

Designing by Principle

A Case Study: Rack

Principles

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Definition

“a basic truth, law, or assumption”

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Where rules are specific principles are general, and therefore have tremendous utility.

Learning to apply them is hard.

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“a basic truth, law, or assumption”

Scientific Method

Keeping clear in mind the outcome we're trying to achieve,
and then considering what principles will help us get there.

Tradeoffs

(everything has a cost)

System design is about balancing *simplicity* with
expressive power

Simplicity	Expressive Power
Reliability, maintainability	Satisfying requirements, flexibility

Rack

Dockerfile
Gemfile
Gemfile.lock
README.md
Rakefile
app/
bin/
config/
config.ru
db/
docker-stack.yml
docs/
extra/
lib/
log/
node_modules/
package.json
public/
spec/
surveyor.iml
tmp/
vendor/
yarn.lock

Rack

```
# This file is used by Rack-based servers to start the application.
```

```
require_relative 'config/environment'
```

```
run Rails.application
```

Rack...Why?

Web Servers / Application Containers



Thin Puma Mongrel
WEBrick Unicorn

Server-side Web Programming Interfaces

CGI FastCGI
SCGI

Web Frameworks



Your web application...

Rack...Why?

Rails 1.0.0...before Rack

```
rails/lib/cgi_handler.rb
```

[illegible]

```
def process(provider, FCGI)
  # Make sure we're in a safe place, can safely reload this instance.
  # ...
  run_fcgi_at_fcgi_request(provider)
end
```

```
require "dispatcher"
```

rails/lib/webrick_server.rb

```

class DispatchServlet < WeBrick::HTTPServlet < AbstractServlet
  REQUEST_MUTEX = Mutex.new

  # Start the WeBrick server with the given options, mounting the
  # DispatchServlet at <tb/>v15.
  def self.dispatch(options = {})
    Socket.do_not_reverse_lookup = true # patch for OS X

    params = { :Port => options[:port], :t, i,
               :ServerType => options[:server_type],
               :BindAddress => options[:ip] }
    params[:MimeType] = options[:mime_types] if options[:mime_types]

    server = WeBrick::HTTPServer.new(params)
    server.mount('/', DispatchServlet, options)

    trap("INT") { server.shutdown }

    require File.join(server.options[:server_root], "...", "config", "environment") unless defined?(RAILS_ROOT)
    require "dispatcher"

    def initialize(server, options) #nodoc:
      @server_options = options
      @file_handler = WeBrick::FileHandler.new(DispatchServlet.new(server_options[:server_root])
      Dir.chdir(server_options[:server_root])
      super
    end

    def service(req, res) #nodoc:
      begin
        unless handle_file(req, res)
          REQUEST_MUTEX.lock unless ActionController::Base.allow_concurrency
          unless handle_dispatch(req, res)
            raise WeBrick::HTTPStatus::NotFound, "“#{req.path}” not found."
          end
        end
      ensure
        unless ActionController::Base.allow_concurrency
          REQUEST_MUTEX.unlock if REQUEST_MUTEX.locked?
        end
      end
    end

    def handle_file(req, res) #nodoc:
      begin
        req = req.dup
        path = req.path.dup

        # Add .html if the last path piece has no . in it
        path << ".html" if path =~ /\A(?!\/)[^./]+\z =~ path)
        path.gsub(":", " ") # Unescape - since FileHandler doesn't do so.

        req.instance_variable_set(:@path_info, path) # Set the modified path...

        @file_handler.send(:service, req, res)
        return true
      rescue HTTPStatus::PartialContent, HTTPStatus::NotModified => err
        res.set_error(err)
        return true
      rescue => err
        return false
      end
    end

    def handle_dispatch(req, res, origin = nil) #nodoc:
      data = StringIO.new
      Dispatcher.dispatch(
        CGI.new("query").create_env_table(req, origin), StringIO.new(req.body || ""),
        ActionController::CGIRequest[:DEFAULT_SESSION_OPTIONS],
        data
      )

      header, body = extract_header_and_body(data)

      set_charset(header)
      assign_status(res, header)
      res.cookies.concat(header.delete("set-cookie") || [])
      header.each { |key, val| res[key] = val.join(", ") }

      res.body = body
      return true
    rescue => err
      p err, err.backtrace
      return false
    end

    private

    def create_env_table(req, origin)
      env = req.meta_vars.clone
      env.delete("SCRIPT_NAME")
      env["QUERY_STRING"] = req.request_uri.query
      env["REQUEST_URI"] = origin if origin
      return env
    end

    def extract_header_and_body(data)
      data rewind
      data < data.read

      raw_header, body = data.split(/^(\s*\n)/m, 2)
      header = WeBrick::HTTUtils.parse_header(raw_header)

      return header, body
    end

    def set_charset(content_type)
      ct = header["content-type"]
      if ct.any? { |x| x =~ /^text\/.*$/ } && !ct.any? { |x| x =~ /^charset/ }
        ch = @server.options[:charset] || "UTF-8"
        ct.find { |x| x =~ /^text\/.*$/ } << ("*; charset=" + ch)
      end
    end

    def assign_status(res, header)
      if /\b(de|s) => header["status"]||[]
        res.status = $1.to_i
        header.delete("status")
      end
    end
  end
end

```

```
@file_handler = Net::HTTPServlet::FileHandler.new(server, options)
Dir.chdir(ABS_PATH)
super
end
```

...after Rack

This file is used by Rack-based servers to start the application.

```
require_relative 'config/environment'
```

run Rails.application

Rack...Why?



Principles

- Well-defined interfaces
(good fences make good neighbors)
- Extensibility *(don't try to predict the future)*
- Composition *(we're better together)*
- Immutability *(respecting boundaries, keeping promises)*

Well-Defined Interface

(good fences make good neighbors)

```
# rack/handler/tomcat.rb
```

```
class Rack::Handler::Tomcat
  def self.run(app, options = {})
    # talk to Tomcat
  end
end
```

```
# rack/handler/apache.rb
```

```
class Rack::Handler::Apache
  def self.run(app, options = {})
    # talk to Apache
  end
end
```

```
# rack/handler/nginx.rb
```

```
class Rack::Handler::Nginx
  def self.run(app, options = {})
    # talk to NGINIX
  end
end
```

```
# config.ru
```

```
run Proc.new { |env| ['200', {'Content-Type' => 'text/html'}, ['Hello neighbor!']] }
```

Extensibility

(don't try to predict the future)

```
# config.ru
```

```
use Rack::CommonLogger  
use Rack::Session::Cookie  
run App
```

Extensibility

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We want to make systems that can easily be extended without modifying its source code.

- **Modularity (via functions, or objects)**
 - **Function Composition**
 - **Higher-order functions**
 - **Adapter Pattern**
 - **Service Objects**
- **Web API**

Composition

(we're better together)

```
# config.ru
```

```
use Rack::CommonLogger
use Rack::Session::Cookie
run App
```

```
# config.ru
```

```
App = Rack::CommonLogger.new(
  Rack::Session::Cookie.new(MyApp.new))

run App
```

Composition

(we're better together)

```
# config.ru
```

```
use Rack::CommonLogger
use Rack::Session::Cookie
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```
# config.ru
```

```
App = Rack::CommonLogger.new(
  Rack::Session::Cookie.new(MyApp.new))

run App
```

Composable systems are extensible systems

Immutability

(respecting boundaries, keeping promises)

```
class MyApp
  def call(env)
    ['200', {'Content-type' => 'text/html'}, ["This is true"]]
  end
end
```

What's missing?

Immutability

(respecting boundaries, keeping promises)

```
class MyApp
  def call(env)
    ['200', {'Content-type' => 'text/html'}, ["This is true"]]
  end
end
```

```
class Logger
  def initialize(app)
    @app = app
  end
```

Why does this work?

```
    def call(env)
      log(env)
      app.call(env)
    end
  end
end
```

References

- Inventing on Principle - Bret Victor
<https://vimeo.com/36579366>
- Simplicity Matters - Rich Hickey
<https://www.youtube.com/watch?v=rI8tNMsozo0>
- The Mess We're In - Joe Armstrong
<https://www.youtube.com/watch?v=IKXe3HUG2I4>