CADEC 2016

AN OVERVIEW OF

SPRING XD

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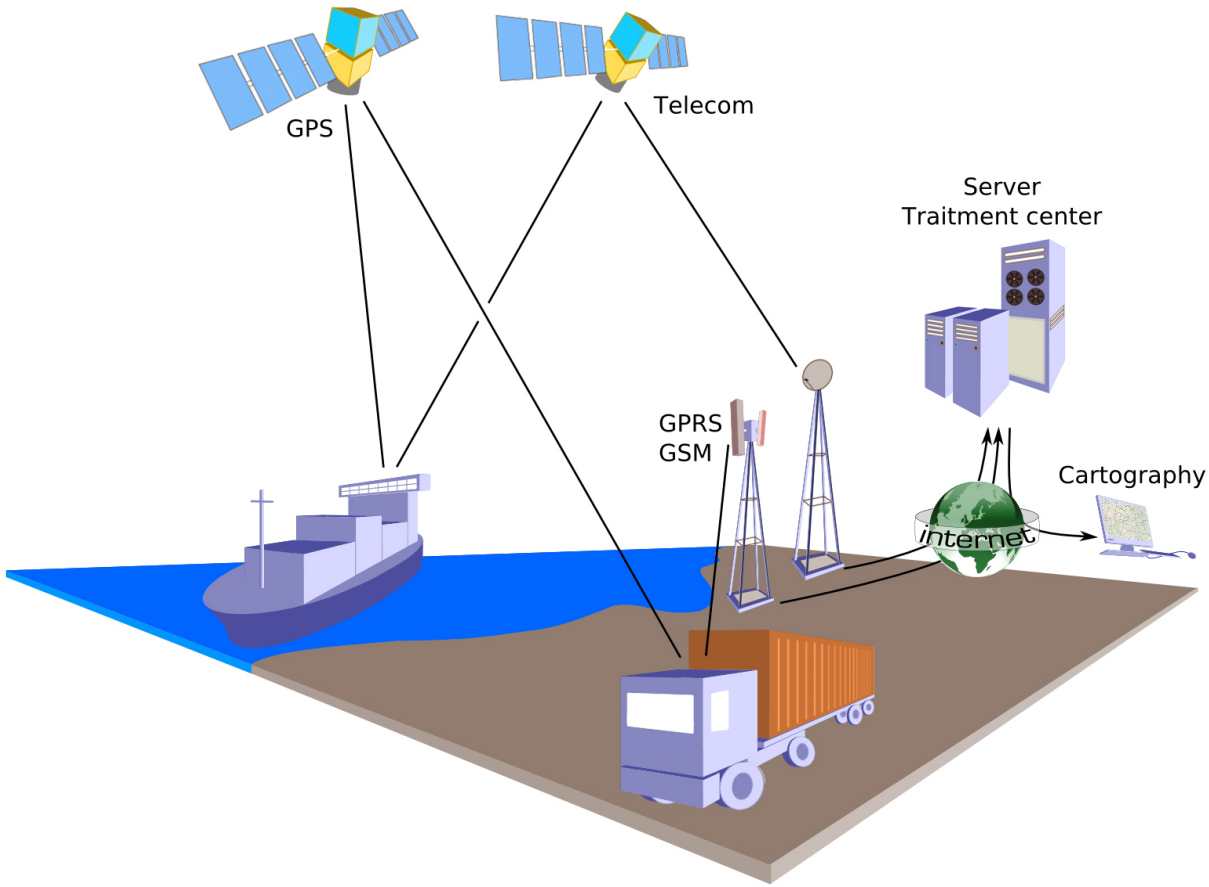
– ENTERPRISE –

ON THE AGENDA…

- Big Data & Data Ingestion
- Spring XD
- Demo



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According to IBM

$2{,}5 \times 10^{18}$

bytes of information is produced each day

That’s roughly

~ 2.5 million 1-terabyte hard drives

~ 3,8 billion CD-ROM discs

~1,7 trillion 3.5” floppy discs

BIG DATA

- Big Data can be about …
  - Collecting data
  - Analyzing data
  - Acting on data
  - And more depending in your context …
- Machine Learning
  - Is often applied on huge datasets
  - Is often used for drawing conclusions from datasets
  - Fascinating subject
    - But not what this presentation is about
- Spring XD
  - Is about collecting data

For the sake of context, a few real-world Big Data examples.

General Electric Jet Engine

- ~ one terabyte per flight

2014 U.S GP Formula 1 race

- 18 cars
- 150 sensors per car
- 243 terabytes of data

A modern connected car

- ~ 25 gb per hour

Oil rigs

- $150 000 per incident
- 25 000 metrics per second
- Machine Learning
  - Predictive maintenance
    - Early warning
    - Reduce failures
    - Progress anticipation

Mining industry

Dundee Precious Metals

- Sensor data mining and machine learning
  - Reduce production outages
  - $60 to $40 per ton raw material extraction cost

Commodity futures

Example from Spring One 2GX:

Predict price of corn, soybean and wheat futures for an undisclosed agricultural company using Twitter posts.

- Ingests ~ 50 million tweets per day using Spring XD
- By using various data analysis technologies together with other data sets, crop futures could be forecasted.

DATA INGESTION

- Data Ingestion is about collecting ”Big Data”
  - Distributed & Scalable
  - Pipelining
- Data is often heterogenous
  - Protocols (HTTP, JMS, JDBC, TCP/UDP, FTP, …)
  - Format (JSON, XML, plain text, binary, …)
- Data may need processing before being sunk into the Data Lake
  - Filtering
  - Transformation
  - Aggregation
  - Splitting
  - Routing
  - (E.g. traditional Integration Patterns)

DATA INGESTION VS INTEGRATION FRAMEWORKS

- Data Ingestion is used for different purposes than Integration Platforms
- Focus is on scalability over correctness:
  - Aggregated data over single data items
    - E.g. metrics
  - Used for enabling analysis of data rather than handling your core business process
  - No focus on guaranteed or eventual data consistency
    - E.g. no transaction, retry or rollback semantics
- Strictly one-way
  - Can’t return data to the remote party

SPRING EXTREME DATA

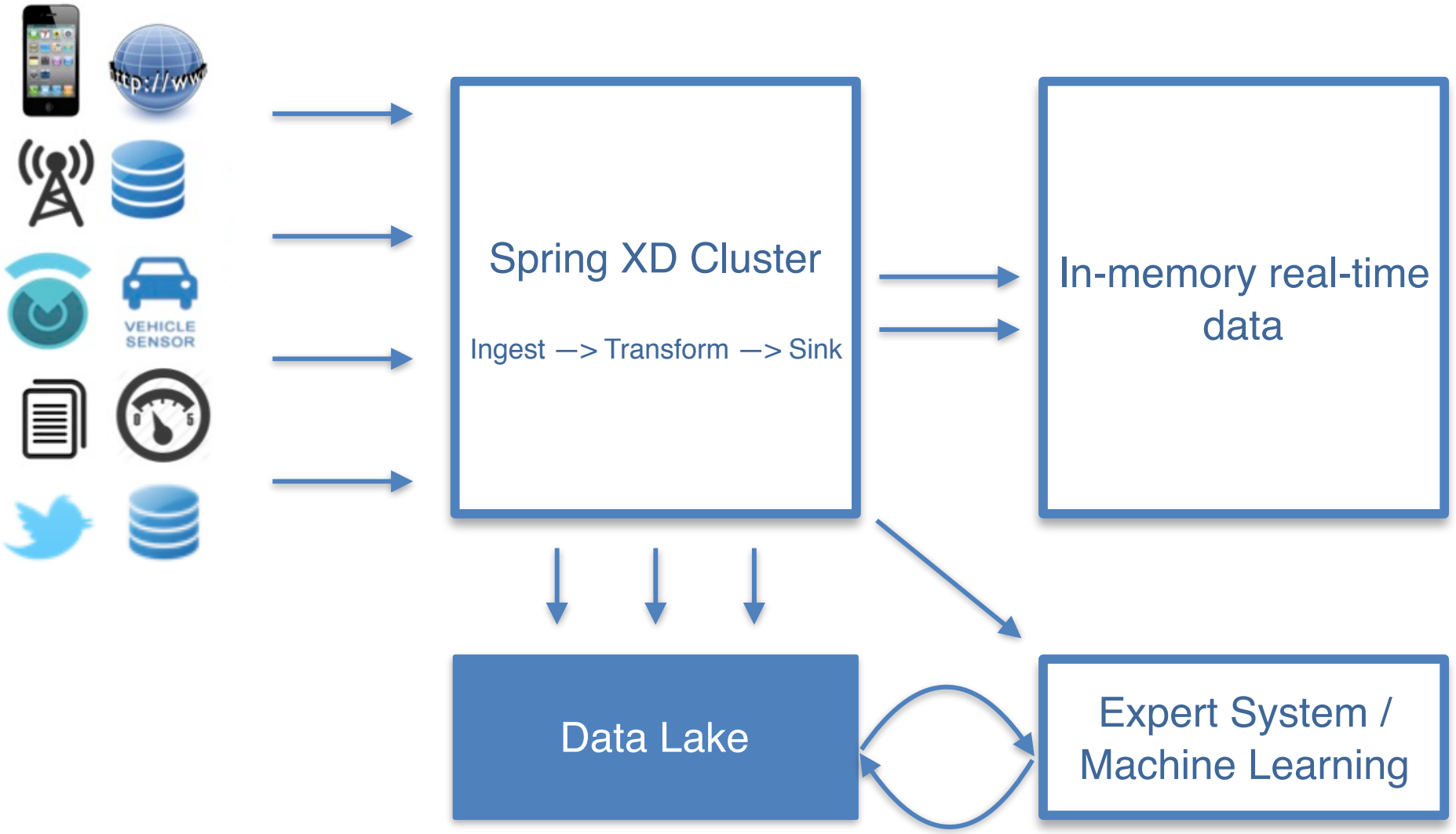
- So, what is Spring XD (eXtreme Data)?

”Distributed data pipelines for real-time and batch processing”

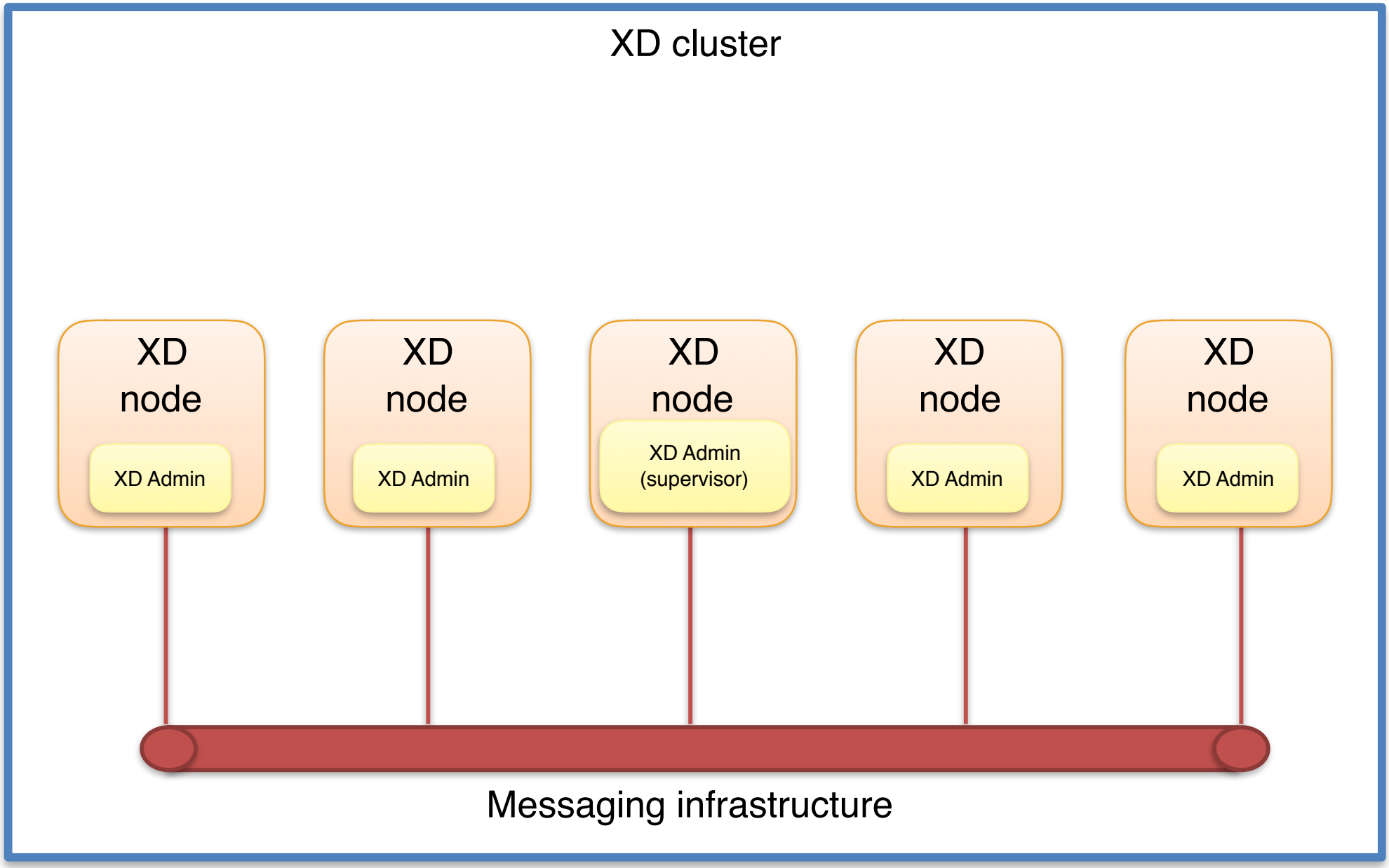
SPRING EXTREME DATA

- Which boils down to:
  - Framework for performing Data Ingestion
  - Distributed streaming of real-time data
  - Real-time analysis of data streams at ingestion time
  - Batch Jobs

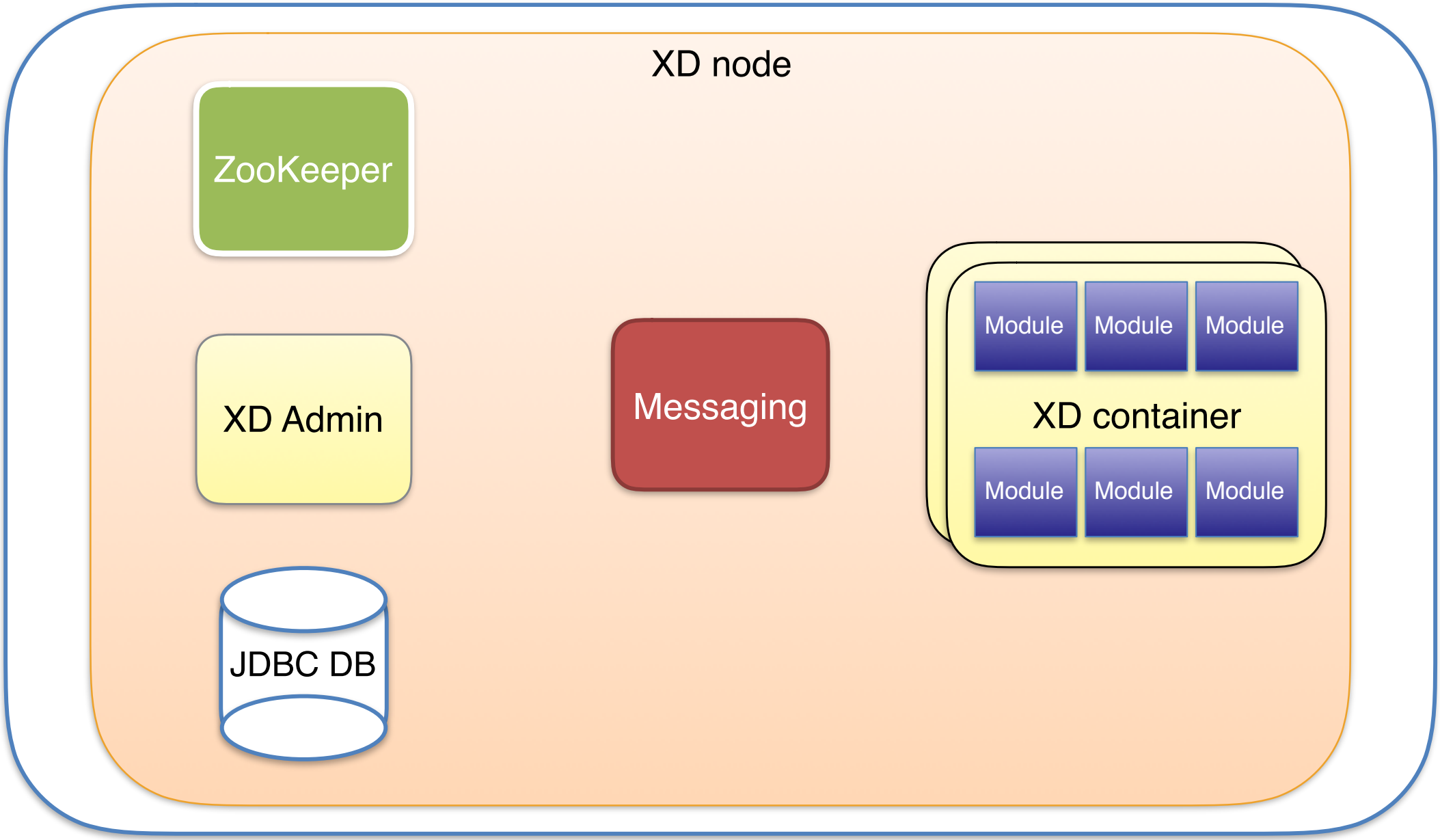
SPRING XD IN THE BIG DATA CONTEXT



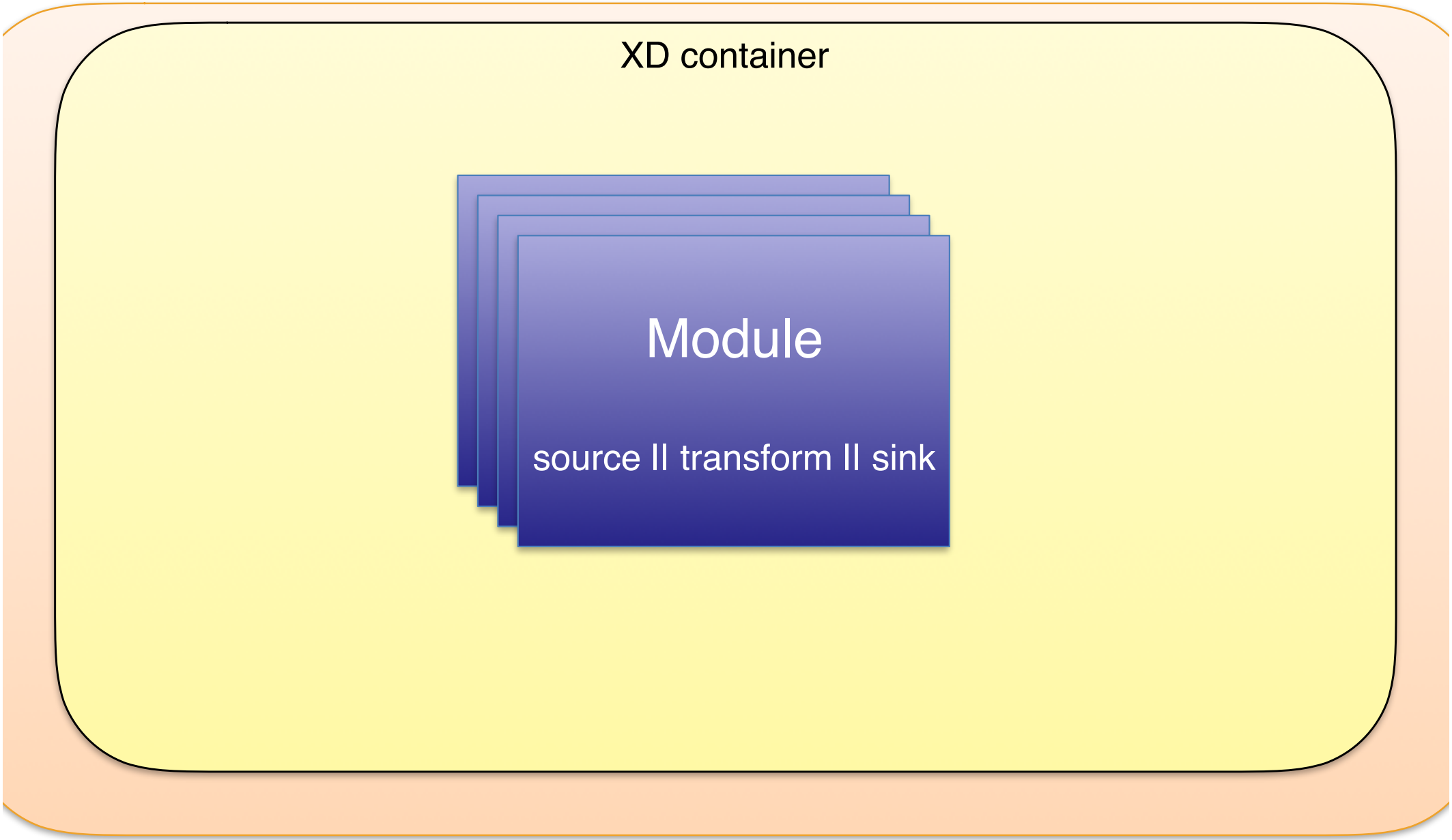
SPRING XD — DISTRIBUTED SYSTEM LANDSCAPE



SPRING XD — A DISTRIBUTED XD NODE



THE XD CONTAINER

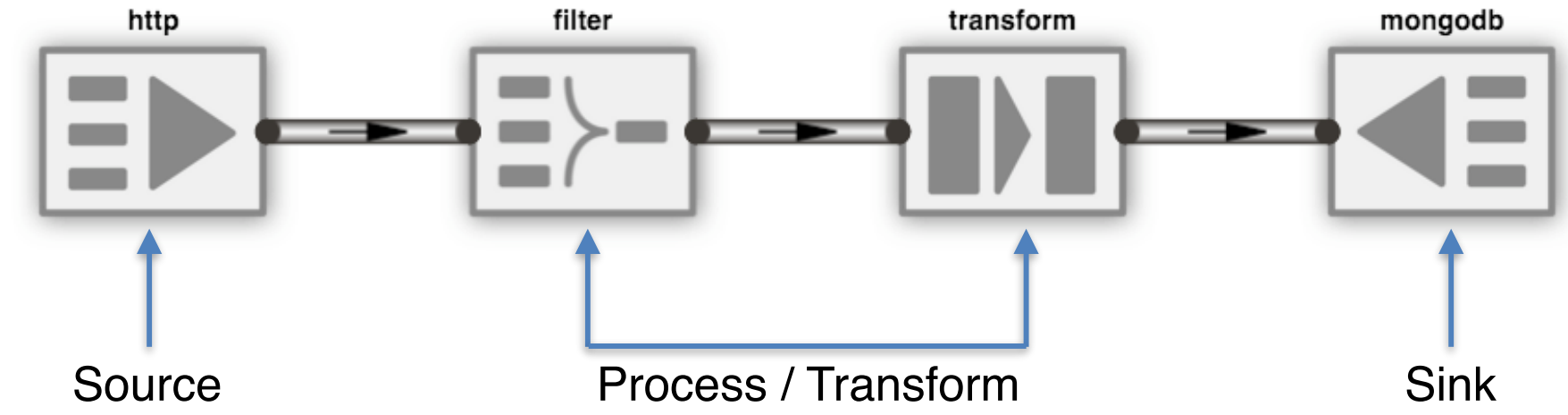


SPRING XD OPERATING MODES

- Distributed
  - QA, production etc.
  - Semi-complex infrastructure, more configuration
- Single-node
  - Development purposes

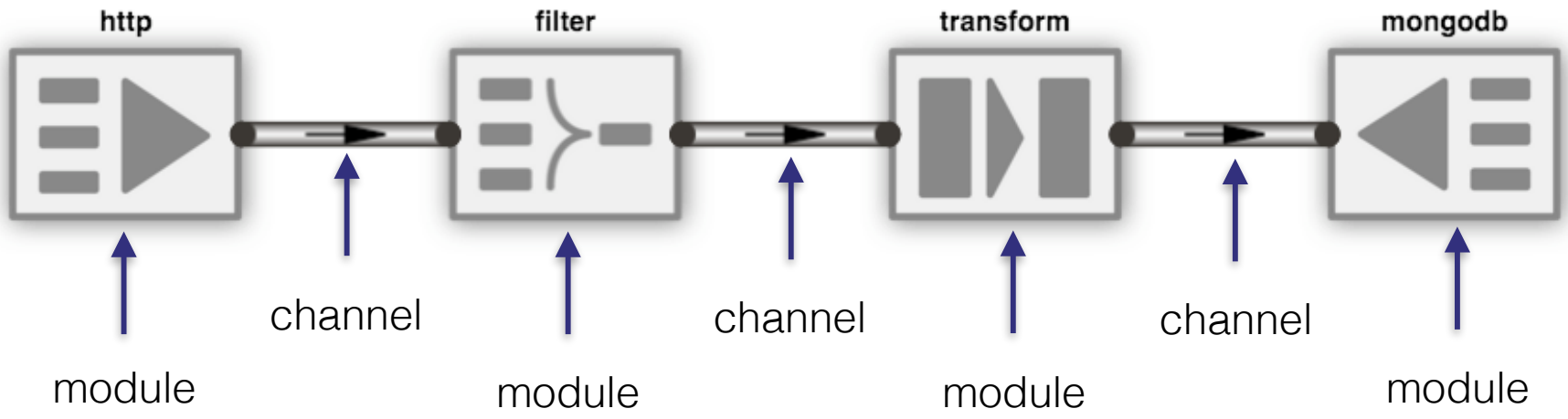
THE SPRING XD STREAM

- Ingest —> Transform —> Sink pattern
- A stream is defined by at least one source and one sink



STREAMS & MODULES

- Each part of a Stream is an XD module
- Each module is a ”Spring Integration message flow” component
- Each module connects to the next one in the stream through a ”channel”



CHANNELS

- Channels connects the XD modules of a Stream
- Based on distributed message passing
  - RabbitMQ, Redis or Kafka
- Modules in the same Stream can live in totally different XD containers and nodes of the cluster

DISTRIBUTION OF MODULES

Containers

Quick filter

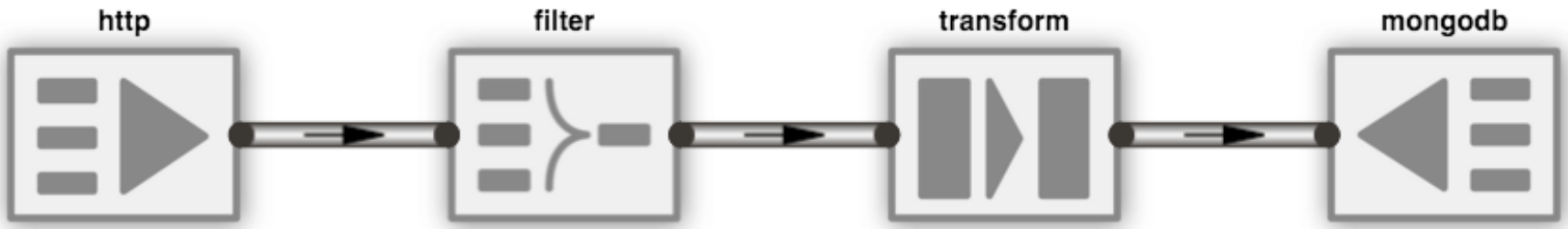
Container Id	Groups	Deployed Modules	Action
03da11e3-ceb0-470f-bd10-76f1b3b37d6e	N/A	httpStream http.1 ↓N/A ↑N/A httpStream file.1 ↓N/A ↑N/A	✖ Shutdown
13aad62d-4ccc-4e33-8c33-af7b37848c81	N/A	httpStream transform.1 ↓N/A ↑N/A	✖ Shutdown
2d6652d7-4d7b-4d16-91a3-74e0e63d5bb5	N/A	httpStream filter.1 ↓N/A ↑N/A	✖ Shutdown

THE SPRING XD MODULE

- The XD module is the core building component
- Three major types:
  - Sources - Data inputs such as HTTP, TCP, JDBC, JMS, FTP
  - Processors - filters, transformers, aggregators, splitters, routers…
    - E.g. Good ol' Integration Patterns
  - Sinks - Data outputs. HDFS, JDBC, JMS, HTTP, TCP, FTP, Logs, Files, Null …
- One special type: Taps
  - Comparable to a wiretap, branches off at a defined position in a Stream with a copy of the payload
- XD comes with ~ 60 ready-to-use modules
- Custom XD modules very easy to develop
  - Groovy scripts, Java, …

INGEST -> TRANSFORM -> SINK

DSL demo

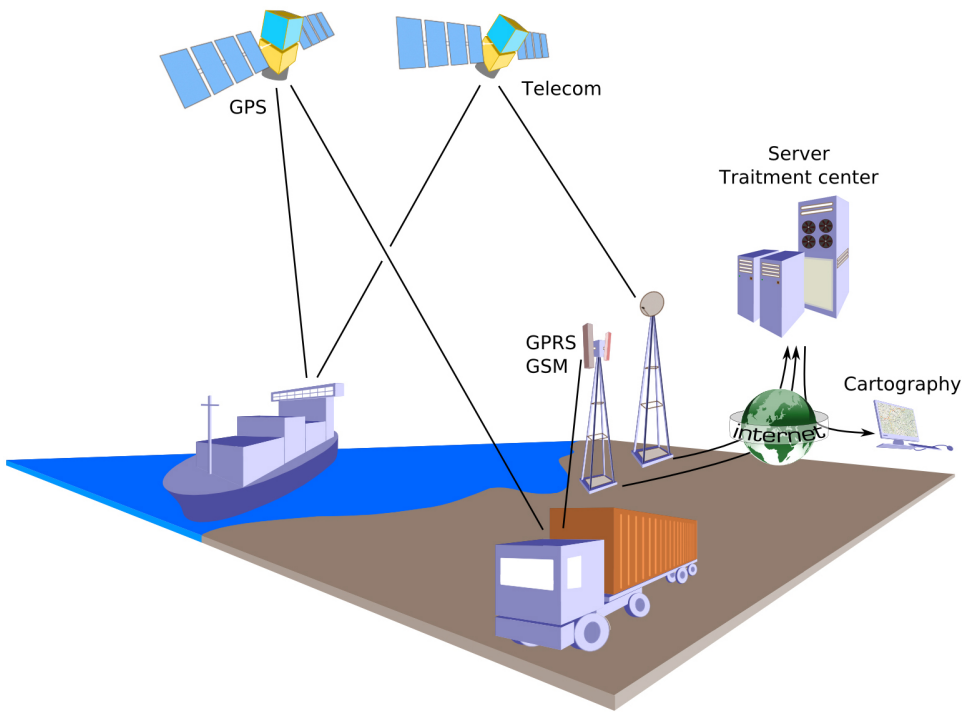


DSL

```
stream create --name myStream --definition
"http --port=1717 |
filter --expression=payload.contains(':')
| log"
```

THE DEMO

- Make-believe ”Fleet Management”
- Simulates 2000 vehicles
- Each submitting one TCP and one HTTP message every two seconds
  - Geolocation & Engine data
- Process and dump TCP into MongoDB
- Log HTTP and TCP
- Realtime analytics



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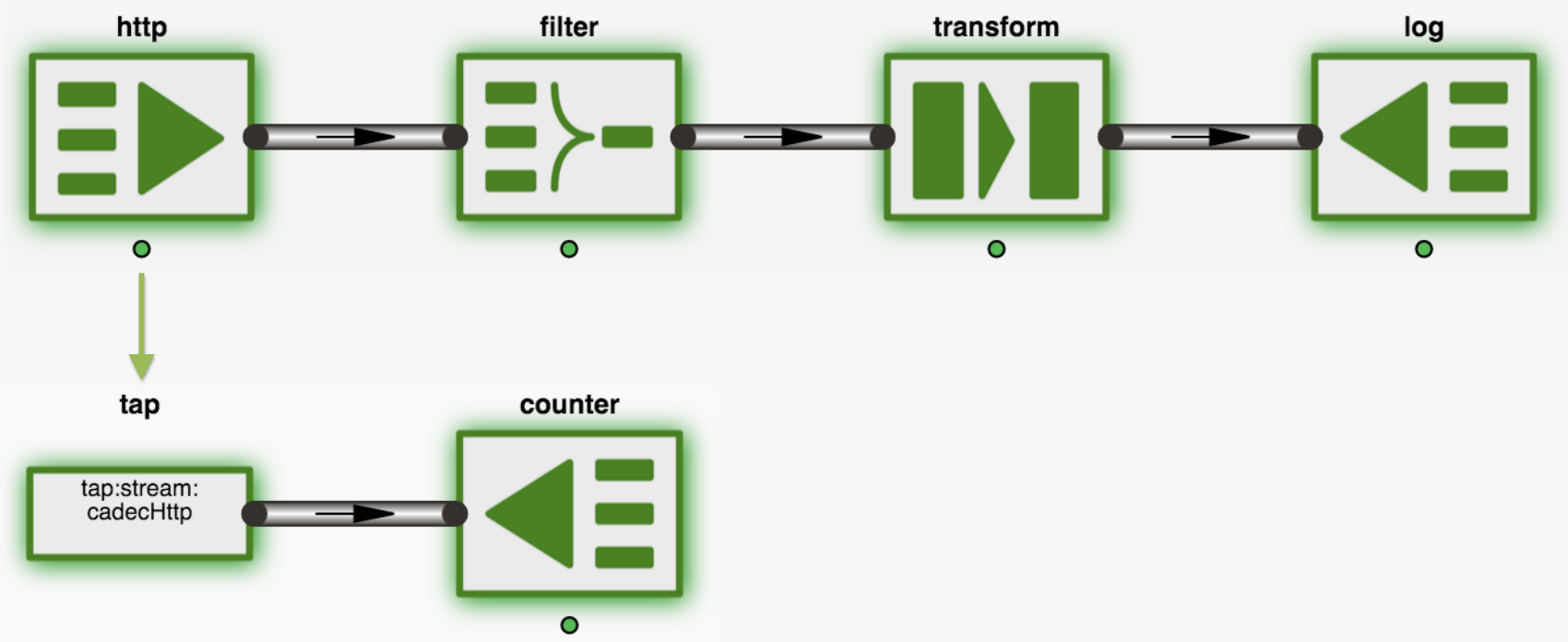
DEMO - LOAD TEST TOOL

- Uses ”Gotling" load-test framework
  - Inspired by Gatling, but written i Go.
  - Support for high volumes of HTTP requests and TCP packets
- See http://callistaenterprise.se/blogg/teknik/2015/11/22/gotling

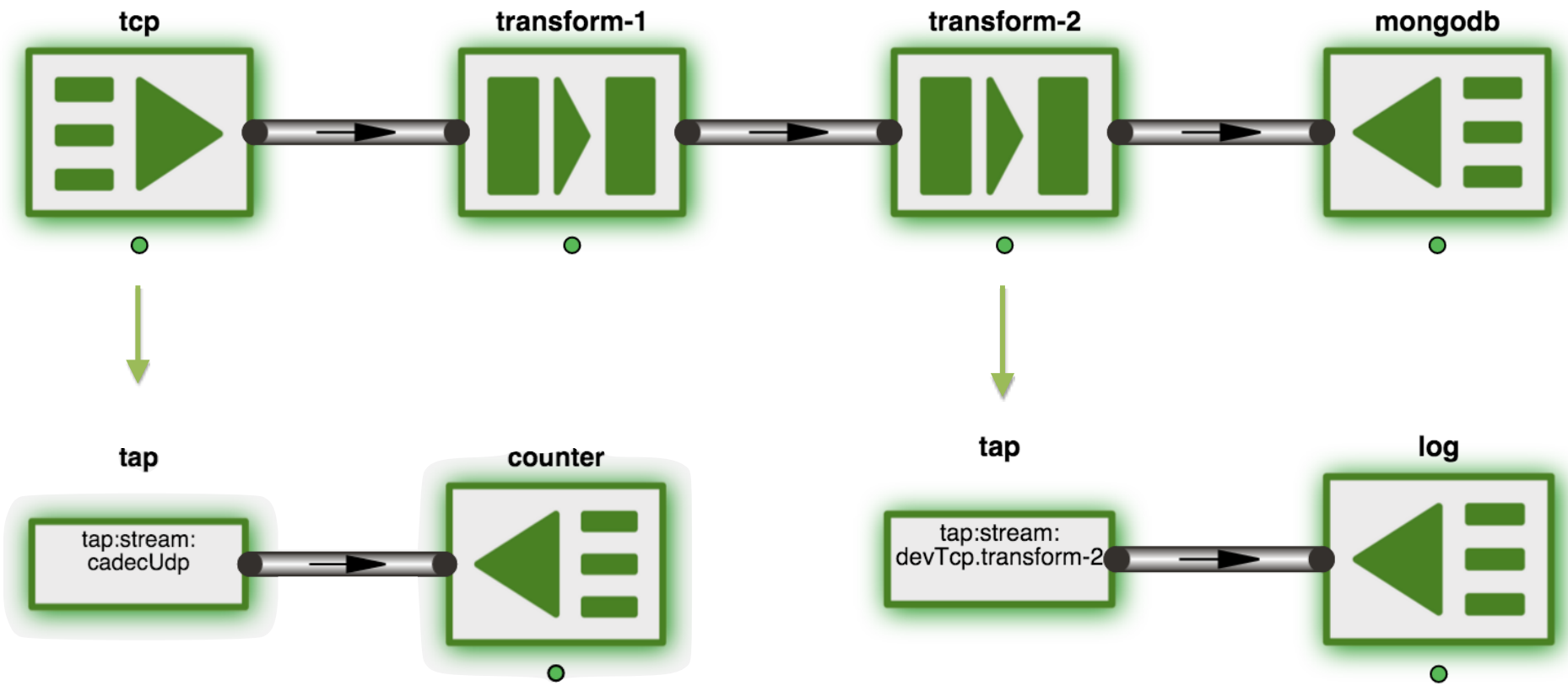
GOTLING SIMULATION SPECIFICATION

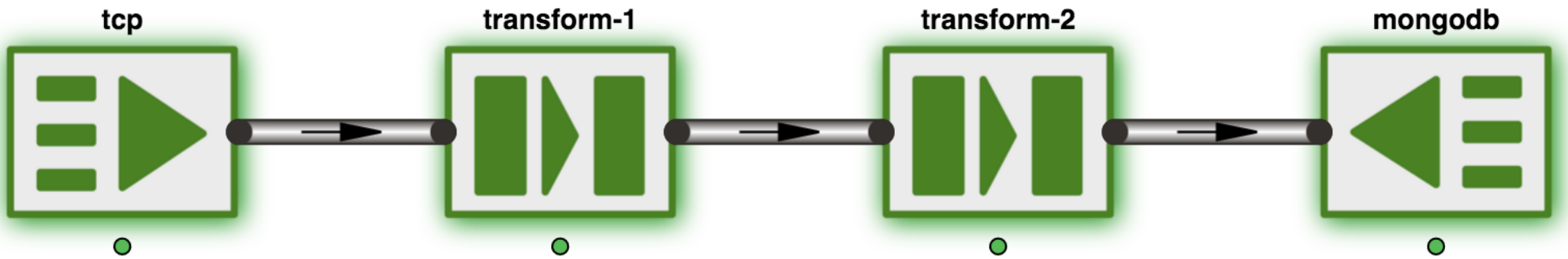
```
---
iterations: 500
users: 2000
rampup: 60
feeder:
  type: csv
  filename: fleetdata.csv
actions:
  - sleep:
      duration: 1
  - http:
      title: Submit Geolocation data
      method: POST
      url: http://localhost:10000
      accept: json
      body: '{"vehicleid":${UID},"lat":${lat},"lon":${lon}}'
  - sleep:
      duration: 1
  - tcp:
      title: TCP engine data packet
      address: 127.0.0.1:8081
      payload: ${UID}|${dp1}|${dp2}|${dp3}|${dp4}|${dp5}
```

DEMO STREAMS - HTTP GEOLOCATION



DEMO STREAMS — TCP ENGINE DATA






```
31303030337c313
32e337c2034332e
357c3334
```

```
10003|13.3|43.5|34
```

```
[
"10003",
"13.3",
"43.5",
"34"
]
```

```
{
  "UID" : "10003",
  "nox" : "13.3",
  "co2" : "43.5",
  "fuel" : "34"
}
```

byte[] → String → String[] → Tuple/JSON

CUSTOM PROCESSOR USING GROOVY

DSL SNIPPET

```
… | transform --script=totuple.groovy | …
```

totuple.groovy

```
return org.springframework.xd.tuple.TupleBuilder.tuple()
        .put("UID", payload[0])
        .put("nox", payload[1])
        .put("co2", payload[2])
        .put("fuel", payload[3])
        .build()
```

DEMO

SPRING CLOUD DATA FLOW VS SPRING XD

- Spring Cloud Data Flow
  - ”Cloud-native Data Ingestion”
- Redesign of Spring XD for the Cloud
  - Uses the same DSL, admin shell, GUI etc.
- Geared for cloud-based (PaaS) runtime environments
  - Pivotal Cloud Foundry
  - YARN
  - Apache Mesos
  - Kubernetes

SIMILAR PROJECTS / PRODUCTS

- Apache Spark Streaming (Berkeley)
- Apache Storm (Twitter)
- Gobblin (LinkedIn)

SUMMARY

- Big Data & Data Ingestion:
  - Huge subject with many use cases and perspectives
  - Data Ingestion is important:
    - Many Data Scientists spend > 50% time on data setup
    - Data is diverse
    - There are a lot of data out there!

- Spring XD:
  - Provides a scalable framework for ingesting data
  - Simple DSL and decent admin tools
  - Easy to extend and customize
  - Slightly complex runtime environment
    - Spring Cloud Data Flow may be an option
  - Is NOT a traditional Integration Framework

Thanks for listening!

SUMMARY

Questions?

SOME URLS

Dundee Precious Metals:
http://www.wsj.com/articles/mining-sensor-data-to-run-a-better-gold-mine-1424226463

GE Jet engine:
http://www.bloomberg.com/bw/articles/2012-12-06/ge-tries-to-make-its-machines-cool-and-connected

Connected car:
https://www.hds.com/assets/pdf/hitachi-point-of-view-internet-on-wheels-and-hitachi-ltd.pdf

F1 teams
http://www.forbes.com/sites/frankbi/2014/11/13/how-formula-one-teams-are-using-big-data-to-get-the-inside-edge/

Oil Industry
https://blog.pivotal.io/pivotal/case-studies/data-as-the-new-oil-producing-value-for-the-oil-gas-industry