SPARK+AI
SUMMIT EUROPE

Apache Spark Based Reliable Data Ingestion in Datalake

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#SAISDev13

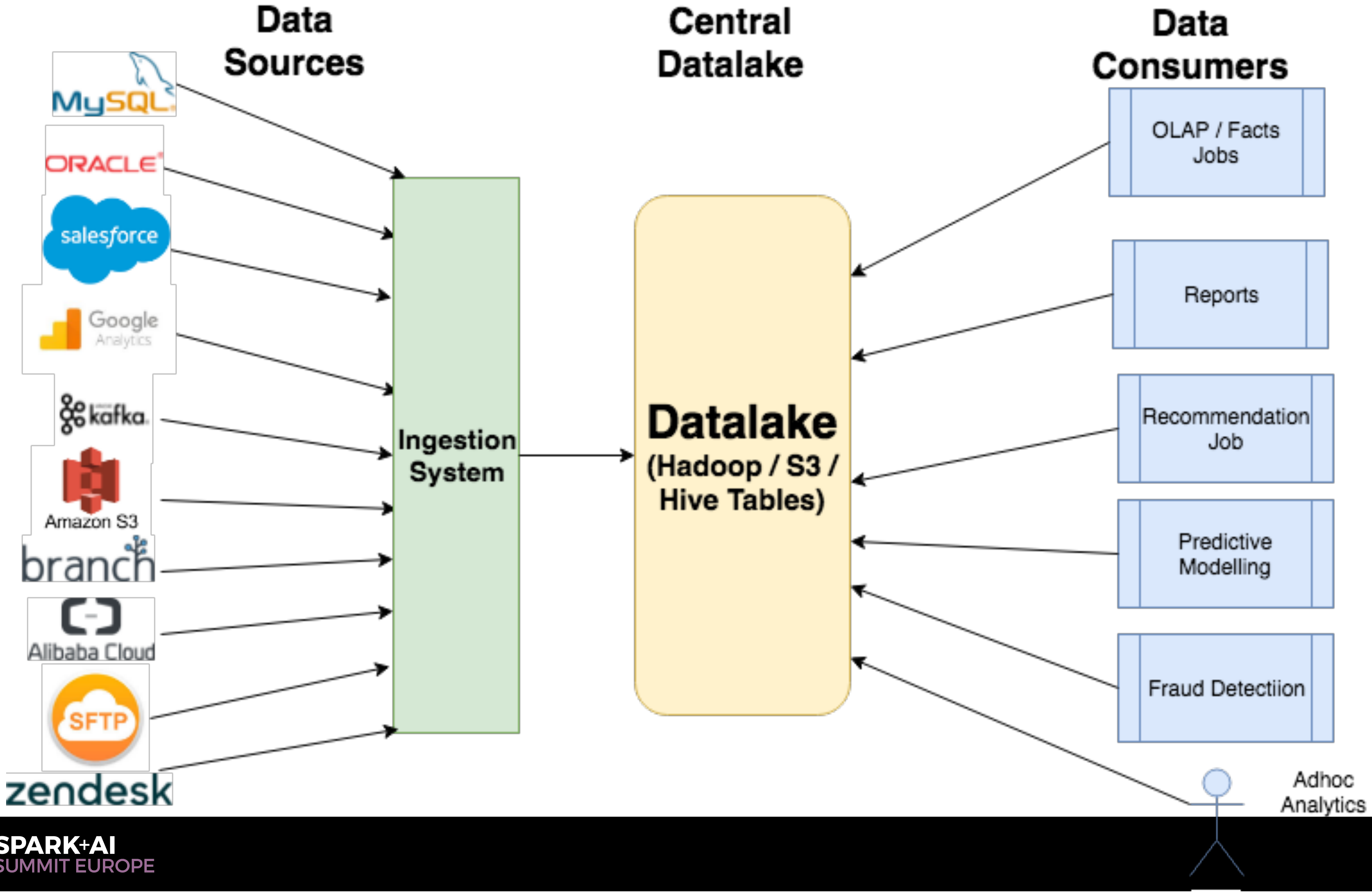
Paytm - Who we are?

- Digital Payment Platform
- Wallet, Payment Banks, Payment Gateway, Paytm Money, e-Commerce, Recharges, Travel & Hotel booking etc.
- Fast growing company. New verticals/business added frequently
- 330M+ of registered users
- Generates multi TB data

Agenda

- Ingestion Requirements
- Traditional Ingestion Mechanism
- Challenges
- Spark Based Reliable Ingestion Platform

Ingestion Requirements



Data Sources

Central Datalake

Data Consumers

Ingestion System

Datalake
(Hadoop / S3 / Hive Tables)

OLAP / Facts Jobs

Reports

Recommendation Job

Predictive Modelling

Fraud Detectiion

Adhoc Analytics

Ingestion Types

- Full Ingestion
  - No checkpointing required
- Incremental Ingestion
  - Requires checkpointing
  - With or without compaction / de-duplication

Source	Configuration	State / Checkpoint
MySQL / Oracle	Host Port User Password	Timestamp e.g 2018-01-01 04:00:00
Kafka	Broker Host Topic	Offsets
S3	Bucket Access Key Secret Key	Last directory (Could be date based)
SFTP	Host Port User Password	Last directory (Could be date based)

Traditional Ingestion Mechanism and it’s Challenges

Traditional Ingestion Mechanism

- Custom scripts for each source
- MySQL / Oracle -> Sqoop
- Salesforce -> Python script to ingest from SF API
- Kafka -> Kafka Connect
- S3 -> S3 Client API
- Cron based scheduler

Challenges

- Variety of sources with their own source code
- More code = Higher chances of bug
- Custom configuration mechanism
- Custom state/checkpoint management
- Custom Transformation Mechanism
- Failure Handling / Retry / Backoff
- Monitoring
- Sanity / Data Correctness Checks

More Challenges…

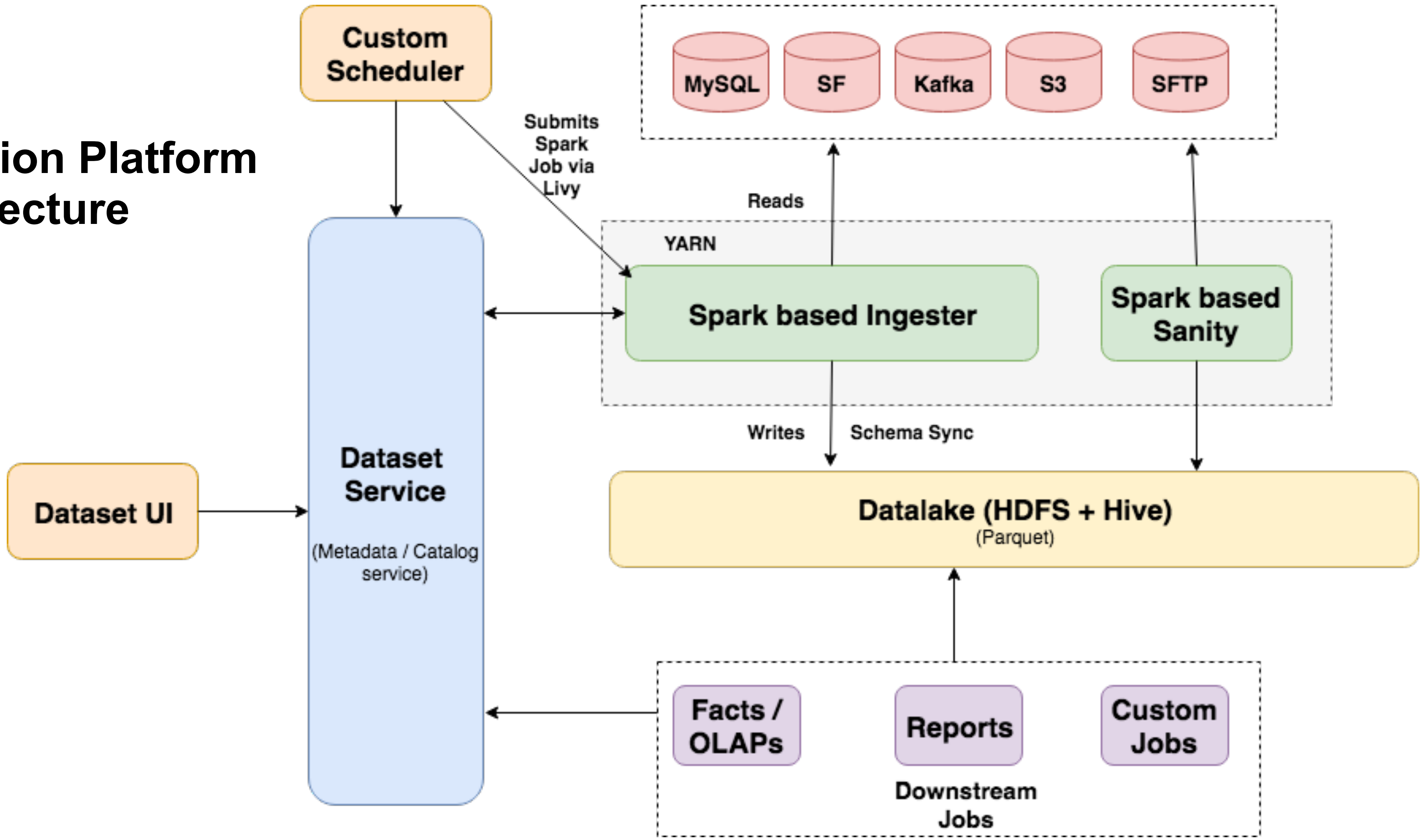
- Schema change at source not communicated
  - New Column Added
  - Datatype Change int -> bigint
  - Column Deleted
- Inconsistent Reads while Writes in progress
- Backfill / Re-Ingestion

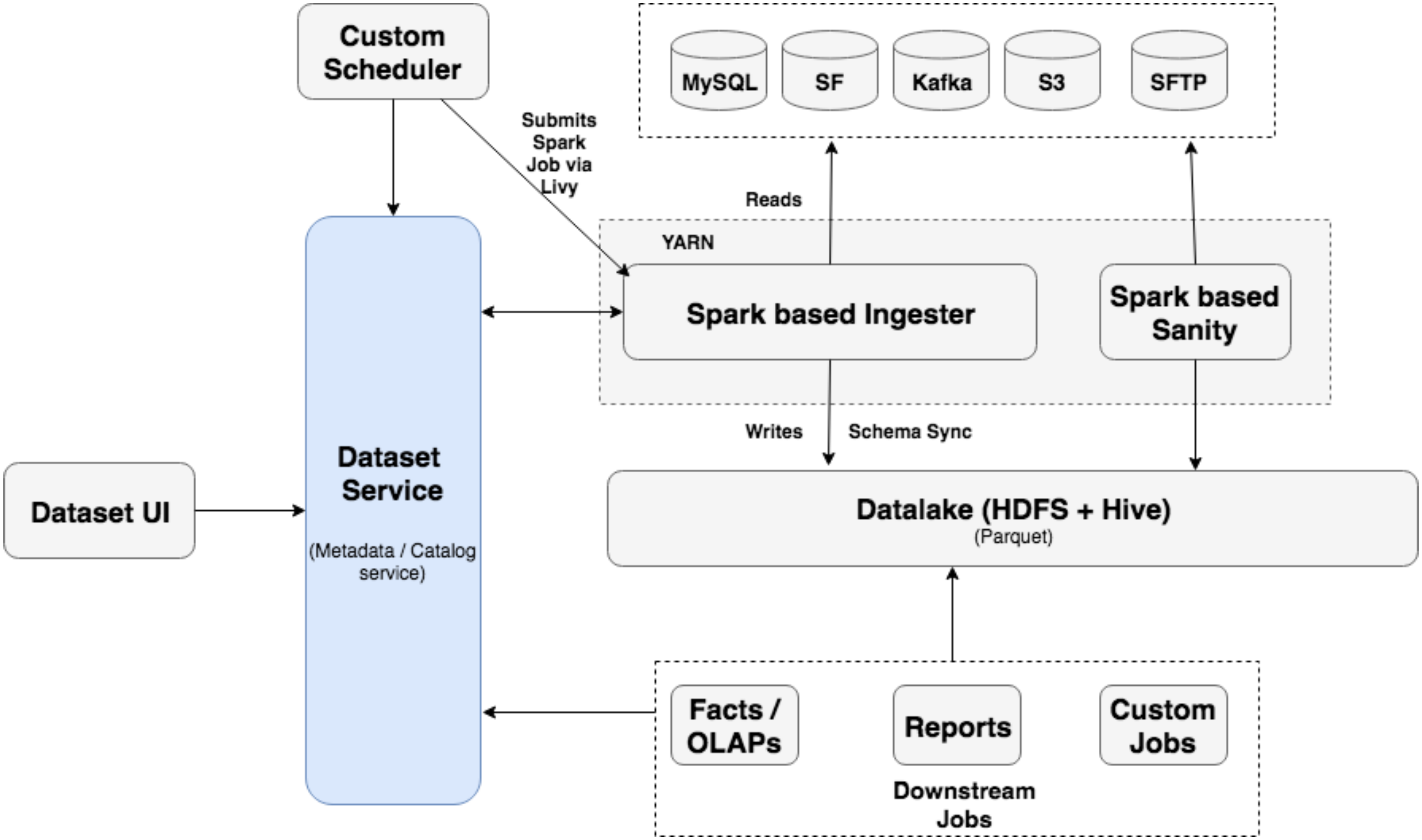
Spark Based Ingestion Platform

Spark Dataframe Abstraction

- Data Source API to connect to various sources
- Unified way of adding transformations
- Leveraging Spark Dataframe schema for auto schema change detection
- Unified way of finding max Record time / Processing time for downstream job dependency management

Ingestion Platform Architecture

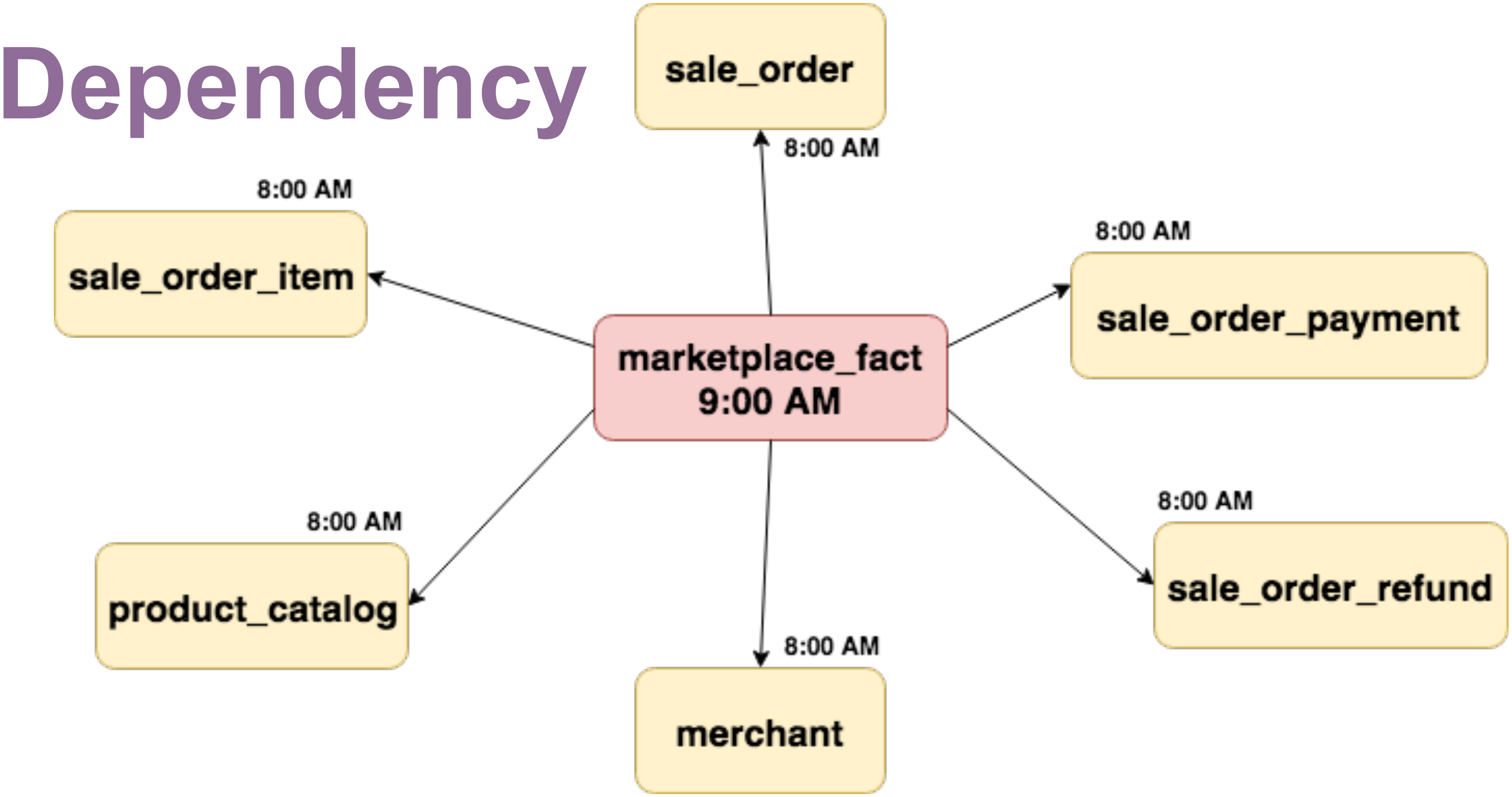


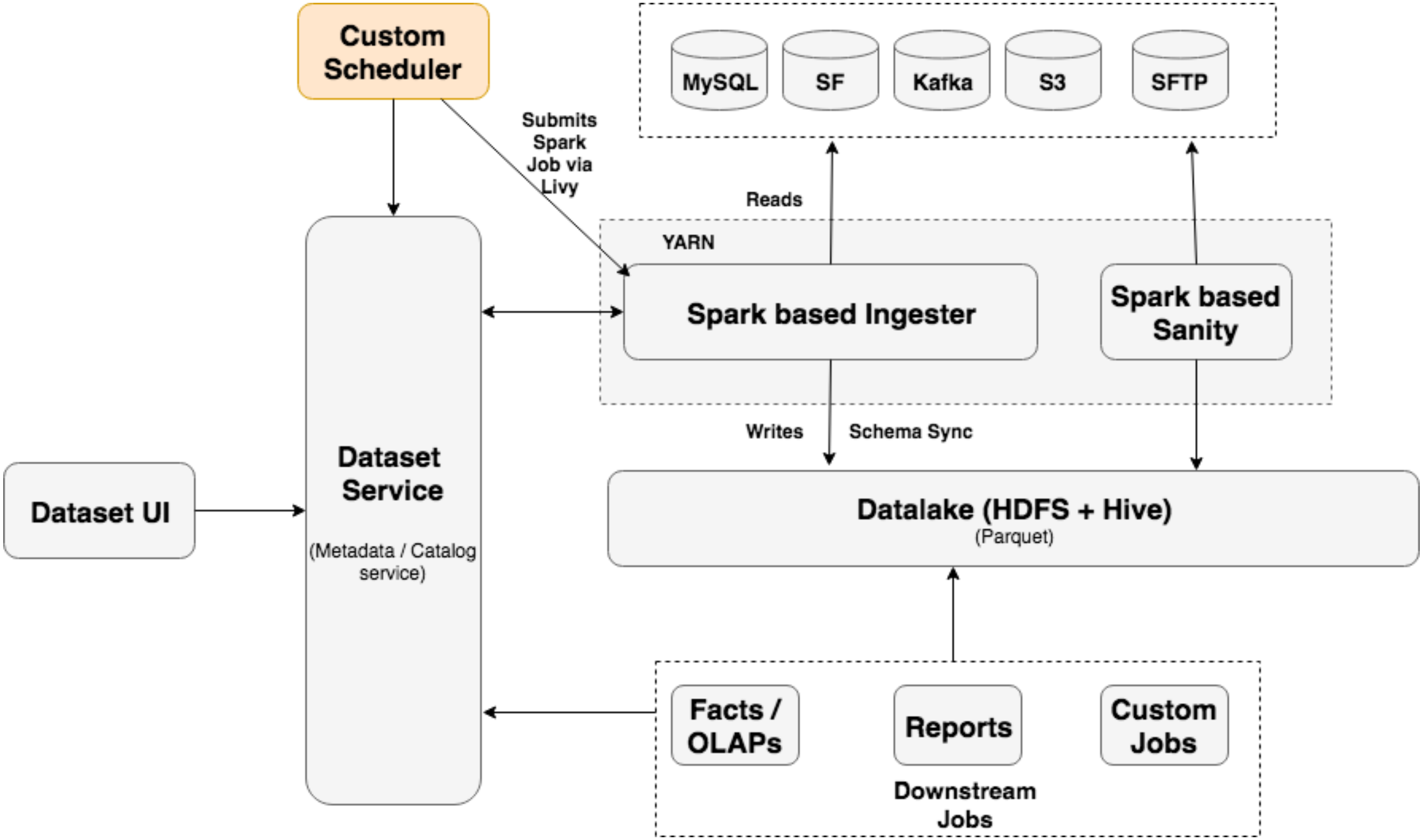

Custom Scheduler
Submits Spark Job via Livy
MySQL
SF
Kafka
S3
SFTP
Reads
YARN
Spark based Ingester
Spark based Sanity
Dataset Service
(Metadata / Catalog service)
Dataset UI
Writes
Schema Sync
Datalake (HDFS + Hive)
(Parquet)
Facts / OLAPs
Reports
Custom Jobs
Downstream Jobs

Dataset Service

- Central Dataset Management Service
- Provides API to connect to source and fetch source details (available table, schema etc) for easy on-boarding
- Manages metadata like
  - State Checkpointing
  - Max Record / Processing time -> Till what time data is available
- Provides Dependency Management API
- Activate / Deactivate
- History Management (Schema changes, config changes etc.)
- Register Transformations

Dependency


sale_order
8:00 AM
8:00 AM
sale_order_item
8:00 AM
sale_order_payment
marketplace_fact
9:00 AM
8:00 AM
8:00 AM
sale_order_refund
product_catalog
8:00 AM
merchant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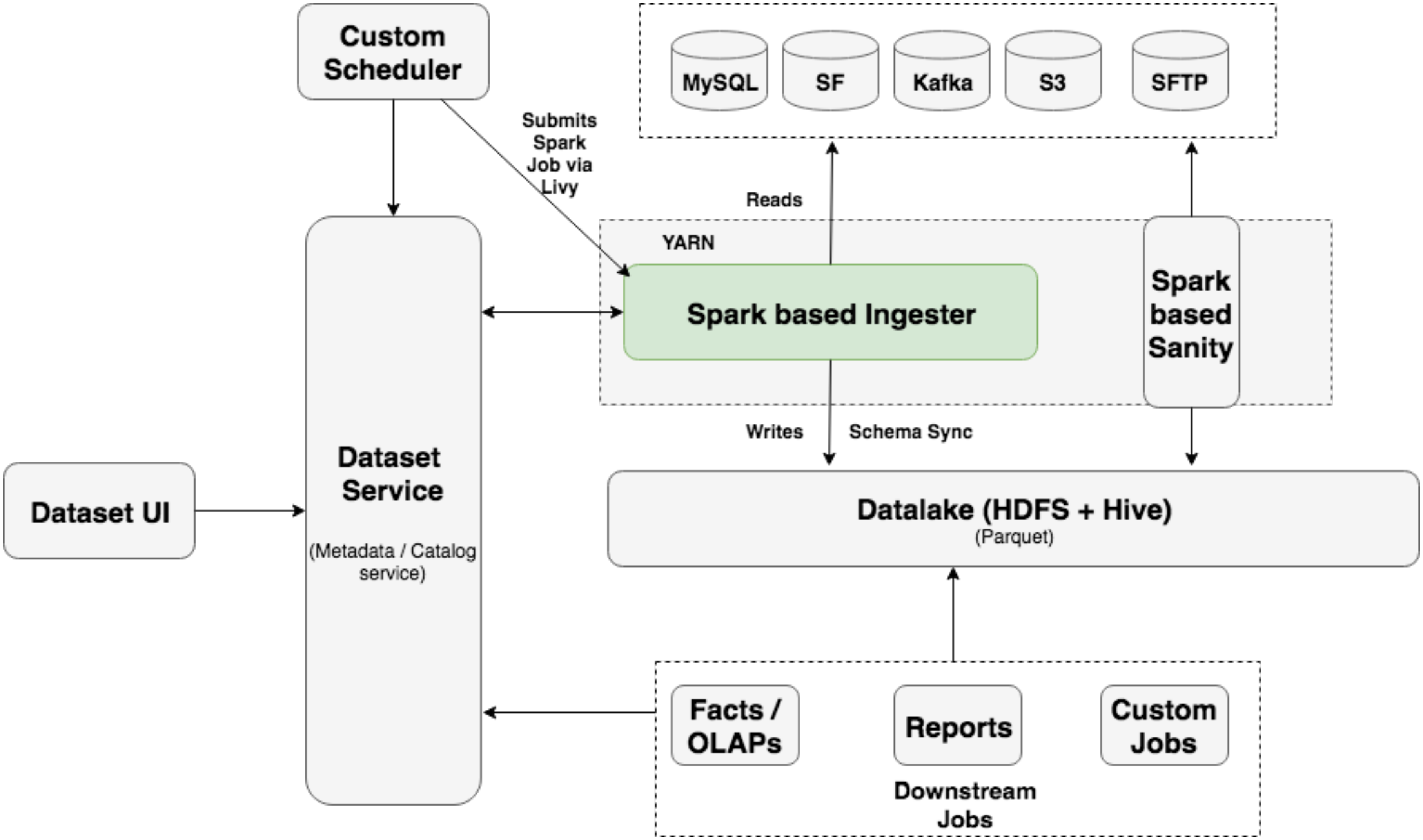
Custom Scheduler

- SLO based scheduling
- High Priority Scheduling for Critical Reporting Datasets
- Max Connections based scheduling
- Submits Spark Job via Livy Rest API
- Retries / Backoff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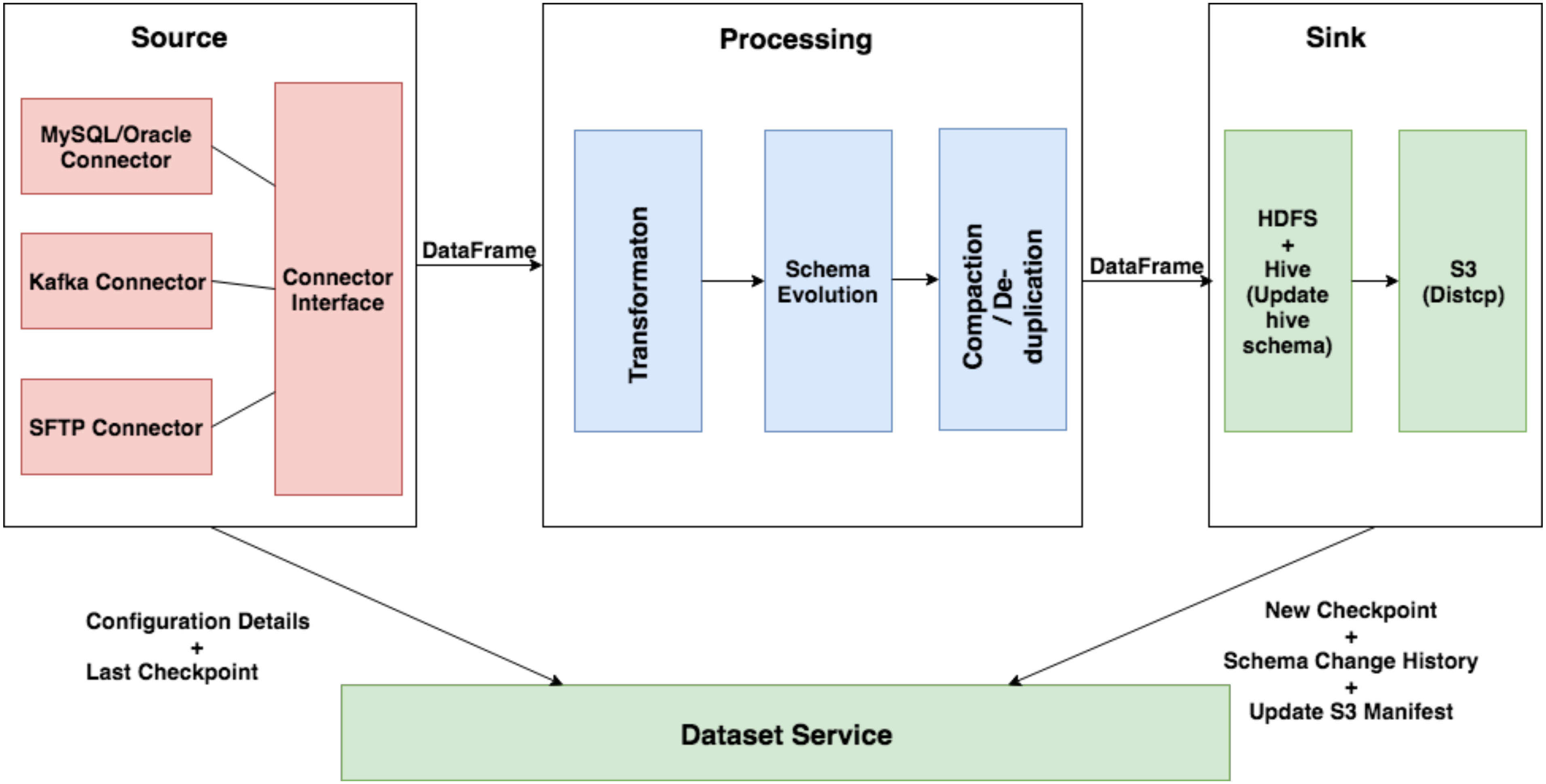
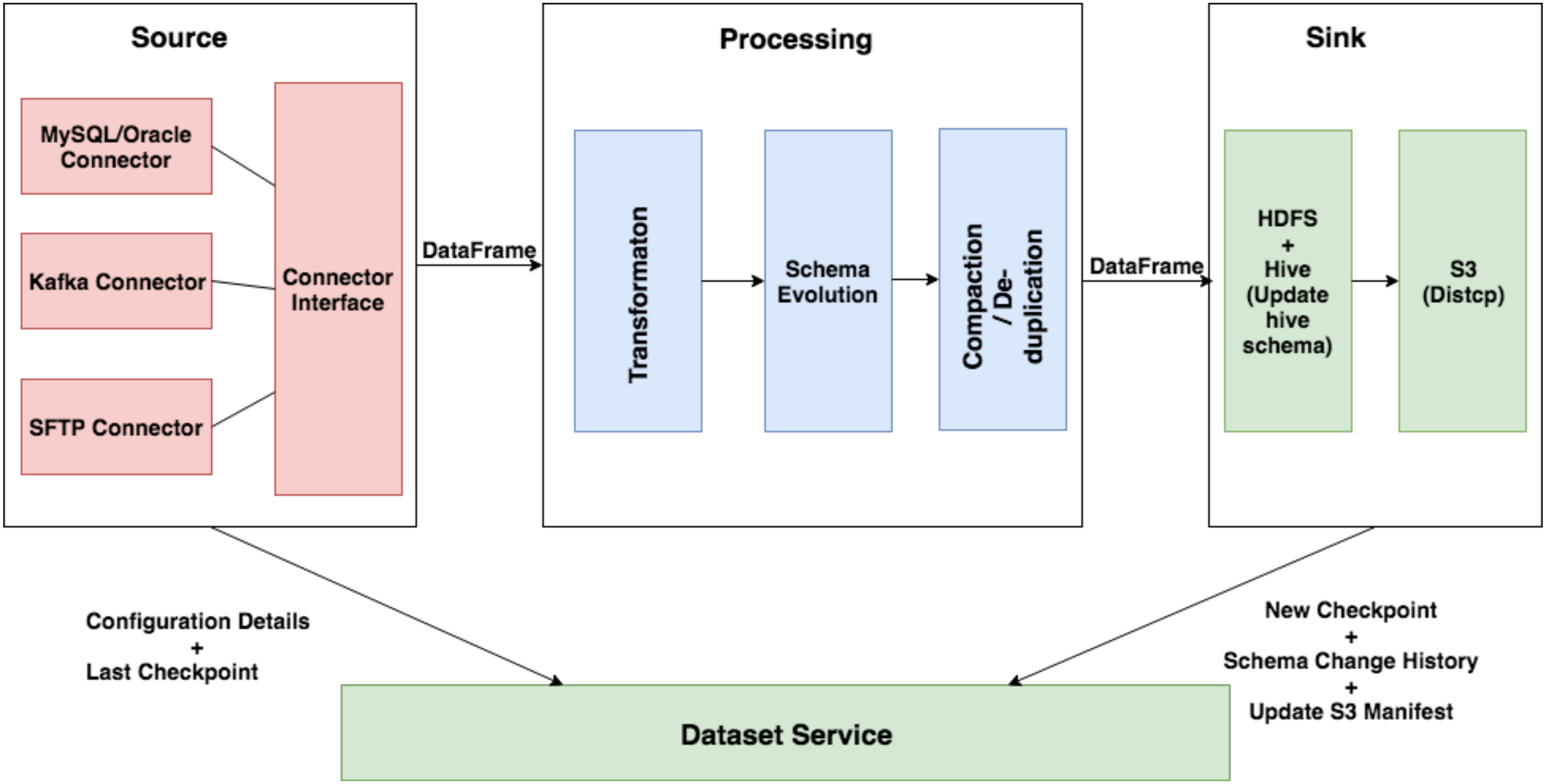
Spark Connector Based Ingestion Architecture



Connector Implementation

- Connect to data source using connection properties
- Create dataframe from source (using last checkpoint state)
- Throttle based on batch size
- Capture new checkpoint
- Optionally capture max record time

Spark Connector Based Ingestion Architecture



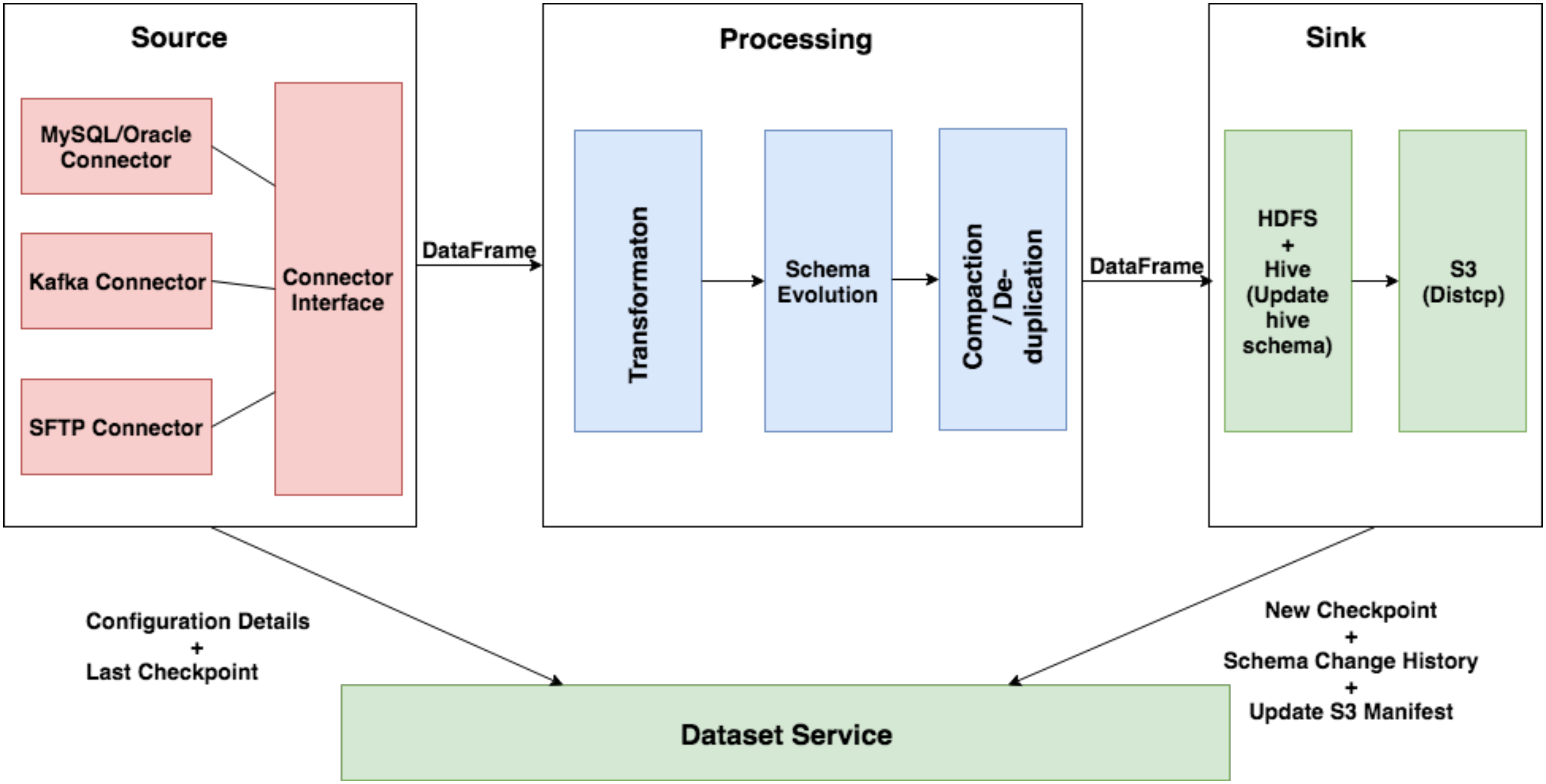
Transformations

```
“df.withColumn(“update_at",to_timestamp(col(“update_at")))
  .withColumn("id", col(“id").cast(LongType))
  .withColumn(“ticket_id”,col("ticket_id").cast(LongType))"
```

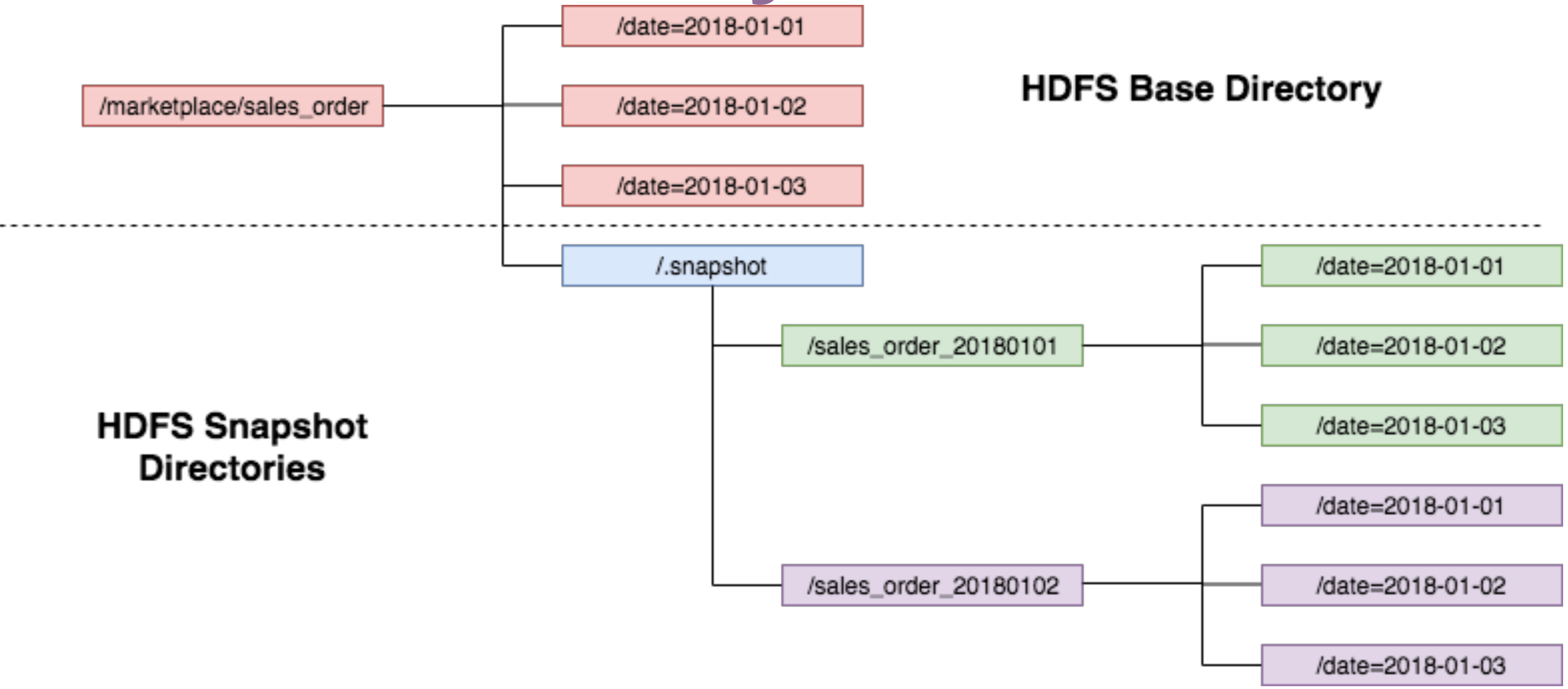
```
“df.withColumn(“phone_no”, md5(col(“phone_no”)))”
```

- Leverage Scala’s Tool Box API
  - Converts to AST
  - Compiles and Runs AST

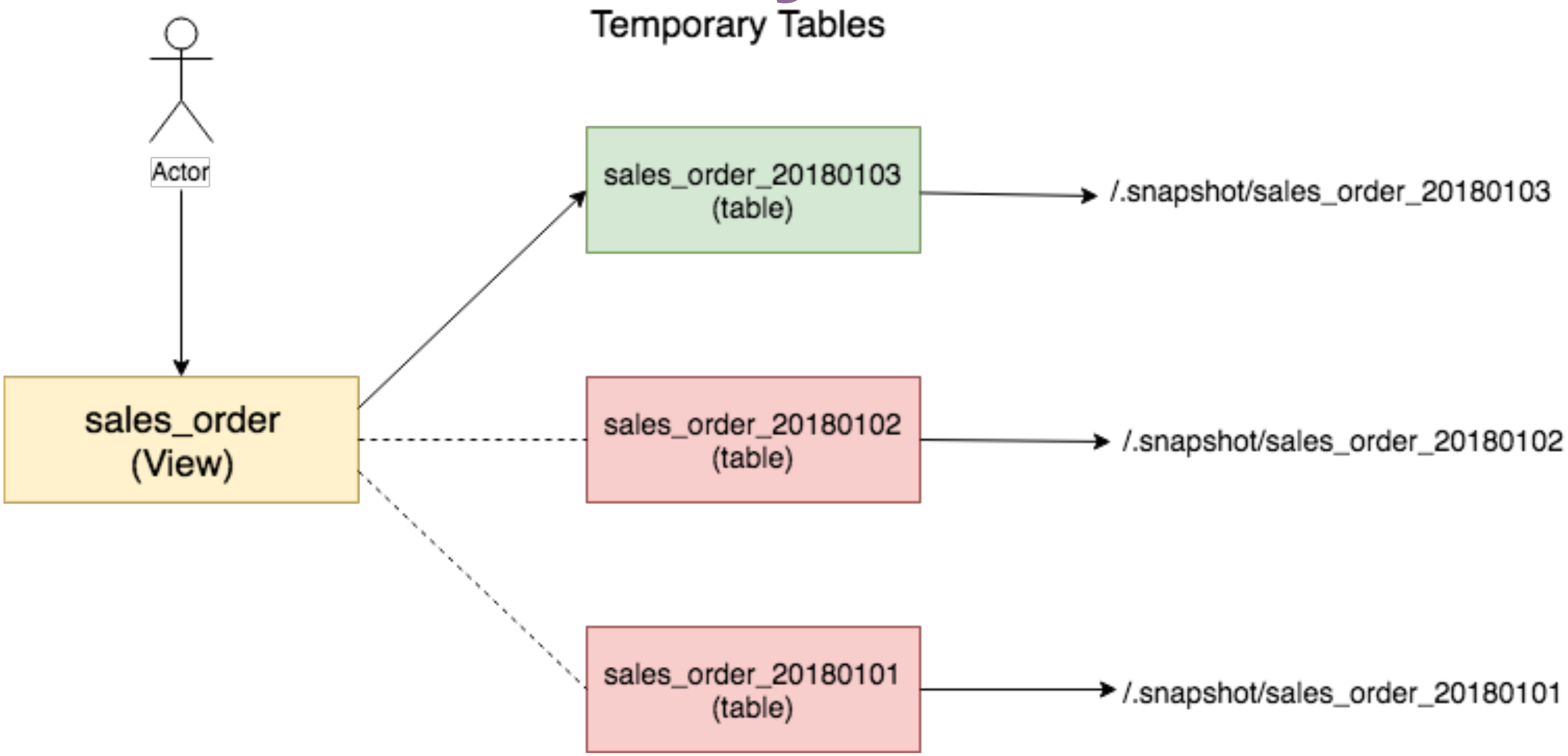
Spark Connector Based Ingestion Architecture



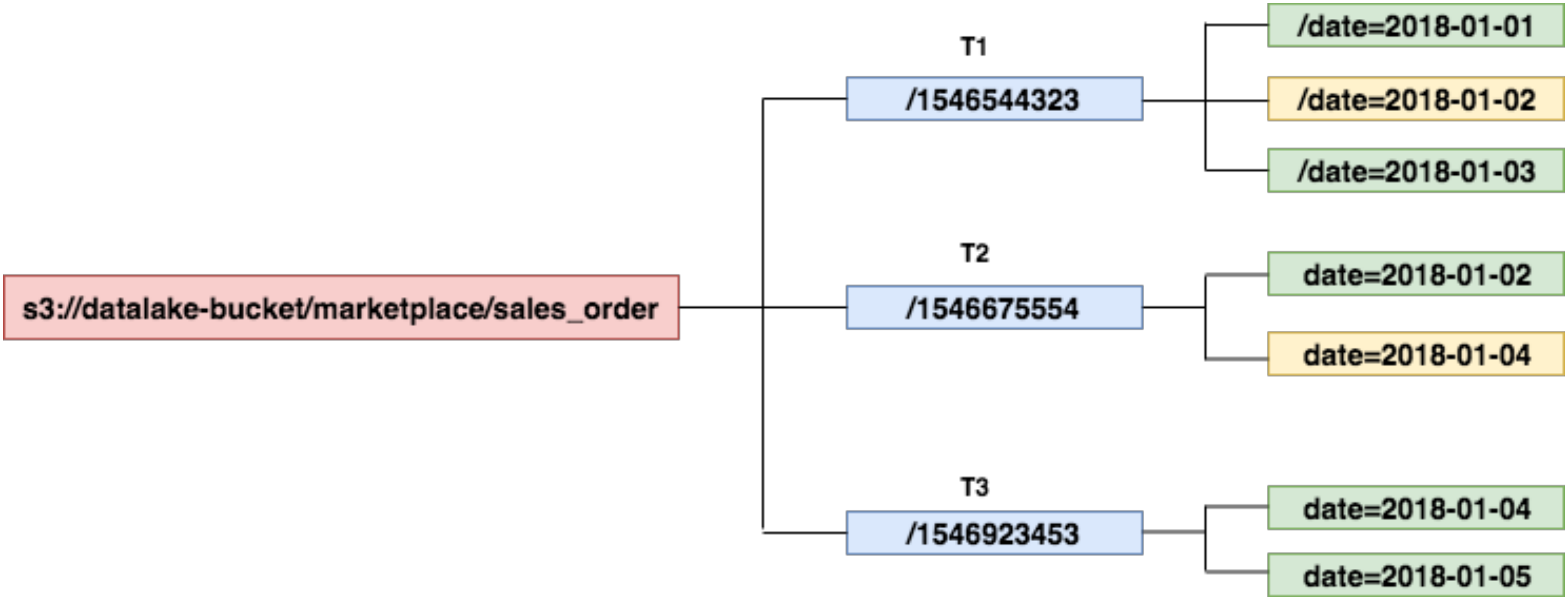
HDFS Directory Structure



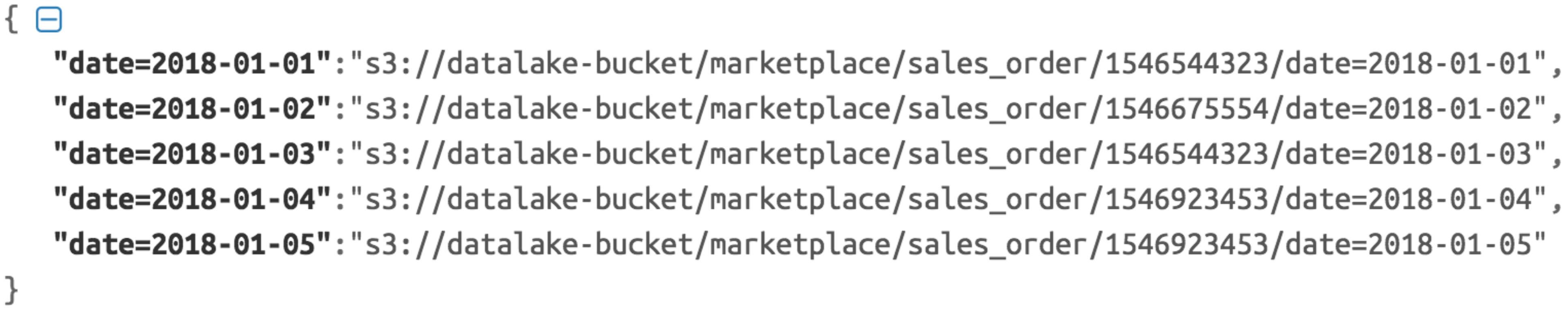
Hive Schema Sync



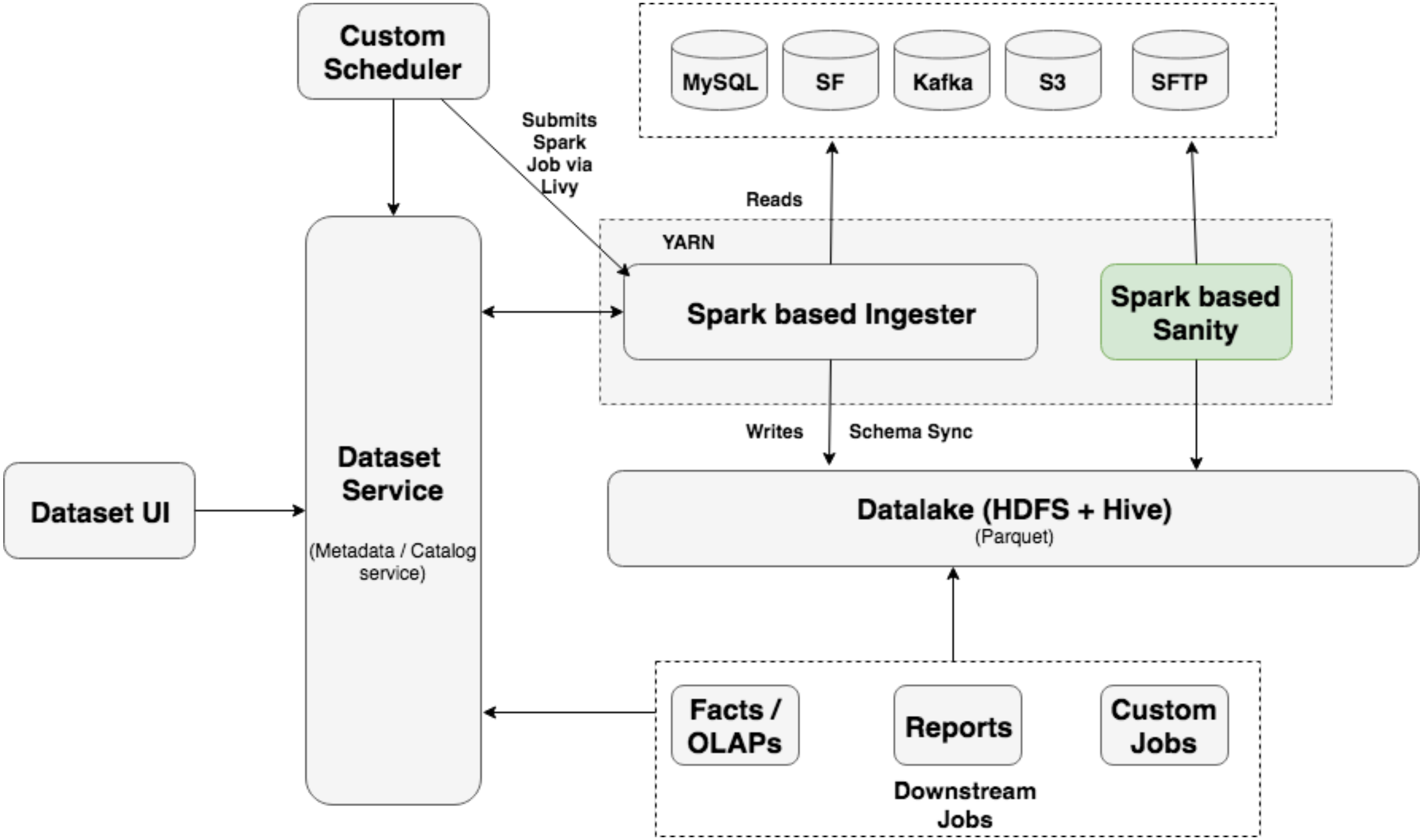
S3 Storage Structure



Dataset Service S3 Manifest API



```
{ ⊟
   "date=2018-01-01":"s3://datalake-bucket/marketplace/sales_order/1546544323/date=2018-01-01",
   "date=2018-01-02":"s3://datalake-bucket/marketplace/sales_order/1546675554/date=2018-01-02",
   "date=2018-01-03":"s3://datalake-bucket/marketplace/sales_order/1546544323/date=2018-01-03",
   "date=2018-01-04":"s3://datalake-bucket/marketplace/sales_order/1546923453/date=2018-01-04",
   "date=2018-01-05":"s3://datalake-bucket/marketplace/sales_order/1546923453/date=2018-01-05"
}
```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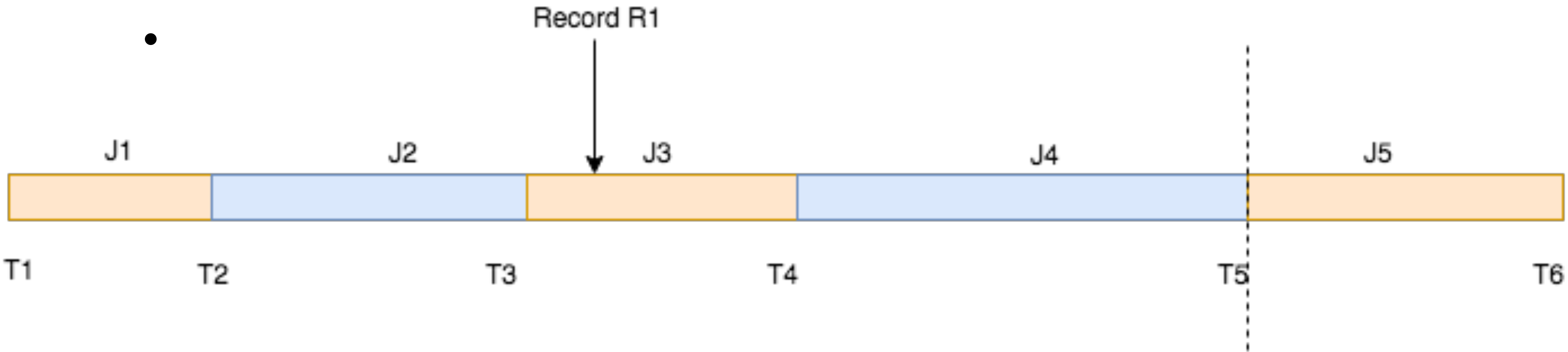
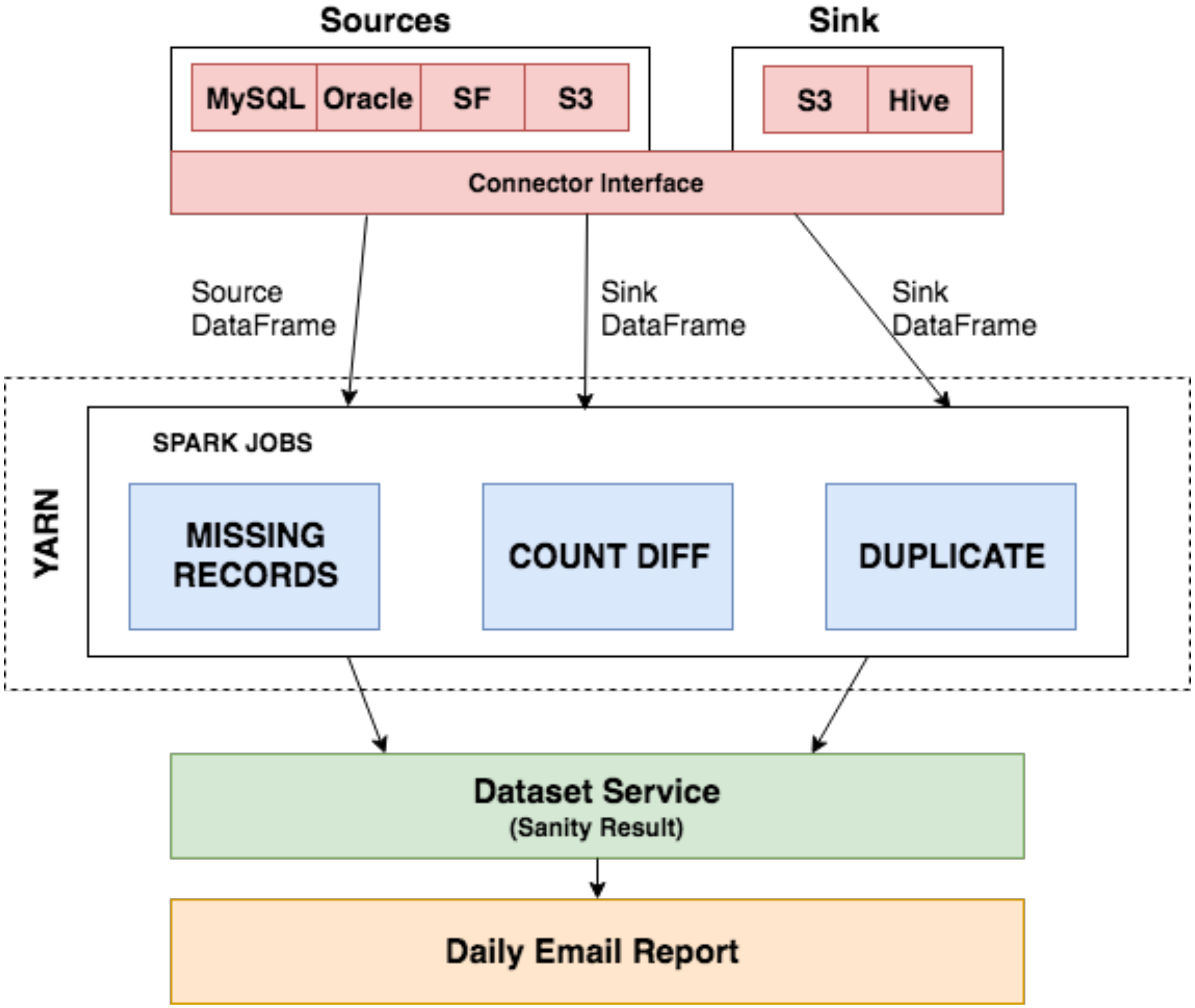
Sanity

- Incomplete data ingestion
- Records with back date timestamp (updated_at) are inserted in source table
- Incremental ingestion only ingest records with updated_at > last max updated_at
-



Sanity


Sources
MySQL
Oracle
SF
S3
Sink
S3
Hive
Connector Interface
Source DataFrame
Sink DataFrame
Sink DataFrame
YARN
SPARK JOBS
MISSING RECORDS
COUNT DIFF
DUPLICATE
Dataset Service
(Sanity Result)
Daily Email Report

Reliability Factors

- One code base leveraging Spark DF abstraction
  - Simplifies monitoring, scheduling, transformations, schema evolution, compaction etc.
- Less code = Less Bugs
- Dependency Management via Record Time / Processing Time
- HDFS snapshots for read time consistencies
- S3 Manifest API for read time consistencies
- Sanity

Thanks

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