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Finatra: Fast, Testable, Scala Services

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FINAGLE

"Finagle is an extensible remote procedure call system for the JVM, used to construct high-concurrency servers."

FINAGLE

box
STRAVA
DICE
rdio
SOUNDCLOUD
foursquare
PAGERDUTY
nest
NCBI
Sabre
SPROUT FINANCIAL
EA
The New York Times

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SINATRA

"Sinatra is a DSL for quickly creating web applications in Ruby with minimal effort."

FINATRA

A lightweight framework for building feature testable applications on Twitter's open source stack.

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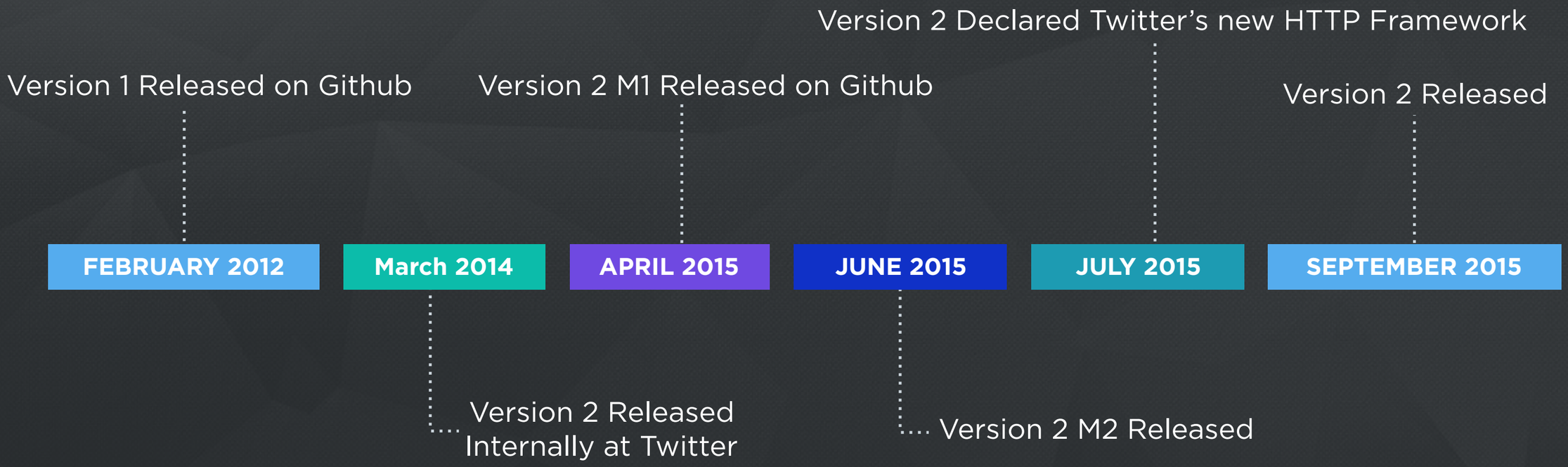
Finatra Project History



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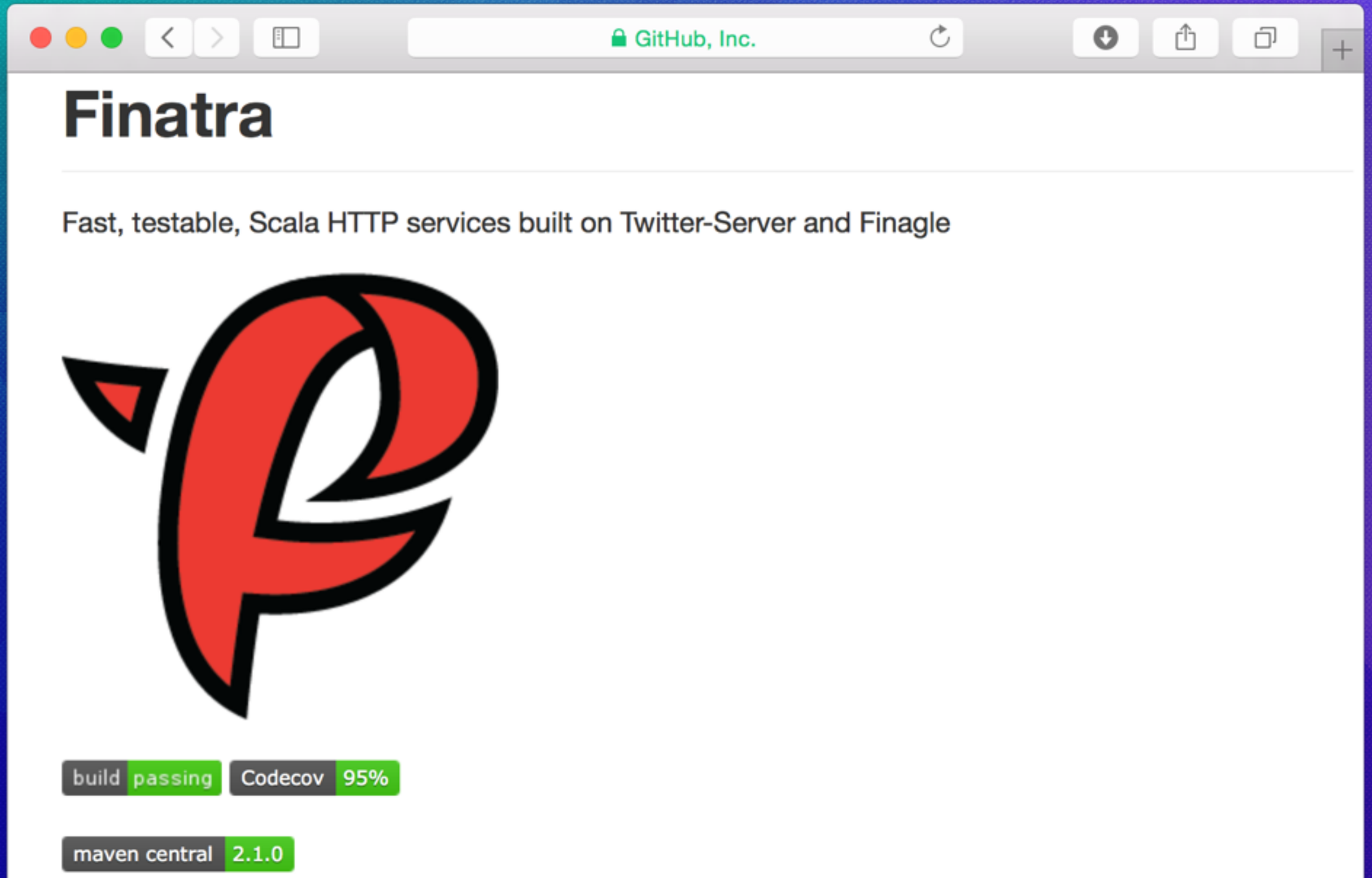
Open Source - Apache 2 License



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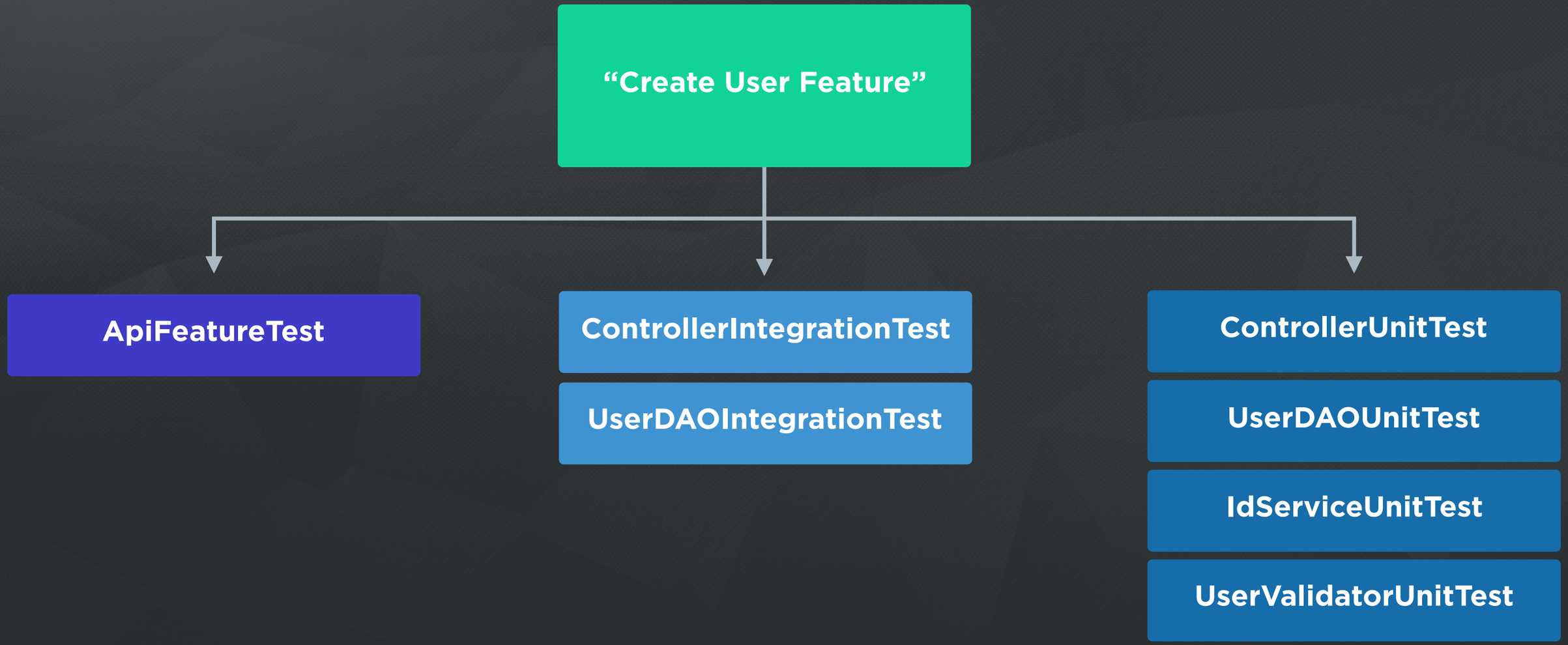
Feature Testing

FEATURE TEST

A hybrid of an integration and component test enabling test-doubles and black-box/white-box assertions.

Feature Tests



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“In our test philosophy... a feature test is something we must have... It’s a test that verifies that something we want to build works, and works as expected... If you don’t have a feature test, you might not even have a feature.”

–Viktor Klang

Akka Tech Lead | Typesafe

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Feature Test

```
class PopularApiFeatureTest extends FeatureTest {
  val server =
    new EmbeddedHttpServer(new PopularApiServer)

  "Handle POST request" in {
    server.httpPost(
      path = "/api/popular",
      postBody = """{ "start": "2015-09-01", ... }""",
      andExpect = Status.Ok,
      withJsonBody = """{
        "start" : "2015-09-01T00:00:00Z",
        "end" : "2015-09-01T00:00:00Z",
        "tweets" : [ ... ]
      }""")
}
```

Qualities Of A Good Test

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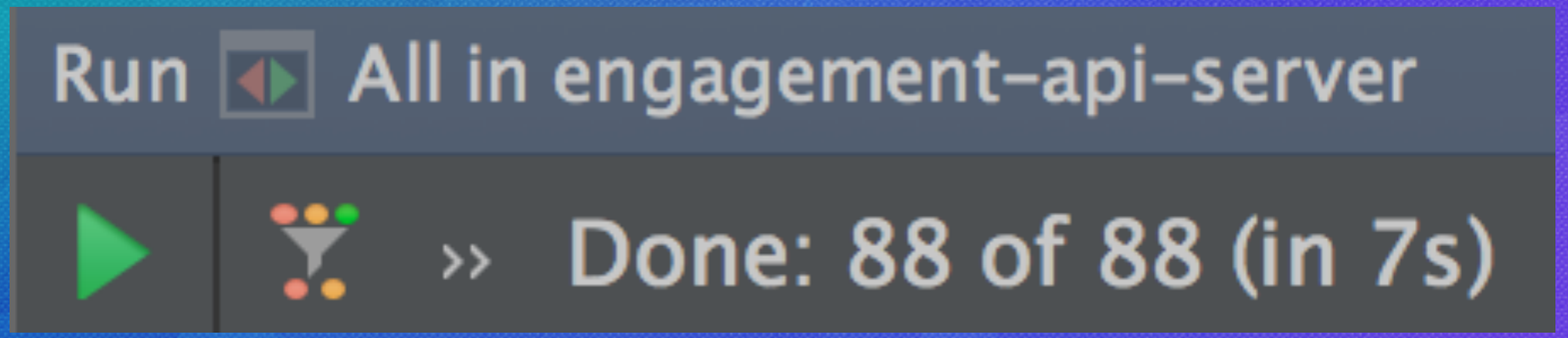
Real World Feature Tests



SCoverage generated at Thu Sep 24 20:40:05 PDT 2015

Lines of code:	1702	Files:	36
Statement coverage:	99.61 %		

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Dependency Injection Frameworks

BOILERPLATE

The sections of code that have to be included in many places with little or no alteration

Dependency Injection Frameworks

Eliminate Boilerplate

Consistent Configuration

Facilitate Testing

“The main advantage that [Dependency Injection] brings is not realised until you start writing tests... once you move onto integration testing, this is where Play can start to realise the advantages of DI.”

–James Roper (March 2015)

Play Framework Tech Lead | Typesafe

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JSR-330

Google

GUICE

"Lightweight dependency injection framework for Java... brought to you by Google."

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JSR-330 Dependency Injection

```
@Singleton
class PopularApiController @Inject()(
  userRepository: UserRepository,
  searchService: SearchService,
  engagementService: EngagementService)
  extends Controller {

  post("/api/popular") { request: PopularPostRequest =>
    ...
  }
}
```

Server Construction

```
class PopularApiServer extends HttpServer {
  override val modules = Seq(
    UserRepositoryModule,
    SearchServiceModule,
    EngagementServiceModule)

  override def configureHttp(router: HttpRouter) {
    router
      .filter[LoggingMDCFilter[Request, Response]]
      .filter[TraceIdMDCFilter[Request, Response]]
      .add[PopularApiController]
  }
}
```

Feature Testing

```
class PopularApiFeatureTest extends FeatureTest with Mockito {
  val server = new EmbeddedHttpServer(new PopularApiServer)

  // Bind Mocks
  @Bind val databaseClient = mock[DatabaseClient]
  @Bind @SearchClient val searchClient = mock[HttpClient]
  @Bind @EngagementsClient val engagementsClient = mock[HttpClient]

  "Handle POST request" in {
    // Setup Mocks
    databaseClient.executeSql(...) returns Future(SqlResponse(...)
    searchClient.execute(...) returns Future(SearchResponse(...))
    engagementsClient.execute(...) returns Future(EngagementResponse(...))

    server.httpPost(...)
  }
}
```

Feature Testing

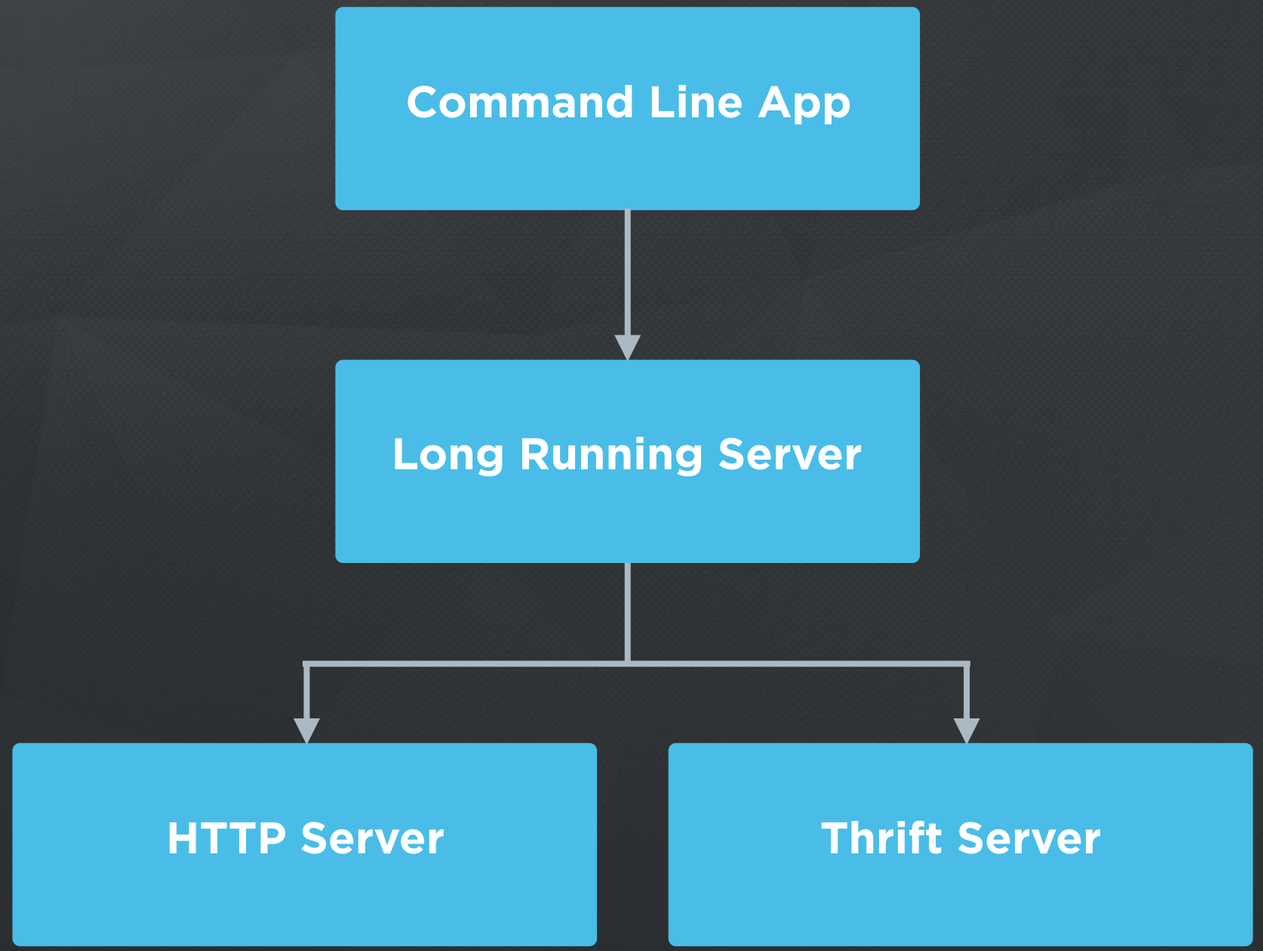
```
class
  val

  // Bind Mocks
  @Bind val databaseClient = mock[DatabaseClient]
  @Bind @SearchClient val searchClient = mock[HttpClient]
  @Bind @EngagementsClient val engagementsClient = mock[HttpClient]

  "Handle POST request"
    // Setup Mocks




  }
}
```

Feature Testing

```
class
  val

  // Bind Mocks
  @Bind
  @Bind @SearchClient
  @Bind @EngagementsClient

  "Handle POST request"
    // Setup Mocks
    databaseClient.executeSql(...) returns Future(SqlResponse(...)
    searchClient.execute(...) returns Future(SearchResponse(...))
    engagementsClient.execute(...) returns Future(EngagementResponse(...))


  }
}
```

Consistency

Consistency



Consistency: Thrift Server

```
class PopularApiThriftServer extends ThriftServer {
  override val modules = Seq(
    UserRepositoryModule,
    SearchServiceModule,
    EngagementServiceModule)

  override def configureThrift(router: ThriftRouter) {
    router
      .filter[LoggingMDCFilter[ThriftRequest, ThriftResponse]]
      .filter[TraceIdMDCFilter[ThriftRequest, ThriftResponse]]
      .add[PopularApiThriftService]
  }
}
```

Consistency: Http And Thrift Server

```
class CombinedServer extends HttpServer with ThriftServer {
  override val modules = Seq(...)

  override def configureHttp(router: HttpRouter) {
    router
      .filter[LoggingMDCFilter[Request, Response]]
      .filter[TraceIdMDCFilter[Request, Response]]
      .add[PopularApiController]
  }

  override def configureThrift(router: ThriftRouter) {
    router
      .filter[LoggingMDCFilter[ThriftRequest, ThriftResponse]]
      .filter[TraceIdMDCFilter[ThriftRequest, ThriftResponse]]
      .add[PopularApiThriftService]
  }
}
```

Consistency: Thrift Feature Testing

```
class PopularApiThriftFeatureTest extends FeatureTest {
  val server =
    new EmbeddedThriftServer(new PopularApiThriftServer)

  val client =
    server.thriftClient[PopularApiService.FutureIface]

  "Handle popularTweets" in {
    client.popularTweets(...) should equal(...)
  }
}
```

Consistency: Java Http Server

```
public class PopularApiServer extends HttpServer {

    @Override
    public Collection<Module> javaModules() {
        return ImmutableList.<Module>of(
            new UserRepositoryModule(),
            new SearchServiceModule(),
            new EngagementServiceModule());
    }

    @Override
    public void configureHttp(HttpRouter httpRouter) {
        httpRouter
            .filter(CommonFilters.class)
            .add(PopularApiController.class);
```

Consistency: Http Controllers

```
@Singleton
class ScalaUserController @Inject()(
  userService: UserService)
  extends Controller {

  get(“/users/:id”) { request: Request =>
    userService.lookup(request.getLongParam("id"))
  }
}

@Singleton
public class JavaUserController extends JavaController {
  @Inject UserService userService;

  @Override protected void configureRoutes() {
    get(“/users/:id”, request ->
      userService.lookup(request.getLongParam("id")));
  }
}
```

An End to End Example

CREATING A POPULAR TWEETS API

Popular API Requirements

POST Request
Path: /api/popular
Header: api_key
JSON Body:

```
{
  "start": "2015-09-01",
  "end": "2015-09-30"
}
```

HTTP 200 Response
JSON Body:

```
{
  "start": "2015-09-01T00:00:00Z",
  "end": "2015-09-30T00:00:00Z",
  "tweets": [
    {
      "id": "123",
      "message": "hi",
      "counts": {
        "impressions": "20",
        "engagements": "10"
      }
    }
  ]
}
```

Feature Test

```
class PopularApiFeatureTest extends FeatureTest {
  val server = new EmbeddedHttpServer(new HttpServer {})
  “Handle POST request" in {
    server.httpPost(
      path = "/api/popular",
      headers = Map("api_key" -> "secret123"),
      postBody = """{ "start": “2015-09-01", ... }""",
      andExpect = Status.Ok,
      withJsonBody = """
        {
          "start" : "2015-09-01T00:00:00Z",
          "end" : "2015-09-01T00:00:00Z",
          "tweets" : [ ... ]
        }
      “""")
}
```

Test Failure

```
================================================================
HTTP POST /api/popular
[Header]Content-Length -> 204
[Header]Content-Type -> application/json;charset=utf-8
[Header]Host -> 127.0.0.1:60102
[Header]api_key -> secret123
{
  "start": "2015-09-01",
  "end": "2015-09-30"
}

================================================================
RoutingService Request("POST /api/popular“, from /127.0.0.1:60103) not
found in registered routes:
----------------------------------------------------------------
[Status]404 Not Found
[Header]Content-Length -> 0
*EmptyBody*
```

Request Parsing

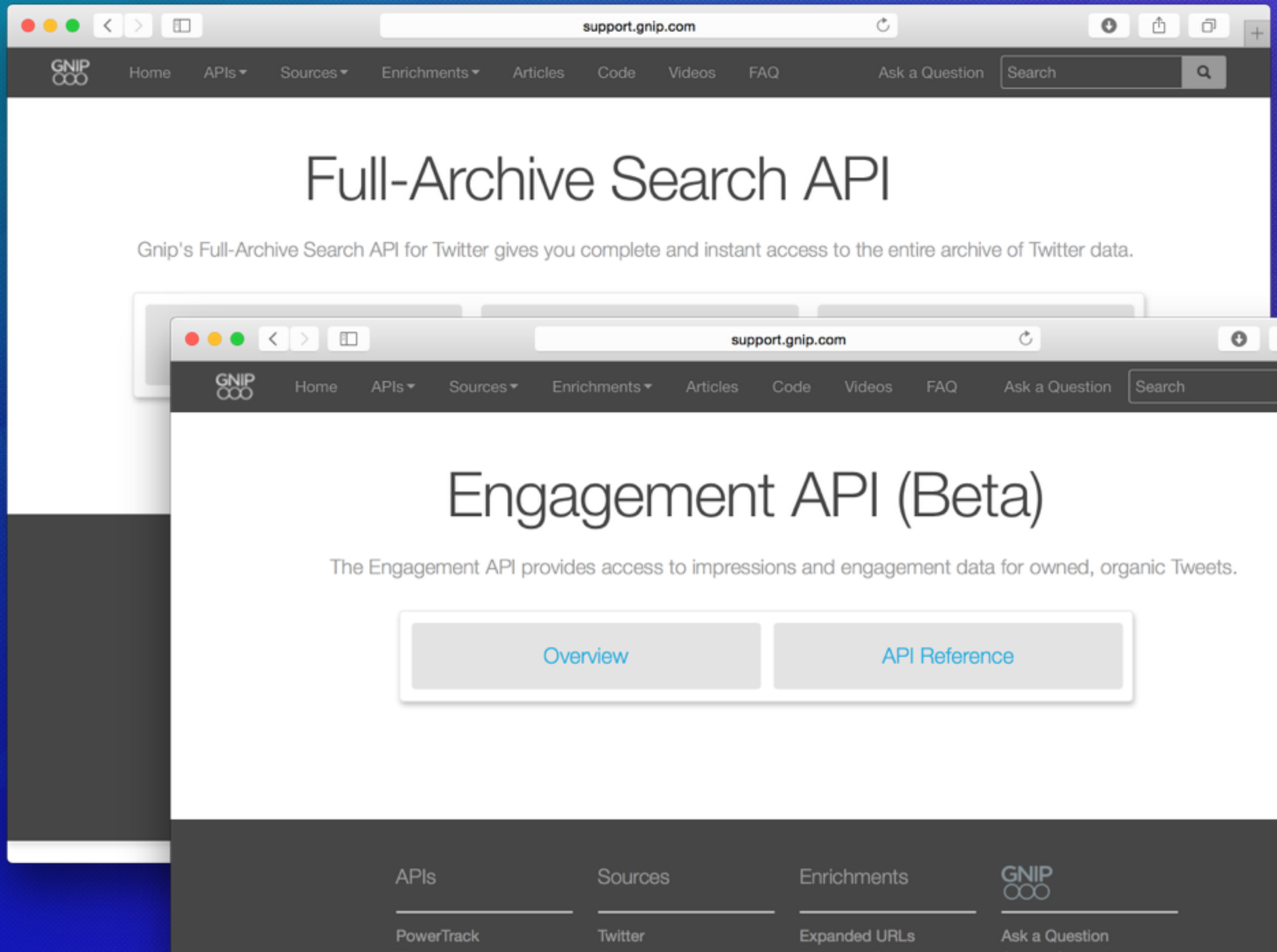
```
{
  "start": "2015-09-01",
  "end": "2015-09-30"
}
```

```
case class PopularPostRequest(
  @PastTime start: DateTime,
  @PastTime end: DateTime,
  @Header @NotEmpty api_key: String)
```

Response Generation

```
{
  "start": "2015-09-01T00:00:00Z",
  "end": "2015-09-30T00:00:00Z",
  "tweets": [
    {
      "id": "123",
      "message": "hi",
      "counts": {
        "impressions": "20",
        "engagements": "10"
      }
    }
  ]
}
```

```
case class ApiResponse(
  start: DateTime,
  end: DateTime,
  tweets: Seq[TweetResponse])

case class TweetResponse(
  id: TweetId,
  message: String,
  counts: Map[EngagementType, Long])
```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Engagement API (Beta)
The Engagement API provides access to impressions and engagement data for owned, organic Tweets.
Overview
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PowerTrack
Sources
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Enrichments
Expanded URLs
GNIP
Ask a Question

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Controller

```
@Singleton
class PopularController @Inject()(
  userRepository: UserRepository,
  searchService: SearchService,
  engagementService: EngagementService)
  extends Controller {

  post("/api/popular") { request: PopularPostRequest =>
    for {
      user <- userRepository.getByApiKey(request.apiKey)
      tweets <- searchService.findTweets(user, request)
      engagements <- engagementService.lookup(user, tweets)
    } yield {
      ApiResponse.create(request, tweets, engagements)
    }
  }
}
```

Server

```
class PopularApiServer extends HttpServer {

  override def modules = Seq(
    UserRepositoryModule,
    SearchServiceModule,
    EngagementServiceModule)

  override def configureHttp(router: HttpRouter) {
    router
      .filter[CommonFilters]
      .add[PopularController]
  }
}
```

Feature Test

```
class PopularApiFeatureTest extends FeatureTest {
  val server = new EmbeddedHttpServer(new PopularApiServer)
  “Handle POST request" in {
    ...
  }
}
```

But When We Run Our Tests...

```
==========================================================
HTTP POST /api/popular
...
==========================================================
GET /search/fullarchive/accounts/popularapi/prod.json
Authorization -> Basic Og==

internal server error
com.twitter.server.NamedResolverNotFoundException:
Resolver not found for scheme 'flag' with name 'data-api'.
```

Feature Test Mocking

```
class PopularApiFeatureTest extends FeatureTest with Mockito {
  val server = new EmbeddedHttpServer(new PopularApiServer)

  // Bind Mocks
  @Bind val databaseClient = mock[DatabaseClient]
  @Bind @SearchClient val searchClient = mock[HttpClient]
  @Bind @EngagementsClient val engagementsClient = mock[HttpClient]

  "Post request" in {
    // Setup Mocks
    databaseClient.executeSql(..) returns Future(SqlResponse(...)
    searchClient.execute(..) returns Future(SearchResponse(...))
    engagementsClient.execute(..) returns Future(EngageResponse(..))

    server.httpPost(...)
  }
}
```

Test Success!

```
================================================================================
HTTP POST /api/popular
...
{
  "start" : "2015-08-01",
  "end" : "2015-08-30"
}
================================================================================
127.0.0.1 - - [15/Sep/2015:22:14:56 +0000] "POST /api/popular HTTP/1.1" 200 149 931 "-"
--------------------------------------------------------------------------------
[Status]  Status(200)
...
{
  "start" : "2015-08-01T00:00:00Z",
  "end" : "2015-08-30T00:00:00Z",
  "tweets" : [
    {
      "id" : "123",
      "message" : "Hi",
      "counts" : {
        "impressions" : "20",
        "engagements" : "10"
      }
    }
  ]
}
```

Let’s Test A Bad Request

```
"Post bad request" in {
  server.httpPost(
    path = "/api/popular",
    postBody = """
      {
        "start": "bad",
        "end": "2020-08-30"
      }
    """,
    andExpect = Status.BadRequest)
}
```

Test Success

```
================================================================
HTTP POST /api/popular
----------------------------------------------------------------
[Status]  Status(400)
{
  "errors" : [
    "api_key: header is required",
    "start: error parsing 'bad' into an ISO 8601 datetime",
    "end: [2020-08-30T00:00:00.000Z] is not in the past"
  ]
}
```

FINATRA

Twitter's Production HTTP Framework

Powerful Feature Testing

Optional JSR-330 Dependency Injection

Designed for Consistency and Modularity

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Thank You

@scosenza

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