Formula 1 telemetry processing using Kafka and Camel

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{CODEMOTION}
Online Tech Conference
- English edition -

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Who are we?

Principal Software Engineer @Red Hat
Working on Apache Kafka and Strimzi

@ppatierno

Senior Software Engineer @Red Hat
Working on Apache Kafka and Strimzi

@tomncooper

Red Hat

Building an events stream pipeline:

- How to ingest events reliably
- How to integrate with different systems for events ingestion (UDP) and providing output
- How to process events in real time
- How to show useful insights
- How to run and deploy the entire pipeline

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F1 2020 Xbox UDP to Kafka

Red Hat

kafka:f1-telemetry-drivers
Streams API
Drivers Avg Speed
kafka:f1-telemetry-drivers-avg-speed

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Kafka to InfluxDB

Red Hat

Streams API
Drivers Avg Speed
kafka:f1-telemetry
-drivers
Source
Filter bad
messages
Extract
(driverID,
speed)
Group by
driverID
Window
into 5
second
batches
Windows
by driverID
Create
count,
sum table
Create
average
table
Sink
kafka:f1-telemetry-
drivers-avg-speed

Red Hat

Setup

```
StreamsBuilder streamsBuilder = new StreamsBuilder();
Serde<Driver> driverSerdes = Serdes.serdeFrom(
    new DriverSerializer(), new DriverDeserializer());
Serde<SpeedCountAndSum> speedCountAndSumSerde = Serdes.serdeFrom(
    new SpeedCountAndSumSerializer(), new SpeedCountAndSumDeserializer());
```

```
TimeWindowedKStream<String, Integer> speedStreamWindowed =
   streamsBuilder
        1 .stream(config.getF1StreamsInputTopic(),
                  Consumed.with(Serdes.String(),
                  driverSerdes))
        2 .filter((driverid, driver) -> driver.hasValidTelemetry())
        3 .map((driverid, driver) -> new KeyValue<>(
              driver.getHashtag(), driver.getCarTelemetryData().getSpeed()))
          .groupByKey(Grouped.with(Serdes.String(), Serdes.Integer()))
        4 .windowedBy(TimeWindows.of(Duration.ofMillis(5000)));
```

kafka:f1-telemetry
-drivers

Processing time

Ingestion time

Event time

Red Hat

Stream processing

```
KTable<Windowed<String>, SpeedCountAndSum> speedCountAndSum =
   speedStreamWindowed.aggregate(new Initializer<SpeedCountAndSum>() {
       @Override
       public SpeedCountAndSum apply() {
           return new SpeedCountAndSum(0, 0);
       }
   }, new Aggregator<String, Integer, SpeedCountAndSum>() {
       @Override
       public SpeedCountAndSum apply(String key,
                                     Integer value,
                                     SpeedCountAndSum aggregate) {
           aggregate.setCount(aggregate.getCount() + 1);
           aggregate.setSum(aggregate.getSum() + value);
           return aggregate;
       }
   }, Materialized.with(Serdes.String(), speedCountAndSumSerde));
```

```
KTable<Windowed<String>, Integer> speedAvarage =
   speedCountAndSum.mapValues(
           new ValueMapper<SpeedCountAndSum, Integer>() {
       @Override
       public Integer apply(SpeedCountAndSum speedCountAndSum) {
           return speedCountAndSum.getSum() /
                    speedCountAndSum.getCount();
       }
   });
```

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Streams API
Drivers Avg Speed
kafka:f1-telemetry
-drivers
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Filter bad
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kafka:f1-telemetry-
drivers-avg-speed

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Topic
kafka:f1-telemetry-drivers
Streams App 1
Tasks 1-2
Streams App 2
Task 3
Streams App 3
Task 4

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Demo

Red Hat

Resources:

- Blog post: https://grafana.com/blog/2021/02/02/real-time-monitoring-of-formula-1-telemetry-data-on-kubernetes-with-grafana-apache-kafka-and-strimzi/
- F1 decoding library: https://github.com/ppatierno/formula1-telemetry
- F1 Kafka project: https://github.com/ppatierno/formula1-telemetry-kafka
- Video demo: https://www.youtube.com/watch?v=Re9LOAYZi2A

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- F1 2020 Codemasters game provides telemetry packets on UDP
  - Specification is available online
- Kubernetes / OpenShift
  - Deploying the Apache Kafka cluster through Strimzi project
  - Running Apache Camel applications, InfluxDB and Grafana
- Apache Camel
  - Ingesting telemetry packets to Apache Kafka
  - Gets telemetry data and race events from Apache Kafka; store into InfluxDB
- InfluxDB
  - Time-series database to provide data to Grafana
- Grafana
  - Showing all telemetry and events on specific dashboards

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Using color in presentations

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Using color in presentations

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Presentation palette 1

#E4F3F4	#43ADAF	#1B4546	#000000	#5F0000	#EE0000	#F56D6D	#FDDBDB

Presentation palette 2

#E2EAF6	#A7C0E4	#316DC1	#261A4C	#5F0000	#EE0000	#F56D6D	#FDDBDB

Presentation palette 3

#FDDBC7	#F7823C	#316DC1	#142C4D	#5F0000	#EE0000	#F56D6D	#FDDBDB

Presentation palette 4

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Using color in presentations

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Neutrals					
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This section includes:

Topic

Topic

Topic

Topic

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What we'll discuss today

- Topic
- Topic
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What we'll discuss today

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Quick tip
To edit a chart, select it and click the dropdown arrow in the top right. Select "Open source." The percentage will need to be updated manually.

Red Hat

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Quick tip
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01 Title of table

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01 Title of table

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Red Hat

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Dark theme slide templates

Template slide
Click on this slide's thumbnail to the left and delete from your presentation before use.

Red Hat

Red Hat
Enterprise Linux

Quick tip
If the presentation is not product focused, simply delete this. Do NOT insert the Red Hat logo here. If this is a product-focused deck, right click on the logo and using “Replace Image” insert the product logo of your choice. After replacing the image, right click and select “Reset Image”. Adjust spacing as needed.

Presentation title should not exceed two lines

Optional subheading

Presenter’s Name
Title

Presenter’s Name
Title

Red Hat

Thank you

Red Hat is the world's leading provider of enterprise open source software solutions. Award-winning support, training, and consulting services make Red Hat a trusted adviser to the Fortune 500.

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Title should not exceed two lines

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Red Hat

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Red Hat

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This section includes:

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Slide title should not exceed one line

Optional subheading

Quick tip

Insert image in this designated area, deleting the shaded background. Keep the left and right margins clear to maintain the open feel in accordance with the brand.

If no subheading is needed, delete the subheading text, and the content can extend into the lighter shaded area.

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Quick tip
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Quick tip
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John Doe
CTO, Acme Unlimited

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Quick tip
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01 Title of chart

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Quick tip
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01 Title of table

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Row header with two lines maximum	Body cell should be limited to two lines	Body cell should be limited to two lines	Body cell should be limited to two lines	Body cell should be limited to two lines	Body cell should be limited to two lines

Source:
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Slide title should not exceed one line

Optional subheading

Body headline
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Body headline
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Quick tip
Try right clicking on the photo and using “Replace Image” to insert your own photo. You are also welcome to use this photo.

Heading

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