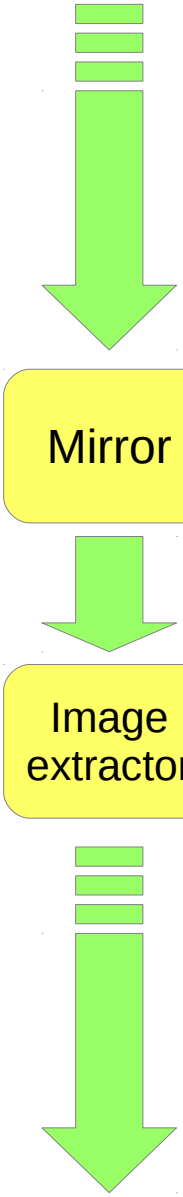
# External receiver



Kafka consumer and producer
in the same process.

Based on the Kafka-mirror concept
from Apache Kafka.

Kafka archive


Kafka logs, split into topic per day.

Long term backup storage system.

Image archive


Add more space as the data grows.

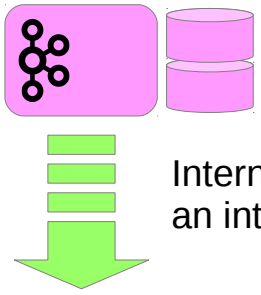
Space per day calculation ...



Inline images replaced by internal URLs.

- Backup before/after image extraction ?
- Mirror and image extractor in the same process ?
- Storage technology ?

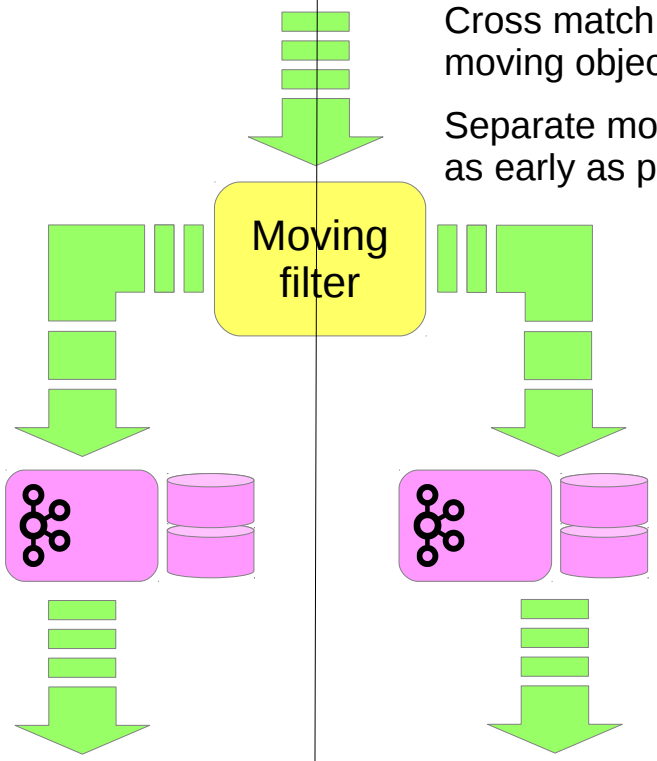
# Internal processing



Internal Kafka acting as an inter-process buffer.

D.Morris
Institute for Astronomy,
Edinburgh University
May 2018

# Moving objects




Cross match with known moving objects.

Separate moving/static as early as possible ?

Internal Kafka acting as an inter-process buffer.

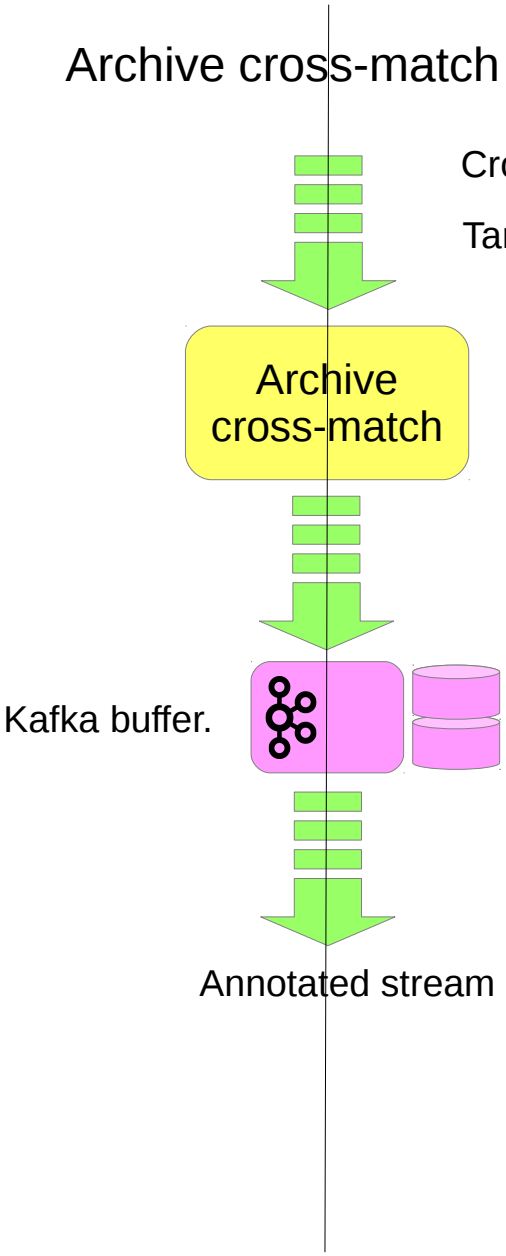
Moving object stream

Static object stream

- Can we do this at the required data rate ?
- Are moving and non-moving objects handled separately ?
- Does it make sense to skip cross-match with static archives for moving objects ?

D.Morris
Institute for Astronomy,
Edinburgh University
May 2018

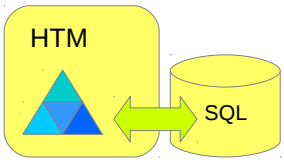
# Archive cross-match



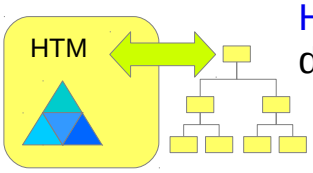

Cross match with main archives.

Target rate < 1ms per match

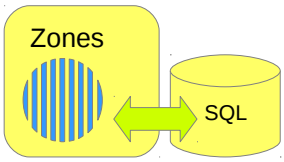
- Plug-and-play component API.
  - Adding new algorithms.
  - Adding new archives.



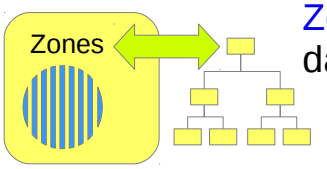

HTM match with data in database.




HTM match with data in memory.




Zone and vector with data in database.




Zone and vector with data in memory.

Multiple interfaces

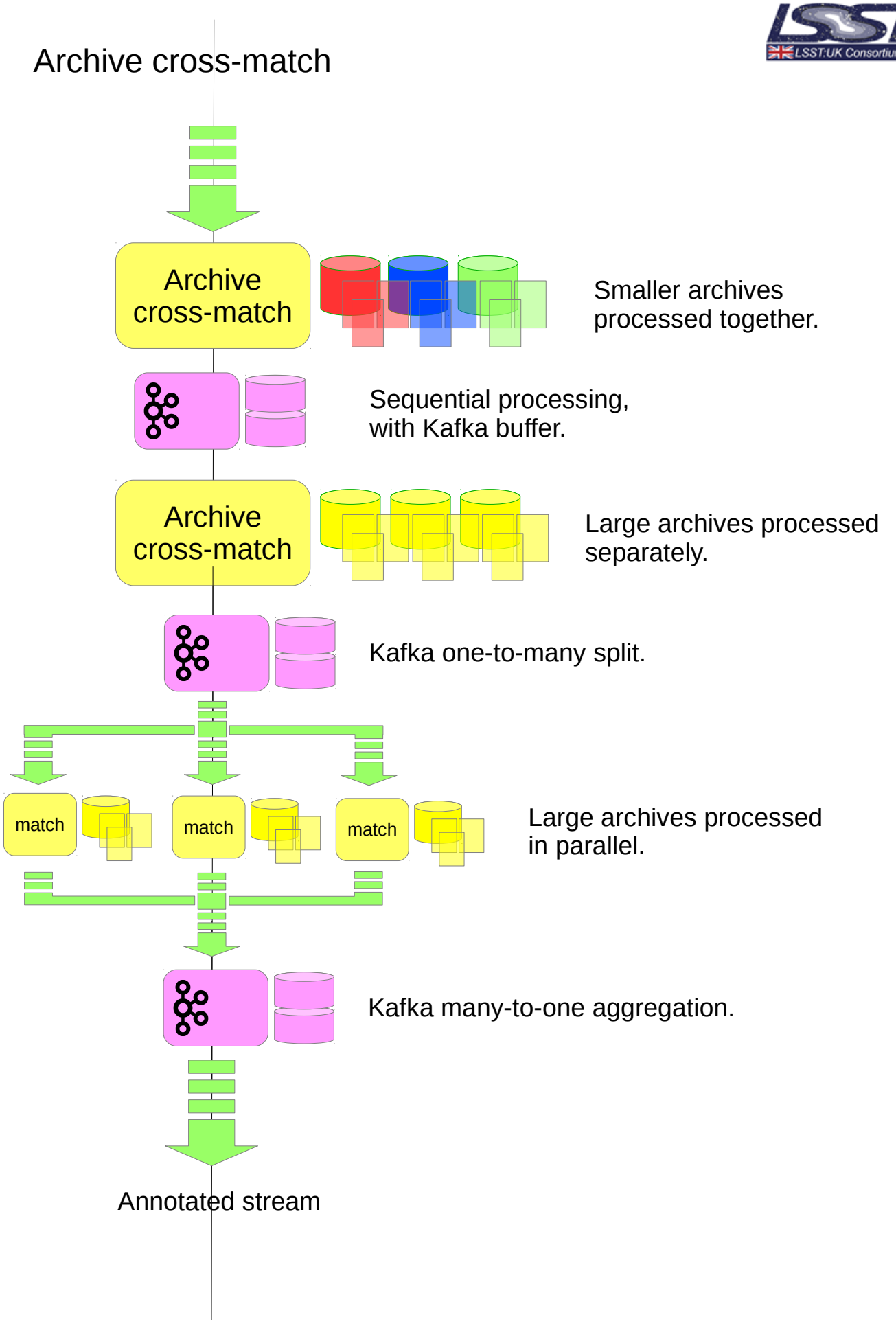
JSON/REST webservice
- Control and configuration
- Cone search
- Cross match

Kafka stream component
- Consumer/Producer API ?
- Kafka Connect component ?

IVOA conesearch
- Publish as IVOA services ?

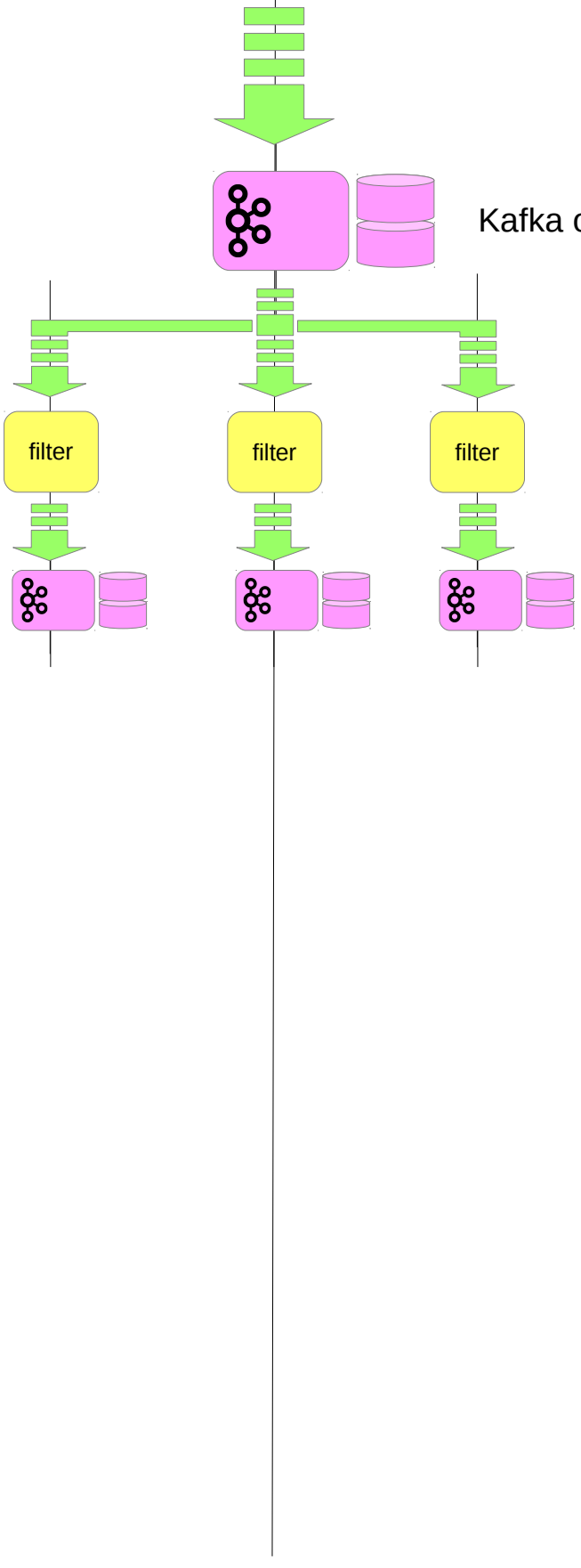
D.Morris
Institute for Astronomy,
Edinburgh University
May 2018

# Archive cross-match




D.Morris
Institute for Astronomy,
Edinburgh University
May 2018

# Selective filtering

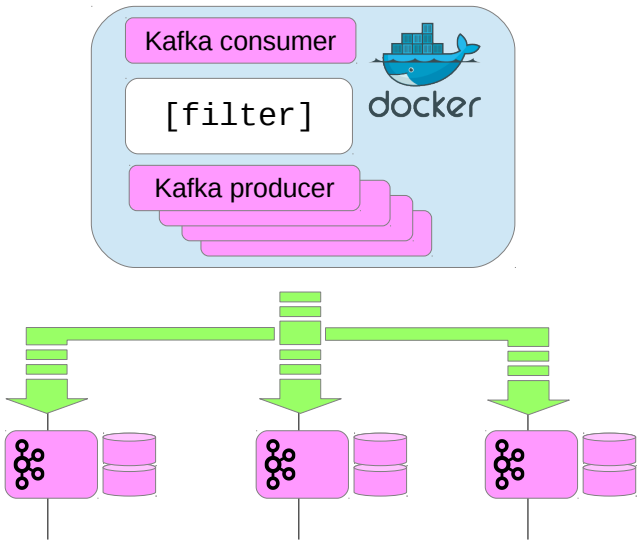



Kafka one-to-many splitter.

Filters create custom streams based on annotations.

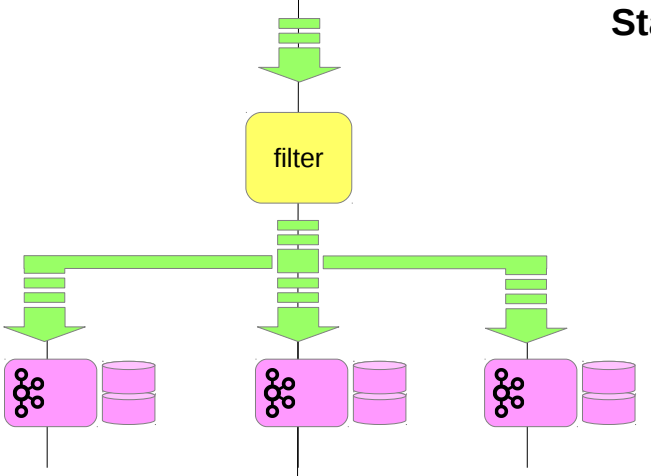
- User defined code (Python).
- User defined code (Java).
- System filters (user = system).

- Multiple output filters




D.Morris
Institute for Astronomy,
Edinburgh University
May 2018

# Selective filtering




Single output yes/no filter

```
if (test)
    {
    output ..
    }
```

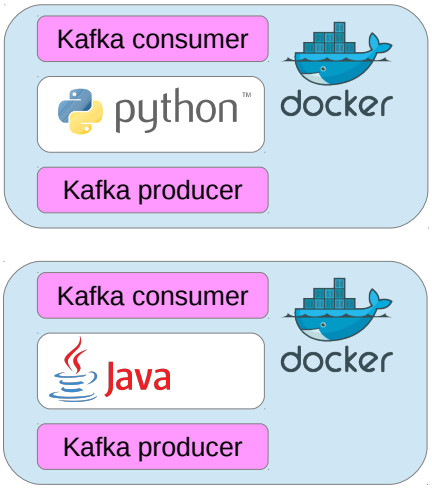
Dual output left/right filter

```
if (test)
    {
    output ..
    }
else {
    output ..
    }
```

Multiple output filter

```
switch (test)
    {
    case xx :
        output ..
    case yy :
        output ..
    case zz :
        output ..
    default :
        output ..
    }
```

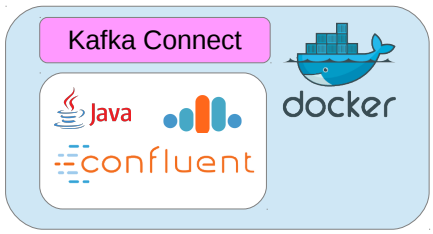
## Standard Docker containers




Standard input and output interfaces.

Similar to the OGSA-DAI Activity class.

## Confluent Kafka Connect



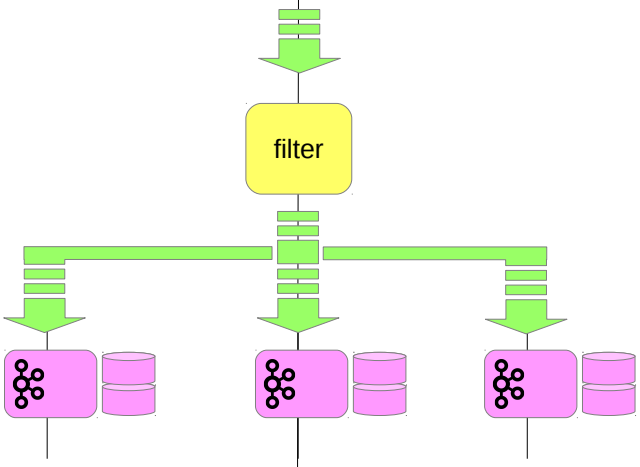

How much of theKafka Connect stack do we use ?

How much do we create ourselves ?

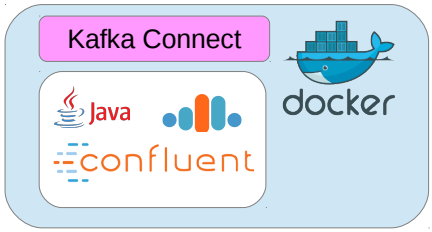
Kafka Connect provides a range of tools for data import and export .. but it adds yet another way of handling message schema.

D.Morris
Institute for Astronomy,
Edinburgh University
May 2018

## Selective filtering




## Kafka Connect
Import/export and schema

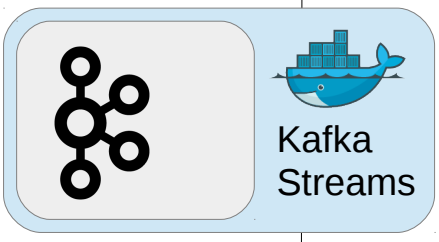



## KSQL
Streaming SQL for Kafka


SQL query language

```
CREATE TABLE
    error_counts
AS SELECT
    error_code,
    count(*)
FROM
    monitoring_stream
WINDOW TUMBLING
    (SIZE 1 MINUTE)
WHERE
    type = 'ERROR
```

## Kafka Streams
Data streaming with Kafka



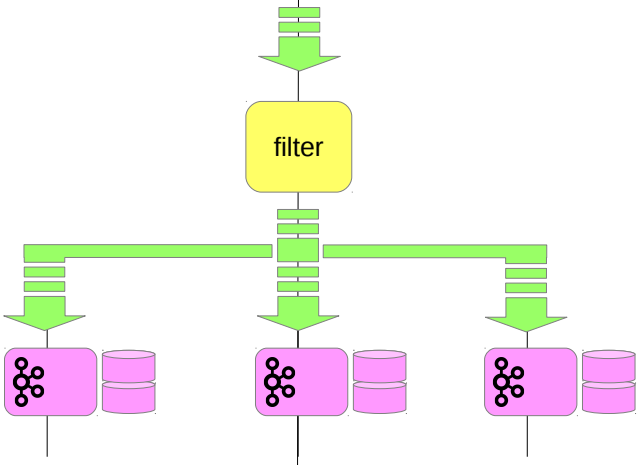

Stream processing API

```
KStream<String, Long> stream = ...;

stream.foreach(
    new ForeachAction<String, Long>()
        {
        @Override
        public void apply(
            String key,
            Long value
            ){
            ....
            }
        }
    );
```

D.Morris
Institute for Astronomy,
Edinburgh University
May 2018

# Selective filtering




Internal event schema, critical set of attributes needed for filtering.

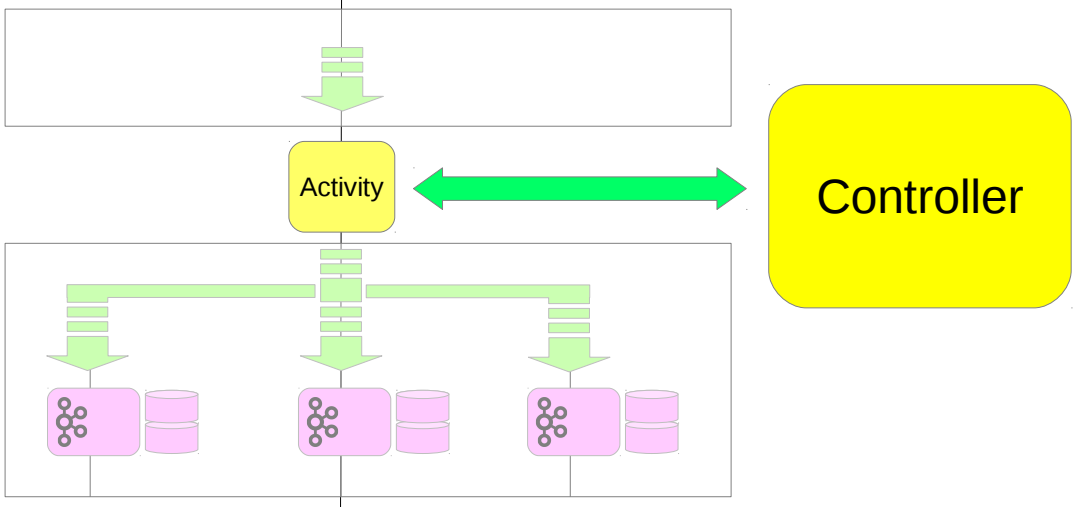
Event-expander, correlates mini-even with original event and creates a new event with additional params.

HTTP webservice with in memory cache ?

memcache ?

D.Morris
Institute for Astronomy,
Edinburgh University
May 2018

REST webservice control API




Spring-cloud … yet another framework

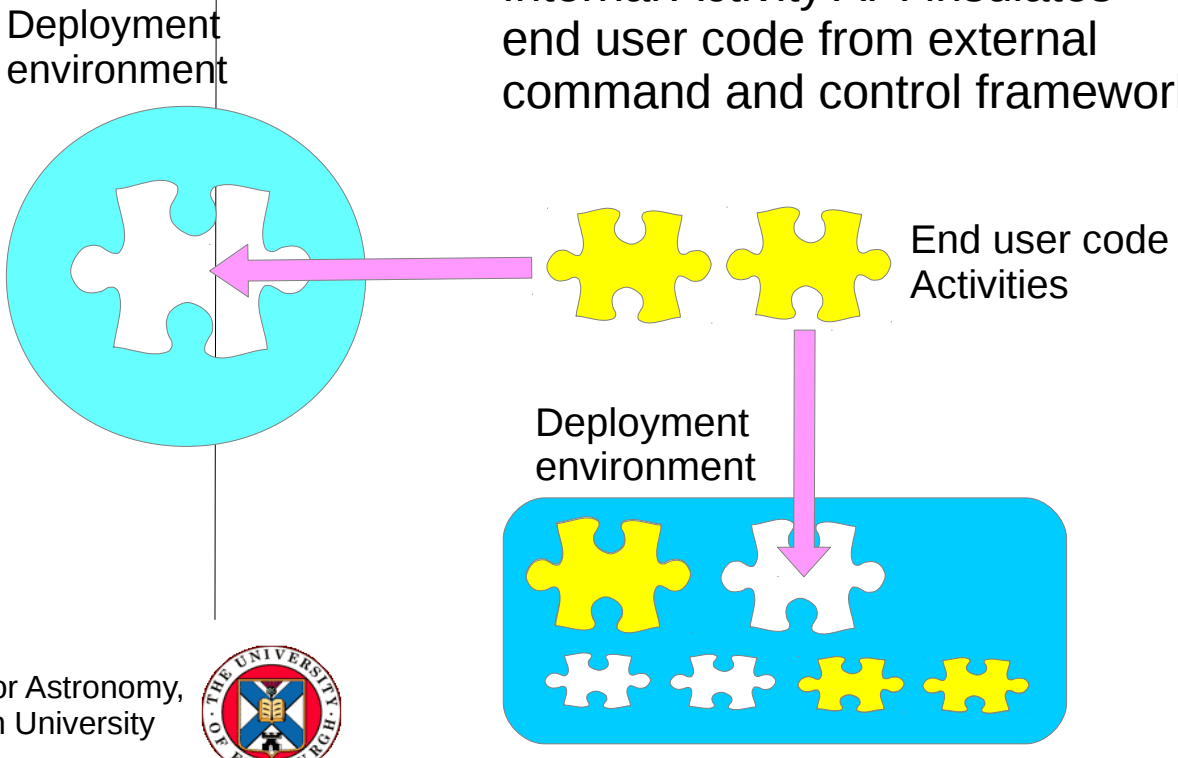
Very easy to start .. harder to control the direction.

Our own REST API for deploying and controlling Kaffa nodes

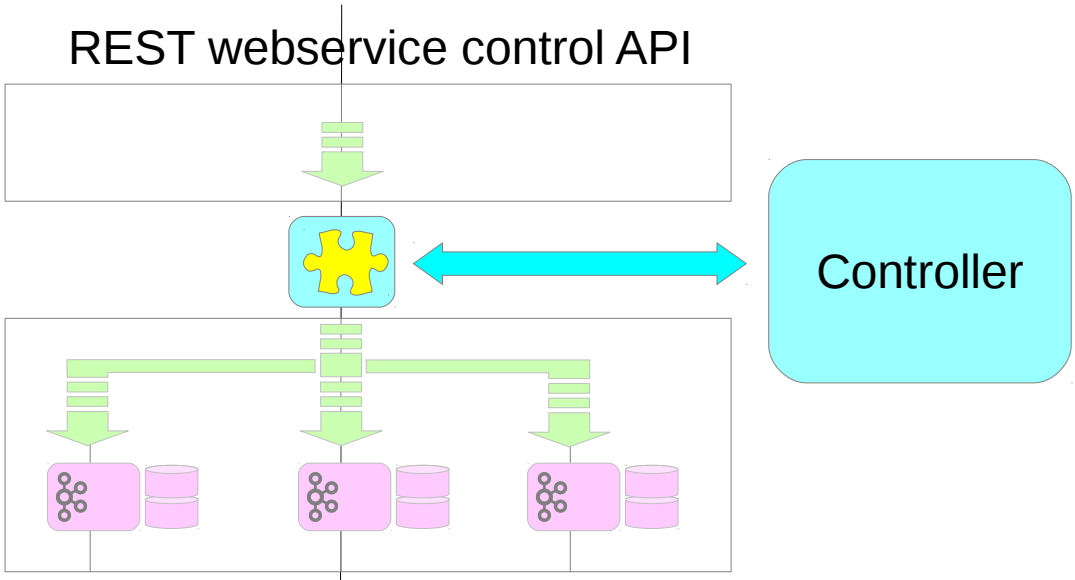
Separation of concerns

- Processor Activity interface
- Command and control API

Internal Activity API insulates end user code from external command and control framework.



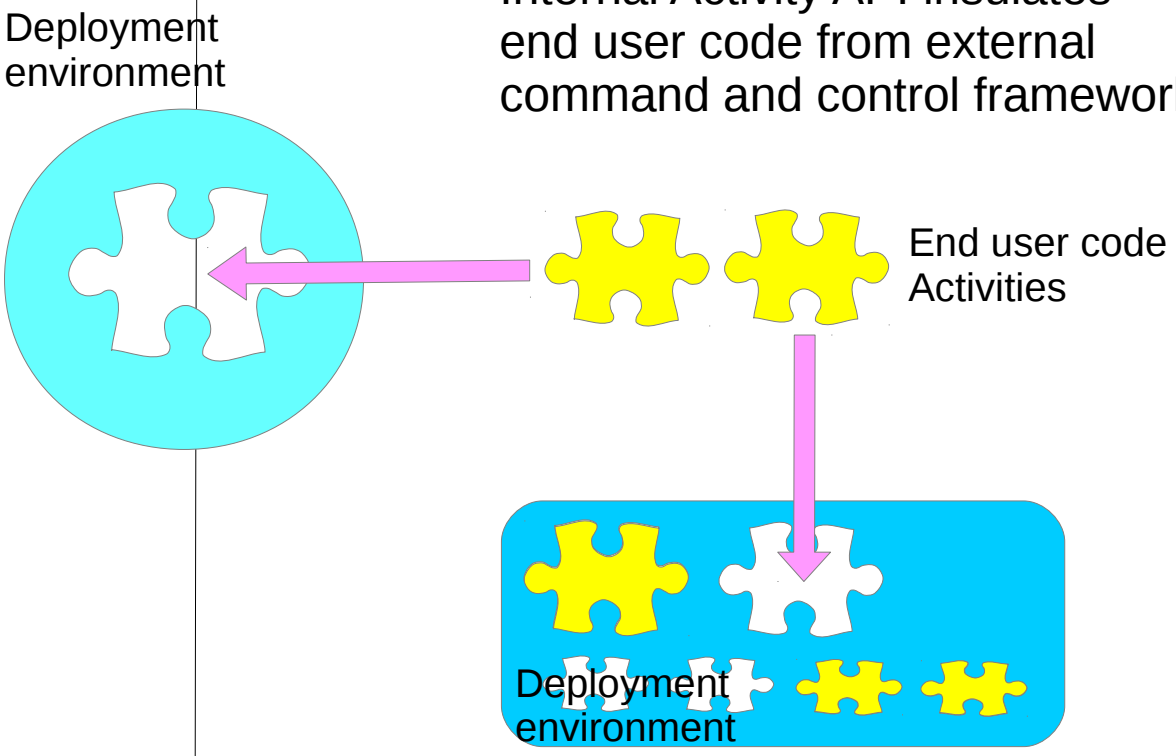

D.Morris
Institute for Astronomy,
Edinburgh University
May 2018



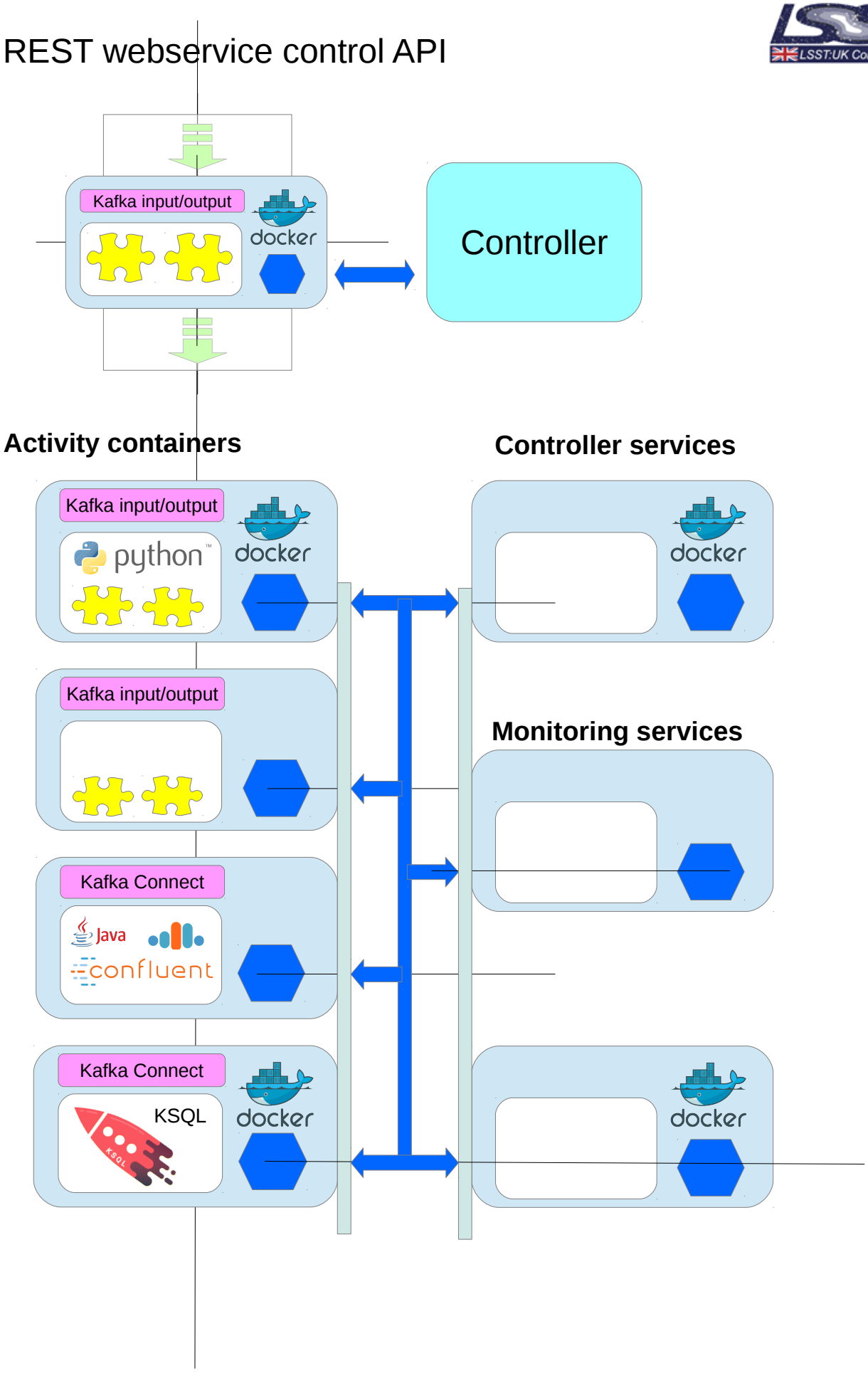

REST API for deploying and controlling Kaffa nodes

Separation of concerns
- Processor Activity interface
- Command and control API

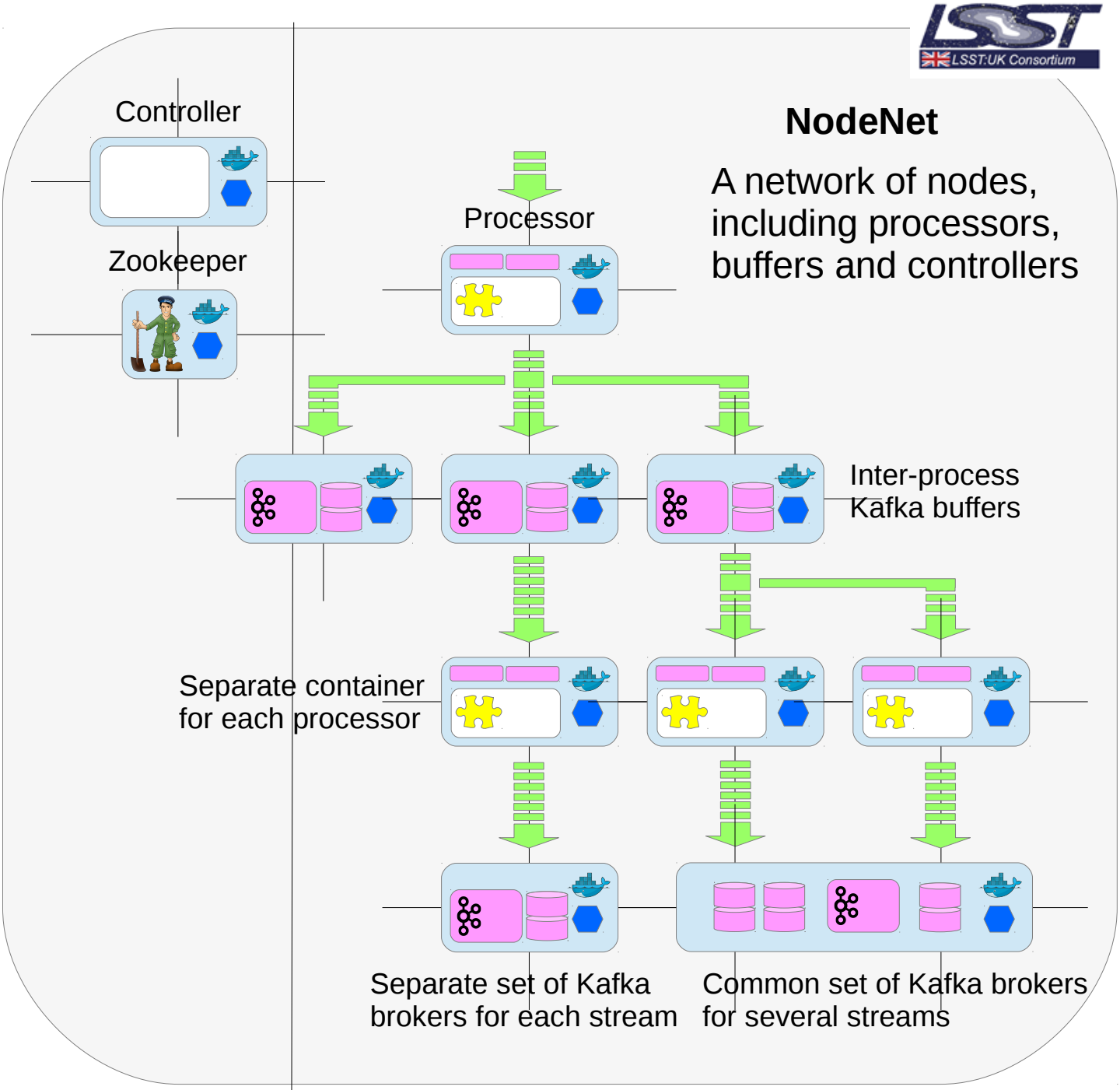
Internal Activity API insulates end user code from external command and control framework.




D.Morris
Institute for Astronomy,
Edinburgh University
May 2018




D.Morris
Institute for Astronomy,
Edinburgh University
May 2018




We need to be able to deploy multiple NodeNet networks.

Development, testing and live services.

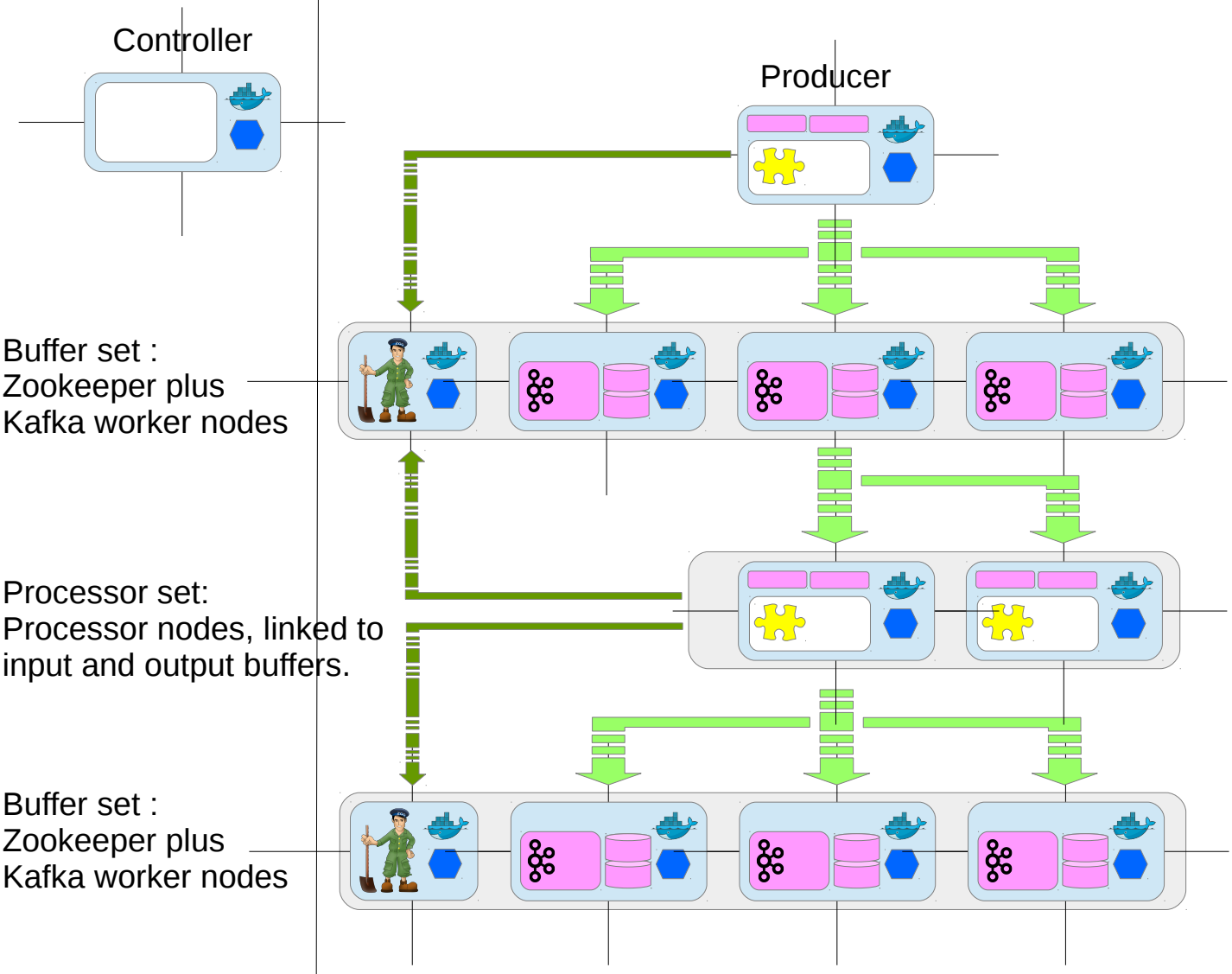
Single VM local instances.

Multiple physical machine deployments.

Start with a controller 'seed' and a set of configuration files.

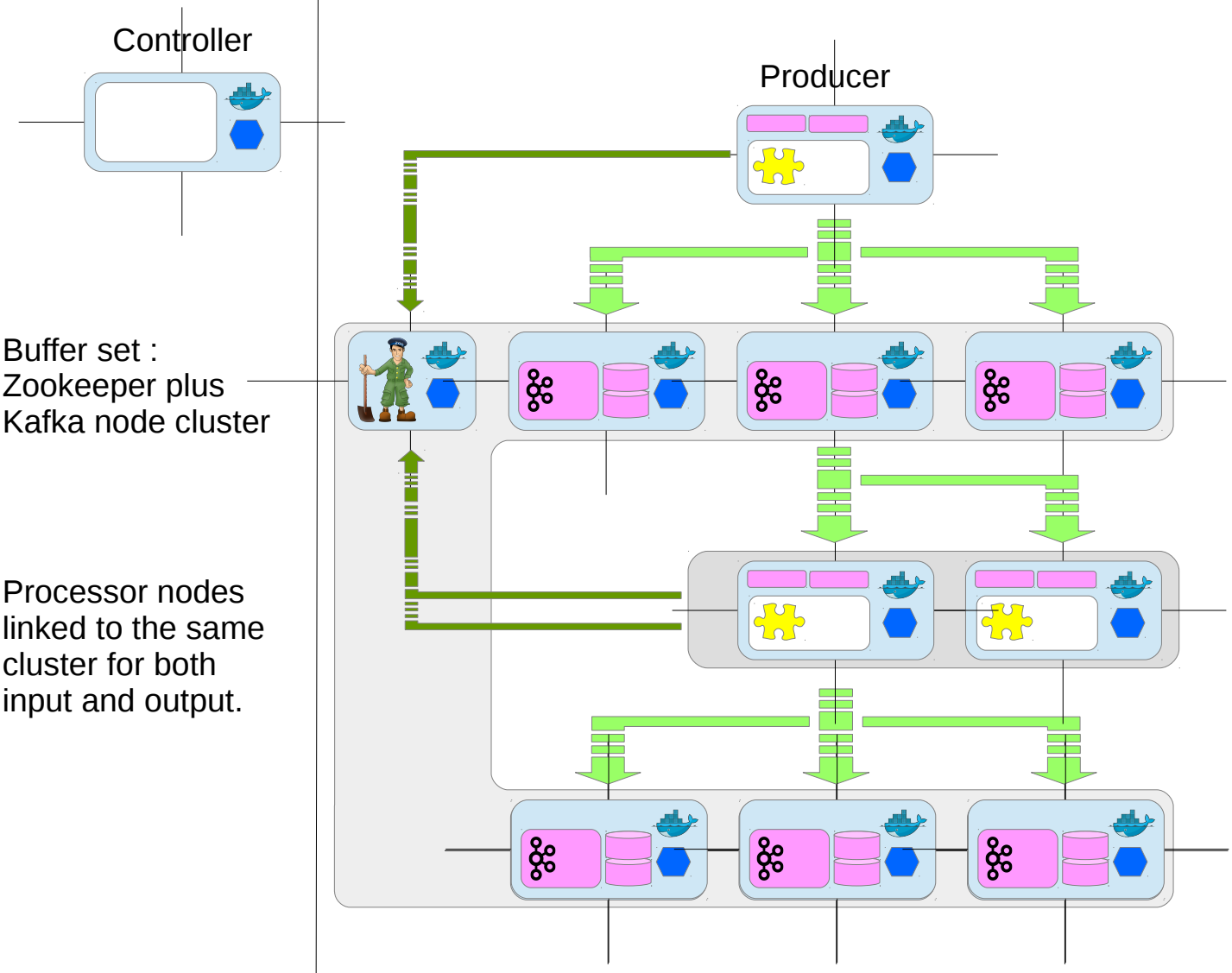
D.Morris
Institute for Astronomy,
Edinburgh University
May 2018

Multiple Buffer sets, each with its own Zookeeper and Kafka worker nodes




D.Morris
Institute for Astronomy,
Edinburgh University
May 2018

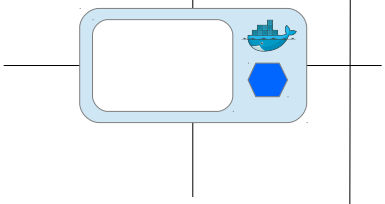
Shared Buffer sets, common Zookeeper and Kafka worker nodes




D.Morris
Institute for Astronomy,
Edinburgh University
May 2018

# Linking buffer sets and processor sets

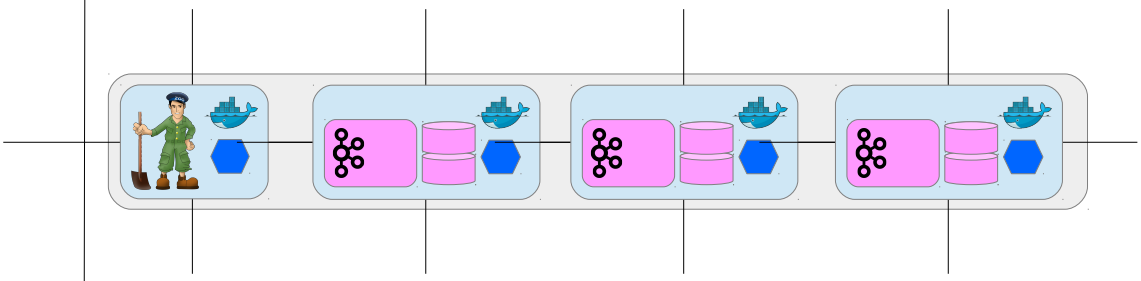
Controller



## Buffer set

Parameters:

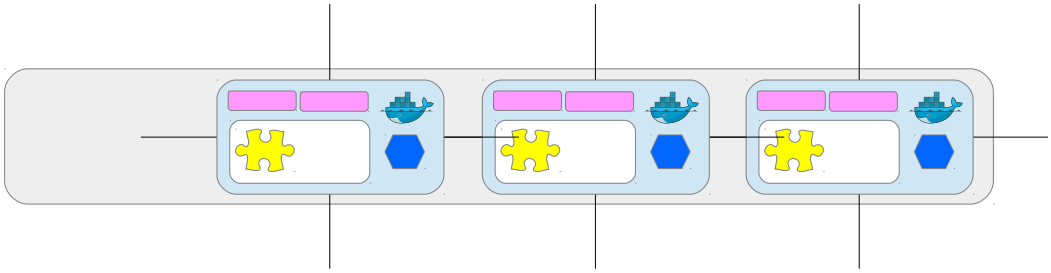
- *n* nodes
- *r* replicas
- *p* partitions



## Processor set

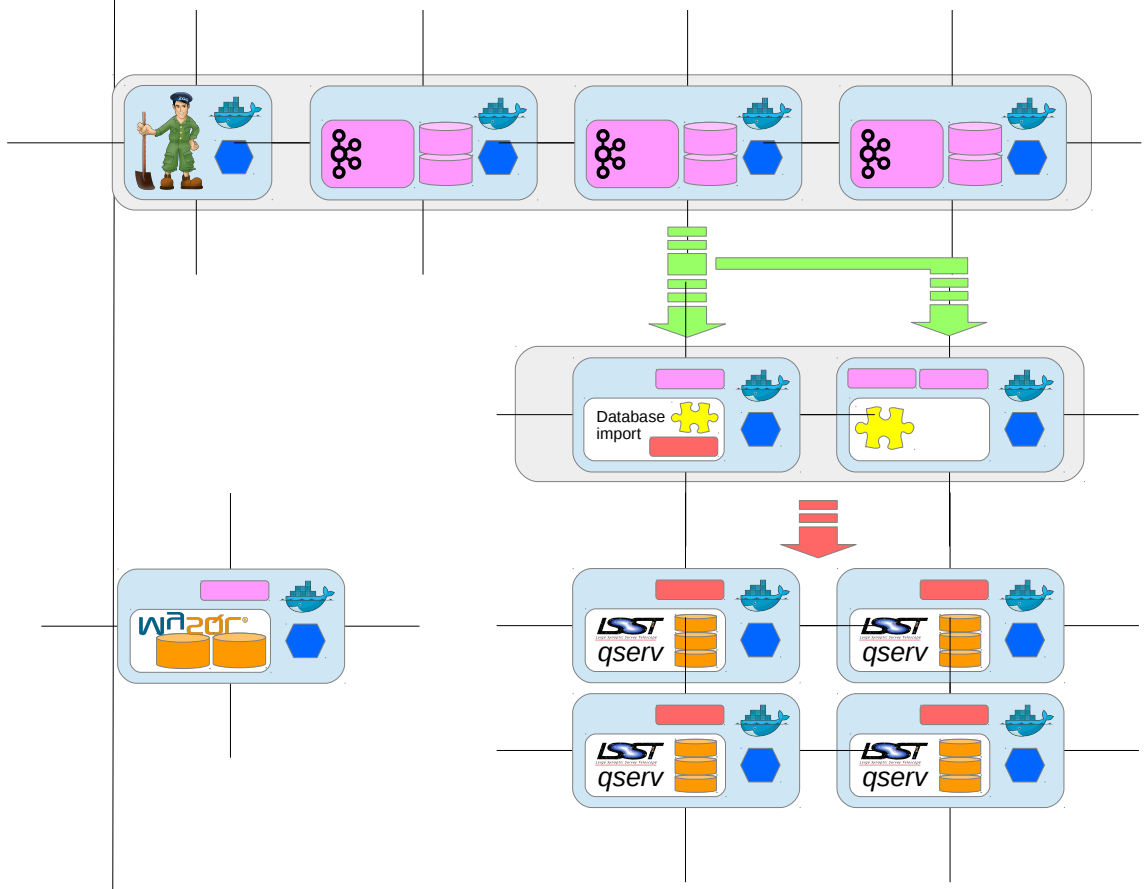
Parameters:

- *n* nodes
- input
  - zookeeper
  - topic
- output
  - zookeeper
  - topic



D.Morris
Institute for Astronomy,
Edinburgh University
May 2018

# Database sets, database nodes



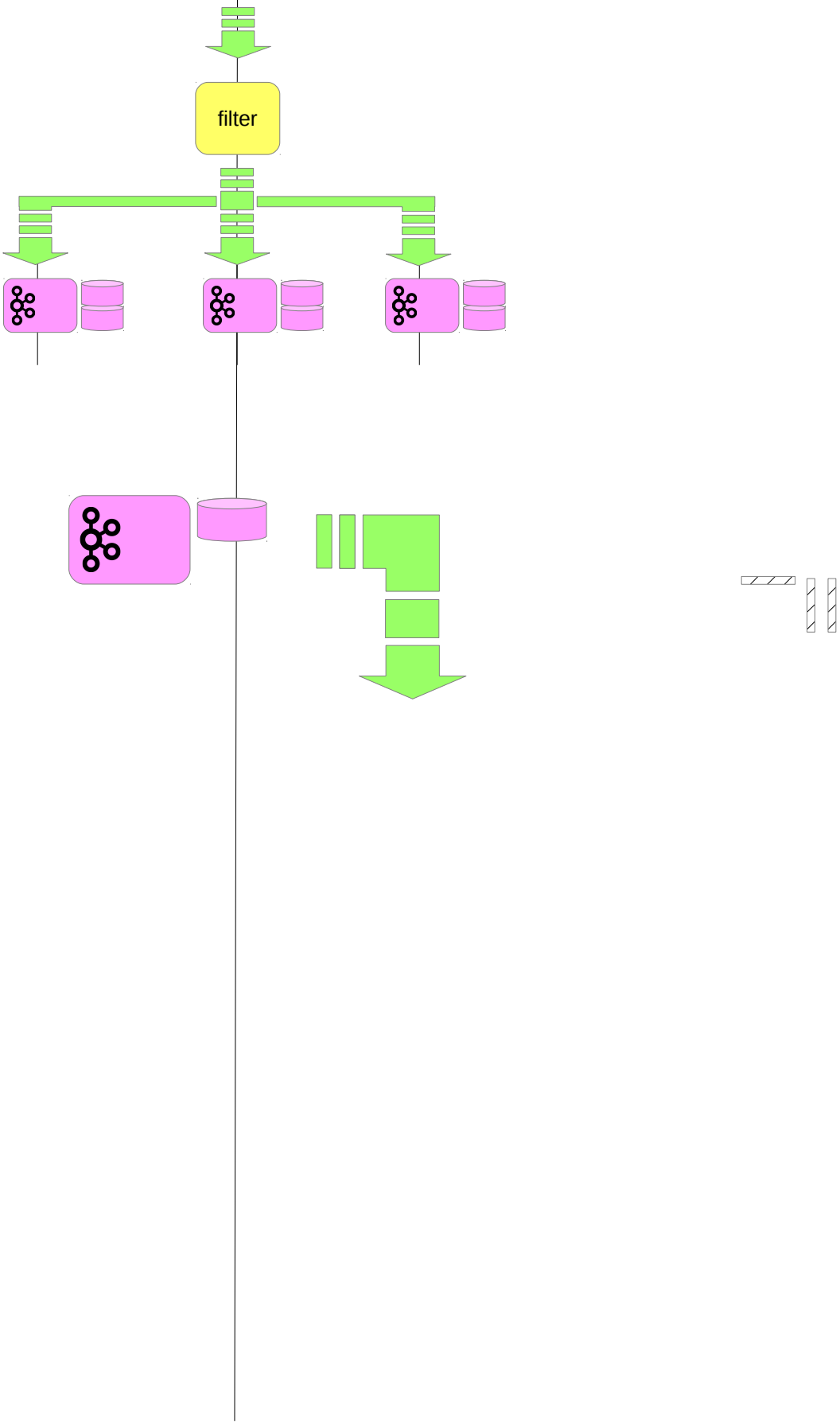

D.Morris
Institute for Astronomy,
Edinburgh University
May 2018

# Jupyter visualization

# Elasticsearch

D.Morris
Institute for Astronomy,
Edinburgh University
May 2018

# Selective filtering




D.Morris
Institute for Astronomy,
Edinburgh University
May 2018