Structured Streaming- ADVANCED Session 3

Segment - 01

Session Introduction

SESSION OVERVIEW

01	Windows
02	Coding Lab
03	Late arriving data and Watermarks

Segment - 02

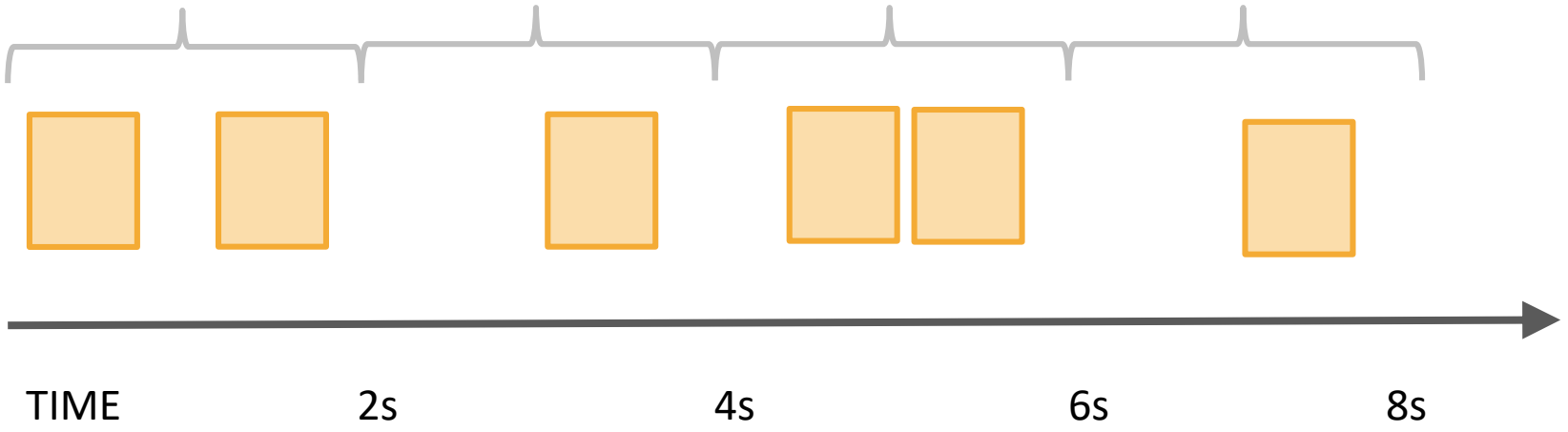
Windows

EVENT TIME

- Time when the record was generated at the source
- Generally, a column in the source dataset
- Different from processing time
  - Processing time is when the record arrives at the Spark processing layer
  - WHY?
  - Publishing failures, distributed system lags, network delays etc.

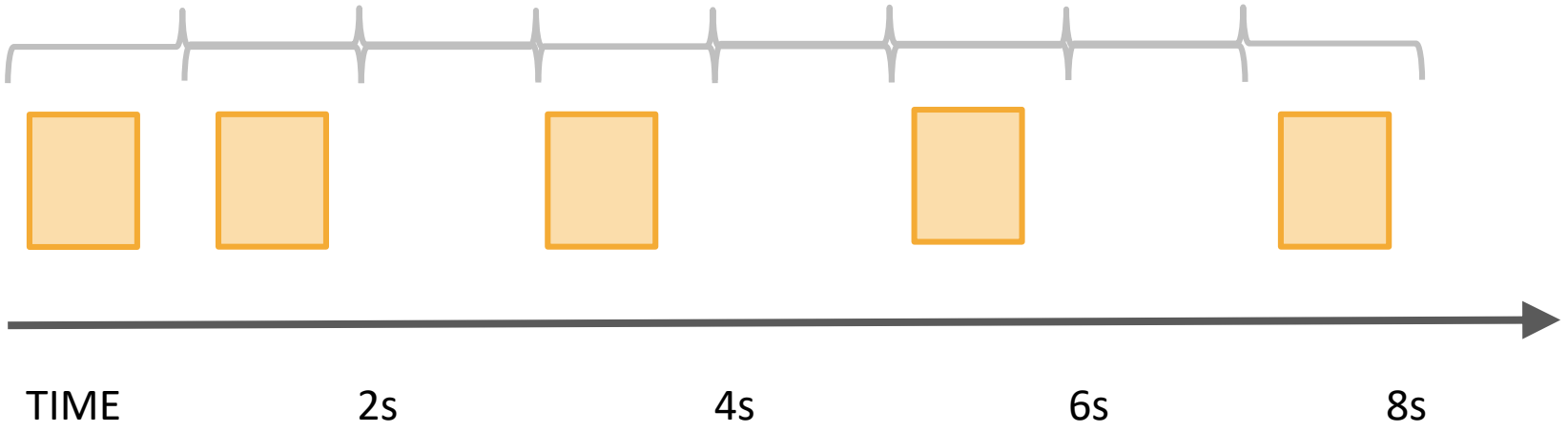
WINDOWS

- Similar to the Window concept of SQL Window concept
- Example:
  - A 2-second window



WINDOWS

- Tumbling Window
  - No two Windows overlap
  - Sliding duration = Window duration
- Sliding Window
  - Sliding duration = 1s, Window duration = 2s



Window Functions

- Values computed over a Window
  - Example 1: Record count, Complete mode
    Batch time = 5 mins, Window duration = 10 mins, Sliding interval = 5 mins

Window	Count
9:55 – 10:05	2
10:00 – 10:10	2

Window	Count
9:55 – 10:05	2
10:00 – 10:10	3
10:05 – 10:15	1

Window	Count
9:55 – 10:05	2
10:00 – 10:10	4
10:05 – 10:15	2

Window	Count
9:55 – 10:05	2
10:00 – 10:10	5
10:05 – 10:15	4
10:10 – 10:20	1

Window Functions

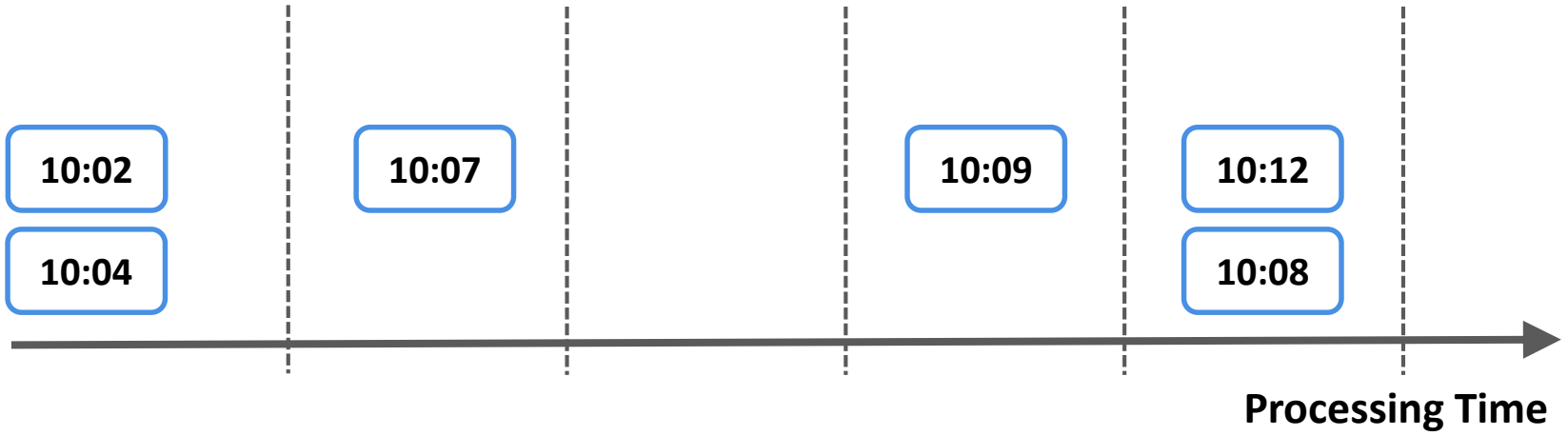
- Example 1: Record count, Append mode
  Batch time = 5 mins, Window duration = 10 mins, Sliding interval = 5 mins

Window	Count
9:55 – 10:05	2
10:00 – 10:10	2

Window	Count
10:00 – 10:10	1
10:05 – 10:15	1

Window	Count
10:00 – 10:10	1
10:05 – 10:15	1

Window	Count
10:00 – 10:10	1
10:05 – 10:15	2
10:10 – 10:20	1



Window Functions

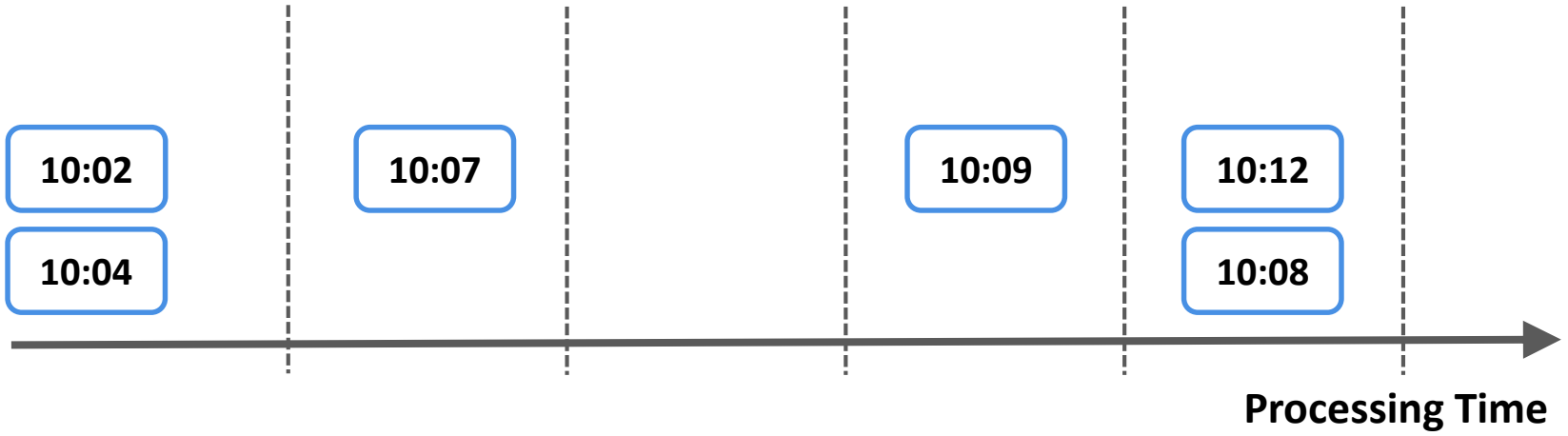
- Example 1: Record count, Update mode
  Batch time = 5 mins, Window duration = 10 mins, Sliding interval = 5 mins

Window	Count
9:55 – 10:05	2
10:00 – 10:10	2

Window	Count
10:00 – 10:10	3
10:05 – 10:15	1

Window	Count
10:00 – 10:10	4
10:05 – 10:15	2

Window	Count
10:00 – 10:10	5
10:05 – 10:15	4
10:10 – 10:20	1



Segment - 03
Coding Lab

Segment - 04

Handling Late Arriving Data

LATE ARRIVING DATA

- Delay between Event Time and Processing Time
- Example: Marketing Campaign Performance Analytics
  - AdView event + AdClick event within 60 seconds is a good impression, else a bad impression. What happens when AdClick event gets delayed? Is it a good impression or bad impression?
- Stream processing systems need a way to handle such data
- Why not have all late arriving data handled forever?
  - Streams are unbounded

LATE ARRIVING DATA

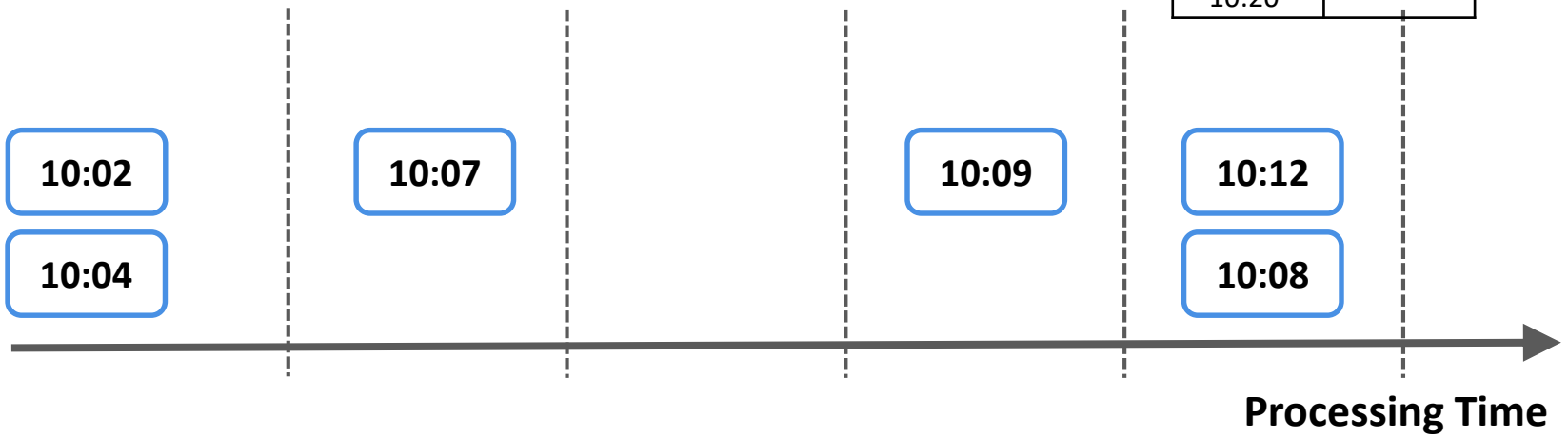
- Example 1: Record count, Complete mode
  Batch time = 5 mins, Window duration = 10 mins, Sliding interval = 5 mins

Window	Count
9:55 – 10:05	2
10:00 – 10:10	2

Window	Count
9:55 – 10:05	2
10:00 – 10:10	3
10:05 – 10:15	1

Window	Count
9:55 – 10:05	2
10:00 – 10:10	4
10:05 – 10:15	2

Window	Count
9:55 – 10:05	2
10:00 – 10:10	5
10:05 – 10:15	4
10:10 – 10:20	1



WATERMARKS

- It defines the time period after which Spark will start dropping records of the stream
- It manages late arriving data in a scalable way
- With every incoming batch, Spark checks the max event time it has already received and applies the watermark on that event time

WATERMARKS

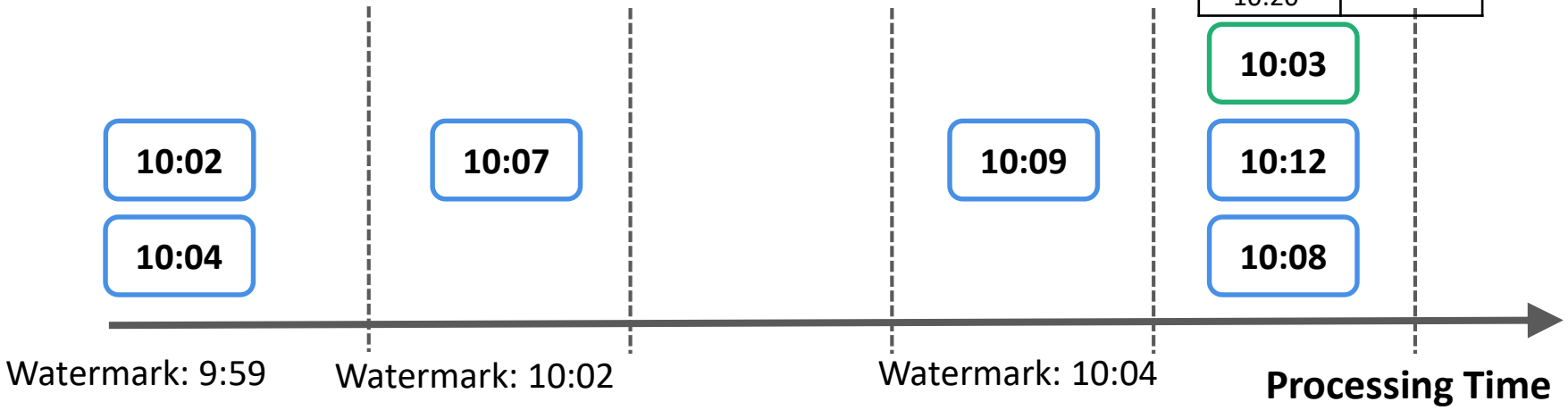
- Example 1: Record count, Complete mode
  Batch time = 5 mins, Window duration = 10 mins, Sliding interval = 5 mins
- Watermark = 5 mins

Window	Count
9:55 – 10:05	2
10:00 – 10:10	2

Window	Count
9:55 – 10:05	2
10:00 – 10:10	3
10:05 – 10:15	1

Window	Count
9:55 – 10:05	2
10:00 – 10:10	4
10:05 – 10:15	2

Window	Count
9:55 – 10:05	2
10:00 – 10:10	5
10:05 – 10:15	4
10:10 – 10:20	1



WATERMARKS

- Example 2: Marketing Campaign Analytics
  - Watermark: 10 mins
  - Processing system can now handle up to 10 mins of delay in the arrival of events
  - Enough time for Failovers, network lag etc.
  - Actual watermark will depend on the available memory and incoming traffic per minute

Segment - 05

Summary

SUMMARY

- Windows
- Event time vs. Processing time
- Window functions on Streams
  - Different output modes = Different behavior
- Late arriving data
- Watermarks
- Handling late arriving data