Microsoft

boontadata

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Introduction

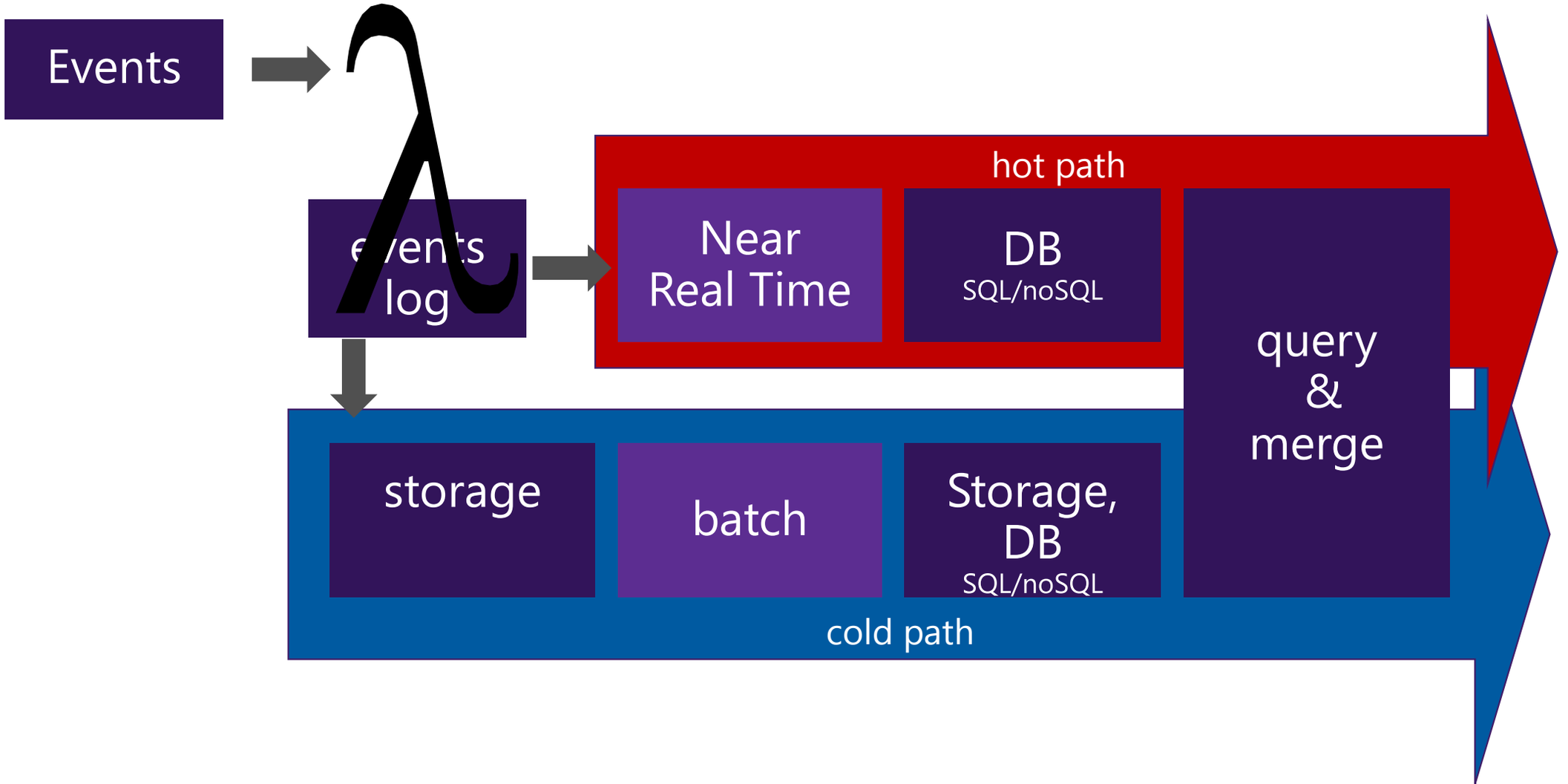
Agenda

- Introduction
- Big Data Architectures
- Stream Processing Challenges
- boontadata
- Conclusion

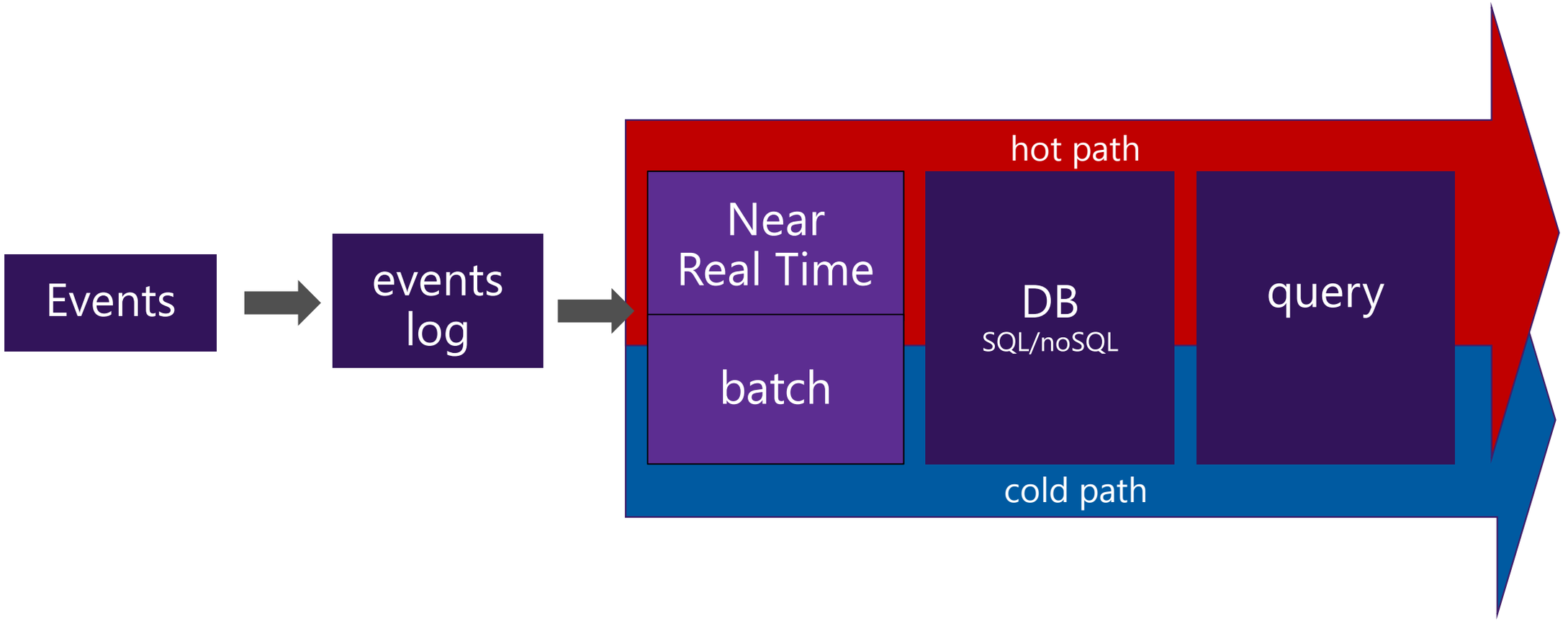
Big Data Architectures

Big Data Processing Engines

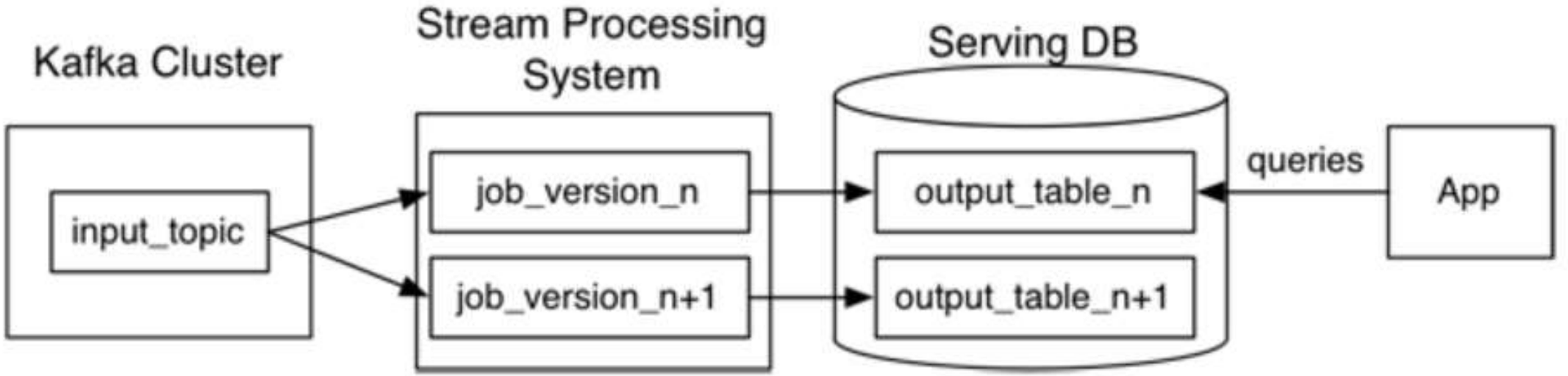
Lambda architecture



Non lambda Architecture



Kappa Architecture



Jay Kreps

Jay Kreps is a Principal Staff Engineer at LinkedIn where he is the lead architect for online data infrastructure. He is among the original authors of several open source projects including a distributed key-value store called Project Voldemort, a messaging system called Kafka, and a stream processing system called Samza.
Twitter: @jaykreps

https://www.oreilly.com/ideas/questioning-the-lambda-architecture , By Jay Kreps, July 2, 2014

Exemples de services
(dans Azure)

http://dev.microsoft.fr/data

Stream Processing Challenges

Example

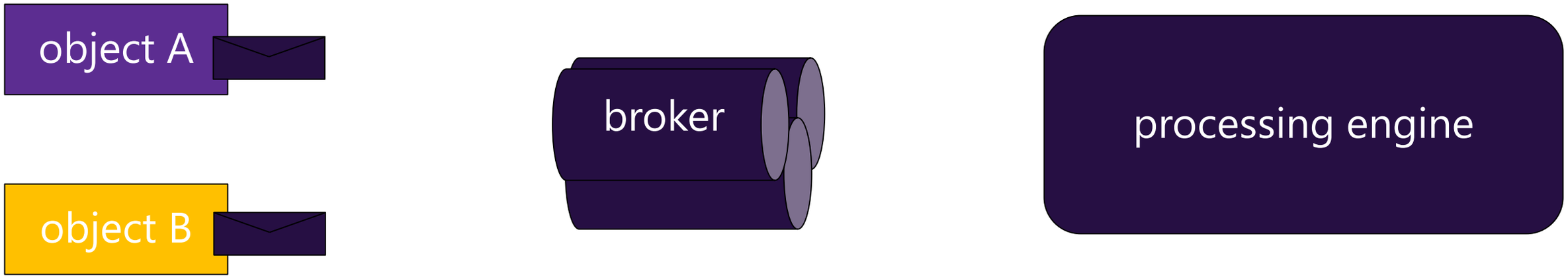
Events:

Time	Object A	Object B
10:00:00	100	2000
10:00:03		1800
10:00:04	85	
10:00:07	40	2500
10:00:08	100	
10:00:09		3000

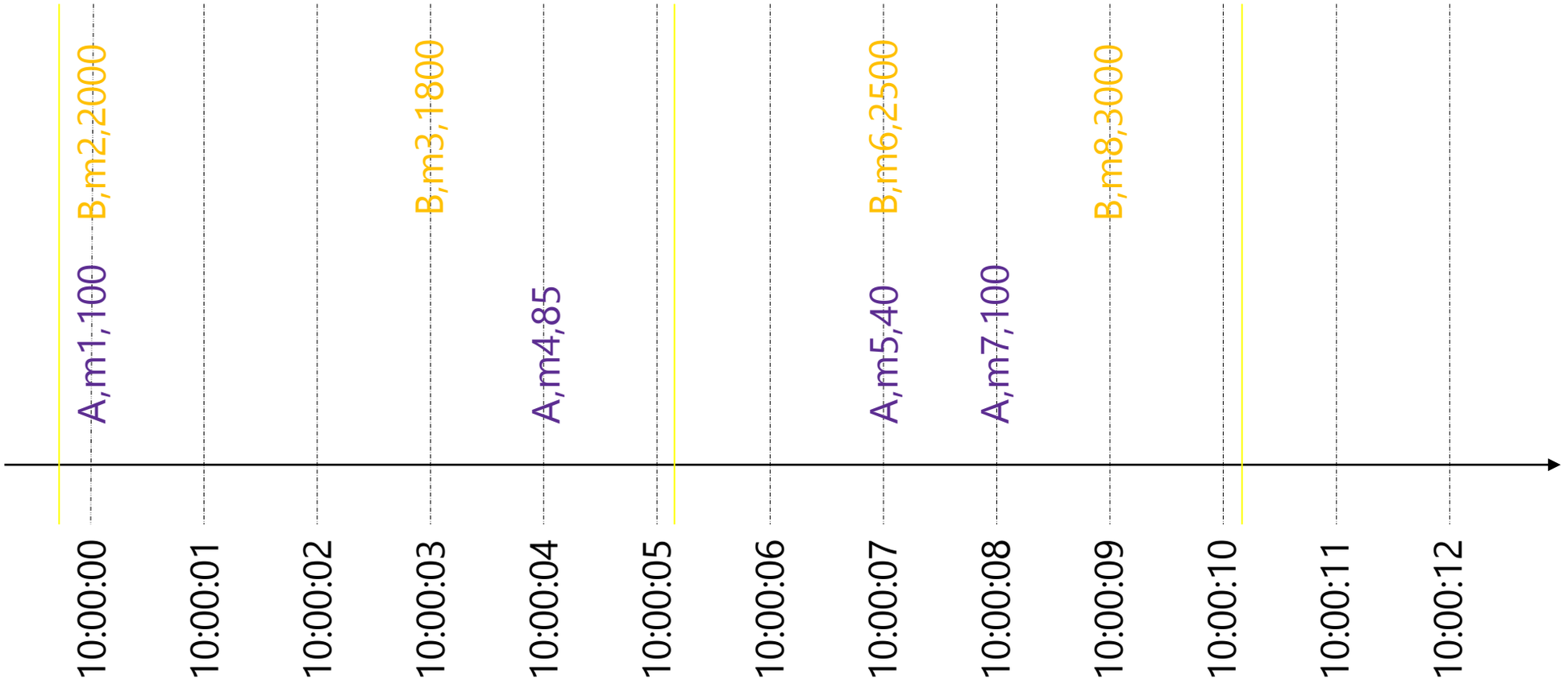
Aggregations:

Time Window	Object A (sum)	Object B (average)
10:00:05	185	1900
10:00:10	140	2750

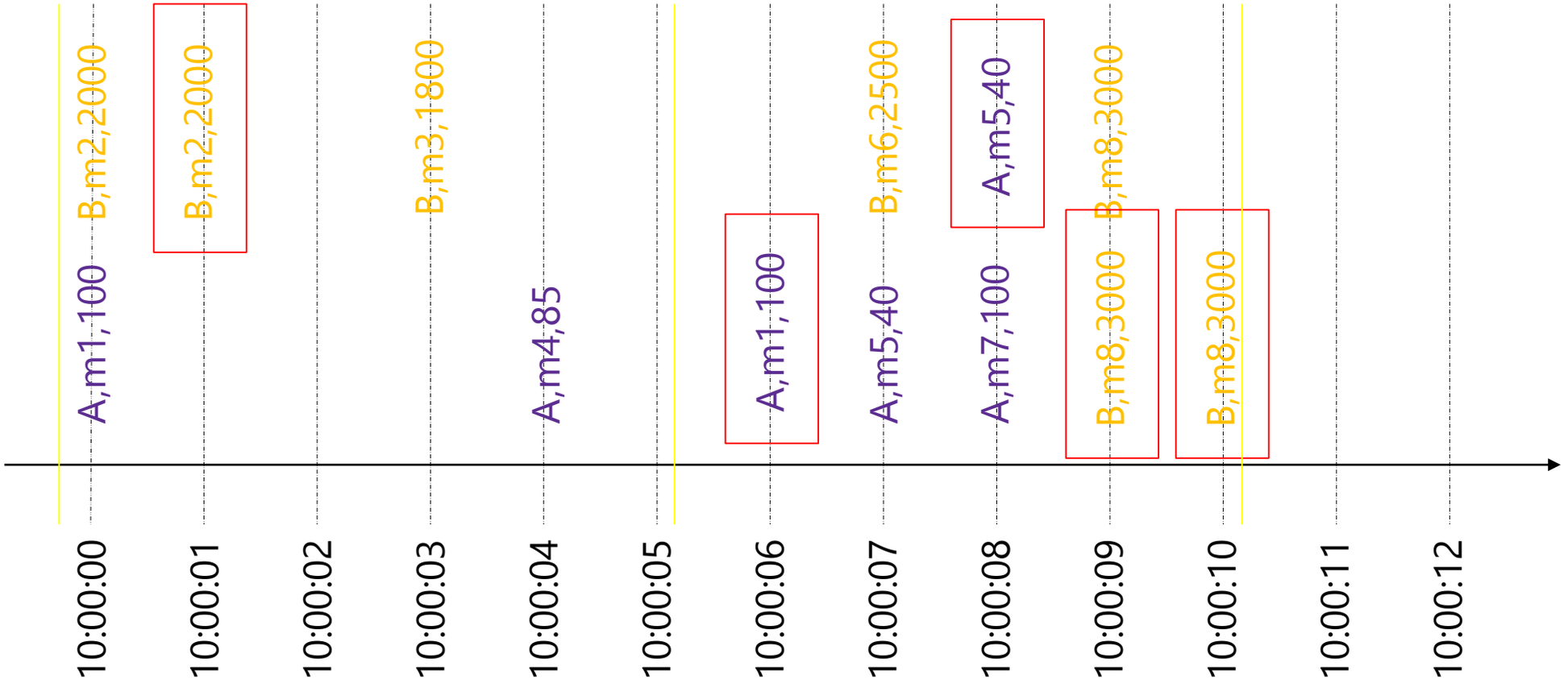
A distributed system



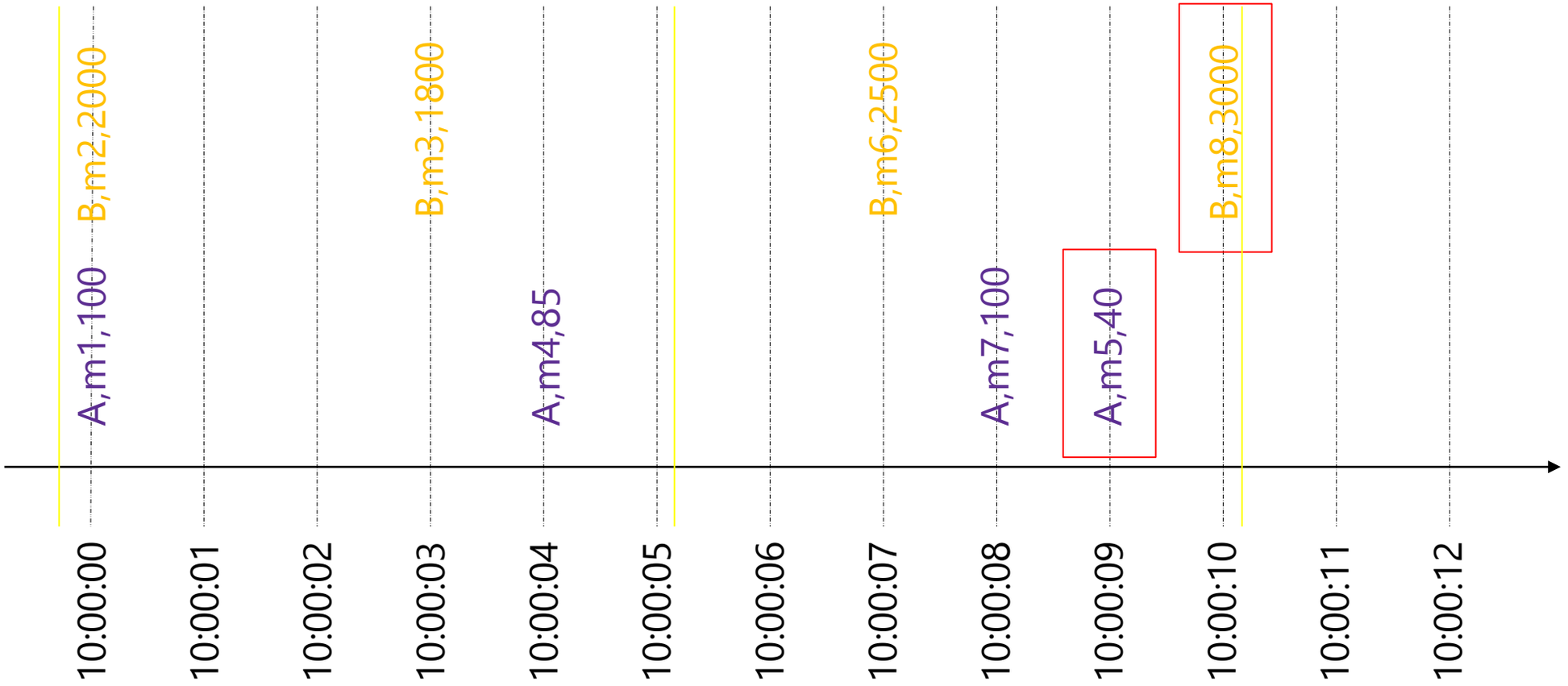
Best Case



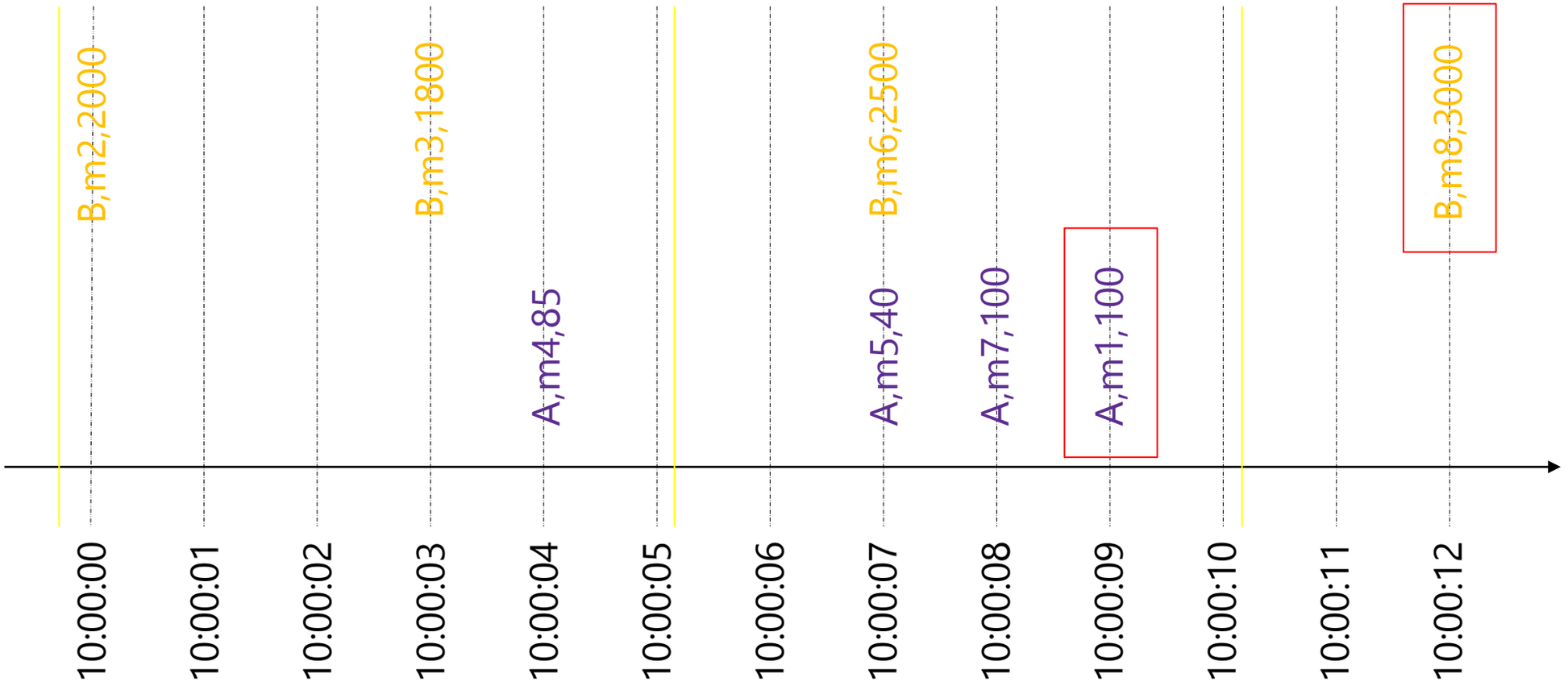
duplicate events



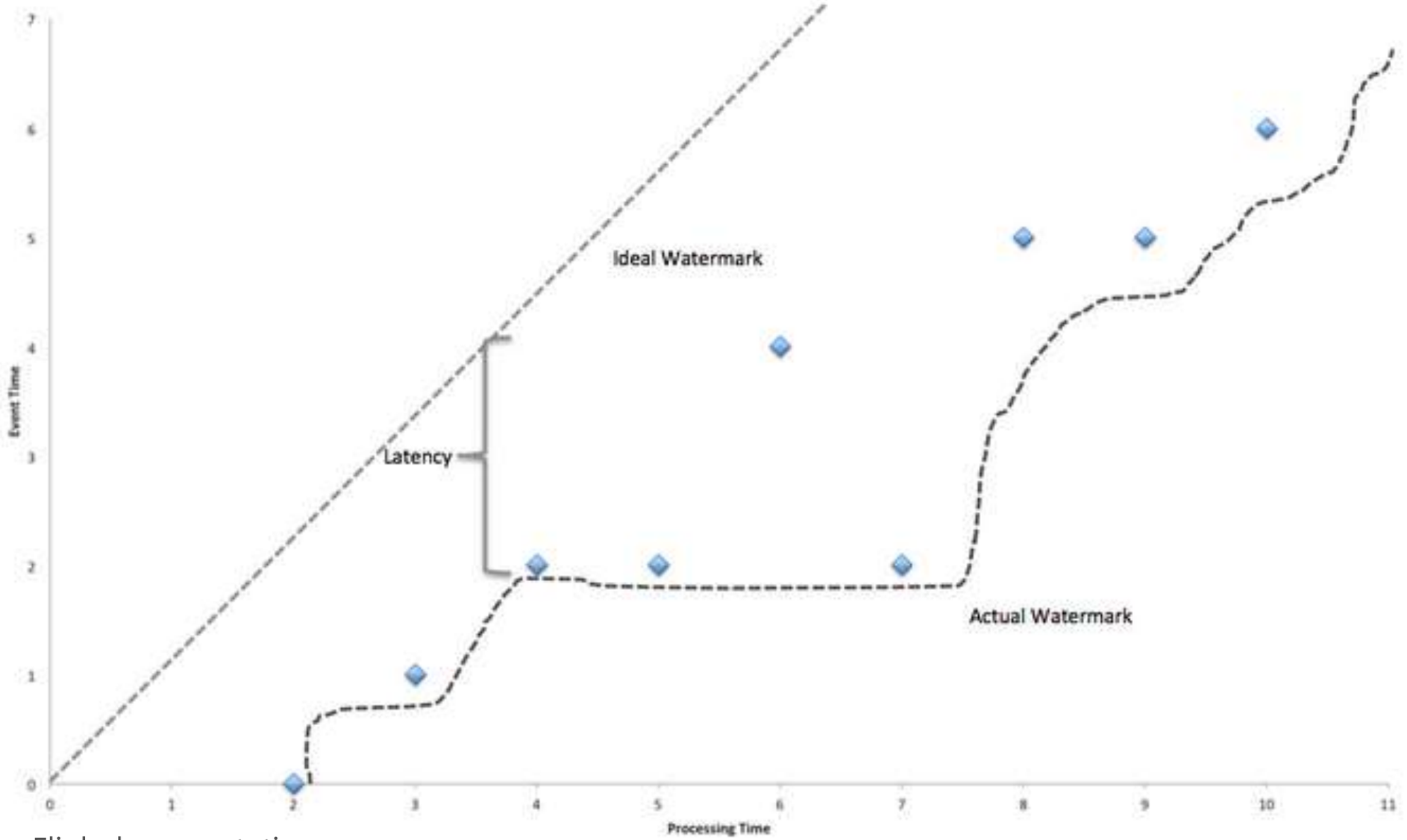
out of order events



late events

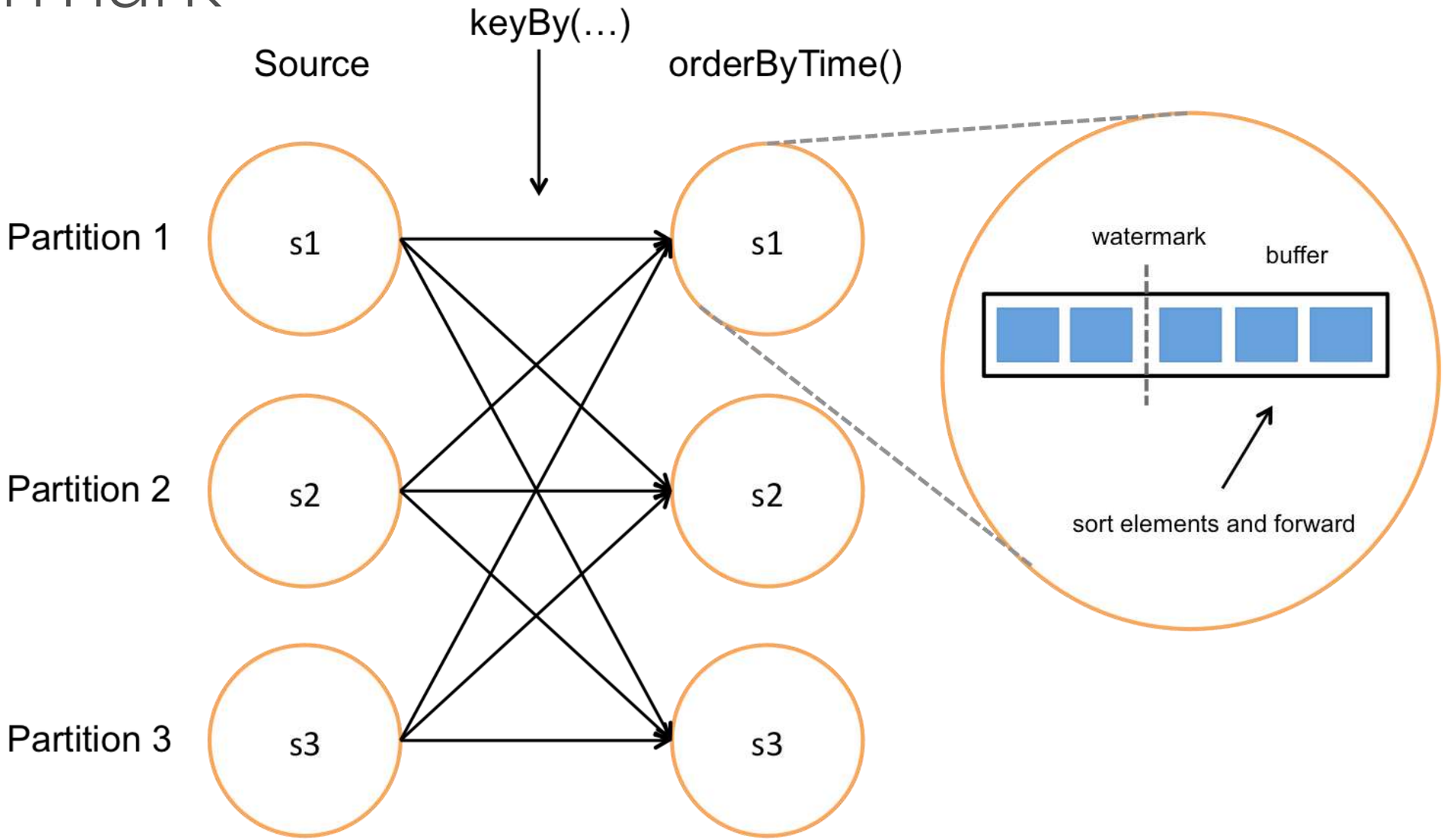


Watermark



from Apache Flink documentation

Watermark



from Apache Flink documentation

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Storm

Flink

Samza

Spark
Streaming

...

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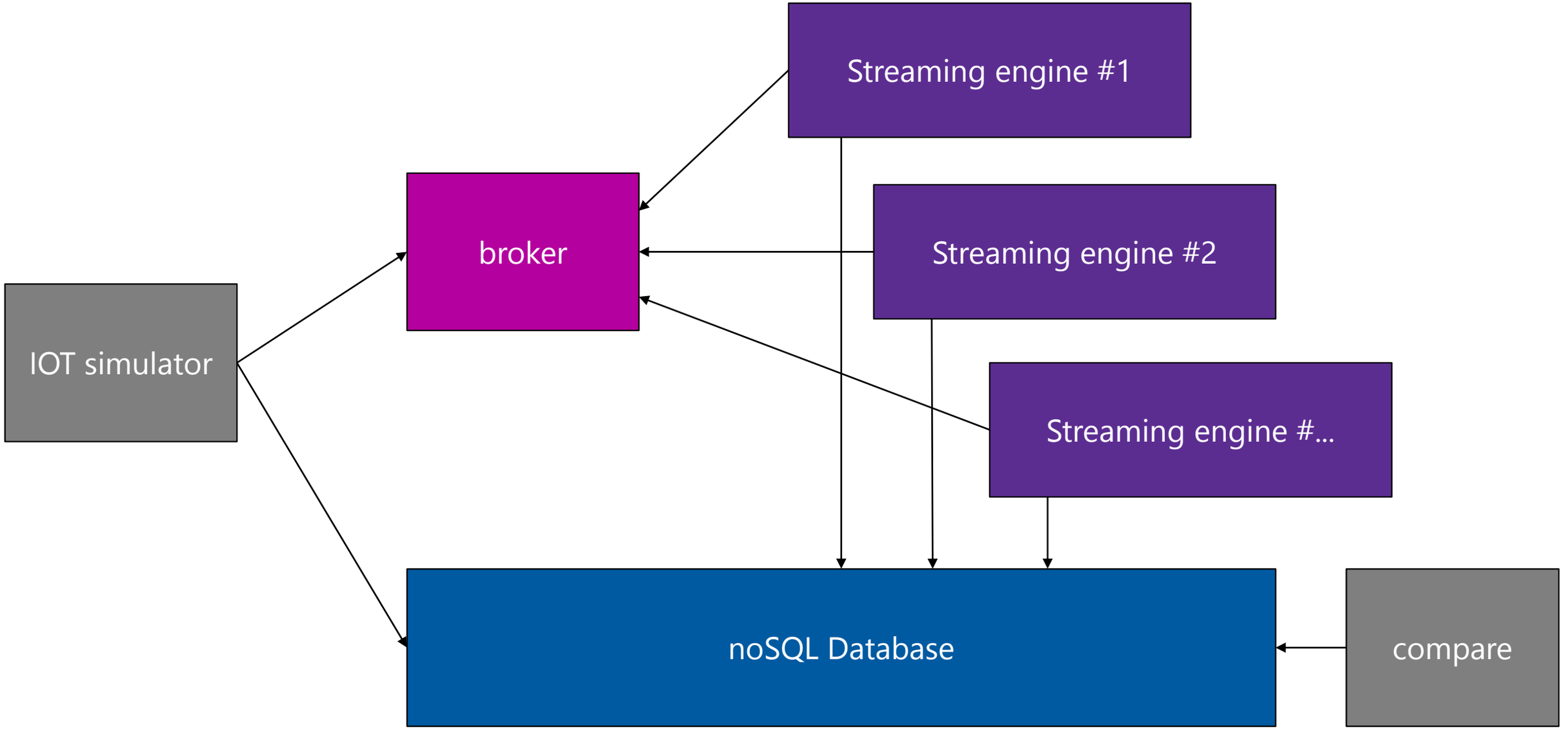
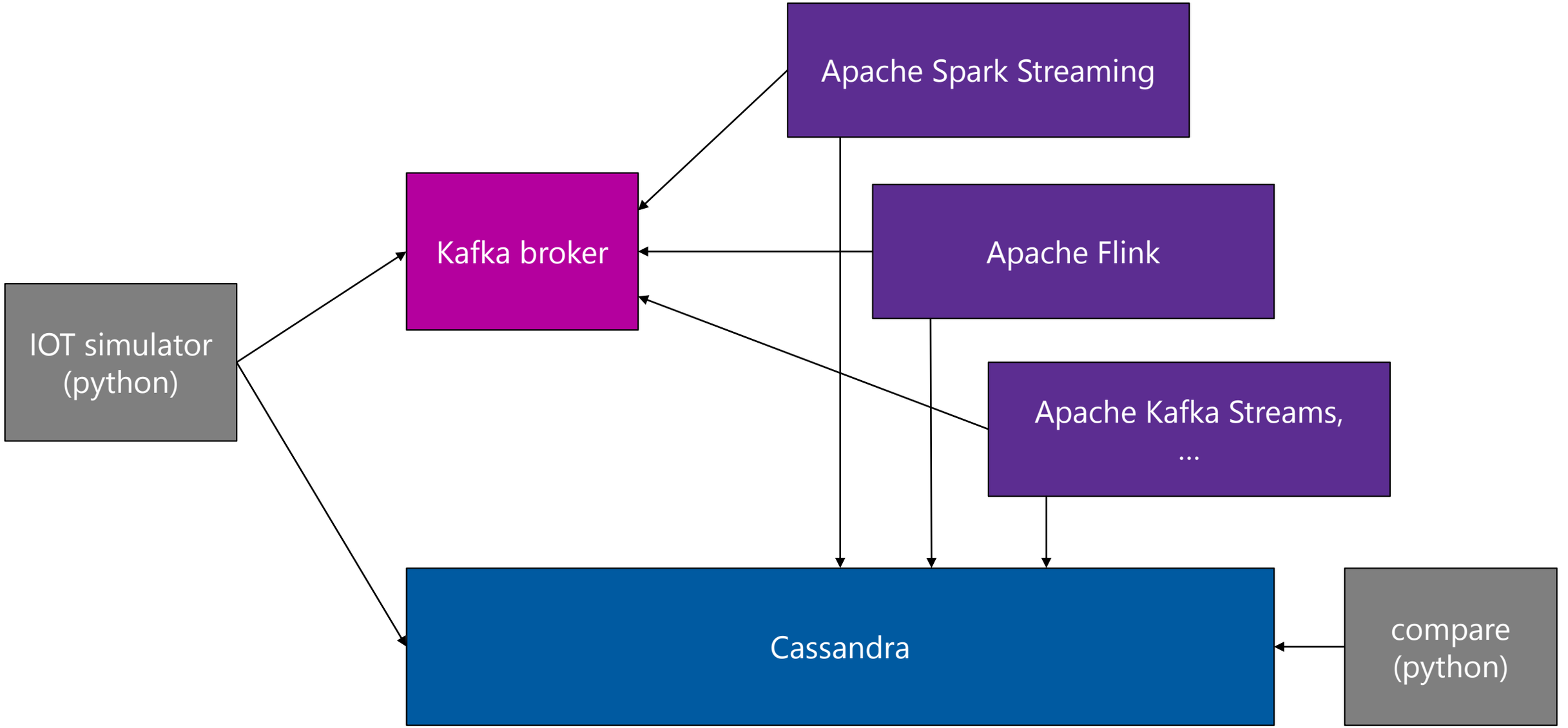
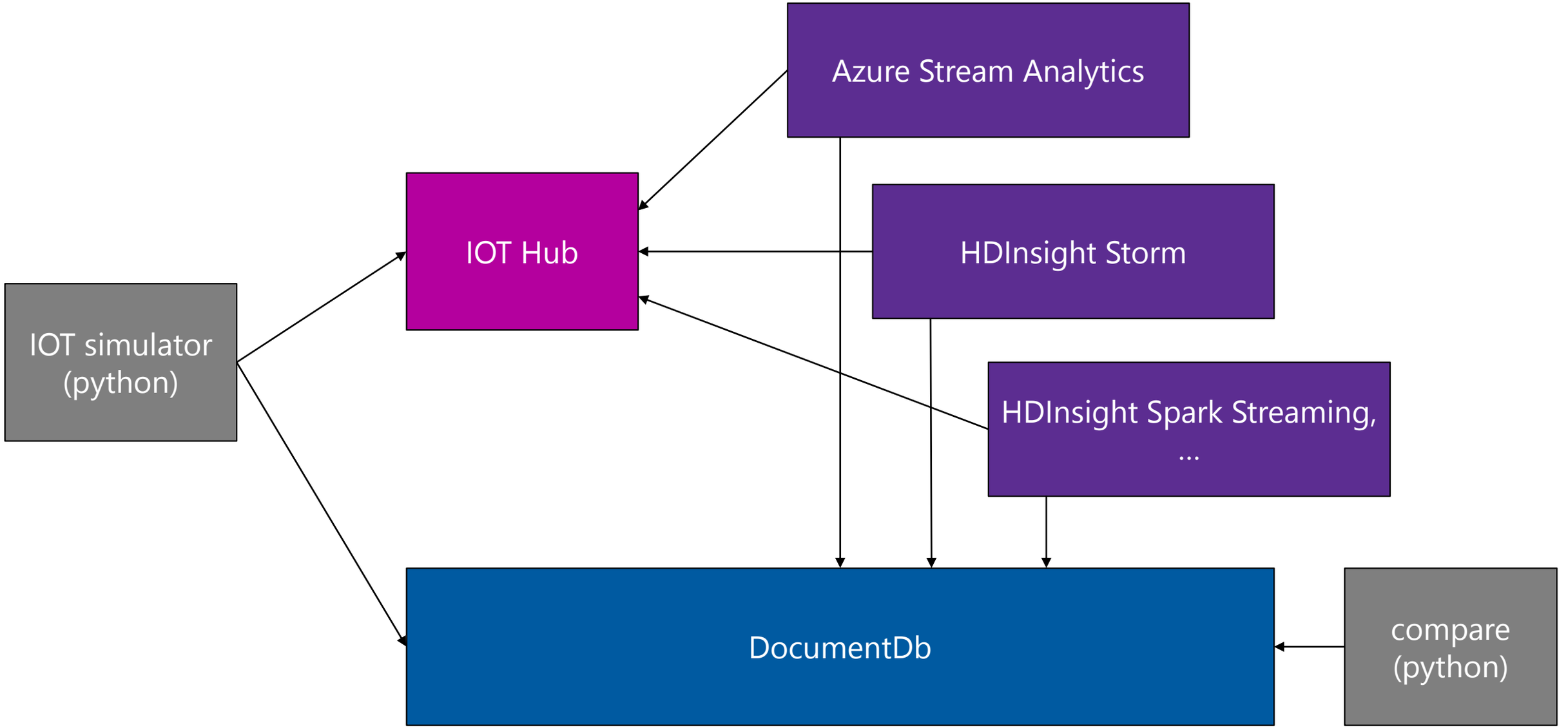


boontadata-streams



boontadata-paas



Implement other engines:

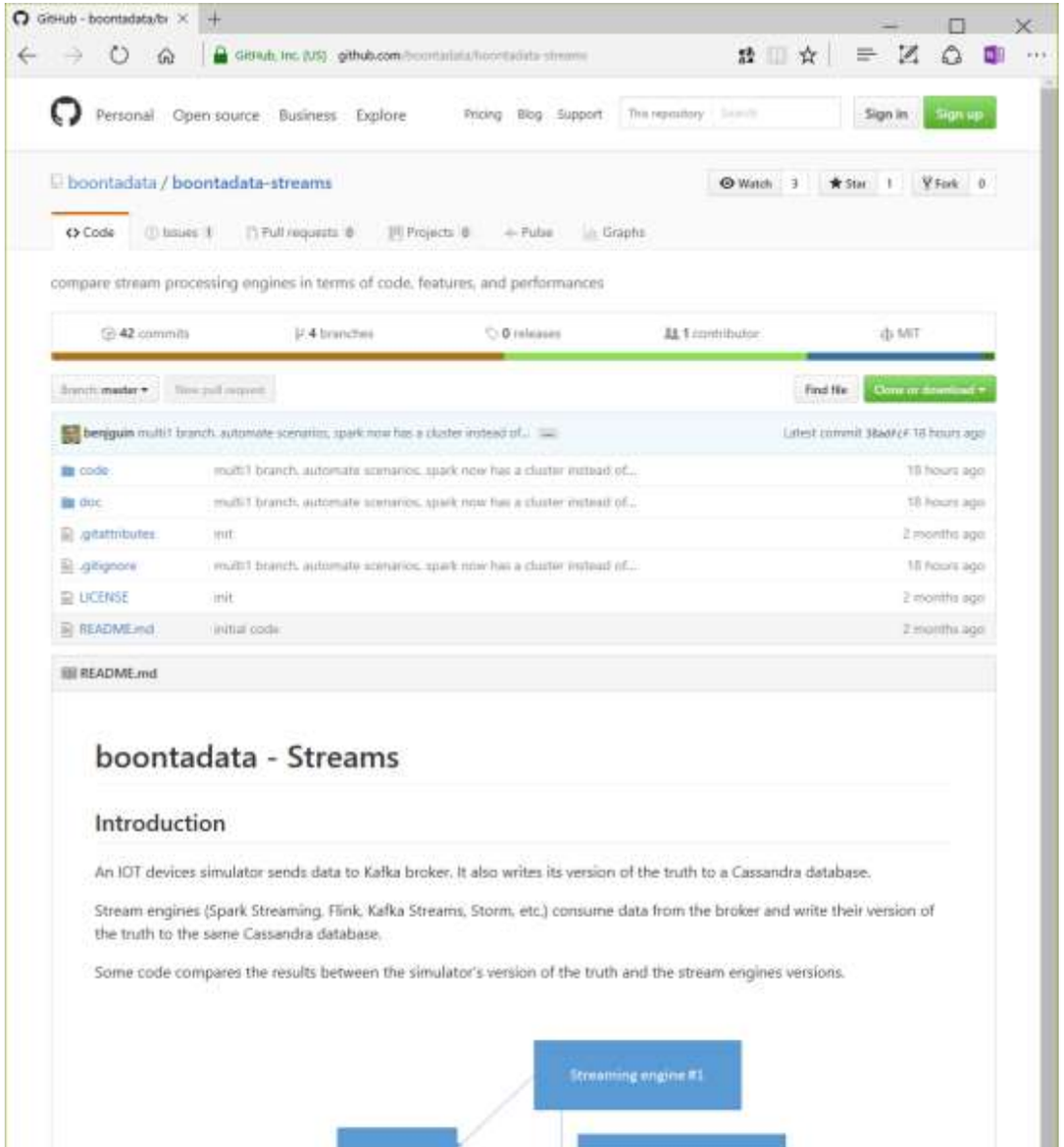
Apache

Samza,

Apex,

…

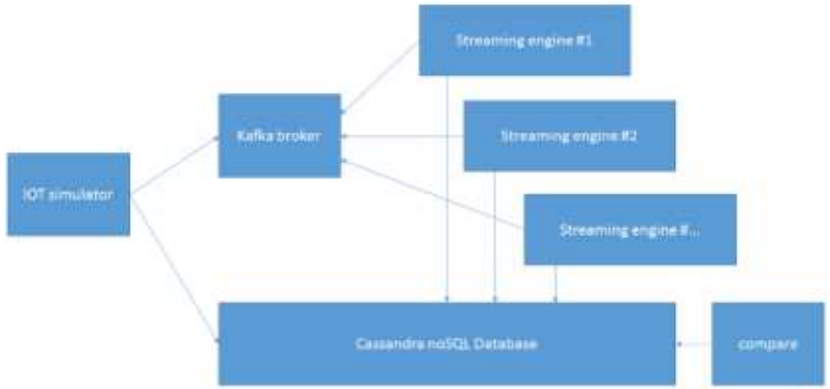
http://boontadata.io



An IOT devices simulator sends data to Kafka broker. It also writes its version of the truth to a Cassandra database.

Stream engines (Spark Streaming, Flink, Kafka Streams, Storm, etc.) consume data from the broker and write their version of the truth to the same Cassandra database.

Some code compares the results between the simulator's version of the truth and the stream engines versions.



The goals are to have code that shows how to do with different frameworks, compare the capabilities of different engines.

Additional goals include comparing performances, resilience to node failures, ...

... more

In which state is the project right now

As you can see in the code folder, we have some code (mostly Python) we should be able to publish soon in this repo. For now, an injector sends data to Kafka. It may send duplicates, send out of order, or send late. The injector also aggregates what it sent and saves its version of the truth to Cassandra. One injector simulates one device. You can use several instances to simulate several devices. Compare.py compares what the injector sent from a device time and a send time perspective.

Then, Spark streaming will be the first stream processing engine. It will aggregate using processing time. For now, it just consumes events from Spark and runs ... Word Count. Obviously this is the first thing that will be replaced, in order to aggregate, based on processing time.

Very simple stuff to start.

Once the initial code is released, the rest of the development will be done in this public repo.

Contribute

This is, and will be, a work in progress. If you are interested in contributing, please tweet us @boontadata or just leverage GitHub!

Why boontadata?

You may want to search for "Boonta Eve Classic".

let's run it

inject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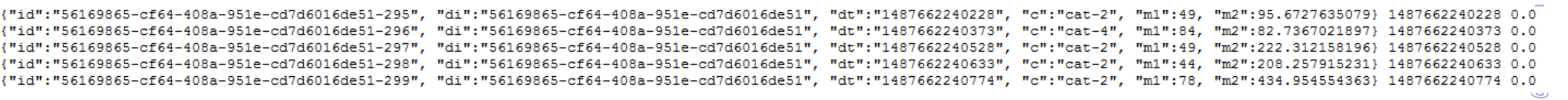
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Spark Streaming – processing time

```
benjguin@benjguinui655a:~/sdc1/boontadata-streams/code$ docker-compose ps
        Name                        Command                 State                Ports
------------------------------------------------------------------------------------------------
cassandra1         /docker-entrypoint.sh cass ...   Up      0.0.0.0:34060->7000/tcp,
                                                            0.0.0.0:34061->7001/tcp,
                                                            0.0.0.0:34062->7199/tcp,
                                                            0.0.0.0:34063->9042/tcp,
                                                            0.0.0.0:34064->9160/tcp
cassandra2         /docker-entrypoint.sh cass ...   Up      0.0.0.0:34070->7000/tcp,
                                                            0.0.0.0:34071->7001/tcp,
                                                            0.0.0.0:34072->7199/tcp,
                                                            0.0.0.0:34073->9042/tcp,
                                                            0.0.0.0:34074->9160/tcp
cassandra3         /docker-entrypoint.sh cass ...   Up      0.0.0.0:34080->7000/tcp,
                                                            0.0.0.0:34081->7001/tcp,
                                                            0.0.0.0:34082->7199/tcp,
                                                            0.0.0.0:34083->9042/tcp,
                                                            0.0.0.0:34084->9160/tcp
cinit              /docker-entrypoint.sh /dat ...   Exit 0
client1            init                             Up
ks1                start-kafka.sh                   Up      0.0.0.0:34001->9092/tcp
ks2                start-kafka.sh                   Up      0.0.0.0:34002->9092/tcp
ks3                start-kafka.sh                   Up      0.0.0.0:34003->9092/tcp
sparkm1            spark-class org.apache.spa ...   Up      0.0.0.0:34101->4040/tcp,
                                                            0.0.0.0:34102->6066/tcp,
                                                            0.0.0.0:34103->7001/tcp,
                                                            0.0.0.0:34104->7002/tcp,
                                                            0.0.0.0:34105->7003/tcp,
                                                            0.0.0.0:34106->7004/tcp,
                                                            0.0.0.0:34107->7005/tcp,
                                                            0.0.0.0:34108->7006/tcp,
                                                            0.0.0.0:34109->7077/tcp,
                                                            0.0.0.0:34110->8080/tcp
sparkw1            spark-class org.apache.spa ...   Up      0.0.0.0:34120->7012/tcp,
                                                            0.0.0.0:34121->7013/tcp,
                                                            0.0.0.0:34122->7014/tcp,
                                                            0.0.0.0:34123->7015/tcp,
                                                            0.0.0.0:34124->7016/tcp,
                                                            0.0.0.0:34126->8081/tcp,
                                                            0.0.0.0:34125->8881/tcp
sparkw2            spark-class org.apache.spa ...   Up      0.0.0.0:34130->7012/tcp,
                                                            0.0.0.0:34131->7013/tcp,
                                                            0.0.0.0:34132->7014/tcp,
                                                            0.0.0.0:34133->7015/tcp,
                                                            0.0.0.0:34134->7016/tcp,
                                                            0.0.0.0:34136->8081/tcp,
                                                            0.0.0.0:34135->8881/tcp
zk1                /bin/sh -c /usr/sbin/sshd  ...   Up      0.0.0.0:34050->2181/tcp,
                                                            0.0.0.0:34053->22/tcp,
                                                            0.0.0.0:34051->2888/tcp,
                                                            0.0.0.0:34052->3888/tcp
```

```
Comparing ingest device and downstream for m1_sum
--------------------------------------------------
10 exceptions out of 21

Exceptions are:
            window_time                             device_id category  m1_sum_ingest_devicetime  m1_sum_downstream  delta_m1_sum_ingestdevice_downstream
1   2017-01-03 17:52:15  84cbc110-f4d0-4bb1-9530-bff92770c382    cat-1                       851              884.0                                 -33.0
2   2017-01-03 17:52:20  84cbc110-f4d0-4bb1-9530-bff92770c382    cat-1                       656              726.0                                 -70.0
6   2017-01-03 17:52:15  84cbc110-f4d0-4bb1-9530-bff92770c382    cat-2                      1137             1156.0                                 -19.0
7   2017-01-03 17:52:20  84cbc110-f4d0-4bb1-9530-bff92770c382    cat-2                       674              709.0                                 -35.0
9   2017-01-03 17:52:30  84cbc110-f4d0-4bb1-9530-bff92770c382    cat-2                       488              536.0                                 -48.0
13  2017-01-03 17:52:25  84cbc110-f4d0-4bb1-9530-bff92770c382    cat-3                       519              618.0                                 -99.0
15  2017-01-03 17:50:05  84cbc110-f4d0-4bb1-9530-bff92770c382    cat-4                        49                NaN                                   NaN
17  2017-01-03 17:52:15  84cbc110-f4d0-4bb1-9530-bff92770c382    cat-4                      1062             1149.0                                 -87.0
18  2017-01-03 17:52:20  84cbc110-f4d0-4bb1-9530-bff92770c382    cat-4                      1519             1605.0                                 -86.0
19  2017-01-03 17:52:25  84cbc110-f4d0-4bb1-9530-bff92770c382    cat-4                       940             1071.0                                -131.0
```

Flink – processing time

```
benjguin@benjguinu1605a:~/sdc1/boontadata-streams/code$ docker-compose ps
    Name                  Command               State                                                 Ports
-----------------------------------------------------------------------------------------------------------------------------------------------------------------------
cassandra1      /docker-entrypoint.sh cass ...   Up      0.0.0.0:34060->7000/tcp, 0.0.0.0:34061->7001/tcp, 0.0.0.0:34062->7199/tcp, 0.0.0.0:34063->9042/tcp, 0.0.0.0:34064->9160/tcp
cassandra2      /docker-entrypoint.sh cass ...   Up      0.0.0.0:34070->7000/tcp, 0.0.0.0:34071->7001/tcp, 0.0.0.0:34072->7199/tcp, 0.0.0.0:34073->9042/tcp, 0.0.0.0:34074->9160/tcp
cassandra3      /docker-entrypoint.sh cass ...   Up      0.0.0.0:34080->7000/tcp, 0.0.0.0:34081->7001/tcp, 0.0.0.0:34082->7199/tcp, 0.0.0.0:34083->9042/tcp, 0.0.0.0:34084->9160/tcp
cinit           /docker-entrypoint.sh /dat ...   Exit 0
client1         init                             Up
flink-master    /opt/flink/bin/start-master.sh   Up      0.0.0.0:34011->6123/tcp, 0.0.0.0:34010->8081/tcp
flink-worker1   /opt/flink/bin/start-worker.sh   Up      0.0.0.0:34012->6121/tcp, 0.0.0.0:34013->6122/tcp
flink-worker2   /opt/flink/bin/start-worker.sh   Up      0.0.0.0:34014->6121/tcp, 0.0.0.0:34015->6122/tcp
ks1             start-kafka.sh                   Up      0.0.0.0:34001->9092/tcp
ks2             start-kafka.sh                   Up      0.0.0.0:34002->9092/tcp
ks3             start-kafka.sh                   Up      0.0.0.0:34003->9092/tcp
zk1             /bin/sh -c /usr/sbin/sshd  ...   Up      0.0.0.0:34050->2181/tcp, 0.0.0.0:34053->22/tcp, 0.0.0.0:34051->2888/tcp, 0.0.0.0:34052->3888/tcp
```

```
Comparing ingest device and downstream for m1_sum
--------------------------------------------------
23 exceptions out of 23

Exceptions are:
```

	window_time	device_id	category	m1_sum_ingest_devicetime	m1_sum_downstream	delta_m1_sum_ingestdevice_downstream
0	2017-01-03 17:08:55	6ecbd33f-f123-4878-bb1a-bcb95913a3cf	cat-1	1078.0	NaN	NaN
1	2017-01-03 17:09:00	6ecbd33f-f123-4878-bb1a-bcb95913a3cf	cat-1	542.0	1005.0	-463.0
2	2017-01-03 17:09:05	6ecbd33f-f123-4878-bb1a-bcb95913a3cf	cat-1	604.0	611.0	-7.0
3	2017-01-03 17:09:10	6ecbd33f-f123-4878-bb1a-bcb95913a3cf	cat-1	1360.0	711.0	649.0
4	2017-01-03 17:09:15	6ecbd33f-f123-4878-bb1a-bcb95913a3cf	cat-1	NaN	1360.0	NaN
5	2017-01-03 17:08:55	6ecbd33f-f123-4878-bb1a-bcb95913a3cf	cat-2	797.0	NaN	NaN
6	2017-01-03 17:09:00	6ecbd33f-f123-4878-bb1a-bcb95913a3cf	cat-2	703.0	797.0	-94.0
7	2017-01-03 17:09:05	6ecbd33f-f123-4878-bb1a-bcb95913a3cf	cat-2	1018.0	758.0	260.0
8	2017-01-03 17:09:10	6ecbd33f-f123-4878-bb1a-bcb95913a3cf	cat-2	1020.0	1034.0	-14.0
9	2017-01-03 17:09:15	6ecbd33f-f123-4878-bb1a-bcb95913a3cf	cat-2	171.0	971.0	-800.0
10	2017-01-03 17:09:20	6ecbd33f-f123-4878-bb1a-bcb95913a3cf	cat-2	NaN	287.0	NaN
11	2017-01-03 17:08:55	6ecbd33f-f123-4878-bb1a-bcb95913a3cf	cat-3	663.0	NaN	NaN
12	2017-01-03 17:09:00	6ecbd33f-f123-4878-bb1a-bcb95913a3cf	cat-3	1068.0	573.0	495.0
13	2017-01-03 17:09:05	6ecbd33f-f123-4878-bb1a-bcb95913a3cf	cat-3	746.0	1158.0	-412.0
14	2017-01-03 17:09:10	6ecbd33f-f123-4878-bb1a-bcb95913a3cf	cat-3	519.0	752.0	-233.0
15	2017-01-03 17:09:15	6ecbd33f-f123-4878-bb1a-bcb95913a3cf	cat-3	NaN	618.0	NaN
16	2017-01-03 17:06:50	6ecbd33f-f123-4878-bb1a-bcb95913a3cf	cat-4	49.0	NaN	NaN
17	2017-01-03 17:08:55	6ecbd33f-f123-4878-bb1a-bcb95913a3cf	cat-4	1297.0	NaN	NaN
18	2017-01-03 17:09:00	6ecbd33f-f123-4878-bb1a-bcb95913a3cf	cat-4	913.0	1198.0	-285.0
19	2017-01-03 17:09:05	6ecbd33f-f123-4878-bb1a-bcb95913a3cf	cat-4	1337.0	988.0	349.0
20	2017-01-03 17:09:10	6ecbd33f-f123-4878-bb1a-bcb95913a3cf	cat-4	944.0	1598.0	-654.0
21	2017-01-03 17:09:15	6ecbd33f-f123-4878-bb1a-bcb95913a3cf	cat-4	84.0	973.0	-889.0
22	2017-01-03 17:09:20	6ecbd33f-f123-4878-bb1a-bcb95913a3cf	cat-4	NaN	84.0	NaN

Flink – event time

```
benjguin@benjguinu1605a:~/sdc1/boontadata-streams/code$ docker-compose ps
    Name                   Command               State                                                  Ports
-------------------------------------------------------------------------------------------------------------------------------------------------------------------
cassandra1      /docker-entrypoint.sh cass ...   Up      0.0.0.0:34060->7000/tcp, 0.0.0.0:34061->7001/tcp, 0.0.0.0:34062->7199/tcp, 0.0.0.0:34063->9042/tcp, 0.0.0.0:34064->9160/tcp
cassandra2      /docker-entrypoint.sh cass ...   Up      0.0.0.0:34070->7000/tcp, 0.0.0.0:34071->7001/tcp, 0.0.0.0:34072->7199/tcp, 0.0.0.0:34073->9042/tcp, 0.0.0.0:34074->9160/tcp
cassandra3      /docker-entrypoint.sh cass ...   Up      0.0.0.0:34080->7000/tcp, 0.0.0.0:34081->7001/tcp, 0.0.0.0:34082->7199/tcp, 0.0.0.0:34083->9042/tcp, 0.0.0.0:34084->9160/tcp
cinit           /docker-entrypoint.sh /dat ...   Exit 0
client1         init                             Up
flink-master    /opt/flink/bin/start-master.sh   Up      0.0.0.0:34011->6123/tcp, 0.0.0.0:34010->8081/tcp
flink-worker1   /opt/flink/bin/start-worker.sh   Up      0.0.0.0:34012->6121/tcp, 0.0.0.0:34013->6122/tcp
flink-worker2   /opt/flink/bin/start-worker.sh   Up      0.0.0.0:34014->6121/tcp, 0.0.0.0:34015->6122/tcp
ks1             start-kafka.sh                   Up      0.0.0.0:34001->9092/tcp
ks2             start-kafka.sh                   Up      0.0.0.0:34002->9092/tcp
ks3             start-kafka.sh                   Up      0.0.0.0:34003->9092/tcp
zk1             /bin/sh -c /usr/sbin/sshd  ...   Up      0.0.0.0:34050->2181/tcp, 0.0.0.0:34053->22/tcp, 0.0.0.0:34051->2888/tcp, 0.0.0.0:34052->3888/tcp
```

```
Comparing ingest device and downstream for m1_sum
--------------------------------------------------
5 exceptions out of 21

Exceptions are:
            window_time                             device_id category  m1_sum_ingest_devicetime  m1_sum_downstream  delta_m1_sum_ingestdevice_downstream
4   2017-01-03 17:25:25  1f7fdc01-3881-4939-879e-15f50965d320    cat-1                       681                NaN                                   NaN
9   2017-01-03 17:25:25  1f7fdc01-3881-4939-879e-15f50965d320    cat-2                       730                NaN                                   NaN
14  2017-01-03 17:25:25  1f7fdc01-3881-4939-879e-15f50965d320    cat-3                       447                NaN                                   NaN
15  2017-01-03 17:23:00  1f7fdc01-3881-4939-879e-15f50965d320    cat-4                        49                NaN                                   NaN
20  2017-01-03 17:25:25  1f7fdc01-3881-4939-879e-15f50965d320    cat-4                       833                NaN                                   NaN
```

Azure Stream Analytics

pyclient container

bd34documentdb	NoSQL (DocumentDB)	North Europe
bd34iothub	IoT Hub	North Europe
bd34streamanalytics	Stream Analytics job	North Europe

```
Comparing inject device and downstream for m1_sum
--------------------------------------------------
1 exceptions out of 31

Exceptions are:
           window_time                             device_id category  m1_sum_inject_devicetime  m1_sum_downstream  delta_m1_sum_injectdevice_downstream
0  2017-02-21 07:28:10  56169865-cf64-408a-951e-cd7d6016de51    cat-4                        49                NaN                                   NaN
```

Run other tests (other seed, several objects, …)

compare the code

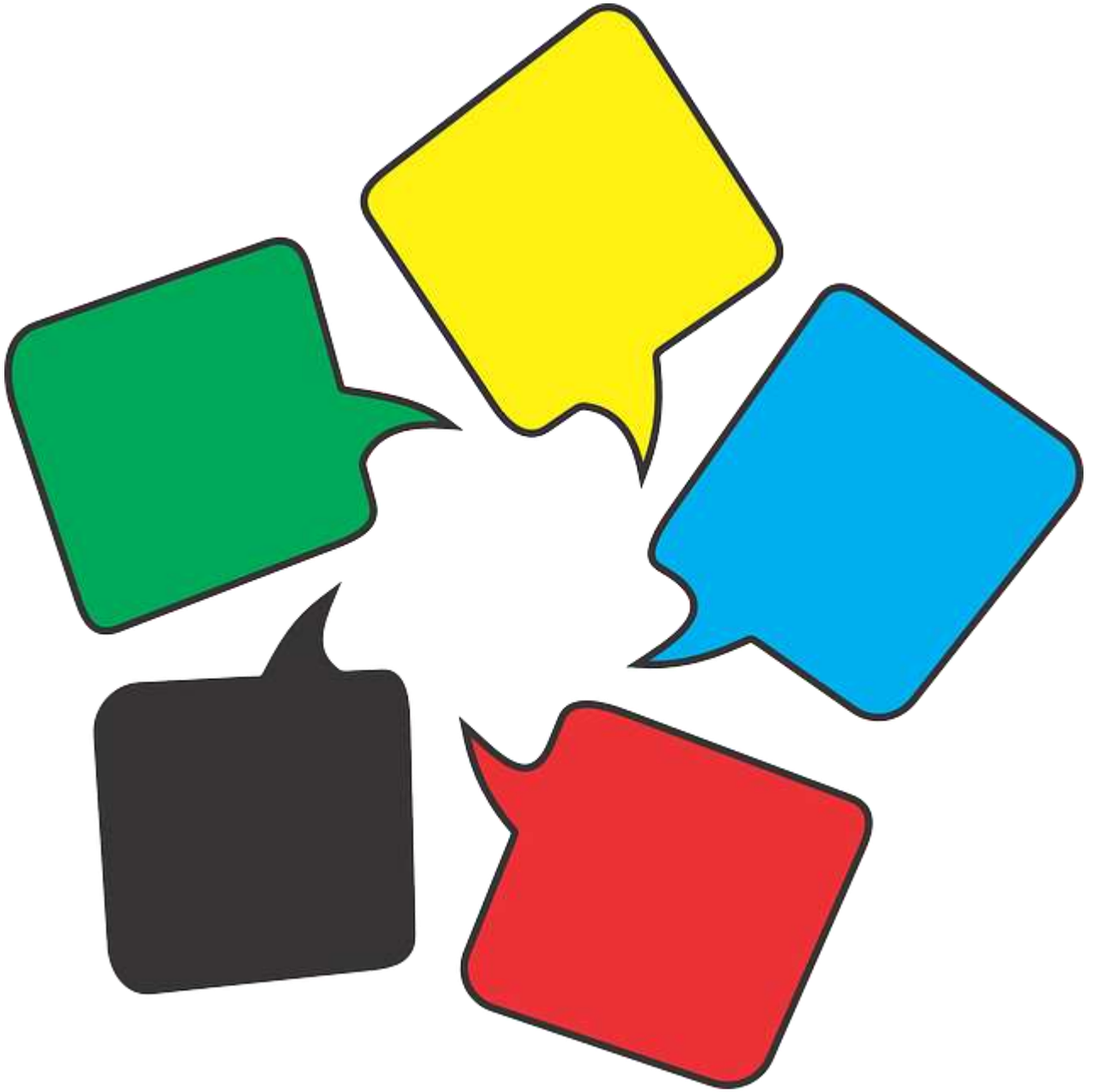
http://boontadata.io

Conclusion

Conclusion

- A number of streaming engines with subtle differences => do your own tests

- Contribute: http://boontadata.io



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