A Simple Framework for Desktop Applications

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TS-3399

What You Will Need to Learn

For the Test at the Conclusion of the Presentation*

The Swing Application Framework Project: why we're doing it, what it is, why you'll want it

*OK, there's no test. Just try and stay alert, or you'll miss the demo at the end.

Agenda

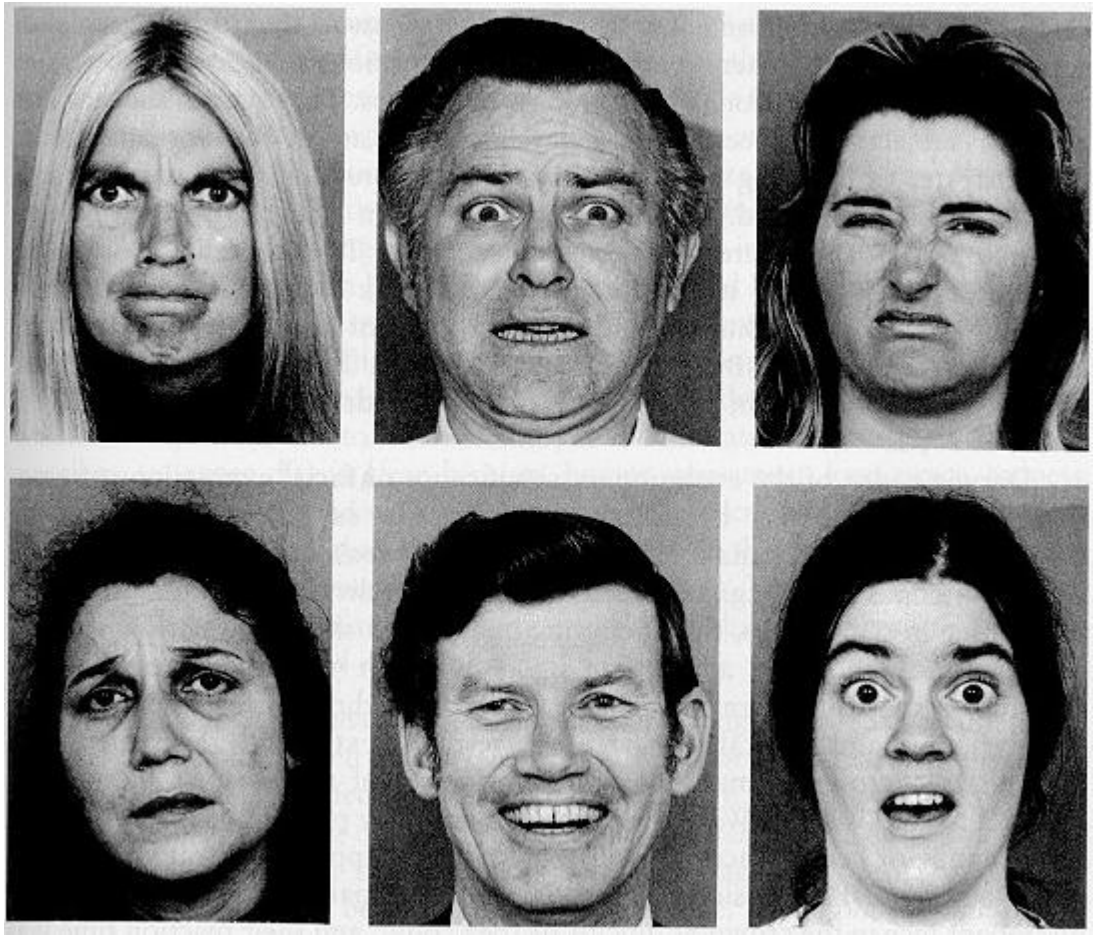
- What's the Problem?
- Aren't App Frameworks Giant Scary Monsters?
- A (Very) Brief Survey of App Frameworks
- Swing Application Framework
  - Application Class
  - Lifecycle: Starting Up, Shutting Down, Milestones
  - Actions and Resources
- Demo!
- Where We're Headed, the JSR

Disclaimer

- This is a preview of a prototype
- The details will almost certainly change
- The fundamentals could change too

What's the Problem?

- Swing has been available for nearly a decade
- Jillions of apps have been written without a standard desktop application framework
- Experienced developers oftentimes actually enjoy building domain specific application frameworks
- But what about novices?
  - The API **is** pretty big
  - How do they feel about building apps from scratch?
- Laboratory results



Reasons Why A Desktop App Framework is Needed: For Starters

- Too many possible paths: developers freeze
  - For many developers, particularly new ones, the absence of any advice about how to structure an application is an obstacle in and of itself
  - Developers should focus on their problem domain, not on the “application architecture” domain
- Pave a standard road to start out on

Reasons Why A Desktop App Framework Is Needed: For Starters

- There some attractive bad paths
  - Build the app on the main thread
  - Your app IS-A JFrame
  - Tangle of actionPerformed methods block the EDT
  - Just English is good enough
- Make getting to the finish line more likely

Reasons Why A Desktop App Framework Is Needed: For Starters

- Today's tool support: minimalist

```
public class YourDesktopApp {
    public static void main(String[] args) {
        // Good Luck!
    }
}
```

- Tool support could be much much better

Desktop App Framework Fears

Aren't App Frameworks Giant Scary Monsters?

- Can be too much frame not enough work
  - Over design
  - Try and do too much
  - A shrine for great hacks
- Swing App Framework goals
  - As small and simple as possible (but not more so)
  - Explain it all in one hour
  - Work very well for small and medium scale apps
  - No integral docking framework, generic app data model, scripting language, GUI definition schema…

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Demo!

Where We're Headed, the JSR

A Very Brief Survey of What Exists

- NetBeans™ Platform
- Spring RCP
- Eclipse RCP

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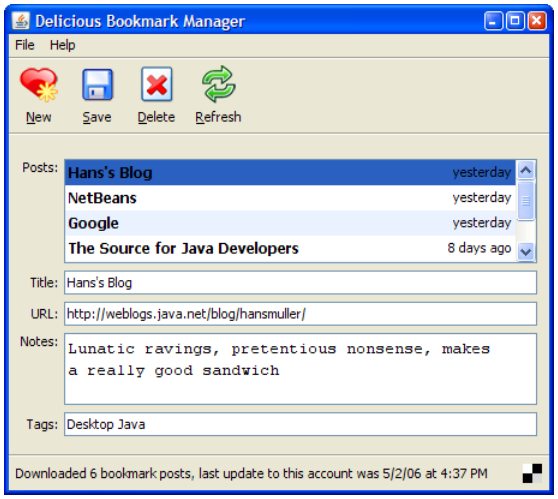
Where We're Headed, the JSR

Overview: The Obligatory Diagram

Elements of the Application Framework

State and Behavior



Resources

Preferences

Actions

LifeCycle

launch()

startup()

shutdown()

exit()

Application Class

- Base class for Desktop Java™ based applications
- Defines lifecycle: startup, shutdown, etc.
- Provides access to
  - Resources
  - Actions
  - Preferences

```
public class Application {
    protected Application()
    public static synchronized Application getInstance()
    public static synchronized <T extends Application>
      void launch(Class<T> appClass, String[] args)

    protected void startup(String[] args)
    protected void shutdown()
    public String getMilestone()
    public void setMilestone(String milestone)

    public ResourceMap getResourceMap(Class cls)
    public ActionMap getActionMap(Class cls)
    public Preferences getPreferences(Class cls)

    // Boilerplate for supporting bound Java Beans properties ...
    public void addPropertyChangeListener(PropertyChangeListener l)
    public void removePropertyChangeListener(PropertyChangeListener l)
    public PropertyChangeListener[] getPropertyChangeListeners()
    public void addPropertyChangeListener(String name, PropertyChangeListener l)
    public void removePropertyChangeListener(String propertyName, PropertyChangeListener l)
    public PropertyChangeListener[] getPropertyChangeListeners(String name)
    protected void firePropertyChange(String name, Object oldValue, Object newValue)
}
```

Define an Application Subclass and Launch!

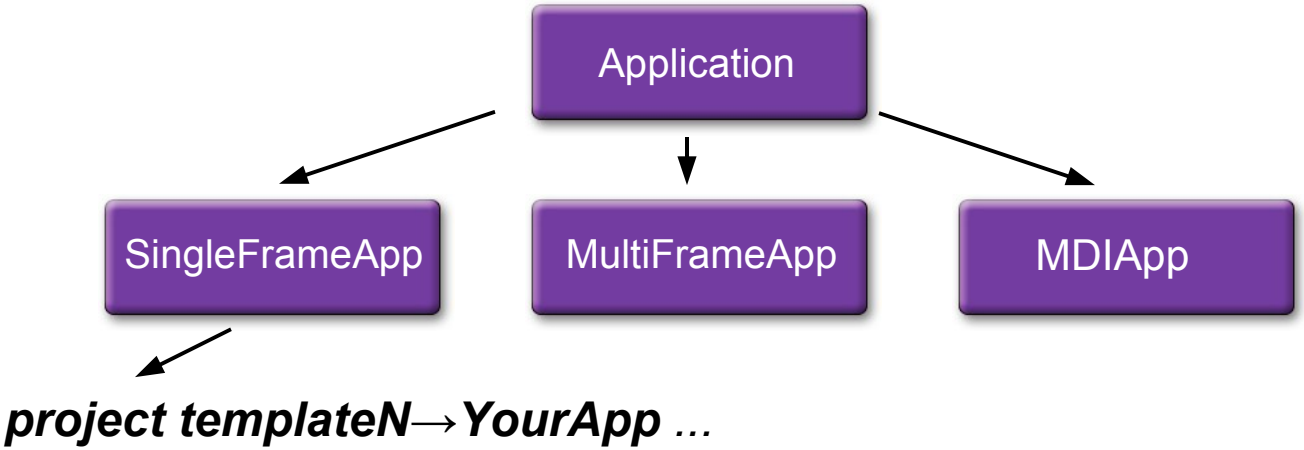
```
class MyApp extends Application {
    protected void startup(String[] args) {
        JFrame frame = new JFrame("My App");
        frame.add(new JLabel("Hello World"));
        frame.pack();
        frame.setVisible(true);
    }
    public static void main(String[] args) {
        Application.launch(MyApp.class, args);
    }
}
```

Application.launch(MyApp.class, args);

- MyApp.class is constructed on the EDT
- MyApp.startup() runs on the EDT
  - Command line argument processing errors can show an error dialog and/or log a warning
- Application.getInstance() returns **the** instance of MyApp

Will My App Subclass Application?

- Probably not
- A few standard Application subclasses will be provided
  - Support some useful GUI archetypes
  - App “shells” encapsulated by IDE project **templates**



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Application Lifecycle

- Application.startup()
  - Called by Application.launch() on EDT
  - Create and show the GUI
  - Milestone changes mark progress
- Application.shutdown()
  - Called on EDT when application attempts to exit
  - “Mother may I” exitListeners can veto

Startup Milestones

- Startup progress reported via a bound property
  - get/setMilestone(String milestone)
- Standard milestones are
  - before/afterResourcesLoaded
  - before/afterGUICreated
  - before/afterGUIRealized
  - before/afterGUIShown
  - afterGUIReady
- Application.startup() is responsible for calling setMilestone

May I exit? exitListener

ExitListeners Must Confirm App Exit

```
Application app = Application.getInstance();
app.addExitListener(new ConfirmExitListener());

class ConfirmExitListener implements ExitListener {
  public boolean canExit() {
    String message = rMap.get("confirmExit.message");
    String title = rMap.get("confirmExit.title");
    int option = JOptionPane.showConfirmDialog(
        mainFrame, message, title,
        JOptionPane.YES_NO_OPTION);
    return (option == JOptionPane.YES_OPTION);
  }
}
```

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Where We're Headed, the JSR

Good Old ResourceBundles

- Initial, read-only values
- Typically just strings
- Typically defined in ".properties" files

Resource Bundles in the Framework

Resources for MyClass in mypkg/resources/MyClass.properties

```
myLabel.text=Hello World
myLabel.icon=hello-world.png
```

Resources for mypkg in mypkg/resources/mypkg.properties

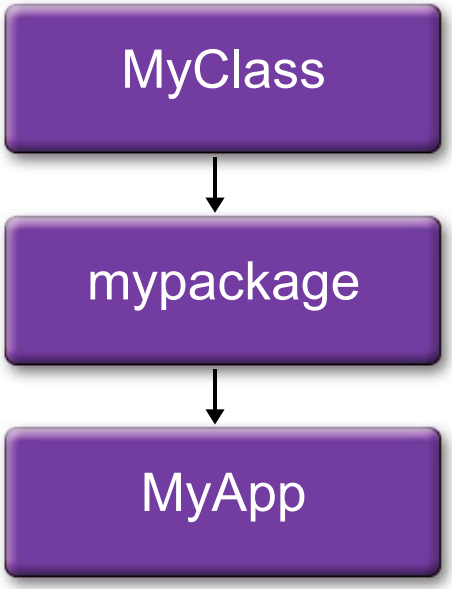
```
myPackage.webSvcErrMsg={0} failed because {1}
myPackage.displayBackground=#556677
```

Resources for MyApp in mypkg/resources/MyApp.properties

```
Application.title=My Application
Application.vendor=Sun Microsystems, Inc.
```

ResourceMaps

- Encapsulate a small set of ResourceBundles
  - Read-only, key set doesn't change dynamically
  - Chained together with parent links




```
ResourceMap myRM =
   myApp.getResourceMap(MyClass.class);
myRM.getString("myLabel.text")
    => "Hello World"
myRm.getString("Application.title")
    => "Bookmark Manager"
```

ResourceMap API: Convert and Cache

StringConverter: Convert Resource Strings to Type

```
public class ResourceMap {
  public Object getObject(String key, Class type)
  // ...
  public static abstract class StringConverter {
    protected StringConverter(Class type)
    public boolean supportsType(Class testType)
    public abstract Object
        convertString(String s, ResourceMap r)
  }
  public static
      void addStringConverter(StringConverter sc)
  public static
      StringConverter stringConverterFor(Class type)
}
```

ResourceMap: StringConverters for Common Desktop GUI Types

- ResourceMap.getIcon(), Color, Font, KeyStroke, KeyCode, ...
- ResourceMap.getString(), Boolean, Integer...
- Looking up message strings with arguments:

```
String getString(String key, Object... args)
    =>
getObject(key, MessageFormat.class).format(args)
```

Example: String Resources

```
   aString = Just a string
  aMessage = Hello {0}
 anInteger = 123
  aBoolean = True
    anIcon = myIcon.png
     afont = Arial-PLAIN-12
 colorRGBA = 5, 6, 7, 8
color0xRGB = #556677

# resourceMap.getString("aMessage","World");
# resourceMap.getColor("colorRBGA");
# resourceMap.getFont("aFont");
```

ResourceMap API: Component Resource Injection

- Set component properties whose names match a resource name

```
public class ResourceMap {
  // ...
  public void injectComponent(Component target)
  public void injectComponents(Component root)
}
```

- Inject just one component, or all components in a hierarchy
- Resource names must match: **`component.getName() + ".propertyName"`**
- Resource type, same as property type

Example: Injecting Component Resources

- `resourceMap.injectComponents(myToolbar)`


```
# resources/MyApp.properties ResourceBundle
    newButton.text = New
    newButton.icon = new-icon.png
   saveButton.text = Save
   saveButton.icon = save-icon.png
 deleteButton.text = Delete
 deleteButton.icon = delete-icon.png
refreshButton.text = Refresh
refreshButton.icon = refresh-icon.png
```

Resources for All Properties?

- No, no, no
- Use them for values that might vary by
  - Locale
  - Platform
  - Look and feel
  - Deployment
- GUI Builders, like NetBeans Matisse software, are the best way to configure the rest

ResourceMap API: Field Injection, @Resource

- Initialize fields marked with **`@Resource*`**
  - For programatically configured GUI elements

```
public class ResourceMap {
  // ...
  public void injectFields(Object target)
}
```

- Resource names must match:
  `target.getClass().getSimpleName() + ".field-name"`
- Resource type, same as field type
- *Thanks to Romain Guy and Daniel Spiewak for pioneering this idea in the java.net Fuse project

Field @Resource Example

- Icon valued fields initialized from a ResourceMap:

```
public class MyForm extends JPanel {
  @Resource Icon busyIcon;
  @Resource Icon readyIcon;
  void showStatus(isBusy boolean) {
    myLabel.setIcon(isBusy) ? busyIcon : readyIcon;
  }
  MyForm() {
    Application app = Application.getInstance();
    ResourceMap rMap = app.getResourceMap(MyForm.class);
    rMap.injectFields(this);
  }
}
```

- ResourceBundle properties File:

```
# resources/MyForm.properties ResourceBundle
MyForm.busyIcon = busy-icon.png
MyForm.readyIcon = ready-icon.png
```

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Where We're Headed, the JSR

What We've Got: Actions, ActionMaps

- Actions
  - Semantics: actionPerformed(), enabled, selected
  - A smattering of presentation attributes
  - `myComponent.setAction(myAction)`
- ActionMaps
  - Map names to Actions
  - Have a parent Actionmap
  - Used with InputMaps to map KeyStrokes to Actions

What We Need

- Action presentation attributes
  - Per locale, platform, look and feel
  - Per Toolbar/Menu/Button/etc context
- Actions that do work on a background thread
- ActionMaps
  - For the entire application
  - For GUI elements, like a form or a dialog
- More annotations!

Defining Actions: @Action

- One “Actions” class can define many Actions
- @Action annotation per actionPerformed method
  - ActionEvent argument is optional

```
class MyActions {
  @Action
  void saveItem() { ... }

  @Action
  void moveItem(ActionEvent e) { ... }
}
```

Define @Actions, enabled/selected

- @Action arguments
  - enabledProperty—names bound boolean property
  - selectedProperty—likewise
  - name—resource prefix, default is method name

Define @Actions, enabled/selected (Cont.)

```
class MyActions {
  @Action(enabledProperty=selectedItemValid)
  void saveItems() { ... }

  @Action(enabledProperty=selectedItemValid)
  void moveItems(ActionEvent e) { ... }

  boolean isSelectedItemValid() { ... }
  boolean setSelectedItemValid(boolean b) { ... }
}
```

Now Make me an ActionMap

- Create an Action for each @Action:

```
Application app = Application.getInstance();
ActionMap aMap = app.getActionMap(MyActions.class)
saveButton.setAction(aMap.get("saveItem"));
moveButton.setAction(aMap.get("moveItem"));
```

- Action attributes come from a ResourceMap:

```
# resources/MyActions.properties ResourceBundle
saveItem.actionName = &Save
saveItem.actionAcceleratorKey = control S
saveItem.actionShortDescription = \
  Save the item in the data warehouse

moveItem.actionName = &Move
moveItem.actionAcceleratorKey = control D
moveItem.actionShortDescription = \
  Move the item to a new data warehouse
```

Action Attributes per Context

- Create 3 Actions for one @Action
  - [*context*]—context specific attribute
  - Other attributes are common

```
# resources/MyActions.properties ResourceBundle
saveItem.actionName = &Save
saveItem.actionName[Menu] = Save Item to Warehouse
saveItem.actionIcon[Toolbar] = save-toolbar-icon.png
saveItem.actionAcceleratorKey = control S
saveItem.actionShortDescription = \
  Save the item in the data warehouse
```

Action Attributes per Context (Cont.)

- Action names get the context qualifier

```
Application app = Application.getInstance();
ActionMap aMap = app.getActionMap(MyActions.class)

saveButton.setAction(aMap.get("saveItem"));

saveMenuItem.setAction(aMap.get("saveItem[Menu]"));

saveTBButton.setAction(aMap.get("saveItem[Toolbar]"));
```

Asynchronous Actions, SwingWorker

- Actions need to run on a background thread if
  - They might take longer than 10-20ms
  - They might block
- SwingWorker class facilitates this

```
class DoWork extends SwingWorker<Object, Object> {
  @Override protected Object doInBackground() {
    // while you're at it:
    // call progress(0 .. 100) if feasible
    return null;
  }
  @Override protected void done() {
     // update GUI - you're on the EDT
  }
}
```

Asynchronous @Actions

- Async @Actions return a SwingWorker object

```
@Action
SwingWorker<Object, Object> saveItems() {
  return new DoSaveItems(getMyItems());
}
```

Asynchronous @Actions: ActionDisplay

- Status changes are reflect in the GUI via the ActionDisplay class:

```
public interface ActionDisplay {
  public void progress(Object src, int value);
  public void message(Object src, String text);
  public void status(Object src, int value);
}

Application app = Application.getInstance();
app.getActionDisplay().message(app, "Working...")
```

- Application subclasses typically override **`getActionDisplay()`**

Async @Action Example

```
class DoSaveItems extends SwingWorker<Object, Object> {
  private final List<MyItem> myItems;
  DoSaveItems(List<MyItem> myItems) {
      this.myItems = myItem;
  }
  @Override protected Object doInBackground() {
      int nSaved = 0;
      for(MyItem myItem : myItems) {
          saveMyItem(myItem);
          setProgress(percentDone(nSaved++));
      }
      return null;
  }
  // continued, next slide ...
}
```

Async @Action Example

```
// ResourceBundle resources/MyApp.properties
// saveItems.doneMessage = Saved {0} items

class DoSaveItems extends SwingWorker<Object, Object> {
  // ... continued from previous slide
  @Override protected void done() {
    int nSaved = myItems.size();
    String key = "saveItems.doneMessage";
    String msg = rMap.getString(key, nSaved);
    getActionDisplay().message(this, msg);
  }
}

@Action
SwingWorker<Object, Object> saveItems() {
  return new DoSaveItems(getMyItems());
}
```

@Actions That Block

- Block keyword specifies scope:

```
@Action(block=Action.Block.APPLICATION)
```

- Three scopes: NONE, WINDOW, APPLICATION
- Application.getBlockingDialog() creates dialog
- Blocking dialog can provide an ActionDisplay

DEMO

A Simple Desktop Client for flickr.com

Where We're Headed, the JSR

- This has been a review of the prototype of the Swing Application Framework
- The JSR-296 Expert Group will begin work on the standard API later this summer
- We will try and
  - Design an API that can be explained in an hour
  - Limit the scope of the framework to common generic desktop application infrastructure
  - Build upon what already exists
- Overall goal is: make building desktop applications (much) easier

Where We're Headed, the JSR (Cont.)

- Development will be similar to JSR-295
  - Public java.net project
  - Implementations planned for Java SE 1.5,1.6,1.7
  - Hope to be bundled with 1.7

Summary

- Swing developers would benefit from an application framework
- We're working on one
- It's narrow in scope: Application class, life cycle, resources, actions
- The final framework spec will be developed through JSR-296

Q&A

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For More Information

- JSR 296 on http://jcp.org
- Related Sessions I hope you've attended
  - TS-4635: Best Practices: Data Access Strategies (Thursday, 11:00AM)
  - TS-1074: Desktop Patterns and Data Binding (Thursday, 1:30PM)

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