

PSD

## Zajęcia zintegrowane 3

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W ramach zajęć został napisany w systemie Flink program do wykrywania temperatur poniżej zera.

Generowanie danych i zapisywanie ich na topikę Kafki odbyło się poprzez skrypt w pythonie:

```
import time
import json
import random
from datetime import datetime
from kafka import KafkaProducer

def serializer(message) -> str:
    return json.dumps(message).encode('utf-8')

producer = KafkaProducer(
    bootstrap_servers=['localhost:9092'],
    value_serializer=serializer
)

def generate_temp() -> int:
    return random.randint(-10, 30)

def generate_id() -> str:
    return f"t{random.randint(1, 100)}"

def generate_data(thermometer_id: str) -> dict[str, str]:
    return {
        "thermometer_id": thermometer_id,
        "timestamp": str(datetime.now()),
        "temperature": str(generate_temp())
    }

if __name__ == '__main__':
    thermometer_id = generate_id()
    while True:
        msg = generate_data(thermometer_id)
        print(f'Producing message @ {datetime.now()} | Message = {str(msg)}')
        producer.send('Temperatura', msg)
        time_to_sleep = random.randint(1, 11)
        time.sleep(time_to_sleep)
```

Program działający w systemie Flink, został napisany w języku Java. Kod źródłowy poniżej:

```
import org.apache.flink.streaming.api.environment.StreamExecutionEnvironment;
import org.apache.flink.streaming.api.datastream.DataStream;
import org.apache.flink.api.common.functions.FilterFunction;
import org.apache.flink.api.common.functions.MapFunction;
import org.apache.flink.api.common.serialization.SimpleStringSchema;
import org.apache.flink.streaming.util.serialization.JSONKeyValueDeserializationSchema;
import org.apache.flink.streaming.connectors.kafka.FlinkKafkaConsumer;
import org.apache.flink.streaming.connectors.kafka.FlinkKafkaProducer;
import org.apache.flink.shaded.jackson2.com.fasterxml.jackson.databind.ObjectMapper;
```

```

import java.util.Random;
import java.util.Properties;

public class Temperature {

    public static void main(String[] args) throws Exception {
        final StreamExecutionEnvironment env = StreamExecutionEnvironment.getExecutionEnvironment();
        FlinkKafkaConsumer<ObjectNode> kafkaConsumer = createConsumerForTopic("Temperatura");

        DataStream<TemperatureInfo> temperaturesStream = env.addSource(kafkaConsumer).map(jsonNode -> {
            return new TemperatureInfo(
                jsonNode.findValue("thermometer_id").asText(),
                jsonNode.findValue("timestamp").asText(),
                jsonNode.findValue("temperature").asDouble()
            );
        });

        DataStream<TemperatureInfo> negativeTemperatures = temperaturesStream.filter(new FilterFunction<TemperatureInfo>() {
            @Override
            public boolean filter(TemperatureInfo temp) throws Exception {
                return temp.temperature < 0;
            }
        });

        FlinkKafkaProducer<String> kafkaProducer = createProducerForTopic("Alarm");
        negativeTemperatures.map(temperature -> {
            return "Alarm! Temperature: " + temperature.temperature + ", timestamp: " + temperature.timestamp;
        }).addSink(kafkaProducer);

        negativeTemperatures.print();
        env.execute();
    }

    public static FlinkKafkaConsumer<ObjectNode> createConsumerForTopic(String topic) {
        Properties props = new Properties();
        props.setProperty("bootstrap.servers", "localhost:9092");
        FlinkKafkaConsumer<ObjectNode> consumer = new FlinkKafkaConsumer<>(topic, new
            JSONKeyValueDeserializationSchema(true), props);

        return consumer;
    }

    public static FlinkKafkaProducer<String> createProducerForTopic(String topic) {
        return new FlinkKafkaProducer<String>("localhost:9092", topic, new SimpleStringSchema());
    }

    public static class TemperatureInfo {
        public String thermometerId;
        public String timestamp;
        public Double temperature;

        public TemperatureInfo(String thermometerId, String timestamp, Double temperature) {
            this.thermometerId = thermometerId;
            this.timestamp = timestamp;
            this.temperature = temperature;
        }

        public String toString() {
            return "thermometerId: " + thermometerId + ", timestamp: " + timestamp + ", temperature: " + temperature;
        }
    }
}

```

Program pobiera dane z topik Temperatura, filtruję rekordy z temperaturami poniżej zera i wysyła alarmy na topik Alarm.

Dodatkowo został napisany prosty skrypt w pythonie służący do monitorowania alarmów:

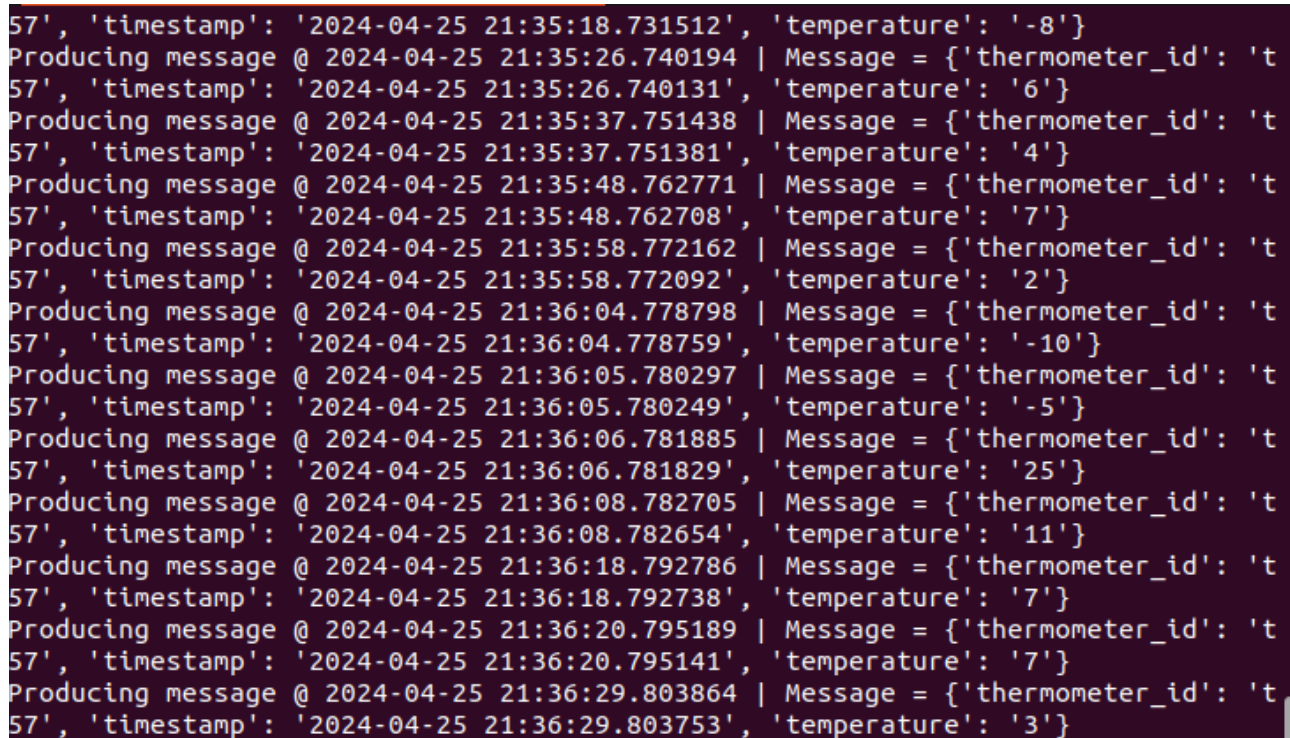
```
from kafka import KafkaConsumer

import json

if __name__ == "__main__":
    consumer = KafkaConsumer(
        "Alarm", bootstrap_servers="localhost:9092", auto_offset_reset="earliest"
    )
    for message in consumer:
        print(message.value.decode("utf-8"))
```

## Zrzuty ekranu demonstrujące działanie programu:

Fragment wygenerowanych danych:



```
57', 'timestamp': '2024-04-25 21:35:18.731512', 'temperature': '-8'}
Producing message @ 2024-04-25 21:35:26.740194 | Message = {'thermometer_id': 't
57', 'timestamp': '2024-04-25 21:35:26.740131', 'temperature': '6'}
Producing message @ 2024-04-25 21:35:37.751438 | Message = {'thermometer_id': 't
57', 'timestamp': '2024-04-25 21:35:37.751381', 'temperature': '4'}
Producing message @ 2024-04-25 21:35:48.762771 | Message = {'thermometer_id': 't
57', 'timestamp': '2024-04-25 21:35:48.762708', 'temperature': '7'}
Producing message @ 2024-04-25 21:35:58.772162 | Message = {'thermometer_id': 't
57', 'timestamp': '2024-04-25 21:35:58.772092', 'temperature': '2'}
Producing message @ 2024-04-25 21:36:04.778798 | Message = {'thermometer_id': 't
57', 'timestamp': '2024-04-25 21:36:04.778759', 'temperature': '-10'}
Producing message @ 2024-04-25 21:36:05.780297 | Message = {'thermometer_id': 't
57', 'timestamp': '2024-04-25 21:36:05.780249', 'temperature': '-5'}
Producing message @ 2024-04-25 21:36:06.781885 | Message = {'thermometer_id': 't
57', 'timestamp': '2024-04-25 21:36:06.781829', 'temperature': '25'}
Producing message @ 2024-04-25 21:36:08.782705 | Message = {'thermometer_id': 't
57', 'timestamp': '2024-04-25 21:36:08.782654', 'temperature': '11'}
Producing message @ 2024-04-25 21:36:18.792786 | Message = {'thermometer_id': 't
57', 'timestamp': '2024-04-25 21:36:18.792738', 'temperature': '7'}
Producing message @ 2024-04-25 21:36:20.795189 | Message = {'thermometer_id': 't
57', 'timestamp': '2024-04-25 21:36:20.795141', 'temperature': '7'}
Producing message @ 2024-04-25 21:36:29.803864 | Message = {'thermometer_id': 't
57', 'timestamp': '2024-04-25 21:36:29.803753', 'temperature': '3'}
```

Alarmy:

```
Alarm! Temperature: -3.0, timestamp: 2024-04-25 21:28:38.374949
Alarm! Temperature: -5.0, timestamp: 2024-04-25 21:29:15.406745
Alarm! Temperature: -9.0, timestamp: 2024-04-25 21:30:10.458239
Alarm! Temperature: -4.0, timestamp: 2024-04-25 21:31:12.510791
Alarm! Temperature: -7.0, timestamp: 2024-04-25 21:31:16.515685
Alarm! Temperature: -3.0, timestamp: 2024-04-25 21:31:39.534977
Alarm! Temperature: -2.0, timestamp: 2024-04-25 21:31:41.539132
Alarm! Temperature: -4.0, timestamp: 2024-04-25 21:31:52.547356
Alarm! Temperature: -7.0, timestamp: 2024-04-25 21:32:28.582744
Alarm! Temperature: -9.0, timestamp: 2024-04-25 21:32:42.597546
Alarm! Temperature: -10.0, timestamp: 2024-04-25 21:32:49.604458
Alarm! Temperature: -1.0, timestamp: 2024-04-25 21:33:08.619482
Alarm! Temperature: -2.0, timestamp: 2024-04-25 21:33:35.644428
Alarm! Temperature: -3.0, timestamp: 2024-04-25 21:33:41.649429
Alarm! Temperature: -9.0, timestamp: 2024-04-25 21:33:48.655802
Alarm! Temperature: -5.0, timestamp: 2024-04-25 21:33:56.664855
Alarm! Temperature: -8.0, timestamp: 2024-04-25 21:34:23.684994
Alarm! Temperature: -6.0, timestamp: 2024-04-25 21:34:35.696646
Alarm! Temperature: -5.0, timestamp: 2024-04-25 21:35:09.724713
Alarm! Temperature: -8.0, timestamp: 2024-04-25 21:35:18.731512
Alarm! Temperature: -10.0, timestamp: 2024-04-25 21:36:04.778759
Alarm! Temperature: -5.0, timestamp: 2024-04-25 21:36:05.780249
Alarm! Temperature: -1.0, timestamp: 2024-04-25 21:37:29.867155
S
```

Podgląd w interfejsie www Flink. Widoczne tylko dane z temperaturami poniżej zera:

|      | Metrics  | Logs               | Stdout | Log List | Thread Dump | Profiler |
|------|--|--------------------|--------|----------|-------------|----------|
| 1012 | thermometerId: t57, timestamp: 2024-04-25 21:25:14.150050, | temperature: -7.0  |        |          |             |          |
| 1013 | thermometerId: t57, timestamp: 2024-04-25 21:25:19.162963, | temperature: -5.0  |        |          |             |          |
| 1014 | thermometerId: t57, timestamp: 2024-04-25 21:25:43.186792, | temperature: -3.0  |        |          |             |          |
| 1015 | thermometerId: t57, timestamp: 2024-04-25 21:26:32.229136, | temperature: -5.0  |        |          |             |          |
| 1016 | thermometerId: t57, timestamp: 2024-04-25 21:26:33.231127, | temperature: -2.0  |        |          |             |          |
| 1017 | thermometerId: t57, timestamp: 2024-04-25 21:27:02.267392, | temperature: -1.0  |        |          |             |          |
| 1018 | thermometerId: t57, timestamp: 2024-04-25 21:27:12.280041, | temperature: -2.0  |        |          |             |          |
| 1019 | thermometerId: t57, timestamp: 2024-04-25 21:27:31.306855, | temperature: -4.0  |        |          |             |          |
| 1020 | thermometerId: t57, timestamp: 2024-04-25 21:28:03.338700, | temperature: -9.0  |        |          |             |          |
| 1021 | thermometerId: t57, timestamp: 2024-04-25 21:28:38.374949, | temperature: -3.0  |        |          |             |          |
| 1022 | thermometerId: t57, timestamp: 2024-04-25 21:29:15.406745, | temperature: -5.0  |        |          |             |          |
| 1023 | thermometerId: t57, timestamp: 2024-04-25 21:30:10.458239, | temperature: -9.0  |        |          |             |          |
| 1024 | thermometerId: t57, timestamp: 2024-04-25 21:31:12.510791, | temperature: -4.0  |        |          |             |          |
| 1025 | thermometerId: t57, timestamp: 2024-04-25 21:31:16.515685, | temperature: -7.0  |        |          |             |          |
| 1026 | thermometerId: t57, timestamp: 2024-04-25 21:31:39.534977, | temperature: -3.0  |        |          |             |          |
| 1027 | thermometerId: t57, timestamp: 2024-04-25 21:31:41.539132, | temperature: -2.0  |        |          |             |          |
| 1028 | thermometerId: t57, timestamp: 2024-04-25 21:31:52.547356, | temperature: -4.0  |        |          |             |          |
| 1029 | thermometerId: t57, timestamp: 2024-04-25 21:32:28.582744, | temperature: -7.0  |        |          |             |          |
| 1030 | thermometerId: t57, timestamp: 2024-04-25 21:32:42.597546, | temperature: -9.0  |        |          |             |          |
| 1031 | thermometerId: t57, timestamp: 2024-04-25 21:32:49.604458, | temperature: -10.0 |        |          |             |          |
| 1032 | thermometerId: t57, timestamp: 2024-04-25 21:33:08.619482, | temperature: -1.0  |        |          |             |          |
| 1033 | thermometerId: t57, timestamp: 2024-04-25 21:33:35.644428, | temperature: -2.0  |        |          |             |          |
| 1034 | thermometerId: t57, timestamp: 2024-04-25 21:33:41.649429, | temperature: -3.0  |        |          |             |          |
| 1035 | thermometerId: t57, timestamp: 2024-04-25 21:33:48.655802, | temperature: -9.0  |        |          |             |          |
| 1036 | thermometerId: t57, timestamp: 2024-04-25 21:33:56.664855, | temperature: -5.0  |        |          |             |          |
| 1037 | thermometerId: t57, timestamp: 2024-04-25 21:34:23.684994, | temperature: -8.0  |        |          |             |          |
| 1038 | thermometerId: t57, timestamp: 2024-04-25 21:34:35.696646, | temperature: -6.0  |        |          |             |          |
| 1039 | thermometerId: t57, timestamp: 2024-04-25 21:35:09.724713, | temperature: -5.0  |        |          |             |          |
| 1040 | thermometerId: t57, timestamp: 2024-04-25 21:35:18.731512, | temperature: -8.0  |        |          |             |          |
| 1041 | thermometerId: t57, timestamp: 2024-04-25 21:36:04.778759, | temperature: -10.0 |        |          |             |          |
| 1042 | thermometerId: t57, timestamp: 2024-04-25 21:36:05.780249, | temperature: -5.0  |        |          |             |          |
| 1043 | thermometerId: t57, timestamp: 2024-04-25 21:37:29.867155, | temperature: -1.0  |        |          |             |          |
| 1044 |  |                    |        |          |             |          |