Using Web Frameworks

An introduction to Rails

Lecture Goals

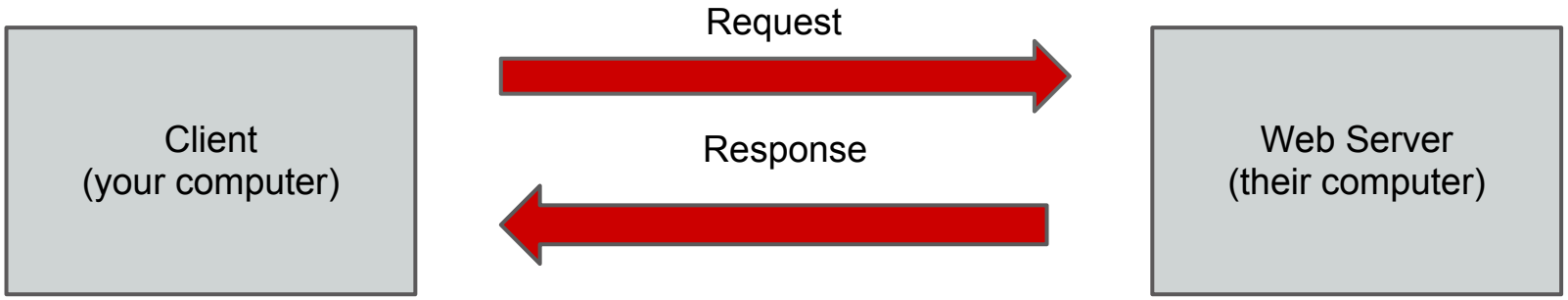
- Understand what frameworks are used for.
- Know how to design an application with a web framework in mind.
- Have a ***vocabulary*** to talk about different parts of web frameworks.
- Understand some of the fundamental ***design patterns*** used by frameworks.
- Know how to navigate a Rails project.

Web Requests

When you type a URL into your browser, a ***client***, your computer issues a ***web request***.

A ***server*** on the other side handles processing your request and builds a ***response***.

Web Requests



- ***HyperText Transfer Protocol*** (HTTP) is the language used to issue and respond to web requests.

HyperText Transfer Protocol (HTTP)

HTTP contains ***verbs*** for distinguishing between different types of requests:

- `GET` - request a web page

  e.g. `GET http://www.reddit.com/r/todayilearned`

- POST - send some resource data to a website

  e.g. make a new post on reddit

- PUT - update a resource on a website

  e.g. make an edit to a post

- DELETE - remove a resource from a website

  e.g. delete a post

State and HTTP

Imagine having a conversation with someone who never remembers anything you've already said.

This communication is ***stateless***, *i.e.*, no context is remembered.

Need a way to remind people of what was spoken before.

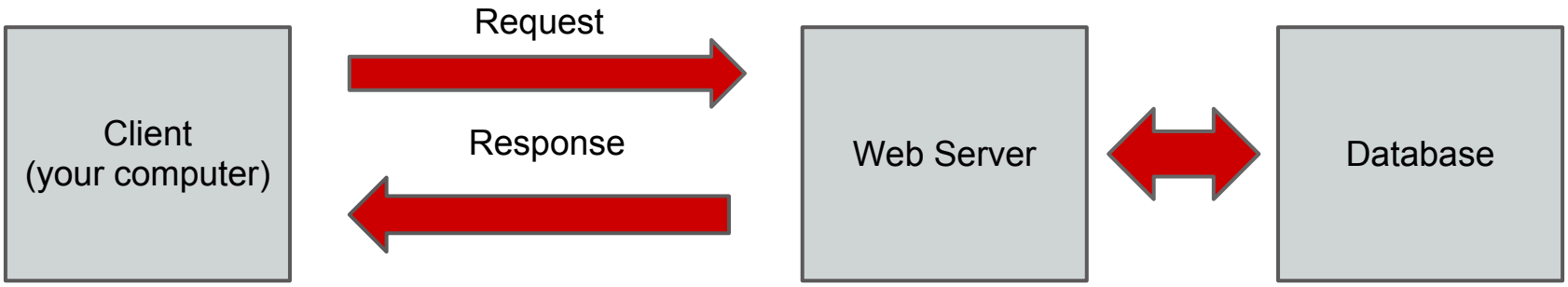
State and HTTP

HTTP is a stateless protocol. We use ***cookies***, ***URL variables***, as well as other methods to save state.

State is any *stored* information that may change over time.

http://www.google.com/search?**q=reddit;**

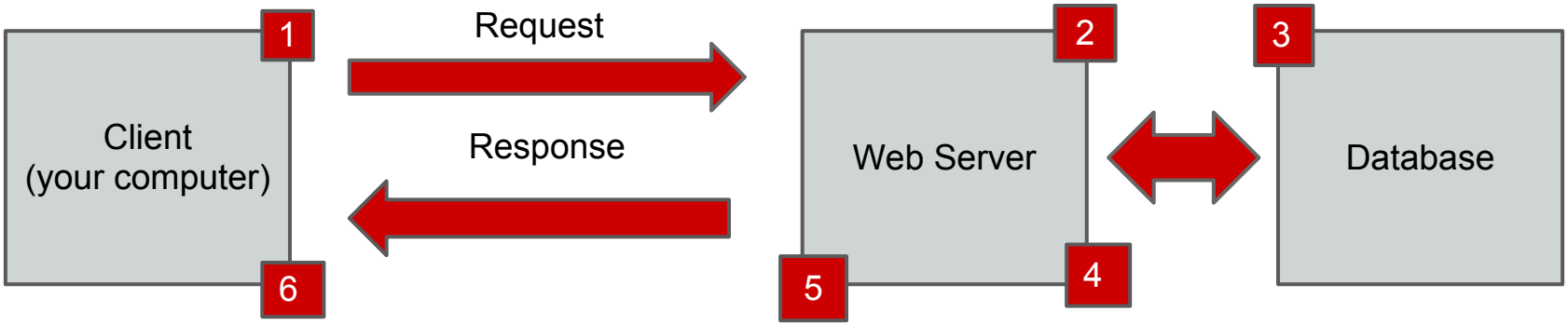
Databases



Application servers keep track of state (e.g. note accounts, forum posts, likes) by ***C****reating*, ***R****eading*, ***U****pdating* and ***D****eleting* (***CRUD***) data stored as ***records*** in a ***database***.

Stored information enables websites like Amazon.com to remember what you've previously bought.

Generic Web Framework Pattern



notes issue web requests to a server, and that server in turn looks up and (maybe) changes data stored in the database.

The server then sends a response to the client, possibly displaying the new data.

Responding to Web Requests

A ***Restful*** API (a design pattern) is a way to design your URLs to give web requests a standardized form.

Restful APIs create a mapping between HTTP Verbs, ***Universal Resource Identifiers (URIs)***, and ***actions*** taken by the web server to satisfy requests.

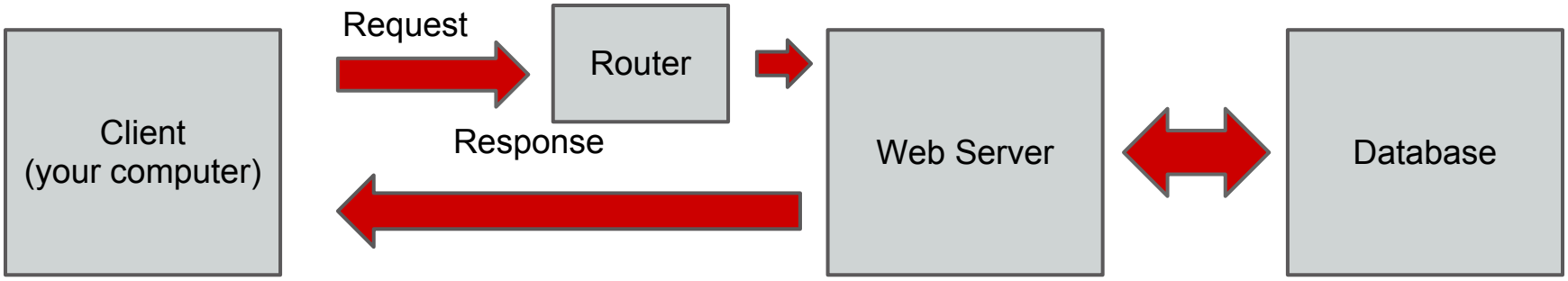
API = ***Application Programmer's Interface***

Restful URLs (API)

Example:

HTTP Verb	URI	Action	Purpose
GET	`/notes`	`index`	List all notes on website
GET	`/notes/1`	`show`	Display details about note 1
POST	`/notes`	`create`	Create a new note
PUT	`/notes/1`	`update`	Update note 1
DELETE	`/notes/1`	`destroy`	Delete note 1

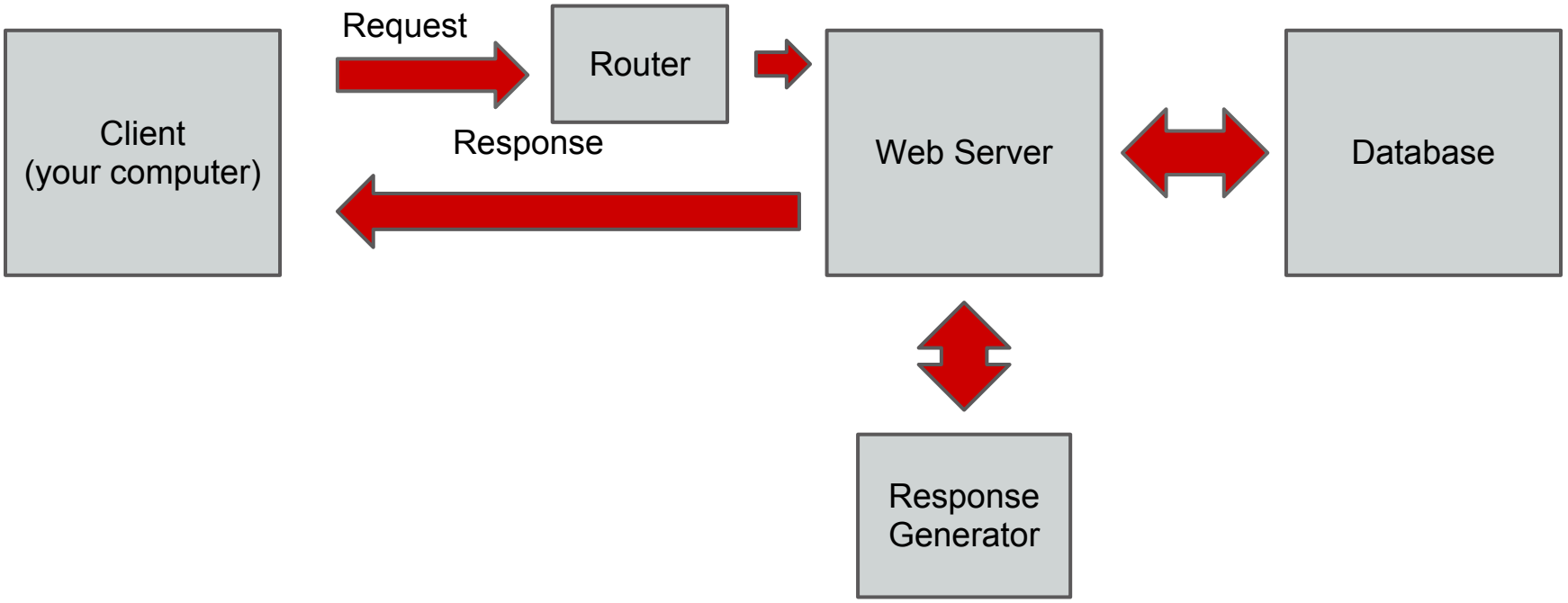
Responding to Web Requests



Web requests are differentiated by which HTTP verb and which URL was used.

Web servers use a ***router*** to decide what ***action*** to take in response to a particular request.

Building Responses



The last step in handling a request is building a ***response***.

Responses

Responses come in many forms:

- Web Page (HTML/CSS)
- Dynamic Content (JS/PHP)
- Data (JSON/XML)

HTML/CSS Responses

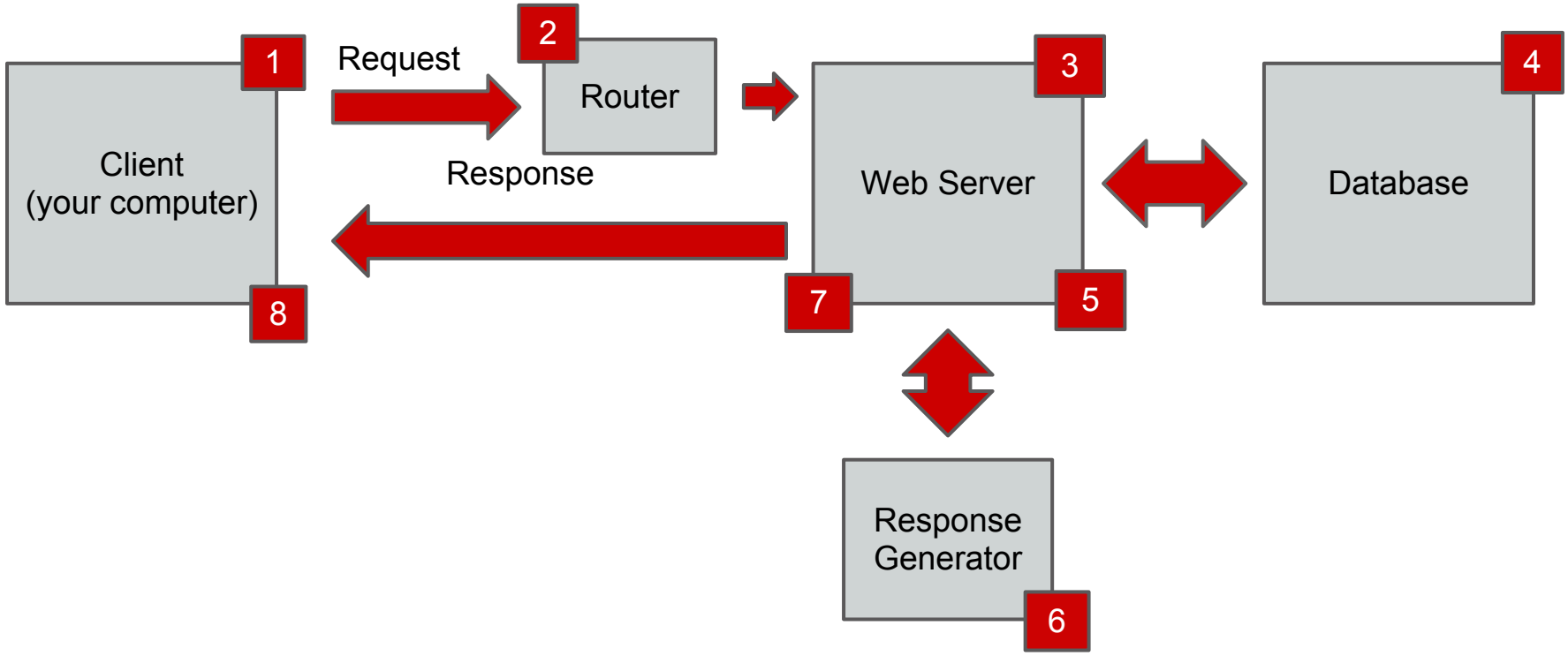
- Often, responses will be partly note-specific, partly static.

- ***Templates*** allow us to write the static parts of web pages once, and fill in the note-specific parts later.

HTML Templates

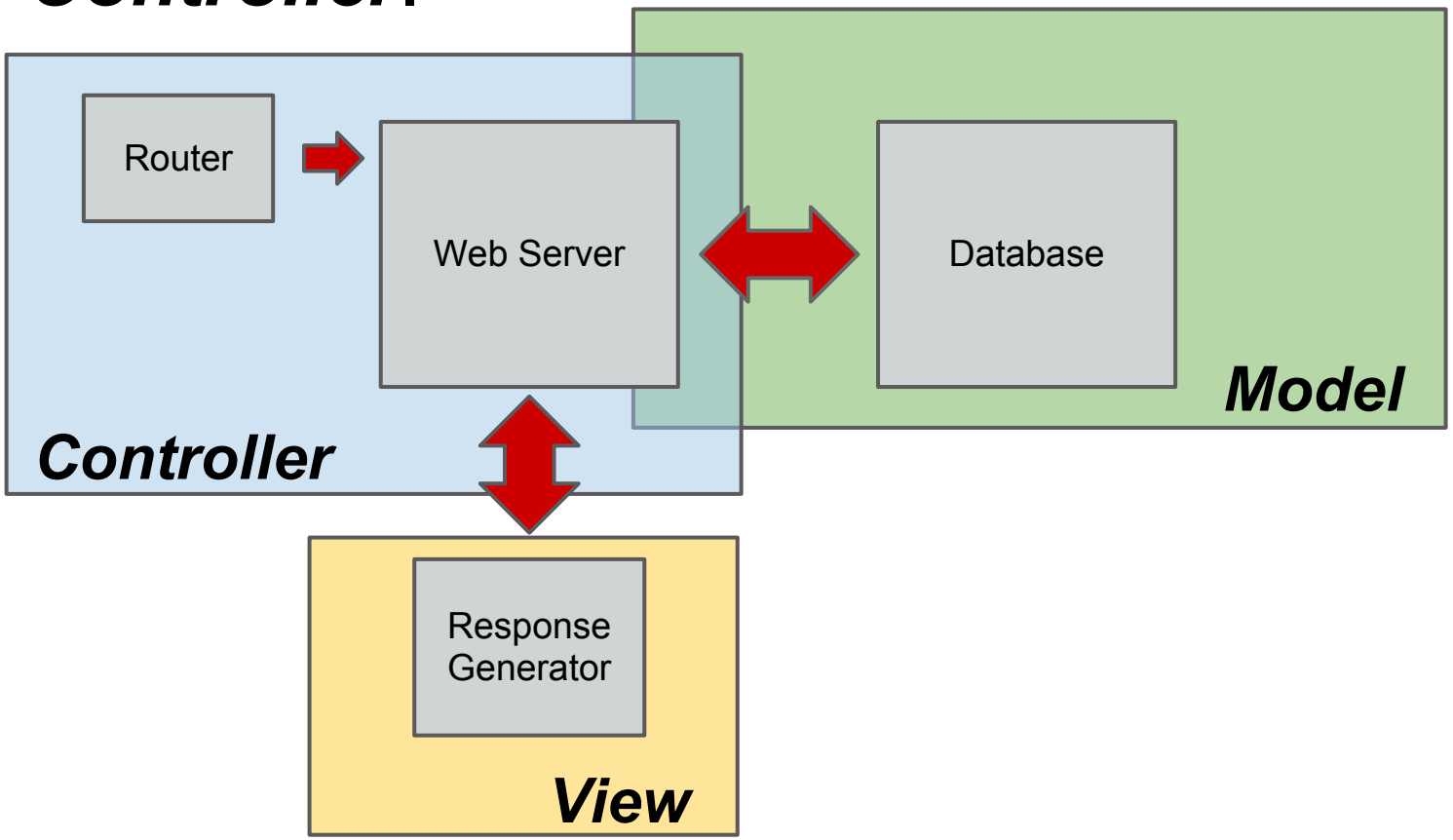
```
<html>
   <body>
      <h1>Welcome! <%= note.name %></h1>

      <p>Our site allows you to....</p>
   </body>
</html>
```

Putting it all together...

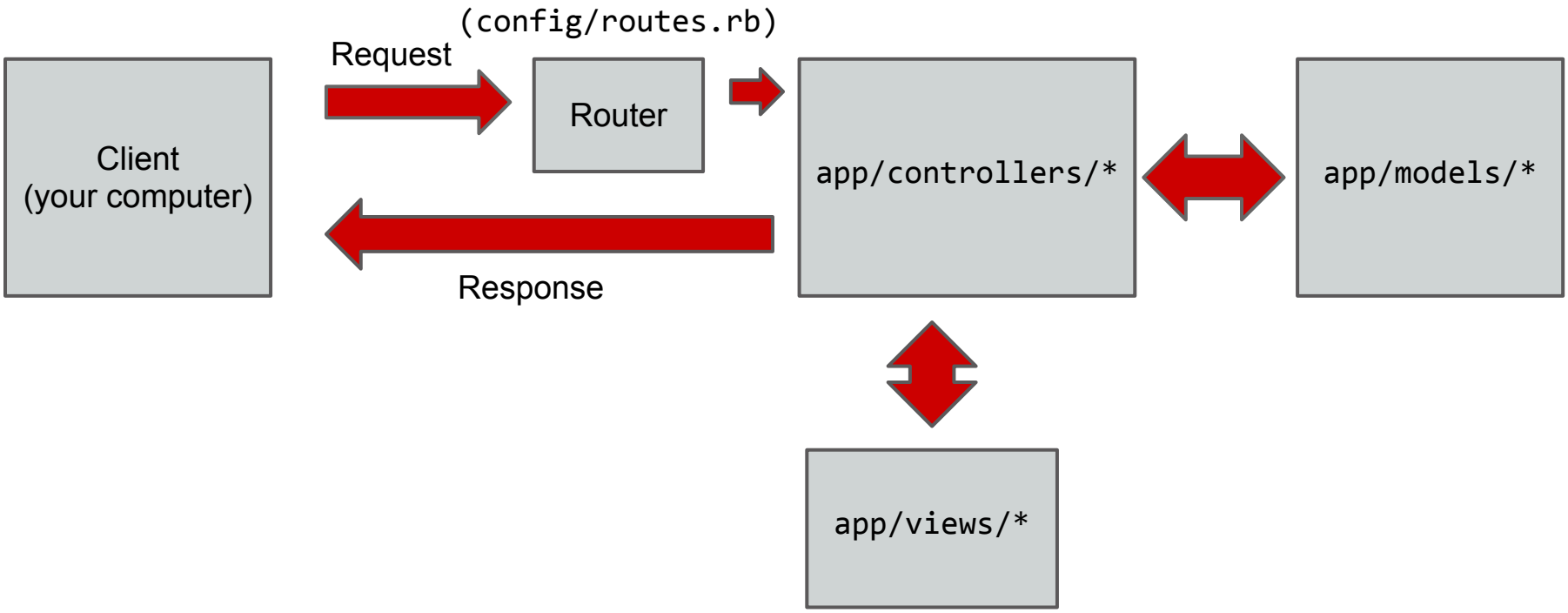


Putting it all together...

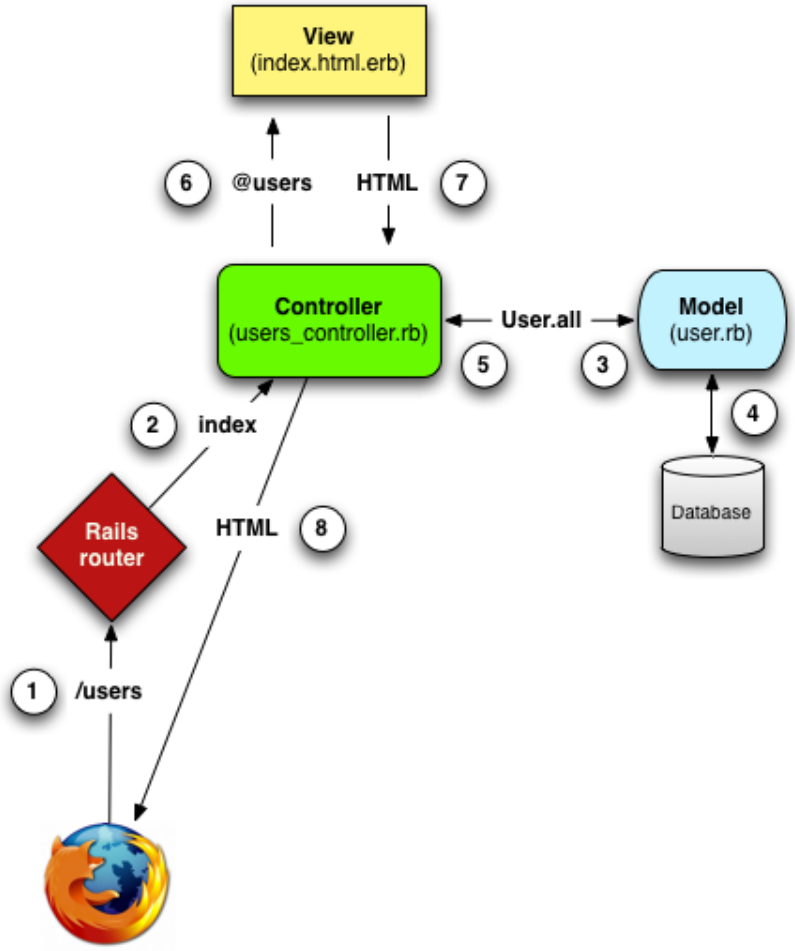
The common name for this pattern is ***Model, View, Controller***.



MVC in Rails


(config/routes.rb)
Request
Client
(your computer)
Router
app/controllers/*
app/models/*
Response
app/views/*

MVC in Rails


View
(index.html.erb)
6
@users
HTML
7
Controller
(users_controller.rb)
User.all
Model
(user.rb)
5
3
4
2
index
Database
Rails
router
HTML
8
1
/users

`rails start sample_app`

```
$ rails start <app_name>
```

Creates a directory `<app_name>`, with several folders beneath to help you organize all of your code.

Note: '$' means a command prompt.

rails start sample_app

```
$ ls sample_app
Gemfile      Rakefile     config.ru    lib          script
Gemfile.lock app          db           log          test
README.rdoc  config       doc          public       tmp
```

```
$ ls sample_app/app
assets      controllers helpers     mailers     models
views
```

Starting the Server

```
$ rails s[erver]
```

More information:

```
$ rails server --help
```

Note: [ ] = optional text

Static Pages

Type localhost:3000 into your browser.
Currently, this shows the file `public/index.html`

Create the page `public/hello.html`:

```
<html>
  <body>
    <h1>Hello World!</h1>
  </body>
</body>
```

Can be viewed at localhost:3000/hello.html

Static Pages

Limitations:

- No templating
- Truly static (can't have any note-specific content).

A Static Pages Controller

```
$ rails g[enerate] controller StaticPages home about
      create  app/controllers/static_pages_controller.rb
       route  get "static_pages/about"
       route  get "static_pages/home"
      invoke  erb
      create    app/views/static_pages
      create    app/views/static_pages/home.html.erb
      create    app/views/static_pages/about.html.erb
      ...
```

This creates our first controller. This will enable us to make use of templates, which will make it much easier to add site-wide content to our site (*e.g.* a navigation bar).

Static Pages

File: `app/views/static_pages/about.html.erb`

`.erb` stands for ***embedded ruby***. It enables us to write ruby code inside out HTML pages, which allows us to add dynamic content (more on this later).

Aside: The Asset Pipeline

```
html.erb
css.scss
js.coffee
```

Assets are ***compiled*** (e.g. translated into a new form). The file-types determine which kinds of compilation are attempted. Files are read from right to left (so .html.erb is first run through the embedded ruby compiler).

In production, this enables us to do JS + CSS ***minification***, a process by which files are made smaller so that they take less time to send to the client.

Routes

File: `config/routes.rb`

```
...
root to: 'static_pages#home'
match 'about', to: 'static_pages#about'
...
```

These lines make localhost:3000 point to `app/views/static_pages/home.html.erb` and localhost:3000/about point to `app/views/static_pages/about.html.erb`.

Note: need to delete `public/index.html`

Adding a new static page

File: `app/controllers/static_pages_controller.rb`

```
def time
end
```

File: `config/routes.rb`

```
match 'time', to: 'static_pages#time'
```

Adding a new static page

Go to localhost:3000/time, no page yet! (template is missing).

File: `app/views/static_pages/time.html.erb`

```
<h1>The time is now: </h1>
```

Adding a template

File: `app/view/static_pages/time.html.erb`

<h1>The time is now: **<%= Time.now %>**</h1>

But, this isn't very pretty... We need a way to ***format*** the time to make it more readable.

Adding dynamic content

```
$ rails c[onsole]
> Time.now
> Time.now.stftime
```

Documentation: http://www.ruby-doc.org/core-2.0/

File: `app/views/static_pages/time.html.erb`

<h1>The time is now: **<%= Time.now.strftime ('%B %d, %Y: %H:%M:%S') %>**</h1>

Adding dynamic content

File: `app/views/static_pages/time.html.erb`

```
<h1>The time is now:</h1>
<h2>
   <%= Time.now.strftime('%B %d, %Y: %H:%M:%S')
%>
</h2>
```

Gemfile

A Gemfile enables you to specify the ***dependencies*** (other software libraries) that your code uses. In ruby, packages of software can be installed as ***gems***.

Adding styling with Bootstrap

File: `Gemfile`

```
group :assets do
   ...
   gem 'bootstrap-sass', '2.1'
   ...
end
```

Adding styling with Bootstrap

Install new gems added to `Gemfile`:

```
$ bundle install
```

File: `app/assets/stylesheets/custom.css.scss`

```
@import "bootstrap"
```

Note: server restart needed

Styling with Bootstrap

File: app/views/static_pages/time.html.erb

```
<div class="container">
    <div class="hero-unit">
        <h1>The time now is:</h1>
        <h2 class="centered">...</h2>
    </div>
</div>
```

File: app/assets/stylesheets/custom.css.scss

```
.centered {
    text-align: center;
}
```

Aside: The Asset Pipeline

For ***development***, we want to make sure that our files are easy to read in the browser. For ***production***, we want files to be as small as possible, even if they aren't readable.

```
$ rails s -e production
$ rake assets:precompile
$ rails s -e production
```

File: `config/environments/production.rb`

```
config.assets.compile = true
```

Aside: The Asset Pipeline

```
$ rake assets:precompile
rails s -e production
```

Now, all of our JS and CSS are compiled into just two files, that are basically impossible to read (this has the added benefit of somewhat protecting intellectual property (IP)).

Partials

File: `app/views/layouts/application.html.erb`

This file gives us structure for the entire site.
Add this line:

```
<%= render 'layouts/header %>
```

File: `app/views/layouts/_header.html.erb`

<%= render 'layouts/header %>

Header Partial

File: `app/views/layouts/_header.html.erb`

(see: `http://twitter.github.com/bootstrap/examples/starter-template.html`)

```
<div class="navbar navbar-inverse navbar-fixed-top">
    <div class="navbar-inner">
        <div class="container">
            <div class="nav-collapse collapse">
                <ul class="nav">
                    <li><a href="/">Home</a></li>
                    <li><a href="/time/">Time</a></li>
                </ul>
            </div>
        </div>
    </div>
</div>
```

Cleaning up home

What do we edit to make localhost:3000 look better?

Where do we add it?

```
<div class="container">
    <div class="hero-unit">
        <%= yield %>
    </div>
</div>
```

File: `app/views/layouts/application.html.erb`

Adding models

We're going to make a simple note taking app. It allows notes to leave notes on a page.

notes can go look at notes, edit specific ones, or leave more.

Sketching out Notes

A note has:

a. Title (string)
b. Content (string)
c. Author (string (for now...))

Form: `rails g model [model_name] [attr]:[data_type]`

```
$ rails g model Note title:string content:string author:string
      invoke  active_record
      create    db/migrate/20130405164422_create_notes.rb
      create    app/models/note.rb
      invoke    test_unit
      create      test/unit/note_test.rb
      create      test/fixtures/notes.yml
```

Migrations

`db/migrate/20130405164422_create_notes.rb`

Migration files allow us to write ruby code to manipulate our database. This saves us from having to learn a specific syntax for a specific database, and enables us to switch between different databases easily.

`sqlite3` is used in development by default

The Notes Model

File: `app/models/note.rb`

File: `config/routes.rb`

```
resources :notes
```

The `resources` line gives us some default URLs for manipulating notes. Notice we wrote `:notes` instead of `:note`. In general, Ruby allows us to use pluralization where it is appropriate.

Notes Routes

Shows all URIs your router responds to:

```
$ rake routes
```

```
...
notes      GET    /notes(.:format)              notes#index
           POST   /notes(.:format)              notes#create
new_note   GET    /notes/new(.:format)          notes#new
edit_note  GET    /notes/:id/edit(.:format)     notes#edit
note       GET    /notes/:id(.:format)          notes#show
           PUT    /notes/:id(.:format)          notes#update
           DELETE /notes/:id(.:format)          notes#destroy

...
```

Creating Notes

```
$ rails c[onsole]
> n = Note.new # should cause a DB error
```

Need to first create Notes table:

```
$ rake db:migrate
```

```
$ rails c
> n = Note.new
> n = Note.new title: "Hello, There", author:
"Samuel Messing", content: "Lorem ipsum
dolor..."
> n.save
```

Model Validations

File: app/models/note.rb

```
validates :title, presence :true

before_save do |note|
   note.title = note.title.titlecase
end
```

```
$ rails c
> n = Note.new title: "MY AWESOMEST NOTE"
> n.save
> n.title
   => "My Awesomest Note"
```

Notes URLs

Example:

HTTP Verb	URI	Action	Purpose
GET	`/notes`	`index`	List all notes on website
GET	`/notes/1`	`show`	Display details about note 1
POST	`/notes`	`create`	Create a new note
PUT	`/notes/1`	`update`	Update note 1
DELETE	`/notes/1`	`destroy`	Delete note 1

Notes Controller

Why does localhost:3000/notes not currently work?

No controller! (The part of the server that actually builds the response).

Form:

```
rails generate controller <ControllerName>
```

Notes Controller

```
rails g controller Notes
      create  app/controllers/notes_controller.rb
      invoke  erb
      create    app/views/notes
      invoke  test_unit
      create    test/functional/notes_controller_test.rb
      invoke  helper
      create    app/helpers/notes_helper.rb
      invoke    test_unit
      create      test/unit/helpers/notes_helper_test.rb
      invoke  assets
      invoke    coffee
      create      app/assets/javascripts/notes.js.coffee
      invoke    scss
      create      app/assets/stylesheets/notes.css.scss
```

Notes Controller

Now localhost:3000/notes gives us an action undefined error. Need to add the action "`index`" to the notes controller.

File: `app/controllers/notes_controller.rb`

```
def index
end
```

Notes Index Template

Now localhost:3000/notes gives us a template not found error. Need to add an `index` template to app/views/notes.

File: `app/views/notes/index.html.erb`

```
<ul class="notes-list">
    <% @notes.each do |note| %>
        <h1><%= note.title %></h1>
        <h2>By <%= note.author %></h2>
        <hr noshade/>
        <p><%= note.content %></p>
    <% end %>
</ul>
```

Passing Notes into the template

Need to define `@notes` for the template. This is done in the controller.

File: `app/controllers/notes_controller.rb`

```
def index
  @notes = Note.all
end
```

Adding a form for new notes

```
$ rake routes
```

Visiting localhost:3000/notes/new gives us errors.

How do we fix the first error?

Once it's fixed, how do we fix the second?

A form to make new notes

File: app/views/notes/new.html.erb

```
<%= form_for(@note) do |f| %>
    <%= f.label :title %>
    <%= f.text_field :title %>

    <%= f.label :author %>
    <%= f.text_field :author %>

    <%= f.label :content %>
    <%= f.text_field :content %>

    <%= f.submit "Create note", class: "btn btn-large
btn-primary" %>
<% end %>
```

Controller Updates

File: `app/controllers/notes_controller.rb`

```
def create
   @note = Note.new(params[:note])
   if @note.save
      # do something...
   else
      render 'new'
   end
end
```

Adding Error Feedback

```
$ rails c
> n = Note.new
> n.save
> n.errors
```

Rails by default adds an `errors` object to models that have failed to be saved. This enables us to give feedback to a user trying to make a new note.

Adding Error Feedback

File: app/views/shared/_error_messsages.html.erb

```
<% if @note.errors.any? %>
  <div id="error_explanation">
    <div class="alert alert-error">
      The form contains <%= pluralize(@note.errors.
count, "error") %>.
    </div>
    <ul>
    <% @note.errors.full_messages.each do |msg| %>
      <li>* <%= msg %></li>
    <% end %>
    </ul>
  </div>
<% end %>
```

Showing individual notes

We want to go to localhost:3000/notes/<note_id> (e.g. localhost:3000/notes/3). Right now this doesn't work.

File: app/controllers/notes_controller.rb

```
def show
  @note = Note.find(params[:id])
end
```

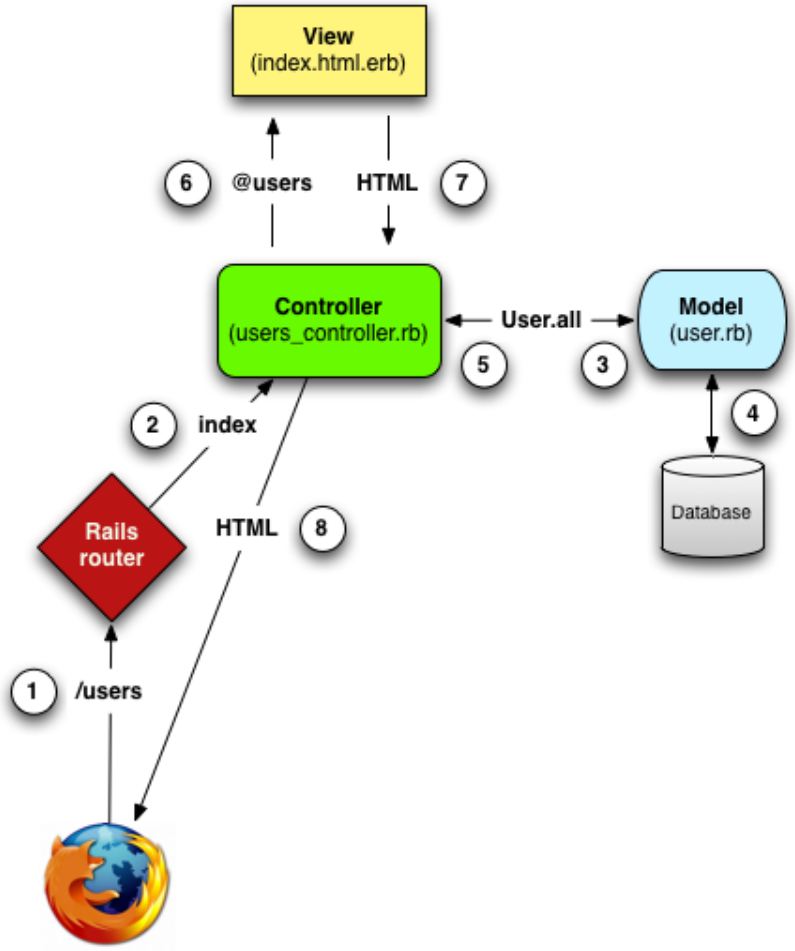
What have we forgotten to do?

Note template

File: `app/views/notes/show.html.erb`

```
<h1><%= @note.title %></h1>
<h2>by <%= @note.author %></h2>
<hr noshade/>
<p><%= @note.content %></p>
```

MVC in Rails


View
(index.html.erb)
6
@users
HTML
7
Controller
(users_controller.rb)
User.all
Model
(user.rb)
5
3
4
2
index
Database
Rails
router
HTML
8
1
/users

Deleting Notes

File: app/views/notes/index.html.erb

```
<%= link_to("Delete", note, method: delete,
class: 'action') %>
```

Deleting Notes (cont'd)

File: `app/controllers/notes_controller.rb`

```
def destroy
   @note = Note.find(params[:id])
   @note.destroy
   @notes = Notes.all
   render 'index'
end
```

Not Covered

- Testing (this is HUGE)
- Security (ditto)
- Adding client-side code (JS)
- Handling data requests (JSON/XML)
- Deployment (AWS, Heroku)
- Version Control (git, subversion, etc.)

Resources

RailsCast

http://ruby.railstutorial.org/

Code from this lecture:

https://github.com/smessing/intro-rails-lecture