What the Bayeux?

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Who is Filip

- Apache Tomcat committer
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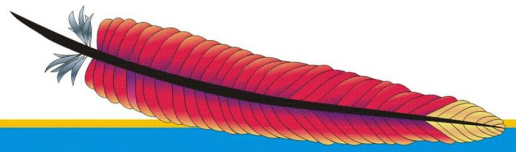
- SpringSource Inc employee

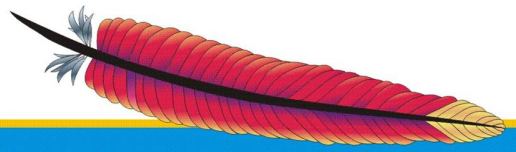
What we will cover

- Introduction to AJAX and Comet
  - AJAX yesterday, today and tomorrow
  - Polling methods
  - Client support
- The Bayeux Protocol
  - Introduction to JSON
  - Publish/Subscribe



What we will cover

- The Bayeux Protocol
  - Message exchange
- Bayeux clients
  - Server side
  - Client side/browser



What we will cover

- Tomcat Bayeux API
  - Server side framework for bayeux web applications
- Implementing a simple app
- What now, buzz or bull?

Introduction to AJAX

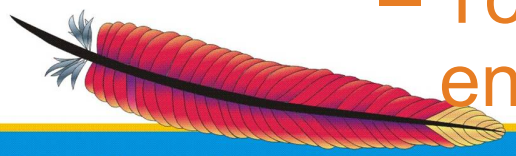
- What is AJAX
  - Asynchronous Javascript and XML
  - Web development technique
  - Term coined in 2005
  - Technique originated from Microsoft
    - 1996 iframe
    - 1999 XMLHttpRequest object

Introduction to AJAX

- AJAX on the client side
  - Javascript running in browser
  - Making HTTP requests in the background
  - Ability to update without refresh
  - Must be tailored to the browser
  - Lots of frameworks out there

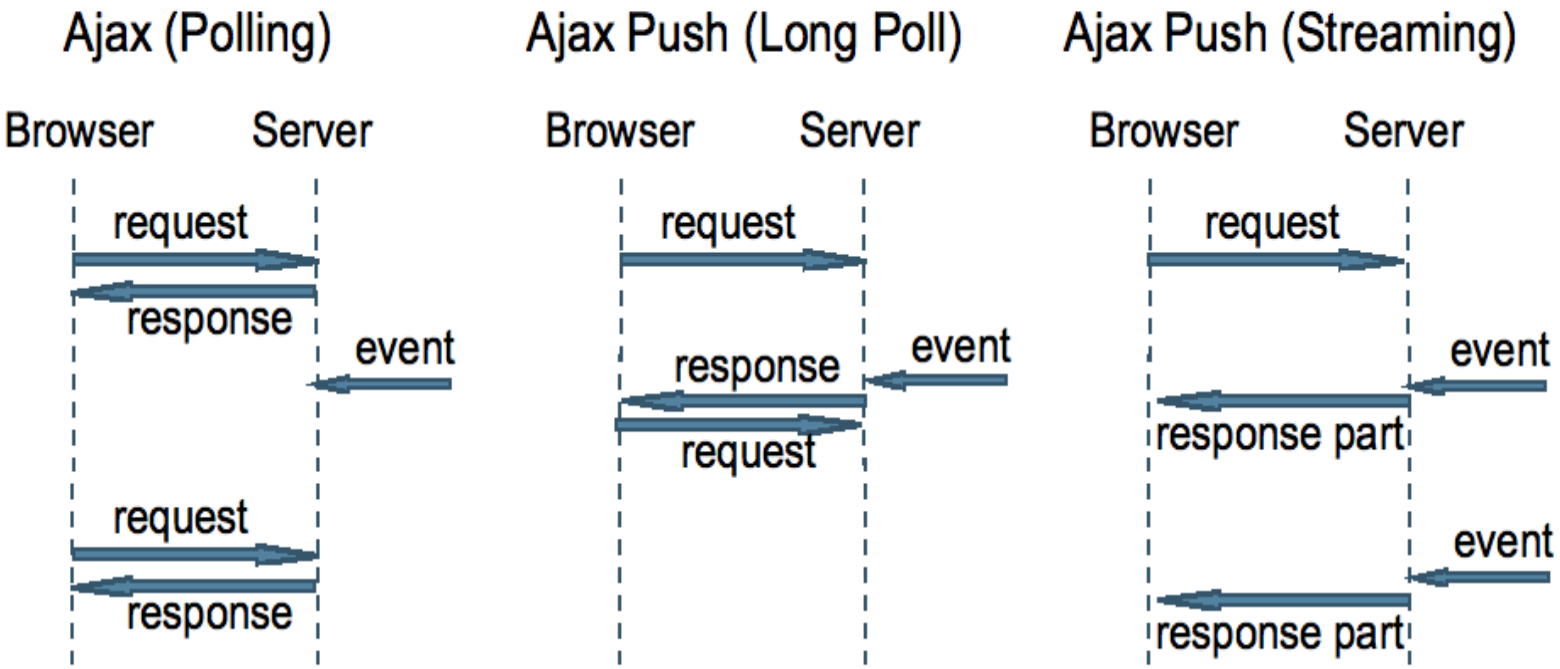
Introduction to AJAX

- AJAX Today
  - Has become a common solution
  - Used by more and more large sites
- AJAX on the server side
  - Scalability has been an issue
  - Polling is expensive
  - Works best when server can do asynchronous processing
  - Tomcat Comet is such asynchronous engine



Introduction to AJAX

- Polling and how it works



Introduction to AJAX

- Client support
  - Various Javascript frameworks
  - Communication with browser is still achieved with

BIG TIME HACKS!!!

The Bayeux Protocol

- Publish Subscribe Model
  - A JSON based publish/subscribe protocol
  - Development lead by Dojo Foundation
  - Approach is similar to JMS topics
  - Still in somewhat of a trial stage
  - Idea is to have someone else take over the specification

The Bayeux Protocol

- Publish Subscribe Model
  - Client and Server side frameworks
  - Remove complexity of cometd/ajax from web developers
  - Instead of pub/sub, one can think of it as listening for events

The Bayeux Protocol

- Introduction to JSON
  - JavaScript Object Notation
  - Portable serialization format
  - Not a markup language – no tags
  - Fast serialization and deserialization

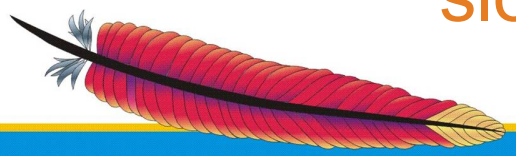
The Bayeux Protocol

- Introduction to JSON

```
{
  "firstName": "John",
  "lastName": "Smith",
  "address":
  {
    "streetAddress": "21 2nd Street",
    "city": "New York",
    "state": "NY",
    "postalCode": 10021
  },
}
```

The Bayeux Protocol

- Introduction to JSON
  - JSON compared to XML?
    - Long (and war like) debate
    - JSON doesn't have tags
    - Much less verbose
    - Parsing libraries much smaller and more efficient
  - JSON is JavaScript! No parsing needed!
  - XML with AJAX has been said to be slow.



The Bayeux Protocol

- Introduction to JSON
  - Cyclic references are supported in custom format
  - http://www.sitepen.com/blog/2008/06/17/json-referencing-in-dojo/

The Bayeux Protocol

- Message exchanges
  - All message exchange is done using JSON
  - Very simple
    - Establish client
    - Subscribe to channel
    - Publish events
    - Receive events
  - Two connection operation (optional)
    - Allows send and receive at the same time

The Bayeux Protocol

- Message exchanges
  - Content type for messaging is
    - text/json
    - text/json-comment-filtered
  - Comment filtered
    - JSON message encapsulated in script comments /* … */
    - Meant to prevent AJAX hi-jacking
    - But it doesn't, so it has been deprecated.

The Bayeux Protocol

- Message exchanges
  - Client establishment is done using handshake

```
[{
      "channel": "/meta/handshake",
      "version": "1.0",
      "minimumVersion":
      "1.0beta",
      "supportedConnectionTypes":
          ["long-polling",
           "callback-polling",
           "iframe"]
}]
```

The Bayeux Protocol

- Message exchanges
  - Client establishment is followed by a connect request

```
[{
    "channel": "/meta/connect",
    "clientId": "Un1q31d3nt1f13r",
    "connectionType": "long-polling"
}]
```

The Bayeux Protocol

- Message exchanges
  - To disconnect, simply send disconnect message

```
[{
    "channel": "/meta/disconnect",
    "clientId": "Un1q31d3nt1f13r",
}]
```

  - Server will also have some sort of timeout in case disconnect message is not received
    - Similar to HTTP sessions

The Bayeux Protocol

- Message exchanges
  - Channel subscription is easy

```
[ {
      "channel": "/meta/subscribe",
      "clientId": "Un1q31d3nt1f13r",
      "subscription": "/foo/**"
} ]
```

  - Wild card patterns are supported

The Bayeux Protocol

- Message exchanges
  - Unsubscribing is equally

```
[ {
      "channel": "/meta/unsubscribe",
      "clientId": "Un1q31d3nt1f13r",
      "subscription": "/foo/individual-
channel"
} ]
```

  - Wild card patterns are supported

The Bayeux Protocol

- Message exchanges
  - meta channels are used to negotiate between client and server
  - The only other exchange is sending and receiving events (data)

The Bayeux Protocol

- Message exchanges
  - Unsubscribing is equally simple

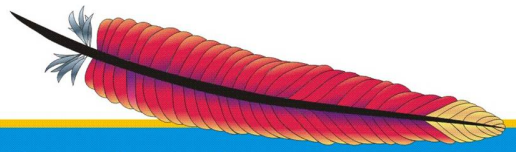
```
[ {
      "channel": "/meta/unsubscribe",
      "clientId": "Un1q31d3nt1f13r",
      "subscription": "/foo/some-channel"
} ]
```

  - Wild card patterns are supported

The Bayeux Protocol

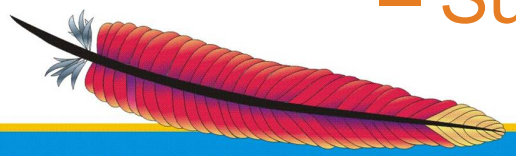
- Message exchanges
  - Messages are simple key value pair objects

```
public interface Message
    extends Map<String,Object>
```



Bayeux actors

- Clients
  - Server side and client side
  - Subscribe to channel
  - Publish and receive events from channels
- Browser side clients
  - Only implementation is the Dojo Toolkit
  - Have to handshake
  - Supports different polling methods



Bayeux actors

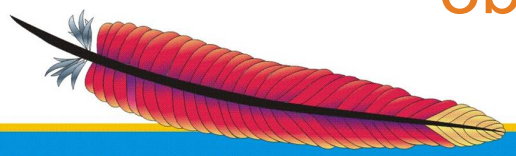
- Server side clients (Java)
  - Implemented in several platforms
    - Tomcat, Jetty, Glassfish
  - All three use different server side API
  - Dojo Foundation has been the hinder for a common Java API
    - Lack of process around infrastructure
    - Lack for process around community development

Bayeux actors

- Server side clients (other)
  - Effort has been put in place to add APIs in other languages
    - Perl
    - Python
    - .NET

Tomcat Bayeux API

- Server Side API
- Goal is to reduce complexity
- Derived from the original Dojo Java API
  - Spaghetti references removed
  - Redundant/ambiguous API removed
  - More object oriented, instead of converting from string-to-object and object-to-string over and over again



Tomcat Bayeux API

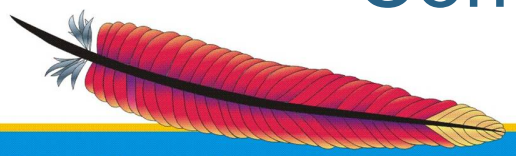
- API found at

```
org.apache.cometd.bayeux
```

- Implementation found at

```
org.apache.tomcat.bayeux
```

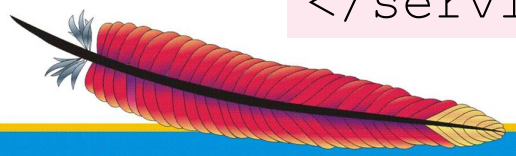
- Built on top of Tomcat's CometProcessor



Tomcat Bayeux API

- Configured through web.xml

```
<servlet>
  <servlet-name>cometd</servlet-name>
  <servlet-class>
    org.apache.tomcat.bayeux.BayeuxServlet
  </servlet-class>
  <load-on-startup>1</load-on-startup>
</servlet>
<servlet-mapping>
  <servlet-name>cometd</servlet-name>
  <url-pattern>/cometd/*</url-pattern>
</servlet-mapping>
```



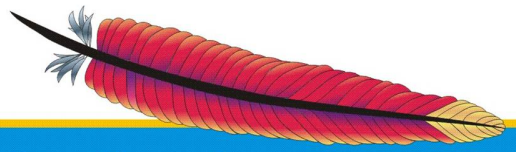
Tomcat Bayeux API

- Create a client

```
Bayeux bayeux = ServletContext.getAttribute(
    "Bayeux.DOJOX_COMETD_BAYEUX");
```

```
Client client =
    bayex.newClient("client-id",callback);
```

  - Callback is an implementation of the org.apache.cometd.bayeux.Listener interface



Tomcat Bayeux API

- Subscribe to a channel

```
Channel channel =
    bayeux.getChannel("/chat/demo",true);
```

```
channel.subscribe(client);
```

Tomcat Bayeux API

- Send a message

```
Message msg = bayeux.newMessage(client);
```

  - Client is the “sender”

```
channel.publish(msg);
```

  - Puts the message into the queue for all subscribed clients

Tomcat Bayeux API

- Receive a message

```
public void deliver(Message[] msgs){
```

  - Messages can come in batches
  - You can reply directly to a client

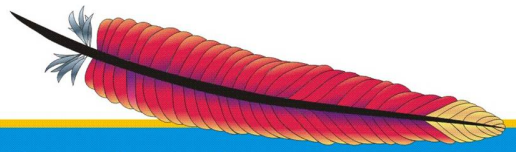
```
Client sender = msgs[i].getClient();
Message reply = bayeux.newMessage(…);
sender.deliver(reply);
```

Tomcat Bayeux API

- Building Bayeux

```
svn
    co
    http://svn.apache.org/repos/asf/tomcat/trunk
    tctrunk
```

```
cd tctrunk
```



Tomcat Bayeux API

- Building Bayeux

```
ant download
```

```
ant
```

  - Tomcat has now been built, build the Bayeux extensions

```
ant -f extras.xml bayeux
```

  - output/extras contains JARs and sample WAR

Tomcat Bayeux API

- Simple API
- Built using Tomcat's CometProcessor
  - Scalable
  - No thread per connection limit
  - Requires NIO or APR connectors

Dojo ToolKit

- Using the Dojo Toolkit

```
dojo.require("dojox.cometd");
```

```
dojox.cometd.init("/cometd/cometd");
```

  - This is the URL of your Bayeux servlet

Dojo ToolKit

- Using the Dojo Toolkit

```
dojox.cometd.subscribe("/chat/demo“,onMsgEvent);
```

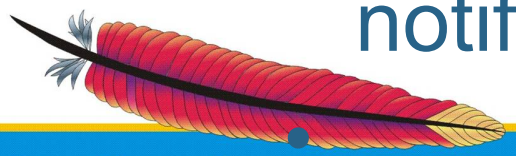
```
var evt =
 {'data': { 'msg': trim(message) + '|' + msg }};
```

```
dojox.cometd.publish("/chat/demo", evt.data);
```

- We’ve subscribed to a channel and sent a message
  - All complexity is behind the scenes

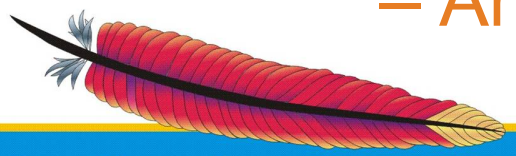
Buzz or Bull?

- A little bit of both
- Dojo lacks some of policy, process and infrastructure that ASF has
  - Good at building user community
  - Harder to build development community
- Client side still focuses on the AJAX hacks
- SPEC changes are fast without SVN notifications!!



Buzz or Bull?

- Once something like 'WebSockets' come in HTML/JavaScript
  - We can probably expect to see more protocols and frameworks
- IMHO – Bayeux is still early, it provides some nice features
  - But we lack more client frameworks
  - And server API's vary a lot



And we're done

- Thank you!
- Questions and hopefully Answers
- fhanik@apache.org