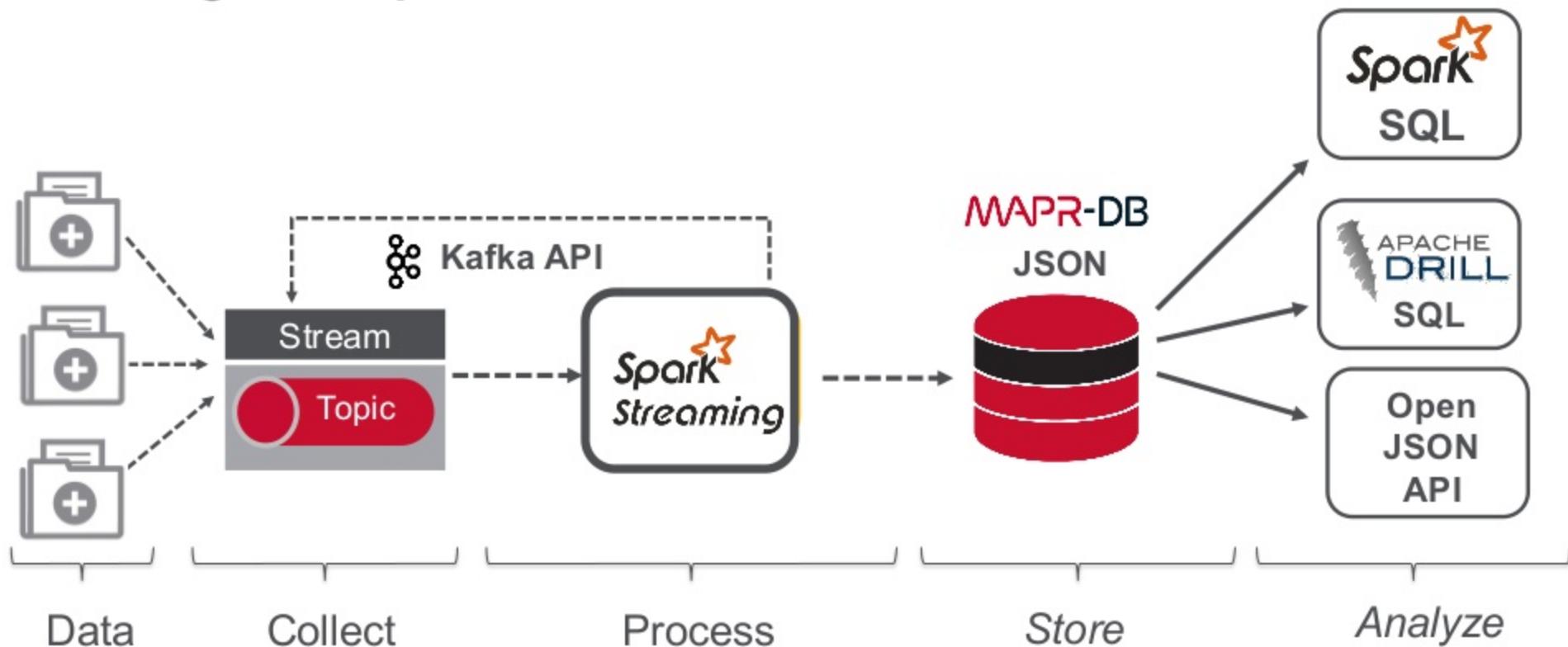


Data Pipeline Using Apache APIs: Kafka, Spark, and MapR-DB

Data Pipeline Using Apache APIs: Kafka, Spark, and MapR-DB

- Kafka
- Spark Streaming
- Spark SQL

Streaming ETL Pipeline



Traditional ETL

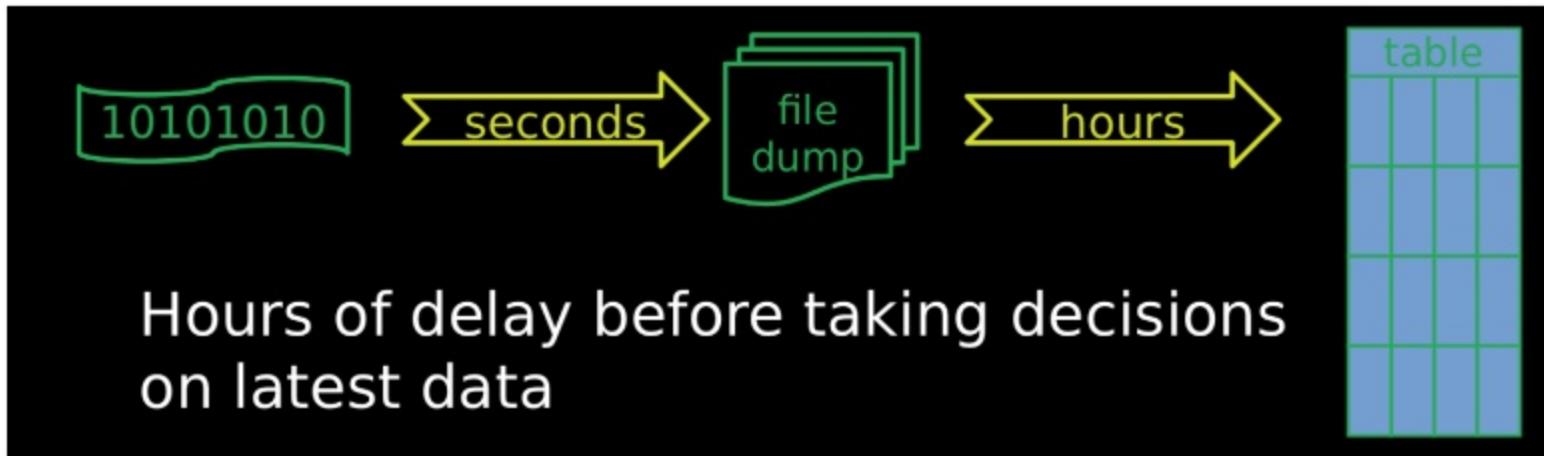


Image Reference: Databricks

Streaming ETL

Streaming ETL w/ Structured Streaming

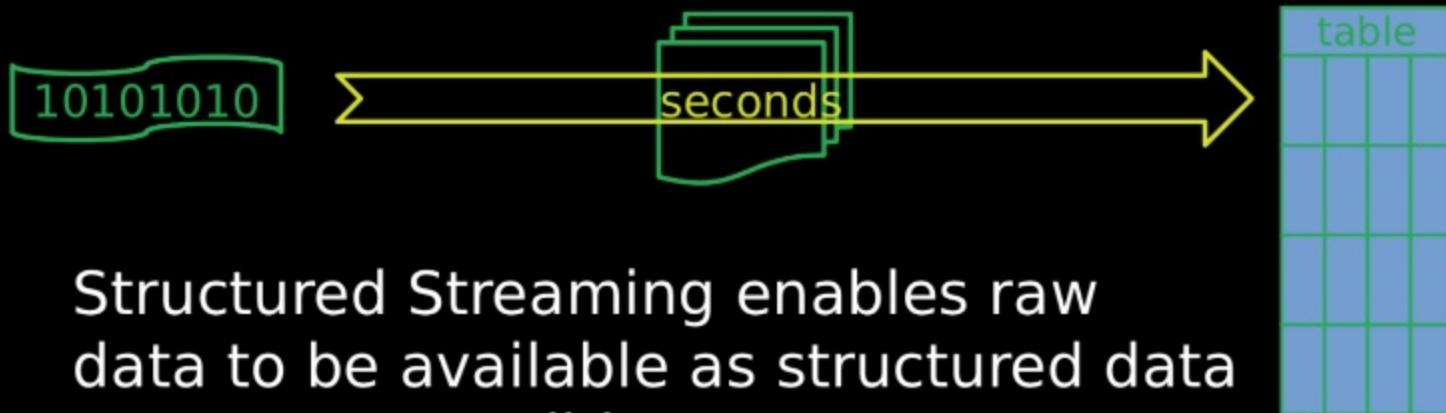


Image Reference: Databricks

What is a Stream ?



- A **stream** is an **continuous** sequence of events or records
- Records are key-value pairs

Examples of Streaming Data



Fraud detection



Smart Machinery



Smart Meters



Home Automation



Networks



Manufacturing



Security Systems



Patient Monitoring

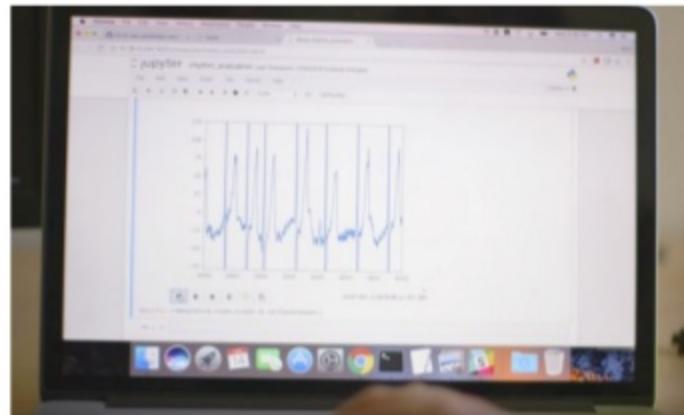
Examples of Streaming Data

- Monitoring devices combined with **ML** can provide **alerts** for Sepsis, which is one of the leading causes for death in hospitals
 - <http://www.computerweekly.com/news/450422258/Putting-sepsis-algorithms-into-electronic-patient-records>



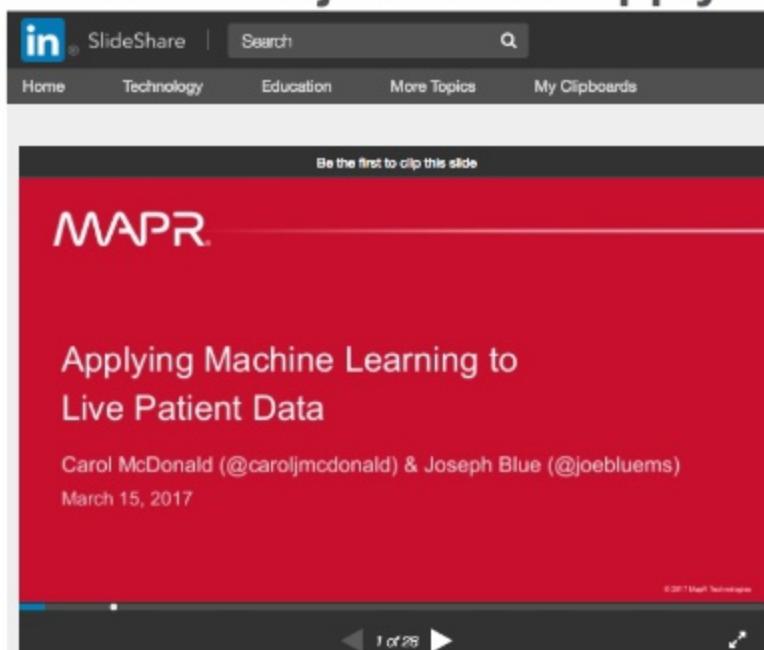
Examples of Streaming Data

- A Stanford team has shown that a machine-learning model can identify **heart arrhythmias** from an electrocardiogram (**ECG**) better than an expert
 - <https://www.technologyreview.com/s/608234/the-machines-are-getting-ready-to-play-doctor/>



Applying Machine Learning to Live Patient Data

- <https://www.slideshare.net/caroljmcdonald/applying-machine-learning-to-live-patient-data>



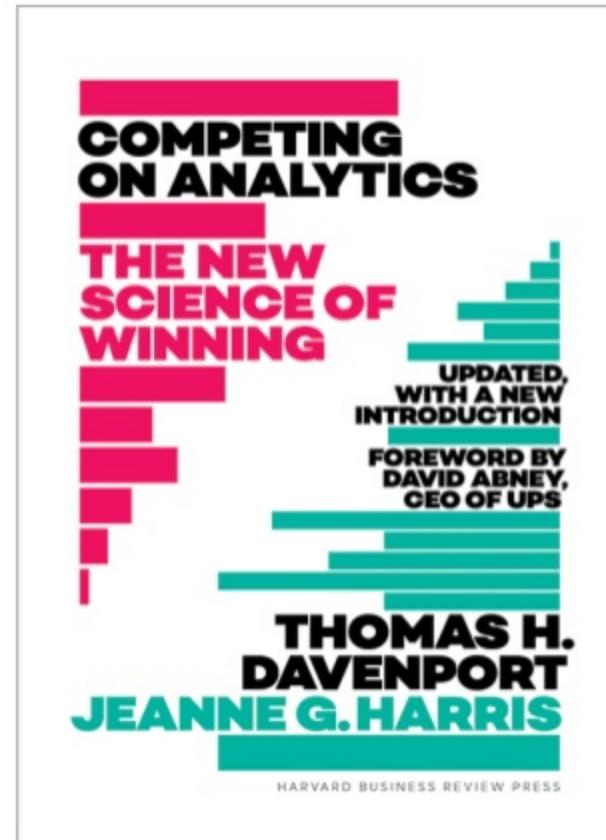
Applying Machine Learning to Live Patient
Data

709 views

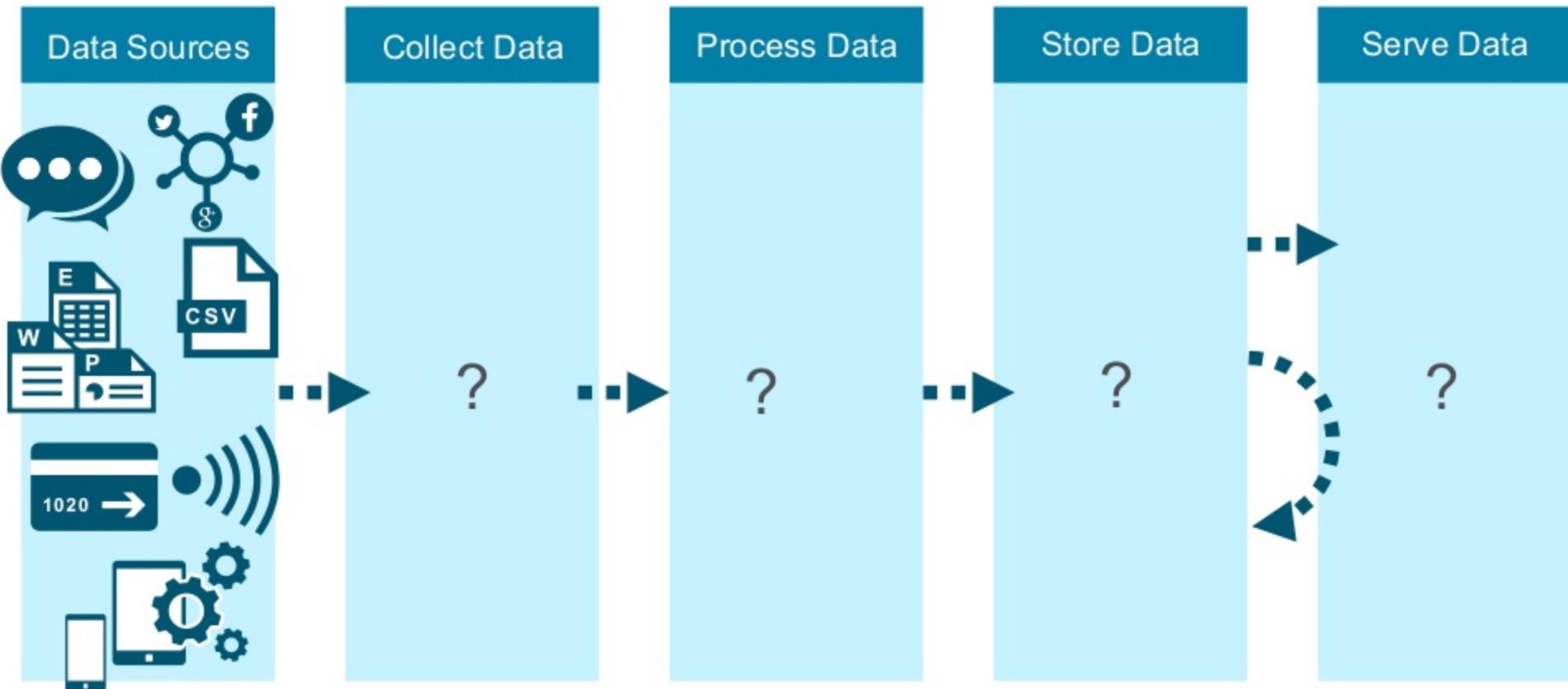
?

What has changed in the past 10 years?

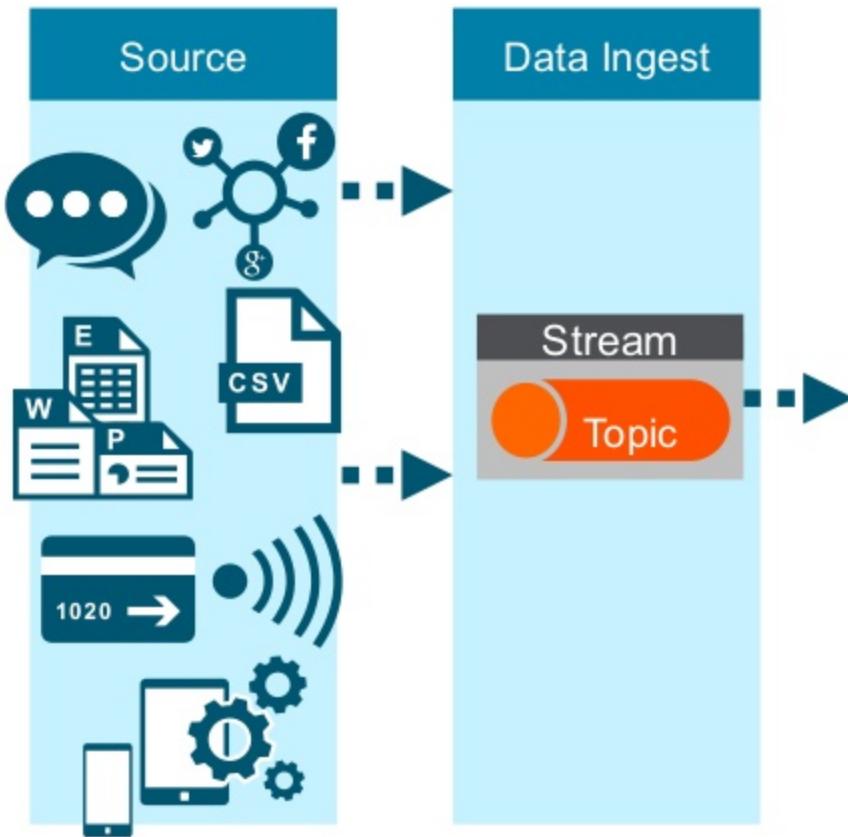
- Distributed computing
- Streaming analytics
- Improved machine learning



What Do We Need to Do ?



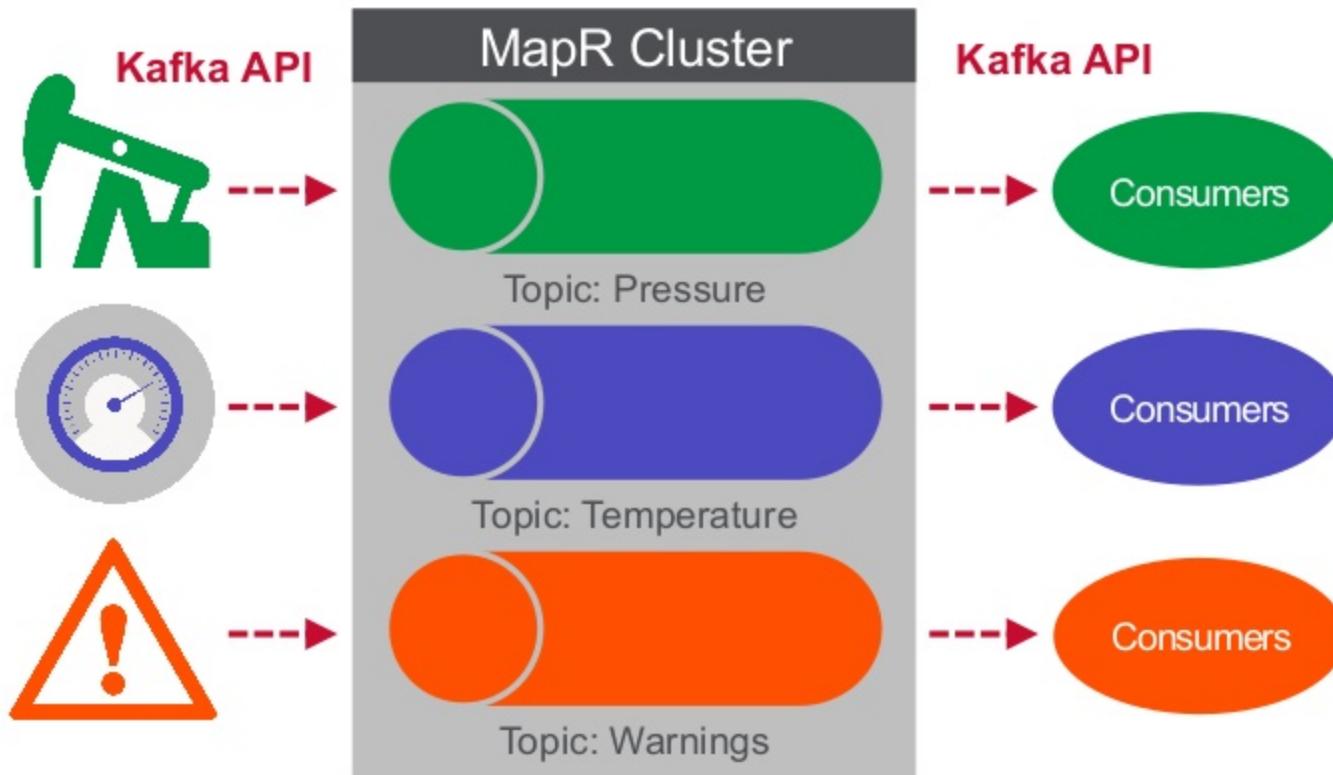
Collect the Data



- **Data Ingest:**
 - Using the Kafka API

Organize Data into Topics with MapR-Event Streams

Topics: Logical collection of events, **Organize** Events into Categories

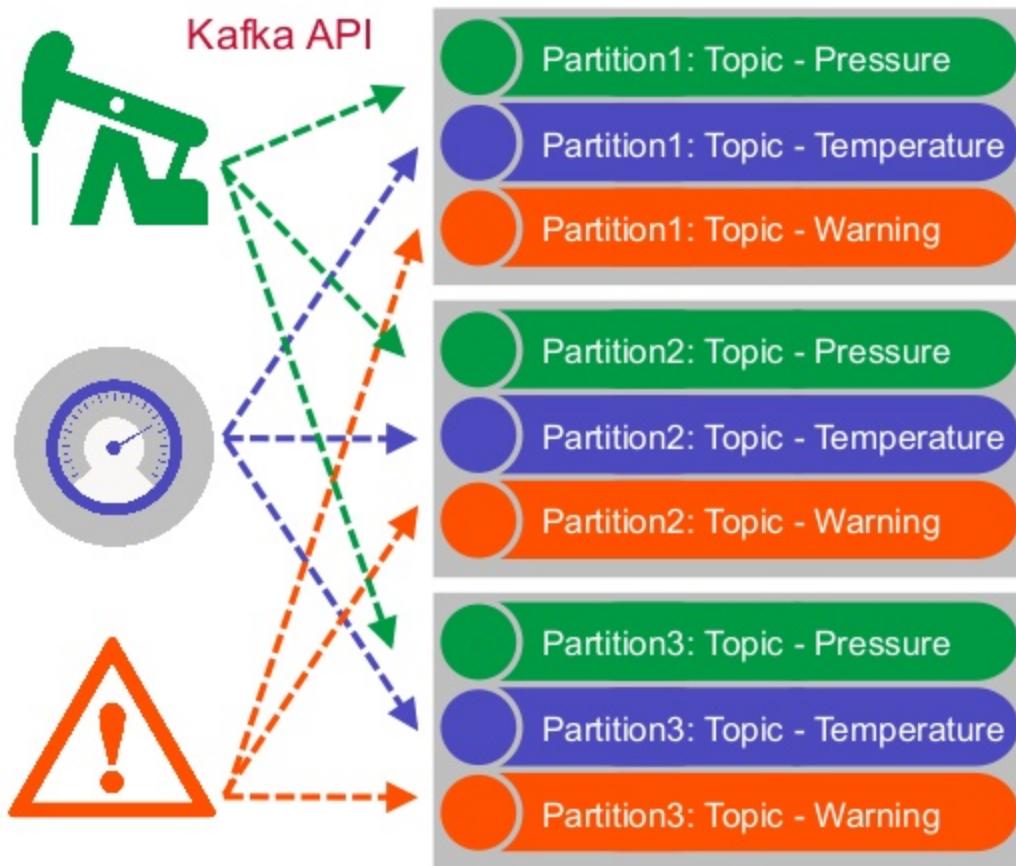


Scalable Messaging with MapR Event Streams

Topics are
partitioned for
throughput and
scalability

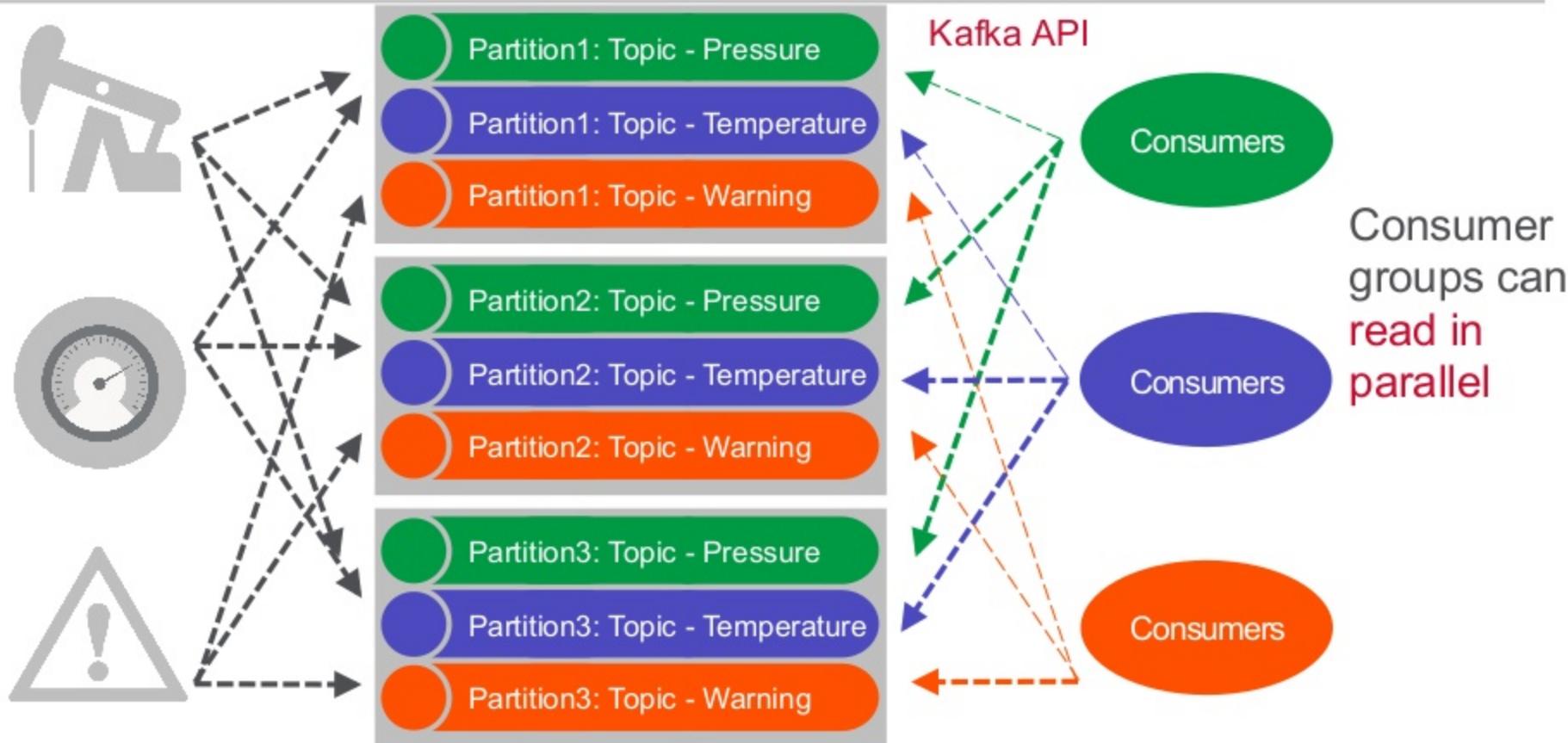


Scalable Messaging with MapR Event Streams



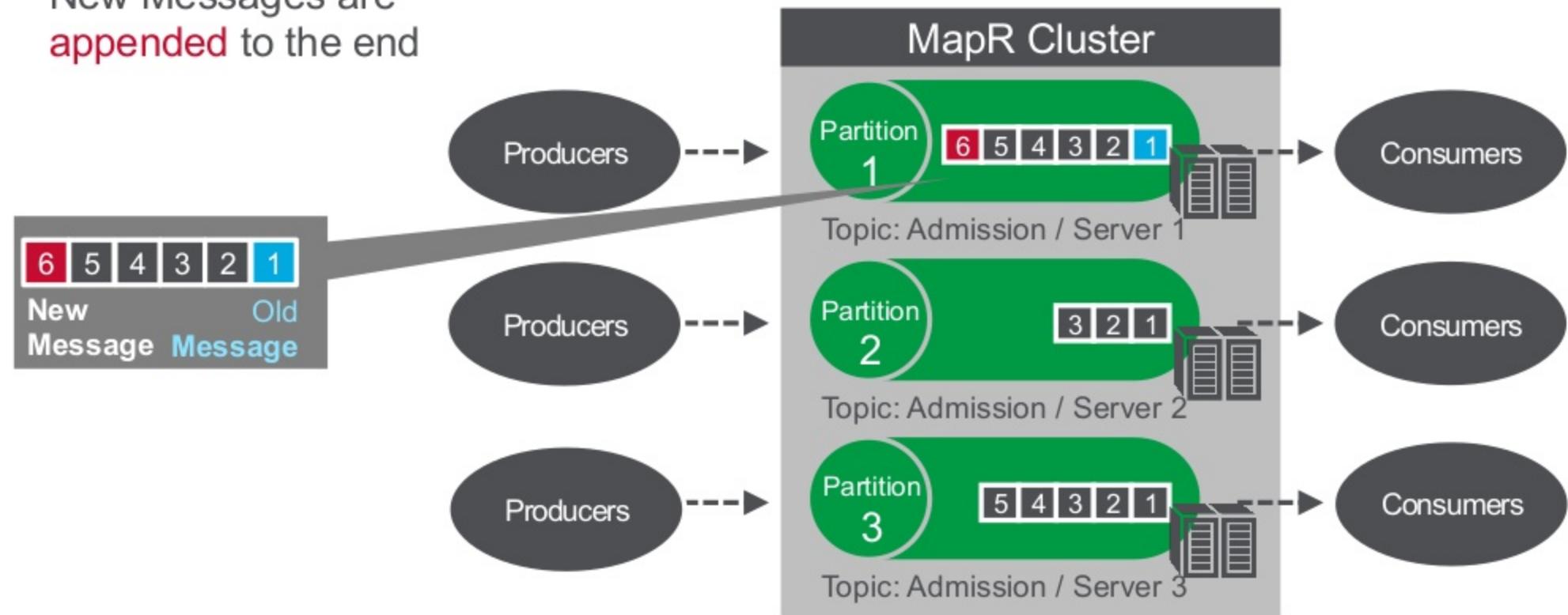
Producers are **load balanced** between partitions

Scalable Messaging with MapR Event Streams



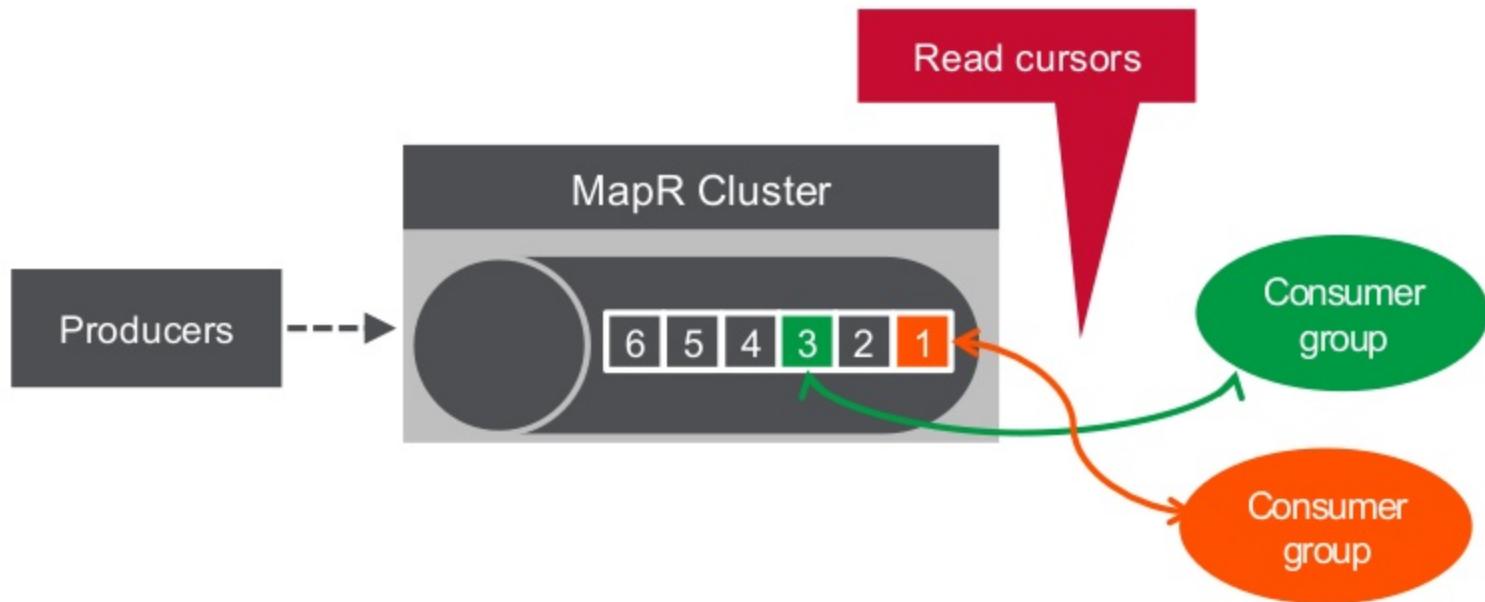
Partition is like an Event Log

New Messages are
appended to the end



Partition is like a Queue

Messages are delivered in the order they are received



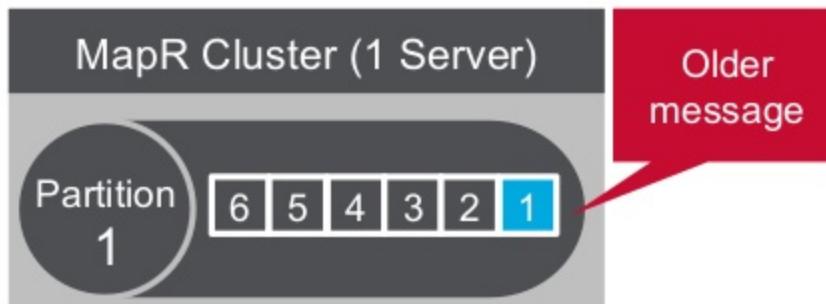
Unlike a queue, events are still persisted after they're delivered



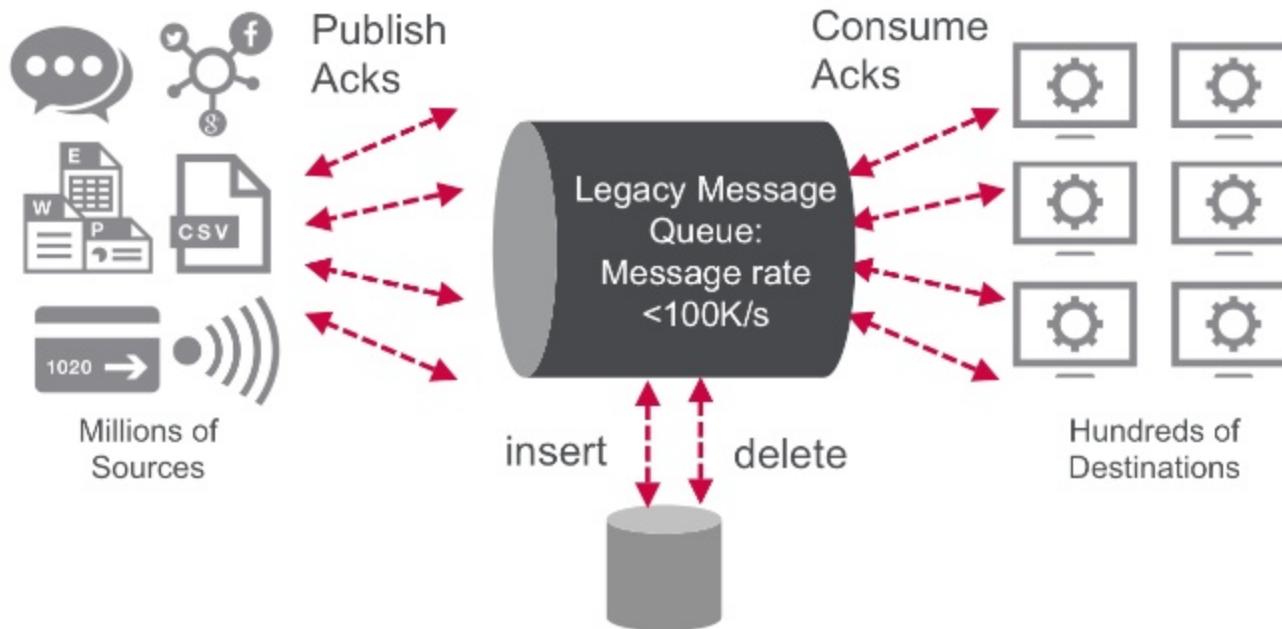
Messages remain on the partition, available to other consumers

When Are Messages Deleted?

- Messages can be persisted forever
- Or
- Older messages can be deleted automatically based on time to live



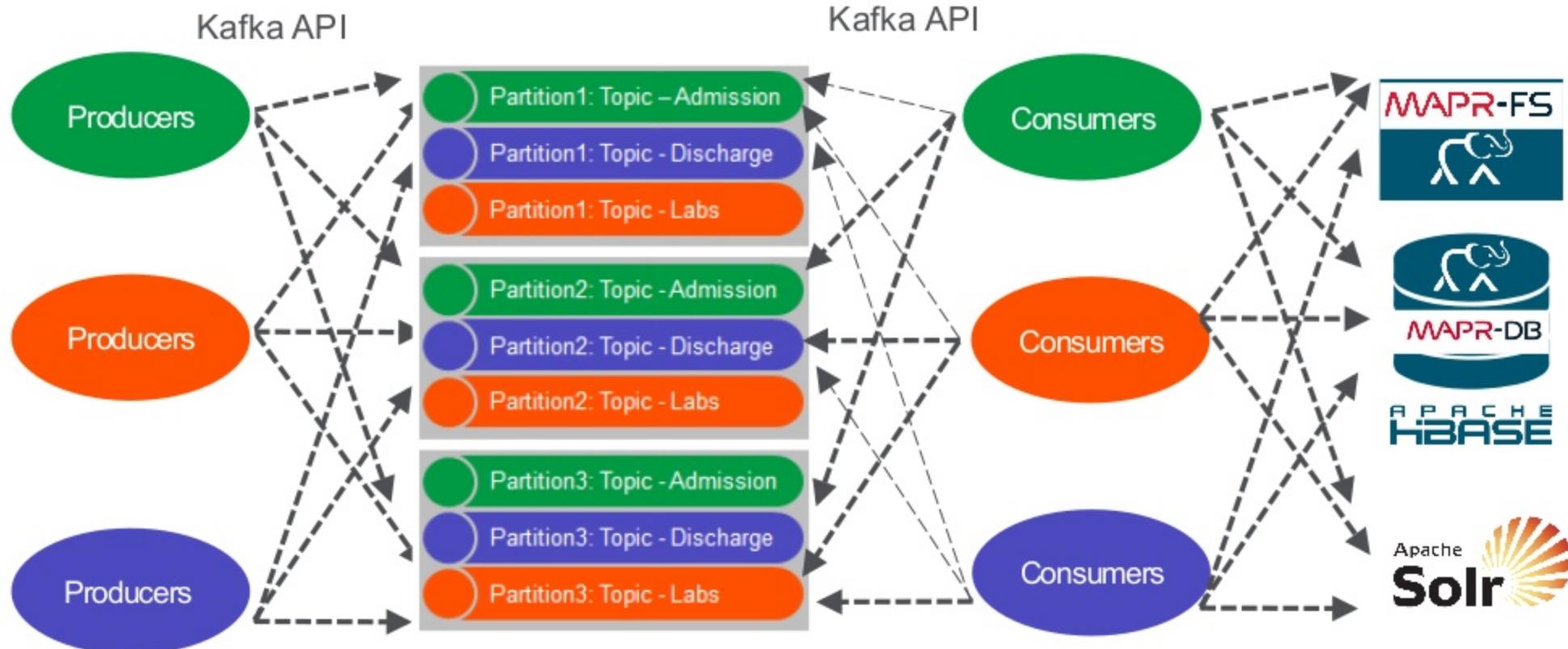
Traditional Message queue



How do we do this with High Performance at Scale?

- Parallel operations
- minimizes disk read/writes

Processing Same Message for Different Purposes



Stream as the System of Record

A Table is a Snapshot of a Stream

Imagine each event as a change to an entry in a database.

- 1: WillO : Deposit : 100.00
- 2: BradA : Deposit : 50.00
- 3: BradA : Withdraw : 30.00
- 4: WillO : Withdraw: 20.00

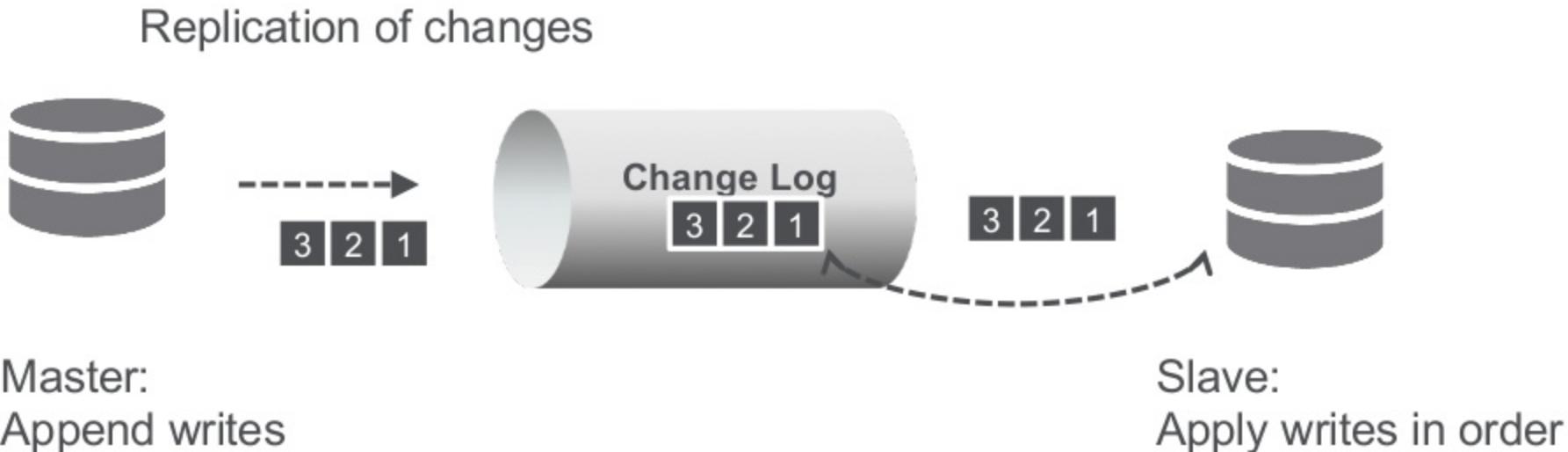


Change log

Account Id	Balance
WillO	80.00
BradA	20.00

<https://engineering.linkedin.com/distributed-systems/log-what-every-software-engineer-should-know-about-real-time-data-unifying>

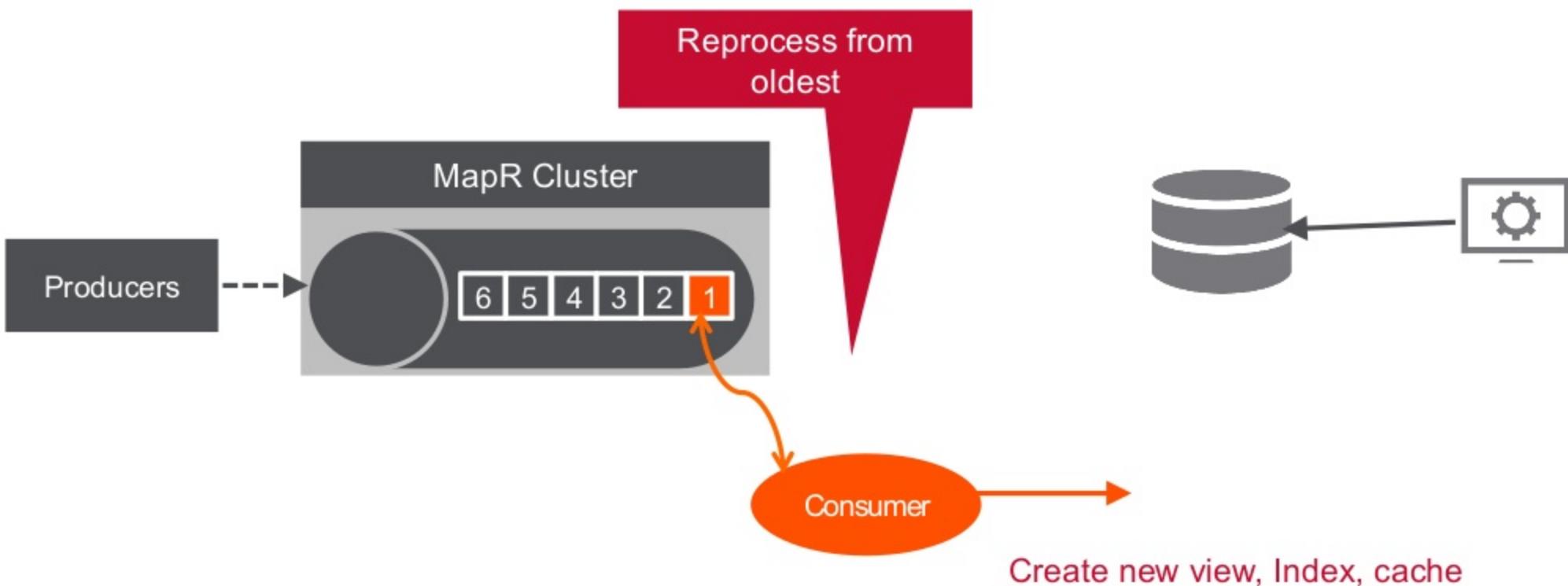
A Stream is a Change Log of a Table



Duality of Streams and Tables

<https://engineering.linkedin.com/distributed-systems/log-what-every-software-engineer-should-know-about-real-time-data-unifying>

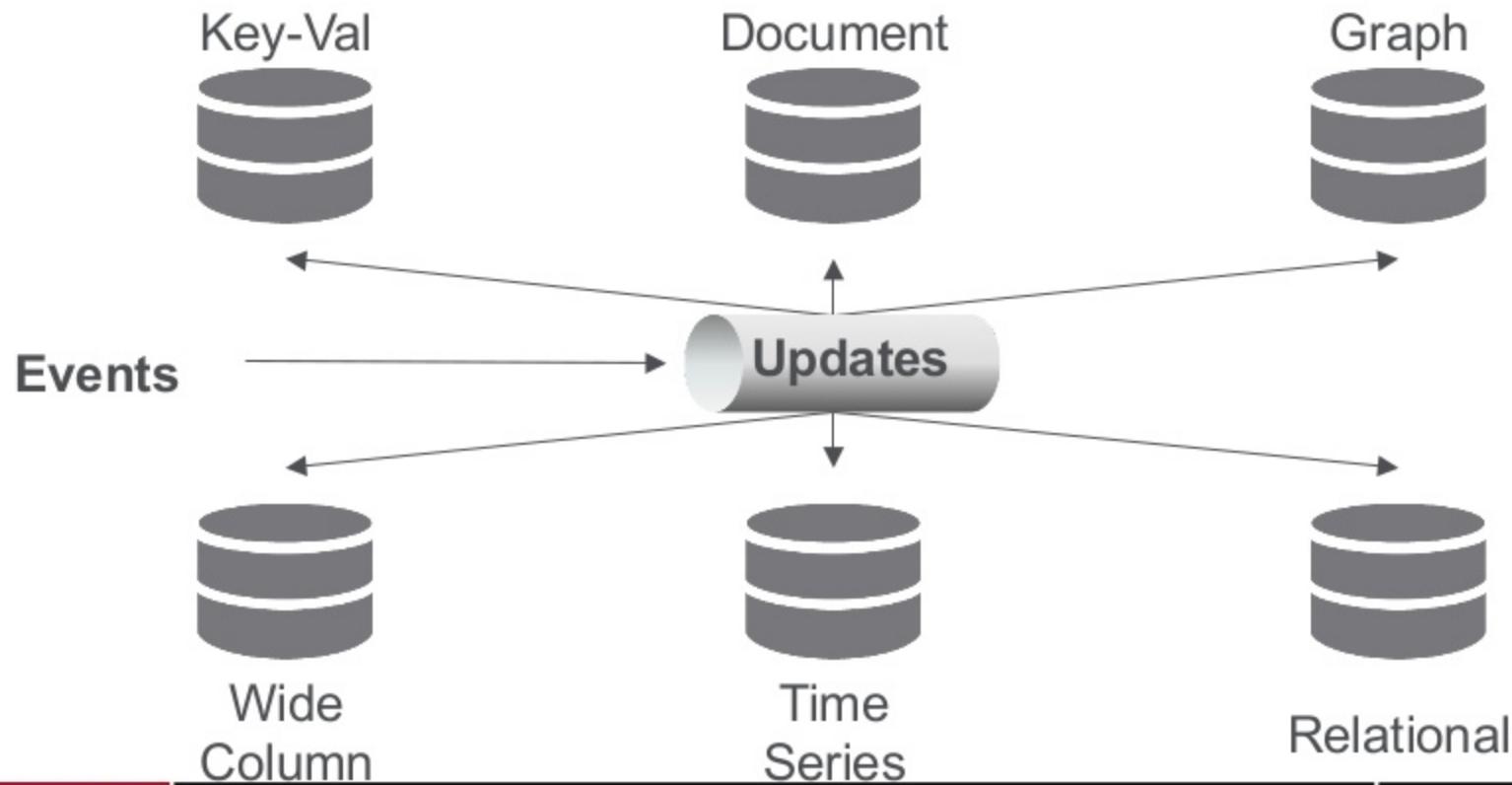
Rewind: Reprocessing Events



Rewind Reprocessing Events



Event Sourcing, Command Query Responsibility Separation: Turning the Database Upside Down



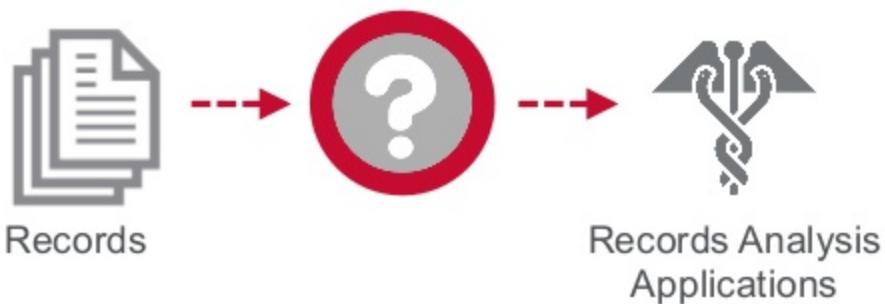
Use Case: Streaming System of Record for Healthcare

Objective:

- Build a flexible, secure healthcare exchange

Challenges:

- Many different data models
- Security and privacy issues
- HIPAA compliance



What are the outcomes in the entire state on diabetes?



Provider
Organizations



Are there doctors that are doing this better than others?

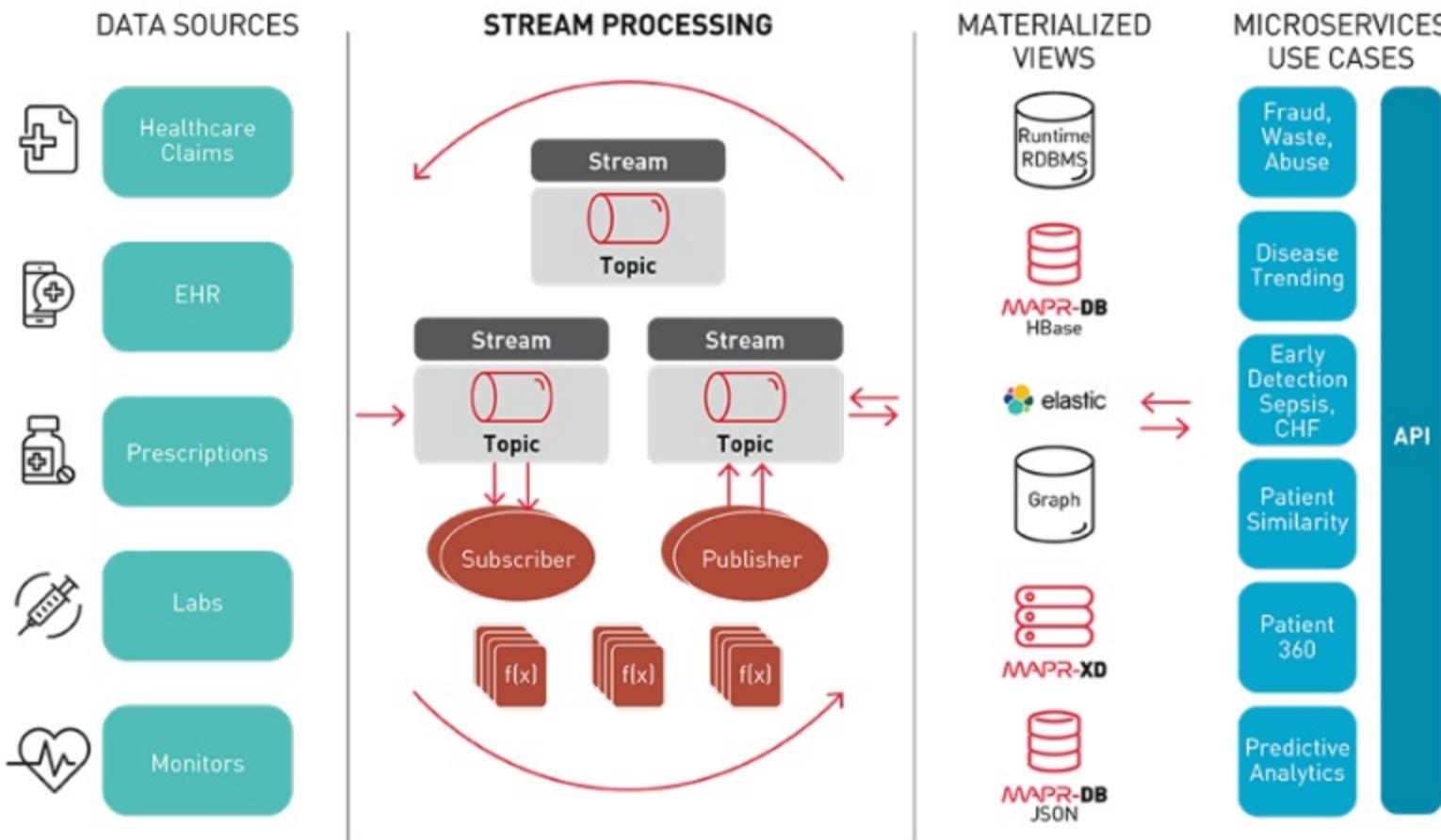


State HIE



GEORGIA
HEALTH
INFORMATION
NETWORK

Use Case: Streaming System of Record for Healthcare



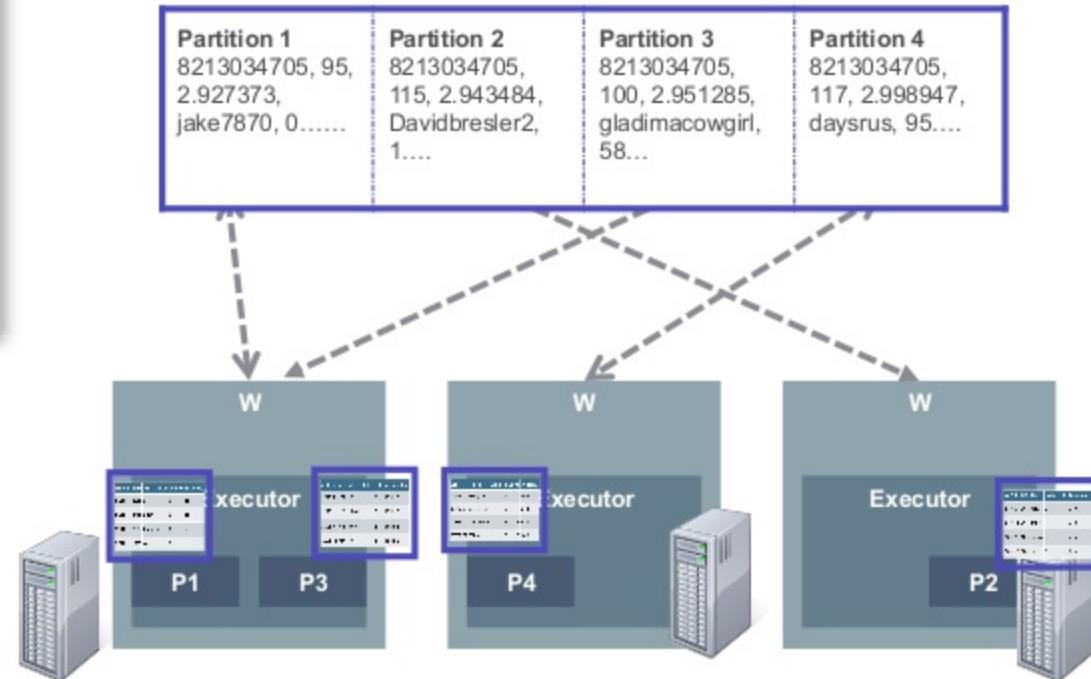
Spark Dataset

Spark Distributed Datasets

- Read only collection of **typed objects**
Dataset[T]
- **Partitioned** across a cluster
- Operated on in **parallel**
- can be **Cached**

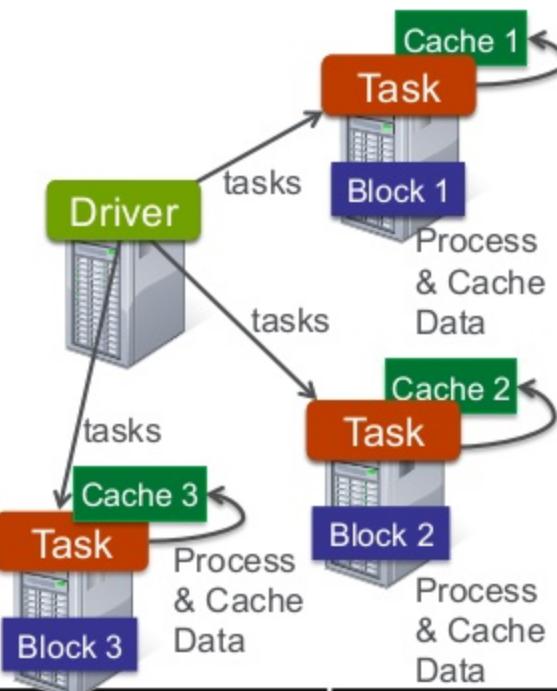


Dataset



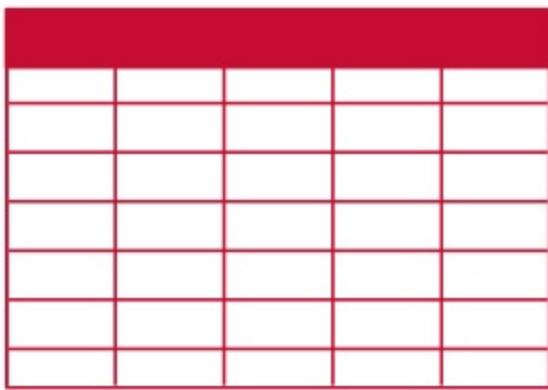
Spark Distributed Datasets read from a file

```
val df: Dataset[Payment] = spark.read.json("/p/file.json").as[Payment]
```



DataFrame = Dataset[Row] can use Spark SQL

DataFrame is like a **table**
Dataset[Row]



Dataset[Typed Object] can use Spark SQL and Functions

A Dataset is a collection of typed objects

Dataset[objects]

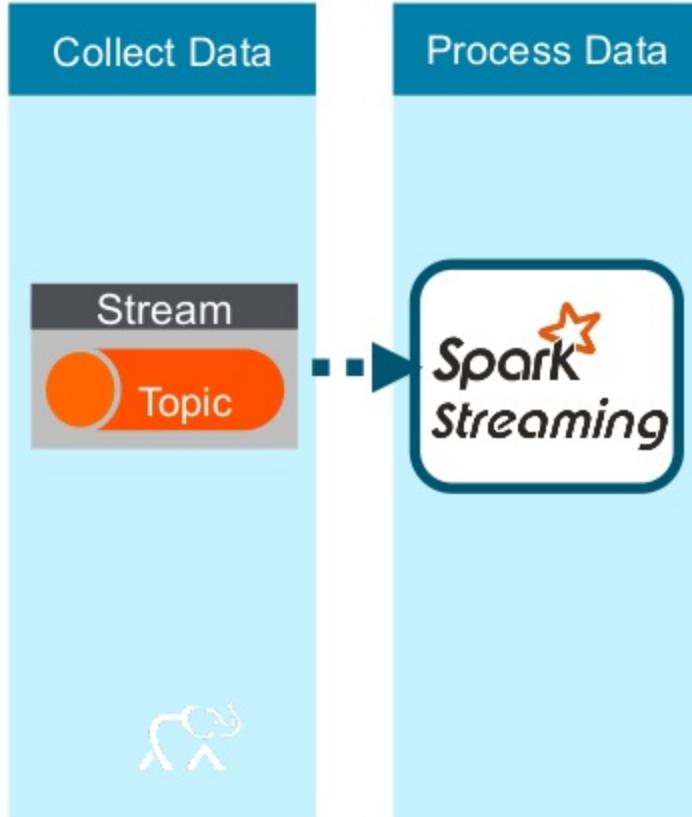


columns

objects

Spark Streaming

Process the Data with Spark Streaming



- scalable, high-throughput, stream processing of live data

What is a Stream ?



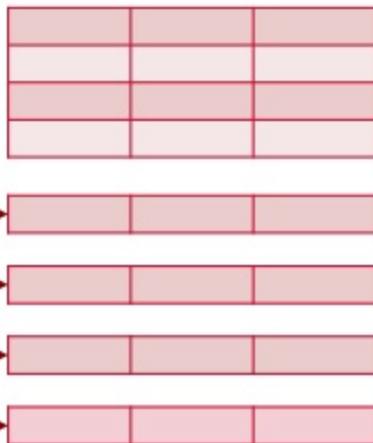
- A **stream** is an **continuous** sequence of events or records
- Records are key-value pairs

Treat Stream as Unbounded Tables

Data stream



Unbounded Table



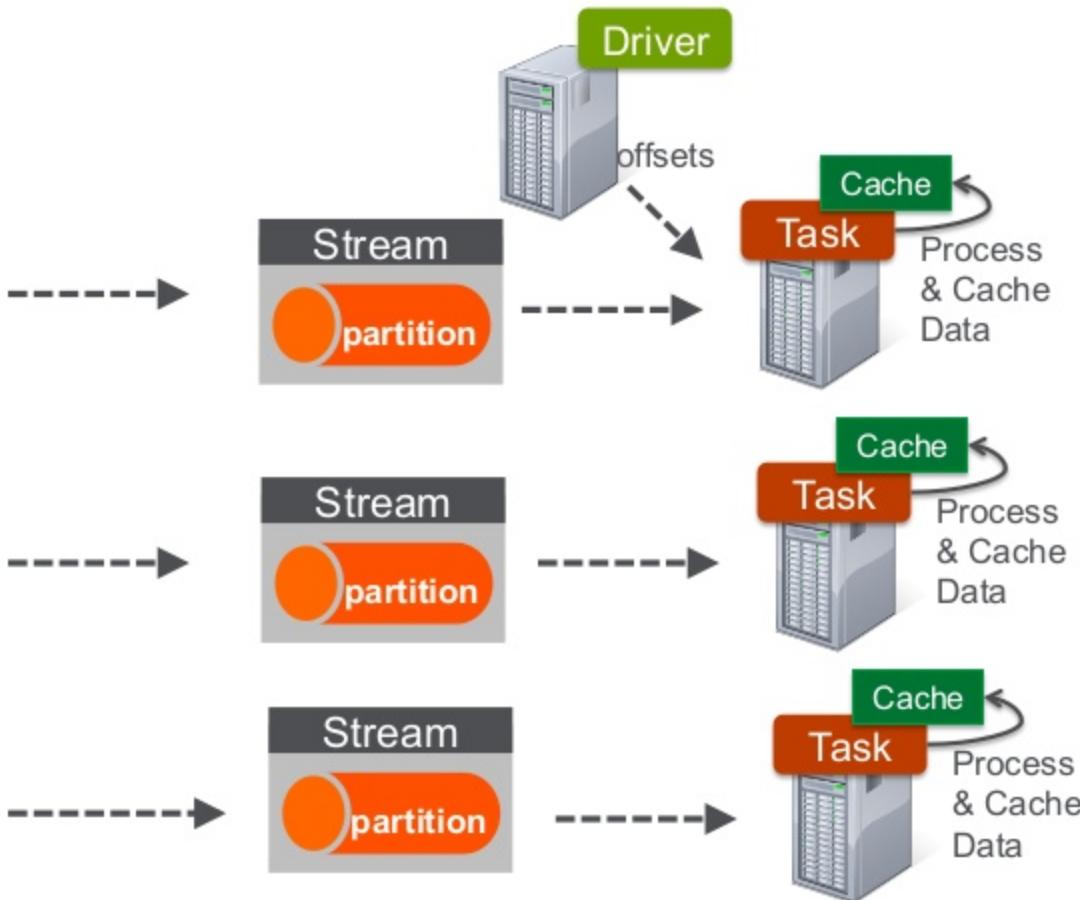
Data stream as an unbounded table

**new data in the
data stream**

=

**new rows appended
to an unbounded table**

Spark Distributed Datasets read from Stream partitions



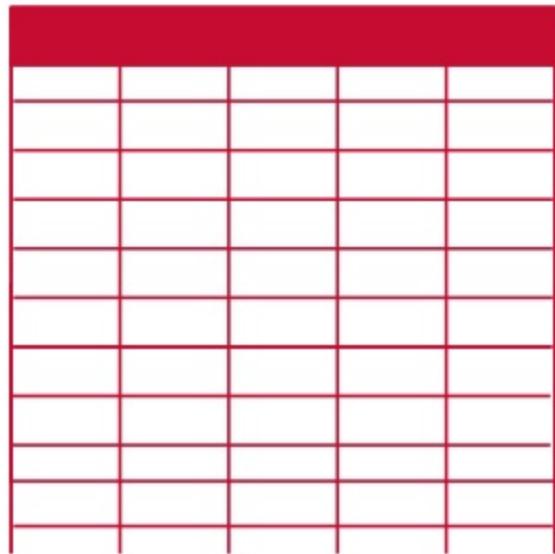
Data is cached for
aggregations
And windowed
functions

Stream Processing on Spark SQL Engine

Static Data =
bounded table



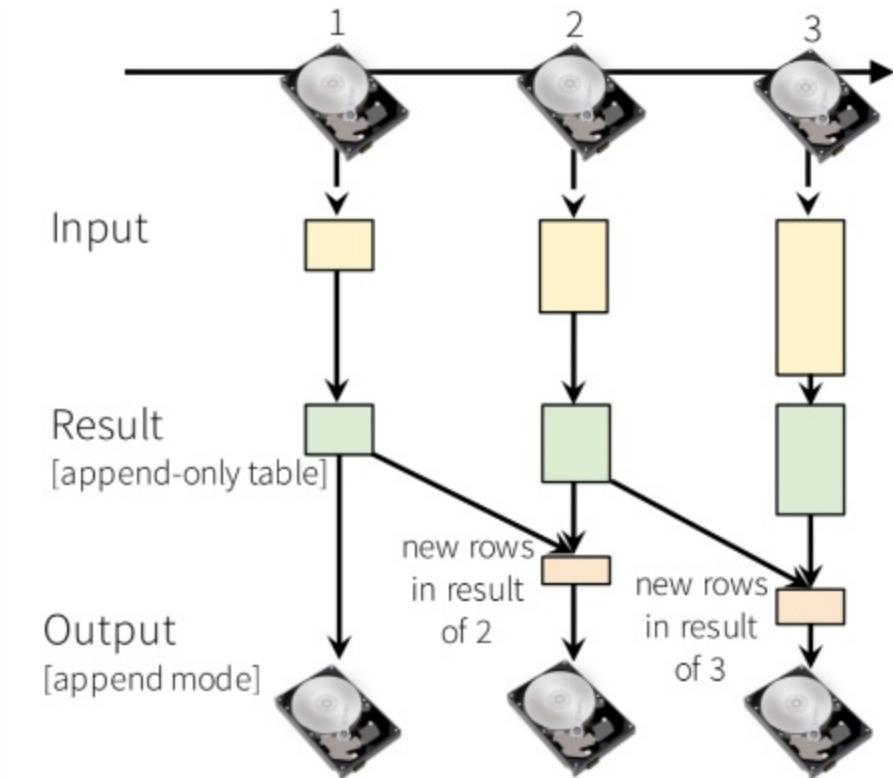
Streaming data =
Unbounded table



Same Dataset operations & SQL

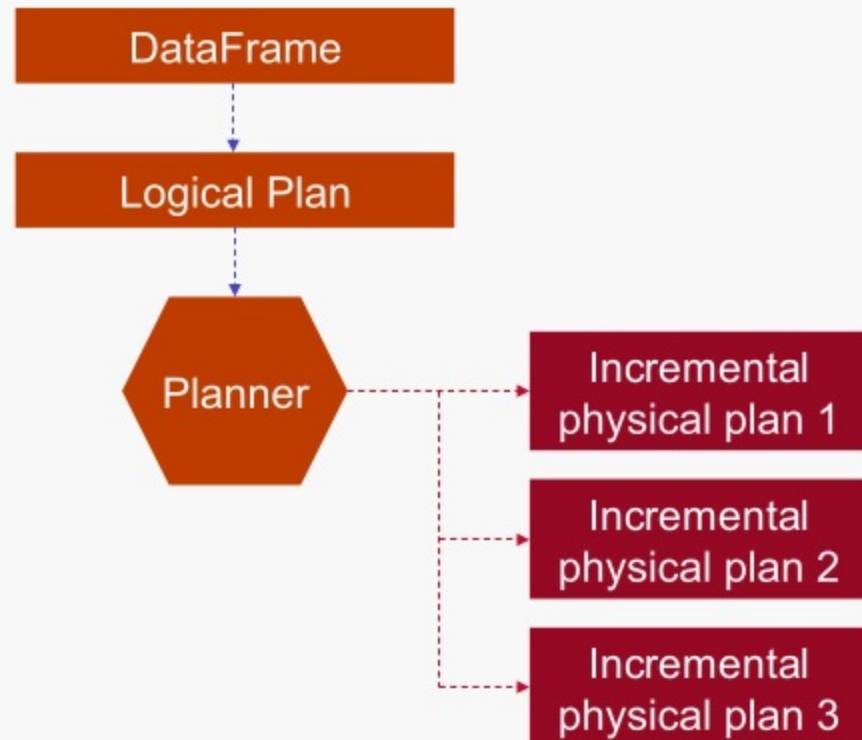
Conceptual model

1. For new input
2. Apply incremental query changes
3. Append the result to Output

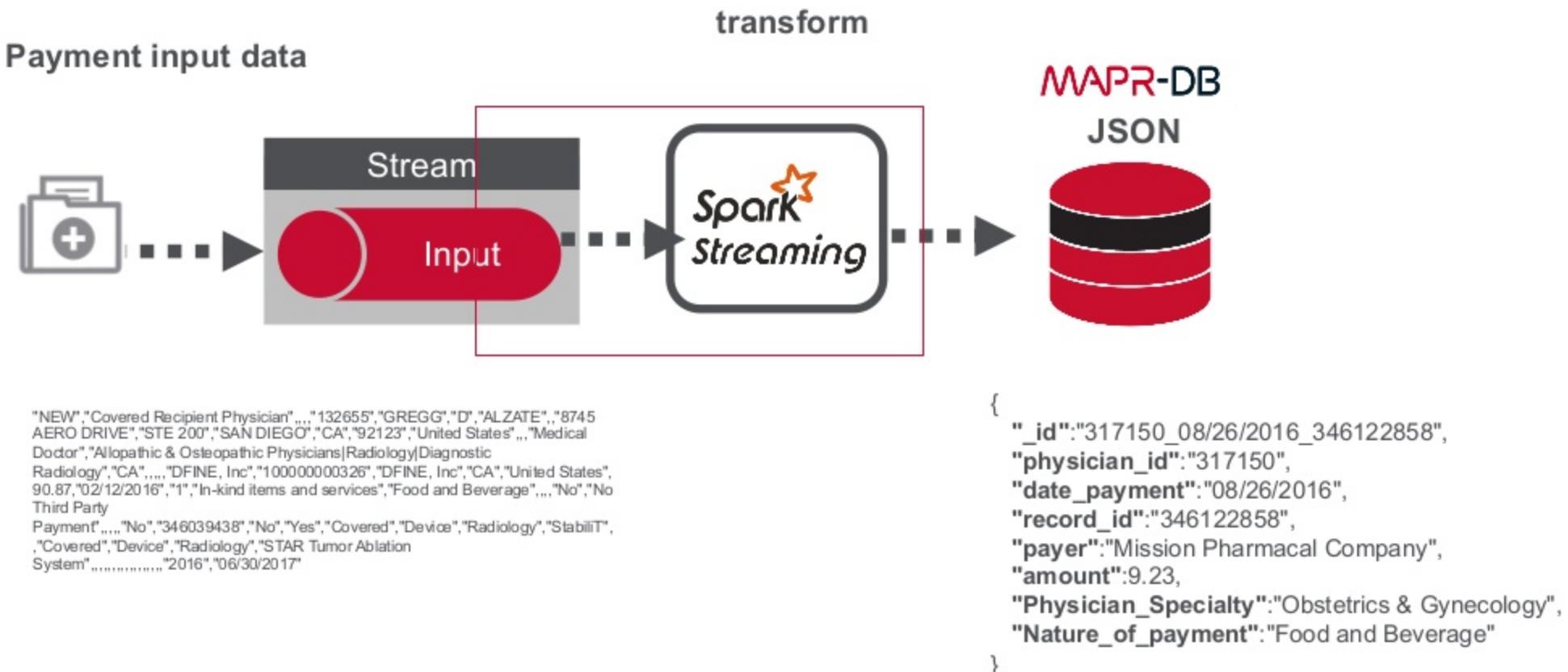


Continuous incremental execution

Spark SQL converts queries
to incremental execution plans
For input of data



Use Case: Payment Data



Use Case: Open Payment Dataset

- Payments Drug and Device companies make to
- Physicians and Teaching Hospitals for
- Travel, Research, Gifts, Speaking fees, and Meals

The Facts About Open Payments Data



Scenario: Payment Data

Provider ID	Date	Payer	Payer State	Provider Specialty	Provider State	Amount	Payment Nature
1261770	01/11/2016	Southern Anesthesia & Surgical, Inc	CO	Oral and Maxillofacial Surgery	CA	117.5	Food and Beverage

Stream the data into a Dataframe: Define the Schema

```
case class Payment(physician_id: String,  
date_payment: String, payer: String, payer_state: String  
amount: Double, physician_specialty: String,  
phys_state: String, nature_of_payment:String)  
  
val schema = StructType(Array(  
StructField("_id", StringType, true),  
StructField("physician_id", StringType, true),  
StructField("date_payment", StringType, true),  
StructField("payer", StringType, true),  
StructField("payer_state", StringType, true),  
StructField("amount", DoubleType, true),  
StructField("physician_specialty", StringType, true),  
StructField("physician_type", StringType, true),  
StructField("physician_state", StringType, true),  
StructField("nature_of_payment", StringType, true)  
))
```

Function to Parse CSV into Payment Class

```
def parse(str: String): Payment = {
    val td = str.split(",(?=([^\"]*\"[^\"]*\"[^\\\"]*[^\\\"]*$))")
    val physician_id = td(5)
    val payer = td(27)
    . . .
    val physician_state = td(20)
    var focus =td(19)
    val id =physician_state+'_'+focus+ '_' + date_payment+ '_'
        + record_id
    Payment(id, physician_id, date_payment, payer, payer_state,
            amount, physician_type, focus, physician_state,
            nature_of_payment)
```

Parsed and Transformed Payment Data

Example Dataset Row

```
{  
  "_id": "TX_Gynecology_08/26/2016_346122858",  
  "physician_id": "317150",  
  "date_payment": "08/26/2016",  
  "payer": "Mission Pharmacal Company",  
  "payer_state": "CO",  
  "amount": 9.23,  
  "physician_specialty": "Gynecology",  
  "physician_state": "TX"  
  "nature_of_payment": "Food and Beverage"  
}
```

Streaming pipeline Data source

```
val df1 = spark.readStream.format("kafka")  
.option("kafka.bootstrap.servers",...)  
.option("subscribe", "topic")  
.load()
```



**Specify data source
returns a dataframe**

Kafka DataFrame

key	value	topic	partition	offset	timestamp
[binary]	[binary]	"topic"	0	345	1486087873
[binary]	[binary]	"topic"	3	2890	1486086721

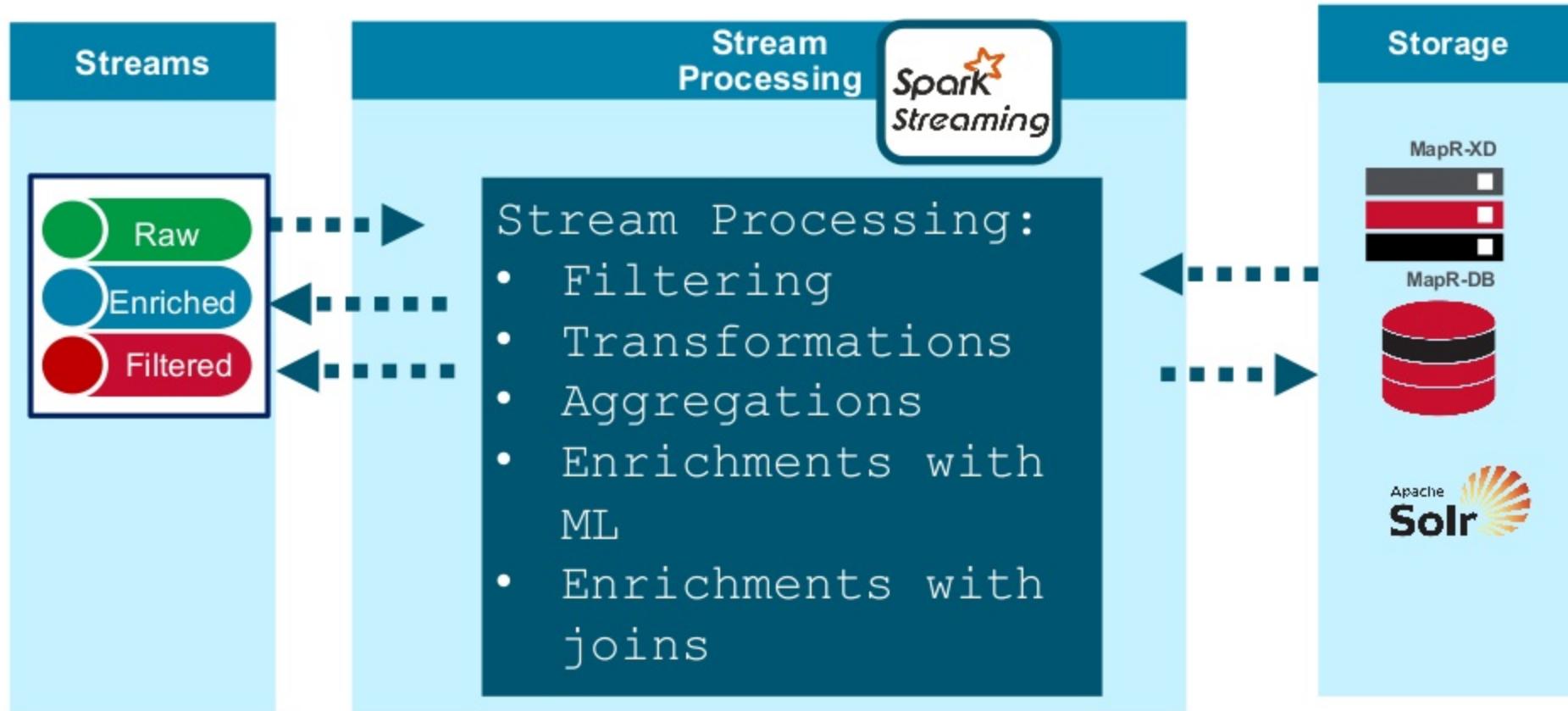
Transformation

```
spark.udf.register("deserialize",
  message: String) => parse(message))
```

```
val df2=df1
  .selectExpr("""deserialize(CAST(value as STRING))
  AS message""")
  .select($"message".as[Payment])
```

Cast bytes from Kafka records
to a string, parse csv , and
return Dataset[Payment]

Stream Processing



Dataframe Integrated Queries

L I Query	Description
<code>agg(expr, exprs)</code>	Aggregates on entire DataFrame
<code>distinct</code>	Returns new DataFrame with unique rows
<code>except(other)</code>	Returns new DataFrame with rows from this DataFrame not in other DataFrame
<code>filter(expr); where(condition)</code>	Filter based on the SQL expression or condition
<code>groupBy(cols: Columns)</code>	Groups DataFrame using specified columns
<code>join (DataFrame, joinExpr)</code>	Joins with another DataFrame using given join expression
<code>sort(sortcol)</code>	Returns new DataFrame sorted by specified column
<code>select(col)</code>	Selects set of columns

Continuous aggregations

```
val d3=df2.avg("amount")
```

Continuously compute **average** payment amount

```
spark.sql("SELECT avg(amount) FROM payment2").show()
```

```
+-----+  
|      avg(amount)|  
+-----+  
|1662.5487485242039|  
+-----+
```

Continuous aggregations and filter

```
val d3=df2.groupBy("payer")  
    .avg("amount")
```

Continuously compute **average** payment amount
by payer

```
spark.sql("SELECT payer, avg(amount) FROM payment2 group by payer ").show()
```

payer	avg(amount)
Ciel Medical Incl	4153.666666666667
Southern Anesthe...	670.01
IHF Acquisition Co...	1708.333333333333
Mission Pharmacal...	11.99500000000001
DFINE, Inc	211.72225728155328
Affordable Pharma...	44246.082500000041

Continuous aggregations and filter

```
val d3=df2  
    .filter($"amount" > 20000)      Continuously filter large payment amount
```

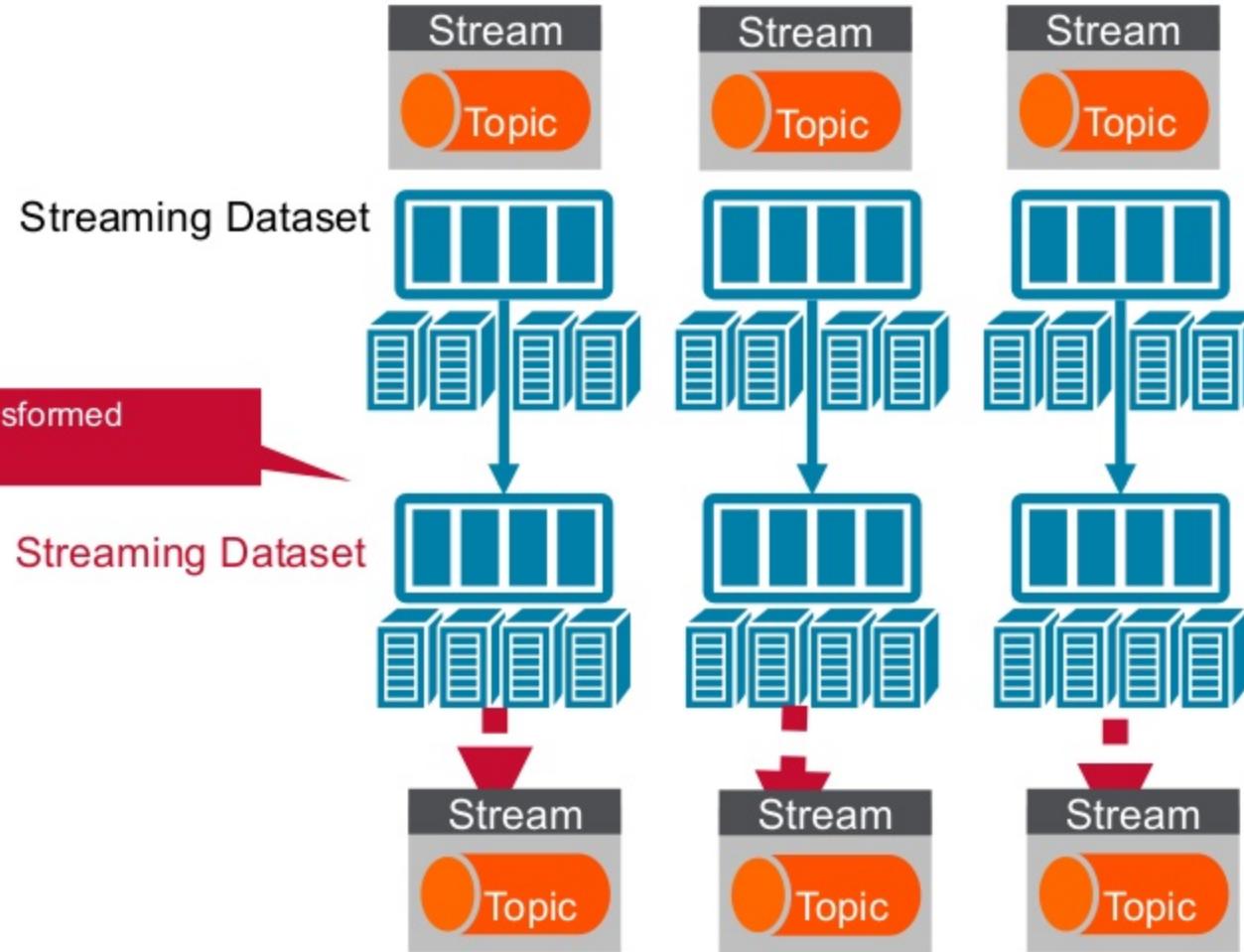
Streaming pipeline Kafka topic Data Sink

```
val query = df3.write  
.format("kafka")  
.option("kafka.bootstrap.servers", "host1:port1,host2:port2")  
.option("topic", "/apps/uberstream:uberp")
```

```
query.start.awaitTermination()
```

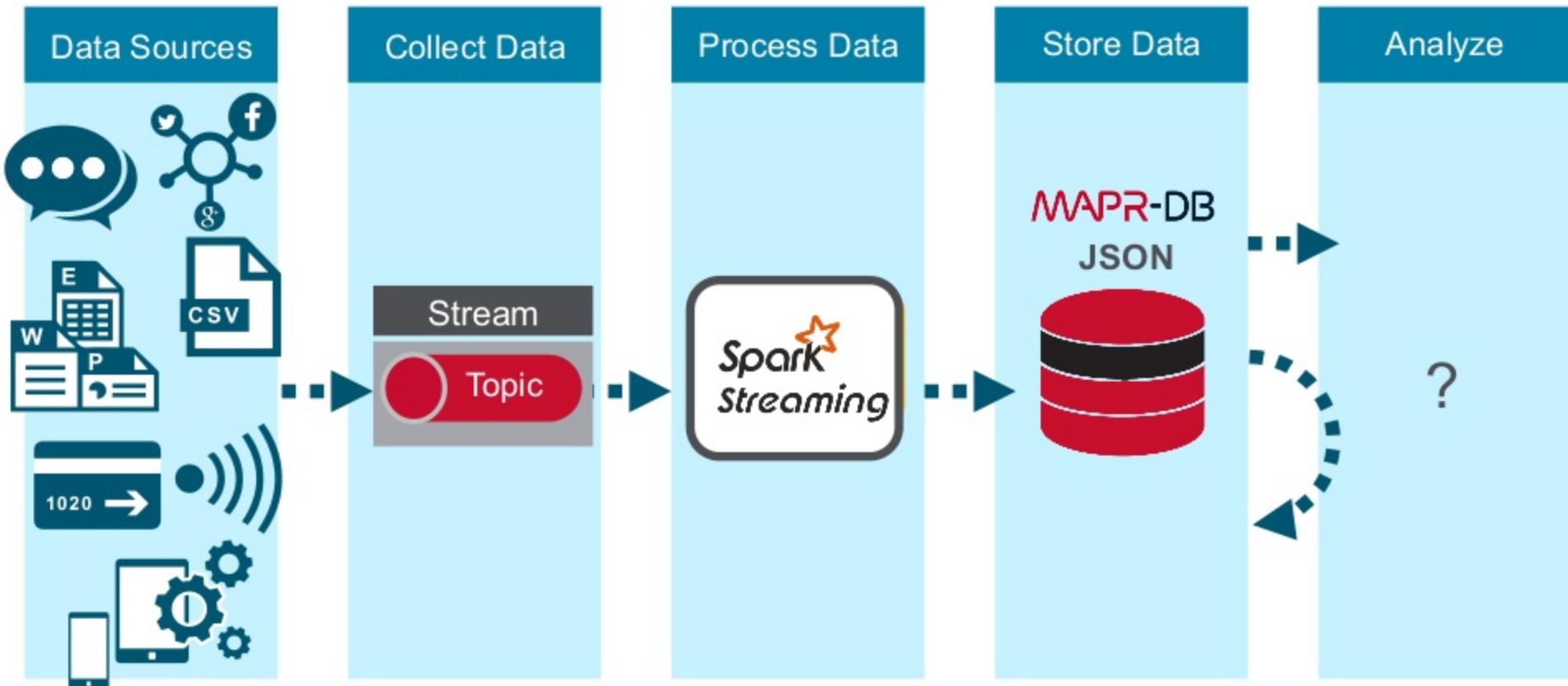
**Write results to Kafka topic
Start running the query**

Streaming Application

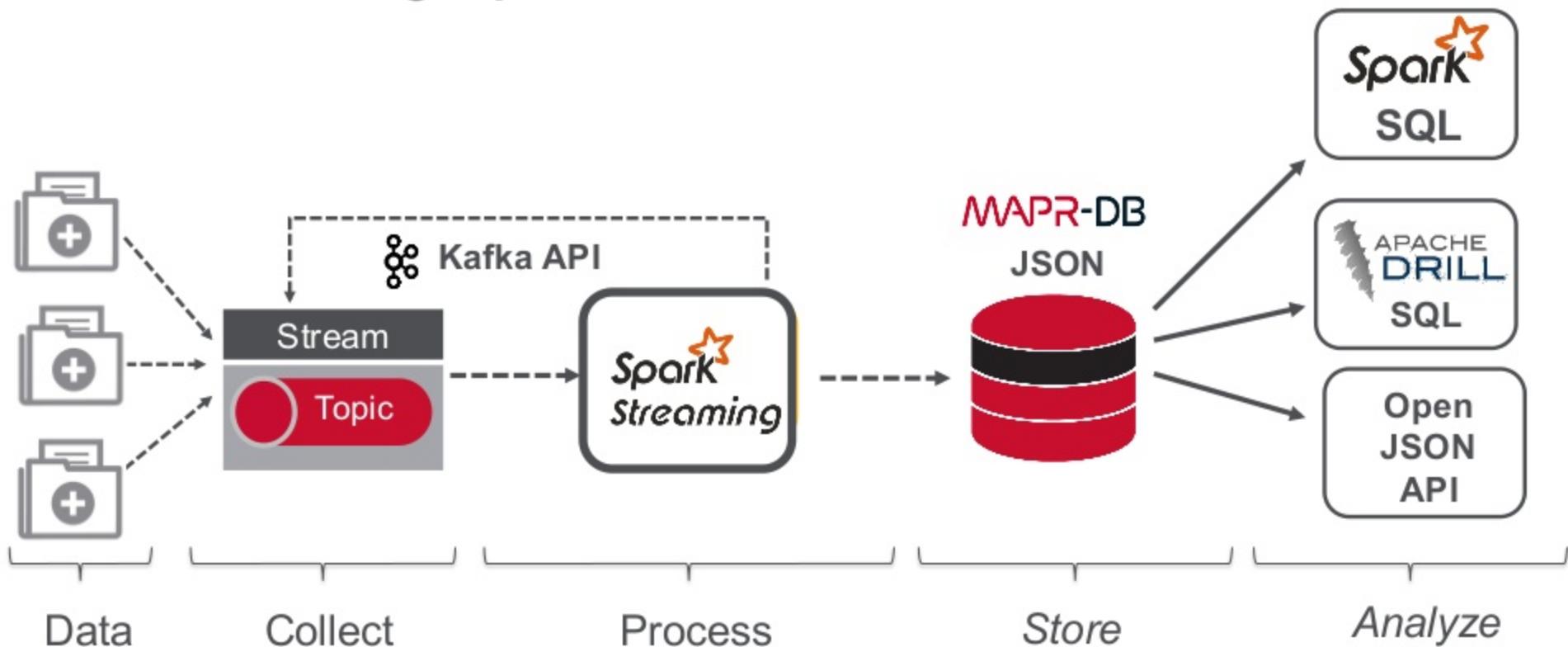


Spark & MapR-DB

What Do We Need to Do ?

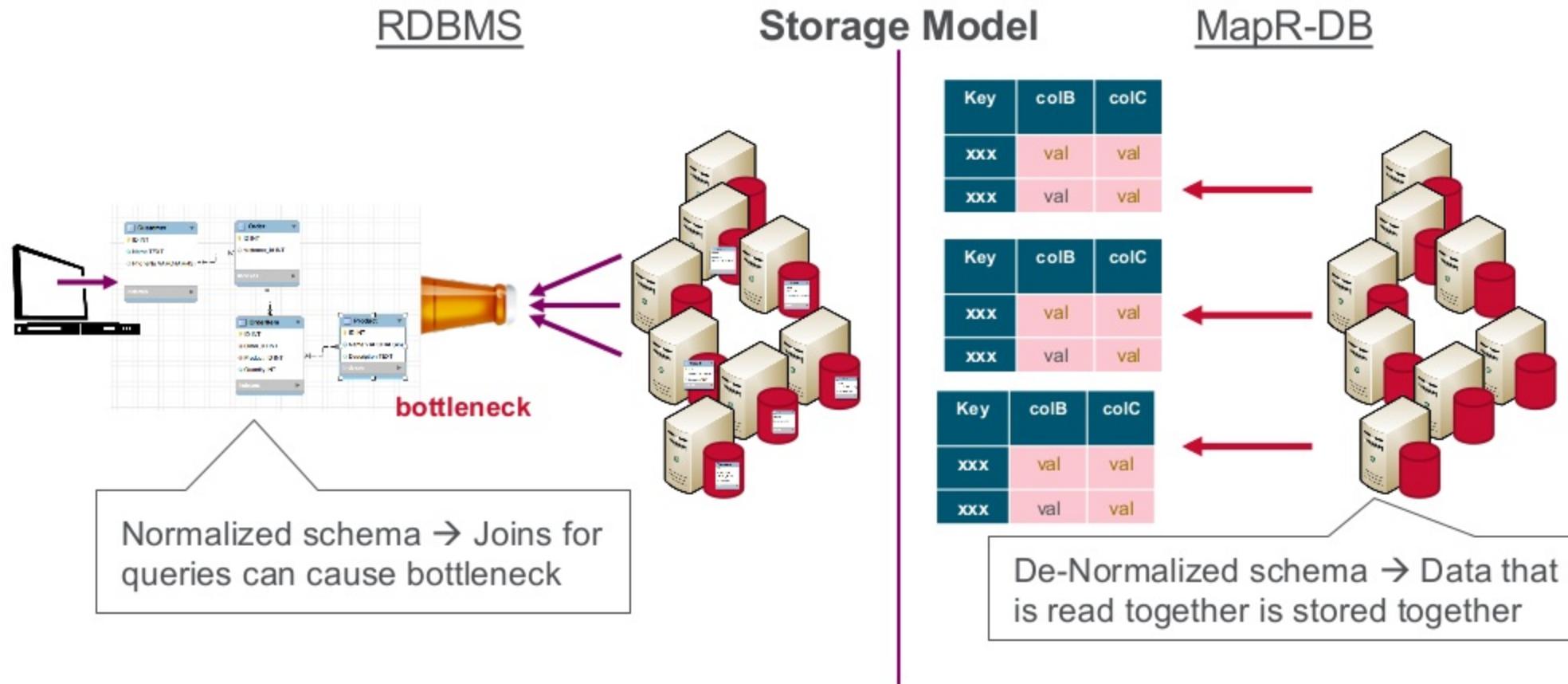


Stream Processing Pipeline



Where/How to store data ?

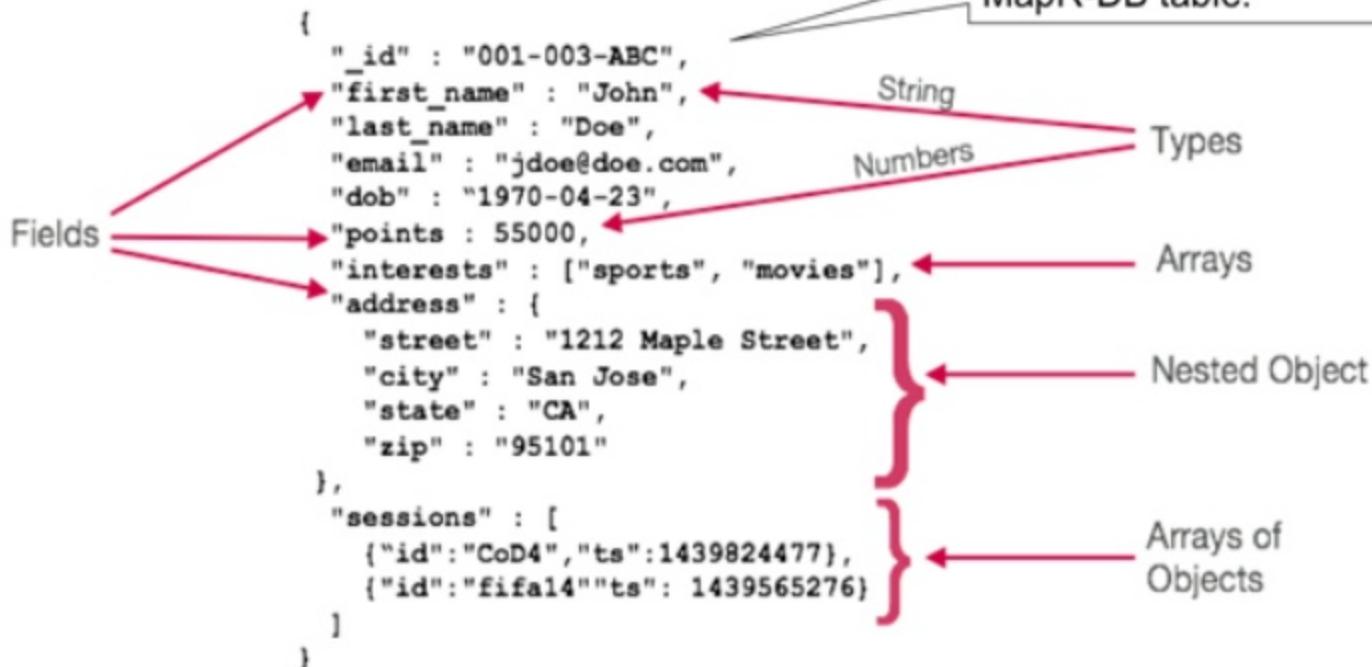
Relational Database vs. MapR-DB



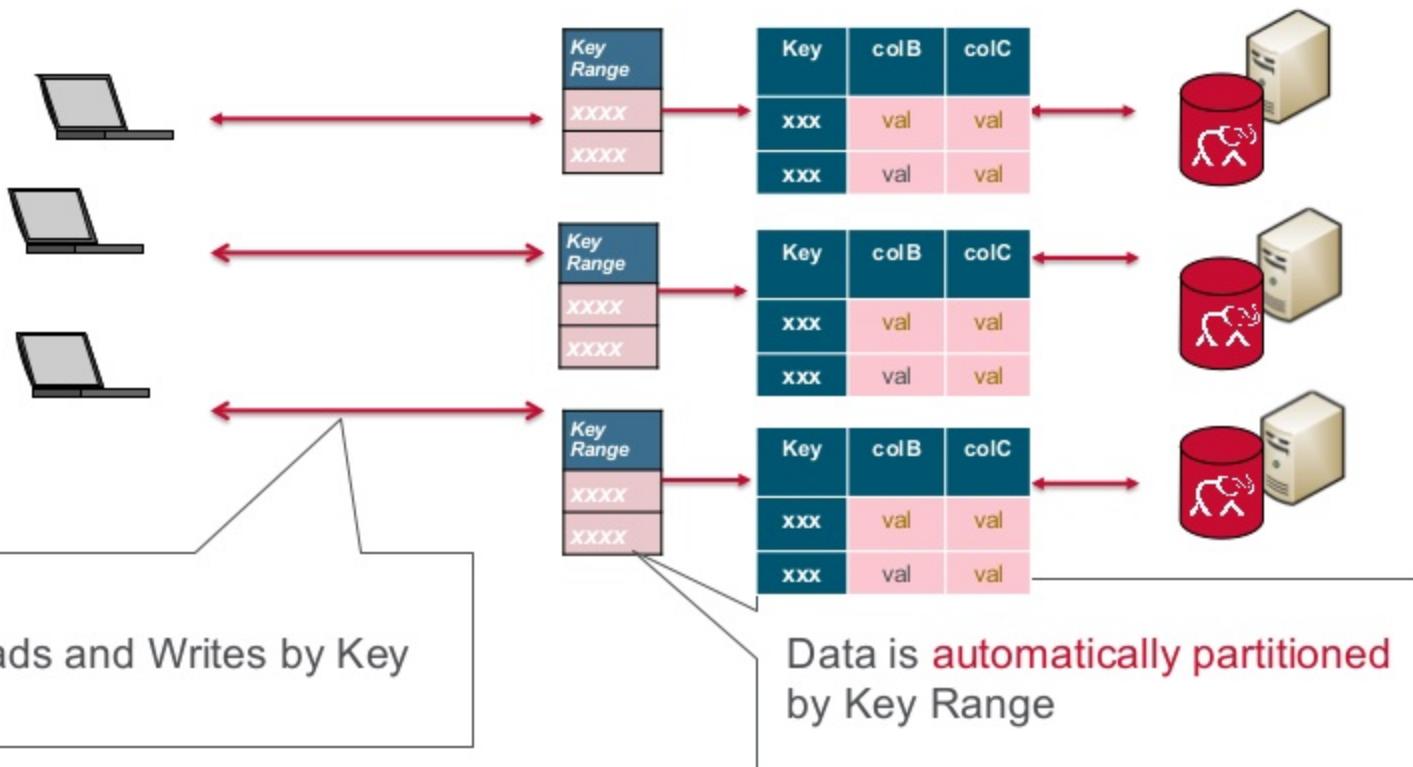
MapR-DB JSON Document Store

Data that is **read together** is **stored together**

Row Keys: identify the rows in an MapR-DB table.



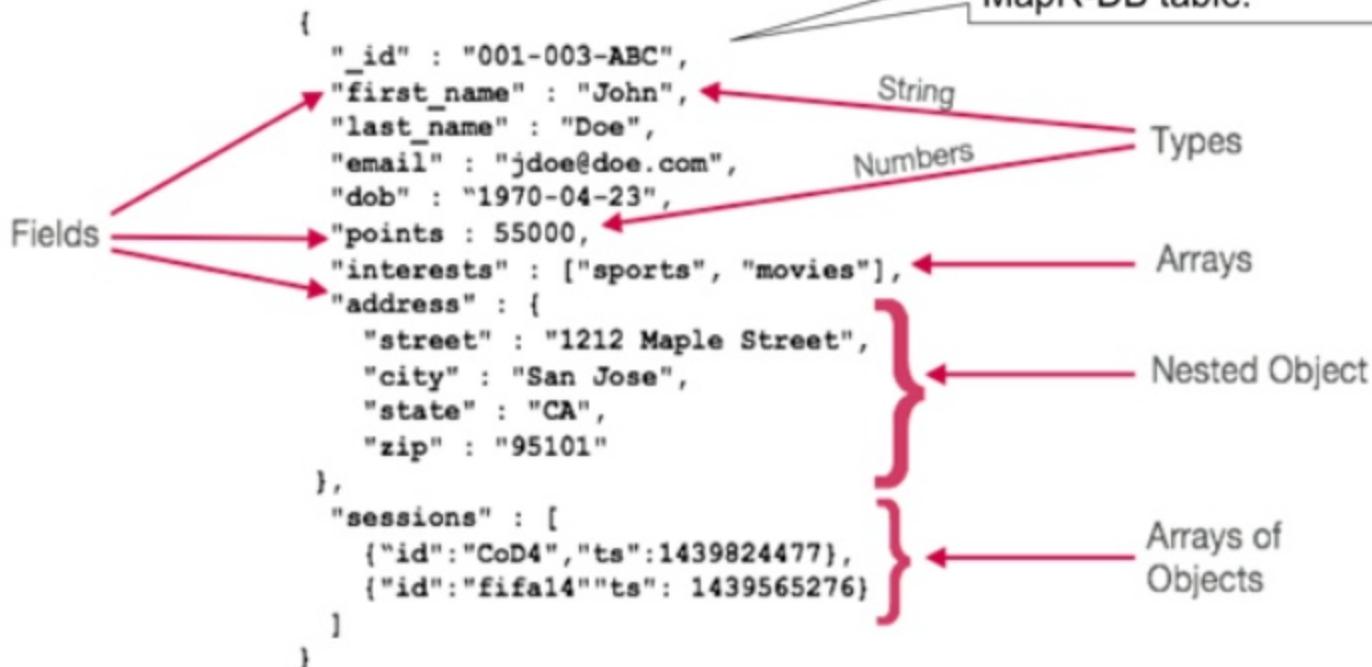
Designed for Partitioning and Scaling



MapR-DB JSON Document Store

Data is automatically partitioned by Key Range

Row Keys: identify the rows in an MapR-DB table.

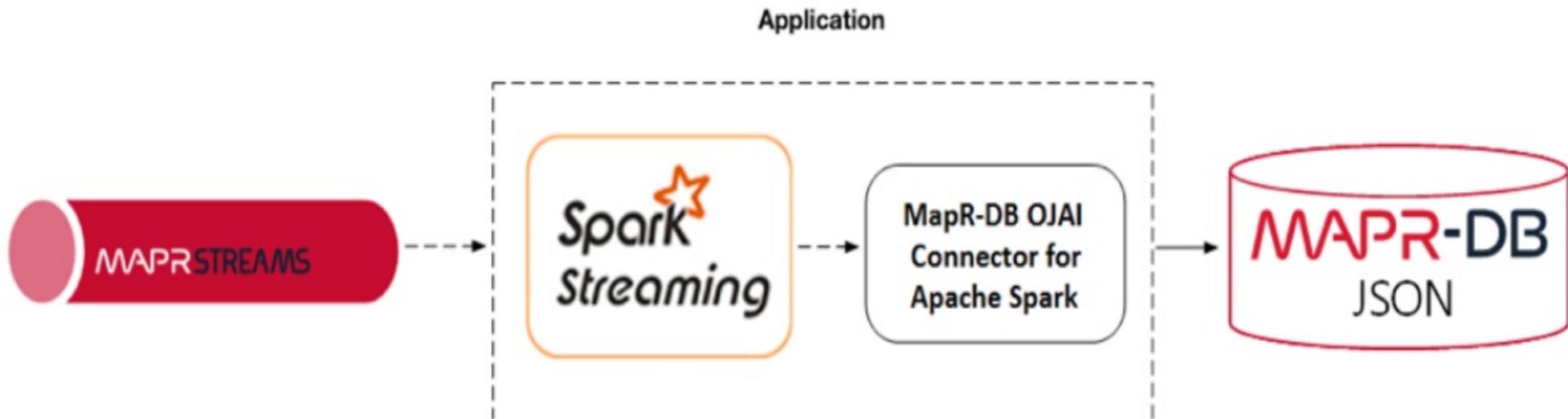


Payment Data

Automatically sorted and
partitioned by Key Range
(_id)

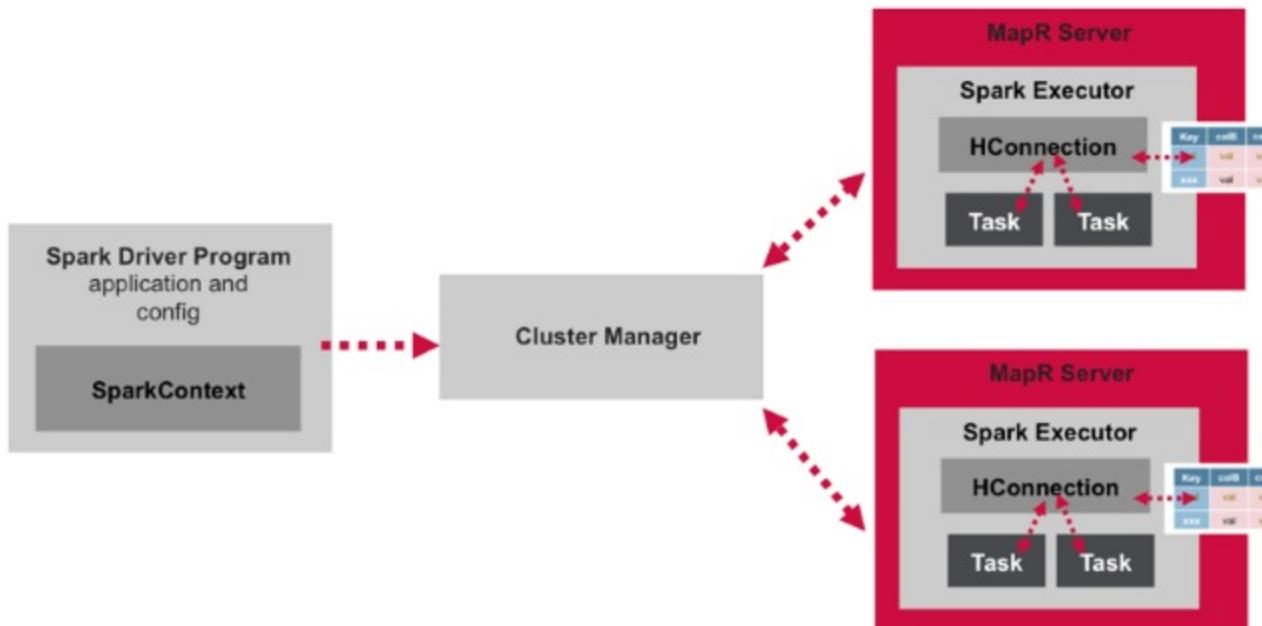
```
{  
  "_id": "TX_Gynecology_08/26/2016_346122858",  
  "physician_id": "317150",  
  "date_payment": "08/26/2016",  
  "payer": "Mission Pharmacal Company",  
  "payer_state": "CO",  
  "amount": 9.23,  
  "physician_specialty": "Gynecology",  
  "physician_state": "TX"  
  "nature_of_payment": "Food and Beverage"  
}
```

Spark Streaming writing to MapR-DB JSON

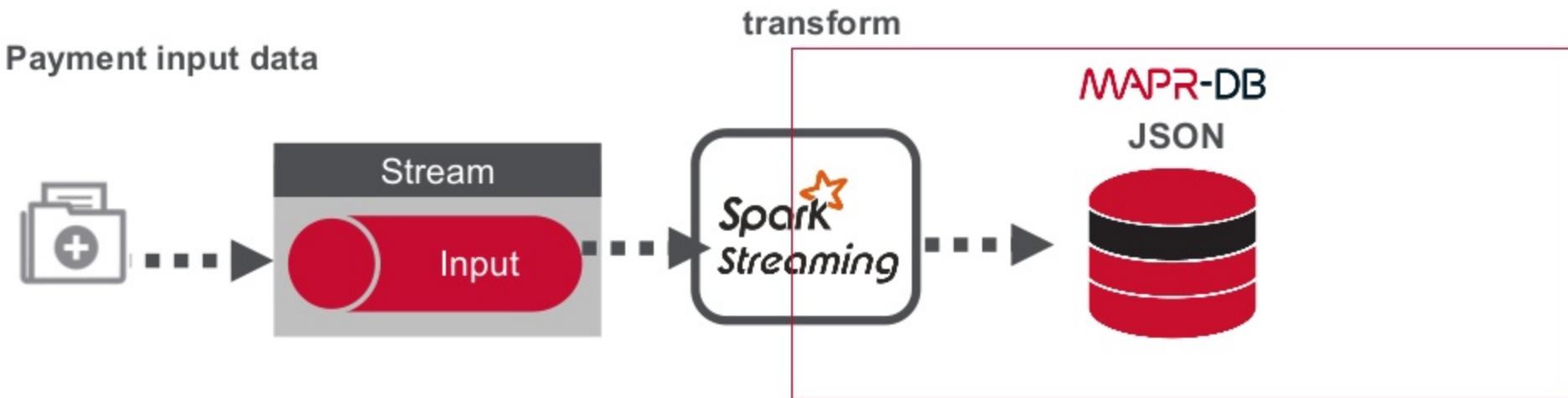


Spark MapR-DB Connector

- Connection object in every Spark Executor:
- **distributed parallel writes & reads**



Use Case: Flight Delays



"NEW", "Covered Recipient Physician", "132655", "GREGG", "D", "ALZATE", "8745
AERO DRIVE", "STE 200", "SAN DIEGO", "CA", "92123", "United States", "Medical
Doctor", "Allopathic & Osteopathic Physicians|Radiology|Diagnostic
Radiology", "CA", "...", "DFINE, Inc", "100000000326", "DFINE, Inc", "CA", "United States",
90.87, "02/12/2016", "1", "In-kind items and services", "Food and Beverage", "...", "No", "No
Third Party
Payment", "...", "No", "346039438", "No", "Yes", "Covered", "Device", "Radiology", "StabiliT",
"Covered", "Device", "Radiology", "STAR Tumor Ablation
System", "...", "2016", "06/30/2017"

{
 "_id": "317150_08/26/2016_346122858",
 "physician_id": "317150",
 "date_payment": "08/26/2016",
 "record_id": "346122858",
 "payer": "Mission Pharmacal Company",
 "amount": 9.23,
 "Physician_Specialty": "Obstetrics & Gynecology",
 "Nature_of_payment": "Food and Beverage"
}

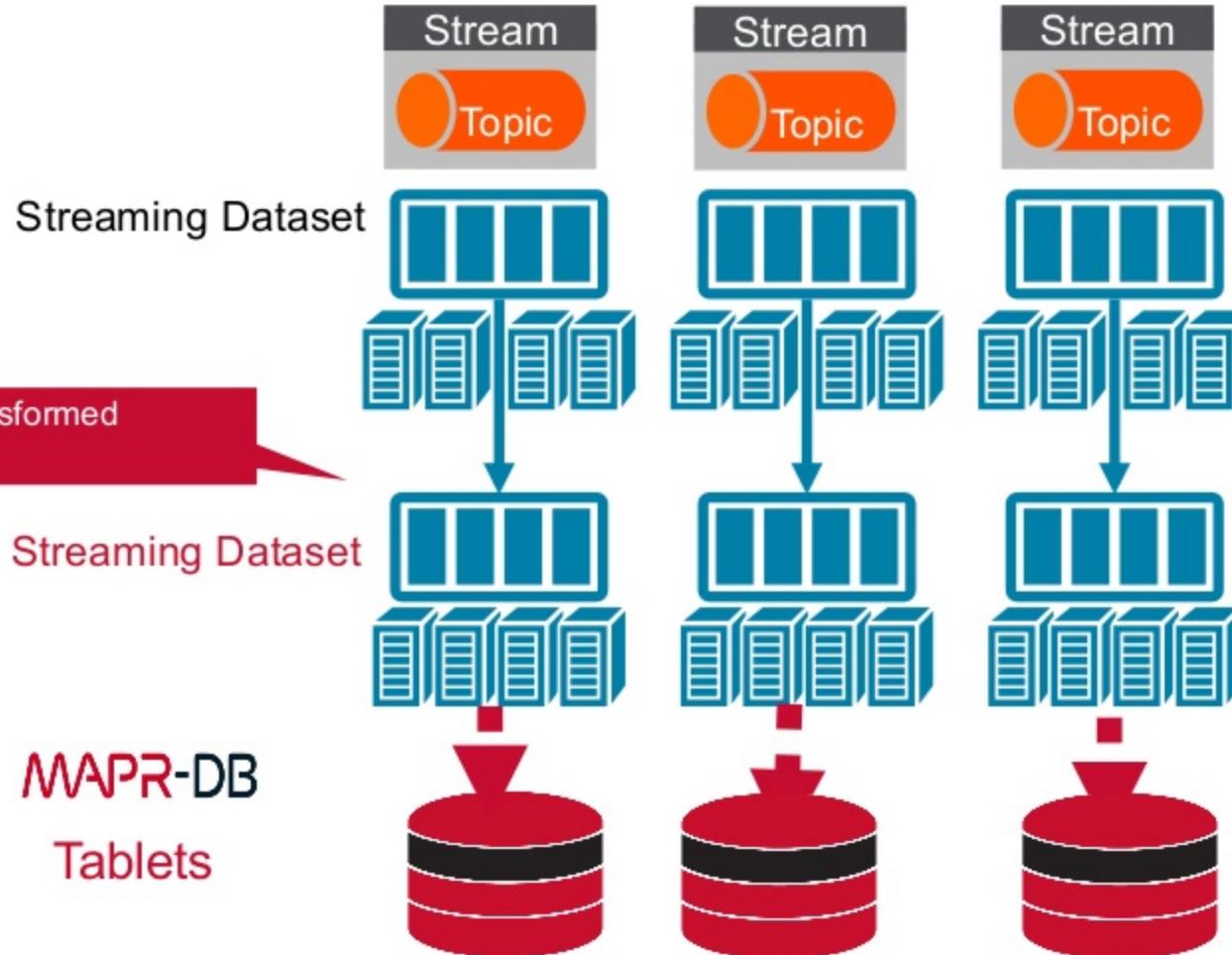
Streaming pipeline Data Sink

```
val query = df2.writeStream  
    .format(MapRDBSourceConfig.Format)  
    .option(MapRDBSourceConfig.TablePathOption, "/apps/paytable")  
    .option(MapRDBSourceConfig.CreateTableOption, false)  
    .option(MapRDBSourceConfig.IdFieldPathOption, "value")  
    .outputMode("append")
```

```
query.start().awaitTermination()
```

Write result to maprdb
Start running the query

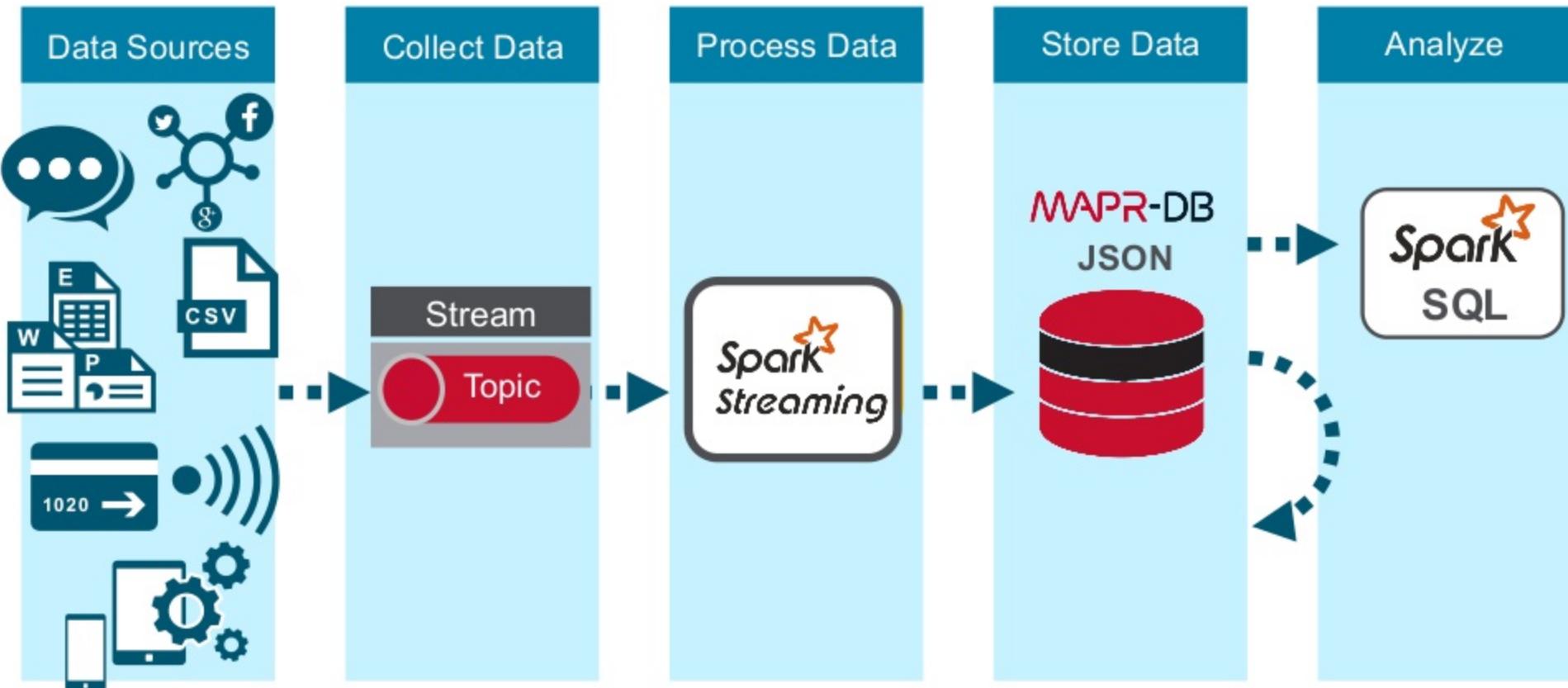
Streaming Application



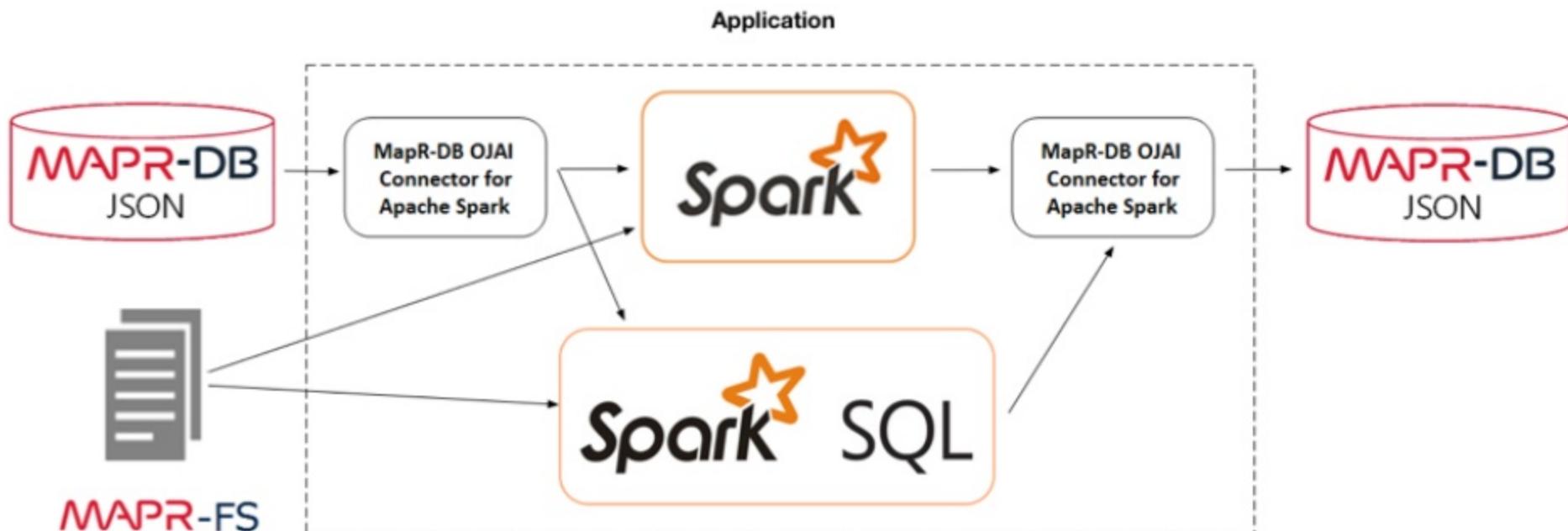
Data is rapidly available for complex, ad-hoc analytics

Explore the Data With Spark SQL

What Do We Need to Do ?



Spark SQL Querying MapR-DB JSON



Load the data into a Dataframe



```
val pdf: Dataset[Payment] =  
    spark.loadFromMapRDB[Payment]("apps/paytable", schema)  
    .as[Payment]
```

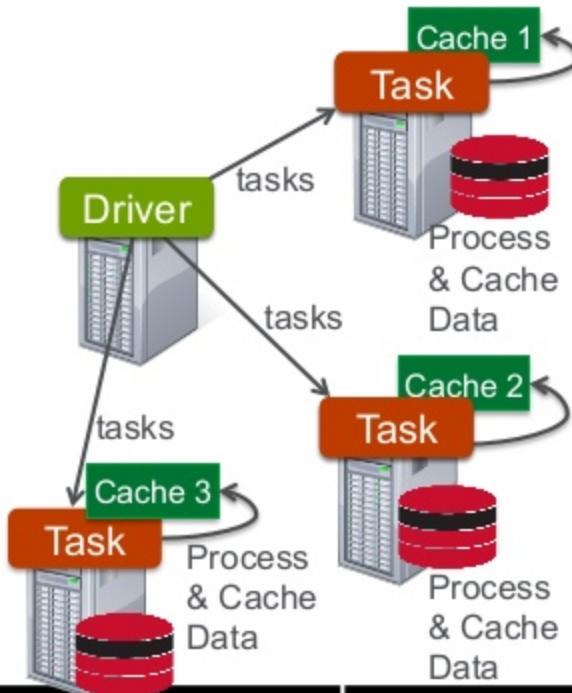
```
pdf.select("_id", "payer", "amount").show
```

_id	payer	amount
AK_Anesthesiology_04/01/2016_346088758	Mission Pharmacal Company	19.58
AK_Gastroenterology_03/15/2016_346146914	Braintree Laboratories, Inc.	13.33
AK_General Practice_10/13/2016_346134424	Mission Pharmacal Company	21.6
AK_Gynecology_12/05/2016_346591748	Bovie Medical Corporation	92.71
AK_Obstetrics & Gynecology_12/05/2016_346591744	Bovie Medical Corporation	92.71

Spark Distributed Datasets read from MapR-DB Partitions

```
val pdf: Dataset[Payment] =  
    spark.loadFromMapRDB[Payment]("apps/paytable", schema)  
.as[Payment]
```

_id
AK_Anesthesiology_04/01/2016_346088758
AK_Gastroenterology_03/15/2016_346146914
AK_General Practice_10/13/2016_346134424
AK_Gynecology_12/05/2016_346591748
AK_Obstetrics & Gynecology_12/05/2016_346591744



Language Integrated Queries

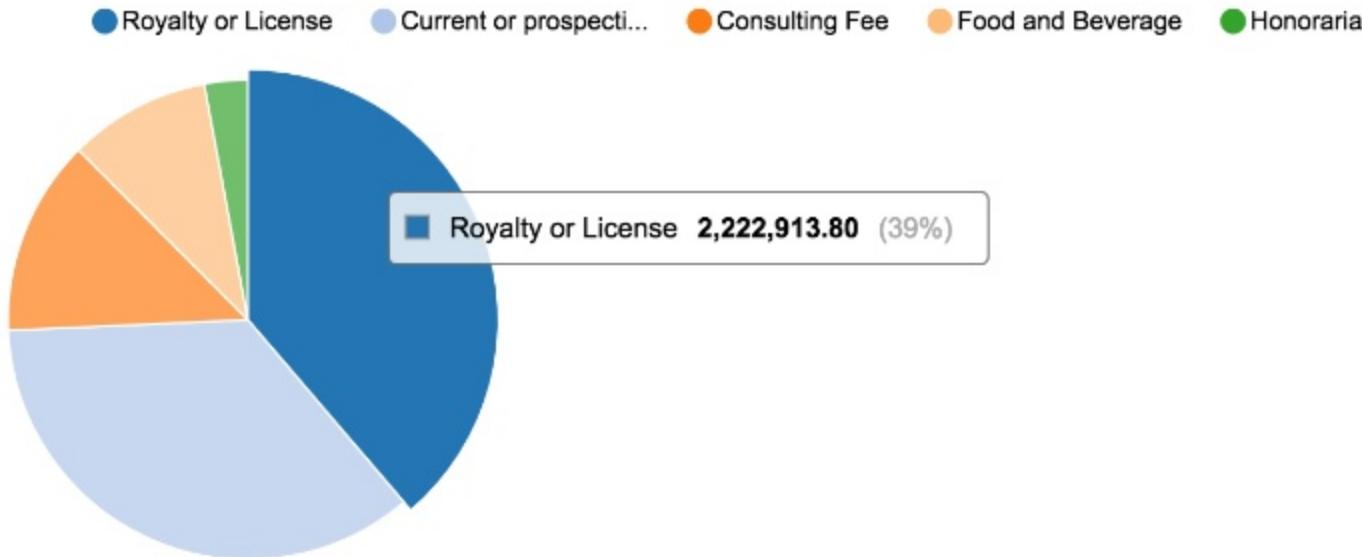
L I Query	Description
<code>agg(expr, exprs)</code>	Aggregates on entire DataFrame
<code>distinct</code>	Returns new DataFrame with unique rows
<code>except(other)</code>	Returns new DataFrame with rows from this DataFrame not in other DataFrame
<code>filter(expr); where(condition)</code>	Filter based on the SQL expression or condition
<code>groupBy(cols: Columns)</code>	Groups DataFrame using specified columns
<code>join (DataFrame, joinExpr)</code>	Joins with another DataFrame using given join expression
<code>sort(sortcol)</code>	Returns new DataFrame sorted by specified column
<code>select(col)</code>	Selects set of columns

Top 5 Nature of Payment by count

```
val res = pdf.groupBy("Nature_of_Payment")
    .count()
    .orderBy(desc(count))
    .show(5)
+-----+-----+
| Nature_of_payment | count |
+-----+-----+
| Food and Beverage | 28806 |
| Travel and Lodging | 446 |
| Consulting Fee | 259 |
| Compensation for ... | 163 |
| Honoraria | 112 |
+-----+-----+
```

Top 5 Nature of Payment by amount of payment

```
%sql select Nature_of_payment,  
       sum(amount) as total from payments  
       group by Nature_of_payment order by total desc limit 5
```



What are the Nature of Payments with payments > \$1000 with count

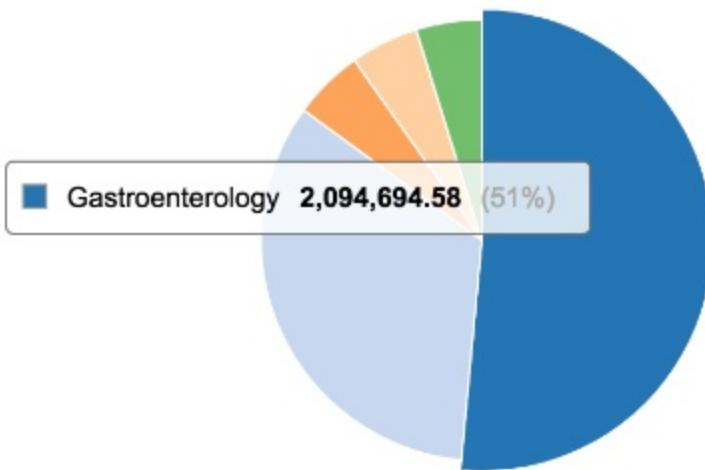
```
pdf.filter($"amount" > 1000)
  .groupBy("Nature_of_payment")
  .count() .orderBy(desc("count")) .show()
```

Nature_of_payment	count
Consulting Fee	156
Honorarial	54
Royalty or License	38
Travel and Lodging	32
Compensation for ...	24
Education	21
Current or prospe...	21
Space rental or f...	10
Grant	5
Food and Beverage	1

Top 5 Physician Specialties by total Amount

```
%sql select physician_specialty, sum(amount) as total  
       from payments where physician_specialty IS NOT NULL  
       group by physician_specialty order by total desc limit 5
```

● Gastroenterology ● Neurological Surgery ● Obstetrics & Gynecol... ● Urology
● Endocrinology, Diabe...



Average Payment by Specialty

What is the average Payment by Specialty?

```
%sql select physician_specialty, count(*) as cnt, avg(amount) as avgamount  
from payments where physician_specialty IS NOT NULL group by physician_specialty order by avgamount desc limit 10
```



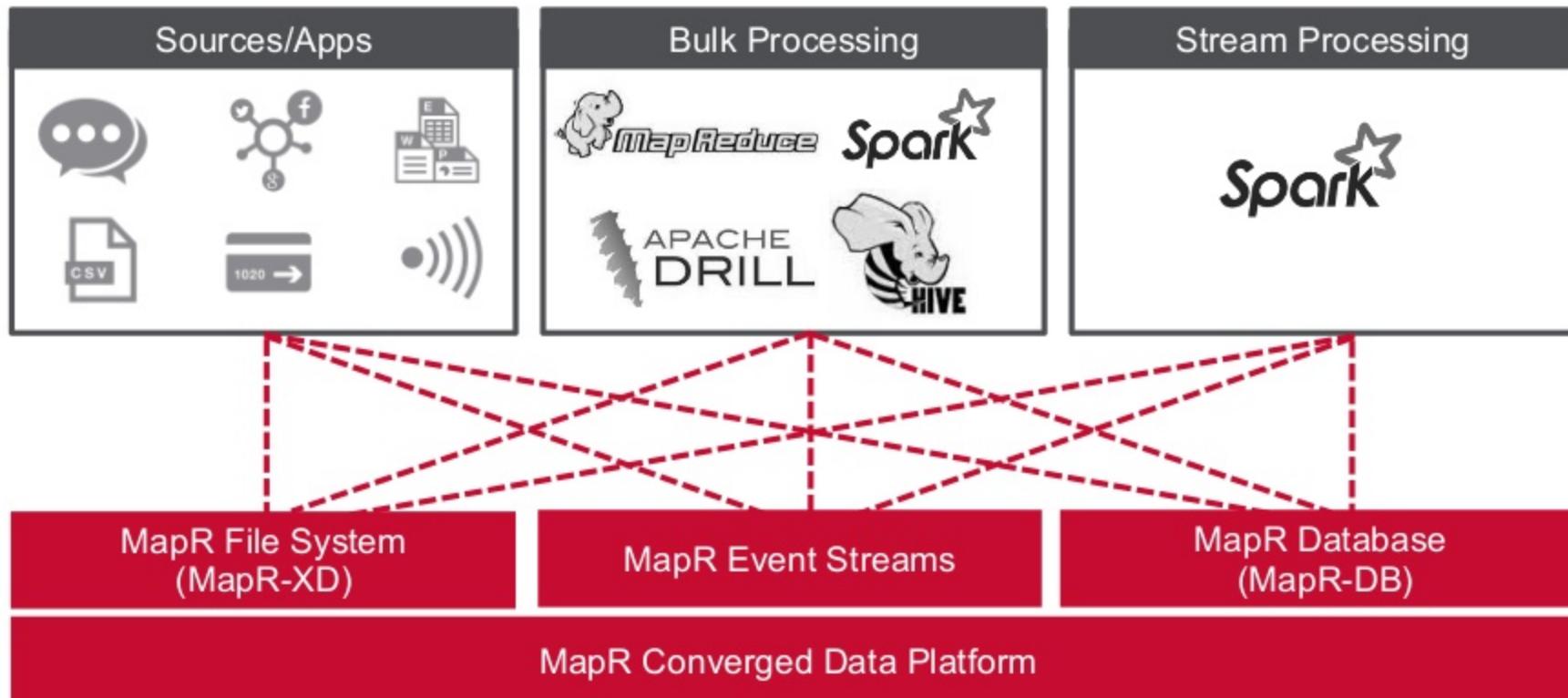
physician_specialty	cnt	avgamount
Neurological Surgery	72	18966.440000000002
Endocrinology, Diabetes & Metabolism	38	5143.806052631579
Blood Banking & Transfusion Medicine	1	2500.0
Emergency Medicine	146	1184.4565753424654
Mental Health	2	589.1999999999999
Podiatrist	294	571.9885374149659

Top Payers by Total Amount with count

```
%sql select payer, payer_state, count(*) as cnt,  
       sum(amount) as total from payments  
       group by payer, payer_state order by total desc limit 10
```

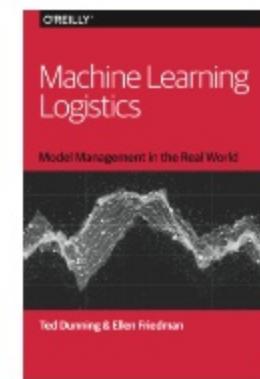
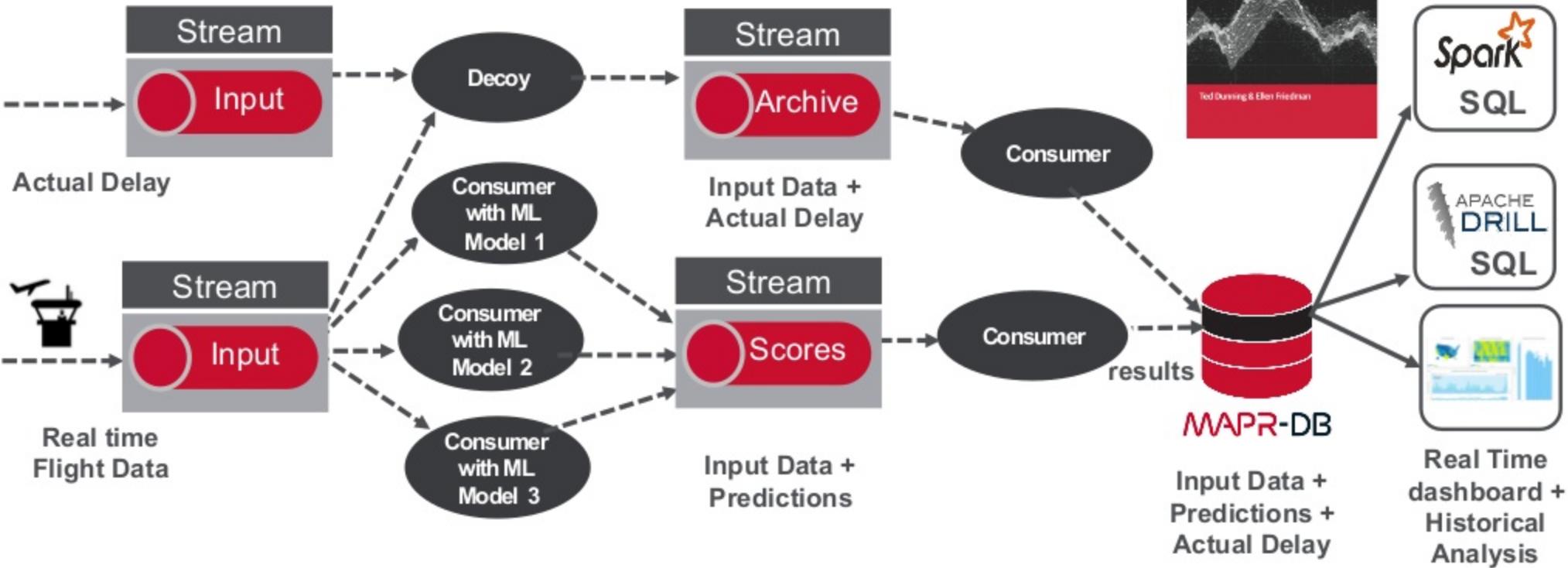
payer	payer_state	cnt	total
Leading Edge Spinal Implants LLC	CO	21	2040000.0
Braintree Laboratories, Inc.	MA	5818	1822474.34000
Mission Pharmacal Company	TX	18818	662132.010000
Affordable Pharmaceuticals, LLC	MA	8	353968.660000
ZOLL Medical Corporation	MA	193	308006.669999
Alliqua BioMedical, Inc.	PA	1013	275810.000000

Building a Complete Data Architecture



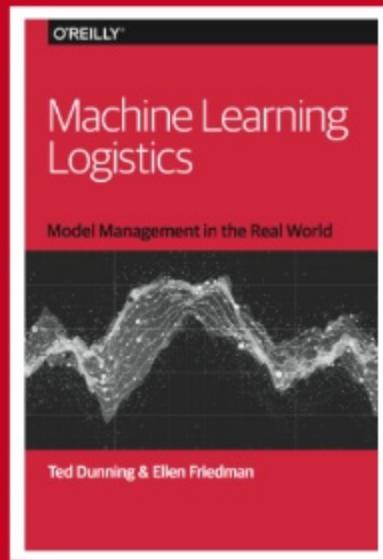
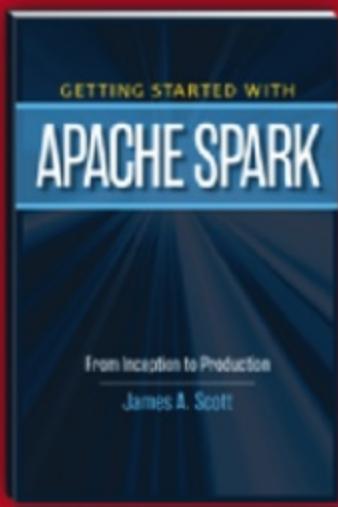
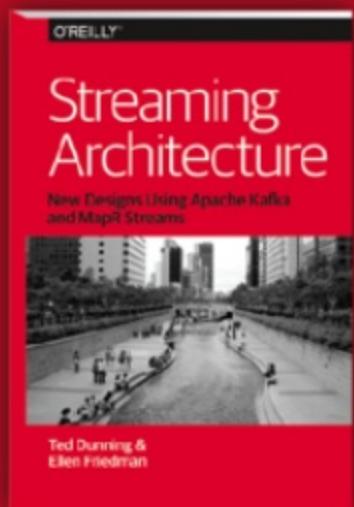
All of these components can run on the same cluster with the MapR Converged platform.

Data Pipelines and Machine Learning Logistics



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The screenshot shows the homepage of the MapR Academy Essentials website. At the top, there's a navigation bar with links for Home, Courses, Support, and Contact. Below the navigation is a search bar and a "Jump to Academy Pro" button. On the left, there's a sidebar with a "Search for..." field and a "Categories" section listing course topics: Cluster Administrator, Apache Spark, MapReduce, Data Analyst, Apache HBase, and Certification. The main content area features a welcome message and a brief description of the Academy Pro feature. Below this, six course tiles are displayed in a grid. Each tile includes a thumbnail icon, the course name, and a "FREE" label. The courses are: ESS 100 – Introduction to Big Data, ESS 101 – Apache Hadoop Essentials, ESS 200 – MapR Administration Essentials, ESS 300 – MapReduce Essentials, ESS 320 – MapR-DB Essentials, and ESS 350 – MapR Streams Essentials.

Welcome to MapR Academy Essentials, where you can take free introductory courses on a variety of big data topics. Select any course tile to register and get started. To access your in-progress courses, click on your profile in the upper right corner. There, you can view your transcript, download certificates of course completion, and re-open any courses you previously registered for. For more information on Academy Essentials and Pro, see the [FAQ](#).

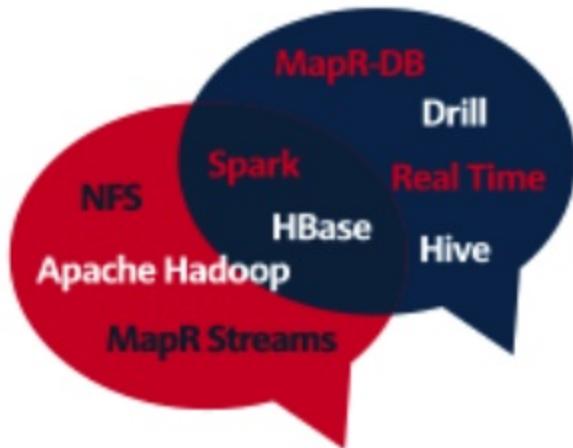
To jump to Academy Pro, click the Academy Pro icon at the top of this page.

Course	Description	Status
ESS 100 – Introduction to Big Data	FREE	Approved
ESS 101 – Apache Hadoop Essentials	FREE	Approved
ESS 200 – MapR Administration Essentials	FREE	
ESS 300 – MapReduce Essentials		Approved
ESS 320 – MapR-DB Essentials		Approved
ESS 350 – MapR Streams Essentials		Approved

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- Join on-demand training course discussions
- Follow release announcements
- Share and vote on product ideas
- Find Meetup and event listings



MapR Blog

- <https://www.mapr.com/blog/>

The screenshot shows the MapR Blog homepage. At the top is a navigation bar with the MAPR logo, links for Why MapR?, Products, Services, Solutions, Customers, Resources, and a 'TRY MAPR' button. Below the navigation is a banner featuring a night-time photograph of a winding highway with blurred lights and the text 'Converge Blog'. A subtitle below the banner reads: 'Find insights, best practices, and useful resources to help you more effectively leverage data in growing your businesses.' The main content area has a breadcrumb navigation: Home > Resources > Blog. On the left, there's a search bar and a 'Categories' section with 'All' selected. The main content area displays three blog post thumbnails: 'New Horizons for MapR' (image of a sunset over mountains), 'Data Tiering: A Capacity and' (image of a person working on a machine), and '5 Ways Intelligent Solutions' (image of two people in a factory setting).

Why MapR? Products Services Solutions Customers Resources TRY MAPR

Converge Blog

Find insights, best practices, and useful resources to help you more effectively leverage data in growing your businesses.

Home > Resources > Blog

Search

Categories

All

Apache Drill

New Horizons for MapR

Data Tiering: A Capacity and

5 Ways Intelligent Solutions

To Learn More: ETL Payment data pipeline

- <https://mapr.com/blog/etl-pipeline-healthcare-dataset-with-spark-json-mapr-db/>
- <https://mapr.com/blog/streaming-data-pipeline-transform-store-explore-healthcare-dataset-mapr-db/>

The screenshot shows the MapR website's header. On the left is the MapR logo. To its right is a navigation bar with links: Why MapR?, Products, Services, Solutions, Customers, Resources, and a red 'TRY MAPR' button. Below the header is a large banner image of a winding road at night with blurred lights, overlaid with white text: 'ETL Pipeline to Transform, Store and Explore Healthcare Dataset With Spark SQL, JSON and MapR-DB'.

Blog > Use Cases > Current Post

Search

Share

Share

Share

Contributed by



Carol
McDonald

Categories

This post is based on a recent workshop I helped develop and deliver at a large health services and innovation company's analytics conference. This company is

MapR Technologies

To Learn More:

- <https://mapr.com/blog/how-stream-first-architecture-patterns-are-revolutionizing-healthcare-platforms/>

The screenshot shows a web browser displaying a blog post on the MapR Technologies website. The URL in the address bar is <https://mapr.com/blog/how-stream-first-architecture-patterns-are-revolutionizing-healthcare-platforms/>. The page header includes the MapR logo, navigation links for Partners, Support, Dev-Hub, Community, Training, Blog, My Account, and a search icon. The main content features a large, bold title: "How Stream-First Architecture Patterns Are Revolutionizing Healthcare Platforms". Below the title, a breadcrumb navigation shows "Blog > Use Cases > Current Post". At the bottom, there are social sharing icons for Twitter, LinkedIn, and Facebook, along with a search bar and a "Contributed by" section.

MapR Technologies, Inc. [US] | <https://mapr.com/blog/how-stream-first-architecture-patterns-are-revolutionizing-healthcare-platforms/>

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How Stream-First Architecture Patterns Are Revolutionizing Healthcare Platforms

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- <https://mapr.com/blog/ml-iot-connected-medical-devices/>

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MapR Technologies, Inc. [US] <https://mapr.com/blog/ml-iot-connected-medical-devices/>

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MAPR Why MapR? Products Services Solutions Customers Resources TRY MAPR

Applying Machine Learning to Streaming IoT for Connected Medical Devices

Blog > Current Post

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Contributed by Carol

Applying Machine Learning to Live Patient Data

- <https://www.slideshare.net/caroljmcdonald/applying-machine-learning-to-live-patient-data>



Applying Machine Learning to Live Patient
Data

709 views



MapR Container for Developers

- <https://maprdocs.mapr.com/home/MapRContainerDevelopers/MapRContainerDevelopersOverview.html>

MapR Container for Developers

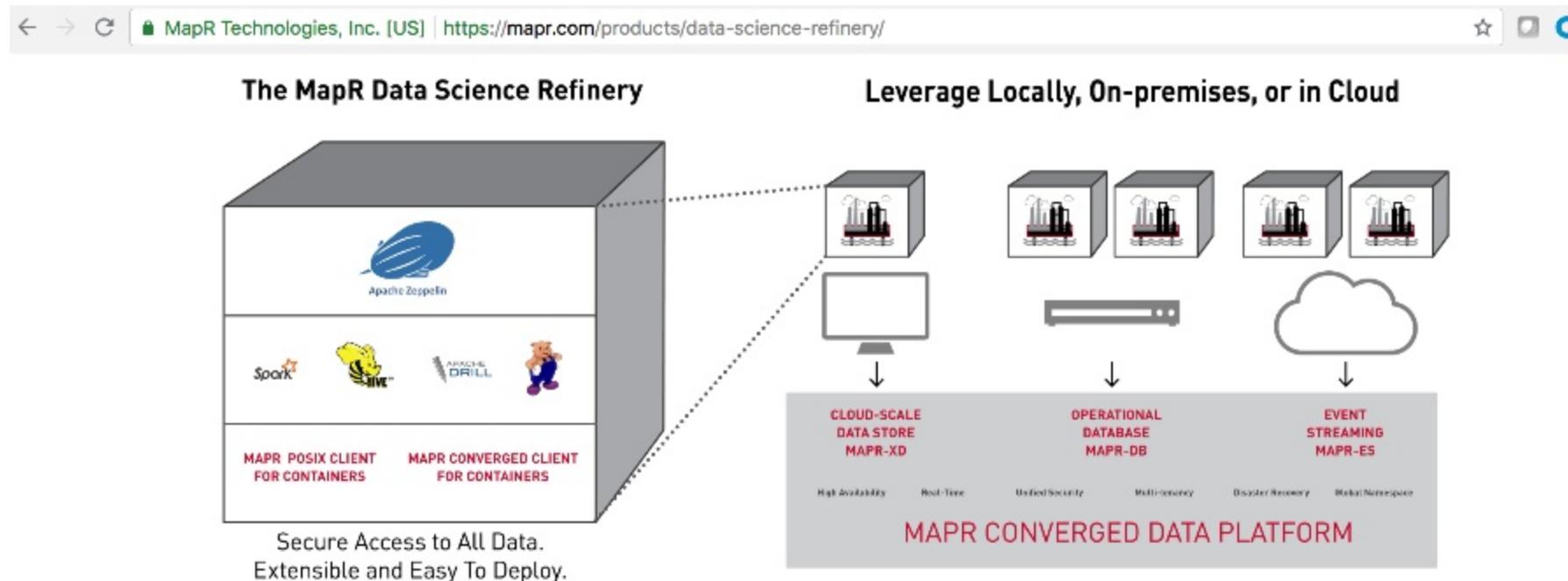
The MapR Container for Developers is a docker container that enables you to create a single node MapR cluster. The container is lightweight and designed to run on your laptop. It requires no additional configuration for you to connect your clients, also running on your laptop, to the cluster.

The MapR cluster created by the docker image includes the following components:

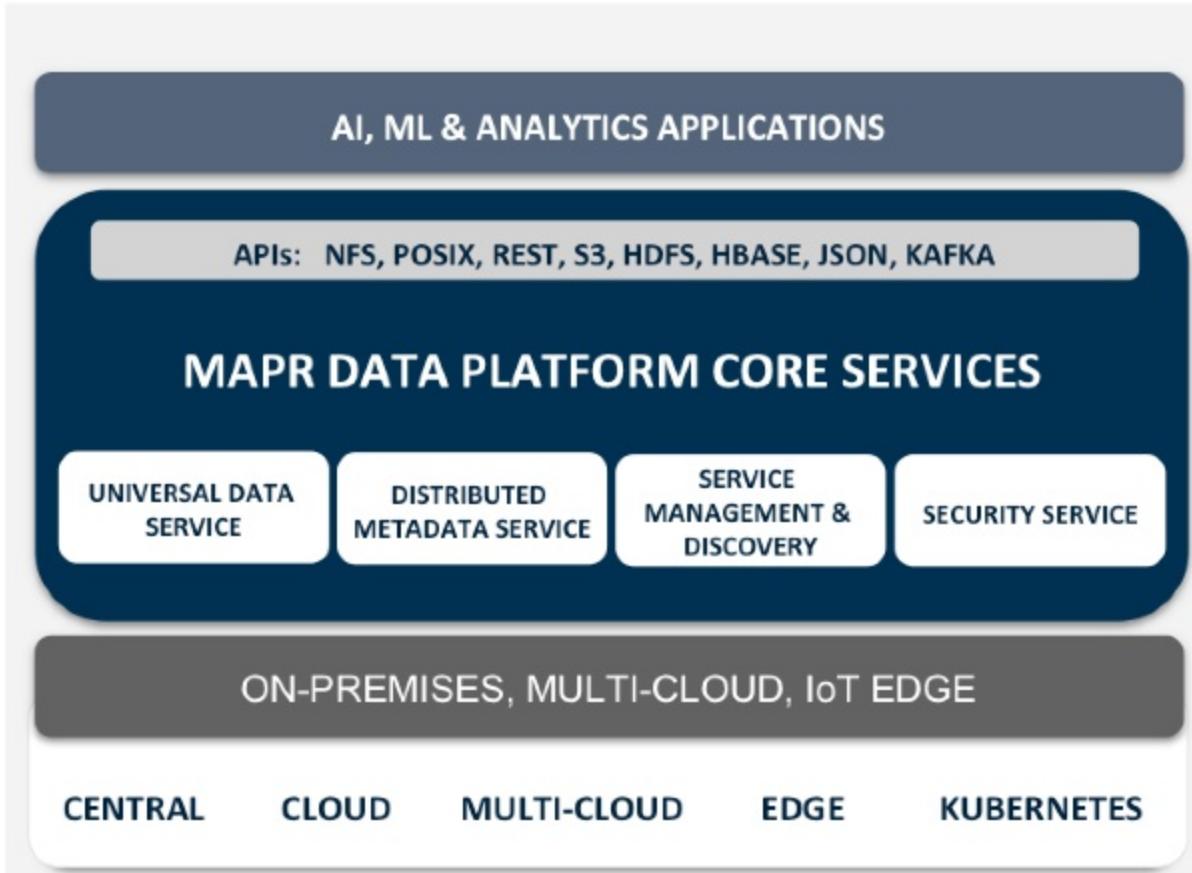
- MapR Core 6.0
 - [MapR-XD](#)
 - [MapR-DB](#)
 - [MapR-ES](#)
 - [MapR Control System](#)
 - [MapR NFS](#)
- Apache Drill 1.11.0-1710
- Apache Spark 2.1.0-1710

MapR Data Science Refinery

- <https://mapr.com/products/data-science-refinery/>



MapR Data Platform



Q&A

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