# RESTful Services with Play Framework, and a Security Level with JWT (JSON Web Tokens)

CODEMASH 2.0.1.8

**Community Leader**
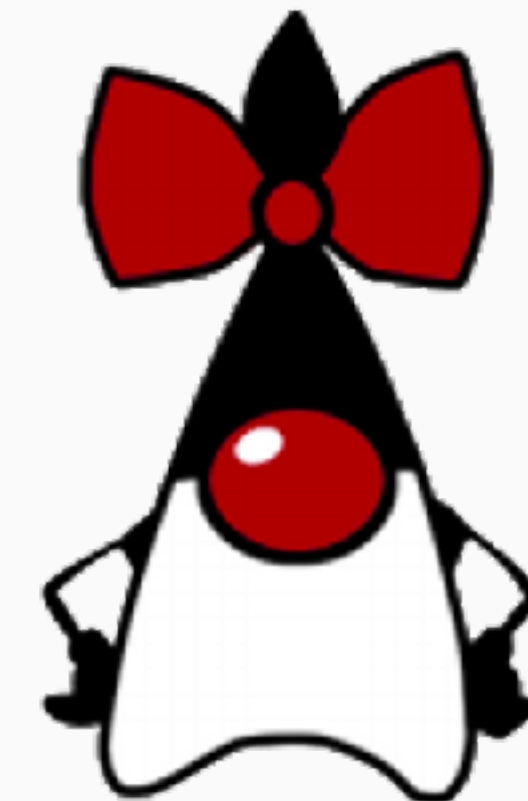JDuchess Chapter Guatemala
Devs+502 (Google Community)

**Ex-JUG Member**
Guatemala Java Users Group (GuateJUG)

**Chief Technology Officer (CTO) at Produactivity**
Full Stack Developer

**Auth0 Ambassador**

# Mercedes Wyss
## @itrjwyss

# Agenda

- Play Framework

- RESTful Services

- JSON

- JWT (JSON Web Tokens)

# Agenda

- **Play Framework**

- RESTful Services

- JSON

- JWT (JSON Web Tokens)

# Play Framework

- Scala Based

- Lightweight, stateless, web-friendly

- Minimal resources consumption
  for highly-scalable applications
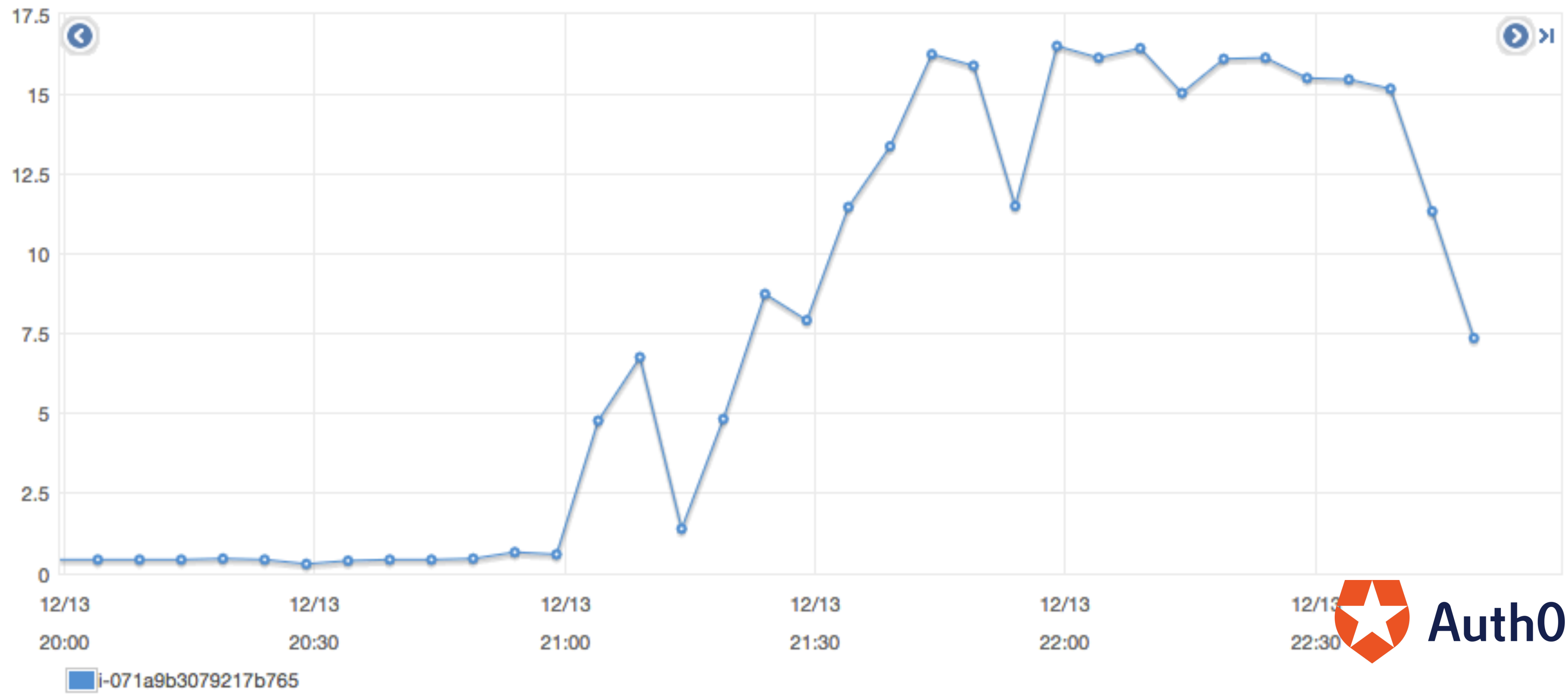
# CloudWatch Monitoring Details

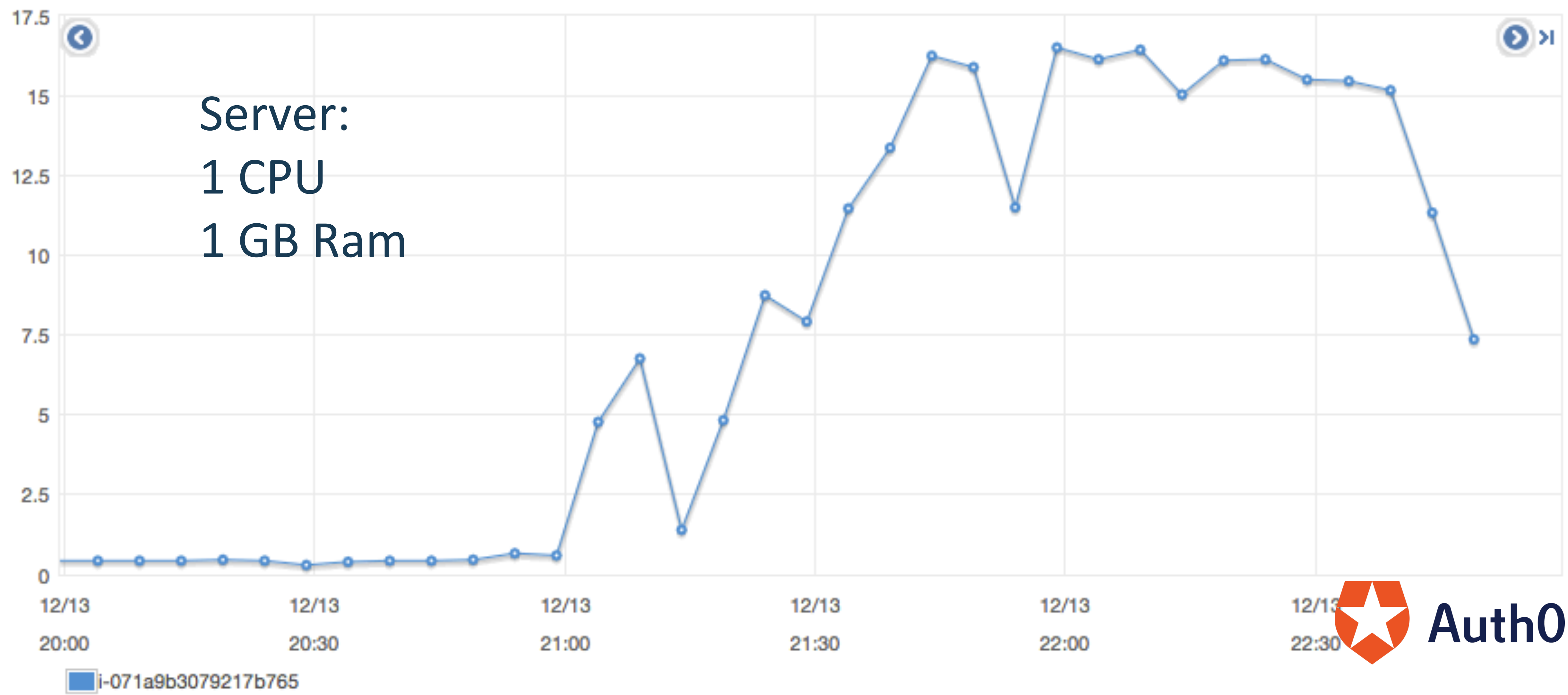CPU Utilization ( Percent )    Statistic: **Average** ▾    Time Range: **Last 3 Hours** ▾    Period: **5 Minutes** ▾    ⟳



i-071a9b3079217b765

# Java or Scala

# Is Reactive

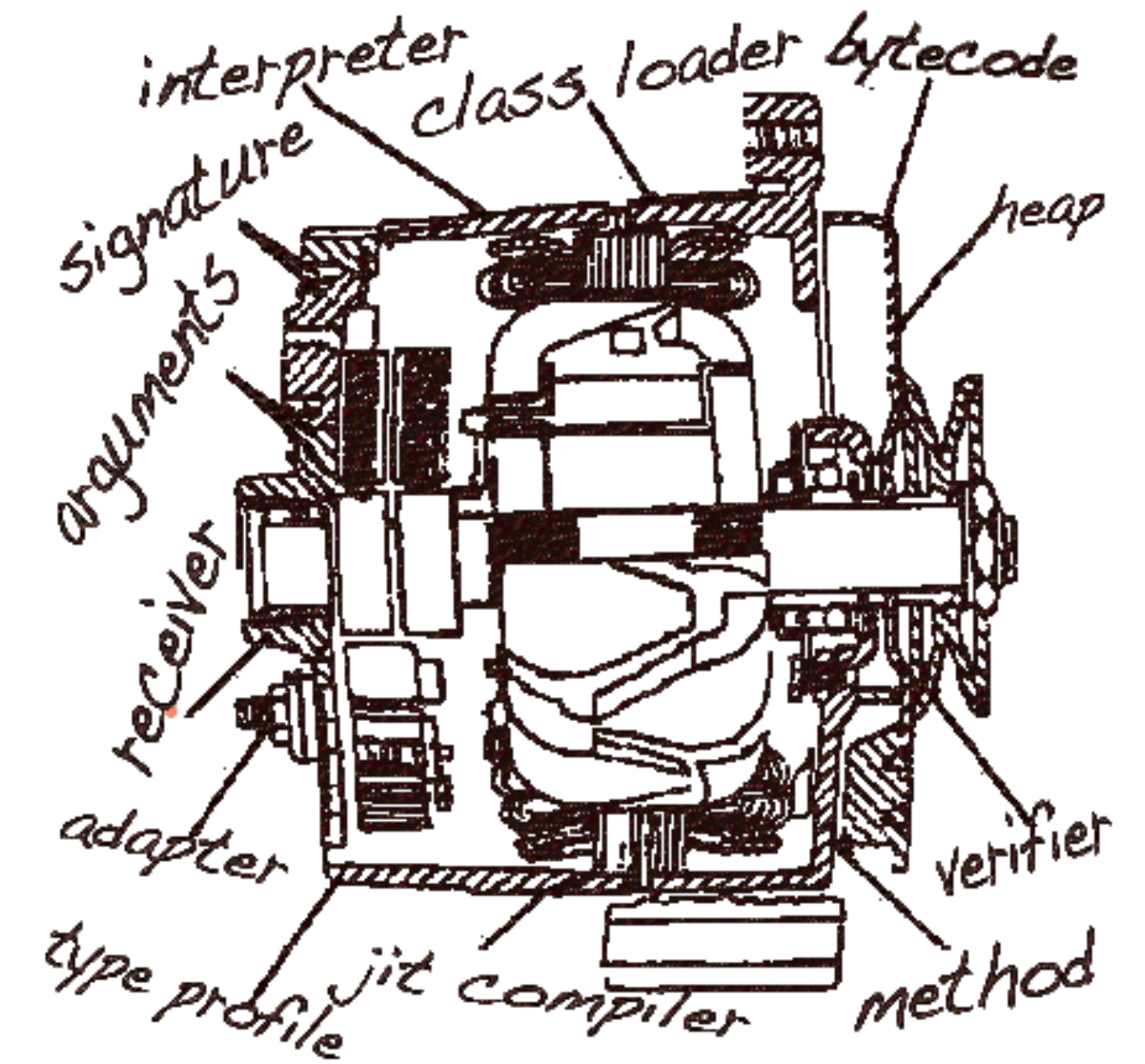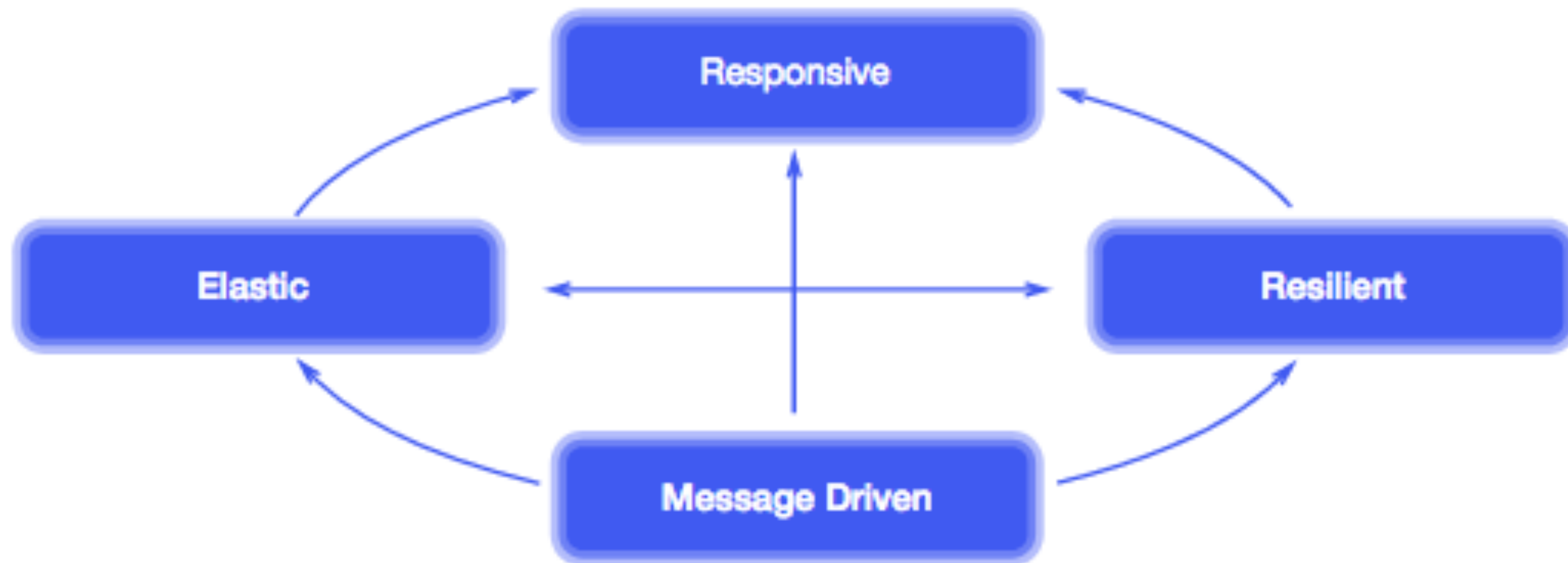# HTML Inheritance

```html
10   <header role="banner">
11       <h1>HTML Essential Training</h1>
12       <nav role="navigation">
13          <ul>
14              <li><a href="intro.htm" title
15              <li><a href="syntax.htm" titl
16              <li><a href="structure.htm" t
17              <li><a href="links.htm" title
18              <li><a href="reference.htm" t
```

# App Server

Netty

akka http

+ Since Version 2.6.x

**Fewer Configurations**

Auth0

# JRebel Behavior

More Code, Less Deploys

# How start a Play project?

- We need **SBT**

- **Create**
  sbt new playframework/play-java-seed.g8
  sbt new playframework/play-scala-seed.g8

- **Deploy**
  sbt run

```
$ sbt new playframework/play-java-seed.g8

This template generates a Play Java project

name [play-java-seed]: CodeMash18
organization [com.example]: com.auth0
scala_version [2.12.4]:
play_version [2.6.10]:
sbt_version [1.0.3]:

Template applied in ./codemash18

CodeMash18 $ sbt run
```

Auth0

```
[info] Loading project definition from /Users/mercedeswyss/Documents/Presentaciones/2017/OracleCode/Mexico/play-java-starter-example/project
[info] Updating {file:/Users/mercedeswyss/Documents/Presentaciones/2017/OracleCode/Mexico/play-java-starter-example/project/}play-java-starter-example-build...
[info] Resolving org.fusesource.jansi#jansi;1.4 ...
[info] downloading https://repo.scala-sbt.org/scalasbt/sbt-plugin-releases/com.typesafe.play/sbt-plugin/scala_2.10/sbt_0.13/2.6.0/jars/sbt-plugin.jar ...
[info]   [SUCCESSFUL ] com.typesafe.play#sbt-plugin;2.6.0!sbt-plugin.jar (3794ms)
[info] downloading https://repo.scala-sbt.org/scalasbt/sbt-plugin-releases/com.typesafe.sbt/sbt-play-enhancer/scala_2.10/sbt_0.13/1.1.0/jars/sbt-play-enhancer.jar ...
[info]   [SUCCESSFUL ] com.typesafe.sbt#sbt-play-enhancer;1.1.0!sbt-play-enhancer.jar (2439ms)
[info] downloading https://repo1.maven.org/maven2/com/typesafe/play/sbt-routes-compiler_2.10/2.6.0/sbt-routes-compiler_2.10-2.6.0.jar ...
[info]   [SUCCESSFUL ] com.typesafe.play#sbt-routes-compiler_2.10;2.6.0!sbt-routes-compiler_2.10.jar (961ms)
[info] downloading https://repo1.maven.org/maven2/com/typesafe/play/run-support_2.10/2.6.0/run-support_2.10-2.6.0.jar ...
[info]   [SUCCESSFUL ] com.typesafe.play#run-support_2.10;2.6.0!run-support_2.10.jar (441ms)
[info] downloading https://repo1.maven.org/maven2/com/typesafe/config/1.3.1/config-1.3.1.jar ...
[info]   [SUCCESSFUL ] com.typesafe#config;1.3.1!config.jar(bundle) (494ms)
[info] downloading https://repo.scala-sbt.org/scalasbt/sbt-plugin-releases/net.contentobjects.jnotify/jnotify/0.94-play-1/jars/jnotify.jar ...
[info]   [SUCCESSFUL ] net.contentobjects.jnotify#jnotify;0.94-play-1!jnotify.jar (8790ms)
[info] downloading https://repo.scala-sbt.org/scalasbt/sbt-plugin-releases/com.typesafe.sbt/sbt-twirl/scala_2.10/sbt_0.13/1.3.2/jars/sbt-twirl.jar ...
[info]   [SUCCESSFUL ] com.typesafe.sbt#sbt-twirl;1.3.2!sbt-twirl.jar (2286ms)
[info] downloading https://repo.scala-sbt.org/scalasbt/sbt-plugin-releases/com.typesafe.sbt/sbt-native-packager/scala_2.10/sbt_0.13/1.2.0/jars/sbt-native-packager.jar ...
[info]   [SUCCESSFUL ] com.typesafe.sbt#sbt-native-packager;1.2.0!sbt-native-packager.jar (4539ms)
[info] downloading https://repo.scala-sbt.org/scalasbt/sbt-plugin-releases/com.lightbend.sbt/sbt-javaagent/scala_2.10/sbt_0.13/0.1.2/jars/sbt-javaagent.jar ...
[info]   [SUCCESSFUL ] com.lightbend.sbt#sbt-javaagent;0.1.2!sbt-javaagent.jar (2553ms)
[info] downloading https://repo.scala-sbt.org/scalasbt/sbt-plugin-releases/com.typesafe.sbt/sbt-web/scala_2.10/sbt_0.13/1.4.1/jars/sbt-web.jar ...
[info]   [SUCCESSFUL ] com.typesafe.sbt#sbt-web;1.4.1!sbt-web.jar (2814ms)
[info] downloading https://repo.scala-sbt.org/scalasbt/sbt-plugin-releases/com.typesafe.sbt/sbt-js-engine/scala_2.10/sbt_0.13/1.2.1/jars/sbt-js-engine.jar ...
[info]   [SUCCESSFUL ] com.typesafe.sbt#sbt-js-engine;1.2.1!sbt-js-engine.jar (2613ms)
[info] downloading https://repo1.maven.org/maven2/com/typesafe/play/twirl-api_2.10/1.3.2/twirl-api_2.10-1.3.2.jar ...
[info]   [SUCCESSFUL ] com.typesafe.play#twirl-api_2.10;1.3.2!twirl-api_2.10.jar (1042ms)
[info] downloading https://repo1.maven.org/maven2/commons-io/commons-io/2.5/commons-io-2.5.jar ...
[info]   [SUCCESSFUL ] commons-io#commons-io;2.5!commons-io.jar (949ms)
[info] downloading https://repo1.maven.org/maven2/com/typesafe/play/build-link/2.6.0/build-link-2.6.0.jar ...
[info]   [SUCCESSFUL ] com.typesafe.play#build-link;2.6.0!build-link.jar (513ms)
[info] downloading https://repo1.maven.org/maven2/com/lightbend/play/play-file-watch_2.10/1.0.0/play-file-watch_2.10-1.0.0.jar ...
[info]   [SUCCESSFUL ] com.lightbend.play#play-file-watch_2.10;1.0.0!play-file-watch_2.10.jar (563ms)
[info] downloading https://repo1.maven.org/maven2/com/typesafe/play/play-exceptions/2.6.0/play-exceptions-2.6.0.jar ...
[info]   [SUCCESSFUL ] com.typesafe.play#play-exceptions;2.6.0!play-exceptions.jar (523ms)
[info] downloading https://repo1.maven.org/maven2/com/lightbend/play/jnotify/0.94-play-2/jnotify-0.94-play-2.jar ...
[info]   [SUCCESSFUL ] com.lightbend.play#jnotify;0.94-play-2!jnotify.jar (2244ms)
[info] downloading https://repo1.maven.org/maven2/com/github/pathikrit/better-files_2.10/2.14.0/better-files_2.10-2.14.0.jar ...
[info]   [SUCCESSFUL ] com.github.pathikrit#better-files_2.10;2.14.0!better-files_2.10.jar (1089ms)
[info] downloading https://repo1.maven.org/maven2/com/typesafe/play/twirl-compiler_2.10/1.3.2/twirl-compiler_2.10-1.3.2.jar ...
[info]   [SUCCESSFUL ] com.typesafe.play#twirl-compiler_2.10;1.3.2!twirl-compiler_2.10.jar (1010ms)
[info] downloading https://repo.scala-sbt.org/scalasbt/sbt-plugin-releases/org.scala-js/sbt-scalajs/scala_2.10/sbt_0.13/0.6.16/jars/sbt-scalajs.jar ...
[info]   [SUCCESSFUL ] org.scala-js#sbt-scalajs;0.6.16!sbt-scalajs.jar (5827ms)
[info] downloading https://repo1.maven.org/maven2/com/typesafe/play/twirl-parser_2.10/1.3.2/twirl-parser_2.10-1.3.2.jar ...
```

```
[info] Loading settings from plugins.sbt,scaffold.sbt ...
[info] Loading project definition from /Users/itrjwyss/Documents/gitrepos/Journey18/CodeMash18/Play-RESTful-JWT/codemash18/
project
[info] Loading settings from build.sbt ...
[info] Set current project to CodeMash18 (in build file:/Users/itrjwyss/Documents/gitrepos/Journey18/CodeMash18/Play-RESTful-
JWT/codemash18/)

--- (Running the application, auto-reloading is enabled) ---

[info] p.c.s.AkkaHttpServer - Listening for HTTP on /0:0:0:0:0:0:0:0:9000

(Server started, use Enter to stop and go back to the console...)

[info] p.a.h.EnabledFilters - Enabled Filters (see <https://www.playframework.com/documentation/latest/Filters>):

    play.filters.csrf.CSRFFilter
    play.filters.headers.SecurityHeadersFilter
    play.filters.hosts.AllowedHostsFilter

[info] play.api.Play - Application started (Dev)
```

# Project Structure

```
▷  .g8
◢  app
   ◢  controllers
      ☕ HomeController.java
   ◢  views
      <> index.scala.html
      <> main.scala.html
▷  conf
▷  logs
▷  project
▷  public
▷  target
▷  test
🌐 build.sbt
```

| Directory | Description |
|-----------|-------------|
| app | The app and client side source directory controllers/ views/ |
| conf | Config directory, route mapping, application config and log config |
| public | Static assets directory (images, css, js) |
| Test | Test source directory |
| project | sbt configuration files |

Auth0

# main.scala.html

```scala
@*
 * This template is called from the `index` template. This template
 * handles the rendering of the page header and body tags. It takes
 * two arguments, a `String` for the title of the page and an `Html`
 * object to insert into the body of the page.
 *@
@(title: String)(content: Html)

<!DOCTYPE html>
<html lang="en">
    <head>
        @* Here's where we render the page title `String`. *@
        <title>@title</title>
        <link rel="stylesheet" media="screen" href="@routes.Assets.versioned("stylesheets/main.css")">
        <link rel="shortcut icon" type="image/png" href="@routes.Assets.versioned("images/favicon.png")">
    </head>
    <body>
        @* And here's where we render the `Html` object containing
         * the page content. *@
        @content

        <script src="@routes.Assets.versioned("javascripts/main.js")" type="text/javascript"></script>
    </body>
</html>
```

# index.scala.html

```
@()

@main("Welcome to Play") {
    <h1>Welcome to Play!</h1>
}
```

# HomeController.java

```java
package controllers;

import play.mvc.*;

/**
 * This controller contains an action to handle HTTP requests
 * to the application's home page.
 */
public class HomeController extends Controller {

    /**
     * An action that renders an HTML page with a welcome message.
     * The configuration in the <code>routes</code> file means that
     * this method will be called when the application receives a
     * <code>GET</code> request with a path of <code>/</code>.
     */
    public Result index() {
        return ok(views.html.index.render());
    }

}
```

# routes

```
# Routes
# This file defines all application routes (Higher priority routes first)
# ~~~~

# An example controller showing a sample home page
GET     /                       controllers.HomeController.index

# Map static resources from the /public folder to the /assets URL path
GET     /assets/*file           controllers.Assets.versioned(path="/
public", file: Asset)
```
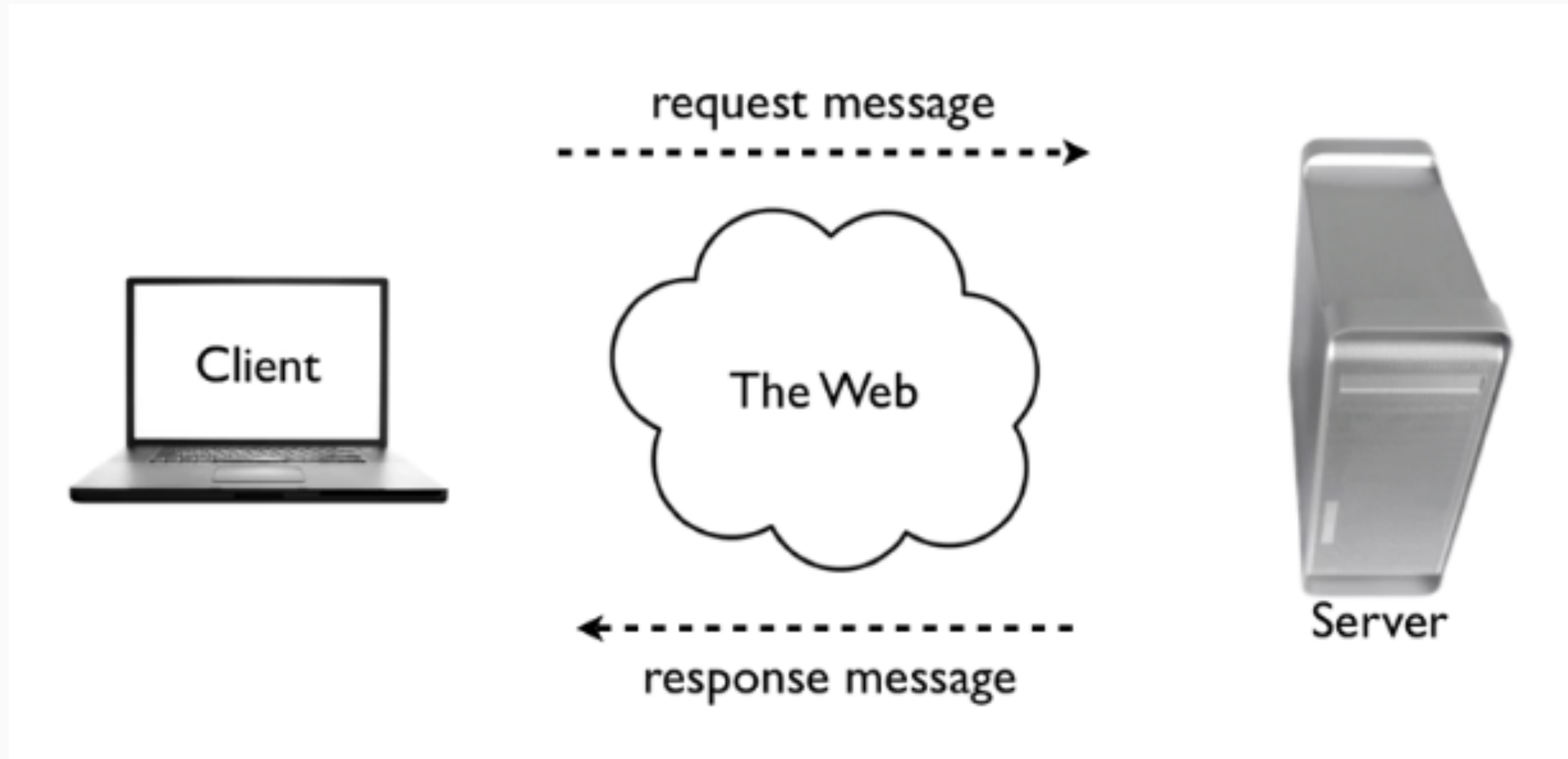
# Agenda

- Play Framework

- **RESTful Services**

- JSON

- JWT (JSON Web Tokens)

request message

The Web

Client

Server

response message

Linda.com (June 2017) https://www.lynda.com/Software-Development-tutorials/What-web-service/126131/145941-4.html

# RESTful

- Representational State Transfer

- Software Architecture

- Based on HTTP methods

- Typically use JSON, can be XML or Text

# HomeController.java

```java
package controllers;

import play.mvc.Controller;
import play.mvc.Result;

public class HomeController extends Controller {

    public Result index() {
        return ok(views.html.index.render());
    }

}
```

# HomeController.java

```java
package controllers;

import play.mvc.Controller;
import play.mvc.Result;

public class HomeController extends Controller {

    public Result index() {
        return ok(views.html.index.render());
    }

}
```

# HomeController.java

```java
package controllers;

import play.mvc.Controller;
import play.mvc.Result;

public class HomeController extends Controller {

    public Result index(){
        return ok("This is just a return message");
    }

}
```

# Agenda

- Play Framework

- Web Services Restful

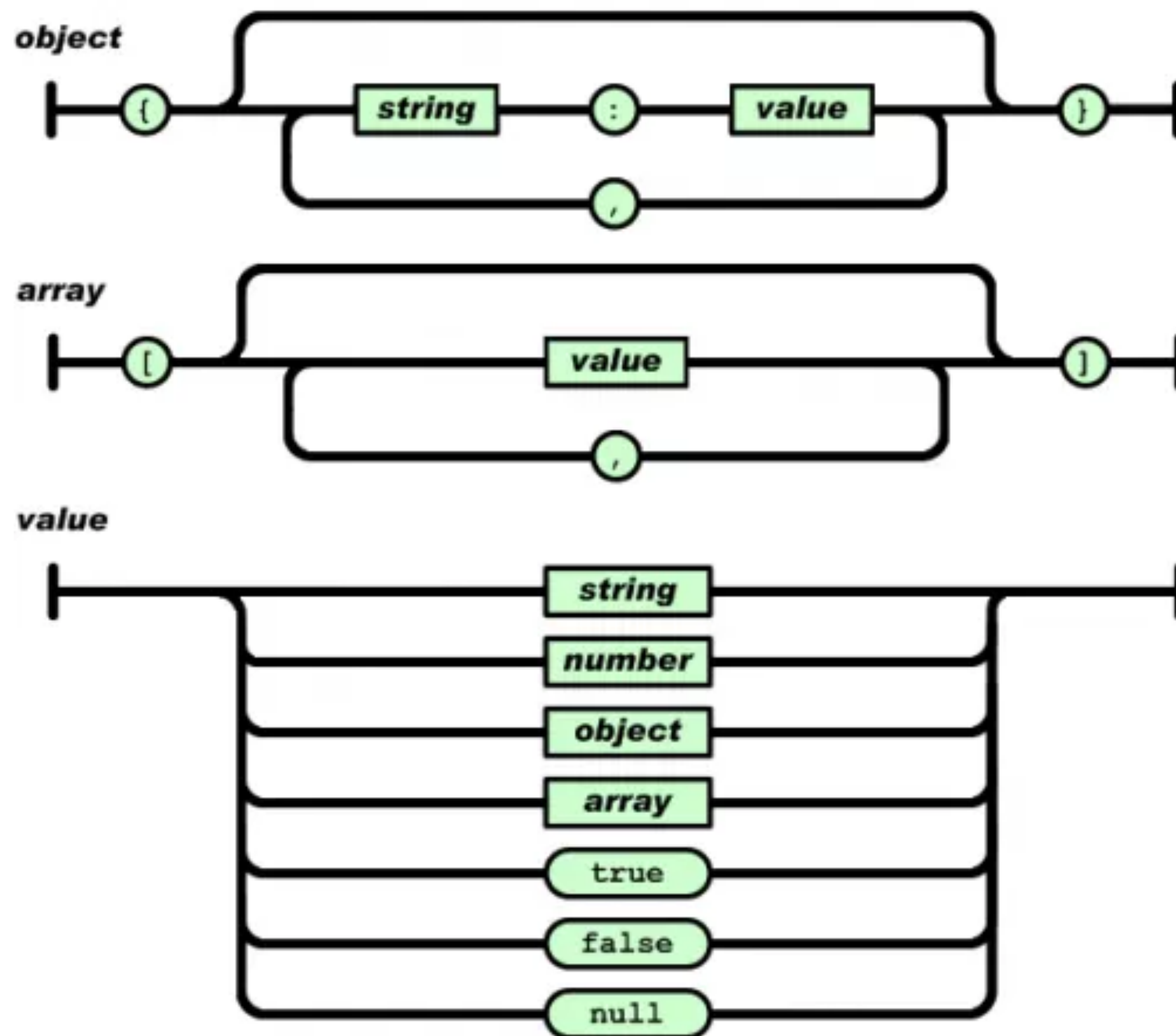- **JSON**

- JWT (JSON Web Tokens)

# JSON

- JavaScript Object Notation

- Lightweight data-interchange format

- Self-describing

- Human-reading

- **Is a Protocol**

JSON Schema

Auth0

# JSON Example

```json
{
    "Rail Booking": {
        "reservation": {
            "ref_no": 1234567,
            "time_stamp": "2016-06-24T14:26:59.125",
            "confirmed": true
        },
        "train": {
            "date": "07/04/2016",
            "time": "09:30",
            "from": "New York",
            "to": "Chicago",
            "seat": "57B"
        },
        "passenger": {
            "name": "John Smith"
        },
        "price": 1234.25,
        "comments": ["Lunch & dinner incl.", "\"Have a nice day!\""]
    }
}
```

# What Play Use?

- Jackson Library

- Helper Utils play.libs.Json

# Returning a Map

# JSONController.java

```java
package controllers;

import play.libs.Json;
import play.mvc.Controller;
import play.mvc.Result;

import java.util.HashMap;
import java.util.Map;

public class JSONController extends Controller {

    public Result usingMap(){
        HashMap<String, Object> result = new HashMap<String, Object>(){
            {
                put("name", "CodeMash 2.0.1.8");
                put("track", "Web/Front-End");
                put("talk", "Restful Services with Play Framework");
                put("schedule", "Thursday 11, 8:00 to 9:00");
            }
        };
        return ok(Json.toJson(result));
    }

}
```

# Returning a Object

# Event.java

```java
package com.auth0.objects;

public class Event {

    public String name;
    public String track;
    public String talk;
    public String schedule;

    public Event(String name, String track, String talk, String schedule){
        this.name = event;
        this.track = track;
        this.talk = talk;
        this.schedule = schedule;
    }

}
```

# JSONController.java

```java
import com.auth0.objects.Event;


public Result usingObject(){
    Event event = new Event("CodeMash 2.0.1.8", "Web/Front-End",
        "Restful Services with Play Framework",
        "Thursday 11, 8:00 to 9:00");


    return ok(Json.toJson(event));
}
```

# Catching a Object

# JSONController.java

```java
public Result catchObject(){
        JsonNode jsonNode = request().body().asJson();
        Event event = Json.fromJson(jsonNode, Event.class);

        return ok(Json.toJson(event));
    }
```

# Agenda

- Play Framework

- Web Services Restful

- JSON

- **JWT (JSON Web Tokens)**

Is an open standard (RFC 7519) that defines a compact and self-contained way for securely transmitting information between parties as a JSON object.

eyJhbGciOiJIUzl1NilsInR5cCl6lkpXVCJ9.eyJzdWIiOilxMjM0NTY3ODkwIiwibmFtZSI6IkpvaG4gRG9lIiwiYWRtaW4iOnRydWV9.TJVA95OrM7E2cBab30RMHrHDcEfxjoYZgeFONFh7HgQ

**Header**

**Claims**

eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.eyJleH
AiOjE0MTY0NzE5MzQsInVzZXJfbmFtZSI6InVzZXIiL
CJzY29wZSI6WyJyZWFkIiwid3JpdGUiXSwiYXV0aG9y
aXRpZXMiOlsiUk9MRV9BRE1JTiIsIlJPTEVfVVNFUiJ
dLCJqdGkiOiI5YmM5MmE0NC0wYjFhLTRjNWUtYmU3MC
1kYTUyMDc1YjlhODQiLCJjbGllbnRfaWQiOiJteS1jb
GllbnQtd2l0aC1zZWNyZXQifQ.AZCTD_fiCcnrQR5X7
rJBQ5rO-2Qedc5_3qJJf-ZCvVY

**Signature**

Auth0

eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.eyJzdWIiOiIxMjM0NTY3ODkwIiwibmFtZSI6IkpvaG4gRG9IiwiYWRtaW4iOnRydWV9.TJVA95OrM7E2cBab30RMHrHDcEfxjoYZgeFONFh7HgQ

# Header

```
{
  "alg": "HS256",
  "typ": "JWT"
}
```

Auth0

# Claims

```
{
    "sub": "1234567890",
    "name": "John Doe",
    "admin": true
}
```

AuthO

# Registered Claims

| | |
|---|---|
| iss | The issuer of the token |
| sub | The subject of the token |
| aud | The audience of the token |
| exp | The expiration in NumericDate value |
| nbf | sbt configuration files |
| iat | The time the JWT was issued |
| jti | Unique identifier for the JWT |

Auth0

# Registered Claims

| | |
|---|---|
| iss | The issuer of the token |
| sub | The subject of the token |
| aud | The audience of the token |
| exp | The expiration in NumericDate value |
| nbf | sbt configuration files |
| iat | The time the JWT was issued |
| jti | Unique identifier for the JWT |

Auth0

# Registered Claims

| | |
|---|---|
| iss | The issuer of the token |
| sub | The subject of the token |
| aud | The audience of the token |
| exp | The expiration in NumericDate value |
| nbf | sbt configuration files |
| iat | The time the JWT was issued |
| jti | Unique identifier for the JWT |

Auth0

# JSON Web Signature

eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.eyJzdWIiOiIxMjM0NTY3ODkwIiwibmFtZSI6IkpvaG4gRG9IiwiYWRtaW4iOnRydWV9.TJVA95OrM7E2cBab30RMHrHDcEfxjoYZgeFONFh7HgQ

eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.eyJzdWIiOiIxMjM0NTY3ODkwIiwibmFtZSI6IkpvaG4gRG9lIiwiYWRtaW4iOnRydWV9.TJVA95OrM7E2cBab30RMHrHDcEfxjoYZgeFONFh7HgQ

# Signature Algorithms

| JWS | Algorithm | Description |
| --- | --- | --- |
| HS256 | HMAC256 | HMAC with SHA-256 |
| HS384 | HMAC384 | HMAC with SHA-384 |
| HS512 | HMAC512 | HMAC with SHA-512 |
| RS256 | RSA256 | RSASSA-PKCS1-v1_5 with SHA-256 |
| RS384 | RSA384 | RSASSA-PKCS1-v1_5 with SHA-384 |
| RS512 | RSA512 | RSASSA-PKCS1-v1_5 with SHA-512 |
| ES256 | ECDSA256 | ECDSA with curve P-256 and SHA-256 |
| ES384 | ECDSA384 | ECDSA with curve P-384 and SHA-384 |
| ES512 | ECDSA512 | ECDSA with curve P-521 and SHA-512 |

Auth0

# What problem does it solve?

- Authentication

- Authorization

- Federated Identity

- Information Exchange

- Client-side sessions ("stateless" sessions)

- Client-side secrets

# What problem does it solve?

- Authentication

- Authorization

- Federated Identity

- Information Exchange

- Client-side sessions ("stateless" sessions)

- Client-side secrets

Client

Server

1. POST /users/login with username and password

2. Creates a JWT with a secret

3. Returns the JWT to the Browser

4. Sends the JWT on the Authorization Header

5. Check JWT signature. Get user information from the JWT

6. Sends response to the client

Auth0 (June 2017) https://cdn.auth0.com/content/jwt/jwt-diagram.png

Auth0

Auth0 (June 2017) https://cdn.auth0.com/content/jwt/jwt-diagram.png

Client

Server

1. POST /users/login with username and password

2. Creates a JWT with a secret

3. Returns the JWT to the Browser

**Authorization Process**

4. Sends the JWT on the Authorization Header

5. Check JWT signature. Get user information from the JWT

6. Sends response to the client

Auth0 (June 2017) https://cdn.auth0.com/content/jwt/jwt-diagram.png

Auth0

# What problem does it solve?

- Authentication

- Authorization

- Federated Identity

- Information Exchange

- Client-side sessions ("stateless" sessions)

- Client-side secrets

```scala
name := """CodeMash18"""
organization := "com.auth0"

version := "1.0-SNAPSHOT"

lazy val root = (project in file(".")).enablePlugins(CodeMash18)

scalaVersion := "2.12.2"

libraryDependencies += guice
libraryDependencies += "javax.xml.bind" % "jaxb-api" % "2.3.0"
libraryDependencies += "io.jsonwebtoken" % "jjwt" % "0.9.0"
```

# Generate a JWT

# JWTUtils.java

```java
public static String generateJWT(final Object object){
        String result = "";

        try {
            result = Jwts.builder()
                        .setClaims(new HashMap<String, Object>(){{
                            put("json", Json.toJson(object));
                        }})
                        .signWith(SignatureAlgorithm.HS256, "secre")
                        .compact();
        } catch (ArrayIndexOutOfBoundsException e){
            e.printStackTrace();
        }

        return result;
    }
```

# JWTController.java

```java
public Result returnToken(){
        Event event = new Event("CodeMash 2.0.1.8", "Web/Front-End",
        "Restful Services with Play Framework",
        "Thursday 11, 8:00 to 9:00");


        return ok(JWTUtils.generateJWT(event));
    }
```

# Validating a JWT

# JWTUtils.java

```java
public static boolean validateJWT(String jwt){
        boolean result = false;

        try {
            Claims claims = Jwts.parser()
                    .setSigningKey(DatatypeConverter.parseBase64Binary("secre"))
                    .parseClaimsJws(jwt).getBody();
            result = true;
        } catch (SignatureException e){
            e.printStackTrace();
        } catch (MalformedJwtException e){
            e.printStackTrace();
        } catch (ArrayIndexOutOfBoundsException e){
            e.printStackTrace();
        }

        return result;
    }
```
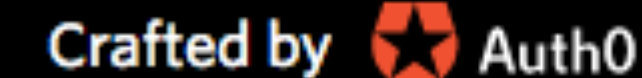
# JWTController.java

```java
public Result validateToken(){
    String token = request().body().asText();

    return ok("Is a valid token: " + JWTUtils.validateJWT(token));
}
```

# Debugger

ALGORITHM   HS256

## Encoded  PASTE A TOKEN HERE

eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.eyJzdW
IiOiIxMjM0NTY3ODkwIiwibmFtZSI6IkpvaG4gRG9lI
iwiYWRtaW4iOnRydWV9.TJVA95OrM7E2cBab30RMHrH
DcEfxjoYZgeFONFh7HgQ

## Decoded  EDIT THE PAYLOAD AND SECRET (ONLY HS256 SUPPORTED)

HEADER: ALGORITHM & TOKEN TYPE

```
{
  "alg": "HS256",
  "typ": "JWT"
}
```

PAYLOAD: DATA

```
{
  "sub": "1234567890",
```

# Parish Announcements

# Rate the Talks

https://github.com/itrjwyss/Journey18

https://www.facebook.com/itrjwyss

@itrjwyss

# Welcome and Enjoy