the POWER of JAVA™

Java™ EE 5 BluePrints for AJAX-Enabled Web 2.0 Applications

Sean Brydon, Greg Murray, Inderjeet Singh, Mark Basler

Java BluePrints
Sun Microsystems, Inc.
http://blueprints.dev.java.net/

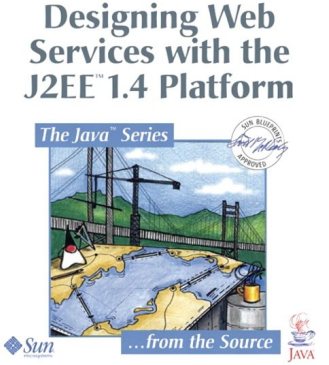
TS-1615

Goal of Our Talk

Learn how to architect and build AJAX-enabled Web 2.0 applications using Java Enterprise Edition™ (Java EE™) 5 platform

Speaker's Qualifications

- Members of the Java BluePrints Program at Sun Microsystems
  - http://blueprints.dev.java.net/
  - Programming Model, Guidelines, Patterns
  - Open-Source BSD License Projects
  - Projects:
    - Java Pet Store, *a new version showing Web 2.0 with Java EE 5*
    - Java BluePrints Solutions Catalog
    - Java Adventure Builder
  - Books
    - Designing Web Services with the J2EE 1.4 Platform
    - Designing Enterprise Applications with the J2EE Platform, 2nd Ed



Web 2.0: Salient Aspects

- Web as a Platform
  - Network is the computer
  - Lightweight de-facto programming models
    - For example: SOAP vs. REST
  - Mashups

- Richer User Experience
- Community created content
  - Collective Intelligence for collaborative categorization
- New security issues
- Do you have a long tail?
- BluePrints focussed on engineering aspects

Agenda

Brief AJAX Overview

Demo

Application Design

JavaScript Guidelines

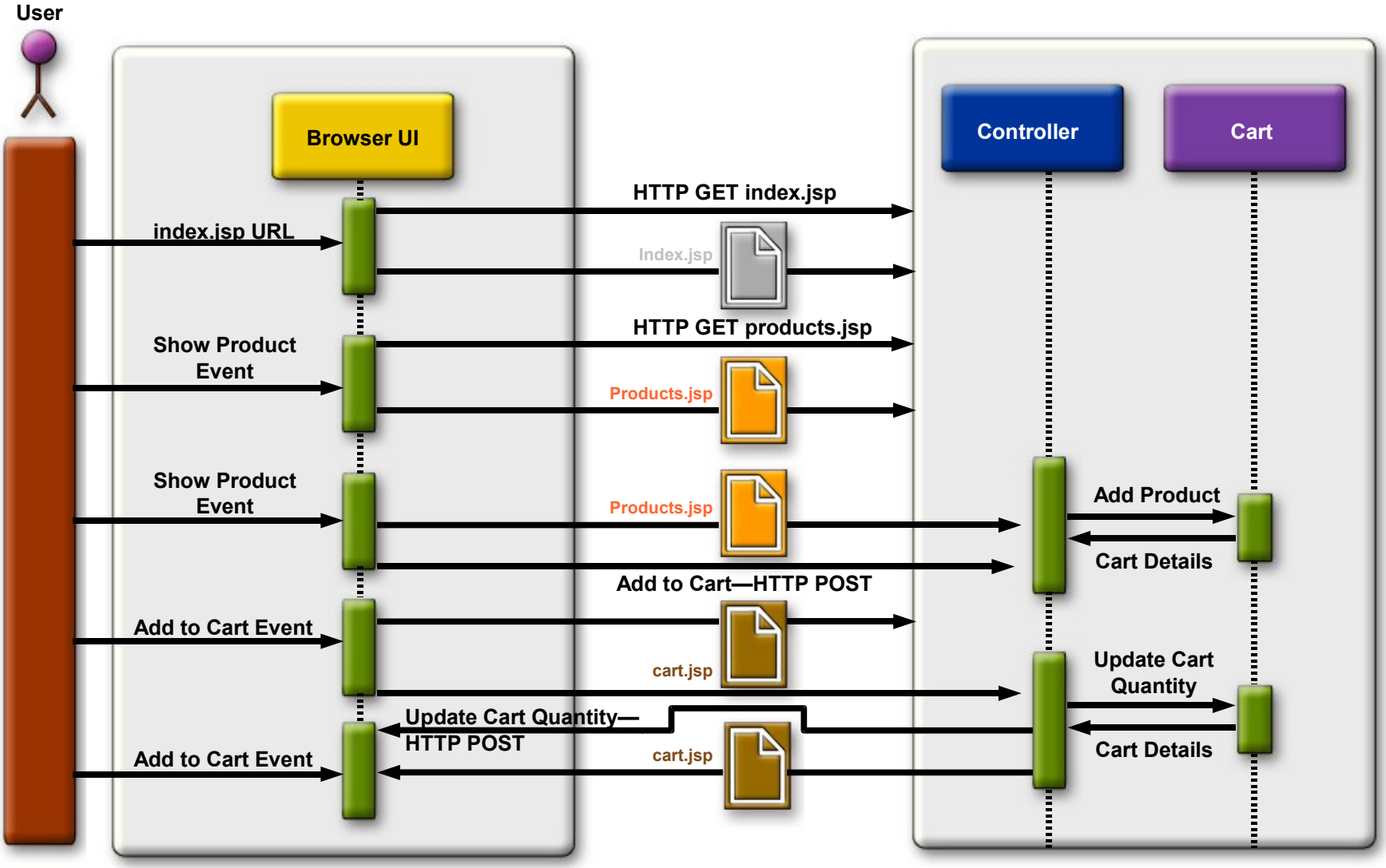
JSF Approach

Summary

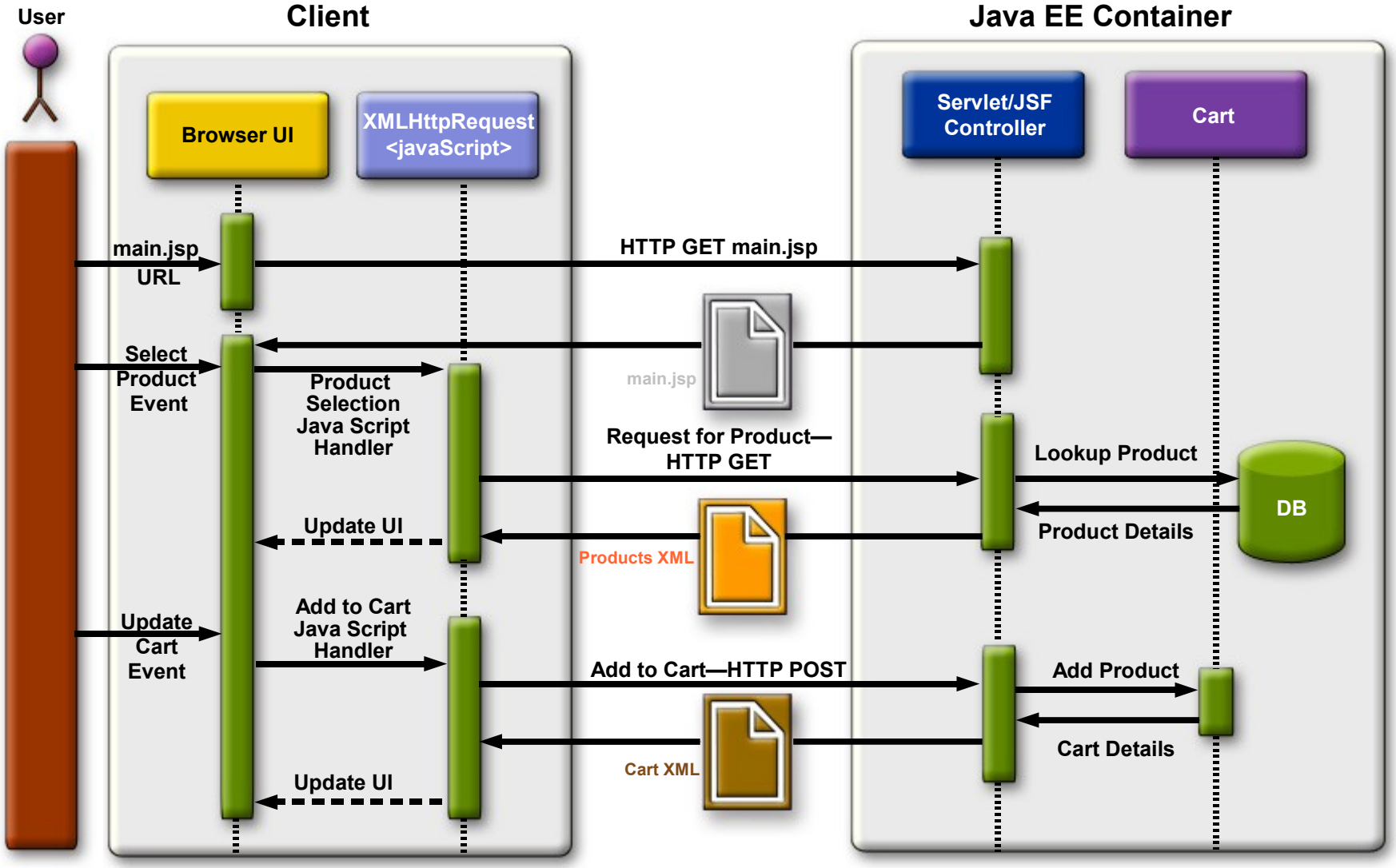
Conventional vs. Rich Web Applications

- Conventional Web Applications
  - Server Centric
  - Page to Page navigation based
- Rich AJAX Web Applications
  - Client executes logic
  - Client holds some data
  - Page is the application

Conventional Interaction Model



High-Level AJAX Interaction Model



Simple AJAX Example

```
var req;
function doCompletion() {
    var target = document.getElementById("autocompleteField");
    var url = "autocomplete?action=complete&id=" +
encodeURI(target.value);
    req = new XMLHttpRequest();
    req.onreadystatechange = myCallBack;
    req.open("GET", url, true);
    req.send(null);
}
function myCallBack() {
  if (req.readyState == 4) {
     var resp = req.responseXML;
     //get data from XML doc
     var personName = resp.getElementsByTagName("person")[0];
     //update dom to add name to page
     mydiv = document.getElementById("peopleListID");
     mydiv.appendChild(document.createTextNode(personName));
   }
}
```

DEMO


Java Pet Store
Seller | Search | Catalog | Map | Main
News from BluePrints
SystemNews discusses Java BluePrints AJAX Components
Dogs
Cats
Birds
Fish
Reptiles

Agenda

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Summary

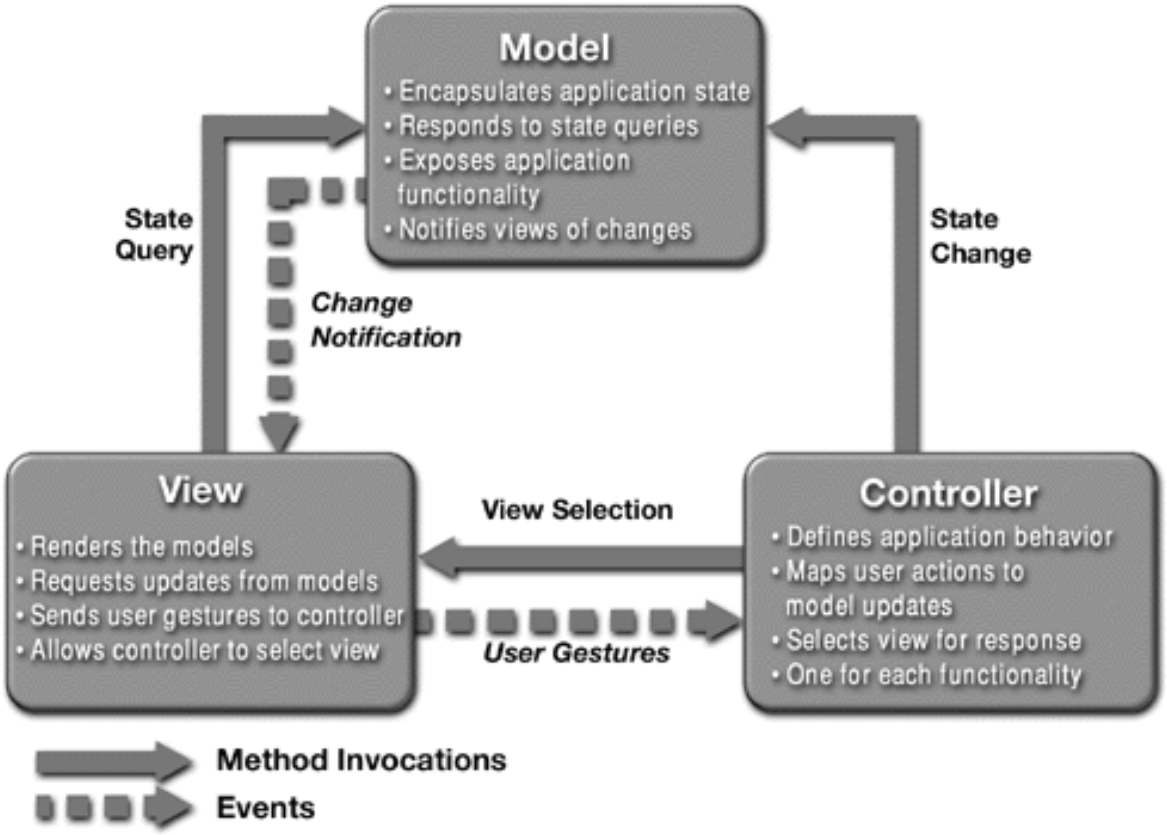
Pet Store 2.0 Design Choices

- When to Use AJAX
- Page is the Application Architecture
- Model View Controller and Patterns
- Leverage Existing AJAX Libraries
- Use JSF Components to Wrap AJAX
- Mashup Architectures
  - Proxy for cross domain
  - Rest service APIs
- Domain model to store and manage data
  - Including user content and images
- Now Build it on Java EE 5!

AJAX Design Choices

- When to Use AJAX
  - When it enhances user experience
  - “But it’s fun to go crazy!”, tech team quote
- Page is the Application
  - Really just one page?
  - Client and server split MVC responsibilities
- Server Centric
  - Server renders everything
- Client Centric
  - More logic coded in JavaScript
  - Client controller
  - Consider existing AJAX library design

Model View Controller



Split Model View Controller

- Client and Server Code need MVC
- Model
  - Java Persistence APIs for Domain Model
  - XML/JSON for Model Data Transport
  - Programmatically Cache Locally in Client
- Controller
  - Server-side is a Servlet or JSF component
  - Server-side returns JavaScript
  - JavaScript executed on client
- View
  - Server Returns Fragments and Style Sheets
  - Presentation Handled by Browser

New Security Issues

- Upload user content
  - Programmatic validation
  - User policing of content—no naked pets!
- CAPTCHA
  - Avoid automated graffiti
- JavaScript Sandbox
  - Origin of domain policy for executing code
- We accessed an RSS over HTTPS
- Using REST APIs
  - Trust Google code on your clients?
- JavaScript code visible to the world
- HTTP-->HTTPS—Requires a page refresh

Mash Design Choices

- Pet Store Uses Four Services
  - Google Map, Yahoo GeoCoder, Pay Pal, RSS feed
- Client directly
- Proxy
- Feeling Clean?
  - Don’t need SOAP!
  - Don’t need WS-Infinity
  - Take a REST
- Wrap in JSF component

Proxy for Cross-Domain

- Example: News Bar using RSS Feed
- Client uses server to mediate with service
- Avoid Server of Origin Security Policy
- Why?
  - Mitigate slow RSS over HTTPS
  - Server pre-processes data
  - Read RSS feed, similar to a datasource
  - Parse big document
  - Return as JSON
- Application-Scoped Data so Cached
- Security Settings on Server

Client-Side Mash Up

- Example: Google Maps for Pet Sale Search
- Use Third-Party Service APIs from Client
  - Presentation and logic comes from service
- Client-Specific Data
- Existing API Satisfies Need
- Hard to Achieve with Proxy Style
  - Handle Presentation Code
- Give up some control

Client-Side Mashup

- Server of origin policy
  - Can not just XMLHttpRequest from page
- Script is Loaded From Third-Party
- Client Request Fetches Page Which Includes Google JavaScript
- Third-Party Code Is Executed in Client

```
<script type="text/javascript"
src="http://maps.google.com/maps?file=api&v=1&key=ABI...">
</script>
<script type="text/javascript"
            src="/petstore/faces//mapviewer/script.js">
</script>
```

Model Tier

- Does Model Need to be Different for AJAX apps?
- Use Java Persistence APIs for Domain Model
  - Goodbye EJB CMPs!
- Use Facade Pattern
  - Web object or Session Bean
  - Transactions and entity manager access encapsulated
  - Detached objects returned from client of facade
- Keep Transformation Code Separate
  - Model is POJOs
  - Client expects XML, JSON, HTML, text, JavaScript code

Use Java Persitence APIs

```
@NamedQuery(
  name="Item.getItemsPerProductCategory",
  query="SELECT i FROM Item i WHERE i.pID = :pID")
@Entity
public class Item implements java.io.Serializable{
  private String itemID;
  private String productID;  //other fields ...
  public Item() {}

  @TableGenerator(name="ITEM_ID_GEN",table="ID_GEN"...)
  @GeneratedValue(strategy=GenerationType.TABLE,
                          generator="ITEM_ID_GEN")
  @Id
  public String getItemID() {
    return itemID;
  }
//other getters & setters...
```

Use Model Facade Pattern

```
public class CatalogFacade
                implements ServletContextListener {
  @PersistenceUnit(unitName="PetstorePu")
        private EntityManagerFactory emf;

  @ResourceUserTransaction utx;
  ...

  public List<Item> getItems(String pID){
    EntityManager em = emf.createEntityManager();
    Query query =   em.createNamedQuery
                    ("Item.getItemsPerProductCategory");
    List<Item>  items =
          query.setParameter("pID",pID).getResultList();
    em.close();
    return items;
  }
```

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JavaScript Guidelines

JSF Approach

Summary

AJAX Guidelines

- JavaScript Libraries
- Eventing
- Return content-types
- Value List Handler
- Usability
- Mashups

JavaScript Programming Language Libraries

- Prototype
- RICO
- Script.aculo.us
- Dojo
- Zimbra

Recommendation: Adopt a library and don't try to re-invent the wheel.

Eventing

- Anonymous
- Publish/Subscribe
- Closely coupled

Recommendation: Consider the meaning of each and weigh the benefits when designing your application.

Eventing

Java Pet Store

Seller | Search | Catalog | Map | Main

News from BluePrints Free Movies of Re-born Pet Store 2.0

Pets

Cats

Dogs

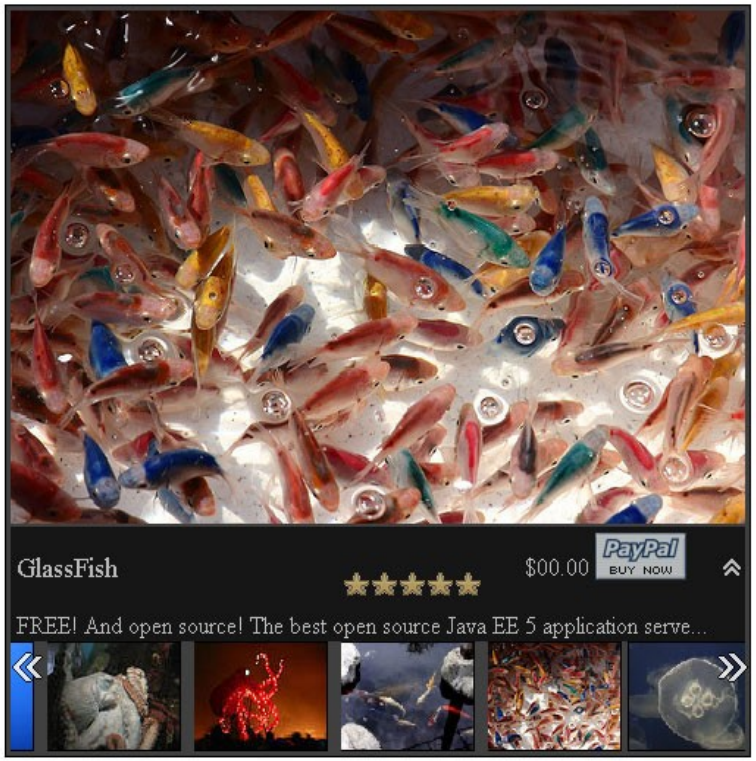
Birds

Reptiles

Fish

Small Fish

Large Fish



JavaScript and AJAX Conventions Used in Petstore Architecture

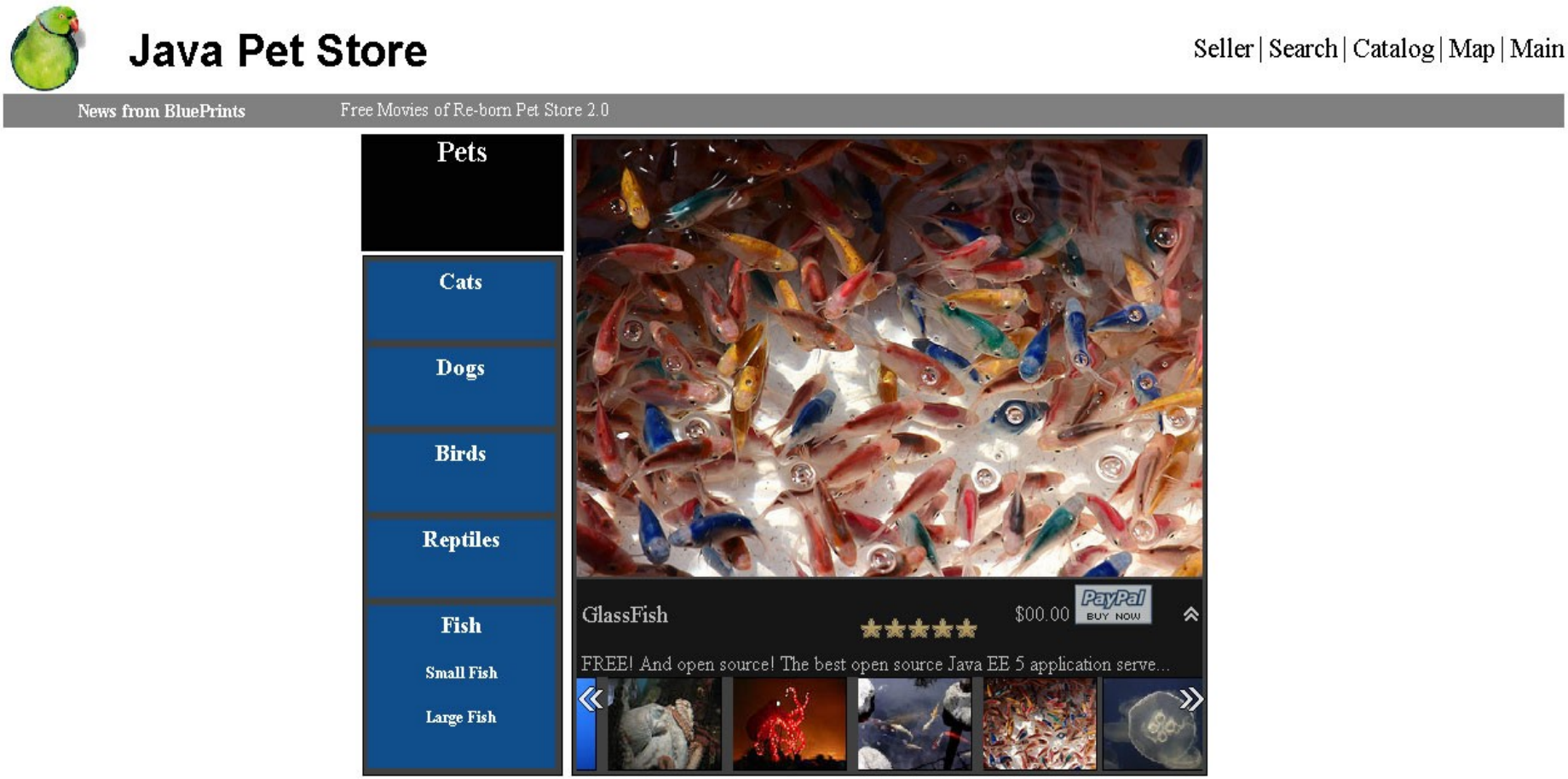
- Standardized on Dojo
  - dojo.event.connect
  - dojo.io.bind
  - dojo.widget.*
- Used Object-Oriented JavaScript
- Cleanly Separation of CSS/JS/HTML (MVC)
- Used Namespaces as much as possible
- Used feature detection
- Favored DOM injection over innerHTML

Response Content Type

- XML
- HTML
- Text
  - Post processing on client
  - Inject directly into the page
- JavaScript
  - Evaluated in JavaScript using eval()
  - JavaScript object representations of data(JSON)

Recommendation: Use XML for structured portable data. Use plain text for when injecting content into the HTML. Use JavaScript to return object representations data.

Value List Handler



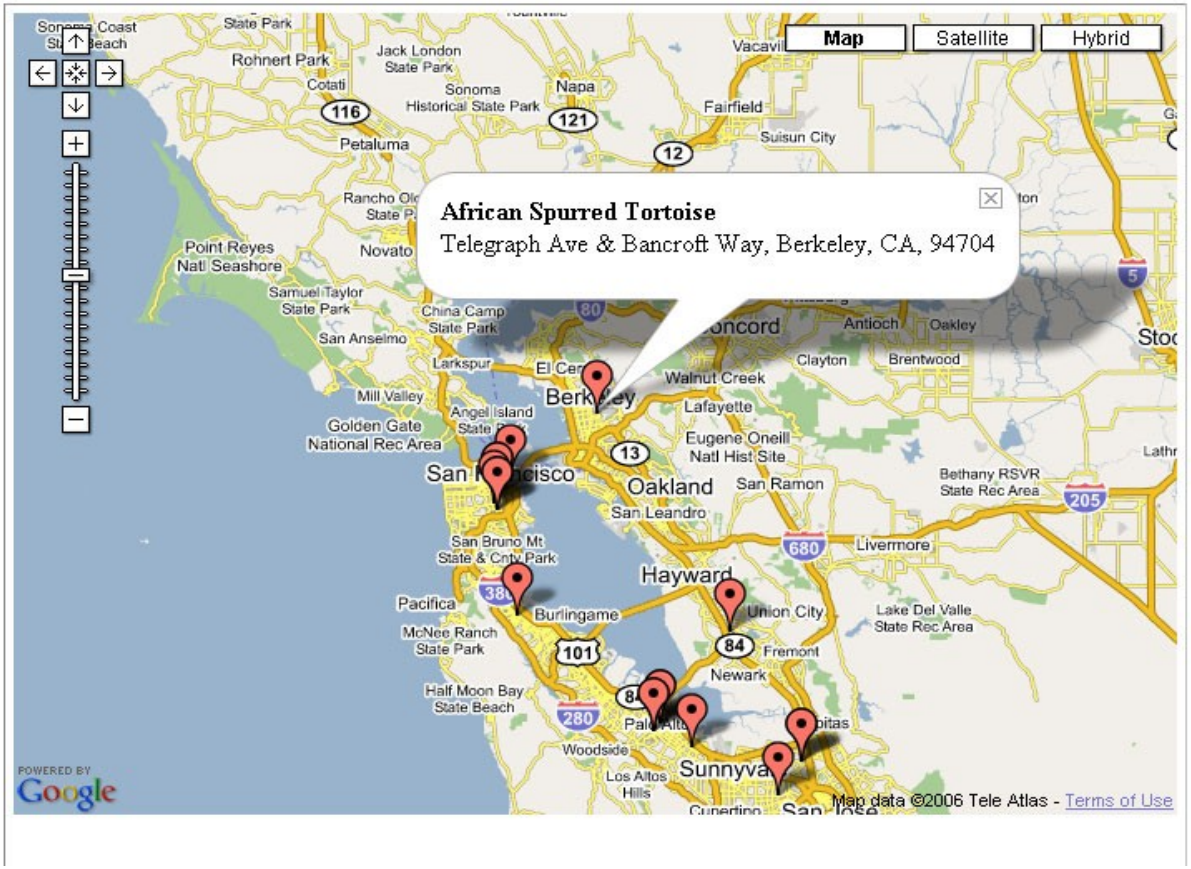
What About Usability?

- Integrated JSF components with their own packaged JavaScript
- Externalized customizable portions of a component rather than embed it in JavaScript (Info Pane)
- Bookmarking using the # (anchor technique)
- Exposing access to specific chunks of data via the CatalogFacade.

Petstore Mashup

19 Items Displayed

- **African Spurred Tortoise** *(detail)*
  Telegraph Ave & Bancroft Way, Berkeley, CA, 94704
- **African Spurred Tortoise** *(detail)*
  River Oaks Pky & Village Center Dr, San Jose, CA, 95134
- **Box Turtle** *(detail)*
  San Antonio Rd & Middlefield Rd, Palo Alto, CA, 94303
- **California Desert Tortoise** *(detail)*
  Millbrae Ave & Willow Ave, Millbrae , CA, 94030
- **Florida King Snake** *(detail)*
  Paseo Padre Pky & Fremont Blvd, Fremont, CA, 94555
- **Frog** *(detail)*
  University Ave & Middlefield Rd, Palo Alto, CA, 94301
- **Green Iguana** *(detail)*
  Leavesley Rd & Monterey Rd, Gilroy, CA, 95020
- **Green slider** *(detail)*
  Palm Dr & Arboretum Rd, Stanford, CA, 94305
- **Guinea Pig** *(detail)*
  Dolores St & San Jose Ave, San Francisco, CA, 94110
- **Hawaiian Green Gecko** *(detail)*
  20th St & Dolores St, San Francisco, CA, 94114
- **Iguana** *(detail)*
  Cesar Chavez St & Sanchez, San Francisco, CA, 94131
- **Iron Dragon** *(detail)*
  Campbell St & Riverside Ave, Santa Cruz, CA, 95060
- **Large Box Turtle** *(detail)*



Mashups From a JavaScript Perspective

- Expose data via JSON for a data-centric mashup
  - Allow for a callback function
- Use document.write() if you want to prevent others from re-purposing your mashup data
- Consider using a key passed in as a URL parameter to prevent improper use
- Consider restricting access to a list of hosts
- Consider Dojo ScriptSrcIO

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JSF and AJAX

Summary

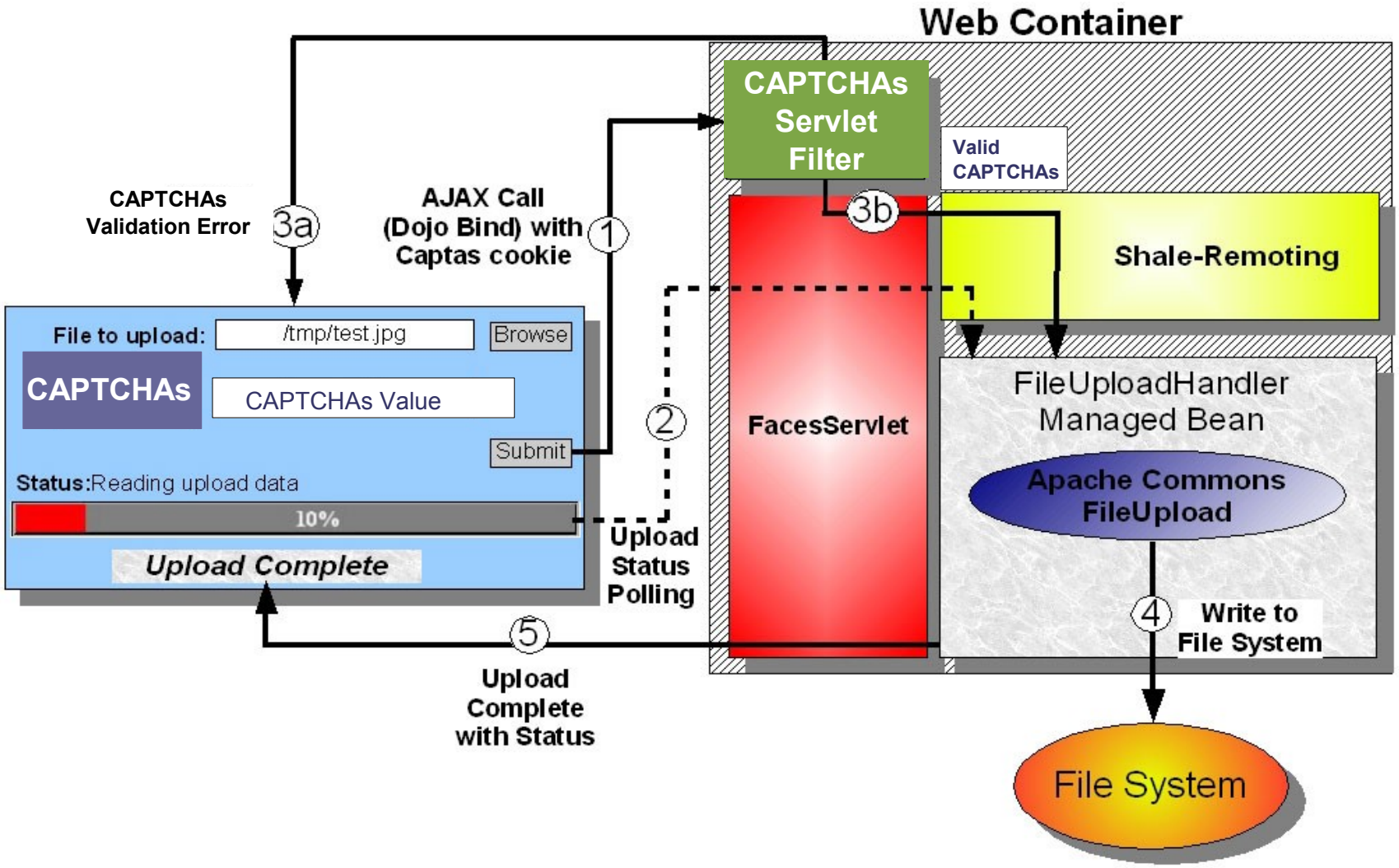
JSF Approach—General

- Took a hybrid approach
- Goals
  - Capture a wider audience
  - Zero setup
- Encapsulates an AJAX component
- Client (browser) can share some of the load for more flexibility
- Demonstrated Javascript frameworks and their widgets
- Still exploring alternative approaches

File Upload Component Implementation

- File Upload through AJAX
- Utilized open source libraries
- Progress bar status
- Ongoing status Available
- CAPTCHAs
- Store the data
- Extending component

File Upload Component's Submit



Accessing Static and Dynamic Resources

Directly Accessing Resources

- Traditional Web Design
- Artifacts need deployment descriptor
- Possible name clash
- Could be appropriate for small groups

Accessing Static and Dynamic Resources

Renderer Serve Resources

- Serve component's resources through renderer
- During the "Apply Request Values" phase
- Serve static resource
- Execute/delegate dynamic call
- Call ResponseComplete method

Accessing Static and Dynamic Resources

Renderer Server Resources (disadvantages)

- “Restore View” phase has to reconstitute the component tree
- Performance Consequences
- Especially if state is maintained on the client
- Phase has to finish executing
- Side-effects also with "immediate=true"
- Not the optimal approach

Accessing Static and Dynamic Resources

PhaseListener Serves Resources

- During the “Restore View” phase
- Serve static resource
- Execute/delegate dynamic call
- Call ResponseComplete method

Accessing Static and Dynamic Resources

PhaseListener Server Resources (disadvantages)

- PhaseListener for each component
- Developers coding differently
- All PhaseListeners fired sequentially
- Performance burden

Accessing Static and Dynamic Resources

Third-Party Libraries (Shale-Remoting)

- Keeps developers from adding functionality
- Single PhaseListener
- Doesn’t require developer configuration
- Serves static requests
- Delegates dynamic requests
- URI starts with context root

Accessing Static Resources

```
import org.apache.shale.remoting.Mechanism;
import org.apache.shale.remoting.XhtmlHelper;
private static XhtmlHelper helper = new XhtmlHelper();
public void encodeEnd(FacesContext context, UIComponent component) throws
    IOException {
   ....
   //shale remoting resource retrieval
   helper.linkJavascript(context, component, writer,
      Mechanism.CLASS_RESOURCE, "/META-INF/fileupload/fileupload.js");
   helper.linkStylesheet(context, component, writer,
      Mechanism.CLASS_RESOURCE, "/META-INF/fileupload/fileupload.css");
}
```

Markup Rendered to Page:

```
<script type="text/javascript" src="/petstore/faces/static/META-
    INF/fileupload/fileupload.js"></script>
<link type="text/css" rel="stylesheet" href="/petstore/faces/static/META-
    INF/fileupload/fileupload.css" />
```

Delegating to Dynamic Resources

```
import org.apache.shale.remoting.Mechanism;
import org.apache.shale.remoting.XhtmlHelper;
private static XhtmlHelper helper=new XhtmlHelper();
public void encodeBegin(FacesContext context, UIComponent component)
    throws IOException {
   ....
   String fileUploadCallback = helper.mapResourceId(context,
    Mechanism.DYNAMIC_RESOURCE,
    "/bpui_fileupload_handler/handleFileUpload");
   outComp.getAttributes().put("onsubmit", "return
    bpui.fileupload.submitForm(this, '" + retMimeType + "', '" + retFunction + "','" +
    progressBarDivId + "', '" + fileUploadCallback + "')");
}
```

Markup Rendered to Page:

```
onsubmit="return bpui.fileupload.submitForm(this, 'text/xml',
    'bpui.fileupload.defaultRetFunction','progress3x',
    '/petstore/faces/dynamic/bpui_fileupload_handler/handleFileUpload')"
```

Extending Base Renderer Functionality

- Adding AJAX functionality
- Need new Tag Handler
- Don’t want to write a renderer from scratch
- Look up default renderer and delegate

Extending Base Renderer Functionality

```
public void encodeBegin(FacesContext context, UIComponent
    component)  {
   ...// lookup using family and rendererType
   Renderer
    baseRenderer=context.getRenderKit().getRenderer("javax.faces.For
    m", "javax.faces.Form");
   baseRenderer.encodeBegin(context, component);
}
public void encodeEnd(FacesContext context, UIComponent
    component)  {
   ... // lookup using family and rendererType
   Renderer
    baseRenderer=context.getRenderKit().getRenderer("javax.faces.For
    m", "javax.faces.Form");
   baseRenderer.encodeEnd(context, component);
}
```

Component Library Summary

- Accessing Resources through Renderers and PhaseListerns can impact performance
- Preferred hybrid approach
- Preferred zero setup time (other than adding jar)
- Still exploring alternative approaches

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Summary

- AJAX and Java EE 5 are Complimentary
- Use Page as the Application Architecture
- Follow MVC in your application
- Use Proxy Style or REST APIs for Mashups
- Use JavaScript Conventions
- Leverage an Existing AJAX Library
- Wrap AJAX in Java Server Faces for Re-Use
- Try the Java BluePrints AJAX Components!

For More Information

- BluePrints Projects on Java.net
  http://blueprints.dev.java.net/
- Java Pet Store 2.0
  https://blueprints.dev.java.net/petstore
- AJAX Components
  http://blueprints.dev.java.net/ajaxcomponents.html

- Talk: BluePrints for Java EE 5, TS-1969
  Wednesday, 4:00pm–5:00pm
- BOF-2594 Thursday Night, 7:30pm–8:20pm

Q&A

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