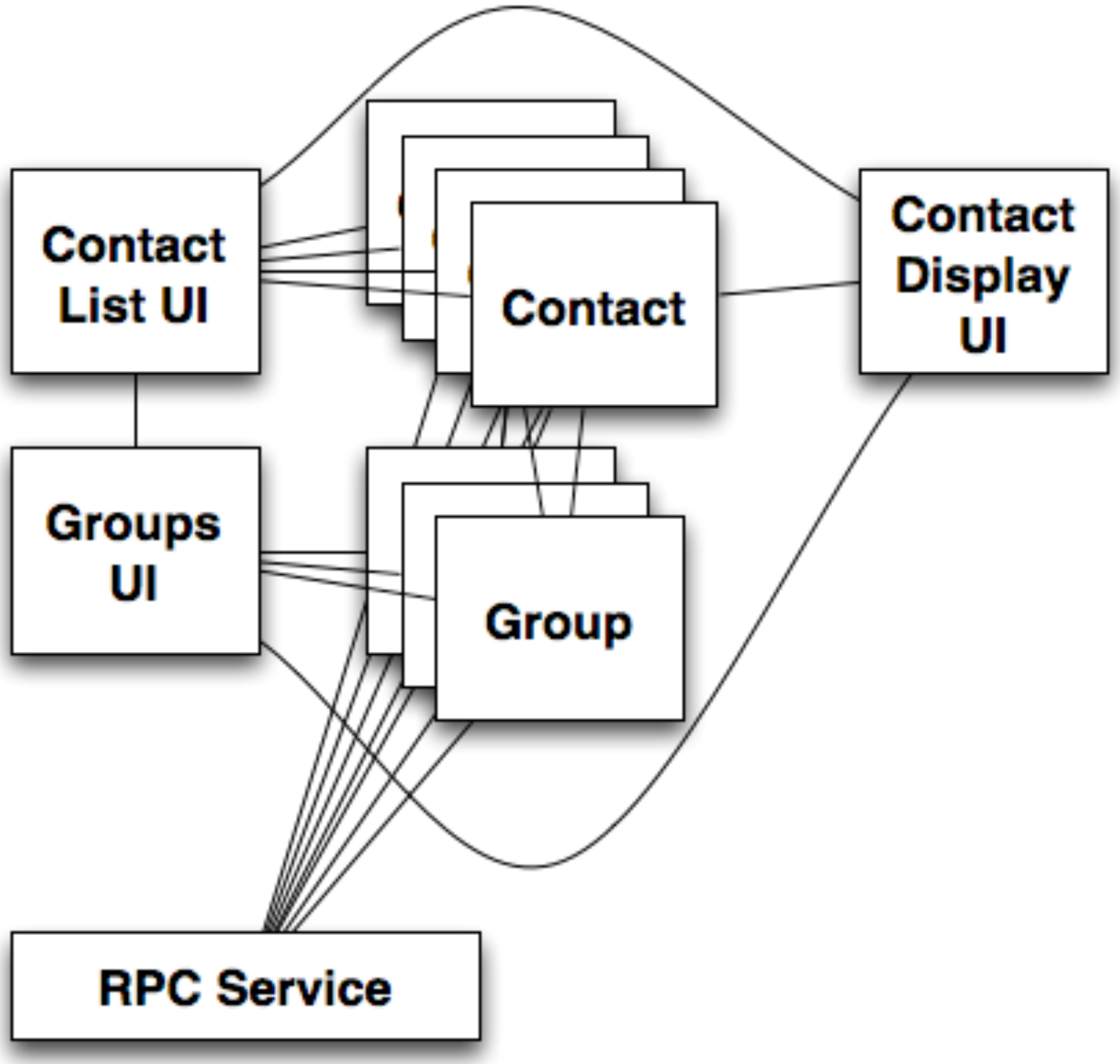
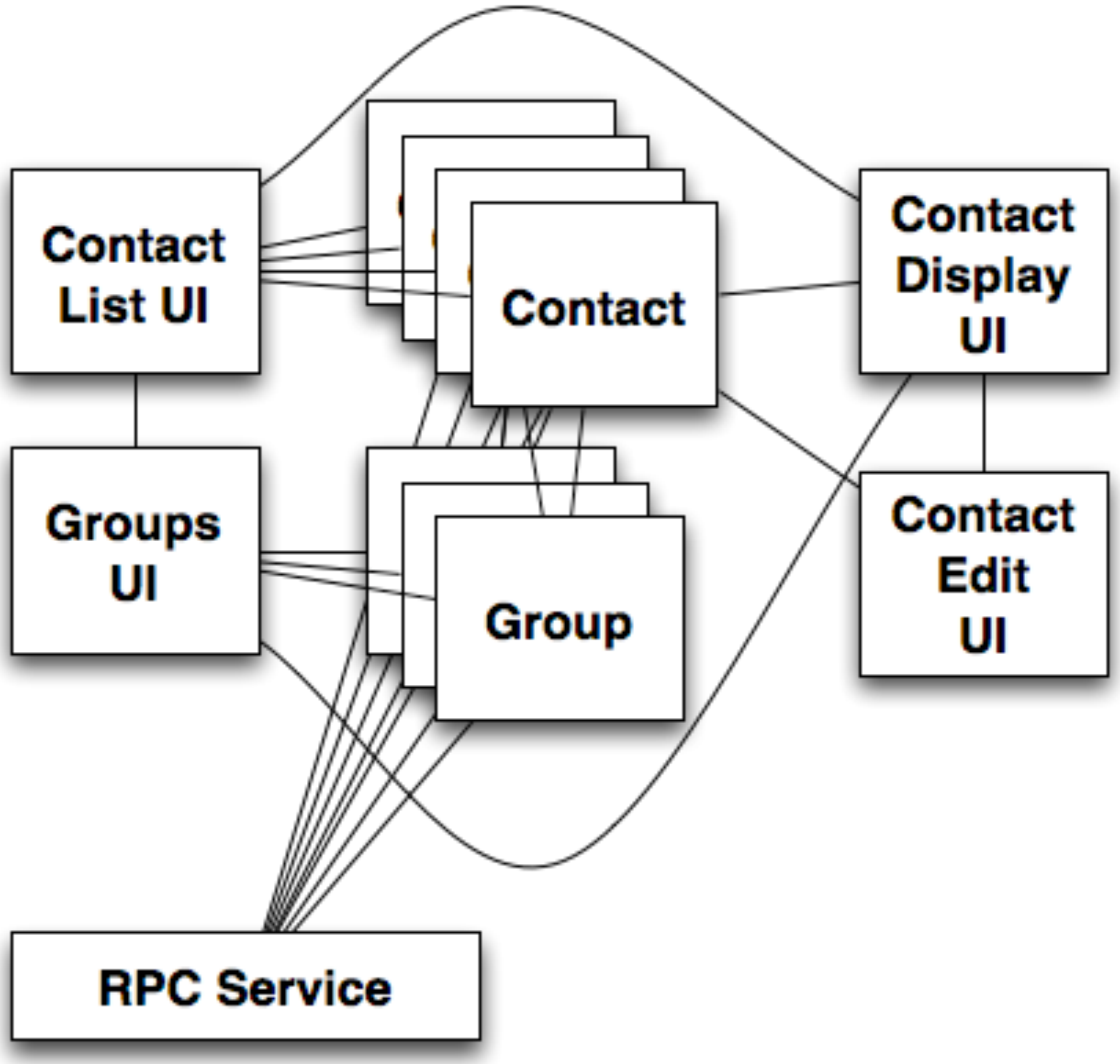

Contact List UI
Contact
Contact Display UI
Groups UI
Group
RPC Service

Coupling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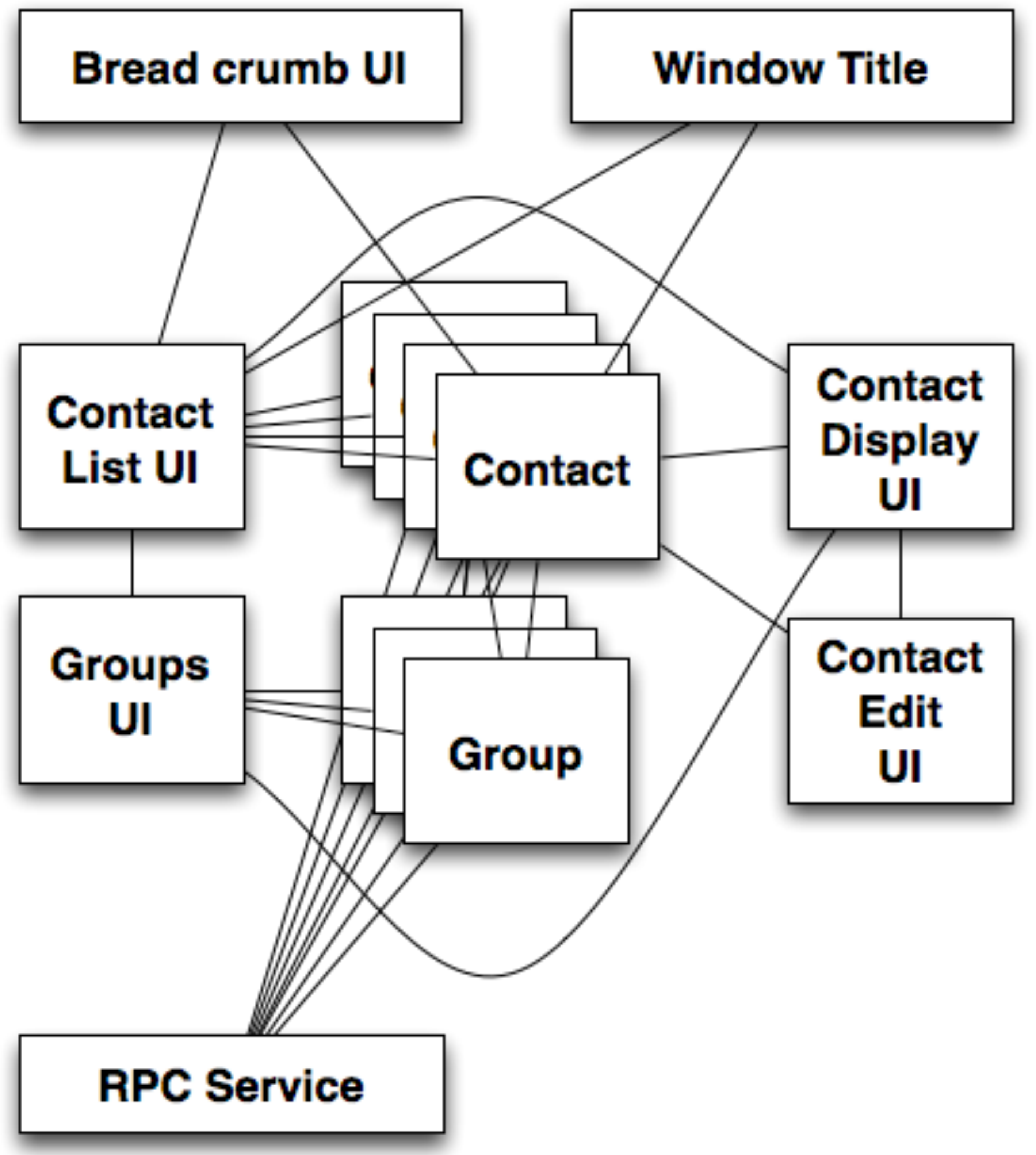

Bread crumb UI
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Contact List UI
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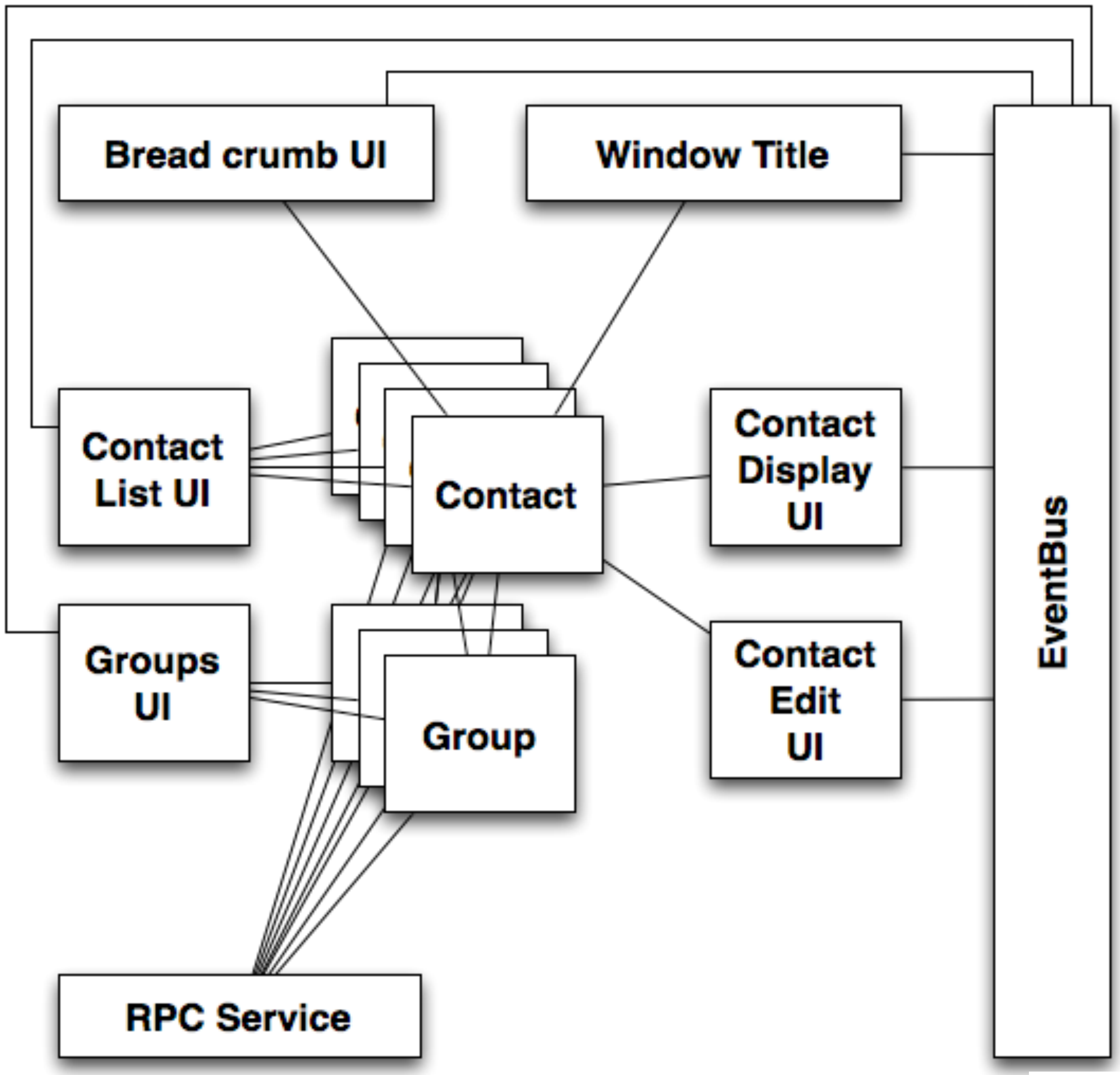
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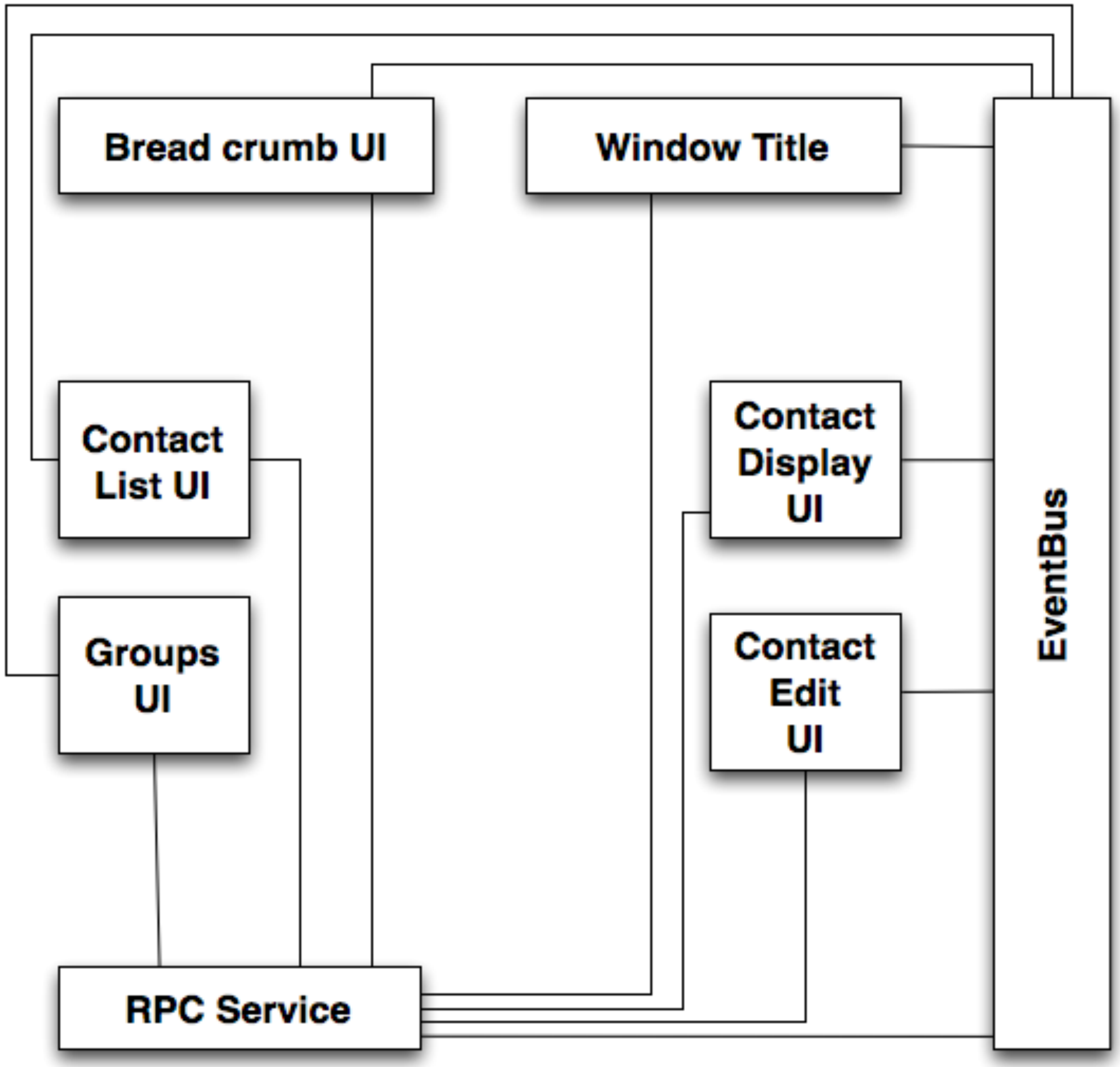
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EventBus

Implement with GWT HandlerManager

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    new GotDetails() {
      public void got(ArrayList<ContactDetail> details) {
        renderContact(contact);
        renderDetails(details);
      }
    }
  });
}
```

EventBus

Implement with GWT HandlerManager

```
ContactId currentContact;

void showContact(final Contact contact) {
    if (!currentContactId.equals(contact)) {
      currentContactId = currentContactId;
      service.execute(new GetDetails(contact.getDetailIds()),
        new GotDetails() {
          public void got(ArrayList<ContactDetail> details) {
            renderContact(contact);
            renderDetails(details);
          }
      });
    }
  }
```

EventBus

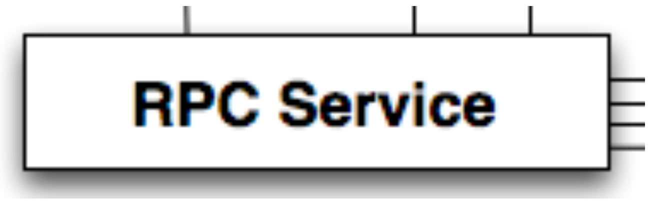
Implement with GWT HandlerManager

```
HandlerManager eventBus;

void listenForContactUpdates() {
  eventBus.addHandler(ContactChangeEvent.TYPE,
    new ContactChangeEventHandler() {
      public void onContactChange(ContactChangeEvent event) {
        Contact contact = event.getContact();
        if (currentContactId.equals(contact.getId())) {
          renderContact(contact);
        }
      }
    });
}
```

EventBus

Tossing the event



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public void execute(final UpdateContact update,
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  realService.execute(update,
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        cb.onFailure(caught);
      }
      public void onSuccess(UpdateContactResponse result) {
        recache(update.getContact());
        cb.onSuccess(result);
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        eventBus.fireEvent(e);
      }
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```

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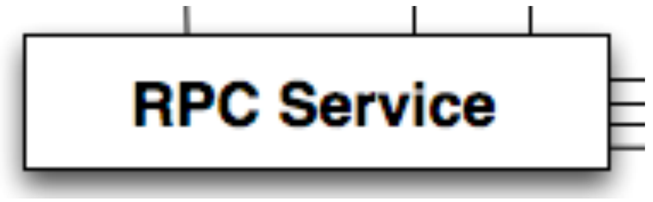

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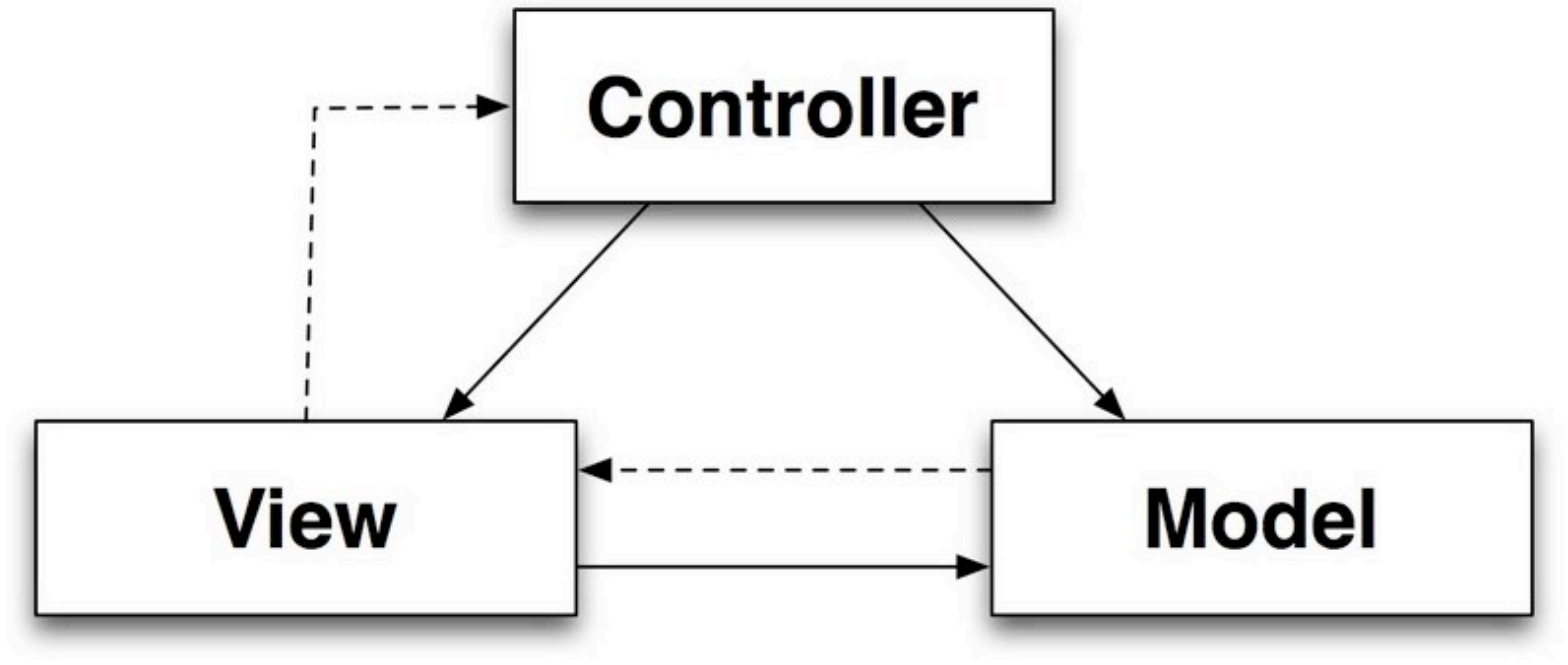
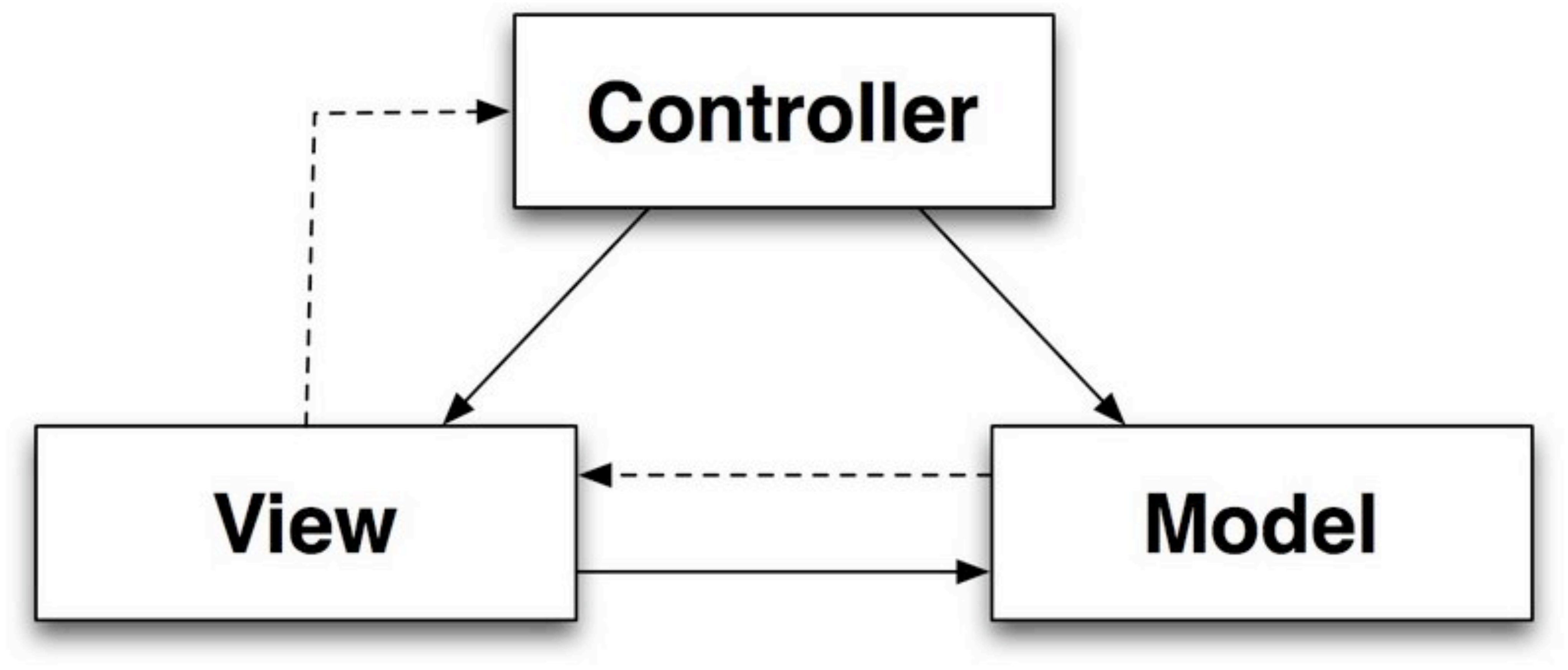
Decoupling via MVP

Classic Model View Controller pattern



Classic Model View Controller pattern

How 1980s



Classic Model View Controller pattern

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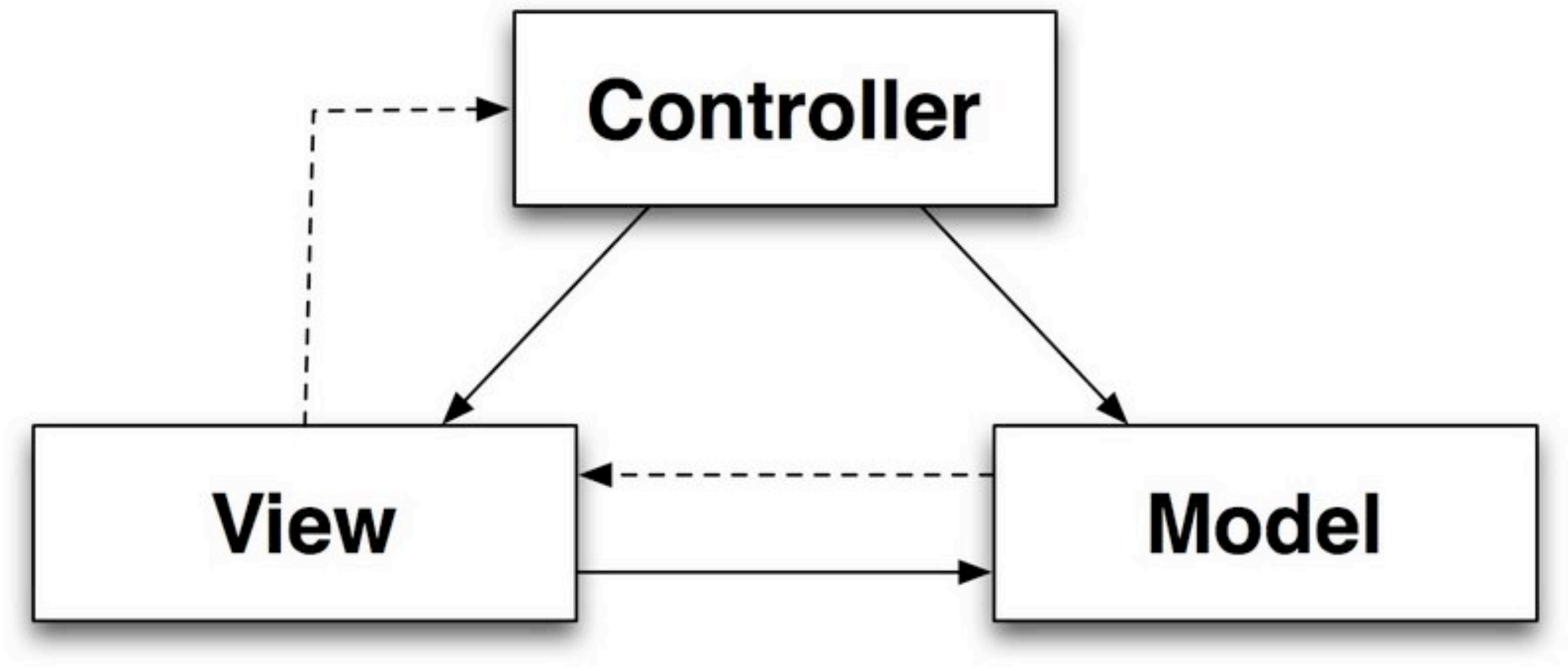
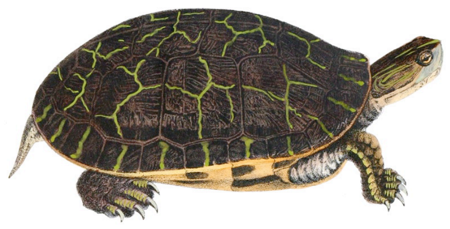
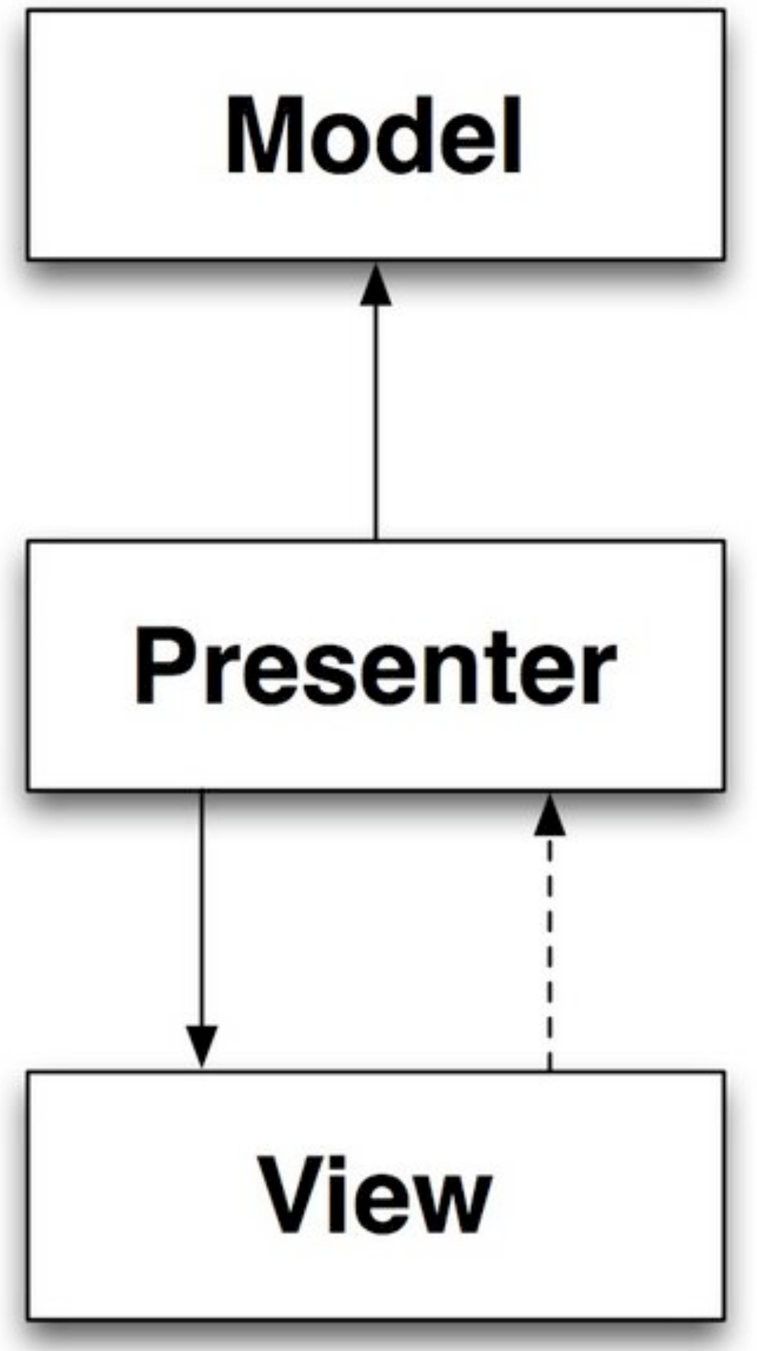
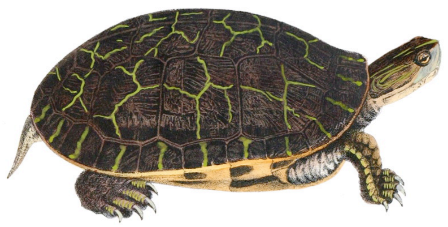




public domain image http://vintageprintable.com/wordpress/wp-content/uploads/2009/04/deirochelys_reticulariaholbrookv1p07a.jpg

MVP





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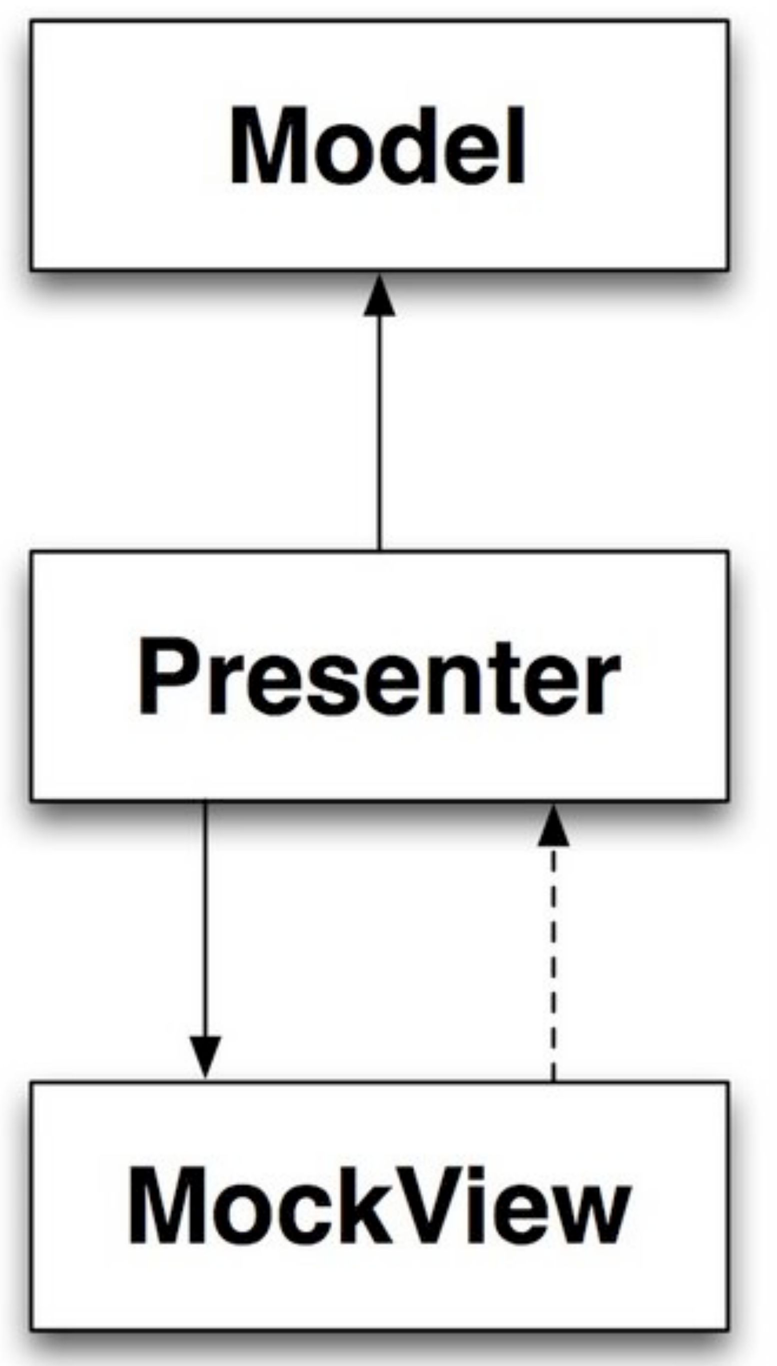
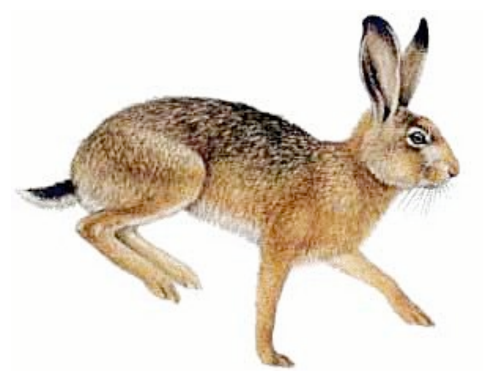


GWTMockUtilities



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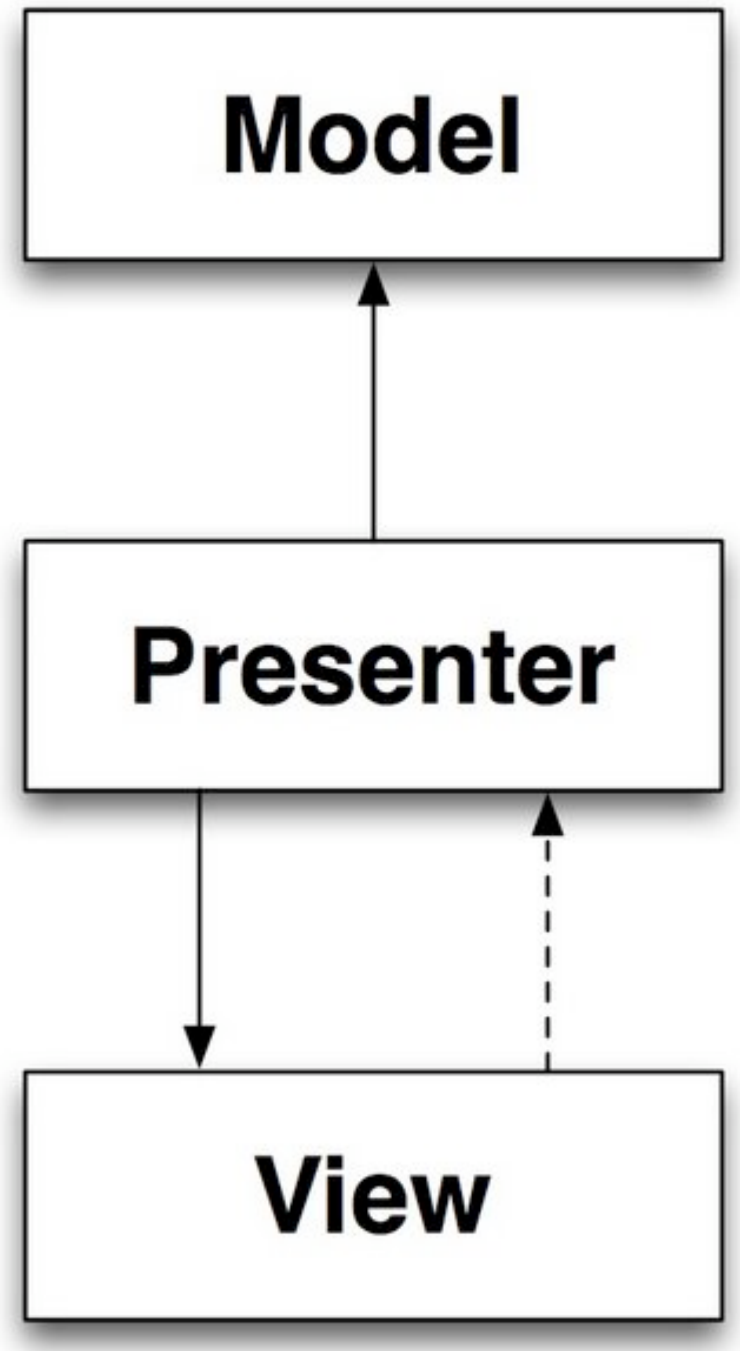
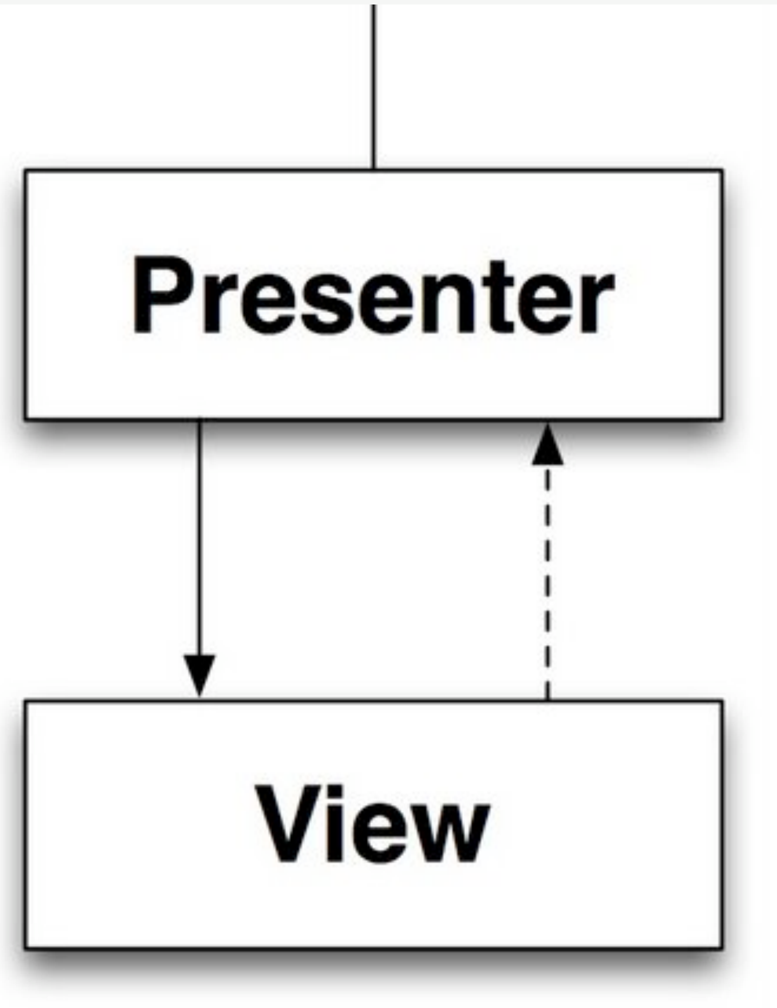


MVP

```
class Phone implements ContactDetail {
  final ContactDetailId id;
  String number;
  String label; // work, home...
}
```



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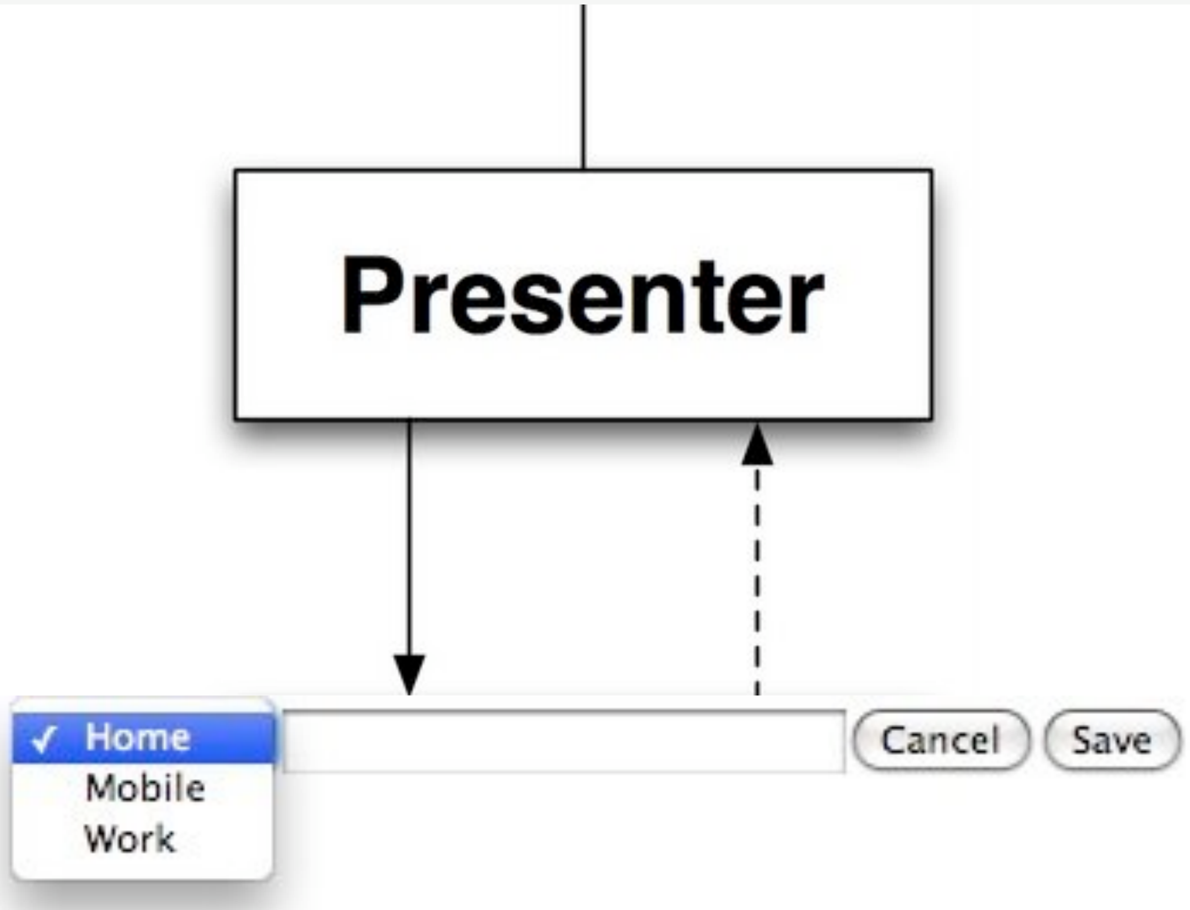

MVP

```
class Phone implements ContactDetail {
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  String label; // work, home...
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```
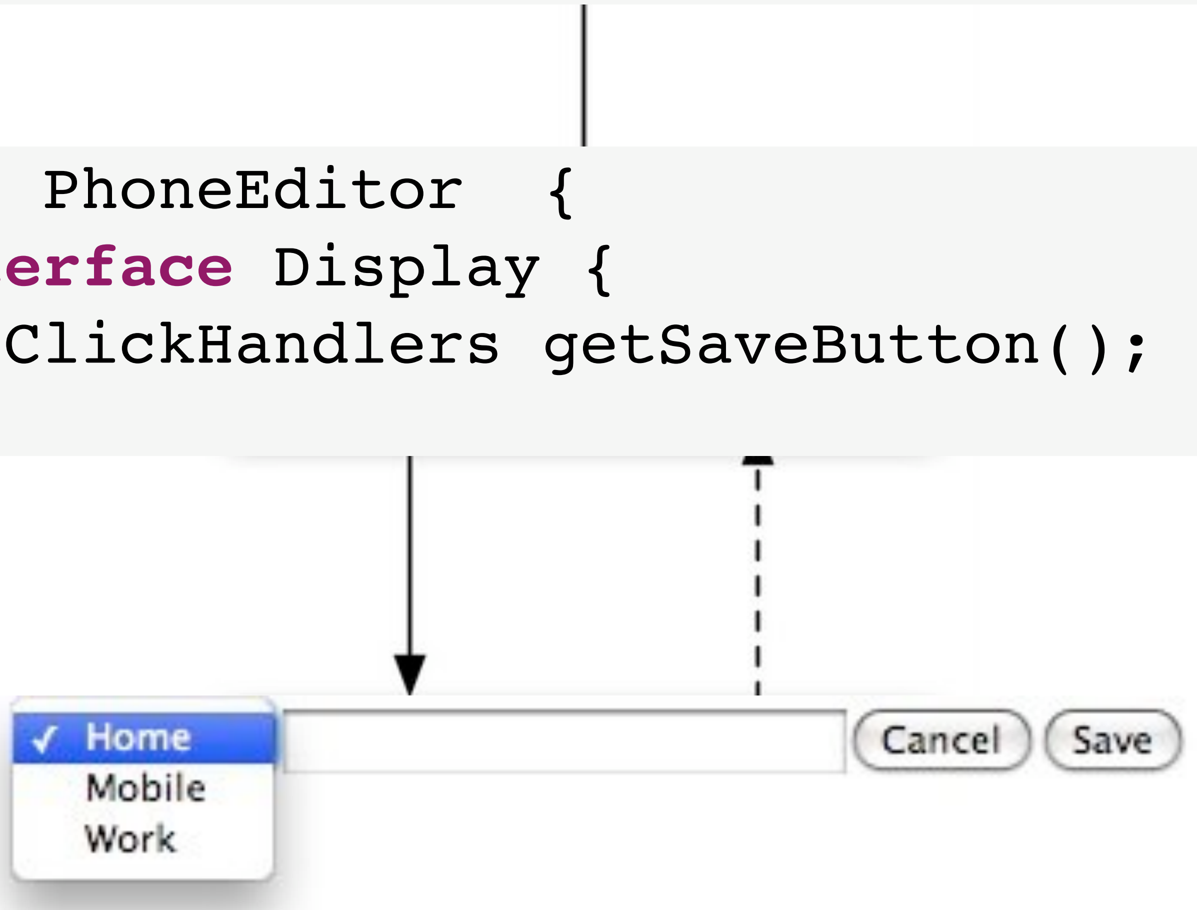
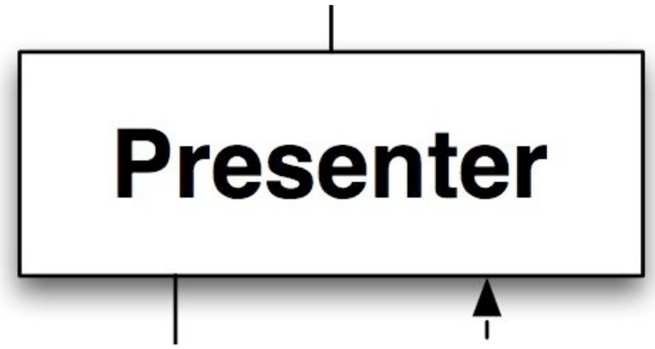

```
class PhoneEditor  {
  interface Display {
  HasClickHandlers getSaveButton();
  ...
```



Sample Presenter: PhoneEditor

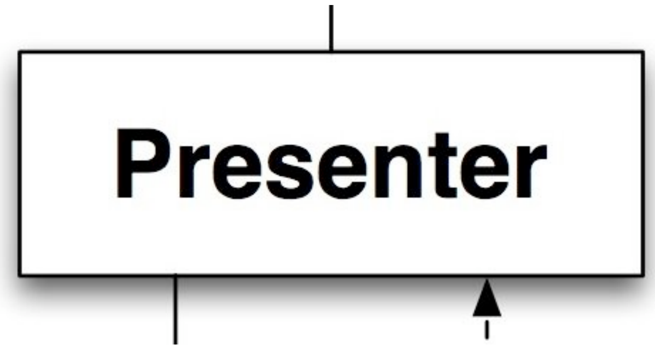
Display interface using characteristic interfaces



```
class PhoneEditor  {
  interface Display {
    HasClickHandlers getSaveButton();
    HasClickHandlers getCancelButton();
    HasValue<String> getNumberField();
    HasValue<String> getLabelPicker();
    ...
}
```

Sample Presenter: PhoneEditor

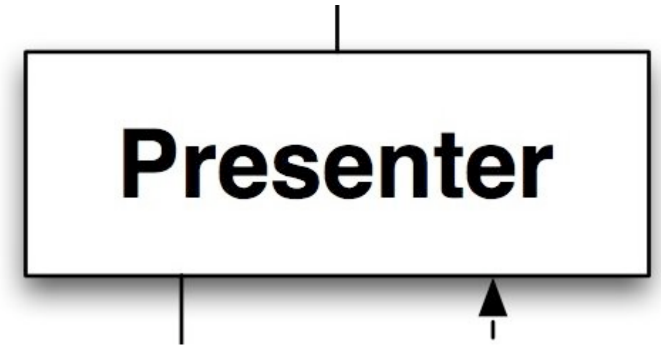
Binding the display



```
void bindDisplay(Display display) {
  this.display = display;

  display.getSaveButton().addClickHandler(new ClickHandler() {
    public void onClick(ClickEvent event) {
      doSave();
    }
  });

  display.getCancelButton().addClickHandler(new ClickHandler() {
    public void onClick(ClickEvent event) {
      doCancel();
    }
  });
}
```

Sample Presenter: PhoneEditor

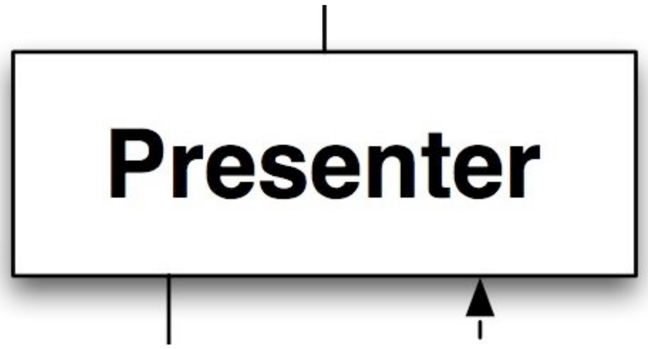
Start editing



```
void editPhone(Phone phone) {
  this.phone = Phone.from(phone);

  display.getNumberField().setValue(phone.getNumber());
  display.getLabelPicker().setValue(phone.getLabel());
}
```

Sample Presenter: PhoneEditor

Save it



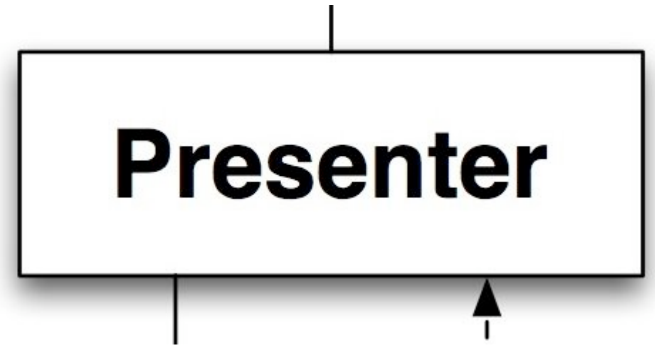
```
void doSave() {
  phone.setNumber(display.getNumberField().getValue());
  phone.setLabel(display.getLabelPicker().getValue());

  service.execute(new UpdatePhone(phone), new UpdatedPhone() {
    public void updated() {
      tearDown();
    }

    public void hadErrors(HashSet<PhoneError> errors) {
      renderErrors(errors);
    }
  });
}
```

Decoupling via DI

Dependency Injection

- Just a pattern:
    - No globals
    - No service locator
    - Dependencies pushed in, preferably via constructor
- Not hard to do manually
- GIN (client) and Guice (server) can automate it
    - http://code.google.com/p/google-guice/
    - http://code.google.com/p/google-gin/

DI slice for the PhoneEditor



```
public void onModuleLoad() {
  ContactsServiceAsync realService =
    GWT.create(ContactsServiceAsync.class);
  CachedBatchingService rpcService =
    new CachedBatchingService(realService);

  HandlerManager eventBus = new HandlerManager(null);

  PhoneEditWidget phoneEditWidget = new PhoneEditWidget();
  PhoneEditor phoneEditor = new PhoneEditor(phoneEditWidget,
    rpcService);

  ContactWidget contactWidget = new ContactWidget();
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  contactViewer.go(RootPanel.get());
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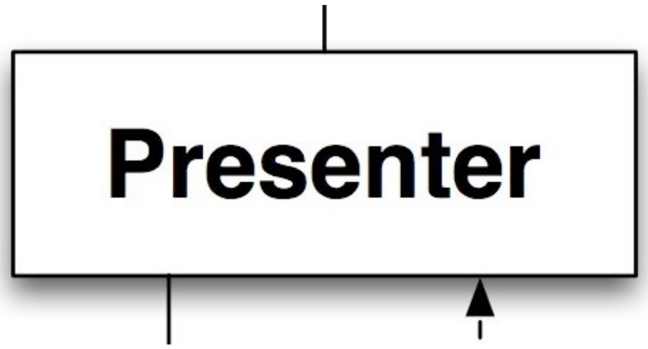

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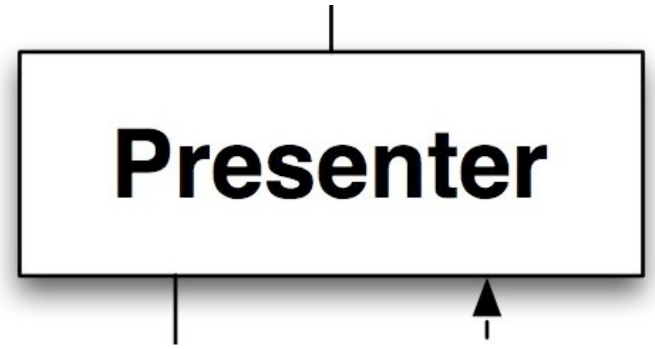

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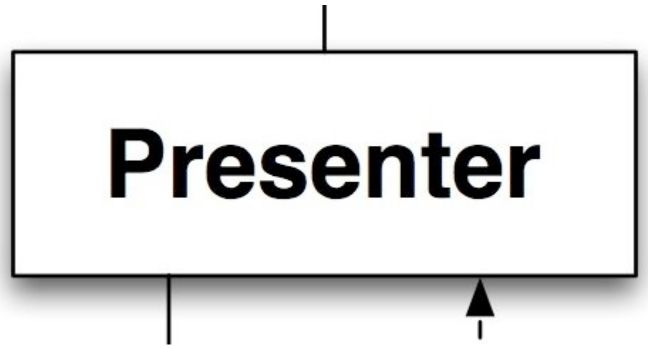

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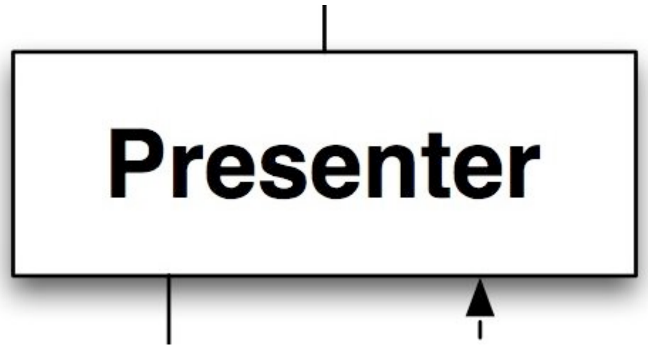

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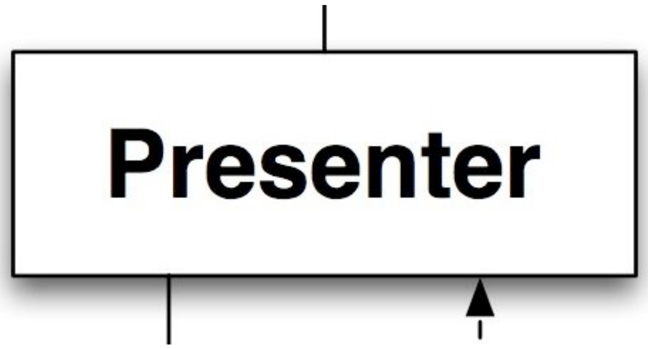

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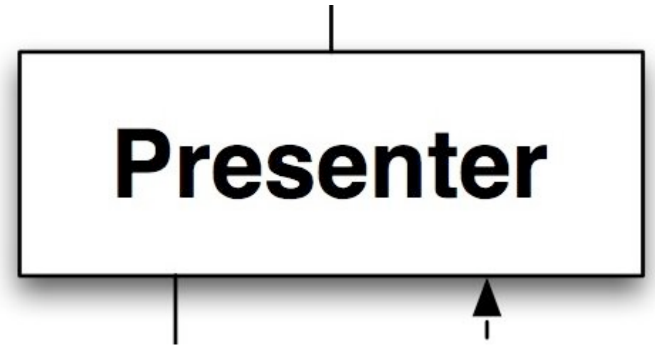

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```
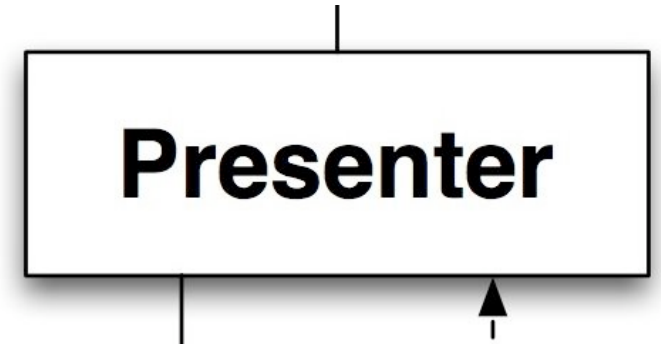
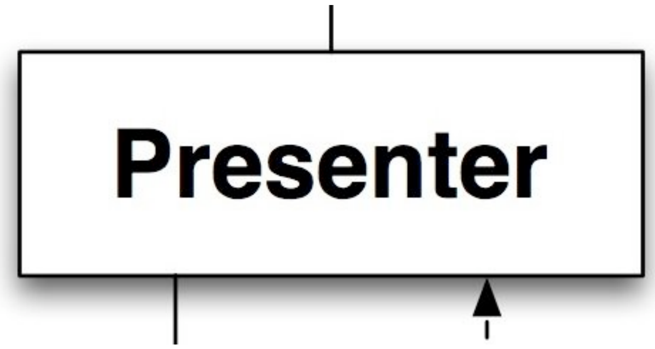

DI slice for the PhoneEditor



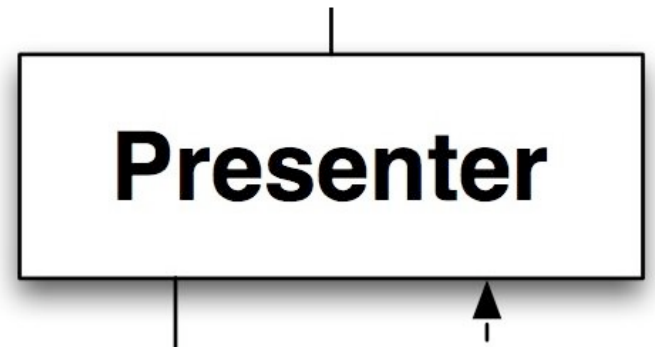
```
public void onModuleLoad() {
  ContactsServiceAsync realService =
    GWT.create(ContactsServiceAsync.class);
  CachedBatchingService rpcService =
    new CachedBatchingService(realService);

  HandlerManager eventBus = new HandlerManager(null);

  PhoneEditWidget phoneEditWidget = new PhoneEditWidget();
  PhoneEditor phoneEditor = new PhoneEditor(phoneEditWidget,
    rpcService);

  ContactWidget contactWidget = new ContactWidget();
  ContactViewer contactViewer =
      new ContactViewer(contactWidget, phoneEditor,
        rpcService, eventBus);
  contactViewer.go(RootPanel.get());
```

DI slice for the PhoneEditor



```
public void onModuleLoad() {
  ContactsServiceAsync realService =
    GWT.create(ContactsServiceAsync.class);
  CachedBatchingService rpcService =
    new CachedBatchingService(realService);
  GVoiceService voiceService = GWT.create(GVoiceService.class);
  HandlerManager eventBus = new HandlerManager(null);

  PhoneEditWidget phoneEditWidget = new PhoneEditWidget();
  PhoneEditor phoneEditor = new PhoneEditor(phoneEditWidget,
    rpcService, voiceService);

  ContactWidget contactWidget = new ContactWidget();
  ContactViewer contactViewer =
      new ContactViewer(contactWidget, phoneEditor,
        rpcService, eventBus);
  contactViewer.go(RootPanel.get());
```

DI slice for the PhoneEditor

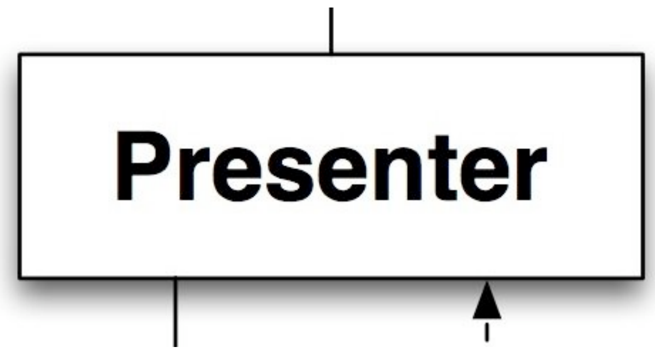


```
public void onModuleLoad() {
  MyGinjector factory = GWT.create(MyGinjector.class);

  factory.createContactViewer().go(RootPanel.get());
}
```

Decoupling payoff: fast tests

Test the PhoneEditor

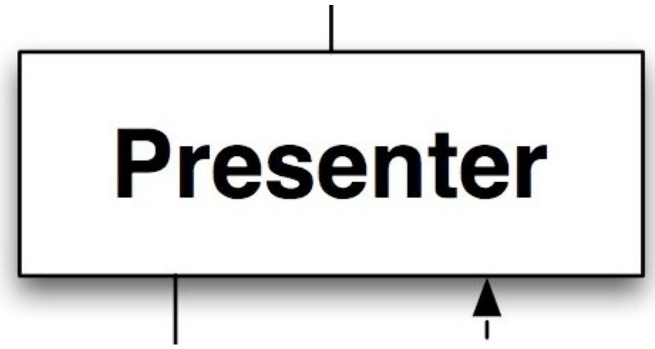
Define some mocks



```
class MockContactsService implements ContactsServiceAsync {
  Action<?> lastAction;
  AsyncCallback<?> lastCallback;

  public <T extends Response> void execute(Action<T> action,
      AsyncCallback<T> callback) {
    lastAction = action;
    lastCallback = callback;
  }
}
```

Test the PhoneEditor

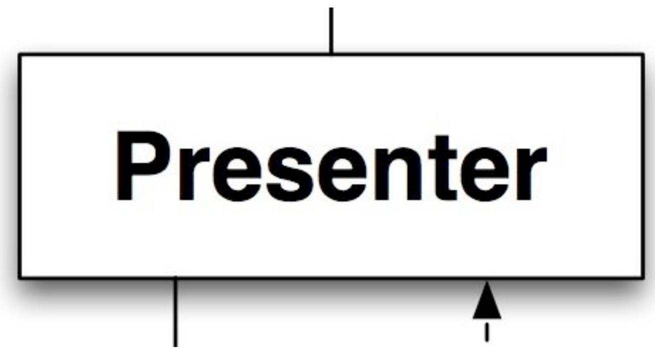
Define some mocks



```
class MockClickEvent extends ClickEvent { }

class MockHasClickHandlers implements HasClickHandlers {
  ClickHandler lastClickHandler;

  public HandlerRegistration addClickHandler(
      ClickHandler handler) {
    lastClickHandler = handler;

    return new HandlerRegistration() {
      public void removeHandler() { }
    };
  }
  public void fireEvent(GwtEvent<?> event) { }
}
```

Test the PhoneEditor

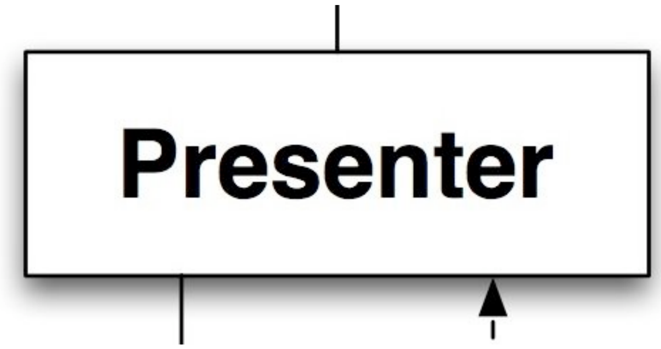
Define some mocks



```
class MockHasValue<T> implements HasValue<T> {
  T lastValue;

  public T getValue() {
    return lastValue;
  }

  public void setValue(T value) {
    this.lastValue = value;
  }

  public void setValue(T value, boolean fireEvents) {
    setValue(value);
  }
  ...
```

Test the PhoneEditor

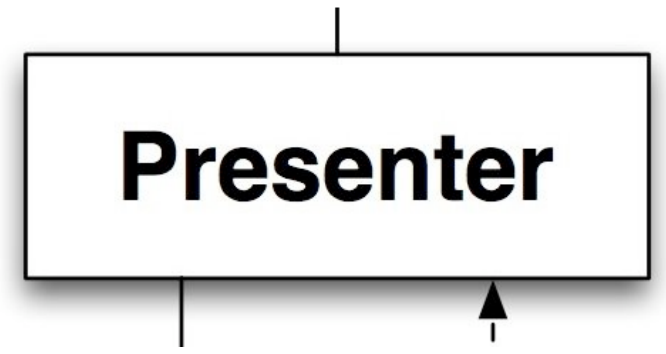
Define some mocks



```
class MockPhoneEditorDisplay implements PhoneEditor.Display {
  MockHasClickHandlers save = new MockHasClickHandlers();
  HasClickHandlers cancel = new MockHasClickHandlers();
  HasValue<String> labelPicker = new MockHasValue<String>();
  HasValue<String> numberField = new MockHasValue<String>();

  public HasClickHandlers getCancelButton() { return cancel; }
  public HasClickHandlers getSaveButton() { return save; }
  public HasValue<String> getLabelPicker() {
    return labelPicker;
  }
  public HasValue<String> getNumberField() {
    return numberField;
  }
}
```

Test the PhoneEditor

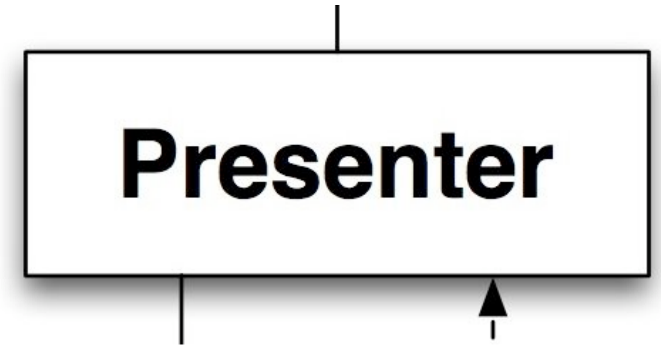
Set up the test...



```
public void testSave() {
  MockContactsService service = new MockContactsService();
  MockPhoneEditorDisplay display =
    new MockPhoneEditorDisplay();

  // Build before and after values

  ContactDetailId id = new ContactDetailId();

  Phone before = new Phone(id);
  before.setLabel("Home");
  before.setNumber("123 456 7890");

  Phone expected = Phone.from(before);
  expected.setLabel("Work");
  expected.setNumber("098 765 4321");
```

Test the PhoneEditor

...and run it



```
  PhoneEditor editor = new PhoneEditor(display, service);
  editor.editPhone(before);
  display.labelPicker.setValue("Work");
  display.numberField.setValue("098 765 4321");
  display.save.lastClickHandler.onClick(new MockClickEvent());

  // Verify

  UpdatePhone action = (UpdatePhone) service.lastAction;
  assertEquals(new UpdatePhone(expected), action);
  Phone actual = action.getPhone();
  assertEquals(expected.getLabel(), actual.getLabel());
  assertEquals(expected.getNumber(), actual.getNumber());
}
```

Strive to achieve statelessness

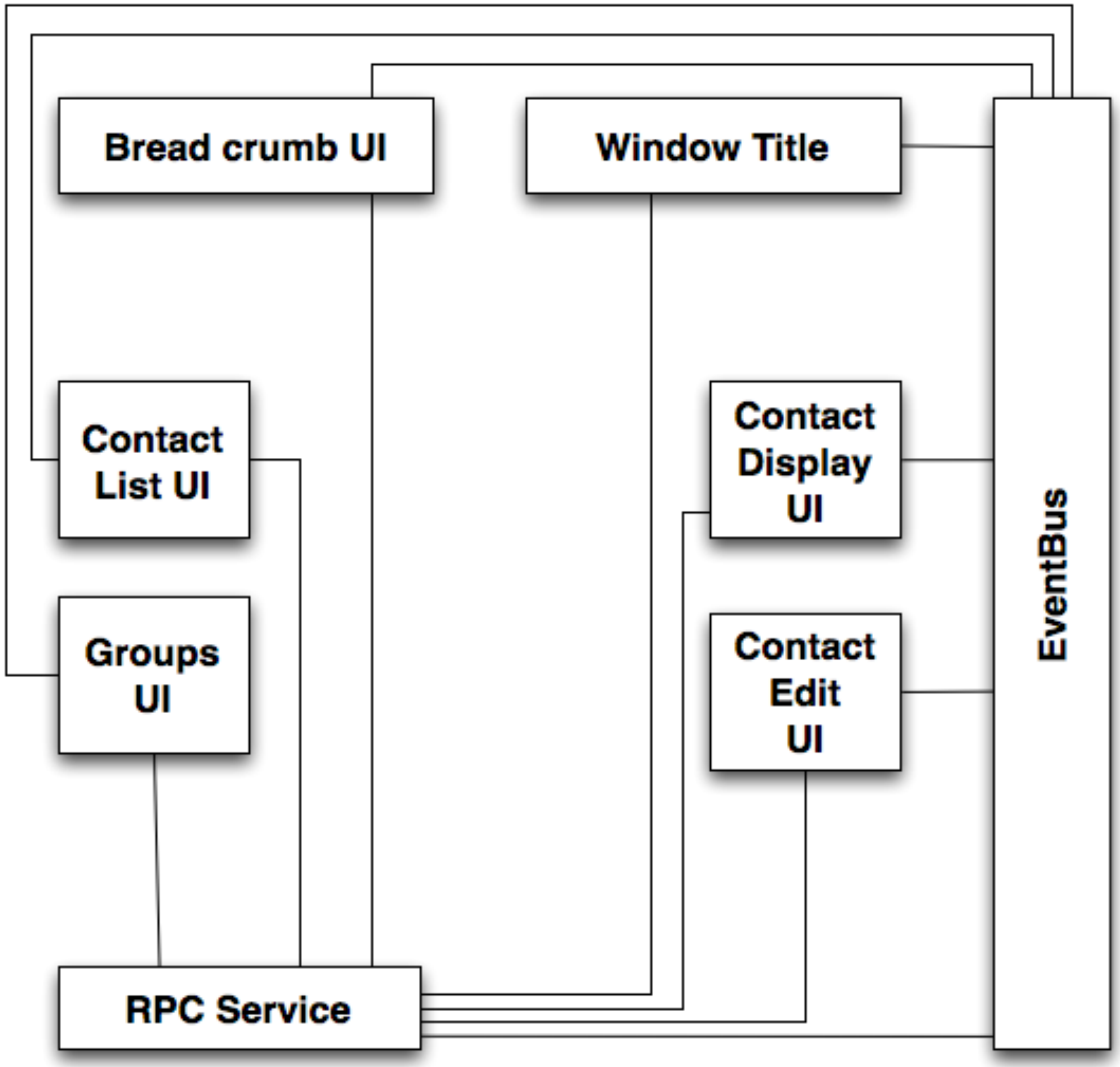
Disposable servers

- The browser embodies the session
- Server effectively stateless (except for caching)
- User should not notice server restart
- On AppEngine, MemCache works well with this attitude
    - "Values can expire from the memcache at any time"

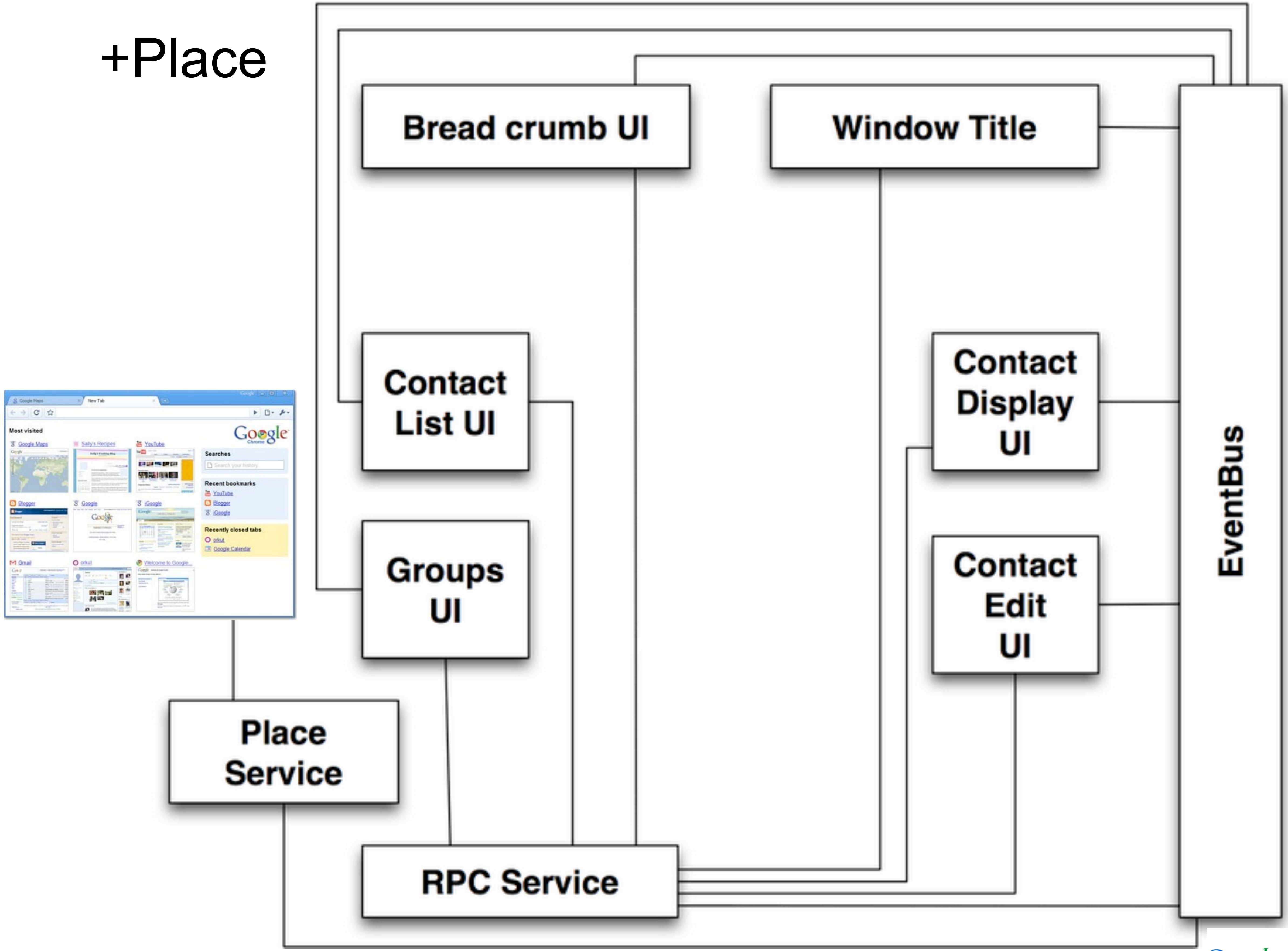
Disposable clients

- Use GWT History right, and get it right early
- Back button, refresh as a feature, not a catastrophe
- Use Place abstraction
    - Layer above History
    - Announce place change via event bus

Recall


Bread crumb UI
Window Title
Contact List UI
Contact Display UI
Groups UI
Contact Edit UI
RPC Service
EventBus

+Place


Bread crumb UI
Window Title
Contact List UI
Contact Display UI
Groups UI
Contact Edit UI
EventBus
Place Service
RPC Service

Q & A

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