

Azure data factory project.

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1. Introduction

In this project we will be building a data platform for reporting and prediction of the covid-19 outbreak.

- Data sources: European Center for Disease prevention and Control (Eurostat)
- Data flows: azure data factory
- Data transformation: HDInsight and databricks
- Ingestion of transformed data: Data Lake
- Necessary data for reporting the data trends: SQL Data warehouse
- We will orchestrate all of these pipelines using Azure data factory.

1.1 Project overview:

Our build data lake:

Data Lake to be built with the following data, to aid Data Scientists to predict the spread of the virus/mortality

- Confirmed cases
- Mortality
- Hospitalization/ ICU Cases
- Testing Numbers
- Country's population by age group

Our build data warehouse:

Data Warehouse to be built with the following data

- Confirmed cases
- Mortality
- Hospitalization/ ICU Cases
- Testing Numbers

The data sources:

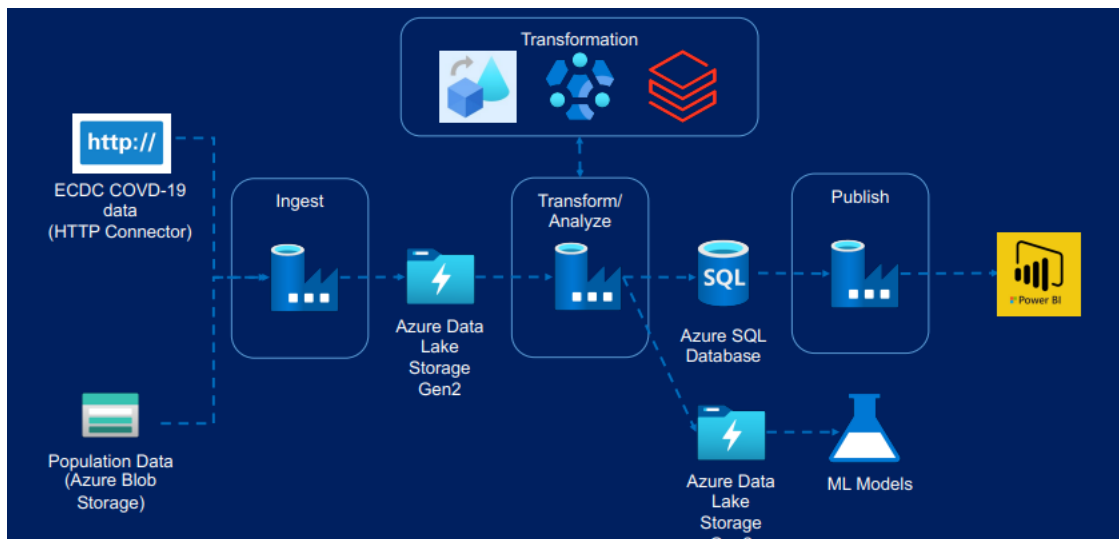
ECDC website:

- Confirmed cases
- Mortality
- Hospitalization / ICU Cases
- Testing Numbers

Eurostat Website:

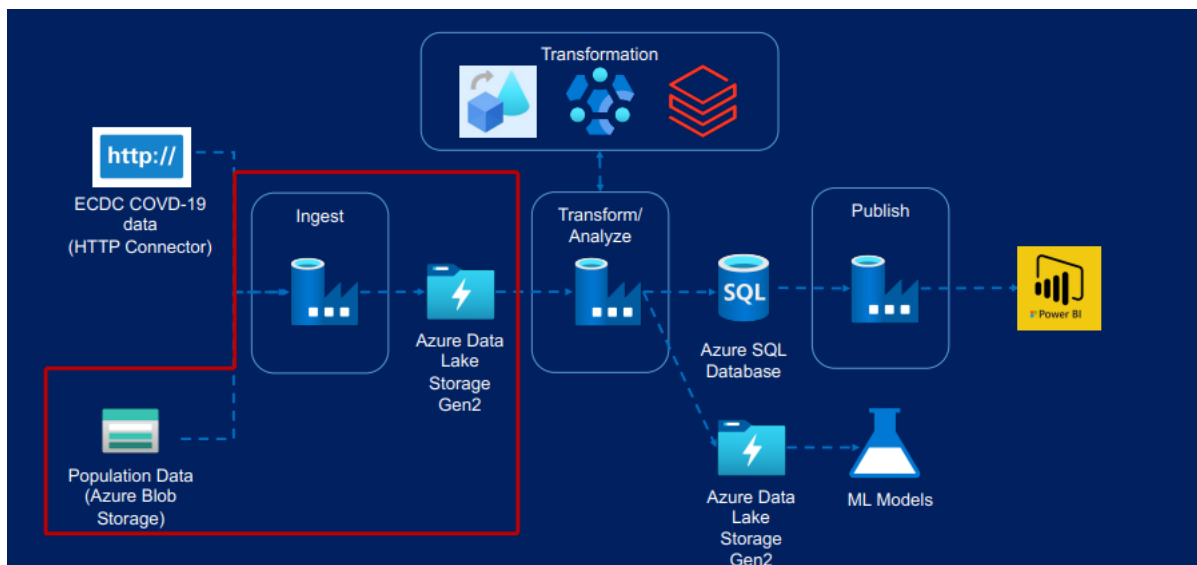
- Population by age

2. Solution Architecture



3. Data ingestion

Overview

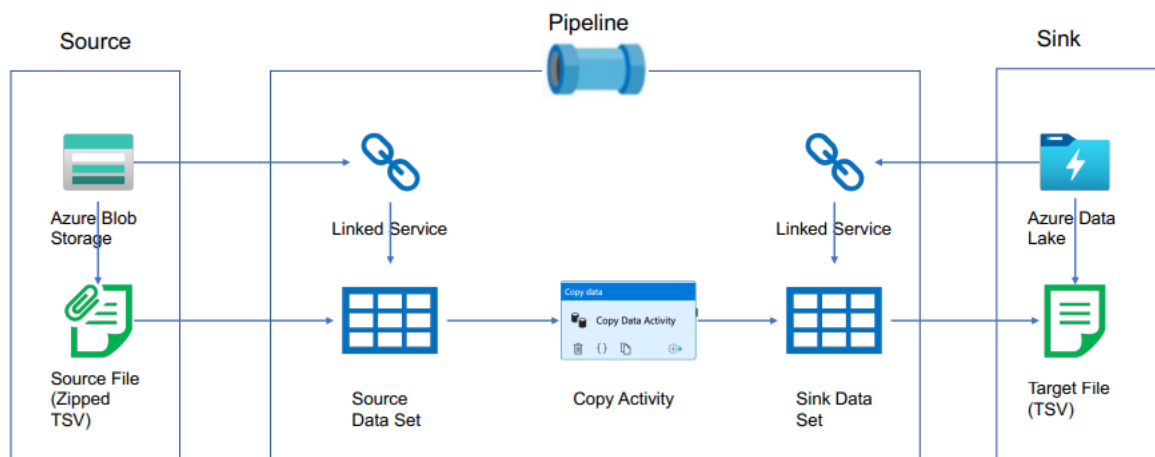


Worked with:



- Copy Activity
- Linked Services
- Datasets
- Validation Activity
- If Condition Activity
- Get Metadata Activity
- Web Activity
- Delete Activity
- Trigger

3.1 Data ingestion with Azure blob storage

Step 1 - Copy activity overview



Step 2 - Linked service

Edit linked service
 Azure Blob Storage [Learn more](#) 

Name *
ls_ablob_covidreportingsa

Description

Connect via integration runtime * ⓘ
AutoResolveIntegrationRuntime

Authentication type
Account key

Connection string **Azure Key Vault**

Account selection method ⓘ
☐ From Azure subscription ☒ Enter manually

Storage account name *
covidreportingsa0202

Storage account key **Azure Key Vault**

Storage account key *
.....

Partitioned DNS enabled ⓘ ☐

Endpoint suffix
core.windows.net


Additional connection properties
[+ New](#)

Test connection ⓘ
☒ To linked service ☐ To file path

Annotations
[+ New](#)
[> Parameters](#)
[> Advanced](#) ⓘ

Apply

Cancel

 Test connection

Step 3 - Blob data set (source)

Factory Resources

Filter resources by name

- Pipelines 9
 - Execute 1
 - Ingest 2
 - Process 3
 - sqlize 3
- Datasets 16
 - lookup 3
 - processed 4
 - raw 6
 - ds_ecdc_raw_csv_dl
 - ds_ecdc_raw_csv_http
 - ds_population_raw_gz**
 - ds_population_raw_tsv
 - ds_raw_cases_and_deaths
 - ds_raw_hospital_admissions
 - sql 3
- Data flows 2
- Power Query 0

ds_population_raw_gz

DelimitedText
ds_population_raw_gz

CSV

Connection Schema Parameters

Linked service * **ls_ablob_covidreportingsa** Test connection Edit + New Learn more

File path * **population** / **Directory** / **population_by_age.tsv.gz** Browse Preview data

Compression type **gzip (.gz)**

Compression level **Optimal**

Column delimiter **Tab (\t)** Edit

Row delimiter **Default (\r\n, or \n\r)** Edit

Encoding **Default(UTF-8)**

Escape character **Backslash (\)** Edit

Quote character **Double quote (")** Edit

First row as header ☒

Null value

Step 4 - Data Lake data set (sink)

Factory Resources

- Pipelines (9)
 - Execute (1)
 - Ingest (2)
 - Process (3)
 - sqlize (3)
- Datasets (16)
 - lookup (3)
 - processed (4)
 - raw (6)
 - ds_ecdc_raw_csv_dl
 - ds_ecdc_raw_csv_http
 - ds_population_raw_gz
 - ds_population_raw_tsv**
 - ds_raw_cases_and_deaths
 - ds_raw_hospital_admissions
 - sql (3)
- Data flows (2)
- Power Query (0)

ds_population_raw_tsv

DelimitedText
ds_population_raw_tsv

Connection Schema Parameters

Linked service * ls_adls_covidreportingdl [Test connection](#) [Edit](#) [+ New](#) [Learn more](#)

File path * raw / population / population_by_age.tsv [Browse](#) [Preview data](#)

Compression type None

Column delimiter Tab (\t)
[Edit](#)

Row delimiter Default (\r\n, or \n)
[Edit](#)

Encoding Default(UTF-8)

Escape character Backslash (\)
[Edit](#)

Quote character Double quote (")
[Edit](#)

First row as header ☒

Null value

Step 5 - Creating an ingestion pipeline

The screenshot displays the Azure Data Factory pipeline editor for a pipeline named 'pl_ingest_populati...'. The left sidebar shows the 'Activities' pane with a search bar and a list of activity categories: Move & transform, Azure Data Explorer, Azure Function, Batch Service, Databricks, Data Lake Analytics, General, HDInsight, Iteration & conditionals, Machine Learning, and Power Query. The main canvas shows a pipeline flow starting with a 'Validation' activity (Check if file exists), followed by a 'Get Metadata' activity (Get File Metadata), and then an 'If Condition' activity (If Column Count Matches). The 'If Condition' activity has two paths: 'True' (Copy population... → Delete source file) and 'False' (Send Email). The bottom pane shows the 'General' tab for the selected 'If Column Count Matches' activity, with fields for 'Name' (If Column Count Matches) and 'Description'.

pl_ingest_populati... x

Activities

Search activities

Move & transform

Azure Data Explorer

Azure Function

Batch Service

Databricks

Data Lake Analytics

General

HDInsight

Iteration & conditionals

Machine Learning

Power Query

Validation

Check if file exists

Get Metadata

Get File Metadata

If Condition

If Column Count Matches

True

Copy population...

Delete source file

False

Send Email

General Activities (3) User properties

Name * If Column Count Matches [Learn more](#)

Description

Step 6 - Trigger (ingestion) pipeline

Edit trigger

Name *

Description

Type *

BlobEventsTrigger


Account selection method * ⓘ

☒ From Azure subscription ☐ Enter manually

Azure subscription ⓘ

Eigen abonnement (9b9a9691-6d3d-43d5-84a2-bddc02aa3789) ▾

Storage account name * ⓘ

covidreportingsa0202 ▾ 

Container name * ⓘ

/population/ ▾

Blob path begins with ⓘ

population_by_age.tsv.gz

Blob path ends with ⓘ


Event * ⓘ

☒ Blob created ☐ Blob deleted

Ignore empty blobs * ⓘ

☒ Yes ☐ No

Annotations

 New

Status ⓘ

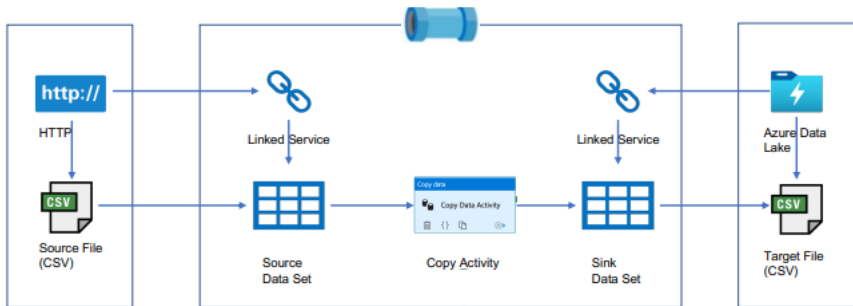
☐ Started ☒ Stopped

Continue

Cancel

3.2 Data ingestion from HTTP

Step 0 - Overview copy activity from HTTP



Step 1 - Created linked services

Edit linked service

HTTP [Learn more](#)

Name *

Is_http_opendata_ecdc_europa_eu

Description

Connect via integration runtime * ^①

AutoResolveIntegrationRuntime

Base URL *

@(linkedService().sourceBaseUrl)

Information will be sent to the URL specified. Please ensure you trust the URL entered.

Server Certificate Validation ^①

☒ Enable ☐ Disable

Authentication type * ^①

Anonymous

Auth headers ^①

+ New

Annotations

+ New

Parameters

+ New

Delete

<input type="checkbox"/>	Name	Type	Default value	
<input type="checkbox"/>	sourceBaseUrl	String	Value	

> Advanced ^①

Step 1 - Create data set (http - source)

The screenshot shows the Azure Data Factory 'Factory Resources' pane on the left and the configuration details for a new dataset 'ds_ecdc_raw_csv_http' on the right. The dataset is of type 'DelimitedText'.

Factory Resources:

- Pipelines: 9
 - Execute: 1
 - Ingest: 2
 - pl_ingest_ecdc_data
 - pl_ingest_population_data
 - Process: 3
 - sqlize: 3
- Datasets: 16
 - lookup: 3
 - processed: 4
 - raw: 6
 - ds_ecdc_raw_csv_dl
 - ds_ecdc_raw_csv_http**
 - ds_population_raw_gz
 - ds_population_raw_tsv
 - ds_raw_cases_and_deaths
 - ds_raw_hospital_admissions
 - sql: 3
- Data flows: 2
- Power Query: 0

Dataset Configuration (ds_ecdc_raw_csv_http):

- Connection:** Is_http_opendata_ecdc_europa_eu (Test connection, Edit, New, Learn more)
- Linked service properties:**

Name	Value	Type
sourceBaseUrl	@dataset().baseUrl	string
- Relative URL:** @dataset().relativeURL (Preview data)
- Compression type:** None
- Column delimiter:** Comma (,) (Edit)
- Row delimiter:** Default (\r, \n, or \r\n) (Edit)
- Encoding:** Default(UTF-8)
- Escape character:** Backslash (\) (Edit)
- Quote character:** Double quote (") (Edit)
- First row as header:** ☒
- Null value:**

Step 2 - Create data set (DL sink)

The screenshot displays the Azure Data Factory (ADF) console. On the left, the 'Factory Resources' pane shows a tree view with 'Pipelines' (9 items) and 'Datasets' (16 items). Under 'Datasets', the 'raw' folder is expanded, showing several datasets, with 'ds_ecdc_raw_csv_dl' selected. The main workspace shows a 'DelimitedText' dataset icon for 'ds_ecdc_raw_csv_dl'. Below this, the 'Connection' tab is active, showing the configuration for the dataset. The configuration includes a linked service 'ls_adls_covidreportingdl', a file path 'raw/ecdc/@dataset().fileName', and various formatting options like compression type, column and row delimiters, encoding, and escape/quote characters. The 'First row as header' checkbox is checked.

Factory Resources

- Pipelines (9)
 - Execute (1)
 - Ingest (2)
 - pl_ingest_ecdc_data
 - pl_ingest_population_data
 - Process (3)
 - sqlize (3)
- Datasets (16)
 - lookup (3)
 - processed (4)
 - raw (6)
 - ds_ecdc_raw_csv_dl (selected)
 - ds_ecdc_raw_csv_http
 - ds_population_raw_gz
 - ds_population_raw_tsv
 - ds_raw_cases_and_deaths
 - ds_raw_hospital_admissions
 - sql (3)
 - Data flows (2)
 - Power Query (0)

Dataset Configuration: ds_ecdc_raw_csv_dl

Connection | Schema | Parameters

Linked service *: ls_adls_covidreportingdl [Test connection] [Edit] [New] [Learn more]

File path *: raw / ecdc / @dataset().fileName [Browse]

Compression type: None

Column delimiter: Comma (,) [Edit]

Row delimiter: Default (\r\n, or \r\n) [Edit]

Encoding: Default(UTF-8)

Escape character: Backslash (\) [Edit]

Quote character: Double quote (") [Edit]

First row as header: ☒

Null value:

Step 3 - Create pipeline for data ingestion

The screenshot displays the Azure Data Factory (ADF) interface. On the left, the 'Factory Resources' pane shows a hierarchy of resources: Pipelines (9), Ingest (2), Process (3), sqlize (3), Datasets (16), lookup (3), processed (4), raw (6), sql (3), Data flows (2), and Power Query (0). The 'pl_ingest_ecdc_data' pipeline is selected. The main canvas shows the pipeline logic: a 'Lookup' activity named 'Lookup ECDC File List' is connected to a 'ForEach' loop. The 'ForEach' loop is configured to 'Execute copy for every record' and contains a 'Copy ECDC Data' activity. The 'Activities' pane on the right lists various activity types: Move & transform, Azure Data Explorer, Azure Function, Batch Service, Databricks, Data Lake Analytics, General, HDInsight, Iteration & conditionals, Machine Learning, and Power Query. The 'General' tab is active in the bottom pane, showing the 'Name' field set to 'Execute copy for every record' and an empty 'Description' field.

Step 4 - Create trigger for pipeline

Edit trigger

Name *

tr_ingest_ecdc_data

Description

Type *

TumblingWindowTrigger

Start Date (UTC) *

12/19/22 00:00:00

Recurrence * ⓘ

Every 24

Hour(s)

☐ Specify an end date

> Advanced

Annotations

+ New

Status ⓘ

☒ Started ☐ Stopped

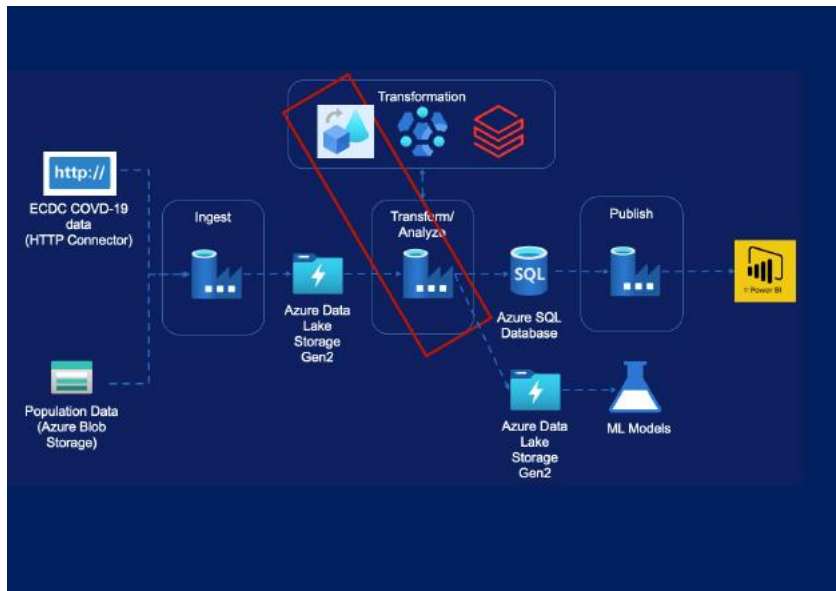
Step 6 - Ecdc file list data set

The screenshot displays the Azure Data Factory (ADF) interface. On the left, the 'Factory Resources' pane shows a tree view with categories: Pipelines (9), Datasets (16), lookup (3), processed (4), raw (6), sql (3), and Data flows (2). The 'ds_ecdc_file_list' dataset is selected under the 'lookup' category. The main pane shows the configuration for this dataset, which is a JSON file. The 'Connection' tab is active, showing the 'Linked service' as 'ls_ablob_covidreportingsa'. The 'File path' is configured as 'configs / Directory / ecdc_file_list.json'. The 'Compression type' is set to 'None' and the 'Encoding' is 'Default(UTF-8)'. The 'Preview experience' toggle is turned off.

4. Data transformation

4.1 Data flow

Step 0 – Overview transformation in data flow



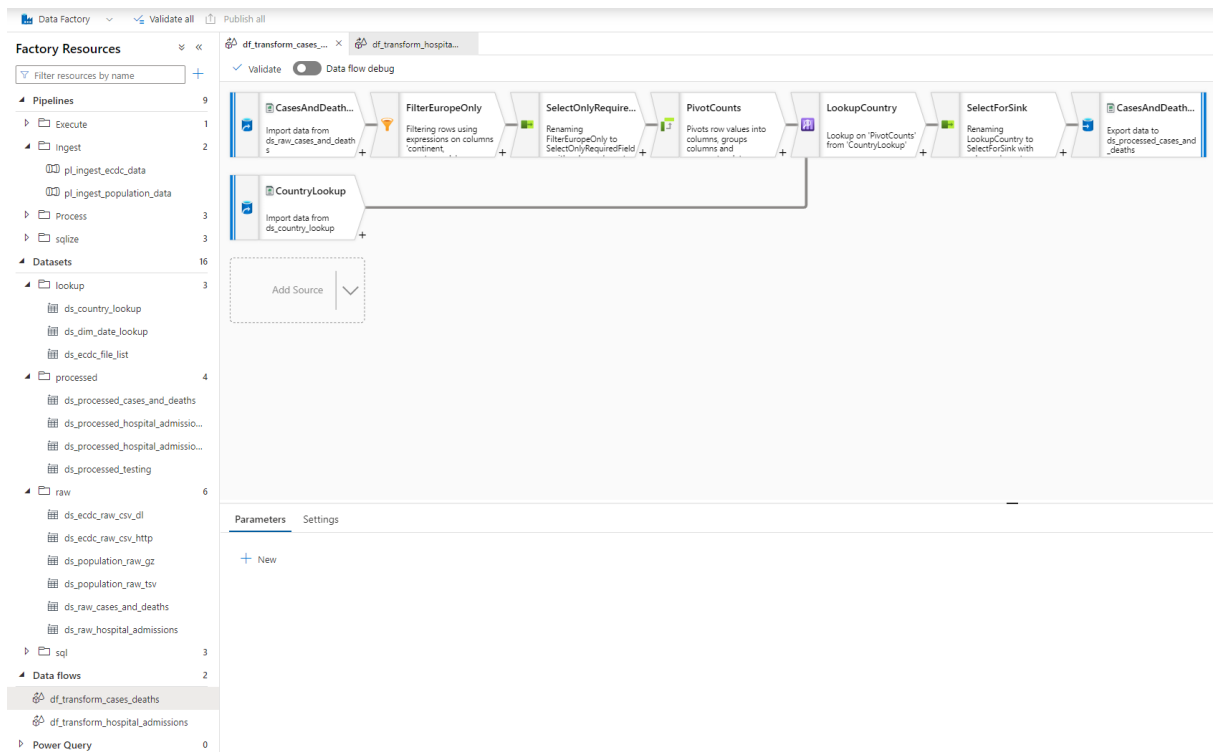
(1) Steps taken:

- Source Transformation
- Filter Transformation
- Select Transformation
- Pivot Transformation
- Lookup Transformation
- Sink Transformation
- Create Pipeline

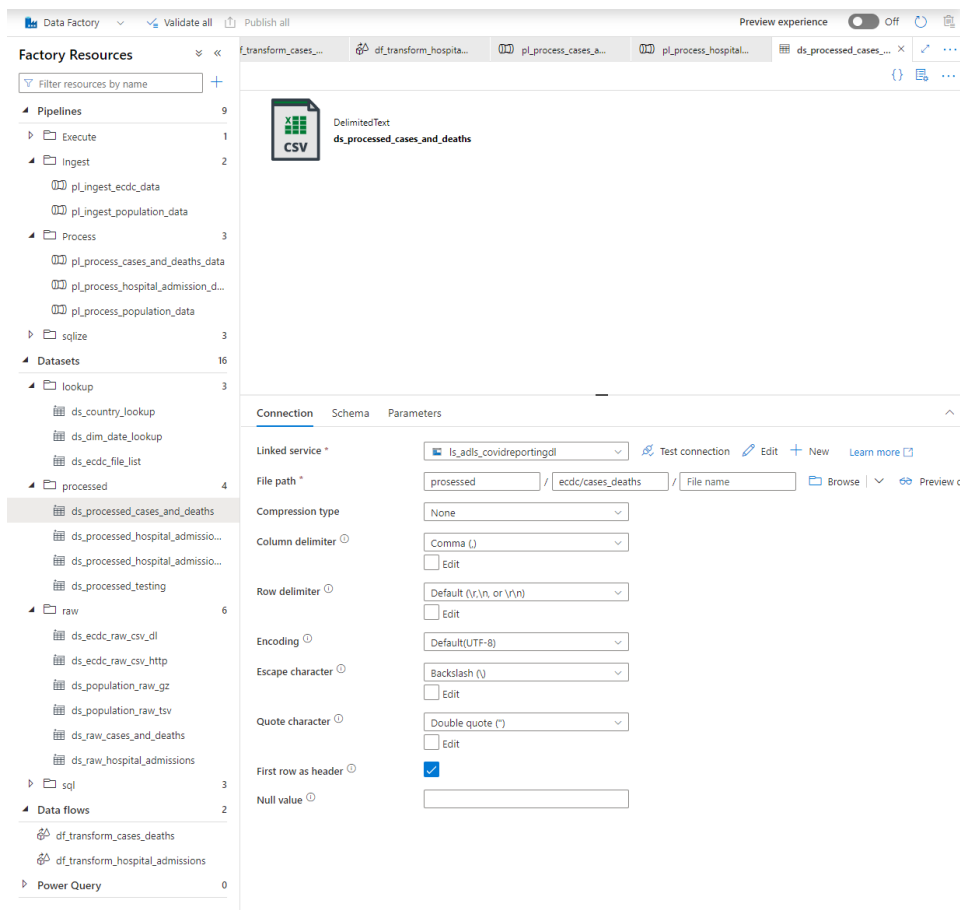
(2) Steps taken:

- Source Transformation
- Select Transformation
- Lookup Transformation
- Pivot Transformation
- Sink Transformation
- Conditional Split Transformation
- Derived Column Transformation
- Aggregate Transformation
- Sort Transformation
- Join Transformation
- Select Transformation
- Create Pipeline

(1) Step 1 - Create transformations with data flow



(1) Step 2 - Create data set for processed data



(1) Step 3 – Create pipeline

The screenshot displays the Azure Data Factory (ADF) interface. On the left, the 'Factory Resources' pane shows a tree view of resources, including Pipelines, Ingest, Process, Datasets, and Power Query. The 'Process' folder is expanded, showing several data flows. The 'Activities' pane in the center lists various activities such as Move & transform, Azure Data Explorer, Azure Function, Batch Service, Databricks, Data Lake Analytics, General, HDInsight, Iteration & conditionals, Machine Learning, and Power Query. The right pane shows the configuration for a 'Data flow' activity. The 'Data flow' dropdown is set to 'df_transform_cases_deaths'. The 'Run on (Azure IR)' dropdown is set to 'AutoResolveIntegrationRuntime'. The 'Compute size' dropdown is set to 'Small'. The 'Logging level' is set to 'Verbose'. The 'Sink properties' and 'Staging' sections are also visible.

The screenshot displays the Databricks Data Factory interface. On the left, the 'Factory Resources' pane shows a tree view of the workspace, including Pipelines, Jobs, Datasets, and Data Flows. The main area shows a data pipeline for COVID-19 data processing. The pipeline starts with two datasets: 'HospitalAdmissions' and 'CountryLookup'. The 'HospitalAdmissions' dataset is processed by a 'SelectRawFields' task, which extracts specific fields. The output of 'SelectRawFields' is then processed by a 'Weekly' task, which is configured to run weekly and uses a 'Daily' task for daily processing. The 'Weekly' task is highlighted, showing its configuration for a weekly schedule and a 'Daily' task for daily processing. The pipeline continues with 'JoinRawData', 'ProcessWeekly', 'SortWeekly', 'SelectWeekly', and 'MonthlyJoin' tasks, each performing specific data processing steps like joining, processing, sorting, and selecting data. The 'MonthlyJoin' task is the final step in the pipeline, which joins the monthly data with the previous month's data.

Data Factory
Validate all
Publish all


Factory Resources

Filter resources by name

- Pipelines 9
 - Execute 1
 - Ingest 2
 - pl_ingest_ecdc_data
 - pl_ingest_population_data
 - Process 3
 - pl_process_cases_and_deaths_data
 - pl_process_hospital_admission_data
 - pl_process_population_data
 - sqlize 3
- Datasets 16
- Lookup 3
 - ds_country_lookup
 - ds_dim_date_lookup
 - ds_ecdc_file_list
- processed 4
 - ds_processed_cases_and_deaths
 - ds_processed_hospital_admission...**
 - ds_processed_hospital_admission...
 - ds_processed_testing
- raw 6
 - ds_ecdc_raw_csv_dl
 - ds_ecdc_raw_csv_http
 - ds_population_raw_gz
 - ds_population_raw_tsv
 - ds_raw_cases_and_deaths
 - ds_raw_hospital_admissions
- sql 3
- Data flows 2
 - df_transform_cases_deaths
 - df_transform_hospital_admissions
- Power Query 0

ds_processed_hospit...

DelimitedText
ds_processed_hospital_admission_daily



Connection Schema Parameters

Linked service *

ds_adis_covidreportingdl
/
ecdc/hospital_admissio...

File path *

processed

/

ecdc/hospital_admissio...

File name

Compression type

None

Column delimiter

Comma (,)

Row delimiter

Default (\r\n, or \n\r\n)

Encoding

Default(UTF-8)

Escape character

Backslash (\)

Quote character

Double quote (")

First row as header

☒

Null value

[Test connection](#) [Edit](#) [New](#) [Learn more](#)

[Browse](#) [Preview data](#)

Step 6 - Create data set for processed data (weekly)

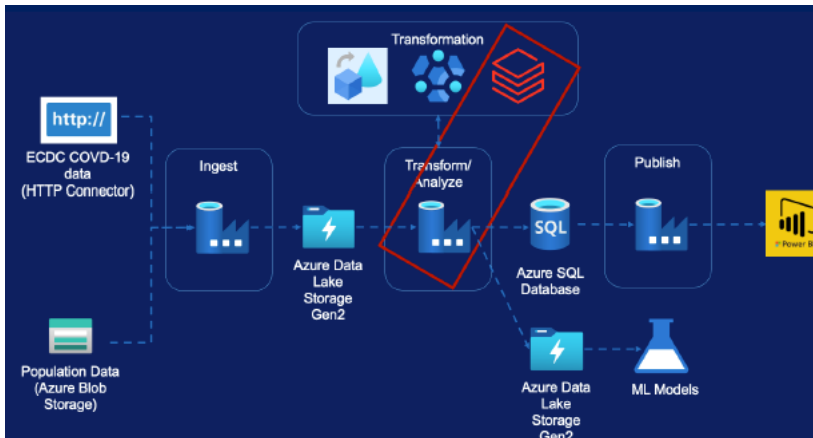
The screenshot displays the Microsoft Fabric Data Factory interface. On the left, the 'Factory Resources' pane shows a tree view of the workspace. Under the 'Datasets' section, the dataset 'ds_processed_hospital_admission_weekly' is selected. The main pane on the right shows the configuration for this dataset, which is a 'DelimitedText' type. The configuration includes the following settings:

- Linked service:** ls_adls_covidreportingdl
- File path:** processed / ecdc/hospital_admissio / File name
- Compression type:** None
- Column delimiter:** Comma (,)
- Row delimiter:** Default (\r\n, or \n)
- Encoding:** Default(UTF-8)
- Escape character:** Backslash (\)
- Quote character:** Double quote (")
- First row as header:** ☒
- Null value:**

Step 7 - Create pipeline

4.2 Databricks

Step 0 - Databricks overview



Steps taken:

- Create Databricks Service
- Create Databricks Cluster
- Mount Storage Accounts
- Transformation requirements
- Creating Pipeline

Step 1 – Mount cluster 1 / 2

mount_storage Python

File Edit View Run Help Last edit was 22 days ago Give feedback

Run all Unknown Schedule Share

Mount the following data lake storage gen2 containers

1. raw
2. processed
3. lookup

Set-up the configs

Please update the following

- application-id
- service-credential
- directory-id

```
1 configs = {"fs.azure.account.auth.type": "OAuth",
2           "fs.azure.account.oauth.provider.type": "org.apache.hadoop.fs.azurebfs.oauth2.ClientCredsTokenProvider",
3           "fs.azure.account.oauth2.client.id": "47846408-5bca-44f4-9de3-71fd3b08a9d6",
4           "fs.azure.account.oauth2.client.secret": "rty8Q-FbCdPt37mAtANTCisANbkYi.XyOYMasI",
5           "fs.azure.account.oauth2.client.endpoint": "https://login.microsoftonline.com/8603b7a6-42b5-4a50-a399-b1332d779cb6/oauth2/token"}
```

Command took 0.04 seconds -- by ossy-80@live.nl at 12/14/2022, 3:47:26 PM on Covid-reporting-cluster

Mount the raw container

Update the storage account name before executing

```
1 dbutils.fs.mount(
2   source = "abfss://raw@covidreportingdl020.dfs.core.windows.net/",
3   mount_point = "/mnt/covidreportingdl020/raw",
4   extra_configs = configs)
```

▶ (1) Spark Jobs
Out[4]: True
Command took 24.09 seconds -- by ossy-80@live.nl at 12/14/2022, 3:48:47 PM on Covid-reporting-cluster

Mount the processed container

Update the storage account name before executing

```
1 dbutils.fs.mount(
2   source = "abfss://processed@covidreportingdl020.dfs.core.windows.net/",
3   mount_point = "/mnt/covidreportingdl020/processed",
```

Step 1 – Mount cluster 2 / 2

mount_storage Python

File Edit View Run Help [Last edit was 22 days ago](#) [Give feedback](#) ▶ Run all ● Unknown ▼ Schedule Share

4

```
extra_configs = configs)
```

▶ (1) Spark Jobs

Out[8]: True

Command took 20.83 seconds -- by ossy-80@live.nl at 12/14/2022, 3:53:14 PM on Covid-reporting-cluster

Cmd 8

Mount the lookup container

Update the storage account name before executing

Cmd 9

```
1 dbutils.fs.mount(
2     source = "abfss://lookup@covidreportingdl020.dfs.core.windows.net/",
3     mount_point = "/mnt/covidreportingdl020/lookup",
4     extra_configs = configs)
```

▶ (1) Spark Jobs

Out[6]: True

Command took 21.14 seconds -- by ossy-80@live.nl at 12/14/2022, 3:50:45 PM on Covid-reporting-cluster

Cmd 10

```
1 dbutils.fs.ls("/mnt/covidreportingdl020/lookup")
```

Out[9]: [FileInfo(path='dbfs:/mnt/covidreportingdl020/lookup/dim_country/', name='dim_country/', size=0),
FileInfo(path='dbfs:/mnt/covidreportingdl020/lookup/dim_date/', name='dim_date/', size=0)]

Command took 0.26 seconds -- by ossy-80@live.nl at 12/14/2022, 3:54:21 PM on Covid-reporting-cluster

Cmd 11

```
1
```

Shift+Enter to run

Step 2 – transform data 1 / 2

transform_population_data Python
File Edit View Run Help Last edit was 22 days ago Give feedback

Run all Connect Schedule Share

Cmd 3

1 from pyspark.sql.functions import *

Cmd 4

Read the population data & create a temp view

Cmd 5

1 df_raw_population = spark.read.csv("/mnt/covidreportingdl020/raw/population", sep=r'\t', header=True)
2 df_raw_population = df_raw_population.withColumn('age_group', regexp_replace(split(df_raw_population['indic_de,geo\time'], ',')[0], 'PC_', ''))
3 df_raw_population = df_raw_population.withColumn('country_code', split(df_raw_population['indic_de,geo\time'], ',')[1])
4 df_raw_population = df_raw_population.select(col("country_code").alias("country_code"),
5 col("age_group").alias("age_group"),
6 col("2019 ").alias("percentage_2019"))
df_raw_population.createOrReplaceTempView("raw_population")

Cmd 6

Pivot the data by age group

Cmd 7

1 # Create a data frame with pivoted percentages
2 df_raw_population_pivot = spark.sql("SELECT country_code, age_group, cast(regexp_replace(percentage_2019, '[a-z]', '') AS decimal(4,2)) AS
percentage_2019 FROM raw_population WHERE length(country_code) =
2").groupBy("country_code").pivot("age_group").sum("percentage_2019").orderBy("country_code")
3 df_raw_population_pivot.createOrReplaceTempView("raw_population_pivot")

Cmd 8

Read the country lookup

Cmd 9

1 # Create a data frame for the country lookup
2 df_dim_country = spark.read.csv("/mnt/covidreportingdl020/lookup/dim_country", sep=r',', header=True)
3 df_dim_country.createOrReplaceTempView("dim_country")

Cmd 10

Join population data with country lookup

Cmd 11

1 df_processed_population = spark.sql("""SELECT c.country,
2 c.country_code_2_digit,
3 c.country_code_3_digit,
4 c.population,
5 p.Y0_14 AS age_group_0_14,
6 p.Y15_24 AS age_group_15_24,
7 p.Y25_49 AS age_group_25_49,
8 p.Y50_64 AS age_group_50_64,
9 p.Y65_79 AS age_group_65_79,
10 p.Y80_MAX AS age_group_80_max
11 FROM raw_population_pivot p
12 JOIN dim_country c ON c.country_code_2_digit = p.country_code_2_digit
13 AND c.country_code_3_digit = p.country_code_3_digit""")

Step 2 – transform data 2 / 2

transform_population_data Python

File Edit View Run Help Last edit was 22 days ago Give feedback

```
5      p.Y0_14 AS age_group_0_14,
6      p.Y15_24 AS age_group_15_24,
7      p.Y25_49 AS age_group_25_49,
8      p.Y50_64 AS age_group_50_64,
9      p.Y65_79 AS age_group_65_79,
10     p.Y80_MAX AS age_group_80_max
11 FROM raw_population_pivot p
12 JOIN dim_country c ON p.country_code = country_code_2_digit
13 ORDER BY country""")
```

Cmd 12

Write output to the processed mount point

Cmd 13

```
1 df_processed_population.write.format("com.databricks.spark.csv").option("header","true").option("delimiter",
  ",").mode("overwrite").save("/mnt/covidreportingdl020/prosessed/population")
```

Cmd 14

```
1
```

Shift+Enter to run

Step 3 – Create linked service

Edit linked service
Azure Databricks Learn more

Name *
ls_db_covid_cluster

Description

Connect via integration runtime *
AutoResolveIntegrationRuntime

Account selection method *
☐ From Azure subscription ☒ Enter manually

Databricks Workspace URL *
https://adb-3875266610093583.3.azuredatabricks.net

Authentication type *
Access Token

Access token

Azure Key Vault

Access token *

Select cluster
☒ New job cluster ☐ Existing interactive cluster ☐ Existing instance pool

Cluster version *
7.3.x-cpu-ml-scala2.12

Cluster node type *
Standard_DS3_v2

Python Version *
3

Worker options
☒ Fixed ☐ Autoscaling

Workers *
1

> Additional cluster settings

Annotations

+ New

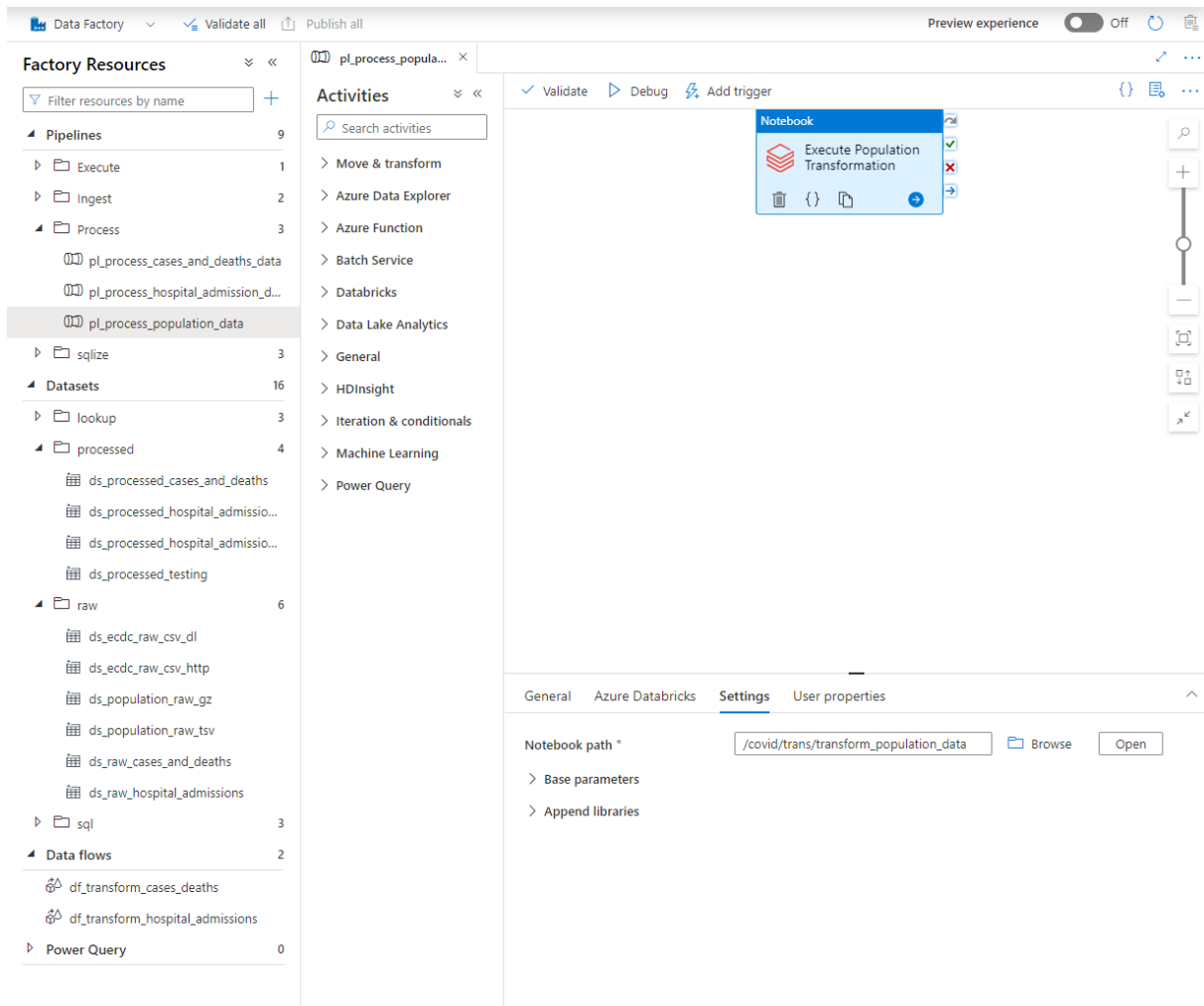
> Parameters

> Advanced

Save Cancel

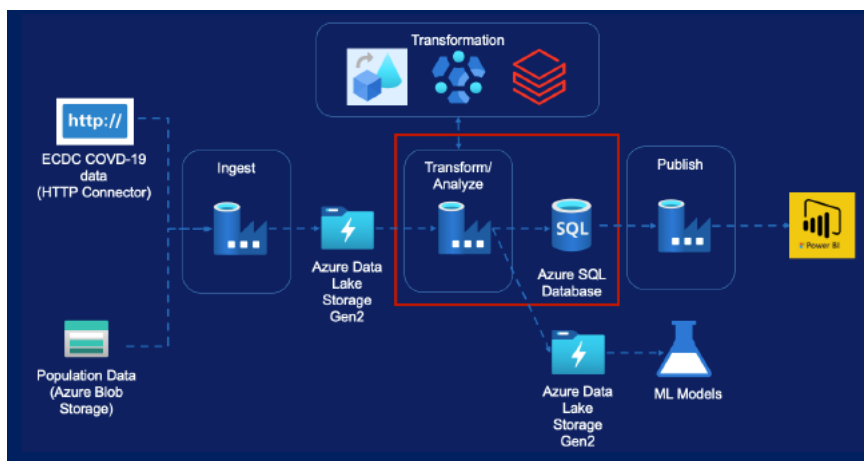
Test connection

Step 4 – Create pipeline



5. Load into database

Step 0 – Overview SQL database



Steps taken:



- Copy Cases & Deaths data
- Copy Hospital Admissions data
- Copy testing data

Step 1 – Create SQL script

```
1 CREATE SCHEMA covid_reporting
2 GO
3
4 CREATE TABLE covid_reporting.cases_and_deaths
5 (
6     country          VARCHAR(100),
7     country_code_2_digit VARCHAR(2),
8     country_code_3_digit VARCHAR(3),
9     population        BIGINT,
10    cases_count        BIGINT,
11    deaths_count        BIGINT,
12    reported_date       DATE,
13    source              VARCHAR(500)
14 )
15 GO
16
17 CREATE TABLE covid_reporting.hospital_admissions_daily
18 (
19     country          VARCHAR(100),
20     country_code_2_digit VARCHAR(2),
21     country_code_3_digit VARCHAR(3),
22     population        BIGINT,
23     reported_date       DATE,
24     hospital_occupancy_count BIGINT,
25     icu_occupancy_count  BIGINT,
26     source              VARCHAR(500)
27 )
28 GO
29
30 CREATE TABLE covid_reporting.testing
31 (
32     country          VARCHAR(100),
33     country_code_2_digit VARCHAR(2),
34     country_code_3_digit VARCHAR(3),
35     year_week         VARCHAR(8),
36     week_start_date    DATE,
37     week_end_date       DATE,
38     new_cases          BIGINT,
39     tests_done          BIGINT,
40     population          BIGINT,
41     testing_data_source VARCHAR(500)
42 )
43 GO
44
```

Step 2 – Create linked service

Edit linked service

 Azure SQL Database [Learn more](#) 

Name *

ls_sql_covid_db

Description

Connect via integration runtime * ^①

AutoResolveIntegrationRuntime

Connection string

[Azure Key Vault](#)

Account selection method ^①

☐ From Azure subscription ☒ Enter manually

Fully qualified domain name *

covid-db020.database.windows.net

Database name *

covid-db020

Authentication type *

SQL authentication

User name *

admin020

Password

[Azure Key Vault](#)

Password *

Always encrypted ^①

☐

Additional connection properties

+ New

Annotations

+ New

> Parameters

> Advanced ^①

Step 3 - Create sink dataset

The screenshot shows the Azure Data Factory (ADF) interface. On the left, the 'Factory Resources' pane is expanded, showing a tree view of resources. The 'sql' folder under 'raw' is selected, and the 'ds_sql_cases_and_deaths' dataset is highlighted. The main pane displays the configuration for this dataset, showing it is an 'Azure SQL Database' sink. The 'Connection' tab is active, showing the 'Linked service' as 'ls_sql_covid_db' and the 'Table' as 'covid_reporting.cases_and_deaths'. The 'Schema' and 'Parameters' tabs are also visible. The top bar includes 'Data Factory', 'Validate all', 'Publish all', and 'Preview experience' toggle.

Factory Resources

- Pipelines (9)
 - Execute (1)
 - Ingest (2)
 - Process (3)
 - sqlize (3)
 - pl_sqlize_cases_and_deaths_data
 - pl_sqlize_hospital_admissions_da...
 - pl_sqlize_testing
- Datasets (16)
 - lookup (3)
 - processed (4)
 - ds_processed_cases_and_deaths
 - ds_processed_hospital_admissio...
 - ds_processed_hospital_admissio...
 - ds_processed_testing
 - raw (6)
 - ds_ecdc_raw_csv_dl
 - ds_ecdc_raw_csv_http
 - ds_population_raw_gz
 - ds_population_raw_tsv
 - ds_raw_cases_and_deaths
 - ds_raw_hospital_admissions
 - sql (3)
 - ds_sql_cases_and_deaths**
 - ds_sql_hospital_admissions_daily
 - ds_sql_testing
- Data flows (2)
 - df_transform_cases_deaths
 - df_transform_hospital_admissions
- Power Query (0)

ds_sql_cases_and_deaths

Azure SQL Database

Connection Schema Parameters

Linked service * **ls_sql_covid_db** Test connection Edit + New Learn more

Table **covid_reporting.cases_and_deaths** Refresh Preview data Edit

Step 4 – Create pipeline

The screenshot displays the Azure Data Factory (ADF) interface. The top navigation bar includes 'Data Factory', 'Validate all', 'Publish all', and a 'Preview experience' toggle set to 'Off'. The left sidebar, titled 'Factory Resources', shows a tree view of resources: Pipelines (9), Datasets (16), and Data flows (2). The 'Pipelines' folder is expanded, showing a list of pipelines including 'pl_sqlize_cases_and_deaths_data'. The 'Activities' pane on the right lists various activity types such as 'Move & transform', 'Azure Data Explorer', 'Azure Function', 'Batch Service', 'Databricks', 'Data Lake Analytics', 'General', 'HDI Insight', 'Iteration & conditionals', 'Machine Learning', and 'Power Query'. The main canvas shows a pipeline named 'pl_sqlize_cases_and_deaths_data' with a single activity, 'Copy Cases and Deaths', which is a 'Copy data' activity. The 'Parameters' tab is selected at the bottom, showing a '+ New' button.

Step 5 – Create pipeline hospital admission data

The screenshot displays the Azure Data Factory (ADF) console interface. The top navigation bar includes 'Data Factory', 'Validate all', 'Publish all', and a 'Preview experience' toggle set to 'Off'. The left sidebar, titled 'Factory Resources', shows a tree view of the workspace. Under 'Pipelines', the 'pl_sqlize_hospital_admissions_data...' pipeline is selected. The 'Activities' pane on the right lists various activity types, with 'Copy data' being the active selection. The main canvas shows a single activity named 'Copy Hospital Admissions Data' with a green checkmark, indicating it is successfully configured. The bottom pane, titled 'Parameters', is currently empty, showing a '+ New' button to add parameters.

Step 6 - Create pipeline testing data

The screenshot displays the Azure Data Factory (ADF) interface. On the left, the 'Factory Resources' pane shows a hierarchy of resources: Pipelines (9), Datasets (16), and Data flows (2). The 'Pipelines' section is expanded, showing a list of pipelines including 'pl_sqlize_testing'. The 'Activities' pane in the center lists various activities such as 'Move & transform', 'Azure Data Explorer', 'Azure Function', 'Batch Service', 'Databricks', 'Data Lake Analytics', 'General', 'HDInsight', 'Iteration & conditionals', 'Machine Learning', and 'Power Query'. The 'Copy data' activity is selected in the main canvas, and its configuration is shown in the 'Parameters' tab at the bottom. The 'Copy data' activity is configured with 'Copy testing' as the source. The 'Parameters' tab is active, showing a '+ New' button.

6. Data orchestration – Making pipelines production ready

Step 1 – Build pipeline

The screenshot displays the Azure Data Factory (ADF) interface. The top navigation bar includes 'Data Factory', 'Validate all', 'Publish all', and a 'Preview experience' toggle set to 'Off'. The left sidebar, titled 'Factory Resources', shows a tree view with 'Pipelines' (9 items) and 'Datasets' (16 items). Under 'Pipelines', the 'Execute' folder is expanded, showing 'pl_execute_population_pipelines'. The main canvas, titled 'Activities', shows a pipeline diagram with two 'Execute Pipeline' activities: 'Execute Ingest Population Data' and 'Execute Process Population Data', connected by a green arrow. The bottom panel shows the 'Parameters' tab with a '+ New' button.

Step 2 – Create trigger

Edit trigger

Name *

tr_population_data_arrived

Description

Type *

BlobEventsTrigger

Account selection method * ⓘ

☒ From Azure subscription ☐ Enter manually

Azure subscription ⓘ

Eigen abonnement (9b9a9691-6d3d-43d5-84a2-bddc02aa3789) ▾

Storage account name * ⓘ

covidreportingsa0202 ▾

Container name * ⓘ

population ▾

Blob path begins with ⓘ

population_by_age.tsv.gz

Blob path ends with ⓘ

Event * ⓘ

☒ Blob created ☐ Blob deleted

Ignore empty blobs * ⓘ

☒ Yes ☐ No

Annotations

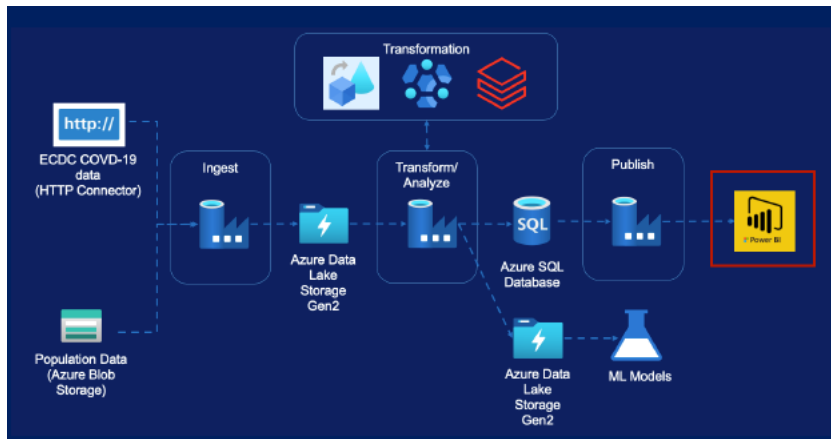
+ New

Status ⓘ

☐ Started ☒ Stopped

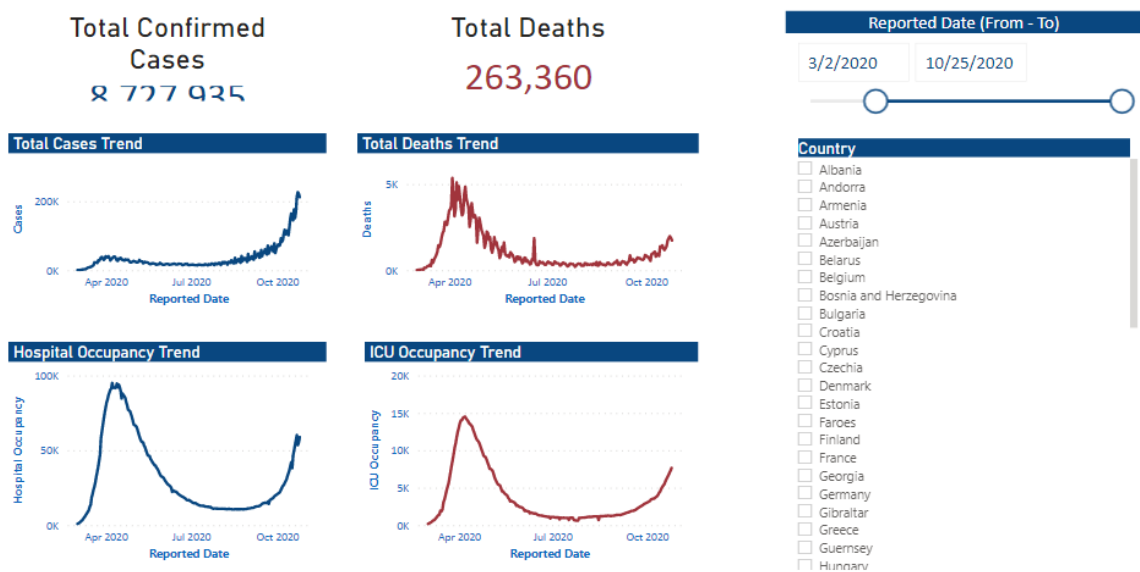
7. Data reporting

Step 0 – Reporting overview in Power BI



Step 1 – Create report 1 / 2

Covid-19 Cases EU/EEA & UK



Step 1 – Create report 2 / 2

Covid-19 Cases UK, France & Germany

Total Cases Trend - United Kingdom



Total Deaths Trend - United Kingdom



Reported Date (From - To)

8/24/2020

10/25/2020

Total Cases Trend - France



Total Deaths Trend - France



Total Cases Trend - Germany

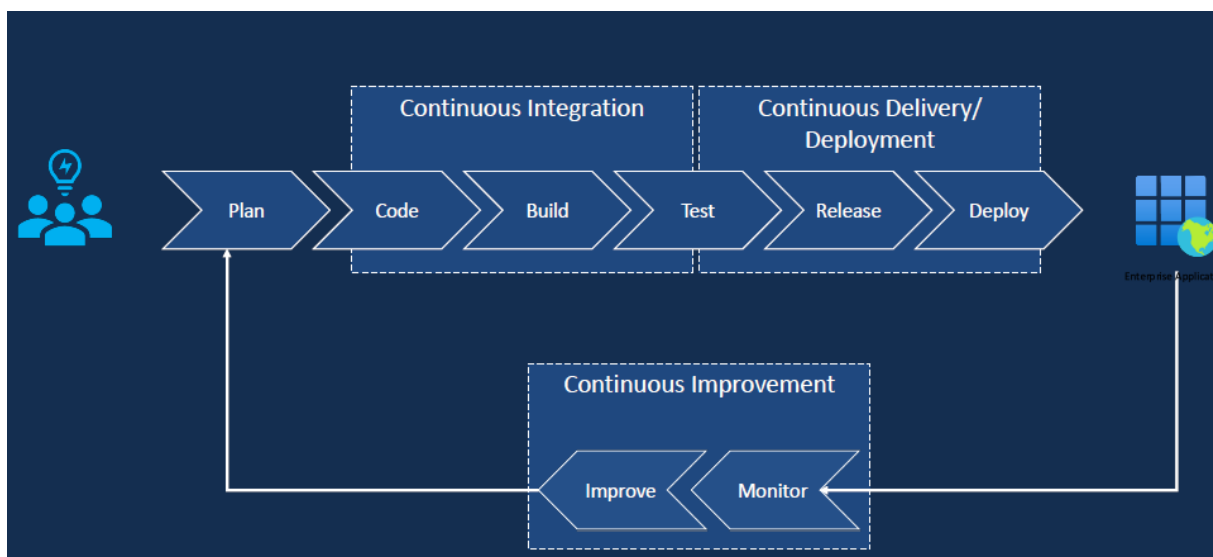
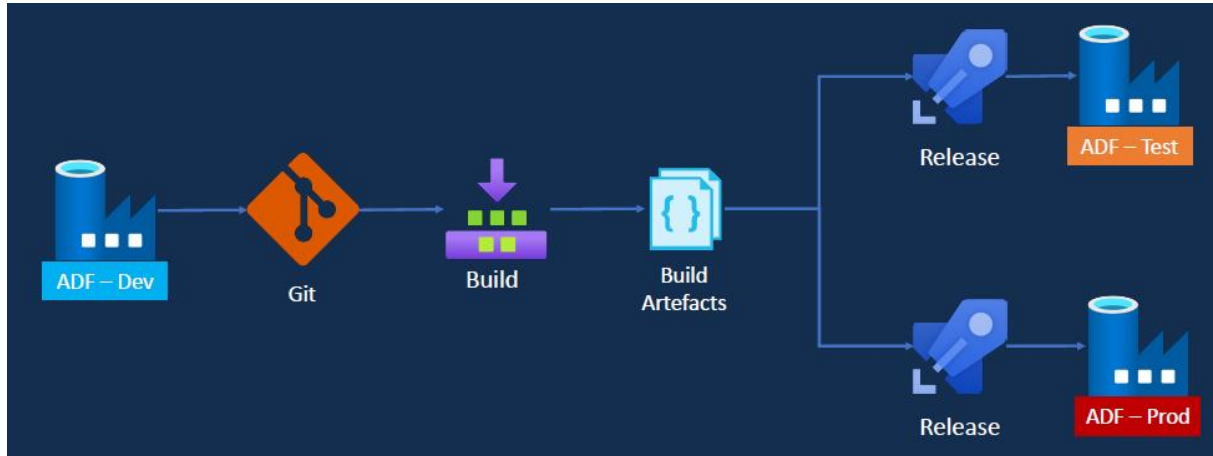


Total Deaths Trend - Germany

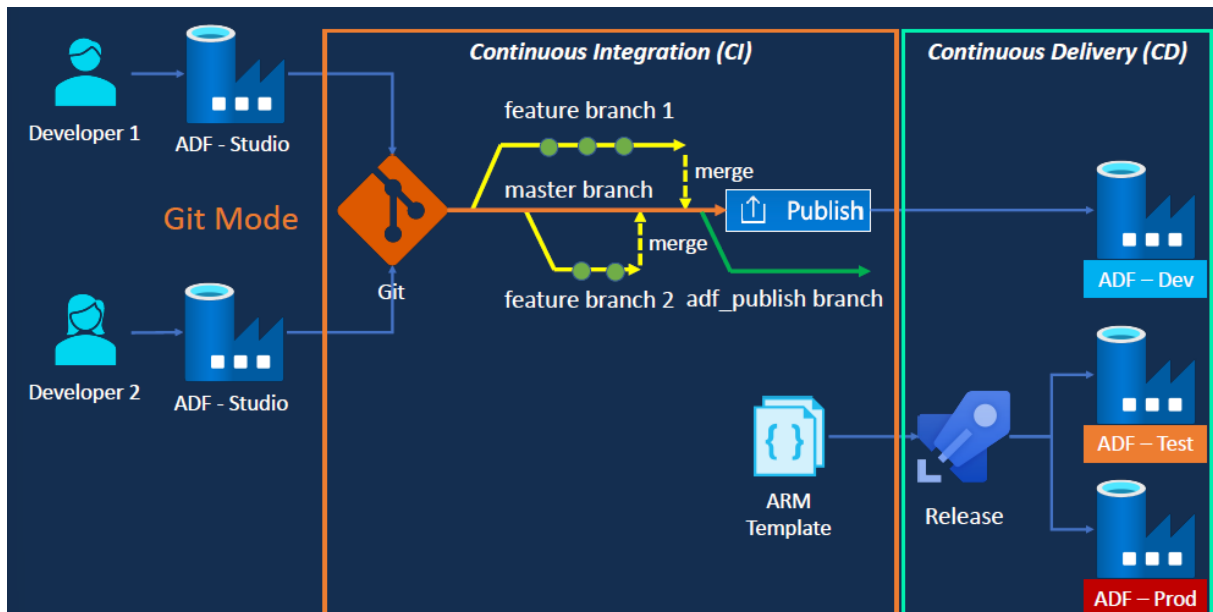


8. CI / CD

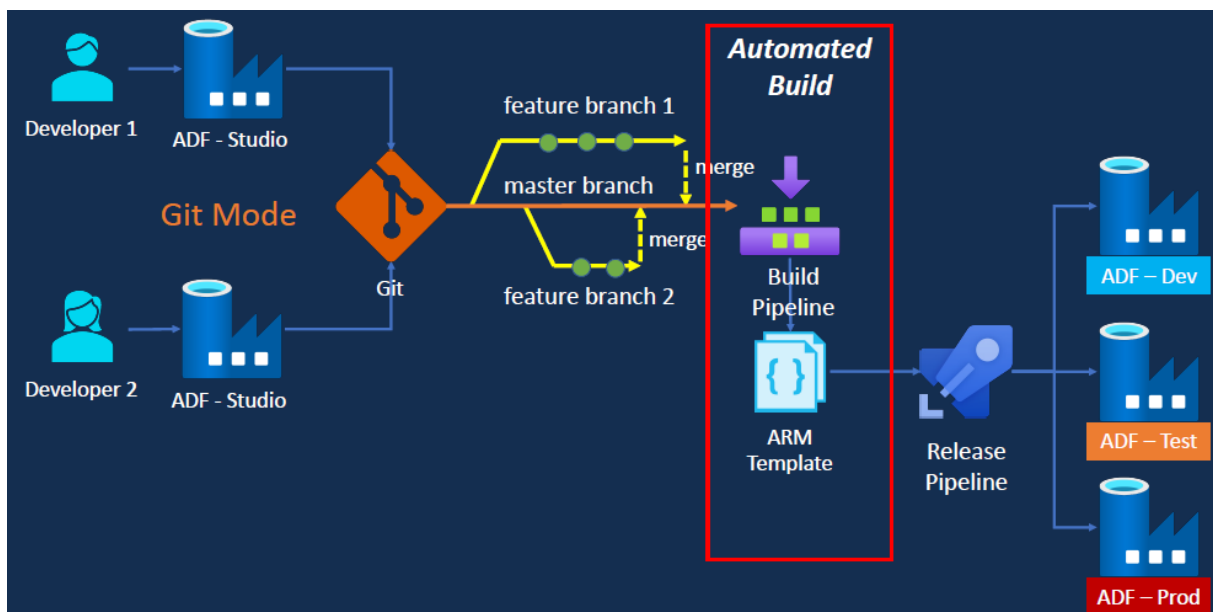
Step 0 – CI / CD overview



Step 0 – Git configuration within DevOps option 1



Step 0 – Git configuration within DevOps option 2



Step 1 – Create git repo

Azure Data Factory CI CD / Repos / Files / dev-ci-cd-adf-020

Search

BS

dev-ci-cd-adf-020

> build
> dataset
> linkedService
> pipeline
> release
> trigger
MI README.md

main

Type to find a file or folder...

Files

succeeded Clone

Contents History

Name ↑	Last change	Commits
build	Dec 27, 2022	4e4a2822 Added 2 files t...
dataset	Yesterday	593bfe03 Adding pipelin...
linkedService	Yesterday	93854955 Adding linkedS...
pipeline	Yesterday	593bfe03 Adding pipelin...
release	Dec 27, 2022	5a9e69e2 Added PrePost...
trigger	Dec 27, 2022	d8afe45f Updating trigg...
MI README.md	Dec 21, 2022	56ab35af Added READM...

Introduction

TODO: Give a short introduction of your project. Let this section explain the objectives or the motivation behind this project.

Getting Started

TODO: Guide users through getting your code up and running on their own system. In this section you can talk about:

1. Installation process
2. Software dependencies
3. Latest releases
4. API references

Build and Test

TODO: Describe and show how to build your code and run the tests.

Contribute

TODO: Explain how other users and developers can contribute to make your code better.

If you want to learn more about creating good readme files then refer the following [guidelines](#). You can also seek inspiration from the below readme files:

- [ASP.NET Core](#)
- [Visual Studio Code](#)
- [Chakra Core](#)

Step 2 – Create Tools for azure (DEV)

dev-ci-cd-rg Resource group

Search

+ Create Manage view Delete resource group Refresh Export to CSV Open query Assign tags Move

Overview

- Activity log
- Access control (IAM)
- Tags
- Resource visualizer
- Events

Settings

- Deployments
- Security
- Policies
- Properties
- Locks

Cost Management

- Cost analysis
- Cost alerts (preview)

Essentials

Subscription (move) [Eigen abonnement](#)

Subscription ID: 9b9a9691-6d3d-43d5-84a2-bddc02aa3789

Deployments: [3 Succeeded](#)

Location: East US

Tags (edit) [Click here to add tags](#)

Resources Recommendations

Filter for any field... Type equals all Location equals all Add filter

Showing 1 to 3 of 3 records. Show hidden types No grouping List view

Name	Type	Location
dev-ci-cd-adf-020	Data factory (V2)	East US
dev-ci-cd-kv-020-1	Key vault	East US
devcicddl	Storage account	East US

Step 2 – Create Tools for azure (TEST)

test-ci-cd-rg Resource group

Search

+ Create Manage view Delete resource group Refresh Export to CSV Open query Assign tags Move

Overview

- Activity log
- Access control (IAM)
- Tags
- Resource visualizer
- Events

Settings

- Deployments
- Security
- Policies
- Properties
- Locks

Cost Management

- Cost analysis

Essentials

Subscription (move) [Eigen abonnement](#)

Subscription ID: 9b9a9691-6d3d-43d5-84a2-bddc02aa3789

Deployments: [5 Failed 6 Succeeded](#)

Location: East US

Tags (edit) [Click here to add tags](#)

Resources Recommendations

Filter for any field... Type equals all Location equals all Add filter

Showing 1 to 3 of 3 records. Show hidden types No grouping List view

Name	Type	Location
test-ci-cd-adf-020	Data factory (V2)	East US
test-ci-cd-kv-020	Key vault	East US
testcicddl	Storage account	East US

Step 2 – Create Tools for azure (PROD)

prod-ci-cd-rg
Resource group

Search

+ Create Manage view Delete resource group Refresh Export to CSV Open query Assign tags Move

Overview

- Activity log
- Access control (IAM)
- Tags
- Resource visualizer
- Events

Settings

- Deployments
- Security
- Policies
- Properties
- Locks
- Cost Management
- Cost analysis

Essentials

Subscription (move)
[Eigen abonnement](#)

Subscription ID
9b9a9691-6d3d-43d5-84a2-bddc02aa3789

Tags (edit)
[Click here to add tags](#)

Deployments
[3 Succeeded](#)

Location
East US

Resources Recommendations

Filter for any field... Type equals all Location equals all Add filter

Showing 1 to 3 of 3 records. Show hidden types No grouping List view

Name	Type	Location
prod-ci-cd-adf-020	Data factory (V2)	East US
prod-ci-cd-kv-020	Key vault	East US
prodciiddl	Storage account	East US

Step 3 - Create release pipeline option 1

All pipelines > ADF CD Option 1 Release Pi... Save Create release

Pipeline Tasks Variables Retention Options History

Artifacts | + Add

- _dev-ci-cd-adf-020
- _dev-ci-cd-adf-020_main
- Schedule not set

Stages | + Add

- Test
1 job, 3 tasks
- Prod
1 job, 3 tasks

Step 4 – Create build pipeline option 2 – 1 / 2

← ADF CI Option 2 Build Pipeline

[Variables](#)[Run](#)


















⋮

main

dev-ci-cd-adf-020 / build/adf-ci-option-2-build-pipeline.yml

```
1 # File Name: adf-ci-option-2-build-pipeline.yml
2 # Purpose: Build pipeline for the development Azure Data Factory
3 # ..... Automatically triggered on completion of a pull request and
4 # ..... Validates the Data Factory resources
5 # ..... Generates the ARM template and publishes for consumption via
6 # Build Pipeline Name: ADF CI Option 2 Build Pipeline
7
8 trigger:
9 - main
10
11 pool:
12 - vmImage: ubuntu-latest
13
14 variables:
15 - subscriptionId: '9b9a9691-6d3d-43d5-84a2-bddc02aa3789' # Use your sub
16 - resourceGroup: 'dev-ci-cd-rg' # Use the reso
17 - dataFactory: 'dev-ci-cd-adf-020' # Use your dev
18 - PackageFolder: 'build' # Use the GIT
19 - adfRootFolder: '' # Use the GIT
20
21 steps:
22
23 # Installs Node
24 Settings
25 - task: NodeTool@0
26   inputs:
27     - versionSpec: '14.x'
28     - displayName: 'Install Node.js'
29
30 # Installs the npm packages saved in your package.json file in the build
31 Settings
32 - task: Npm@1
33   inputs:
34     - command: 'install'
35     - workingDir: '$(Build.Repository.LocalPath)/$(packageFolder)' #replac
36     - verbose: true
37     - displayName: 'Install npm packages'
38
39 # Validates all of the Data Factory resources in the repository. You'll
40 Settings
41 - task: Npm@1
42   inputs:
43     - command: 'custom'
44     - workingDir: '$(Build.Repository.LocalPath)/build' #replace with the
45     - customCommand: 'run build validate $(Build.Repository.LocalPath)/$(a
46     - displayName: 'Validate Data Factory Resources'
47
48 # Generate the ARM template into the destination folder, which is the sa
49 Settings
50 - task: Npm@1
51   inputs:
52     - command: 'custom'
53     - workingDir: '$(Build.Repository.LocalPath)/build' #replace with the
54     - customCommand: 'run build export $(Build.Repository.LocalPath)/$(adf
55     - displayName: 'Generate ARM template'
56
57 # Publish the artifact to be used as a source for a release pipeline.
58 Settings
```

Tasks

-  **.NET Core**
Build, test, package, or publish a dotnet applicatio...
-  **Android signing**
Sign and align Android APK files
-  **Ant**
Build with Apache Ant
-  **App Center distribute**
Distribute app builds to testers and users via Visu...
-  **App Center test**
Test app packages with Visual Studio App Center
-  **Archive files**
Compress files into .7z, .tar.gz, or .zip
-  **ARM template deployment**
Deploy an Azure Resource Manager (ARM) templ...
-  **Azure App Service deploy**
Deploy to Azure App Service a web, mobile, or AP...
-  **Azure App Service manage**
Start, stop, restart, slot swap, slot delete, install sit...
-  **Azure App Service Settings**
Update/Add App settings an Azure Web App for ...
-  **Azure CLI**
Run Azure CLI commands against an Azure subscri...
-  **Azure Cloud Service deployment**
Deploy an Azure Cloud Service
-  **Azure Database for MySQL deployment**
Run your scripts and make changes to your Azure...
-  **Azure file copy**
Copy files to Azure Blob Storage or virtual machin...
-  **Azure Function on Kubernetes**
Deploy Azure function to Kubernetes cluster.
-  **Azure Functions**
Update a function app with .NET, Python, JavaScri...
-  **Azure Functions for container**
Update a function app with a Docker container

Step 5 – Create release pipeline option 2

