Logisland

event-mining@scale

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Schedule

- Introduction
- Core concepts
- Knowledge Paradigm
- Technical stack
- API Design
- Quick start

Introduction

Logisland Big picture

- **Multi-Purpose** realtime analytics framework
- **High scalability** and **Fault-tolerant**.
- **High throughput** (billions messages / day).
- **Easy** to operate on Hadoop or on **standalone containers**
- **Easily Extensible** to build high level apps
- **Open source**, initiated by Hurence

Use cases

- **Log aggregation** : low latency log processing
- **Stream processing** : multiple stages of processing (enriching, ...)
- **Complex Event processing** : write custom business Rules to generate alerts, for fraud detection
- **click stream tracking** : capture user click stream data
- **SIEM** : security manager for intrusion detection
- **IoT** : generate alerts based on outliers and forecasting.

Challengers

- **ELK** is great to start with, but hard to centralize processing and lacks of real offline ML
- **Splunk** is fantastic but clients are not rich enough to afford it ;)
- **NIFI** is a great tool but doesn't play well with distributed processing
- **Metron**, **Eagle** are security centric

Features

- **out-of-the-box components** (no code required)
- high level **extensible** framework
- raw data to structured records automatic **conversion**
- alert percolation or **query matching**
- event **governance** with Avro schema management
- **online prediction** with offline trained ML models

Features 2

- I/O to Elasticsearch, HBase, HDFS, RocksDB, …
- telemetry sources (bro, pcap, netflow)
- live enrichement (geoip, custom lookups)
- SQL aggregations
- Time series **sampling**
- Outliers detection
- **Network footprint** clustering

Core

Core Concepts

event =

chronological change
in the system state

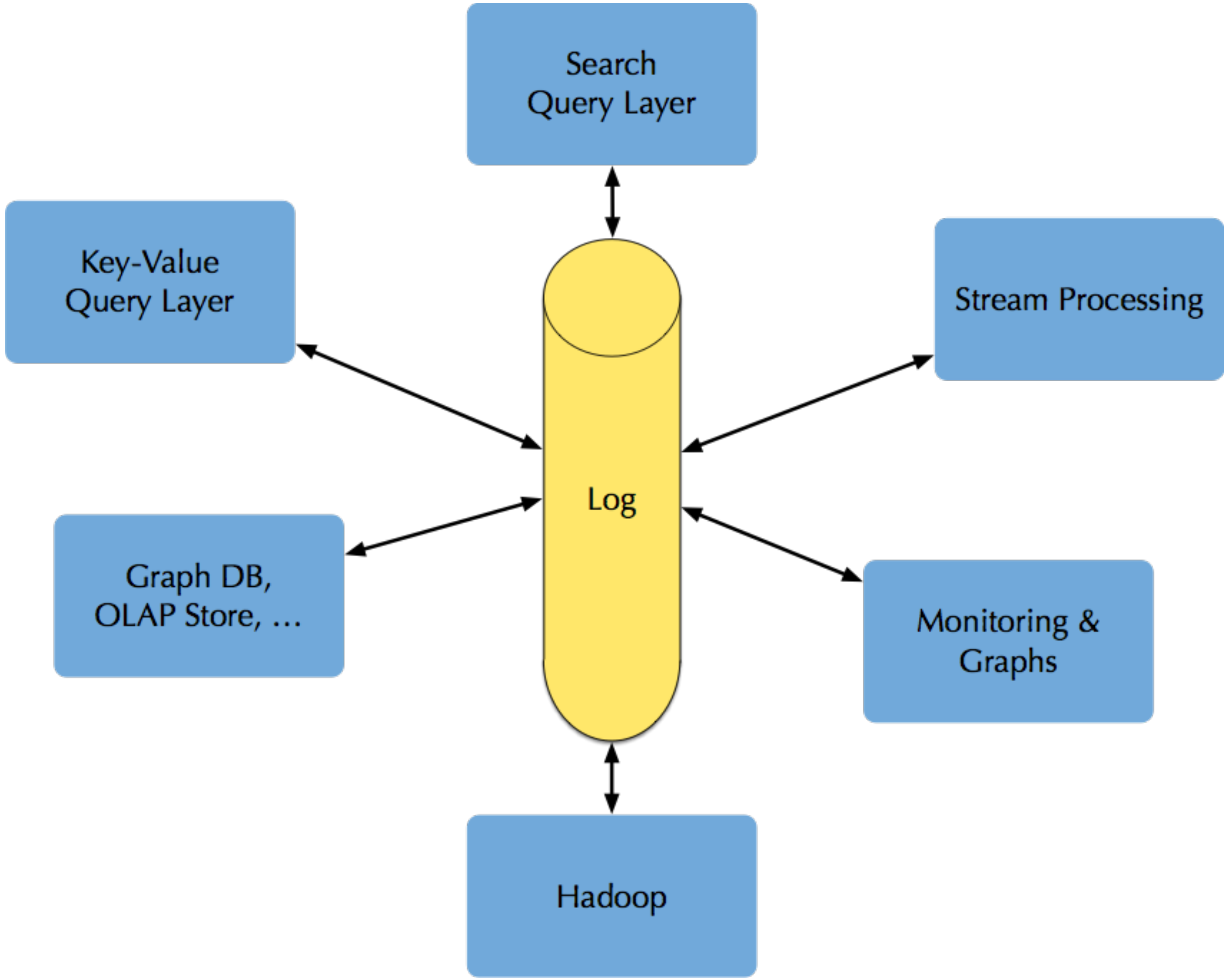
log =

centralized registry of

chronologically ordered events

Log centric architecture

- **async** event production and consumption.
- **uncorrelated** publishers and subscribers.
- acts as a **Messaging system**.
- replay the log from any point in time.
- **realtime** event availability.



Logisland =

high level stream analytics solution

to handle massive scale

event processing

Pyramidal Knowledge Paradigm

Logisland continuously transforms

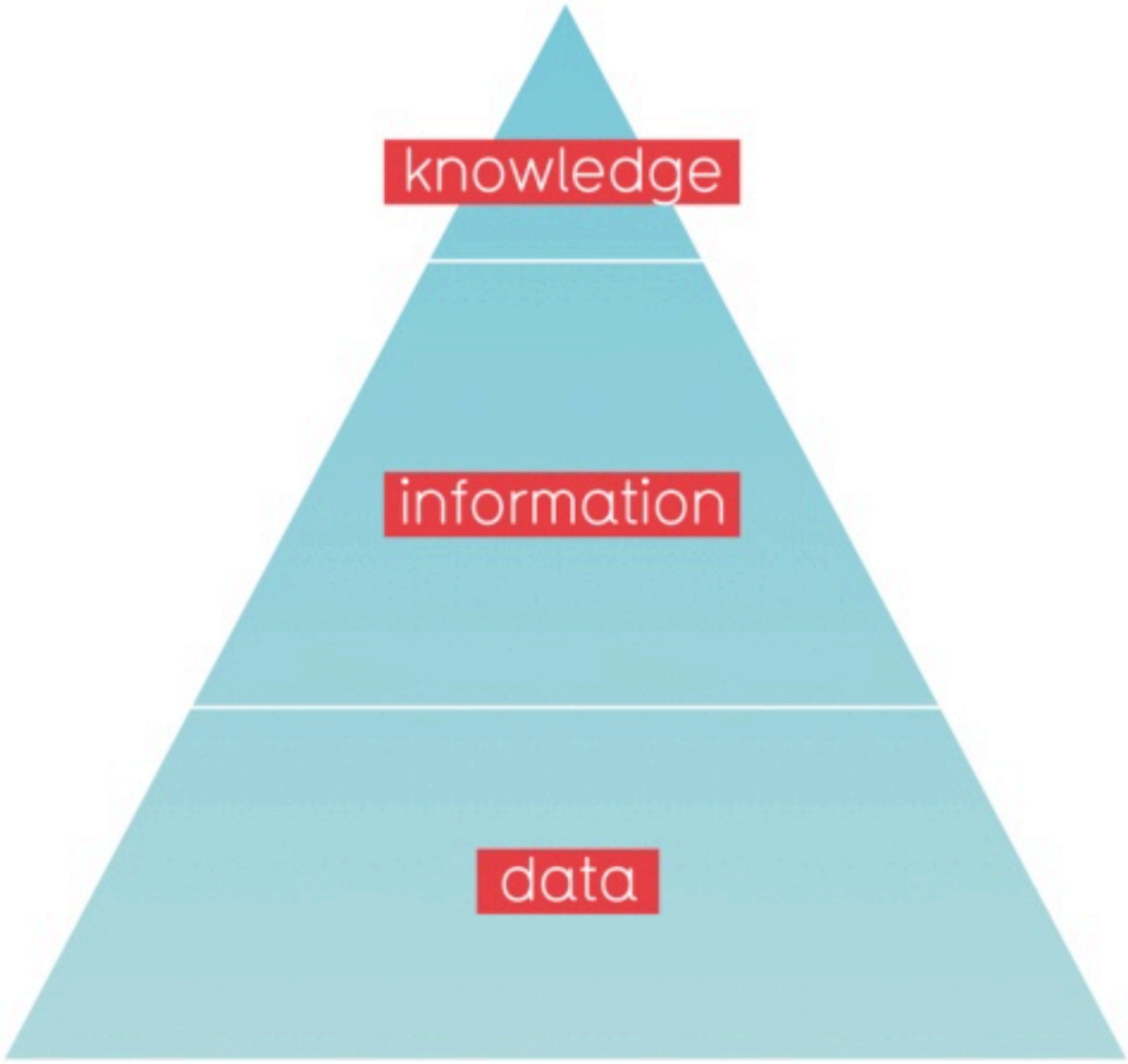
data into information &

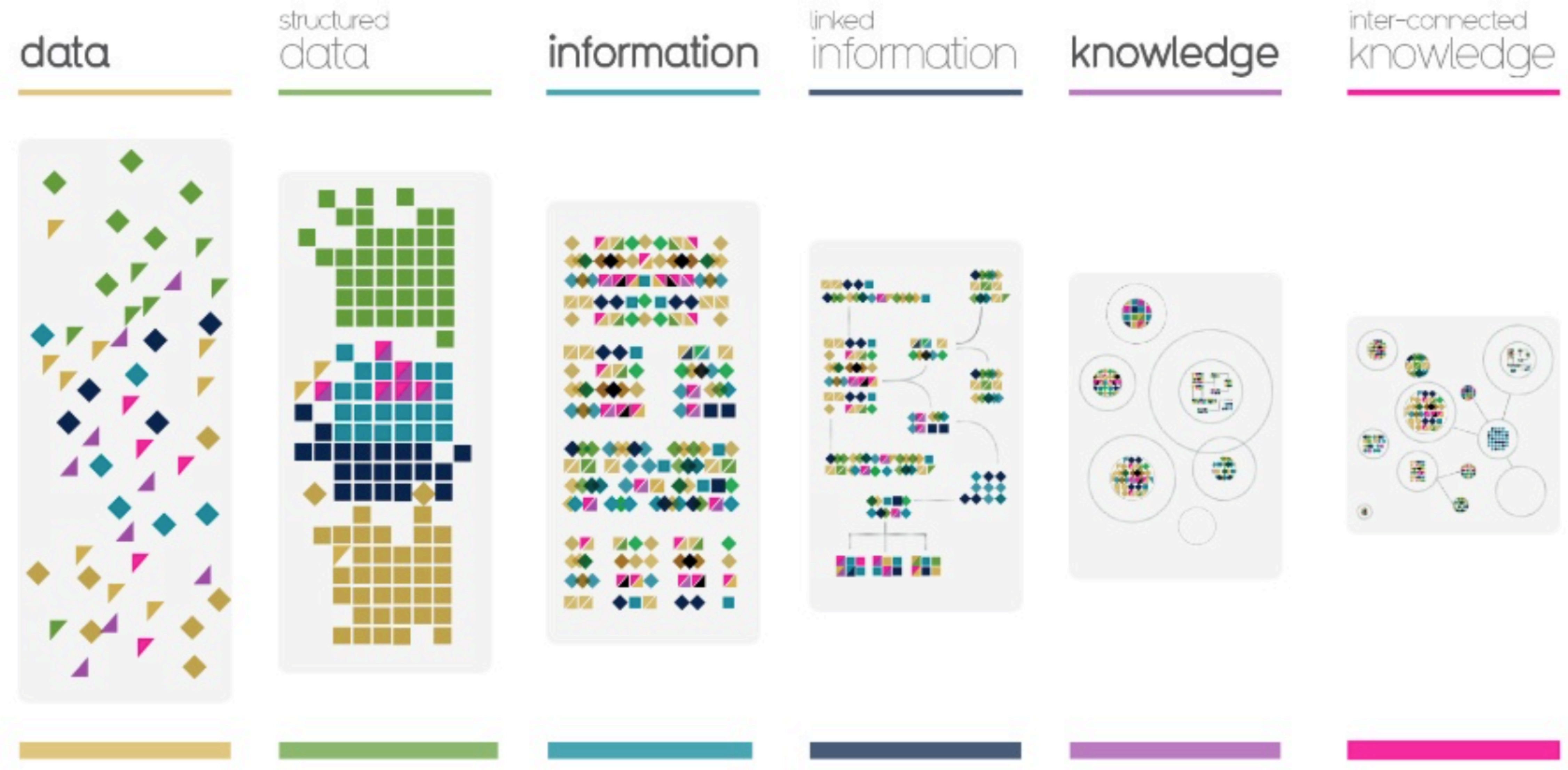
information into knowledge

by using asynchronous processing on

increasingly abstract

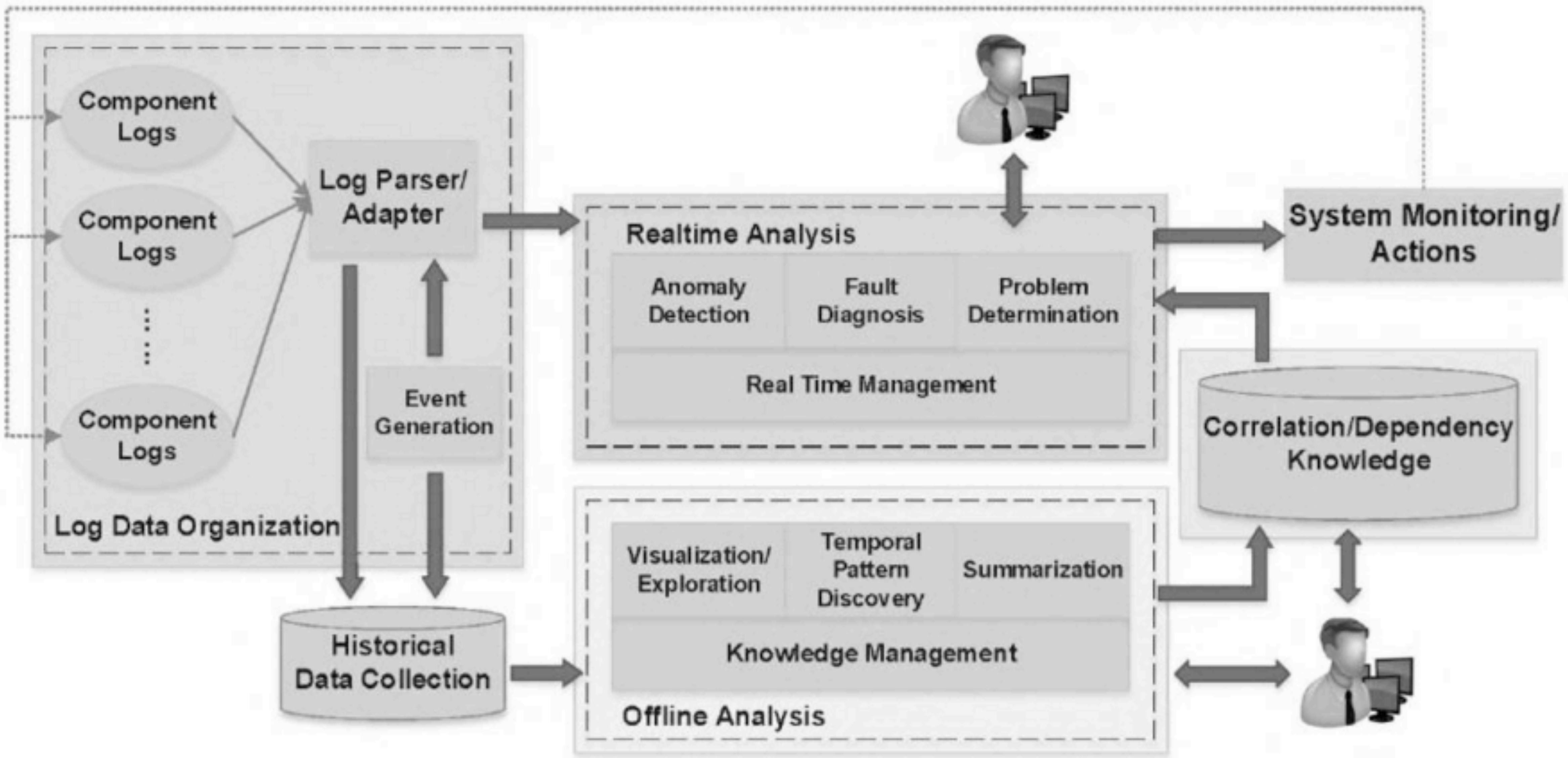
and meaningful records.





(credits : David McCandless, Information is Beautiful)

Data Driven Computing

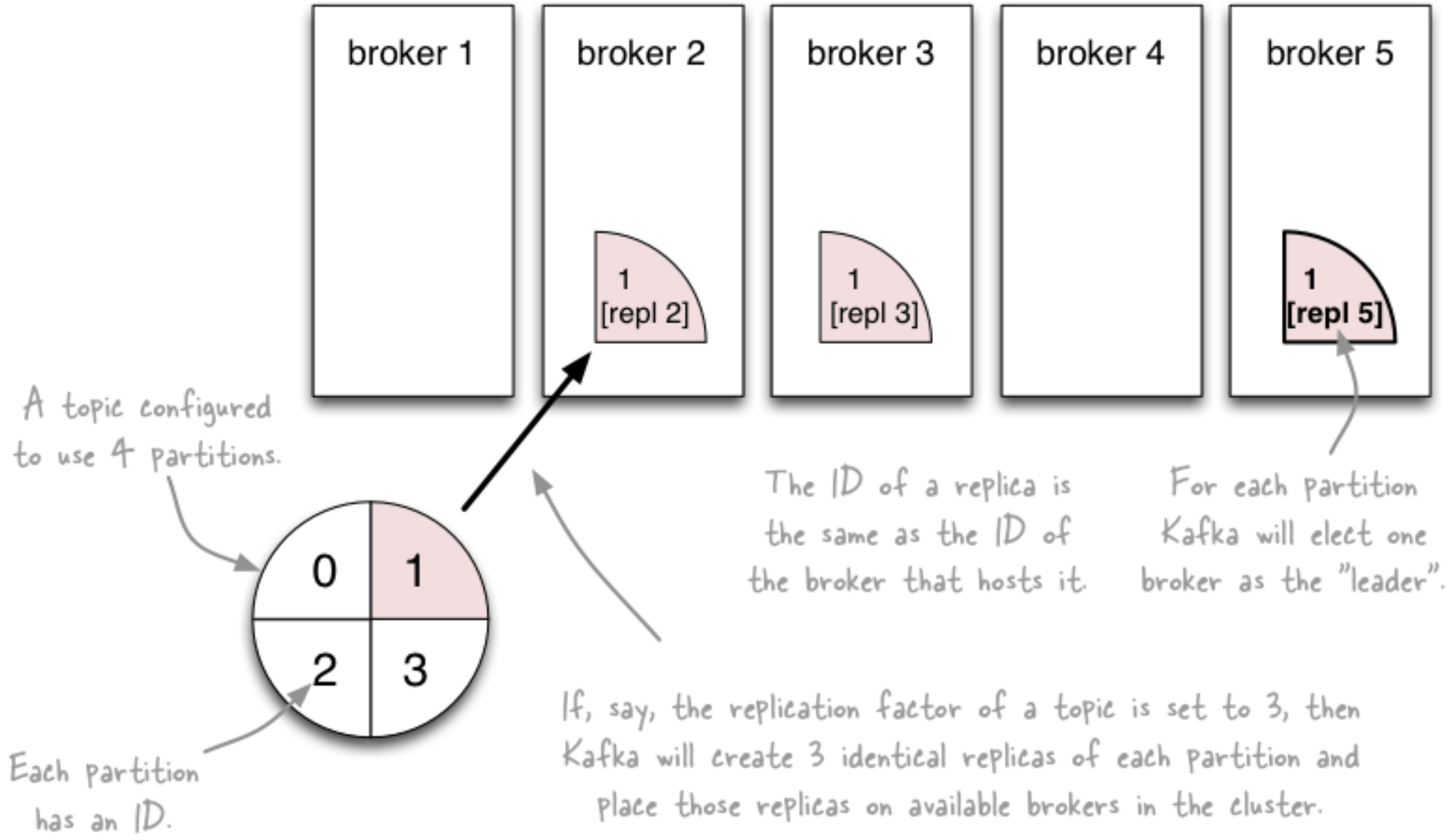


Technical Stack

Technos

- distributed message bus : **Kafka**
- stream processing : **Spark Streaming** (**Storm** or **KafkaStreams**)
- machine learning : **Spark MLLib**, **DeepLearning4J**
- realtime analytics : **Kibana**
- external backends : **Elasticsearch**, **HBase**, **RocksDb**

Handling distributed logs with Kafka



A topic configured to use 4 partitions.

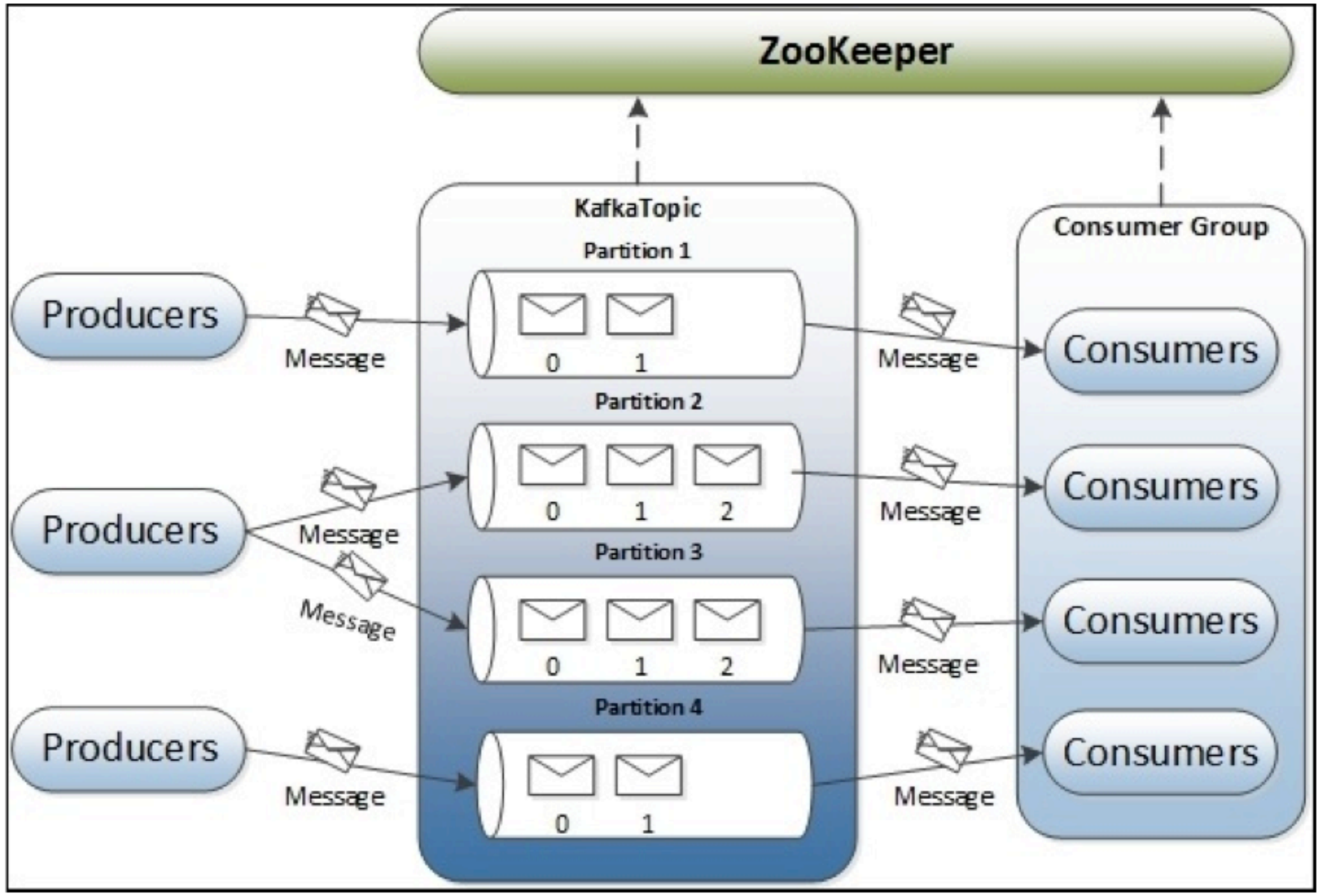
Each partition has an ID.

The ID of a replica is the same as the ID of the broker that hosts it.

For each partition Kafka will elect one broker as the "leader".

If, say, the replication factor of a topic is set to 3, then Kafka will create 3 identical replicas of each partition and place those replicas on available brokers in the cluster.

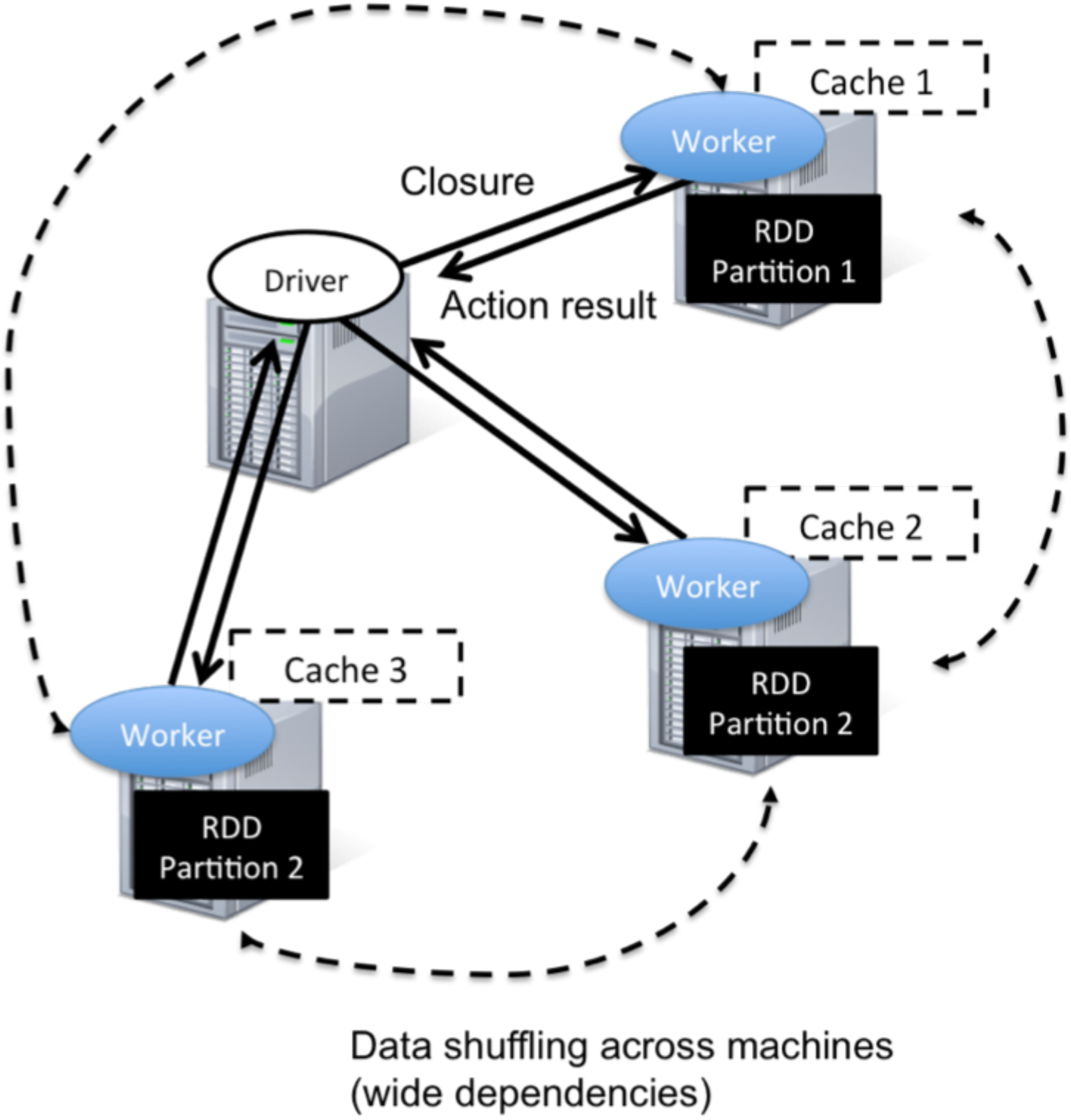
Kafka architecture



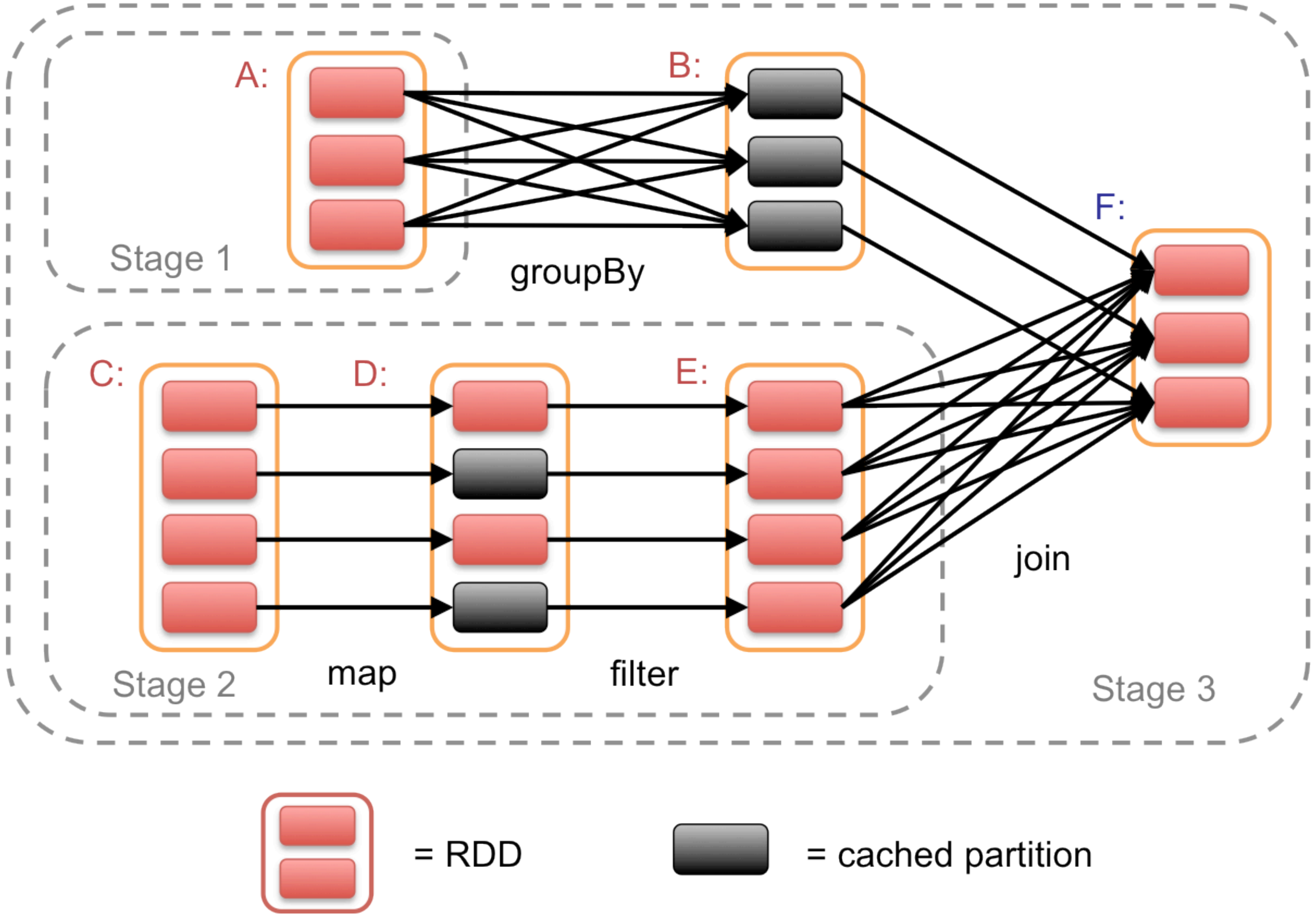
Distribute processing load with Spark

```
// load file lines
val lines = spark.sparkContext.textFile("hdfs://...")
// get only those starting with "ERROR"
val errors = lines.filter(_.startWith("ERROR"))
// extract log fields
val messages = errors.map(_.split('\t')(2))
// put those logs in cache
messages.cache()
// get mysql error count
messages.filter(_.contains("mysql")).count()
// get php error count
messages.filter(_.contains("php")).count()
```

Cache data => faster results
(1TB processed in 5/7s from cache vs 170s from hd)

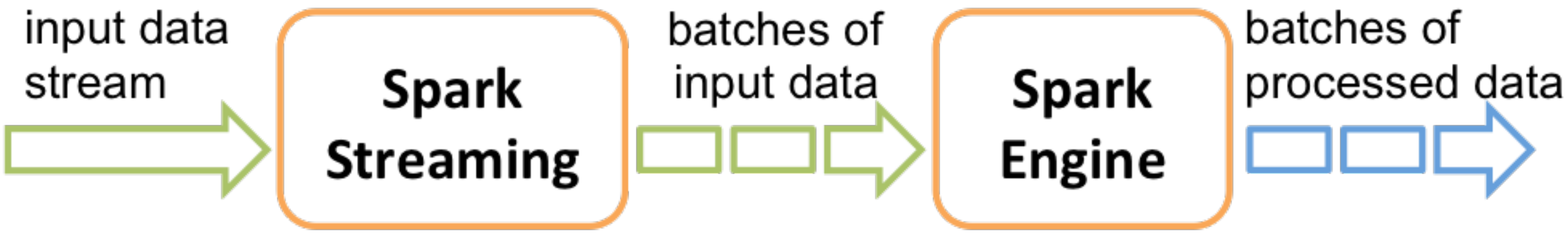


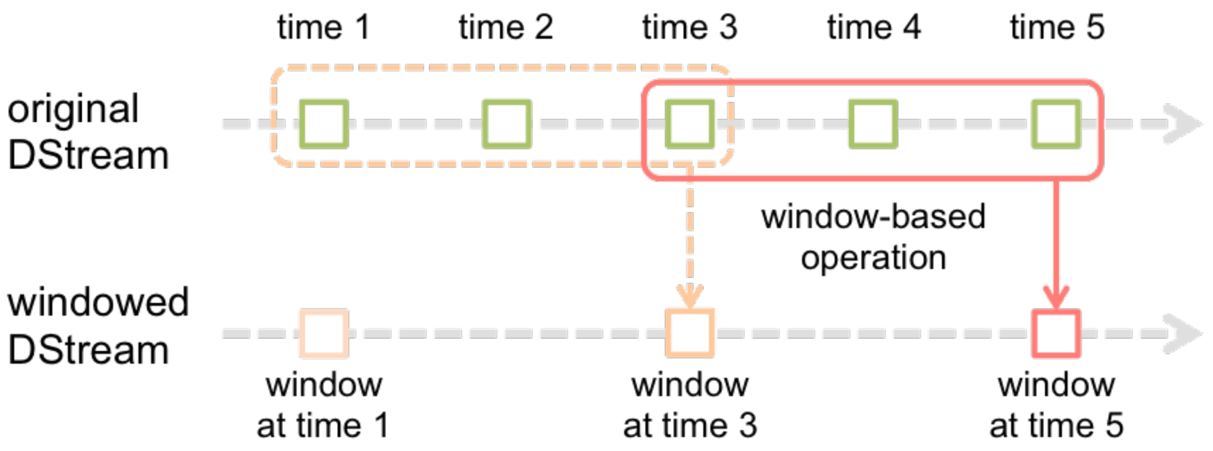
Spark lineage graph



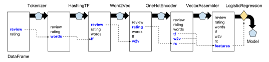
Source: [Matei Zaharia]() slide deck on Spark at Strata conference Feb 2013

Micro-batching with Spark-Streaming





MLLib pipelines



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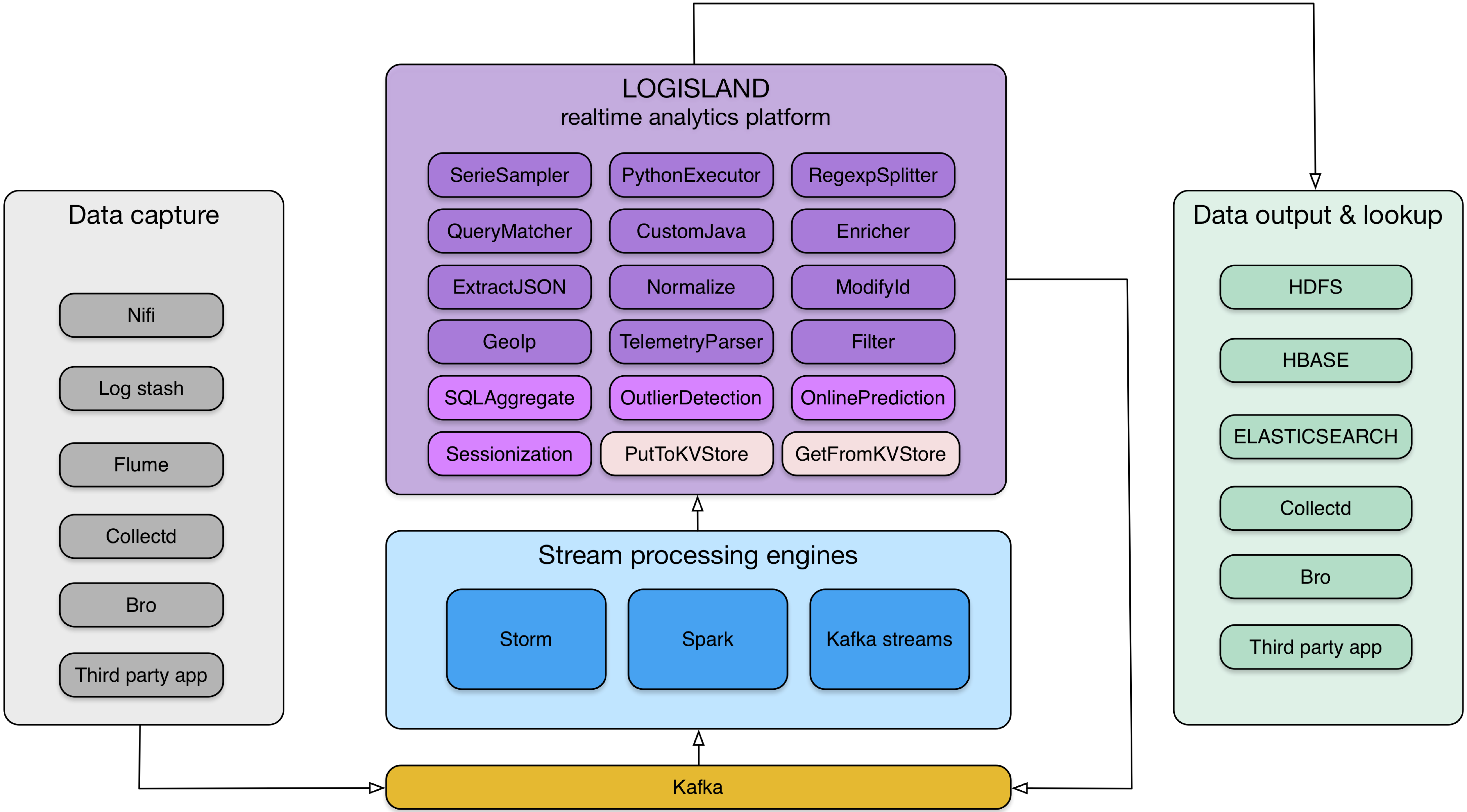
API Design


LOGISLAND
realtime analytics platform
SerieSampler
PythonExecutor
RegexpSplitter
QueryMatcher
CustomJava
Enricher
ExtractJSON
Normalize
ModifyId
GeoIp
TelemetryParser
Filter
SQLAggregate
OutlierDetection
OnlinePrediction
Sessionization
PutToKVStore
GetFromKVStore
Data capture
Nifi
Log stash
Flume
Collectd
Bro
Third party app
Stream processing engines
Storm
Spark
Kafka streams
Data output & lookup
HDFS
HBASE
ELASTICSEARCH
Collectd
Bro
Third party app
Kafka

Record

The basic unit of processing is the Record.
A `Record` is a collection of `Field`, while a `Field` has a name, a `type` and a `value`.

```
String id = "firewall_record1";
String type = "cisco";
Record record = new Record(type).setId(id);

assertTrue(record.isEmpty());
assertEquals(record.size(), 0);
```

Field

A record holds a collection of fields.

```
record.setStringField("url_host", "origin-www.20minutes.fr")
      .setField("method", FieldType.STRING, "GET")
      .setField("response_size", FieldType.INT, 452)
      .setField("is_outside_office_hours", FieldType.BOOLEAN, false)
      .setField("tags",
                FieldType.ARRAY,
                Arrays.asList("spam", "filter", "mail"));

assertEquals( record.getField("method").asString(), "GET");
assertTrue( record.getField("response_size").asInteger() - 452 == 0);
record.removeField("is_outside_office_hours");
assertFalse( record.hasField("is_outside_office_hours"));
```

Special Field

A Record also has some special fields (type, time and id).

```
// shortcut for id
assertEquals(record.getId(), id);
assertEquals(record.getField(FieldDictionary.RECORD_ID).asString(),
             id);

// shortcut for time
assertEquals(record.getTime(),
  record.getField(FieldDictionary.RECORD_TIME).asLong());

// shortcut for type
assertEquals(record.getType(), type);
```

Field typing and validation

Fields are strongly typed, you can validate them

```
Record record = new StandardRecord();
record.setField("request_size", FieldType.INT, 1399);
assertTrue(record.isValid());

record.setField("request_size", FieldType.INT, "tom");
assertFalse(record.isValid());

record.setField("request_size", FieldType.DOUBLE, 45.5d);
assertTrue(record.isValid());

record.setField("request_size", FieldType.STRING, 45L);
assertFalse(record.isValid());
```

Processor

Logisland is a **component centric** framework,

It's built over an abstraction layer to build **configurable components**.

A component can be `Configurable` and `Configured`.

The most common component you'll use is the `Processor` which takes a collection of `Record` and publish another collection of records

A configurable component that process Records

```
public interface Processor extends ConfigurableComponent {

  void init(final ProcessContext context);

  Collection<Record> process(ProcessContext context,
                             Collection<Record> records);
}
```

SplitText implementation

Define PropertyDescriptor to handle components config.

```java
@Tags({"parser", "regex", "log", "record"})
@CapabilityDescription("This is a processor that is used ...")
@DynamicProperty(name = "alternative regex & mapping",   ...)
public class SplitText extends AbstractProcessor {

    public static final PropertyDescriptor VALUE_REGEX =
      new PropertyDescriptor.Builder()
            .name("value.regex")
            .description("the regex to match for the message value")
            .required(true)
            .addValidator(StandardValidators.NON_EMPTY_VALIDATOR)
            .build();
    ...
}
```

SplitText config

Use the components with simple yaml blocs.

```
- processor: apache_parser
  component: com.hurence.logisland.processor.SplitText
  type: parser
  documentation: a parser for apache log REGEX
  configuration:
    record.type: apache_log
    value.regex: (\S+)\s+(\S+)\s+(\S+)\s+\[([\w:\/] ...
    value.fields: src_ip,identd,user,record_time,http_method, ...
```

Stream

a record `Stream` basically :

- is a configurable Component
- reads a distributed collection of `Record` from Kafka input topics
- transmits them to a chain of `Processor`
- write the output collection of `Record` to some Kafka output topics

Streaming paradigm

You can handle partionned data in 2 ways :

- **fully in parrallel**, eg. a thread by partition, like with `KafkaRecordStreamParallelProcessing`, when records have no link with each other
- by **joining partitions** like with `KafkaRecordStreamSQLAggregator` or `KafkaRecordStreamHDFSBurner` when you need to join related records (costly join and shuffling operations)

Sample Stream configuration

Define a processing pipeline

```
- stream: parsing_stream
  component: com.hurence.logisland.stream.spark.KafkaRecordStreamParallelProcessing
  type: stream
  documentation: a processor that links
  configuration:
    kafka.input.topics: logisland_raw
    kafka.output.topics: logisland_events
    kafka.error.topics: logisland_errors
    kafka.input.topics.serializer: none
    kafka.output.topics.serializer: com.hurence.logisland.serializer.KryoSerializer
    kafka.error.topics.serializer: com.hurence.logisland.serializer.JsonSerializer
    ...
  processorConfigurations:
```

Engine

- The `Engine` manage a collection of `Stream`
- this is the abstraction of the execution model, mainly in Spark actually but plans are to integrate Beam to move on Storm and Kafka Streams
- you configure here your Spark job parameters

Sample engine configuration

Define a processing job

```
engine:
  component: com.hurence.logisland.engine.spark.KafkaStreamProcessingEngine
  type: engine
  documentation: Index some apache logs with logisland
  configuration:
    spark.app.name: IndexApacheLogsDemo
    spark.master: yarn-cluster
    spark.driver.memory: 1G
    spark.driver.cores: 1
    spark.executor.memory: 2G
    spark.executor.instances: 4
    spark.executor.cores: 2
    spark.yarn.queue: default
    ...
  streamConfigurations:
```

Transverse service injection : ControllerService

we often need to share access to external Services across the Processors, for example

- bulk buffers or client connections to external data
- a cache service that could cache K/V tuple across the worker node.

Sample ControllerService component

We need to provide an interface API for this service :

```
public interface CacheService<K,V> extends ControllerService {

    PropertyDescriptor CACHE_SIZE = new PropertyDescriptor.Builder()
            .name("cache.size")
            .description("The maximum number of element in the cache.")
            .required(false)
            .defaultValue("16384")
            .addValidator(StandardValidators.POSITIVE_INTEGER_VALIDATOR)
            .build();

    public V get(K k);

    public void set(K k, V v);
}
```

Inject service in Processor

You can then use this service in a custom processor :

```
public class TestProcessor extends AbstractProcessor {

    static final PropertyDescriptor CACHE_SERVICE = new PropertyDescriptor.Builder()
            .name("cache.service")
            .description("CacheService")
            .identifiesControllerService(CacheService.class)
            .required(true)
            .build();

    @Override
    public boolean hasControllerService() {
        return true;
    }
}
```

Define service in config

The injection is done through yaml config files by injecting the instance of `lru_cache` Service.

```
controllerServiceConfigurations:

  - controllerService: lru_cache
    component: com.hurence.logisland.service.elasticsearch.LRUKeyValueCacheService
    configuration:
      cache.size: 5000

streamConfigurations:
  - stream: parsing_stream

    processorConfigurations:
      - processor: mock_processor
        component: com.hurence.logisland.processor.TestProcessorhing
        configuration:
           cache.service: lru_cache
```

Quick Start

Getting started (Hadoop cluster)

Download the latest release from github

```
tar -xzf logisland-0.10.1-bin.tar.gz
```

Create a job configuration

```
vim conf/index-apache-logs.yml
```

Run the job

```
export SPARK_HOME=/usr/hdp/current/spark-client
bin/logisland.sh --conf conf/index-apache-logs.yml
```

Getting started (lightweight container)

Pull & run the image from Docker Repository

```
docker pull hurence/logisland
docker run  -it --name logisland \
    -p 8080:8080 -p 5601:5601 -p 9200:9200 \
    -h sandbox  hurence/logisland bash
```

Run the job

```
bin/logisland.sh --conf conf/index-apache-logs.yml
```

Next ?

Roadmap

- MLLib components wrappers
- visual Stream configuration / dashboards through Ambari views
- Auto-scaling to optimize cluster resources
- Density based automatic system usage profiling
- Pattern discovery through Deep Learning
- vertical bundles (cybersecurity, fraud, …)

Resources

- **source** : https://github.com/Hurence/logisland/releases
- **Docker** : https://hub.docker.com/r/hurence/logisland/tags/
- **Documentation** : http://logisland.readthedocs.io/en/latest/concepts.html
- **support** : https://gitter.im/logisland/logisland
- **contact** : bailet.thomas@gmail.com

Q&A