Datalake File Format: Parquet

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This document:
https://github.com/Arnaud-Nauwynck/presentations/pres-bigdata/Datalake-File-Format-Parquet

Outline

- Parquet Caracteristics
  - Structured, with Schema
  - Data – Metadata (footer)
  - Columnar ... Column Pruning
  - Splittable ... spark Dataset Partitions
  - Compression
  - Encoding
  - Statistics, Bloom ... spark Predicate-Push-Down
  - Optimize write once, read many
    ... spark dataset.repartition().sortWithinPartition().write

Parquet is a Structured Format
Strongly Typed (Schema)

File Formats

Unstructured

Text

```
text line 1 \n
text line 2 \n
```

Csv

```
Col1;Col2;Col3\n
a1;b1;c1\n
a2;b2;c2\n
```

Semi-Structured

Json

```
{"a":"a1","b":"b1"} \n
{"a":"a2","b":"b2"} \n
```

Xml

```
<elt>
  <a>a1</a>
  <b>b1</b>
```

Structured

Serialization Structured

Avro,Thrift,Protobuf

```
schema:XX,
value:0101010101
```

Columnar Structured

Orc, Parquet

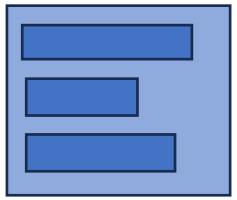
Structured : struct<>, array<>, map<>

Scalar Value
(= terminal element in grammar)
= primitive data-type

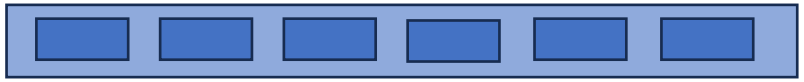
String
boolean
int
double
Date
…

Composite Value

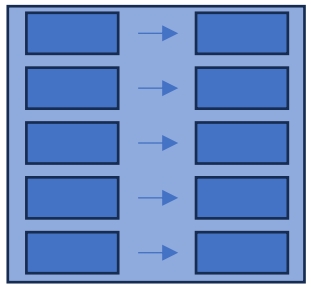
struct<a:Type1, b:Type2, ...>



array<ElementType>



map<KeyType,ValueType>



Type constraint = Schema

semi-structured
schema is optional

{ JSON } → JSON Schema (optional)

<xml> → XSD Schema (optional)

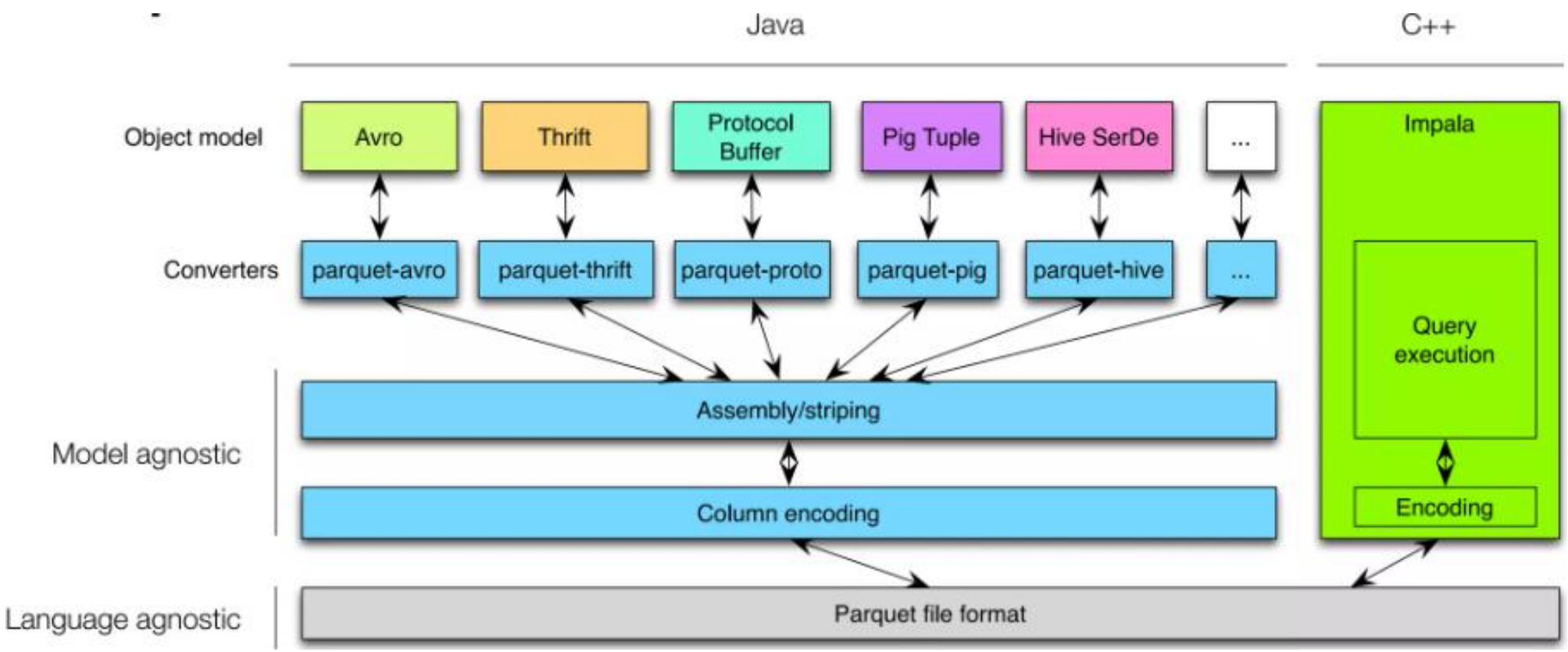
structured
schema is strict

.avro → .avsc = avro schema
included in avro datafile format header
implicit in avro client-server exchanges

thrift
protobuf

.parquet → included in parquet file footer (= metadata)

Parquet SDK / Converter / ObjectModel

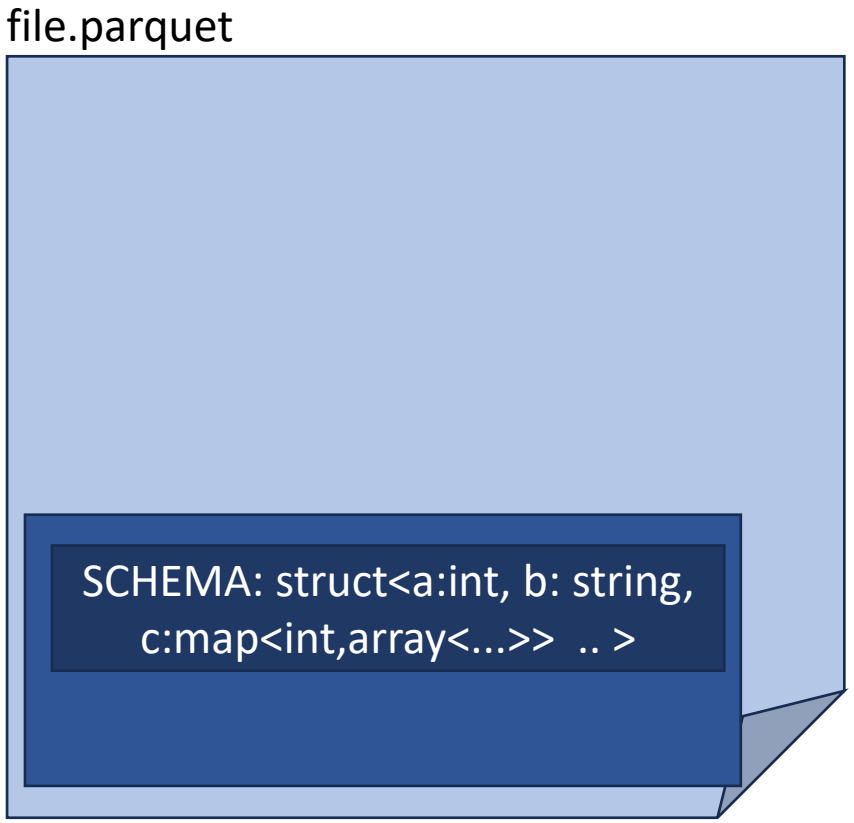


Parquet separates Data and MetaData

Parquet Schema : in metadata footer

data part
(usually N x blocks of 128 Mo)

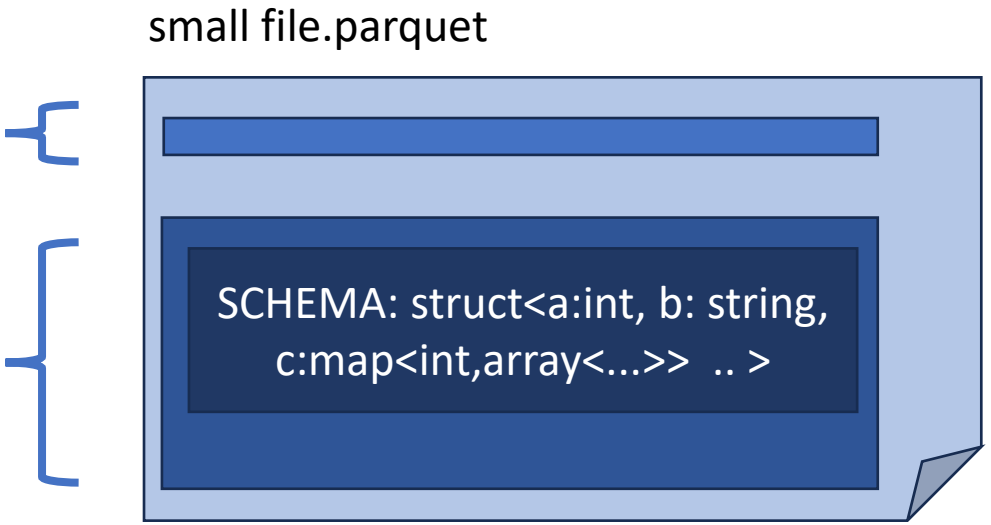
footer: metadata part
(usually <= 50 ko)



Parquet for Small Files ?

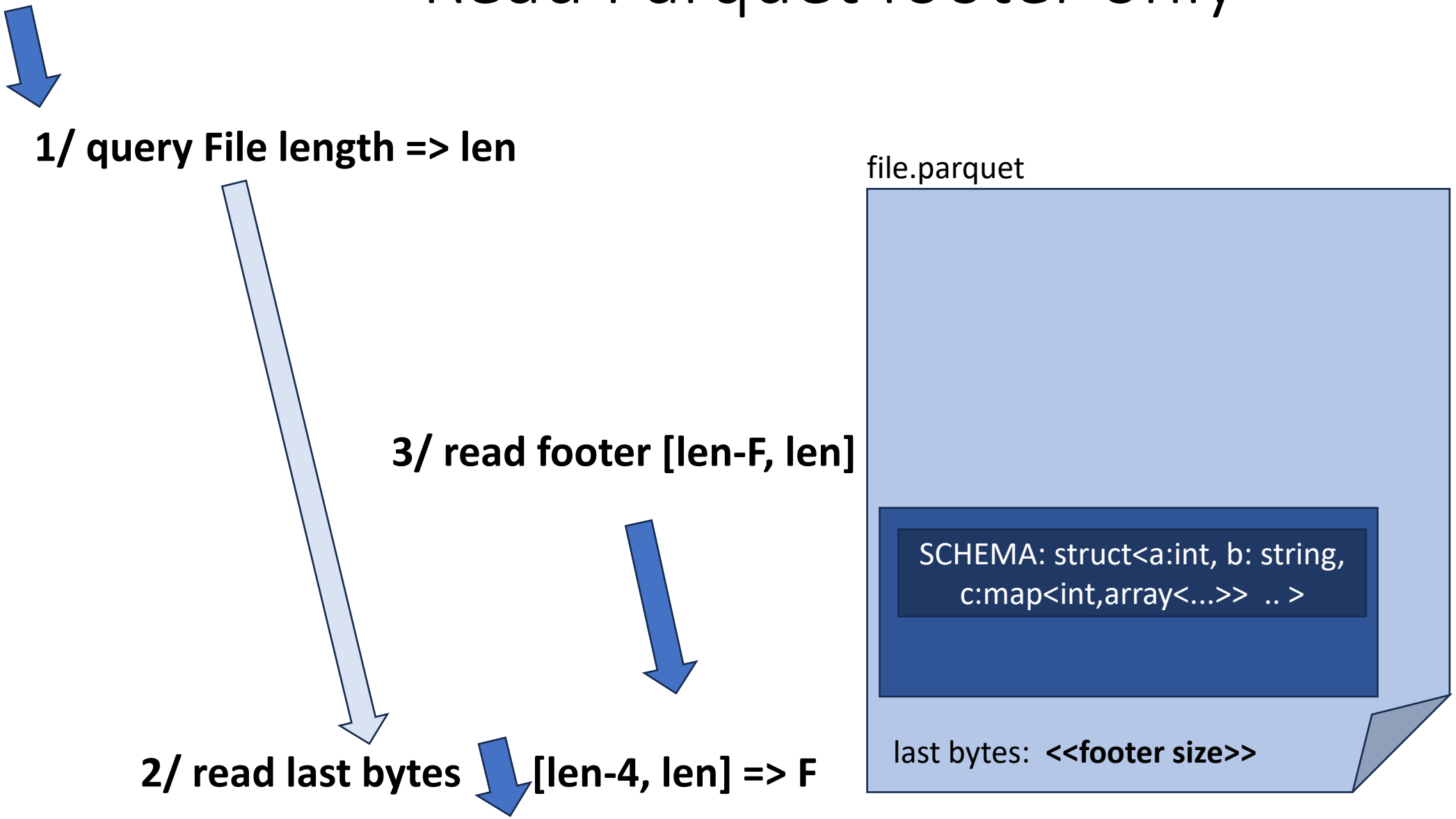
data part can be small
(even empty)

parquet files
ALWAYS have an
uncompressable footer,
containing SCHEMA



Parquet for small data is NOT efficient
bad ratio of "data / metadata" size

Read Parquet footer only



Why Footer instead of Header?

For reader : not a big overhead, ONLY 3 calls to read

For writer : MUCH more practical to "stream" write Nx rows,
keep in-memory only few metadata,
to flush write at end

Parquet is Columnar

Parquet : Columnar File Format

Logical view: rows - columns

a1	b1	c1	d1
a2	b2	c2	d2
a3	b3	c3	d3
a4	b4	c4	d4

On Disk Row Serialization: like CSV, JSON, AVRO,

a1	b1	c1	d1	a2	b2	c2	d2	a3	b3	c3	d3	a4	b4	c4	d4

On Disk: **Columnar**

a1	a2	a3	a4	b1	b2	b3	b4	c1	c2	c3	c4	d1	d2	d3	d4

Columnar
=> better memory aligned,
Vectorized CPU pipeline

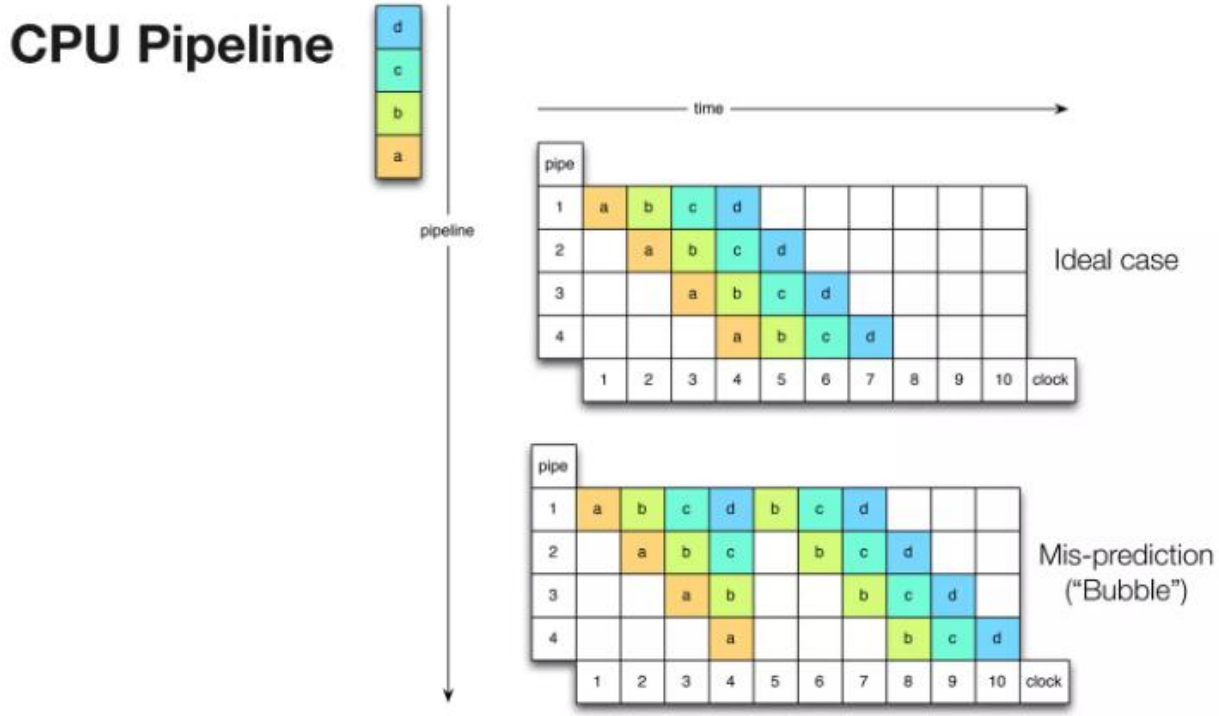
```
struct A {

  boolean f1;   // <= 1 bit (on 1 byte)
                // in-memory padding 3 bytes
  int       f2;  // 4 bytes, aligned on multiple of 4
                //  in-memory padding 4 bytes
  long      f3  // 8 bytes
}
```

array[struct<..>] <=> **array[boolean]**
array[int]
array[long]

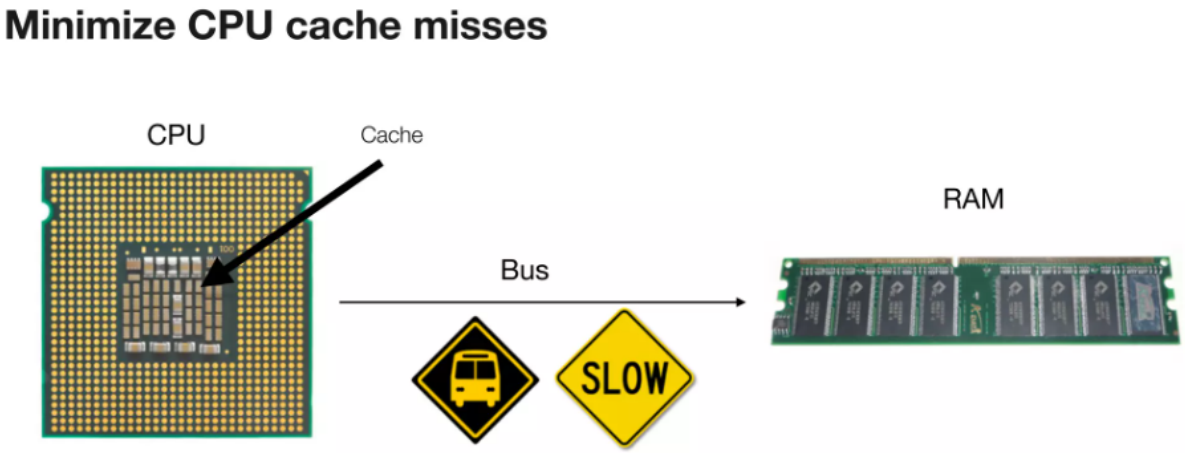
Vectorized Reader **~9x Faster**

Vectorized code ... fewer "If", "Loop", "calls"

Better CPU Pipeline



Better Memory Cache



a cache miss costs 10 to 100s cycles depending on the level

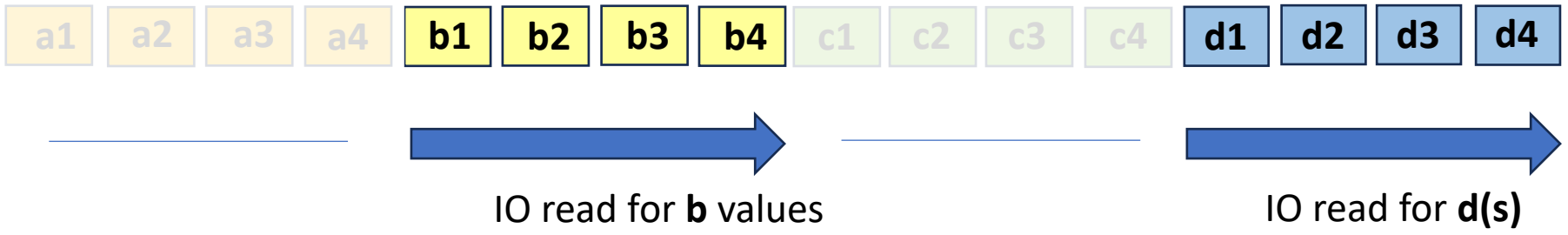
Column Pruning Optimization

SELECT b, d -- ONLY 2 columns
FROM table
WHERE ..

Logical view: rows - columns

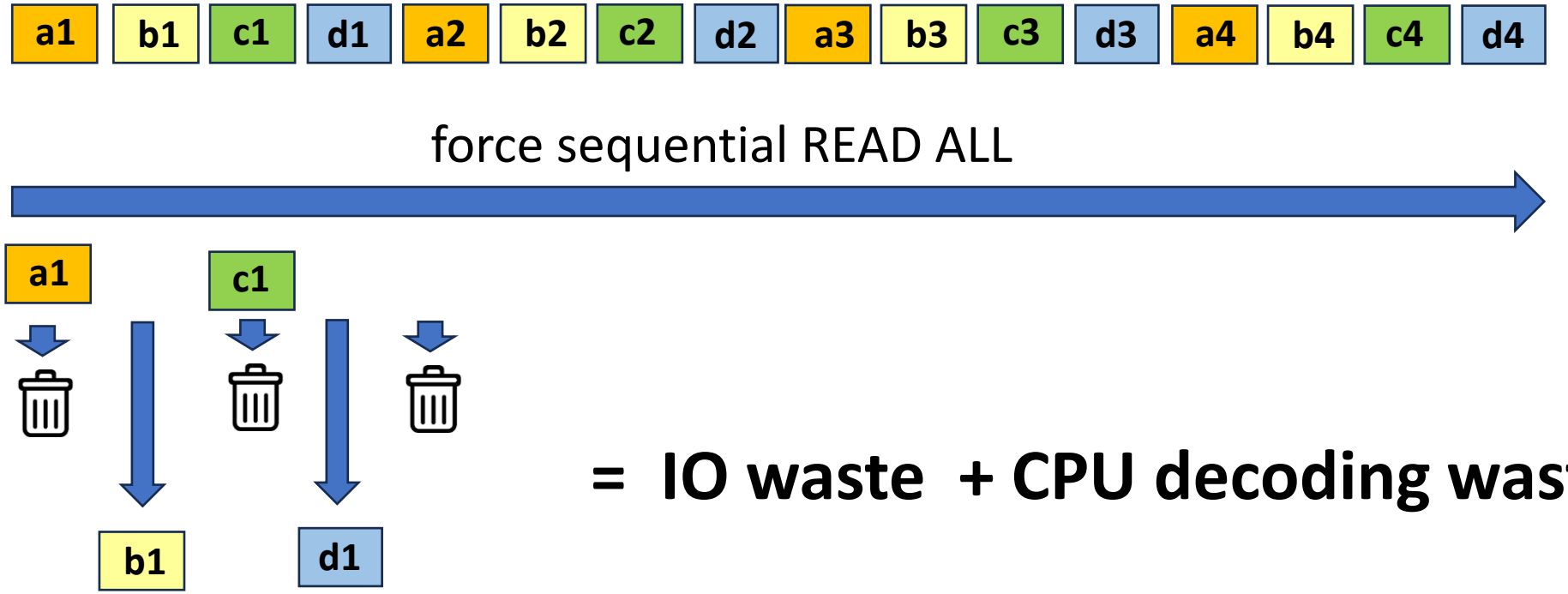
a1	b1	c1	d1
a2	b2	c2	d2
a3	b3	c3	d3
a4	b4	c4	d4

On Disk READ: columnar



Compare IO Reads with JSON, CSV, Avro, ..

SELECT b, d -- ONLY 2 columns
FROM table
WHERE ..

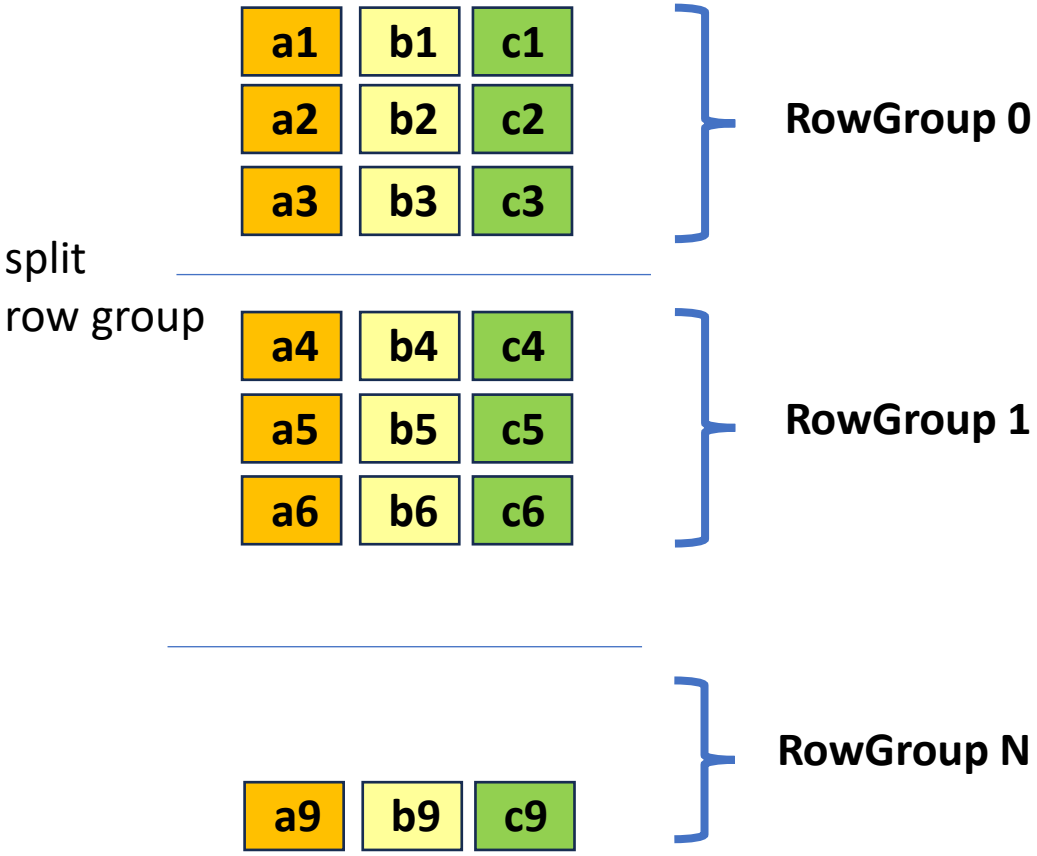


= IO waste + CPU decoding waste

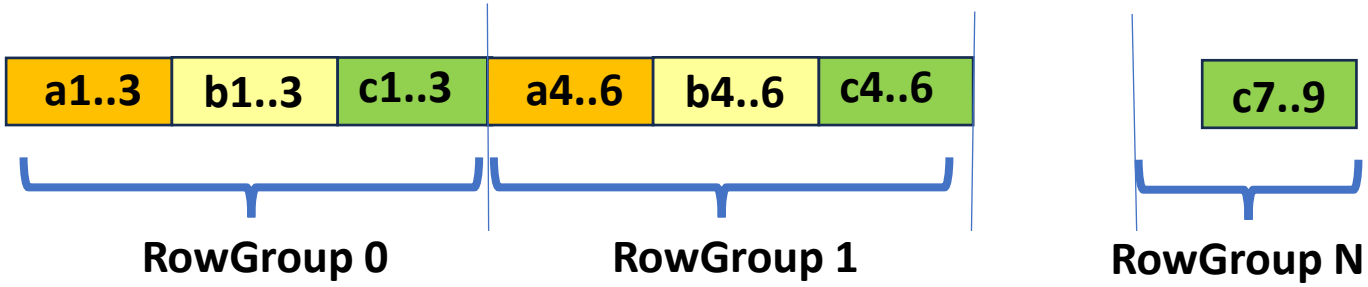
Parquet is Splitteable

Parquet split rows by RowGroups

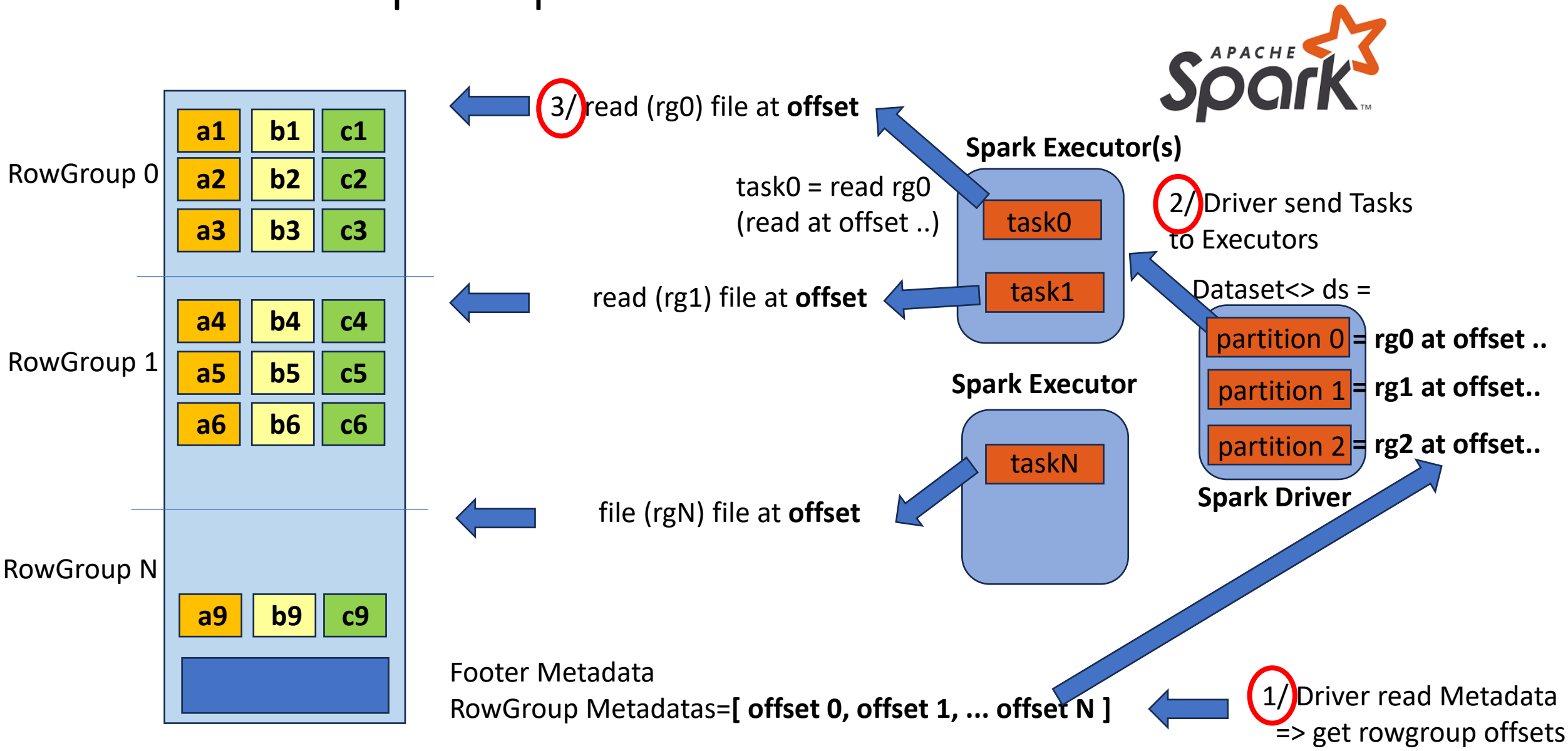
Logical view: rows - columns



On Disk: **columnar**



RowGroup ~ Spark Partition ~ Executor Thread



1 Parquet RowGroup(s)
-> default to 1 Spark DataSet partition

by default,

parquet.block.size = 128 Mo

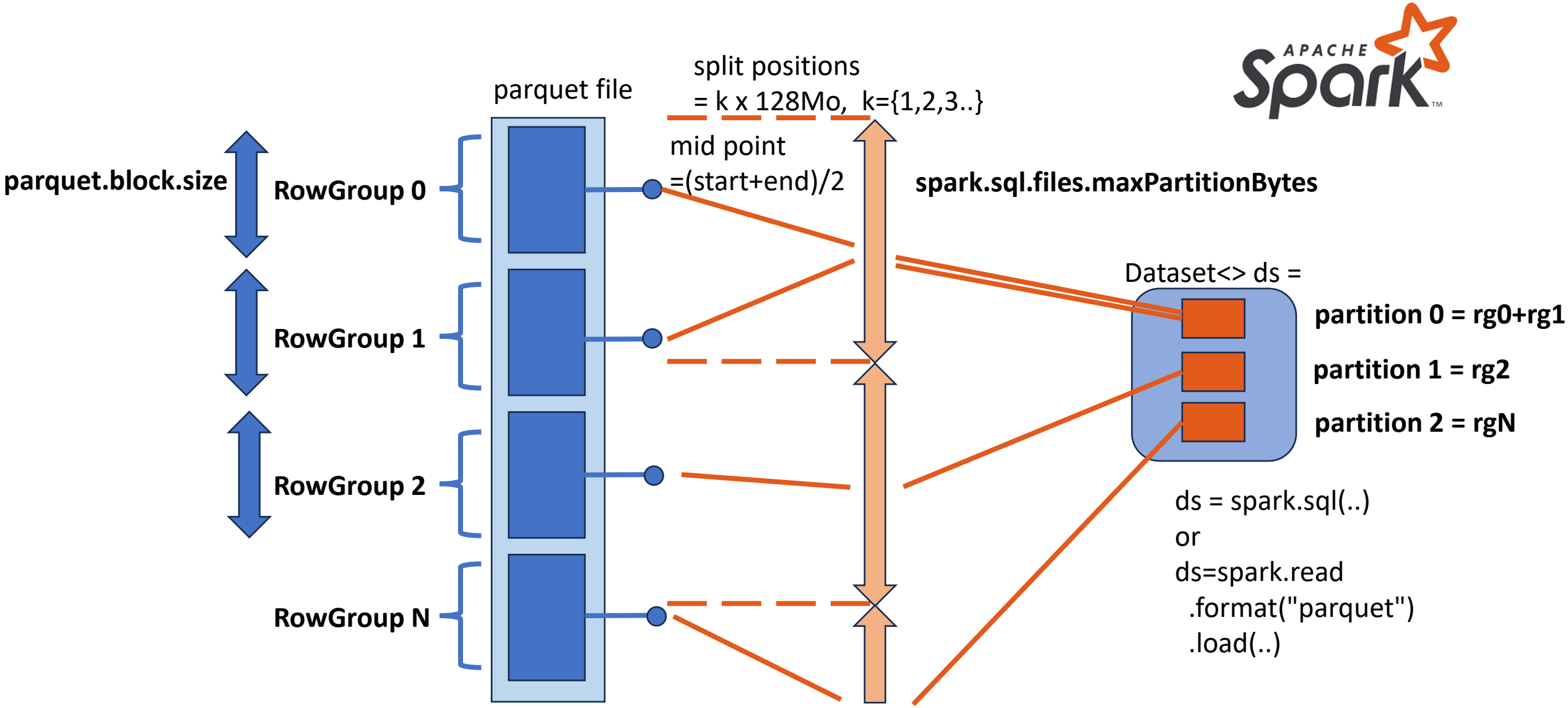
=

spark.files.maxPartitionBytes = 128 Mo

=

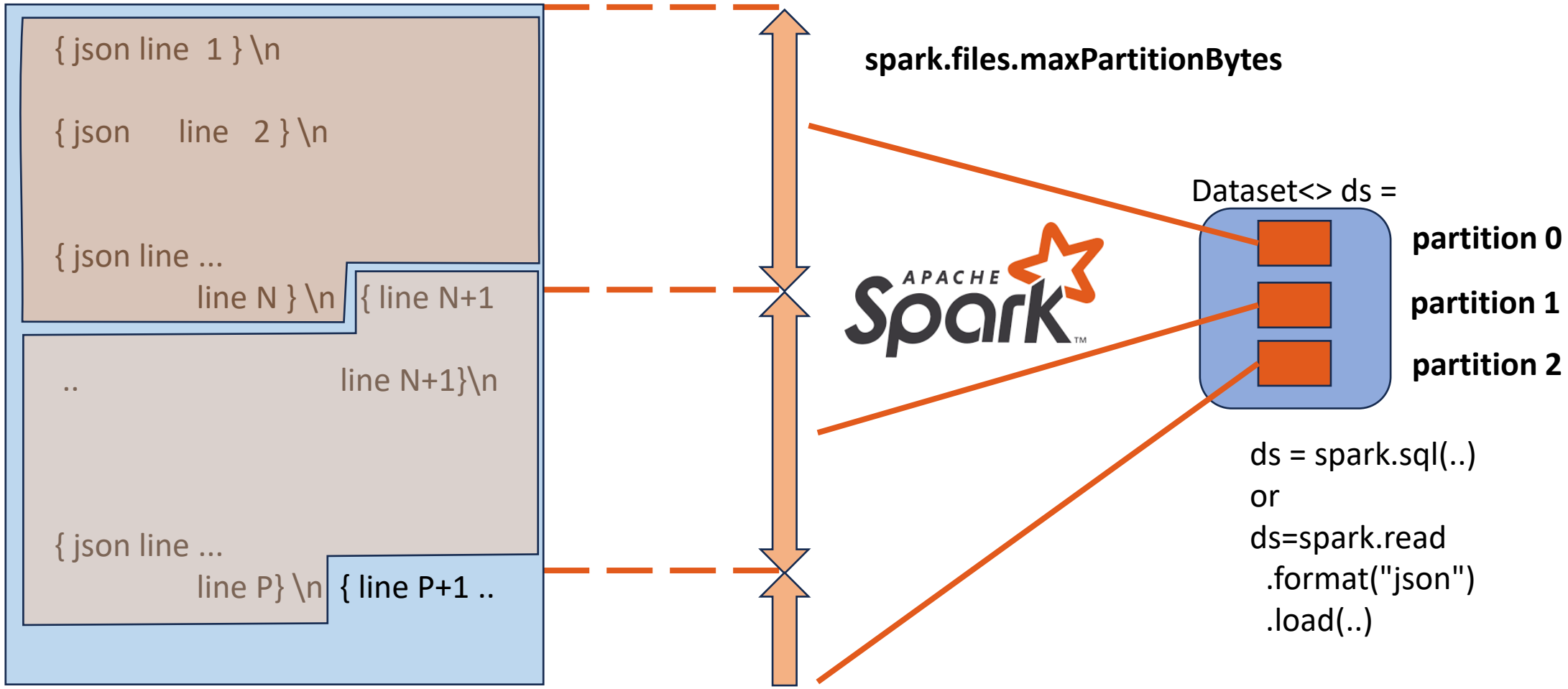
spark.sql.files.maxPartitionBytes = 128 Mo

N Parquet RowGroups
-> FileSplit to P (<=N) Spark Partitions



{Texts,CSV,Json} formats FileSplit

each spark executor reader Thread
  at split start => ignore first chars until '\n'
  at split end => read extra chars until '\n



Example : Reading 1 CSV of 3.2 Go
=> 26 splits = 25 (~128 Mo) + 1 very small

Windows-SSD (C:) › data › OpenData-gouv.fr › bal

Nom	Modifié le	Type	Taille
adresses-france.csv	08/09/2022 13:49	Fichier CSV Microsoft Excel	3 280 937 Ko

3 280 937 / (128*1024) = 25.03

```
scala> val ds = spark.read.format("csv").option("delimiter",";").load("C:/data/OpenData-gouv.fr/bal")
val ds: org.apache.spark.sql.DataFrame = [_c0: string, _c1: string ... 17 more fields]

scala> ds.toJavaRDD.getNumPartitions
val res0: Int = 26
```

Parquet is Compressable { snappy | gz }

*.gz is NOT Splitteable !

Windows-SSD (C:) › data › OpenData-gouv.fr › bal-gz

Nom	Modifié le	Type	Taille
adresses-france.csv.gz	08/09/2022 13:49	Dossier d'archive compressé	659 936 Ko

CSV file was 3.2 Go, now 660 Mo in .gz
but NOT Splitteable => 1 spark partition, reading (CPU intensive) by 1 Thread only !
~8 times slower on a 8 cores PC

```
scala> val csvGzDs = spark.read.format("csv").option("delimiter",";").load("C:/data/OpenData-gouv.fr/bal-gz")
23/11/05 20:17:12 WARN ZlibFactory: Failed to load/initialize native-zlib library
val csvGzDs: org.apache.spark.sql.DataFrame = [_c0: string, _c1: string ... 17 more fields]

scala> csvGzDs.count()
[Stage 2:>                                                          (0 + 1) / 1]
```

Compressions Algorithm

data

0101010101001

.snappy

010101

fast compression/decompression
(focus on speed)

.gz (gzip)

01101

slower-compression,
better compression ratio
(focus on size)

.lz4

010101

compromise between
fast / compression ratio

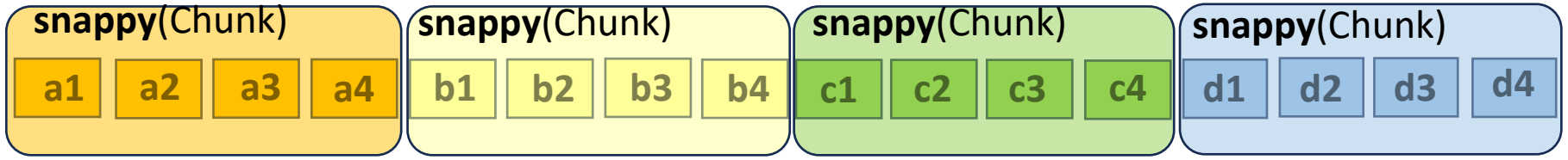
PARQUET.{snappy | gz}

Logical view: rows - columns

a1	b1	c1	d1
a2	b2	c2	d2
a3	b3	c3	d3
a4	b4	c4	d4

On Disk: **Columnar NO compression**

On Disk: **Columnar parquet.{snappy | gz }**



every "Chunk" of column data are compressed INDEPENDENTLY
=> file is STILL Splitteable

Parquet use Encodings

Run-length encoding (RLE)

a
a
a

repeated **x3** times

bb
bb
bb
bb
bb
bb

repeated **x6** times

c
c
c
c

repeated **x4** times

Var Length Encoder:

3 a
6 bb
4 c

Size of Adding "Constant" Column

adding a column with only "0" for Billions of rows

=> take only ~100 bytes per RowGroup

Dictionary Encoding

Manchester City,
Arsenal,
Manchester City,
FC Barcelone,
Arsenal,
Newcastle,
Manchester United,
Newcastle,
FC Barcelone,
Arsenal,
Manchester United,
…

Dictionary Encoder:

Distinct Dictionary Values:

1=Manchester City
2=Arsenal
3=FC Barcelone
4=Newcastle
5..

Value Indexes:

1, 2, 1, 3, 4, 5 ..

Dictionary Size Limit

By default, Dictionary size = max 1 Mega (per RowGroup - Column Chunk)

When using

Huge RowGroup (> 128Mo) => less Dictionaries used

Small RowGroup (32M, 64Mo) => more Dictionaries

Parameters:

parquet.enable.dictionary=true (default)

parquet.dictionary.page.size=1M

Delta Encoding

BaseValue=10007

MinDelta=-7

	Delta		**Delta-MinDelta (>=0)**
10007			
10003	-4	+7	3
10005	+2		9
10002	-3		4
10009	+7		14
10002	-7	+7	0
10008	+6		13
	..		..

example size when fitting "int"(4 bytes)
7 x 4 = 28 bytes

when fitting 2 bytes
4 + 6 x 2 = 28 bytes

when fitting 1 bytes
4 + 2 + 6 x 1 = 12 bytes

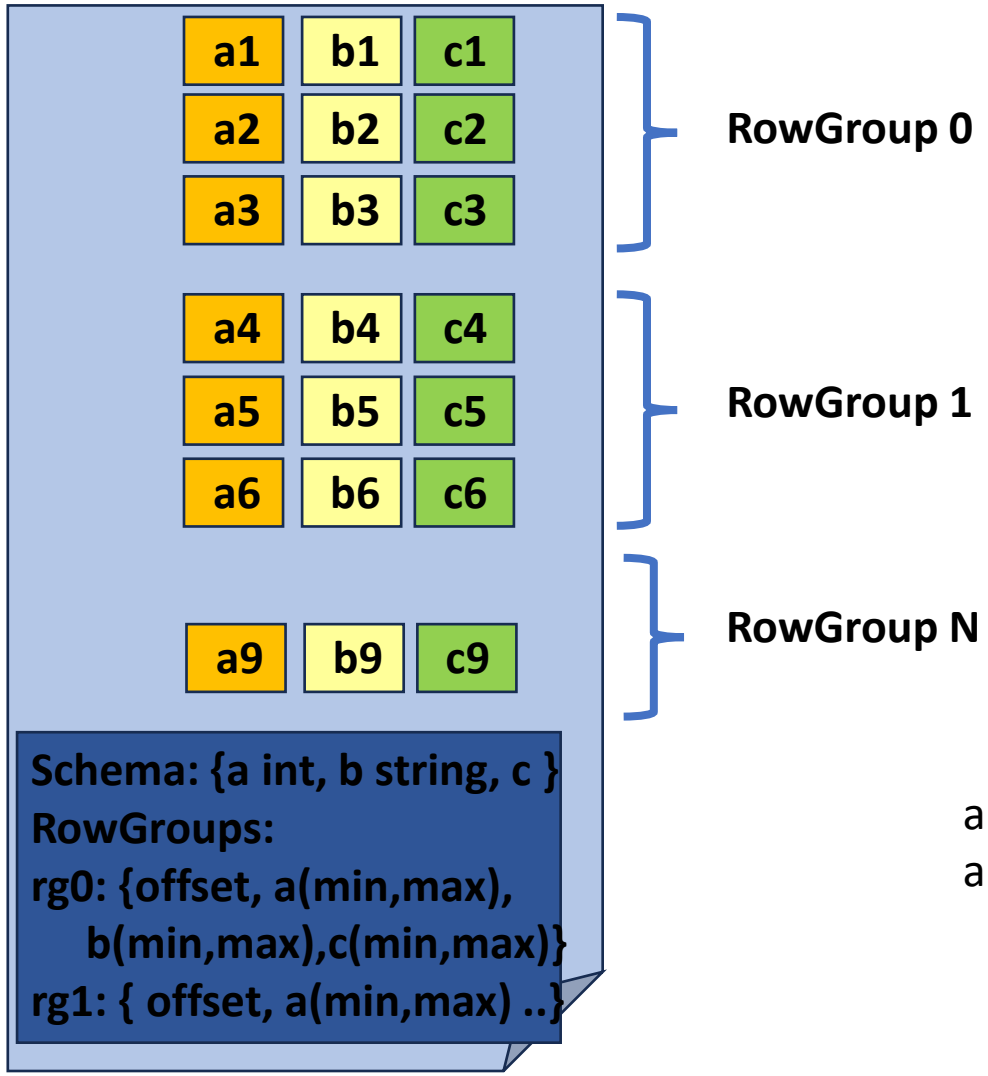
Delta Encoding

10007, -7, 3,9,4,14,0,13

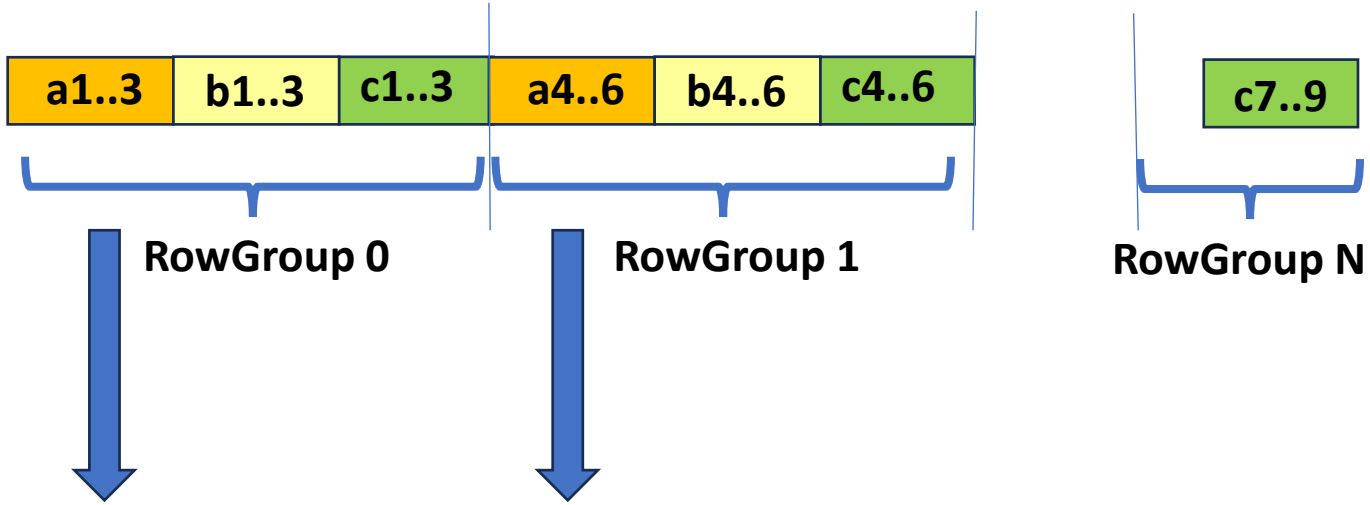
Parquet use Statistics

Column Statistics: min/max Value per RowGroup

Logical view: rows - columns



On Disk: **columnar**



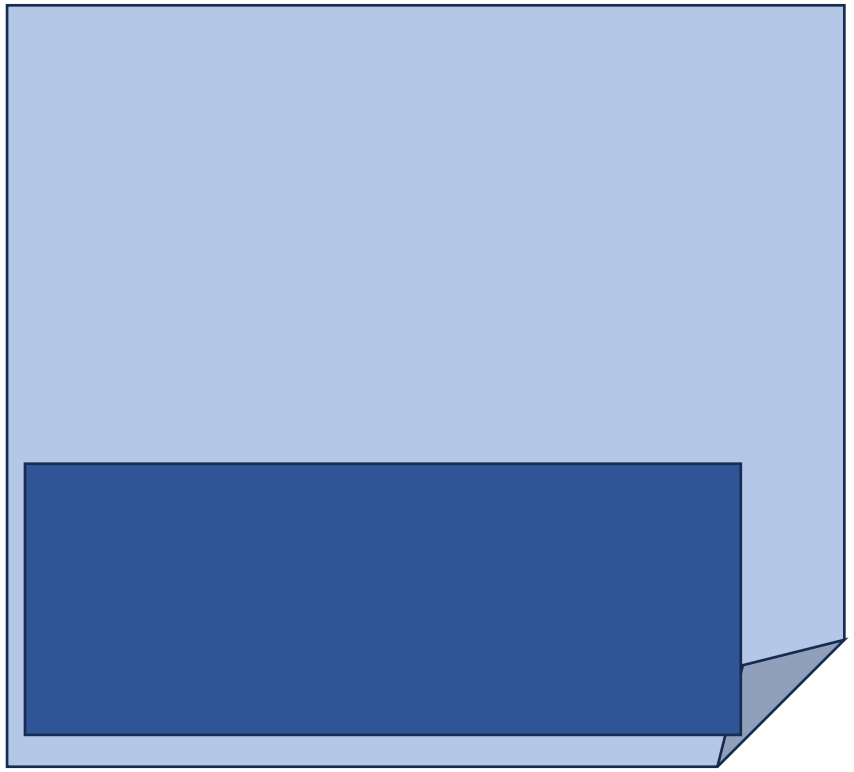
a min = min (a1,a2,..a3)
a max = max(a1,a2,..a3)

a min = min (a4,a5,..a6)
a max = max(a4,a5,..a6)

Reading Metadata
=> read schema + offset + statistics

data part
(usually N x blocks of 128 Mo)

footer: metadata part
(usually <= 50 ko)

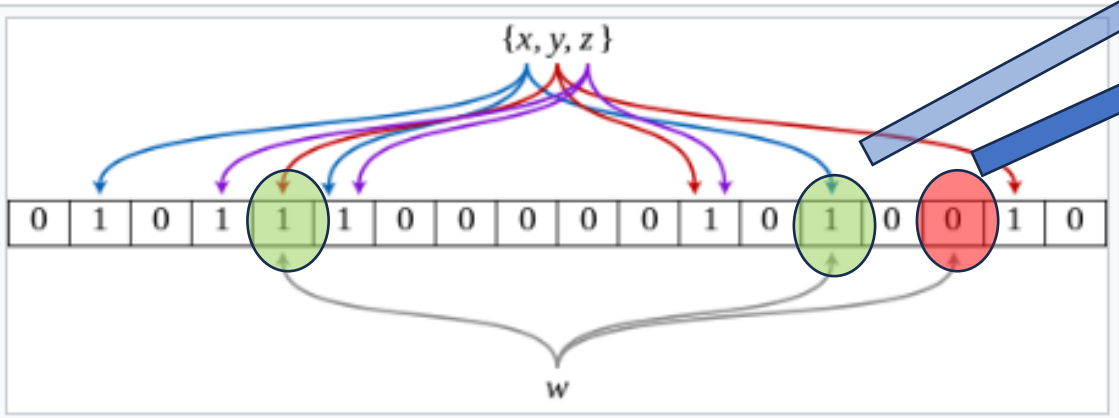


Parquet use Bloom Filter

Bloom Filter

is W in the set {x,y,z} ?

hash(W) = 0000100...10100



An example of a Bloom filter, representing the set $\{x, y, z\}$. The colored arrows show the positions in the bit array that each set element is mapped to. The element w is not in the set $\{x, y, z\}$, because it hashes to one bit-array position containing 0. For this figure, $m = 18$ and $k = 3$.

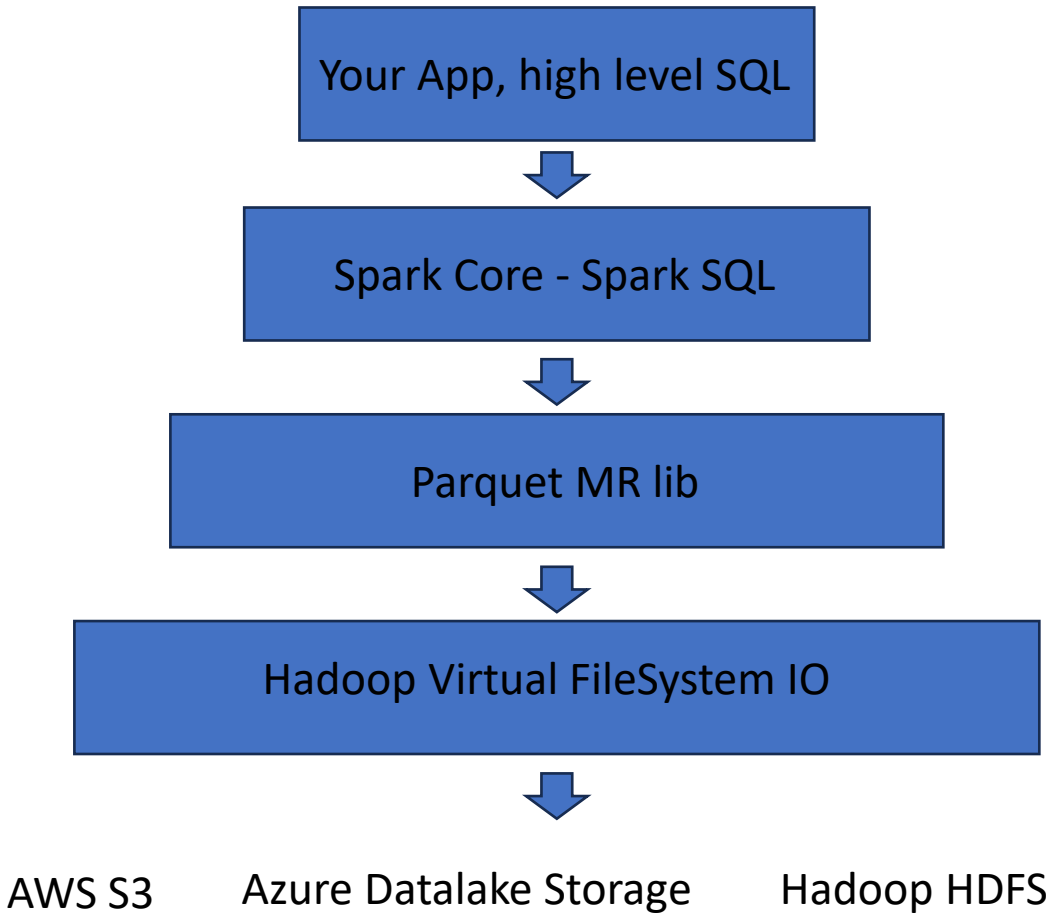
Probably Yes ...

Firm NO

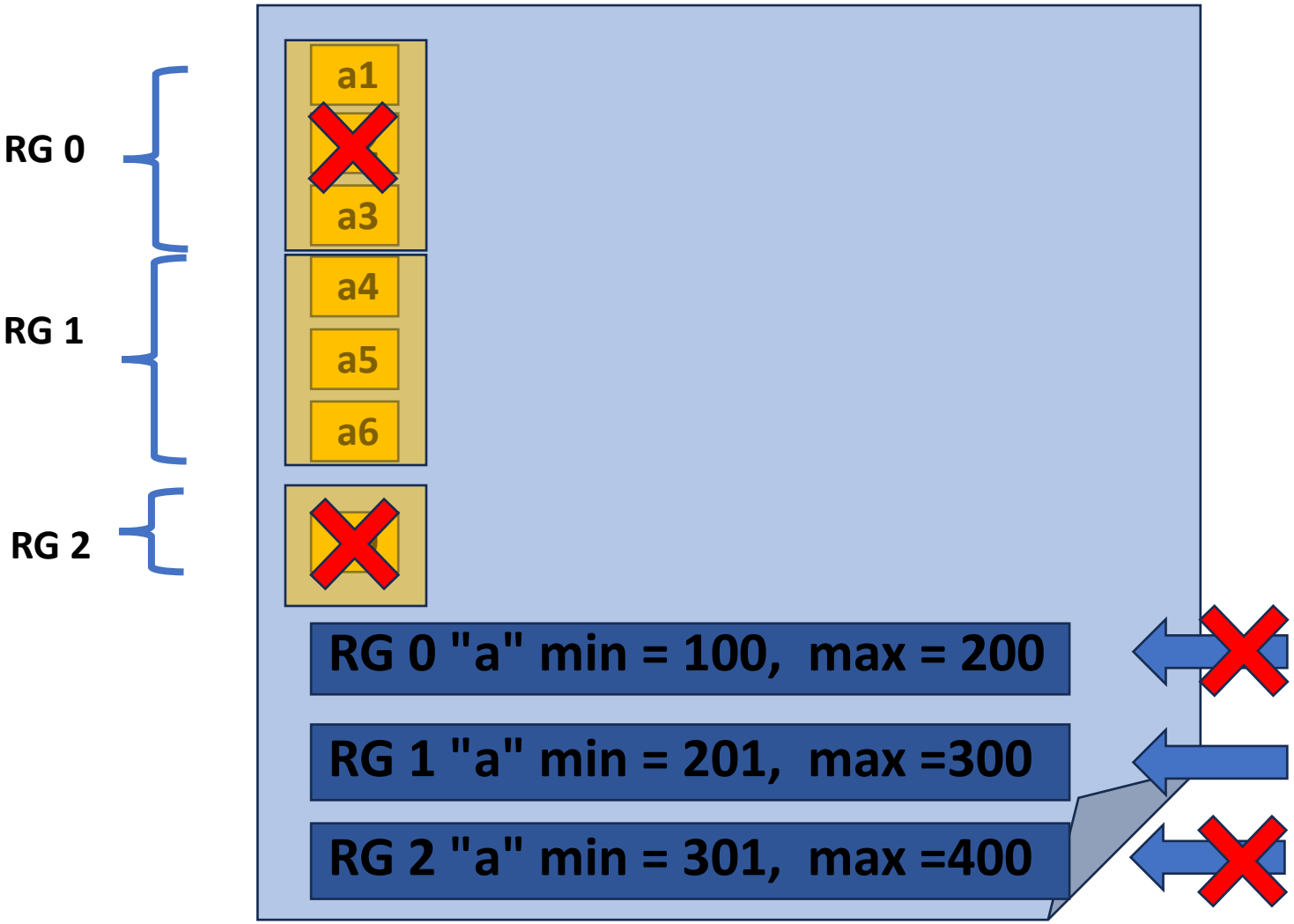
https://en.wikipedia.org/wiki/Bloom_filter

Parquet Predicate-Push-Down

Push-Down :
from Spark -> Parquet Lib -> IO Storage



Statistics for skip read RowGroup
SELECT .. WHERE column=value



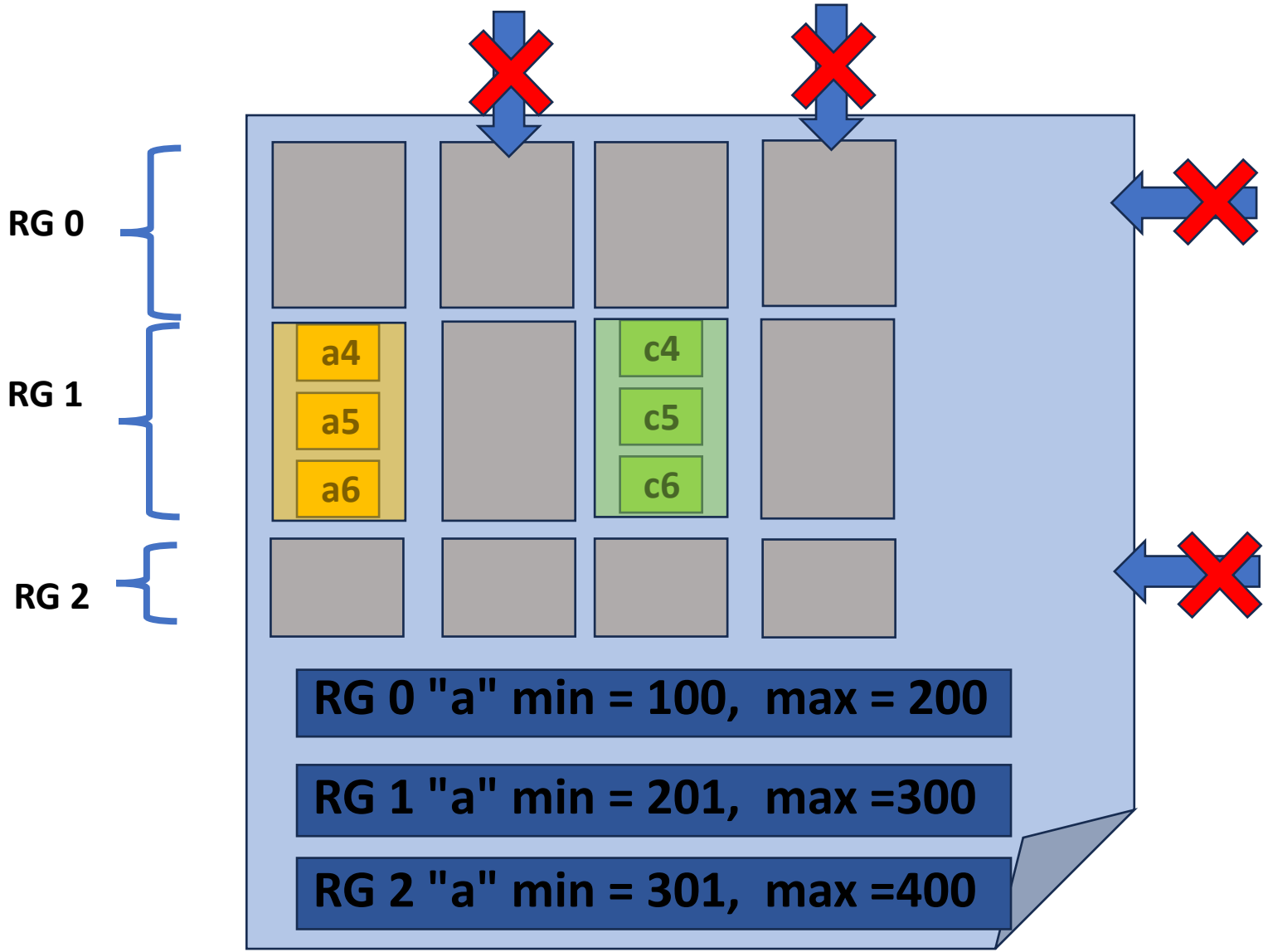
SELECT ...
WHERE a = 250

NO match max < a

OK min <= a <= max (maybe false positive)

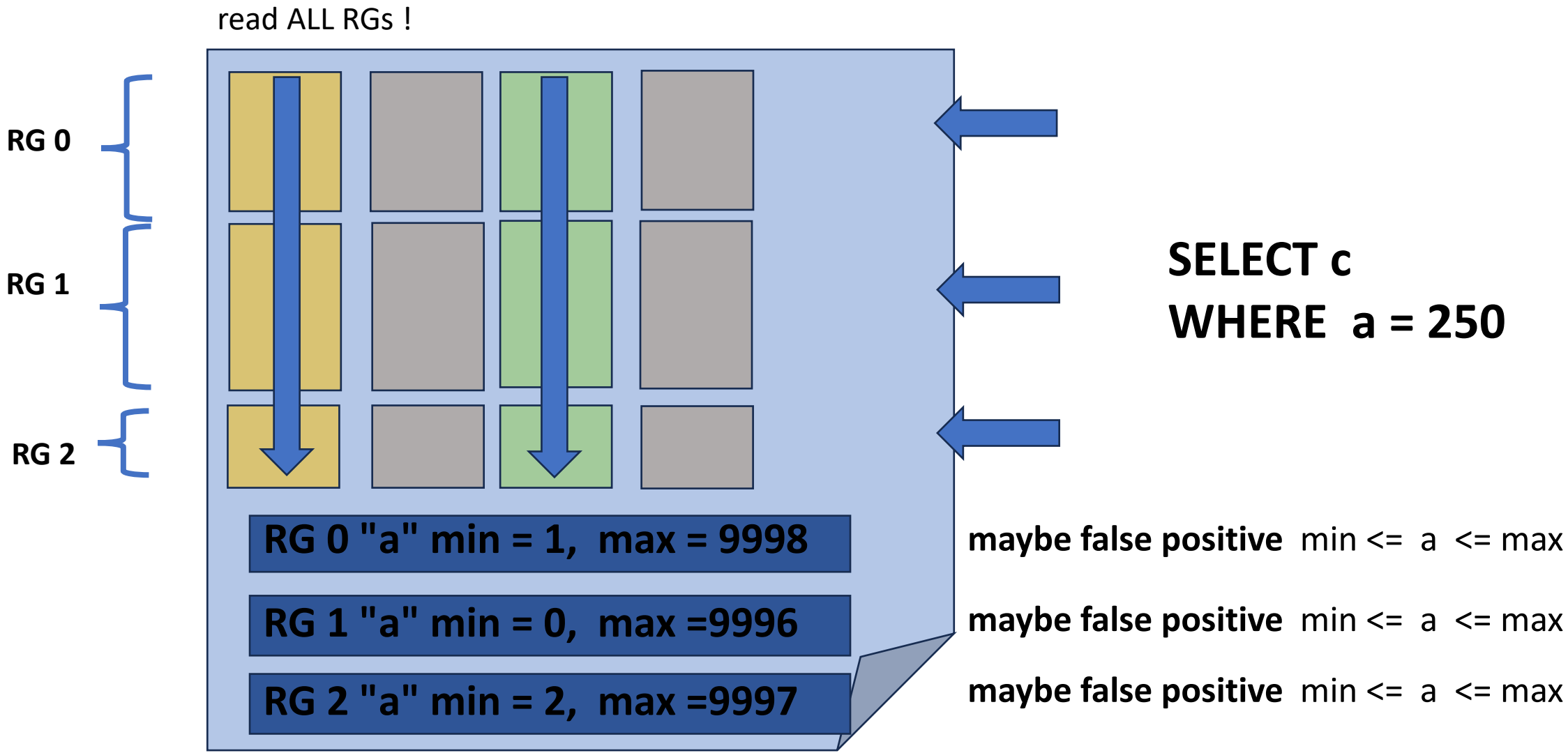
NO match a < min

Column Pruning
+ RowGroup Pruning(PPD) = minimal Reads



SELECT c
WHERE a = 250

Badly sorted files
=> Bad min/max statistics => False positives



Optim Write Once / Read Many

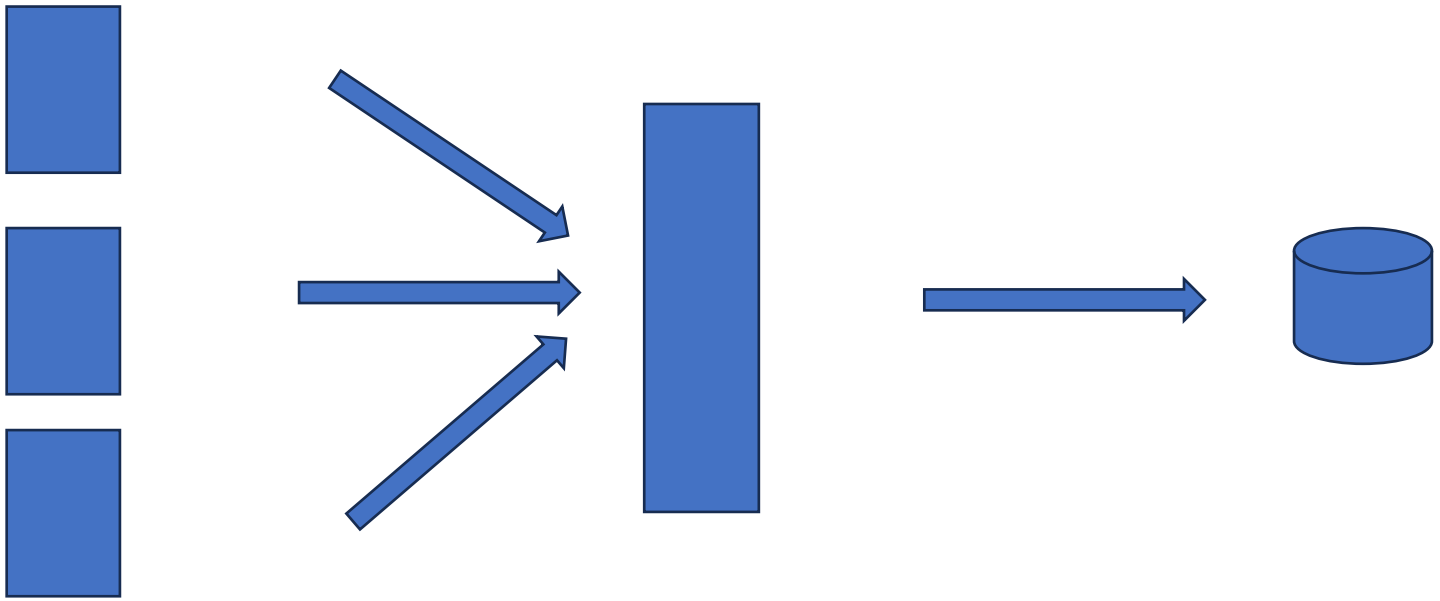
when writing Parquet files ... think how file might be read later !

spend CPU when writing to save CPU / IO later reading

```
dataset
    .repartition(nRepartitionCount)
    // or  .repartition("col1", nRepartitionHash)

    .sortWithinPartitions("colA", "colB")

    .write
    .option("parquet.block.size", 32*MEGA)

    .format("parquet")
    .save("file://some-dir")
    // or
    // .format("hive").insertInto("hiveDb.hiveTableName")
```

avoid many small files
dataset.repartition(1)
or .coalesce(1)

```
dataset
    .repartition(nRepartitionCount)  // or  .coalesce(nRepartitionCount)
```



N spark in-memory Partitions
distributed over N executors

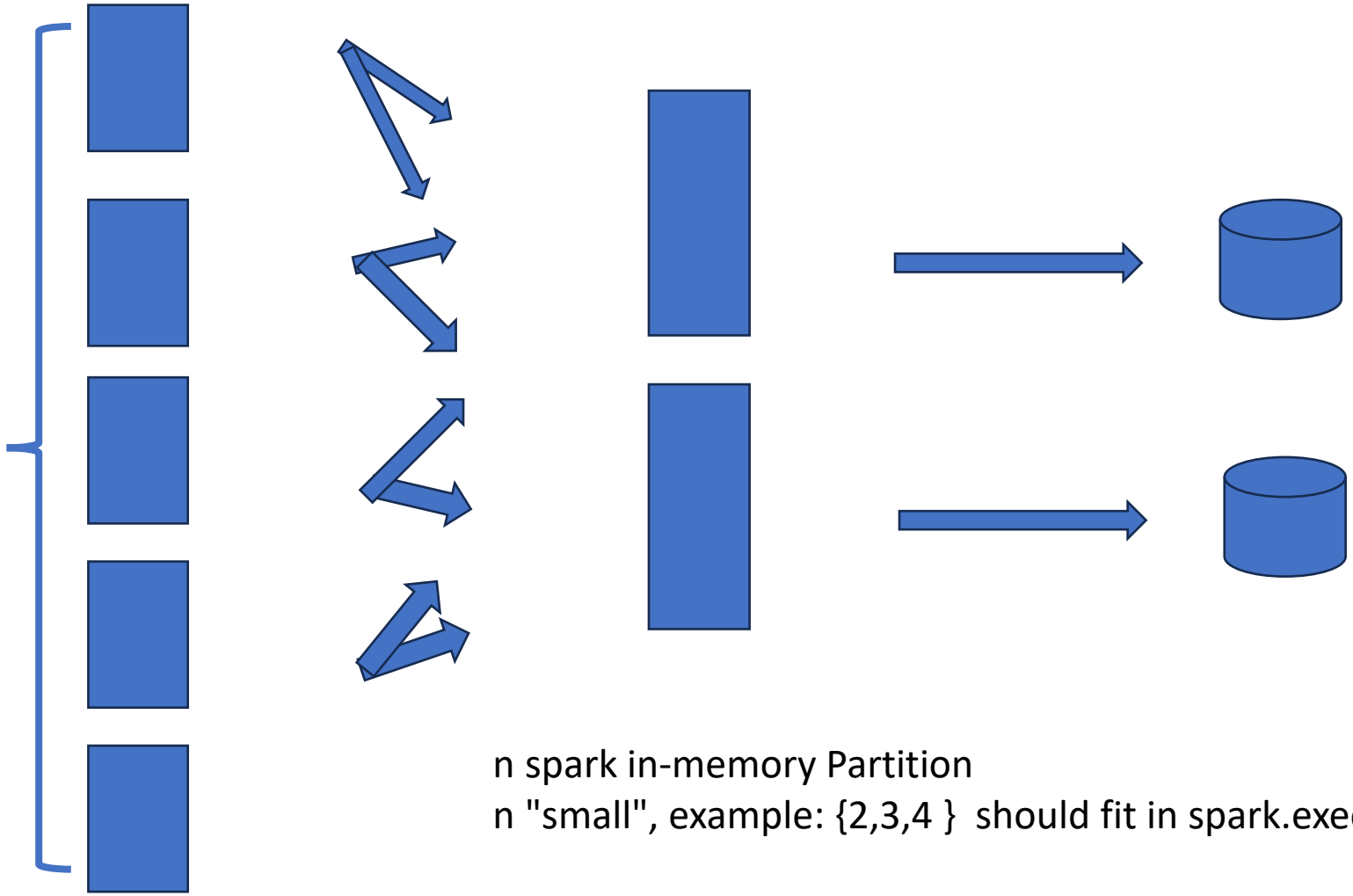
1 spark in-memory Partition
(should fit in spark.executor.memory !!)

write 1 parquet file

Does not fit in memory.. compromise to .repartition(smallN)

typically 200 partitions

default
spark.shuffle.size=200

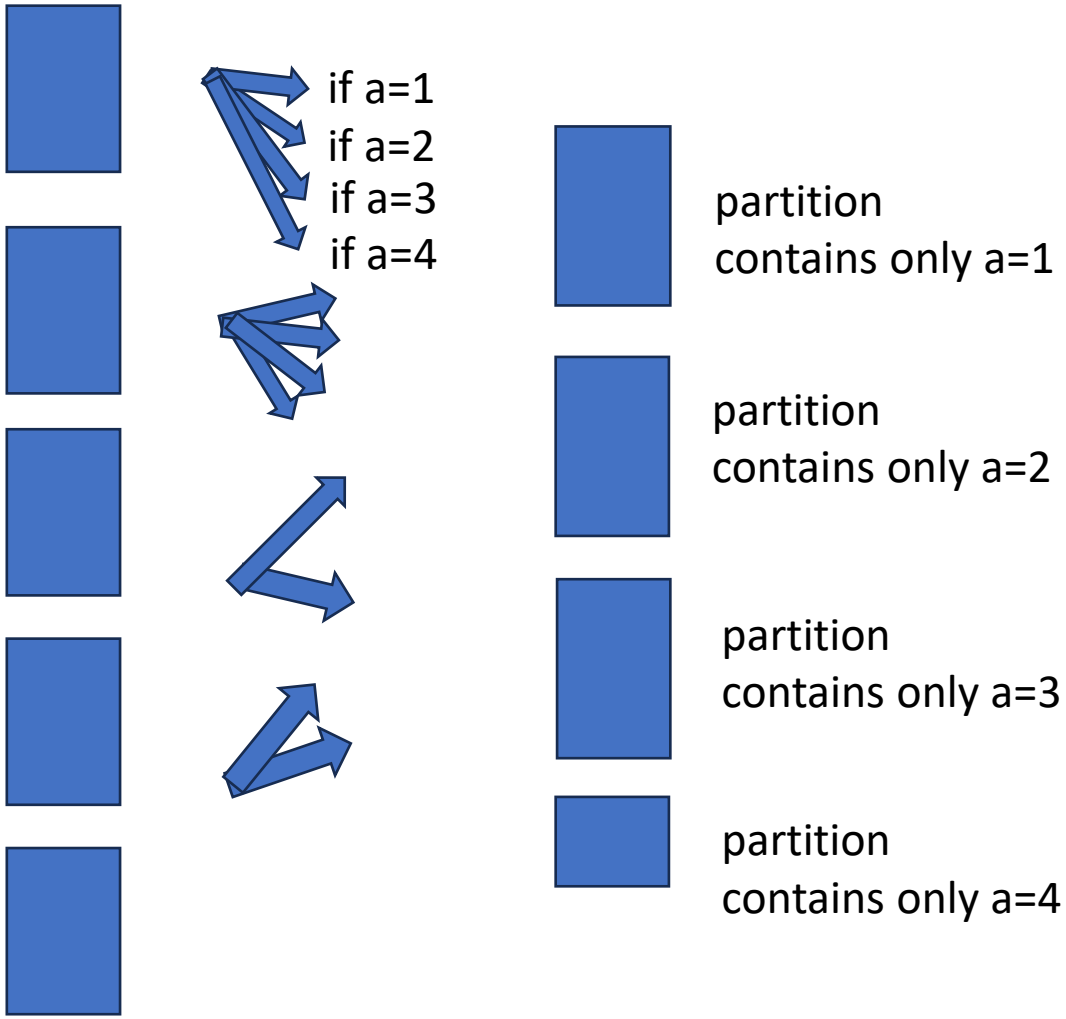


n spark in-memory Partition
n "small", example: {2,3,4 } should fit in spark.executor.memory !!

.repartition("column")

typical usage:
column "a" has FEW distinct values { 1, 2, 3, 4 }

ds = dataset.repartition("a")

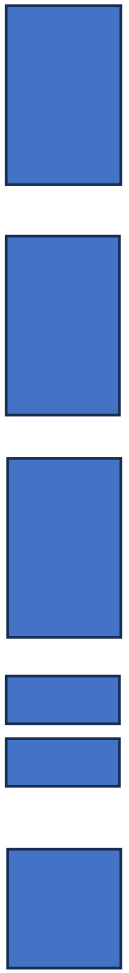


.repartition("column", nHashCount)

example ... having many distinct values

col "a" values in [1, 2, 3, ... 500000]

=> h = hash(a) % 15 in [0, 1, .. 14]



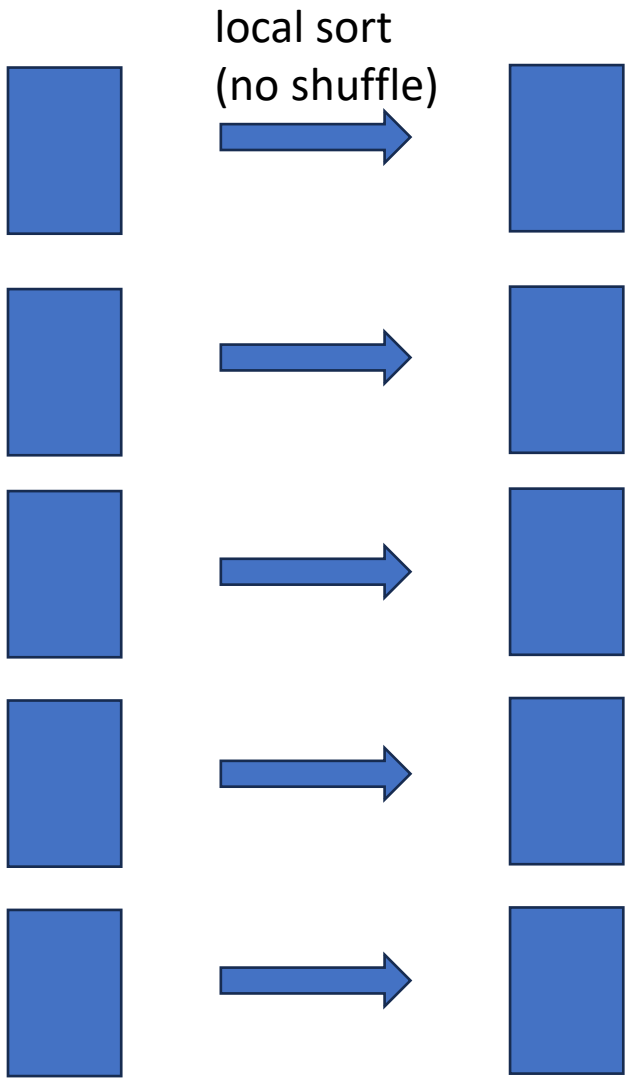
partition
contains only a%15==0 i.e. {0, 15, 30, 45, ..}

partition
contains only a%15==1 i.e. {1, 16, 31, 46, ..}

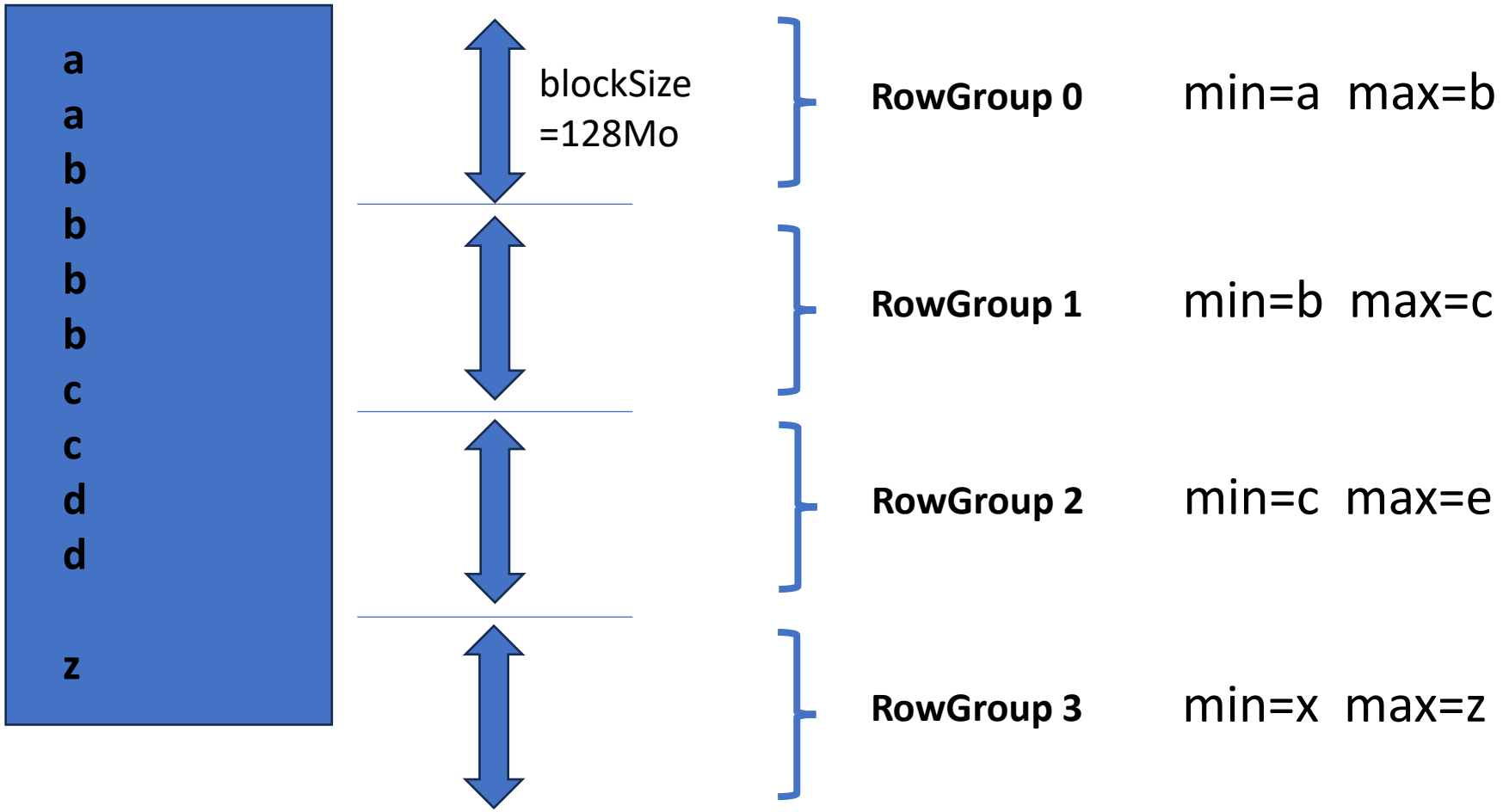
partition
contains only a%15==2 i.e. {2, 12, 32, 47, ..}

partition
contains only a%15==14 i.e. {14, 29, 44, ..}

.sortWithinPartitions("a", "b", ...)



.sortWithinPartitions
=> RowGroups stats more "compact"



see also Dataset.write .bucketBy(..)

explain spark Dataset write bucketBy

In Apache Spark, the `bucketBy` method is used to organize data into buckets (or partitions) based on the values of specific columns. This improves performance for certain operations like joins, aggregations, and lookups, particularly when the same bucketing is used across datasets.

What is Bucketing?

Bucketing is a technique to partition data into a fixed number of buckets based on the hash value of one or more columns. Unlike partitioning by directory structure, bucketing determines which bucket a record belongs to by applying a hash function to the column values.

Dataset's `write.bucketBy`

The `bucketBy` method in Spark is part of the `DataFrameWriter` API and is used to specify bucketing when writing data. It allows you to save a dataset in a bucketed format.

Syntax

java Copy code

```java
Dataset<Row> dataset = ...;

// Write data with bucketing
dataset.write()
        .bucketBy(numBuckets, "column1", "column2") // Define the number of buckets and buc
        .sortBy("column1")                          // (Optional) Specify sort order within
        .format("parquet")                          // Specify file format (e.g., parquet, O
        .save("/path/to/output");
```

Parameters

1. `numBuckets`:
   - The number of buckets to divide the data into.
   - This is a fixed number and cannot be changed later.
2. `column1`, `column2`, ...:
   - The columns based on which the data will be hashed and distributed into buckets.

Analyzing Parquet Files, using "parquet-cli"

Analysing Parquet File, using "parquet-cli"

github.com/apache/parquet-java/tree/master/parquet-cli

apache / parquet-java

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Files

master

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Add file

wgtmac MINOR: bump version to 1.16.0-SNAPSHOT (#3097) ✓ 4aeba6c · 4 days ago History

Name	Last commit message	Last commit date
..		
src	GH-2976: Parquet CLI compression commands should accept lowercase com...	4 months ago
README.md	GH-2952: Add maven wrapper (#2953)	4 months ago
pom.xml	MINOR: bump version to 1.16.0-SNAPSHOT (#3097)	4 days ago

README.md

Building

You can build this project using maven:

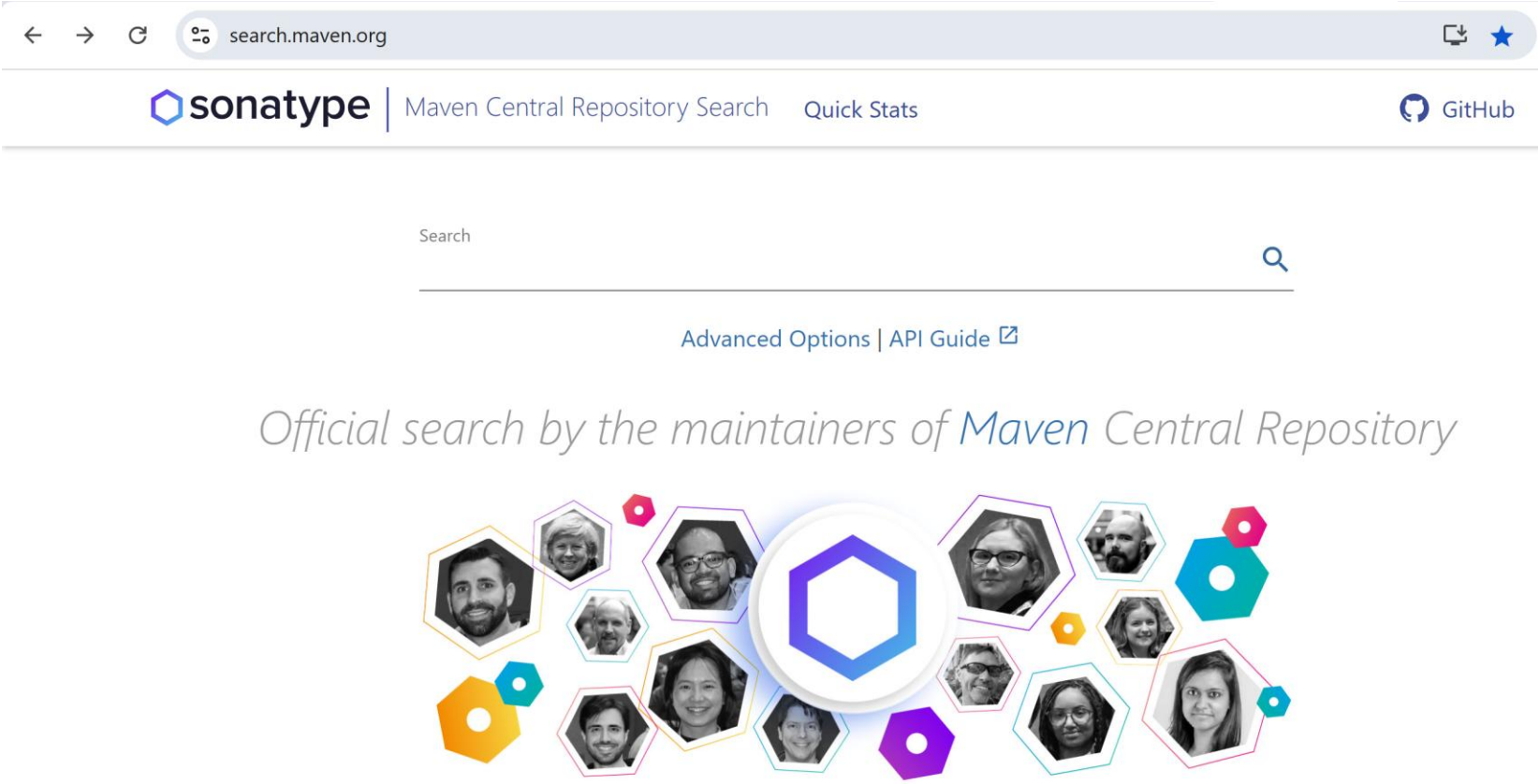
```
./mvnw clean install -DskipTests
```

Running

The build produces a shaded Jar that can be run using the `hadoop` command:

```
hadoop jar parquet-cli-1.12.3-runtime.jar org.apache.parquet.cli.Main
```

Search jar in maven repo: https://search.maven.org



type search "a:parquet-cli" g:org.apache.parquet

search.maven.org

sonatype | Maven Central Repository Search Quick Stats GitHub

Search

a:parquet-cli

Official s ... epository

org.apache.parquet Updated 28-Nov-2024

Artifact ID	parquet-cli
Latest Version	1.15.0

com.gojek.parquet Updated 31-May-2021

Artifact ID	parquet-cli
Latest Version	1.11.9

com.intel.qat Updated 29-May-2020

Artifact ID	parquet-cli
Latest Version	1.10.0

Downloading "parquet-cli" runtime.jar for same version 1.13.0 (same as spark/jars/*.jar)

search.maven.org/artifact/org.apache.parquet/parquet-cli/1.13.0/jar

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org.apache.parquet:parquet-cli:1.13.0

org.apache.parquet:parquet-cli: 1.13.0 View on OSS Index Browse Downloads

cyclonedx.json
cyclonedx.xml
jar
javadoc.jar
pom
runtime.jar
sources.jar
tests.jar

Apache Parquet Command-line

Home page https://parquet.apache.org

org.apache.parquet:parquet-cli
1.13.0

```
<!--
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  ~ distributed with this work for additional information
  ~ regarding copyright ownership.  The ASF licenses this file
  ~ to you under the Apache License, Version 2.0 (the
  ~ "License"); you may not use this file except in compliance
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  ~
  ~   http://www.apache.org/licenses/LICENSE-2.0
  ~
  ~ Unless required by applicable law or agreed to in writing,
  ~ software distributed under the License is distributed on an
```

Apache Maven
maven.apache.org

```
<dependency>
  <groupId>org.apache.par
  <artifactId>parquet-cli
  <version>1.13.0</versic
</dependency>
```

Gradle Groovy DSL
gradle.org

```
implementation 'org.apach
```

Gradle Kotlin DSL

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Launching parquet-cli

java -jar parquet-cli-runtime.jar help

(using shaded jar, otherwise may need to add hadoop classpath)

```
C:\apps\spark>java -jar parquet-cli-1.15.0-SNAPSHOT-runtime.jar help

Usage: parquet [options] [command] [command options]

  Options:

    -v, --verbose, --debug
        Print extra debugging information

  Commands:

    help
        Retrieves details on the functions of other commands
    meta
        Print a Parquet file's metadata
    pages
        Print page summaries for a Parquet file
    dictionary
        Print dictionaries for a Parquet column
    check-stats
        Check Parquet files for corrupt page and column stats (PARQUET-251)
    schema
        Print the Avro schema for a file
    csv-schema
        Build a schema from a CSV data sample
    convert-csv
```

parquet-cli meta [1/2]

java -jar parquet-cli-runtime.jar meta file.parquet

```
C:\apps\spark>java -jar parquet-cli-1.15.0-SNAPSHOT-runtime.jar meta  C:\apps\spark\spark
t

File path:  C:\apps\spark\spark-warehouse\db1.db\addr\part-c000.snappy.parquet
Created by: parquet-mr version 1.13.1 (build db4183109d5b734ec5930d870cdae161e408ddba)
Properties:
                   org.apache.spark.version: 3.5.0
  org.apache.spark.sql.parquet.row.metadata: {"type":"struct","fields":[{"name":"uid_adre
e":"cle_interop","type":"string","nullable":true,"metadata":{}},{"name":"commune_insee","
mmune_nom","type":"string","nullable":true,"metadata":{}},{"name":"commune_deleguee_insee
:"commune_deleguee_nom","type":"string","nullable":true,"metadata":{}},{"name":"voie_nom"
lieudit_complement_nom","type":"string","nullable":true,"metadata":{}},{"name":"numero","
uffixe","type":"string","nullable":true,"metadata":{}},{"name":"position","type":"string"
e","nullable":true,"metadata":{}},{"name":"y","type":"double","nullable":true,"metadata":
ata":{}},{"name":"lat","type":"double","nullable":true,"metadata":{}},{"name":"cad_parcel
e":"source","type":"string","nullable":true,"metadata":{}},{"name":"certification_commune
:"date_der_maj","type":"date","nullable":false,"metadata":{}}]}
Schema:
message spark_schema {
  optional binary uid_adresse (STRING);
  optional binary cle_interop (STRING);
  optional binary commune_insee (STRING);
  optional binary commune_nom (STRING);
  optional int32 commune_deleguee_insee;
  optional binary commune_deleguee_nom (STRING);
  optional binary voie_nom (STRING);
  optional binary lieudit_complement_nom (STRING);
  optional int32 numero;
  optional binary suffixe (STRING);
  optional binary position (STRING);
  optional double x;
```

parquet-cli meta [2/2]

```
Row group 0:  count: 219962  71,92 B records  start: 4  total(compressed): 15,086 MB total(uncompressed):33,177 MB
--------------------------------------------------------------------------------
                         type      encodings count     avg size   nulls   min / max
uid_adresse              BINARY    S _ R_ F  219962    34,79 B    47399   " @a:00003b17-45be-48c1-aa..." / "Argence""
cle_interop              BINARY    S   _     219962    5,47 B     0       "01001_0005_00026" / "54"
commune_insee            BINARY    S _ R     219962    0,01 B     1       "01001" / "01350"
commune_nom              BINARY    S _ R     219962    0,02 B     0       "Ambléon" / "Évosges"
commune_deleguee_insee   INT32     S _ R     219962    0,02 B     202278  "1015" / "1442"
commune_deleguee_nom     BINARY    S _ R     219962    0,02 B     202277  "6518380.18" / "Étrez"
voie_nom                 BINARY    S _ R     219962    1,44 B     0       """"le château"""" / "Îlot Grammont"
lieudit_complement_nom   BINARY    S _ R     219962    0,09 B     197279  """"le château"""" / "Étrez"
numero                   INT32     S _ R     219962    1,45 B     1       "0" / "99999"
suffixe                  BINARY    S _ R     219962    0,11 B     206335  "1" / "z"
position                 BINARY    S _ R     219962    0,25 B     15376   "bâtiment" / "service technique"
x                        DOUBLE    S   _     219962    5,06 B     226     "-0.0" / "943078.82"
y                        DOUBLE    S   _     219962    5,37 B     227     "6505390.74" / "6603083.59"
long                     DOUBLE    S   _     219962    7,99 B     227     "4.730471" / "6.163086"
lat                      DOUBLE    S   _     219962    7,64 B     227     "45.617249" / "46.506743"
cad_parcelles            BINARY    S _ R     219962    1,87 B     167172  "010010000A1033" / "01380000_E0291"
source                   BINARY    S _ R     219962    0,06 B     2266    "arcep" / "inconnue"
certification_commune    INT32     S _ R     219962    0,03 B     1       "0" / "1"
date_der_maj             INT32     S _ R     219962    0,23 B     0       "1901-01-01" / "2024-12-05"

Row group 1:  count: 215938  72,72 B records  start: 15819187  total(compressed): 14,976 MB total(uncompressed):33,489 MB
--------------------------------------------------------------------------------
                         type      encodings count     avg size   nulls   min / max
uid_adresse              BINARY    S   _     215938    36,79 B    39793   " @a:00003774-58fc-46a7-b1..." / " @v:ffe769c6-a8b
cle_interop              BINARY    S   _     215938    5,19 B     0       "01350_0005_00707" / "02546_rcnpc4_00054"
commune_insee            BINARY    S _ R     215938    0,02 B     0       "01350" / "02546"
commune_nom              BINARY    S _ R     215938    0,04 B     0       "Abbécourt" / "Évergnicourt"
commune_deleguee_insee   INT32     S   _     215938    0,01 B     208894  "1059" / "2811"
commune_deleguee_nom     BINARY    S   _     215938    0,03 B     208894  "Anizy-le-Château" / "Virieu-le-Petit"
```

parquet-cli meta | grep "Row group"

java -jar parquet-cli-runtime.jar meta file.parquet > meta.txt

grep "Row group" meta.txt | head

```
Row group 0:  count: 219962  71,92 B records  start: 4  total(compressed): 15,086 MB total(uncompressed):33,177 MB
Row group 1:  count: 215938  72,72 B records  start: 15819187  total(compressed): 14,976 MB total(uncompressed):33,489 MB
Row group 2:  count: 213992  73,68 B records  start: 31523114  total(compressed): 15,036 MB total(uncompressed):33,821 MB
Row group 3:  count: 233199  70,29 B records  start: 47289138  total(compressed): 15,631 MB total(uncompressed):34,232 MB
Row group 4:  count: 231558  69,04 B records  start: 63679653  total(compressed): 15,246 MB total(uncompressed):33,383 MB
Row group 5:  count: 219962  74,89 B records  start: 79665824  total(compressed): 15,710 MB total(uncompressed):34,531 MB
Row group 6:  count: 218409  73,91 B records  start: 96138854  total(compressed): 15,394 MB total(uncompressed):33,957 MB
Row group 7:  count: 199907  75,02 B records  start: 112281114  total(compressed): 14,301 MB total(uncompressed):31,914 MB
Row group 8:  count: 218409  69,87 B records  start: 127277278  total(compressed): 14,552 MB total(uncompressed):34,174 MB
Row group 9:  count: 272568  65,80 B records  start: 142536439  total(compressed): 17,104 MB total(uncompressed):35,616 MB
```

grep "Row group" meta.txt | tail

```
Row group 108:  count: 252150  64,55 B records  start: 1719335249  total(compressed): 15,522 MB total(uncompressed):34,027 MB
Row group 109:  count: 215240  71,68 B records  start: 1735611436  total(compressed): 14,715 MB total(uncompressed):34,014 MB
Row group 110:  count: 219962  68,48 B records  start: 1751040857  total(compressed): 14,365 MB total(uncompressed):32,978 MB
Row group 111:  count: 219962  68,18 B records  start: 1766103960  total(compressed): 14,302 MB total(uncompressed):32,914 MB
Row group 112:  count: 234887  64,52 B records  start: 1781100645  total(compressed): 14,454 MB total(uncompressed):33,355 MB
Row group 113:  count: 236624  66,44 B records  start: 1796256273  total(compressed): 14,993 MB total(uncompressed):37,495 MB
Row group 114:  count: 234063  65,95 B records  start: 1811977242  total(compressed): 14,722 MB total(uncompressed):33,626 MB
Row group 115:  count: 213992  73,42 B records  start: 1827414634  total(compressed): 14,983 MB total(uncompressed):34,526 MB
Row group 116:  count: 230100  69,58 B records  start: 1843125866  total(compressed): 15,269 MB total(uncompressed):36,039 MB
Row group 117:  count: 152925  67,36 B records  start: 1859136956  total(compressed): 9,823 MB total(uncompressed):26,622 MB
```

parquet-cli column-size

java -jar parquet-cli-runtime.jar column-size file.parquet

```
C:\apps\spark>java -jar parquet-cli-1.15.0-SNAPSHOT-runtime.jar column-size  C:\apps\spark\spa
commune_deleguee_insee-> Size In Bytes: 431641 Size In Ratio: 2.3089352E-4
commune_insee-> Size In Bytes: 322609 Size In Ratio: 1.725701E-4
numero-> Size In Bytes: 26951190 Size In Ratio: 0.014416738
voie_nom-> Size In Bytes: 35412828 Size In Ratio: 0.01894304
uid_adresse-> Size In Bytes: 882820344 Size In Ratio: 0.4722385
date_der_maj-> Size In Bytes: 7501158 Size In Ratio: 0.0040125214
cle_interop-> Size In Bytes: 139359234 Size In Ratio: 0.07454608
source-> Size In Bytes: 1142012 Size In Ratio: 6.108854E-4
long-> Size In Bytes: 213866608 Size In Ratio: 0.11440159
commune_deleguee_nom-> Size In Bytes: 836453 Size In Ratio: 4.4743568E-4
suffixe-> Size In Bytes: 3721170 Size In Ratio: 0.0019905292
cad_parcelles-> Size In Bytes: 66126109 Size In Ratio: 0.035372198
certification_commune-> Size In Bytes: 673339 Size In Ratio: 3.601827E-4
x-> Size In Bytes: 133896306 Size In Ratio: 0.07162385
lieudit_complement_nom-> Size In Bytes: 2886263 Size In Ratio: 0.0015439206
y-> Size In Bytes: 143779166 Size In Ratio: 0.07691039
commune_nom-> Size In Bytes: 549711 Size In Ratio: 2.9405157E-4
position-> Size In Bytes: 4716951 Size In Ratio: 0.0025231927
lat-> Size In Bytes: 204444396 Size In Ratio: 0.109361455
```

Column Sizes ... sorting

```
cat column-size
 | sed 's/-> Size In Bytes//g' |  sed 's/ Size In Ratio//g' | sed 's/: /;/g' > column-size.csv
```

Column	Size	Ratio	Size in Mo
uid_adresse	882820344	47,22%	841,9
long	213866608	11,44%	204,0
lat	204444396	10,94%	195,0
y	143779166	7,69%	137,1
cle_interop	139359234	7,45%	132,9
x	133896306	7,16%	127,7
cad_parcelles	66126109	3,54%	63,1
voie_nom	35412828	1,89%	33,8
numero	26951190	1,44%	25,7
date_der_maj	7501158	0,40%	7,2
position	4716951	0,25%	4,5
suffixe	3721170	0,20%	3,5
lieudit_complement_nom	2886263	0,15%	2,8
source	1142012	0,06%	1,1
commune_deleguee_nom	836453	0,04%	0,8
certification_commune	673339	0,04%	0,6
commune_nom	549711	0,03%	0,5
commune_deleguee_insee	431641	0,02%	0,4
commune_insee	322609	0,02%	0,3
total	1869437488	100,00%	1782,8

Parquet Column Sizes Summary

zipcode ("commun_insee") : 0.3 Mo
+
city name ("commun_nom") : 0.5 Mo
+
street name ("voie_nom") : 33.8 Mo
+
numero : 25.7 Mo

=> 60 Mega (3% of file)

+ longitude, latitude : 204 Mo + 195 Mo
=> 459 Mo

most of the column size is

uid_address : 840 Mo (47.2%)
+
x, y ... redundant with longitude,lattitude
+
cle_interop : 132 Mo (7.4%)

... we will see parquet "column-pruning" in action : skipping unnecessary columns !

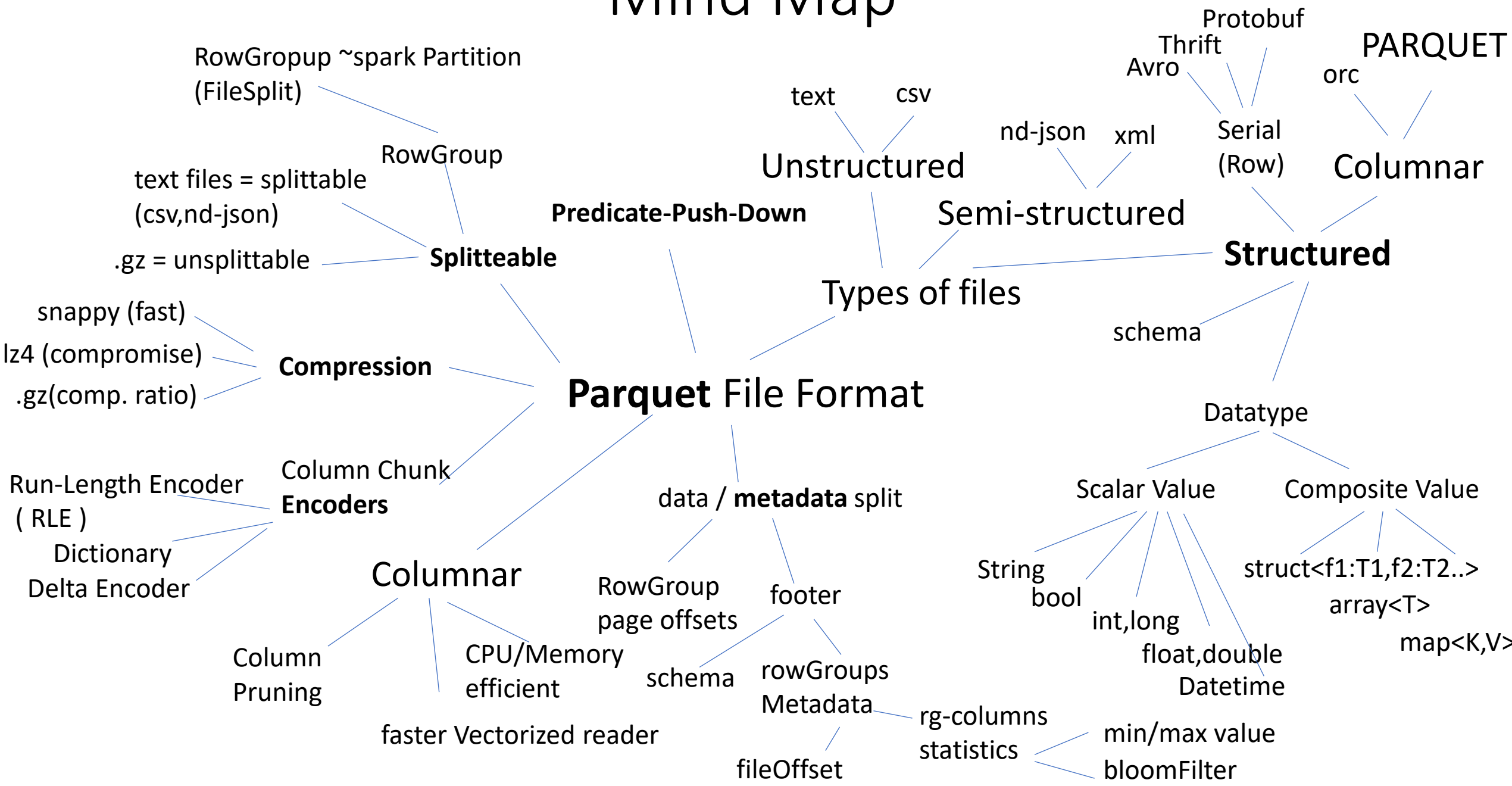
Conclusion

Parquet File Format is AMAZING

Spark is great using Parquet

Doing BigData processing = doing Spark + Parquet
with good .repartition(...)
.bucketBy(...)
.sortWithinPartitions(...)

Mind Map


RowGropup ~spark Partition
(FileSplit)
RowGroup
text files = splittable
(csv,nd-json)
.gz = unsplittable
Splitteable
snappy (fast)
lz4 (compromise)
.gz(comp. ratio)
Compression
Predicate-Push-Down
text
csv
Unstructured
nd-json
xml
Semi-structured
Protobuf
Thrift
Avro
Serial
(Row)
PARQUET
orc
Columnar
Structured
Types of files
schema
Parquet File Format
Datatype
Scalar Value
Composite Value
Column Chunk
Encoders
Run-Length Encoder
(RLE)
Dictionary
Delta Encoder
data / metadata split
Columnar
RowGroup
page offsets
footer
schema
rowGroups
Metadata
rg-columns
statistics
min/max value
bloomFilter
fileOffset
Column
Pruning
CPU/Memory
efficient
faster Vectorized reader
String
bool
int,long
float,double
Datetime
struct<f1:T1,f2:T2..>
array<T>
map<K,V>

Questions?

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