Accelerating Data Delivery

How the FT automated its ETL pipelines with Airflow

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Airflow Summit

Let's flow together

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Big Data in FT

FT

- Important decisions taken based on data
- More and more data use cases across the company
- **Our legacy batching solution was not up for the job**

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Airflow was the perfect fit

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- Durable and flexible
- Many built-in functionalities
- Large community

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FT Airflow setup

- Extension of the original Airflow project
- Developed and maintained by a dedicated FT Airflow team
- Additional built-in functionalities
- Provided to other FT teams as self-service

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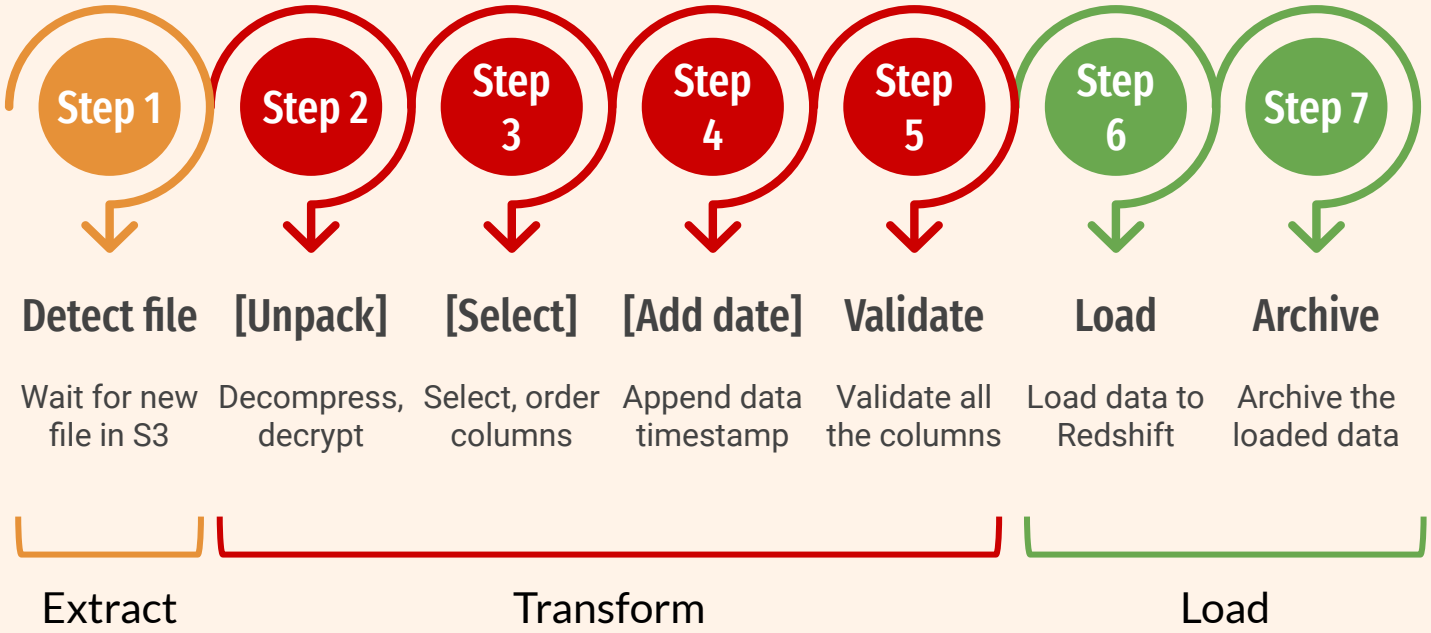
Extract, transform and load (ETL)

FT


Step 1
Step 2
Step 3
Step 4
Step 5
Step 6
Step 7
Detect file
[Unpack]
[Select]
[Add date]
Validate
Load
Archive
Wait for new file in S3
Decompress, decrypt
Select, order columns
Append data timestamp
Validate all the columns
Load data to Redshift
Archive the loaded data
Extract
Transform
Load

How we implemented them back then?

```
18  with FTDAG(dag_id='sfdc_case_cdc',
19             schedule='0 23 * * *'):
20
21      detect_file = ETLFileIngesterSensorOperator(
22          task_id='detect_new_file',
23          timeout=10800,
24          poke_interval=900)
25
26      validation = ETLFileValidatorOperator(
27          task_id='validate_data',
28          data_input=StoragePath(task_id='transform_file'),
29          file_format=FileFormat.CSV,
30          file_delimiter=FileDelimiter.COMMA)
```

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How we implemented them back then?

```
32      load_data_in_redshift = ETLS3ToRedshiftOperator(
33          task_id='load_data_to_redshift',
34          redshift_conn_id='redshift_conn_id',
35          table='ftsfv2db.sfdc_case_cdc',
36          s3_input=StoragePath(task_id='validate_data'),
37          copy_options=[
38              "DELIMITER ','",
39              "EMPTYASNULL",
40              "CSV",
41              "timeformat 'auto'",
42              "TRUNCATECOLUMNS"
43          ])
44
45      archive_data_in_s3 = ETLS3ToS3Operator(
46          task_id='archive_file',
47          s3_input=StoragePath(task_id='validate_data'))
48
49      detect_file >> validation >> [load_data_in_redshift, archive_data_in_s3]
```

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Challenges

- A lot of ETL pipelines to be migrated from the legacy tool
- Increasing requests for new ones
- Problem having different DAG configuration per environment
- **The pipelines look more or less the same**

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We had to do something..

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Dynamic ETL DAGs from configuration?

We decided to try it out..

Let’s start with:

DAG Configuration system

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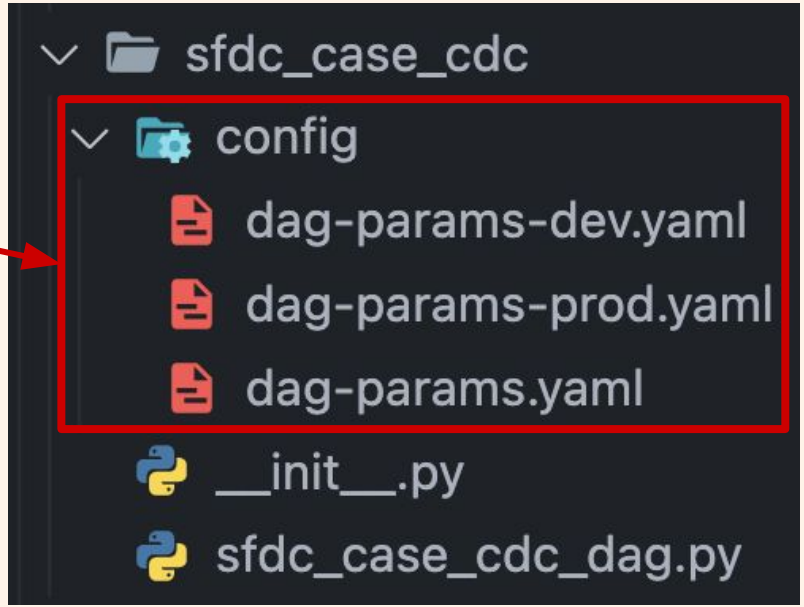
Separate DAG config per environment

DAG configuration folder



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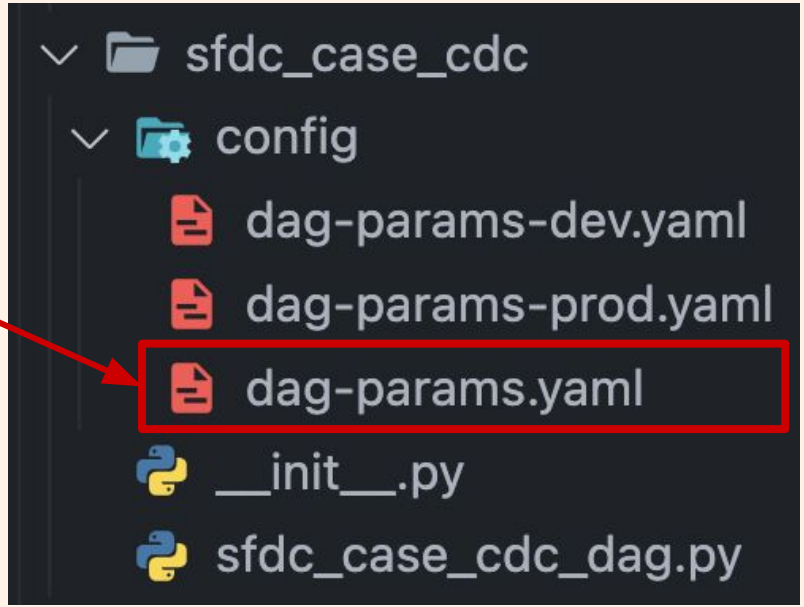
Separate DAG config per environment

Main DAG configuration



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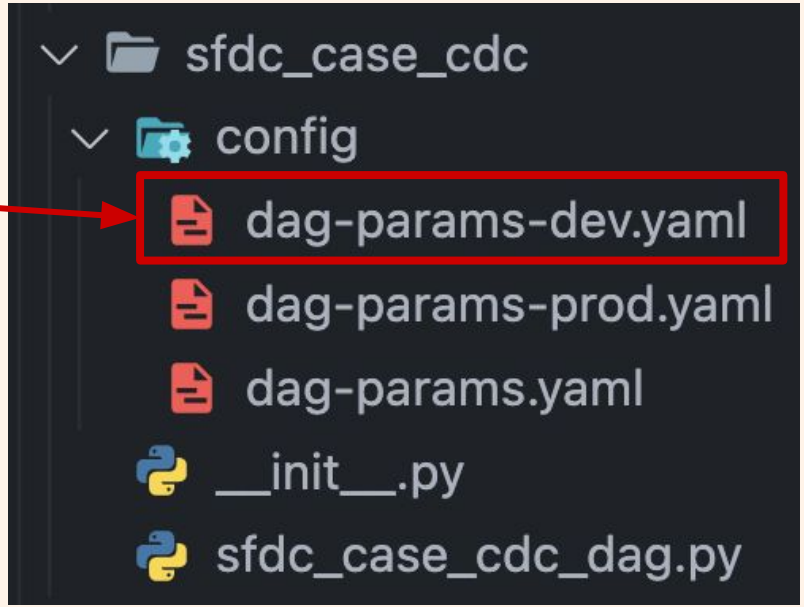
Separate DAG config per environment

DAG configuration for DEV



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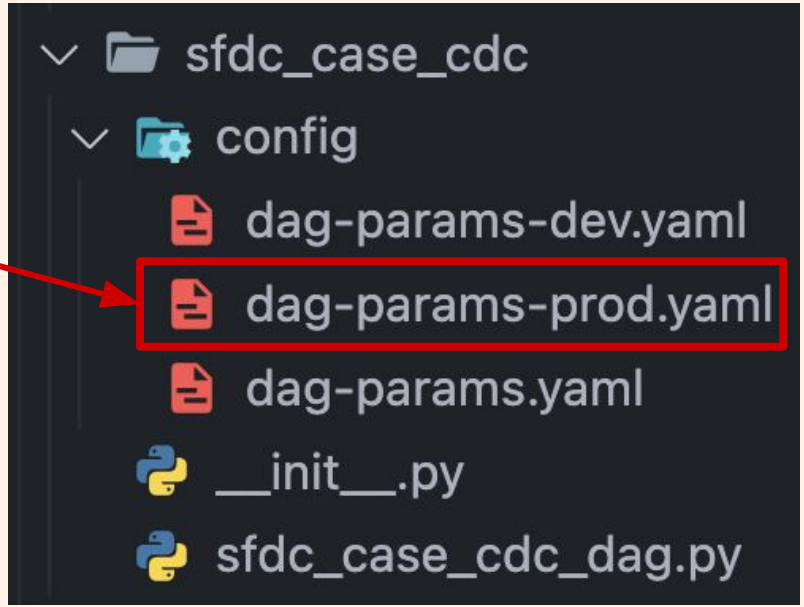
Separate DAG config per environment

DAG configuration for PROD



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Example

Main config

```yaml
detect_file:
  poke_interval: 900
  input:
    bucket: ft.localdev
    file_path: test/
```

DEV config

```yaml
detect_file:
  timeout: 10800
  input:
    bucket: ft.dev
```

Final config

```yaml
detect_file:
  timeout: 10800
  poke_interval: 900
  input:
    bucket: ft.dev
    file_path: test/
```

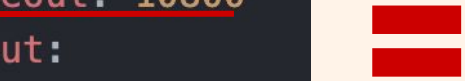
Example

Main config

```yaml
detect_file:
  poke_interval: 900
  input:
    bucket: ft.localdev
    file_path: test/
```

DEV config

```yaml
detect_file:
  timeout: 10800
  input:
    bucket: ft.dev
```



Final config

```yaml
detect_file:
  timeout: 10800
  poke_interval: 900
  input:
    bucket: ft.dev
    file_path: test/
```

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Usage inside DAG definition

```
with FTDAG(dag_id='sfdc_case_cdc',
           max_active_runs=1,
           schedule='0 23 * * *') as dag:

    detect_file = ETLFileIngesterSensorOperator(
        task_id=dag.dag_params.tasks.detect_file.task_id,
        timeout=dag.dag_params.tasks.detect_file.timeout,
        poke_interval=dag.dag_params.tasks.detect_file.poke_interval,
        s3_input=StoragePath(connection_id=dag.team_params.connections
                             bucket=dag.dag_params.tasks.detect_file.i
                             file_path=dag.dag_params.tasks.detect_fil
```

One step further:

Nested DAG Configurations

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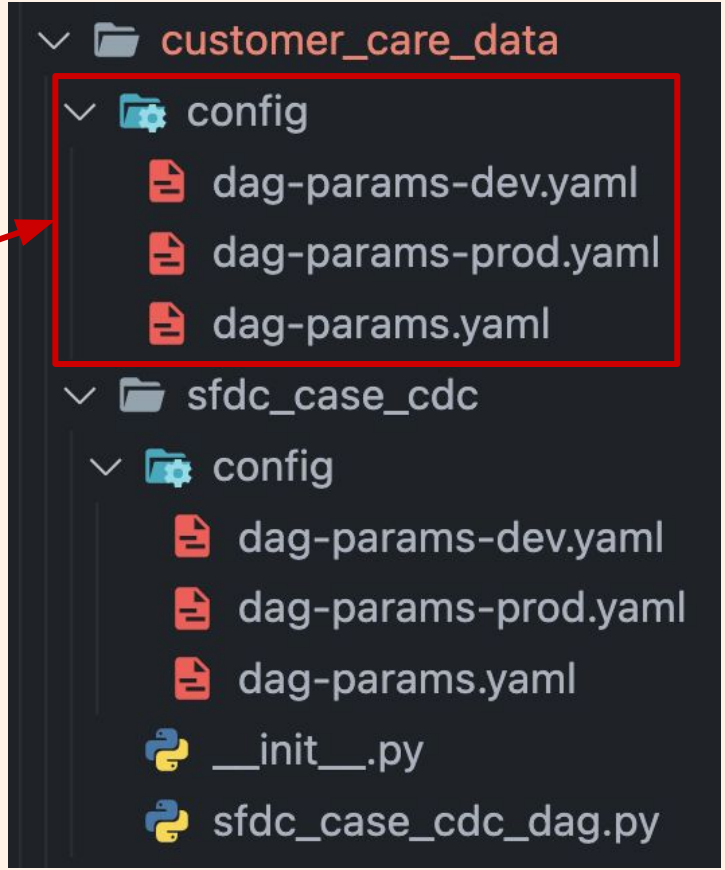
Nested DAG configs



Parent folder configuration

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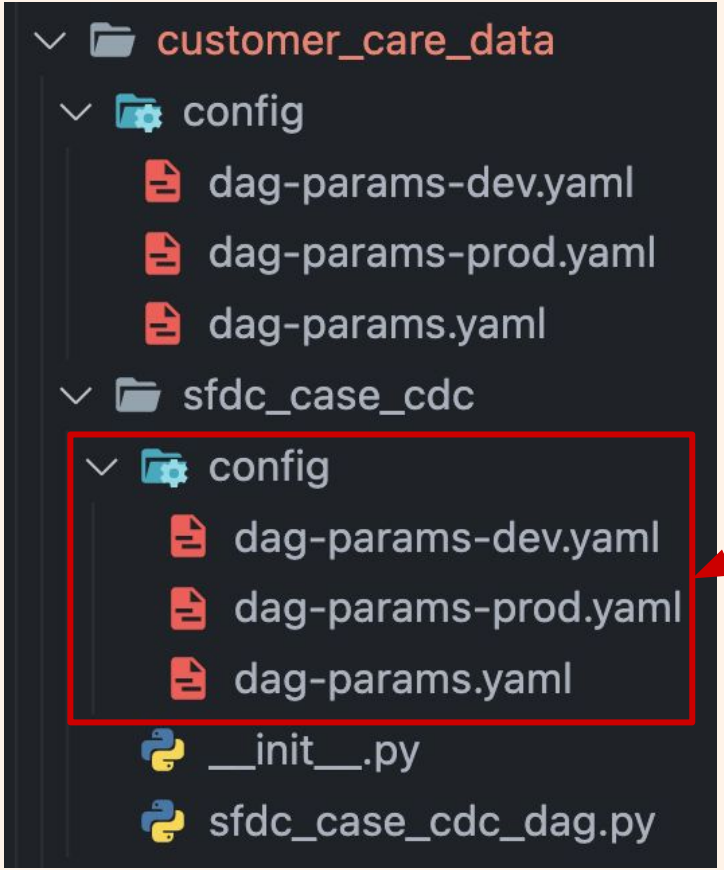
Nested DAG configs



DAG folder configuration

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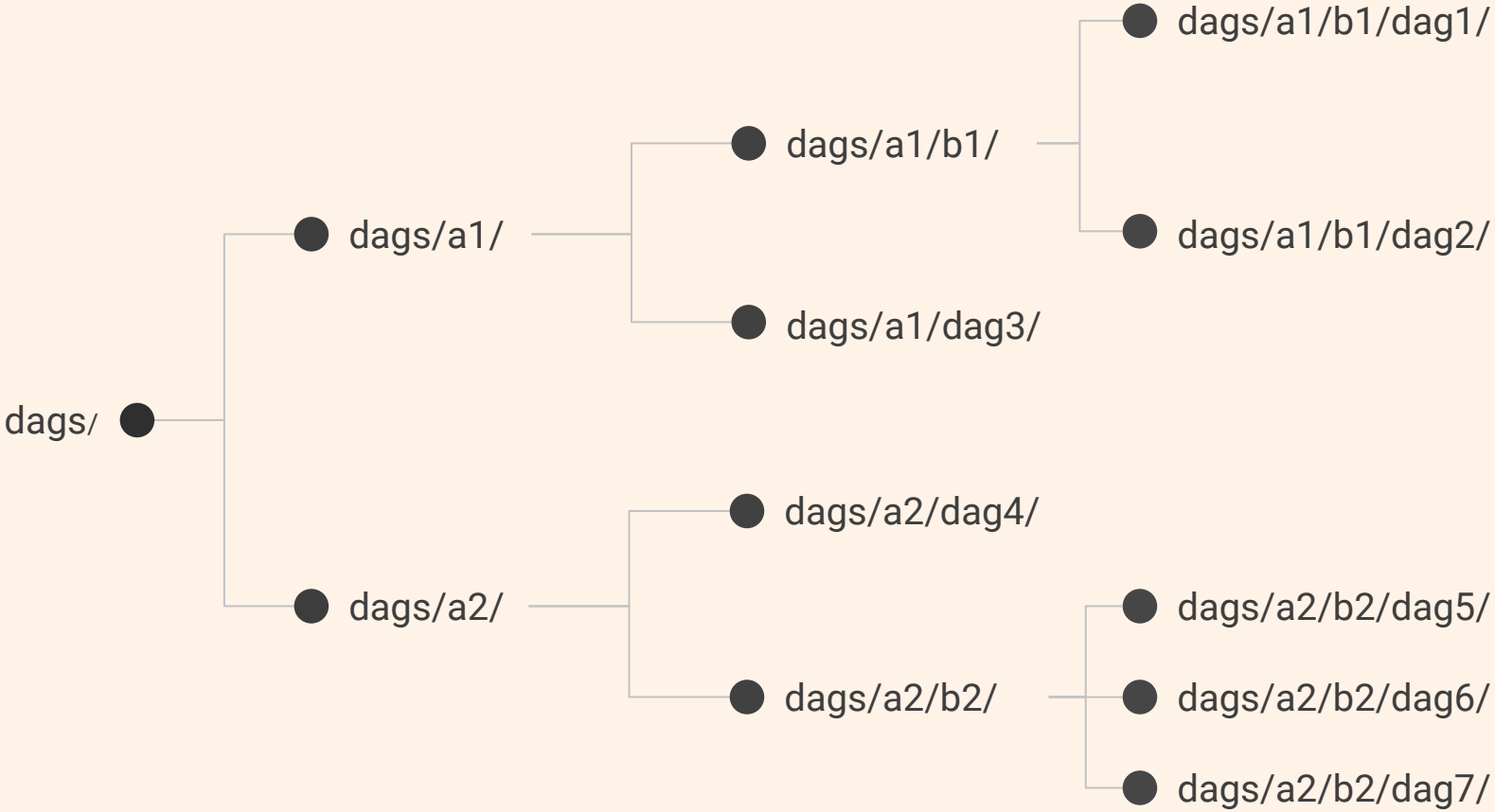
Let’s see some examples..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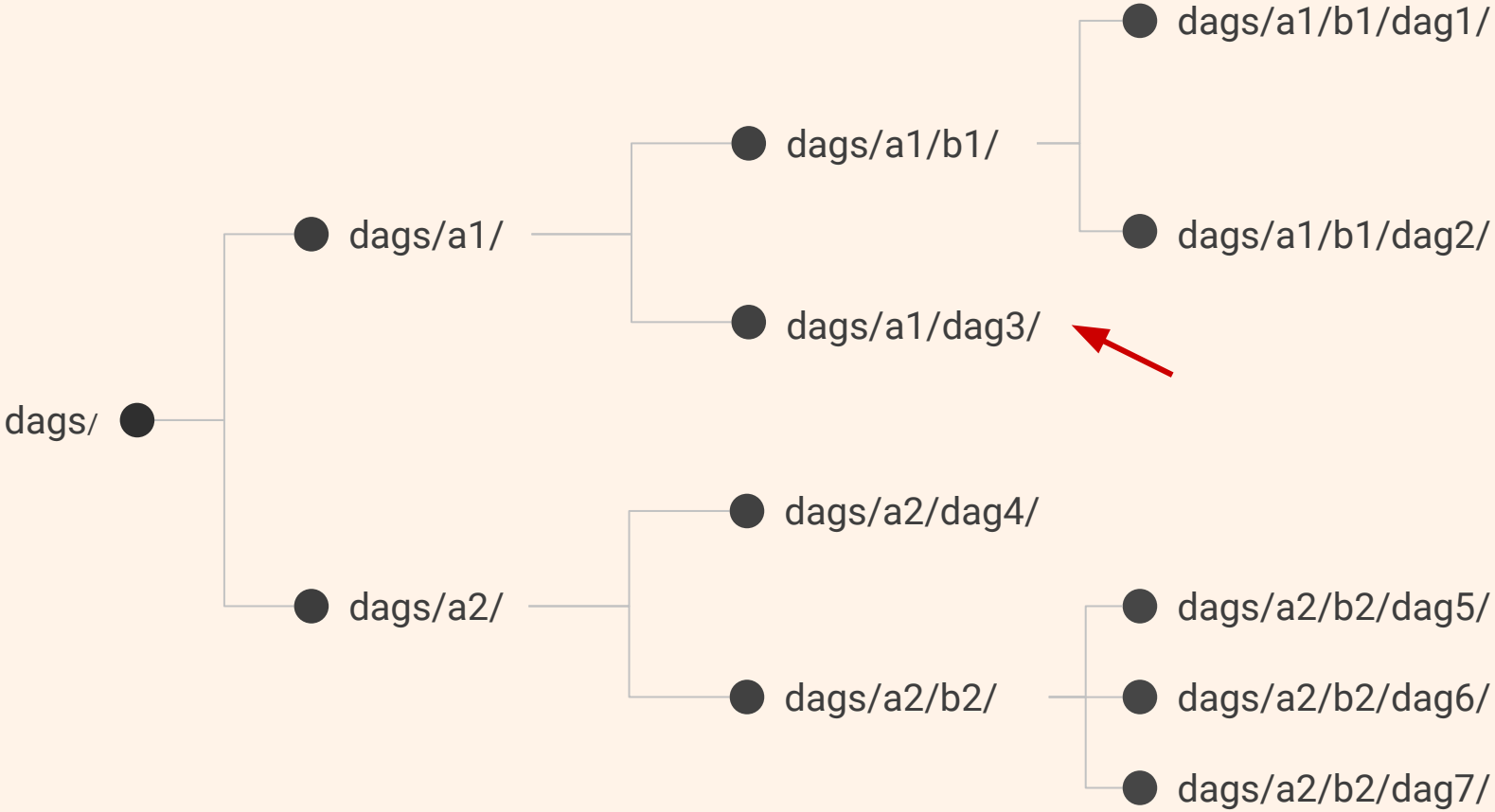
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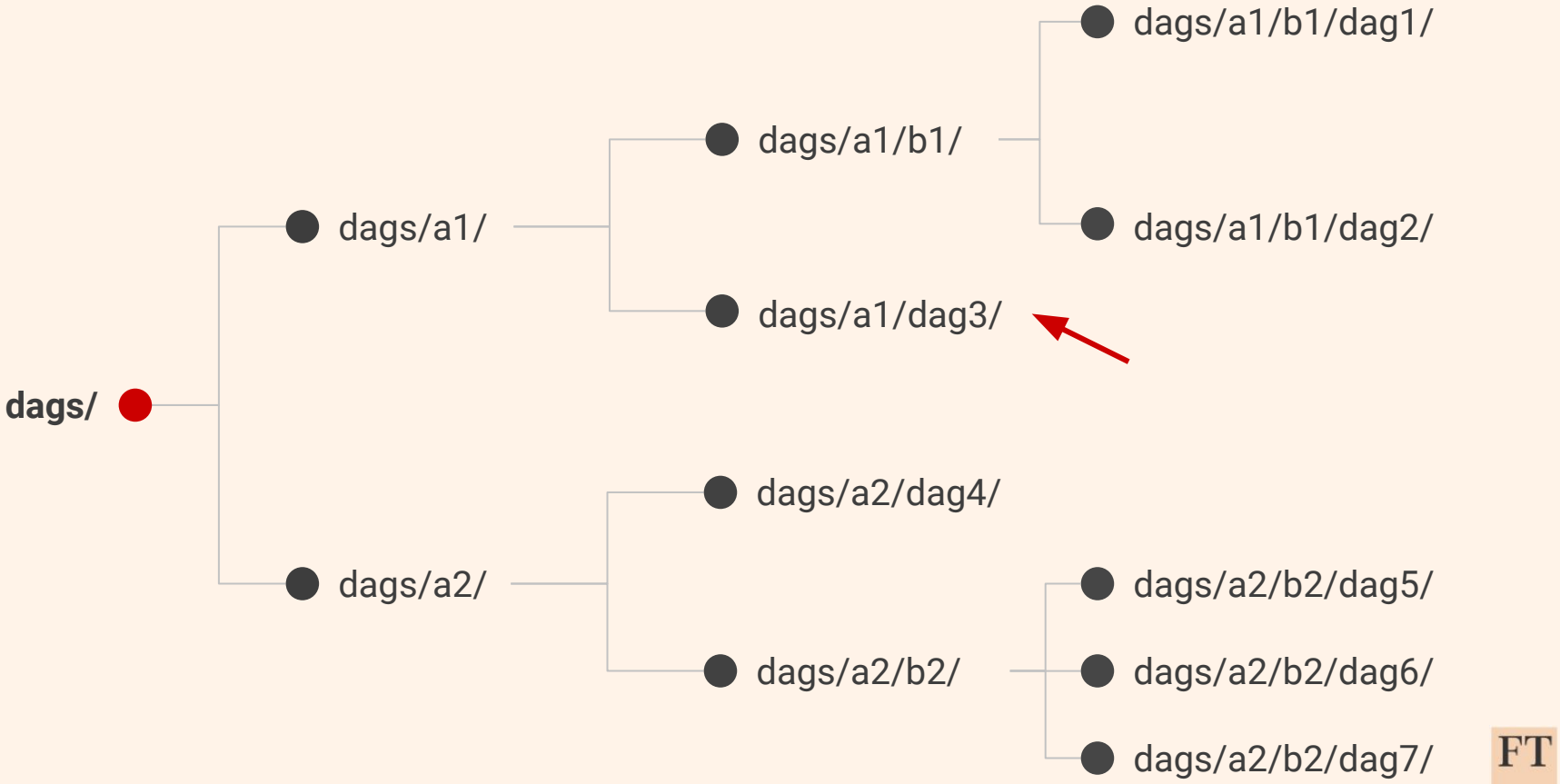
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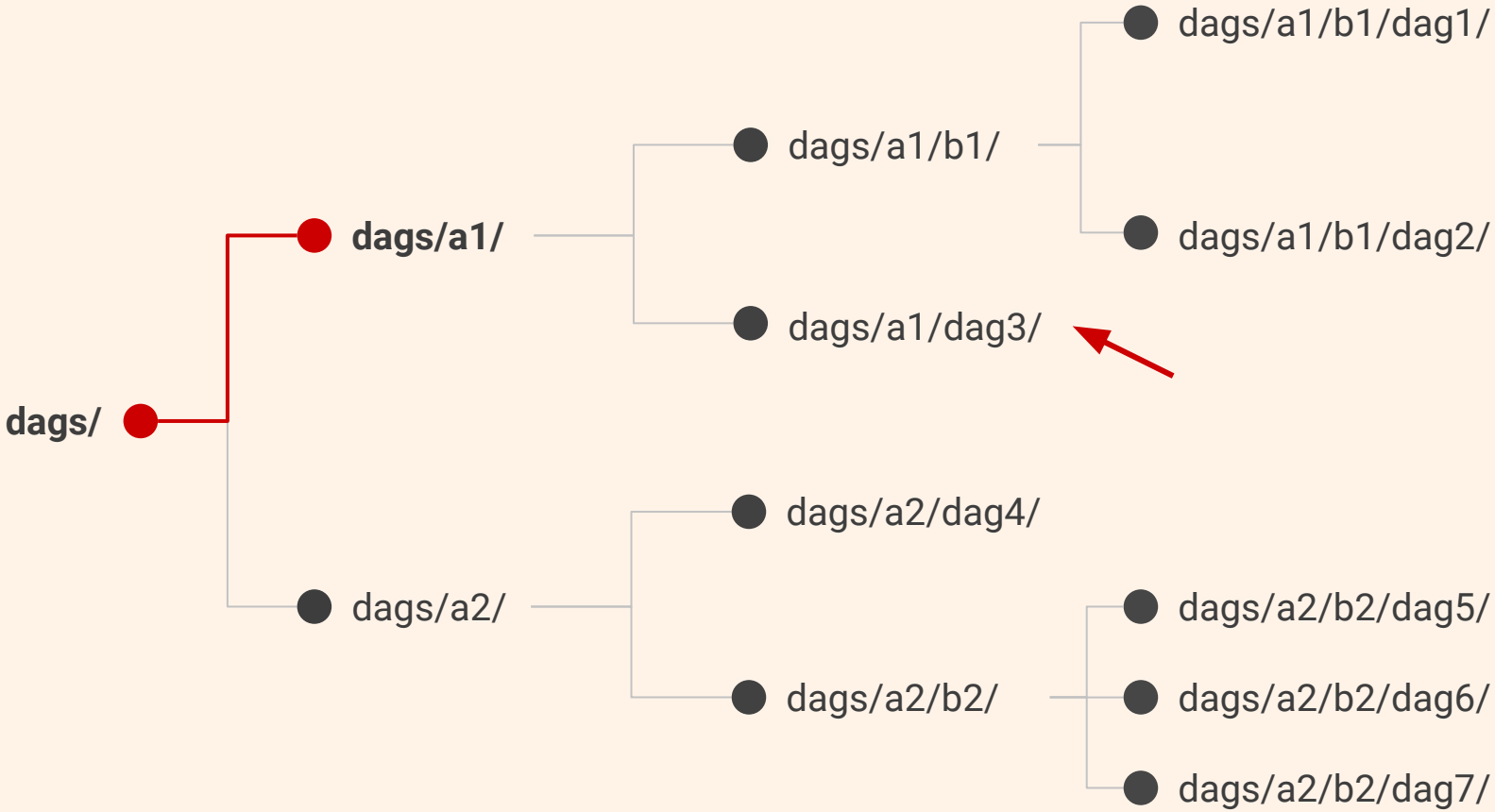
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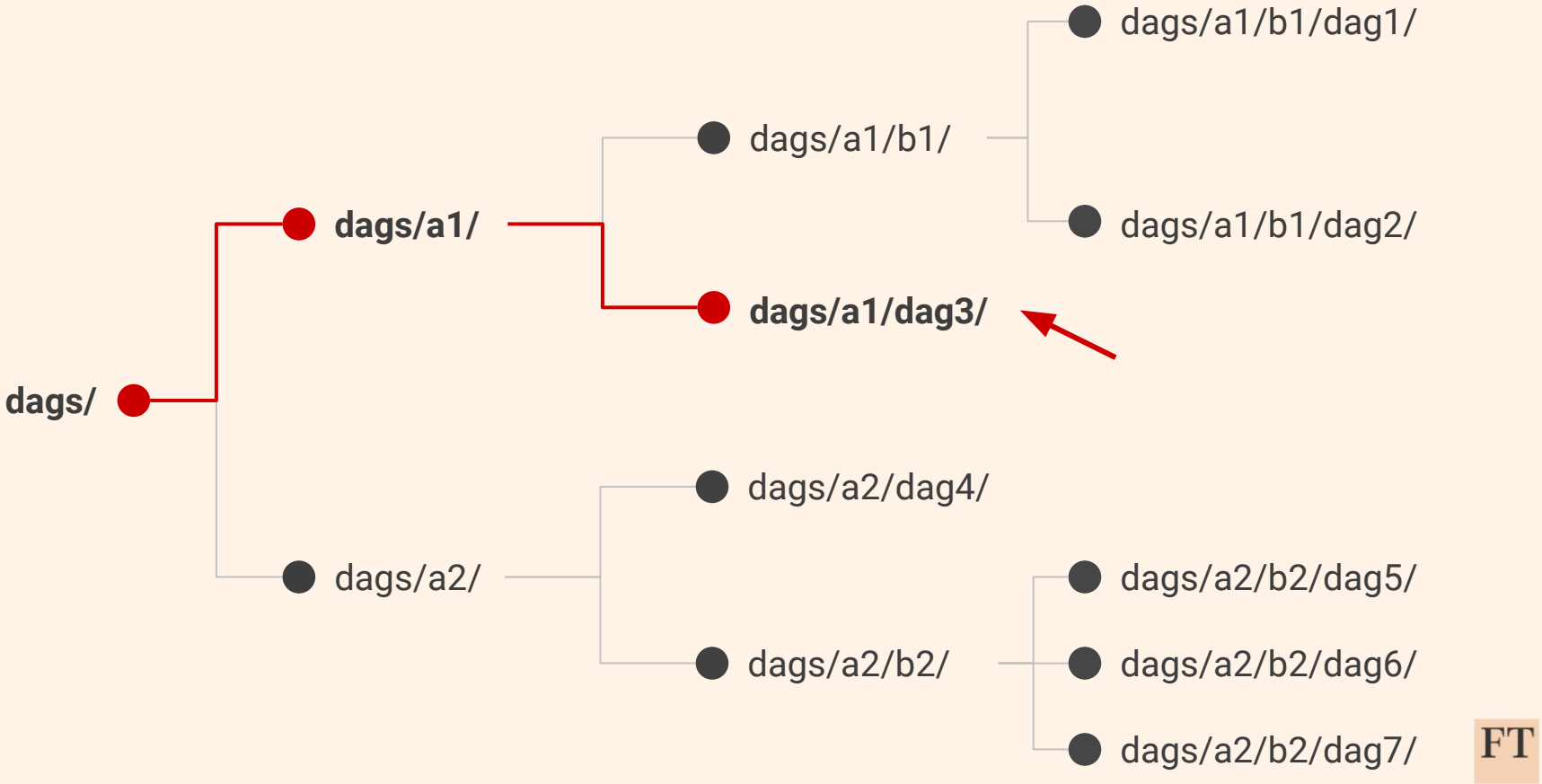
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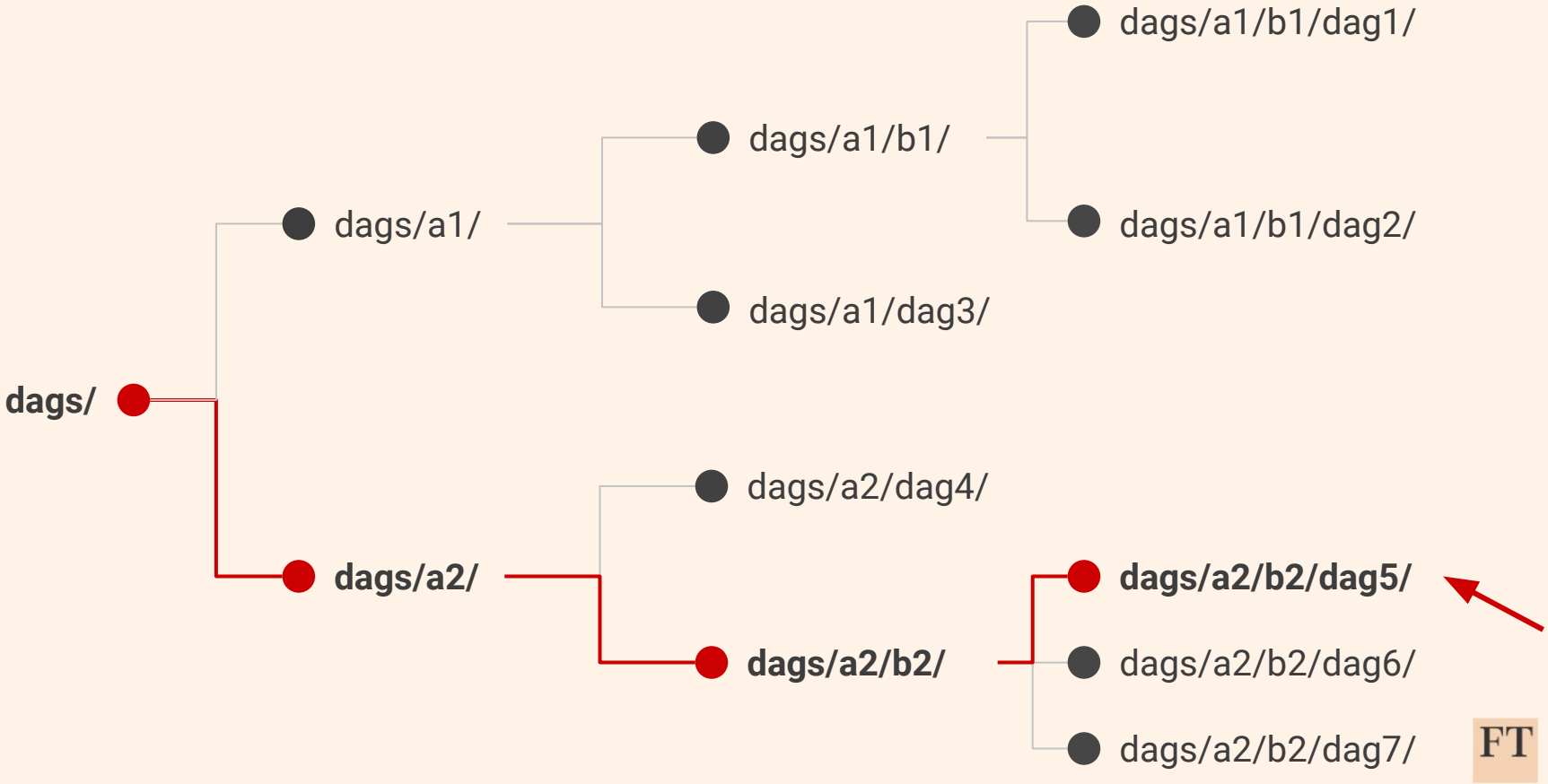
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dags/a2/
dags/a2/b2/dag5/
dags/a2/b2/
dags/a2/b2/dag6/
dags/a2/b2/dag7/

What’s the final config?!

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DAG: dataplatform_sfdc_case_cdc

Local

```
etl:
  archive:
    s3_output:
      bucket: localdev.ft.dw.archive
      connection_id: aws_conn_id
      sub_path: '{{dag.dag_id}}/{{logical_date}}'
tasks:
  archive_data_in_s3:
    output:
      bucket: localdev.ft.dw.archive
      file_path: dataplatform/sfdc_archive/sfdc_case_cdc
    task_id: archive_files_for_storage
  call_stored_procedure:
    parameters:
      business_key: id
      job_type: IU
      row_order: id
    task_id: staging_to_cdc
  common:
    job_id: sfdc_case_cdc
    redshift:
      cdc_table: sfdc_case_cdc
      schema: ftsfv2db
      staging_table: sfdc_case_stg
  detect_file:
    input:
      bucket: ip-crm-data-bridge-dev
      file_path: Exports/dw/Global-case/
    mode: reschedule
    poke_interval: 900
    soft_fail: true
```

Dev

```
etl:
  archive:
    s3_output:
      bucket: dev.ft.dw.archive
      connection_id: aws_conn_id
      sub_path: '{{dag.dag_id}}/{{logical_date}}'
tasks:
  archive_data_in_s3:
    output:
      bucket: dev.ft.dw.archive
      file_path: dataplatform/sfdc_archive/sfdc_case_cdc
    task_id: archive_files_for_storage
  call_stored_procedure:
    parameters:
      business_key: id
      job_type: IU
      row_order: id
    task_id: staging_to_cdc
  common:
    job_id: sfdc_case_cdc
    redshift:
      cdc_table: sfdc_case_cdc
      schema: ftsfv2db
      staging_table: sfdc_case_stg
  detect_file:
    input:
      bucket: ip-crm-data-bridge-dev
      file_path: Exports/dw/Global-case/
    mode: reschedule
    poke_interval: 900
    soft_fail: true
```

Prod

```
etl:
  archive:
    s3_output:
      bucket: prod.ft.dw.archive
      connection_id: aws_conn_id
      sub_path: '{{dag.dag_id}}/{{logical_date}}'
tasks:
  archive_data_in_s3:
    output:
      bucket: prod.ft.dw.archive
      file_path: dataplatform/sfdc_archive/sfdc_case_cdc
    task_id: archive_files_for_storage
  call_stored_procedure:
    parameters:
      business_key: id
      job_type: IU
      row_order: id
    task_id: staging_to_cdc
  common:
    job_id: sfdc_case_cdc
    redshift:
      cdc_table: sfdc_case_cdc
      schema: ftsfv2db
      staging_table: sfdc_case_stg
  detect_file:
    input:
      bucket: ip-crm-data-bridge-dev
      file_path: Exports/dw/Global-case/
    mode: reschedule
    poke_interval: 900
    soft_fail: true
```

And what’s next?

Defining a common structure:

ETL Pipeline Config

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Structure

```yaml
job_id: salesforce_contact_v2_cdc
vendor: 'salesforce_v2'

meta:
  header_lines_count: 1
  threshold_percentage: 0
  file_delimiter: ','

file_ingest:
  poll_interval: 900 # 15 minutes
  timeout: 10800 # 3 hours
  entrypoint_path:
    connection_id: 'aws_conn_id_crm_role_prod'
    bucket: 'ip-crm-data-bridge-prod'
    file_path: dw/Global-contact/
```

FT

Structure

```yaml
columns:
  - name: id
    data_type: varchar
    max_length: 18
    nullable: true
  - name: isdeleted
    data_type: boolean
    nullable: true
  - name: lastmodifieddate
    data_type: timestamp
    data_format: '%Y-%m-%dT%H:%M:%S.%f%z'
    nullable: true
  - name: annualrevenue
    data_type: numeric
    precision: 18
    scale: 2
    should_round: true
    nullable: true
```

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Structure

```yaml
redshift:
  schema: ftsalesforcev2db
  final_table: salesforce_contacts_v2_cdc
  copy_options:
    - EMPTYASNULL
    - timeformat 'auto'
    - TRUNCATECOLUMNS
    - dateformat 'auto'

archive:
  s3_output:
    connection_id: aws_conn_id
    bucket: prod.ft.dw.archive
    file_path: dataplatform/salesforce_v2_archive
    sub_path: '{{dag.dag_id}}/{{logical_date}}'
  s3_output_encryption_config:
    keys_to_use: ftwebanalytics
```

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Time for automation..

FT

ETL Reusable DAG

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What is the idea behind it?

1. Read the ETL Pipeline config

FT

What is the idea behind it?

1. Read the ETL Pipeline config
2. Create the DAG

FT

Implementation

```
@classmethod
def build_dag(cls,
              dag_configuration: Dict,
              default_args: Dict) -> FTDAG:
    default_args = default_args or {}
    default_args['depends_on_past'] = default_args.get('depends_on_past', True)
    default_args['wait_for_downstream'] = default_args.get('wait_for_downstream', True)
    default_args = DAGArgumentsBuilder.build(**default_args)

    with FTDAG(**dag_configuration,
               default_args=default_args) as dag:
        cls._build_tasks(dag=dag)
        return dag
```

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What is the idea behind it?

1. Read the ETL Pipeline config
2. Create the DAG
3. Add the necessary operators

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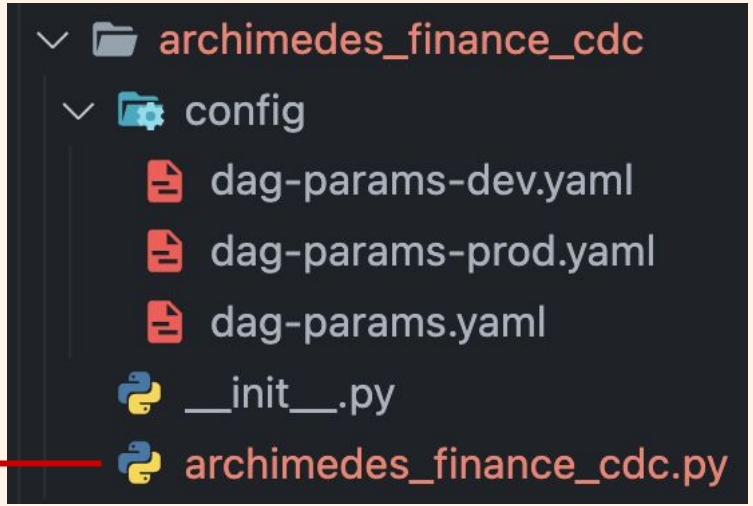
Implementation

```python
@classmethod
def _build_tasks(cls,
                 dag: FTDAG,
                 entrypoint_path: Optional[StoragePath] = None,
                 is_task_group: bool = False) -> None:
    job_config = ETLConfigService.read_job_config_from_dag_params(dag_params=dag.dag_params)
    tasks = []

    if not is_task_group:
        task = cls._entry_task_factory(job_config)
        tasks.append(task)

    if job_config.get_transformations():
        file_transformer = ETLFileTransformerOperator(
            task_id='transform',
            data_input=StoragePath(task_id=tasks[-1].task_id) if tasks else entrypoint_path
        )
        tasks.append(file_transformer)
```

Usage with predefined data sources




```
ETLReusableDAG.build_dag(
    dag_configuration={'dag_id': 'archimedes_finance_cdc',
                       'schedule': '0 10 * * *',
                       'tags': ['dataplatform', 'ingester', 'archimedes', 'finance']},
    default_args={'start_date': datetime(2023, 7, 28, 11, 0, 0)}
)
```

Usage with custom data sources

```
with FTDAG(dag_id="appsflyer_aggregated_skan_installs",
           schedule='0 1 * * *',
           start_date=datetime.datetime(2022, 8, 30, 0, 0, 0)) as dag:

    http_to_s3 = HttpToS3Operator(task_id=dag.dag_params.http_to_s3.task_id,
                                  http_conn_id=dag.dag_params.http_to_s3.http_conn_id,
                                  endpoint=dag.dag_params.endpoint)

    TG = ETLReusableDAG.build_task_group(
        dag=dag,
        entrypoint_path=StoragePath(task_id=dag.dag_params.http_to_s3.task_id)
    )

    http_to_s3 >> TG
```

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And even more automation..

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Generation of DDL SQLs

YAML

```yaml
redshift:
  final_table: finance_cdc
  stg_table: finance_stg
  business_key: financeid

columns:
- name: addressid
  data_type: bigint
  nullable: true
- name: product
  data_type: varchar
  max_length: 110
  nullable: true
- name: subcounter
  data_type: bigint
  nullable: true
```

SQL

```sql
CREATE TABLE ftarchimedesdb.finance_stg
(
    addressid BIGINT
    ,product VARCHAR(110)
    ,subcounter BIGINT
    ,"type" VARCHAR(110)
    ,financeid BIGINT
    ,createdate DATE
    ,periodfrom DATE
```

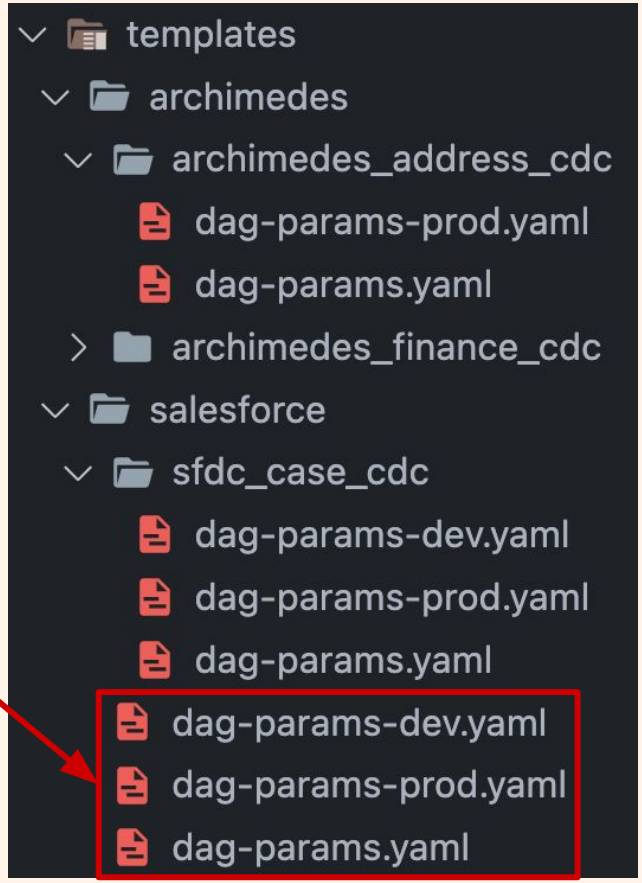
Let’s recap..

- Flexible DAG config system
- Additional ETL feature
  - Automates the DAG creation
  - Enforces the same config structure throughout all the DAGs
  - Removes most of the repetitive configuration and DAG code
  - Easily apply changes to all DAGs (can be a problem as well)
  - Opens the door for more automations

Further improvements

Step 1: No DAG code at all

Parent folder configuration



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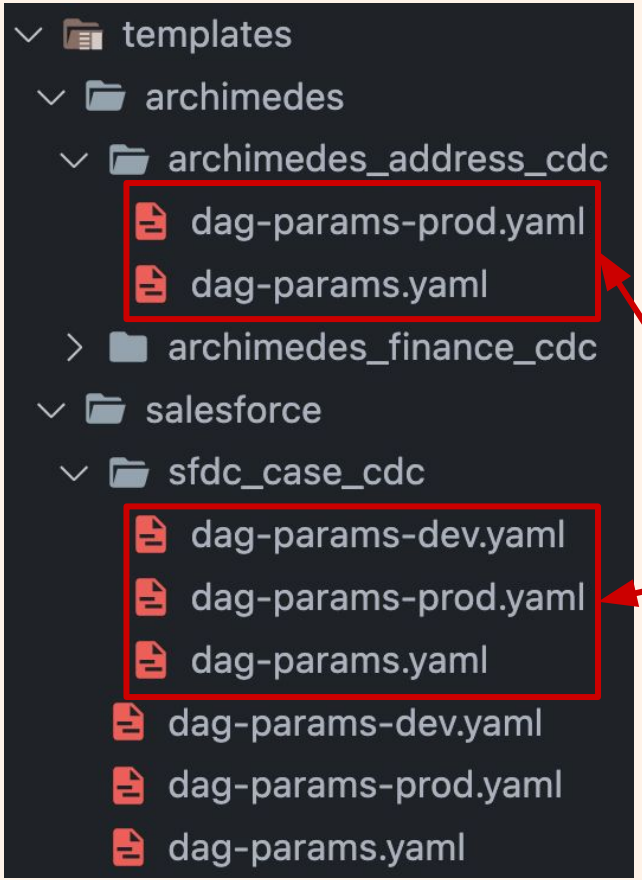
Step 1: No DAG code at all



DAG folder configuration

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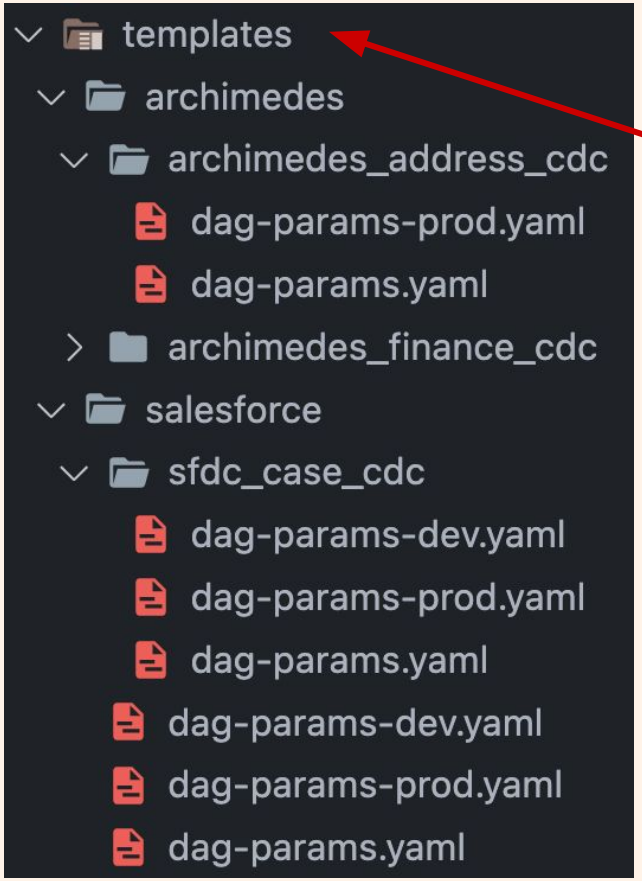
Step 1: No DAG code at all



Service which scans the folder and creates the DAGs

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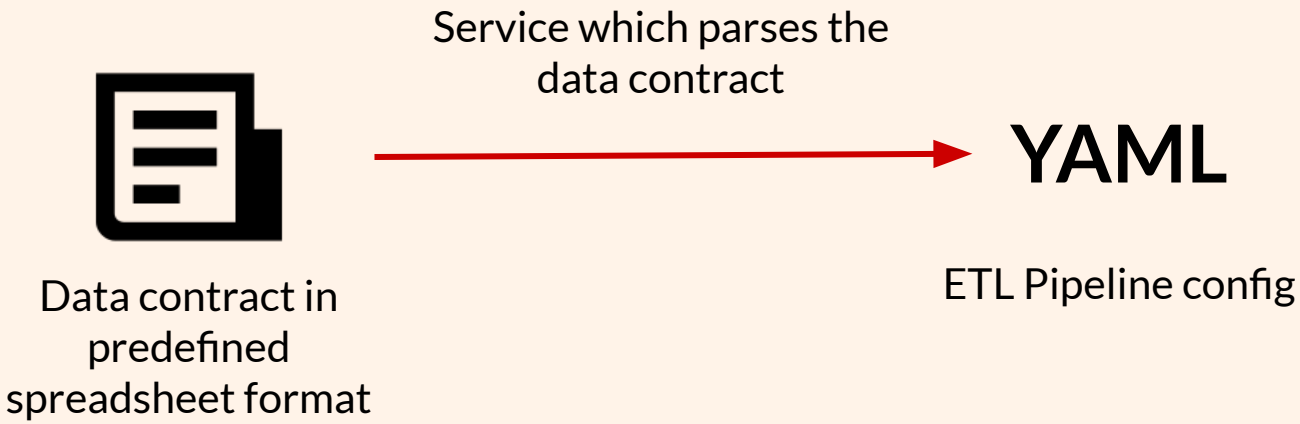
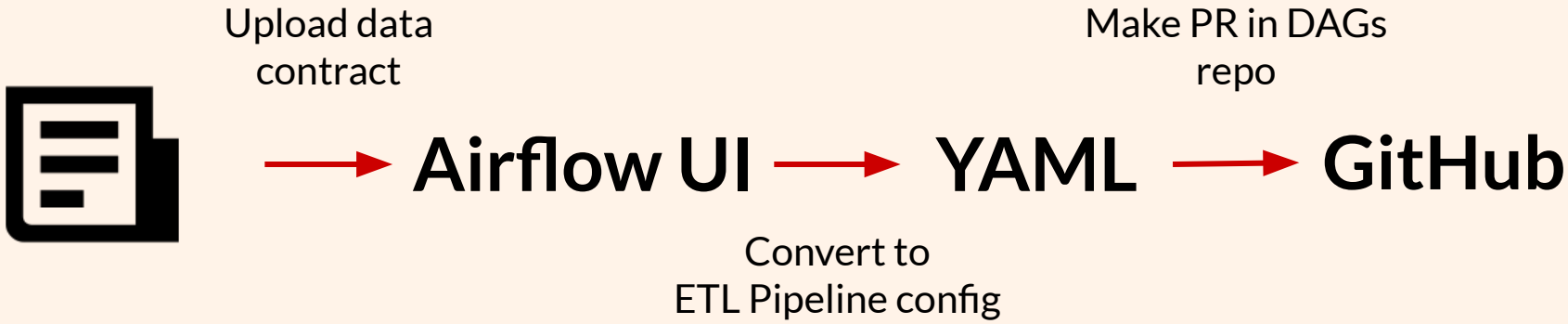
Step 2: Convert data contract to ETL Pipeline config



Step 3: Connect everything and make a GitHub PR



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Yes!

ETL DAGs can be written just from configuration!

Questions?

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LinkedIn: Zdravko Hvarlingov & Vladi Nekolov