Pivotal & AxonIQ

How to Build CQRS & Event Sourcing Applications with Axon & Pivotal Cloud Foundry

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Axon

AxonFramework

Solving non-functional app complexity in Message-Driven systems

- First-class support for CQRS, DDD and EDA concepts
  - **Aggregates** & Aggregate Roots
  - **Commands**, **Queries** and **Events**
  - **Event Sourcing**
  - Sagas
- Works great with spring by Pivotal
- **Open Source** (Apache 2 License) Java framework
- https://axoniq.io/

PCF

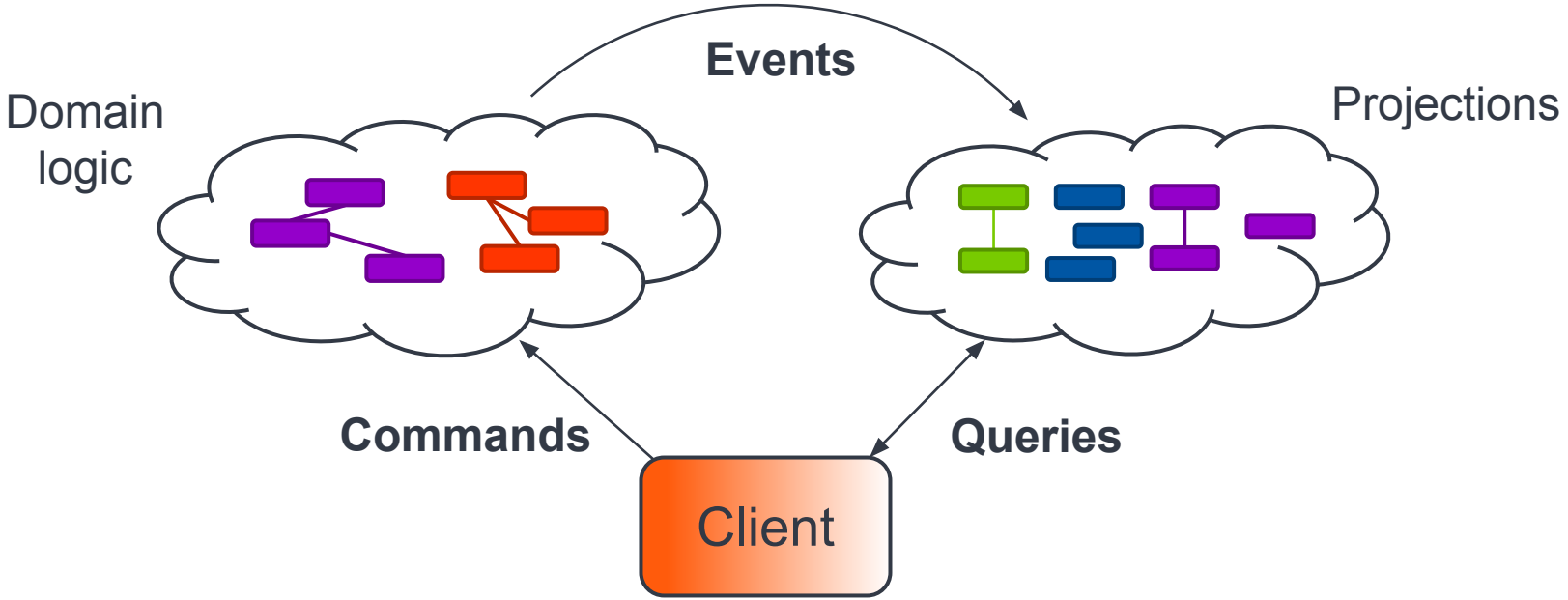
Pivotal
Cloud Foundry®

The premier platform for cloud-native development

- Focussed on **developer productivity**
- **The fastest path to production**
- Fully **polyglot** with support for Java, .Net, NodeJS, Python, etc.
- Marketplace **services** - DBs, MQs, APMs, etc.
- Highly automatable & CI / CD friendly
- Deploy code to production 000's of times a month!
- Available **online** via Pivotal Web Services (PWS) at run.pivotal.io

CQRS, what is it?

C(ommand) Q(uery) R(esponsibility) S(egregation)



Event Sourcing, what is it?

Example: Virtual Wallet

C.R.U.D.

Wallet

Id: 123

Owner: Steven

Balance: €1000

Balance is persisted, but how we got here isn't clear.
Great for projections and views, but somewhat 'lossy'.

Event Sourcing

WalletCreatedEvent:
Id: 123, Owner: Steven
> Balance: €0

CashDepositedEvent: €1500
> Balance: €1500

CashWithdrawnEvent: €500
> Balance: €1000

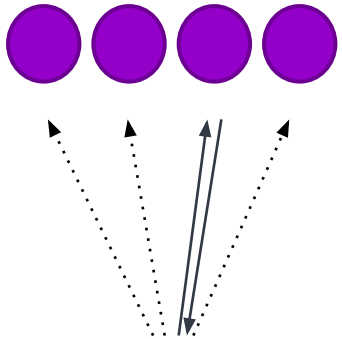
CashWithdrawnEvent: €500
> Balance: €500

CashDepositedEvent: €500
> Balance: €1000

Message Driven APIs: what do they consist of?

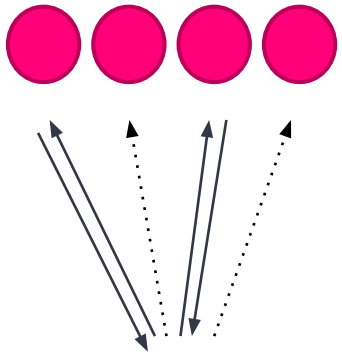
Public API

Commands



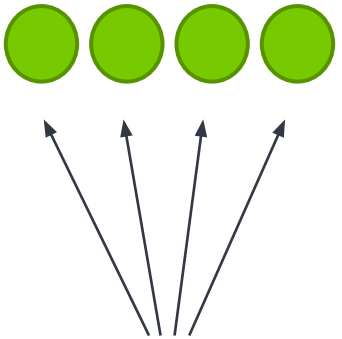
Route to single handler
Use consistent hashing
Return a result

Queries



Route with load balancing
Sometimes scatter/gather
Return a result

Events



Distribute to all event handlers
Consumers express ordering req's
Return no result
Can be persisted
Can be a 'source' of agg. state
Can be used to build projections

⚠ **"Event"** and **"Message"** are not the same thing!

Virtual Wallet: let's code it!

Commissioning Databases with PCF...

No DBA's. No IT tickets. Just 2 simple commands:

- `"cf create-service"`
  - Provisions a 'tablespace' with inline with the selected **plan**
  - Fully automated - no manual steps
  - HA

- `"cf bind-service"`
  - Creates a dedicated **user** for the application with **credentials**
  - Adds the **connection** string and **credentials** into the applications environment variables (picked up automatically by SpringBoot)

Demo: Pushing code to production with PCF...

No servers. No containers. Just 1 simple command:

➢ `"cf push"`

- **Uploads** your code to Cloud Foundry
- Layers required **runtimes** (e.g. JVM) onto a hardened **container**
- Sets up a **route** (URL) for your app
- Creates a **load balancing** entry for each instance
- Sets up **SSL termination** and **mTLS**
- Creates **health monitoring & logging** subsystems
- Binds all required **backing services** (database, messaging etc.)
- **Schedules** your app container to start
- Starts your app with the desired number of **instances** (scale)
- Automatic **restarts** if your app should ever stop...

But how does this help us..?

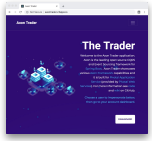
Pivotal Cloud Foundry (PAS)

`cf push | cf create-service | cf bind-service`

Application Code & Frameworks Buildpacks | Spring Boot & Java | .NET | NodeJS | Python | Go | Staticfile | PHP | Ruby

Trader UI

- Home
- Dashboard
- Order Books
- Users
- Images
- Layout



Trader App

- Companies
- Users
- Portfolios
- Order Books

Evolutionary Architecture!

Start with a Monolith
It's easier to design & build

Pivotal Services Marketplace

- Redis Key Value Store
- MySQL Relational DB
- Spring Cloud Services (Registry, Config, etc.)
- Rabbit MQ Messaging

Open Service Broker API

→ Public Cloud Services

→ Customer Managed Services

Marketplace for Pivotal and Partner Products

CLOUDFOUNDRY BOSH

CPI (Multi-cloud 'Cloud Provider API')

vSphere | Openstack | AWS | Google Cloud | Azure & Azure Stack

Pivotal

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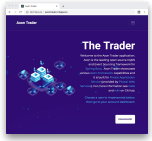

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Trading Engine

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Strangle the Monolith
using location transparency and adding services

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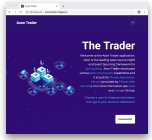

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Separate into Microservices
makes it easier to maintain and scale

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Pivotal

AxonIQ

What's next?

Pivotal
Cloud Foundry®

&

Axon Server

Coming "Soon"...

Axon Server in the Pivotal Service Marketplace

We're working on getting Axon Server into the PCF marketplace allowing dedicated on-demand Event Store, Command, Query and Event routing services

```
$> cf create-service axon-server
```

Axon Trader RefArch

Wallet Demo Code

Thanks for attending!

Check it out!

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Pivotal

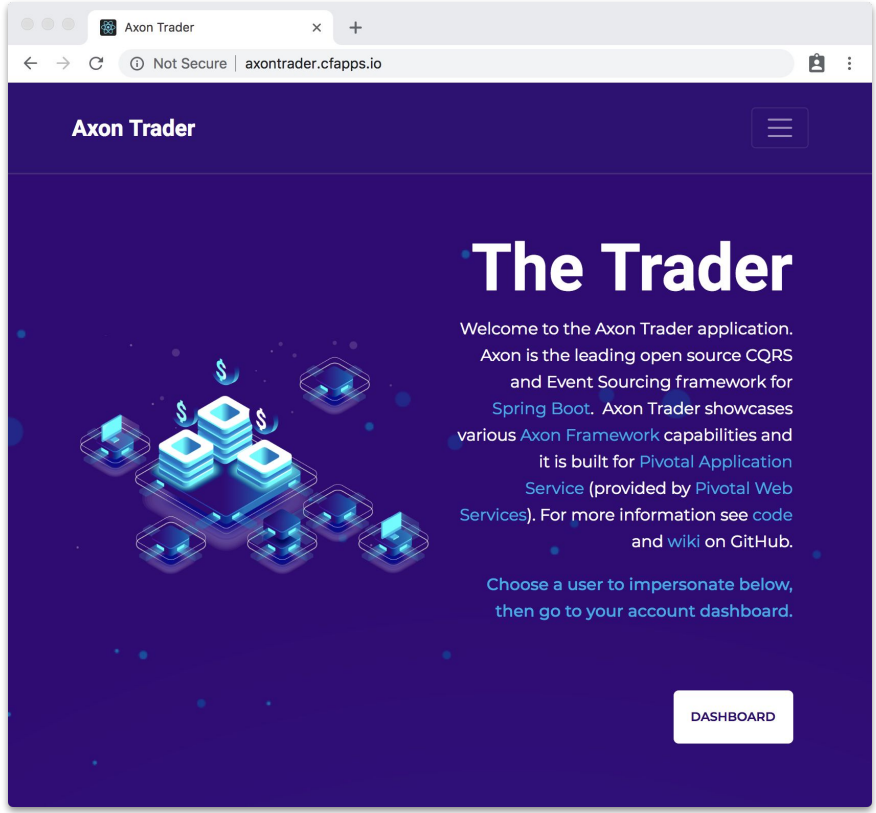
AxonIQ

Introducing: Axon Trader

An open-source CQRS & Event Sourcing reference architecture built with...

- Spring Boot
- Axon Framework
- PCF (Pivotal Web Services)

axontrader.cfapps.io



Spring Boot

Java's most popular microservices framework

- Is there anyone who hasn't heard of Spring Boot?
- Fast, easy to build stand-alone **Spring** applications
- Opinionated 'starter' dependencies that **autoconfigure**
- '`starter-web`' is great for RESTful **microservices**
- Embeds Tomcat, Jetty or Undertow
- Production-ready features (metrics, health, config)
- Easy to get started with **guides** & **initializer**
- https://spring.io/projects/spring-boot