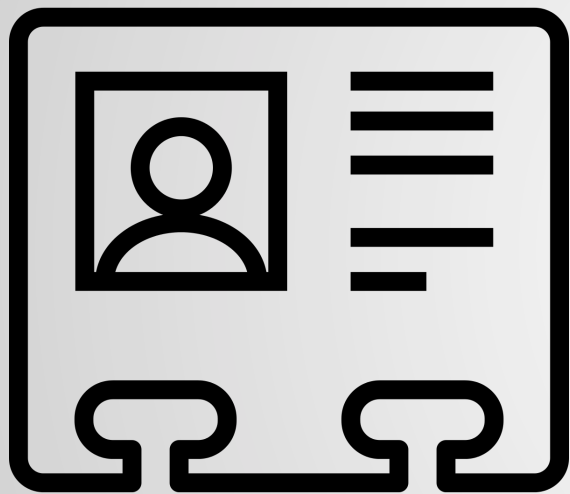




IoT REALIZED
CONNECTED CAR

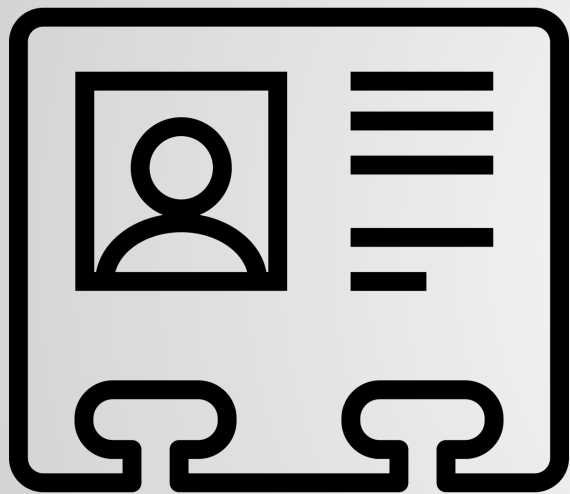




CONTACT INFO

EMAIL: mminella@pivotal.io

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CONTACT INFO

EMAIL: pberman@pivotal.io

TWITTER: [@PivotalPhil](https://twitter.com/PivotalPhil)



THANKS!





**BACK TO THE
BEGINNING**



REALLY COOL IoT **PROJECT**

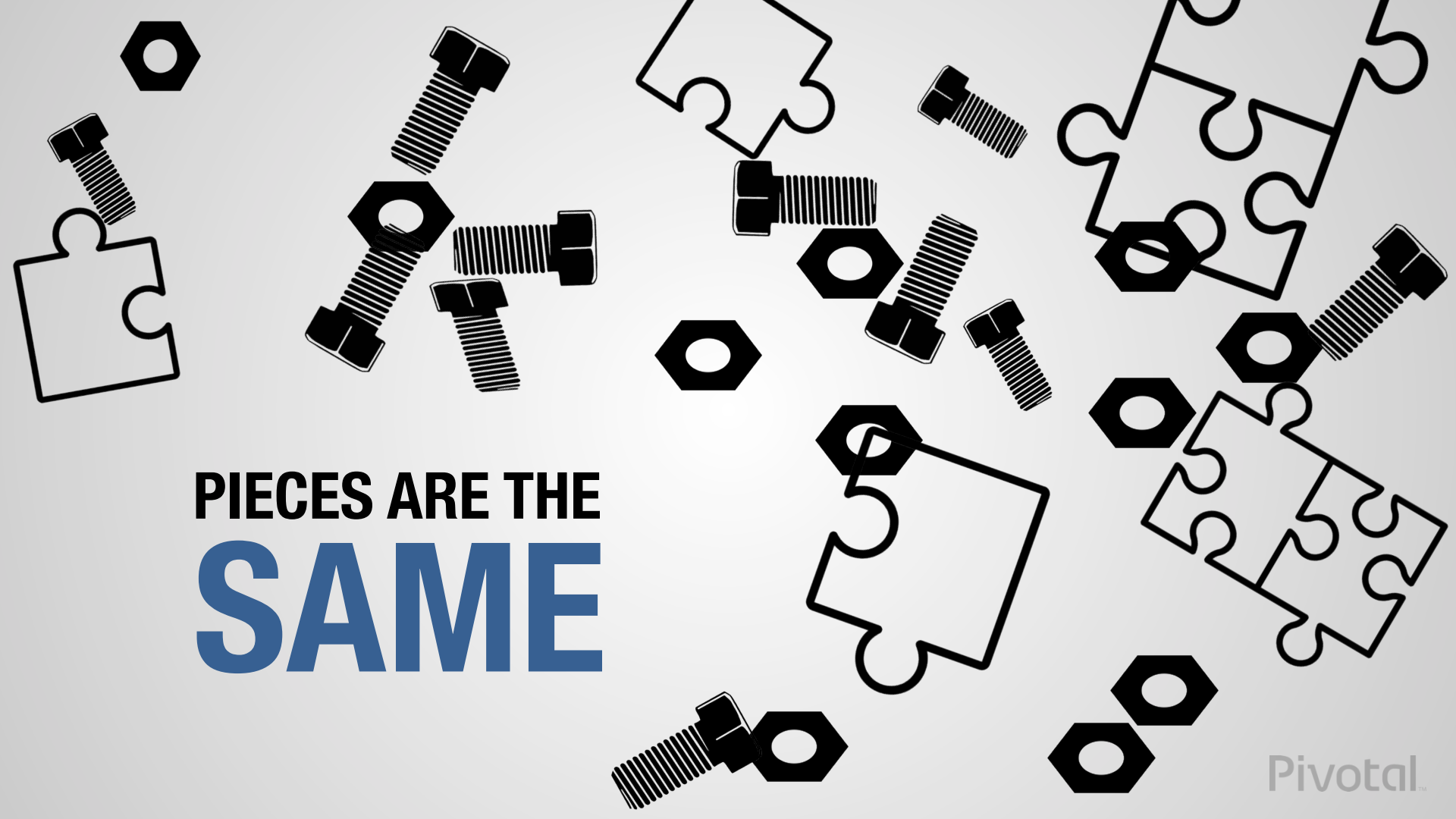


COVERED BY AN
NDA





CONNECTED
CAR



**PIECES ARE THE
SAME**



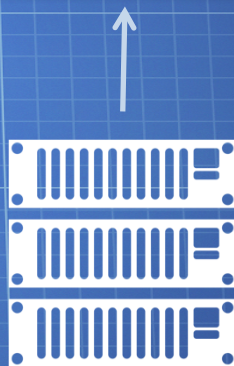
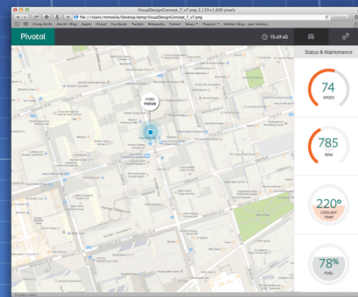
**IoT IS NOT ABOUT
TWEETING APPLIANCES**



1% IS A
BIG DEAL



CONNECTED
CAR



ON AIR

**HOW DOES THIS
WORK?**



START IN THE CAR





ON BOARD DIAGNOSTICS

OBD II

01 0D

01 0D

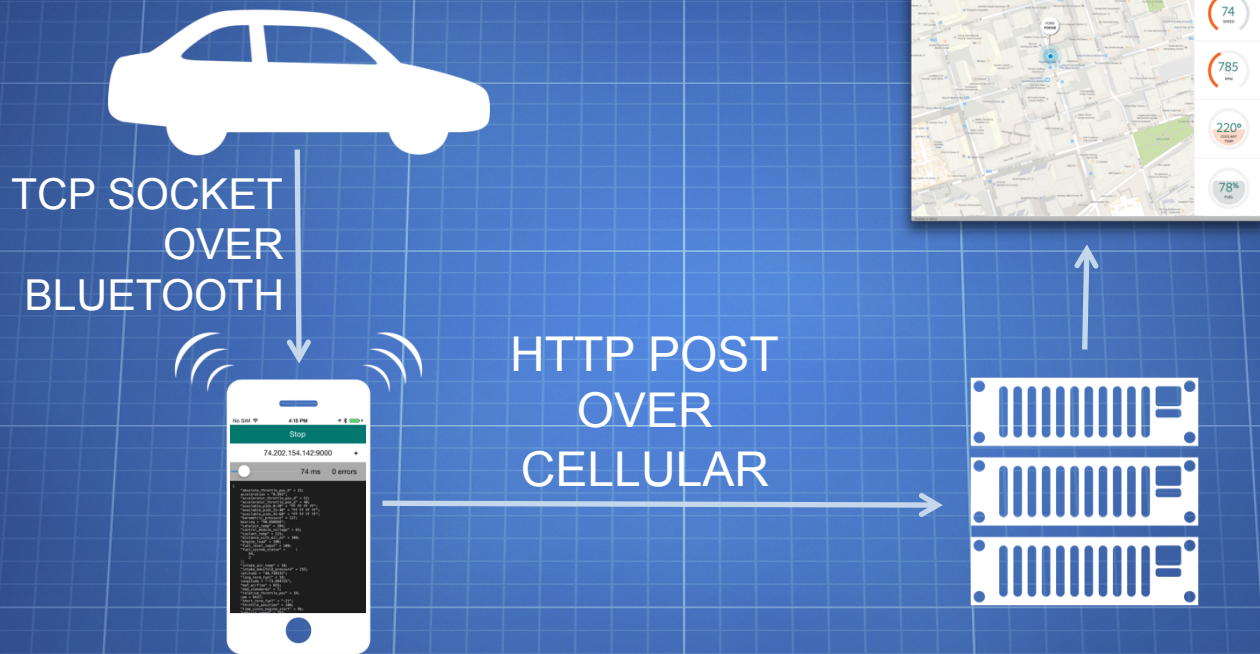
18 DA F1 11 03 41 0D 30

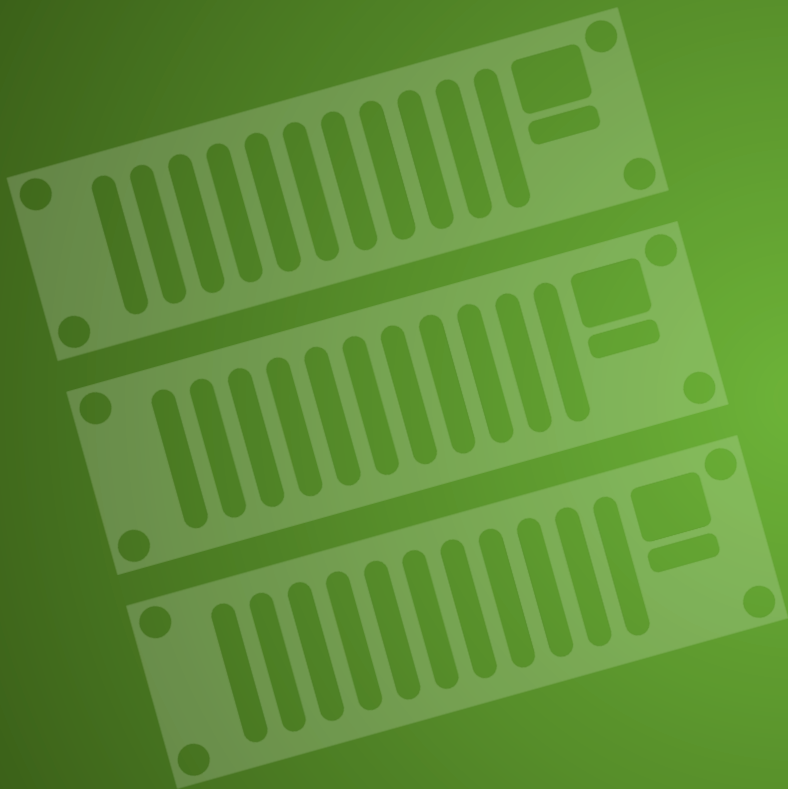
>

```
/**
 * Performs the domain transformation into an acme model.
 *
 * @author gfoster
 */
public class AcmeMotorEnrichingTransformer implements Transformer<
    Message<?>, Message<?>> {
    @Bean
    public Message<?> transform(final Message<?> message) {
        final Object payload = message.getPayload();
        Map<String, Object> = new HashMap<>();
        try {
            if (payload != null) {
                map = mapper.readValue(payload.toString(), Map<String, Object>
                    .class);
                map.put("timestamp", System.currentTimeMillis());
                map.put("guid", UUID.randomUUID());
            }
        } catch (IOException e) {
            // ...
        }
    }
}
```



PHONE PROVIDES CONNECTIVITY





ON THE SERVER

IO EXECUTION



XD
Stream, Taps,
Jobs

BOOT



Bootable, Minimal, Ops-Ready



GRAILS
Full-stack,
Web



SPRING CLOUD

IO COORDINATION

IO FOUNDATION

INTEGRATION



Channels, Adapters,
Filters, Transformers

BATCH



Jobs, Steps,
Readers, Writers

BIG DATA



Ingestion, Export,
Orchestration, Hadoop

WEB



Controllers, REST,
WebSocket

DATA



RELATIONAL
DATA ACCESS



NON-RELATIONAL
DATA ACCESS

SPRING CORE



FRAMEWORK



SECURITY



GROOVY



REACTOR

SPRING XD

EXTREME DATA



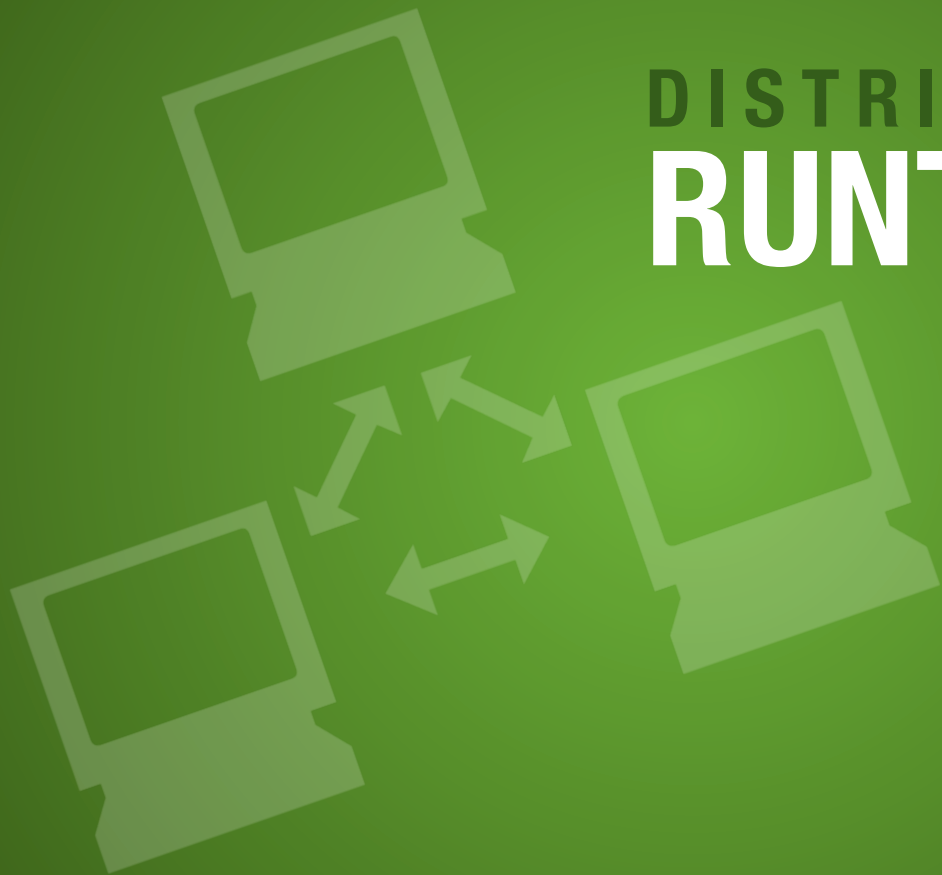


Ingestion
Orchestration
SPRING
Extraction

Real-time
Analytics



DISTRIBUTED RUNTIME





STREAMING BATCH &



java

XD Shell 1.0.0.M7 (java)

1- XD Shell

Spring XD

Michael's-MacBook-Pro-2:bin mminella\$./xd-shell

(~)

Spring XD

1.0.0.M7 | Admin Server Target: http://localhost:8090
Welcome to the Spring XD shell. For assistance, type 'help'.
xd:>

Streams

JOBS

ABOUT

to executions and provides the control to restart the job execution (if restartable).

ments

Executions

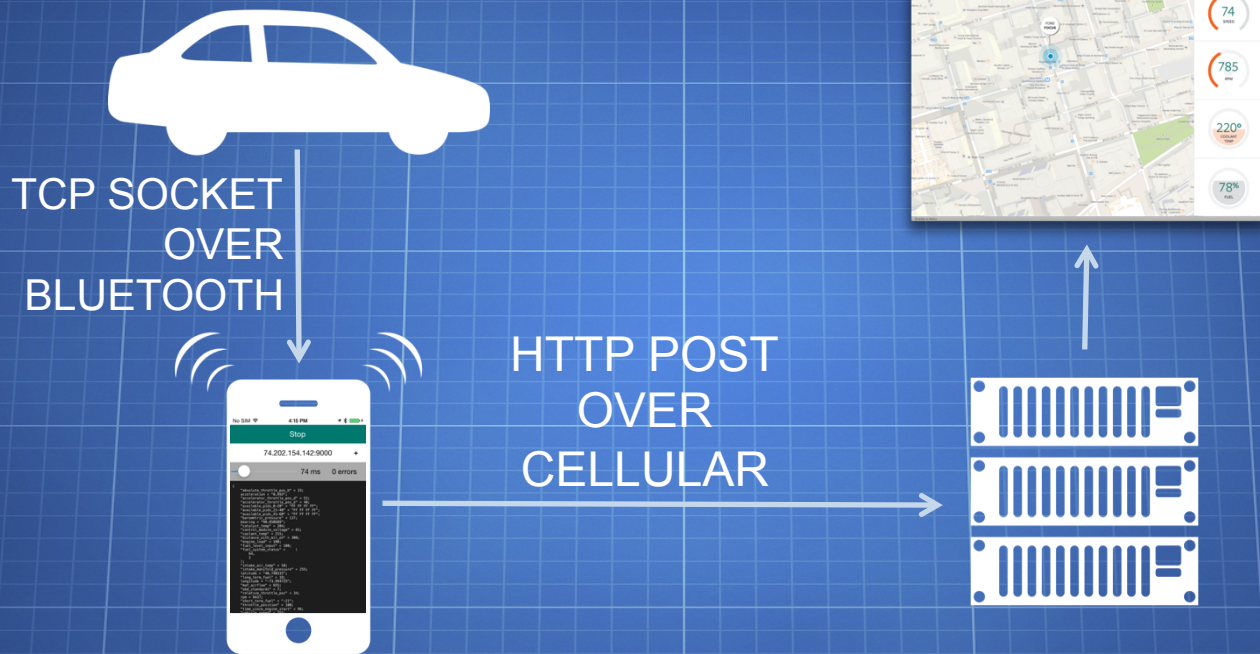
Quick filter

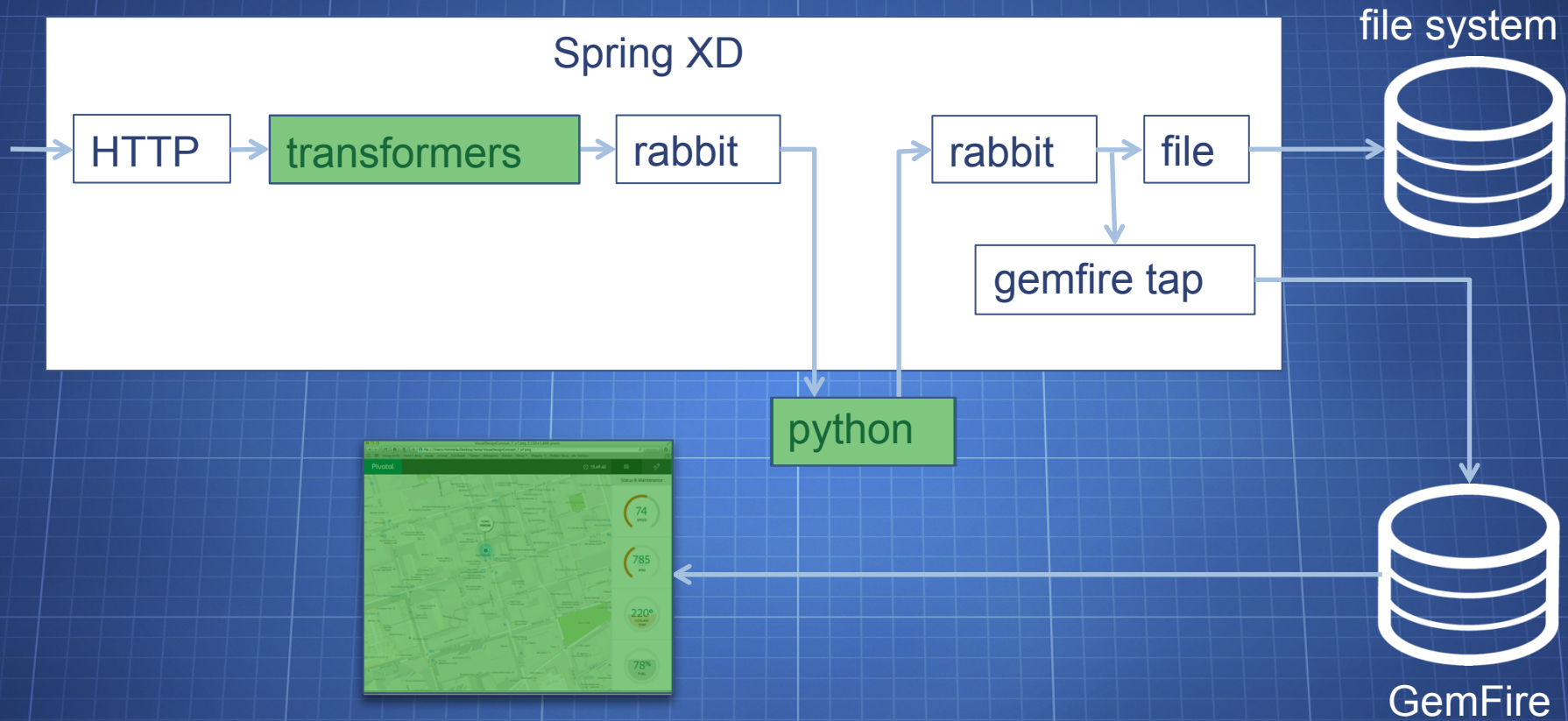
Id	Execution Id	Job Start Time	Step Executions Count	Status	Actions
6	6	2014-07-14 16:39:18	1	COMPLETED	  
5	5	2014-07-14 16:38:34	1	COMPLETED	  
4	4	2014-07-14 16:38:06	1	FAILED	  
3	3	2014-07-14 16:37:34	1	FAILED	  
2	2	2014-07-14 16:36:06	1	COMPLETED	  
1	1	2014-07-14 16:34:20	4	COMPLETED	  

http | acmeenrich | rabbit

rabbit | file

```
tap:stream:IoT-HDFS > gemfire-json-server
```





```
/**
 * Performs the domain transformation into an acme model.
 *
 * @author gfoster
 */
public class AcmeMotorEnrichingTransformer implements Transformer<
    Message<?>, Message<?>
> {
    @Bean
    public Message<?> transform(final Message<?> message) {
        final Object payload = message.getPayload();
        Map<String, Object> = new HashMap<>();
        try {
            if (payload != null) {
                map = mapper.readValue(payload.toString(), Map<String, Object>
                    .class);
                map.put("timestamp", System.currentTimeMillis());
                map.put("guid", UUID.randomUUID());
            }
        } catch (IOException e) {
            // ...
        }
    }
}
```



REALTIME DATA **SCIENCE**

1 **PREDICT** **JOURNEY**

2 **PREDICT** **RANGE**

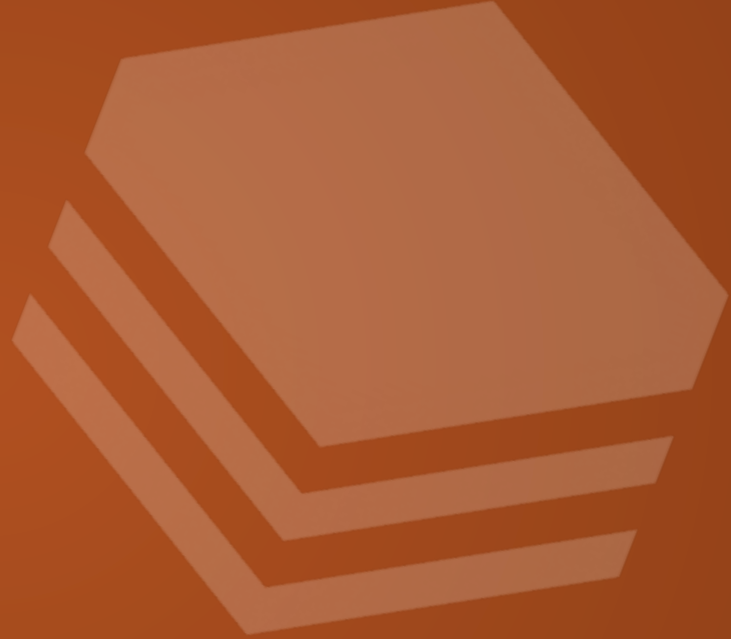
HOW DOES IT WORK?



STORE SENSOR
DATA



OFFLINE BATCH TRAINING



INITIAL PREDICTION





REALTIME EVALUATION

```
...
"Predictions": {
  "ClusterPredictions": {
    "0": {
      "EndLocation": [
        32.98525175453122,
        -96.70940837440399
      ],
      "MPG_Journey": 25.60900810315203,
      "Probability": 0.63736
    },
    ...
  }
}
```



REALTIME DASHBOARD

1 GEMFIRE

2 REST

3 YOEMAN

4 ANGULARJS

```
/**
 * Performs the domain transformation into an acme model.
 *
 * @author gfoster
 */
public class AcmeMotorEnrichingTransformer implements Transformer<
    Message<?>, Message<?>
> {
    @Bean
    public Message<?> transform(final Message<?> message) {
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        try {
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                map = mapper.readValue(payload.toString(), Map<String, Object>
                    .class);
                map.put("timestamp", System.currentTimeMillis());
                map.put("guid", UUID.randomUUID());
            }
        } catch (IOException e) {
            // ...
        }
    }
}
```



SOLUTION AT **SCALE**



100,000's OF
CLIENTS

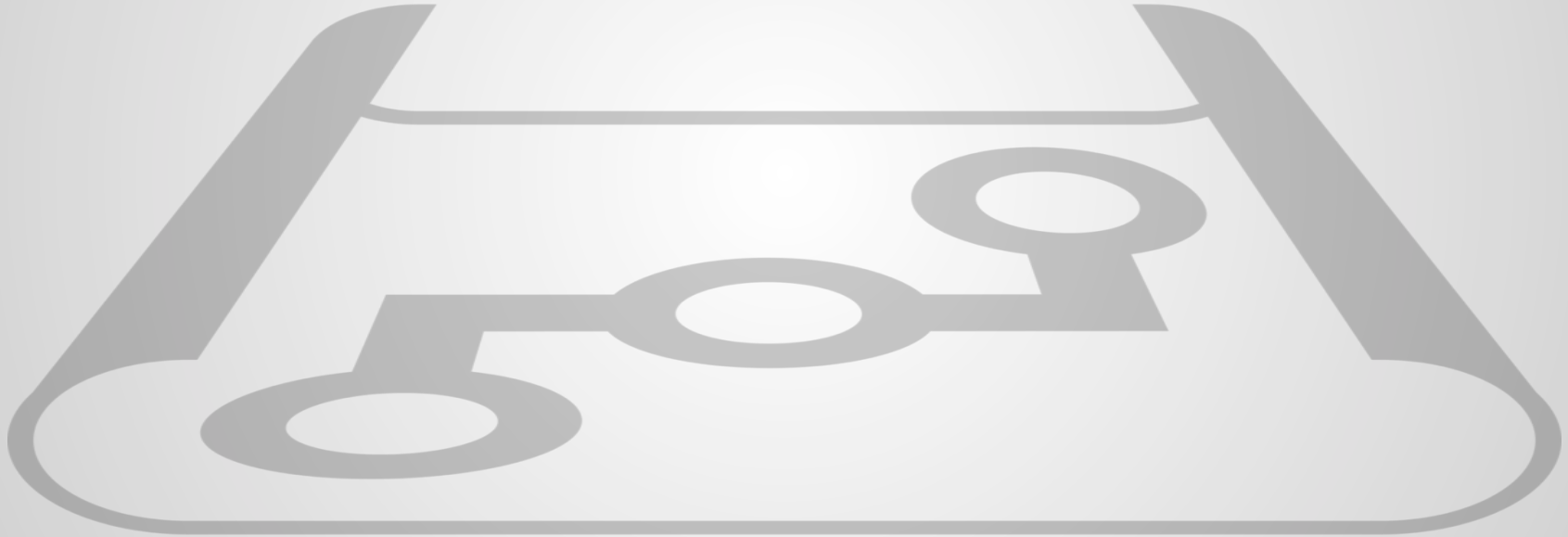


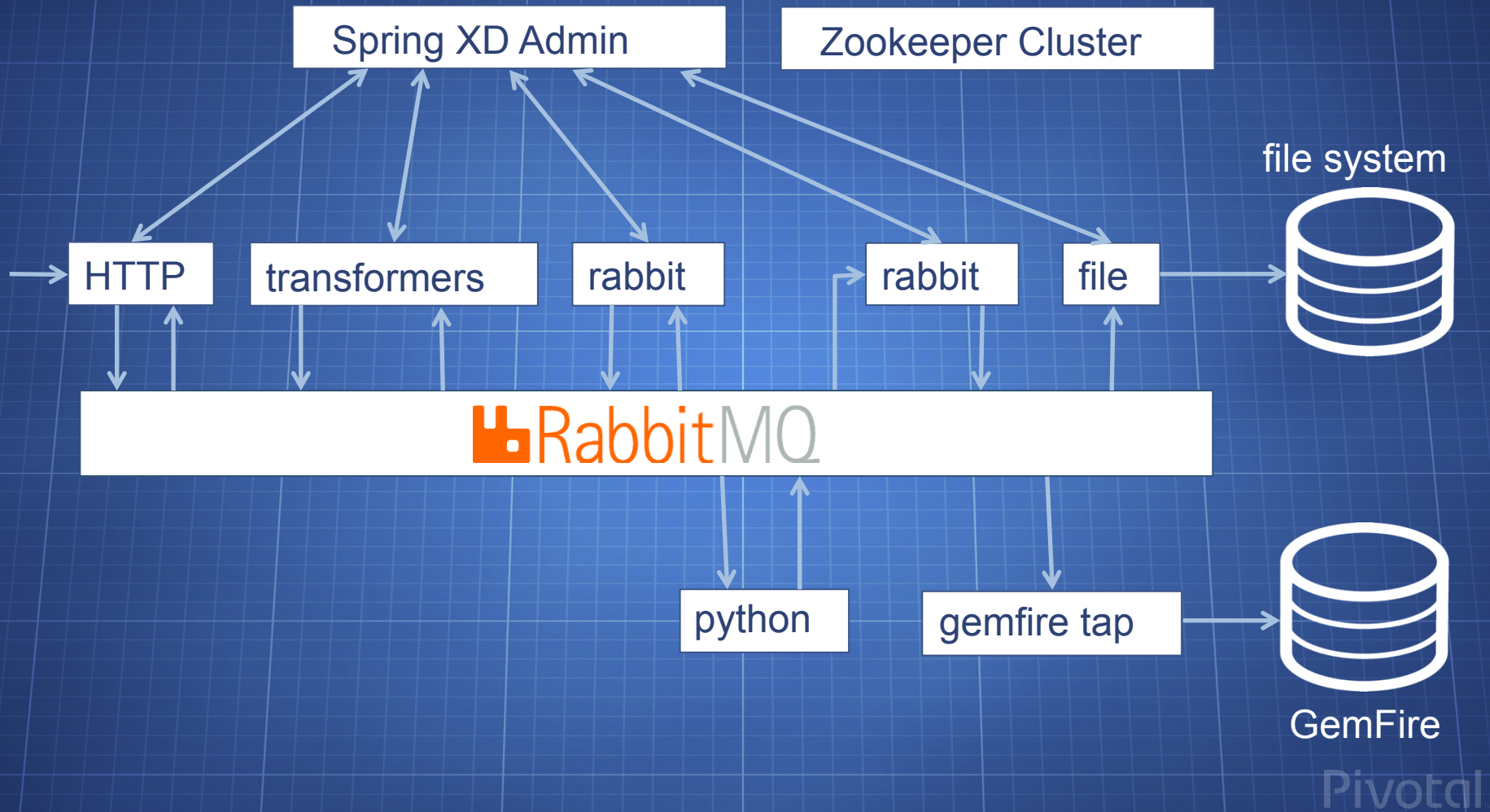
**MILLIONS OF
MESSAGES**



PER MINUTE OVER
100 GB

**WHAT DOES THIS
LOOK LIKE?**







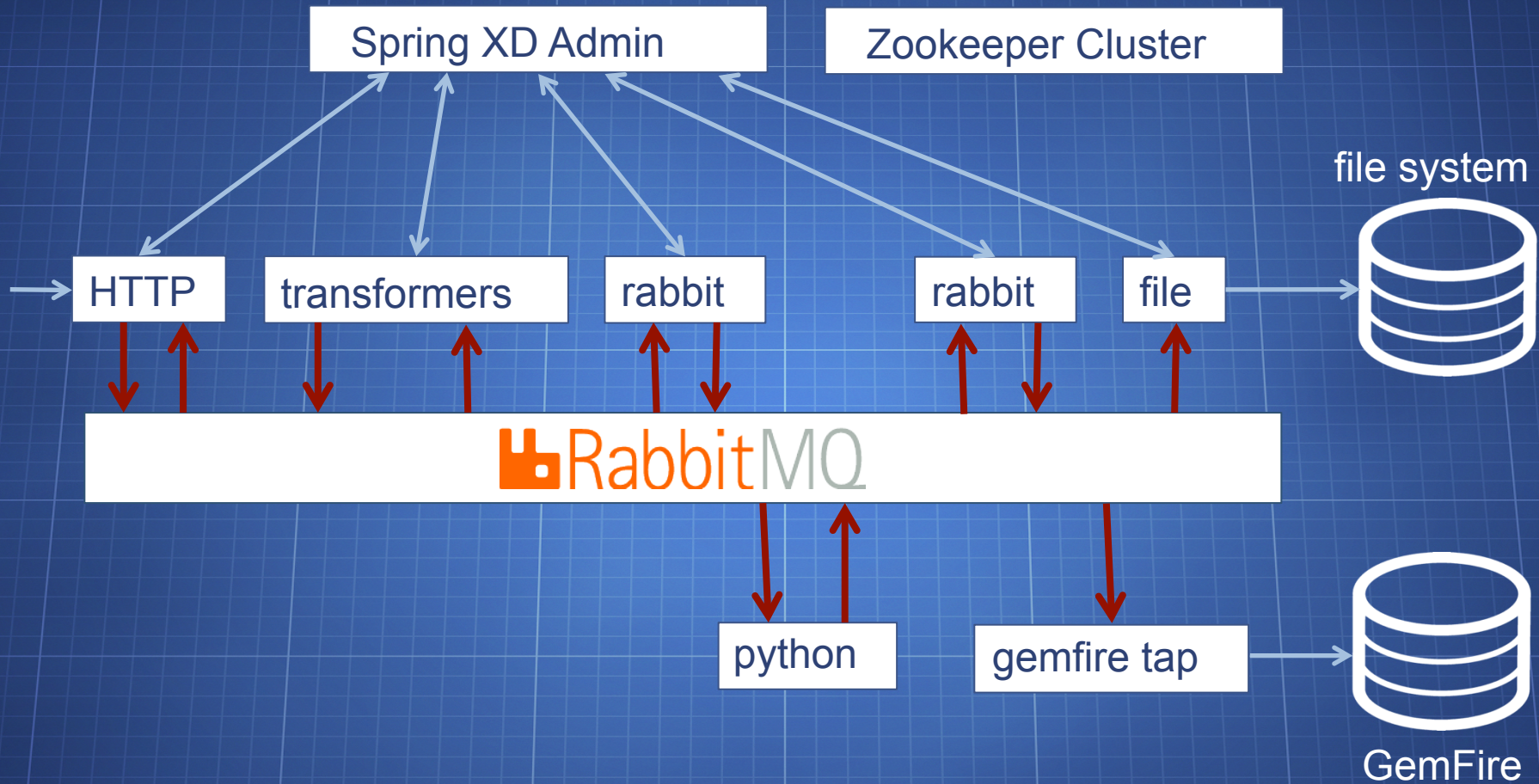
HOW DO WE MAKE IT
FASTER?

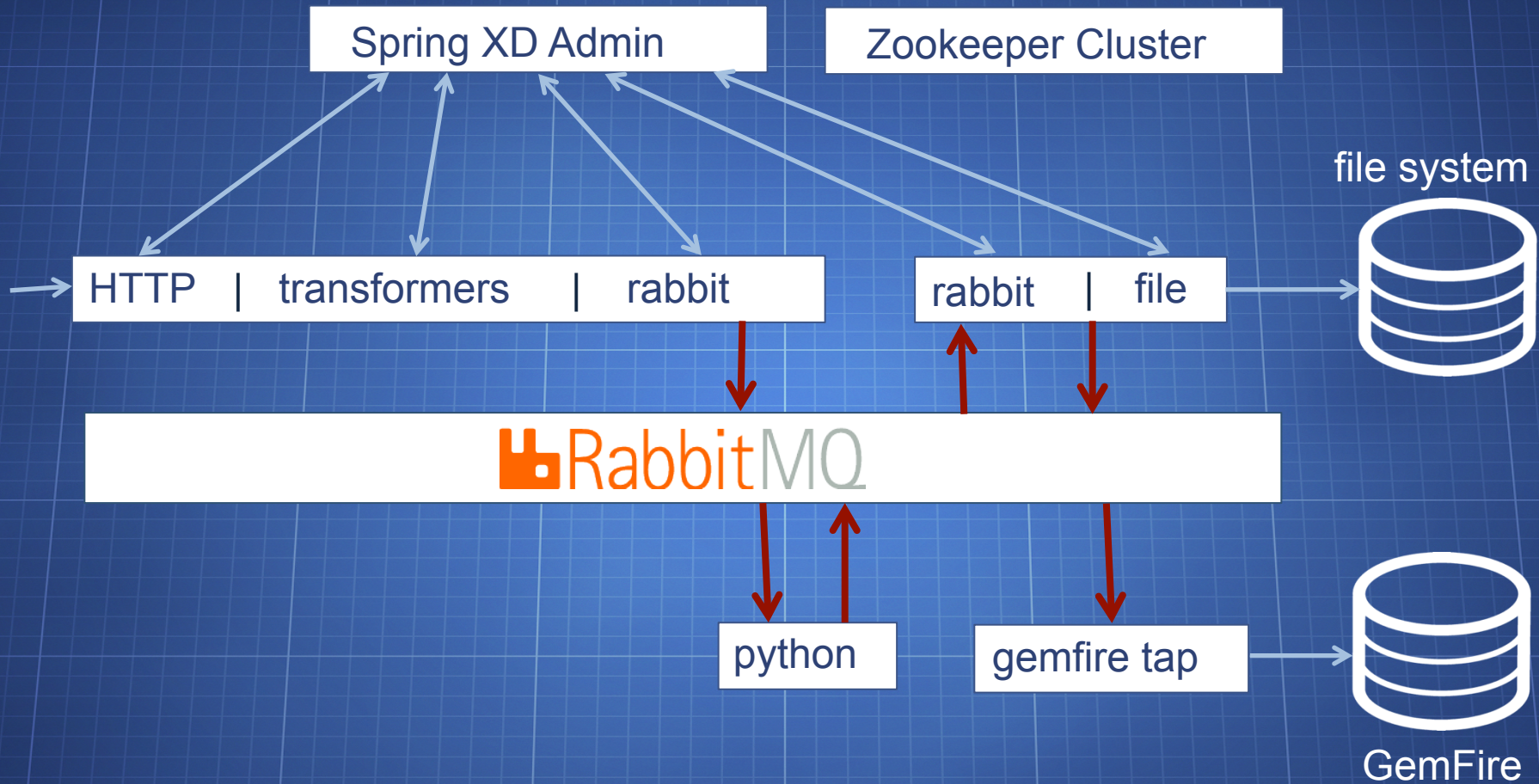


MAKE THE PAYLOAD
SMALLER



**PROCESS IS
I/O BOUND**







HIGH **AVAILABILITY**

Spring XD Admin

Zookeeper Cluster

file system



GemFire Cluster

Pivotal

HTTP | transformers | rabbit

HTTP | transformers | rabbit

HTTP | transformers | rabbit

rabbit | file

rabbit | file

rabbit | file

gemfire tap

gemfire tap



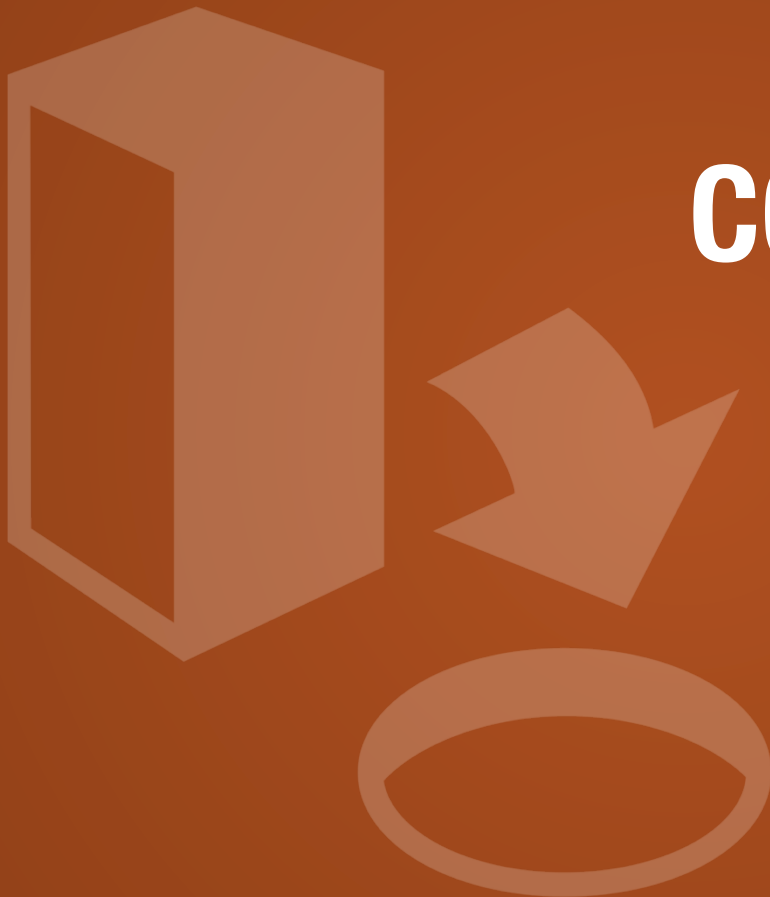
RabbitMQ

Cluster



IoT ISSUES

COMPATIBILITY



CONNECTIVITY





SECURITY



LOOKING INTO THE **FUTURE**



BATCH TRAINING IN **SPRING BATCH**

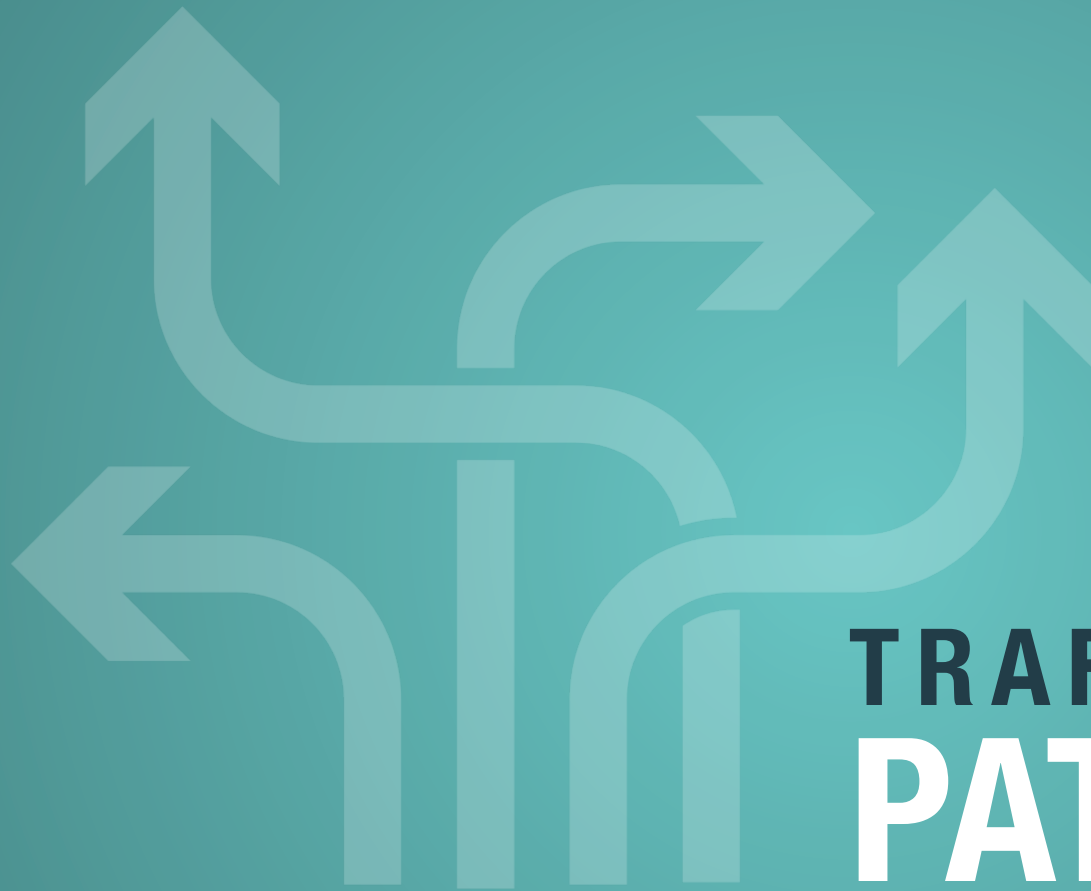




ADDITIONAL **USE CASES**

DRIVING EFFICIENCY





TRAFFIC **PATTERNS**



GAS **PRICING**

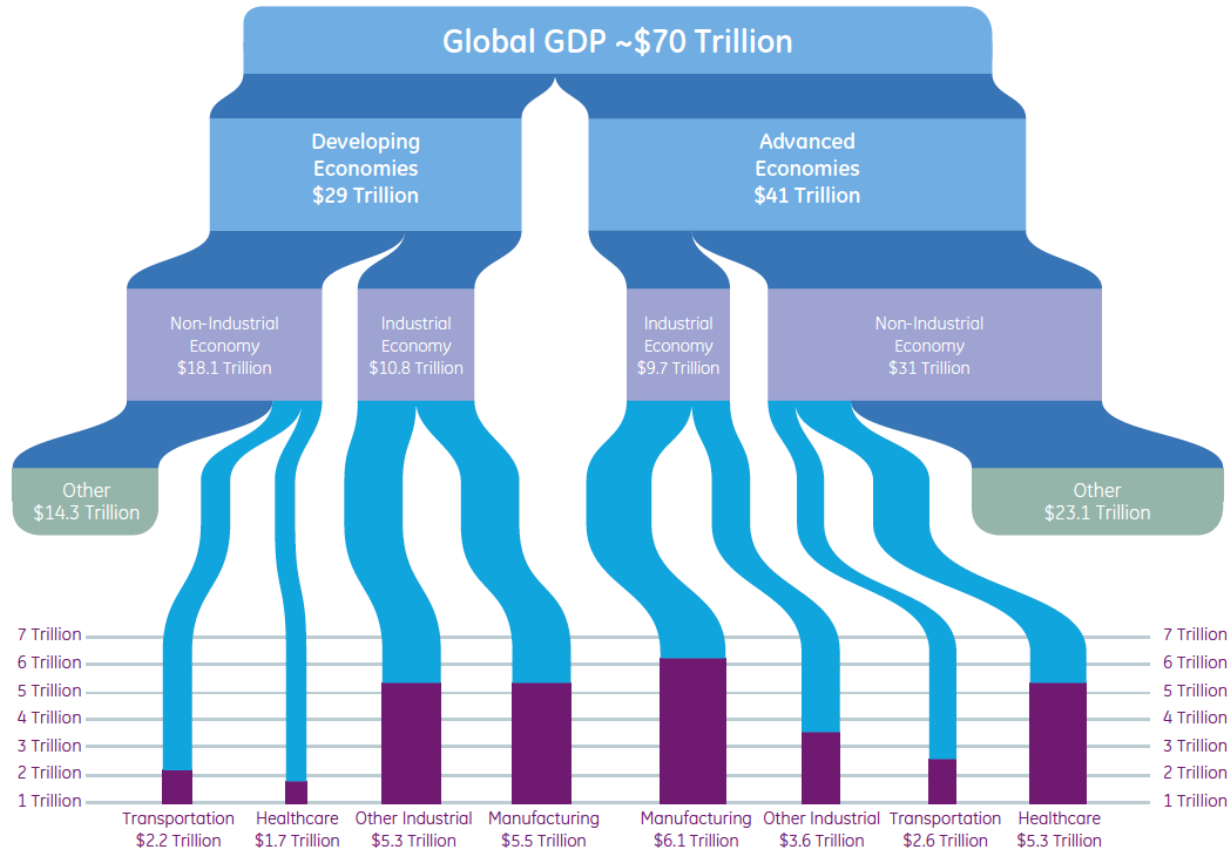
ACCIDENT ASSISTANCE





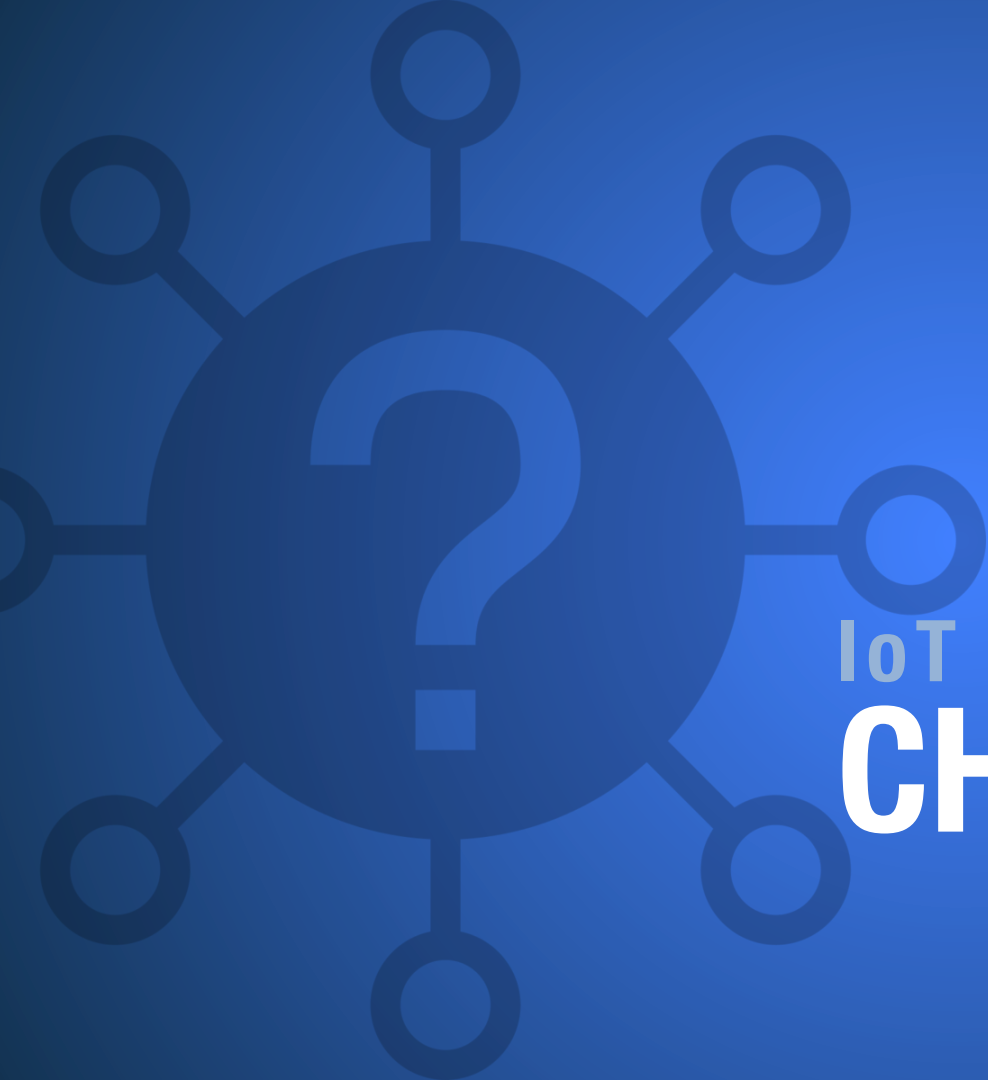
**IoT IS
EVERYWHERE**

Pivotal[™]



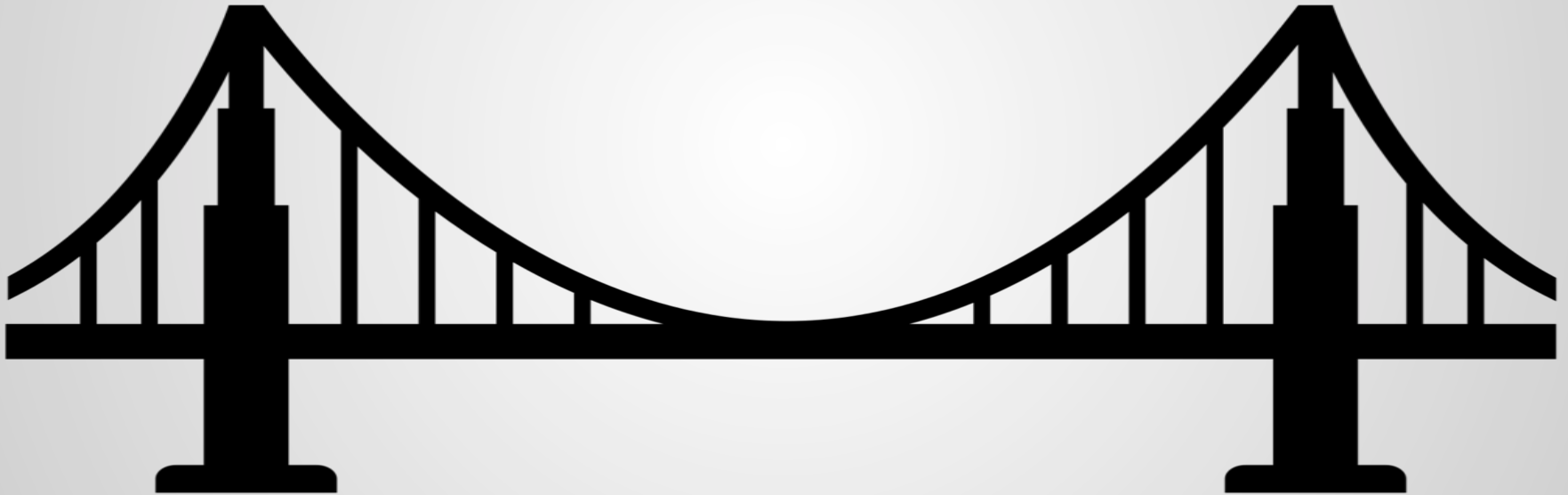
Industrial Internet opportunity (\$32.3 Trillion) 46% share of global economy today

Source: World Bank, 2011 and General Electric



IoT PRESENTS UNIQUE
CHALLENGES

IF YOU CAN
BRIDGE THE GAPS



SPRING XD

MAKES THE REST EASY





Learn More. Stay Connected.



Spring Framework

Project: spring.io/spring-framework

Github: github.com/spring-projects/spring-framework

Jira: jira.spring.io/browse/SPR

Spring Boot

Project: spring.io/spring-boot

Github: github.com/spring-projects/spring-boot

Spring XD

Project: spring.io/spring-xd

Github: github.com/spring-projects/spring-xd

Jira: jira.spring.io/browse/XD

Twitter: twitter.com/springcentral

YouTube: spring.io/video

LinkedIn: spring.io/linkedin

Google Plus: spring.io/gplus



Connected Car by OliM
from The Noun Project



Scale by Edward Boatman
from The Noun Project



Question by Jessica Lock
from The Noun Project



Servers by Jaime Carrion
from The Noun Project



Running by Dillon Arloff
from The Noun Project



Puzzle by Matthew Hall
from The Noun Project



Sad by Austin Condiff
from The Noun Project



Happy by Austin Condiff
from The Noun Project



Nut by Naomi Atkinson
from The Noun Project



iPhone by Oleg Frolov
from The Noun Project



Plus by P.J. Onori
from The Noun Project



Erlenmeyer Flask by Emily van den Heever
from The Noun Project



Loop by useiconic.com
from The Noun Project



Square Peg Round Hole by Brady Clark
from The Noun Project



Arrows by Juan Pablo Bravo
from The Noun Project



Flow Chart by Michael Wohlwend
from The Noun Project



Network by Mister Pixel
from The Noun Project



Car Accident by Stephanie Wauters
from The Noun Project



Contract by Dimitry Baranovskiy
from The Noun Project



Thumbs Up by Alv Jørgen Bovolden
from The Noun Project



World by Janique Le Bail
from The Noun Project



Stopwatch by Scott Lewis
from The Noun Project



Puzzle by Eric M. Ellis
from The Noun Project



Thinking by Jens Tärning
from The Noun Project



Clock by Nick Green
from The Noun Project



Database by Anton Outkine
from The Noun Project



Refridgerator by Rohan Gupta
from The Noun Project



Car by Laura Beggs
from The Noun Project



Car Accident by Stephanie Wauters
from The Noun Project



Error by Dmitry Baranovskiy
from The Noun Project



Blueprint by Dimitry Sokolov
from The Noun Project



Hard Drive by Mike Wirth
from The Noun Project



Fuel by Yair Cohen
from The Noun Project

The End