Pixaxe - A Declarative Web Application Framework

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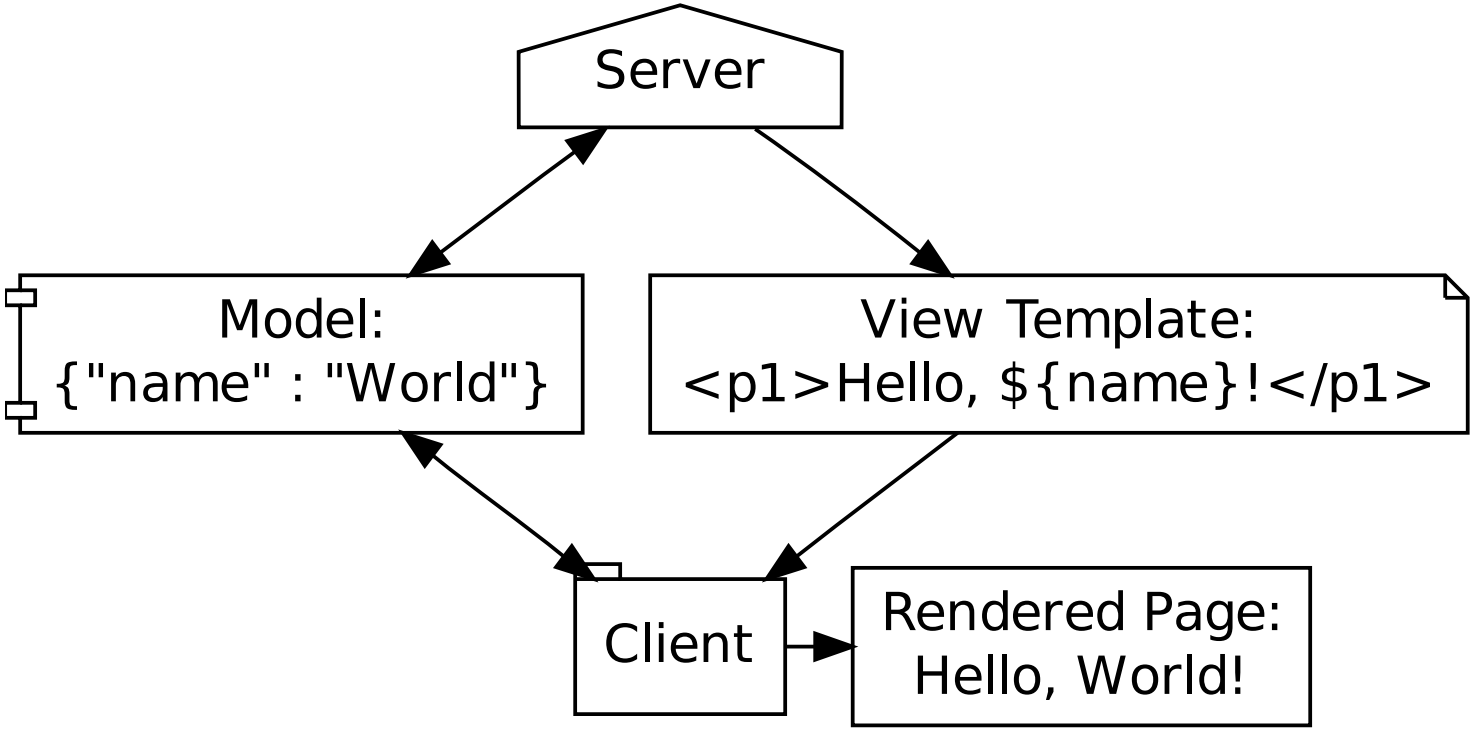
Decoupled Pixaxe is built up of several distinct technologies, and these technologies can be used individually as required.

The Anatomy of a Pixaxe Application



Model-View-Controller

Pixaxe follows a traditional Model-View-Controller design:

- The Model is viewed as a single JSON document that is synchronized among the server, browser, interface, and user. Pixaxe automatically synchronizes the model when necessary.
- The View is a single XHTML document with embedded expressions in Pixaxe's template language. This view is automatically re-rendered in response to changes in the model.
- The Controller exists entirely within the client, and relationships between the controller and the model are also specified declaratively.

Specifying Views

Web Pages as Expressions

- The technology used for the specification of views is known as Jenner, and is usable independently of the rest of Pixaxe.
- Jenner is an expression language; all XHTML pages are valid Jenner expressions, but Jenner is a superset of XHTML. Rendering a page is identical to evaluating the Jenner expression.
- No explicit calls need to be made to render a Jenner expression; the web page itself is considered the Jenner source code and it is reevaluated whenever necessary.

A Simple Jenner Expression

- The Model, a JSON document:

```
{"name" : "world"}
```

- The View, a Jenner expression:

```
<head>
    <title>Example</title>
    <script lang="text/javascript"
            src="pixaxe.js" />
    <script lang="text/javascript"
            src="model.js" />
</head>
<body>
    <p1>Hello, ${name}!</p1>
</body>
```

- The Result, a rendered web page:

```
Hello, world!
```

A More Complicated Jenner Expression

The Model

```
{
    "log" : [
        {"level" : "CRIT"
         "text"  : "Core temp critical"},
        {"level' : "INFO",
         "text"  : "Fries are done"}
    ]
}
```

A More Complicated Jenner Expression

The View

```
<head>
    <title>Log Messages</title>
    <script lang="text/javascript" src="pixaxe.js" />
    <script lang="text/javascript" src="model.js" />
</head>
<body>
    <ul>
        ${for i from 0 to log.length - 1
            var m := log[i]
            return
            <li class="${m.level == 'CRIT' ?
                        'log-red' : 'log-black'}">
                ${m.text}
            </li>
        }
     </ul>
</body>
```

Jenner

Language Features

- Standard operators, including modular arithmetic, Boolean combination, etc.
- List comprehensions.
- Lexical scoping (the Model serves as the root environment).
- Document elements as expressions and results.
- Attribute values may be Jenner expressions.
- Functions and a foreign function interface with JavaScript.
- Can be used separately from Pixaxe as a powerful client-side template engine.
- Can use XSLT as a page-load-time macro language.

Jenner

Example Macro Usage

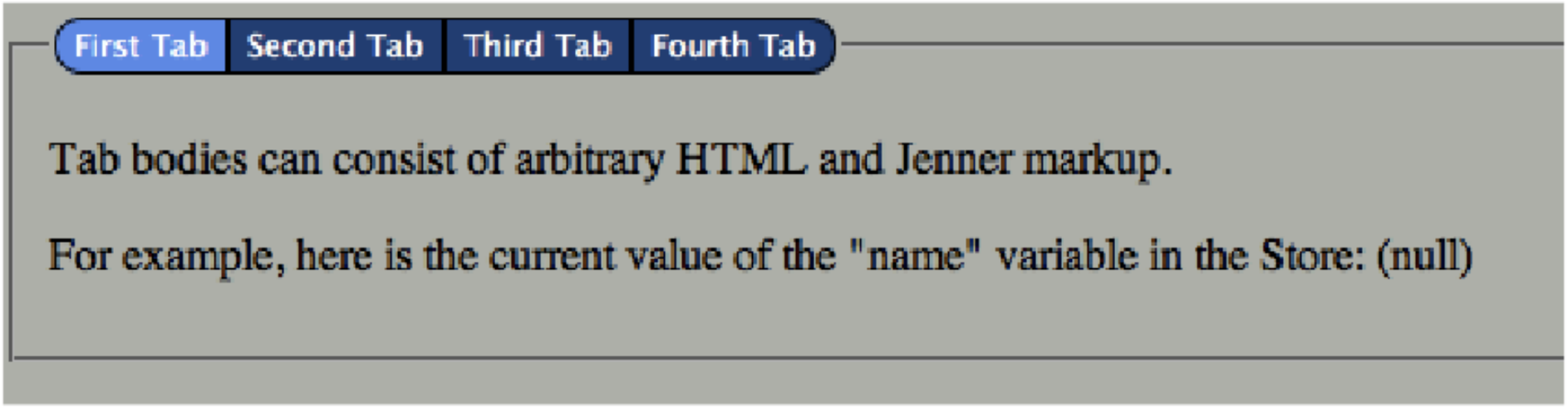
- Jenner provides a richer “target language” for browser XSL transformations than plain XHTML.
- Pixaxe provides a variety of XSLT macros, for things like tab boxes, lightboxes, and AJAX-style file uploads.
- Below is a page fragment using the standard “tab-box” macro.

```
<dppx:tab-box>
 <dppx:tab label="First Tab" selected="true">
  <p>Tab bodies can consist of arbitrary HTML and
     Jenner markup.</p>
  <p>For example, here is the current value
     of the "name" variable in the Store: ${name}</p>
 </dppx:tab>
 <dppx:tab label="Second Tab">
  <p>Another tab.</p>
 </dppx:tab>
    ...
```

Below is a partial expansion of the macro:

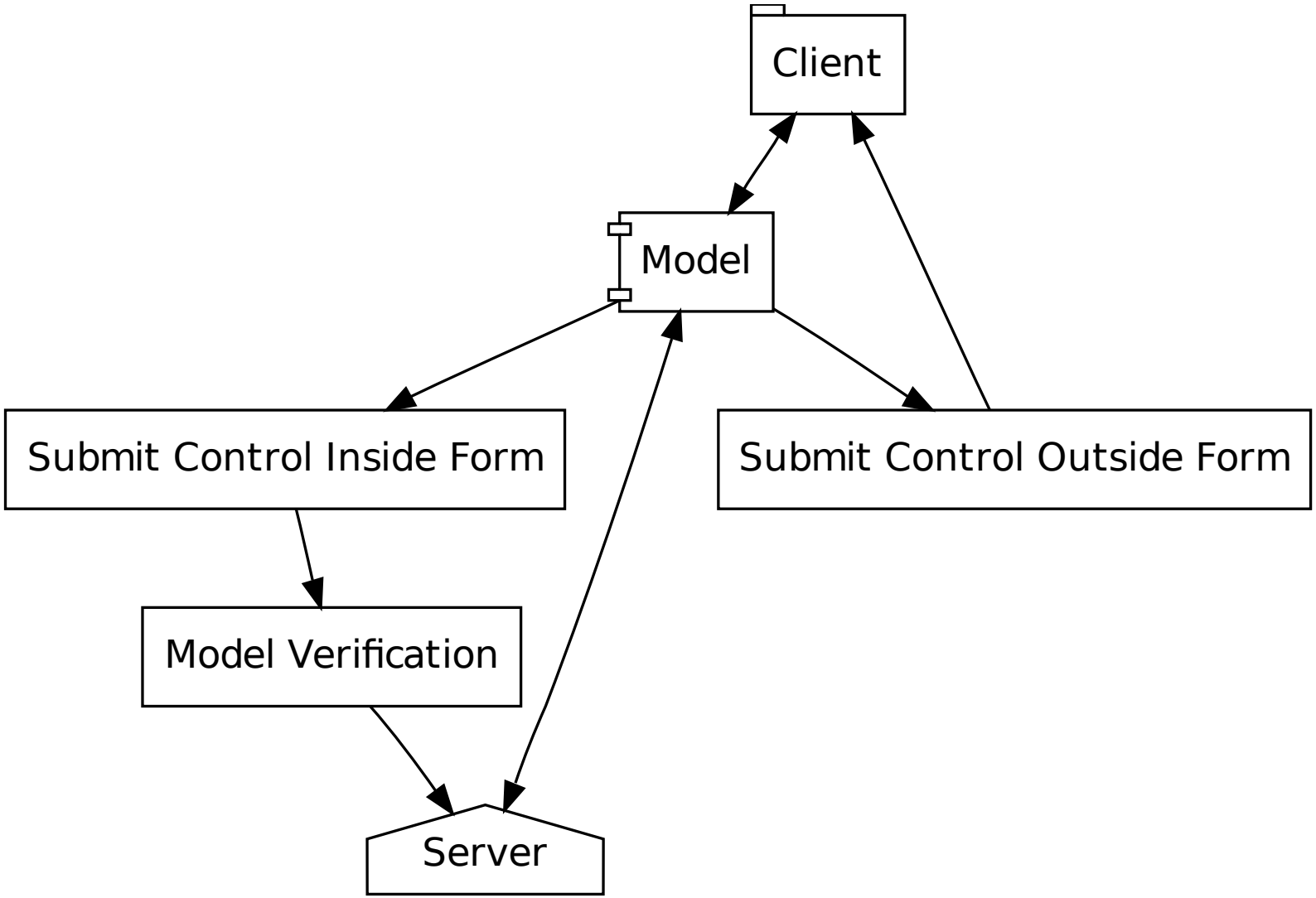
```
<fieldset><input type="hidden" value="id4127134"
name="#{controller.dppx_tabselid4127132}"/>
<legend><input type="submit"
name="#{controller.dppx_tabselid4127132}"
class="dppx-tab dppx-tab-left
dppx-tab-${controller.dppx_tabselid4127132
!= 'id4127134' ?
'un' : ''}selected"
accept="id4127134" value="First Tab" />
...
dppx-tab-body-${controller.dppx_tabselid4127132
!= 'id4127134' ? 'un' : ''}selected">
<p>Tab bodies can consist of arbitrary HTML and
   Jenner markup.</p>
<p>For example, here is the current value of the "name"
variable in the Store: ${name}</p>
</div>
```

The above macro as rendered by the browser:



Pixaxe

Adding Input Handling to Jenner



- Pixaxe uses traditional HTML form controls for input, but augments some of their functionality.
- By placing expressions inside the `name` and `value` attributes of controls, controls can be linked to values in the model.
- For example, below is an `input` element that is linked to the `person.name` member of the model:

```
<input name="#{person.name}" value="${person.name}" />
```

- By placing an expression in the `accept` attribute of a control, that control's value can be validated or manipulated before being applied to the model.
- For example, the input control below can be set to automatically uppercase the first letter of its input before it is synchronized with the model:

```
<input name="#{person.name}" value="${person.name}"
accept="${str:titlecase($value)}" />
```

Pixaxe

Synchronizing the Model With the Server

- Pixaxe overloads the meaning of HTML `form` elements.
- Submit controls inside form elements result in the synchronization of the model with the server, if the form's `enctype` attribute is set to `text/javascript`.
- Forms can also validate the model before it is synchronized with the server by evaluating an expression placed in the form's `accept` attribute; this expression must evaluate to true for the model to be synchronized.
- It is important to note that this is not HTML form submission; only the model is serialized and then synchronized; the page is re-rendered entirely locally with the freshly synchronized model.

Pixaxe

Interacting With JavaScript

- Pixaxe allows for a simple foreign function interface with JavaScript code in the browser.
- Jenner expressions can call JavaScript functions exported to the Jenner runtime, and JavaScript code can easily interact with Pixaxe - either indirectly by manipulating the model, or directly by explicitly evaluating Jenner expressions.
- Jenner comes with a large standard library of functions for a variety of tasks, including text manipulation, cookie storage, mathematical functions, alert boxes, and so on.
- Functions can be namespaced similarly to XML Namespaces, preventing collisions.

Underlying Technology

Kouprey

- Pixaxe is built on top of a complete parser combinator library written in pure JavaScript, called Kouprey.
- Kouprey is usable separately from Pixaxe, and provides a useful tool for the development of parsers running in web browsers and other JavaScript environments.
- Grammars are specified inline using normal JavaScript statements, but in such a way as to resemble EBNF.

Underlying Technology

Esel

- Esel is a powerful expression and query language, useful for querying JSON and other hierarchical datasets.
- Esel is a perfect subset of Jenner; Jenner is in fact Esel with the addition of XML element types and syntax.
- Esel's parser, compiler, and virtual machine are written entirely in JavaScript and run entirely within the browser.
- Esel's virtual machine is Turing complete and easily extensible, with an efficient code representation.
- Esel is useful as an embedded expression language in web applications, for example, in a web-based spreadsheet.

Potential Uses

- Pixaxe is useful as an application toolkit for small and rapidly-developed web applications.
- It also proves useful in situations where server resources are extremely limited or not under the control of the application developer.
- Pixaxe is useful in situations where the developer is more familiar with HTML and CSS than with JavaScript or programming.
- Pixaxe, with it's traditional form- and page-oriented design and extremely flexible server interface, may be useful for developing web based interfaces to legacy applications.
- Kouprey greatly eases the creation of parsers in web browsers, easing the development of application-specific languages in web applications (think expressions in web-based spreadsheets, for example).

The Future

- Kouprey 2 is already finished, and has proven to be considerably faster, with a simpler grammar specification syntax. It is currently just awaiting documentation.
- Esel 2 is nearing completion, and adds useful features such as nested comments, an *n*-way case statement, optional assignment, and improved facilities for runtime analysis of expressions.
- Pixaxe 2 is being planned on top of these features, and will have a much more “reactive programming” feel.

Conclusion

- Pixaxe is available for use today, under the GNU General Public License.
- Pixaxe is still under development and has some bugs, but it has been used in production environments for relatively large and complex projects.
- For more information, please contact Rob King at either:
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  - jking@deadpixi.com
  - rob.r.king@hp.com