Reactive Microservices with Eclipse Vert.x

Burr Sutter

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Reactive Microservices with Eclipse Vert.x

@burrsutter

vertx.io

http://developers.redhat.com

http://bit.ly/reactivemsa

Change History

0.1 - Forked from bit.ly/helloworldmsa

1.0 - JavaOne 2016

2.0 - http://javaday.org.ua/kyiv/

2.1 - Added “Be This Tall” and 2 Gene Kim books slides

2.2 - Changed color scheme/art on several slides

2.3 - reordered slides, added links to mono2micro data book and Reactive Tutorial, updated getting started section

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Developer Evolution :-)

70s	80s	90s	00s	10s	
					
COBOL JCL WFL	C/C++ 4GLs CASE Netware RDBMS SQL Unix	HTTP/HTML CGI GET/POST Cookies Java Servlet EJB Windows NT Solaris/AIX OOP	MVC - Struts DI - Spring ORM - Hibernate XML WS-* JSF AJAX Agile Automated Testing CI SVN Linux	HTML5 Mobile iOS/Android Maven/Gradle Git Node.js MongoDB/Redis Hadoop/Spark *-aaS/Cloud **Reactive** Functional	Mythical Beast

Reactive

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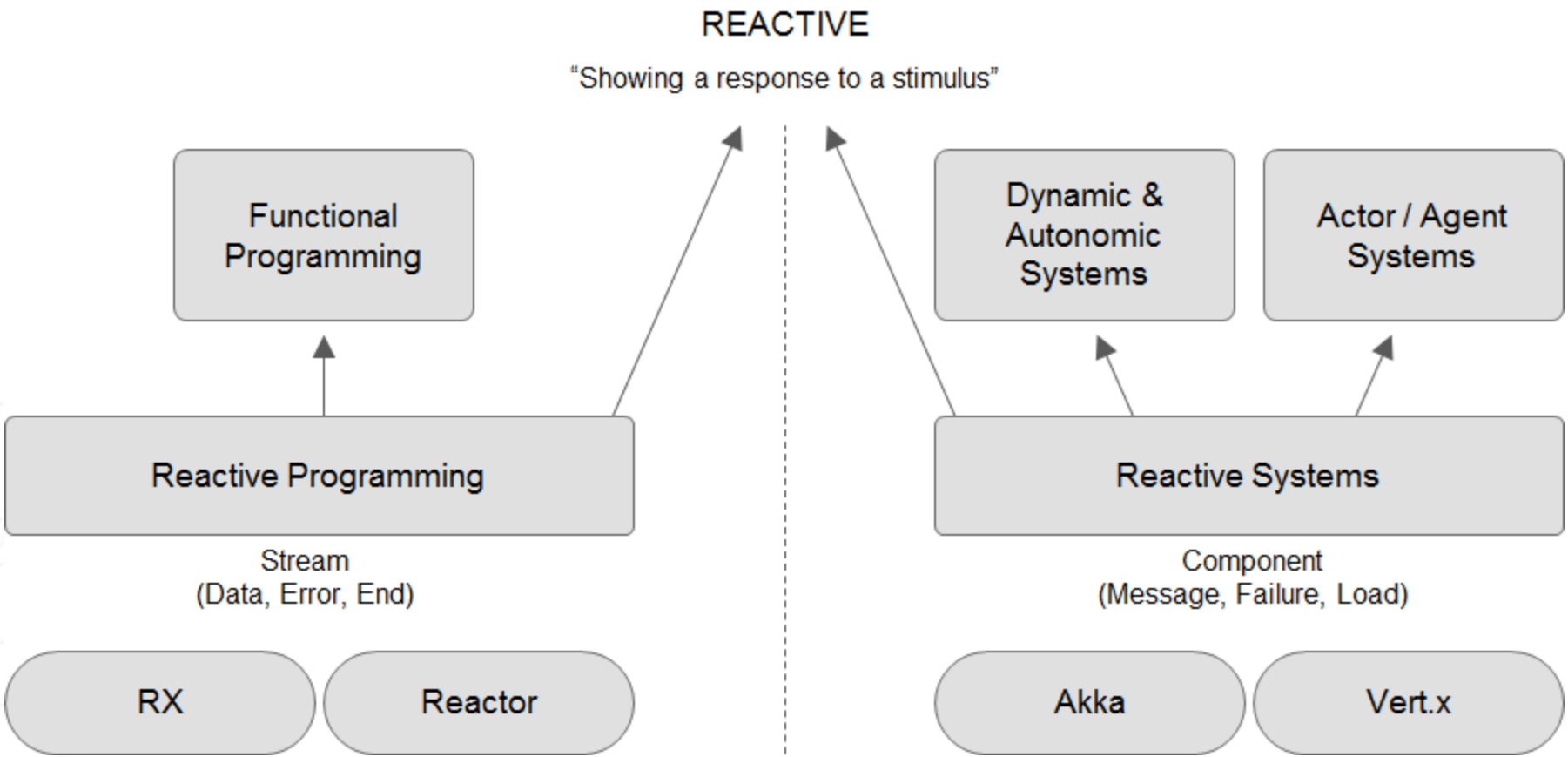

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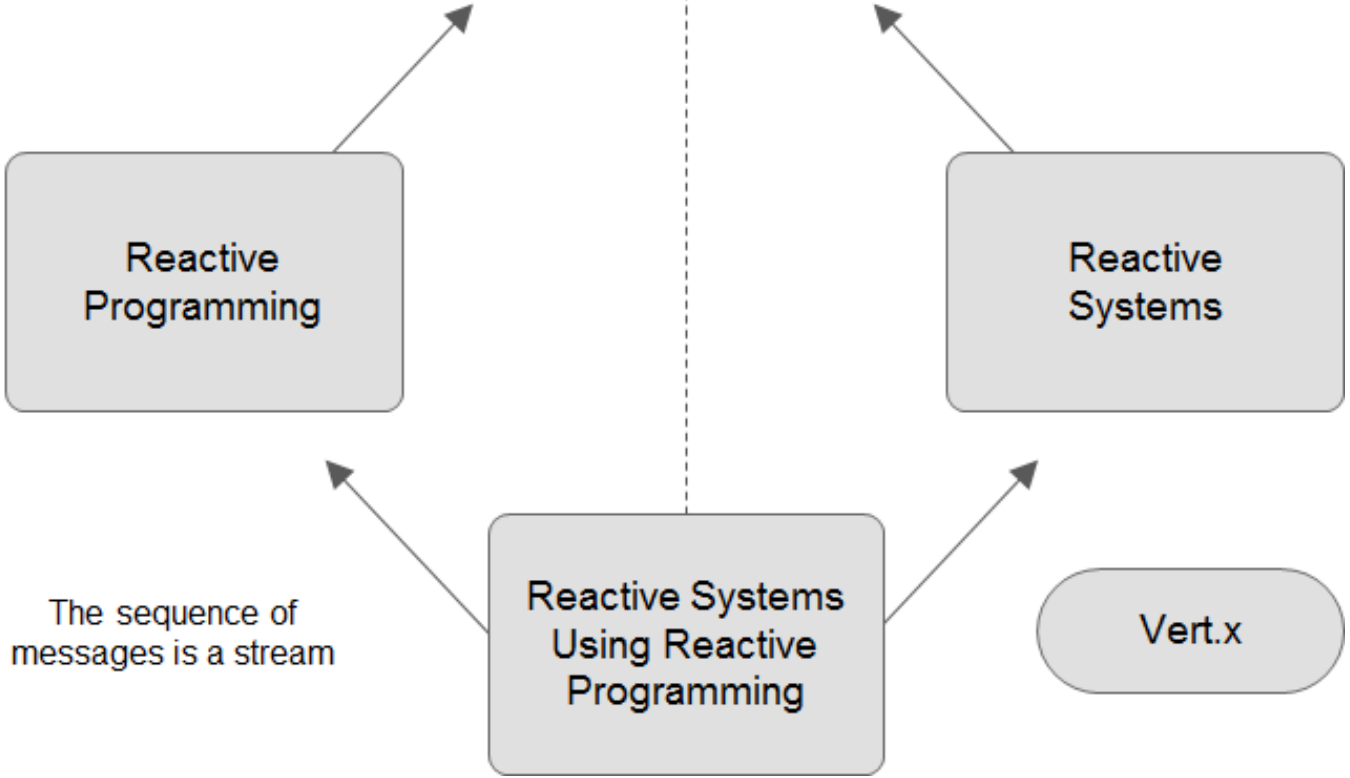
REACTIVE

"Showing a response to a stimulus"



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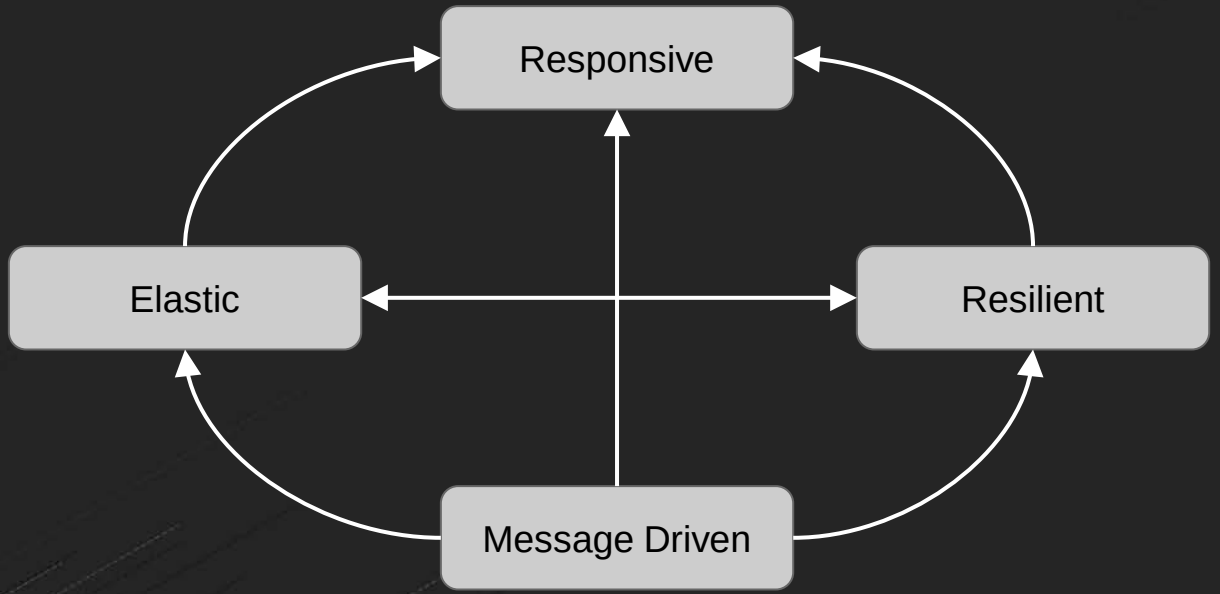
Reactive Manifesto

Reactive Systems (not Programming)



http://www.reactivemanifesto.org/

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Responsive Demo

https://github.com/redhat-helloworld-msa/goodbye

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Microservices

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You Must Be This Tall

1. Self-Service, on-demand, elastic infrastructure as code

   (how many days/weeks to provision a new VM?)

2. Dev vs Ops

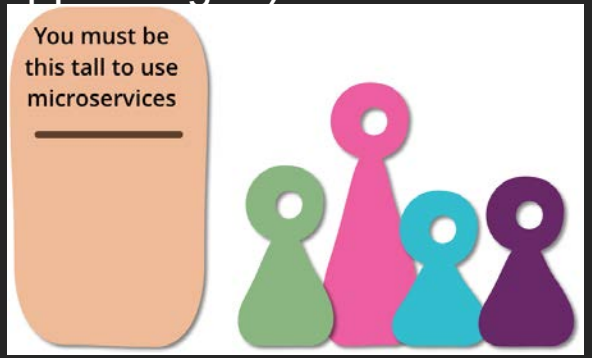
   (who is on the pager for production app outage?)

3. Automation

   (phoenix vs snowflake?)

4. CI & CD

5. Deployment Pipeline



http://martinfowler.com/bliki/MicroservicePrerequisites.html

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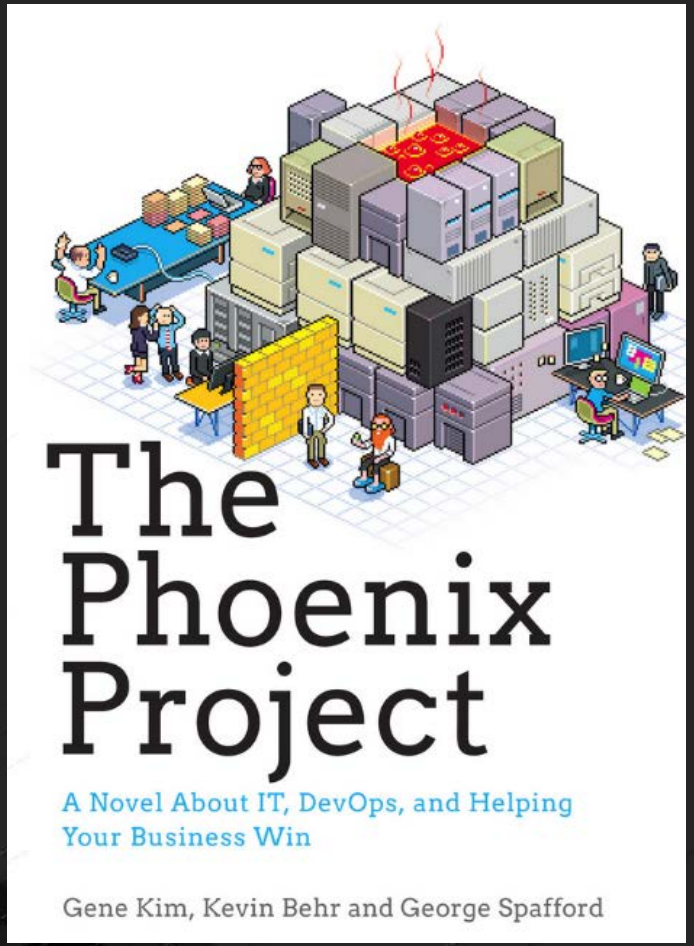

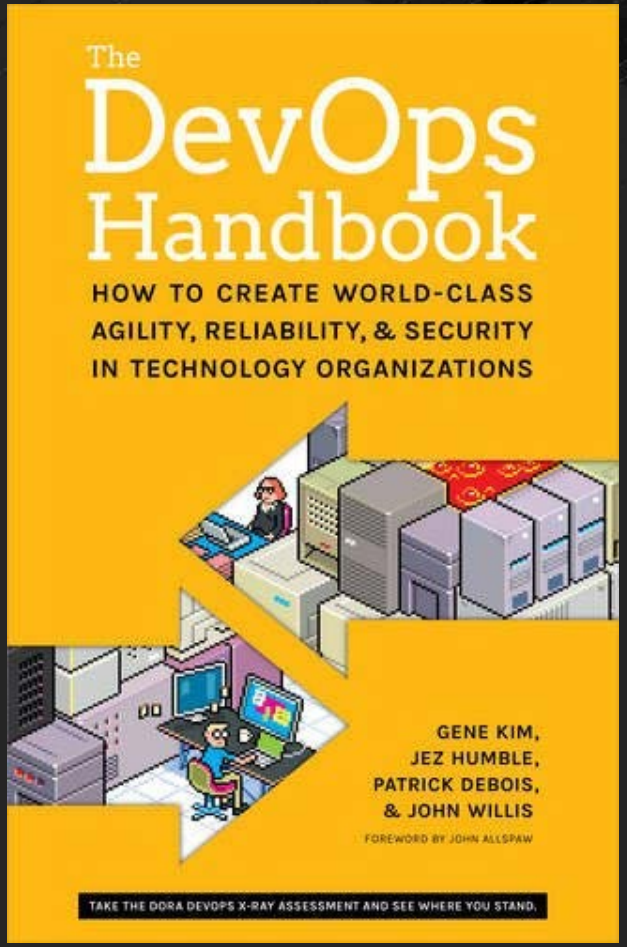

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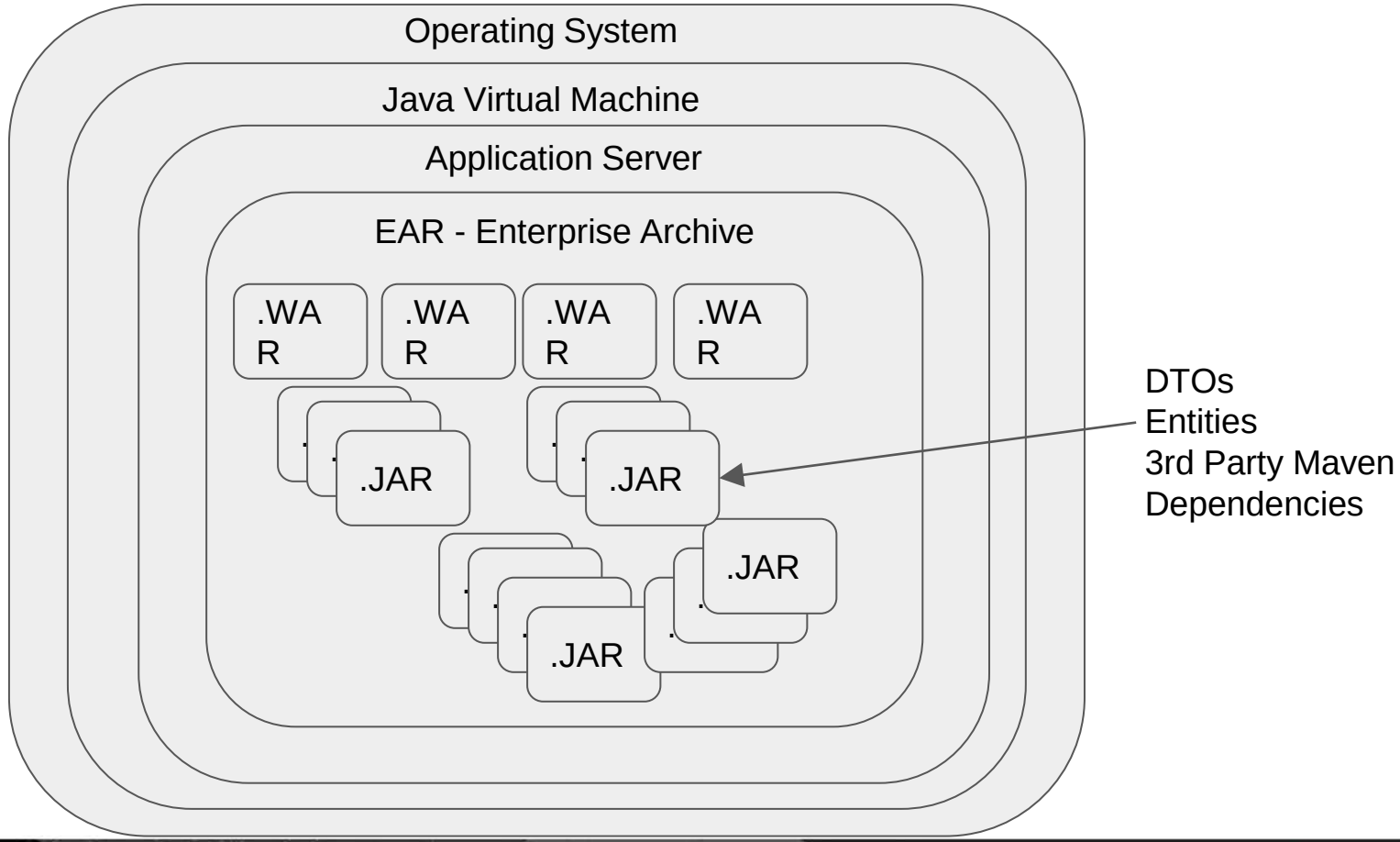

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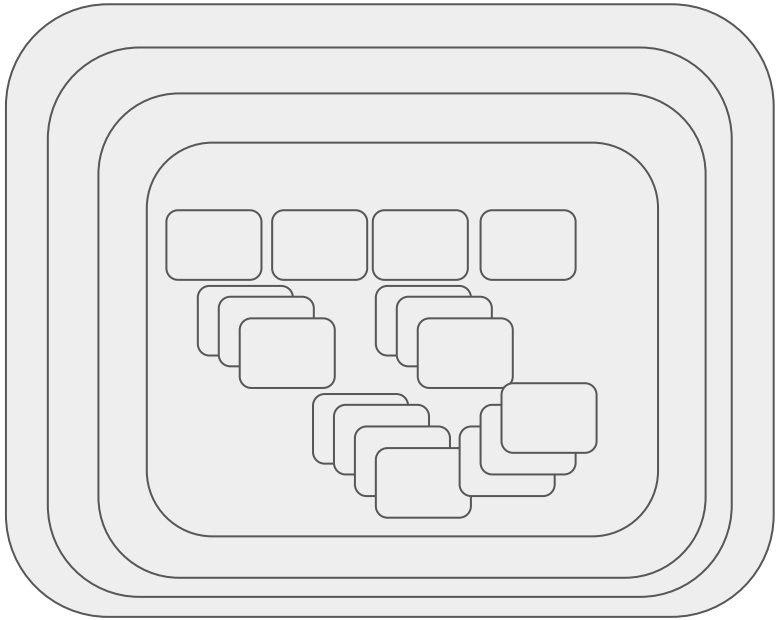

Programmers
(18)

Business
Analysts
(4)

Project
Managers
(2)

Quality
Assurance
(6)

Compliance
(2)

Operators
(6)

DBAs
(3)

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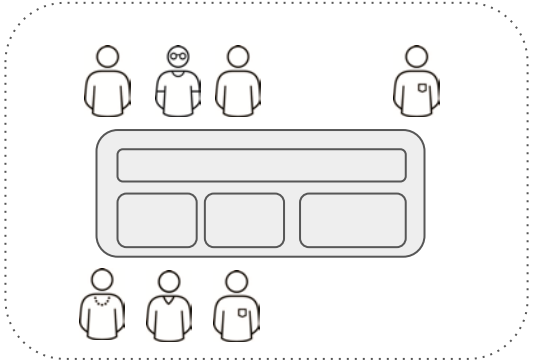
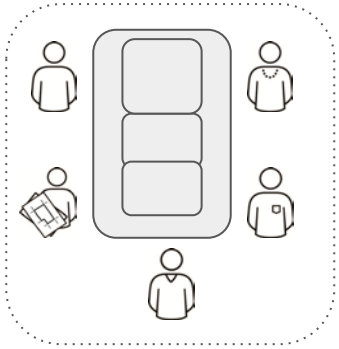
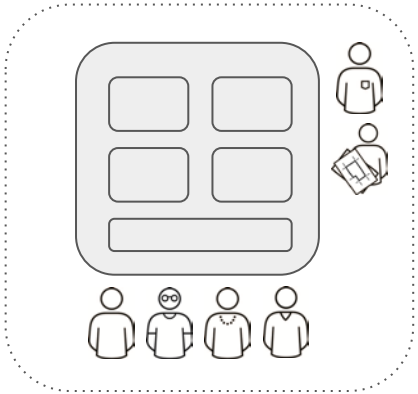
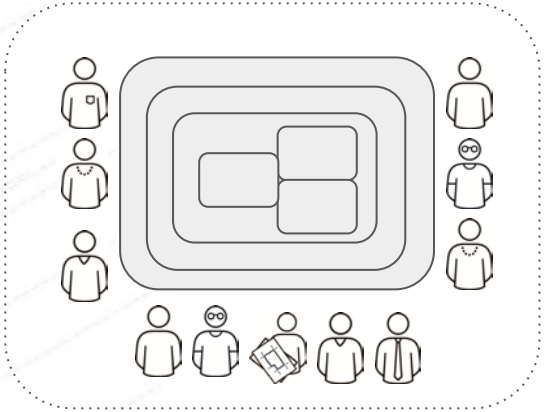
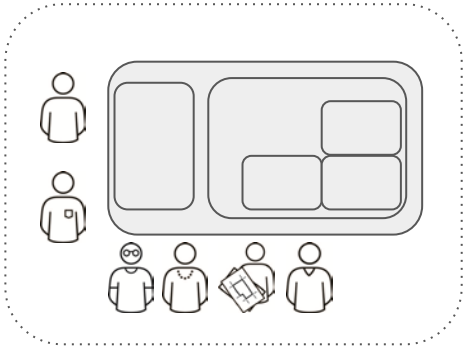


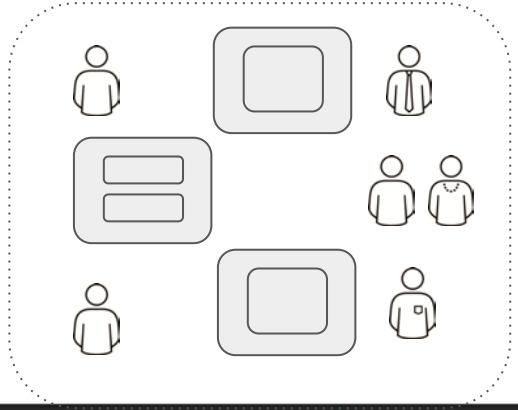




2-Pizza Teams
You Build It, You Own it







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Microservice Principles/Characteristics

1. Deployment **Independence**: updates to an individual microservice have no negative impact to any other component of the system. Optimized for **Replacement**.
2. Organized around **business** capabilities
3. **Products** not Projects
4. **API**-Focused
5. **Smart** endpoints and dumb pipes
6. Decentralized Governance
7. Decentralized Data Management
8. Infrastructure Automation (infrastructure as code)

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Decentralized Data Management

What?

https://developers.redhat.com/promotions/migrating-to-microservice-databases/

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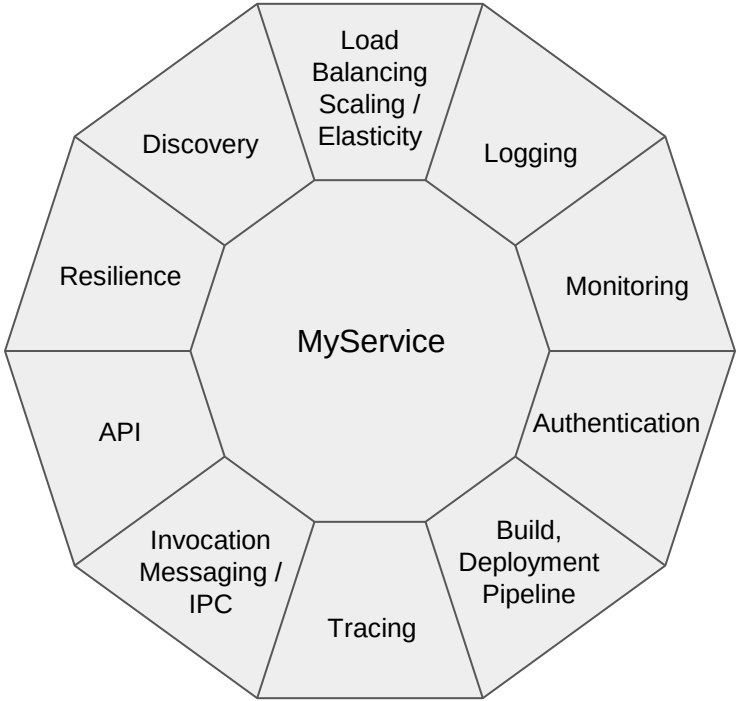
Microservice Concerns



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Microservice Patterns

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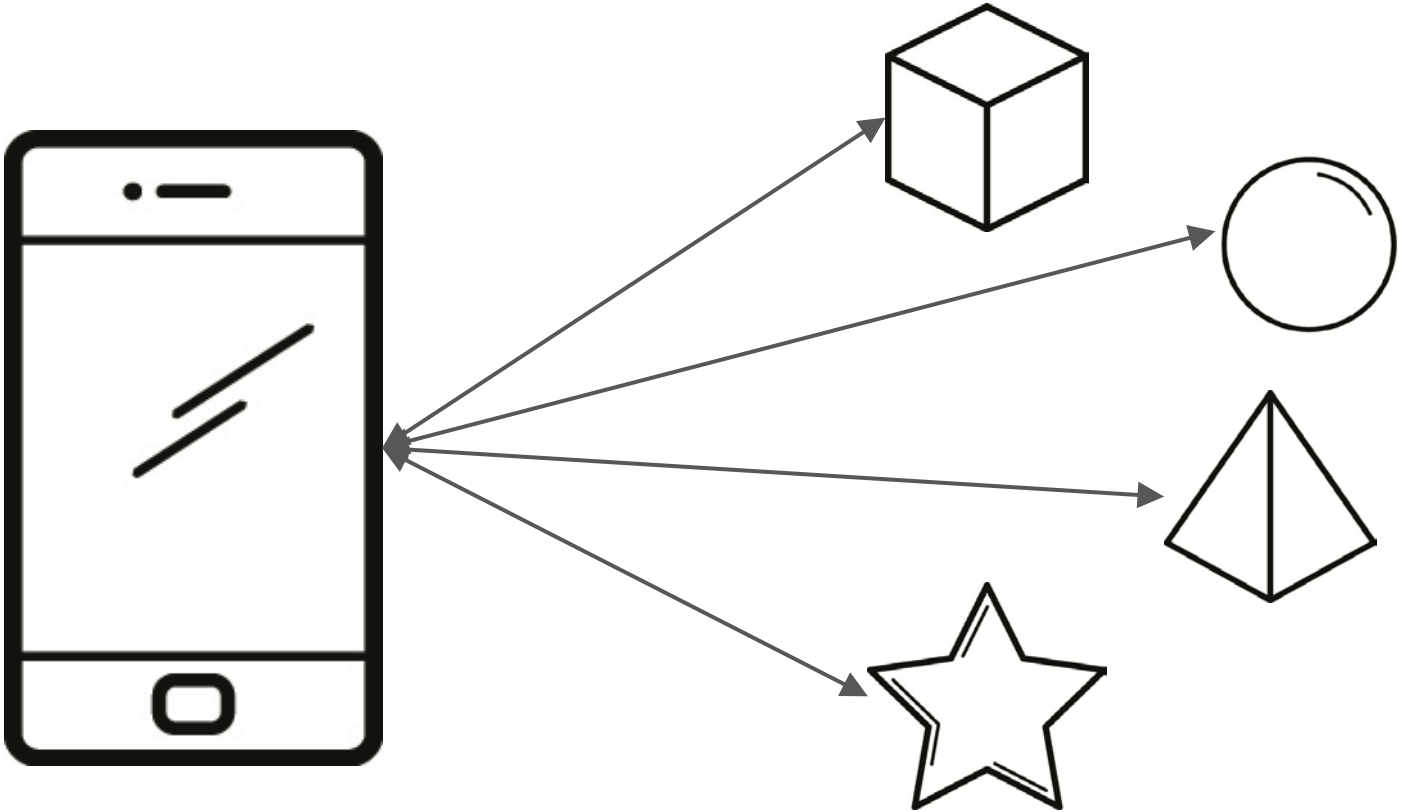
Browser



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Example

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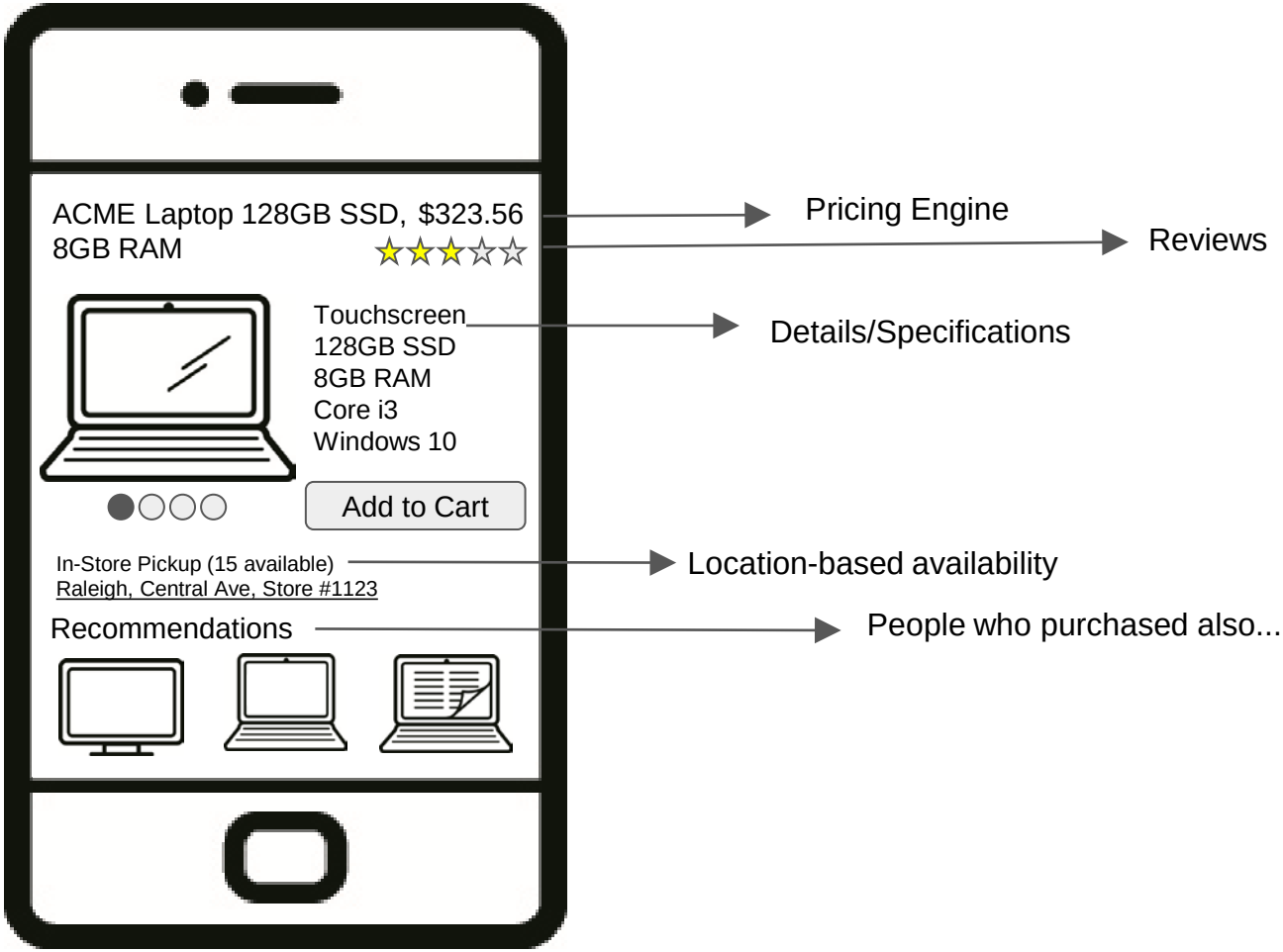
Example



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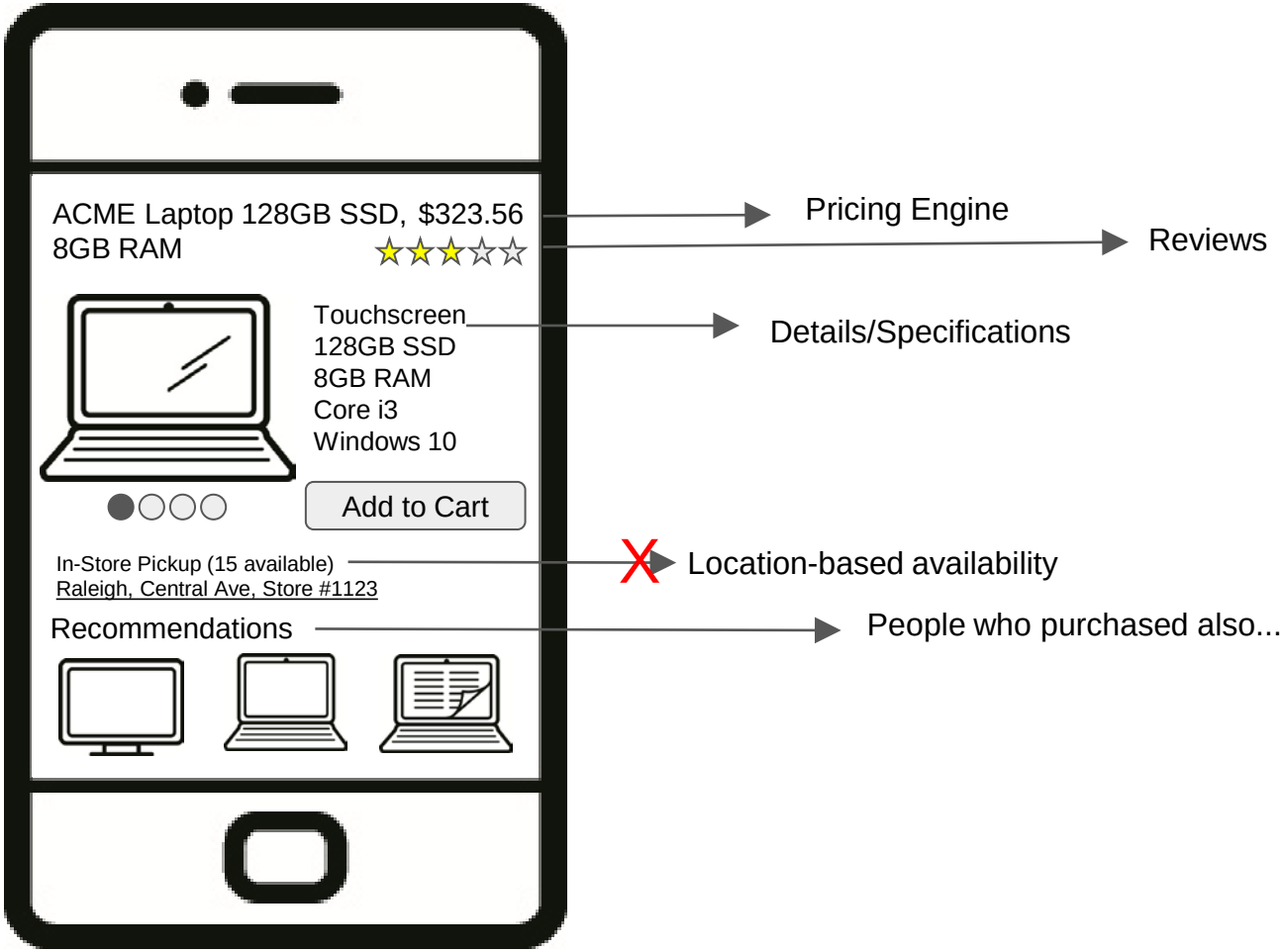
Example (Fail)



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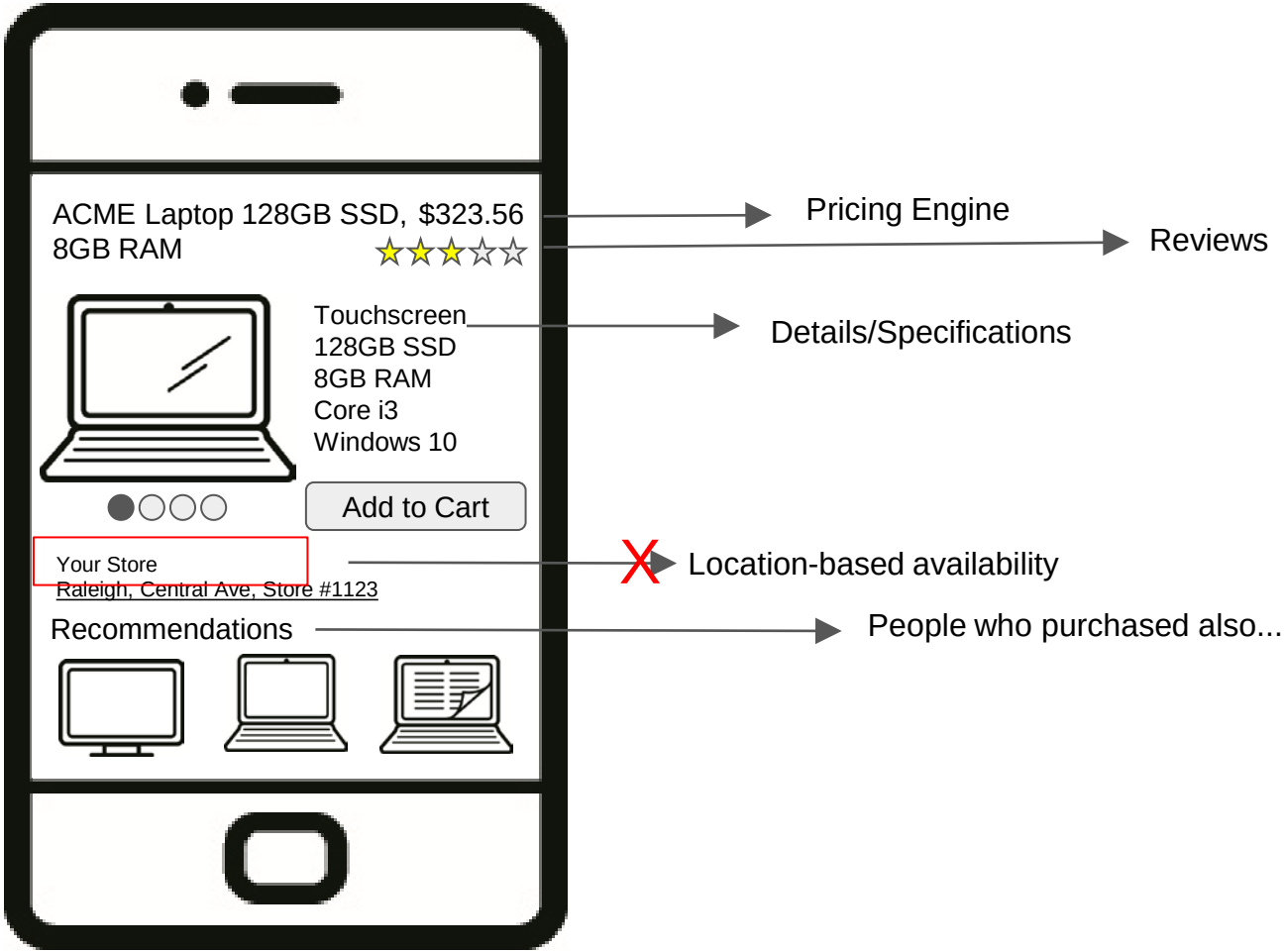
Example (Fallback)



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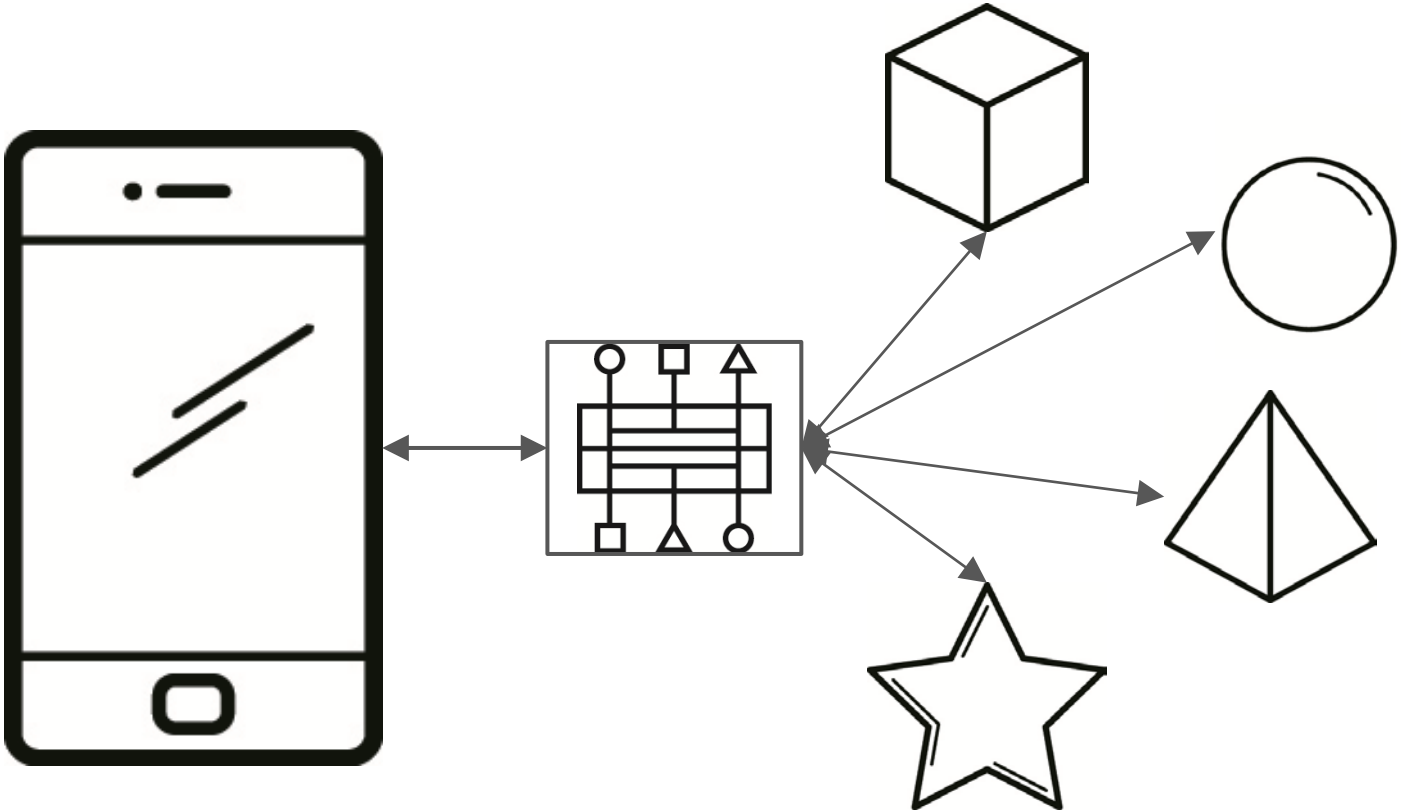
API “Gateway”



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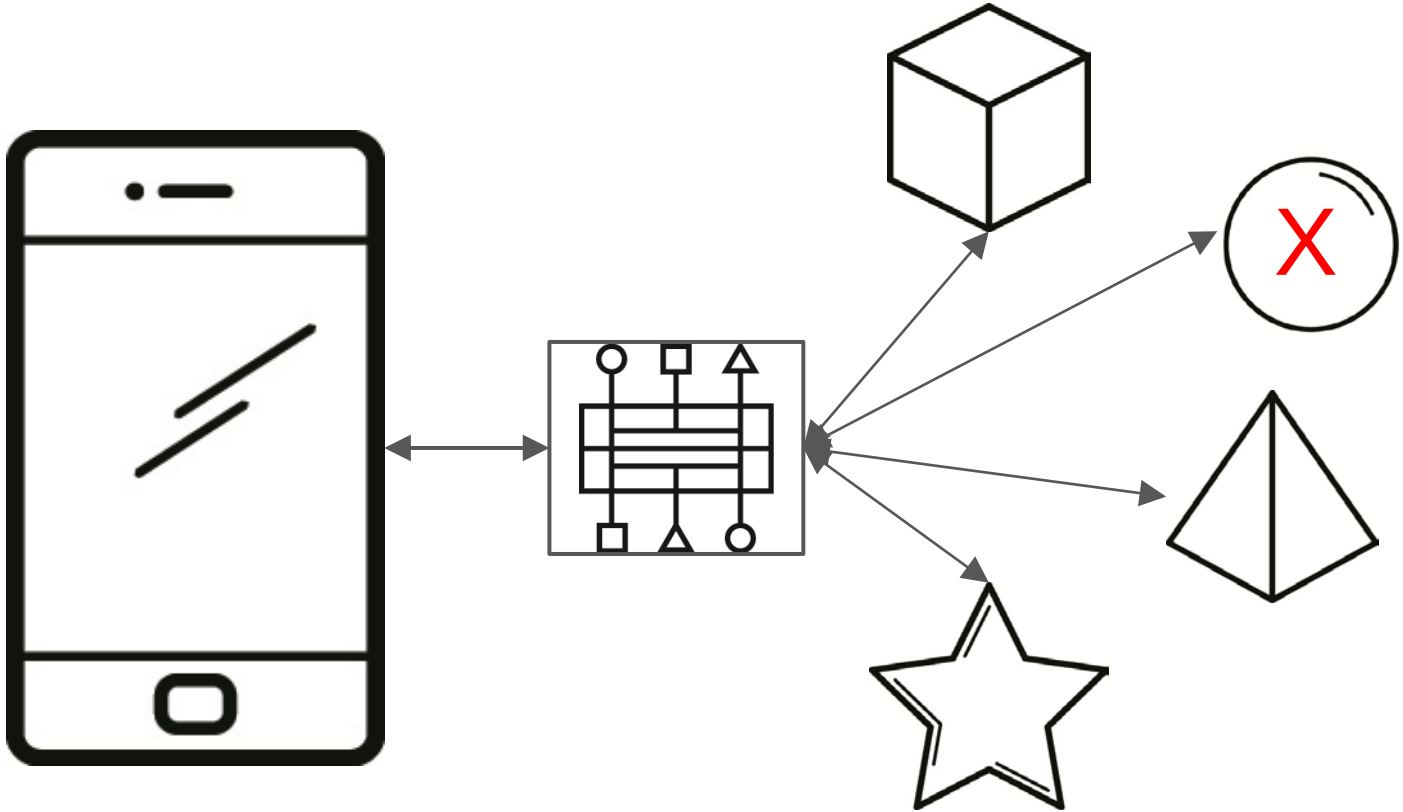
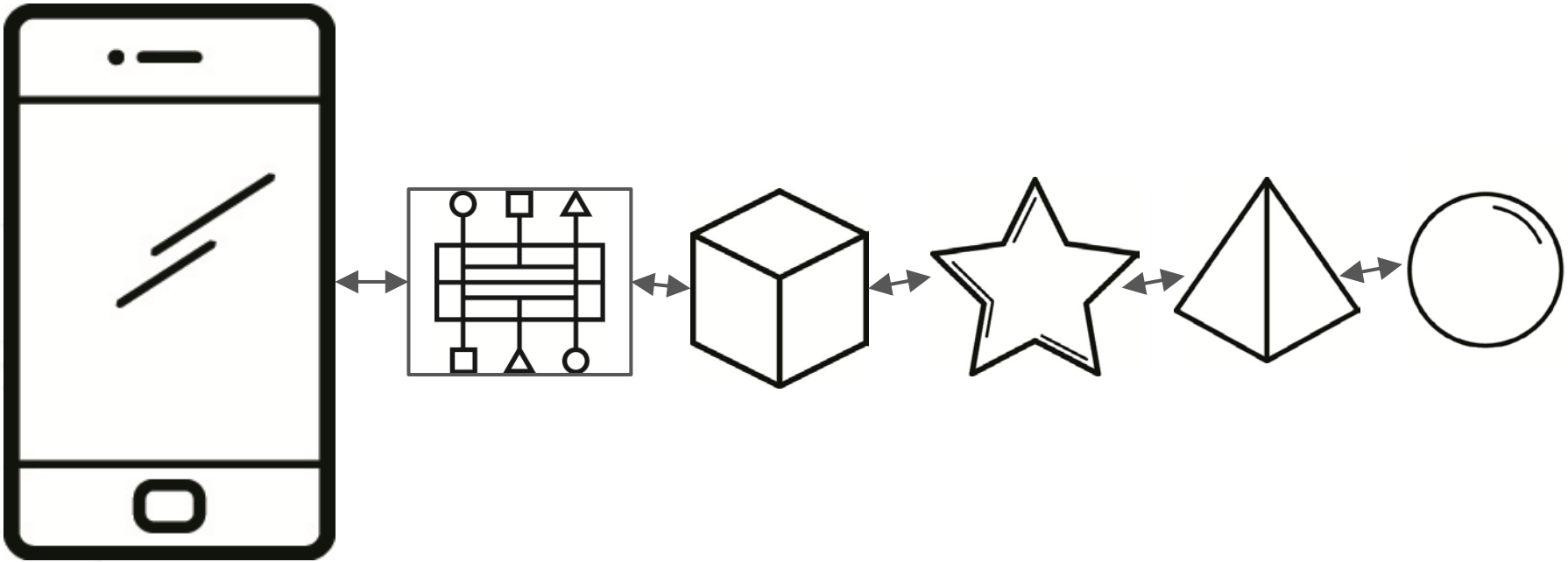
API “Gateway” (Fail)



Chaining



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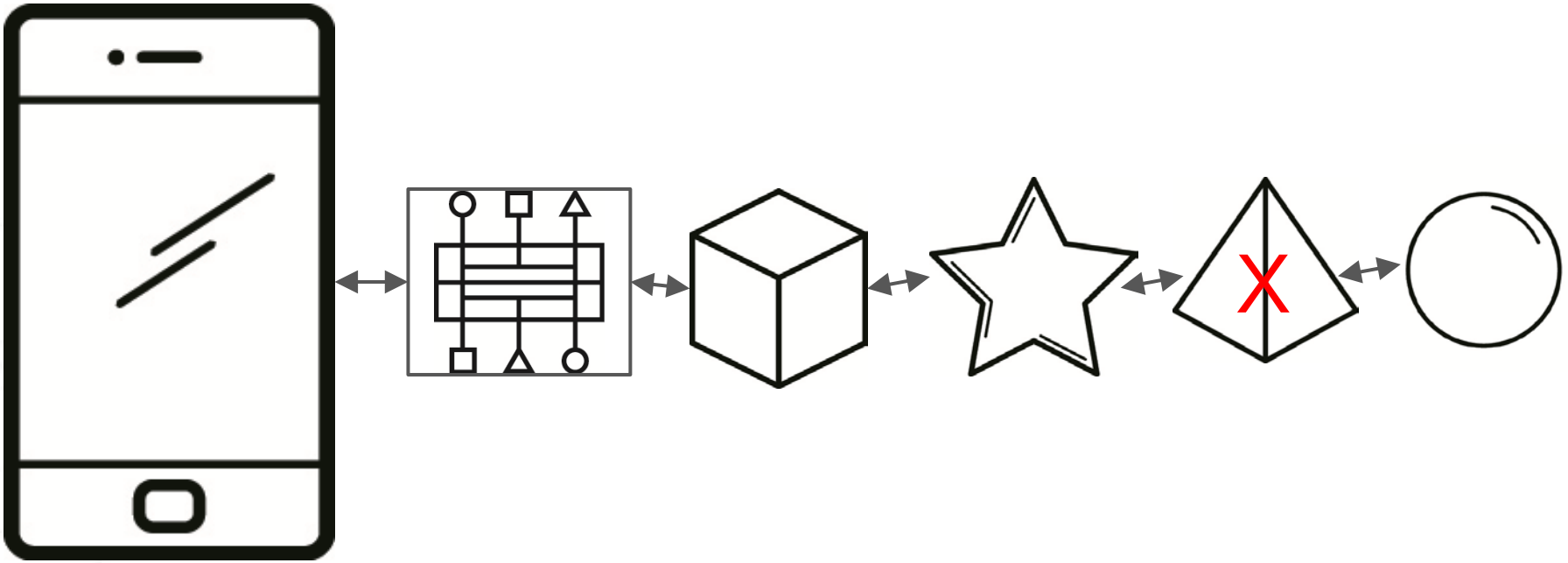
Chaining (Fail)



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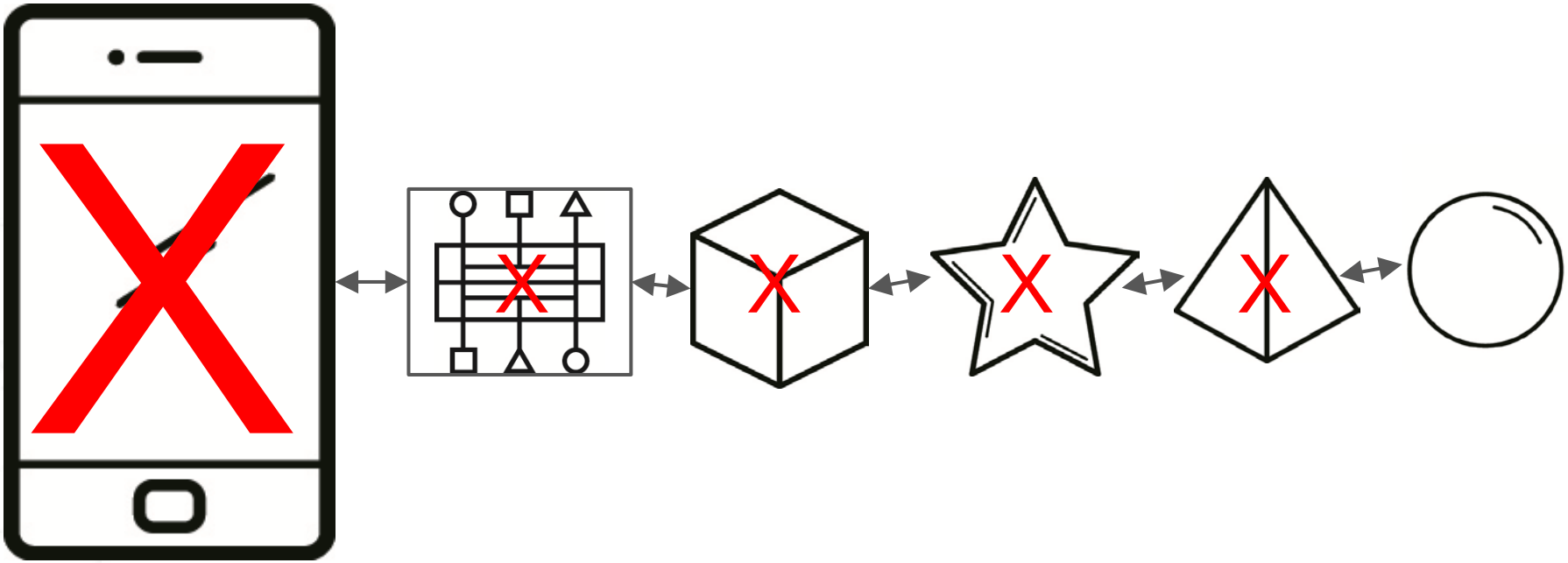
Chaining (Cascading Fail)



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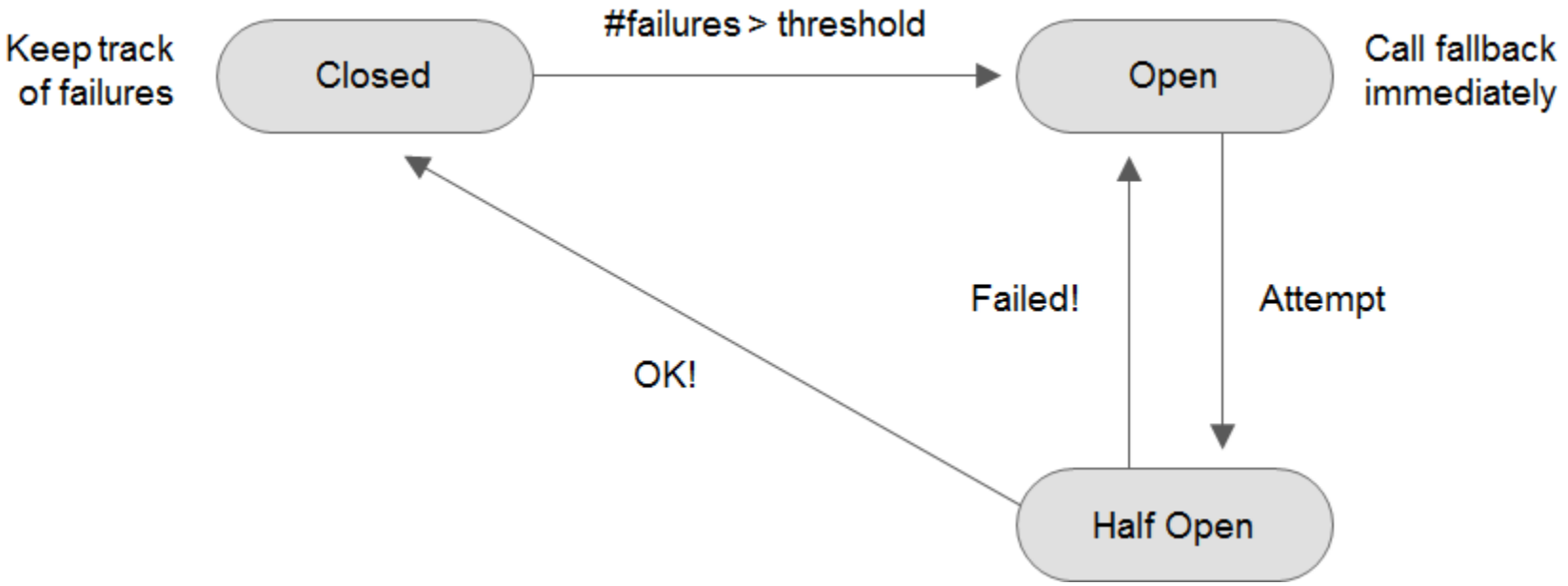
Circuit Breaker



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Demo

bit.ly/msa-instructions

https://github.com/burrsutter/kube4docker

Videos: https://www.youtube.com/watch?v=SPATMHP-xw8&list=PLuWlr4oKSRUYjjwDOaZOX-54X4_OIUUeS

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Vertx.io—an Eclipse project

Vert.x is a toolkit
for building reactive
applications on the JVM.

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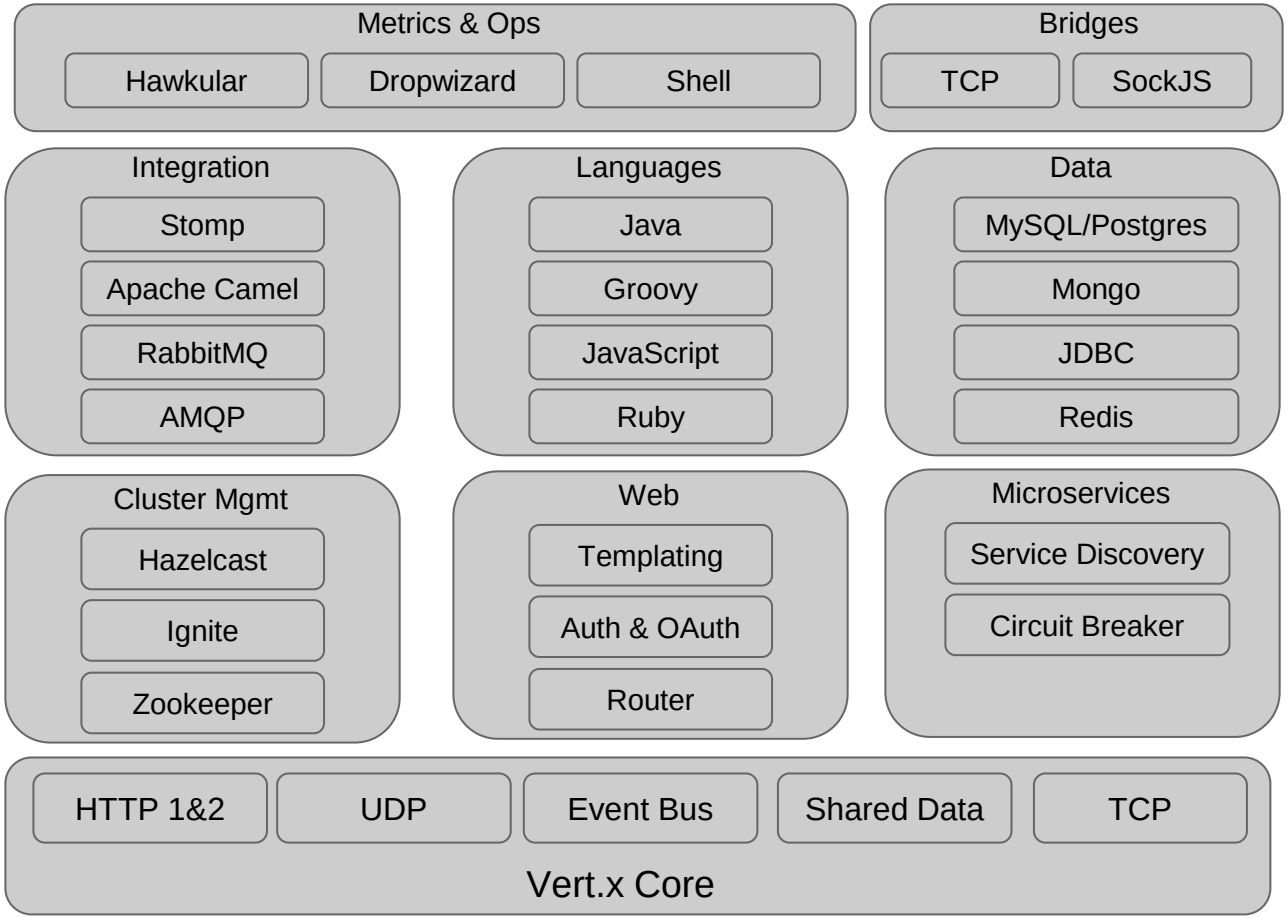

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Vert.x

(**Un**-Opinionated) Toolkit for reactive, async applications

Every user has their own Vert.x way

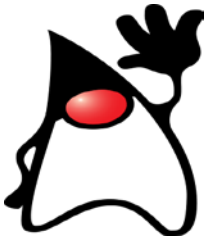
Low-latency microservices that interact using the EventBus

Built in elasticity and resiliency

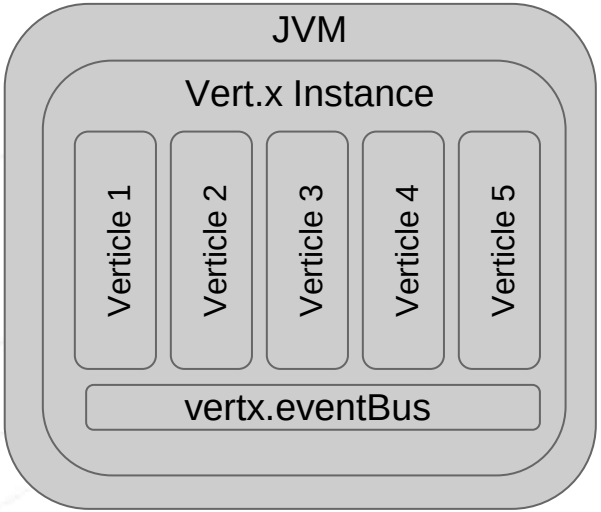
Polyglot: Java, JavaScript, Groovy, Ruby, Ceylon

vertx.io

http://vertx.io/blog/my-first-vert-x-3-application/



Vert.x Verticle



A Verticle is the programmable unit – a component

A Verticle is always executed on the same thread

A single thread may execute several verticles – event loop

A Verticle Instance normally starts 1 thread/event-loop per core

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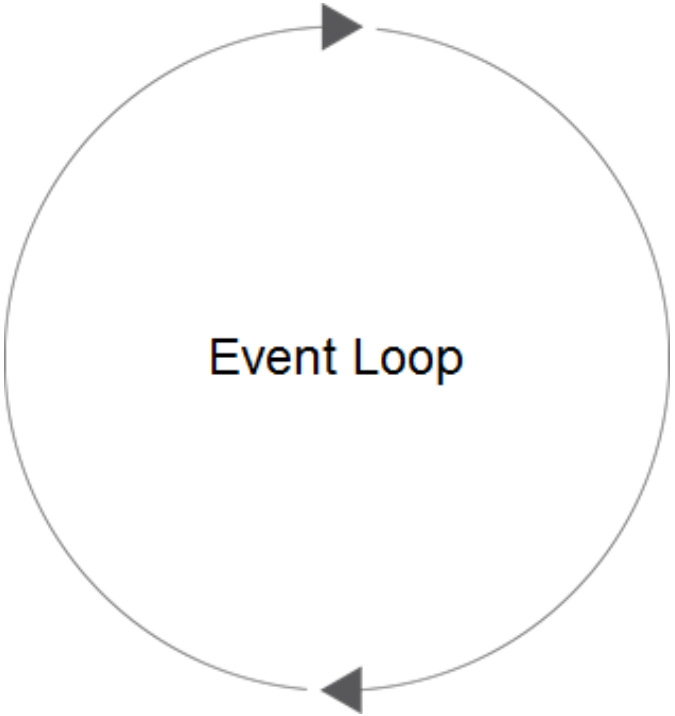

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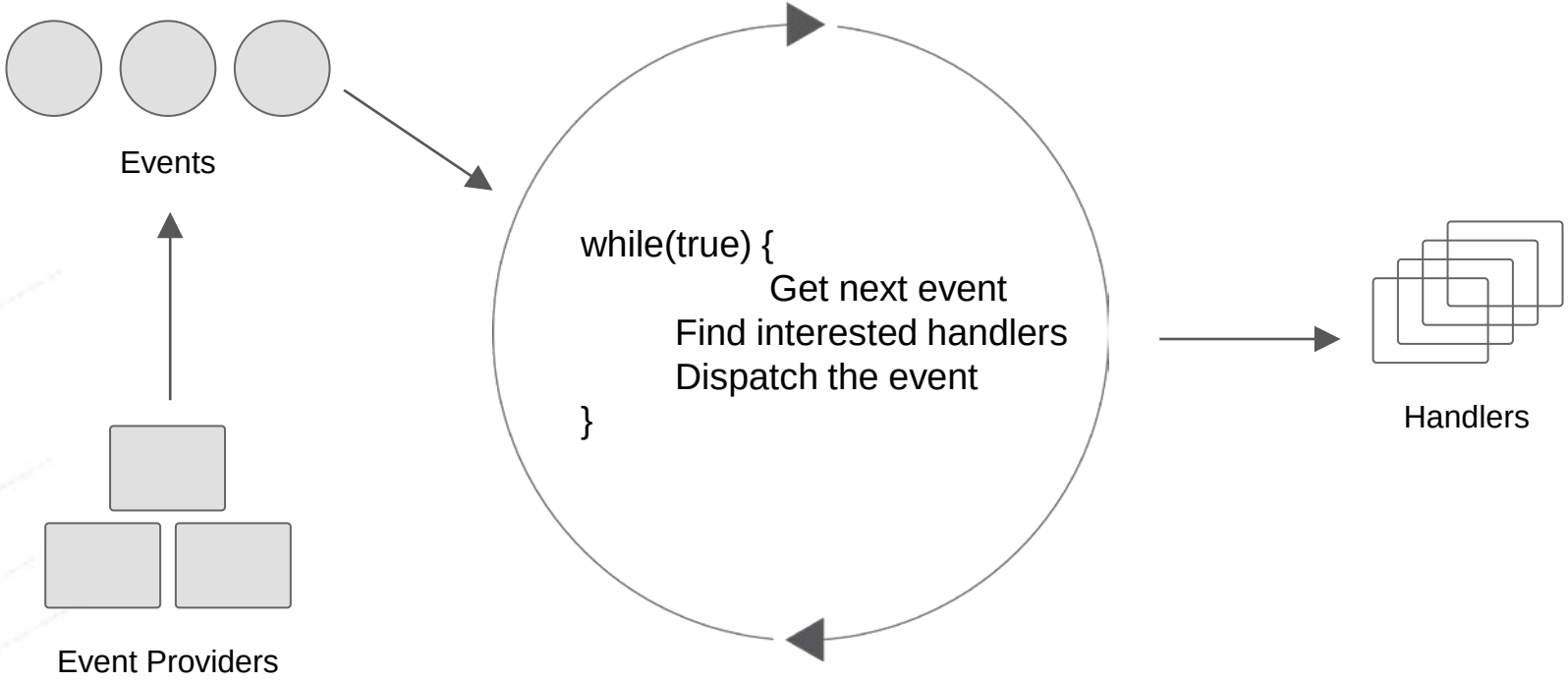
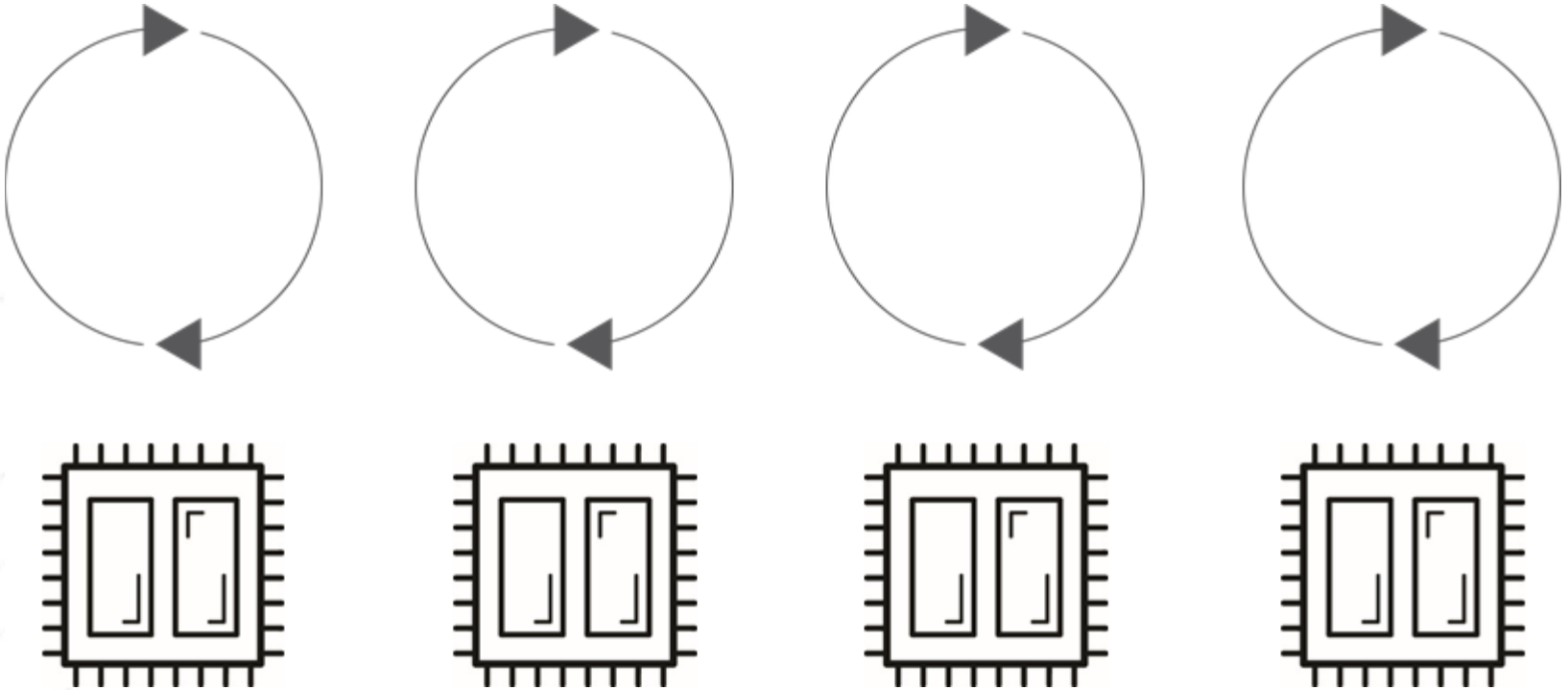

Events
while(true) {
Get next event
Find interested handlers
Dispatch the event
}
Handlers
Event Providers



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Vert.x HTTP Verticle

```
import io.vertx.core.AbstractVerticle;

public class MainVerticle extends AbstractVerticle {

  @Override
  public void start() {
    vertx.createHttpServer()
        .requestHandler(req ->
          req.response().end("Hello Vert.x v3!"))
        .listen(8080);
  }
}
```


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Super-Fast Getting Started: Step 1

```
mkdir hello-microservice-http
cd hello-microservice-http

mvn io.fabric8:vertx-maven-plugin:1.0.5:setup -
DprojectGroupId=io.vertx.microservice -
DprojectArtifactId=hello-microservice-http -
Dverticle=io.vertx.book.http.HelloMicroservice -
Ddependencies=web

mvn compile vertx:run
```


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Super-Fast Getting Started: Step 2

```
public void start() {
  Router router = Router.router(vertx);
  router.get("/").handler(this::hello);
  router.get("/:name").handler(this::hello);
  vertx.createHttpServer()
      .requestHandler(router::accept)
      .listen(8080);
}

private void hello(RoutingContext rc) {
  String message = "hello";
  if (rc.pathParam("name") != null) {
     message += " " + rc.pathParam("name");
  }
  JsonObject json = new JsonObject().put("message", message);
  rc.response()
       .putHeader(HttpHeaders.CONTENT_TYPE, "application/json")
       .end(json.encode());
}
```


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Web Apps & REST

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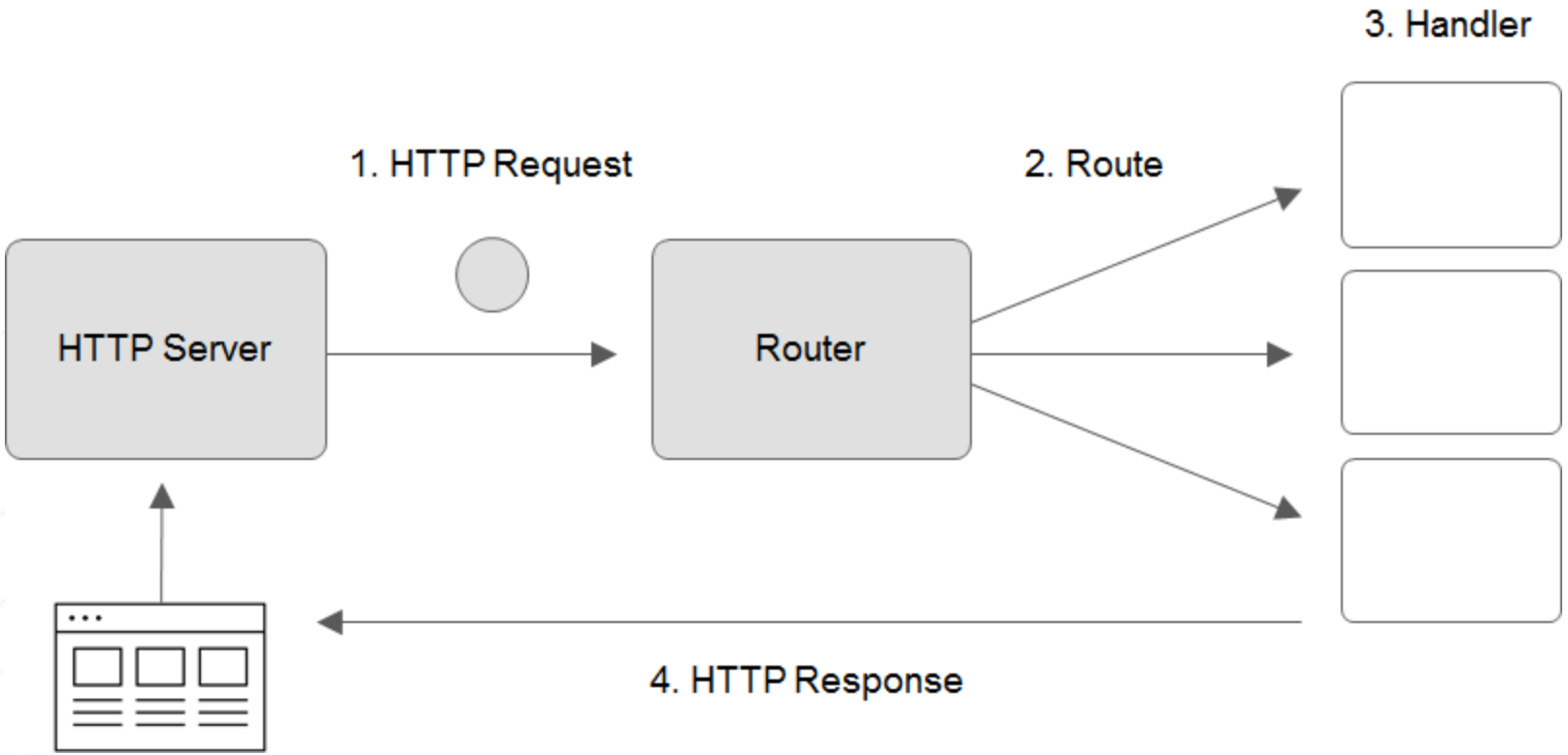
3. Handler
1. HTTP Request
2. Route
HTTP Server
Router
4. HTTP Response

Vert.x HTTP Router

```
router.get("/api/whiskies").handler(this::getAll);
router.get("/api/whiskies/:id").handler(this::getOne);
router.post("/api/whiskies").handler(this::addOne);
router.delete("/api/whiskies/:id").handler(this::deleteOne);
router.put("/api/whiskies/:id").handler(this::updateOne);
// Serve static resources from the /assets directory
router.route("/assets/*").handler(StaticHandler.create("assets"));

vertx
  .createHttpServer()
  .requestHandler(router::accept)
  .listen(8080, result -> {
    if (result.succeeded()) {
      future.complete();
    } else {
      // could be something else is running on our port
      future.fail(result.cause());
    }
  });
```


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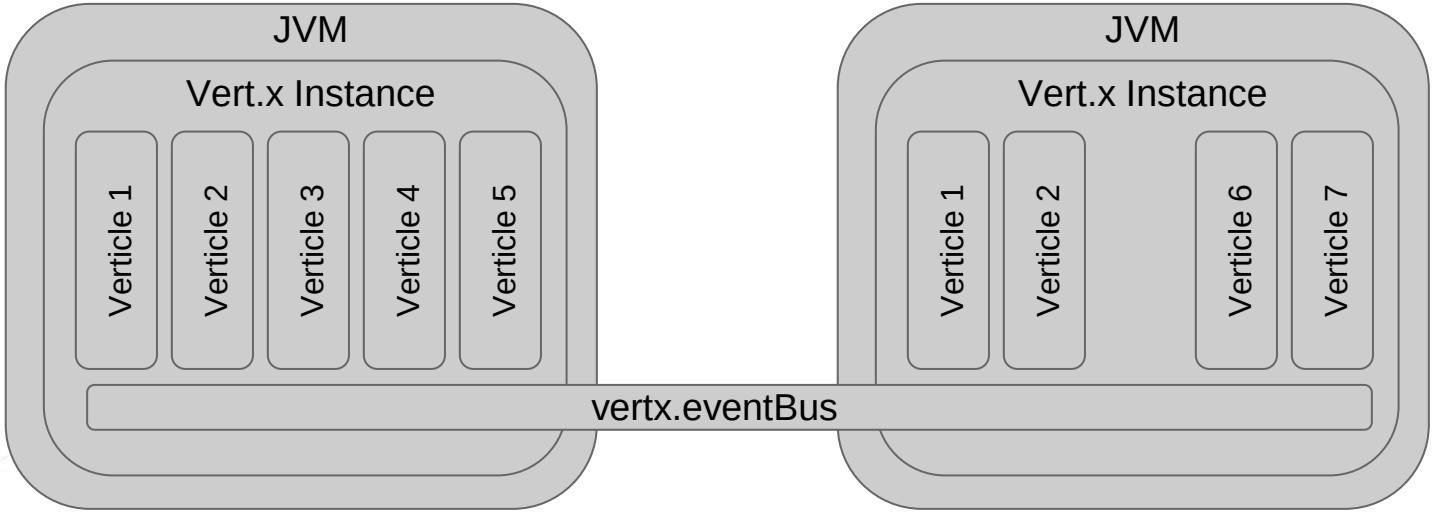
Vert.x EventBus



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Demo

https://github.com/burrsutter/vertx3_introduction

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HTTP getNow() Circuit Breaker

```
CircuitBreakerOptions options = new
   CircuitBreakerOptions()
    .setMaxFailures(5)
    .setTimeout(5000)
    .setFallbackOnFailure(true);

CircuitBreaker breaker =
    CircuitBreaker.create("my-circuit-breaker", vertx,
        options)
    .openHandler(v -> {
      System.out.println("Circuit opened");
    }).closeHandler(v -> {
      System.out.println("Circuit closed");
    });
```

```
Future<String> result = breaker.executeWithFallback(future -> {
  vertx.createHttpClient().getNow(8080, "localhost", "/",
    response -> {
    if (response.statusCode() != 200) {
      future.fail("HTTP error");
    } else {
      response.exceptionHandler(future::fail).bodyHandler(buffer
       -> {
        future.complete(buffer.toString());
      });
    }
  });
}, v -> {
  // Executed when the circuit is opened
  return "Hello (fallback)";
});
```

https://github.com/burrsutter/vertx3_introduction/blob/master/7_httpinvoker/Client.java#L13

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Demos

https://github.com/redhat-reactive-msa

https://github.com/burrsutter/reactive_tutorial_jfokus17

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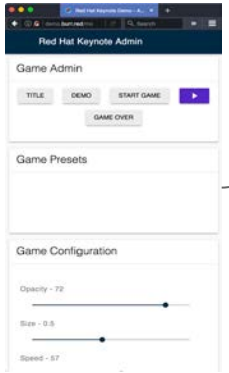
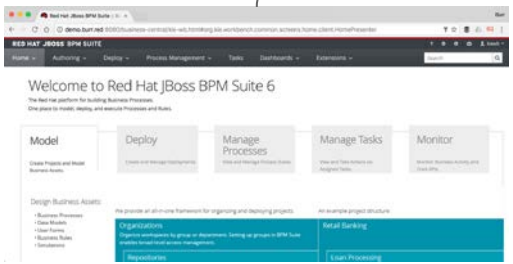
Recording: https://youtu.be/ooA6FmTL4Dk?t=1739

vertx-game-server

vertx-achievement-server

Java EE on JBoss with Drools+jBPM





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http://bit.ly/reactivemsa

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