Mobile Web Appplications Development with HTML5

Lecture 3: Templating and MVC

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Aalto University - Fall 2012

Lecture 3: Templating and MVC

A quick recap

Client-side Templating

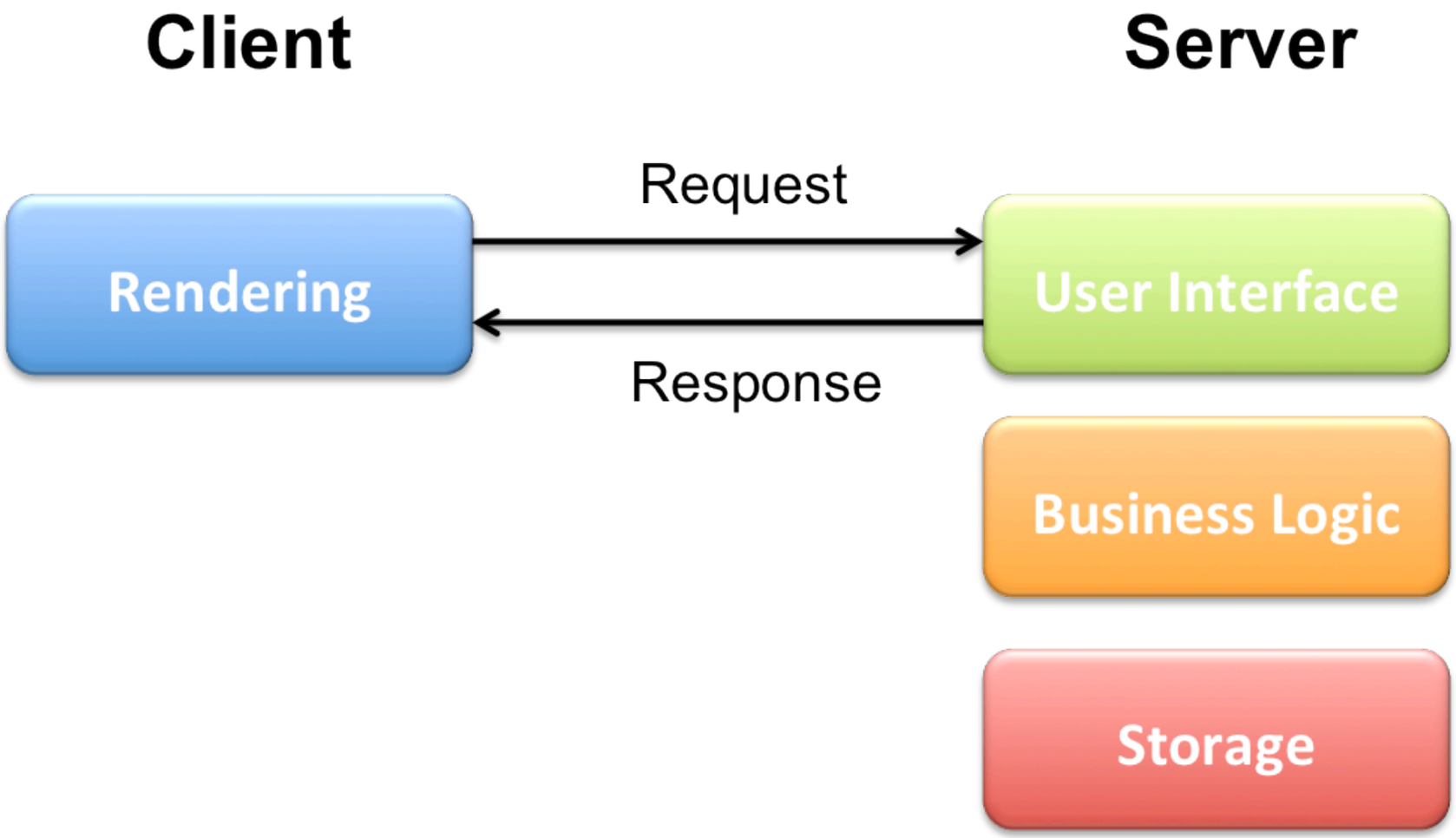
Handlerbar.js

Model-View-Controller

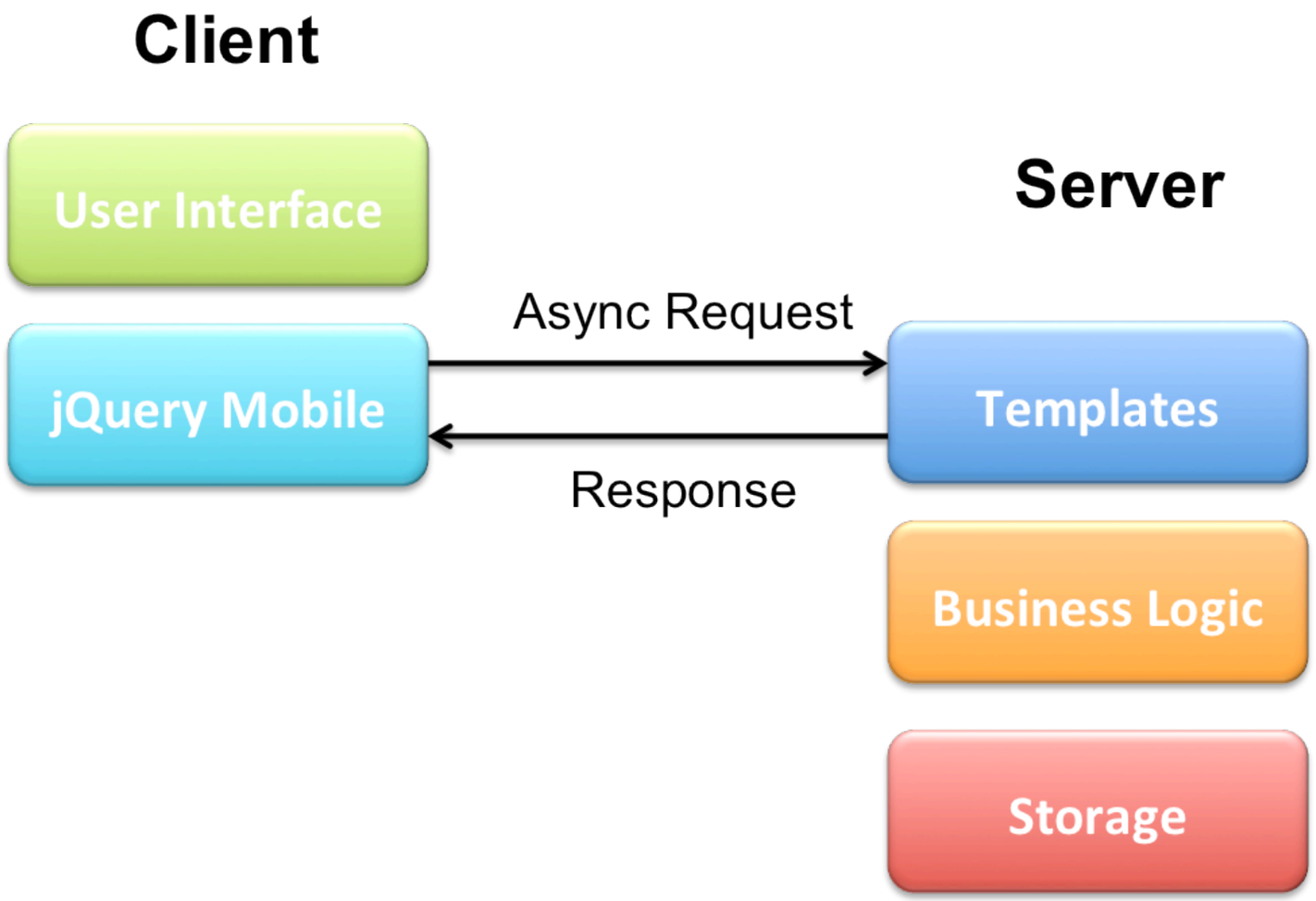
Backbone.js

Examples

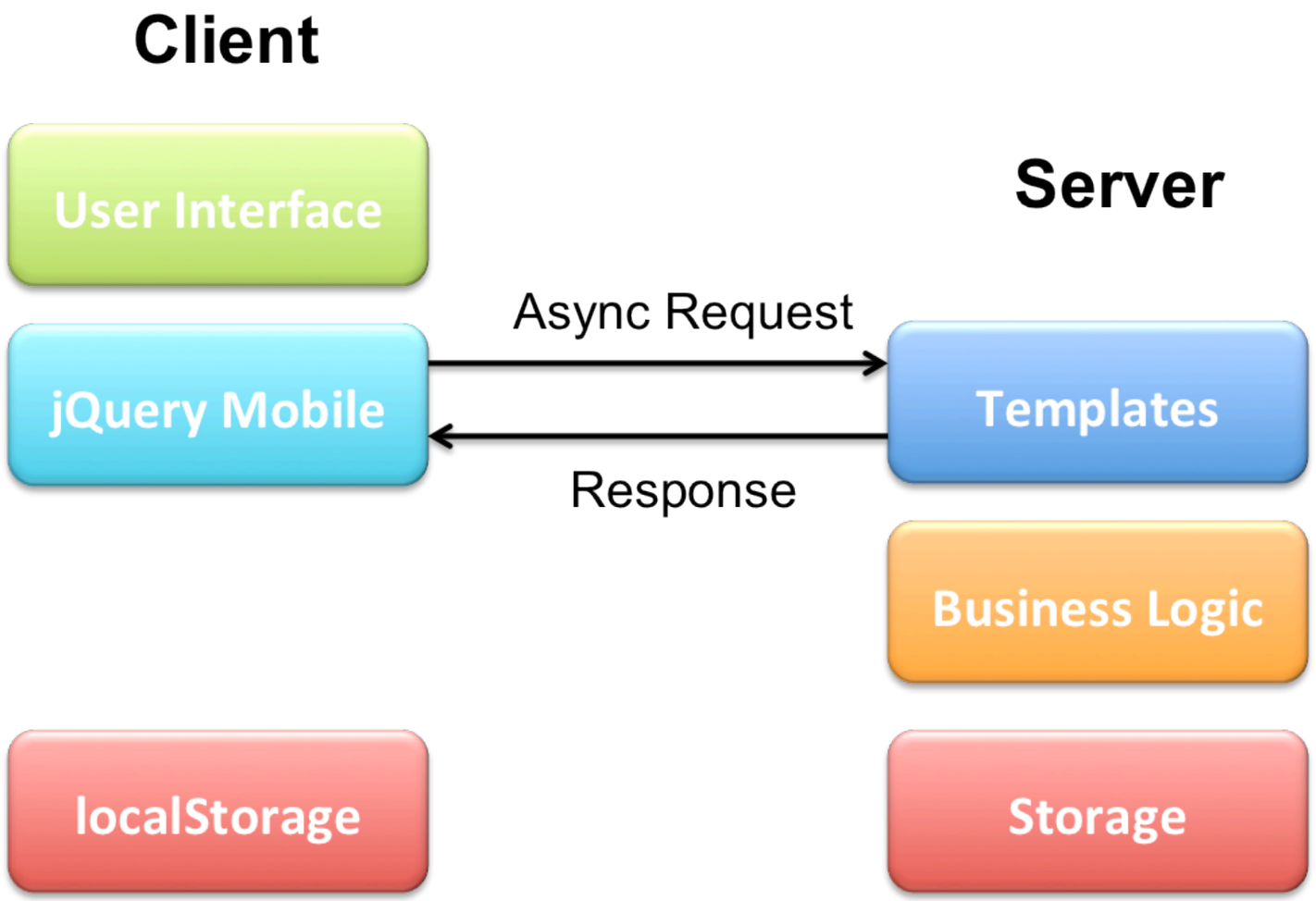
We started here



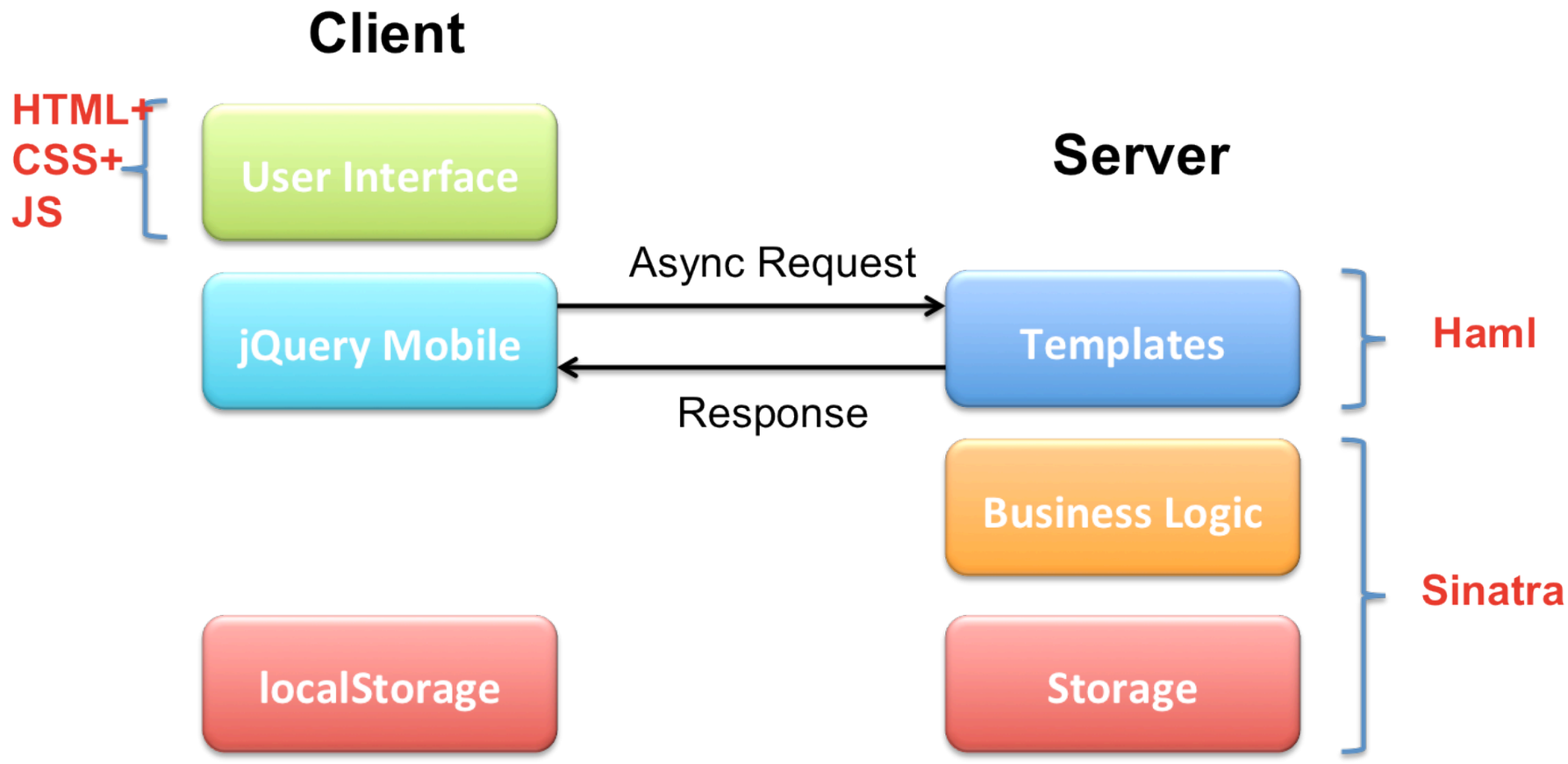
We added jQuery Mobile



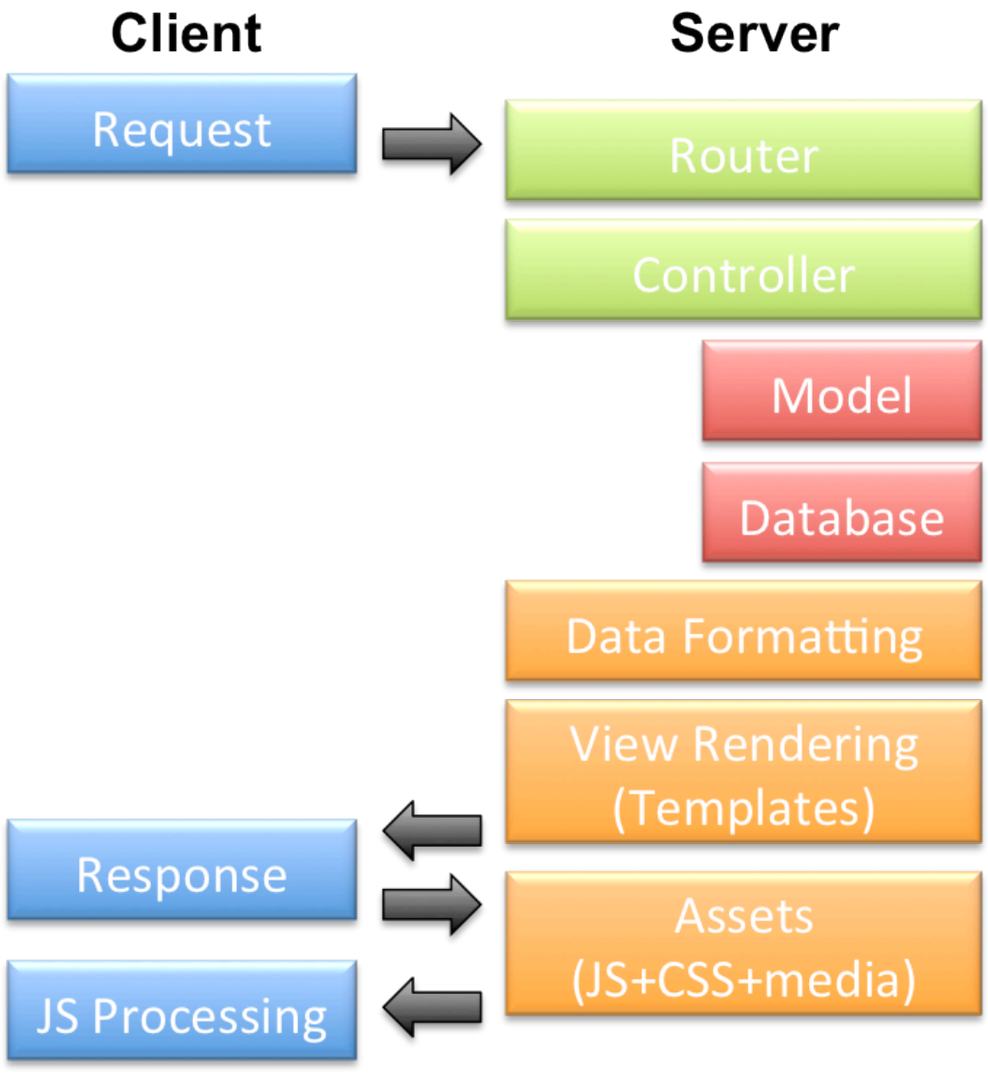
We added local storage



Server-side templates with Haml



Traditional Sequence in a Web Request



Router + Controller

```
get '/' do
  haml :index, :layout => :layout
end
```

Model

```
$articles = [{ :title => "Welcome", :content => "My first
post",
  :email => "hello@blog.com", :timestamp => "1.1.2012
10:20:30"}]
```

Template

```
%div(data-role="content")
  %ul(data-role = "listview")
    - $articles.each_with_index do |a, i|
      %li
        %p.ui-li-aside
          =a[:timestamp]
        %h3(contenteditable="true" data-name="title" data-id='#
{i}')
          =a[:title]
        %p
          %strong
            =a[:email]
        %p(contenteditable="true" data-name="content" data-
id='#{i}')
          =a[:content]
```

Traditional Response

```
<div data-role='content'>
  <ul data-role='listview'>
    <li>
      <p class='ui-li-aside'>1.1.2012 10:20:30</p>
      <h3 contenteditable='true' data-id='0' data-name='title'>Welcome</h3>
      <p>
        <strong>hello@blog.com</strong>
      </p>
      <p contenteditable='true' data-id='0' data-name='content'>My first post</p>
    </li>
    <li>
      <p class='ui-li-aside'>04.02.2012 12:28:31</p>
      <h3 contenteditable='true' data-id='1' data-name='title'>Test</h3>
      <p>
        <strong>hello@blog.com</strong>
      </p>
      <p contenteditable='true' data-id='1' data-name='content'>This is test content</p>
    </li>
  </ul>
</div>
```

Important Data in Response

```
<div data-role='content'>
  <ul data-role='listview'>
    <li>
      <p class='ui-li-aside'>1.1.2012 10:20:30</p>
      <h3 contenteditable='true' data-id='0' data-name='title'>Welcome</h3>
      <p>
        <strong>hello@blog.com</strong>
      </p>
      <p contenteditable='true' data-id='0' data-name='content'>My first post</p>
    </li>
    <li>
      <p class='ui-li-aside'>04.02.2012 12:28:31</p>
      <h3 contenteditable='true' data-id='1' data-name='title'>Test</h3>
      <p>
        <strong>hello@blog.com</strong>
      </p>
      <p contenteditable='true' data-id='1' data-name='content'>This is test content</p>
    </li>
  </ul>
</div>
```

Client-side templating

```
%ul(data-role = "listview")
  {{#articles}}
  %li
    %p.ui-li-aside
      {{timestamp}}
    %h3(contenteditable="true" data-name="title" data-id='{{id}}')
      {{title}}
    %p
      %strong
        {{email}}
    %p(contenteditable="true" data-name="content" data-id='{{id}}')
      {{content}}
  {{/articles}}
```

```
{
  articles: [
    title: "Welcome",
    content: "My first post",
    email: "hello@blog.com",
    timestamp: "1.1.2012 10:20:30",
    id:0
  ]
}
```

Handlebars.js

Handlebars.js provides the tools for building **semantic templates** that can be compiled and instantiated on the client-side

Template

```
<script id="entry" type="text/x-handlebars-
template">
  <div>
    <h1>{{title}}</h1>
    <div class="content">
      {{content}}
    </div>
  </div>
</script>
```

Instance

```
<div>
  <h1>My New Post</h1>
  <div class="content">
    This is my first post!
  </div>
</div>
```

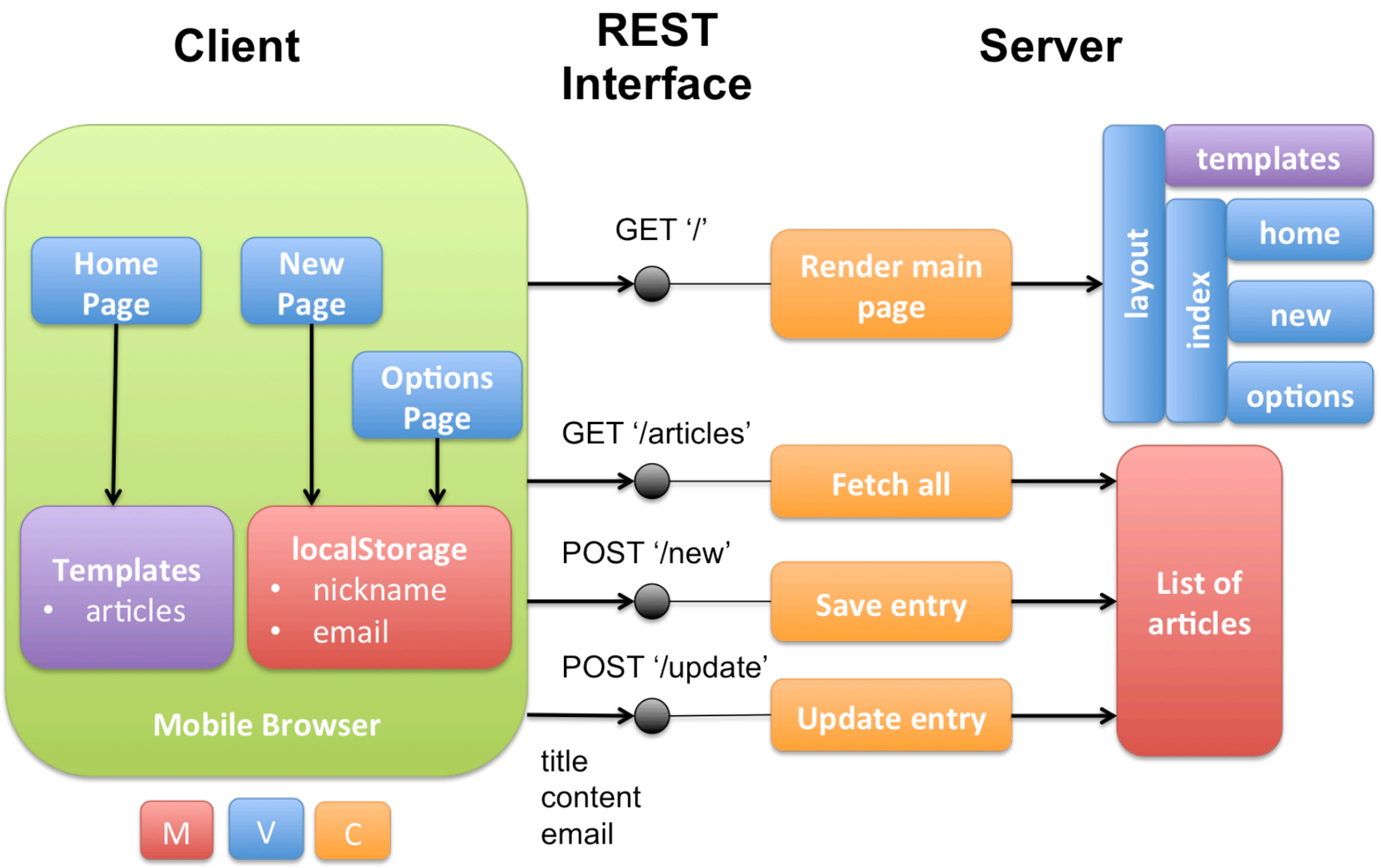
```
var source   = $("#entry").html();
var template = Handlerbars.compile(source);
var context  = {title: "My New Post", content: "This is my first post!"}
var html     = template(context);
```

Blog with Templates templateHandlebarBlog

views/templates.haml

```
%script(id="articles" type="text/x-handlebars-template")
  %ul(data-role = "listview")
    {{#articles}}
    %li
      %p.ui-li-aside
        {{timestamp}}
      %h3(contenteditable="true" data-name="title" data-id='{{id}}')
        {{title}}
      %p
        %strong
          {{email}}
      %p(contenteditable="true" data-name="content" data-id='{{id}}')
        {{content}}
  {{/articles}}
```

Design with Templates



Blog with Templates templateHandlebarsBlog

views/layout.haml

```
%body
  = haml :templates
  = yield
```

views/index.haml

```
%div(data-role="page" id="home")
  = haml :header

  %div(data-role="content" id="articlesList")

  = haml :footer

%div(data-role="page" id="new")
  = haml :header

  %div(data-role="content")
    = haml :new

  =haml :footer

%div(data-role="page" id="options")
  =haml :options
  =haml :footer
```

Blog with Templates templateHandlebarsBlog

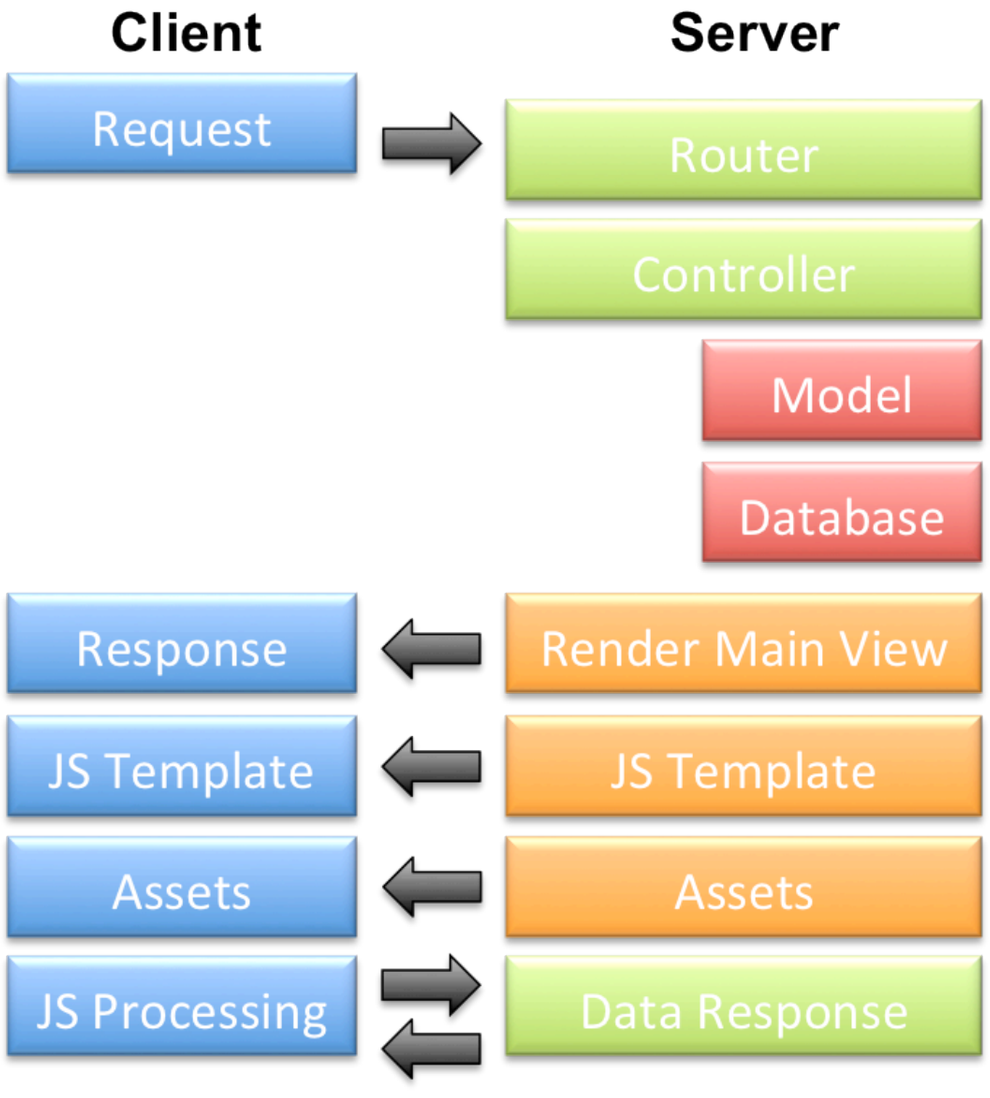
server.rb

```
get '/articles' do
  content_type :json
  {:articles => $articles}.to_json
end
```

views/layout.haml

```
  var Templates = {};

  function loadArticles () {
    $.getJSON('/articles', function(json) {
      var content = Templates.articles(json);
      $("#articlesList").html(content).find("ul").listview();
    });
  }

  $(function() {
    $('script[type="text/x-handlebars-template"]').each(function () {
      Templates[this.id] = Handlebars.compile($(this).html());
    });

    loadArticles();
    ...
```

Achievements

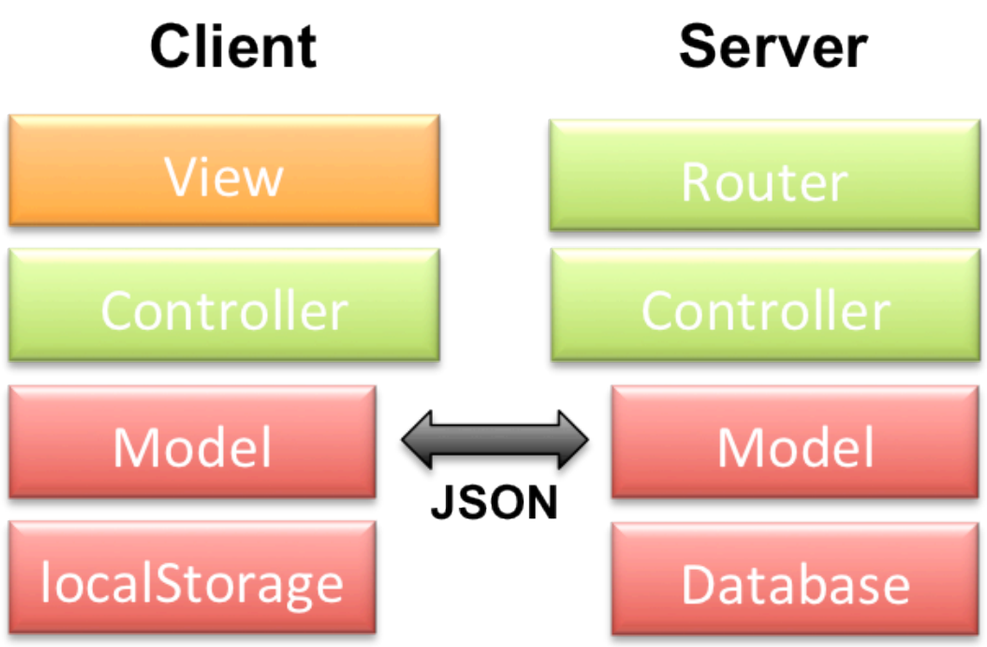


- Controller provides a clear **interface**
- Server-side view prepares **formatted output** (as a **decorator**)
- Client-side receives a decorated **JSON** and a **template** in HTML/JS
- Client **instantiates** the template with the JSON data and **renders** it
- Less work on server-side means **more requests per second**
- Views become API customers, **unifying the data interface**

Templating Tools

- **Mustache** : Generic logic-less templates for HTML, config files, code, anything.
- **Mustache.js** : Mustache implementation in Javasscript
- **Haml-js** : Haml implemenation in Javascript (popular with node.js)
- **Eco** : Embed CoffeScript logic in markup (popular with node.js)
- **ICanHaz.js** : JS helper for client-side templating.

Towards a Client-Side MVC Architecture



Various MVC frameworks:

- **Backbone.js**
- Sproutcore
- Cappuccino
- KnockoutJS
- JavaScriptMVC
- Sammy.js
- Ember.js

Backbone.js

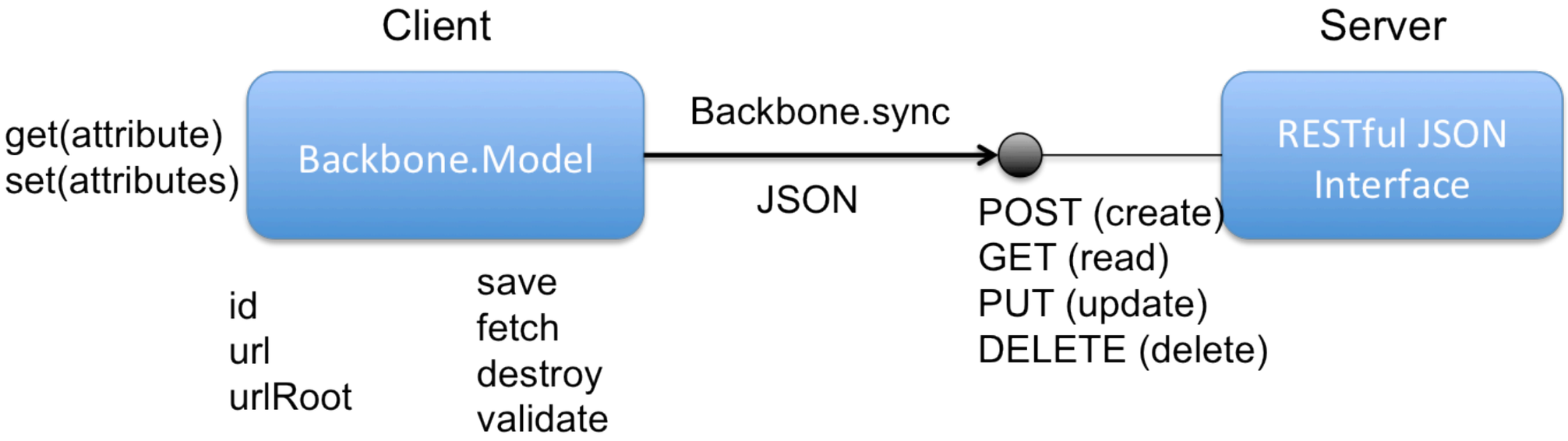
Backbone.js supplies structures to web applications by providing:

- **models** with key-value binding and custom events
- **collections** with a rich API for enumerable functions
- **views** with declarative handling
- **routers** for connecting client-side pages to actions and events
- **RESTful JSON interface** for connecting to existing applications

Backbone.js - Benefits

- No assumptions about the UI
- Flexible about the data persistence possibilities
- Support any HTML templating engine
- Only hard dependency is with Underscore.js
- Lightweight: no UI widgets
- Backend agnostic by using RESTful JSON endpoints

Backbone.js - Models



Model endpoints:

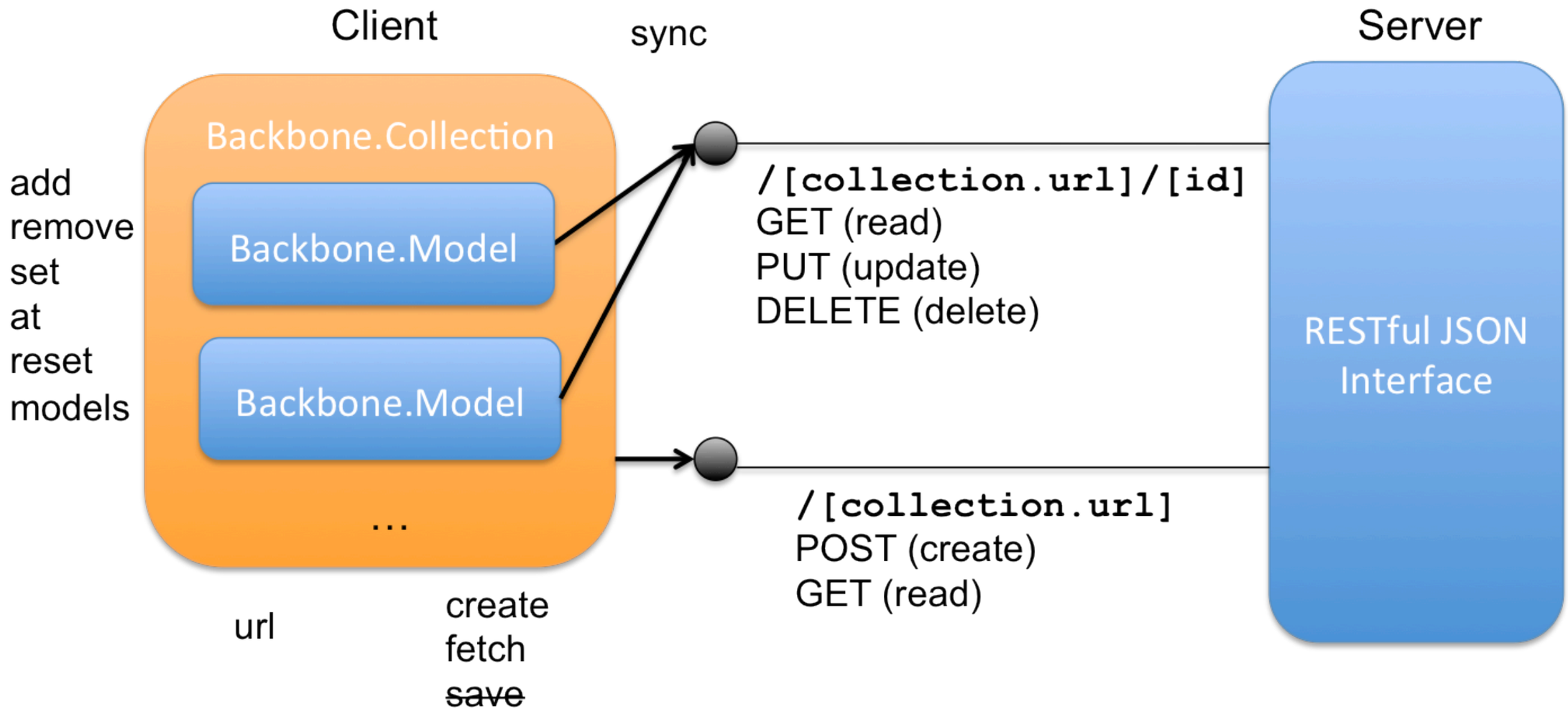
`/[collection.url]/[id]` (if in a collection)

`/[urlRoot.url]/[id]` (if not in a collection)

Let's try it in the Javascript console

```
var Book = Backbone.Model.extend({});
var book = new Book;
//try book, book.id
book.set('title', 'Hello');
book.set({author: "someone"});
book.get('title'); //book.attributes
book.isNew();
book.save();
book.url();
book.urlRoot;
book.urlRoot = "/books";
book.save();
book.fetch();
```

Backbone.js - Collections



Let's try it in the Javascript console

```
var Book = Backbone.Model.extend({});
var Library = Backbone.Collection.extend({model: Book});
var library = new Library;
var book = library.create({title: "Hello", author: "myself"});
library.url = "/books";
var book = library.create({title: "Hello", author: "myself"});
var book = library.create({title: "Stories", author: "myself"}, {wait: true});
library.models;
JSON.stringify(library.toJSON());
library.fetch();
library.reset();
//Add and Remove don't trigger Backbone.sync
book = new Book({title: "HTML5", author: "myself"});
library.add(book);
//Saving the model will trigger the Backbone.sync
book.save();
//The model is only removed from the collection but not from the server
library.remove(book);
//To remove from the server user either:
library.remove(book).destroy();
//or:
book.destroy(); //deletes from all collections as well
```

Backbone Model for Blog mvcBackboneBlog

Read collection

```
get '/articles' do
  content_type :json
  $articles.to_json
end
```

Read item

```
get '/articles/:id' do
  content_type :json
  $articles[params[:id].to_i].to_json
end
```

Create item

```
post '/articles' do
  data = JSON.parse(request.body.string)
  article = {}
  [:title, :content, :email, :name].each do |k|
    article[k] = data[k.to_s] || ""
  end
  article[:timestamp] = timestamp
  article[:id] = $articles.length
  $articles[article[:id].to_i] = article
  article.to_json
end
```

Update item

```
put '/articles/:id' do
  data = JSON.parse(request.body.string)
  article = {}
  [:title, :content, :email, :name].each do |k|
    article[k] = data[k.to_s] || ""
  end
  article[:timestamp] = timestamp
  article[:id] = params[:id].to_i

  $articles[article[:id].to_i].merge!(article)

  content_type :json
  $articles[params[:id].to_i].to_json
end
```

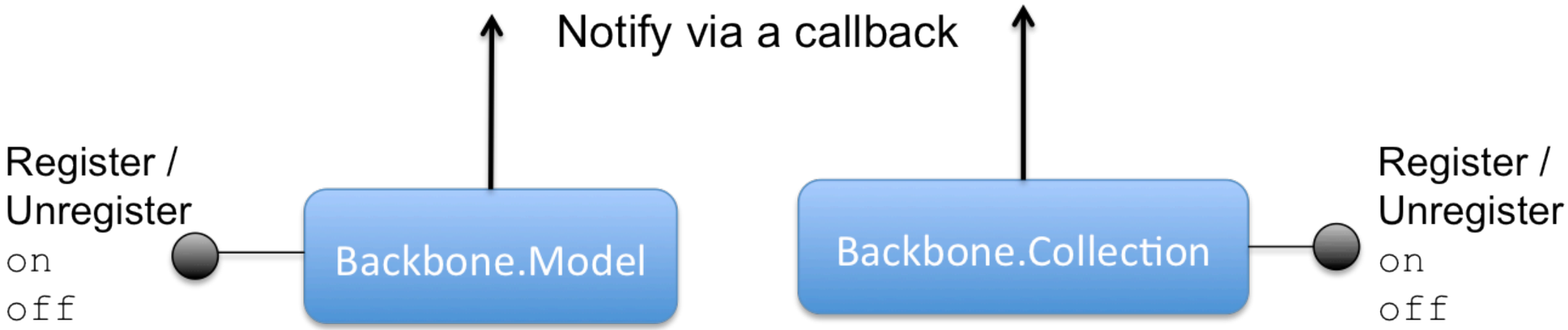
Destroy item

```
delete '/articles/:id' do
  $articles.delete_at(params[:id].to_i)
end
```

Let's test the model in the Javascript console

```
var Article = Backbone.Model.extend ({ });

var Articles = Backbone.Collection.extend ({
  model: Article,
  url: '/articles'
});

articles.fetch();
articles.length;
articles.add([{title: "First Post"}, {title: "Second post"}]);
articles.reset();
articles.create({title: "First Post", content: "The content goes here"});
articles.reset();
articles.fetch();
articles.at(2).set({title: "Something", content: "different"}).save();
articles.at(1).remove();
```

Backbone.js - Events



Events:
`change`
`change:[attribute]`

Events:
`change`
`change:[attribute]`
`add`
`remove`

Let's test the events in the Javascript console

```
articles.fetch();
m=articles.at(0);
//Event for all changes of the model
m.on('change', function(model) { alert(JSON.stringify(model.changedAttributes())); } );
m.set('title', 'a new value');
//Event only for changes of the content
m.on('change:content', function(model) { alert(JSON.stringify(model.changedAttributes())); } );
//Events can be set on the collection as well.
articles.on('change', function(model) {alert(JSON.stringify(model.changedAttributes()))});
```

Backbone.js - View

A view handles two duties fundamentally:

- Listen to events thrown by the DOM and models/collections.
- Represent the application's state and data model to the user.

```
var View = Backbone.view.extend ({
  tagName: "div",           //tag of the generated element
  className: "item",        //class of the generated element
  id: "home",               //id of the generated element
  el: $('#homeContainer'), //reference to the DOM element

  //function for rendering the view
  render: function() { this.el.innerHTML = ... ; return this; }
});

var v = new View(); //Instantiate a view
v.el;  // DOM element of the view
v.$el; //Cached jQuery object for the view's element
v.render(); //Renders the view into the element
v.render().el; //DOM element of the rendered view
```

Inserting a view in the DOM

```
var itemView = Backbone.View.extend ({
  tagName: "li",
  className: "item",
  render: function() { this.el.innerHTML = 'Hello'; return this; }
});

var i = new itemView();
i.el;
i.render();
i.el;
$("#articlesList").html(i.render().el);
```

Attaching the View to an Existing DOM Element

```
var itemView1 = Backbone.View.extend ({
  el: $("#articlesList"),
  render: function() { $(this.el).html('Hello'); return this; }
});

var i1 = new itemView1();
i1.render();

var itemView2 = Backbone.View.extend ({
  el: $("#articlesList"),
  render: function() { $(this.el).html('Hello World'); return this; }
});

var i2 = new itemView2();
i2.render();
i2.$el.html('Cheers');
i1.render();
i2.render();
```

Attaching a Model to a View

```
var itemView = Backbone.View.extend ({
  el: $("#articlesList"),
  render: function() { $(this.el).html(this.model.get('title') + "," + this.model.get('content'));
return this; }
});

var m = new Article({title: "Hello World", content: "not much to say"});
var v = new itemView({model: m});

v.render();
```

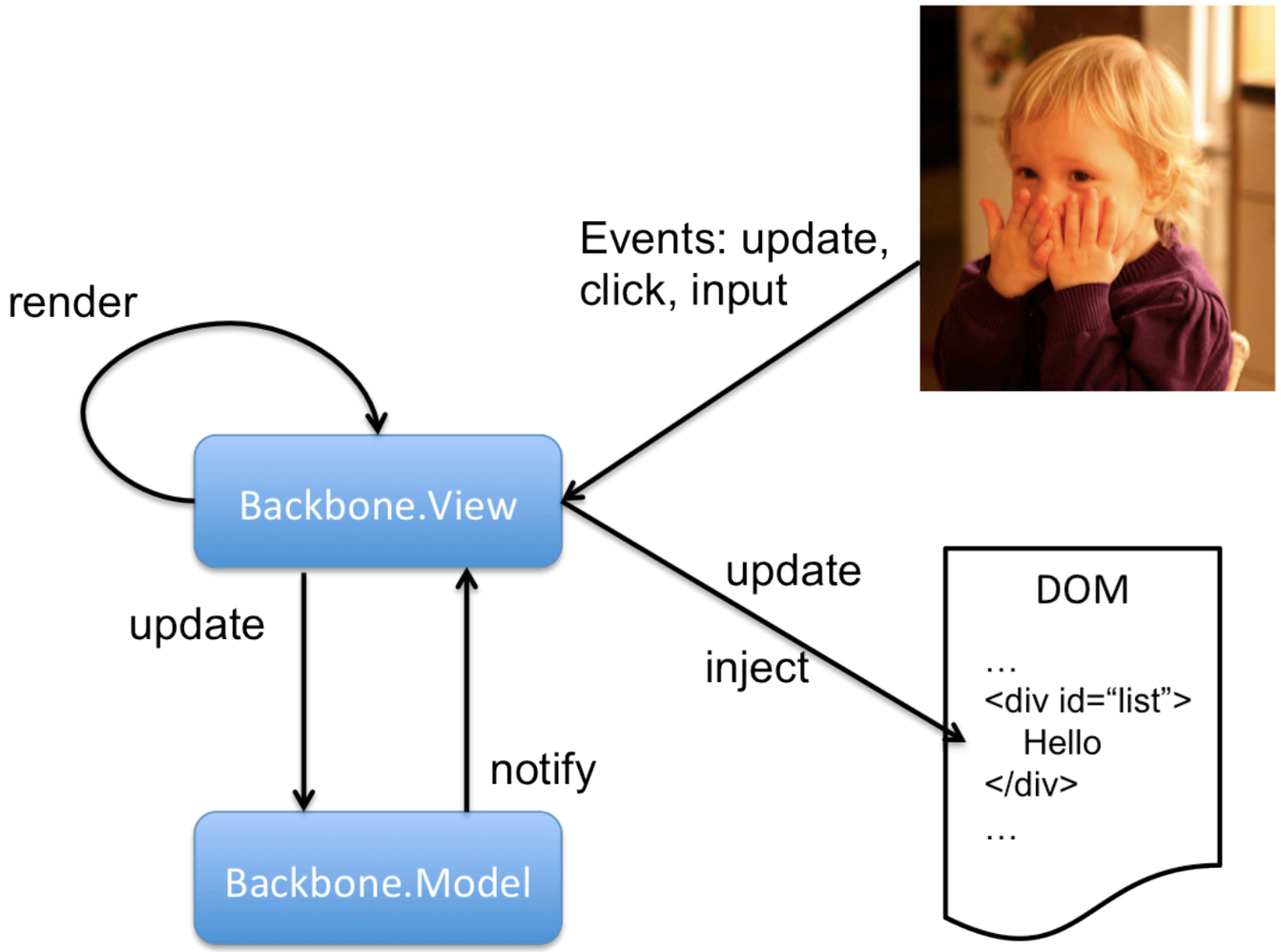
Binding the View to the Model

```
var itemView = Backbone.View.extend ({
  el: $("#articlesList"),
  initialize: function() { this.model.on('change', this.render, this); },
  render: function() { $(this.el).html(this.model.get('title') + "," + this.model.get('content'));
return this; }
});

var m = new Article({title: "Hello World", content: "not much to say"});
var v = new itemView({model: m});

v.render();
m.set('title','Good morning');
```

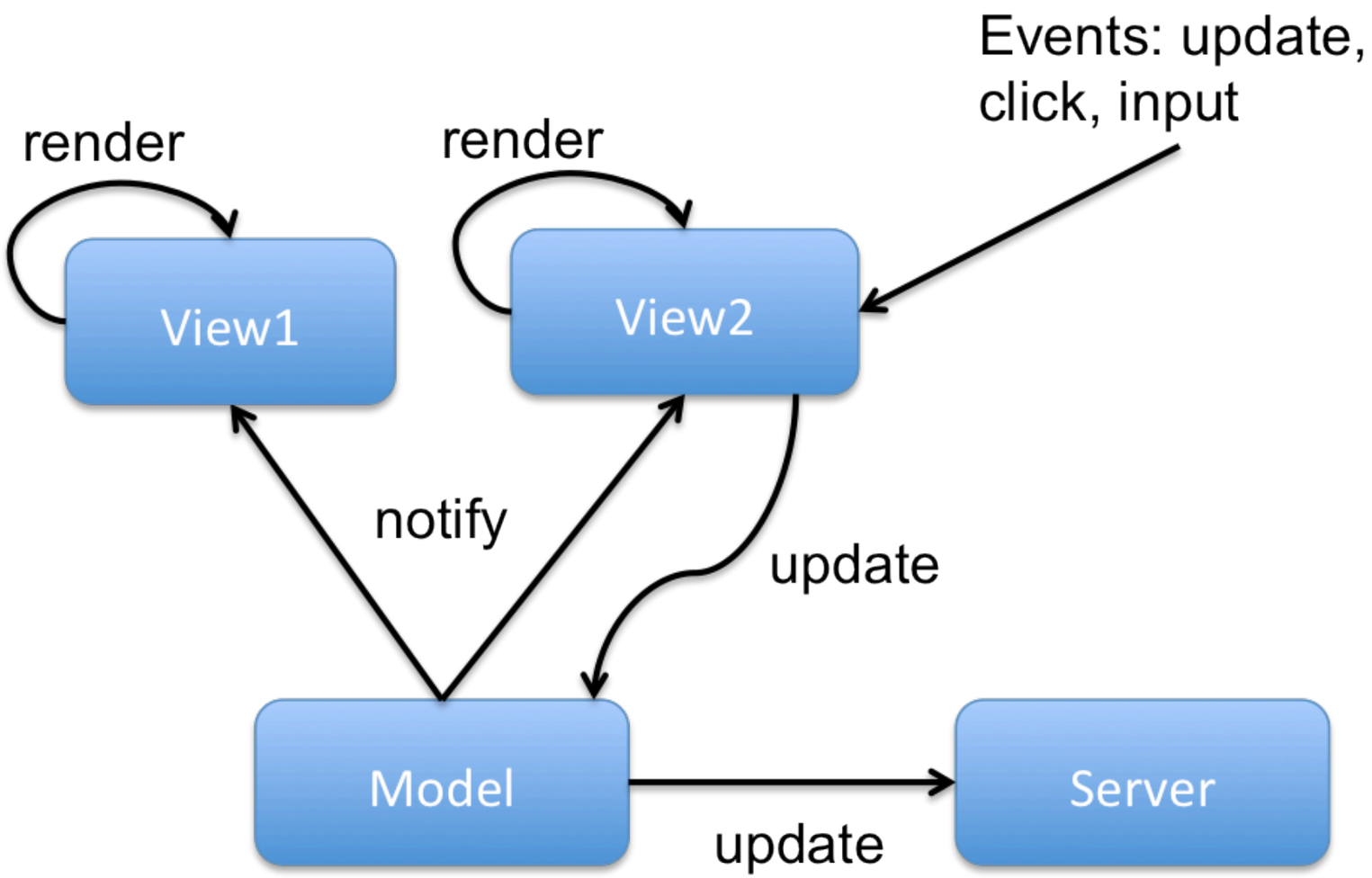
Binding to the View's Events

```
var itemView = Backbone.View.extend ({
  el: $("#articlesList"),
  events: {'click': 'handleClick'},
  initialize: function() { this.model.on('change', this.render, this); },
  render: function() { $(this.el).html(this.model.get('title') + "," + this.model.get('content'));
return this; },
  handleClick: function() { this.$el.fadeOut().fadeIn(); }
});

var m = new Article({title: "Hello World", content: "not much to say"});
var v = new itemView({model: m});

v.render();
```

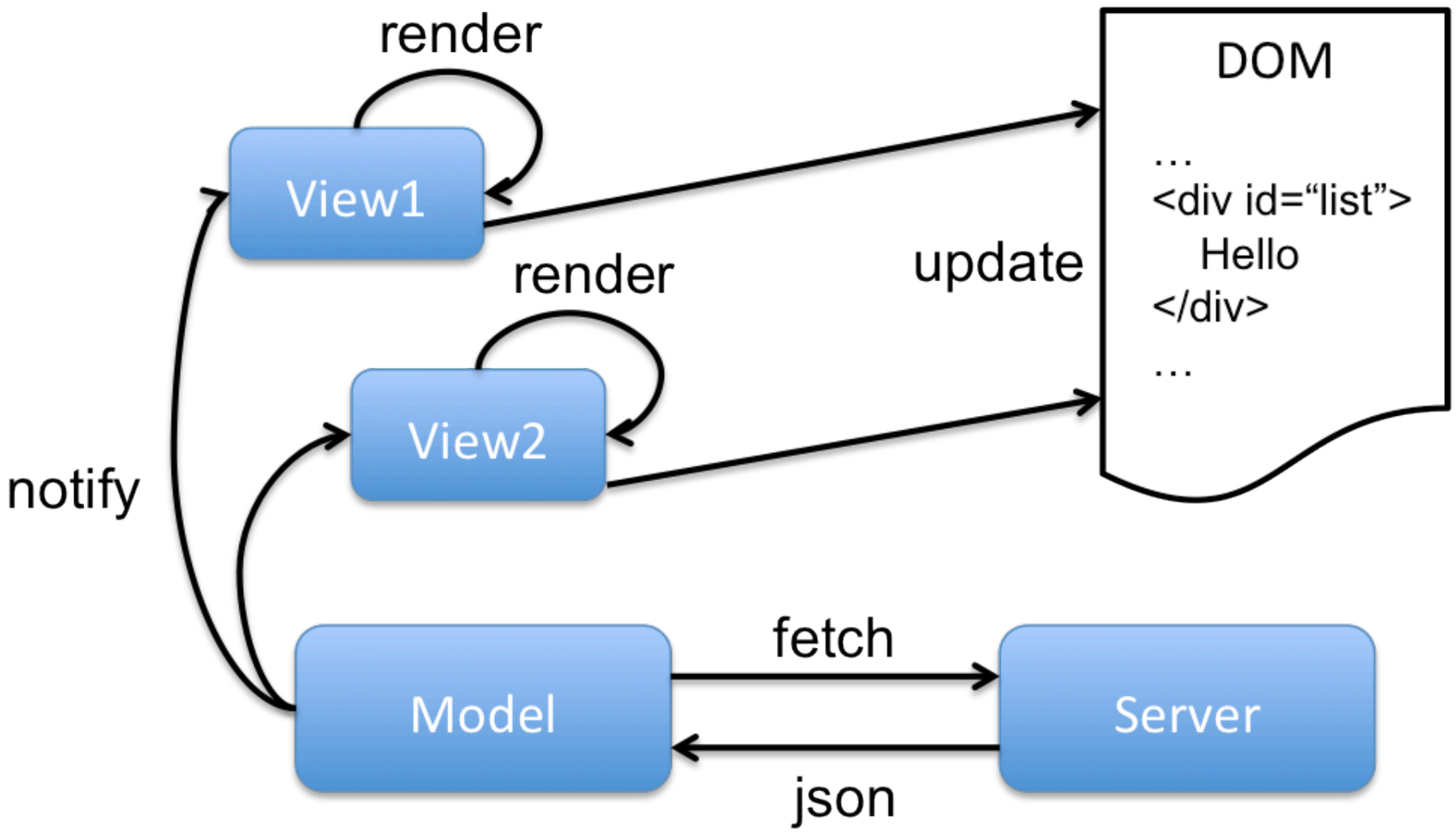
Backbone.js - View



Backbone.js - User Triggers an Update to the Server



Backbone.js - Server's Changes trigger an Update



Backbone Blog - Model mvcBackboneBlog

```
var Article = Backbone.Model.extend ({
});

var Articles = Backbone.Collection.extend ({
  model: Article,
  url: '/articles'
});
```

Backbone Blog - Item View mvcBackboneBlog

```
//View for rendering one entry of the blog
var ItemView = Backbone.View.extend ({
  tagName: "li",
  events: {
    "blur [contenteditable]": "saveValues"
  },
  initialize: function() {
    this.model.bind('change', this.render, this);
    this.template = Templates.article;
  },
  render: function() {
    $(this.el).html( this.template(this.model.toJSON()) );
    return this;
  },
  saveValues: function() {
    this.model.save({
      title: this.$("[data-name='title']").html(),
      content: this.$("[data-name='content']").html()
    },{silent: true});
  }
});
```

Backbone Blog - List View mvcBackboneBlog

```
//View for rendering the list of entries
var ListView = Backbone.View.extend ({
  el: $("#articlesList"),
  events: {
  },
  initialize: function() {
    this.collection.bind('reset', this.render, this);
    this.collection.bind('all', this.render, this);
  },
  render: function() {
    var el = this.$el;
    el.empty();
    this.collection.each(function(item) {
      var itemView = new ItemView({model: item});
      el.append(itemView.render().el);
    });
    this.$el.listview('refresh');
    return this;
  },
});
```

Backbone Blog - New View mvcBackboneBlog

```
//View for creating a new entry
var NewView = Backbone.View.extend({
  el: $("#new"),
  events: { "click #postEntry": "createNew" },
  initialize: function() {
    this.title = this.$("#title");
    this.content = this.$("#content");
  },
  createNew: function() {
    this.$(".invalid").removeClass("invalid");
    if (this.$(":invalid").length) {
      this.$(":invalid").addClass("invalid");
      return false;
    }
    this.collection.create({
      title: this.title.val(),
      content: this.content.val(),
      email: localStorage.email,
      name: localStorage.name
    }, {at: 0});
    this.title.val("");
    this.content.val("");
  }
});
```

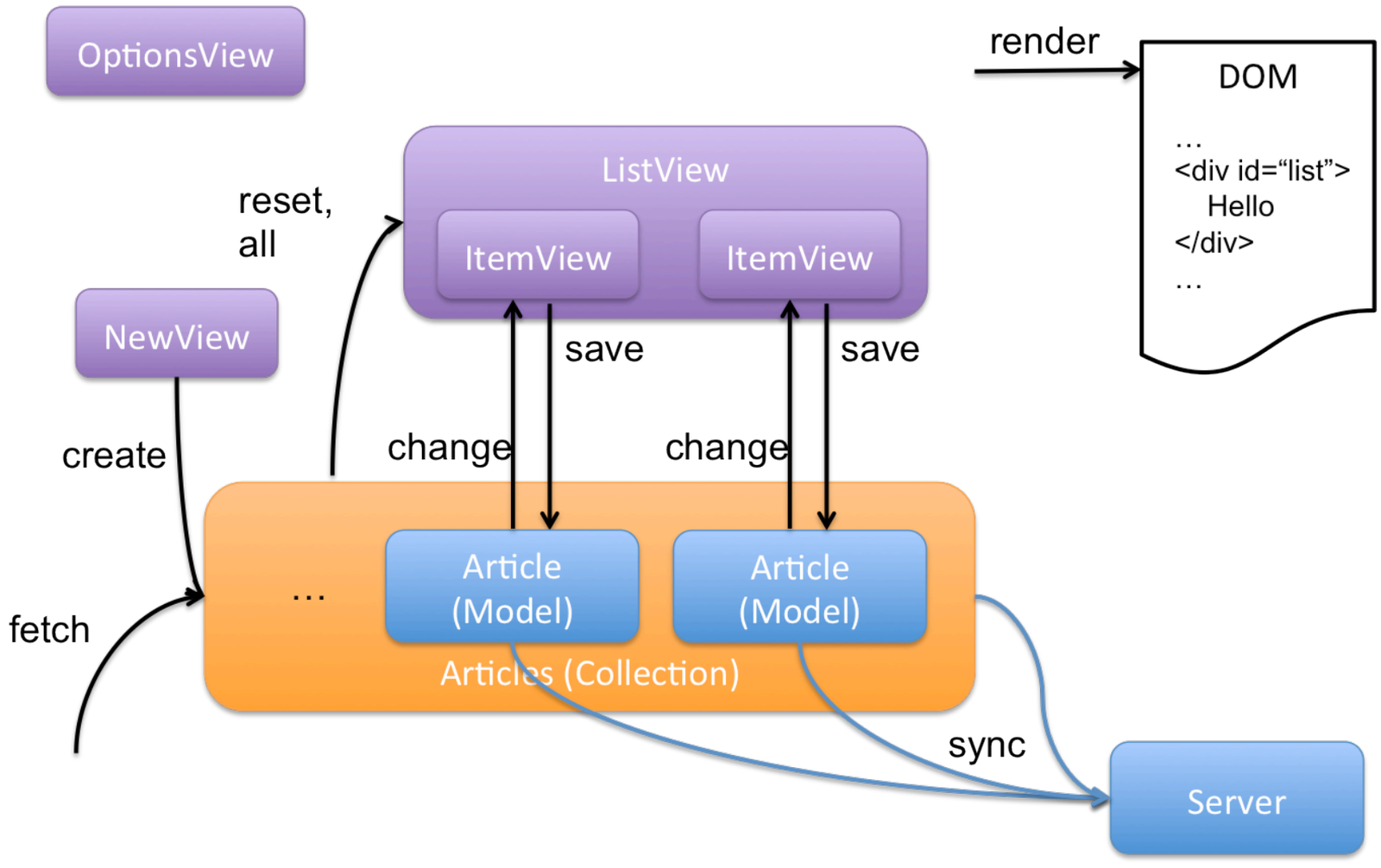
Backbone Blog - Options View mvcBackboneBlog

```
//View for editing the options
var OptionsView = Backbone.View.extend({
  el: $("#options"),
  events: {
    "click #saveOpt": "saveOptions"
  },
  initialize: function() {
    this.name = this.$("#optName");
    this.email = this.$("#optEmail");

    // Assign the options from the local storage
    this.name.val(localStorage.name);
    this.email.val(localStorage.email);
  },
  saveOptions: function() {
    this.$(".invalid").removeClass("invalid")
    if (this.$(":invalid").length) {
      this.$(":invalid").addClass("invalid");
      return false;
    }
    localStorage.name = this.name.val();
    localStorage.email = this.email.val();
  }
});
```

Backbone Blog - Initialization mvcBackboneBlog

```
var Templates = {};
var articles;

$(function() {
  //Load the templates and store them in a global variable
  $('script[type="text/x-handlebars-template"]').each(function () {
    Templates[this.id] = Handlebars.compile($(this).html());
  });

  //Trigger an update of the articles collection
  $("#refresh").live('click',function () {
    articles.fetch();
  });

  //Instantiate the collection of articles
  var articles = new Articles();

  //Instantiate the views
  var listView = new ListView({collection: articles});
  var newView = new NewView({collection: articles});
  var optionsView = new OptionsView();

  //Fetch the latest articles and trigger an update of the views
  articles.fetch();
}
```

Backbone Blog - Diagram mvcBackboneBlog



Backbone.js - Summary

- MVC Pattern
  - User or server triggers data change, never update view direcrtly
  - Data update triggers change event
  - Views can subscribe to change events and re-render
- Models are clearly separated from view logic. One HTTP Sync request can cause many UI updates
- Support for templates (default from Underscore)
- Persistence comes from Backbone.sync
  - The default is RESTful JSON
  - You can override sync() to use XML or LocalStorage
- Optimized for simplicity and speed

Backbone.js - Local Storage

- The extension `backbone.localstorage.js` provides the persistence with local storage
- The bad news is that the extension disables the communication with the server (rewrites `Backbone.sync`)
- Original `Backbone.sync` is available at `Backbone.ajaxSync`

Blog with localStorage mvcBackboneLocalBlog

layout.haml

```
...
%script(type="text/javascript" src="backbone.js")
%script(type="text/javascript" src="backbone.localStorage.js")
...
```

JS

```
...
var Articles = Backbone.Collection.extend ({
  model: Article,
  localStorage: new Backbone.LocalStorage("Articles")
});
...
```

Pre-compilation of the assets

- If your are developing a standalone application (without a server) you can compile the Haml files to HTML (e.g. using a Rakefile)
- If you are developing a server-based webapp there are tools for precompiling the assets (including the Handlebars.js templates):
  - Handlerbar.js compilation
  - Sprockets
- Static Web Site Generation

Synchronization of models

Racer but not ready yet

Backbone.js on the server

Backbone and local storage