Stateful Web Application Development with Spring Web Flow

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Centare Group, Ltd

- Centare Group Mission
  - Help clients achieve success through the delivery of appropriate technical solutions
- Specialists in:
  - Software application development
  - System integration
  - Information delivery (business intelligence)
- Strategic Partnerships
  - SpringSource, Actuate, Microsoft Gold Certified Partner

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About Me

- Senior Consultant with Centare Group
- 7+ years professional Java development experience
- First used Spring 1.2 in fall of 2005
- First used WebFlow in summer of 2007
- Currently working with Spring 2.5

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Agenda

- Stateful web application development
- Model business process as a single unit
- Processes are reusable across different areas of the application
- Testing

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Stateful Web Application

- Most web based applications are stateful
- Any application in which the user enters all data required for a single business transaction across multiple pages
  - Shopping Cart Checkout
  - Booking a flight online
- Partial data from early pages is either stored in HTTP Session or written to a database
  - Explicitly managed by the application

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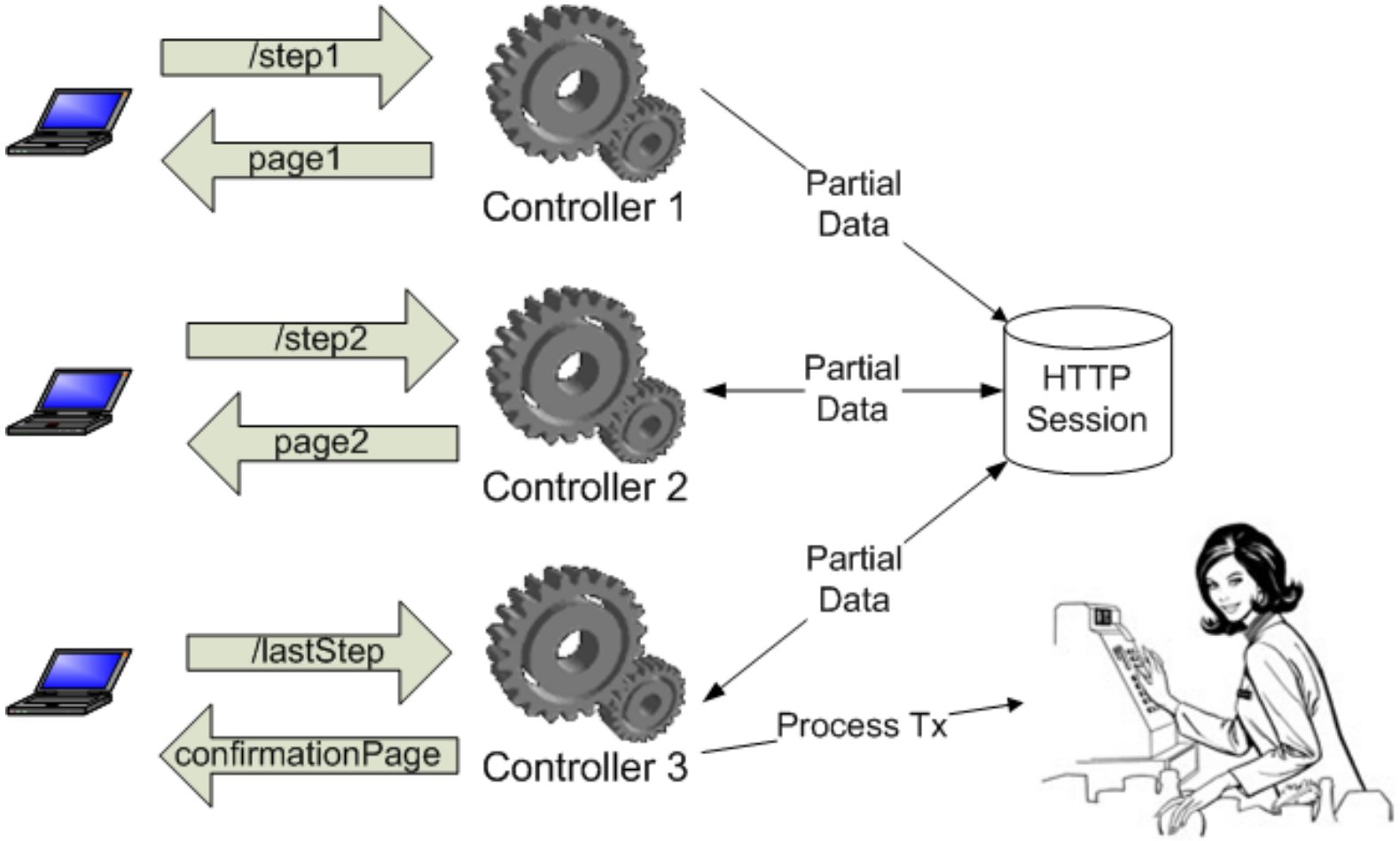
Stateful Web Application Challenges

- HTTP is an inherently stateless protocol
  - Each request is an event unto itself
- Traditional Web Frameworks rely on a request driven approach
  - Each page submits to a distinct controller
  - Each controller only responsible for a single step in the overall process

Stateful Web Application Challenges

- Many navigation paths can be difficult to manage
  - No central place to manage all navigation
- Request and Session scopes often not sufficient
  - Client side redirects clear out request scope
  - Double post and back button problems
- Difficult to test

Traditional Stateful Web Application



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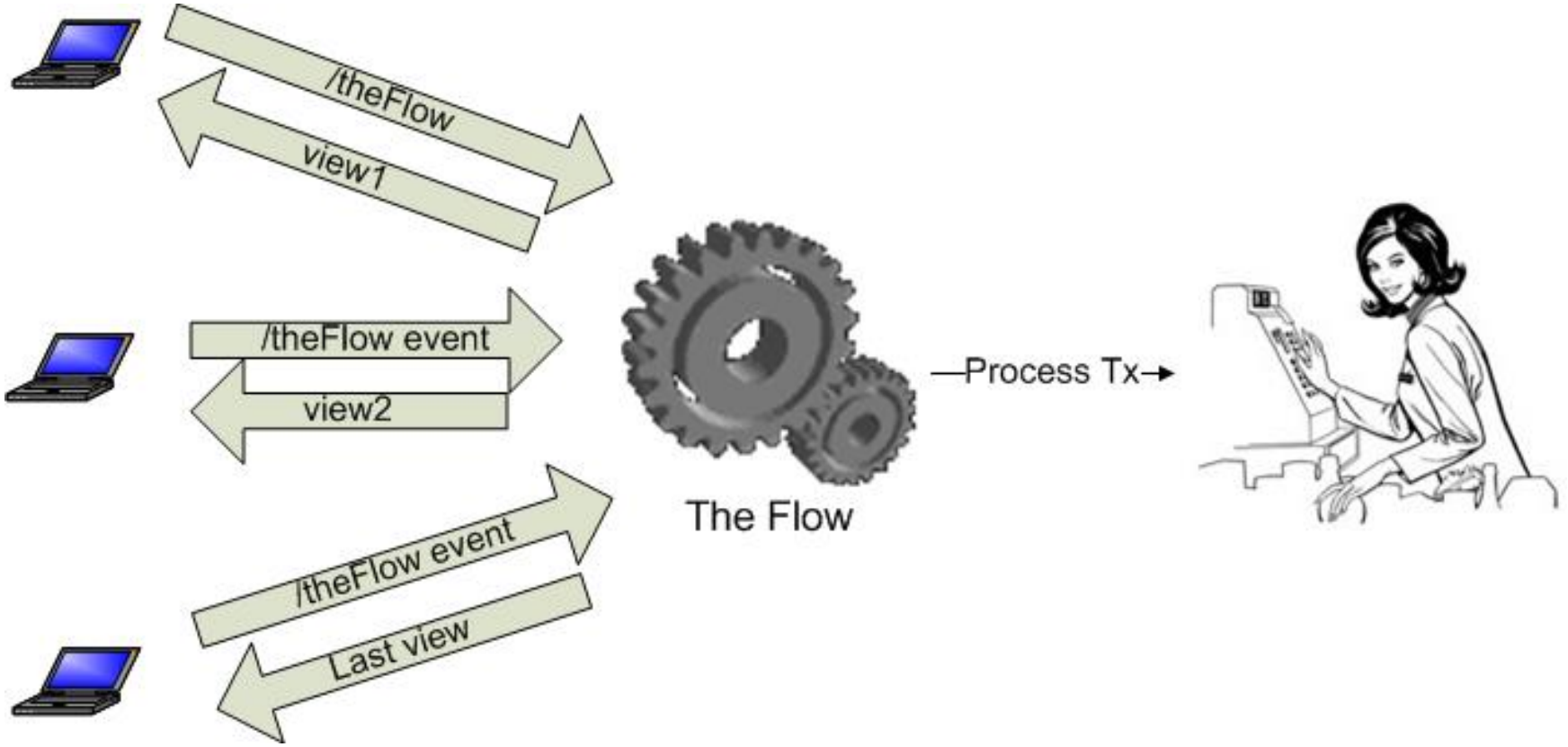
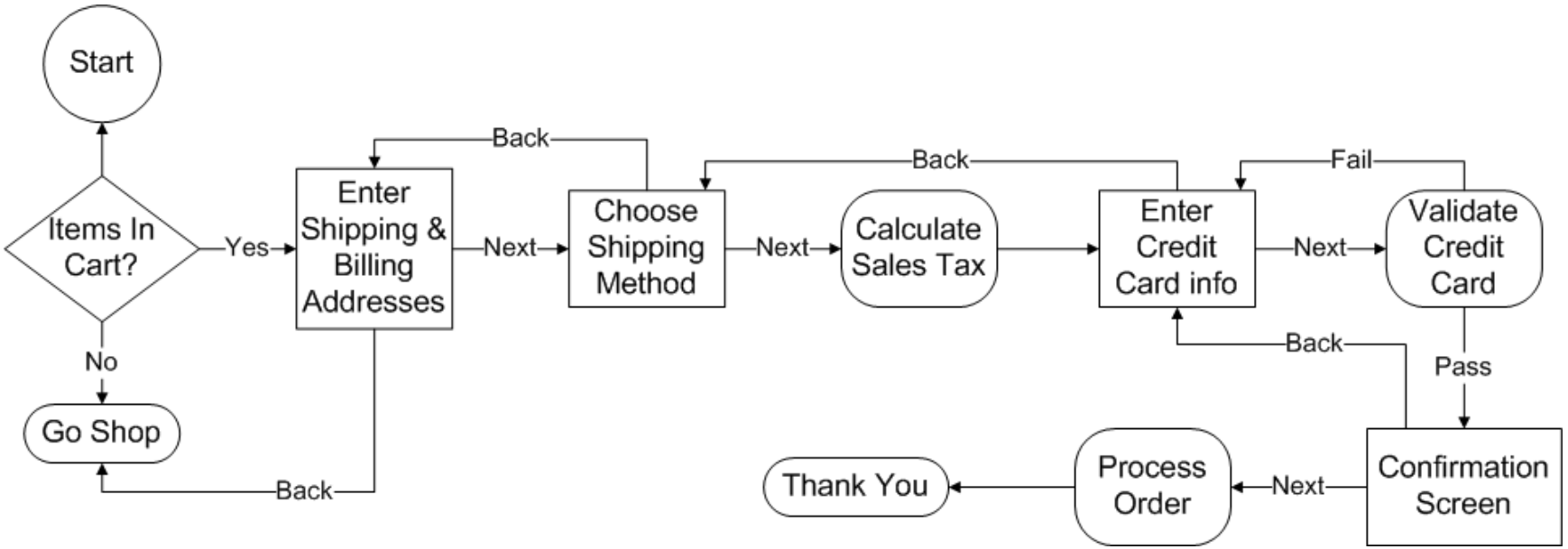
Process Driven Application

- Define all navigation in a central location
- Treat the entire interaction as one algorithm
- Let the framework decide what to do and where to go based on events triggered by the user

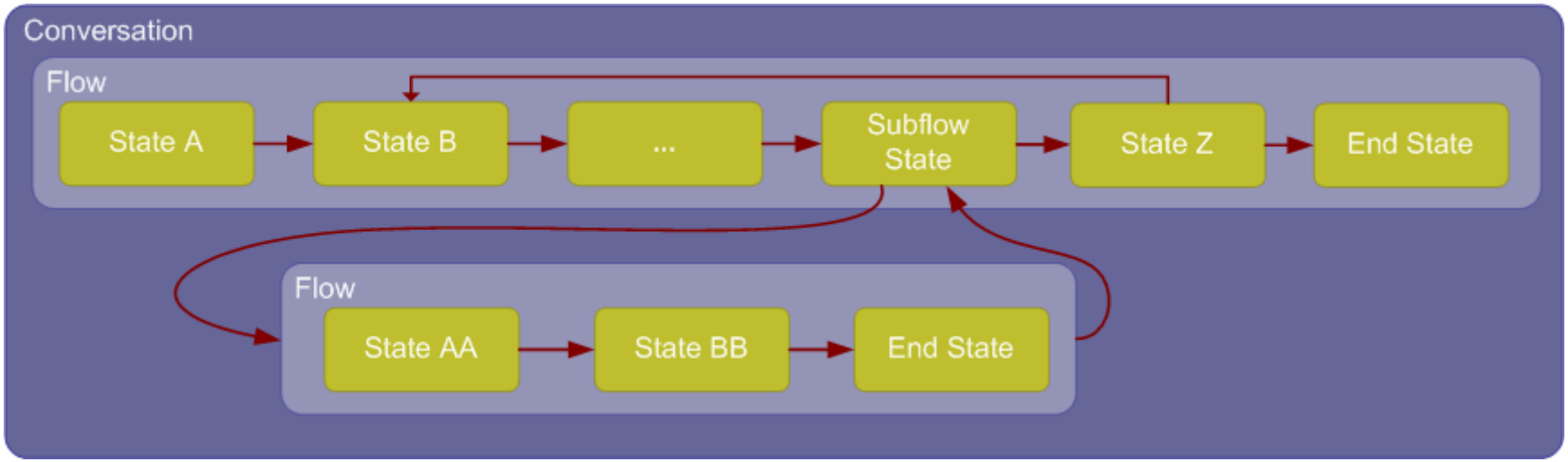
Process Driven Application



Shopping Cart Flow Diagram



High Level Concepts



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States

- View State
  - Pause execution and render a view to obtain user input
- Action State
  - Execute Java code
  - Can transition to different states depending on outcome
- Decision State
  - Branch logic

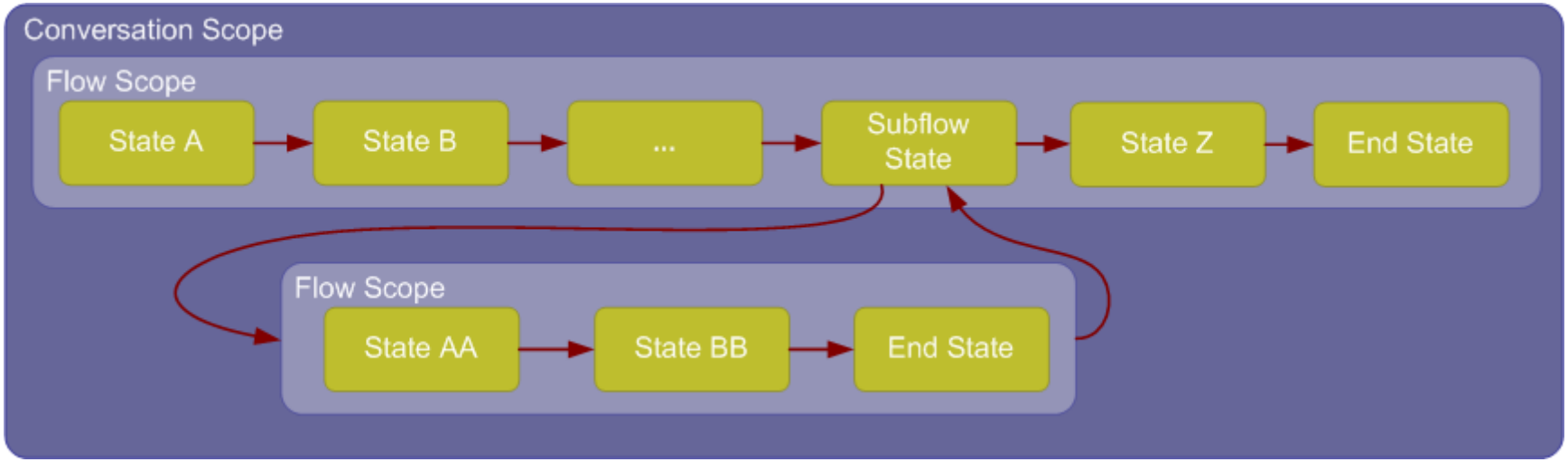
States

- Subflow State
  - Transfer execution to a different flow
  - Execution will return to this state when the subflow has completed
- End State
  - Final state of the flow
  - May or may not define a view to render

Variables

- WebFlow allows you to define variables as part of the process model
- Variables can be stored in one of several different scopes
  - Conversation, Flow, Flash, View, Request

Conversation And Flow Scopes



- Conversation scope available to all flows
- Flow scope limited only to a single flow

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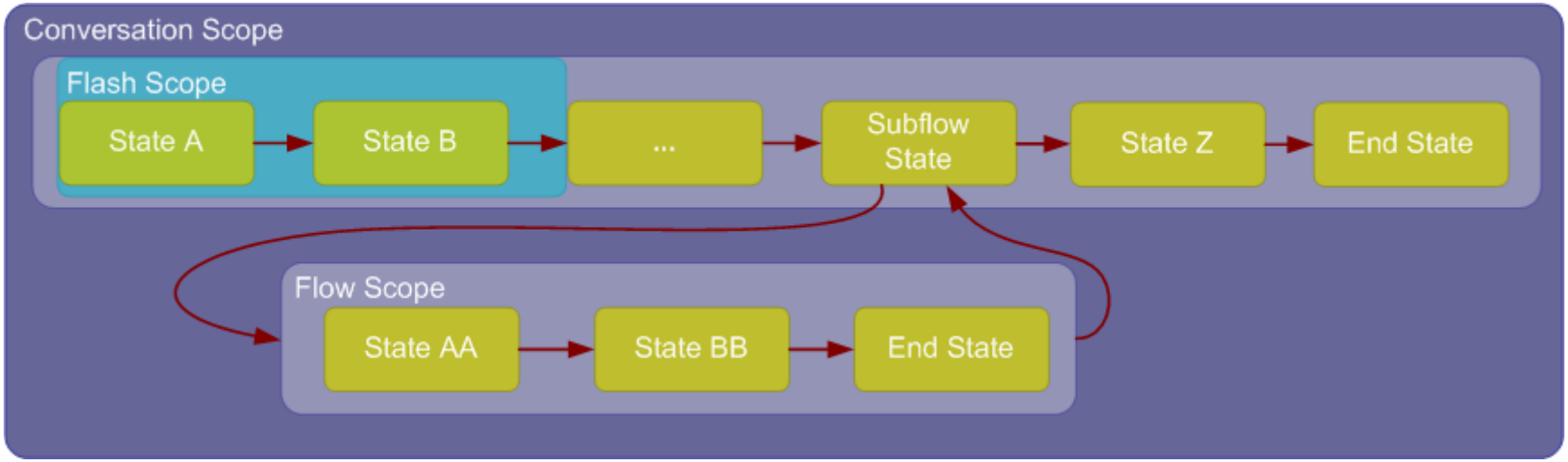
Flash Scope



- Cleared once a view is rendered
- Useful for temporarily saving results from action states
- Live through client-side redirects

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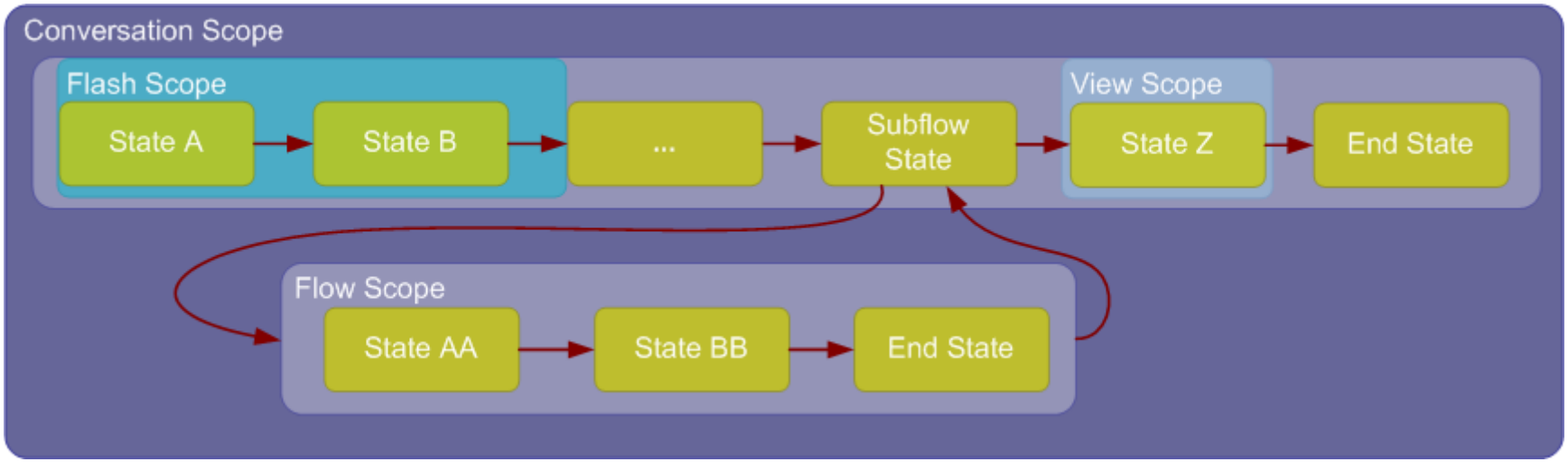
View Scope



- Created once a view-state is entered
- Destroyed when that view is exited
- Useful on pages that submit many AJAX requests

Request and Session Scopes

- Standard request scope still available
  - Same life span as always
  - Does not live across client-side redirects
- Session scope is not easily accessible
  - Is larger than conversation scope
  - Does not make sense from within WebFlow
  - Interact with session via input and output attributes of the flow

Modeling the Process

- Domain Specific Language (DSL) provided out of the box
  - XML
- It is possible to define a flow programmatically
- Implement FlowAssembler and FlowBuilder to create your own flow definition language

Packaging

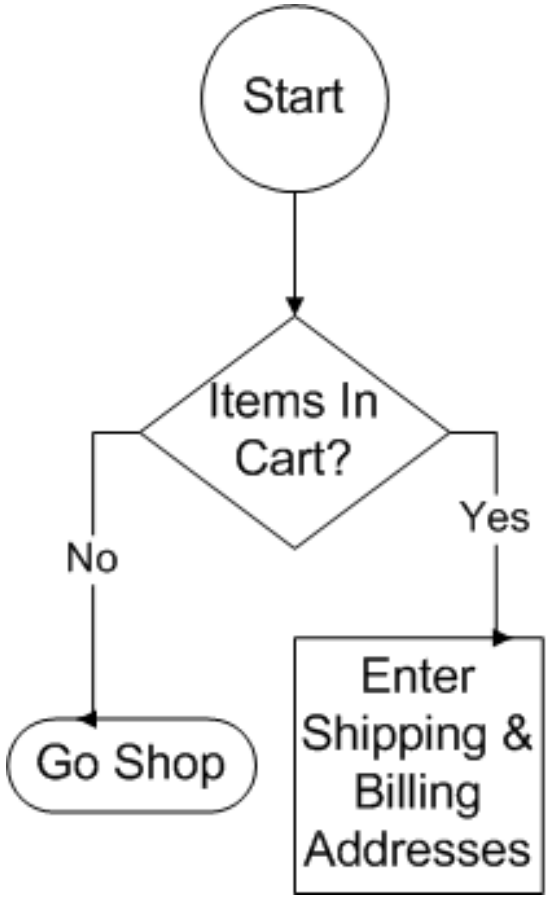
- A flow is a self contained unit
- Flow definition and associated JSP pages packaged in the same directory
- Flows are registered with the FlowController by name

Shopping Cart Flow Definition

```
<flow xmlns="…">

   <input name="cart"
          required="true"
          type="com.mycomp…" />

   <decision-state id="hasItems">
          <if test="cart.empty"
                then="goShopping"
                else="enterAddresses"/>
    </decision-state>
```



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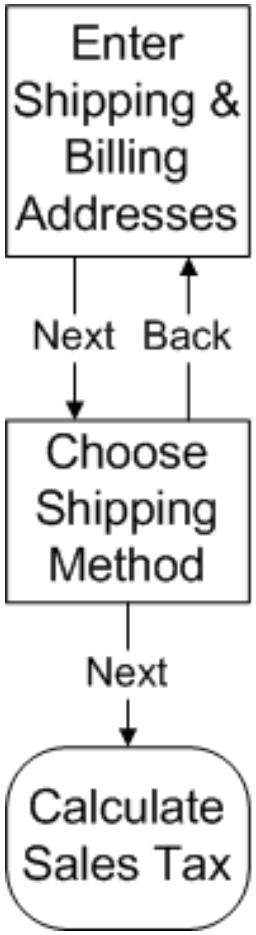
Shopping Cart Flow Definition

```
<view-state id="enterAddresses“ >
    <transition
        on="next“
        to="shipMethod" />
</view-state>

<view-state id="shipMethod">
    <transition
        on="back“
        to="enterAddresses" />
    <transition
        on="next“
        to="calculateTax" />
</view-state>
```



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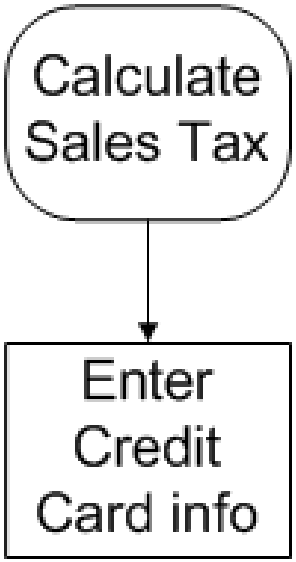
Shopping Cart Flow Definition

```
<action-state id="calculateTax">
    <evaluate
            expression="basketService.calcTax(cart)" />
    <transition to="ccInfo" />
</action-state>

<view-state id="ccInfo">
    …
</view-state>
```



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Evaluate

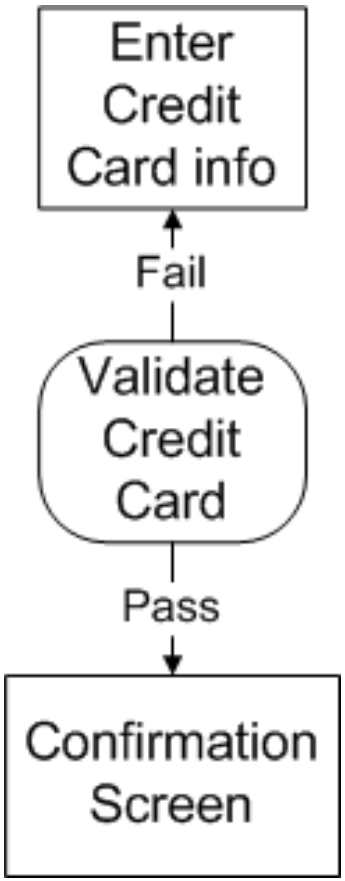
- Primary connection point between WebFlow and the back end services
- Expression in the evauate tag is Unified EL
  - Same expression language as JSP 2.1
  - Can directly reference Spring beans by name
  - Access to scoped variables
    - flashScope.foo
  - Expect to see more of this in Core Spring 3.0

Evaluate

- Use in action states
- Use in view states
  - on-entry
  - on-render
  - on-exit

Shopping Cart Flow Definition

```
<action-state id="validateCC">
    <evaluate
        expression="basketService.validateCC(cart)" />
    <transition on="yes" to="confirm" />
    <transition on="no" to="ccInfo" />
</action-state>
```



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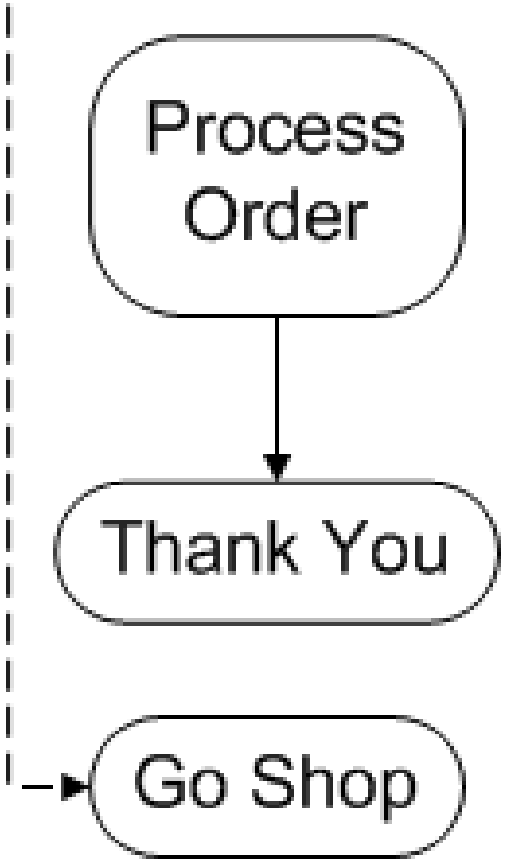
Shopping Cart Flow Definition

```
<action-state id="processOrder">
    <evaluate expression="…"/>
    <transition to="thankYou" />
</action-state>

<end-state id="thankYou" view="thankYou">
    <output name="confirmationNumber"
            value="cart.confirmationNumber" />
</end-state>

<end-state id="goShopping"
    view="externalRedirect:servletRelative:/home" />
```



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Coding the View

- Standard HTML forms
- Can use Spring MVC form tags
- Variables from all scopes are available to EL expressions as request scoped variables
- Always POST to the flow controller
  - EL Variable: ${flowExecutionURL}

Triggering an Event: Named Button

```
    </select>
</div>

<input type="submit"
       name="_eventId_back"
       value="Back" />

<input type="submit"
       name="_eventId_next"
       value="Next" />
```

Triggering an Event: Link

```
Nunc lorem augue, tincidunt
at, venenatis et, faucibus
vestibulum, tortor.
<div>

<a href="${flowExecutionUrl}
          &eventId=next">
    Next
</a>
```

corper turpis. Sed pede ac
Nunc lorem augue, tincidunt
at, venenatis et, faucibus
vestibulum, tortor.

Next

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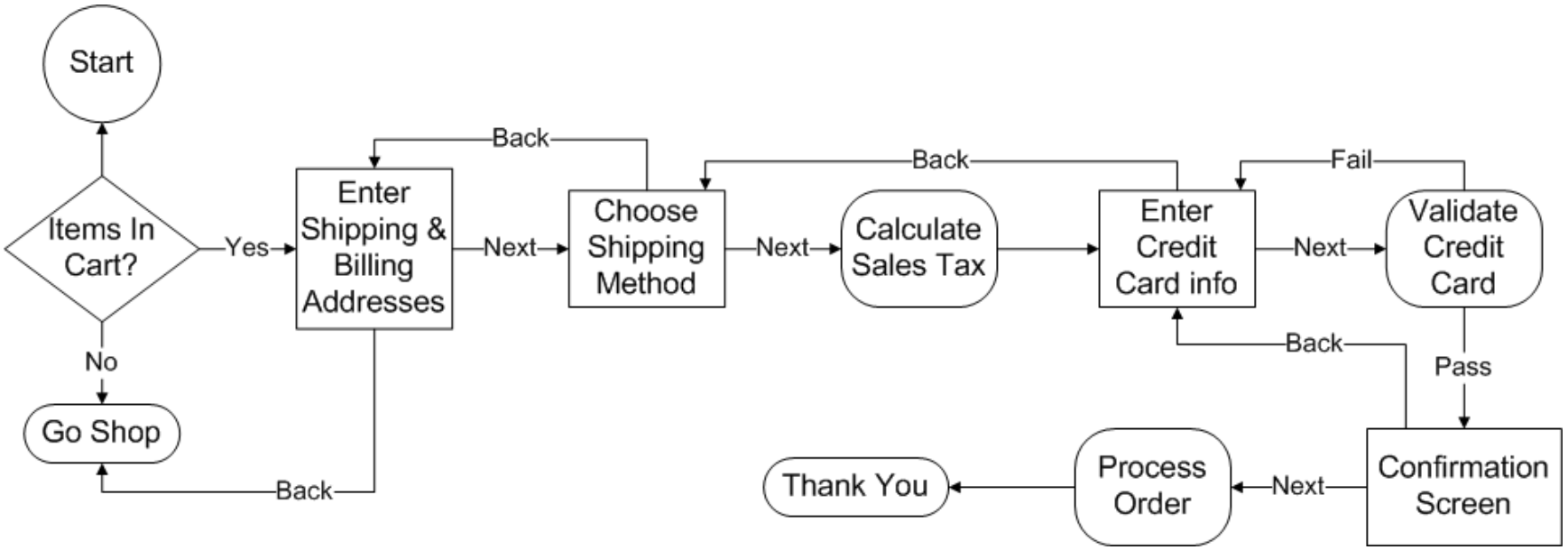
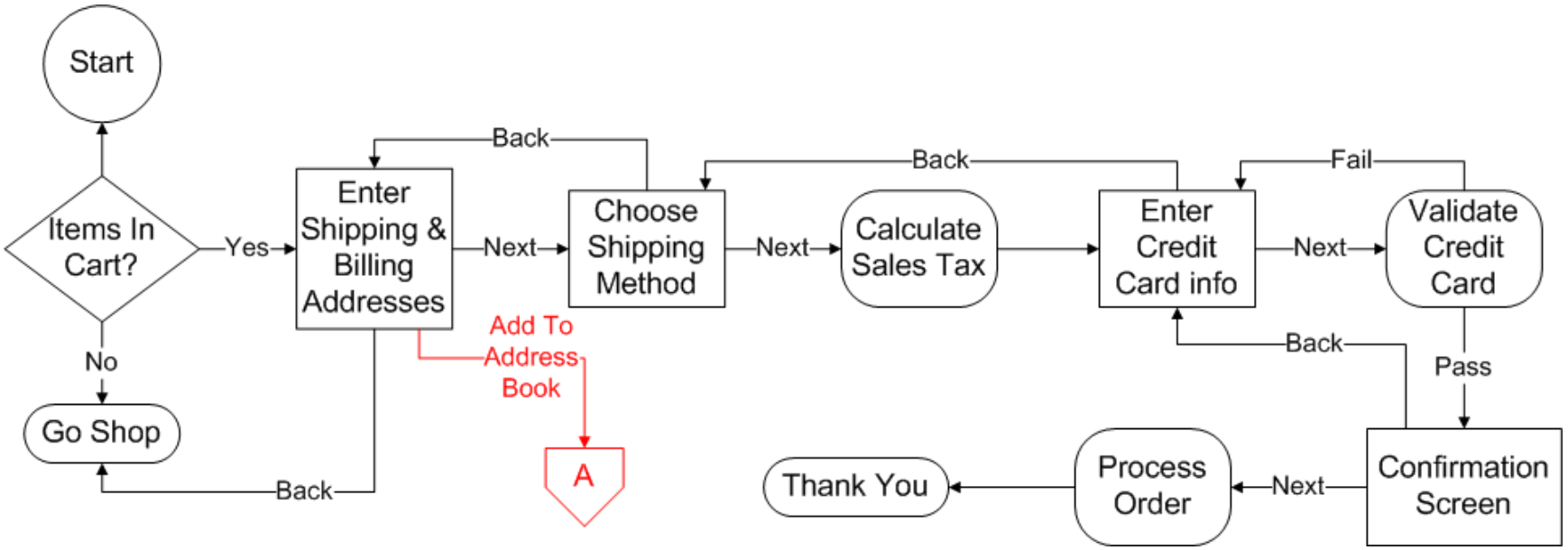
Subflows

- No different than a flow
- Call a flow from another flow
- Has its own variable namespace
  - Flow scope not shared between flows
  - Conversation scope is shared between flows
- Analogous to a method call in Java code

Shopping Cart Flow Diagram



Shopping Cart Flow Diagram



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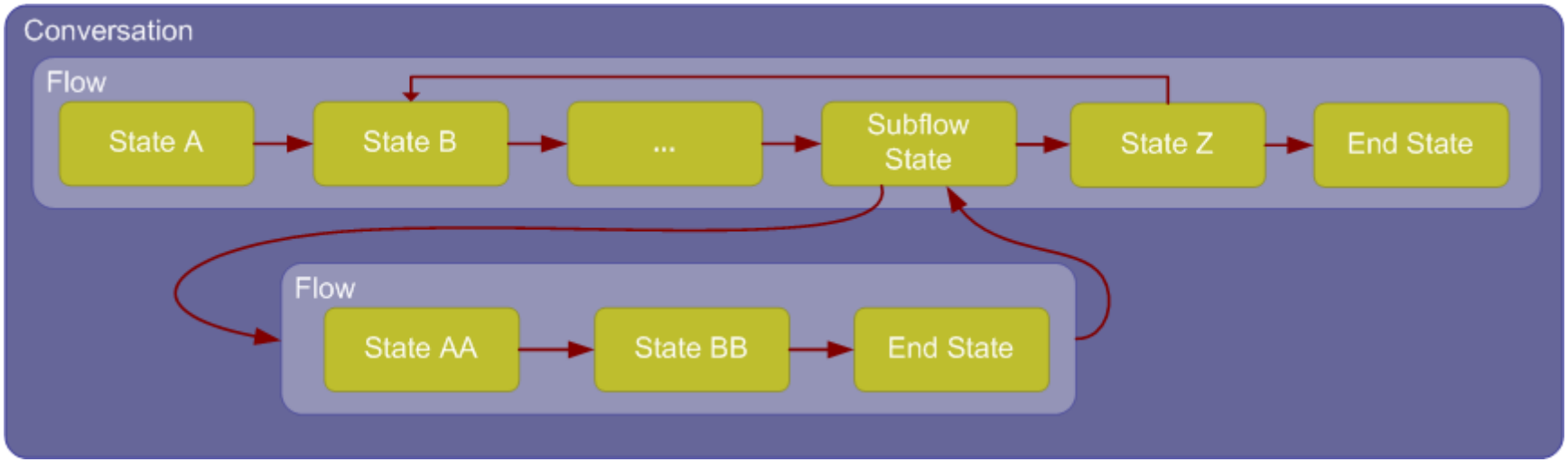

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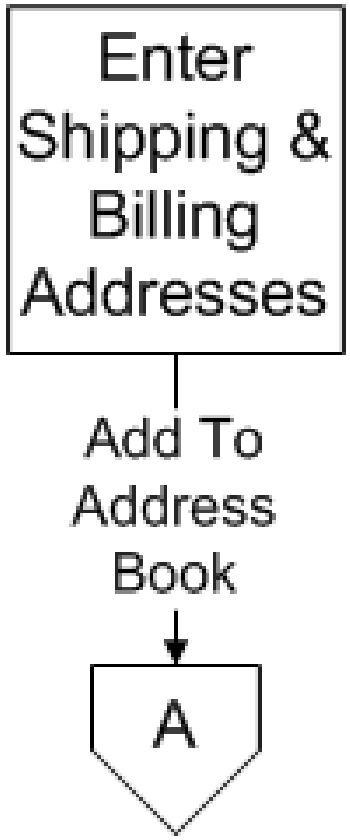
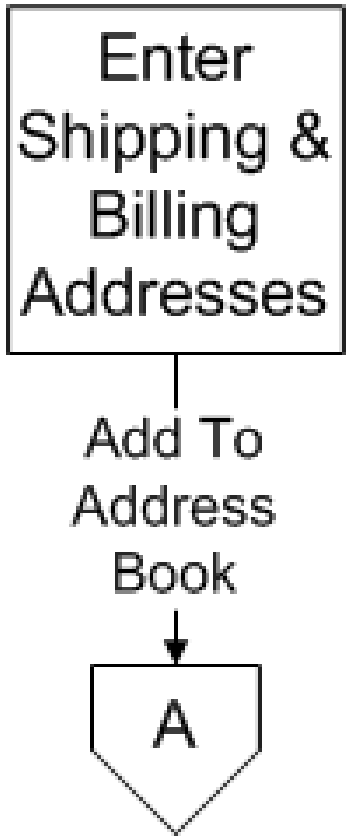
Subflow Definition

```
<view-state id="enterAddresses">
    <transition on="next" to="shipMethod" />
    <transition on="addrBook" to="addrBook" />
</view-state>

<subflow-state id="addrBook“
            subflow="addressBookFlow">
    <attribute name="user" value="cart.user" />
    <transition to=“enterAddresses” />
</subflow-state>
```



Securing WebFlow

```
<view-state id="enterAddresses">
    <transition on="next" to="shipMethod" />
    <transition on="addrBook" to="addrBook" />
</view-state>

<subflow-state id="addrBook“
            subflow="addressBookFlow">
    <secured attributes=“ROLE_AUTHENTICATED” />
    <attribute name="user" value="cart.user" />
    <transition to=“enterAddresses” />
</subflow-state>
```



Securing WebFlow

- Integrates with Spring Security
- <secured> tag can be applied to
  - States
  - Transitions
  - Flows
- AccessDeniedException thrown
  - Handled by Spring Security according to its own configuration

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Testing WebFlow

- Testing a multi page web process can be very difficult
  - Usually involves setting up a test server and actually running the application
  - Difficult to isolate the process flow definition from the execution
  - Difficult to test middle steps without executing all previous steps

Testing WebFlow

- WebFlow ships with the AbstractXmlFlowExecutionTests class
  - JUnit test
  - All tests run inside of a full Spring container, with all objects wired up
- At minimum, give it the location of your XML flow definition
- Provides other useful hooks
  - Register stubs and mocks with the Spring container
  - Provide path to parent flow definition if necessary

AbstractXmlFlowExecutionTests

- Drive Flow Execution
  - startFlow(), setCurrentState(), resumeFlow()
- Assertions
  - assertCurrentStateEquals()
  - assertFlowExecutionEnded()
  - more
- Scoped Variable Access
  - Get and set

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MockExternalContext

- Use this class to populate whatever external state you expect for the portion of the flow under test
  - setCurrentUser()
  - setEventId()
  - getRequestParameterMap().put(“name”, “value”)

Example Test: Making Transitions

```
public void testSomething() throws Exception {
  setCurrentState("enterAddresses");

  MockExternalContext context =
          new MockExternalContext();
  context.setEventId("next");

  resumeFlow(context);

  assertCurrentStateEquals("shipMethod");
}
```

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Summary

- Stateful web application development
  - Process driven approach very different from request driven approach of traditional MVC frameworks
- Model business process as a single unit
  - WebFlow uses a Domain Specific Language (DSL) analogous to a flow chart to model the process in a single file

Summary

- Processes are reusable across different areas of the application
  - Flows can be called by other flows just like a method call in Java code. Flows can accept input parameters and can return output values.
- Easily Testable
  - AbstractXmlFlowExecutionTests and MockExecutionContext provide a valuable harness for testing flow definitions in isolation from application logic.

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Thank You!

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